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FINAL

**AMENDMENT TO RECORD OF DECISION
OPERABLE UNIT NO. 12 (SITE 3)**

**MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA**

CONTRACT TASK ORDER 0274

MAY 7, 1999

Prepared For:

**DEPARTMENT OF THE NAVY
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NAVAL FACILITIES
ENGINEERING COMMAND
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Prepared by:

**BAKER ENVIRONMENTAL, INC.
*Coraopolis, Pennsylvania***

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ACRONYMS AND ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
Baker	Baker Environmental, Inc.
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DoN	Department of Navy
FS	Feasibility Study
MCB	Marine Corps Base
mg/L	Milligrams per Liter
mg/kg	Milligrams per Kilogram
µg/kg	Micrograms per Kilogram
NCDENR	North Carolina Department of Environment and Natural Resources
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPW	Net Present Worth
OHM	OHM Remediation Services Corporation
O&M	Operation and Maintenance
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
POL	Petroleum, Oil, and Lubricants
PRAP	Proposed Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RL	Remediation Level
RAAs	Remedial Action Alternatives
SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
TBCs	To-Be-Considered Criteria
TCLP	Toxicity Characteristics Leaching Procedure
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

DECLARATION

Site Name and Location

Operable Unit No. 12 (Site 3 - Old Creosote Plant)
Marine Corps Base
Camp Lejeune, North Carolina

Statement of Basis and Purpose

This Amended Record of Decision (ROD) presents a revision to the selected remedy for polynuclear aromatic hydrocarbon (PAH) contaminated soils at Operable Unit (OU) No. 12 (Site 3) at Marine Corps Base (MCB), Camp Lejeune, North Carolina. The Amended ROD is being submitted in accordance with the Comprehensive, Environmental Response, Compensation, and Liability Act (CERCLA) Section 117 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Section 300.435(c)(2)(ii). The original ROD for this site was submitted by the Department of the Navy (DoN) on January 6, 1997 and accepted by the North Carolina Department of Environment and Natural Resources (NC DENR) and the United States Environmental Protection Agency (USEPA) Region IV as the selected remedy for soils at OU No. 12 (Site 3). The remedy presented in the original ROD stipulated source removal and biological treatment using either a new biocell or an existing on-Base biocell. Prior to full scale treatment, a pilot-scale treatability study was performed on PAH-contaminated soils from Site 3. Results of this treatability study indicated that biological treatment of the site soils was not effective. Therefore, an amendment to the original ROD is required to document this fundamental change.

The DoN and the Marine Corps have obtained concurrence from NC DENR and USEPA Region IV on the amended remedy. A copy of the NC DENR approval letter dated _____, 1999 is provided as Attachment A.

Description of the Amended Soil Remedy: Source Removal and Off-site Landfill Disposal

The amended remedy for the soil at OU No. 12 (Site 3) includes excavation of PAH-contaminated subsurface soil to an estimated depth of nine feet below ground surface (bgs) and disposal of the excavated soil in a Subtitle D landfill. More specifically, the amended remedy includes:

- Excavating the soil from zero to three feet bgs (approximately 660 cubic yards) and stockpiling the soil at Site 3 for testing and potential use later as backfill. The excavated soil is not expected to contain PAHs.
- Excavating the subsurface soil from three to nine feet bgs within the area of concern (approximately 1,340 cubic yards), or to just above the water table.
- Transporting the excavated soil to a Subtitle D disposal facility. Based upon preliminary Toxicity Characteristic Leaching Procedure (TCLP) testing conducted in October 1997, the soil appears to be nonhazardous and may be disposed of at a Subtitle D facility. The soil will be tested to reconfirm the nonhazardous status.

- Confirmatory soil sampling in the excavation area to ensure that PAH-contaminated soil located above the water table has been removed to acceptable remediation levels listed in Table 1.
- Backfilling the excavated area with clean soil, including the excavated soil from zero to three feet bgs, and clean soil from an on-Base borrow pit.

The amended remedy addresses the principal threat at OU No. 12 (Site 3) which is the PAH-contaminated subsurface soil. Although the groundwater remedy selected in the original ROD has not been affected by this change to the soil remedy, the following will also be implemented in accordance with the LUCAP:

- Aquifer use controls will be instituted to prohibit future use of the groundwater at Site 3 as a potable water source. Restrictions will remain in place until it is demonstrated that continued attainment of remedial goals has been achieved.
- A Notice of Inactive Hazardous Substance or Waste Disposal Site (Notice) for Site 3 will be filed according to the requirements of North Carolina.

Statutory Determinations

The amended remedy for the PAH-contaminated soil is protective of human health and the environment and may be cost-effective if the on-Base Landfill can be used for disposal. Although no chemical-specific applicable or relevant and appropriate requirements (ARARs) apply to the soil at Site 3, the remedy does comply with the to-be-considered criteria (TBCs) established for soil (i.e., soil screening levels established for the protection of groundwater). The statutory preference for treatment will not be satisfied because the soil will not be treated; instead, the soil excavated will be transported to a Subtitle D disposal facility. The remedy will require five-year reviews by the lead agency, at which time the remedial action alternative (RAA) for groundwater will be re-evaluated and further action may be warranted.



Signature (Commanding General, MCB, Camp Lejeune)

28 July 99

Date

- Confirmatory soil sampling in the excavation area to ensure that PAH-contaminated soil located above the water table has been removed to acceptable remediation levels listed in Table 1.
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Signature (Commanding General, MCB, Camp Lejeune)

Date

DECISION SUMMARY

1.0 INTRODUCTION

This Amended Record of Decision (ROD) presents the remedial action plan selected by the Department of the Navy (DoN) for polynuclear aromatic hydrocarbon (PAH) contaminated soils at Operable Unit (OU) No. 12 (Site 3) at Marine Corps Base (MCB), Camp Lejeune, North Carolina. Figure 1 shows the location of Site 3 within MCB, Camp Lejeune. The Amended ROD is being submitted in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Section 117 and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) Section 300.435(c)(2)(ii). The original ROD for OU No. 12 was submitted on January 6, 1997 (signed on April 3, 1997) and accepted by the North Carolina Department of Environment and Natural Resources (NC DENR) and the United States Environmental Protection Agency (USEPA) Region IV.

The selected soil remedy presented in the original ROD included source removal and on-site biological treatment of the PAH-contaminated soils. A pilot-scale treatability study was conducted to evaluate the effectiveness of the biological treatment system on the PAH-contaminated soils from Site 3. The results of the treatability study concluded that biological treatment of the site soils was not effective. Therefore, another soil remedy had to be selected for the site. The change in the soil remedy presents a fundamental change to the original ROD, thereby requiring the submittal of this Amended ROD.

This Amended ROD addresses only the fundamental change to the remedy selected for the PAH-contaminated site soils. Included in this document are reasons for the ROD amendment and evaluations of both the original and the amended soil remedies along with statutory determinations regarding the newly selected remedy. Information on site history, previous investigations, and extent of site contamination was presented in detail in the original ROD and will be briefly summarized in this Amended ROD.

In accordance with Section 300.825(a)(2) of the NCP, this Amended ROD will become part of the Administrative Record File for Site 3. The Administrative Record File is available for public review

at the Onslow County Library during the following hours: Monday - Thursday 9:00 AM to 9:00 PM and Friday - Saturday 9:00 AM to 6:00 PM, and at the MCB, Camp Lejeune Environmental Management Division during the hours of 7:00 AM to 3:00 PM Monday - Friday.

2.0 SITE NAME, LOCATION, AND DESCRIPTION

Located in Onslow County, North Carolina, MCB, Camp Lejeune is a training base for the United States Marine Corps. 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. 12 is one of 18 OUs located within MCB, Camp Lejeune. Operable units were developed to combine one or more sites that share a common element. OU No. 12 contains only one site, Site 3, which is otherwise known as the Old Creosote Plant. Figure 1 depicts the location of OU No. 12 (Site 3) within MCB, Camp Lejeune.

Figure 2 presents a map of OU No. 12 (Site 3). Located within the Mainside Supply and Storage areas at MCB, Camp Lejeune, Site 3 encompasses an area of approximately five acres and is generally flat and unpaved. Open Storage Lots 201 and 203 (i.e., Site 6) are located nearby along Holcomb Boulevard approximately 1-1/2 miles from Site 3. However, Site 3 itself is not currently used for open storage.

