Remedial Investigation
Work Plan
Site 4 - Fire Fightining Training Unit
Site 12 - Harbor Dredge Spoil Area
Naval Training Center
Great Lakes, Illinois

Northern Division
Naval Facilities Engineering Command

Contract No. N62472–90–D–1298
Contract Task Order 0071

January 1993

HALLIBURTON NUS
Environmental Corporation

DRAFT
REMEDIAL INVESTIGATION WORK PLAN
SITE 4 - FIRE FIRE TRAINING UNIT
SITE 12 - HARBOR DREDGE SPOILS AREA
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) PROGRAM

Submitted to:
Southern Division
Environmental Branch, Code 18
Naval Facilities Engineering Command
2155 Eagle Drive, Box 10068
Charleston, South Carolina 29411-0068

Submitted by:
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Contract No. N62472-90-D-1298
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REMEDIAL INVESTIGATION WORK PLAN
SITE 4 - FIRE FIGHTING TRAINING UNIT
SITE 12 - HARBOR DREDGE SPOILS AREA
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

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R/71WPD/AA0

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LIST OF ACRONYMS/ABBREVIATIONS

ACBMs	Asbestos Containing Building Materials
ARARs	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
BETX	Benzene, Ethylbenzene, Toluene, Xylene
BNA	Base Neutral Acid Extractables
CHSM	Corporate Health and Safety Manager
CLEAN	Comprehensive Long-Term Environmental Action Navy
CST	Central Standard time
CTO	Contract Task Order
DOT	Department of Transportation
DQO	Data Quality Objective
FDC	Field Data Coordinator
FFTU	Fire Fighting Training Unit
FID	Flame Ionization Detector
FS	Feasibility Study
FTL	Field Team Leader
HASP	Health and Safety Plan
IAS	Initial Assessment Study
IATA	International Air Transport Association
IEPA	Illinois Environmental Protection Agency
MSL	Mean Sea Level
NAVFAC	Naval facilities
NEESA	Naval Energy and Environmental Support Activity
NORTHDIV	Northern Division, Naval Facilities Engineering Command
NTC	Naval Training Center
PAH	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PID	Photoionization Detector
POLs	Petroleum Oils and Lubricants
PPE	Personal Protective Equipment
PWC	Public Works Center
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
RPM	Remedial Project Manager

SSO	Site Health and Safety Officer
SVOC	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TBC	To Be Considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TRPH	Total Recoverable Petroleum Hydrocarbon
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VA	Veterans Administration
VOC	Volatile Organic Compounds

R/71WPD/AA0

1.0 INTRODUCTION

1.1 REMEDIAL INVESTIGATION OBJECTIVES

SEC Donohue Inc. (SEC Donohue) has been retained by HALLIBURTON NUS Environmental Corporation to conduct a Remedial Investigation (RI) at Site 4, Fire Fighting Training Unit and Site 12, Harbor Dredge Spoil Area, at the Naval Training Center (NTC) Great Lakes, Illinois. This project is being performed under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298, Contract Task Order (CTO) Number 0071.

This Work Plan and the associated project plans are contained in three volumes. This volume presents the technical scope of work and includes a discussion of the site background and setting, an initial evaluation of the site including the types of contaminants present and the potential pathways of contaminant migration, the RI Work Plan approach and rationale, and field sampling techniques, procedures, and documentation. Also included are a discussion of the RI tasks to be completed within each of the investigative areas, schedule and project management, and field team organization.

The second volume is the Quality Assurance Project Plan (QAPP) which describes the policy organization, functional activities, and quality assurance/quality control (QA/QC) protocols necessary to achieve the data quality objectives (DQOs) dictated by the intended use of the data. The Field Sampling Plan is included within this document.

The third volume, the Health and Safety Plan (HASP), documents protocols pertaining to protecting the health and safety of site personnel during RI field activities. Potentially hazardous operations and exposures are identified, and appropriate protective measures are specified in the HASP.

Prior to completing this Work Plan, SEC Donohue:

- Reviewed background information including the Technical Memorandum about the Remedial Investigation Verification Step for the Naval Training Center, Great Lakes, Illinois (Dames & Moore, 1991), and the Initial Assessment Study (Roger, Golden & Halpern, 1986).

- Completed a scoping meeting.

- Conducted site visits.

The purpose of the RI is to obtain information which will be used to identify and characterize the nature and extent of contamination at Sites 4 and 12. The investigation will include determination of horizontal and vertical extent of contamination and contaminant characterization in support of a baseline risk assessment to determine potential risks to human health and the environment and to provide information for evaluating potential remedial alternatives.

During the Initial Assessment Study (IAS) for the NTC seven sites were identified as requiring further study. Five of the seven sites were the subject of the Remedial Investigation Verification Step as described in a Technical Memorandum (Dames & Moore, 1991). Based on the Dames & Moore investigation, the Fire Fighting Training Unit (FFTU) and the Harbor Dredge Spoil Area, Sites 4 and 12, respectively, were selected for RI/Feasibility Study (FS) activities. RI objectives are as follows:

- Characterize the presence of soil and groundwater contamination at each site.
- Determine the presence or absence of possible underground storage tanks (USTs) in the FFTU area.
- Define site stratigraphy and hydrogeology.
- Establish a groundwater monitoring well network to evaluate potential contaminant migration from each investigative site.
- Identify potential contaminant migration pathways and receptors associated with each site. Characterize the extent, nature, and rate of contaminant migration from each site.
- Characterize the potential impact of each site on human health and the environment.

1.2 WORK PLAN ORGANIZATION

Subsequent sections of this document describe the proposed implementation of the RI activities from the planning stage to the completion of the final RI report.

The Work Plan is divided into 12 sections, as described below:

- Section 1, Introduction - Presents the objectives of the RI and describes the contents of the project plans.

- Section 2, Site Background and Setting - Provides history of the NTC, as well as a physical description of the base and its setting.

- Section 3, Initial Evaluation - Describes the development of the Site Conceptual Model of site contamination and potential contaminant migration pathways.

- Section 4, Remedial Investigation Approach and Rationale - Discusses the RI approach and rationale for each site by investigative area.

- Section 5, Remedial Investigation Tasks - Describes the tasks that will be performed during the RI. This section provides a framework for the RI process, describing the tasks required to supplement the site-specific field investigation activities presented in Section 4. It summarizes general field activities, data evaluation, fate and transport analyses, risk assessment, and RI report preparation.

- Section 6, Project Management and Field Team Organization - Provides a description of the project organization, reporting, quality assurance document control, and the field team organization and responsibilities.

- Section 7, Site-Generated Waste Disposal - Presents containment, characterization, and disposal of wastes generated during the study, and the required documentation.

- Section 8, Sample Identification Numbers and Documentation -Establishes the sample identification number system and discusses the on-site sample documentation procedures.

- Section 9, Chain of Custody - Discusses sample collection, laboratory analysis, final project files, and chain of custody protocols to be established during the field investigation.

- Section 10, Packaging and Shipping - Presents the sample packaging, labeling, and shipping protocols.

- Section 11, References.

R/71WPD/AA1

2.0 SITE BACKGROUND AND SETTING

2.1 LOCATION, SITE HISTORY, AND PAST RESPONSE ACTIONS

2.1.1 Location

The NTC is located in Shields Township, on the shore of Lake Michigan. The base is located approximately 55 miles north of downtown Chicago, as shown on Figure 2-1. Dedicated in 1911, NTC is the largest naval training center (1,650 acres) in the United States. It is bounded on the west by U.S. Route 41 (Skokie Highway), on the north by the city of North Chicago, and on the south by the Veterans Administration (VA) Hospital and Golf Course and the Shoreacres Country Club. Lake Michigan lies to the east. "Mainside" includes the area east of Sheridan Road, which includes the location of the original base. "Hospitalside" includes the area west of Sheridan Road, which includes the VA Hospital.

2.1.2 Site History

The NTC site, initially consisting of a 167 acre tract, was purchased by the Navy under the Naval Appropriations Act of 1904. The base was commissioned on July 1, 1911 and was officially dedicated by President Taft on October 28, 1911. The original facility, which consisted of 39 permanent buildings, was bounded on the west by Sheridan Road, on the north by Bronson Avenue, on the east by Lake Michigan, and on the south by an irregular line through what is now Hospitalside. Expansion to the present boundaries was accomplished by various land acquisitions from 1917 to 1942.

During World War I, the facility accommodated up to 47,721 men. The facility expanded to 1,200 acres with 775 buildings, many of which were temporary structures. By the close of the war in 1918, most of the temporary buildings had been demolished. By 1922, the Navy had stopped training recruits at the NTC.

All the land west of Sheridan Road had been transferred to the VA Hospital by 1932. At that time, the NTC consisted of 102 buildings on 507 acres.

Recruit training resumed at the facility in 1935. The second period of major growth for the NTC began in 1939. By March 1944, the facility reached an all-time peak of 100,156 men. Today, approximately 9,000 officers and personnel are stationed at the NTC, maintaining facilities and conducting the training of the 80,000 recruits and students graduated annually. The base currently consists of 1,060 buildings on approximately 1,650 acres of land.

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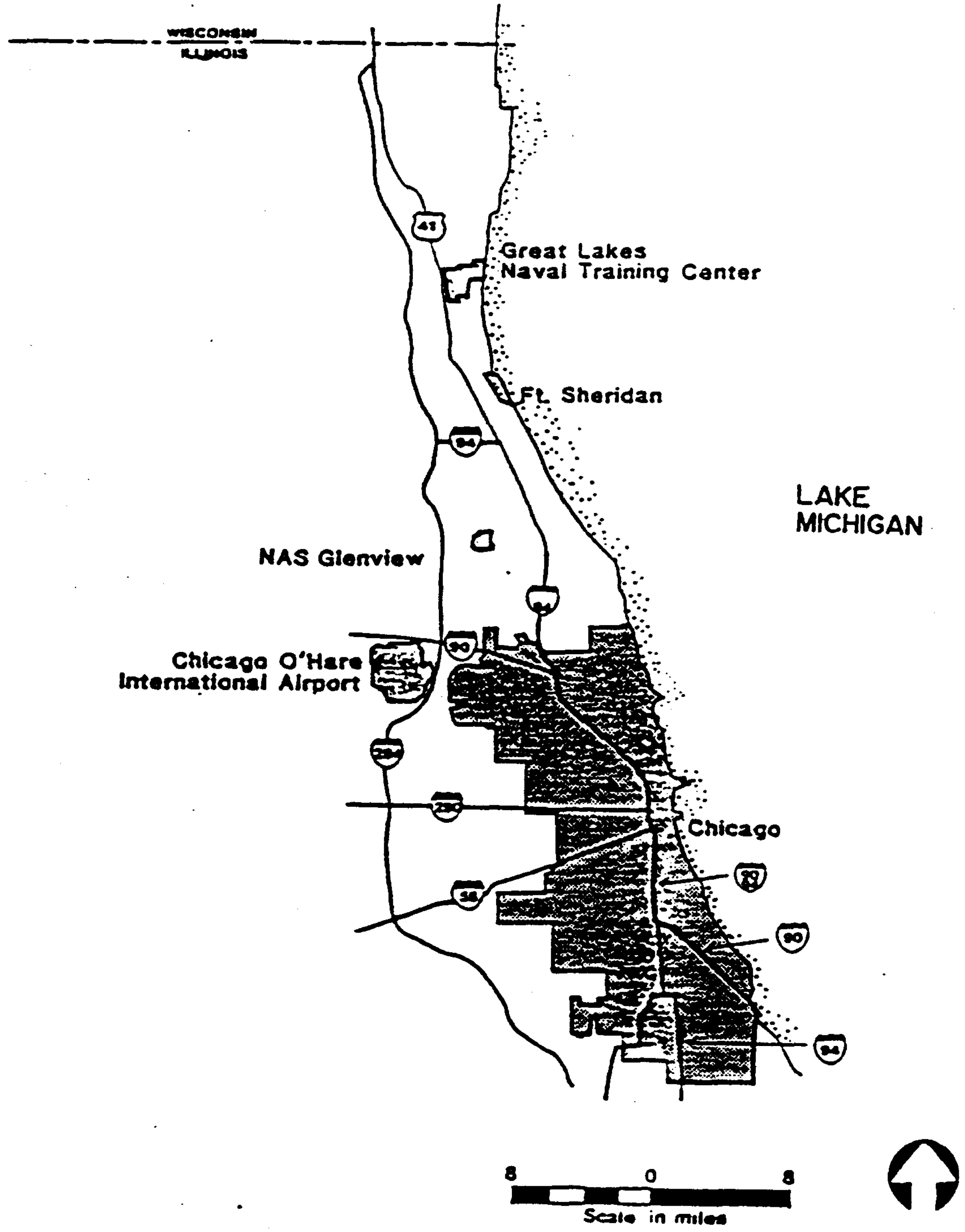


SOURCE:
INITIAL ASSESSMENT STUDY
ROGERS, GOLDEN, HALPERN, 1986

SEC DONOHUE
Environment & Infrastructure

FIGURE 2-1
GENERAL LOCATION MAP

NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

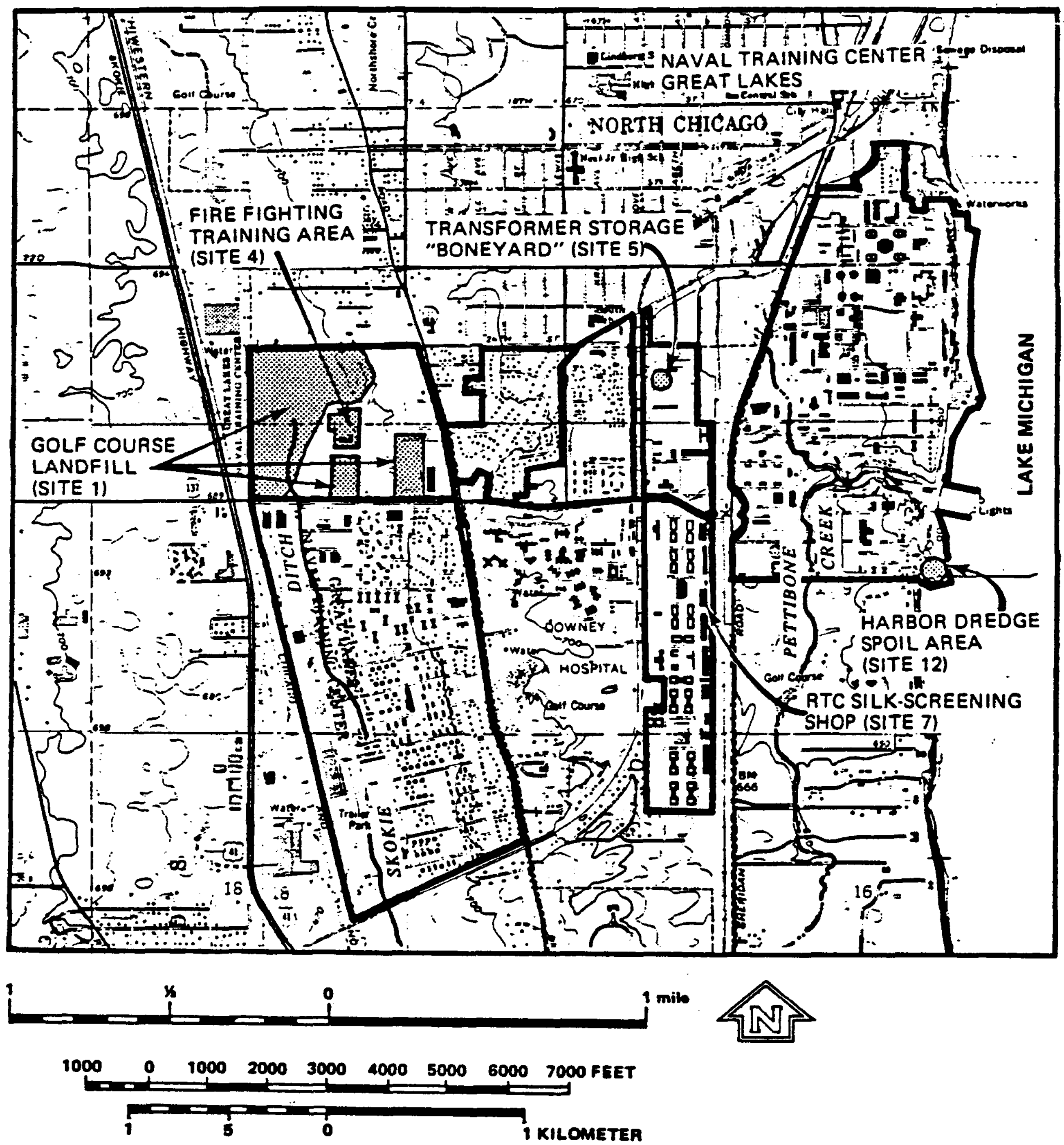
This RI is limited to two sites within the NTC facility. Selection of these two sites for further investigation was based on two studies as follows: an IAS completed in March 1986 which recommended that seven sites within the NTC be subjected to further study to either confirm or refute the presence of suspected contamination and to better define the extent. A subsequent investigation, Remedial Investigation Verification Step was completed in 1991 for five of the seven areas. Sites 4 and 12 were selected for the RI based on the outcome of the 1991 investigation.

Activities conducted in both Site 4 and Site 12 are summarized in the following sections. Descriptions of activities at each site were taken from the Technical Memorandum on the Remedial Investigation Verification Step prepared by Dames & Moore (1991) and from a September 30, 1992 interview with Navy personnel. Observations of current conditions were made during site visits conducted in September 1992 by the HALLIBURTON NUS Team.

2.1.2.1 Site 4 - Fire Fighting Training Unit

Site 4, the former FFTU, is located approximately 0.5 miles northeast of the intersection of U.S. 41 and Buckley Road. The FFTU is a 10-acre, partially paved parcel surrounded on all sides by the Willow Glen Golf Course (Figure 2-2). The FFTU was in operation between 1942 until October 1990. Site 4 is occupied by an "L" shaped building used for classroom instruction (Building 3304), a small structure used as a gas chamber (Building 3305), and four small practice burn buildings (Buildings 3304A, B, C and D). Six round, open steel tanks, referred to as Fire Fighting Rings (FF1, FF2, FF3, FF4, FF5, and FF6 on Figure 2-3), five square open steel tanks referred to as Christmas Tree Vaults (FC1, FC2, FC3, FC4, FC5 on Figure 2-3), and the Torch Shack (FC6 on Figure 2-3) are located north of Building 3304. Two 5,000-gallon aboveground diesel fuel tanks, and one existing 5,000-gallon diesel fuel UST and seven possible additional USTs are situated on the site. An oil/water separator and former drum storage area are located on the western portion of the site. West of the oil/water separator are two unlined decant ponds and an aboveground volume gasoline storage tank. The north and part of the west side of the FFTU are bounded by an unlined ditch that was used to contain an emergency water supply for fire fighting in case of loss of water pressure, and which can also receive site runoff.

Review of aerial photographs from 1946 to 1985 by Dames & Moore (1991) indicates no major changes have occurred over the period the FFTU was in operation. The FFTU was used to stage fires in open steel tanks and smoke practice buildings for training exercises. Practice fires were set in open steel tanks filled either with No. 2 fuel oil or diesel fuel (Chief Damage Controlman, September 1992) or with oil floating on water. A section of the burn buildings was filled with one to two feet of diesel fuel to simulate fires inside ship compartments. Gasoline was used to ignite the fires. Fires were extinguished using water, Aqueous Film Forming Foam or dry extinguisher chemicals. In the past, other flammable materials, including other petroleum products and solvents were used for igniting practice fires.



