FINAL

PROPOSED REMEDIAL ACTION PLAN FOR OPERABLE UNIT NO. 1 (SITES 21, 24 and 78)

MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0177

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LIST OF ACRONYMS AND ABBREVIATIONS

AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
Baker	Baker Environmental, Inc.
BTEX	benzene, toluene, ethylbenzene, xylene
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
cis-1,2-DCE	cis-1,2-dichloroethene
COC	contaminant of concern
1,1-DCE	1,1-dichloroethene
DON	Department of the Navy
FFA	Federal Facilities Agreement
FS	feasibility study
gpm	gallons per minute
HI	hazard index
HPIA	Hadnot Point Industrial Area
IAS	Initial Assessment Study
ICR	incremental cancer risk
IRA	interim remedial action
IRP	Installation Restoration Program
MCB	Marine Corps Base
NC DEHNR	North Carolina Department of Environment, Health, and Natural Resources
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPW	net present worth
O&M	operation and maintenance
OU	operable unit
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
ppm	parts per million
PRAP	proposed remedial action plan
RA	risk assessment
RAA	remedial action alternative
RCRA	Resource Conservation Recovery Act
RI	remedial investigation
ROD	record of decision
STP	sewage treatment plant
SVOC	semivolatile organic compound

T-1,2-DCE	trans-1,2-dichloroethene
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound

PROPOSED REMEDIAL ACTION PLAN

Introduction

This Proposed Remedial Action Plan (PRAP) is issued to describe the Marine Corps Base (MCB), Camp Lejeune's and the Department of the Navy's (DON's) preferred remedial action for Operable Unit (OU) No. 1 at MCB, Camp Lejeune. OU No. 1 is located approximately one mile east of the New River and two miles south of State Route 24, within MCB, Camp Lejeune, Onslow County, North Carolina. OU No. 1 consists of three sites, Site 21 (Transformer Storage Lot 140), Site 24 (Industrial Area Fly Ash Dump), and Site 78 (Hadnot Point Industrial Area or HPIA).

MCB, Camp Lejeune and the DON are issuing this PRAP as part of the public participation responsibility established under Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the Federal Facilities Agreement (FFA) between the DON, United States Environmental Protection Agency (USEPA) Region IV, and the North Carolina Department of Environment, Health, and Natural Resources (NC DEHNR).

MCB, Camp Lejeune and the DON, with the assistance of USEPA Region IV and the NC DEHNR, will select a remedy for OU No. 1 only after the public comment period has ended and the information submitted during this time has been reviewed and considered. The Final Record of Decision (ROD) may recommend a different remedial action than is presented in this plan depending upon new information or public comments.

This PRAP briefly summarizes information that can be found in greater detail in the Remedial Investigation (RI) and Feasibility Study (FS) Reports, and other documents referenced in the RI and FS Reports prepared for OU No. 1. The DON encourages the public to review these other documents in order to gain a more comprehensive understanding of the sites. The administrative record file, which contains information on which the selection of the remedial action will be based, is available for public review at MCB, Camp Lejeune, North Carolina. The public is invited to review and comment on the administrative record and this PRAP.

Operable Unit Description

MCB, Camp Lejeune is a training base for the United States Marine Corps, located in Onslow County, North Carolina. The Base covers approximately 236 square miles and includes 14 miles of coastline. MCB, Camp Lejeune is bounded to the southeast by the Atlantic Ocean, to the northeast by State Route 24, and to the west by U.S. Route 17. The town of Jacksonville, North Carolina is located north of the Base.

OU No. 1 is one of 13 operable units within MCB, Camp Lejeune. An "operable unit" as defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is a discrete action that comprises an incremental step toward comprehensively addressing site problems. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems, or initial phases of an action. With respect to MCB, Camp Lejeune, operable units were developed to combine one or more individual sites where Installation Restoration Program (IRP) activities are or will be implemented. The sites which are combined into an operable unit share a common element. As the case with OU No. 1, Sites 21, 24, and 78 are geographically close.

OU No. 1 covers an area of approximately 690 acres. It is located approximately one mile east of the New River and two miles south of State Route 24 (see Figure 1). OU No. 1 is bordered by Holcomb Boulevard to the northwest, Sneads Ferry Road to the northeast, Main Service Road to the southwest, and woodlands and Cogdels Creek to the southeast.

Site 21 is located within the northwest section of Site 78. The site is bordered by Ash Street to the southwest, Center Road to the southeast, and a wooded area to the northwest. The site covers less than 10 acres. Figure 2 presents a site plan of Site 21. A dirt road surrounds most of the site along with surface drainage ditches. The southern and central portions of the site (approximately 220 feet by 900 feet) include several fenced-in areas, while the northern section (approximately 500 feet long) is an open area. A water tower is located in the fenced portion of the site. Surface cover within the site consists of gravel, sandy soil, and concrete with a few vegetated areas. In the northern portion of the site, a small area, slightly depressed in elevation, is evident. This may have been the reported former transformer oil disposal pit. The southern portion of the site is periodically utilized for storage by Marine Corps Reserve units. Currently this portion of the site is being used for storage of military vehicles.

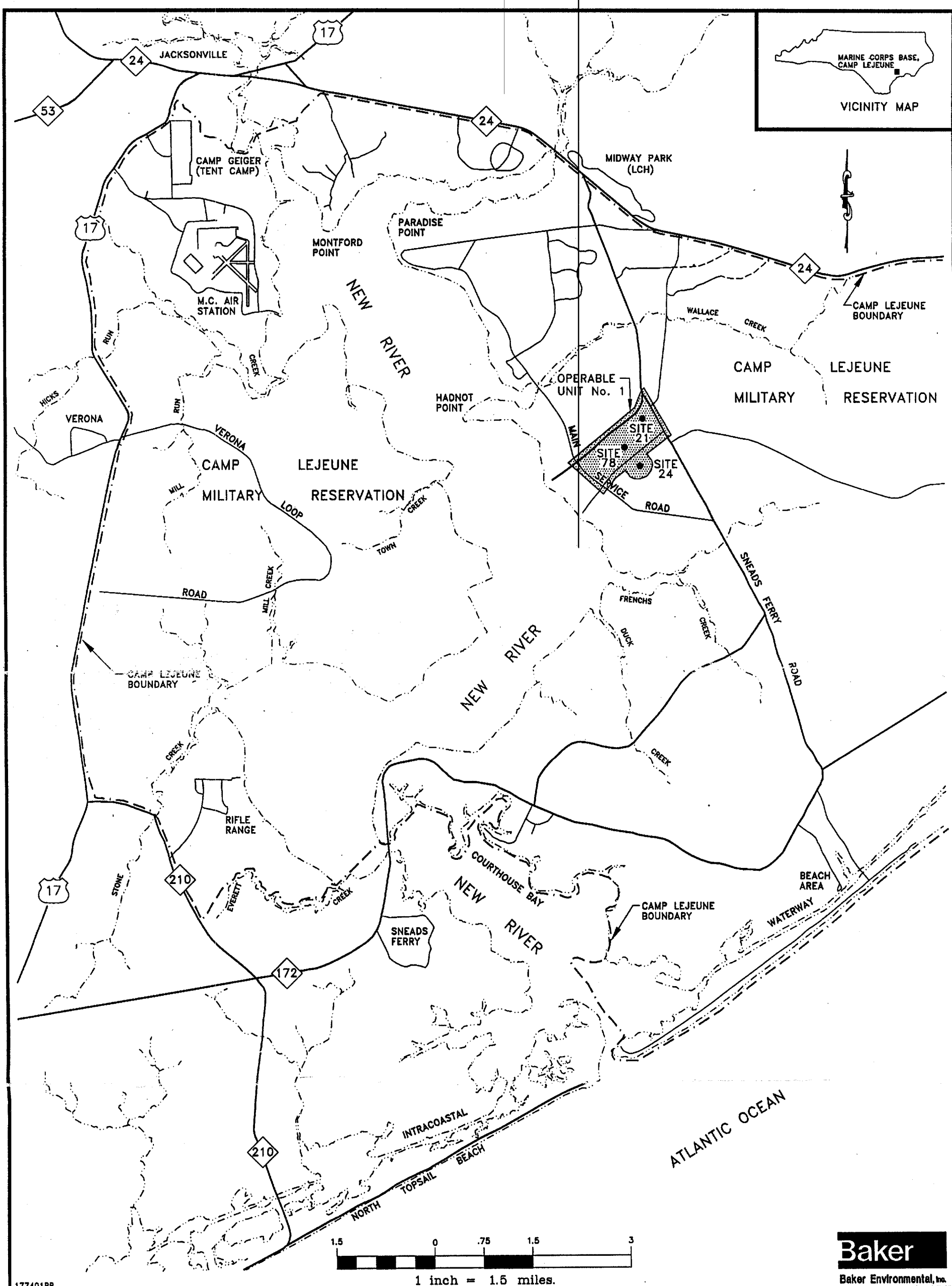

FIGURE 1
LOCATION MAP–OPERABLE UNIT No. 1
SITES 21, 24 AND 78
PROPOSED REMEDIAL ACTION PLAN CTO–0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

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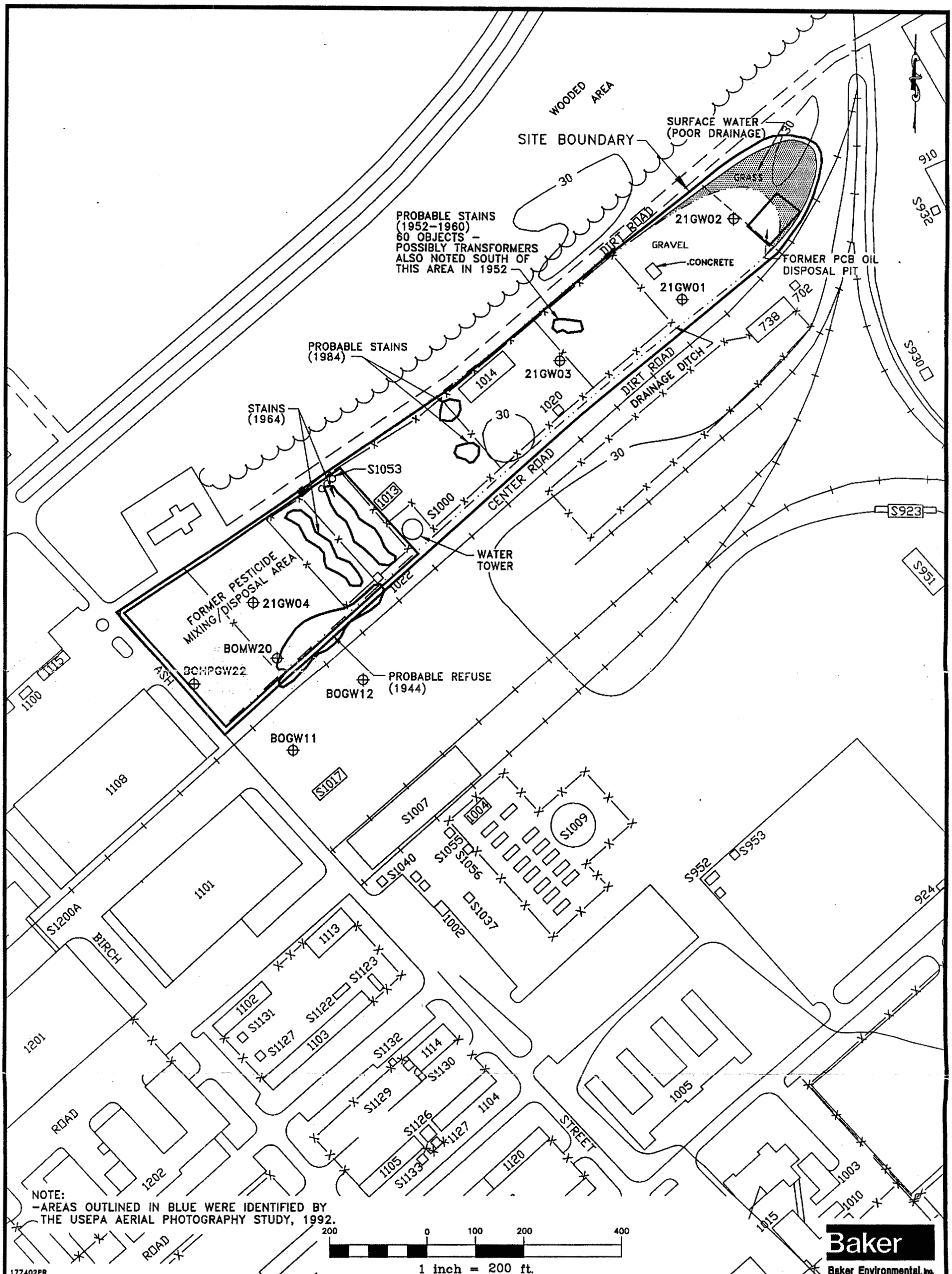


LEGEND

21GW01 ⊕ SHALLOW MONITORING WELL

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 2
SITE MAP
SITE 21: TRANSFORMER STORAGE LOT 140
PROPOSED REMEDIAL ACTION PLAN CTO-0177

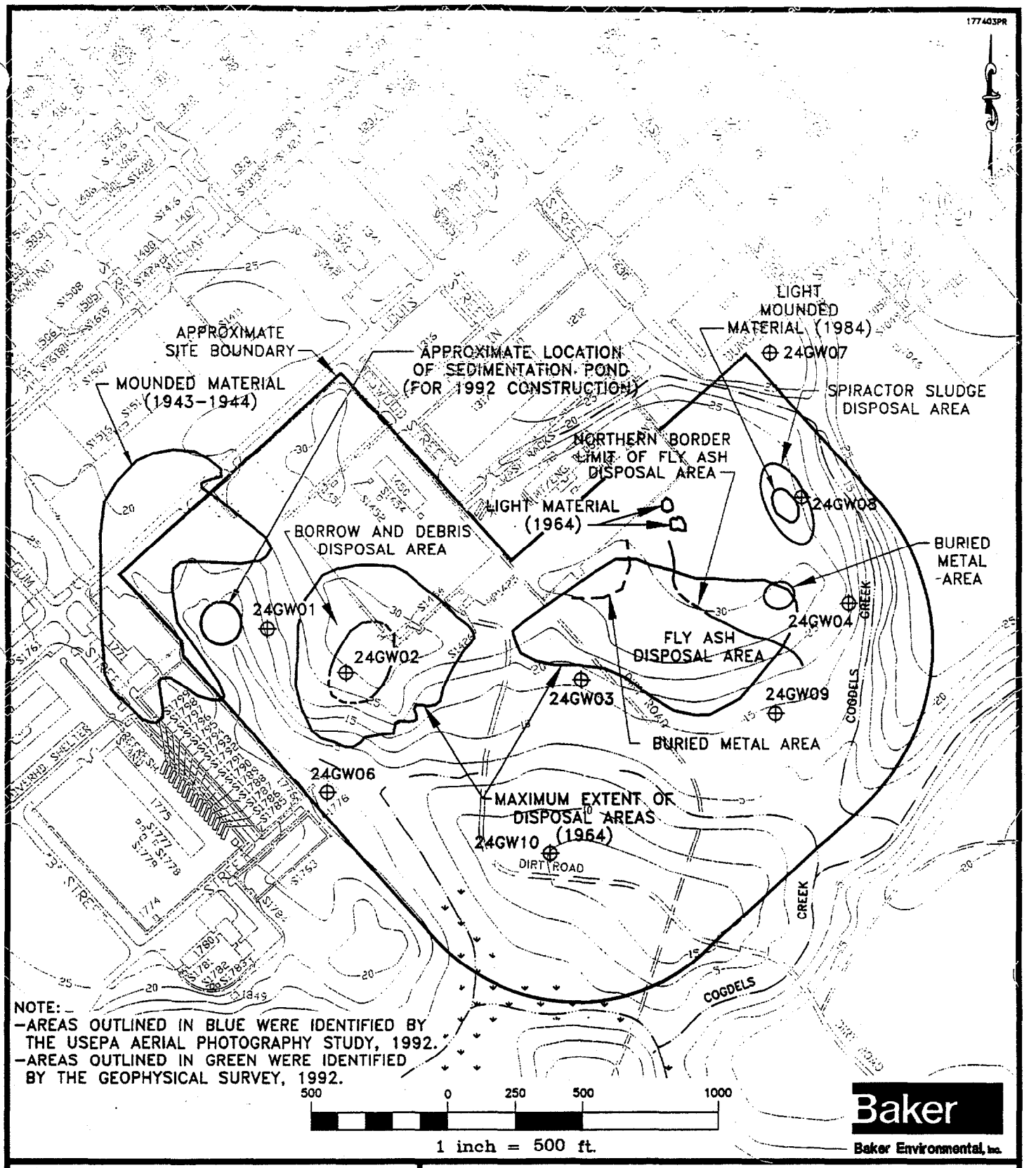
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

A few potential areas of concern within Site 21 were identified by a USEPA aerial photography study, as shown on Figure 2. The two primary areas of concern are the Former Pesticide Mixing/Disposal Area and the Former PCB Transformer Disposal Area. As shown on Figure 2, the Former Pesticide Mixing/Disposal Area is located in the southwestern portion of the site, and the Former Transformer PCB Disposal Area is located in the northeastern portion of the site. With the exception of a low depressed area at the northern portion of the site, there are no visual signs of past waste disposal throughout the site.

Site 24 is located adjacent to the southeast portion of Site 78. Specifically, the site is located south and east of the intersection of Birch and Duncan Streets and extends south towards Cogdels Creek. Figure 3 presents a site plan of Site 24, with suspected areas of former disposal shown (based on the USEPA aerial photography study). The site is primarily a wooded area, approximately 100 acres in size, that is somewhat overgrown. The site is hilly and unpaved with site drainage towards Cogdels Creek. Dirt roads are interspersed throughout, which lead to the suspected disposal areas. The roads are periodically utilized for military vehicle maneuvers. Several areas indicating past disposal activities are evident throughout the site (i.e., surficial deposits of fly ash and mounding). Site 24 is not currently used for the disposal of wastes.