As shown in Figure 2, the site is intersected by two roadways: a dirt path that runs north-south and forms a loop in the southern portion of the site, and a gravel road that runs east-west and leads directly to Holcomb Boulevard. Access to the site via these roadways is currently unrestricted. In addition, the Camp Lejeune Railroad line runs parallel to the site's western edge and intersects an old railroad spur line at the site's southern extreme. The intersection of these two lines creates a spike formation that points south. Wooded areas lie north and east of the site.

3.0 SITE BACKGROUND

3.1 Site History

The old creosote plant reportedly operated from 1951 to 1952 to supply treated lumber during construction of the Base railroad. Reportedly, an on site sawmill, located in the northern portion of the site, was used to trim logs into railroad ties. The ties were then treated with hot creosote in pressure cylinder chambers. Although the exact treatment procedures that were used are not known, records show that preservatives (i.e., creosote) were stored for reuse in a railroad tank car.

In typical pressure treatment processes, wood ties are placed inside cylindrical chambers which are filled with wood-treating preservatives. Then, hydrostatic or pneumatic pressures, ranging from 50 to 200 pounds per square inch (psi), are applied within the treatment chamber until the wood absorbs the desired amount of preservatives. When the treatment process is complete, a pump removes the excess preservative from the chamber and sends it to a storage vessel for reuse. Excess preservative is then removed from the wood by applying a vacuum, or by allowing the wood to drip dry. In the past, treated wood lay in open areas for several days, allowing preservative to drip. Today, treated wood is typically placed on lined and covered drip pads to collect excess preservative.

The main treatment area at Site 3 was most likely located within and immediately surrounding the dirt path loop in the southern portion of the site. This area contains an abandoned chimney that was probably associated with creosote heating/thinning activities. (Creosote is heated and mixed with fuel oil to create a less viscous consistency.) The 240 foot long concrete pad encircled by the dirt path loop was probably used as a drip track for pressure cylinder chambers or treated wood ties. However, the concrete pad does not contain visual evidence of contamination. South of the pad, evidence of rail lines was observed indicating that a railroad connection may have been located in this area. The railroad connection may have transported creosote or ties to and from the treatment area.

3.2 Previous Investigations and Enforcement Activities

Previous investigations conducted at Site 3 include a Site Inspection (1991) and a Remedial Investigation (1994-95). Field activities for these studies/investigations included soil, groundwater, and sediment investigations. In general, these investigations indicated that the most frequently detected organic compounds were PAHs. Since creosote is comprised of PAH compounds, the PAHs detected at Site 3 are believed to be associated with past operations at the former wood treatment plant. More detailed information is located in the Site Inspection Report (Halliburton/NUS, 1991) and the Remedial Investigation Report (Baker, 1996). Tables and Figures presenting analytical results and showing sampling locations for soil and groundwater are in the original ROD for Site 3 dated January 6, 1997.

4.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The Remedial Investigation (RI), Feasibility Study (FS), and original Proposed Remedial Action Plan (PRAP) documents for OU No. 12 (Site 3) were released to the public on November 6, 1996. The Final Amended PRAP and Community Information Sheet were released to the public on August 28, 1998. These documents are available in an administrative record file at information repositories maintained at the Onslow County Public Library and at the Installation Restoration Division Office (Room 238, MCB, Camp Lejeune). The notice of availability of the original PRAP, RI, and FS documents was published in the "Jacksonville Daily News" on November 3, 1996. A public comment period was held from November 6, 1996 to December 6, 1996. In addition, a public meeting was held on November 6, 1996 to respond to questions and to accept public comments on the PRAP for OU No. 12 (Site 3). The public meeting minutes were transcribed and a copy of the transcript is presented in Attachment A of the original ROD document dated January 6, 1997. A copy of the transcript was also made available to the public at the repository locations.

The notice of availability of the Amended PRAP was published in the "Jacksonville Daily News" on August 28, 29 and 30, 1998 and from September 13 through September 19, 1998. The 30-day public comment period began on August 28, 1998 and ended September 26, 1998. A public meeting was not requested and, therefore, a Responsiveness Summary was not prepared. In addition, no written comments or new relevant information was received during the 30-day comment period. Upon signature of this Amended ROD, MCB, Camp Lejeune and the Department of the Navy (DoN) will place this Amended ROD in the information repositories.

5.0 BASIS FOR ROD AMENDMENT

The environmental media at Site 3 were investigated as part of a Remedial Investigation (RI). The Areas of Concern (AOC) for both media are delineated in Figure 3. Remedial Action Alternatives were developed and evaluated as part of a Feasibility Study (FS) conducted for OU No. 12 (Site 3). Based upon the results of the RI and FS, preferred RAAs were identified in PRAP document. Then, the public was given the opportunity to comment on the RI, FS, and PRAP. Based upon comments received during the public comment period, and any new information that became available in the interim, a final remedial action plan was selected for soil and groundwater at OU No. 12 (Site 3) and documented in the ROD dated January 6, 1997.

The soil remedy presented in the original ROD included excavation of PAH-contaminated soils and treatment of those soils at either an existing on-Base biocell or a newly constructed biocell. However, prior to full-scale treatment, a pilot-scale treatability study was conducted to determine the effectiveness of biological treatment on the PAH-contaminated soils. The primary objectives of this pilot-scale treatability study were to:

- Determine if biological treatment could render the soil "nonhazardous" by definition, (assuming the soil was originally characterized as hazardous).
- Assess the biological treatment efficiencies of the target PAH contaminants (i.e., naphthalene, 2-methylnaphthalene, carbazole, benzo(a)anthracene, and chrysene) for on-Base remediation in an engineered biocell.
- Develop performance data and design parameters to estimate costs for larger scale operations.

Results from this treatability study met two of the three objectives described above. Based upon the information provided in the treatability study, there was no need to develop performance data and design parameters for the larger scale operations. The results of the study provided the following conclusions:

- The soil sample collected for the treatability study was classified as non-characteristically hazardous following Resource Conservation and Recovery Act (RCRA) Toxicity Characteristics Leaching Procedure (TCLP) testing for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs).
- Solid-phase biological treatment of the PAH-contaminated soil could not achieve all of the treatment criteria for the target PAH constituents.

Results from the treatability study provide the primary reason for the fundamental change to the selected remedy for soils at OU No. 12 (Site 3). However, there are additional reasons for developing this Amended ROD. As stated previously, excavated PAH-contaminated soils were to be treated on-Base at either a newly constructed biocell or at an existing biocell. The existing biocell is currently receiving soils contaminated with petroleum, oil, and lubricants (POLs). Due to reduced capacity in the existing, permitted biocell, it would not be economically feasible to use the remaining capacity by treating the nonhazardous material in the permitted biocell.

Cost effectiveness was also reconsidered in the selection of the remedy. Costs associated with the construction of a new biocell (which as stated above would not fully treat the PAH-contaminated soils) was estimated to be approximately \$514,000 (as presented in the original ROD prepared January 6, 1997). Source removal and disposal of the contaminated soil in a Subtitle D landfill was estimated for two scenarios, on-Base and off-site. On-Base disposal would require the contaminated soils to be hauled to the Subtitle D landfill located along Piney Green Road, approximately one mile from Site 3 (see Figure 1). This option was estimated to cost approximately \$317,800. The nearest off-site disposal facility is a Subtitle D landfill located within 300 miles of the Base. This option was estimated to cost approximately \$864,200 for excavation and disposal. Therefore, the most cost effective soil remedy was determined to be the on-Base disposal of contaminated soils.

The selected groundwater remedy presented in the original ROD, Aquifer Use Controls and Monitored Natural Attenuation, has not been revised and therefore is not described in this Amended ROD. However, Attachment B is included to provide restrictions for aquifer use at Site 3.

6.0 SUMMARY OF SITE RISKS

As part of the RI, a human health risk assessment (RA) and an ecological RA were conducted to determine the potential risks associated with the chemical constituents detected at Site 3. The human health RA concluded that unacceptable risk values, per USEPA guidance, were generated for future residents via exposure to groundwater contaminants. The ecological RA indicated that the environmental impacts from the site would be minimal. More details on the risk assessment are available in the original ROD dated January 6, 1997.

7.0 DESCRIPTION OF ORIGINAL AND AMENDED SOIL REMEDIES

The original soil remedy, Source Removal and Biological Treatment, was the chosen alternative for remediation of PAH-contaminated soils located at OU No. 12 (Site 3) as detailed in the ROD dated January 6, 1997. However, due to results from the treatability study, an alternative remedy was chosen for the PAH-contaminated soils. The amended remedy is Source Removal and Off-Site Landfill Disposal. Both remedies (original and amended) are discussed in further detail below.