SOURCE:
USGS 7.5 MINUTE QUADRANGLE
WAUKEGAN, ILLINOIS 1960
PHOTOREVISED 1972 AND 1980

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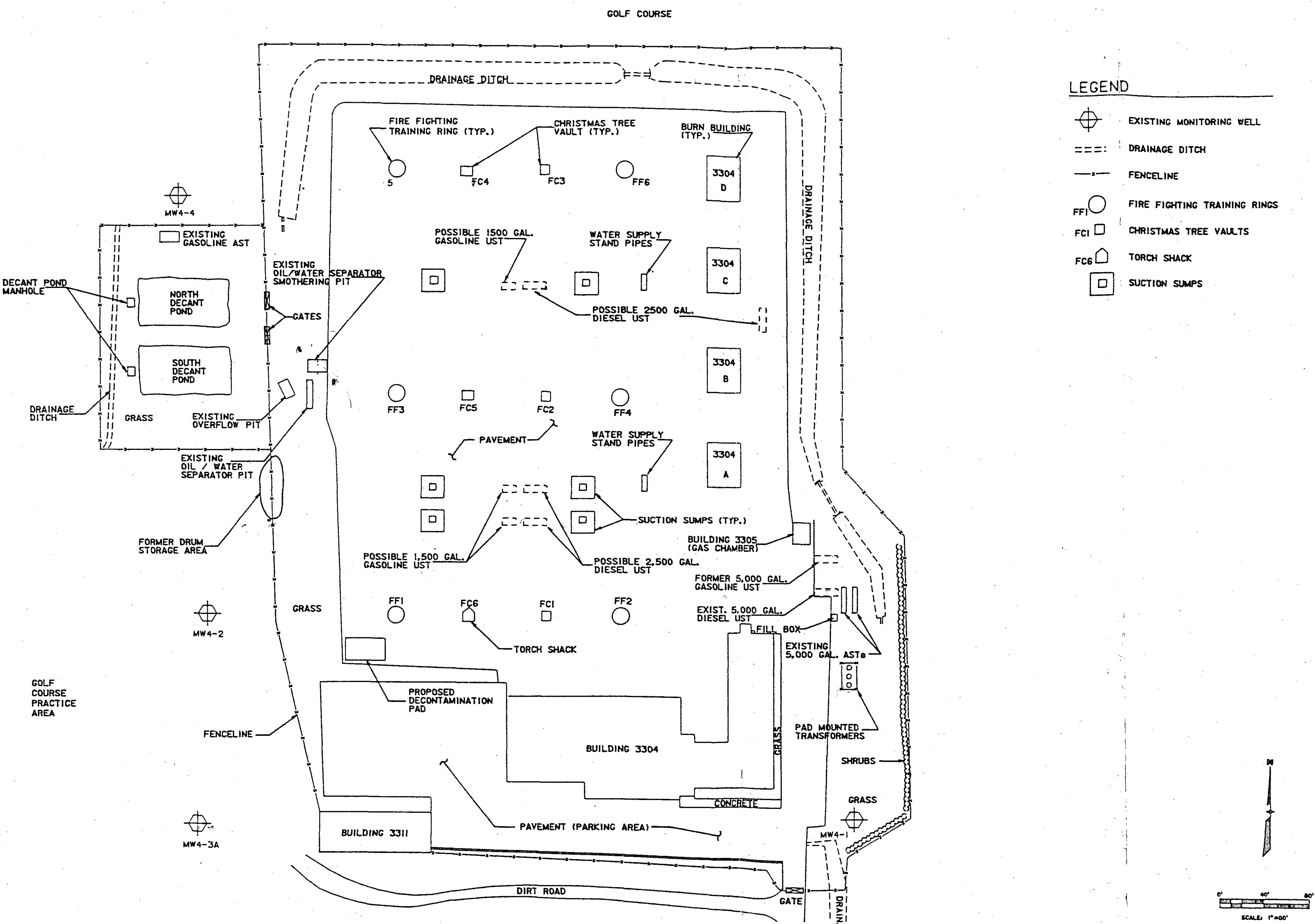
FIGURE 2-2
SITE LOCATION MAP

NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS



DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION — CHARLESTON, SC

FIGURE 2-3 LOCATION MAP
SITE 4-FIRE FIGHTING TRAINING UNIT
REMEDIAL INVESTIGATION
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

SEC DONOHUE ENVIRONMENT & INFRASTRUCTURE
CHICAGO, ILLINOIS

REV.	DESCRIPTION	PREP. BY	DATE APPROVED

DESIGN: DRAWN: CHECK:
SUPV: CH ENG:
SUBMITTED BY: (NAME) (TITLE) (DATE)
OFFICER IN CHARGE
APPROVED DATE
APPROVED SOUTHDIV FOR COMMANDER, NAVFAC DATE

SENT TO: DATE:
CODE I.D. NO.
SCALE: AS SHOWN
SPEC. NO.
CONSTRUCTION CONTRACT NO.
NAVFAC DRAWING NO.
SHEET OF

A centrifugal oil/water separator was installed in the waste line between the training area and the decant ponds in 1979. Wastes from the training area are directed to the decant ponds via underground drain lines. After 1979, oil removed from the separator and residual oil skimmed manually from the lagoons was drummed, and the 55-gallon drums were stored along the western fence line of the training area. Prior to 1979 all wastes from the training area were discharged directly to the decant ponds.

The IAS reported that between 1942 and 1979 the southwestern portion of the site was used for storage of drums containing waste Petroleum Oils and Lubricants (POLs) and solvents as well as oils and materials recovered from the training exercises. Chemicals that may have been stored in the drums include Solvent 144, turpentine, gasoline, No. 2 diesel fuel, crank case motor oil, and antifreeze. Dames & Moore reported up to 300 55-gallon drums of such materials were accumulated in this area by 1983. Three have since been removed, and only a few empty drums remained at the time of the HALLIBURTON NUS Team site visits in September 1992.

2.1.2.2 Site 12 - Harbor Dredge Spoil Area

The Harbor Dredge Spoil Area is located in a flat area on the shore of the NTC Outer Harbor, south of the installation sewage treatment plant (Figure 2-2). The site is bounded on the west by an approximately 50-foot high bluff.

During harbor dredging activities in 1952 and 1979, dredge spoils were disposed of in this area (Rogers, Golden & Halpern, 1986). The IAS delineated the area designated as a dredge spoil disposal area as shown in Figure 2-3. Dames & Moore reviewed aerial photographs taken between 1946 to 1985 which indicated evidence of some filling and other modifications of the site over this period. However, these filling activities do not coincide with or closely follow the reported dates of harbor dredging and, therefore, may not be related to the disposition of dredge spoils, as originally reported by the IAS (Dames & Moore 1991). Dames & Moore reported that discussions with personnel at the base regarding the 1970 dredging operations indicated that spoils from this period were placed in the lake approximately 5 miles from shore. Installation personnel were not able to provide personal knowledge of the 1952 dredging operations. The sludge material dredged from the harbor could have high organic content and may potentially contain heavy metals, oils, pesticides, and polychlorinated biphenyls (PCBs) from industries upstream of the NTC.

2.1.3 Response Actions

On March 15, 1985, the Naval Energy and Environmental Support Activity (NEESA), contracted with Rogers, Golden & Halpern to perform an IAS of the NTC. The objective of that investigation was to identify sites within the facility with potential environmental contamination which would require the performance of a RI. The work included a site evaluation based on existing documents and information and preparation of a report documenting findings of the site assessment.

The final IAS prepared by Rogers, Golden & Halpern identified seven sites which required further study. The IAS identified site conditions for each of the seven sites indicating a potential for contamination of groundwater, surface water, and/or soil as a result of past disposal, spills, or other site operations, in addition to a potential for contaminant migration and for exposure of potential receptors.

Based on the recommendations of the IAS report, Dames & Moore conducted the Verification Step of the RI on five of the seven sites. The objective of the investigation was to perform a field program consisting of groundwater monitoring, well installation, and collection and chemical analysis of groundwater, surface water, and soil samples to verify the presence of contaminants at the sites and to determine the approximate degree of contamination, if present (Dames & Moore 1991). The laboratory data generated during the investigation could not be validated using United States Environmental Protection Agency (USEPA) Level III data validation procedures and therefore were not usable for their intended purpose. As a result, Dames & Moore did not present conclusions and recommendations, and the document was issued as a Technical Memorandum.

2.1.4 Current Conditions

2.1.4.1 Site 4 - Fire Fighting Training Unit

Currently, the FFTU is abandoned. A new propane fired Fire Fighting Training center, located elsewhere on the base, was recently put into service. The entire abandoned site is surrounded by chain link fencing to prevent unauthorized entry.

The primary features of the FFTU are presented on Figure 2-3. These features are discussed below. The discussion is based on information gathered during two site visits, a review of historical engineering drawings, and conversation with Navy personnel.

1. Building 3304 - This is the largest building on the site. It was used primarily for classrooms. It is in a current state of disrepair. During the site visit, it was observed that several sections of the roof have collapsed. Possible asbestos containing building materials (ACBMs) are present in this building. The paint on both the interior and exterior walls of this building have peeled to a great extent. To the best of the HALLIBURTON NUS Team's knowledge, samples have never been taken in Building 3304 of potential ACBM or paint.

2. Buildings 3304A, 3304B, 3304C and 3304D - These four buildings are referred to as the burn buildings. Certain rooms of these buildings were filled with diesel fuel and ignited with gasoline (Navy personnel, 1992). Recruits would enter the buildings and extinguish the diesel fires.

3. Building 3305 - The gas chamber. Recruits would don breathing apparatus and enter this building which would be filled with various noxious gases (Navy personnel, 1992). Based on field observations of the building, it is believed that the gas was dissipated directly to the atmosphere.

4. Two 5,000 Gallon Aboveground Storage Tanks (ASTs) Southeast of Building 3305 - According to Navy personnel, these two tanks, surrounded by a concrete dike, contained diesel fuel which was piped via underground piping to the Fire Fighting Rings (discussed below). The HALLIBURTON NUS Team could not locate any as-built engineering drawings which indicate the presence of underground piping.

5. Existing 5,000 Gallon Diesel Fuel Underground Storage Tank - This UST stored diesel fuel which, according to engineering drawings, was pumped through underground piping to the Fire Fighting Rings. During a September 30, 1992 site visit, this UST contained about 1,400 gallons of diesel fuel as measured with a calibrated dipstick.

6. Former 5,000 Gallon Gasoline UST - Based on the NTC Public Works Center (PWC) Drawing No. 3304-3-841, this UST was approved for removal in March 1984. It is believed that this tank was removed at that time (Chief Damage Controlman, 1992).

7. Seven Possible Gasoline and Diesel Fuel USTs - Based on Yards and Docks Drawing No. 286,490 (dated March 18, 1946), three 1,500 gallon diesel fuel USTs and four 2,500-gallon gasoline USTs were to have been installed at the locations shown on Figure 2-3. It is unknown whether these USTs were ever installed. Naval facilities (NAVFAC) Drawing No. 1206831, dated March 31, 1970, does not show any of these seven USTs as having been installed. A memorandum dated March 5, 1984, provided by the Activity Point of Contact, discusses two soil borings placed at the FFTU in an attempt to locate one of the three 1,500 gallon gasoline USTs. The UST was not located. There is no

mention in this memorandum of the possible four 2,500 gallon diesel USTs. During a site visit, the HALLIBURTON NUS Team searched the areas where these USTs should be located if they were installed and found no evidence of any fill pipes or vent pipes in these areas.

8. Fire Fighting Rings FF1, FF2, FF3, FF4, FF5, FF6 - The Fire Fighting Rings (rings) were typically filled with diesel fuel and ignited with gasoline. Diesel fuel was transferred to the rings via underground piping. Recruits would then extinguish the fires.

9. Christmas Tree Vaults FC1, FC2, FC3, FC4, FC5 - Based on Yards and Docks Drawing No. 286,493, dated March 20, 1946, these square structures housed either a real or an artificial tree which was ignited with gasoline. It is believed that recruits would then enter the vaults and extinguish the fires.

10. Decant Ponds - Once a fire in the burn buildings, rings, or Christmas Tree Vaults had been successfully extinguished, the remaining liquids in these structures (unburned diesel fuel, unburned gasoline, water, foam) were drained from the structures and transported via underground piping to the Decant Ponds where the liquid was discharged. This direct discharge to the Decant Ponds occurred through 1979, at which time an oil/water separator was installed. The HALLIBURTON NUS Team found no evidence that would indicate that these decant ponds were constructed with an engineered liner. According to Navy personnel, each pond contains a drain in its bottom which allows the accumulated liquid in the pond to drain to an underground pipeline. This pipeline ultimately discharges to Skokie Ditch about 250 feet west of the ponds. In October 1992, the north pond contained liquid, while the south pond did not. According to Navy personnel, this is most likely because the drain in the north pond became clogged. Dames & Moore reported that the sides of the ponds were "black with heavy oily stains" during a site visit they conducted in December 1987 (Dames & Moore 1991). These black heavy stains were not apparent in October 1992. However, at that time a rainbow sheen was noticed on the water in the north pond.

11. Oil/Water Separator - In 1979, an oil/water separator was installed at the FFTU. Drainage from the burn buildings, the rings and the Christmas Tree Vaults passed through this separator. After petroleum product was recovered and containerized in drums, the remaining liquid was discharged to the Decant Ponds. The oil/water separator consists of three subsurface pits (the smothering pit, the separator pit and the overflow pit), two pumps (located in the smothering pit), and two oil water separators.

12. Drum Storage Area - Petroleum product recovered from the oil/water separator was containerized in 55-gallon drums and stored along the west fenceline of the FFTU in the Drum Storage Area. In addition, reportedly between 1942 and 1979, this area of the FFTU was used for storage of drums containing waste Solvent 144, turpentine, gasoline, crankcase motor oil and antifreeze (Dames & Moore 1991). The source(s) of these other materials is unknown. Up to 300 55-gallon drums of such material were accumulated in this area by 1983. By the time of the HALLIBURTON NUS Team site visit on September 30, 1992, all of these drums had been removed from the FFTU. However, it was observed during this site visit that the ground surface in this area is stained.

13. Existing Gasoline AST Located North of the Decant Ponds - This AST is surrounded by a concrete dike. According to Navy personnel, gasoline was dispensed from this AST into 5-gallon cans and carried by hand to the burn buildings and rings where it was used to ignite diesel fuel in these structures.

14. Torch Shack FC6 - This shack was the storage area for metal torches which were used to ignite the gasoline and consequently the diesel fuel in the burn buildings, rings and vaults.

15. Water Supply Stand Pipes - The recruits would attach fire fighting hoses to these stand pipes and use the water to extinguish set fires.

16. Suction Sumps - These sumps were filled with water and used as an emergency source of fire fighting water.

17. Drainage Ditch - A drainage ditch is present at the FFTU at the locations shown on Figure 2-3. This ditch contained water during a HALLIBURTON NUS Team site visit on September 30, 1992. Oil sheening or staining of the water or ditch shore was not observed during this site visit. Dames & Moore reported the water in this ditch to have an oily sheen during a site visit they conducted in December 1987 (Dames & Moore 1991).

18. Underground Piping - Beneath the FFTU, there are the following underground pipelines:

    - Gasoline and diesel fuel supply lines.

    - Petroleum product/water drain lines leading from the rings, Christmas Tree Vaults and burn buildings to the oil/water separator.

- Stormwater sewer lines.

- Water supply mains.

19. Pad-Mounted Transformers - Three pad-mounted transformers are situated within a fenced area, east of Building 3304. The activity point of contact reported that the transformers are owned by the Navy and that they currently do not contain dielectric fluid, but they may have contained PCBs in the past. The HALLIBURTON NUS Team observed stressed vegetation around the pad during the October 1992 site visits, however, no visible staining was noted.

20. Monitoring Wells MW4-1, MW4-2, MW4-3A and MW4-4 - These four monitoring wells were installed by Dames & Moore in 1988. The HALLIBURTON NUS Team located these wells except for flush mounted well MW4-1 during a September 30, 1992 site visit. The area where MW4-1 is located was covered with tall grass. A metal detector will be used to locate this well during the RI.

Building 3311, which is shown on Figure 2-3, is actively being used by the Willow Glen Golf Course as a maintenance shed and is not included as part of the FFTU.

2.1.4.2 Site 12 - Harbor Dredge Spoil Area

Currently Site 12 is a grass covered field rising westward from the shore of Lake Michigan to a 50 to 60-foot high wooded bluff (Figure 2-4). The site is currently used as a picnic and recreational area; an archery range is situated on the northern portion of the site, immediately south of the sewage treatment plant. A gravel road transects the site from north to south and terminates in a gravel parking lot on the south, against a concrete pier. The only structure on the site is a picnic pavilion overlooking the lake. The only other notable feature is a drainage ditch which emerges from the bluff and extends eastward across the site to Lake Michigan.

2.2 PHYSICAL AND CULTURAL SETTING

2.2.1 Physiography

The topography of Lake County is gently sloping with poorly defined drainage patterns. Drainage patterns are swales which enter into depressions and marshes. The highest point in Lake County is Gander Mountain in the county's northwest corner. The lowest point is where the Des Plaines River flows out of the county at the southeast corner.

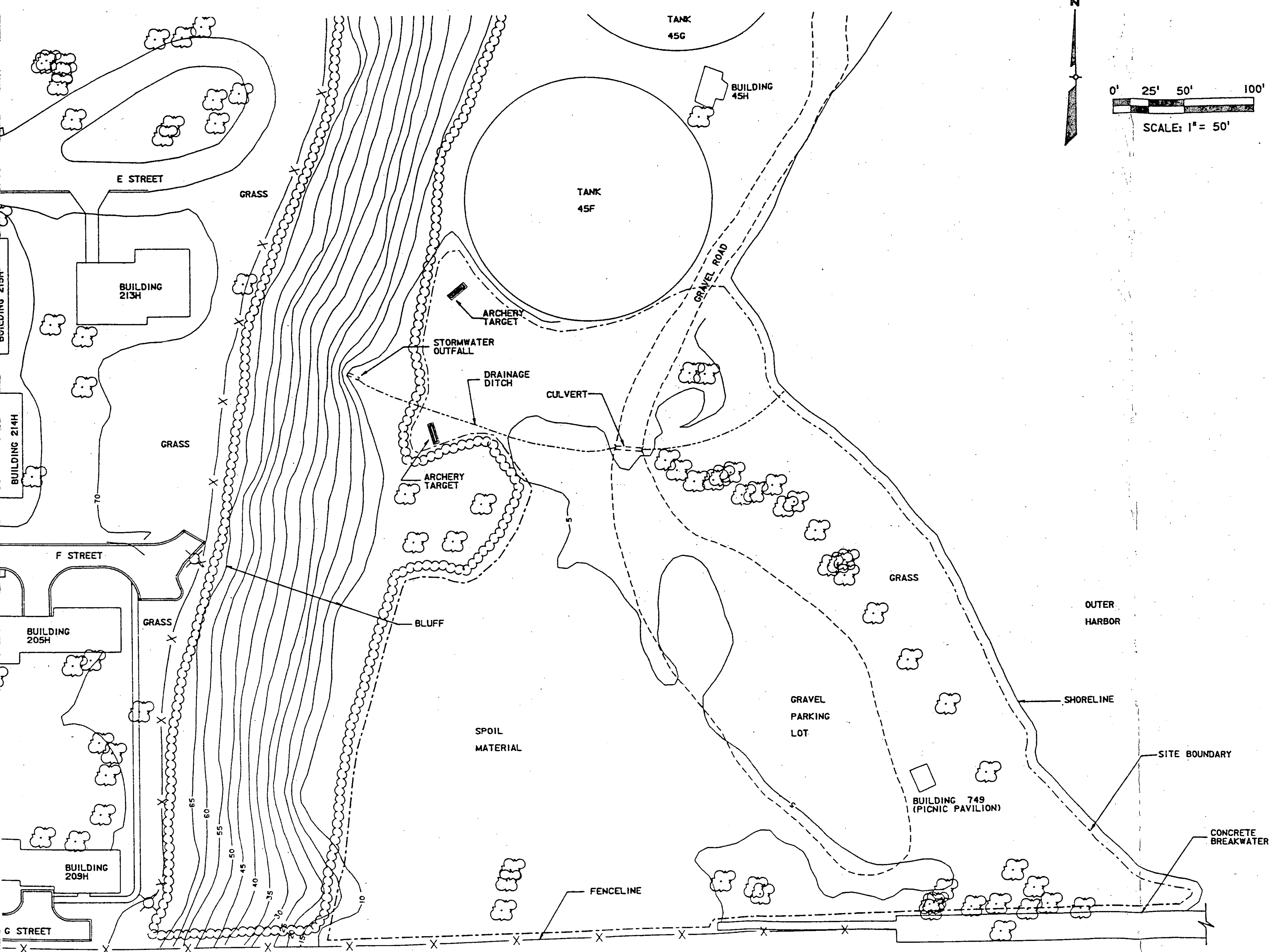


ABB-SEC DONOHUE ENVIRONMENT & INFRASTRUCT
CHICAGO, ILLINOIS

DESIGN:	DRAWN:	CHECK:
SUPV:	CH ENG:	

SUBMITTED BY: (NAME) (TITLE) (D

OFFICER IN CHARGE

APPROVED DATE

REV.	DESCRIPTION	PREP. BY	DATE APPROVED

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

SOUTHERN DIVISION CHARLESTON, SC

FIGURE 2-4 LOCATION MAP

SITE 12 - HARBOR DREDGE SPOILS AREA
REMEDIAL INVESTIGATION
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

APPROVED DATE SOUTHDIV FOR COMMANDER, NAVFAC

SENT TO: DATE:

CODE I.D. NO.

SCALE: AS SHOWN

SPEC. NO.

CONSTRUCTION CONTRACT NO.

NAVFAC DRAWING NO.

SHEET OF

SIZE: GIS. SH. NO.

The NTC is located in the Wheaton Morainal Country of the Great Lakes section of the Central Lowland physiographic province. The facility is situated on land with a constant elevation of 650 feet above mean sea level (MSL), plus or minus 10 feet, with the exception of the Pettibone Creek area, which is 600 feet ABMS, and the eastern portion of the NTC along Lake Michigan which is approximately 590 feet above mean sea level (Rogers, Golden & Halpern, 1986).

NTC is located within two major drainage basins, the Lake Michigan north drainage basin and the North Branch Chicago River drainage basin. Areas east of Green Bay Road drain into Lake Michigan, in large part by Pettibone Creek; areas to the west of Green Bay Road drain to Skokie River, which is locally referred to as Skokie Ditch. Site 4 is located west of Green Bay Road and drains to Skokie Ditch; Site 12 is located east of Green Bay Road and drains to Lake Michigan. Skokie River receives a major portion of its flow from urban runoff and storm drainage in the more than 20 miles it flows to Chicago. The water quality of both Skokie River and Pettibone Creek is reported to be poor because of urban runoff (Roger, Golden & Halpern, 1986).

2.2.2 Geology

2.2.2.1 Regional Geology

Lake County is blanketed by unconsolidated glacial tills deposited by Wisconsin stage glaciation during the Late Pleistocene Age 10,000 to 12,000 years ago (Mickelson et al., 1977). Several glacial moraine systems are present in Lake County including the Valparaiso Morainic System, the Tinley Moraine, and Lake Border Morainic System. Outwash and lake sediments are present in the Chain O' Lakes lowland in the extreme western portion of the county. Lake sediments are present in the extreme northeastern portion of the county within the Lake Chicago Plain (Hansel, 1983).

