√ 04.07 - 8/29/96 - 00206

DRAFT

PROJECT PLANS
PILOT-SCALE BIOREMEDIATION
TREATABILITY STUDY
OPERABLE UNIT NO. 12 (SITE 3)
MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

CONTRACT TASK ORDER 0274

AUGUST 29, 1996

Prepared for:

DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
Norfolk, Virginia

Under:

LANTDIV CLEAN PROGRAM
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

1.0 INTRODUCTION

These Project Plans for the Pilot-Scale Bioremediation Treatability Study at Operable Unit No. 12 (Site 3), Marine Corps Base (MCB), Camp Lejeune have been prepared by Baker Environmental, Inc. under the United States Department of the Navy (DoN), Atlantic Division, Naval Facilities Engineering Command (LANTDIV) Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, Contract Task Order 0274 (Mod 02). The treatability study is being conducted as part of a Feasibility Study (FS) for polynuclear aromatic hydrocarbon (PAH)-contaminated subsurface soil at Operable Unit No. 12 (Site 3). The Project Plans were prepared in accordance with the requirements of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300.430]. The NCP regulations were promulgated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly referred to as Superfund, and amended by the Superfund Amendments and Reauthorization Act (SARA) signed into law on October 17, 1986. The USEPA's document Guide for Conducting Treatability Studies Under CERCLA (USEPA, 1992) was used as guidance for preparing this document.

MCB, Camp Lejeune was placed on the CERCLA National Priorities List (NPL) on October 4, 1989 (54 Federal Register 41015, October 4, 1989). The United States Environmental Protection Agency (USEPA) Region IV, the North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), and the DoN then entered into a Federal Facilities Agreement (FFA) for MCB, Camp Lejeune. The primary purpose of the FFA is to ensure that environmental impacts associated with past and present activities at MCB, Camp Lejeune are thoroughly investigated and appropriate CERCLA response/Resource Conservation and Recovery Act (RCRA) corrective action alternatives are developed and implemented as necessary to protect public health and the environment.

1.1 Purpose and Organization of the Project Plans

These Project Plans present Baker's approach to executing the Pilot-Scale Bioremediation Treatability Study at Site 3. The Project Plans detail the scope of the treatability study activities, including the objectives and methodologies that will be used to conduct the study.

The Project Plans consist of five parts: a Work Plan, a Design for the Treatability Unit, a Sampling and Analysis Plan (SAP), a Health and Safety Plan (HASP), and a Quality Assurance Protocol Plan (QAPP). The Work Plan is presented in the remaining sections of this document. The Design for the Treatability Unit including technical specifications and construction drawings, is contained within Appendix A of this document. The SAP is provided in Section 5.0 of this document and in the Final Remedial Investigation/Feasibility Study Field Sampling and Analysis Plan for Operable Unit No. 12 (Site 3) (Baker, October 1994). The HASP is provided in the Final Remedial Investigation/Feasibility Study Health and Safety Plan, Operable Unit No. 12 (Site 3) (Baker, September 1994). The QAPP is provided in the Final Remedial Investigation/Feasibility Study Quality Assurance Project Plan for Operable Unit No. 12 (Site 3) (Baker, October 1994).

1.2 Project Description

The following subsections describe the site's history and the subsurface soil area of concern.

1.2.1 Site Description and History

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. Figure 1-1 identifies the location of Site 3 within MCB, Camp Lejeune, and Figure 1-2 presents a map of Site 3.

As shown in Figure 1-2, 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.

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. 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 preservatives 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 onto the ground surface. 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 (USEPA, 1992).

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. The portable steel bridge identified in Figure 1-2 is not associated with the former creosote plant. It was more recently stationed in the area by Base personnel.

Several concrete pads, which may also be remnants of the former creosote plant, are scattered throughout the northern and southern portions of Site 3. However, these pads do not contain visual evidence of contamination. In addition, a small trash pile containing palettes and metal debris is located in the northern portion of Site 3. However, this trash pile does not appear to have been associated with the former creosote plant.

1.2.2 Subsurface Soil Area of Concern

Based on the Remedial Investigation/Feasibility Study (RI/FS) conducted for Site 3, several PAHs were identified as subsurface soil contaminants of concern. These contaminants of concern, and their corresponding remediation levels (USEPA Region III Soil Screening Levels), are listed below.

Contaminant of Concern	Remediation Level
Naphthalene	30,000 parts per billion (ppb)
2-Methylnaphthalene	30,000 ppb
Carbazole	500 ppb
Benzo(a)anthracene	700 ppb
Chrysene	1,000 ppb
4-Nitrophenol	0 ppb
N-nitrosodiphenylamine	200 ppb

Figure 1-3 identifies the contaminant concentrations in subsurface soil that exceeded remediation levels. Based on these exceedances, a subsurface soil area of concern was delineated as shown in Figure 1-4. This area of concern extends from approximately 3 to 9 feet below ground surface (just above the water table), and encompasses approximately 1,340 cubic yards of PAH-contaminated soil. The area of concern is believed to be a source of the semivolatile organic contamination detected in the shallow aquifer at Site 3.

Based on the FS, Source Removal and Biological Treatment appears to be the most appropriate treatment option for this area of concern. Source Removal and Biological Treatment includes excavation of the area of concern, followed by ex situ biological treatment of the contaminated soil in a landfarming unit. It is currently anticipated that the existing Lot 203 biocell at MCB, Camp Lejeune (a landfarm unit with a 1,000 cubic yard capacity) will be used for the full-scale treatment. Thus, a Pilot-Scale Bioremediation Treatability Study is being conducted at Site 3 to evalute the viability of the treatment technology for the PAH-contaminated soil.

2.0 TREATMENT TECHNOLOGY DESCRIPTION

The technology that will be tested during the pilot-scale study is ex situ, solid-phase, aerobic biological treatment in the form of a landfarm unit. Using ex situ landfarming, contaminated soil, sediment, or sludge is placed in a thin layer (e.g., 12 inches) within a controlled unit. The unit typically contains a drainage layer (e.g., a 24 inch layer of coarse sand) underneath the contaminated soil, and an impermeable liner. The unit may also contain a leachate collection system (usually consisting of perforated pipelines and a sump), and it may be sloped to facilitate leachate collection. The unit may be fitted with a cover to prohibit water infiltration and to control temperature, and surrounded by a berm to contain and isolate the contaminated soil.

Bioremediation is a process in which indigenous or inoculated microorganisms (e.g., bacteria and fungi) metabolize, or degrade, organic contaminants. Bioremediation has successfully remediated soil and groundwater contaminated with petroleum hydrocarbons, solvents, pesticides, wood preservatives, and other organic chemicals. Under aerobic conditions (i.e., in the presence of sufficient oxygen), microorganisms will convert organic contaminants to carbon dioxide, water, and microbial cell mass. Under anaerobic conditions (i.e., in the absence of sufficient oxygen), microorganisms will convert organic contaminants to methane, limited amounts of carbon dioxide,

and trace amounts of hydrogen gas (USEPA, 1994). For the treatability study at Site 3, aerobic bioremediation of PAH-contaminated soil will be tested using indigenous bacteria.

Literature indicates that aerobic bioremediation is an effective treatment for PAH contaminants in soil. For 2- and 3-ring PAHs, such as naphthalene and 2-methylnaphthalene, 80 to 90 percent removal has been achieved. For 4-ring PAHs, such as benzo(a)anthracene and chrysene, 60 to 80 percent removal has been achieved (Mahaffey, 1991). Treatment time increases with increasing number of PAH rings. Therefore, treatment time must be gaged using the degradation rates of the larger PAHs.

Aerobic bioremediation is only successful with the appropriate density and distribution of soil microorganisms. In soil where contamination has existed for extended periods of time, there will be natural microorganisms that are already acclimated to the soil conditions. These microorganisms may only require a boost to begin the contaminant degradation process at an efficient pace (O'Malley, 1996). The microorganism density and distribution is highly dependent on the following environmental parameters (Bandyopadhyay, 1994):

- Carbon Source
- Nutrients (macronutrients such as phosphorous and nitrogen, and micronutrients such as metals and vitamins)
- Oxygen
- Optimal pH (a neutral pH is usually most effective)
- Optimal Temperature (usually between 20 to 25 degrees Celcius or 68 to 77 degrees Fahrenheit)
- Optimal Moisture (usually between 40 to 75 percent of the moisture holding capacity of a soil, or 10 to 20 percent weight)
- Adequate Organism Retention Time (enough time must pass for organisms to duplicate)

An effective carbon/nitrogen/phosphorous ratio is generally 20:10:1, although this ratio will vary based on site-specific conditions. The carbon source may be enhanced by adding organic substrates such as compost, animal waste, or sewage sludge. However, additional organic substrates may be detrimental to the bioremediation process if the microorganisms develop a preference for the added carbon source. In this case, sufficient contaminant degradation may not occur. Conversely, excessive contaminant concentrations may be toxic to the microorganisms. To decrease this toxicity, the contaminated soil may be diluted with a non-contaminated soil (Baker and Herson, 1994).

Nutrient levels are adjusted by mixing mineral salts and urea, contained within common agricultural fertilizer, into the contaminated soil. Necessary macronutrients include nitrogen (as nitrate or ammonia), and phosphorous (as phosphate). Necessary micronutrients include sulfur, potassium, magnesium, calcium, manganese, iron, cobalt, copper, molybdenum, nickel, and zinc Only trace amounts of these micronutrients are required so the amount found in the natural environment is

usually sufficient. To enhance the oxygen supply within the soil matrix, the soil is periodically tilled or mixed. The pH may be adjusted through the addition of commercial-grade lime or aluminum sulfate. Temperature may be adjusted using heat-trapping covers or cooling systems. Moisture may be adjusted through irrigation, spraying, or sprinkling of either potable water or leachate collected from the treatment unit. Recirculation of collected leachate through the contaminated soil may also enhance the effectiveness of biological treatment. However, under-watering of the soil will prohibit microbial growth and over-watering will drown the microbes.

3.0 TREATABILITY STUDY OBJECTIVES

The treatability study objectives are:

- Assess the technical implementability and effectiveness of bioremediation as a means of remediating PAH-contaminated soil from Site 3.
- Assess the effectiveness of using an ex situ landfarm unit for full-scale treatment.
- Obtain preliminary design data for a full-scale system (e.g., moisture, oxygen, and nutrient requirements).

4.0 DESIGN AND OPERATION

This section describes the treatability unit design and operation and maintenance (O&M) requirements. The construction drawings and specifications presented in Appendix A provide additional detail.

4.1 Design

Located approximately 60 feet east of the abandoned chimney and 40 feet south of the gravel access road, the treatability unit will span an area of approximately 2,565 square feet. The treatability unit is designed to contain two cells: a control cell and an experimental cell. The control cell will represent bioremediation effects without nutrient, oxygen, pH, or moisture adjustments. The experimental cell will represent bioremediation effects with these adjustments. Each cell will contain approximately four cubic yards of contaminated soil. In addition, each cell will span an area of approximately 320 square feet and will be surrounded by 4-foot high earthen berms. The entire treatability unit will be surrounded by a safety fence throughout the study duration.