Site 78 is located adjacent to the northwest portion of Site 24 and houses the industrial area of MCB, Camp Lejeune. This area is comprised of maintenance shops, warehouses, painting shops, printing shops, auto body shops, and other similar industrial facilities. In general, Site 78 is defined as the area bounded by Holcomb Boulevard to the northwest, Sneads Ferry Road to the northeast, Duncan Street to the southeast, and Main Service Road to the southwest. Site 78 covers approximately 590 acres. The majority of the site area is paved (e.g., roadways, parking lots, loading dock areas, and storage lots), however, there are many small lawn areas associated with individual buildings within the site and along lengthy stretches of roadways. In addition, there are several acres of woods in the southern portion of the site. Recreational ballfields and a parade ground are located in the southwest corner of the site. Figure 4 presents a plan view of Site 78 and the approximate site boundary. The site boundaries for Sites 21 and 24 are also shown on this figure. The location of the Hadnot Point Fuel Farm (Site 22) is shown although it is not a part of the operable unit addressed in this PRAP.



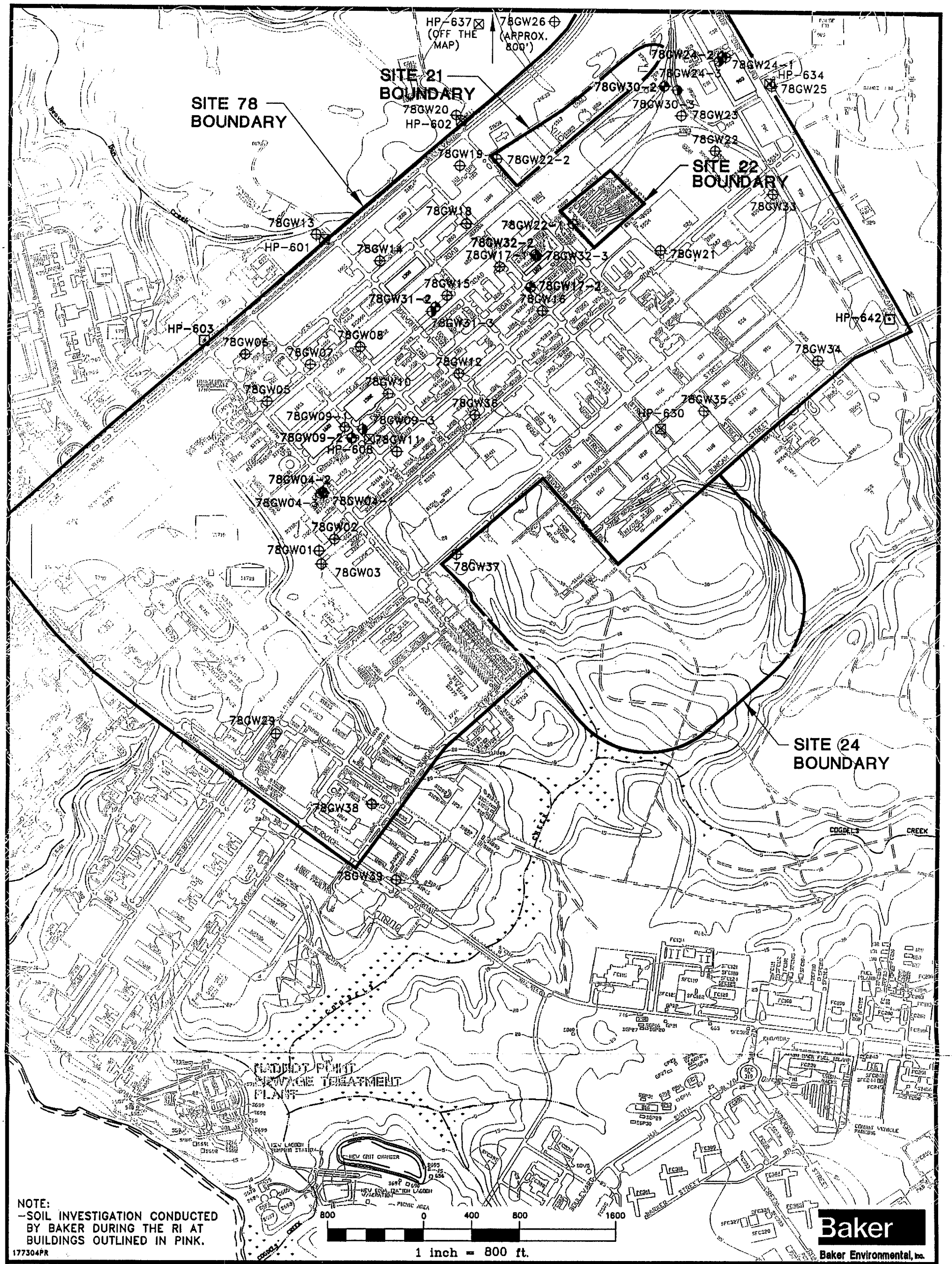
LEGEND

24GW01 ⊕ SHALLOW MONITORING WELL

SOURCE: LANTDIV, FEB. 1992

FIGURE 3
SITE MAP
SITE 24: INDUSTRIAL FLY ASH DUMP
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
-SOIL INVESTIGATION CONDUCTED BY BAKER DURING THE RI AT BUILDINGS OUTLINED IN PINK.

177304PR

LEGEND

78GW02	SHALLOW MONITORING WELL	HP-603	WATER SUPPLY WELL (ACTIVE)
78GW04-2	INTERMEDIATE MONITORING WELL	HP-601	WATER SUPPLY WELL (INACTIVE)
78GW04-3	DEEP MONITORING WELL		

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 4
SITE MAP
SITE 78: HPIA
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

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Operable Unit Background History

Site 21 has had a history of pesticide usage and reported transformer oil disposal. The site was used as a pesticide mixing area and as a cleaning area for pesticide application equipment from 1958 to 1977. This area, the Former Pesticide Mixing/Disposal Area, was reported to be located in the southeast corner of the lot (the exact location is not documented). Based on the RI data, the area appears to be throughout the southern portion of the site. Chemicals reportedly stored and handled at this site included diazinon, chlordane, lindane, DDT, malathion (46 percent solution), mirex, 2,4-D, silvex, dalapon and dursban. Small spills, discharge of washout fluids, and indiscriminate disposal are believed to have occurred in this area. In 1977, before these mixing/cleaning activities were moved to a different location, overland discharge of washout fluids was estimated to be approximately 350 gallons per week. It is not clear for how long this discharge of washout fluids occurred.

Aerial photographs from 1944, 1964, and 1984 revealed several areas which appear as ground stains possibly resulting from the pesticide mixing. The approximate stain areas are shown on Figure 2. The stains appear as long narrow dark patches which are adjacent to the suspected pesticide mixing area. These stains are no longer visible.

The Former Transformer Oil Disposal Pit was located in the northeastern portion of the site. The pit was reportedly used as a disposal area for transformer oil during a one year period between 1950 and 1951. The pit reportedly measured 25 to 30 feet long by 6 feet wide by 8 feet deep. Sand was occasionally placed in the pit when oil was found standing in the bottom of the pit. The total quantity of oil disposed in this pit is unknown. A small area, slightly depressed in elevation, which may be the former oil pit, is evident in the northern portion of Site 21.

Site 24 was used for the disposal of fly ash, cinders, solvents, used paint stripping compounds, sewage sludge, water treatment spiractor sludge, and construction debris from the late 1940s to 1980. Spiractor sludge from the wastewater treatment plant and sewage sludge from the sewage treatment plant were reportedly disposed at this site since the late 1940s. Construction debris was reportedly disposed at the site in the 1960s. During 1972 to 1979, fly ash and cinders were dumped on the ground surface, and solvents used to clean out boilers were poured onto these piles. Furniture stripping wastes were also reported to be disposed in this area. Due to these past waste disposal activities, there are five primary areas of concern within Site 24: the Spiractor Sludge Disposal Area; the Fly Ash Disposal Area; the Borrow and Debris Disposal Area; and two Buried Metal Areas.

The HPIA (Site 78), constructed in the late 1930s, was the first developed area at MCB, Camp Lejeune. It was comprised of approximately 75 buildings and facilities including: maintenance shops, gas stations, administrative offices, commissaries, snack bars, warehouses, and storage yards.

There is presently no known uncontrolled disposal of wastes related to the various industrial activities at the site. Due to the industrial nature of the site, many spills and leaks have occurred over the years. Most of these spills and leaks have consisted of petroleum-related products and solvents from underground storage tanks (USTs), drums, and uncontained waste storage areas. It appears that several general building areas within Site 78 may be potential source areas of contamination.

Previous Investigations

Initial Assessment Study

In 1983, an Initial Assessment Study (IAS) was conducted at MCB, Camp Lejeune. The study identified a number of areas within MCB, Camp Lejeune, including Sites 21 and 24, as potential sources of contamination. Site 78 was later added to the list of sites to be further evaluated. As a result of this study, the DON initiated further investigations at the three sites as summarized below.

Confirmation Study

During 1984 through 1987, Confirmation Studies at OU No. 1 were conducted which focused on potential source areas identified in the IAS. The results of the Confirmation Study conducted for Site 21 indicated that the soil within the site may be contaminated with pesticides and possibly polychlorinated biphenyls (PCBs). Groundwater at Site 21 did not appear to be impacted by these contaminants. The results of the Confirmation Study conducted for Site 24 indicated that several metals were present in the groundwater. Metals were also detected in the surface water and sediment samples collected from Cogdels Creek. No soil samples were collected at Site 24 during this study. The Confirmation Study results for Site 78 indicated that the shallow groundwater near the Hadnot Point Fuel Farm (Site 22) was contaminated with fuel-related volatile organic compounds (VOCs) such as benzene and toluene. In addition, VOCs such as trichloroethene (TCE), benzene, trans-1,2-dichloroethene

(T-1,2-DCE), and tetrachloroethylene (PCE) were detected in nearby water supply wells. As a result, four supply wells (HP-601, HP-602, HP-608, and HP-634) were immediately shut down by Camp Lejeune utilities staff.

The groundwater results from Site 78 triggered additional investigations under the Confirmation Study. The results from these additional investigations indicated that there were several primary potential source areas for waste solvent and fuel-related material throughout Site 78. Groundwater samples indicated that three primary zones of contamination were present in the shallow portion of the surficial aquifer, centered in the vicinity of Building 902, Site 22, and Building 1601.

Groundwater Study at Hadnot Point Fuel Farm

A groundwater study was conducted at the Hadnot Point Fuel Farm (Site 22) as part of the MCB, Camp Lejeune UST Program. Although this study was conducted for Site 22 and not Site 78, the results are applicable to Site 78 given the proximity of the sites (Figure 4). The fuel farm consisted of several USTs which had contained either diesel fuel, leaded gasoline, unleaded gasoline, or kerosene. The study concluded that fuel losses of gasoline/fuels have likely occurred predominantly through leaks in the transfer lines or valves. Laboratory analyses indicated that floating product had contributed significant levels of dissolved petroleum compounds including benzene, toluene, ethylbenzene, xylenes (BTEX) into the groundwater. Trace levels of non-petroleum VOCs including TCE and PCE were also detected within the fuel farm area. Based on the results of this study, a product recovery/groundwater treatment system was designed for the fuel farm. The system began operation in the latter part of 1991.

Supplemental Characterization Step

A Supplemental Characterization Step was performed in 1990 and 1991 for Site 78 to further evaluate the extent of contamination in the shallow and deeper portions of the aquifer and to characterize the contamination within the shallow soils at suspected source locations. The soil sample results from this study detected VOCs and a few semivolatile organic compounds (SVOCs) near Building 902. Fuel-related VOCs were detected near Building 1202. Pesticides were detected near Buildings 1103 and 1601. PCBs and pesticides were identified near Building 1300. The results of the shallow groundwater sampling yielded similar results as with the previous studies. The results from the intermediate and deep monitoring wells

indicated that BTEX constituents were detected downgradient of the fuel farm and at other areas of the site.

RI for the Shallow Soils and Castle Hayne Aquifer

An RI was conducted in 1991 to investigate shallow soils and the deeper portion of the aquifer (the Castle Hayne aquifer) at Site 78. This RI did not involve any additional field investigations. The RI was conducted using data from the previous Confirmation Study and Supplemental Characterization Step. The RI report concluded that while TCE and other VOCs were the primary concern during the soil gas survey, these compounds were detected in only a few of the soil samples collected. The only TCE detected in soils appeared to be associated with an UST at Building 902, which reportedly was used to store spent solvents. The detected SVOCs were fuel related and fit with the use of the area (Building 1202) for vehicle repairs and maintenance. Many of the metals detected were found in all samples analyzed and therefore, may be indicative of the naturally occurring soil matrix and associated clays.

Interim Remedial Action RI and FS for the Surficial Aquifer

Baker Environmental, Inc. (Baker) conducted an Interim Remedial Action (IRA) RI for the surficial aquifer at Site 78. This RI report used the data from previous investigations only; no additional field studies were conducted. The IRA RI report concluded that three contaminant plumes were identified within the shallow aquifer at Site 78; however, one plume was associated with the Hadnot Point Fuel Farm (Site 22) which is being remediated under a separate investigative program. The second plume was located east of Cedar Street and extended from the vicinity of the 901/903 Building area to the fuel farm. The plume exhibited solvent contamination (e.g., TCE) and low levels of fuel-related contamination (e.g., BTEX). The third plume was believed to originate in the vicinity of Buildings 1502, 1601, and 1602. This plume was contaminated with the same constituents as the second plume with the addition of lead.

As part of the IRA RI, a qualitative risk assessment (RA) was performed to identify receptors and exposure pathways, quantify exposure levels, and evaluate human and/or environmental risk. The qualitative RA concluded that benzene and TCE could impact human health if shallow groundwater were to migrate into the deep portions of the aquifer (used as a source of potable water), or if the shallow aquifer were to be utilized in the future as a potable water source.

Based on the results of the IRA RI for the shallow aquifer, Baker prepared an IRA FS Report. The IRA FS developed and evaluated several IRA alternatives for the impacted shallow groundwater. The preferred alternative involved two on-site pump and treat systems to contain the two fuel/solvent-contaminated plumes at the site. Following extraction, the groundwater was to be treated on site via air stripping, carbon adsorption, and metals removal, then discharged to the Hadnot Point Sewage Treatment Plant (STP). This IRA alternative was accepted by the USEPA, the NC DEHNR, and the public. The extraction/treatment systems have been designed and construction began in 1994.

Pre-Investigation Study for RI/FS

Pre-investigation activities were conducted by Baker at Sites 24 and 78 in 1992 to assist in preparing the scope of work for the RI field program for OU No. 1. As part of the pre-investigation activities, groundwater samples were collected from several existing monitoring wells and water supply wells in the area of OU No. 1. Further, a geophysical survey was conducted at these sites by using surface investigative techniques. The geophysical investigation was conducted at Site 24 to delineate the boundaries of suspected buried metal disposal areas; the investigation was conducted at Site 78 to confirm the presence or absence of several suspected USTs. Suspected USTs were identified at Buildings 903, 1502, and 1601. BTEX and several metals were detected in the wells sampled during this investigation.

RI for OU No. 1

The RI field program conducted at OU No. 1 was initiated by Baker in 1993 to further characterize potential environmental and ecological impacts, and to evaluate threats to human health resulting from previous storage, operation, and disposal activities. The field investigations commenced in April 1993, and continued through December 1993. The field program initiated at OU No. 1 consisted of a soil gas survey (Site 78 only); a preliminary site survey; a soil investigation which included drilling and sampling; a groundwater investigation which included well installation and sampling; test pit sampling (Site 24 only); and a surface water/sediment investigation (Site 21, Cogdels Creek/New River, and Beaver Dam Creek). The results of the RI are summarized below with respect to each site and the nearby surface water bodies.

Site 21 - Transformer Storage Lot 140

Soils

- Pesticides and PCBs were the dominant contaminants present in soils at Site 21. The majority of the pesticides were detected in surface soils collected in the vicinity of the Former Pesticide Mixing/Disposal Area (the pesticides were detected in an area covering approximately 150,000 square feet). The maximum detected concentration was 34,000 micrograms per kilogram (µg/kg).

- PCBs, specifically PCB-1260, were present primarily in surface soils in the vicinity of the Former PCB Transformer Disposal Area (approximately 20,000 square feet). PCBs were also detected in two other areas of the site. The maximum detected concentration was 4,600 µg/kg.

- VOCs and SVOCs were not extensively found in Site 21 soils.

Groundwater

- Metals were the most prevalent contaminants in groundwater at Site 21. The metals that were detected at concentrations above Federal drinking water standards and/or State groundwater standards included: arsenic, chromium, beryllium, lead, and manganese. Note that metals were also present extensively in groundwater throughout OU No. 1 (all three sites) and, therefore, the metals detected in groundwater at Site 21 are most likely the result of a regional (entire MCB, Camp Lejeune) problem rather than a site-specific problem.

- VOCs (TCE and BTEX) in the groundwater were primarily limited to the northeastern portion of the site. Note that this groundwater contamination is most likely related to Site 78, specifically the edge of a contaminated groundwater plume located near Buildings 901, 902, and 903. Note that pesticides and PCBs, which were found in site soils, were not detected in the groundwater at Site 21.

Surface Water and Sediments

- Surface water at the site (which was only present in the northern section of the site) did not appear to be contaminated.

- Pesticides and PCBs were the dominant contaminants present in sediments collected from the drainage ditch surrounding Site 21. The highest pesticide concentrations were detected at locations downgradient of the suspected pesticide mixing area, along the southwestern corner of the site (along approximately 600 feet of the drainage ditch). PCBs were detected near the Former PCB Transformer Disposal Area. Pesticide and PCB concentrations exceeded sediment screening values.

Site 24 - Industrial Fly Ash Dump

Soils

- Analytical results indicated that pesticides and metals were the predominant contaminants detected in the soils at Site 24. The relatively low pesticide levels appear to be the result of historical pest control spraying activities rather than direct disposal due to their relatively low concentrations and widespread detections throughout the Base.

- The highest concentrations of metals, in both surface and subsurface soils, were detected within the Fly Ash Disposal Area and one of the Buried Metal Areas (an area covering approximately 180,000 square feet). The metals that exceeded base-specific background levels included: arsenic, beryllium, copper, chromium, lead, and manganese. Some of these metals concentrations were comparable to those detected at Sites 21 and 78.

- Test pit samples, which were collected in the vicinity of the Buried Metal Areas and the Fly Ash Disposal Area, were tested for leachability via Resource Conservation and Recovery Act (RCRA) toxicity characteristics leaching procedure (TCLP). The samples tested were below TCLP regulatory levels indicating that the soils are not characteristically hazardous. Additionally, the soils classified as nonhazardous under the RCRA for ignitability, corrosivity, and reactivity. Low levels of TCE, the

pesticides 4,4'-DDD, and 4,4'-DDT and several metals were detected in some of the samples collected from the test pits.