The Valparaiso Morainic System, Tinley Moraine, and Lake Border Morainic System are composed of Wadsworth Till. The Wadsworth Till is divided into upper and lower units which are commonly separated by relatively thin outwash deposits. The Lake Border Morainic System is composed of the upper unit of the Wadsworth Till. The Tinley Moraine and Valparaiso Morainic System are composed of the lower unit of the Wadsworth Till. The upper unit is characterially clayey and less illitic than the slightly sandy, relatively more illitic lower unit.

The NTC is located within the Lake Border Morainic System; the Wadsworth Till and Lake Plain deposits comprise the surficial material. These glacially derived deposits beneath the NTC are underlain by Silurian age bedrock consisting of Niagran and Alexandrian dolomite. Bedding is nearly horizontal to gently eastward-dipping in the vicinity of NTC. The shape of the bedrock surface is not well defined, but is generally considered to be nearly horizontal with slight surface indulations as a result of glaciation.

The bedrock surface is blanketed by glacial till that ranges from approximately 170 to 210 feet in thickness, based on review of several well logs from the Lake Bluff area. The predominant glacial deposit in the vicinity of the NTC is the Wadsworth Till member, an unsorted material consisting of elements ranging from clay to large boulders. The Wadsworth Till member has been further subdivided into phases according to the size of the dominant particles (clayey phase and sandy phase). The clayey phase is predominant in the vicinity of the NTC, but both the sandy phase and clayey phase may be interbedded as well. Because this till is unsorted, interstices between rocks in the till are filled with fine clay-sized particles, resulting in low permeabilities within the till unit (Dames & Moore, 1991).

The depositional patterns associated with the glacial till are highly variable; significant changes often occur over very short distances. In general, the till at the NTC is clayey with thin, irregular lenses of sand or silty sand occurring over limited areas. These small lenses or pockets of sandy material may have been deposited during minor fluctuations in the movement of the ice sheet causing thawing and hence fluvial deposition. Whatever the source of the coarser deposits, they are generally, although not always, discontinuous and limited in areal extent.

In addition to the localized deposits of coarse material within the till, the interface of the bedrock surface with the overlying till generally consists of from 1 to 15 feet of broken bedrock (dolomite), gravel, and sand and represents coarser material. This layer has been identified from local well logs and appears to be debris ground from the bedrock by the advancing ice sheet.

The Soil Survey of Lake County, Illinois indicates that surface soils at NTC have been classified primarily into two groups: the Morley-Beecher-Hennepin association and Made Land (SCS, 1970). Made Land is defined as areas of manmade cuts and fills, and areas covered by roads and buildings. Fill materials include a variety of soils and nonsoil materials that have not been distinguished. The Morley-Beecher-Hennepin association consists primarily of loams and silt loams that are characterized as nearly level to very steep in deep ravines, well drained to somewhat poorly drained, and having moderately slow to moderate permeability.

2.2.2.2 Site Geology

Site 4 - Fire Fighting Training Unit

The subsurface investigation performed by Dames & Moore as described in the 1991 Technical Memorandum, indicated the presence of glacial till and manmade fill within the top 5 feet. The shallow soil borings (0 to 5 feet deep) generally encountered sand, with variable percentages of silt, clay, and gravel, however, two of the nine soil borings encountered primarily clay. Five deeper soil borings (10 to 20 feet deep) encountered similar variations. A north-south cross-section intersecting monitoring wells on the western portion of Site 4 indicates variable lithologies within the shallow subsurface strata. The cross section suggests lenticular, discontinuous sandy units interbedded with the more predominant clay unit.

Site 12 - Harbor Dredge Spoil Area

Site 12 is underlain by approximately 100 feet of glacial till over bedrock. The composition of the underlying till is believed to be primarily clay, but no data are available to confirm this, nor to indicate the depth to which the effects of lake activity (water level, wave action, etc.) could be anticipated. The shallow borings installed by Dames & Moore in 1988 encountered various mixtures of primarily sand and gravel, with construction debris and lesser amounts of silt and clay. This is indicative of filling and active sorting by wave action of the lake, as would be expected by lake dredgings. Dames & Moore reported that during soil boring installation, additional debris was being deposited at this site and that during the last sampling event in August 1989 the site was being developed for recreational and aesthetic purposes.

2.2.3 Hydrogeology

2.2.3.1 Regional Hydrogeology

NTC is underlain by a sheet of glacial material up to 170 to 210 feet thick. This material ranges from unsorted to well sorted. Where unsorted, the glacial till commonly forms aquitards, while sorted materials comprise local water-bearing zones.

The IAS reported three water-bearing or saturated units within the till underlying NTC that may serve as migration pathways for contamination. The IAS did not consider the deep sand and gravel aquifer located at the interface of the till and the limestone bedrock as a pathway because the authors deemed it hydrologically isolated from the shallower till layers. The three water bearing zones are as follows: the area north of Buckley Road is underlain by a shallow water bearing unit less than 15 feet from the surface; the southern portion of NTC is underlain by saturated materials that rest at a minimum depth of 50 feet; the area immediately adjacent to the south side of Buckley Road is underlain by a water-bearing zone between 15 to 50 feet deep.

Groundwater occurs throughout the till, but due to the extremely low hydraulic conductivity of the clayey material, the till yields very little water and does not constitute an aquifer (Dames & Moore, 1991). Hydraulic conductivities in till are typically very low, with values in the range of 10 to the minus 10 centimeters per second (cm/sec) to 10 to the minus 3 cm/sec (USGS, 1983). The generally flat nature of these sheet-like deposits results in very low hydraulic gradients. Groundwater flow through these materials is governed by these low conductivities and is severely restricted. Regional groundwater flow is to the east; local groundwater flow and on the eastern portion of the facility is expected to be eastward towards Lake Michigan; groundwater flow across the western portion of the facility is likely directed westward, towards Skokie Ditch.

The discontinuous lenses of sandy materials are potential sources of groundwater and have been reported to have been used for limited water supplies in the past. Due to the proximity and acceptable water quality of Lake Michigan, the NTC does not rely on groundwater wells for drinking water. Water from the hydrologically isolated region of the till-bedrock interface is used as a source of irrigation water but is not known to supply potable water (Dames & Moore, 1991).

The water table is usually within 10 feet of the ground surface and may discharge to the surface in low-lying depressions. Groundwater movement is predominantly horizontal through the till, and rates of movement are slow due to the very low hydraulic conductivities. There is also a vertical component to groundwater flow as a result of fracturing in the till. However, compaction of the till at increasing depth, and infilling of interstices and fractures with calcareous cement, hydrologically isolate the deep limestones from the overlying fill by preventing vertical flow at depth (Rogers, Golden & Halpern, 1986).

The Silurian dolomite bedrock underlying the NTC is a primary source of groundwater, with yields reported to reach 25 to 40 gallons per minute. The consolidated bedrock is hydraulically isolated from the overlying till. An additional limited source of groundwater is the deep sand and gravel aquifer overlying the bedrock (Dames & Moore, 1991).

2.2.3.2 Site-Specific Hydrogeology

Site 4 - Fire Fighting Training Unit 1

Thin zones of sand and gravel saturated with water were encountered at shallow, intermediate, and deeper levels within the glacial till as reported in the 1991 Dames and Moore Technical Memorandum. From the data assembled Dames & Moore concluded that two different water bearing zones are present, one with a potentiometric surface less than 10 feet deep, the other with a potentiometric surface approximately 20 to 30 feet deep. Dames & Moore reported no indication that these two zones are connected or that wells in the same apparent zones area connected. In addition, they reported no indication that the shallow water bearing zones are connected to the bedrock aquifer.

Water level data collected from the four monitoring wells installed on and near the site was insufficient to determine the direction of groundwater flow. In addition, the extensive network of underground piping and the presence of various underground tanks is certain to influence groundwater flow. Sand and gravel used to backfill tank excavations and pipe trenches could act as sinks or conduits for shallow groundwater flow at the site. The inferred direction of groundwater flow within the shallow water bearing units, based on the general direction of surface water runoff is westerly.

Site 12 - Harbor Dredge Spoil Area

The Harbor Dredge Spoil Area is located in a flat area on the lakeshore, beneath a bluff, south of the sewage treatment plant. Ground elevations at the site are approximately 585 feet above MSL, only a few feet above lake level. The surface consists of hard-packed gravel, sand and silt covered with weeds and grasses. No site specific water level data are available; however, due to the site's proximity to the lakeshore, water levels are expected to be very shallow, with some groundwater discharge to the lake. Surface runoff drains directly into Lake Michigan. Groundwater quality at Site 12 has not been evaluated.

2.2.4 Private and Public Water Supplies

Throughout Lake County, water wells are the primary drinking water sources. Private residential wells are commonly screened in the glacial deposits overlying bedrock. Lake Michigan is used to supply drinking water to cities and villages including Lake Forest, Lake Bluff, and North Chicago.

Most water-producing wells in the area of the NTC are completed in the bedrock aquifer, which is isolated from contamination in shallow deposits by the low permeability till which overlies the bedrock. The NTC receives all its drinking water from Lake Michigan.

2.2.5 Climate

Lake County's eastern border is Lake Michigan. The lake, however, has little effect on the overall climate of Lake County and surrounding counties. Lake County experiences weather that is typical of a midcontinental climate. Changes in temperature, humidity, cloudiness, and wind direction are frequent occurrences. The summer season is warm with few prolonged hot spells. Major droughts are infrequent; however, long spells of dry weather during the growing season are common. Lake County experiences approximately 34 inches of rain per year (Rogers, Golden & Halpern, 1986).

The winter months usually have temperatures below freezing. Lake County experiences about 37.2 inches of snowfall per year. The average temperature during the year is 58° F (Dames & Moore, 1991).

3.0 INITIAL EVALUATION

3.1 INTRODUCTION

The following chapter presents an evaluation of the existing information for both Site 4 and Site 12. The first section describes the site conceptual model for Site 4 which includes the primary sources (USTs, ASTs, oil/water separator, christmas tree vaults, decant ponds, underground piping, fire fighting rings, burn buildings, drum storage area, pad-mounted transformers, building 3304); primary release mechanisms; (leaks and spills, flaking paint and asbestos containing building material, particulate emissions); secondary sources; secondary release mechanisms; pathways and receptors. The second section describes the site conceptual model for Site 12 which includes primary source (spoils); primary release mechanisms (leaching, erosion/runoff, dust emissions); secondary sources and pathways; and receptors.

3.2 SITE 4 - FIRE FIGHTING TRAINING UNIT

3.2.1 Types and Quantities of Waste Present

Available information about the types of contaminants potentially present at Site 4 include past engineering reports and information from the Navy regarding past practices. Wastes potentially present at the site include petroleum products, solvents, metals, pesticides, decant pond sludges and PCBs from transformer and dielectric oils.

3.2.2 Chemical Constituents in Site Media

Previous investigation at Site 4 identified volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), oil and grease, and lead in soil, and oil and grease in groundwater above background levels. However, the analytical data generated during the investigation could not be validated under USEPA Level III, and therefore, was not considered usable for its intended purpose. VOCs are generally highly mobile in both aqueous and gaseous phases and are considered to be contaminants of interest for this investigation. SVOC, referred to as polynuclear aromatic hydrocarbons (PAHs) have been detected in Site 4 soil samples. PAHs, which are byproducts of incomplete combustion and are considered relatively immobile, could be related to the burning of liquid fossil fuels at the site, but are more likely due to the ash and cinders that are frequently used as fill material. Petroleum hydrocarbons are also of interest because they may affect both soil and groundwater. Metals, though also relatively immobile, are important because they have been detected in soil and groundwater above background levels.

3.2.3 Potential Contaminant Migration Pathways and Impacts

3.2.3.1 Primary Sources

A Site Conceptual Model, developed for Site 4 (Figure 3-1), identifies twelve potential primary sources of contamination for consideration during this investigation: USTs, ASTs, oil/water separator system, Christmas tree vaults, decant ponds, underground piping, fire training rings, burn buildings, drum storage area, transformers, and Building 3304. These primary sources of contamination have potentially released or may potentially release contaminants into the environment resulting in impacts to soil, surface water, or groundwater. The following sections discuss the potential primary sources of contamination.

Underground Storage Tanks

Suspected USTs have been identified in both the IAS Report (Rogers, Golden & Halpern, 1986) and the Dames & Moore Technical Memorandum on the Remedial Investigation Verification Step (1991). USTs may be leaking currently or may have leaked in the past. USTs at Site 4 may have contained heating oil, diesel fuel, gasoline, or waste oil.

Aboveground Storage Tanks

Three ASTs currently exist at Site 4. Two 5,000-gallon, concrete bermed tanks contain or formerly contained No. 2 fuel oil or diesel fuel which was burned in practice fires. The third tank contains gasoline which was used to ignite practice fires. Releases due to overfills and/or leaks may have resulted in petroleum product contamination in the tank area.

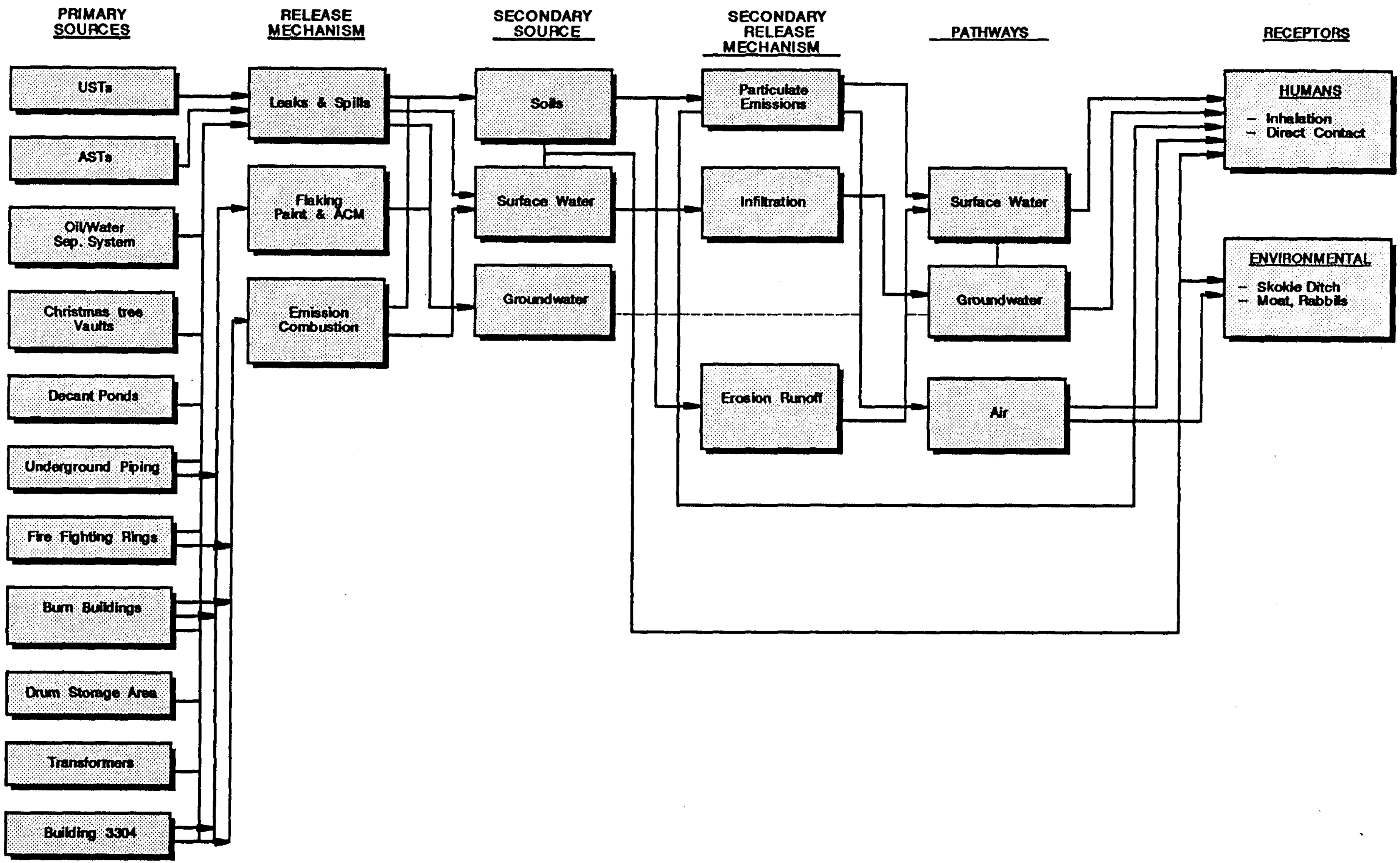
Oil/Water Separator System

The IAS and the Technical Memorandum report that the oil/water separator was installed around 1979. The system was designed to separate used oil and water which were drained from the burn buildings and fire training rings via the underground piping system. The oil was then pumped into holding tanks and drummed for off-site disposal or pumped into a tanker for removal. The water was discharged to the decant ponds located west of the oil/water separator system. The oil/water system consists of three concrete and brick subsurface pits (the smothering pit, the separator pit and the overflow pit), two pumps located in the smothering pit and two oil/water separators. Releases and/or spills of waste oils and oil/water mixtures may have impacted soils and groundwater.

FIGURE 3–1

SITE 4 – FIRE FIGHTING TRAINING UNIT (FFTU)
SITE CONCEPTUAL MODEL

NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS



Christmas Tree Vaults

Available maps pertaining to operations at Site 4 indicate that these square metal structures contained either a real or artificial tree which was ignited with gasoline. The gasoline was transferred to these vaults via underground piping. It is assumed that recruits would then enter the vaults and extinguish the fires. Releases and spills during training sessions may have impacted surrounding soils and groundwater.

Decant Ponds

Two rectangular Decant Ponds are situated on the western portion of Site 4. Once a fire in the burn buildings, rings, or Christmas tree vaults had been successfully extinguished, the remaining liquids in these structures (unburned diesel fuel, No. 2 fuel oil, gasoline, water and foam) were drained from the structures and transported via underground piping to the Decant Ponds where the liquid was discharged. Direct discharge to the Decant Ponds occurred through 1979, at which time an oil/water separator was installed. The Decant Ponds are apparently unlined. According to Navy personnel, each pond contains a bottom drain at the western end which allows the accumulated liquid in the pond to drain to an underground pipe which ultimately discharges to Skokie Ditch. Skokie Ditch flows from north to south and is located approximately 250 feet west of the Decant Ponds. The Decant Ponds were repositories for discharged liquids from the fire fighting training area and hence may contain VOCs, SVOCs, petroleum hydrocarbons, solvents, and metals. As a result, these constituents may have impacted subsurface soils, surface water and groundwater at the site.

Underground Piping

The diesel fuel, gasoline and water were supplied to the training areas via an underground piping system. Underground drain lines transported waste material to the oil/water separator and Decant Ponds. The integrity of the underground piping system is not known. Observations made during the October 1992 site visit suggested that the piping system still contains fuel. Leaks within the system may have impacted both subsurface soils and groundwater.

Fire Fighting Rings

During training exercises, the six fire fighting rings were typically filled with diesel fuel and ignited with gasoline. (At times, diesel fuel may have been floated on water, then ignited with gasoline.) Diesel fuel was transferred to the rings via underground piping. Recruits would then extinguish the fires. Releases of oil, water and gasoline may have occurred via surface splashing, spills, and leaks within the rings or underground piping. Solvents were also possibly released as they were occasionally used to ignite the fires.

Burn Buildings

Four burn buildings were used to simulate shipboard fires. Certain rooms within the buildings were filled with diesel fuel and ignited with gasoline. Recruits would enter the buildings and extinguish the fires. The diesel fuel was supplied to the buildings via the underground piping system. Waste diesel fuel was discharged through the underground drain lines to the oil/water separator and Decant Ponds. Metal structures located behind each of the buildings indicated when the buildings were sufficiently filled with diesel fuel. Releases of diesel fuel and gasoline are suspected in the building areas.

Drum Storage Area

Petroleum product recovered from the oil/water separator was containerized in 55-gallon drums and stored along the west fenceline of the FFTU in the Drum Storage Area. During the period from 1942 to 1979, other drummed wastes such as waste Solvent 144, turpentine, gasoline, crankcase oil and antifreeze were accepted and stored in this area. Although no drums were stored in the area at the time of the October 1992 site visits, stained and discolored soil was observed throughout the Drum Storage Area.

Pad-Mounted Transformers

Three transformers are situated within a fenced area on a concrete pad. Navy representatives have reported that the transformers are owned by the Navy and that they currently do not contain dielectric fluid; however, they may have contained PCBs in the past. Stressed vegetation surrounds the pad. No visible stains were noted during the October 1992 site visits, however, the surface soil had recently been disturbed around the pad due to water or sewer line repair. Past releases of dielectric fluid may have impacted surface and subsurface soils.

Building 3304

Building 3304, now boarded up, abandoned, and in disrepair, was used for classroom training during operation of the FFTU. The exterior and interior paint on the building has peeled to a great extent. During the site visit, it was observed that several sections of the roof have collapsed. Possible asbestos containing building material (ACBM) was observed in the building. Surrounding soils may be contaminated with lead from the peeled paint, and the lead paint and possible ACBM inside the building represent possible air emissions.