Each treatability cell will include three layers: a 40 mil high density polyethylene (HDPE) liner with an underlying layer of non-woven geotextile, a 12-inch layer of coarse sand, and a 12-inch layer of contaminated soil. Initially, the natural subgrade underneath each cell will be graded to a 4 percent slope. Some minor excavation or backfilling may be required to achieve this slope. A leachate collection trench, approximately 2 feet deep, will be excavated across the downgradient edge of each cell. Each trench will be graded to facilitate leachate runoff into the center of the trench. Following trench excavation, the inner berm that separates the two treatability cells will be constructed. Fill material will be obtained from an on-Base borrow pit. One continuous piece of geotextile will be placed over the subgrade, the inner berm, and within the trenches. Then one continuous piece of 40 mil HDPE liner will be placed over the geotextile. The geotextile will protect the liner from subsurface conditions. Excess liner/geotextile will be left along the edges to form anchor trenches following the outer berm construction.

Within each trench, two 4-inch diameter perforated HDPE pipes (wrapped in filter fabric) will be placed on either side of a vertical 12-inch diameter HDPE pipe that is capped at the bottom. The 4-inch pipes will slope into the 12-inch pipe which will function as a leachate collection sump. Gravel will be placed within the trenches to surround the pipes and fill void spaces. This gravel will anchor the piping system in place.

A twelve inch layer of clean sand will be placed within each treatability cell. The sand will be smoothed and leveled and periodically gaged to ensure a 12 inch lift. Over the sand layer, a 12 inch layer of contaminated soil will be placed. The soil will be placed immediately after it is excavated to avoid stockpiling. Therefore, the same backhoe that is used for excavation will be used for soil placement. Unloading of each backhoe bucket will alternate between the experimental cell and control cell to ensure a representative soil mixture in each cell. The soil will be placed without the backhoe entering the treatability cells. (To accomplish this, a portion of the outer berm may have to be constructed after soil placement occurs.) Once it is placed in the cells, the soil will be pulverized and homogenized using hand tools, then mixed using a rototiller. The final soil layer will be smoothed and leveled and periodically gaged to ensure a 12-inch lift.

What precautions will be taken to prevent rain, if any, in the area during the full-scale?

As the soil is being excavated and placed, the initial characterization sample will be collected as described in Section 5.0. This sample will require 24-hour turnaround laboratory analyses to maintain the anticipated construction schedule.

After contaminated soil placement, the Contractor will be notified when to add the initial nutrient, pH, and moisture adjustments. (The Contractor will also be notified of the quantities of initial additives.) The backfilling of the Area of Concern excavation may then begin. The initial additives will be mixed into the contaminated soil in the experimental cell using a hand-held rototiller. Then the operation and maintenance period will begin.

Ideally, the sample collection and construction activities will proceed in the following order:

1. Inspect the sample collection and construction areas for underground utilities and aboveground utilities that are not identified in the construction drawings.
2. Construct the equipment laydown/decontamination area, including safety fencing.
3. Install safety fencing around the excavation area.
4. Clear the treatability unit area.
5. Prepare the subgrade underneath treatability cells; establish 4 percent slopes.
6. Excavate the leachate collection trenches.
7. Grade the trench floors to promote drainage.
8. Construct the inner berm that separates the two treatability cells.
9. Install the geotextile.
10. Install the 40-mil HDPE liner.

Other — Do we want to be able to reuse the cell for baseline characterization? — what about an earthen ramp so that cell can be reused in future?

11. Construct the outer berm, but leave open spaces for equipment access.

12. Anchor the liner and geotextile fabric.

13. Place the piping systems within the leachate collection trenches; make all pipe connections and seals.

14. Fill the trenches with gravel.

15. Place the 12-inch sand layer.

16. Begin excavation to collect the contaminated soil.

17. Stockpile the soil located from 0 to 3 feet below ground surface to reuse it as fill for the excavation area.

18. Place the 12-inch layer of contaminated soil.

19. Collect the initial characterization sample. — why collect this now? why not after homogenization — when are nutrients added?

20. Pulverize and homogenize the contaminated soil within the treatability cells.

21. Smooth and level the 12-inch layers of contaminated soil.

22. Finish the construction of the outer berm.

23. Install safety fencing around the treatability unit.

24. Backfill the excavation area.

4.2 Operation and Maintenance

Operation and maintenance of the treatability unit will consist of periodic soil tilling/oxygen adjustment, nutrient, pH, moisture, and temperature adjustment, and soil sampling and analysis, as directed by Baker and as specified in Appendix A. However, all operation procedures are subject to change as the study progresses. The anticipated duration of the treatability study is three months.

4.2.1 Soil Tilling/Oxygen Adjustment

Throughout the duration of the study, the contaminated soil in the experimental cell will be tilled on a weekly basis to promote aeration (i.e., oxygen adjustment). At the beginning of the study, the contaminated soil in both the control and experimental cell will be pulverized then tilled/mixed to create a generally homogeneous soil matrix. All subsequent tilling will only be conducted on the contaminated soil in the experimental cell. Tilling will be accomplished using a rototiller. Tilling will not affect the underlying sand layer, but will adequately mix the full 12 inches of contaminated soil.

4.2.2 Nutrient Addition

Nutrient addition will consist of mixing a dry, granular fertilizer into the contaminated soil in the experimental cell. The amount of fertilizer and the frequency of applications will be determined by Baker after the initial soil characterization. A rototiller may be used to mix the fertilizer into the soil.

4.2.3 pH Adjustment

The soil pH will be adjusted by adding commercial-grade lime or aluminum sulfate to the contaminated soil as directed by Baker. The amount of lime or aluminum sulfate and the frequency of application will be determined by Baker after the initial soil characterization. Most likely, the optimal pH will remain near neutral. A rototiller may be used to mix the pH adjuster into the soil.

4.2.4 Moisture Adjustment

At least on a weekly basis, moisture will be adjusted by spraying collected leachate back onto the biocell. Periodically, leachate collected within the HDPE sump will be pumped using a 2 inch submersible pump. The pump discharge will be connected to a 25 foot flexible hose that will be used to sprinkle the leachate onto the biocell. The leachate will be applied evenly across the entire cell. At the optimal moisture content, the soil will exhibit a friable, but not saturated, consistency, and a moisture content of 40 to 75 percent the maximum holding capacity. An in-field moisture tester will be used to measure the moisture content on a weekly basis. When the leachate supply is exhausted, potable water from an on-Base supply will be used for moisture adjustment. Excess leachate will be periodically pumped into 55-gallon drums.

4.2.5 Temperature Adjustment

Most likely, the optimal soil temperature will be between 68 and 77 degrees Fahrenheit. Under the current schedule (see Section 7.0), the treatability study will be conducted during the late winter and early spring. The average temperature at MCB, Camp Lejeune during this time period is 44 to 53 degrees Fahrenheit. Thus, a biocell cover may be required to trap heat and increase the soil temperature. This cover will be a plastic laminate tarp that will be securely anchored at all edges around the cell. One cover may be used for both the experimental cell and the control cell. The soil temperature will be monitored on a weekly basis.

4.2.6 Soil Sampling and Analysis

Soil sampling will be conducted on a biweekly basis as described in Section 5.0 of these Work Plans.

5.0 SAMPLING AND ANALYSIS

This sampling and analysis section describes the collection of contaminated soil for the treatability units, and the collection of soil samples to be analyzed during the study. Additional sampling and analysis instructions are contained within the Final Remedial Investigation/Feasibility Study Field Sampling and Analysis Plan for Operable Unit No. 12 (Site 3) (Baker, October 1994).

are there MW's in or near excavation or treatment area?

where are these?

5.1 Collection of the Treatability Soil

Approximately 10 cubic yards of contaminated soil will be collected as shown in the construction drawings and placed within the treatability cells. Sample collection will occur in a portion of the contaminated area of concern that appears to contain average PAH concentrations. This area is located near the treatability unit so that excavated soil can be deposited directly into the unit. Excavation will be accomplished using a backhoe that will be thoroughly decontaminated before and after soil excavation and placement occurs. Prior to excavation, the site will be inspected for utilities (underground and aboveground) that may not be identified in the construction drawings. Appendix B contains boring logs and well construction records for drilling locations near the sample collection area.

5.2 Collection of Study Samples

Three types of samples will be collected for the study: an initial characterization sample, periodic O&M samples, and a final confirmation sample. All samples will be analyzed for the following parameters:

TCL Semivolatiles	EPA Method 3550/EPA Method 8270
Total Organic Carbon	SW-846 Method 9060
Ammonium-Nitrogen	ASA/SSSA Method 33-3,33-4
Phosphate-Phosphorous	ASA/SSSA Method 24-5.1, 24-5.3
pH	ASA/SSSA Method 12-2.6
Moisture Content	ASA/SSSA Method 21-22
Bacterial Population Density	SM EWW 9215B

In addition, the initial characterization sample will be analyzed for TAL Metals using EPA Methods 6010, 7060, 7080, 7131, 7191, 7421, 7470, 7760, and 7740. The Contractor will ship all samples to the analytical laboratory that Baker selects. The sample shipping documentation will indicate that all analytical results should be sent directly to Baker.

5.2.1 Initial Characterization Sample

should be collected after soil is tilled.

One initial characterization (or "baseline") sample will be collected from the contaminated soil as it is being excavated and placed within the treatability unit. This composite sample will consist of at least three grab samples from representative locations throughout the contaminated soil matrix; the sample will be thoroughly pulverized, mixed, and homogenized. The analytical results will be used to determine the quantity and frequency of nutrient addition and other O&M parameters. To meet the construction schedule, this sample will be analyzed using 24-hour turnaround time.

5.2.2 O&M Samples

Throughout the duration of the study, O&M samples will be collected on a biweekly basis. Based on a three month O&M period, there will be five sampling events (a sixth event at the end of the three months will be considered the final confirmation sample). During each O&M sampling event, two samples will be collected: one from the experimental cell and one from the control cell. Each sample will be a soil composite consisting of at least three, representative grab samples from the contaminated soil matrix; each sample will be thoroughly pulverized, mixed, and homogenized. The

analytical results will be used to assess the effectiveness of the landfarming process and to further refine O&M procedures (e.g., nutrient and moisture adjustments).

5.2.3 Final Confirmation Sample

At the conclusion of the treatability study O&M period, two final confirmation samples will be collected from the treatability soil, one from each treatability cell. Each sample will be a soil composite consisting of at least three, representative grab samples from the contaminated matrix; each sample will be thoroughly pulverized, mixed, and homogenized. If the analytical results do not exceed the specified remediation levels, the treatability study will be considered complete. If the analytical results exceed the remediation levels, the treatability study may be extended or it may be terminated. Baker and the NTR will decide at this point whether the treatability study objectives have been met.

6.0 REPORTS

Two reports are associated with the treatability study. These reports include the Treatability Study Project Plans and the Treatability Study Report. Submission and review of these reports are discussed in the following sections.

6.1 Treatability Study Project Plans

These Draft Treatability Study Project Plans, which detail the scope of the treatability study activities, are being submitted to LANTDIV, the Activity, USEPA Region IV, and NC DEHNR for review. Comments received from the NC DEHNR and USEPA Region IV will be addresses and incorporated, as appropriate, into the Final Treatability Study Project Plans. Baker will distribute the Final Treatability Study Project Plans to LANTDIV, the Activity, USEPA Region IV, NC DEHNR, and the other members of the TRC.

6.2 Treatability Study Report

Upon completion of the on-site study, a Treatability Study Report will be prepared in accordance with USEPA's Guide for Conducting Treatability Studies Under CERCLA (USEPA, October 1992). The Treatability Study Report will provide a presentation and evaluation of the treatability study results. The Treatability Study Report will also include engineering and design-related information needed for evaluating the short- and long-term effectiveness, implementability (including long-term operation and maintenance requirements), and cost (both capital and operation and maintenance) of implementing the full-scale remedial action.