Groundwater

- Metals were the predominant contaminants detected in the shallow groundwater at Site 24. No trends or source areas were identified. The metals that were detected above the Federal drinking water standards and/or State groundwater standards included: arsenic, chromium, lead, manganese, cadmium, mercury, and nickel. The metals concentrations detected in the shallow groundwater at Site 24 were similar to the metals concentrations detected at Site 21.

- The pesticide, heptachlor epoxide, was detected in the groundwater at Site 24 near the Spiractor Sludge Disposal Area and south of the Fly Ash Disposal Area. Although the concentrations appeared to be low, they exceeded the State groundwater standard. It is relevant to note that low levels of heptachlor epoxide (5.0 J µg/kg) was only detected in one soil sample collected at the site.

<u>Site 78 - HPIA</u>

Soils

- The soil around the suspected UST at Building 903 was primarily contaminated with SVOCs. The extent of the contamination appeared to be limited to the UST area.

- Pesticides and SVOCs were the primary contaminants detected in the soil samples collected around Building 1103. The impacted area appeared to be limited, approximately 400 square feet.

- Although PCBs were expected to be found in the soils near Building 1300, only one detection was found. The PCB concentration does not appear to present a contamination problem at this building area.

- Pesticides were the primary contaminants detected in the soils around Building 1502. A limited area (approximately 400 square feet) at the northeastern side of the building and near the southern edge of the building (approximately 400 square feet) had the

highest level of pesticide contamination. The pesticide levels at this building are higher than typical levels detected throughout the Base, but disposal is not documented.

- The soils sampled near Buildings 1601 and 1608 did not appear to be impacted.

Groundwater

- The analytical findings indicated that shallow groundwater at Site 78 was impacted by organics and metals. The primary organic contaminants were VOCs, including: BTEX, PCE, TCE, vinyl chloride, 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), T-1,2-DCE, and 1,2-dichloropropane. The highest concentrations of these compounds were detected in wells located near the northeastern portion of Site 78 in the vicinity of the 901/903 buildings and in the southwestern portion of the site near Buildings 1601 and 1709. There was no particular area which exhibited excessive metals contamination since the entire site (as with Sites 21 and 24) appeared to be impacted.

- Benzene, TCE, 1,2-DCE, vinyl chloride, and dichloromethane were the most prevalent VOCs detected in the intermediate wells (screened at the deeper portion of the surficial aquifer) at Site 78. The concentrations of the detected VOCs were less than those concentrations found from the shallow wells.

- Benzene, 1,2-DCE, cis-1,2-DCE, T-1,2-DCE, and TCE were the only organics detected in the deep wells sampled at Site 78. Benzene was detected near Buildings 903, 1301, and 1709. The other volatiles were detected near Building 903, in between Buildings 1103 and 1301, and near Building 1709.

- Contamination levels in the shallow groundwater appear to have decreased over time. An increase in the contamination levels in several of the deeper monitoring wells has been noted.

Cogdels Creek and New River

- The surface water within Cogdels Creek and the New River did not appear to be impacted with the exception of a few VOCs, pesticides, and metals. VOCs (TCE, and 1,2-DCE) were detected at a limited number of locations in the upper portion of Cogdels Creek. Pesticides were detected at a few random locations throughout. Copper was detected throughout the creek and river at concentrations above Federal and/or State surface water standards. Lead, zinc, and chromium were detected above the standards at random locations. No trends were detected. The highest metals concentrations were detected near the Hadnot Point Sewage Treatment Plant.

- The most prevalent contaminants found in Cogdels Creek and New River sediments were polynuclear aromatic hydrocarbon compounds (PAHs), pesticides (particularly 4,4'-DDD), and several inorganics. A number of inorganics were detected at every sediment sample location. Lead and zinc were most often in exceedance of sediment screening values. No trends or source areas were identified.

Beaver Dam Creek

- The only contaminants that were present in Beaver Dam Creek surface water were inorganics. Copper, lead, and zinc were detected at levels exceeding Federal and/or State surface water standards. No trends or source areas could be identified. The location exhibiting the highest concentrations was east of the northern portion of Site 78.

- The most prevalent contaminants found in Beaver Dam Creek sediments were PAHs, pesticides, and inorganics (lead was the only inorganic to exceed sediment screening values). No trends or source areas could be identified.

Scope and Role of Action

The proposed remedial action identified in this PRAP is the overall final cleanup strategy for the entire operable unit in that it remediates both media of concern: groundwater and soil. The contaminant plumes will be remediated along with contaminated soils. Implementation of this remedial action will reduce the potential for the migration of contamination, which in turn will reduce the risk to human health and to the environment.

Surface water and sediment will not be addressed under this action for the following reasons:

- The overall risk to human health posed by either Cogdels Creek or Beaver Dam Creek is acceptable.
- Potential adverse impacts to terrestrial organisms at OU No. 1 appear to be low.
- There are no known spawning and nursery areas for resident fish species within Cogdels or Beaver Dam Creeks, therefore, there is no potential for decreased viability of fish spawning or nursing.

Summary of Site Risks

As part of the RI, a baseline human health RA and an ecological RA were conducted to evaluate the current or future potential risks to human health and the environment resulting from the presence of contaminants identified at OU No. 1. A summary of the key findings from both of these studies is presented below.

Human Health Risk Assessment

The human health RA was conducted for several environmental media including soil (surface and subsurface), groundwater, surface water, and sediments. Contaminants of concern (COCs) for each of these media were selected based on prevalence, mobility, persistence, and toxicity. Table 1 lists the potential COCs which were evaluated in the human health RA for each media. For soil, the potential COCs included pesticides, PCBs, and inorganics. For groundwater, the potential COCs included VOCs, one SVOC (phenol), and inorganics. Surface water COCs included one VOC (TCE) and inorganics. Sediment COCs included PAHs, pesticides, and inorganics.

The exposure routes evaluated in the human health RA included ingestion, dermal contact, and particulate inhalation of surface soils; ingestion and dermal contact of subsurface soils, future potential ingestion, dermal contact, and inhalation of VOCs in groundwater; and ingestion and dermal contact of surface water and sediments. Several exposed populations were evaluated in the RA with respect to both current and future potential scenarios for the operable unit. For surface soil and groundwater, current military personnel and future on-site

TABLE 1

SUMMARY OF POTENTIAL CONTAMINANTS OF CONCERN EVALUATED IN THE HUMAN HEALTH RISK ASSESSMENT
PROPOSED REMEDIAL ACTION PLAN - CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Potential Contaminant of Concern	Soil			Groundwater	Surface Water		Sediment	
	21	24	78	OU No. 1	CC/NR	BDC	CC/NR	BDC
Volatiles								
Benzene				●				
1,2-Dichloroethene (total)				●				
Tetrachloroethene				●				
Ethylbenzene				●				
Total Xylenes				●				
Trichloroethene				●	●			
Vinyl Chloride				●				
Toluene				●				
Semivolatiles								
Chrysene	●	●					●	●
Fluoranthene	●						●	●
Pyrene	●	●					●	●
Phenanthrene		●					●	●
Benzo(a)anthracene	●						●	
Benzo(b)fluoranthene	●	●					●	
Benzo(k)fluoranthene	●						●	
Benzo(a)pyrene	●						●	
Benzo(g,h,i)perylene							●	
Indeno(1,2,3-cd)pyrene	●						●	
Phenol				●				
Pesticides and PCBs								
4,4'-DDD	●	●					●	●
4,4'-DDE	●	●					●	●
4,4'-DDT	●	●					●	●
Dieldrin		●						
Heptachlor Epoxide				●				
Total Chlordane	●	●					●	●
Total PCBs	●	●						
Inorganics								
Arsenic	●	●		●	●	●	●	●
Barium				●	●	●	●	●
Beryllium		●		●	●	●	●	●
Cadmium						●	●	
Chromium	●	●		●	●	●	●	●
Copper				●	●	●		
Lead				●	●	●		
Manganese	●	●		●	●	●	●	●
Mercury				●				
Nickel				●				
Selenium						●		
Vanadium	●	●		●	●	●	●	●
Zinc	●	●		●	●	●	●	●

Notes: CC/NR = Cogdels Creek and New River
BDC = Beaver Dam Creek

residents (adults and children) were retained as potentially exposed populations. Site construction workers were retained as potentially exposed populations for subsurface soils. Adults and adolescents (future) were retained for surface water and sediment exposures.

As part of the human health RA, incremental cancer risk (ICRs) and hazard indices (HIs) were calculated for each of the exposure routes and potentially exposed populations. An ICR refers to the cancer risk that is over and above the background cancer risk in unexposed individuals. For example, an ICR of 1.0E-04 means that one additional person out of ten thousand may be at risk of developing cancer due to excessive exposure at the site if no actions are conducted. USEPA considers the risk range of 1.0E-04 to 1.0E-06 to be safe and protective of public health. The HI refers to noncarcinogenic effects and is a ratio of the level of exposure to an acceptable level for all COCs. A HI greater than or equal to unity (i.e., 1.0) indicates that there may be a concern for noncarcinogenic health effects.

With respect to OU No. 1, all of the exposure routes/exposure populations evaluated had ICRs within the USEPA's acceptable risk range of 1.0E-4 to 1.0E-6 except for groundwater. Groundwater at OU No. 1 had calculated ICRs of 7E-04 and 2E-03 for future on-site residential children, and future on-site residential adults, respectively.

The calculated HIs were below the acceptable level of 1.0 except for groundwater. The calculated HI values for groundwater were 29 and 13 for future on-site residential children and future adult residents, respectively.

It is important to note that actual or threatened releases of hazardous substance from OU No. 1, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

Ecological Risk Assessment

An ecological RA was conducted at OU No. 1 in conjunction with the RI. The objectives of this RA were to determine if past reported disposal activities are adversely impacting the ecological integrity of Cogdels Creek and Beaver Dam Creek; and to evaluate the potential effects on sensitive environments at the operable unit such as wetlands, protected species, and fish nursery areas.

The ecological RA was conducted for several environmental media including soil, surface water, and sediments. Table 2 lists the COCs which were evaluated in this ecological RA for each media. Surface water COCs included one VOC (TCE) and inorganics. Sediment COCs included PAHs, pesticides, and inorganics. For soil, the potential COCs included PAHs, pesticides, PCBs, and inorganics.

The aquatic environment was assessed in the ecological RA. Based on the potential habitat, and other physical characteristics, the most significant populations of aquatic organisms at OU No. 1 were in Cogdels Creek and Beaver Dam Creek since the surface water in the drainage ditch at Site 21 was either shallow or nonexistent, and intermittent in flow.

Chromium, copper, lead, and zinc were the only COCs detected in the surface water in Cogdels Creek at concentrations that exceeded any of the water quality standards. These same four constituents, along with silver, several PAHs and pesticides were detected in sediments at concentrations that potentially may decrease the viability of aquatic life. The PAH and pesticide concentrations may be related to past disposal practices. However, the pesticide concentration in Cogdels Creek may also be due to the widespread pesticide spraying that has occurred at MCB, Camp Lejeune.

Copper and zinc were the only COCs detected in surface water at Beaver Dam Creek that exceeded any of the water quality standards. Lead, several PAHs, and several pesticides were detected in sediment samples from Beaver Dam Creek.

Overall, pesticides appear to be the most significant site-related COCs that have the potential for decreasing the viability of aquatic organisms at OU No. 1. There is some aquatic life inhabiting Cogdels Creek and Beaver Dam Creek including fish, tadpoles, and benthic macroinvertebrates. In addition, some terrestrial invertebrates probably inhabit the undeveloped areas within OU No.1. Pesticides are not only potentially toxic to aquatic life through a direct exposure pathway, but as indicated by their high bioconcentration factor value, they have a high potential to bioconcentrate pesticides in organisms. Therefore, other fauna that feed on these organisms will be exposed to pesticides via this indirect exposure pathway.

The terrestrial environment was assessed in the ecological RA. Based on the soil toxicity data for plants and terrestrial invertebrates (earthworms), lead and chromium were detected in concentrations that potentially may decrease the viability of terrestrial invertebrates and

TABLE 2

SUMMARY OF POTENTIAL CONTAMINANTS OF CONCERN EVALUATED IN THE ECOLOGICAL RISK ASSESSMENT
PROPOSED REMEDIAL ACTION PLAN - CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Potential Contaminant of Concern	Surface Water		Sediments		Surface Soils		
	CC/NR	BDC	CC/NR	BDC	Site 21	Site 24	Site 78
Volatiles							
Trichloroethene	●						
Semivolatiles							
Phenanthrene			●	●	●	●	●
Anthracene							●
Carbazole							●
Fluoranthene			●	●	●		●
Pyrene			●	●	●	●	●
Benzo(a)anthracene			●		●		●
Chrysene			●	●	●	●	●
Benzo(b)fluoranthene			●		●	●	●
Benzo(k)fluoranthene					●		●
Benzo(a)pyrene			●		●		●
Indeno(1,2,3-cd)pyrene			●		●		●
Benzo(g,h,i)perylene			●		●		●
Pesticides							
4,4'-DDE			●	●	●	●	●
4,4'-DDD			●	●	●	●	●
4,4'-DDT			●	●	●	●	●
Dieldrin						●	●
alpha-Chlordane			●	●	●	●	●
gamma-Chlordane			●	●	●	●	
PCBs							
Aroclor - 1254						●	
Aroclor - 1260					●	●	

Notes: CC/NR = Cogdels Creek and New River
BDC = Beaver Dam Creek

TABLE 2

SUMMARY OF POTENTIAL COCs EVALUATED IN THE
ECOLOGICAL RISK ASSESSMENT
PROPOSED REMEDIAL ACTION PLAN - CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Potential Contaminant of Concern	Surface Water		Sediments		Surface Soils		
	CC/NR	BDC	CC/NR	BDC	Site 21	Site 24	Site 78
Inorganics							
Aluminum	●	●	●	●	●	●	●
Arsenic	●	●	●	●	●	●	●
Barium	●	●	●	●		●	●
Beryllium	●		●	●	●	●	●
Cadmium			●				●
Chromium	●		●	●	●	●	●
Cobalt			●	●		●	
Copper	●	●	●	●	●	●	●
Iron	●	●	●	●	●	●	●
Lead	●	●	●	●	●	●	●
Manganese	●	●	●	●	●	●	●
Mercury						●	
Nickel						●	
Selenium			●	●	●	●	●
Silver			●				
Thallium						●	
Vanadium	●	●	●	●	●	●	●
Zinc	●	●	●	●	●	●	●

Notes: CC/NR = Cogdels Creek and New River
BDC = Beaver Dam Creek

floral species at Site 21. Lead and chromium, along with beryllium, copper, mercury, and vanadium were detected in concentrations that potentially may decrease the viability of terrestrial invertebrates and floral species at Site 24. At Site 78, lead and chromium were once again detected in concentrations that potentially may decrease the viability of terrestrial invertebrates and floral species, along with beryllium and zinc. Other terrestrial organisms (e.g., rabbits, birds, deer) may be exposed to contaminants in the surface soils and surface water by ingestion. Overall, pesticides appear to be the most significant site-related COCs that have the potential for decreasing the viability of terrestrial organisms at OU No. 1. Potential adverse impacts to these threatened or endangered species from contaminants at OU No. 1 appear to be low.

No wetlands were identified within OU No. 1 from available wetland maps, although some wetland areas border the southeastern boundary of the site.

There are no known spawning and nursery areas for resident fish species within Cogdels Creek or Beaver Dam Creek. Therefore, there is no potential for decreased viability of fish spawning or nursing in Cogdels Creek or Beaver Dam Creek.

For surface water and groundwater, fish, crab, benthic macroinvertebrates, birds, and other aquatic and terrestrial life were evaluated as potentially exposed populations. Bottom feeding fish and crabs, benthic macroinvertebrates, aquatic vegetation, and other aquatic life were evaluated with respect to sediment exposure. For soil, terrestrial species were evaluated as the potentially exposed population.