3.2.3.2 <u>Primary Release Mechanisms</u>

Primary contaminant release mechanisms include: leaks and spills from USTs, ASTs, oil/water separator, Christmas tree vaults, Decant Ponds, underground piping, fire fighting rings, burn buildings, drum storage area, transformers, and Building 3304; flaking paint and ACBM; particulate and volatile emissions from underground piping, fire fighting rings, burn buildings, drum storage area, transformers and Building 3304. Volatile emissions may also have been considered a primary release mechanism during operations at the NTC. Since two years have elapsed since operations, however, the role of volatile emissions as a release mechanism is not considered significant.

<u>Leaks and Spills</u>

Leaks and spills from preliminarily identified primary sources at the NTC may have directly impacted soil, surface water, and groundwater. Leaks and spills associated with past operations will be evaluated. Additionally, the nature and extent of contamination resulting from leaks and spills will be evaluated to provide sufficient site specific data for evaluation and selection of remedial alternatives.

In addition, infiltration of leaks and spills may affect these same media. To evaluate infiltration, the geology, hydrogeology, presence and properties of contaminants, and nature and extent of contamination will be investigated.

<u>Flaking Paint and Asbestos Containing Material</u>

Exterior flaking paint from preliminarily identified primary sources at the NTC may have directly impacted surface and subsurface soil. The nature and extent of contamination resulting from flaking exterior paint will be evaluated to provide site specific data for the evaluation and selection of remedial alternatives.

Interior flaking paint and deteriorated ACBM may impact soils. An assessment of the interior of the building will be performed to evaluate the quantity of ACBM and lead paint. ACBM will require abatement prior to building demolition, while lead paint within the building may not.

<u>Particulate Emissions</u>

Particulate emissions as fugitive dust from the preliminarily identified primary sources may impact soil, surface water, and air in the vicinity of the NTC. The presence of contamination at primary sources will be investigated.

In addition, airborne lead and ACBM dust may impact soil, surface water and air in the vicinity of Site 4. The presence and extent of lead and ACBM will be investigated.

3.2.3.3 Secondary Sources

As shown on the Site Conceptual Model (Figure 3-1), soil can be a secondary source of contamination after being impacted through the above release mechanisms. Contamination may also result from groundwater fluctuation into the unsaturated zone in the vicinity of the primary sources. The types and concentrations of contaminants present in the soil at primary source areas will be investigated to allow an evaluation of the soil's ability to act as a secondary source.

Surface water and sediment may act as a secondary source after being impacted by contaminants from sewers and underground piping or as a result of leaks, spills, or particulate emissions. The types and concentrations of contaminants present in surface water and sediment will be investigated to evaluate the ability of these media to act as secondary sources.

3.2.3.4 Secondary Release Mechanisms

If soil is impacted, the soil can serve as a source of groundwater contamination through advective and diffusive flow. Similarly, contaminated surface water could infiltrate into the unsaturated zone and spread contamination through advective and diffusive flow. Erosion of surface soils can serve as a source of surface water contamination and air emissions. Airborne particulates from contaminated soils may result in surface water contamination. Defining the hydrogeology and hydrology of the site will provide information about groundwater flow, soil permeabilities, and depositional environments which will be useful in assessing secondary release mechanisms. Evaluating the nature and extent of soil contamination will provide information about potential surface water contamination from particulate emissions.

3.2.3.5 Pathways

Pathways for human or environmental exposure to contaminants present at the NTC include groundwater and surface water.

<u>Groundwater</u>

Groundwater is potentially an important contaminant migration pathway at the NTC because groundwater may be impacted by primary and secondary contaminant sources and provide a contaminant migration pathway to receptors.

Surface Water

If soil, surface water, and sediment at the NTC are impacted, runoff from surface spills, infiltration from primary sources, and particulate emissions would be the expected causes. Interconnection between surface water and groundwater systems may also result in surface water acting as a migration pathway for contaminants into groundwater.

Air

Air impacted by particulate emissions from primary sources may act as a migration pathway of contaminants to off-site receptors.

3.2.3.6 Receptors

Exposure routes for groundwater include ingestion, inhalation and direct contact. Exposure routes for surface water include ingestion and direct contact. Exposure routes for air include inhalation and direct contact. To complete a risk evaluation it is necessary to characterize the nature and extent of contaminants in soil, surface water, sediment, and groundwater, and compare the results of characterization to existing health-based regulatory standards. Potential human receptors include, but may not be limited to, workers in Building 3311, workers at the golf course, golfers, and nearby residents.

3.3 SITE 12 - HARBOR DREDGE SPOIL AREA

3.3.1 Types and Quantities of Waste Present

Available information about the types of contaminants potentially present at the NTC is contained in past engineering reports. Wastes potentially present at Site 12 include VOCs, heavy metals, and pesticides.

3.3.2 Chemical Constituents in Site Media

Previous investigation at Site 12 identified VOCs, pesticides and metals in soil above background levels. However, with the exception of the pesticide/PCB data, the analytical data from previous investigations could not be validated under USEPA Level III and therefore are not considered usable for their intended purpose.

In addition, the priority pollutant VOCs detected are all common laboratory contaminants. Metals, though generally considered relatively immobile, have been detected in soil above background levels.

3.3.3 Potential Contaminant Migration Pathways and Impacts

3.3.3.1 Primary Sources

A Site Conceptual Model, developed for Site 12 (Figure 3-2), identifies the Harbor Dredge Spoil Area as the potential primary source of contamination for consideration during this investigation. This primary source of contamination has potentially released or may potentially release contaminants into the environment resulting in impacts to soil, surface water, sediment, or groundwater. The following section discusses the potential primary source of contamination.

Harbor Dredge Spoil Area

The lake dredgings or other fill materials that have been deposited at the Harbor Dredge Spoil Area contains a number of heavy metals and pesticide contaminants. Several heavy metals are present at concentrations exceeding those representative of natural soils; of these lead and mercury are of concern due to their toxicity to humans and their prevalence throughout the lateral and vertical extent of the site.

3.3.3.2 Primary Release Mechanisms

Primary contaminant release mechanisms include: leaching and dust emissions from the primary source, and erosion of the primary source.

Leaching

Leaching of contaminants within the spoils area may have impacted natural sediments and groundwater. The nature and extent of contamination resulting from leaching will be evaluated to provide sufficient site specific data for evaluation and selection of remedial alternatives.

Erosion/Runoff

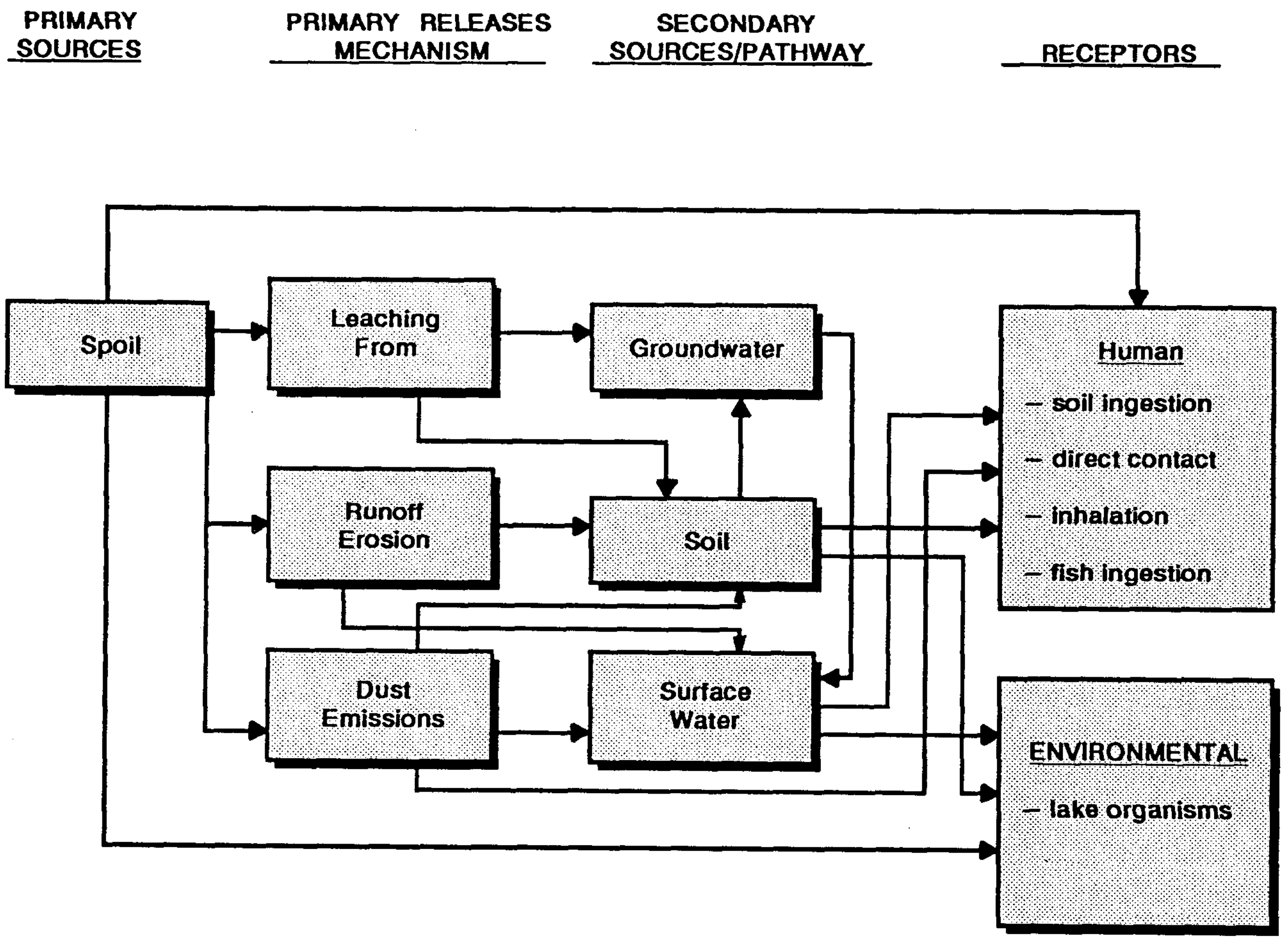
Erosion of spoils materials and surface water runoff from the spoils area may impact soil and surface water. The nature and extent of contamination within Site 12 will be evaluated to provide sufficient data to develop appropriate remedial alternatives.

Dust Emissions

Dust emissions from the spoils area may impact surface water and soil. The nature and extent of contamination within the site area will be evaluated.

FIGURE 3-2

SITE CONCEPTUAL MODEL
SITE 12 – HARBOR DREDGE SPOIL AREA
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS



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3.3.3.3 Secondary Sources/Pathways

As shown on the Site Conceptual Model (Figure 3-2), soil, groundwater and surface water can be a secondary source of contamination. Soil as a secondary source and pathway may cause contamination of groundwater due to fluctuations within the unsaturated zone in the vicinity of the primary source. The types and concentrations of contaminants present in the soil at primary source areas will be investigated to allow an evaluation of the soil's ability to act as a secondary source and pathway.

Surface water and sediment may act as a secondary source and pathway after being impacted by contaminants from the spoils area as a result of erosion, runoff, and dust emissions. The types and concentrations of contaminants present in surface water and sediment will be investigated to evaluate the ability of these media to act as secondary sources and pathways.

Groundwater may act as a secondary source and pathway after exposure to contaminated spoils materials. The types and concentrations of contaminants present in the groundwater will be investigated to evaluate the ability of these media to act as secondary sources and pathways.

3.3.3.4 Receptors

Exposure routes for groundwater include ingestion, inhalation and direct contact. Exposure routes for soil include ingestion and direct contact. Exposure routes for surface water include ingestion and direct contact. Exposure routes for air include inhalation and direct contact. To complete a risk evaluation it is necessary to characterize the nature and extent of contaminants in soil, surface water, sediment, and groundwater, and compare the results of characterization to existing health-based regulatory standards.

R/71WPD/AA1

4.0 REMEDIAL INVESTIGATION APPROACH AND RATIONALE

4.1 INTRODUCTION

Data collected during the NTC RI will be used for a number of purposes which include: 1) determine the nature and extent of surface and subsurface soil and groundwater contamination, identify potential contaminant migration pathways, and evaluate whether contamination of surface water and sediment has occurred (site and waste characterization); 2) establish the level of protection needed for investigators or workers at the site (health and safety); 3) evaluate the threat posed by the site to public health and environment (risk assessment); and 4) provide site-specific contaminant characterization information for future evaluation of remedial technologies and alternatives.

Data needs specific to the NTC have been preliminarily identified by evaluating historical information concerning the site and the operation and maintenance of Sites 4 and 12; reviewing the Dames & Moore, 1991 Technical Memorandum on the RI Verification Step; developing a Site Conceptual Model (Figure 3-1); and determining what additional data are necessary to accomplish the project objectives. Data needs are identified in the following sections for achieving the overall site investigative approach and objectives. The investigation to be conducted at Site 4 and Site 12 is also subsequently discussed.

4.2 SITE 4 - INVESTIGATIVE APPROACH AND OBJECTIVES

The NTC RI for Site 4, the FFTU, consists of the following field tasks to accomplish the project objectives:

- Geophysical survey to locate potential USTs.

- Surface and shallow subsurface (hand augered) soil sampling to investigate nature and horizontal extent of soil contamination around transformers, buildings, the Drum Storage Area, and the Decant Ponds.

- Soil borings and subsurface sampling to evaluate potential impacts to soil in the vicinity of USTs, ASTs, underground piping, fire fighting rings, Christmas tree vaults, the oil/water separator system, and the Decant Ponds.

- Soil borings to evaluate site stratigraphy and collect geotechnical samples.

- Groundwater monitoring well installation and sampling to evaluate horizontal and vertical groundwater flow direction and gradients, monitor potential groundwater impacts, and establish background water quality.

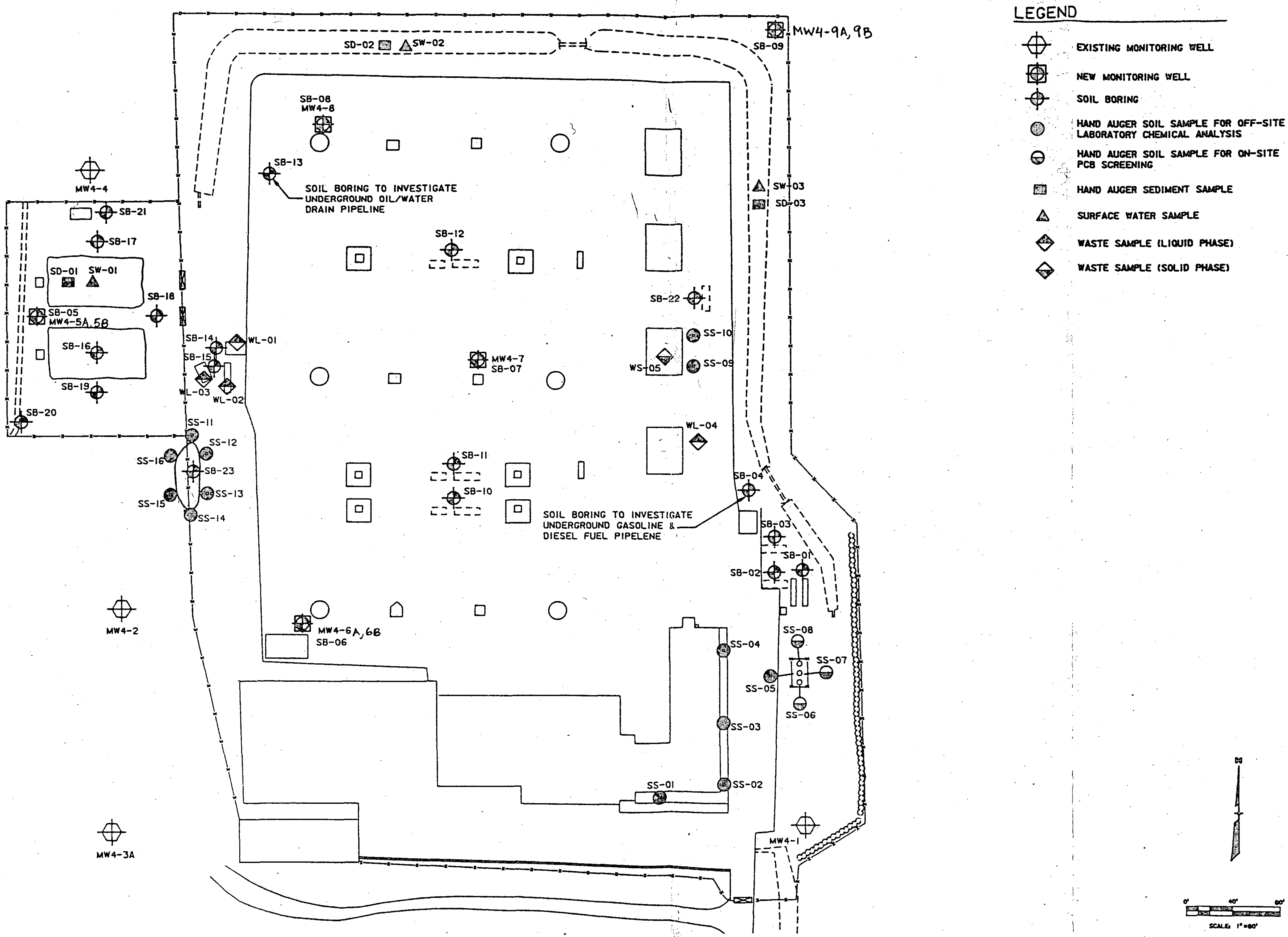
- Surface water and sediment sampling to monitor potential off-site migration of contaminants.

The investigative approach and objectives for the Site 4 RI are presented below for the media to be investigated. Table 4-1 summarizes the RI investigative approach, analytical parameters and sampling rationale. The RI for Site 4 consists of fourteen components: UST Investigation, Aboveground Storage Tank Investigation, Pad Mounted Transformer Area Investigation, Oil/Water Separator Investigation, Building 3304 Investigation, Decant Pond Investigation, Underground Piping Investigation, Fire Fighting Rings Investigation, Christmas Tree Vault Investigation, Burn Buildings 3304A-D Investigation, Drum Storage Area Investigation, Site Stratigraphy and Hydrogeology Investigation, and Surface Water and Sediment Investigation. Sample locations are presented on Figure 4-1. Previously detected analytes at Site 4 are presented in Table 4-1. The RI Investigative Approach, Analytical Parameters and Rationale for Site 4 are presented in Table 4-2. Summary of laboratory analysis of samples collected is presented in Table 4-3.

Surface and subsurface soil sampling will be conducted to evaluate the potential impacts of leaks and spills from USTs, ASTs, Drum Storage Area, transformer pads, oil/water separator, underground piping, fire fighting rings, Christmas tree vaults, burn buildings, and Decant Ponds. Surface soil samples will be collected from a depth of 0 to 0.5-foot to investigate the nature and horizontal extent of surface contamination associated with former site operations and evaluate the potential for contaminated surface soils to impact groundwater or surface water. Surface soil sample locations were selected based upon historical site information, and contamination detected during previous investigations.

Subsurface soil samples will be collected from potentially impacted areas to investigate vertical extent of contaminant migration. In addition, soil borings will be located in areas where historical information indicated potential contamination and where surface contamination was noted. Laboratory analysis of surface and subsurface soil samples will include the Target Compound List (TCL) Base Neutral Acids (BNA), TCL PCB/pesticides, TCL volatile organic compounds (VOCs) (subsurface samples only), Target Analyte List (TAL) metals, and Total Recoverable Petroleum Hydrocarbon (TRPH).

Subsurface soils will be continuously sampled and submitted for laboratory analysis based on visual contamination or field screening readings. Soil borings will be abandoned with cement-bentonite grout upon completion of sampling.



DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION CHARLESTON, SC

FIGURE 4-1 SAMPLE LOCATIONS

SITE 4-FIRE FIGHTING TRAINING UNIT
REMEDIAL INVESTIGATION
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

SEC DONOHUE ENVIRONMENT & INFRASTRUCTURE
CHICAGO, ILLINOIS

REV.	DESCRIPTION	PREP. BY	DATE	APPROVED

DESIGN: DRAWN: CHECK:
SUPV: CH ENG:
SUBMITTED BY: (NAME) (TITLE) (DATE)
OFFICER IN CHARGE
APPROVED DATE
APPROVED SOUTHDIV FOR COMMANDER, NAVFAC DATE

SENT TO: DATE:
CODE I.D. NO.
SCALE: AS SHOWN
SPEC. NO.
CONSTRUCTION CONTRACT NO.
NAVFAC DRAWING NO.
SHEET OF
SIZE: GIS. SH. NO.