Two versions of the Treatability Study Report will be prepared as follows: a Draft Treatability Study Report for review by the Navy, USEPA, and NC DEHNR; and a Final Treatability Study Report, which will incorporate review comments from the Navy and regulatory agencies. Upon completion, Baker will distribute the Final Treatability Study Reports to LANTDIV, the Activity, USEPA Region IV, NC DEHNR, and the other members of the TRC.

7.0 SCHEDULE

A preliminary schedule for the treatability study is presented in Table 7-1. As shown, the treatability study execution, which includes construction and O&M periods, is anticipated to require 14 weeks

to complete. The entire treatability study process, which includes development and review of the Final Treatability Study Project Plans and the Draft and Final Treatability Study Reports, is anticipated to require 38 weeks (or 9-1/2 months) to complete.

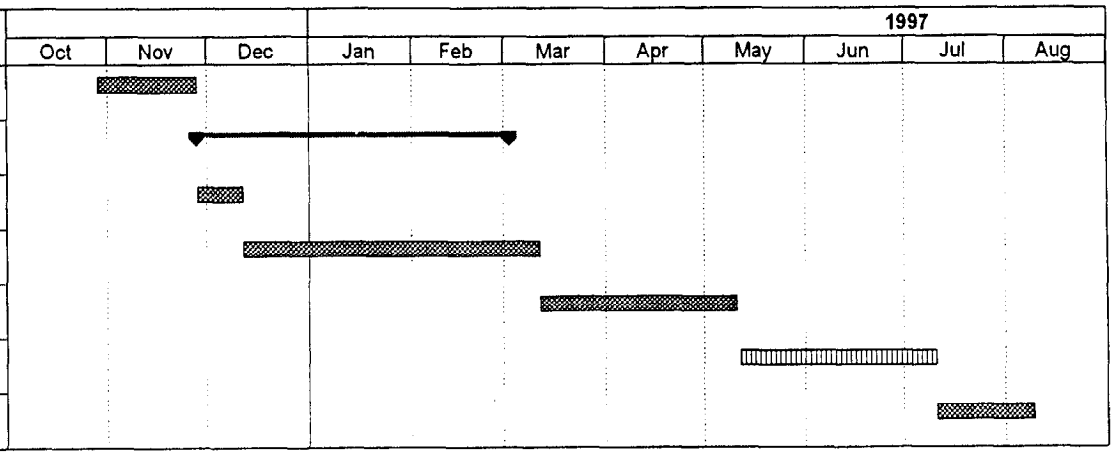
8.0 MANAGEMENT AND STAFFING

The proposed management and staffing for this Treatability Study are graphically represented in Figure 8-1. As shown, the Baker project team will be managed by Mr. Matthew D. Bartman. His primary responsibilities will include monitoring the technical performance, cost, and schedule, and maintaining close communication with the Navy Environmental Technical Representative (NTR) Ms. Katherine Landman. Ms. Tara L. Beckman will be responsible for coordination with subcontractors and the Remedial Action Contractor, Ms. Coreen M. Casadei will be responsible for overall quality assurance/quality control, and Mr. John W. Mentz will be responsible for program level support.

TABLES

Table 7 - 1
Projected Schedule for the Treatability Study
Operable Unit No. 12 (Site 3) MCB Camp Lejeune, North Carolina

Task Name	Duration	Start	Finish
Final Treatability Study Project Plans	30ed	10/29/96	11/28/96
Treatability Study Execution	95ed	11/28/96	3/3/97
* Construction of the Treatability Unit	14ed	11/28/96	12/12/96
* Operation of the Treatability Unit	90ed	12/12/96	3/12/97
Draft Treatability Study Report	60ed	3/12/97	5/11/97
Government Review	60ed	5/12/97	7/11/97
Final Treatability Study Report	30ed	7/11/97	8/10/97



this schedule will need to be pushed back

will full-scale implementation need to wait until next spring?

what is status of biocell availability?

- base schedule
- permitting status?

FIGURES

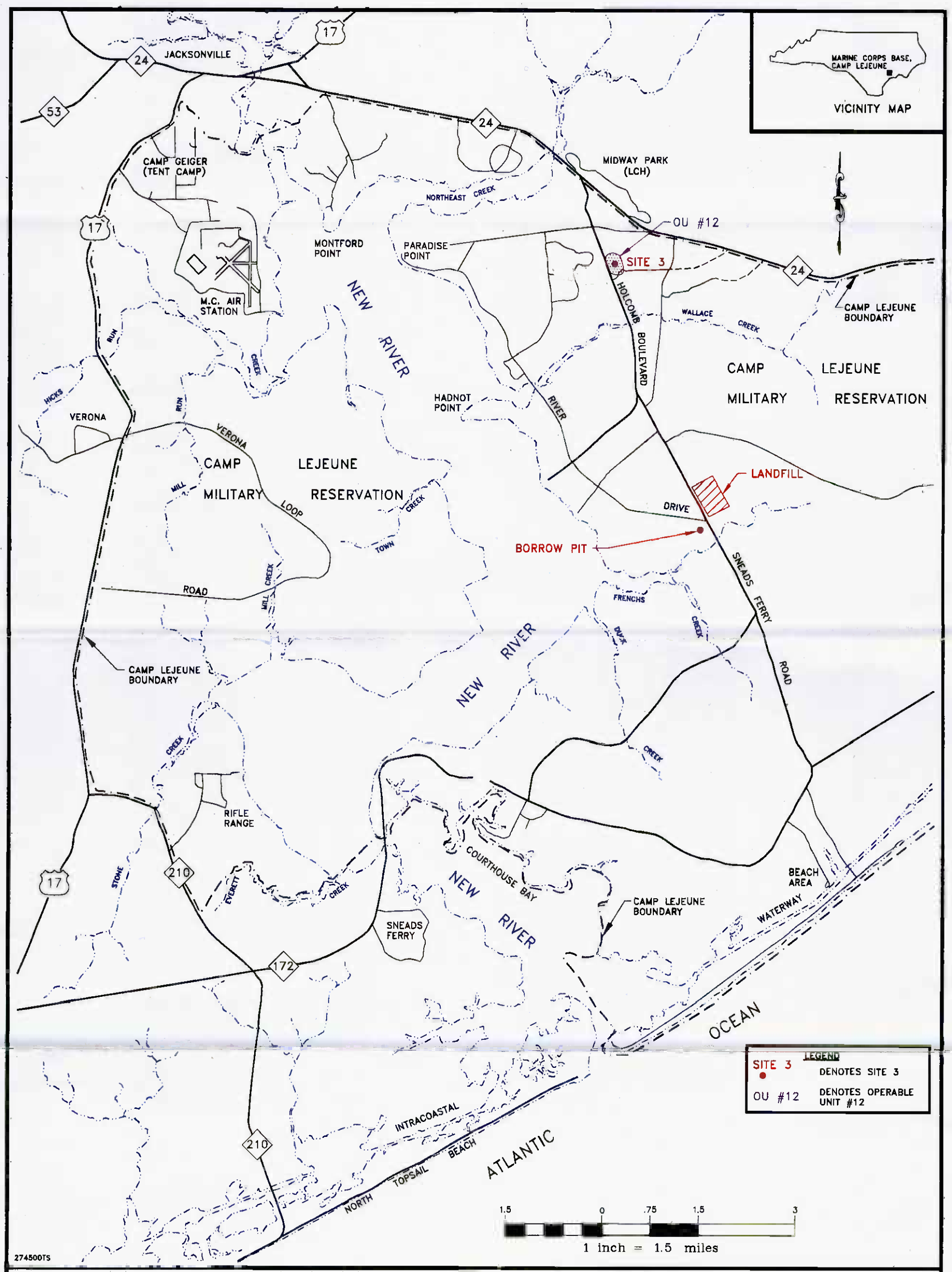
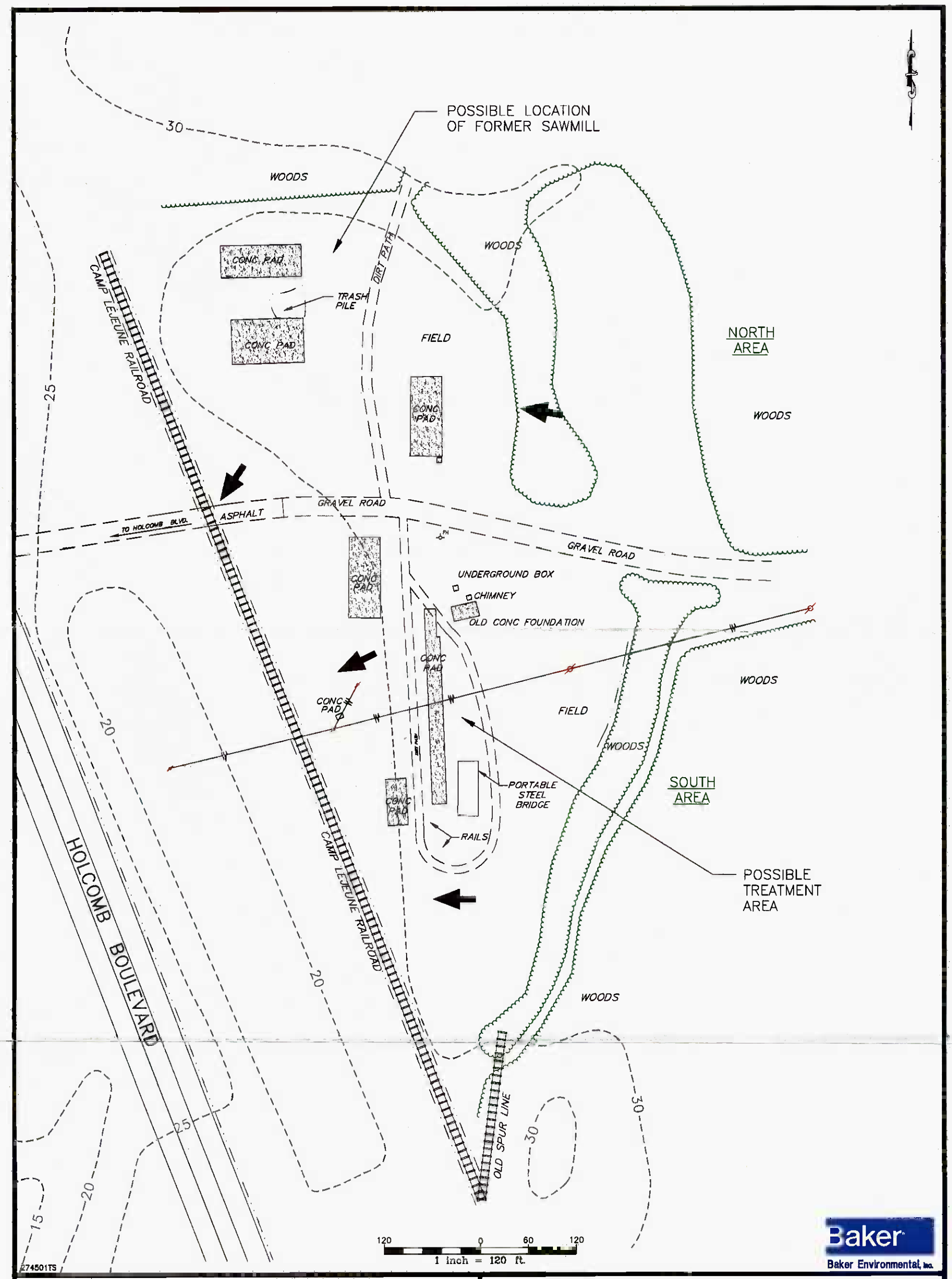