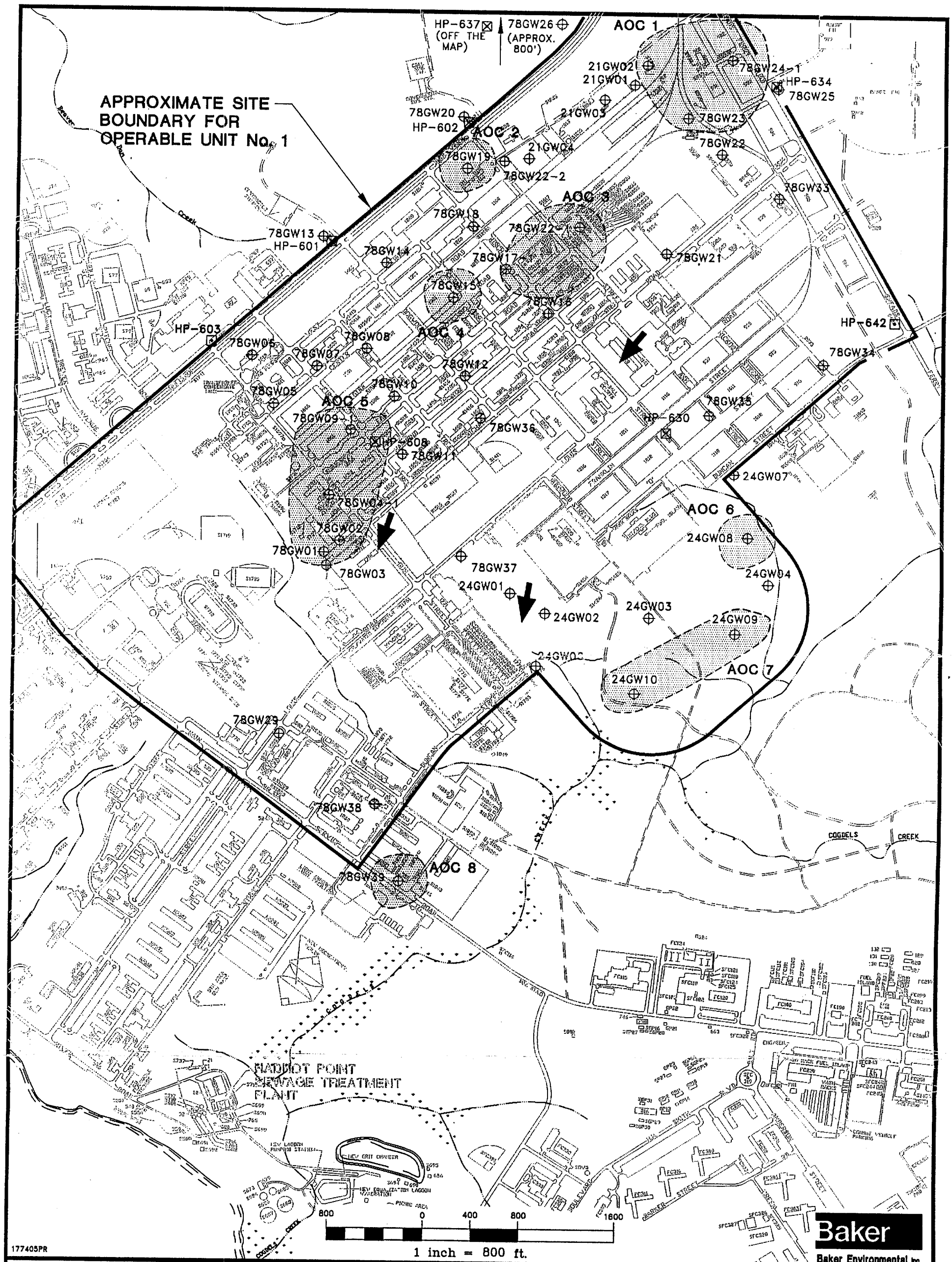
It is important to note that actual or threatened releases of hazardous substances from OU No. 1, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

Summary of Alternatives

Remedial action alternatives (RAAs) were developed to address contaminated media at various areas of concern (AOCs) within OU No. 1, including the following eight Groundwater AOCs and four Soil AOCs:

- VOC-contaminated plume located near the 901/903-Series Building area within Site 78 (referred to as Groundwater AOC 1).
- Three small areas of groundwater contamination (PCE only) located throughout Site 78 (Groundwater AOCs 2, 4, and 8).
- A fuel-contaminated plume located near the Hadnot Point Fuel Farm (Groundwater AOC 3).
- A VOC-contaminated plume located near the 1600 and 1700 Series Building area of Site 78 (Groundwater AOC 5).
- Two areas of groundwater contamination located within Site 24 (heptachlor epoxide only) (Groundwater AOCs 6 and 7).
- Northeast portion of Site 21 with elevated levels of PCBs in surface soil (Soil AOC 1).
- Southwest portion of Site 21 with elevated levels of PCBs in surface soil (Soil AOC 2).
- Southwest portion of Site 21 with elevated levels of pesticides in surface soil (Soil AOC 3).
- Northeastern edge of Building 1502 within Site 78 with elevated levels of pesticides in surface soil (Soil AOC 4).

Figures 5 and 6 show the general location of the above-mentioned AOCs for groundwater and soil, respectively.



LEGEND

- 78GW02 ⊕ SHALLOW MONITORING WELL
- → ESTIMATED DIRECTION OF GROUDWATER FLOW
- APPROXIMATE AREA OF GROUNDWATER CONTAMINATION EXCEEDING REMEDIATION LEVELS FOR ORGANICS (SHALLOW MONITORING WELLS)
- AOC 8 AREA OF CONCERN
- HP-603 WATER SUPPLY WELL (ACTIVE)
- HP-601 WATER SUPPLY WELL (INACTIVE)

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 5
GROUNDWATER AREAS OF CONCERN
AT OPERABLE UNIT No. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

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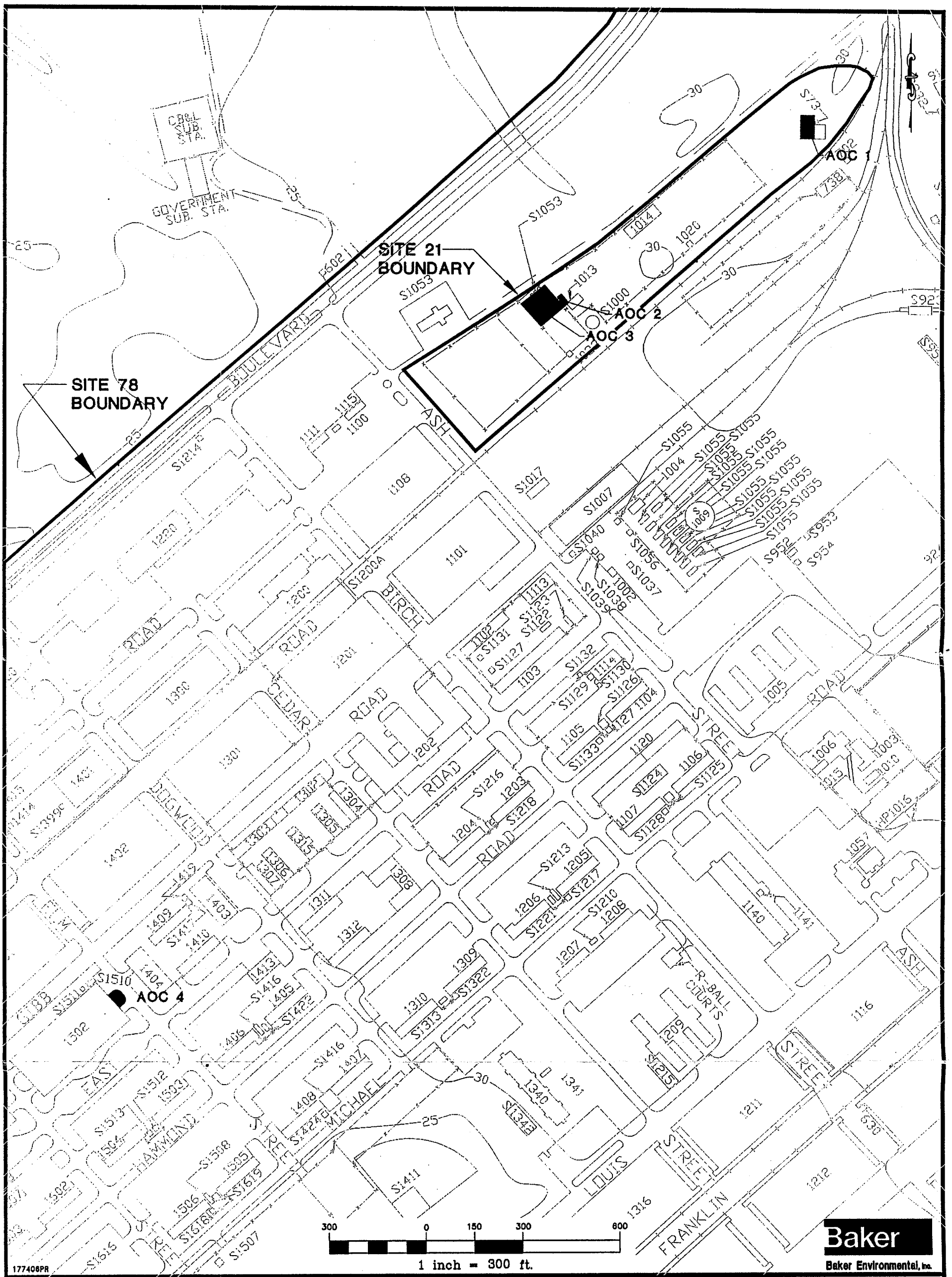


LEGEND

AOC 1 ● APPROXIMATE LOCATION OF SOIL EXCEEDING REMEDIATION LEVELS.

SOURCE: LANTDIV, OCT. 1991

FIGURE 6
APPROXIMATE LOCATION OF SOIL AREAS OF CONCERN
OPERABLE UNIT NO. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

Based on the AOCs identified above, five groundwater RAAs and four soil RAAs were developed and evaluated in the FS. A brief overview of each of the RAAs per media is included below. All costs and implementation times are estimated.

Groundwater RAAs

The following groundwater RAAs were developed and evaluated for OU No. 1:

- RAA No. 1 No Action
- RAA No. 2 Institutional Controls
- RAA No. 3 Source Control (Interim Action Treatment System Extension)
- RAA No. 4 Source Control (Air Sparging)
- RAA No. 5 Source Control and Vertical Containment

Common Elements - All of the Groundwater RAAs will have a few common components. Specifically, the components of the IRA to be implemented at Site 78 will be included under all of the Groundwater RAAs. RAA Nos. 2 through 5 have several common remedial elements between them including aquifer-use restrictions, deed restrictions, and long-term monitoring of existing monitoring wells and water supply wells. Each of the common elements will be briefly discussed below.

The IRA includes the installation of two groundwater pump and treat systems within Site 78, a long-term groundwater monitoring program, and institutional controls. The primary objective of the IRA is to contain the migration of the two shallow groundwater plumes located within Site 78. In terms of the FS for the entire operable unit, the IRA will contain the shallow groundwater contamination from Groundwater AOCs 1 and 5.

The IRA groundwater treatment systems will include air stripping, carbon adsorption, oil/water separation, and metals removal. One treatment system is to be located within the northeast contaminated plume (AOC 1). Four extraction wells will be initially installed near the downgradient edge of this plume. The second treatment system is to be located within the southwest contaminated plume (AOC 5). Five extraction wells will be initially installed along the downgradient edge of this second plume. Approximately three to five gallons of groundwater per minute are anticipated to be extracted from each well. Each of the treatment units will be designed to handle a maximum influent of 80 gallons per minute (gpm).

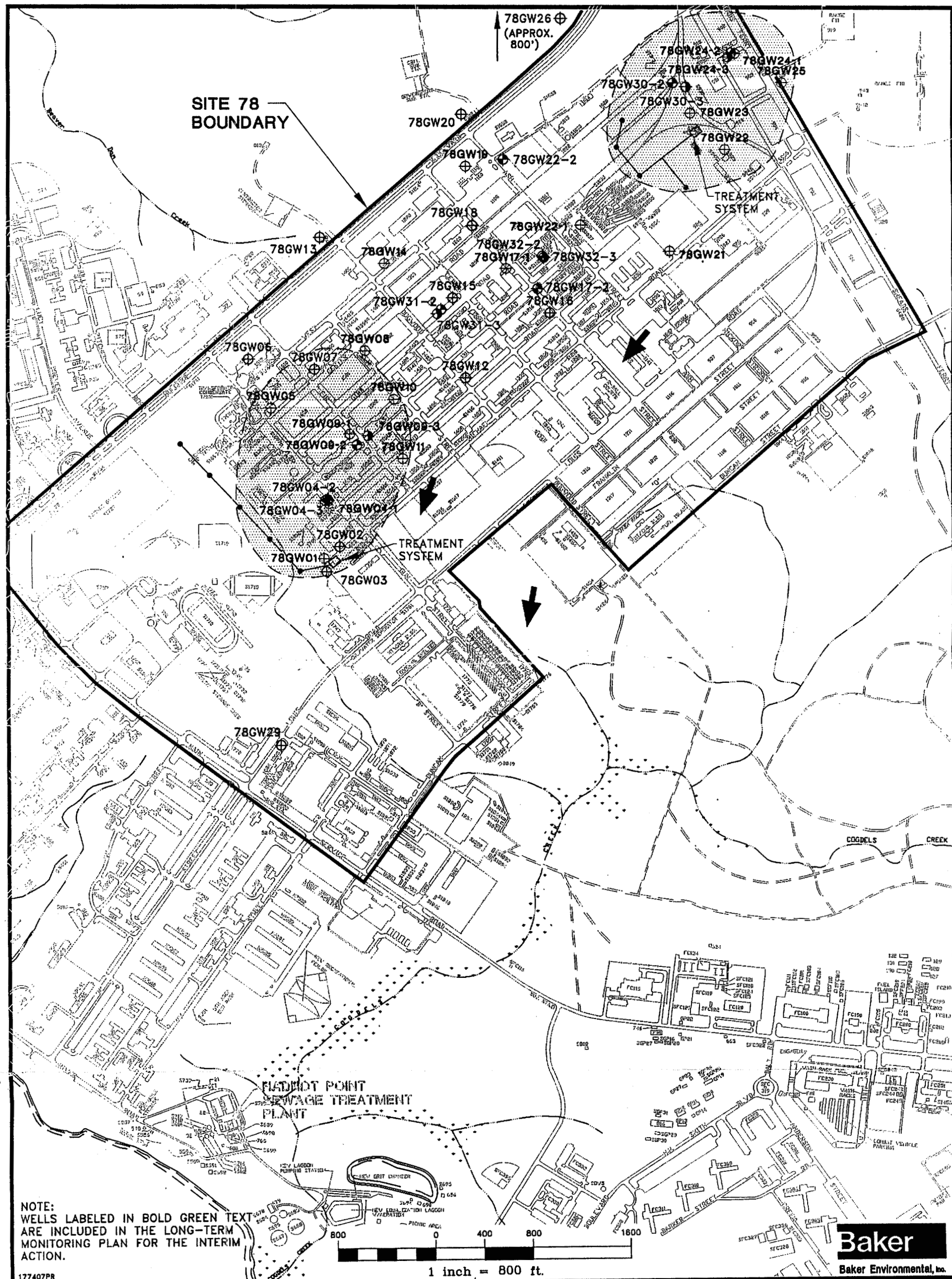
In addition to the pump and treat systems, the interim remedial action will include a long-term groundwater monitoring program. Under this program, 20 existing monitoring wells will be sampled for the contaminants of concern (i.e., VOCs and inorganics) on a quarterly basis. As shown on Figure 7 and listed below, the wells to be monitored include 16 shallow monitoring wells, two intermediate wells, and two deep wells.

Shallow Wells	Intermediate Wells	Deep Wells
78GW01	78GW09-2	78GW09-3
78GW04-1	78GW24-2	78GW24-3
78GW05		
78GW08		
78GW09-1		
78GW10		
78GW11		
78GW14		
78GW17-1		
78GW19		
78GW21		
78GW22		
78GW22-1		
78GW23		
78GW24-1		
78GW25		

The institutional controls under the interim action include placing aquifer-use restrictions on the shallow aquifer and keeping the closed water supply wells out of service.

Under Groundwater RAA Nos. 2 through 5, aquifer-use restrictions will be remain on water supply wells HP-601, HP-602, HP-608, HP-630, HP-634, and HP-637. Deed restrictions restricting the placement of additional water supply wells within the entire OU No. 1 will also be included with these four RAAs.

In addition to the twenty wells included under the long-term monitoring program for the interim remedial action for Site 78, an additional five shallow monitoring wells and the nearby water supply wells will also be included under a long-term monitoring program for the groundwater RAA Nos. 2, 3, 4, and 5. The five shallow monitoring wells will include:



NOTE:
WELLS LABELED IN BOLD GREEN TEXT ARE INCLUDED IN THE LONG-TERM MONITORING PLAN FOR THE INTERIM ACTION.

LEGEND

- 78GW02 — SHALLOW MONITORING WELL
- 78GW04-2 — INTERMEDIATE MONITORING
- 78GW04-3 — DEEP MONITORING WELL
- APPROXIMATE AREA OF SHALLOW GROUNDWATER CONTAMINATION EXCEEDING REMEDIATION LEVELS (BASED ON 1991 ESE DATA)
- ESTIMATED DIRECTION OF GROUNDWATER FLOW
- TREATMENT SYSTEM
- EXTRACTION WELLS AND PIPING

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 7
INTERIM REMEDIAL ACTION TO BE IMPLEMENTED FOR THE SURFICIAL AQUIFER AT SITE 78
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

01254 B022

78GW15, 78GW39, 24GW08, 24GW09, and 24GW10. Several of these wells are associated with the newly identified Groundwater AOCs. Both active and inactive water supply wells will be monitored. The active supply wells include HP-603, and HP-642. The inactive supply wells to be monitored include HP-601, HP-602, HP-608, HP-630, HP-634, and HP-637. Additional wells may be added to the monitoring program, if necessary.

Samples will be collected on a semiannual basis for five years and analyzed for Target Compound List (TCL) VOCs. As required, after five years the remedial action will be re-evaluated to determine its effectiveness. Based on the the semiannual groundwater data and the data from the interim remedial action, a less frequent sampling program may be implemented (such as annually), or it may be determined that sampling is no longer required at certain areas. In time, the results of the monitoring program may indicate that one or more of the currently inactive water supply wells can be considered for use.

The Groundwater RAAs will only include active remediation of the groundwater from Groundwater AOCs 1 and 5. No additional remedial actions, other than the long-term monitoring, will be performed for Groundwater AOCs 2, 3, 4, 6, 7, and 8 under any of the Groundwater RAAs. This decision for most of the AOCs was based on the contaminant concentrations and since no apparent source(s) were identified. If the monitoring indicates that the groundwater at these areas is deteriorating, additional measures will be taken. This will be evaluated every five years. Once the remediation levels have been obtained for these areas, monitoring will no longer be necessary. Since these areas will potentially exceed chemical-specific criteria or "applicable or relevant and appropriate requirements" (ARARs), a waiver will be invoked for this monitoring action.

No additional actions will be implemented at Groundwater AOC 3 since this is the area of the Hadnot Point Fuel Farm (Site 22). A fuel recovery system/groundwater treatment is currently operating at this area. Investigations/remediations related to the Fuel Farm are being handled under the UST Program, not CERCLA. Therefore, only monitoring will be conducted near this area under this proposed cleanup plan.

A description of the remaining remedial actions associated with each groundwater alternative as well as the estimated cost and timeframe to implement the alternative follows:

- **RAA No. 1: No Action**

  Capital Cost: $0
  Annual Operation and Maintenance (O&M) Costs: $0
  Net Present Worth (NPW): $0
  Months to Implement: None

  The No Action RAA is required under CERCLA to establish a baseline for comparison. Under this RAA, no further action at the operable unit will be implemented (note that an interim remedial action to contain the migration of the plumes and prevent exposure to groundwater contamination will be implemented).

- **RAA No. 2: Institutional Controls**

  Capital Cost: $0
  Annual O&M Costs: $26,000 for Years 1 through 5, $13,000 for Years 6 through 30
  NPW: $260,000
  Months to Implement: 3-6

  Under RAA No. 2, no additional remedial actions will be performed to reduce the toxicity, mobility, or volume of the wastes at OU No. 1. This RAA will include only the common institutional controls of monitoring, ordinances or directives preventing the operation of nearby supply wells, and deed restrictions for prohibiting construction of potable supply wells.