TABLE 4-1

PREVIOUSLY DETECTED ANALYTES - SITE 4
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

PARAMETERS	CONCENTRATION RANGE
SOIL SAMPLES	
PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS (ug/kg)	
Acetone	ND-150
Chlorobenzene	ND-62
Methylene Chloride	ND-220
Toluene	ND-30
PRIORITY POLLUTANT SEMIVOLATILE ORGANIC COMPOUNDS (ug/kg)	
Benzo(g,h,i)perylene	ND-870
bis(2-ethylhexyl)phthalate	ND-11,000
Fluoranthene	ND-530
2-Methylnaphthalene	ND-21,000
Naphthalene	ND-5,700
Phenanthrene	ND-1,000
Pyrene	ND-870
PRIORITY POLLUTANT METALS (mg/kg)	
Lead	8.7-299.0
GROUNDWATER SAMPLES - DECEMBER 1988	
PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS (ug/L)	
Acetone	ND (all samples)
Chlorobenzene	ND (all samples)
Methylene Chloride	ND (all samples)

TABLE 4-1 (Continued)

PREVIOUSLY DETECTED ANALYTES - SITE 4
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

PARAMETERS	CONCENTRATION RANGE
PRIORITY POLLUTANT SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	
bis(2-ethylhexyl)phthalate	ND (all samples)
PRIORITY POLLUTANT METALS (ug/L)	
Lead	ND (all samples)
Mercury	0.38*
Zinc	ND*
OTHER PARAMETERS (mg/L)	
Chloride	5.1*
Total Organic Carbon	8*
Oil and Grease	49.7-237.6
GROUNDWATER SAMPLES - MARCH 1989	
PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS (ug/L)	
Acetone	ND-12
Chlorobenzene	ND-3
Methylene Chloride	ND-13
PRIORITY POLLUTANT SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	
bis(2-ethylhexyl)phthalate	ND-13

TABLE 4-1 (Continued)

PREVIOUSLY DETECTED ANALYTES - SITE 4
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

PARAMETERS	CONCENTRATION RANGE
PRIORITY POLLUTANT METALS (ug/L)	
Lead	3.3-5.7
Mercury	ND*
Zinc	11.9*
OTHER PARAMETERS (mg/L)	
Chloride	4.5*
Total Organic Carbon	0.87*
Oil and Grease	ND (all samples)
SURFACE WATER SAMPLES - DECEMBER 1988	
PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS (ug/L)	
Acetone	ND-110
Benzene	ND (all samples)
Chlorobenzene	ND (all samples)
Methylene Chloride	ND-5
PRIORITY POLLUTANT SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	
bis(2-ethylhexyl)phthalate	ND (all samples)
Chrysene	ND (all samples)
Fluorene	ND-900
2-Methylnaphthalene	ND-2,600
Pyrene	ND (all samples)
Phenanthrene	ND (all samples)

TABLE 4-1 (Continued)

PREVIOUSLY DETECTED ANALYTES - SITE 4
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

PARAMETERS	CONCENTRATION RANGE
PRIORITY POLLUTANT METALS (ug/L)	
Lead	ND-38
OTHER PARAMETERS (mg/L)	
Oil and Grease	ND-86,853
SURFACE WATER SAMPLES - MARCH 1989	
PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS (ug/L)	
Acetone	ND-26
Benzene	ND-2
Chlorobenzene	ND-5
Methylene Chloride	4-96
PRIORITY POLLUTANT SEMIVOLATILE ORGANIC COMPOUNDS (ug/L)	
bis(2-ethylhexyl)phthalate	6-11
Chrysene	ND-3
Fluorene	ND (all samples)
2-Methylnaphthalene	ND (all samples)
Pyrene	ND-11
Phenanthrene	ND-22
PRIORITY POLLUTANT METALS (ug/L)	
Lead	5.67-27.0

TABLE 4-1 (Continued)

PREVIOUSLY DETECTED ANALYTES - SITE 4
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

PARAMETERS	CONCENTRATION RANGE
OTHER PARAMETERS (mg/L)	
Oil and Grease	ND (all samples)

Abbreviations:

mg/kg - milligram per kilogram or parts per million
mg/L - milligram per liter or parts per million
ND - Not Detected
ug/kg - microgram per kilogram or parts per billion
ug/L - microgram per liter or parts per billion

Notes:

1. * An asterisk indicates that only one sample was analyzed for this parameter.
2. Tentatively Identified Compounds (TICs) were also detected at Site 4 but are not included in this table.
3. SOURCE: Dames & Moore, November 1991, Technical Memorandum on the Remedial Investigation Verification Step for the Naval Training Center, Great Lakes, Illinois.

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TABLE 4-2

SITE 4 - INVESTIGATIIVE APPOACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Source	Investigative Approach	Laboratory Analytical Parameters	Rationale
Former 5,000-gallon Gasoline UST East of Building 3305	(1) Geophysics - Magnetometry (2) 1 soil boring will be placed in the area of the former UST. Former UST Area will be located based on existing site maps. Soil samples will be collected with split spoons based upon visual contamination or field screening readings. At a minimum, soil samples will be collected from 6'-8', 8'-10' and the two-foot interval above the water table.	(1) None (2) TRPH BTEX Total Lead TCLP Lead Paint filter Open cup flashpoint Microbes/Nutrients	(1A) Determine whether an anomaly representative of an UST is present. (1B) Help identify the orientations and limits of UST if present. (2A) Determine whether residual petroleum contaminated soil is present at this location. (2B) Test the soil for special waste landfill disposal parameters. (2C) Determine the number of indigenous bacteria at the site, and nutrient concentrations.
5,000-gallon No. 2 Diesel Fuel UST East of Building 3305	(1) 1 soil boring will be placed adjacent to this existing UST. Soil samples will be collected with split spoons based upon visual contamination or field screening readings. At a minimum, soil samples will be collected from 6'-8', 8'-10' and the two-foot interval above the water table.	(1) TRPH BTEX PNAs Paint filter Open cup flashpoint Microbes/Nutrients	(1A) Identify potential releases from this existing tank. (1B) Test the soil for special waste landfill disposal parameters. (1C) Determine the number of indigenous bacteria at the site, and nutrient concentrations.
Three Possible 1,500-Gallon Gasoline USTs and Four Possible 2,500-Gallon Diesel USTs	(1) Geophysics - Magnetometry (2) A total of 4 soil borings will be advanced to investigate these 7 possible USTs. It is not known whether these 7 USTs were ever installed. Soil samples for chemical analysis will be collected with split spoons based upon visual contamination or field screening readings. At a minimum, soil samples will be collected from 6'-8', 8'-10' and the two-foot interval above the water table.	(1) None (2) TRPH BTEX PNAs Total Lead	(1A) Determine whether anomalies representative of these USTs are present (1B) If present, help determine orientations and limits of USTs. (2A) Identify potential petroleum contaminated soil at these locations.

TABLE 4-2 (continued)

SITE 4 - INVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Source	Investigative Approach	Laboratory Analytical Parameters	Rationale
Two 5,000-Gallon Diesel Fuel ASTs Southeast of Bldg. 3305	(1) 1 soil boring (north of the ASTs) to water table with continuous split spoons sampling. Soil samples for chemical analysis to be collected from split spoons with visually contaminated soil or field screening readings. At a minimum, one soil sample will be collected from 0'-2' and one sample will be collected from immediately above the water table.	(1) TRPH BTEX PNAs Total Lead	(1A) Identify potential spills or releases from these ASTs. (1B) Obtain site geologic/hydrogeologic information.
2,000-Gallon Gasoline AST North of Decant Ponds	(1) 1 soil boring (near dispenser) to the water table. Continuous split spoon samples will be collected. Soil samples for chemical analysis will be collected with split spoons based upon visual contamination or field screening readings. A minimum of one soil sample will be collected from 0'-2' and one sample will be collected from immediately above the water table.	(2) TRPH BTEX PNAs Total Lead	(1A) Identify potential spills or releases from this AST. (1B) Obtain site geologic/hydrogeologic information.
Pad Mounted Transformers	(1) 4 hand auger soil samples (0-0.5') will be collected from around the transformer concrete pad. These 4 samples will be screened for PCBs on-site. Any sample containing PCBs above 5 ppm based on screening will be sent to the lab. If none of the 4 samples contain PCBs above 5 ppm, one soil sample will be chosen and sent to the lab to verify screening results that PCBs are not present above 5 ppm in this area. Also, if a screening sample contains PCBs above 5 ppm, addition soil samples will be collected both vertically and horizontally, and screened on-site for PCBs.	(1) Pesticides/PCBs	(1A) Identify potential past leaks from these transformers. (1B) The on-site PCB screening technique will be used to preliminarily identify the vertical and horizontal extent of any PCB contamination in this area.
Oil/Water Separator	(1) At least one liquid phase sample will be collected from each of three subsurface pits associated with the oil/water separator: (1) The surge pit -- also referred to as smothering pit; (2) the sludge pit -- also referred to as separator pit; and (3) the overflow pit.	(1) TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	(1) Characterize the liquid material present in the three pits for disposal purposes.

TABLE 4-2 (continued)

SITE 4 - INVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Source	Investigative Approach	Laboratory Analytical Parameters	Rationale
Oil/Water Separator (Continued)	(2) 1 soil boring will be placed adjacent to the smothering pit and 1 soil boring will be placed adjacent to the overflow pit. Soil samples will be collected with split spoons based upon visual contamination or field screening readings. At a minimum, soil samples will be collected from 4'-6' and from the two-foot interval immediately above the water table in each soil boring.	(2) TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	(2A) Identify potential subsurface pit releases. (2B) Obtain site geologic/hydrogeologic information.
Building 3304	(1) Conduct building walkthrough (2) Conduct asbestos survey and collect samples of potential ACBM from inside the building (3) Collect 4 hand auger soil samples (0-0.5') from unpaved areas around the building. Soil samples will not be collected in areas where concrete/asphalt paving abuts the building.	(1) None (2) Asbestos (3) Total Lead TCLP lead	(1) Investigate the repair shop and boiler room for the presence of potential hazardous wastes/ hazardous materials. (2) Identify ACBM present in this building which would need to be removed prior to building demolition. (3) Identify potential contamination associated with flaking paint on outside of Building 3304.
Decant Ponds	(1) In north pond, collect two sediment samples (0-1' and 1'-2') from one location. (2) Use ATV drill rig to place one soil boring into the dry south pond floor. Advance the boring to the water table. Collect continuous split spoon samples. Collect soil sample, for chemical analysis from 0-0.5', 1'-2', 2'-4', 4'-6', 6'-8' and from the two-foot interval above the water table. (3) Collect one surface water sample from the north pond, if possible. (4) Place borings to the north, south, east, west and southwest of the ponds (5 total borings). Each boring will be drilled to the water table. Collect continuous split spoon samples. Soil samples for chemical analysis will be collected from 0'-2', 2'-4', 4'-6', 6'-8' and from the two-foot interval above the water table.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals, Dioxin One sample: TCLP lead Paint Filter Open Cup Flashpoint Bacteria/Nutrients (2) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals (3) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals (4) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals	(1) Characterize the sediments in the decant ponds. (2A) Determine vertical distribution of contaminants, if any, below the decant ponds. (2B) Obtain site geologic/hydrogeologic information. (3) Characterize surface water retained in the decant ponds. (4A) These five borings have been placed surrounding the decant ponds to identify whether potential contaminants have migrated laterally from the ponds. (4B) Obtain site geologic/hydrogeologic information.

TABLE 4-2 (Continued)

SITE 4 - INVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Source	Investigative Approach	Laboratory Analytical Parameters	Rationale
Underground Piping	(1) 1 soil boring will be placed adjacent to a selected run of diesel/gasoline underground piping and 1 soil boring will be placed adjacent to a selected run of oil/water drain line which connect with the oil/water separator. Soil samples for chemical analysis will be collected based upon visual contamination or field screening readings. At a minimum soil samples for chemical analysis will be collected from 2'-4' and from the two-foot interval immediately above the water table. The selected pipe runs will be located in the field based on existing engineering drawings.	(1A) Diesel/Gasoline Pipes, TRPH, BTEX, PNAs, Lead (1B) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals, Oil/Water Drain Pipe	(1) Identify potential contaminant sources associated with underground piping. Borings will be placed near piping joints, connections and/or elbow joints.
Fire Fighting Rings Christmas Tree Vaults	(1) 1 soil boring will be placed adjacent to Fire Fighting Ring FF1 and FF5 and adjacent to Christmas Tree Vault FC2. Soil samples for chemical analysis will be collected from 0'-2', 2'-4', 4'-6', 6'-8', 8'-10' and from the two-foot interval above the water table in each soil boring. Water table monitoring wells will be installed in these three borings.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals Microbes/Nutrients (1 Sample only)	(1A) Potential contaminant impacts associates with these structures will be assessed through the soil boring program. (1B) The 0-2', 4'-6' and 8'-10' samples in the borings will provide an indication of the vertical distribution of contamination, if any. (1C) These three structures (FF1, FF5 and FC2) were selected as representative of the other rings and vaults present.
Burn Buildings 3304A, 3304B, 3304 C and 3304D	(1) A backhoe will be used to remove pavement east of building 3304B. A hand auger will be used to collect soil samples from 0'-2' and 2'-4' at two locations from the exposed soil (4 samples total). (2) One sample will be collected of the ash-like material present on the floor of the burn buildings.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals (2) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals, Dioxin	(1A) Identify potential releases from the diesel fuel and drain pipelines connected to the east side of this building. (1B) Building 3304B was chosen as representative of the other burn buildings. (2A) Characterize the ash-like material for disposal. (2B) Dioxin was reported to be formed during combustion of diesel fuel. For this reason, the ash-like material will be tested for dioxin.

TABLE 4-2 (Continued)

SITE 4 -INVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Source	Investigative Approach	Laboratory Analytical Parameters	Rationale
Drum Storage Area (DSA)	(1) The DSA is estimated to be 15' by 70' in area. One boring will be placed in the approximate center of the DSA in an area of heavy staining. This boring will be advanced to the water table. Continuous split spoon samples will be collected and soil samples for chemical analysis will be collected from depths of 0-1', 1'-2', 2'-4', 4'-6', 6'-8', 8'-10', the 2-foot interval and immediately above the water table. (2) Six hand auger surface soil samples (0-0.5') will be collected just beyond the visual perimeter of the DSA in visually clean areas.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals (2) TRPH, TCL VOA, Dioxin (1 sample only)	(1A) Chemical samples collected from this boring will preliminarily identify the vertical extent of contamination in the DSA. (1B) Obtain site geologic/hydrogeologic information. (2A) The surface soil sample results will be used to determine the horizontal extent of soil contamination in the DSA. (2B) Dioxin will be tested for in one sample to assess the potential for past diesel fires in the fire fighting rings to have deposited this compound in the soil in DSA.
New On-Site Monitoring Well Soil Borings	(1) New monitoring wells will be installed to monitor the uppermost saturated zone (10-15' deep) at the following locations: adjacent to Ring FF1, Ring FF5, Vault FC2, and west of the Decant Ponds. Couplet wells will be installed at two of these locations (Ring FF1 and Decant Pond) to intercept the deeper Saturated Zone (20'-30' feet deep). At the couplet well locations, soil samples will be collected from the deeper well boring from 0'-2', 2'-4', 4'-6', 6'-8', 8'-10', 13-15' 18-20', 23-25', and the bottom two feet of the boring. Soil samples will not be collected from the shallower boring at each couplet location. At single well locations, soil samples will be collected from 0-2', 2-4', 4-6', 6-8', 8-10' and from the bottom two foot interval of the boring.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals	(1A) Soil samples from borings to assess subsurface conditions adjacent to FF1, FF5, FC2 and the Decant Ponds. (1B) The locations of these monitoring wells were selected to provide site hydrogeologic information and to assess site shallow aquifer conditions.
Background Sampling	(1) 3 background soil borings will be placed at the NTC parade grounds. Soil samples will be collected in these borings from 0'-2', 4'-6', 8'-10' and from the two-foot interval above the water table.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/ PCB, TAL Metals, Dioxin (1 sample) Microbes/Nutrients (1 Sample)	(1), (2), (3) Background sample results will be compared statistically and qualitatively to on-site sample results to assess the extent of site contamination.

TABLE 4-2 (Continued)

SITE 4 - NVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Task	Discussion/Approach	Laboratory Analytical Parameters	Rationale
	(2) One background boring will be placed in the north-east corner of the site to the water table. Soil samples for chemical analysis will be collected from 0-1', 1'-2', 2'-4', 4'-6', 6'-8', 8'-10' and immediately above the water table. (3) One background couplet monitoring well will be installed in the boring described above in (2).	(2) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals (3) None	
Groundwater Sampling	(1) Groundwater samples will be collected from the 4 existing on-site monitoring wells and the 5 new monitoring wells, three of which are couplet wells. Two sampling rounds will be conducted.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals (filtered and unfiltered), TDS, TSS, Microbes/Nutrients	(1) To identify potential site groundwater impacts.
Surface Water/Sediment Sampling	(1) Collect a surface water and sediment sample from two locations in the drainage ditch.	(1) TRPH, TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals,Dioxin (1 sediment sample only)	(1) Identify potential adverse impacts associated with runoff from the site to the drainage ditch.
Surveying	(1) The locations of all samples and soil borings will be surveyed horizontally. (2) Newly installed monitoring wells will be surveyed both horizontally and vertically.	(1) N/A (2) N/A	(1) Sample repeatability (2) Identify hydrogeologic parameters (ground-water flow patterns, groundwater elevations).

Abbreviations:

ACBM - Asbestos Containing Building Materials
O & G - Oil and Gas
PNAs - Polynuclear Aromatic Compounds
TRPH - Total Recoverable Petroleum Hydrocarbons
BTEX - Benzene, Toluene, Ethylbenzene, Xylenes
BNA - Base Neutral Acids
TAL - Target Analyte List
VOCs - Volatile Organic Compounds
N/A - Not Applicable
TBD - To Be Determined
PCB - Polychlorinated Biphenyls
VOA - Volatile Organic Analysis
TCL - Target Compound List

TABLE 4-3

SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER - REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

POTENTIAL SOURCE AND SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
FORMER 5,000 GALLON GASOLINE UST SOUTHEAST OF BUILDING 3305 Subsurface Soil (1 soil boring - samples from 6-8', 8-10' and two foot interval above water table)	VOC screening with PID/FID	TRPH BTEX Lead TCLP Lead Paint Filter Open Cup Flashpoint Microbes/Nutrients	3 3 3 1 1 1 1
EXISTING 5,000 GALLON DIESEL UST SOUTHEAST OF BUILDING 3305 Subsurface Soil (1 soil boring - samples from 6-8', 8-10' and two foot interval above water table)	VOC screening with PID/FID	TRPH BTEX PNAs Paint Filter Open Cup Flashpoint Microbes/Nutrients	3 3 3 1 1 1
OTHER POSSIBLE USTs (7) Subsurface Soil (4 soil borings - samples from 6-8', 8-10' and two foot interval above water table)	VOC screening with PID/FID	TRPH BTEX PNAs Lead	12 12 12 12
TWO 5,000 GALLON ASTs Subsurface Soil (1 soil boring - samples from 0'-2' and from two foot interval above water table)	VOC screening with PID/FID	TRPH BTEX PNAs Lead	2 2 2 2
2,000 GALLON GASOLINE AST NORTH OF DECANT PONDS Subsurface Soil (1 soil boring - samples from 0-2' and two foot interval above water table)	VOC screening with PID/FID	TRPH BTEX PNAs Lead	2 2 2 2
PAD - MOUNTED TRANSFORMERS Subsurface Soil (hand auger - samples from 0-1')	PCBs (4 samples minimum)	Pesticides/PCBs	1
OIL/WATER SEPARATOR Subsurface Soil (2 soil borings - samples from 4-6' and two foot interval above water table)	VOC Screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	4 4 4 4 4
Waste Samples (Oil/water separator vaults contents: 3 vaults; 1 liquid phase sample per vault)	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	3 3 3 3 3

TABLE 4-3 (continued)

SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER – REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

POTENTIAL SOURCE AND SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
BUILDING 3304 Building Materials	None	Asbestos (PLM)	10
Surface soil surrounding building (4 hand auger samples – 0–1')	None	Lead TCLP Lead	4 4
DECANT PONDS Sediment (2 hand auger samples from one location in North Decant Pond – 0–1' and 1–2')	VOC Screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Dioxin (2,3,7,8 – TCDD) TCLP Lead Paint Filter Open Cup Flashpoint Microbes/Nutrients	2 2 2 2 2 1 1 1 1 1
Surface Water (North Decant Pond)	Temp., pH, Specific Cond., D.O.	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	1 1 1 1 1
Subsurface Soil (Soil borings – 1 in south pond: samples from 0–1', 1–2', 2–4', 4–6', 6–8', and two foot interval above water table. 4 other borings: samples from 0–2', 2–4', 4–6', 6–8' and two foot interval above water table). 1 Deep boring: samples from 0–2', 2–4', 4–6', 6–8', 8–10', 13–15', 18–20', 23–25', and bottom two feet of boring.	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Microbes/Nutrients	35 35 35 35 35 1
UNDERGROUND PIPING – GASOLINE AND DIESEL LINES Subsurface soil (1 soil boring – samples from 2–4' and two foot interval above water table)	VOC screening with PID/FID	TRPH BTEX PNAs Total Lead	2 2 2 2
UNDERGROUND PIPING – DRAIN LINE TO OIL/WATER SEPARATOR Subsurface soil (1 soil boring – samples from 2–4' and two foot interval above water table)	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	2 2 2 2 2
FIRE FIGHTING RING FF1, FF5 Subsurface soil (1 soil boring (FF5) – samples from 0–2', 2–4', 4–6', 6–8', 8–10' and two foot interval above water table. A second soil boring (FF1) – samples from 0–2', 2–4', 4–6', 6–8', 8–10', 13–15', 18–20', 23–25' and bottom two feet of boring.	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Microbes/Nutrients	15 15 15 15 15 1

TABLE 4-3 (continued)

SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER - REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