FIGURE 1-1
OPERABLE UNIT NO. 12 (SITE 3)
MARINE CORPS BASE, CAMP LEJEUNE

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA



LEGEND

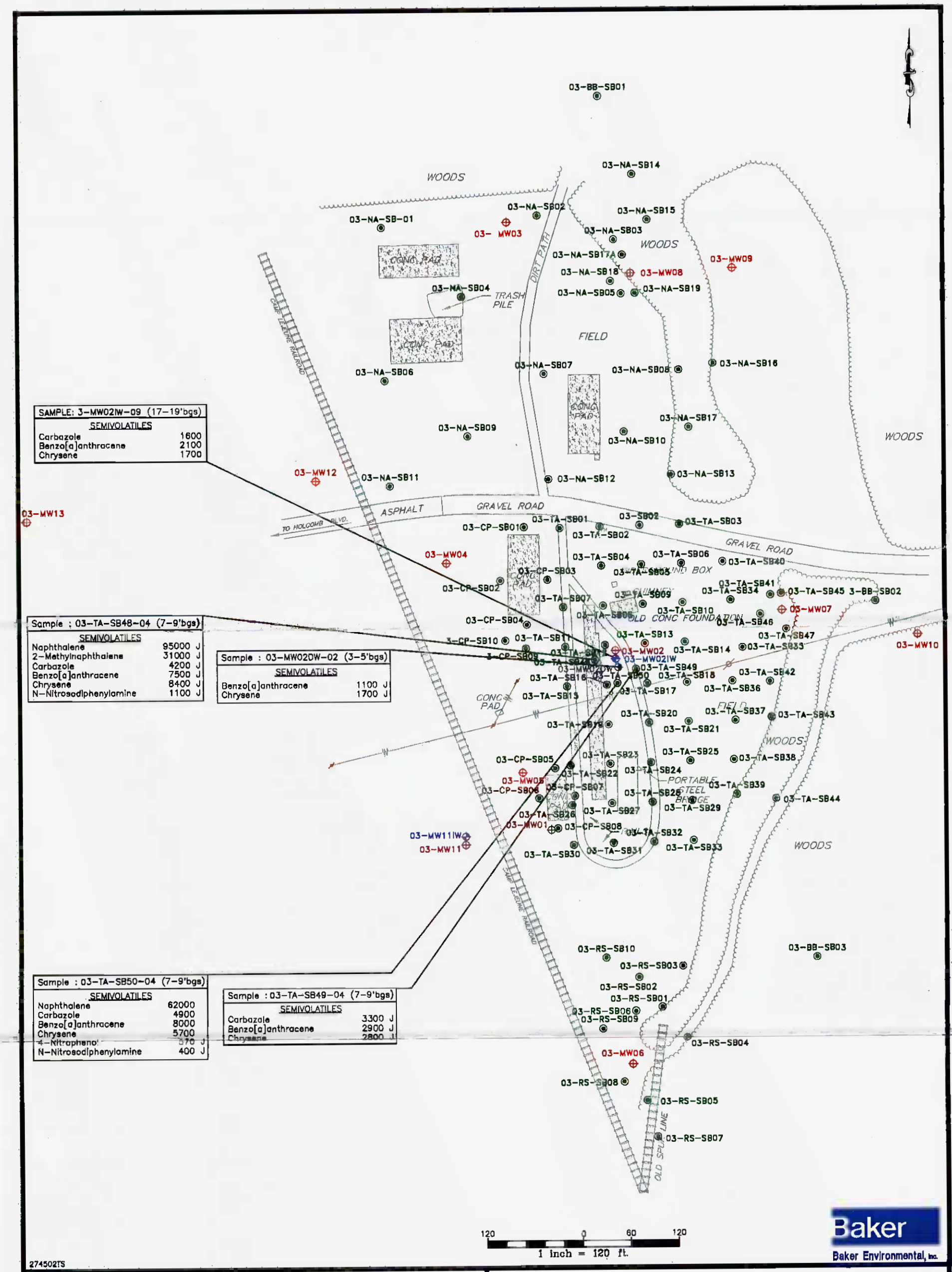
- DRAINAGE PATH
- GRAVEL ROAD/DIRT PATH
- GROUNDWATER FLOW DIRECTION IN THE SHALLOW AQUIFER
- --15-- TOPOGRAPHIC ELEVATION LINE (FEET, MSL)

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

Baker Environmental, Inc.

FIGURE 1-2
SITE MAP
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

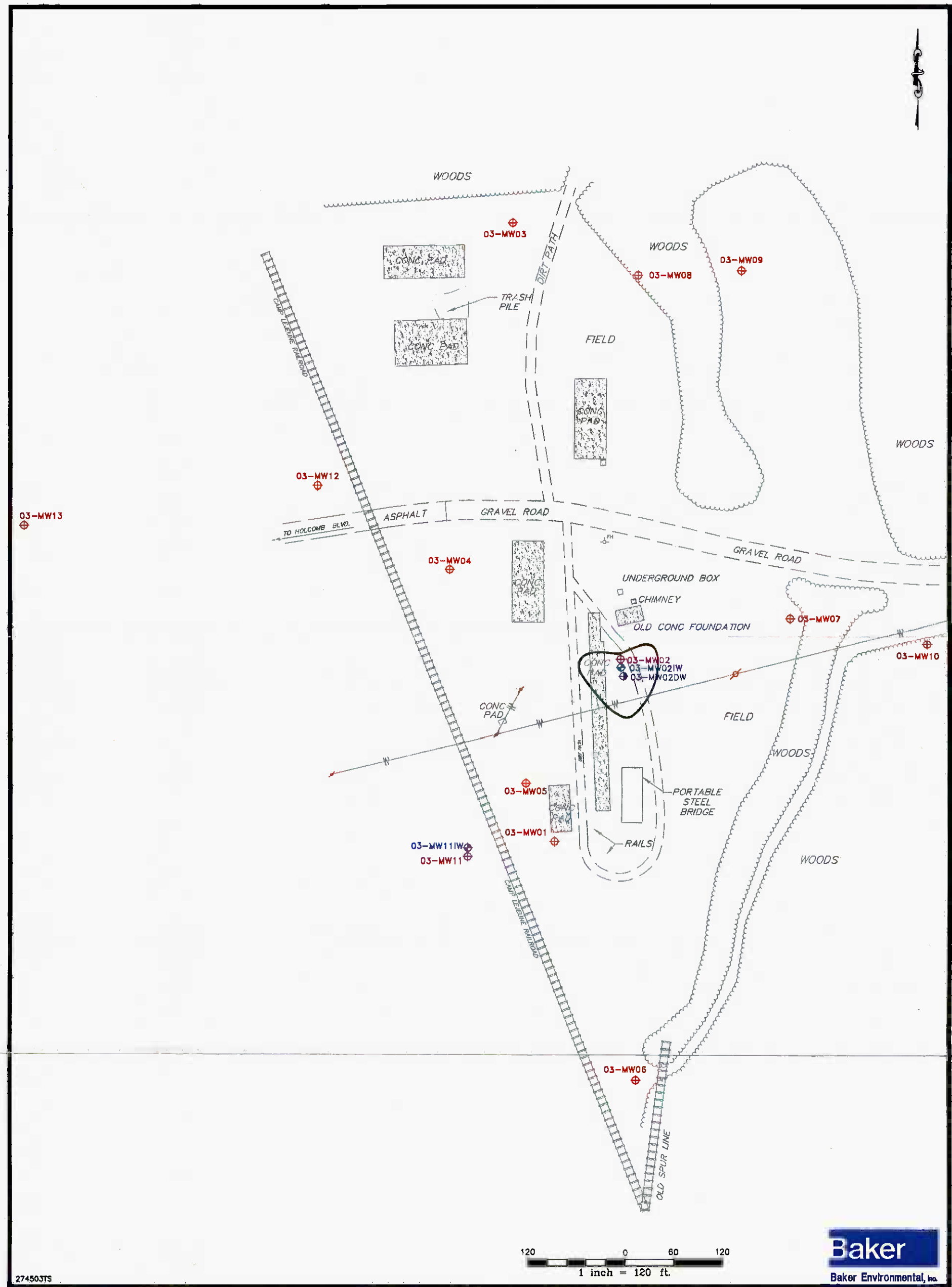
03-MW02DW DEEP MONITORING WELL LOCATION

03-RS-SB01 SOIL BORING LOCATION

NOTE:
-CONCENTRATIONS ARE EXPRESSED IN MICROGRAMS PER KILOGRAM (ug/kg).

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

FIGURE 1-3
CONTAMINANT CONCENTRATIONS EXCEEDING REMEDIATION LEVELS SUBSURFACE SOIL
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

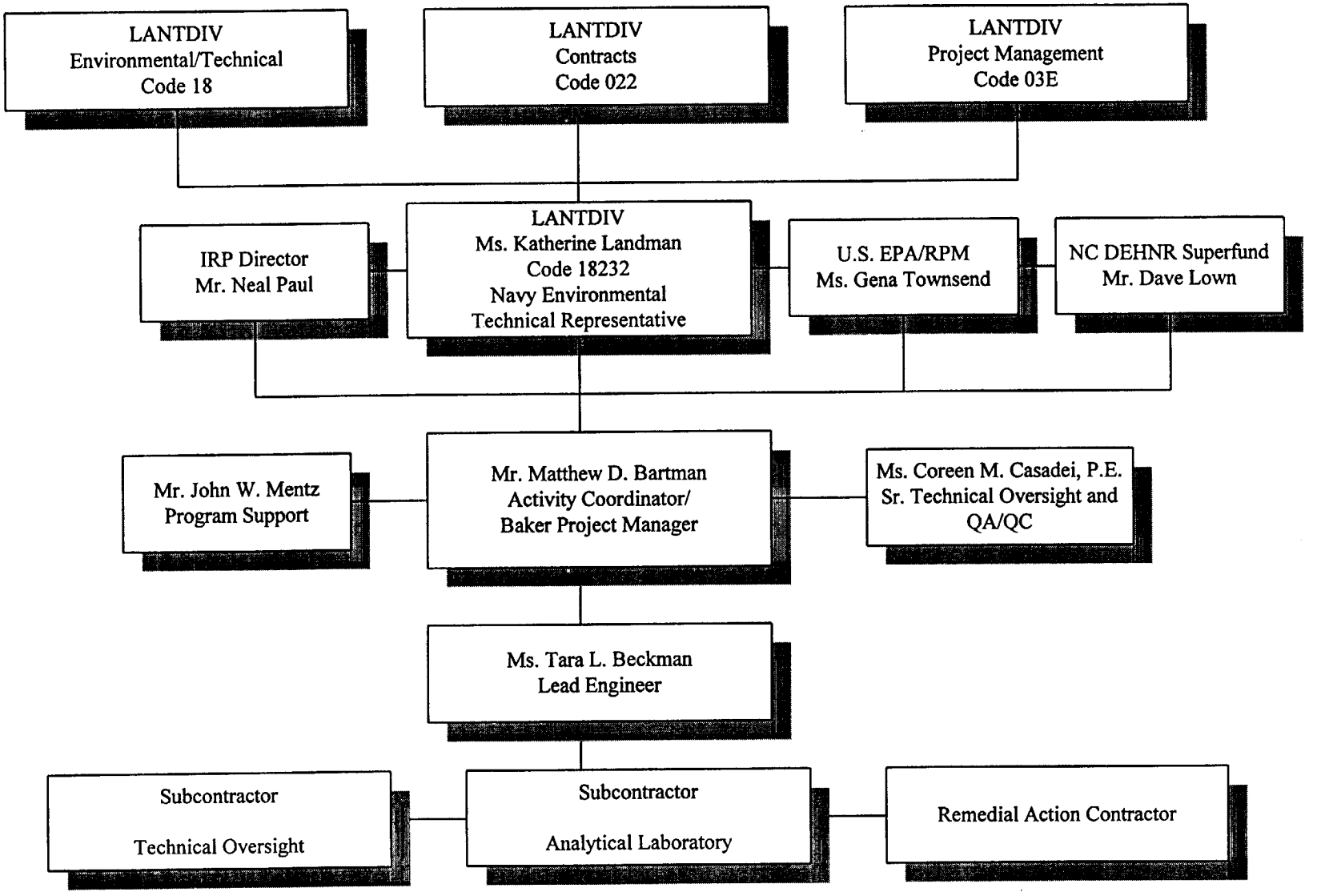
SOURCE: W.K. DICKSON & Co., INC., JANUARY 1995