7.1 Original Soil Remedy: Source Removal and Biological Treatment

The original soil remedy selected for Site 3 included excavation of contaminated subsurface soils and biological treatment of those soils at either an existing on-Base biocell Lot 203 or at a newly constructed biocell at Site 3. The subsurface soil area of concern at Site 3 (Figure 3) would be excavated to a depth of nine feet below ground surface (bgs). Confirmatory soil samples would be collected from the excavation area to ensure that contaminated soil above the water table was removed to acceptable limits (i.e., the remediation levels listed on Table 1). The excavated soil (approximately 1340 cubic yards) would undergo aerobic, solid-phase biological treatment. The biological treatment would be conducted using land farming technology within a controlled unit (the "biocell"). The contaminated soil would be placed in a 12 inch lift underlain by a 24 inch lift of coarse sand, a high density polyethylene geomembrane liner, and a non-woven geotextile fabric. Leachate would be collected by a leachate collection line and sump, and periodically resprayed back onto the contaminated soil. Maintenance of the biocell would consist of periodic leachate collection and respraying, soil tilling, nutrient and fertilizer addition, and soil sampling.

7.2 Amended Soil Remedy: Source Removal and Off-Site Landfill Disposal

The amended soil remedy selected for Site 3 includes excavation of PAH-contaminated soils and disposal of the soils in a permitted Subtitle D landfill facility. The subsurface soil area of concern, which is considered a source of groundwater contamination at Site 3, would be excavated to a depth of nine feet bgs. Figure 3 identifies the location of the soil area of concern. Confirmatory soil samples would be taken from the excavation area to ensure that PAH-contaminated soil above the water table has been removed to the acceptable remediation levels. The excavated soil located from 0 to 3 feet bgs (approximately 660 cubic yards) would be tested for SVOCs and later used as backfill

for the excavation area provided the soil does not contain PAHs in excess of the remediation levels listed in Table 1. Based upon results from the treatability study, which indicated that the PAH-contaminated soil was non-hazardous, the excavated soil located from 3 to 9 feet bgs (approximately 1340 cubic yards) would be transported to a Subtitle D disposal facility located either on-Base or off site. Excavated soils must be tested for TCLP characteristics to verify the nonhazardous classification prior to disposal in a Subtitle D Landfill. The excavated area would be backfilled with clean fill from an on-Base borrow pit. The location of the on-Base borrow pit is shown on Figure 1.

At Site 3, the subsurface soil area of concern appears to be the main source of groundwater contamination (via contaminant leaching). As a result, source removal alternatives were considered to be more appropriate than leaving the soil in situ and untreated. Under this source removal alternative, contaminants that could potentially leach would be removed from the subsurface and disposed at either an on-Base landfill or an off-site landfill which is appropriately permitted to accept contaminated soil from this site. Although the subsurface soil area of concern would be removed under this amended remedy, a 5-year review by the lead agency may still be required due to the contaminated groundwater remaining at the site (refer to the original ROD).

Monitored natural attenuation and institutional controls are the remedy for groundwater. The institutional controls and monitoring plan are outlined in the Land Use Control Implementation Plan (LUCIP, Attachment B). The LUCIP is part of this ROD and an integral part of the remedy.

7.2.1 Estimated Costs

The following cost was estimated for the selected amended soil remedy.

- **Source Removal and On-Base Landfill Disposal**

Capital Cost:	\$317,800
Annual O&M:	\$0
Net Present Worth (NPW):	\$317,800

- **Source Removal and Off-Site Landfill Disposal**

Capital Cost:	\$864,200
Annual O&M:	\$0
NPW:	\$864,200

7.2.2 Remediation Levels

Table 1 presents the remediation levels developed for soil. These levels are based upon North Carolina screening levels that were established to estimate the concentration at which contaminants may leach from soil and create unsafe groundwater conditions.

8.0 EVALUATION OF ORIGINAL AND AMENDED SOIL REMEDIES

This section summarizes the detailed evaluation of the original and the amended soil remedies. During the evaluation, the soil remedies were comparatively evaluated using seven USEPA evaluation criteria: overall protection of human health and the environment; compliance with applicable and relevant or appropriate requirements (ARARs)/ to-be-considered criteria (TBCs); long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

8.1 Overall Protection of Human Health and the Environment

This criteria 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 or institutional controls.

Both the original and amended soil remedies would significantly reduce the human health risks associated with groundwater by completely removing a potential source of the groundwater contamination - the subsurface soil area of concern above the water table. Both of these remedies are source removal alternatives, therefore they would prevent the further leaching of PAH contaminants from the subsurface soil (at 3 to 9 feet bgs) to the groundwater.

Because ecological risks were determined to be insignificant, conditions at Site 3 are already considered to be protective of the environment. As a result, both of the remedies would provide overall protection of the environment. The biocell included under the original soil remedy could potentially present risks to terrestrial receptors. However, if the biocell is properly controlled, these ecological risks would be insignificant.

8.2 Compliance with ARARs/TBCs

This criteria addresses whether or not an alternative will meet the ARARs, TBCs, and other federal and state environmental statutes, and/or provide grounds for invoking a waiver.

No chemical-specific ARARs apply to soil contaminants. Since soil contaminants that exceed the federal soil screening levels would be removed from the subsurface under both of the remedies, soil conditions at the site would meet chemical-specific TBCs. Both soil remedies can be designed to meet all of the location- and action-specific ARARs/TBCs that apply to them.

8.3 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criteria 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 (remediation levels) have been met.

Both of the soil remedies provide high levels of long-term effectiveness and permanence. Under each of these remedies, the subsurface soil area of concern would be completely removed (to the level just above the groundwater), preventing contaminants from leaching into the groundwater.

8.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The reduction of toxicity, mobility, or volume through treatment criteria refers to the anticipated performance of the treatment options that may be employed within an alternative.

The original and amended soil remedies each involve the removal and treatment and/or disposal of PAH-contaminated soils. The amended soil remedy (Source Removal and Landfill Disposal) does not satisfy the statutory preference for treatment. Although the original soil remedy would satisfy the statutory preference for treatment, the treatability study indicated the solid-phase biological treatment of the PAH-contaminated soil could not achieve all of the treatment criteria for the target PAH constituents.

8.5 Short-Term Effectiveness

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

Both the original and amended soil remedies will generate potential risks during soil excavation and backfilling activities. The Source Removal and Landfill Disposal remedy could generate potential risks during transportation of the contaminated soil to the disposal facility. The Source Removal and Biological Treatment remedy could generate potential risks during the initial placement of the contaminated soil in the biocell, and during the treatment operation and maintenance (O&M).

The following measures would be taken to provide adequate community and worker protection for both of these remedies: proper materials handling procedures, personal protective equipment, and construction safety fencing. A cover/liner system and periodic maintenance checks would provide additional protection for the treatment cell associated with the original remedy. Neither of the soil remediation alternatives would present significant environmental impacts.

8.6 Implementability

The implementability criteria refers to the technical and administrative feasibility of an alternative, including the availability of materials and services required to implement the chosen solution.

Both of the selected remedies are similar in that they involve excavation of contaminated soils. They vary in the treatment/disposal methods. The original remedy includes biological treatment of the soils, which requires mixing of the excavated soil with bulking agents and additives, and long-term O&M of the biocell. The amended soil remedy includes transportation of the contaminated soils to an approved disposal facility, which requires appropriate material handling procedures. The amended remedy would be easier to implement.

8.7 Cost

Cost includes capital and O&M costs for each alternative. For comparative purposes, present worth values are provided.

Costs associated with both of these remedies were estimated at various levels of the investigations. Costs were initially developed for the FS and were presented in the January 1997 ROD. During the development of the Basis of Design report and as new information became available, cost estimates were updated. The biological treatment treatability study provided additional information on the

characteristics of the soil, which affected the cost estimates. For the FS cost estimate, the assumption was that the soil was hazardous. However, the treatability study indicated that the soil is nonhazardous. Therefore, instead of disposing the soil in a Subtitle C landfill, the contaminated soil may be disposed of in a Subtitle D landfill, thereby reducing the costs for disposal.