- **RAA No. 3: Source Control (Interim Remedial Action Treatment System Extension)**

  Capital Cost: $180,000
  Annual O&M Costs: $30,000 for Years 1 through 5, $15,000 for Years 6 through 30
  NPW: $460,000
  Months to Implement: 10

  In general, RAA No. 3 is a source control alternative with the primary objective to remediate the source(s) of shallow groundwater contamination. Under this alternative three additional shallow extraction wells will be installed at areas exhibiting the highest VOC contamination. The contaminated groundwater will be pumped to the interim action groundwater treatment system. Two of the extraction wells will be installed near existing monitoring wells 78GW24-1 and 78GW23 within Groundwater AOC 1. The third extraction well will be installed near existing monitoring well 78GW09-1 within Groundwater AOC 5. The extraction wells will be designed the same as for the interim action wells (i.e., 6-inch minimum diameter,

approximately 35 feet deep). Based on site geology, it is anticipated that the wells will produce 3 to 5 gpm of water.

No extraction wells will be placed in the deeper portions of the aquifer under this alternative. It is believed that once the contaminants in the source of the deep groundwater contamination (i.e., the shallow aquifer) are removed and treated, the contaminant levels in the deeper portions of the aquifer will be reduced in time. Deeper extraction wells could actually draw the existing shallow contamination down into the deeper portions of the aquifer, and thereby increase the vertical extent of the contaminant plume.

- **RAA No. 4: Source Control (Air Sparging)**

  Capital Cost: $230,000
  Annual O&M Costs: $110,000 for Years 1 through 5
  NPW: $690,000
  Months to Implement: 12

  In general, RAA No. 4 is a source control alternative with the primary objective to remediate the highly contaminated shallow aquifer, which is the source of deep groundwater contamination. Under this alternative, two in situ air sparging/soil venting treatment systems will be installed at areas of the highest VOC contamination. One of the units will be installed near existing monitoring well 78GW24-1 (Groundwater AOC 1). The other treatment system will be installed near existing monitoring well 78GW09-1 (Groundwater AOC 5).

  The treatment systems will be designed to primarily treat the shallow (source) contamination. It is believed that once the source of contamination (the shallow aquifer) is remediated, the contaminant levels in the deeper portions of the aquifer will be reduced in time.

- **RAA No. 5: Source Control and Vertical Containment**

  Capital Cost: $310,000
  Annual O&M Costs: $32,000 for Years 1 through 5, $16,000 for Years 6 through 30
  NPW: $615,000
  Months to Implement: 15

  In general, RAA No. 5 is a source control and vertical containment alternative with the primary objectives to remediate the source(s) of groundwater contamination and to

mitigate the vertical migration of the contamination. The source control component of this alternative is the same as with RAA No. 3. In such, three additional shallow extraction wells will be installed at areas of the highest VOC contamination and connected to the interim action groundwater treatment system. Two of the extraction wells will be installed near existing monitoring wells 78GW24-1 and 78GW23 within Groundwater AOC 1. The third extraction well will be installed near existing monitoring well 78GW09-1 within Groundwater AOC 5. The extraction wells will be designed the same as for the interim action wells (i.e., 6-inch minimum diameter, approximately 35 feet deep). Based on site geology, it is anticipated that the wells will produce 3 to 5 gpm of water.

The vertical containment component of this alternative includes the installation of two extraction wells at the areas of the highest VOC contamination in the deeper portions of the aquifer at OU No. 1. One of the wells will be installed near existing monitoring well 78GW24-3 within Groundwater AOC 1. The second extraction well will be installed near existing monitoring wells 78GW4-2 and 78GW4-3 within Groundwater AOC 5. The extraction wells will be 6-inch minimum diameter and installed at approximately 75 feet below ground surface.

Soil RAAs

The following Soil RAAs were developed and evaluated for OU No. 1:

- RAA No. 1 No Action
- RAA No. 2 Capping
- RAA No. 3 On-Site Treatment
- RAA No. 4 Off-Site Treatment/Disposal

A description of each alternative as well as the estimated cost and timeframe to implement the alternative follows:

- **RAA No. 1: No Action**

  Capital Cost: $0
  Annual O&M Costs: $0
  NPW: $0
  Months to Implement: None

  The No Action RAA is required under CERCLA to establish a baseline for comparison. Under this RAA, no further action at the operable unit will be implemented to prevent exposure to contaminated soil.

- **RAA No. 2: Capping**

  Capital Cost: $260,000
  Annual O&M Costs: $60,000 for 30 years
  NPW: $1.2 million
  Months to Implement: 6

  In general, Soil RAA No. 2 includes the installation of an asphalt or concrete cap over the four contaminated soil areas within Site 21 and Site 78. The thickness of the cap will be approximately four to eight inches. To ensure the integrity of the capping system, periodic maintenance (e.g., applying a sealant over asphalt) will be required. In order to monitor the effectiveness of the cap (i.e., the prevention of migration of the COCs), groundwater sampling will be conducted semiannually. Groundwater samples will be collected from the following six monitoring wells: 21GW01, 21GW02, 21GW03, 21GW04, 78GW09-1 and 78GW10. The capped areas will be fenced to restrict access to the capped areas and reduce damage to the caps. New fencing may not be necessary for Soil AOC 3. This RAA will require approximately 900 linear feet of new chain-link fence to be installed. The fence will be of sufficient height and construction so as to limit access to the caps. In addition, "No Trespassing" signs will be posted along the fences to further deter access. Routine maintenance and repairs of the fence, as necessary, are also included under this RAA. In addition to the fence, deed restrictions restricting the use of the area in and around the capped areas will be implemented. Any soil excavated during potential future construction activities will require appropriate disposal in accordance with applicable Federal and State regulations.

  The objectives of this RAA are to prevent the potential for direct contact with the soils, and to prevent the potential for the horizontal or vertical migration of contaminants via storm water infiltration.

- **RAA No. 3: On-Site Treatment**

  Capital Cost: $650,000 (incineration); $1.4 million (dechlorination)
  Annual O&M Costs: $0
  NPW: $650,000 (incineration); $1.4 million (dechlorination)
  Months to Implement: 8-12

  RAA No. 3 includes the excavation of up to 1,050 cubic yards of contaminated soil from Soil AOCs 1 through 4 and treatment on site via either chemical dechlorination, or incineration. Following treatment, any residual soils will be removed from the treatment unit, analyzed, and if permitted (due to treated levels which exceed the remediation levels), used as backfill at the site. If not permitted (due to treated levels which exceed the remediation levels), the treated soils will be properly disposed off site. The excavated areas will be graded to conform to the surrounding terrain. Clean fill may be added to the excavated areas as necessary to bring the areas up to grade. The excavated areas will be revegetated.

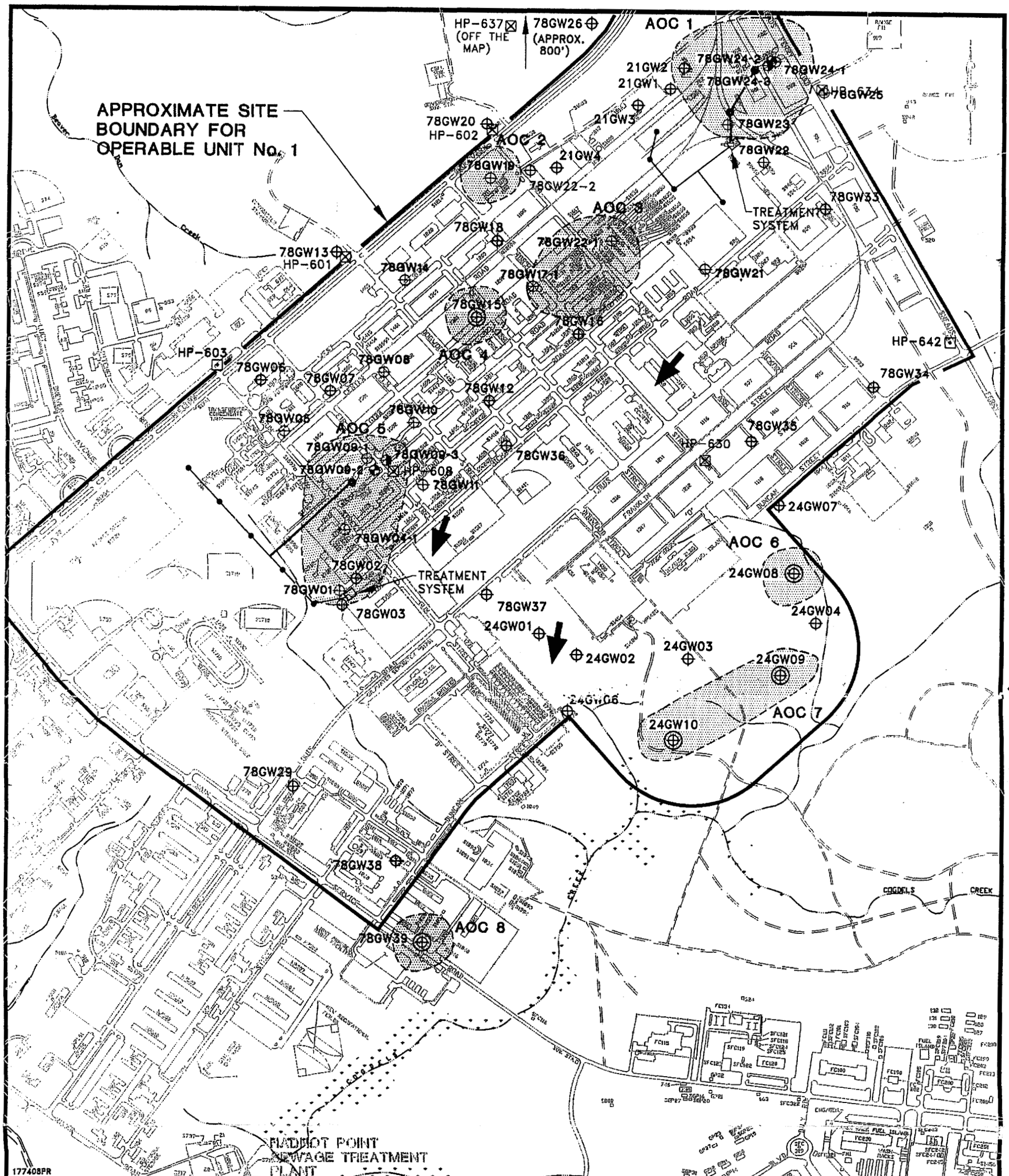
- **RAA No. 4: Off-Site Treatment/Disposal**

  Capital Cost: $480,000 (disposal); $1.3 million (treatment)
  Annual O&M Costs: $0
  NPW: $480,000 (disposal); $1.3 million (treatment)
  Months to Implement: 8-12

  Soil RAA No. 4 includes the excavation of soil from the four Soil AOCs (1,050 cubic yards) and off-site treatment and/or disposal. The treatment/disposal facility will have to be permitted to accept low levels [i.e., less than 50 parts per million (ppm)] of PCBs and pesticides.

Evaluation of Alternatives and the Preferred Alternative

The preferred overall RAA for OU No. 1 is a combination of Groundwater RAA No. 3: Source Control (Interim Remedial Action Treatment System Extension) and Soil RAA No. 4: Off-Site Treatment/Disposal. The principal components of both of these RAAs are presented on Figures 8 and 9. Based on available information, these alternatives appear to provide the best balance with respect to the nine CERCLA evaluation criteria used to evaluate alternatives. Based on new information or public comments, MCB, Camp Lejeune/DON, in consultation with USEPA and the State of North Carolina, may later modify the preferred alternative or select another treatment alternative presented in this PRAP and the FS. The public,



LEGEND

- 78GW02 — SHALLOW MONITORING WELL
- 78GW15 — SHALLOW MONITORING WELL INCLUDED IN THE LONG-TERM MONITORING PROGRAM
- 78GW09-2 — INTERMEDIATE MONITORING WELL
- 78GW09-3 — DEEP MONITORING WELL
- HP-603 — WATER SUPPLY WELL (ACTIVE)
- HP-601 — WATER SUPPLY WELL (INACTIVE)
- APPROXIMATE AREA OF GROUNDWATER CONTAMINATION EXCEEDING REMEDIATION LEVELS FOR ORGANICS (SHALLOW MONITORING WELLS)
- AOC 8 — AREA OF CONCERN
- ESTIMATED DIRECTION OF GROUNDWATER FLOW
- TREATMENT SYSTEM
- IRA EXTRACTION WELLS AND PIPING
- RAA EXTRACTION WELLS AND PIPING

SOURCE: LANTDIV, FEBRUARY 1992

NOTES:
- ALL IDENTIFIED SUPPLY WELLS WILL BE INCLUDED UNDER THE LONG-TERM MONITORING PROGRAM.
- WELLS LABELED IN BOLD GREEN TEXT ARE INCLUDED IN THE LONG-TERM MONITORING PLAN FOR THE INTERIM ACTION.

800 0 400 800 1600

1 inch = 800 ft.

Baker
Baker Environmental, Inc.

FIGURE 8
GROUNDWATER RAA: SOURCE CONTROL
(INTERIM TREATMENT SYSTEM EXTENSION)
OPERABLE UNIT No. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

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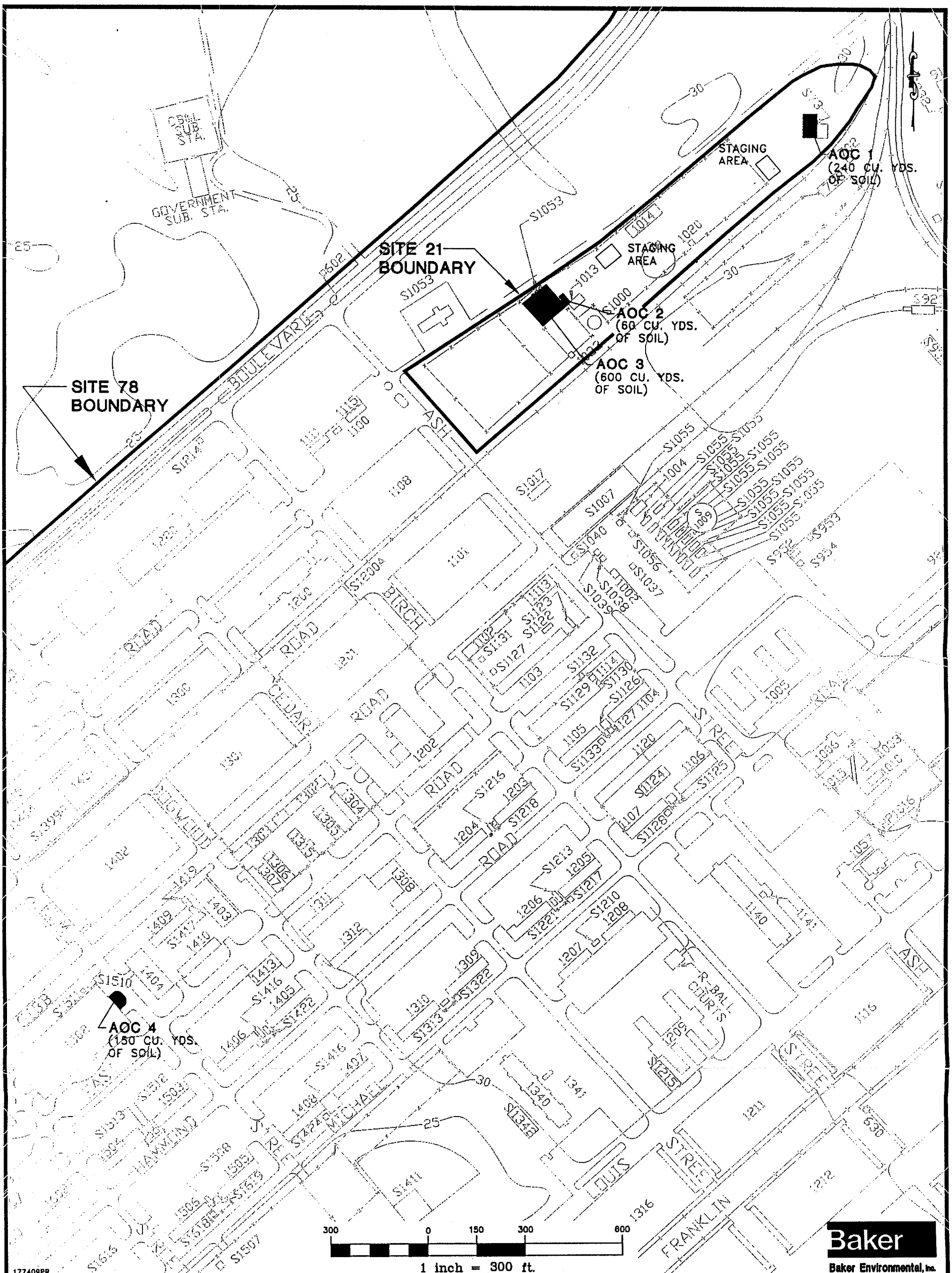

LEGEND

AOC 1 ● APPROXIMATE LOCATION OF SOIL EXCEEDING REMEDIATION LEVELS. EXCAVATION TO TAKE PLACE WITHIN THIS AREA

SOURCE: LANTDIV, OCT. 1991

FIGURE 9
PREFFERED SOIL RAA : OFF-SITE TREATMENT/DISPOSAL
OPERABLE UNIT NO. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

therefore, is encouraged to review and comment on all of the information on these RAAs identified in this plan.

A profile of the performance of alternatives with respect to seven of the nine criteria is presented on Tables 3, and 4. With respect to USEPA/State Acceptance (the eighth evaluation criteria), both the USEPA and the NC DEHNR concur with the selection of Groundwater RAA No. 3 and Soil RAA No. 4. The remaining criteria for Community Acceptance will be assessed in the Responsiveness Summary and ROD following a review of the public comments on the RI/FS Reports and this PRAP. A glossary of the evaluation criteria is presented on Table 5.

Summary of the Preferred Alternative

In summary, the preferred alternatives (Groundwater RAA No. 3 and Soil RAA No. 4) will achieve substantial risk reduction through treatment or removal of the principal threats at the operable unit (i.e., the VOC-contaminated groundwater, and the PCB- and pesticide-contaminated soils). These two RAAs are believed to provide the best balance of trade-offs among the RAAs with respect to the pertinent evaluation criteria. Based on the available information, MCB, Camp Lejeune/DON believe the preferred RAAs will be protective of human health and the environment, will comply with pertinent ARARs (a waiver has been invoked for groundwater contaminants in some areas of the OU), will be cost effective, and will utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Note that attaining the chemical-specific ARARs for all of the groundwater COCs is technically impracticable from an engineering perspective. For instance, it would not be practicle to install extraction wells and associated piping at the three isolated well locations that slightly exceeded the state water quality standard for PCE. Since the contaminated groundwater and contaminated soil will be treated under these RAAs, the statutory preference for the use of a remedy that involves treatment as a principal element is satisfied.