POTENTIAL SOURCE AND SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
CHRISTMAS TREE VAULT FC2 Subsurface soil (Soil boring - lab samples from 0-2', 2-4', 4-6', 6-8', 8-10' and two foot interval above water table)	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	6 6 6 6 6
BURN BUILDING 3304B			
Surface Soil (2 hand auger soil samples from 0-2')	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	2 2 2 2 2
Subsurface Soil (2 hand auger soil samples from 2-4')	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	2 2 2 2 2
Waste Sample (ash-like material inside of building)	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Dioxin (2,3,7,8 - TCDD)	1 1 1 1 1 1
DRUM STORAGE AREA			
Subsurface Soil (Soil boring - samples from 0-1', 1-2', 2-4', 4-6', 6-8', 8-10' and two foot interval above water table)	VOC Screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	7 7 7 7 7
Surface Soil (6 hand auger samples from 0-0.5')	VOC Screening with PID/FID	TRPH TCL VOA Dioxin (2,3,7,8 - TCDD)	6 6 1
GROUNDWATER			
4 existing wells - two sampling rounds	Temp., pH, Specific cond., D.O.	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals (filtered) TAL Metals (unfiltered) TDS TSS	8 8 8 8 8 8 8 8
8 new wells - two sampling rounds (2 on-site couplet wells, 1 background couplet well, 2 on-site shallow wells)	Temp., pH, Specific cond., D.O.	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals (filtered) TAL Metals (unfiltered) TDS TSS Microbes/Nutrients	16 16 16 16 16 16 16 16 2

TABLE 4-3 (continued)

SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER - REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

POTENTIAL SOURCE AND SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
BACKGROUND MONITORING WELL SOIL BORING Subsurface Soil (1 soil boring - lab samples from 0-1', 1-2', 2-4', 4-6', 6-8', 8-10', 13-15', 18-20', 23-25', and bottom two feet of boring.	VOC screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Microbes/Nutrients	10 10 10 10 10 1
BACKGROUND SURFACE SOIL (3 hand auger lab samples from 0-0.5' collected at the NTC Parade Ground)	VOC Screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Dioxin (2,3,7,8 - TCDD)	3 3 3 3 3 1
DRAINAGE DITCH SURFACE WATER SAMPLING	Temp., pH, Specific cond., D.O.	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals	2 2 2 2 2
DRAINAGE DITCH SEDIMENT SAMPLING (2 hand auger sediment samples from 0-0.5')	VOC Screening with PID/FID	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals Dioxin (2,3,7,8 - TCDD)	2 2 2 2 2 1
QUALITY CONTROL SAMPLES (See Notes) Equipment Rinsate Blanks for Soil and Sediment Sampling Equipment	None	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals (unfiltered)	30 30 30 30 30
Equipment Rinsate Blanks for Waste Sampling Equipment	None	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals (unfiltered)	2 2 2 2 2

SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER – REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

POTENTIAL SOURCE AND SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
Equipment Rinsate Blanks for Surface Water Sampling	None	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals (unfiltered)	1 1 1 1 1
Field Blanks	None	TRPH TCL VOA TCL BNA TCL Pest/PCB TAL Metals (unfiltered)	3 3 3 3 3

ACRONYMS

ASTs – Aboveground Storage Tanks
BTEX – Benzene, Toluene, Ethyl Benzene and Xylene
D.O. – Dissolved Oxygen
FC – Christmas Tree Vault
FD – Field Duplicate
FF – Fire Fighting Ring
FID – Flame Ionization Detector
LD – Laboratory Duplicate
MS – Matrix Spike
MSD – Matrix Spike Duplicate
Pest/PCB – Pesticides/Polychlorinated Biphenyls
PID – Photoionization Detector
PLM – Polarized Light Microscopy
PNAs – Polynuclear Aromatic Compounds
QC – Quality Control
TAL – Target Analyte List
TB – Trip Blank
TCDD – Tetrachlorodibenzo-p-dioxin
TCL – Target Compound List
TCLP – Toxicity Characteristic Leaching Procedure
TDS – Total Dissolved Solids
TRPH – Total Recoverable Petroleum Hydrocarbons
TSS – Total Suspended Solids
USTs – Underground Storage Tanks
VOA – Volatile Organic Analysis
VOC – Volatile Organic Compounds

A – One Trip Blank sample will be placed in each cooler shipped containing VOA samples.
B – Number of equipment rinsate blanks is estimated based on one equipment rinsate blank per day per type of sampling equipment used.
C – One field blank will be collected per source of distilled water used during the RI. Also, a field blank will be collected from the water source used by the drilling subcontractor to steam clean drilling equipment.
D – Field duplicates will be collected at frequency of 10% per sample matrix.
E – Laboratory matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of 5% per sample matrix.

Groundwater monitoring wells will be installed so that the screened interval intersects contiguous geologic units where possible. Due to the complex geologic and hydrogeologic conditions of glacial fill, the soil boring program may require field modifications as site conditions warrant. groundwater flow across the site will be determined using groundwater elevation data from the proposed monitoring wells. The HALLIBURTON NUS Team is considering the installation of couplet monitoring wells (two monitoring wells installed adjacent to each other but screened in different units) to investigate vertical gradients within the saturated zone.

Groundwater sampling of the five new monitoring wells including the background well will be performed to characterize groundwater quality across the site and to evaluate whether groundwater has been impacted by primary and/or secondary sources on the site. Two sampling rounds will be conducted.

In-situ permeability tests (slug tests) will be performed on the five new monitoring wells using an in-situ data logger system. Results of the slug tests will be evaluated using the software Aqtesolve™, which uses the Bouwer and Rice method for unconfined aquifers.

Sampling locations will be surveyed horizontally for sample repeatability. New monitoring wells will be surveyed both horizontally and vertically so that groundwater flow patterns can be assessed. Detailed discussions of the investigative techniques, methods, and procedures are presented in the Quality Assurance Project Plan (QAPP).

4.2.1 Underground Storage Tank Investigation

Several existing, former, and possible USTs have been reported at Site 4 as follows: one former 5,000-gallon UST east of Building 3305; one existing 5,000-gallon diesel fuel UST located east of Building 3305; and three possible 1,500-gallon gasoline USTs, and four possible 2,500-gallon diesel USTs, located at the center of the site.

A magnetometer geophysical survey will be performed in areas suspected of containing USTs. The presence or absence of suspected USTs will be determined by first identifying geophysical anomalies to evaluate the need for further investigation. Magnetic anomalies considered to be representative of USTs or buried debris will be further investigated by advancing soil borings to identify the source of the magnetic anomalies. Soil borings installation advanced in the area of tanks was selected over test pit excavation to investigate USTs. The primary reason behind this selection is that test pit excavation would require the stockpiling and subsequent off-site disposal of large quantities of potentially contaminated soil. Soil borings will be advanced in the vicinity of known and suspected USTs (SB-02, SB-02, SB-07, SB-10, SB-11, SB-12 and SB-22).

Soil samples will be collected using split spoons and will be selected for laboratory analysis based on field screening results. At a minimum, soil samples will be collected from 6 to 8 feet, 8 to 10 feet, and the two foot interval above the water table. Laboratory parameters include TRPH; benzene, ethylbenzene, toluene, and xylene (BETX); and lead to identify potential residual petroleum contaminations. Additional parameters Toxicity Characteristic Leaching Procedure (TCLP) lead, paint filter and flashpoint) will be performed to test the soil for special waste landfill disposal parameters.

The location of confirmed USTs will be reported immediately to the Navy Remedial Project Manager (RPM) who will in turn notify the Illinois Environmental Protection Agency (IEPA). Information obtained during the excavation and analytical results for soil, tank contents, and groundwater will be incorporated into the RI report.

4.2.2 Aboveground Storage Tank Investigation

Two 5,000-gallon diesel ASTs are located southeast of Building 3305. One soil boring (SB-01) will be advanced north of the ASTs to identify potential spills or releases associated with the ASTs. Split-spoon samples will be collected continuously and soil samples for chemical analysis will be collected based on visual contamination of field screening results. Laboratory parameters include TRPH, BTEX, PNAs and Lead to evaluate the presence of petroleum products which may have spilled and/or leaked into site soils. A second soil boring (SB-21) will be advanced adjacent to the dispenser of the aboveground storage tank. Table 4-2 presents the sampling approach, analytical parameters and rationale for the aboveground storage tank investigation.

4.2.3 Pad-Mounted Transformer Area Investigation

The pad-mounted transformer area will be investigated to identify if surrounding soils have been impacted by potential releases of PCB contaminated dielectric fluid. Four hand-augered soils samples (SS-05, SS-06, SS-07 and SS-08) will be taken from 0 to 0.5-foot around the transformer pad. These four samples will be screened on-site for PCBs. Samples containing PCBs exceeding 5 ppm based on the field screening will be sent to the laboratory for confirmatory PCB analysis. If field screening indicates that none of the four samples contain PCBs, one sample will be sent to the laboratory to verify that PCBs are not present above 5 ppm based upon preliminary field screening results. If the field screening indicates a sample contains greater than 5 ppm PCBs, additional samples will be collected vertically and horizontally to preliminary identify the horizontal and vertical extent of PCBs in the soil. Table 4-2 presents the sampling approach, analytical parameters and rationale for pad-mounted transformer area investigation.

4.2.4 Oil/Water Separator Investigation

The oil/water separator system will be investigated by advancing soil borings (SB-14, SB-15) to identify potential impacts from the subsurface pits. One soil boring will be placed adjacent to the smothering pit and one soil boring will be placed adjacent to the overflow pit. Soil samples will be collected and submitted to the laboratory based upon visual identification or field screening results. At a minimum, soil samples will be collected from 4 to 6 feet and from the two foot interval immediately above the water table. Because the oil/water system accepted waste liquids from the training area, which included petroleum products, solvents, and fire extinguishing foam, the laboratory parameters for soils were selected to detect the presence of these materials. The laboratory parameters include TRPH, TCL VOA, TCL BNA, TCL PCB/Pest, and TAL metals.

In addition, at least one liquid phase sample will be collected from each of the three subsurface pits associated with the oil/water separator: the surge pit, also referred to as the smothering pit; the sludge pit, also referred to as the separator pit; and the overflow pit. The samples will be analyzed for disposal parameters. Table 4-2 presents the sampling approach, analytical parameters, and rationale for the oil/water separator investigation.

4.2.5 Building 3304 Investigation

The investigation of Building 3304 focuses on possible ACBM, lead paint and hazardous materials inside the building and potential lead contamination of soils from flaking exterior paint. A survey of the building will be performed to identify the presence and quantity of ACBM and lead paint, and to assess the presence of hazardous wastes. A building specific sampling plan will be developed for ACBM based on the results of the building survey. Samples will then be collected for asbestos analysis.

Shallow (hand augered) samples (SS-01, SS-02, SS-03, SS-04) will be collected for lead analysis at four locations along the exterior of the building to identify potential impacts from flaking exterior paint. Table 4-2 presents the sampling approach, analytical parameters and rationale for Building 3304.

4.2.6 Decant Ponds

The Decant Ponds will be investigated to identify if potential impacts from contaminants discharged to the pits have impacted surrounding soils, groundwater and surface water. For the purposes of this investigation, the two decant ponds are considered to be one unit, and are assumed to be identical in construction and operation, and in the amounts and types of wastes they received. Each media will be sampled in one or the other of the decant ponds, but not both.

A sediment sample (SD-01) from 0 to 2 feet will be collected in the pit area to characterize the sediments in the decant ponds. Analytical parameters include TRPH, TCL VOA, TCL BNA, TCL PCB/Pest, TAL metals, and dioxin to cover the varied wastes such as waste oil, solvents, diesel fuel and gasoline, that were discharged to the ponds. The sample will also be analyzed for disposal parameters.

A soil boring will be advanced in the south decant pond (SB-16) to identify potential vertical distribution of contaminants, and to characterize geologic conditions. Continuous split spoon samples will be collected at 2-foot intervals for chemical analysis for the same parameters as the sediment samples.

To characterize surface water retained in the decant ponds, a surface water sample (SW-01) will be collected from the north pond, if possible. The north pond retains water, possibly due to a clogged drain, while the south pond is free of standing water as observed during the October 1992 site visits. Analytes include TRPH, TCL VOA, TCL BNA, TCL PCB/Pest, TAL metals.

Five borings (SB-05, SB-17, SB-18, SB-19, and SB-20) will be advanced around the decant ponds as shown on Figure 4-1 to identify if potential contaminants have migrated laterally from the ponds. Each boring will be drilled to the water table. Split spoon samples will be collected continuously to characterize the site geology and hydrogeology. Soil samples will be collected for chemical analysis from 0 to 2 feet, 2 to 4 feet, 4 to 6 feet, 6 to 8 feet and from the 2-foot interval above the water table. The soil samples will be subjected to the same analytical parameters described above. Table 4-2 presents the sampling approach, analytical parameters and rationale for the Decant Ponds.

4.2.7 Underground Piping

The extensive underground piping will be investigated to identify potential past releases of petroleum hydrocarbons, solvent or other waste materials. One soil boring (SB-04) will be advanced to investigate the underground gasoline and diesel fuel pipeline and one soil boring (SB-13) will be advanced to investigate the underground oil/water waste drain line.

Soil samples for chemical analysis will be collected based upon visual contamination and/or field screening. At a minimum, soil samples for chemical analysis will be collected from 2 to 4 feet and from the 2-foot interval immediately above the water table. Table 4-2 presents the sampling approach, analytical parameters and rationale for the underground piping.

4.2.8 Fire Fighting Rings

The fire fighting rings will be investigated to identify if potential spills or leaks of diesel fuel and/or gasoline may have impacted site soils and groundwater. Two soil borings, SB-06 and SB-08 will be advanced adjacent to FFI and FF5, respectively. Soil samples for chemical analysis will be collected from 0 to 2 feet, 2 to 4 feet, 4 to 6 feet, 6 to 8 feet, 8 to 10 feet, and from the 2-foot interval above the water table in each soil boring to preliminarily identify vertical distribution of contaminants, if any. Water table monitoring wells will be installed in the two borings to evaluate impacts to groundwater from potential releases from the fire fighting rings and to characterize the hydrogeology. Table 4-2 presents the sampling approach, analytical parameters and rationale for the fire fighting rings.

4.2.9 Christmas Tree Vaults

The Christmas tree vaults will be investigated to identify and potential impacts to surrounding soils from past spills and leaks. One soil boring, SB-07 will be placed adjacent to FC2. Soil samples for chemical analysis will be collected from 0 to 2 feet, 2 to 4 feet, 4 to 6 feet, 6 to 8 feet, 8 to 10 feet, and from the 2-foot interval above the water table in the soil boring to preliminarily identify potential vertical distribution of contaminants, if any. Chemical parameters will consist of TRPH, TCL VOA, TCL BNA, TCL PCB/Pest, and TAL metals to target the oils and solvents that were used in the vaults. A water table monitoring well will be installed in the boring to identify impacts to groundwater from potential releases from the Christmas tree vaults and to characterize the hydrogeology. Table 4-2 presents the sampling approach, analytical parameters and rationale for the Christmas Tree Vaults.

4.2.10 Burn Buildings 3304A-D

The area around the four burn buildings will be investigated to assess if potential releases have occurred from the diesel fuel and drain pipelines connected to the east side the buildings. Burn building 3304B was selected as representative of the four buildings. A backhoe will be used to remove pavement east of building 3304B. A hand auger will be used to collect soil samples from 0 to 2.0 feet and 2.0 to 4.0 feet at two locations (SS-10 and SS-09) for a total of four samples. Chemical parameters will consist of TRPH, TCL VOA, TCL BNA, TCL PCB/Pest, and TAL metals to target the oils and gasoline that were used in the burn buildings.

To characterize the ash-like material for disposal, one sample (WS-05) will be collected of the ash-like material present on the floor of the burn buildings and subjected to the same analyses presented above. In addition, because dioxin was reported to be formed during combustion of diesel fuel, the ash material will also be analyzed for dioxin. Table 4-2 presents the sampling approach, analytical parameters and rationale for the Burn Buildings.

4.2.11 Drum Storage Area

The drum storage area will be investigated to identify impacts to soil due to spills and leaks. A soil boring (SB-23) will be advanced in the center of the 15-foot by 70-foot area. The boring will be advanced to water table and continuous split spoon samples will be collected. Soil samples for chemical analysis will be collected from 0 to 1-foot, 1 to 2 feet, 2 to 4 feet, 4 to 6 feet, 6 to 8 feet, 8 to 10 feet and immediately above the water table.

Shallow hand-augered soil samples will be collected from six locations (SS-11, SS-12, SS-13, SS-14, SS-15 and SS-16) around the perimeter of the visually contaminated soil. The objective of the sampling is to preliminarily identify areal extent of the contaminated soil. The samples will be analyzed for TRPH, TCL VOA, and one sample for dioxin, as an indicator of contamination. Table 4-2 presents the sampling approach, analytical parameters and rationale for the Drum Storage Area.

4.2.12 Site Stratigraphy and Hydrogeology Investigation

The investigative approach for evaluating potential groundwater contamination and migration pathways involves investigative techniques to rapidly define site stratigraphy utilizing both indirect and direct methods. The stratigraphic investigation will evaluate the continuity of sand lenses within the glacial till which may provide a contaminant migration pathway, and will identify the depth, thickness, and physical characteristics of stratigraphic units. The proposed and existing groundwater monitoring network will:

- Establish horizontal and vertical groundwater flow directions, gradients, and flow rates.
- Monitor background water quality.
- Provide area-specific groundwater quality information.
- Monitor potential impacts downgradient of the Site 4
- Evaluate groundwater and surface water interactions.

Four new monitoring wells will be installed on-site at the locations (SB-05 converted to MW4-5, SB-06 converted to MW4-6, SB-07 converted to MW4-7 and SB-08 converted to MW4-8) shown on Figure 4-1 and will be continuously sampled to evaluate site stratigraphy. Two of the new monitoring well locations (MW4-5 and MW4-6) will consist of well couplets. The shallow well will be drilled into the uppermost saturated zone and screened at that zone (expected depth of 10 to 15 feet). The deep well will be drilled into the deeper saturated zone and screened at that zone (expected to be 20 to 30 feet deep). At each couplet location, the deeper well will be installed first. The locations were selected to provide horizontal and vertical groundwater flow direction data for use in conjunction with data collected from existing monitoring wells. In addition, a background soil boring/monitoring well (SB/MW-09) will be installed in the northeast corner of the site. It was determined that the previous background monitoring well (MW4-1) was not upgradient of on-site contamination sources. Proposed well locations will provide on-site upgradient background water quality information and downgradient water quality information indicative of potential contaminated groundwater migration off-site in addition to providing groundwater quality specific to individual investigative areas known or suspected to be impacted.

Soil borings will penetrate the first water bearing zone and continue 10 feet into the underlying unconsolidated unit or bedrock to identify the hydraulic and physical properties of the zone and underlying unit. Existing and new well installations will be sampled for chemical analysis. Two rounds of water level measurements and groundwater sampling will be completed.

Geologic cross-sections of the site and surrounding area will be constructed with existing soil boring logs, and the new soil boring logs.

4.2.13 Surface Water and Sediment Investigation

To evaluate whether contaminants released by leaks and spills, paint and ACBM flaking, or particulate emissions have impacted surface water and sediment at the NTC, surface water and sediment will be investigated. Laboratory analysis of surface water and sediment samples will provide an indication of contaminants such that a determination may be made if surface water and sediment pose a threat to human health or the environment, whether surface water and/or sediment has the potential to act as a migration pathway and secondary contaminant source, and if infiltration has the potential to impact groundwater. Surface water and sediment samples will be collected from the drainage ditch (SW/SD-02 and SW/SD-03) and from the decant ponds (SW/SD-01). Surface water samples from the drainage ditch and Decant Ponds will be collected in a manner such that if two liquid phases (including a product layer) are present, both will be submitted for laboratory analysis.

4.2.14 Background Sampling

Background samples will be collected for surface soils, subsurface soils, and groundwater as described in Table 4-2. Location SB-09 will serve as the background location because it appears to be topographically upgradient of the site and it is not located within the active training area where petroleum hydrocarbons were used. Couplet wells will be placed at this location to intercept shallow and deeper saturated zones. Additional background samples will be collected from the Parade Grounds located at the NTC near the main gate.

The investigative approach and rationale for each investigation area are discussed below. Discussions concerning approach, rationale, and sampling effort are based on information from the October 1992 site visit, the Site conceptual Model, and the Dames & Moore Technical Memorandum (1991).

4.3 INVESTIGATIVE APPROACH AND OBJECTIVES - SITE 12

The primary source of contamination at Site 12 is the spoil area, which encompasses the majority of the site. Harbor dredgings, suspected to be contaminated with PCBs and heavy metals, were deposited on the site on at least two occasions. In addition, the site has accepted demolition debris and other waste over the years. Of major concern is the current use of the site for picnic and recreational purposes. The investigation objectives are to delineate the nature and extent of contamination within the spoil area and to assess the potential for off-site migration of contaminants to human and environmental receptors. In addition, information will be collected to evaluate remedial alternatives for the site.

The approach will therefore focus on collecting soil and groundwater samples of both the spoil and the underlying natural sediments via a soil boring program. In addition, sediment sampling will be performed in the drainage ditch to assess whether runoff and erosion are causing migration of contaminants within the spoils area. Groundwater will also be evaluated to determine if it has been impacted by on-site primary sources. The geologic and hydrogeologic framework will be characterized to gain an understanding of potential secondary sources and migration pathways.

The investigative approach and objectives for the Site 12 RI are presented below for the media to be investigated. Table 4-4 presents previously detected analytes for Site 12. Table 4-5 summarizes the RI approach, analytical parameters and sampling rationale. A sampling and analysis summary is presented on Table 4-6. The Site 12 RI consists of four investigative components: on-site spoil material, sediment in the on-site drainage ditch, groundwater and background samples. Sample locations are presented on Figure 4-2.