FIGURE 1-4
SUBSURFACE SOIL AREA OF CONCERN
SITE 3 - OLD CREOSOTE PLANT

MARINE CORPS BASE, CAMP LEJEUNE
NORTH CAROLINA

FIGURE 8-1

PROJECT ORGANIZATION
OPERABLE UNIT NO. 12 (SITE 3)
MCB, CAMP LEJEUNE, NORTH CAROLINA



APPENDIX A
TECHNICAL SPECIFICATIONS

PROJECT TABLE OF CONTENTS

-- End of Project Table of Contents --

SECTION 01010

GENERAL PARAGRAPHS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

CORPS OF ENGINEERS (COE)

COE EP 1110-1-8	1988 Construction Equipment Ownership and Operating Expense Schedule

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 241	1989 Safeguarding Construction, Alteration, and Demolition Operations

1.2 SUBMITTALS

Submit the following in accordance with Section C of the Basic Contract.

1.2.1 SD-18, Records

a. As Built Records

b. Status Reports

c. Rework Items List

d. Permits

e. Contractor's Closeout Report

1.2.1.1 As Built Records

Maintain two sets of full size contract drawings and two sets of full size approved shop drawings marked to show any deviations which have occurred, including buried or concealed construction and utility features revealed during the course of construction. Record horizontal and vertical locations of buried utilities that differ from the contract drawings. These drawings shall be available for review by the NTR at any time. At the completion of the work, deliver marked sets of the contract drawings to the NTR. The Contractor shall incorporate all shop drawing deviations, and deliver one complete set of reproducible mylars of the shop drawings to the NTR.

1.2.1.2 Contract Management System (CMS)

The CMS shall be a system able to provide, as a minimum, the activities in sorts or groups as specified in the Basic Contract and any subsequent

Delivery Orders.

a. Status Reports

All Status Reports shall comply with the Basic Contract and any subsequent Deliver Orders. Submit a Technical Progress Report, Cost Performance Report, Modification Log, Time-Scaled Logic Diagram, Government Materials Tracking Report, Variance Analysis Report, and Waste Materials Report. Submit the first delivery order Status Report at the beginning of the treatability study. Submit Status Reports bimonthly. Status report periods shall be consistent with the invoice reporting periods.

The Technical Progress Report will include field notes describing the soil in the experimental and control cells, tilling procedures, the quantity of nutrient additions, the quantity of pH adjusters, the quantity of water that is pumped from the sumps, the quantity of water that is sprayed onto the experimental and control cells, the soil temperature, the soil moisture content, and detailed records of all field events and the sequence of events.

1.2.1.3 Rework Items List

The QC Representative shall deliver a copy of the rework items list to the NTR on a monthly basis in accordance with Section C, Part 6.0, of the Basic Contract.

1.2.1.4 Permits

Fifteen days prior to beginning onsite work, submit draft copies of the following permits required for onsite activities:

a. Hot Works Permit; from the Public Works Officer, Utilities Division

b. Excavation Permit; from the Public Works Officer, Utilities Division

c. Outage Permit; from the Public Works Officer, Utilities Division

1.2.1.5 Contractor's Closeout Report

Submit upon completion of the project. This report shall include: Introduction, Summary of Action, Final Health and Safety Report, Summary of Record Documents, Field Changes and Contract Modification, Final Documents, Offsite Transportation and Treatment of Materials, and QC Summary Report.

1.2.2 Forwarding Submittals

Before procurement or fabrication, submit, except as specified otherwise, to the Architect-Engineer, Baker Environmental, Inc., Airport Office Park, Building #3, 420 Rouser Road, Coraopolis, PA 15108, the submittal required in this specification. The Architect-Engineer for this project shall review and provide surveillance for the NTR to determine if

Contractor-approved submittals comply with the contract requirements, and shall review and approve for the NTR those submittals not permitted to be Contractor approved to determine if submittals comply with the contract requirements. At each "Submittal" paragraph in the individual specification sections, a notation "G", following a submittal item, indicates the Architect-Engineer, acting as the agent for the NTR, is the approving authority for that submittal item. One copy of the transmittal form for submittals shall be forwarded to the NTR.

1.3 GENERAL INTENTION

It is the declared and acknowledged intention and meaning to provide and secure a Pilot-Scale Bioremediation Treatability Study for polynuclear aromatic hydrocarbon (PAH)-contaminated soil at Operable Unit (OU) No. 12 (Site 3), Marine Corps Base, Camp Lejeune, complete and ready for use.

1.4 GENERAL DESCRIPTION

This work includes preparation of submittals previously described, and providing all labor, supervision, tools, materials, equipment and transportation necessary to install a pilot-scale land farm unit. Components of this project include: construction of the unit, collection of the treatability soil; and site restoration and other related work.

After the remediation system has been installed the Contractor will operate and maintain the remediation system for a period of approximately 90 days. The Contractor shall be responsible for correcting and repairing all problems that may occur during this 90 day period.

1.5 DESCRIPTION OF CONTAMINANTS PRESENT

Subsurface soils at OU No. 12 (Site 3) have been contaminated with PAHs as identified by the analytical work performed to date. These PAHs include naphthalene, 2-methylnaphthalene, carbazole, benzo(a)anthracene, chrysene, 4-nitrophenol, and N-nitrosodiphenylamine. Site characterization activities conducted at the site have defined the approximate extent of PAH contamination present. The results of the chemical analyses for the soil borings and monitoring wells installed at the site are indicated in the reference documents. (The above list of contaminants may not be all inclusive.)

1.6 LOCATION

The work shall be located at the Marine Corps Base, Camp Lejeune, approximately as shown in the work plan. The exact location shall be as indicated by the NTR.

1.7 PROJECT INFORMATION

1.7.1 Drawings, Maps and Specifications

Four sets of contract drawings, maps and specifications shall be furnished to the Contractor, except applicable publications incorporated into the technical provisions by reference. Additional sets shall be furnished on request at no additional charge. The work shall conform to the following

contract drawings and maps, all of which form a part of these specifications and are available in the office of the NTR.

Title	Sheet#
Sample Collection and Construction Plan	C-1
Cross- Sections	C-2

where are these?

1.7.2 Reference Report

The following reference reports are available for examination in the office of the NTR and are intended only to show the existing conditions. The reports and drawings are the property of the Government and shall not be used for any purpose other than that intended by the specification.

Reports

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

B. "Remedial Investigation Report, Operable Unit No. 12 (Site 3), Marine Corps Base, Camp Lejeune, North Carolina", Baker Environmental, Inc., 1996.

C. "Site Inspection Report for Site 3, Old Creosote Plant, Marine Corps Base, Camp Lejeune, North Carolina," Halliburton/NUS, 1991.

1.8 PROJECT SCHEDULE AND TIME CONSTRAINTS

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 90 calendar days after receiving approval of the work plan.

1.9 SAFETY PROGRAM

In addition to safety requirements in the Basic Contract, the Contractor shall implement a safety program conforming to the requirements of Federal, State, and local laws, rules and regulations. The program shall include, but is not limited to, the following:

a. Occupational Safety and Health Standards

b. COE EM-385-1-1

c. NFPA 241

PART 2 PRODUCTS

2.1 SAFETY FENCING

Safety Fencing shall be orange, high density, ultraviolet stabilized polyethylene, at least four feet in height.

PART 3 EXECUTION

3.1 FACILITIES AND SERVICES

The Contractor shall provide all temporary facilities required for the proper completion of the work, as necessary and as specified.

3.1.1 Availability of Utilities Services

a. Government utilities shall be made available without charge.

b. The Government shall supply potable water required to perform work to the Contractor. The water source location will be as directed by the NTR. Work shall be coordinated with the Base Civil Engineer. The Contractor shall provide all piping, hoses, pumps, and connections to transport water to the desired locations on site. The Contractor shall also provide a backflow-prevention device at the water source.

c. The Government shall supply reasonable amounts of electricity to the Contractor. The Contractor shall provide all equipment and labor necessary to connect, convert, and transfer the utilities to the work. The Contractor shall make connections and disconnections.

d. The Contractor shall not operate nor disturb the setting of control devices in the Base utilities system, including water, sewer, electrical, and steam services. The Government shall operate the control devices as required for normal conduct of the work. The Contractor shall notify the NTR, giving 15 days advance notice when such operation is required.

e. The Contractor shall contact Base Telephone Services in writing to obtain telephone connection. The Contractor shall provide all equipment and labor necessary to connect the telephone service to the site. The Contractor shall make arrangements for connections and disconnections and payments.

3.1.2 Open Site Storage Size and Location

The open site available for storage/laydown/decontamination shall be confined to the areas indicated by the NTR.

3.1.3 Trailers, Storage, and Temporary Buildings

Locate trailers, storage, and temporary buildings where directed and within the indicated operations area. Trailers or storage buildings shall be permitted where space is available subject to the approval of the NTR. The trailers or storage buildings shall be suitably painted and kept in a good state of repair. Failure of the Contractor to maintain the trailers or storage buildings in good condition shall be considered sufficient reason to require their removal. Trailers shall be anchored to resist high winds and must meet applicable State or local standards for anchoring mobile trailers.

3.1.3.1 Storage and Office Trailers

Trailers must meet State law and Base requirements and must be in good condition. Trailers shall be lockable and shall be locked when not in use. Trailers shall have a sign not smaller than 24 inches by 24 inches in the lower left hand corner of the left trailer door with the following information: company name, address, registration number of trailer or vehicle identification number, location on base, duration of contract or stay on-base, contract number, local on-base phone number, off-base phone number of main office, and emergency recall person and phone number.

3.1.4 Cleaning Up

During the progress of the remediation, the work area and adjacent areas shall be kept clean and free of all rubbish, surplus materials, and unneeded construction equipment.

No material or debris shall be allowed to flow or wash into watercourses, ditches, gutters, drains, or pipes.

The Contractor shall remove all temporary buildings and structures built under this contract on or before the completion of the work.

All materials and equipment installed by the Contractor or any subcontractors shall be thoroughly clean. Upon completion of the work, the Contractor shall deliver it undamaged and in fresh and new-appearing condition.

The Contractor shall restore or replace, when and as directed by the NTR, any property damaged by the contract work and equipment or by employees. The property shall be restored in a condition at least equal to that existing prior to the beginning of construction operations. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of property shall be done promptly and shall not be left until the end of the contract period.

3.2 RESTRICTIONS ON OPERATIONS

3.2.1 Scheduling

The Marine Corps Base, Camp Lejeune, North Carolina shall remain in operation during the entire construction period. The work shall be scheduled to cause the least amount of interference with Base operations. Work schedules shall be subject to the approval of the NTR. Permission to interrupt Base roads shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption. Notify the NTR 48 hours prior to starting excavation.