COMMUNITY PARTICIPATION

A critical part of the selection of a remedial action alternative is community involvement. The following information is provided to the community in order to obtain input that addresses the selection of remedial action alternative for OU No. 1.

TABLE 3

SUMMARY OF DETAILED ANALYSIS - GROUNDWATER RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Institutional Controls	RAA No. 3 Source Control (Interim Remedial Action Treatment System Extension)	RAA No. 4 Source Control (Air Sparging)	RAA No. 5 Source Control and Vertical Containment
OVERALL PROTECTIVENESS					
• Human Health Protection	Potential risks associated with groundwater exposure are mitigated due to the interim remedial action and long-term monitoring program.	Potential risks associated with groundwater exposure are mitigated due to the interim remedial action and long-term monitoring program.	Although treatment is employed, aquifer is not usable until remediation levels are met. The alternative is protective of public health by implementing institutional controls (i.e., monitoring and restrictions on potable supply wells).	Although treatment is employed, aquifer is not usable until remediation levels are met. The alternative is protective of public health by implementing institutional controls (i.e., monitoring and restrictions on potable supply wells).	Although treatment is employed, aquifer is not usable until remediation levels are met. The alternative is protective of public health by implementing institutional controls (i.e., monitoring and restrictions on potable supply wells).
• Environmental Protection	Migration of contamination is reduced via the interim remedial action.	Migration of contamination is reduced via the interim remedial action.	Migration of contaminated groundwater is reduced by pump and treat.	Migration of contaminated groundwater is reduced by in situ treatment.	Migration of contaminated groundwater is reduced by pump and treat.
COMPLIANCE WITH ARARS					
• Chemical-Specific ARARs	Will exceed Federal and/or NC groundwater quality ARARs.	Will exceed Federal and/or NC groundwater quality ARARs.	A waiver will be required since organics and inorganics above State and Federal standards will remain untreated in some portions of the operable unit. These portions are outside of the primary VOC plumes. All other chemical-specific ARARs will be met over time.	A waiver will be required since organics and inorganics above State and Federal standards will remain untreated in some portions of the operable unit. These portions are outside of the primary VOC plumes. All other chemical-specific ARARs will be met over time.	A waiver will be required since organics and inorganics above State and Federal standards will remain untreated in some portions of the operable unit. These portions are outside of the primary VOC plumes. All other chemical-specific ARARs will be met over time.
• Location-Specific ARARs	Not applicable.	Not applicable.	Will meet location-specific ARARs.	Will meet location-specific ARARs.	Will meet location-specific ARARs.
• Action-Specific ARARs	Not applicable.	Not applicable.	Will meet action-specific ARARs.	Will meet action-specific ARARs.	Will meet action-specific ARARs.

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TABLE 3 (Continued)

SUMMARY OF DETAILED ANALYSIS - GROUNDWATER RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Institutional Controls	RAA No. 3 Source Control (Interim Remedial Action Treatment System Extension)	RAA No. 4 Source Control (Air Sparging)	RAA No. 5 Source Control and Vertical Containment
LONG-TERM EFFECTIVENESS AND PERMANENCE					
• Magnitude of Residual Risk	Risk reduced via the interim remedial action.	Risk reduced via the interim remedial action.	Shallow groundwater in the operable unit that will not be addressed pose no current risk since the shallow aquifer is not utilized for potable supply. Future use of the shallow aquifer is unlikely due to poor transmissivity. The long term effectiveness of pump and treat is unknown. Contaminant levels may decrease in time, but could potentially increase if the extraction/treatment system is shut down. Institutional controls will prevent residual risk.	Shallow groundwater in the operable unit that will not be addressed pose no current risk since the shallow aquifer is not utilized for potable supply. Future use of the shallow aquifer is unlikely due to poor transmissivity. The long term effectiveness of pump and treat is unknown. Contaminant levels may decrease in time, but could potentially increase if the extraction/treatment system is shut down. Institutional controls will prevent residual risk.	Shallow groundwater in the operable unit that will not be addressed pose no current risk sinc the shallow aquifer is not utilized for potable supply. Future use of the shallow aquifer is unlikely due to poor transmissivity. The long term effectiveness of pum and treat is unknown. Contaminant levels may decrease i time, but could potentially increas if the extraction/treatment system is shut down. Institutional control will prevent residual risk.
• Adequacy and Reliability of Controls	Not applicable - no additional controls.	Additional monitoring is adequate to determine effectiveness of alternative.	Institutional controls are reliable to prevent potential human health exposure. Periodic operation and maintenance and monitoring will ensure that the treatment system is effective.	Institutional controls are reliable to prevent potential human health exposure. Periodic operation and maintenance and monitoring will ensure that the treatment system is effective.	Institutional controls are reliable to prevent potential human health exposure. Periodic operation and maintenance and monitoring will ensure that the treatment system is effective.
• Need for 5-year Review	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review not needed once remediation levels are met.	Review not needed once remediation levels are met.	Review not needed once remediation levels are met.

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TABLE 3 (Continued)

SUMMARY OF DETAILED ANALYSIS - GROUNDWATER RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Institutional Controls	RAA No. 3 Source Control (Interim Remedial Action Treatment System Extension)	RAA No. 4 Source Control (Air Sparging)	RAA No. 5 Source Control and Vertical Containment
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
• Treatment Process Used	No additional treatment other than the IRA treatment system. The IRA treatment train consisting of air striping, activated carbon, and metals removal.	No additional treatment other than the IRA treatment system. The IRA treatment train consisting of air striping, activated carbon, and metals removal.	Treatment train for metals removal, air stripping, and activated carbon.	In addition to IRA treatment train, includes air sparging and soil vapor extraction.	Treatment train for metals remove air stripping, and activated carbon
• Amount Destroyed or Treated	Contaminants in groundwater at the outer edges of two plumes.	Contaminants in groundwater at the outer edges of two plumes.	Majority of contaminants in groundwater plumes.	Majority of contaminants in groundwater.	Majority of contaminant in groundwater plumes.
• Reduction of Toxicity, Mobility or Volume	Reduced volume and toxicity of contaminated groundwater via the IRA.	Reduced volume and toxicity of contaminated groundwater via the IRA.	Reduced volume and toxicity of contaminated groundwater.	Reduced volume and toxicity of contaminated groundwater.	The mobility of the VOC contamination in the shallow aquifer may be increased due to operating extraction wells in the deeper zones.
• Residuals Remaining After Treatment	Source areas will be a continuing source of contamination.	Source areas will be a continuing source of contamination.	Potentially minimal residuals after goals are met.	Potentially minimal residuals after goals are met.	Potentially minimal residuals afte goals are met.
• Statutory Preference for Treatment	Satisfied via the IRA.	Satisfied via the IRA.	Satisfied.	Satisfied.	Satisfied.
SHORT-TERM EFFECTIVENESS					
• Community Protection	Risks to community not increased by remedy implementation.	Risks to community not increased by remedy implementation.	Minimal, if any, risks during extraction and treatment.	Possible migration of toxic vapors, should be controlled with the soil vapor extraction systems.	Minimal, if any, risks during extraction and treatment.
• Worker Protection	No significant risk to workers.	No significant risk to workers.	Protection required during treatment.	Protection required during treatment.	Protection required during treatment.

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TABLE 3 (Continued)

SUMMARY OF DETAILED ANALYSIS - GROUNDWATER RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Institutional Controls	RAA No. 3 Source Control (Interim Remedial Action Treatment System Extension)	RAA No. 4 Source Control (Air Sparging)	RAA No. 5 Source Control and Vertical Containment
• Environmental Impacts	Continued impacts from existing conditions.	Continued impacts from existing conditions.	Aquifer drawdown during extraction. This is not expected to be an environmental concern.	Possible migration of toxic vapors, should be controlled with the soil vapor extraction systems.	Aquifer drawdown during extraction. This is not expected to be an environmental concern. Potential vertical migration of contaminants may occur via remediation of the Castle Hayne aquifer.
• Time Until Action is Complete	Estimated 30 years.	Estimated 30 years.	Estimated 30 years.	Estimated 5 years.	Estimated 30 years.
IMPLEMENTABILITY					
• Ability to Construct and Operate; Reliability	No construction or operation activities.	No construction or operation activities.	No significant difficulties are anticipated to construct or operate the system. Construction within a highly-developed area like the HPIA will pose minor problems due to infrastructure. Extensive coordination with Base Public Works/Planning Department will be required.	No significant difficulties are anticipated to construct or operate the system. Construction within a highly-developed area like the HPIA will pose minor problems due to infrastructure. Extensive coordination with Base Public Works/Planning Department will be required.	No significant difficulties are anticipated to construct or operate the system. Construction within a highly-developed area like the HPIA will pose minor problems du to infrastructure. Extensive coordination with Base Public Works/Planning Department will be required.
• Ability to Monitor Effectiveness	No monitoring. Failure to detect contamination will result in potential ingestion of contaminated groundwater.	Proposed monitoring will give notice of failure before significant exposure occurs.	Adequate system monitoring.	Adequate system monitoring.	Adequate system monitoring.
• Availability of Services and Capacities; Equipment	None required.	None required.	Services and materials are available.	Services and materials are available.	Services and materials are available.
COSTS NPW	$0	$260,000	$460,000	$690,000	$615,000

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TABLE 4

SUMMARY OF DETAILED ANALYSIS - SOIL RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Capping	RAA No. 3 On-Site Treatment	RAA No. 4 Off-Site Treatment/Disposal
OVERALL PROTECTIVENESS				
• Human Health Protection	No reduction in risk.	Would reduce potential for human exposure.	Reduces overall risk to human health.	Reduces overall risk to human health.
• Environmental Protection	No reduction in risk to ecological receptors.	Would reduce potential for exposure and migration.	Reduces overall risk to ecological receptors.	Reduces overall risk to ecological receptors.
COMPLIANCE WITH ARARs				
• Chemical-Specific ARARs	Will exceed ARARs.	Will exceed ARARs.	Will meet contaminant-specific ARARs.	Will meet ARARs.
• Location-Specific ARARs	Not applicable.	Will meet location-specific ARARs.	Will meet location-specific ARARs.	Will meet location-specific ARARs.
• Action-Specific ARARs	Not applicable.	Will meet action-specific ARARs.	Will meet action-specific ARARs.	Will meet action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
• Magnitude of Residual Risk	Source has not been removed. Potential risks not reduced.	Contaminated soils are not removed from the site, but potential risk due to exposure to COCs are reduced as long as the cap is maintained.	Soil AOCs will be remediated. Remaining contaminants do not present an unacceptable human health or environmental risk.	Contaminated soil is removed from the site. No residual wastes will remain onsite.
• Adequacy and Reliability of Controls	Not applicable - no controls.	Multilayered cap controls contaminated soil - can be a reliable option if maintained properly.	Soil will be treated to meet risk-based action levels. Treated soil will be analyzed to ensure that remediation levels are met.	No residual wastes will remain onsite. Wastes will be treated offsite and disposed of in a suitable landfill.
• Need for 5-year Review	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review would be required to ensure adequate protection of human health and the environment is maintained.	Review not needed since contaminated soil treated.	Review not needed since contaminated soil removed.

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TABLE 4 (Continued)

SUMMARY OF DETAILED ANALYSIS - SOIL RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Capping	RAA No. 3 On-Site Treatment	RAA No. 4 Off-Site Treatment/Disposal
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT				
• Treatment Process Used	None.	None.	Chemical dechlorination, or incineration.	Off-site treatment.
• Amount Destroyed or Treated	None.	None.	Majority of soil COCs.	Majority of soil COCs.
• Reduction of Toxicity, Mobility or Volume	None.	No reduction in toxicity or volume. However; capping will mitigate contaminant migration.	Reduction in toxicity, mobility and volume of contaminated soil.	Reduction in toxicity, mobility and volume of contaminated soil.
• Residuals Remaining After Treatment	Not applicable - no treatment.	Residuals are capped.	Residuals remaining onsite will be below remediation goals.	No residuals will remain onsite.
• Statutory Preference for Treatment	Not satisfied.	Not satisfied.	Satisfied.	Satisfied.
SHORT-TERM EFFECTIVENESS				
• Community Protection	Risks to community not increased by remedy implementation.	Temporary potential risks during soil grading and cap installation activities.	Limited potential risks during soil excavation and treatment activities.	Limited potential risks during soil excavation and transport activities.
• Worker Protection	No significant risks to workers.	Temporary potential risks during soil grading and cap installation activities.	Potential risks during soil excavation and treatment activities.	Potential risks during excavation and transportation activities.
• Environmental Impacts	Continued impacts from existing conditions.	No additional environmental impacts.	Air quality and odors - but treatment system will be designed to meet standards.	No additional environmental impacts.
• Time Until Action is Complete	Not applicable.	Less than one year. Monitor for 30 years.	Less than one year.	Less than one year.

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TABLE 4 (Continued)

SUMMARY OF DETAILED ANALYSIS - SOIL RAAs
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MCB CAMP LEJEUNE, NORTH CAROLINA

Evaluation Criteria	RAA No. 1 No Action	RAA No. 2 Capping	RAA No. 3 On-Site Treatment	RAA No. 4 Off-Site Treatment/Disposal
IMPLEMENTABILITY				
• Ability to Construct and Operate	No construction or operation activities.	Simple to construct and maintain. Requires materials handling procedures.	Requires soil excavation activities. Requires assembly of treatment systems.	Requires soil excavation activities. No other on-site operations.
• Ability to Monitor Effectiveness	No monitoring included.	Cap maintenance and groundwater monitoring will adequately monitor effectiveness.	Adequate system monitoring.	No monitoring other than confirmation soil sampling.
• Availability of Services and Capacities; Equipment	None required.	No special services or equipment required. Cap materials should be readily available.	Qualified vendors available to perform on-site treatment.	Off-site treatment and disposal facilities should have adequate capacity.
COSTS NPW	$0	$1.2 million	$650,000 (incineration) $1.4 million (dechlorination)	$480,000 (disposal) $1.3 million (treatment)

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TABLE 5
GLOSSARY OF EVALUATION CRITERIA

- **Overall Protection of Human Health and Environment** - addresses whether or not an alternative provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment engineering controls or institutional controls.

- **Compliance with ARARs** - addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements (ARARs) or other Federal and State environmental statutes and/or provide grounds for invoking a waiver.

- **Long-term Effectiveness and Permanence** - refers to the magnitude of residual risk and the ability of an alternative to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

- **Reduction of Toxicity, Mobility, or Volume through Treatment** - is the anticipated performance of the treatment options that may be employed in an alternative.

- **Short-term Effectiveness** - refers to the speed with which the alternative achieves protection, as well as the remedy's potential to create adverse impacts on human health and the environment that may result during the construction and implementation period.

- **Implementability** - is the technical and administrative feasibility of an alternative, including the availability of materials and services needed to implement the chosen solution.

- **Cost** - includes capital and operation and maintenance costs. For comparative purposes, presents present worth values.

- **USEPA/State Acceptance** - indicates whether, based on review of the RI and FS reports and the PRAP, the USEPA and State concur with, oppose, or have no comments on the preferred alternative.

- **Community Acceptance** - assessed in the ROD following a review of the public comments received on the RI and FS reports and the PRAP.

Public Comment Period

The public comment period will begin on July 27, 1994 and end on August 27, 1994, for the Proposed Remedial Action Plan for OU No. 1. Written comments should be sent to the following address:

Commander
Atlantic Division Naval Facilities Engineering Command
1510 Gilbert Street (Bldg. N-26)
Norfolk, Virginia 23511-2699
Attention: Ms. Linda Berry, Code 1823

Administrative Record

The administrative record is available to the community at the following locations:

MCB, Camp Lejeune
Environmental Management Department
Building 67, Room 237
Marine Corps Base
Camp Lejeune, North Carolina 28542
910-451-5068

Hours:
M-F: 7:00 a.m.- 3:00 p.m.
Closed Saturday and Sunday

Onslow County Library
58 Doris Avenue East
Jacksonville, North Carolina 28540
919-455-7350

Hours:
M-Thu: 9:00 a.m. - 9:00 p.m.
F-S: 9:00 a.m. - 6:00 p.m.
S: Closed

IF YOU HAVE ANY QUESTIONS ABOUT OU NO. 1, PLEASE CONTACT ONE OF THE FOLLOWING:

Commanding General
AC/S EMD (IRD)
Marine Corps Base
PSC Box 20004
Building 67
Camp Lejeune, North Carolina 28452-0004
Attention: Mr. Neal Paul
(910) 451-5068

Commander
Atlantic Division
Naval Facilities Engineering Command
1510 Gilbert Street (Bldg. N-26)
Norfolk, Virginia 23511-2699
Attention: Ms. Linda Berry, Code 1823
(804) 322-4793

MAILING LIST

If you are not on the mailing list and would like to receive future publications pertaining to OU No. 1, please fill out, detach, and mail this form to:

Attn: Mr. Neal Paul
Commanding General
AC/S EMD (IRD)
Marine Corps Base
PSC Box 20004
Building 67
Camp Lejeune, North Carolina 28452-0004
(910) 451-5068