4.3.1 <u>On-Site Spoil Material</u>

Twelve soil borings (SB-01 through SB-12) will be advanced across the site in a grid pattern. Each boring will be advanced until the native soil beneath the spoil and/or groundwater is encountered. Twenty hand augered soil borings will be advanced around the perimeter of the suspected spoils area to a maximum depth of 5 feet. Samples will be visually characterized as either spoils or natural soils. The purpose of the hand augered soil borings is to identify the horizontal extent of the spoils area. Samples will be logged, collected and analyzed as described in Table 4-5. The rationale for the boring and sampling plan is to preliminarily identify horizontal and vertical extent of soil contamination at the site and to characterize the spoil material for remediation.

TABLE 4-4

PREVIOUSLY DETECTED ANALYTES
SITE 12 - HARBOR DREDGE SPOIL AREA
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

PARAMETERS	CONCENTRATION RANGE
SOIL SAMPLES	
PRIORITY POLLUTANT VOLATILE ORGANIC COMPOUNDS (ug/kg)	
Methylene Chloride	ND-69
Acetone	ND-165
2-Butanone	ND-34
Toluene	ND-17
PRIORITY POLLUTANT PESTICIDES (ug/kg)	
4,4'-DDE	ND-830
4,4'-DDD	ND-430
4,4'-DDT	ND-160
PRIORITY POLLUTANT METALS (mg/kg)	
Antimony	ND-10
Arsenic	ND-20.85
Beryllium	0.74-2.20
Cadmium	ND-8.73
Chromium (total)	5.62-92.83
Copper	19.18-308.45
Lead	28.83-396.40
Mercury	0.26-5.14
Nickel	ND-78.43
Selenium	ND-2.34
Silver	ND-36.73
Zinc	65.26-845.28

TABLE 4-4 (Continued)

PREVIOUSLY DETECTED ANALYTES
SITE 12 - HARBOR DREDGE SPOIL AREA
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Abbreviations:

ug/kg - microgram per kilogram
mg/kg - milligram per kilogram

Notes:

1. TICs (Tentatively Identified Compounds) were detected, but were not included in this table.
2. Only soil was previously sampled and analyzed for Site 12.
3. These data could not be validated, and are provided for informational purposes only.

R/71WPD/AA2

TABLE 4-5

SITE 12 - INVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Matrix	Investigative Approach	Laboratory Analytical Parameters	Rationale
On-Site Spoil Material	12 on-site borings will be placed across the site. Each boring will be advanced until the native soil beneath the spoil is encountered and/or groundwater is encountered. Continuous split spoon samples will be collected in order to log each boring and to collect soil samples for chemical analysis. Soil samples for chemical analysis will be collected from 0'-0.5', 4'-6', and from the two-foot interval above the water table.	Soil samples for chemical analysis will be analyzed for: TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals Select samples will be analyzed for the following chemical and geotechnical parameters: TOC, soil pH, % organic matter, TCLP metals, grain size, permeability, % moisture, Atterberg limits, proctor density, triaxial compression, direct shear.	Soil samples will be subjected to chemical and geotechnical analysis to achieve the following objective. (1) Preliminarily identify the horizontal and vertical extent of soil contamination at Site 12. (2) Characterize the spoil material to assist in the evaluation of remedial alternatives. (for example, the spoil material's ability to support a clay cap)
On-site Spoil Material/ Natural Soils	20 hand augered soil borings will be advanced around the perimeter of the suspected spoils area to a maximum depth of five feet. Samples will be visually characterized as either spoils or natural soils.	None	The purpose of the hand augered soil borings is to identify the horizontal extent of the spoils area.
Sediment in the On-Site Drainage Ditch	3 sediment samples will be collected in the drainage ditch from a depth of 0'-0.5'.	TCL VOC, TCL BNA, TCL Pest/PCB, TAL Metals, TOC, Sediment pH	The sediment samples will be collected to evaluate potential impacts to the drainage ditch as a result of surface runoff from the spoil material. The ditch will be evaluated as a potential contaminant migration pathway to the Outer Harbor.
Groundwater	Water table monitoring wells will be installed in two of the twelve on-site soil borings. These wells will be constructed as 2-inch diameter wells with 10-foot screen intervals. The screen will be set to intersect the upper-most water table. Two rounds of groundwater samples will be collected from these wells.	TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals (total), TAL Metals (dissolved), Sulfate, Chloride, TOC, pH, Alkalinity, TDS, TSS, Nitrate-Nitrite, Ammonia	Two rounds of groundwater samples will be collected from the two on-site wells to identify if potential groundwater contamination is present as a result of contaminant leaching from the spoil material.

TABLE 4-5 (Continued)

SITE 12 - INVESTIGATIVE APPROACH, ANALYTICAL PARAMETERS AND RATIONALE
NAVAL TRAINING CENTER REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

Matrix	Investigative Approach	Laboratory Analytical Parameters	Rationale
Background Soil	A soil boring will be advanced at the top of the bluff at the west of the site. This boring will be advanced until groundwater is encountered. Soil samples for chemical analysis will be collected from 0'-0.5', 4'-6', and the two-foot interval above the water table.	TCL VOC, TCL BNA, TCL Pest/PCB, TAL Metals	These background soil samples will be grouped with background soil samples collected as part of the Site 4 RI to form a background soil sample data set. This background data set will then be compared to on-site soil sample data to assess the nature and extent of on-site contamination.
Background Groundwater	A water table monitoring well will be installed in the boring placed at the top of the bluff. This well will be constructed in the same manner as the two on-site wells. The screen of this well will be set to intersect the same water bearing zone as the two on-site wells.	TCL VOA, TCL BNA, TCL Pest/PCB, TAL Metals (total), TAL Metals (dissolved), Sulfate, Chloride, TOC, pH, Alkalinity, TDS, TSS, Nitrate-Nitrite, Ammonia	Two rounds of groundwater samples will be collected from this well. The analytical results of these groundwater samples will be compared to the on-site groundwater data to determine the presence or absence of groundwater contamination at Site 12. Also, by surveying the elevations and locations of the 3 wells, (1 background and 2 on-site wells) and by measuring the water level in each well, groundwater flow direction can be determined.

Abbreviations:

TAL - Target Analyte List
TCL - Target Compound List
TOC - Total Organic Carbon
PCB - Polychlorinated Biphenyl
TDS - Total Dissolved Solids
TSS - Total Suspended Solids

TABLE 4–6
SITE 12 – SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER – REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
SOIL	VOC screening with PID/FID	TCL VOC	39
(12 on–site borings and one background boring – samples in each boring from 0 to 0.5 feet, 4 to 6 feet and bottom of boring)		TCL BNA	39
		TCL Pest/PCB	39
		TAL Metals	39
		% Organic Matter	9
		TOC	9
		pH	9
		TCLP	9
		Grain Size	12
		Permeability	12
		% Moisture	12
		Atterberg Limits	12
		Proctor Value	12
		Triaxial Compression	12
		Direct Shear	12
SEDIMENT	VOC screening with PID/FID	TCL VOC	3
(Three to 0.5 foot samples in drainage ditch)		TCL BNA	3
		TCL Pest/PCB	3
		TAL Metals	3
		TOC	3
		pH	3
GROUNDWATER	pH	TCL VOC	6
(3 wells – 2 rounds)	Temperature	TCL BNA	6
	Specific Conductivity	TCL Pest/PCB	6
		TAL Metals (Unfiltered)	6
		TAL Metals (Dissolved)	6
		SO_4	6
		Cl	6
		TOC	6
		pH	6
		Alkalinity	6
		TDS	6
		TSS	6
		NO_2\\NO_3	6
		NH_3	6

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TABLE 4–6 (continued)
SITE 12 – SAMPLING AND ANALYSIS SUMMARY
NAVAL TRAINING CENTER – REMEDIAL INVESTIGATION
GREAT LAKES, ILLINOIS
JANUARY 1993

SAMPLE MATRIX	FIELD PARAMETERS	LABORATORY PARAMETERS	ESTIMATED FIELD SAMPLES
QUALITY CONTROL SAMPLES (See Notes) Equipment Rinsate Blanks for Soil and Sediment Sampling Equipment	None	TCL VOC TCL BNA TCL Pest/PCB TAL Metals (Unfiltered)	10 10 10 10
Equipment Rinsate Blanks for Groundwater Sampling Equipment	None	TCL VOC TCL BNA TCL Pest/PCB TAL Metals (Unfiltered)	2 2 2 2

ABBREVIATIONS

BNA – Base/Neutral and Acid extractable compounds
Cl – Chloride
FD – Field Duplicate
LD – Laboratory Duplicate
MS – Matrix Spike
MSD – Matrix Spike Duplicate
NH3 – Ammonia
PEST/PACB – Pesticides/Polychlorinated Biphenyls
QC – Quality Control
SO4 – Sulfate
TAL – Target Analyte List
TCL – Target Compound List
TCLP – Toxicity Characteristic Leaching Procedure
TDS – Total Dissolved Solids
TOC – Total Organic Carbon
TSS – Total Suspended Solids
VOC – Volatile Organic Compounds

Notes:

A – One trip blank sample will be included in each cooler containing VOC samples.
B – The number of equivalent rinsate blanks is estimated based on one equipment rinsate blank per day.
C – One field blank will be collected per source of deionized water used in the RI.
D – Field duplicate samples will be collected at frequency of 10% per sample matrix.
E – Laboratory MS/MSD samples will be collected at à frequency of 5% per sample matrix.

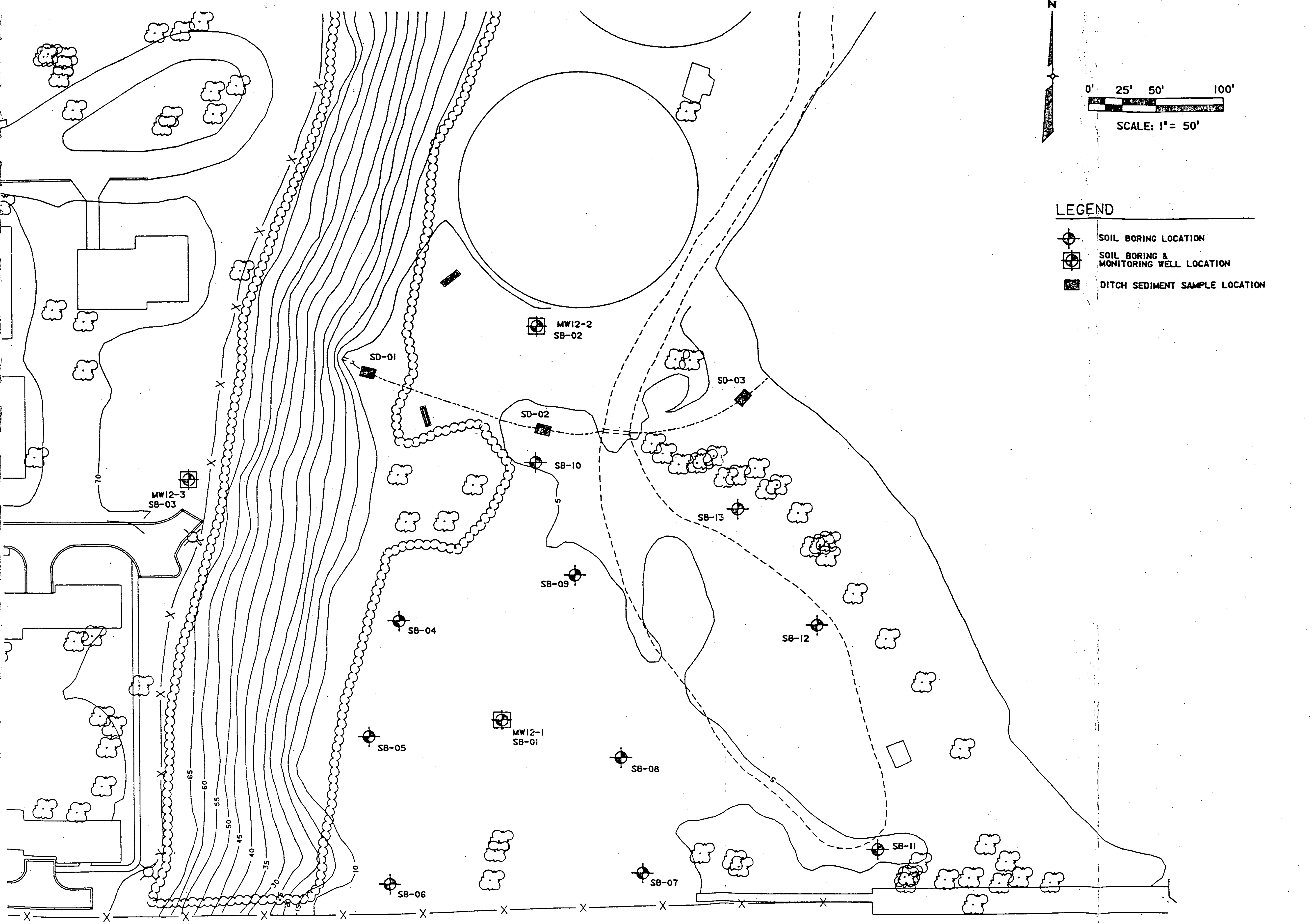

FIGURE 4-2 SAMPLE LOCATIONS

SITE 12 - HARBOR DREDGE SPOILS AREA
REMEDIAL INVESTIGATION
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND
SOUTHERN DIVISION CHARLESTON, SC

SEC DONOHUE ENVIRONMENT & INFRASTRUCTURE
CHICAGO, ILLINOIS

REV. DESCRIPTION	PREP. BY
DATE APPROVED	
DESIGN:	DRAWN:
SUPV:	CH ENG:
CHECK:	
SUBMITTED BY:	
(NAME)	(TITLE)
OFFICER IN CHARGE	
APPROVED	DATE
APPROVED	DATE
SOUTHDIV FOR COMMANDER, NAVFAC	
SENT TO:	DATE:
CODE	I.D. NO.
SCALE:	AS SHOWN
SPEC. NO.	
CONSTRUCTION CONTRACT NO.	
NAVFAC DRAWING NO.	
SHEET	OF
SIZE:	GIS. SH. NO.

4.3.2 Drainage Ditch Sediment

Three sediment samples (SD-01, SD-02 and SD-03) will be collected in the drainage ditch from a depth of 0 to 0.5-foot. The sediment samples will be collected to evaluate potential impacts to the drainage ditch as a result of surface runoff from the spoil material. The ditch will be evaluated as a potential contaminant migration pathway of the Outer Harbor of Lake Michigan. Table 4-5 contains the analytical parameters and the sampling rationale.

4.3.3 Groundwater Sampling

Water table monitoring wells will be installed in two of the 12 on-site soil borings. The background monitoring well, located off-site on the bluff will be used in conjunction with the two on-site wells to evaluate groundwater flow. These wells will be constructed as 2-inch diameter wells with 10-foot screen intervals. The screen will be set to intersect the uppermost water bearing zone. Two rounds of groundwater samples will be collected from the wells. The wells will be used to characterize the hydrogeology of the site area as well as to assess the impacts from the primary on-site source.

In-situ permeability tests (slug tests) will be performed on each of the monitoring wells using an in-situ data logger system. The data will be evaluated using the Geraghty & Miller software Aqtesolve™, which uses the Bouwer and Rice method to solve for permeability in unconfined aquifers. Table 4-5 contains the analytical parameters and the sampling rationale.

4.3.4 Background Sampling

Background samples will be grouped with background soil samples for Site 4. Background soil samples will be collected from the Parade Grounds located near the main entrance. Background soil samples will be obtained from a soil boring SB-03 located on top of the bluff, on the west side of the site. A background groundwater sample will be collected from MW12-3, the monitoring well installed in SB-03.

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5.0 REMEDIAL INVESTIGATION TASKS

The NTC RI will be implemented by performing standard tasks identified in the CTO No. 71 Statement of Work. These tasks are described in the following sections.

5.1 TASK 1 - PROJECT PLANNING

The project planning task includes activities from project initiation through completion of the project plans. The following project activities have been completed:

- Project kickoff teleconferences involving the Navy RPM, Navy technical specialists, SEC Donohue Program Manager, and SEC Donohue Project Manager.
- A project scoping meeting involving SEC Donohue technical specialists.
- A site visit.
- Collection and evaluation of existing information. (It is anticipated that collection and evaluation of existing data will continue throughout the RI.)
- Identification of preliminary remedial action alternatives.
- Preliminary determination of Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered requirements (TBCs).
- Preparation of RI draft plans including the Work Plan, Quality Assurance Project Plan (which includes a Field Sampling Plan), and Health and Safety Plan.

5.2 TASK 2 - FIELD INVESTIGATION

The field investigation will include the following activities: subcontracting for drilling, backhoe excavation of asphalt pavement, well installation, mobilization and demobilization, surface soil sampling, borehole drilling and subsurface sampling, monitoring well installation, slug testing, geophysics, groundwater sampling, sediment and surface water sampling, soil sampling, surveying, and quality control review of all activities.

5.3 TASK 3 - SAMPLE ANALYSIS AND DATA VALIDATION

This task includes laboratory analysis of samples collected during the field investigation and data validation. As indicated in this Work Plan and QAPP, samples collected during the field investigation will be analyzed through NEESA approved laboratories, and data validation will be performed by the HALLIBURTON NUS Team according to the HALLIBURTON NUS/NEESA Data Validation Template/Reference Book. Information from this task will be included in the RI report.

5.4 TASK 4 - DATA EVALUATION

This task will include analysis of chemical and physical data after the data are verified to be of acceptable accuracy and precision. Data evaluation will be initiated upon receipt of validated analytical data from the field investigation (Task 2) and after sample analysis and data validation of laboratory parameters are performed (Task 3). Data evaluation activities may include data reduction and tabulation, calculation of aquifer characteristics, statistical analysis, environmental fate and transport modeling, and mapping. The results of this task will be incorporated into the RI report.

5.5 TASK 5 - RISK ASSESSMENT

A Baseline Risk Assessment will be performed to evaluate the potential human health and environmental risks associated with chemical contamination at the NTC. A scoping meeting will be performed between the project manager, field team, and risk assessment team to coordinate activities such that appropriate information is gathered during the field activities to support the risk assessment.

The risk assessment consisting of an exposure assessment, a toxicity assessment, and an ecological assessment will characterize and quantify the potential impact of site contamination on various human and ecological populations. The exposure assessment analyzes the means by which human populations may be exposed to site contaminants. The toxicity assessment analyzes both the known adverse effects of each contaminant of potential concern and the regulatory criteria for each chemical. The ecological assessment will address the potential for site contamination to adversely affect local ecological receptors.

5.6 TASK 6 - REMEDIAL INVESTIGATION REPORT

A draft RI Report will be prepared which summarizes the activities performed, data collected, and conclusions drawn from on-site investigations. The report will include an updated site description, results of field investigation and laboratory analyses, a discussion of potential routes of contaminant migration, and a baseline risk assessment.

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6.0 PROJECT MANAGEMENT AND ORGANIZATION

6.1 PROJECT ORGANIZATION

The project organization chart shown on Figure 6-1 shows the lines of communication which will be adhered to during the RI. The Navy will solicit IEPA's approval and input for the project but most of the communication will be through the Navy and the HALLIBURTON NUS Project Team.

6.2 REPORTING

The Navy Remedial Project Manager is in direct contact with the IEPA and the CLEAN Program Manager. The Project Manager is responsible for maintaining the RI scope, budget, and schedule, and will provide day-to-day contact with the Navy RPM. The personnel responsible for quality assurance, health and safety, and project control report directly to the CLEAN Program Manager. The Field Team Leader reports to the RI Lead who in turns reports directly to the Project Manager. The Site Safety Officer and Site QA Manager report to the Field Team Leader and also report independently to the CLEAN Health and Safety Manager and QA Manager.