3.2.2 Regular Work Hours

The regular work hours for the Marine Corps Base, Camp Lejeune, North Carolina are 0645 to 1615, Monday through Friday.

3.2.3 Work Outside Regular Hours

If the Contractor desires to carry on work outside regular hours or on Saturdays, Sundays, or holidays, the Contractor shall submit an application to the NTR. The Contractor shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, the Contractor shall light the different parts of the work in an approved manner.

3.2.4 Security Requirements

The Contractor shall comply with the general security requirements as stipulated in Section C of the Basic Contract.

3.3 ACTIONS REQUIRED OF THE CONTRACTOR

The Contractor shall comply with all requirements stated in Section C, Part 2.0 of the Basic Contract.

3.3.1 Base Permits

Permits are required for, but not necessarily limited to, welding, digging, and burning. Allow 7 calendar days for processing of the application. One copy of all applicable permits shall be posted at the job site.

3.4 PUBLIC RELEASE OF INFORMATION

The Contractor shall comply with all requirements stipulated in Section C, Part 2.0 of the Basic Contract.

3.5 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in Section C of the Basic Contract with additional requirements as follows:

a. Provide 24 hour advance written notice to the NTR of Contractor's intention to dispose of off-Base.

b. Disposal at facilities not holding a valid State of North Carolina permit is specifically prohibited. The prohibition also applies to sites where a permit may have been applied for but not yet obtained.

c. Off-Base disposal of construction debris outside the parameters of this paragraph at sites without state permits and/or not in accordance with all regulatory requirements shall require the Contractor at his own expense to remove, transport, and relocate the debris to a state approved site. The Contractor shall also be required to pay any fines, penalties, or fee related to the illegal disposal of construction debris.

3.6 PUBLIC SAFETY MEASURES

3.6.1 Safety Fencing

Safety fencing shall be installed around the excavation area and the treatability unit as indicated.

3.6.2 Safety Drums

Safety drums shall be installed in front of the safety fences.

3.7 REQUIRED INSURANCE

Insurance requirements from Section H of the Basic Contract are enforced in their entirety.

3.8 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

Whenever a contract or modification of contract price is negotiated, the Contractor's cost proposal for equipment ownership and operating expenses shall be determined in accordance with the following requirements. A copy of COE EP 1110-1-8 is available for review at:

Commander
LANTNAVFACENGCOM (Code 02)
Building N-26, Room 266
1510 Gilbert Street
Norfolk, Virginia 23511-2699

a. Allowable cost for construction, marine plant, and equipment in workable condition, owned or controlled, and furnished by a Contractor or subcontractor at any tier shall be based on actual cost data when the Government can determine both ownership and operating costs for equipment or equipment groups of similar serial numbers and series from the Contractor's accounting records. When both ownership and operating costs cannot be determined from the Contractor's accounting records, equipment costs shall be based on the applicable provisions of COE EP 1110-1-8, Region III, using the appropriate schedule. Working conditions shall be considered to be average for determining equipment rates using the schedule unless otherwise specified by the NTR. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in effect at the time of negotiations shall apply. For retrospective pricing, the schedule in effect at the time the work was performed shall apply.

b. Equipment rental costs are allowable, subject to FAR 31.105(d)(2)(ii) and FAR 31.205-36, when substantiated by certified copies of paid invoices. Rates for equipment rented from an organization under common control, lease purchase, or sale-lease back arrangements will be determined using the schedule. However rental costs leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated leasees shall not be allowed. Costs for

major repairs and overhaul are not allowed.

c. When actual equipment costs are proposed and the total amount of the pricing action is over $25,000, submit cost or pricing data on Standard Form 1411, "Contract Pricing Proposal Cover Sheet." By submitting cost or pricing data, the Contractor grants to the Contracting Officer or an authorized representative the right to examine those books, records, documents, and other supporting data that will permit evaluation of the proposed equipment costs. After price agreement the Contractor shall certify that the equipment costs or pricing data submitted are accurate, complete, and current.

3.9 FIRE PROTECTION

3.9.1 Compliance

COE EM-385-1-1, NFPA 241, and activity fire regulations. Obtain approval from the activity Fire Chief prior to commencement of hot work operations.

3.9.2 Notification of Fire

Post the activity fire poster in a conspicuous location and at telephones in construction shacks.

3.10 QUARANTINE FOR IMPORTED FIRE ANT (4/82)

Onslow, Jones, and Cartaret Counties and portions of Duplin and Craven Counties have been declared a generally infested area by the United Stated Department of Agriculture (USDA) for the imported fire ant. Compliance with the quarantine regulations established by this authority as set forth in USDA Quarantine No. 81 dated 9 October 1970, and USDA Publication 301.81-2A of 23 July 1976, is required for operations hereunder. Pertinent requirements of the quarantine for materials originating of the Camp Lejeune reservation, the Marine Corps Air Station (Helicopter), New River and the Marine Corps Air Station and Cherry Point, which are to be transported outside Onslow County or adjacent suppression areas, include the following:

a. Certification is required for the following articles and they shall not be moved from the reservation to any point outside Onslow County and adjacent designated areas unless accompanied by a valid inspection certificate issued by an Officer of the Plant Protection and Quarantine Program of the U.S. Department of Agriculture.

(1) Bulk Soil,

(2) Used mechanized soil-moving equipment. (Used mechanized soil-moving equipment is exempt if cleaned of loose noncompacted soil).

(3) Other products, articles, or means of conveyance, if it is determined by an inspector that they present a hazard of transporting spread of the imported fire ants and the person in possession thereof has been so notified.

b. Authorization for movement of equipment outside the imported fire and regulated area shall be obtained from USDA, APHIS, PPQ, Box 83, Goldsboro, North Carolina, 27530, Attn: Mr. Haywood Cox, telephone (919) 735-1941. Requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Soil on or attached to equipment, supplies, and materials shall be removed by washing with water or such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as necessary and as directed.

-- End of Section --

SUBMITTAL REGISTER (PART A)

Contract Number: | Project Title: Pilot-Scale Bioremediation Study, OU No. 1

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1) 01010	SD-18, Records	1.2.1				
2)	As Built Records	1.2.1.1				
3)	Status Reports	1.2.1.2				
4)	Rework Items List	1.2.1.3				
5)	Permits	1.2.1.4				
6)	Contractor's Closeout Report	1.2.1.5				
7) 01430	SD-08, Statements	1.2.1				
8)	Sample Log	3.1.3				
9) 02315	SD-12, Field Test Reports	1.3.1				
10)	Fill and backfill	3.4				
11) 02661	SD-02, Manufacturer's Catalog Data	1.2.1				
12)	Liner	2.1				
13)	Filter fabric	2.3				
14) 02661	SD-06, Instructions	1.2.2				
15)	Liner	2.1				
16) 02661	SD-13, Certificates	1.2.3				
17)	Liner	2.1				
18)	Filter fabric	2.3				
19) 02910	SD-02, Manufacturer's Catalog Data	1.3.1				
20)	Components of the Treatability					

* Navy Notes:
Approved by:
G: NTR
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

* Army Notes:
Classification:
GA: Gov't Approval
FIO: For Information Only

SUBMITTAL REGISTER (PART A)

Contract Number: | Project Title: Pilot-Scale Bioremediation Study, OU No. 1

SPEC SECTION NO.	SD NO, AND TYPE OF SUBMITTAL MATERIAL OR PRODUCT	SPEC PARA NO.	CLASSIF/ APPR BY CO *	GOVT OR A/E REVIEWER	TRANS CONTROL NO.	PLANNED SUBMITTAL DATE
(a)	(b)	(c)	(d)	(e)	(f)	(g)
1)	Unit					
2)	Components of the Treatability					
3)	Unit					

* Navy Notes:
Approved by:
G: NTR
Blank: CQC Manager

* NASA Notes:
Approved by:
Blank: Contracting Officer

* Army Notes:
Classification:
GA: Gov't Approval
FIO: For Information Only

SECTION 01430

WASTE SAMPLING REQUIREMENTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA)

EPA/540/P-91/008	Compendium of ERT Waste Sampling Procedures, 1991
EPA SW-846	Test Methods for Evaluating Solid Wastes (Nov. 1986)

NAVAL ENERGY AND ENVIRONMENTAL SUPPORT ACTIVITY (NEESA)

NEESA 20.2-047B	Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (June 1988)

1.2 SUBMITTALS

Submit the following in accordance with Section C of the Basic Contract.

1.2.1 SD-08, Statements

a. Sample Log

1.3 DEFINITIONS

1.3.1 Contractor Generated Wastes

Contractor generated wastes shall include all materials which become contaminated with wastes as defined in the Basic Contract as a result of Contractor activity at the site after the commencement of contract work.

1.3.2 Government Generated Wastes

Government generated wastes shall include all contaminated materials existing at the site prior to the commencement of contract work.

1.3.3 Characterization Sampling

Characterization sampling shall include all sampling conducted on the PAH-contaminated soil to provide treatability data.

1.3.4 Confirmation Sampling

Confirmation sampling shall include all sampling conducted on the

PAH-contaminated soil to determine if it has met the specified remediation levels.

1.4 DESCRIPTION OF WORK

1.4.1 Contractor Generated Wastes

Collect and analyze environmental samples from each Contractor generated waste stream to determine applicable transportation and disposal requirements.

1.4.2 Characterization Sampling

Collect and analyze an initial characterization sample (i.e., a "baseline" sample) from the excavated soil and periodic characterization samples from the soil in the treatability cells during the operation and maintenance period.

1.4.3 Confirmation Sampling

Collect and analyze confirmation samples from the soil in the treatability cells at the conclusion of the operation and maintenance period.

1.5 QUALITY ASSURANCE

1.5.1 Waste Sampling

Adhere to all sample acquisition, handling, custody documentation, decontamination, and quality assurance/quality control (QA/QC) requirements and procedures as required by federal, state and local regulations.

1.5.2 Analytical Laboratory

why not let ohm do this? is Baker paying for it - check Baker. P&T's cost estimate

Baker shall procure the analytical laboratory. The Contractor shall be responsible for the sample collection and sample shipment to the analytical laboratory. The shipping documentation will clearly indicate that analytical results will be sent directly to Baker Environmental, Inc. The analytical laboratory shall be NEESA-certified. All analytical standard methods shall meet, at a minimum, NEESA 20.2-047B QA/QC Level C requirements and shall also be in accordance with federal, local and state regulations.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 GENERAL

Supply all personnel, equipment, and facilities to collect and analyze the environmental samples required.

3.1.1 Sample Acquisition

Sampling procedures shall be consistent with NEESA 20.2-047B Guidelines.

3.1.1.1 Initial Characterization Sample

One initial characterization sample (or "baseline" sample) shall be collected from the excavated soil as it is being placed in the treatability unit. This sample will establish baseline soil characteristics that will provide a basis of comparison for the remainder of the study. The initial characterization sample will consist of three grab samples that are thoroughly composited. Sample analyses will include the following:

TCL Semivolatiles	EPA Method 3550/EPA Method 8270
TAL Metals	Methods 6010, 7060, 7080, 7131, 7191, 7421, 7470, 7760, 7740
Total Organic Carbon	SW-846 Method 9060
Ammonium-Nitrogen	ASA/SSSA Method 33-3, 33-4
Phosphate-Phosphorous	ASA/SSSA Method 24-5.1, 24-5.3
pH	ASA/SSSA Method 12-2.6
Moisture Content	ASA/SSSA Method 21-22
Bacterial Population Density	SM EWW 9215B

The initial characterization sample will be analyzed using 24- hour turnaround.