Name _____

Address _____

Affiliation _____

Telephone (_____) _____

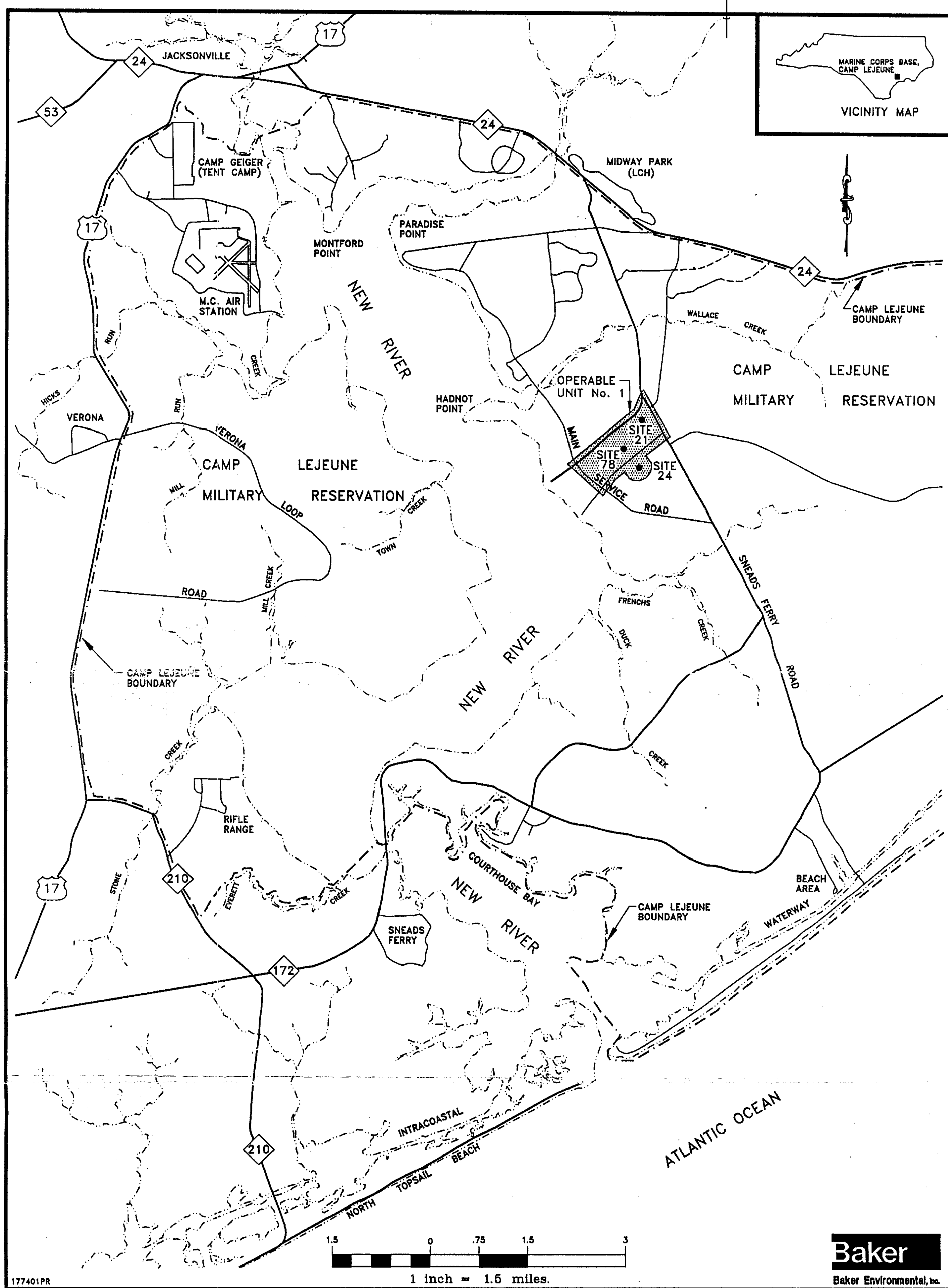

FIGURE 1
LOCATION MAP–OPERABLE UNIT No. 1
SITES 21, 24 AND 78
PROPOSED REMEDIAL ACTION PLAN CTO–0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

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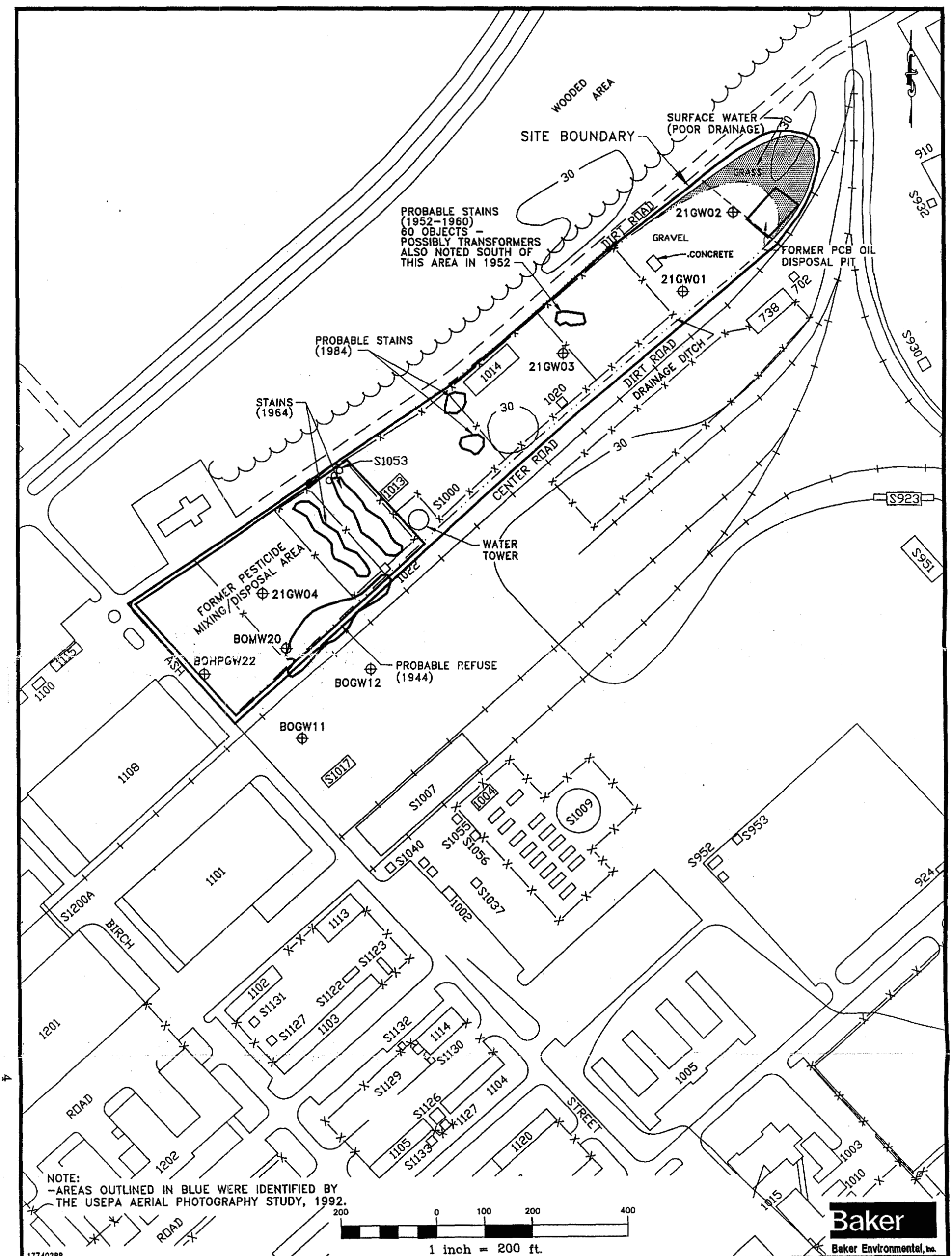

LEGEND

21GW01 ⊕ SHALLOW MONITORING WELL

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 2
SITE MAP
SITE 21: TRANSFORMER STORAGE LOT 140
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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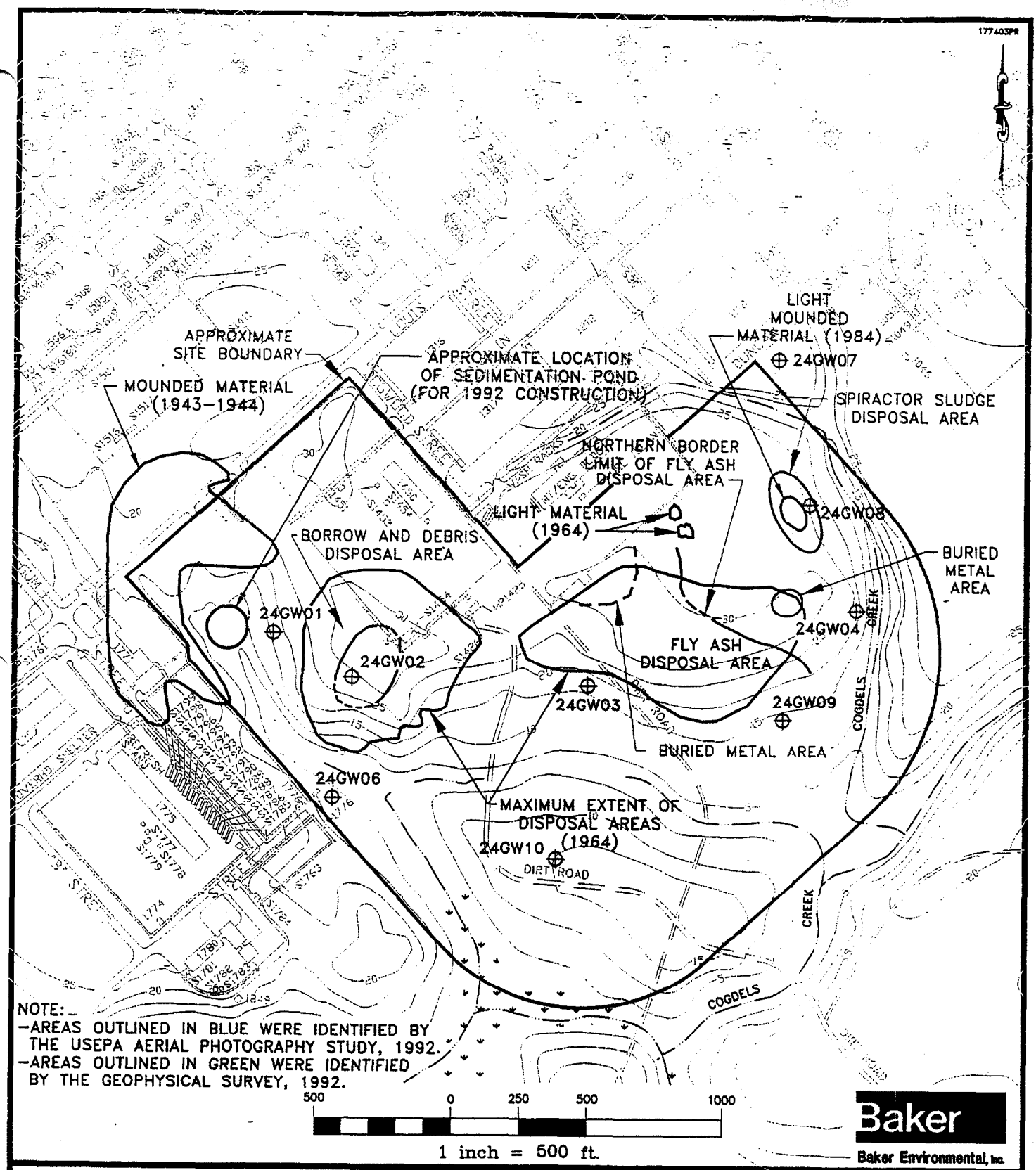


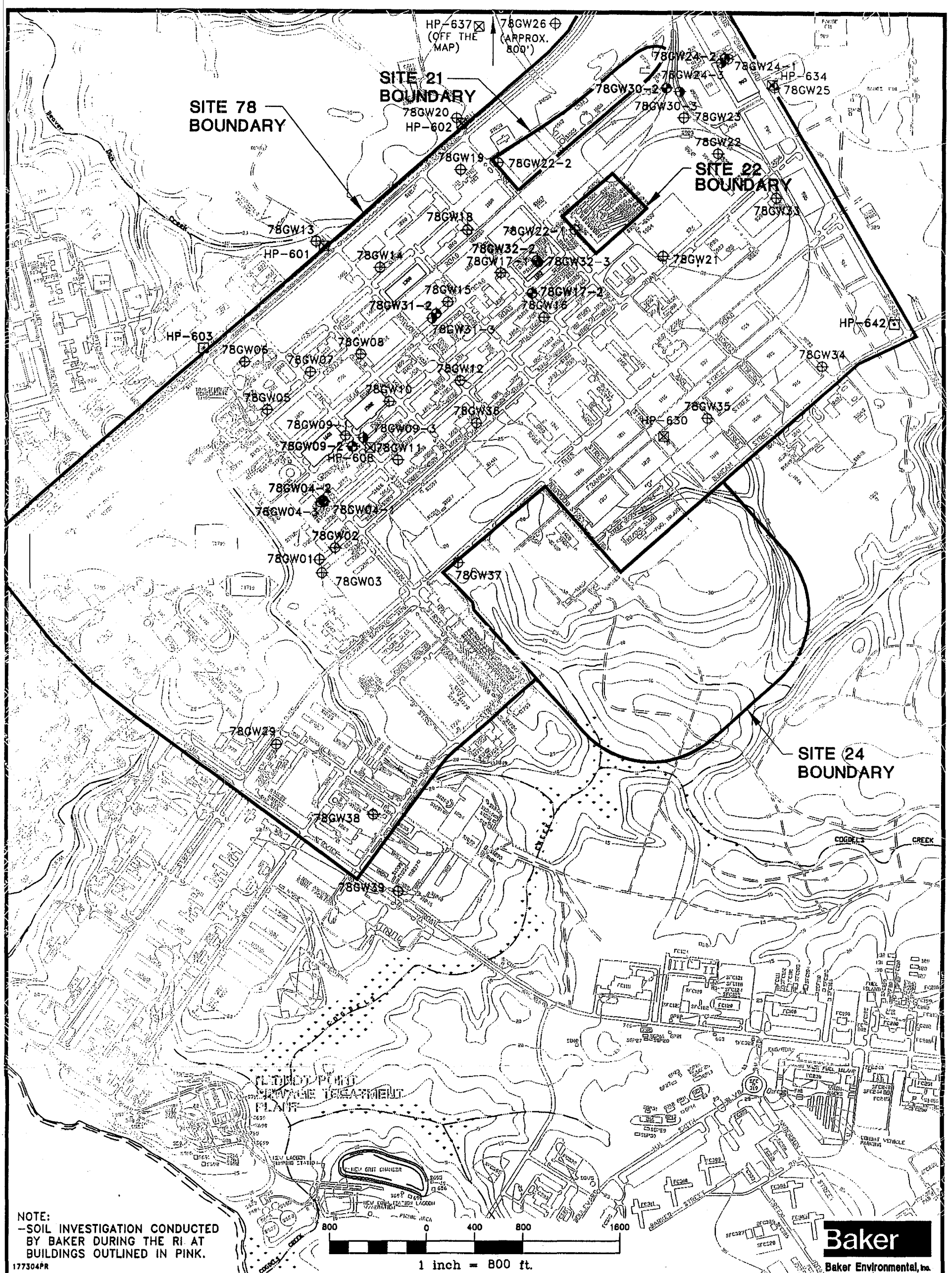
LEGEND

24GW01 ⊕ SHALLOW MONITORING WELL

SOURCE: LANTDIV, FEB. 1992

FIGURE 3
SITE MAP
SITE 24: INDUSTRIAL FLY ASH DUMP
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



NOTE:
-SOIL INVESTIGATION CONDUCTED BY BAKER DURING THE RI AT BUILDINGS OUTLINED IN PINK.

177304PR

LEGEND

78GW02	SHALLOW MONITORING WELL	HP-603	WATER SUPPLY WELL (ACTIVE)
78GW04-2	INTERMEDIATE MONITORING WELL	HP-601	WATER SUPPLY WELL (INACTIVE)
78GW04-3	DEEP MONITORING WELL		

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 4
SITE MAP
SITE 78: HPIA
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94

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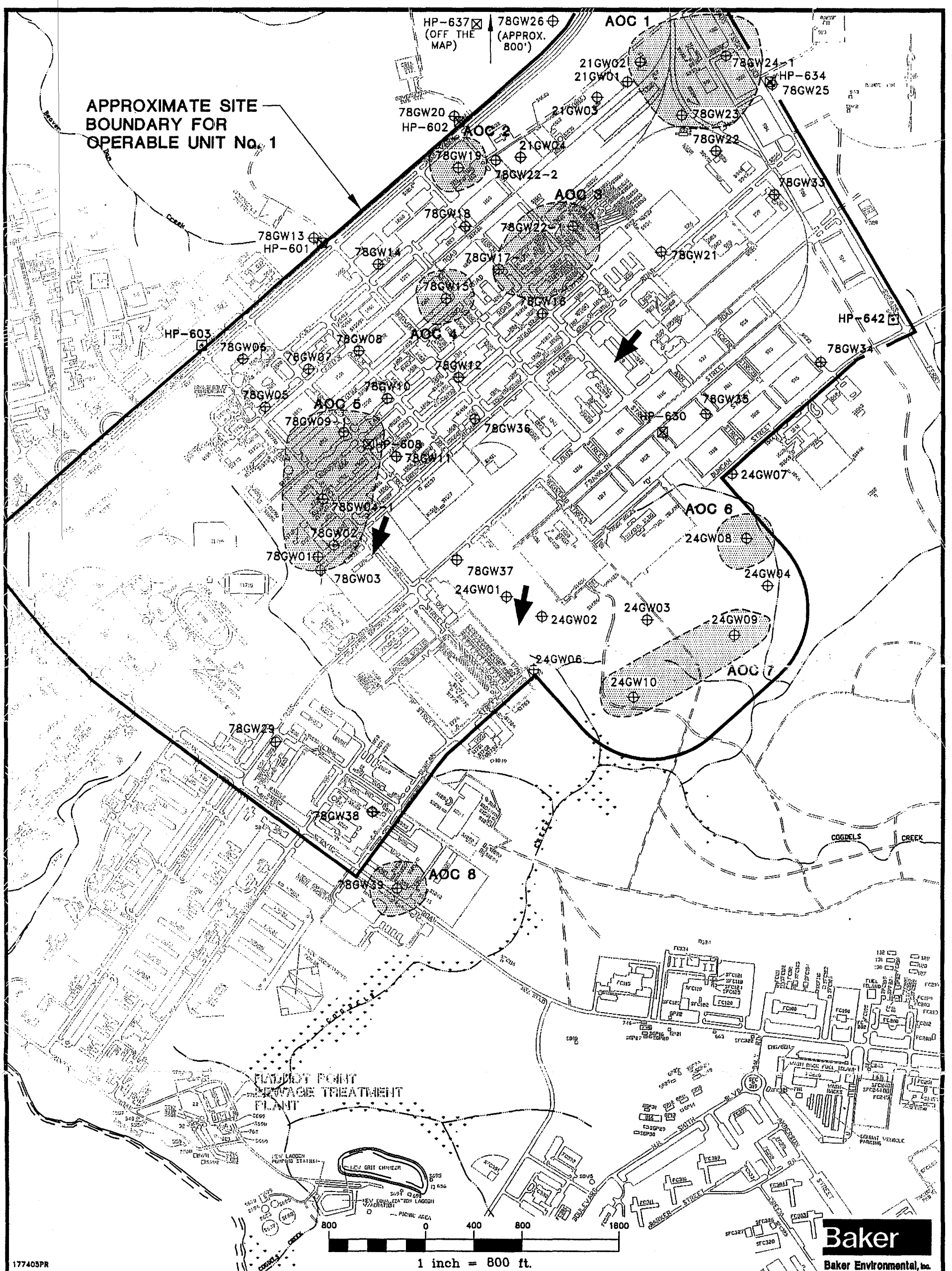