6.3 QUALITY ASSURANCE DOCUMENT CONTROL

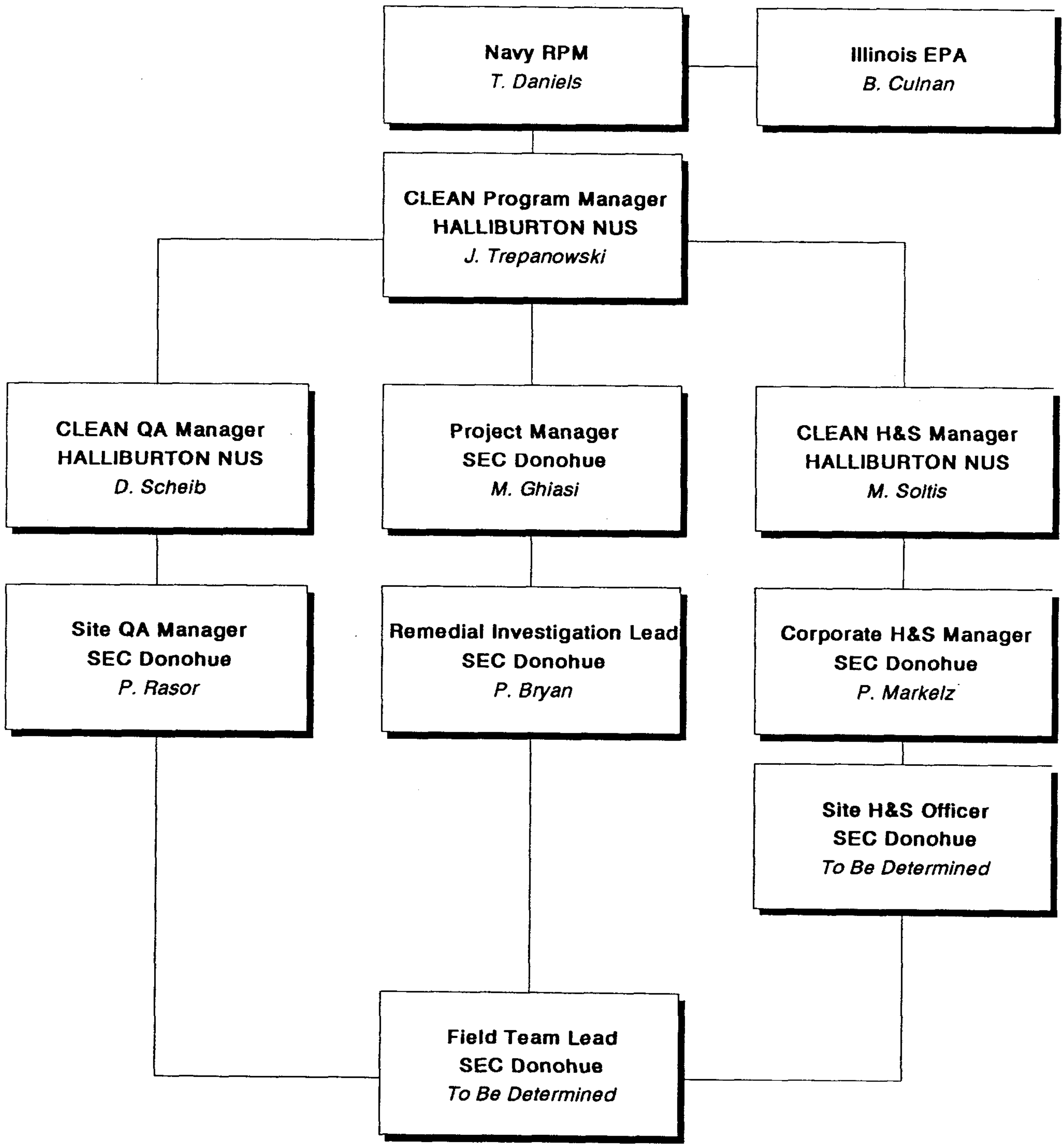
Quality assurance is provided for from sample collection through laboratory analysis and data evaluation. The Field Team Leader is responsible for QA/QC in the field. Field QC reviews are conducted on field documentation and daily on-site QC checks. Laboratory quality control is the responsibility of the contract laboratory as identified in the laboratory's QA plan which is an appendix to the QAPP. The laboratory reports to the QA Manager and CLEAN QA Manager who track the QA process through data validation. The QAPP more fully explains field and laboratory QA/QC procedures.

6.4 FIELD TEAM ORGANIZATION AND RESPONSIBILITIES

SEC Donohue and subcontractors will perform field sampling activities under the direction of the Field Team Leader. Field team members and their responsibilities follow.

FIGURE 6–1

PROJECT ORGANIZATION CHART
NAVAL TRAINING CENTER – REMEDIAL INVESTIGATON
GREAT LAKES, ILLINOIS
JANUARY 1993



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6.4.1 Field Team Leader

The Field Team Leader (FTL) will have overall responsibility for completion of field activities according to the Work Plan. The FTL is the overall coordinator of activities at the site and is the communication link between field team members, the Site QC Officer, the Field Data Coordinator (FDC), and the RI Lead and Project Manager. The FTL will assign specific field duties to team members in conjunction with the RI Lead and Project Manager. The FTL will be on-site during field activities and oversee operations. The FTL will be responsible for mobilization and demobilization of equipment and the field team and subcontractors. The FTL will direct the activities of subcontractors on-site. Logistical problems hindering field activities such as equipment malfunctions or availability, personnel conflicts, or weather dependent working conditions will be relayed to the FTL and resolved by the FTL.

Field team members will report directly to the FTL and provide daily verbal progress reports of field activities. The FTL is responsible for completing the Site Daily Log Book. The FTL is responsible for informing the RI Lead and Project Manager of daily activities. The FTL is responsible for supplying field team members with appropriate field notebooks and field documentation and forms.

6.4.2 Field Team

Field team members will report directly to the FTL. Field team members will conduct geophysical investigations, collect samples, advance soil borings, install groundwater monitoring wells, and observe test pit excavations. Decontamination of sampling equipment will be accomplished by the field team under the direction of the FTL. Field team members will complete and file personal Daily Time Logs and complete field documentation forms as indicated in the QAPP. Field team members will submit personal Daily Time Logs to the FTL for compilation into the Site Daily Log Book; the FTL will subsequently submit Daily Time Logs to the Site QC Officer for review and filing. Field team members will submit field documentation forms to the Site QC Officer and will relinquish custody of field samples to the FDC. Field team members may assist in sample packaging and shipping. All field team members, subcontractors, and site visitors will comply with the provisions of the Site-Specific Health and Safety Plan.

6.4.3 Site Quality Control Officer

The Site QC Officer will check the completion of Chain of Custody Forms, packaging and shipment of samples, Sample Log Book entries, and paperwork for accuracy and compliance with NEESA protocols and other specified procedures. The Site QC Officer will check Daily Time Logs and field data forms for accuracy and compliance with the

QAPP and Work Plan. The Site QC Officer is responsible for reviewing the calibration log sheets for field instruments. After review of these documents, the Site QC Officer is responsible for filing the field documentation. The Site QC Officer may be a member of the field team but cannot be the FDC.

6.4.4 Field Data Coordinator

The FDC will be responsible for maintaining an adequate supply of sample containers, preservatives, labels, and shipping materials in the field. The FDC will complete the Chain of Custody forms, assign Site-Specific Sample Numbers, and contact the laboratories regarding the shipment and arrival of samples. The FDC will receive samples from the field team and package them for shipment according to the procedures specified in Section 10.0. The FDC will ensure that custody seals are on shipping containers and that samples are shipped promptly. The FDC will file the shipping airbills in a secure area. The FDC will maintain sample collection, labeling, and shipment documentation in the Sample Log Book. The Sample Log Book will follow the format shown in Figure 6-4 in the QAPP. The FDC will receive field documentation reviewed by the Site QC Officer, copy the documentation, forward the copies to the Project Manager, and file the original documentation in a secure area. The FDC may also be a member of the field team but cannot be the Site QC Officer.

6.4.5 Site Health and Safety Officer

The Site Health and Safety Officer (SSO) will be present on-site during Level A, B, or C field operations and will be responsible for health and safety activities and the delegation of duties to the health and safety staff in the field. Because NTC is identified as low-hazard Level C or Level D, the SSO may direct site health and safety efforts through an Assistant SSO approved by the Corporate Health and Safety Manager (CHSM). The SSO will be responsible for implementing the site-specific Health and Safety Plan. The SSO may direct or participate in downrange activities as appropriate when this does not interfere with primary SSO responsibilities. The SSO has stop-work authorization which can be executed upon his/her determination of an imminent safety hazard, emergency condition, or other potentially dangerous situations, such as detrimental weather conditions. Authorization to proceed with work will be issued by the CHSM in conjunction with the Project Manager. The SSO will initiate and execute contact with support facilities and personnel when this action is appropriate.

6.4.6 Assistant Health and Safety Officer

On low-hazard Level C or Level D sites, the Assistant SSO may have collateral duties but must be qualified for the health and safety responsibility by the CHSM. At Level A, B, or specific Level C sites, the Assistant SSO will be the downrange person who accompanies field sampling teams and will report to the SSO. Additionally, he/she will be required to support the SSO when multiple operations are conducted that require monitoring and SSO surveillance. His/her primary responsibility is to provide appropriate monitoring to ensure the safe field operations. He/she will have access to continuous communications with the command post. The number of Assistant SSOs will be dependent upon the number of downrange operations occurring simultaneously, the designated level of protection, and the individual assignments made by the SSO. The Assistant SSO will also share responsibility with the FTL and the SSO for ensuring that safety practices are followed by downrange teams.

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7.0 SITE-GENERATED WASTE DISPOSAL

7.1 INTRODUCTION

Standard wastes generated during sampling activities include: drill cuttings, excavated soils, purge waters, decontamination fluids, personal protective equipment (PPE), disposable sampling equipment, and plastic sheeting. Waste disposal procedures described below will be followed by on-site personnel.

7.2 PURGE WATER AND DECONTAMINATION WATER

Purge water derived from the development and sampling of groundwater monitoring wells, and all decontamination fluids, will be containerized and discharged by the HALLIBURTON NUS Team to the NTC sanitary sewer system, with prior permission. If permission for this discharge is denied, containerized fluids will be disposed of at an off-site treatment, storage and disposal facility. Either the HALLIBURTON NUS Team or the NTC environmental point of contact (to be determined) will coordinate the disposal of the containerized fluids at an off-site facility, if necessary.

7.3 WASTES FOR REFUSE HAULER

Wastes generated on-site from office-related activities such as wastepaper and shipping boxes will be staged for disposal by a licensed refuse hauler.

7.4 DISPOSABLE PERSONAL PROTECTIVE EQUIPMENT

Disposable PPE, disposable sampling equipment, and plastic sheeting will be collected in appropriately labeled plastic bags and staged for future disposal by the remediation contractor. Labeling and disposal will be in accordance with appropriate regulations.

7.5 DRILL CUTTINGS AND EXCAVATED SOILS

Drill cuttings will be returned to borings and the remaining space, if any, will be backfilled with cement-bentonite grout slurry. Any excess cuttings will be spread across the area adjacent to the boring. Excavated soils will be returned to the excavation so as not to create an open excavation hazard.

8.0 SAMPLE IDENTIFICATION NUMBERS AND DOCUMENTATION

8.1 FIELD LOGBOOK

Bound field notebooks with sequentially numbered pages will provide the means for recording activities performed at the base. Entries will be described in as much detail as possible so that sampling events can be reconstructed without reliance upon memory.

The cover of each notebook will contain:

- Naval Training Center
- Great Lakes, Illinois
- Contract Number N62472-90-D-1298
- Contract Task Order
- Start Date
- End Date
- Book Number

At the beginning of each entry, the date, start time, weather, field personnel present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site and the purpose of their visit will be recorded in the field notebook.

Entries will be made in indelible ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed, and dated. The number and type of samples collected each day is typically noted in the field logbook although a detailed description of the sampling location is recorded on the appropriate field forms. If photographed, the film roll number and the number of the photograph taken at the location will be noted. Equipment used to make measurements will be identified along with results of Field Instrument Readings and other notable observations will be recorded.

8.2 SAMPLE LOGBOOK

Matrix samples collected for laboratory chemical analysis will be entered by the sample custodian in a separate bound notebook with sequentially numbered pages. The sample logbook will contain the following information for each sample collected for chemical or geotechnical analysis:

- Field sample identification.
- Type of sample (field, QC, QA).
- Depth of sample.

- Date and time of sample collection.
- Initials of sampler.
- Number and type of samples containers filled.
- Field screening readings, if any.
- Analyte(s).
- Laboratory.
- Date shipped.
- Airbill number.

8.3 FIELD SAMPLE IDENTIFICATION NUMBER

Each sample will be identified with a field sample identification number consisting of a project identifier, sample matrix code, sample location numbers, and a sample identifier. The components of the field sample identification number, including examples, are explained below. Samples collected from existing monitoring wells will incorporate the existing well numbers into the field sample identification procedure.

8.3.1 Project Identifier

The following designation will be used to identify the NTC and this RI CTO: "GL###", where ### will be the last three digits of the RI CTO.

8.3.2 Site Identification Code

Each sample will be further identified with a two-digit number corresponding to the site where the sample was collected (04 or 12).

8.3.3 Sample Matrix Codes

Each sample will be identified by alpha-codes corresponding to the sample medium and sample type. The alpha codes are as follows:

- SS Surface Soil Sample
- SB Soil Boring Sample
- SW Surface Water Sample Duplicate
- SD Sediment Sample
- MW Groundwater Monitoring Well Sample
- FB Field Blank Sample
- RB Rinsate Blank Sample
- TB Trip Blank Sample
- MS/MSD Matrix Spike/Matrix Spike Duplicate Sample
- WL Liquid Waste Sample
- WS Solid Waste Sample

Each alpha matrix code will then be followed by a two-digit location number. Location numbers will be assigned sequentially across the site for each sample medium and type.

8.3.4 Sample Identifier

Subsurface soil samples will have a letter code as the last component of the identification system. These letters will correspond to a specific depth interval form which the soil sample was collected.

For surface soil, groundwater, surface water, sediment and waste samples, the sampling round number will be placed in this last field (01 designates Round 1, 02 designates Round 2).

Examples of site-specific field sample identification numbers are as follows:

GL###-04-SS01-01	Naval Training Center, Great Lakes, CTO###, Site 4, Surface Soil Sample Location No. 1, sample collection during Round 1.
GL###-12-SB05-C	Naval Training Center, Great Lakes, CTO###, Site 12, Soil Boring No. 5, sample collected from 4 to 6 feet.
GL###-04-MW4-1-01	Naval Training Center, Great Lakes, CTO###, Site 4, Monitoring Well MW-4, Groundwater Sample collected during Round 1.
GL###-04-MW4-9B-02	Naval Training Center, Great Lakes, CTO###, Site 4 Deeper Couplet Monitoring Well MW-4B, Groundwater Sample collected during Round 2.

Rinsate blank samples will have an identification code of "RB" followed by a numerical code which will be assigned in sequential order (for example, sample GL###-04-RB-02 is the second rinsate blank sample collected during field work at Site 4.

Field blank samples will have an identification code of "FB" followed by a numerical code which will be assigned in sequential order (for example, sample GL###-12-FB-01 is the first rinsate blank sample collected during field work at Site 12.

Trip blank samples will have an identification code of "TB" followed by a numerical cod which will be assigned in sequential order (for example, sample GL###-04-TB-08 is the eighth trip blank collected during field work at Site 4.

Field duplicates will be identified in the same manner as the corresponding field sample. For example, if a field duplicate soil sample is to be collected at Site 4, surface soil sample location 03, the original field sample will be identified as GL###-04-SS03-01, and the field duplicate sample will be identified as GL###-04-SS03-02. In this way, the laboratory will be unaware that two samples are an original sample/field duplicate sample pair.

8.4 SAMPLE LABEL NUMBER

Each sample container will have an adhesive label attached to it and will be identified by a sample identification number as discussed above. See Figure 6-1 in the QAPP for an example of a sample label.

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9.0 CHAIN OF CUSTODY

9.1 INTRODUCTION

USEPA Chain of Custody protocols will be followed. Custody is in three parts: sample collection, laboratory analysis, and final evidence files. Field evidence files, including original laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under custody if it:

- Is in the possession of the sampler/analyst.
- Is in the view of, after being in the possession of the sampler/analyst.
- Is in the possession of the sampler/analyst and then placed in a secured location.
- Is in a designated secure area.

9.2 FIELD CUSTODY PROCEDURES

The sample packaging and shipment procedures summarized below will ensure that samples arrive at the appropriate laboratories with the Chain of Custody intact.

Field procedures are as follows:

- The field sampler is personally responsible for the care and custody of the samples. As few people as possible will handle the samples.
- Each sample container will have an adhesive label affixed to it.
- Sample labels are to be completed for each sample using waterproof ink (ball-point pen) unless prohibited by weather conditions. A logbook notation will explain that an ink marker was used to complete the sample label because the ball-point pen would not function in freezing weather.

- A Field Chain of Custody Record (Figure 6-3 in the QAPP) will be completed by the field samplers. The sample identifiers, date, sample collection time, and field sampler's signatures will be listed on the Field Chain of Custody Record. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. The Field Chain of Custody Record will be retained to document transfer of custody of samples from the sampler to another sampler, to the laboratory, or to/from a secure storage area on-site. The Field Chain of Custody Record is not used to document transfer of samples from the site to the analytical laboratory.

- Samples will be properly packaged for shipment (Section 10.0) and dispatched to the appropriate laboratory for analysis, with a separate signed Laboratory Chain of Custody Record enclosed in each sample shipping container. Shipping containers will be secured with fiber reinforced tape. Custody seals will be attached to opposite corners of the top of the shipping container. The custody seals will be covered with clear tape. The shipping container will be strapped shut with fiber reinforced tape in at least two locations.

- Shipments will be accompanied by the Laboratory Chain of Custody Record identifying the contents. The Laboratory Chain of Custody Record is a carbonless triplicate form. The original copy (white) and yellow copy will accompany the shipment in a plastic bag to the laboratory, and the pink copy will be retained on-site by the sample custodian to document transfer of samples to the laboratory.

- If the samples are sent by common carrier, a bill of lading will be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by U.S. mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign the custody forms as long as the custody forms are sealed inside the shipping container and the custody seals remain intact.

9.3 LABORATORY CUSTODY PROCEDURES

Upon receipt of the shipping containers at the laboratories, the airbill will be dated, the time of arrival, and signature of the person accepting the shipment will be entered directly on the airbill. The laboratory sample custodian will then break and record the condition of the custody seals, inventory the samples, sign the Custody Record, and inform the Project Manager of any discrepancies between bottles, labels, and custody documentation. If samples cannot be analyzed within the holding times, the Project Manager will be notified.

9.4 FINAL PROJECT FILES CUSTODY PROCEDURES

The NTC Great Lakes Remedial Investigation files along with relevant records, reports, logs, field notebooks, photographs, and laboratory data will be maintained in a secure area, until relinquished to the Navy.

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10.0 PACKAGING AND SHIPPING

Samples collected at the NTC are anticipated to be classified as low concentration level. Each level requires specific packaging, labelling, and shipping as determined by the U.S. Department of Transportation (DOT), the International Air Transport Association (IATA), and each commercial carrier. Requirements listed in this section were obtained from Federal Express and the IATA Dangerous Goods Regulations, effective January 1, 1992.

Sample collected at the NTC will be screened for VOCs with a photoionization detector (PID) and/or a flame ionization detector (FID) at the time of collection. If the PID/FID reading is less than 10 ppm, the samples will be considered low level and will be packed according to the procedures outlined below. If the PID/FID reading is a sustained 10 ppm or greater, the samples will be considered medium level and packed according to the procedures in Section 10.3.

10.1 GENERAL REQUIREMENTS

Samples, regardless of level, will be prepared as follows:

- Attach completed adhesive sample label to the sample container.
- Place container in appropriate size Ziploc® bag and seal.

10.2 LOW LEVEL PACKAGING

Low level samples will be prepared according to the following instructions:

1. Attach completed adhesive sample label to the sample container.

2. Place container in appropriate size Ziploc® bag and seal.

3. Wrap bagged container in bubble wrap or foam sleeve to minimize breakage.

4. Select an appropriately sized metal or plastic shipping container and tape the drain plugs on the inside and outside with fiber reinforced tape (duct tape).

5. Line the shipping container with a large polyethylene garbage bag.

6. Place the samples in the large polyethylene garbage bag.

7. Put absorbent packaging material under and around the samples to minimize the possibility of breakage.

8. Place a completed Chain of Custody Record (white and yellow copies) listing the contents of the shipping container and a completed shipping container return address/label in a Ziploc® bag and tape to the underside of the shipping container lid.

9. Place bagged ice on top and around the samples and seal the large polyethylene garbage bag and close the shipping container.

10. Place the signed and dated Custody Seal on the shipping container at opposite corners on top of the shipping container, so if the shipping container was opened, the seals would break. Cover the seals with clear tape. Tape the shipping container shut with fiber reinforced tape (duct tape or strapping tape). Tape should partially overlap Custody Seals.

11. A label marked "Environmental Samples" will be placed on top of the shipping container and covered with clear tape. The appropriate sides of the container will be marked "This End Up" and arrows should be drawn accordingly. "Fragile" labels will be placed on the shipping container lid if glass bottles/jars are contained in the shipping container.

12. Weigh the shipping container and complete the courier air bill. Weight will not exceed 150 pounds.

10.3 MEDIUM LEVEL PACKAGING

Medium level samples will be packed according to the instructions above with the following exceptions:

Do not wrap the container in bubble wrap or foam sleeve as described in Step 4 above. Instead, place the container in a metal transportation can. Fill the transportation can with vermiculite and tape the lid shut. Continue packaging as in Steps 5 through 13, omitting Step 8.

10.4 SHIPMENT COORDINATION

The SEC Donohue field sample coordinator will notify the laboratory performing chemical analyses of sample shipments on the day of shipment. At that time, the field sample coordinator will provide the following information:

1. Field sample coordinator name and office telephone number.

2. Site name.

3. Exact number(s), matrix(ces), and level(s) of samples.

4. Carrier name and air bill number(s) for the shipment.

5. Method of shipment (i.e., overnight, two-day).

6. Date of shipment.

7. Suspected hazards associated with the samples or site.

8. Irregularities or anticipated problems with the samples, including special handling instruction or deviations from established sampling procedures or numbers of samples.

9. Status of the sampling project (i.e., final shipment, update of future shipping schedule).

Sample shipments made after 5:00 p.m. Central Standard Time (CST) will be called in at the start of business the next day (8:00 a.m. CST). Laboratories will be notified by 3:00 p.m. CST Friday concerning information on sample shipments going out Friday intended for Saturday delivery/pickup.

10.5 FINAL EVIDENCE FILES CUSTODY PROCEDURES

The final laboratory evidence files from the laboratory will be assembled by the Quality Assurance Manager and relinquished to the Project Manager.

Laboratory files along with relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews will be maintained in a secure area under custody of the Project Manager.

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11.0 REFERENCES

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