Another factor affecting the cost estimate is the location of the landfill to be used for disposal. Approximately 1,340 cubic yards of PAH-contaminated soil will require disposal in a Subtitle D landfill. There is an on-Base Subtitle D landfill located along Piney Green Road, approximately one mile from Site 3. Costs for disposing of the soil in this landfill is estimated to be \$317,800. However, if disposal in the on-Base landfill is not possible, an off-site facility located within 300 miles of the Base would be used for disposal at a cost of approximately \$864,200. The estimated cost of implementing the original soil remedy (biological treatment) was approximately \$514,000.

Therefore, in a comparison of the original and the amended soil remedies, and depending on which landfill would be used in the landfill disposal alternative, the most cost effective alternative could be either of the two remedies. However, when evaluating each remedy considering the results of the treatability study, it would not be feasible or cost effective to treat the contaminated soil in the biocell since the treatability study proved that solid-phase biological treatment of the PAH-contaminated soil could not achieve all of the treatment criteria for the target PAH constituents.

9.0 STATUTORY DETERMINATIONS

The selected remedy will satisfy the statutory requirements of CERCLA Section 121 which include: (1) protect human health and the environment; (2) comply with ARARs; (3) achieve cost-effectiveness; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element, or provide an explanation as to why this preference is not satisfied. The following paragraphs evaluate the amended soil remedy for OU No. 12 (Site 3) with respect to these requirements.

9.1 Protection of Human Health

Source Removal and Landfill Disposal will protect human health by removing the source area of contamination (i.e., the subsurface soil area of concern) from the site. When this source area is removed, PAH contaminants will no longer leach from the soil to the groundwater. As a result, subsurface soil will no longer be contributing to unacceptable human health risks associated with groundwater.

Because ecological risks were determined to be insignificant, conditions at Site 3 are already considered to be protective of the environment, regardless of any remedy that is implemented.

9.2 Compliance with Applicable or Relevant and Appropriate Requirements

Although there were no chemical-specific ARARs identified for soil at Site 3, the federal soil screening levels were identified as chemical-specific TBCs. Because soil with contaminant levels exceeding these screening levels will be excavated from the subsurface and removed from the site, the selected amended remedy will achieve the soil TBCs.

The selected amended soil remedy will meet all of the location-specific and action-specific ARARs that apply to it.

9.3 Cost-Effectiveness

Compared to the original soil remedy, Source Removal and Landfill Disposal may be less expensive or slightly more expensive than Biological Treatment of the excavated soils depending on the location of the disposal facility. If the contaminated soils can be disposed at the on-Base landfill, the amended soil remedy would be the most cost effective alternative at nearly \$200,000 less than Biological Treatment. However, if the contaminated soils must be hauled to the nearest off-site landfill facility, located approximately 300 miles from the site, then costs for disposal would be greater than the treatment costs, approximately \$350,000 greater. Therefore, cost effectiveness between the original and amended soil remedies cannot be determined at this time.

9.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected amended remedy will provide a permanent, long-term solution since the source area of contaminated soil will be removed and landfilled.

9.5 Preference for Treatment as a Principal Element

The selected amended remedy will not satisfy the statutory preference for treatment of the soil. A treatment alternative was selected in the original ROD. But as previously stated throughout this Amended ROD, the results of a treatability study determined that the treatment alternative was not capable of meeting the soil remediation levels. Therefore, the treatment alternative would not adequately protect human health and the environment. The amended soil alternative will be protective of human health and the environment since the PAH contaminants will be removed to meet the remediation levels.

10.0 REFERENCES

Baker Environmental, Inc. August 1996. Feasibility Study for Operable Unit No. 12 (Site 3). Final. Marine Corps Base, Camp Lejeune, North Carolina.

Baker Environmental, Inc. January 6, 1997. Record of Decision Operable Unit No. 12 (Site 3). Marine Corps Base, Camp Lejeune, North Carolina.

Baker Environmental, Inc. April 9, 1998. Remediation of PAH-Contaminated Soil Operable Unit No. 12 (Site 3). 100% Basis of Design. Marine Corps Base, Camp Lejeune, North Carolina.

Baker Environmental, Inc. April 9, 1998. Remediation of PAH-Contaminated Soil Operable Unit No. 12 (Site 3). 100% Cost Estimate. Marine Corps Base, Camp Lejeune, North Carolina.

USEPA, 1988. United States Environmental Protection Agency. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/G-89/004.

TABLES

TABLE 1
SOIL REMEDIATION LEVELS
OPERABLE UNIT NO. 12 (SITE 3)
MCB CAMP LEJEUNE, NORTH CAROLINA

Contaminant of Concern	RL	Basis of Goal
Naphthalene	585	NC DENR
2-Methylnaphthalene	4,900	NC DENR
Carbazole	273	NC DENR
Benzo(a)anthracene	343	NC DENR
Chrysene	3,810	NC DENR
2-Methylphenol	1,050	NC DENR
4-Methylphenol	17.4	NC DENR
Acenaphthene	8,160	NC DENR
Phenol	1,750	NC DENR

Notes:

RL = Remediation Level in microgram per kilogram ($\mu\text{g}/\text{kg}$)
 NC DENR = North Carolina Department of Environment and Natural Resources
 Soil to Groundwater (S3: G1)