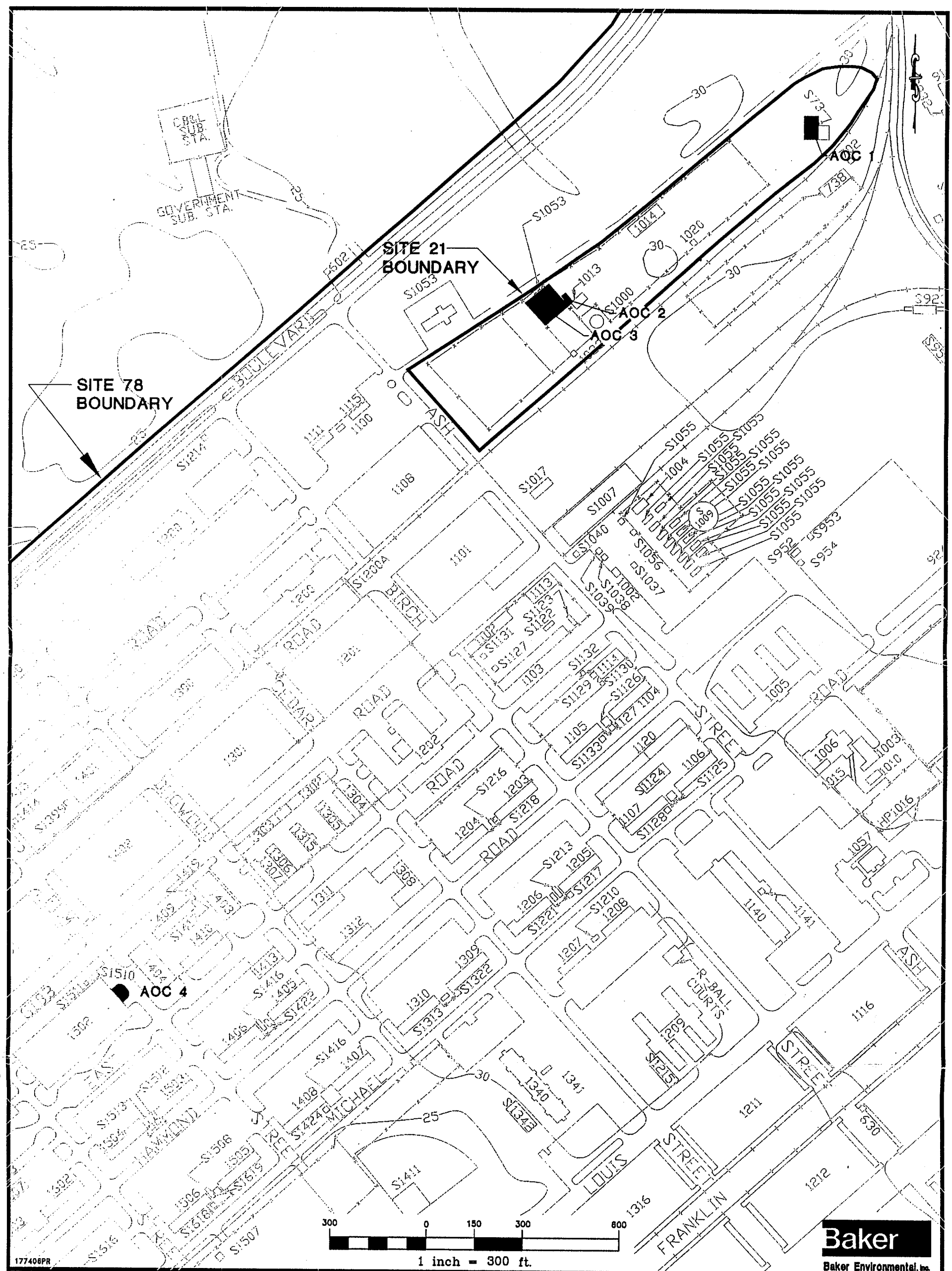
LEGEND

- 78GW02 — SHALLOW MONITORING WELL
- ESTIMATED DIRECTION OF GROUDWATER FLOW
- APPROXIMATE AREA OF GROUNDWATER CONTAMINATION EXCEEDING REMEDIATION LEVELS FOR ORGANICS (SHALLOW MONITORING WELLS)
- AOC 8 — AREA OF CONCERN
- HP-603 — WATER SUPPLY WELL (ACTIVE)
- HP-601 — WATER SUPPLY WELL (INACTIVE)

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 5
GROUNDWATER AREAS OF CONCERN
AT OPERABLE UNIT No. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



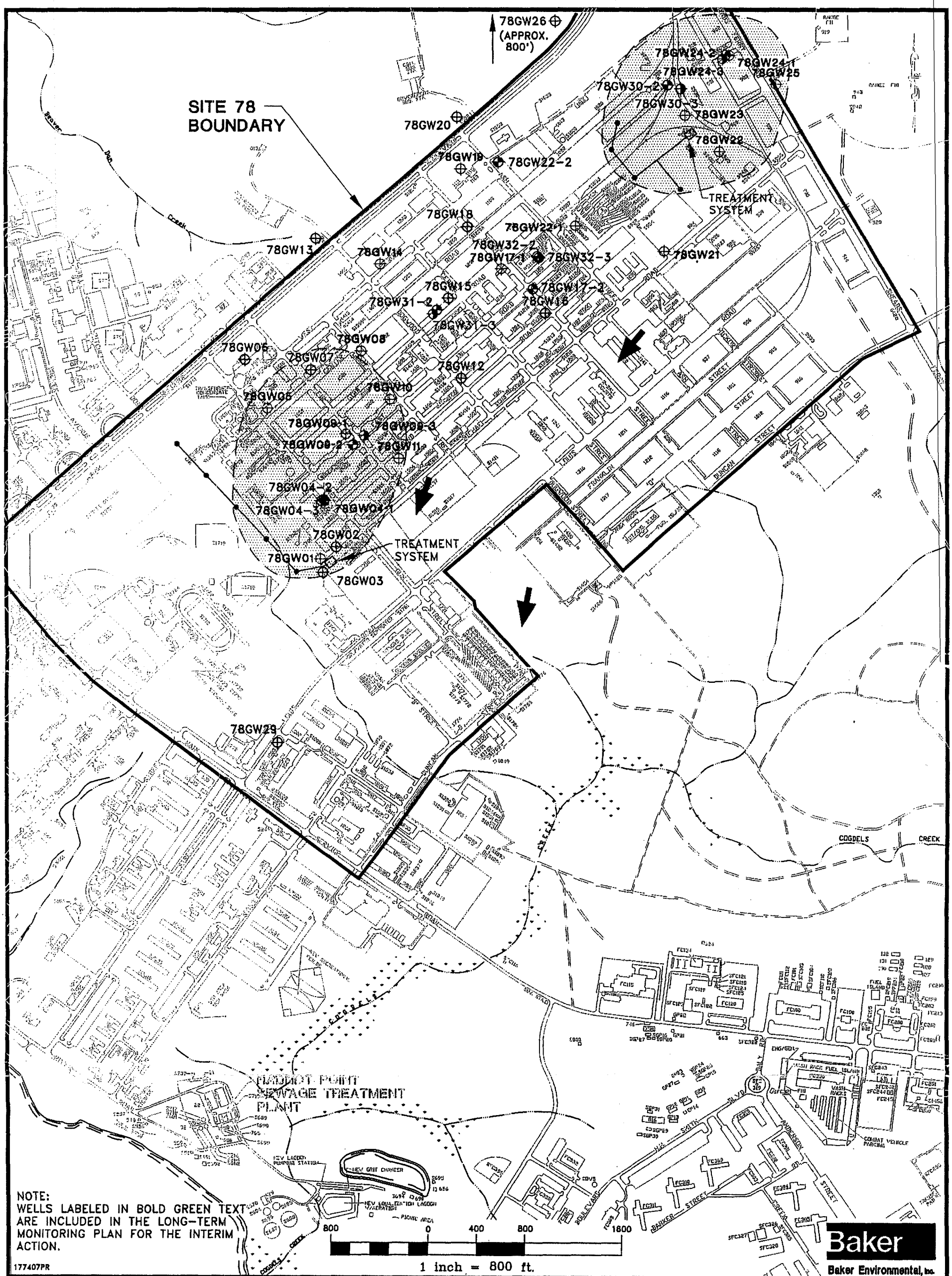
LEGEND

AOC 1 ● APPROXIMATE LOCATION OF SOIL EXCEEDING REMEDIATION LEVELS.

SOURCE: LANTDIV, OCT. 1991

FIGURE 6
APPROXIMATE LOCATION OF SOIL AREAS OF CONCERN
OPERABLE UNIT NO. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94



NOTE:
WELLS LABELED IN BOLD GREEN TEXT ARE INCLUDED IN THE LONG-TERM MONITORING PLAN FOR THE INTERIM ACTION.

LEGEND

- 78GW02 — SHALLOW MONITORING WELL
- 78GW04-2 — INTERMEDIATE MONITORING
- 78GW04-3 — DEEP MONITORING WELL
- APPROXIMATE AREA OF SHALLOW GROUNDWATER CONTAMINATION EXCEEDING REMEDIATION LEVELS (BASED ON 1991 ESE DATA)
- ESTIMATED DIRECTION OF GROUNDWATER FLOW
- TREATMENT SYSTEM
- EXTRACTION WELLS AND PIPING

SOURCE: LANTDIV, FEBRUARY 1992

FIGURE 7
INTERIM REMEDIAL ACTION TO BE IMPLEMENTED FOR THE SURFICIAL AQUIFER AT SITE 78
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

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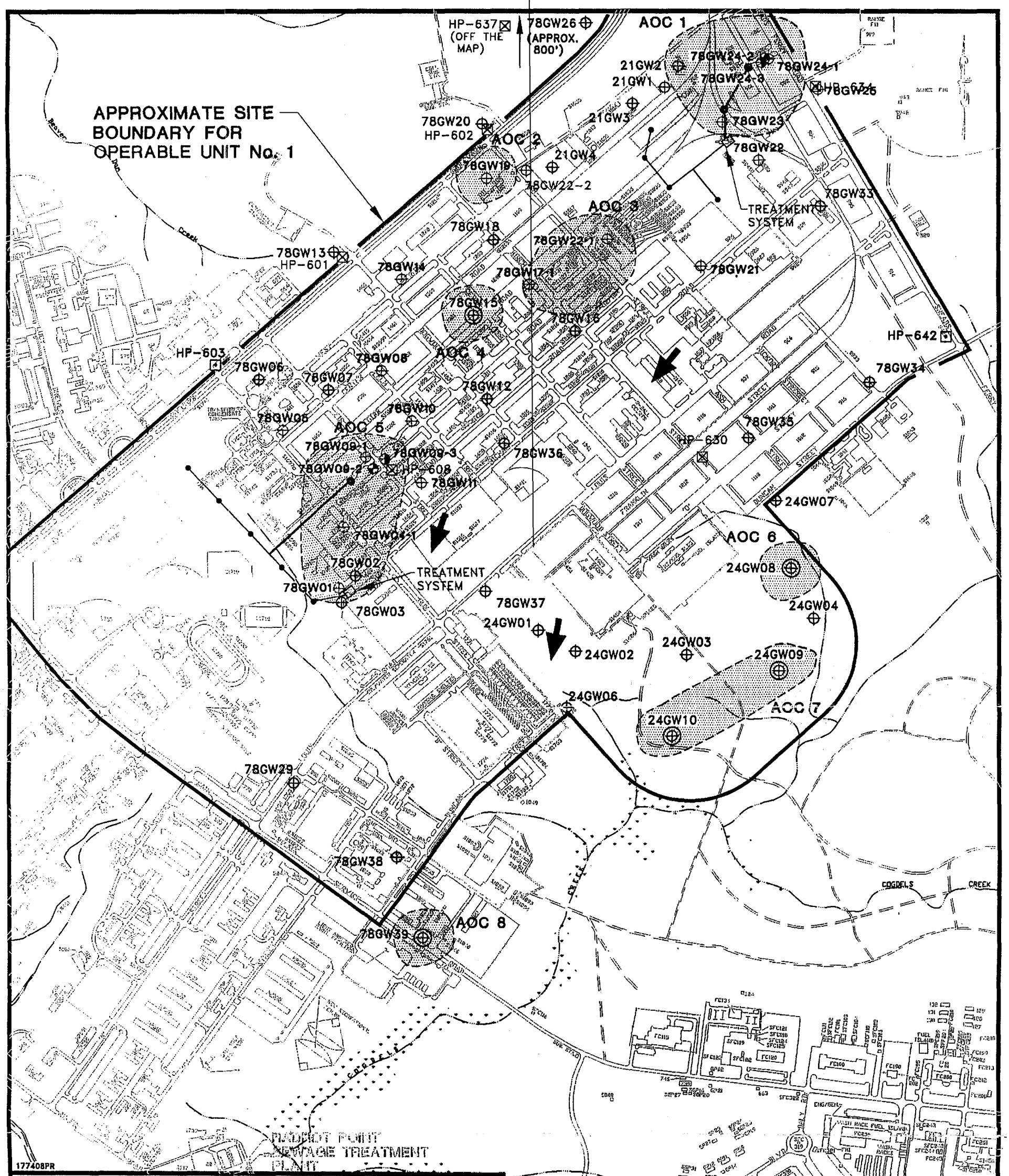
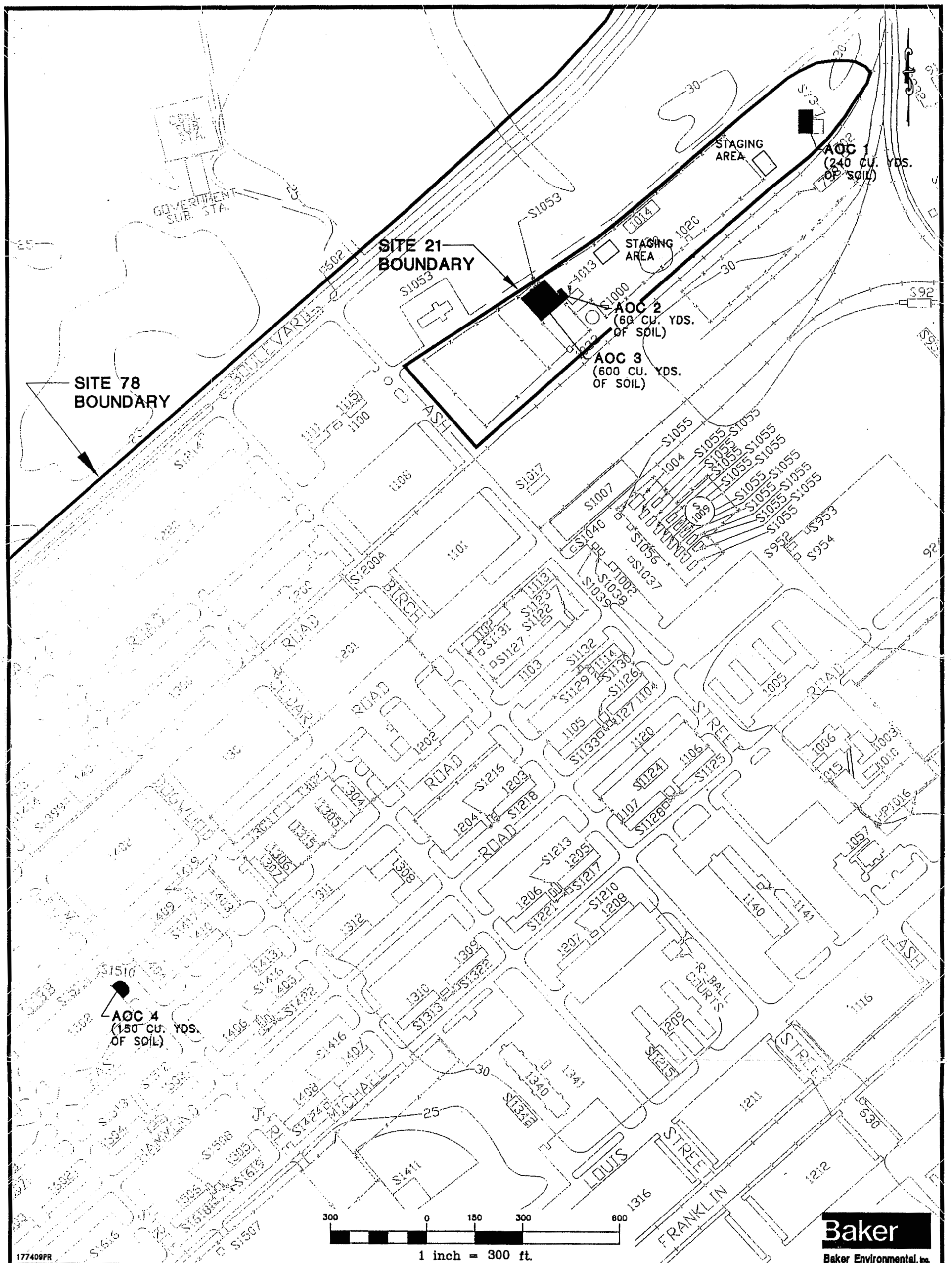


FIGURE 8
GROUNDWATER RAA: SOURCE CONTROL
(INTERIM TREATMENT SYSTEM EXTENSION)
OPERABLE UNIT No. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94



LEGEND

AOC 1 ● APPROXIMATE LOCATION OF SOIL EXCEEDING REMEDIATION LEVELS. EXCAVATION TO TAKE PLACE WITHIN THIS AREA

SOURCE: LANTDIV, OCT. 1991

FIGURE 9
PREFFERED SOIL RAA : OFF-SITE
TREATMENT/DISPOSAL
OPERABLE UNIT NO. 1
PROPOSED REMEDIAL ACTION PLAN CTO-0177
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CLEJ-01254-4.09-07/22/94