3.1.1.2 Characterization Samples During the O&M Period

During the treatability unit operation and maintenance period, characterization samples will be collected form the soil located within both treatability cells. Sampling will be conducted bimonthly throughout the duration of the study which is estimated to be 3 months. During each sampling event, one sample shall be collected from the control cell and one sample shall be collected from the experimental cell. (These cells are identified in the construction drawings.) Each characterization sample will consist of three grab samples that are thoroughly composited. Sample analyses will include the following:

TCL Semivolatiles	EPA Method 3550/EPA Method 8270
Total Organic Carbon	SW-846 Method 9060
Ammonium-Nitrogen	ASA/SSSA Method 33-3, 33-4
Phosphate-Phosphorous	ASA/SSSA Method 24-5.1, 24-5.3
pH	ASA/SSSA Method 12-2.6
Moisture Content	ASA/SSSA Method 21-22
Bacterial Population Density	SM EWW 9215B

The Contractor shall be prepared to modify the sampling frequency and chemical analyses if requested by Baker or the NTR.

3.1.1.3 Final Confirmation Samples

At the conclusion of the operation and maintenance period, two final confirmation samples will be collected from the soil located within the treatability cells. One sample shall be collected from the experimental

cell and one sample shall be collected from the control cell. Each sample shall consist of three grab samples that are thoroughly composited. Sample analyses will include the following:

TCL Semivolatiles	EPA Method 3550/EPA Method 8270
Total Organic Carbon	SW-846 Method 9060
Ammonium-Nitrogen	ASA/SSSA Method 33-3, 33-4
Phosphate-Phosphorous	ASA/SSSA Method 24-5.1, 24-5.3
pH	ASA/SSSA Method 12-2.6
Moisture Content	ASA/SSSA Method 21-22
Bacterial Population Density	SM EWW 9215B

3.1.1.4 Contractor Generated Waste Samples

Collect samples from Contractor generated waste to determine applicable transportation and disposal requirements. Analyze Contractor generated waste samples for the following parameters:

1. TAL Metals - EPA Methods 6010, 7060, 7080, 7131, 7191, 7421, 7470, 7760, 7740
2. TCL Volatiles - EPA Method 3550/EPA Method 8240
3. TCL Semi-Volatiles - EPA Method 3550/EPA Method 8270
4. TCL Pesticides/PCBs - EPA Method 3550/EPA Method 8080

3.1.2 Sample Handling

Sampling, sample handling, and sampling containers must be consistent with the chemicals expected, the matrix of the sample, and planned analytical procedures. Precleaned glass sample containers with teflon lids are required.

The Contractor shall refer to the Sampling and Analysis Plan for chain-of-custody procedures to be used during collection, transport, and analysis of all samples. The analytical results from the laboratory shall be sent directly to Baker.

3.1.3 Sampling Documentation

Maintain a sample log containing, at a minimum, the following information:

a. Date and Time of Sampling

b. Sample Locations

c. Sample Matrix

d. Sample Identification Number

e. Analyses to be Performed

f. Type and Number of Sample Containers

g. Signatures of Individuals Performing Sampling

-- End of Section --

SECTION 01781

OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.1 SUBMISSION OF OPERATION AND MAINTENANCE DATA

Submit operation and maintenance (O&M) data/manuals which are specifically applicable to this contract and a complete and concise depiction of the provided equipment or product. Data containing extraneous information to be sorted through to find applicable instructions will not be accepted. Present information in sufficient detail to clearly explain O&M requirements at the system, equipment, component, and subassembly level. Include an index preceding each submittal. Submit in accordance with this section and Section 01330, "Submittal Procedures."

1.1.1 Quantity

Submit five copies of the manufacturers' O&M information specified herein for the components, assemblies, subassemblies, attachments, and accessories. The item for which O&M data/manual are required is listed in the technical section which specifies that particular item.

1.1.2 Package Content

For each product, system, or piece of equipment requiring submission of O&M data, submit the data package required in the individual technical section. Data package content shall be as required in the paragraph entitled "Schedule of Operations and Maintenance Data Packages."

1.1.3 Delivery

Submit O&M data to the Contracting Officer for review and acceptance; submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.

a. In the event the Contractor fails to deliver O&M Data/Manuals within the time limits set forth above, the Contracting Officer may withhold from progress payments 50 percent of the price of the item with which such data/manuals are associated.

1.1.4 Changes to Submittals

Manufacturer-originated changes or revisions to submitted data shall be furnished by the Contractor if a component of an item is so affected subsequent to acceptance of the O&M data. Changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data, shall be submitted by the Contractor within 30 calendar days of the notification of this change requirement.

1.2 TYPES OF INFORMATION REQUIRED IN O&M DATA PACKAGES

1.2.1 Operating Instructions

Include specific instructions, procedures, and illustrations for the following phases of operation:

1.2.1.1 Safety Precautions

List personnel hazards and equipment or product safety precautions for all operating conditions.

1.2.1.2 Operator Prestart

Include procedures required to set up and prepare each system for use.

1.2.1.3 Startup, Shutdown, and Postshutdown Procedures

Provide narrative description for each operating procedure including control sequence for each.

1.2.1.4 Normal Operations

Provide narrative description of normal operating procedures. Include control diagrams with data to explain operation and control of systems and specific equipment.

1.2.1.5 Emergency Operations

Include emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.

1.2.1.6 Operator Service Requirements

Include instructions for services to be performed by the operator such as lubrication, adjustment, inspection, and gage reading recording.

1.2.1.7 Environmental Conditions

Include a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.

1.2.2 Preventive Maintenance

Include the following information for preventive and scheduled maintenance to minimize corrective maintenance and repair.

1.2.2.1 Lubrication Data

Include lubrication data, other than instructions for lubrication in accordance with paragraph entitled "Operator Service Requirements":

a. A table showing recommended lubricants for specific temperature ranges and applications;

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities; and

c. A lubrication schedule showing service interval frequency.

1.2.2.2 Preventive Maintenance Plan and Schedule

Include manufacturer's schedule for routine preventive maintenance, inspections, tests and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft. For periodic calibrations, provide manufacturer's specified frequency and procedures for each separate operation.

1.2.3 Corrective Maintenance

Include manufacturer's recommendations on procedures and instructions for correcting problems and making repairs.

1.2.3.1 Troubleshooting Guides and Diagnostic Techniques

Include step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.2.3.2 Wiring Diagrams and Control Diagrams

Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type, identically to actual installation numbering.

1.2.3.3 Maintenance and Repair Procedures

Include instructions and list tools required to restore product or equipment to proper condition or operating standards.

1.2.3.4 Removal and Replacement Instructions

Include step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies,

subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Instructions shall include a combination of text and illustrations.

1.2.3.5 Spare Parts and Supply Lists

Include lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.

1.2.3.6 Corrective Maintenance Work-Hours

Include manufacturer's projection of corrective maintenance work-hours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.

1.2.4 Appendices

Provide information required below and information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment. Include the following:

1.2.4.1 Parts Identification

Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies. Parts data may cover more than one model or series of equipment. components, assemblies, subassemblies, attachments, or accessories, such as a master parts catalog, in accordance with the manufacturer's standard commercial practice.

1.2.4.2 Warranty Information

List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force. Include warranty information for primary components such as the compressor of air conditioning system.

1.2.4.3 Personnel Training Requirements

Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.

1.2.4.4 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

1.2.4.5 Contractor Information

Provide a list that includes the name, address, and telephone number of the General Contractor and each subcontractor installing the product or equipment. Include local representatives and service organizations most convenient to the project site. Provide the name, address, and telephone number of the product or equipment manufacturers.

1.3 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Furnish the O&M data packages specified in individual technical sections. The required information for each O&M data package is as follows:

1.3.1 Data Package 1

a. Safety precautions

b. Maintenance and repair procedures

c. Warranty information

d. Contractor information

1.3.2 Data Package 2

a. Safety precautions

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan and schedule

f. Maintenance and repair procedures

g. Removal and replacement instructions

h. Spare parts and supply list

i. Parts identification

j. Warranty information

k. Contractor information

1.3.3 Data Package 3

a. Safety precautions

b. Normal operations

c. Emergency operations

d. Environmental conditions

e. Lubrication data

f. Preventive maintenance plan and schedule

g. Troubleshooting guides and diagnostic techniques

h. Wiring diagrams and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Parts identification

m. Warranty information

n. Testing equipment and special tool information

o. Contractor information

1.3.4 Data Package 4

a. Safety precautions

b. Operator prestart

c. Startup, shutdown, and postshutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Lubrication data

i. Preventive maintenance plan and schedule

j. Troubleshooting guides and diagnostic techniques

k. Wiring diagrams and control diagrams

l. Maintenance and repair procedures

m. Removal and replacement instructions

n. Spare parts and supply list

o. Corrective maintenance man-hours

p. Parts identification

q. Warranty information

r. Personnel training requirements

s. Testing equipment and special tool information

t. Contractor information

1.3.5 Data Package 5

a. Safety precautions

b. Environmental conditions

c. Preventive maintenance plan and schedule

d. Troubleshooting guides and diagnostic techniques

e. Wiring and control diagrams

f. Maintenance and repair procedures

g. Spare parts and supply list

h. Warranty information

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 02315

EXCAVATION AND FILL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1993) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	(1991) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D 1140	(1992) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances

COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909	Fertilizer

CORPS OF ENGINEERS (COE)

COE EM-385-1-1	(1992) Safety and Health Requirements Manual

1.2 DEFINITIONS

1.2.1 Cohesive Materials

Materials ASTM D 2487 classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

1.2.2 Cohesionless Materials

Materials ASTM D 2487 classified as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0 of the Basic Contract.

1.3.1 SD-12, Field Test Reports

a. Fill and backfill test

b. Density tests

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

Free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and frozen, deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

2.1.1 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.2 MULCHES

Free from noxious weeds, mold, and other deleterious materials.

2.2.1 Wood Chips

Ground redwood or fir tree bark, 3/16-inch maximum particle size.

2.2.2 Straw

Stalks from oats, wheat, rye, barley, or rice. Furnish in air-dry condition and of proper consistency for placing with commercial mulch

blowing equipment.

2.2.3 Hay

Air-dry condition and of proper consistency for placing with commercial mulch blowing equipment. Provide only marsh hay for lawn areas.

2.2.4 Wood Cellulose Fiber Mulch

Processed to contain no growth or germination-inhibiting factors and dyed an appropriate color to facilitate visual metering of materials application. Composition on air-dry weight basis: 9 to 15 percent moisture, pH range from 3.5 to 5.0. Use with hydraulic application of grass seed and fertilizer.

2.3 BORROW

Obtain borrow materials conforming to common fill and fill and backfill material specifications from the Government borrow pit. A Government borrow pit is located approximately 4 miles from the work site along Sneads Ferry Road. If the Government borrow pit is used, the Contractor shall perform clearing, grubbing, and stripping required for providing access to suitable borrow material. Dispose of materials from clearing and grubbing operations at a Base landfill. Strip top 12 inches of soil material from borrow area and stockpile. After removal of borrow material, regrade borrow pit using stockpiled soil material to contours which will blend in with adjacent topography. Maximum side slopes shall be two horizontal to one vertical. Excavation and backfilling of borrow pit shall ensure proper drainage.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Clearing and Grubbing

Unless indicated otherwise, remove trees, stumps, logs, shrubs, and brush within the excavation limits. Remove stumps entirely. Grub out matted roots and roots over 2 inches in diameter to at least 18 inches below existing surface.