FIGURES

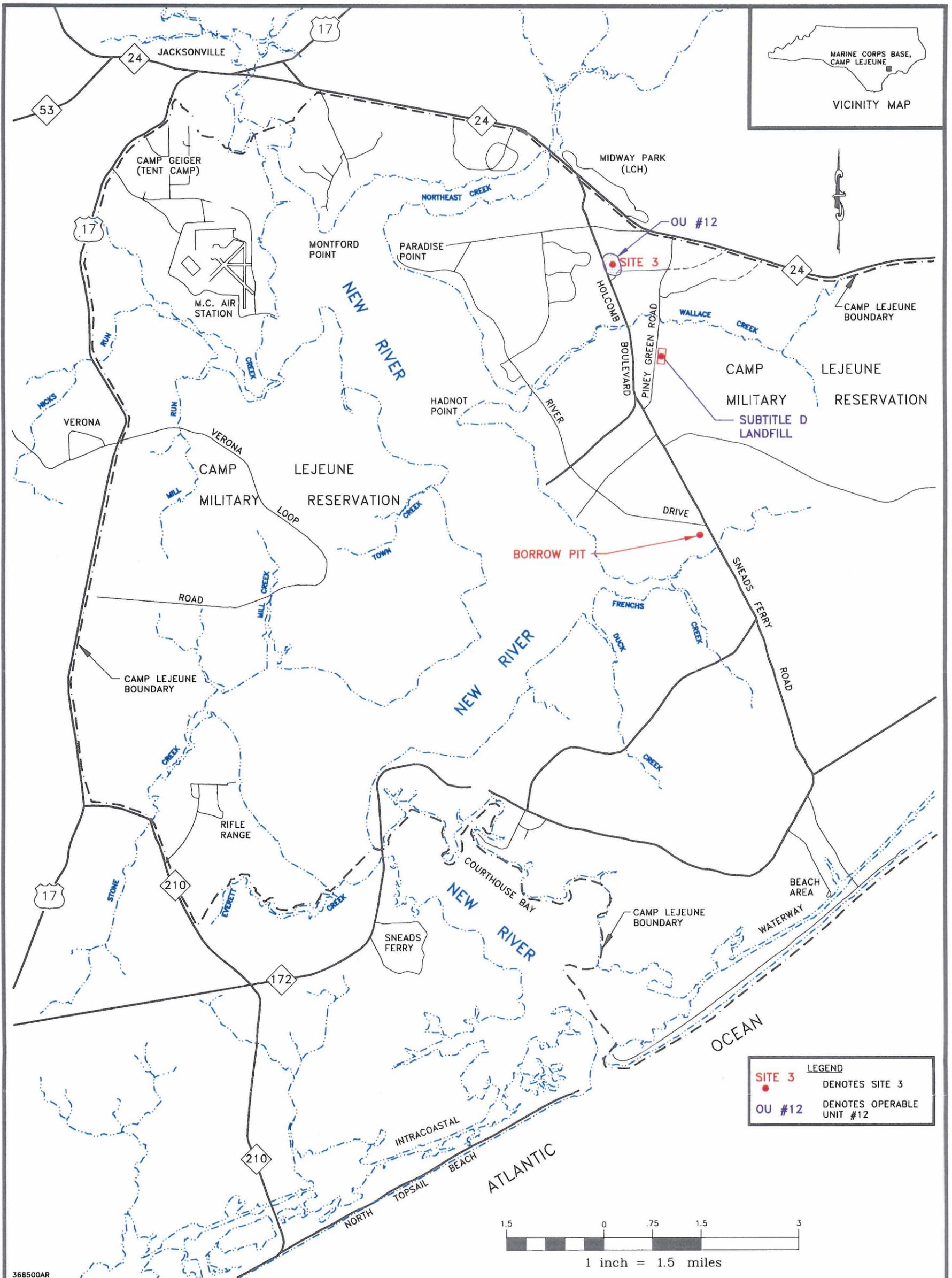
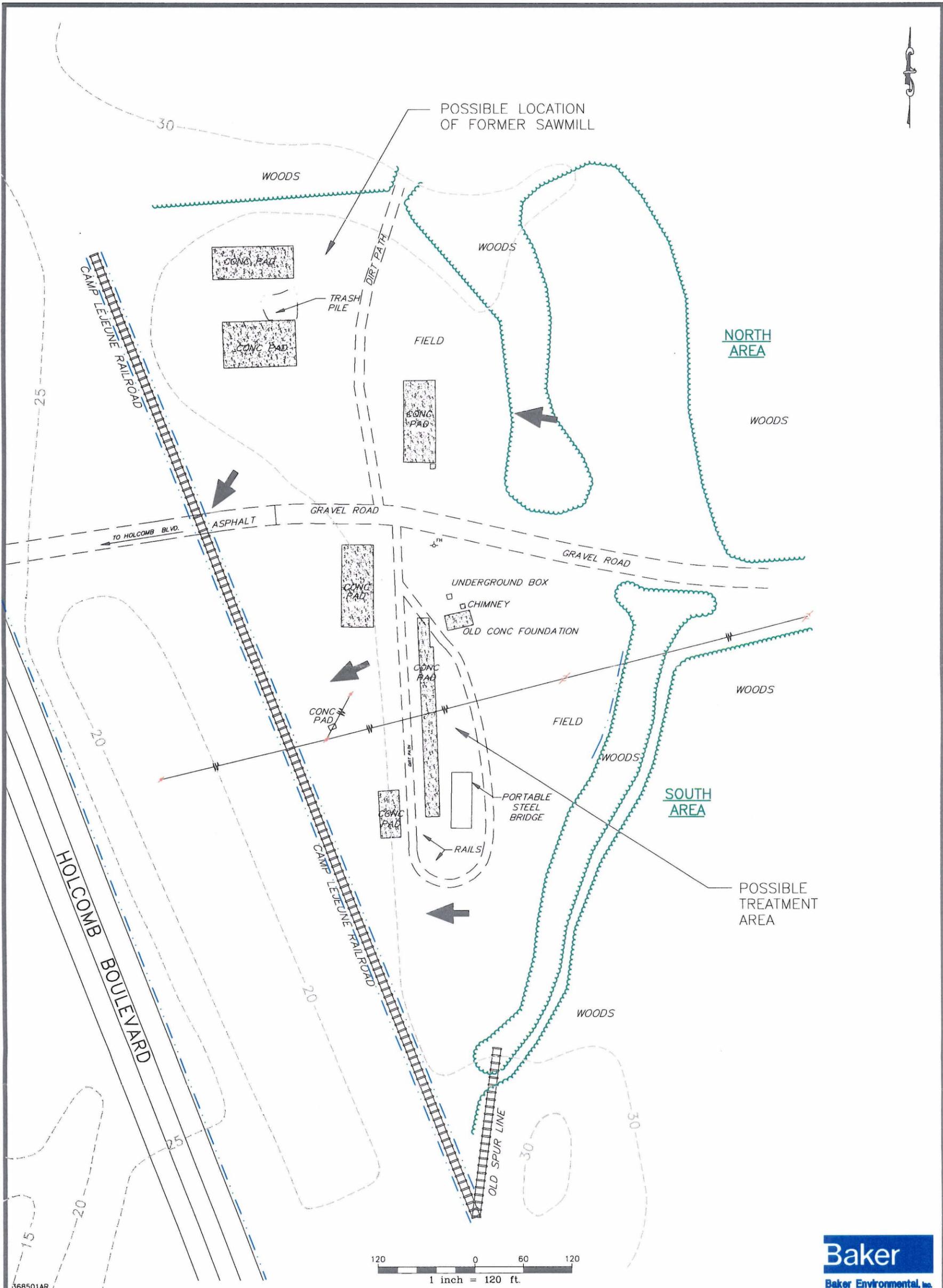


FIGURE 1
 OPERABLE UNIT NO. 12 (SITE 3)
 MARINE CORPS BASE, CAMP LEJEUNE

MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA



368501AR

LEGEND

- DRAINAGE PATH
- GRAVEL ROAD/DIRT PATH
- GROUNDWATER FLOW DIRECTION IN THE SHALLOW AQUIFER
- TOPOGRAPHIC ELEVATION LINE (FEET, MSL)

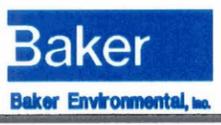
SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

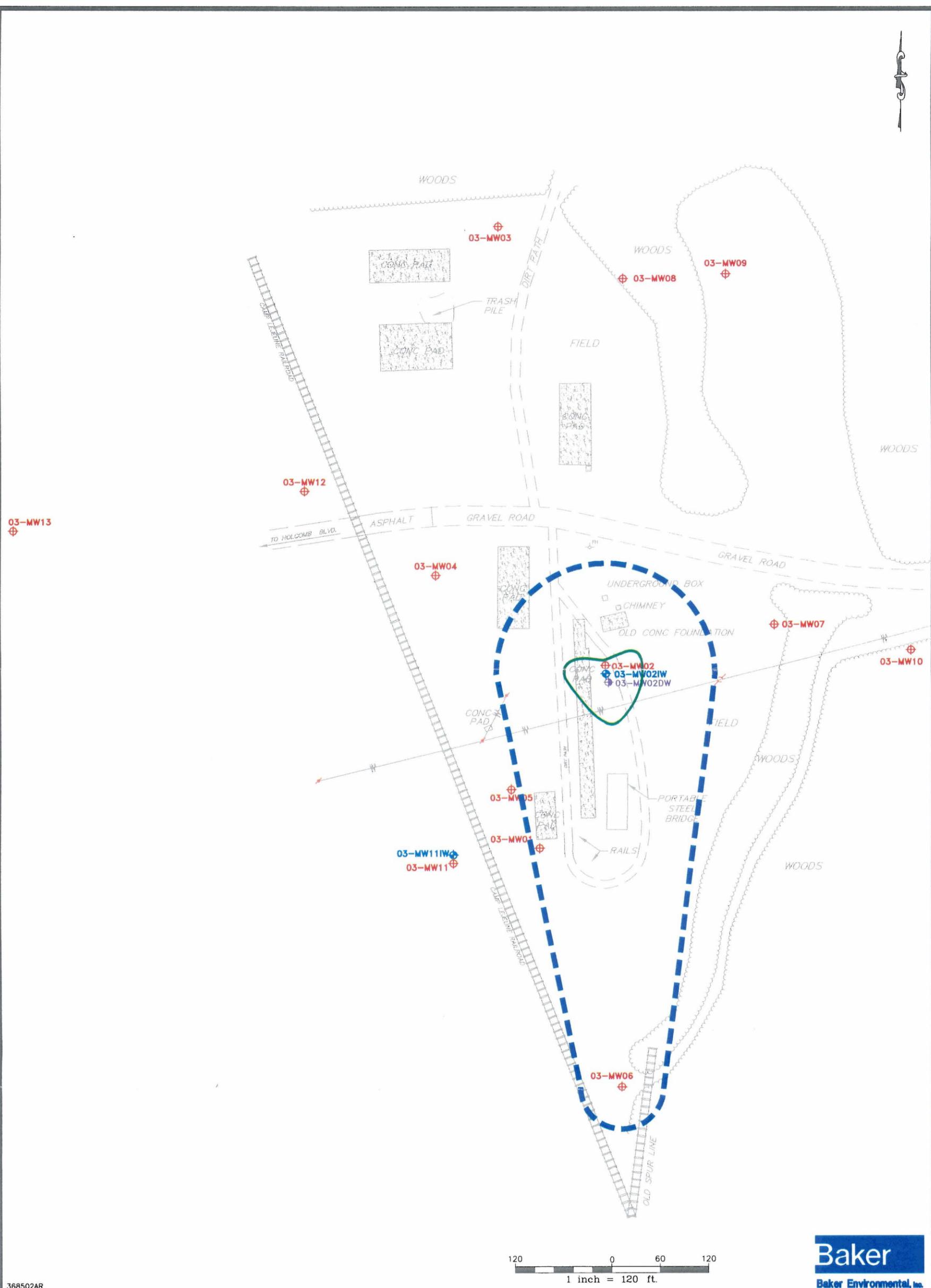
FIGURE 2

SITE MAP

SITE 3 - OLD CREOSOTE PLANT

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA





368502AR

LEGEND

- 03-MW01 SHALLOW MONITORING WELL LOCATION
- 03-MW02IW INTERMEDIATE MONITORING WELL LOCATION
- 03-MW02DW DEEP MONITORING WELL LOCATION
- GROUNDWATER AREA OF CONCERN (SHALLOW AQUIFER)
- SUBSURFACE SOIL AREA OF CONCERN

SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

FIGURE 3

**AREAS OF CONCERN
SITE 3 - OLD CREOSOTE PLANT**

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

ATTACHMENT A
NC DENR APPROVAL LETTER

TO BE INCLUDED

ATTACHMENT B
LAND USE CONTROL IMPLEMENTATION PLAN

ATTACHMENT B

LAND USE CONTROL IMPLEMENTATION PLAN (LUCIP) MCB CAMP LEJEUNE OU NO. 12 (SITE 3) OLD CREOSOTE PLANT

GENERAL

By separate Memorandum of Agreement dated May 24, 1999, hereinafter referred to as the Land Use Control Assurance Plan (LUCAP), the U.S. Environmental Protection Agency (U.S. EPA); the North Carolina Department of Environment and Natural Resources (NCDENR); and the Department of the Navy (Navy) on behalf of U.S. Marine Corps Base, Camp Lejeune, agreed that the Navy and the United States Marine Corps (Marine Corps) shall follow certain procedures for implementing and maintaining site-specific land use controls. Those procedures are contained in the LUCAP, and, for Site 3, this Land Use Control Implementation Plan (LUCIP). The LUCAP is intended to ensure that all of the Department of the Navy's site-specific selected remedies with land use controls remain protective of human health and the environment. This LUCIP and its requirements are part of the selected remedy within the Final Record of Decision (ROD).

The parties to the LUCAP also agree that the efficacy/protectiveness of the land use controls within this Land Use Control Implementation Plan is contingent upon the Department of the Navy's substantial good-faith compliance with those procedures applicable to the selected remedy. Should such compliance not occur or should the LUCAP be terminated, the parties agree that the protectiveness of the selected remedy may be reconsidered by any party and additional remedial measures may be necessary to ensure the selected remedy remains protective of human health and the environment.

This document is the LUCIP for MCB Camp Lejeune, Site 3, Old Creosote Plant. Site 3 is the sole site comprising Operable Unit (OU) No.12. This LUCIP is an attachment to and a part of the ROD for the site.

The Navy and the Marine Corps will, pursuant to the LUCAP, include the land use controls set forth in this LUCIP within the Installation's Geographic Information System (GIS) and the base master planning process. Pursuant to the LUCAP paragraph IV. a), the Installation will provide written notification to the State and EPA when the requirements of this paragraph have been met.

All proposed changes to this LUCIP will be submitted to the state and EPA for review and concurrence prior to implementation. Changes to this LUCIP will, if required under the National Contingency Plan, be reflected in changes to the selected remedy made through the appropriate process (e.g., Explanation of Significant Differences, ROD amendment).

The parties agree that the Navy's annual certification of land use control implementation is necessary for as long as the Navy retains ownership of the site. The NCDENR maintains this annual certification is part of the selected remedy. The Navy and Marine Corps maintain this annual certification is a procedure to implement the selected remedy and is not a part of the selected remedy. Nevertheless, all parties agree that a written certification is desirable. Accordingly, pursuant to the LUCAP paragraph V. b)., MCB Camp Lejeune will provide that certification annually to U.S. EPA and the NCDENR that the land use controls within the ROD remain implemented.

SITE BOUNDARY IDENTIFICATION

The geographic boundary of the site is identified in ROD Figure B-1. This boundary indicates the outermost border of all controlled portions of the site (i.e., no areas subject to land use controls lie outside this boundary).

The geographic boundary of the current soil contamination is identified in ROD Figure B-2. This boundary indicates the limits of soil contamination prior to implementation of the remedial action for soil.

The geographic boundaries of the current shallow and deep groundwater contamination are identified in ROD Figure B-3. These boundaries indicate the current limits of groundwater contamination at the depths specified.

SITE USE CONTROLS

Construction at Site 3 is temporarily prohibited, except for the implementation of the selected remedy. This control will remain in place only until the selected soil remedy can be implemented and only as long as aquifer contamination exists. See Figure B-4 (Boundary of Temporary Land Use Controls).

Unless specifically excepted by both the NCDENR and the USEPA, intrusive activities (e.g., excavation of soil or insertion of objects into the ground – except for monitoring purposes) are prohibited below the water table within the geographic boundary of the Site. See Figure B-5 (Boundary of Land Use Controls for Intrusive Activities).

AQUIFER USE CONTROLS

Except for monitoring purposes or as specifically excepted by NCDENR or the USEPA, all use of groundwater beneath Site 3 is prohibited. In addition, the installation of any well, other than those constructed for monitoring purposes, is prohibited except as authorized by North Carolina Administrative Code Title 15A, Chapter 2C (as amended), Well Construction. See Figure B-6 (Boundary of Aquifer Use Controls).

SITE ACCESS CONTROLS

There are no controls on site access.

NOTIFICATION

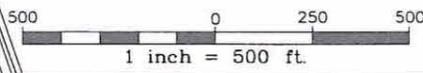
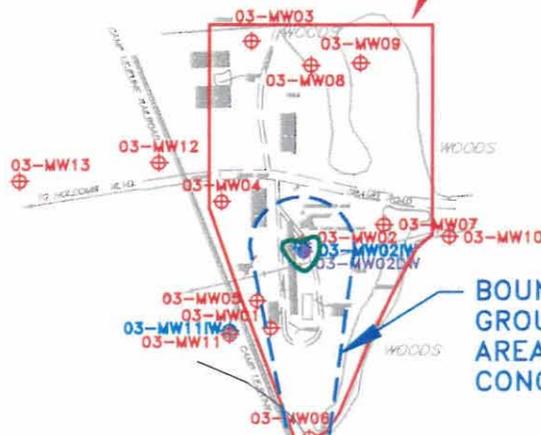
Following the procedures contained within the LUCAP, MCB Camp Lejeune shall file a Notification of Inactive Hazardous Substance or Waste Disposal Site meeting the requirements of NCGS 130A-310.8.

BOUNDARY OF AQUIFER
USE RESTRICTIONS

SITE 3 BOUNDARY

BOUNDARY OF
GROUNDWATER
AREA OF
CONCERN

HOLCOMB BLVD.

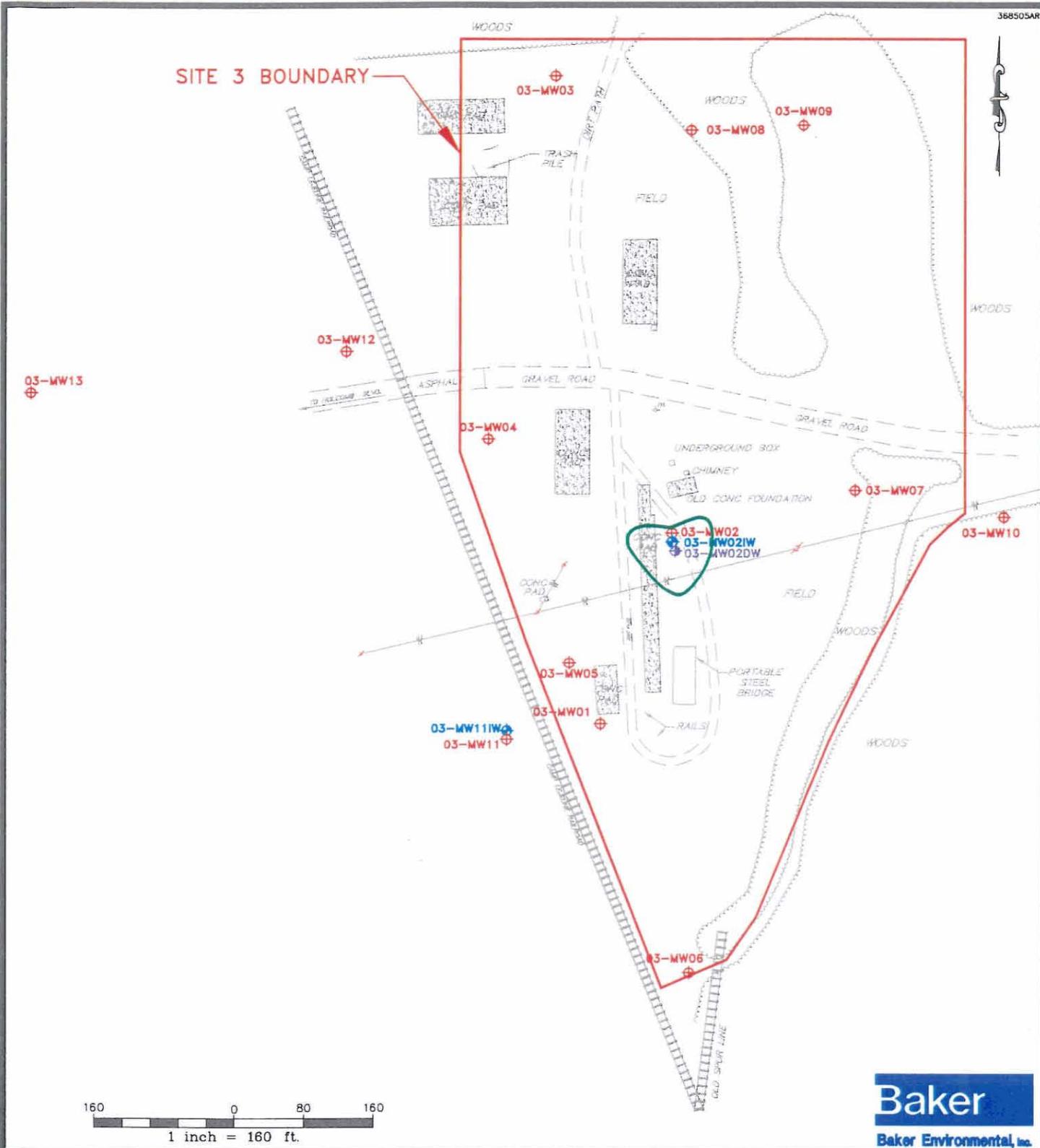


LEGEND

- 03-MW01 SHALLOW MONITORING WELL LOCATION
- 03-MW02IW INTERMEDIATE MONITORING WELL LOCATION
- 03-MW02DW DEEP MONITORING WELL LOCATION
- GROUNDWATER AREA OF CONCERN (SHALLOW AQUIFER)
- SUBSURFACE SOIL AREA OF CONCERN
- AQUIFER USE RESTRICTION

SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

FIGURE B-1
 BOUNDARY OF THE SITE
 SITE 3 - OLD CREOSOTE PLANT
 MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA

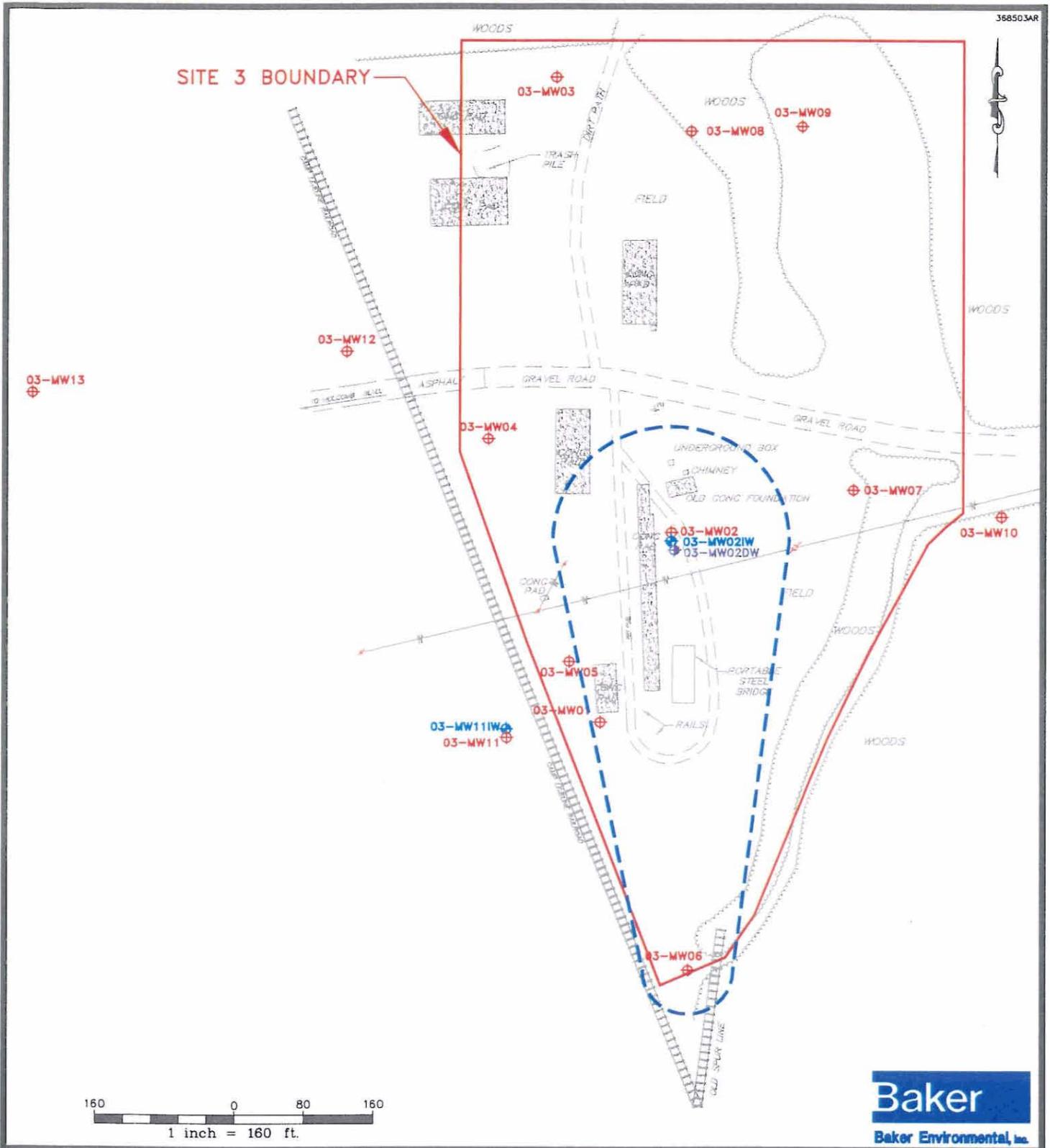


LEGEND

- 03-MW01 SHALLOW MONITORING WELL LOCATION
- 03-MW02IW INTERMEDIATE MONITORING WELL LOCATION
- 03-MW02DW DEEP MONITORING WELL LOCATION
- SUBSURFACE SOIL AREA OF CONCERN

FIGURE B-2
BOUNDARY OF CURRENT SOIL CONTAMINATION
SITE 3 - OLD CREOSOTE PLANT
 MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA

SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995



LEGEND

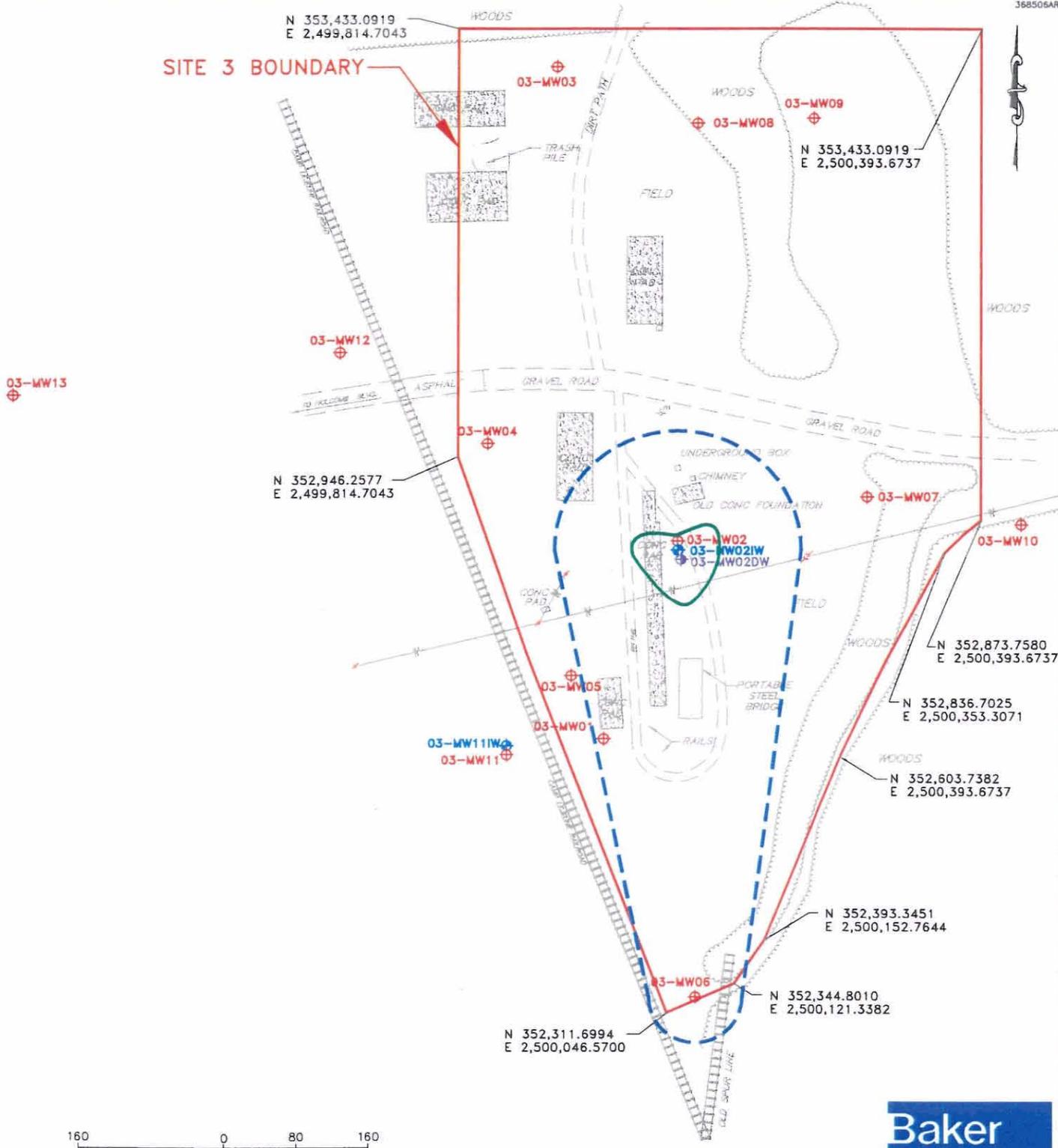
- 03-MW01 SHALLOW MONITORING WELL LOCATION
- 03-MW02IW INTERMEDIATE MONITORING WELL LOCATION
- 03-MW02DW DEEP MONITORING WELL LOCATION
- GROUNDWATER AREA OF CONCERN (SHALLOW AQUIFER)

FIGURE B-3

**BOUNDARY OF CURRENT
GROUNDWATER CONTAMINATION
SITE 3 – OLD CREOSOTE PLANT
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA**

SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

SITE 3 BOUNDARY



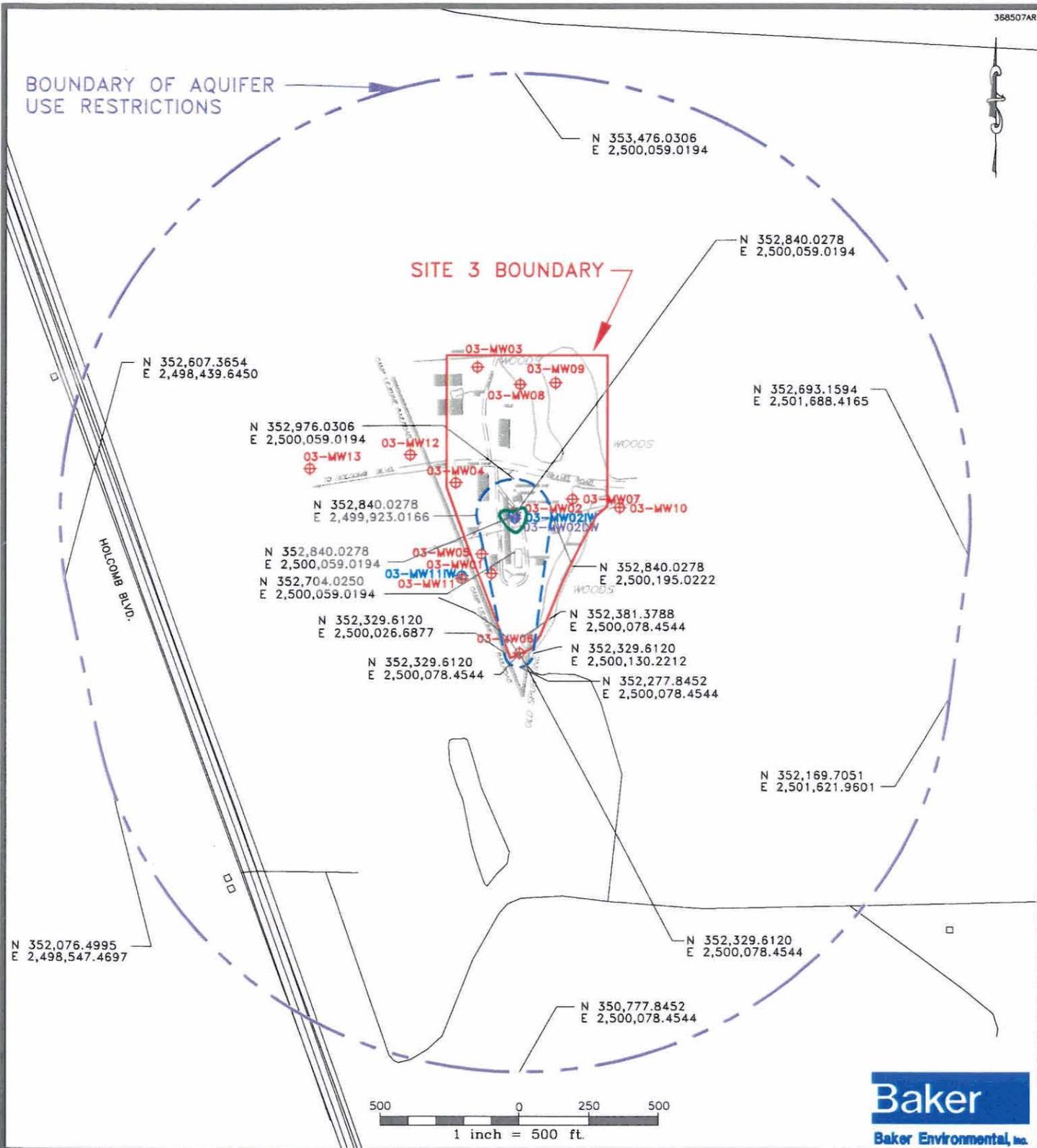
LEGEND

- 03-MW01 SHALLOW MONITORING WELL LOCATION
- 03-MW02IW INTERMEDIATE MONITORING WELL LOCATION
- 03-MW02DW DEEP MONITORING WELL LOCATION
- GROUNDWATER AREA OF CONCERN (SHALLOW AQUIFER)
- SUBSURFACE SOIL AREA OF CONCERN

SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

FIGURE B-4

BOUNDARY OF LAND USE RESTRICTIONS
 FOR INTRUSIVE ACTIVITIES
 SITE 3 – OLD CREOSOTE PLANT
 MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA



LEGEND

- 03-MW01 SHALLOW MONITORING WELL LOCATION
- 03-MW02IW INTERMEDIATE MONITORING WELL LOCATION
- 03-MW02DW DEEP MONITORING WELL LOCATION
- GROUNDWATER AREA OF CONCERN (SHALLOW AQUIFER)
- SUBSURFACE SOIL AREA OF CONCERN
- AQUIFER USE RESTRICTION

SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

FIGURE B-5
BOUNDARY OF AQUIFER USE RESTRICTIONS
SITE 3 - OLD CREOSOTE PLANT
 MARINE CORPS BASE, CAMP LEJEUNE
 NORTH CAROLINA