3.2 PROTECTION

3.2.1 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.2.1.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. Provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for

subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein.

3.2.2 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of existing utilities prior to starting construction. The Contractor shall contact the Public Works Department for assistance in locating existing utilities. The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark the surface of the ground where existing underground utilities are discovered.

3.2.3 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.3 EXCAVATION

Excavate to dimensions indicated. The soil located from 0 to 3 feet below ground surface shall be removed without contamination by subsoil material and stockpiled separately from other excavated material. The stockpile shall be located convenient to the excavation area.

Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Refill with common fill material and compact to 95 percent of ASTM D 698 maximum density. Unless specified otherwise, refill excavations cut below indicated depth with common fill material and compact to 95 percent of ASTM D 698 maximum density.

3.3.1 Materials and Equipment

3.3.1.1 General

a. Provide all labor, materials, and equipment necessary to accomplish the work specified in these paragraphs.

b. The Contractor shall notify the NTR at least 48 hours prior to the start of excavation of contaminated soils. The Contractor shall stage operations to minimize the time the contaminated soil is exposed to the weather.

3.3.1.2 Unclassified Excavation

Excavation is unclassified. All excavation shall be completed regardless of the type, nature, or condition of the materials encountered.

3.3.2 Limits of Excavation

a. Excavations shall be to the limits indicated on the construction drawings or until groundwater is encountered. If groundwater is contacted, excavation shall stop and the Contractor shall immediately notify Baker and the NTR.

b. Final excavation areas shall be governed by field conditions and determined by the NTR.

c. The excavated soil from 3 to 9 feet below ground surface will be transported directly to the treatability unit and deposited there. There will be no stockpiling of this contaminated soil.

d. Care shall be taken during hauling operations to minimize the potential for spillage, tracking, or other means of deposition of contaminated materials outside the work area. Contaminated materials which become spilled on roads, streets, or other areas during the hauling operation shall be immediately cleaned up to the satisfaction of the NTR.

e. Backfilling of excavated areas will begin only after the approval of the NTR.

f. The Contractor, Baker and the NTR shall work together closely to coordinate excavation, sampling, analyses, and treatability unit construction to minimize downtime. The Contractor shall schedule work to minimize downtime.

3.3.3 Method of Measurement

a. The quantity of work done under this paragraph will be measured in tons, which shall be the actual weight of the solid waste removed. Quantity shall be verified by the certified delivery tickets provided by the treatment/disposal facility.

3.4 FILLING AND BACKFILLING

Fill and backfill to dimensions indicated. Compact each lift before placing overlaying lift. Initially, the stockpiled, excavated soil that was located from the ground surface to 3 feet below ground surface will be used as fill material for the excavation area. After this soil has been used, common fill material from an on Base borrow pit will be used.

3.4.1 Stockpiled Soil Placement

Place in 6 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content.

3.4.2 Common Fill Placement

Provide for general site including treatability unit berms. Place in 6 inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to

a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

3.5 COMPACTION

Expressed as a percentage of maximum density. Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required. Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.

3.5.1 General Site

Compact underneath areas outside the 5 foot line of any structure to 85 percent of ASTM D 698.

3.5.2 Structures, Spread Footings, and Concrete Slabs

Compact top 12 inches of subgrades to 95 percent of ASTM D 698. Compact common fill material to 95 percent of ASTM D 698. The treatability unit is considered a structure.

3.5.3 Adjacent Area

Compact areas within 5 feet of structures to 90 percent of ASTM D 698.

3.5.4 Berms

Compact top 12 inches of subgrades to 95 percent of ASTM D 698. Compact common fill material to 95 percent of ASTM D 698.

3.6 FINISH OPERATIONS

3.6.1 Grading

Finish grades as they previously were within one-tenth of one foot. Grade areas to drain water away from structures. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.6.2 Mulch

Spread evenly over the excavated area limits. Anchor by crimping mulch with serrated disc.

3.6.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.7 DISPOSITION OF SURPLUS MATERIAL

Waste in Government disposal area which is located approximately 4 miles from Site 3 along Sneads Ferry Road. Remove from the site surplus or other

soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber.

-- End of Section --

SECTION 02661

POND AND RESERVOIR LINERS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 751	(1989) Method of Testing Coated Fabrics
ASTM D 1505	(1990) Test Method for Density of Plastics by the Density-Gradient Technique

1.2 SUBMITTAL

Submit the following in accordance with the submittal procedures described in Section 01010.

1.2.1 SD-02, Manufacturer's Catalog Data

a. Liner

b. Welding methods

c. Filter fabric

1.2.2 SD-06, Instructions

a. Liner

1.2.3 SD-13, Certificates

a. Liner

b. Filter fabric

1.3 DELIVERY AND STORAGE

Deliver liner and filter fabric to site in largest sizes possible to minimize field seaming. Protect from sunlight and other ultraviolet light sources during storage. Keep materials clean and dry.

PART 2 PRODUCTS

2.1 LINER

2.1.1 High Density Polyethylene (HDPE) Geomembrane

40.0 mils nominal thickness, 38.8 mils average thickness, and 38.0 mils lowest individual reading according to ASTM D 751. Density of 0.94 g/cm^3 by ASTM D 1505.

2.2 WELDING EQUIPMENT

Provide as recommended by manufacturer.

2.3 FILTER FABRIC

Provide a non-woven synthetic geotextile having a minimum mass per unit area of 6.0 oz/yd^2 as determined by ASTM D 5261.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Soil or Granular Subgrade

Remove vegetation, boulders and rocks larger than 3/4 inch in size and other sharp objects. Fill in holes, including stake holes. Inspect subgrade surface and correct defects prior to continuing construction.

3.2 CLEANING OF LINER SHEET

Clean liner sheets of dust, dirt, and other foreign matter. Carefully clean area (both mating surfaces) of seams.

3.3 FILTER FABRIC INSTALLATION

Place synthetic fiber filter fabric on prepared subgrade. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of three feet overlap in all directions. Overlap fabric at joints a minimum of three feet. Obtain approval of filter fabric installation before placing liner. Follow manufacturer's recommended installation procedures.

3.4 LINER INSTALLATION

3.4.1 Placement

Position liner on previously prepared surface or filter fabric as indicated. Unroll or unfold carefully. Avoid stretching. Allow liner to lie in a relaxed state for a minimum of 1/2 hour prior to seaming.

3.4.2 Seams and Laps

Provide welding personnel with protective clothing and other appropriate safety equipment. Make laps or seams according to manufacturer's instructions. Use approved welding equipment.

3.4.2 Seams and Laps

Provide welding personnel with protective clothing and other appropriate safety equipment. Make laps or seams according to manufacturer's instructions. Use approved welding equipment.

3.4.3 Repairs

Make repairs to liner with same material as liner. Extend patch 6 inches in all directions from puncture. Use same method as for seams.

3.5 ANCHORAGE

3.5.1 Earth Anchorage

Make perimeter trench a minimum of 12 inches wide by 12 inches deep as indicated. After installation of liner in reservoir is complete, place liner in perimeter trench. Backfill trench.

3.6 BACKFILL OVER LINER

Cover installed liner with sand to depth of 12 inches as indicated in Section 02910. Cover liner within time limits specified by liner manufacturer. Place earth on liner using rubber tired or tracked vehicles. Drive only on earth cover. Correct any damage to liner caused by covering operations.

3.7 FIELD QUALITY CONTROL

3.7.1 Inspection

Inspect completed liner for pinholes, punctures, and tears. Inspect seams and joints for unbonded areas. Repair defects as specified herein.

-- End of Section --

SECTION 02910

ASSEMBLING, OPERATING, AND DECOMMISSIONING THE TREATABILITY UNIT

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced only. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2487 (1993) Classification of Soils for Engineering Purposes

1.2 GENERAL REQUIREMENTS

1.2.1 Standard Products

Material and equipment shall be the standard product of a manufacturer regularly engaged in the manufacture of such product.

1.2.2 Safety Requirements

Access to construction areas shall be restricted by safety fencing. Once constructed, the treatability unit shall be fully enclosed by safety fencing.

1.3 SUBMITTALS

Submit the following in accordance with Section C, Part 7.0 of the Basic Contract.

1.3.1 SD-02, Manufacturer's Catalog Data

a. Components of the Treatability Unit

Submit manufacturer's data and information for the following components of the Treatability Unit: the high density polyethylene liner and the non-woven geotextile fabric.

1.4 ENVIRONMENTAL PROTECTION

Provide in accordance with Section C, Part 4.0 of the Basic Contract.

1.5 DESCRIPTION OF WORK

The work includes the installation of a Pilot-Scale Bioremediation Treatability Unit as specified herein and as indicated on the construction drawings. The treatability unit shall include all components including, but not limited to, a high density polyethylene (HDPE) liner, non-woven geotextile fabric, coarse sand, gravel, leachate collection piping, earthen berms, and safety fencing. Installation of the unit shall include

subgrade preparation; installation of the unit components; placement of the contaminated soil within the treatability unit; initial characterization sampling; and initial pulverization, mixing, and homogenization of the contaminated soil; complete and ready for use. The work also includes the operation and maintenance of this treatability unit including but not limited to, periodic soil tilling, water spraying, nutrient addition, pH adjustment, and soil sample collection and shipping. Decommissioning of the unit will include disposal of the treated soil and disassembling and disposal of the treatability unit components.

PART 2 PRODUCTS

2.1 COMPONENTS OF THE TREATABILITY UNIT

2.1.1 HDPE Liner

A 40 mil HDPE liner will be placed over the prepared subgrade as specified in Section 02661, "Pond and Reservoir Liners." The liner shall be pre-manufactured, and ready for field installation.

2.1.2 Non-Woven Geotextile Fabric

A non-woven geotextile fabric will be placed underneath the HDPE liner as specified in Section 02661, "Pond and Reservoir Liners." The fabric shall minimize liner damage from subgrade conditions.

2.1.3 Coarse Sand

A 12-inch layer of clean, coarse sand shall be placed over the HDPE liner. The sand shall meet ASTM D 2487 classification SW or SP, with a maximum of 10 percent by weight passing No. 200 sieve and 100 percent passing 3/8-inch sieve. The sand layer will serve as a protective layer for the liner and as a leachate drainage layer.

2.1.4 Gravel

The gravel shall be placed within the leachate collection trench to provide support for the underlying leachate collection pipes. Number 57 gravel, or gravel of a comparable size, shall be used.

2.1.5 Leachate Collection Piping

Two sections of 4-inch diameter perforated HDPE pipe shall be placed at the bottom of each leachate collection trench. Both sections of 4-inch diameter pipe shall be connected to a vertically placed section of 12-inch diameter non-perforated HDPE pipe with an end cap. The 12-inch pipe shall serve as a leachate collection sump; the end cap shall be sealed onto the pipe. The top of the 12-inch pipe will be threaded and fitted with a removable cap. The 4-inch pipes shall be connected to the 12-inch pipe by welding, glue, or fittings.

2.1.6 Berms

4-foot high earthen berms, consisting of fill material from an on-Base borrow pit, shall be constructed around the perimeter of the treatability

cells and between both cells. The fill material shall meet the requirements specified in Section 02315, "Excavation and Fill."

2.1.7 Safety Fencing

Safety fencing shall be installed around the perimeter of the treatability unit, as shown in the construction drawings, and shall remain there until the study is complete. Safety fencing shall be orange, high density, ultraviolet stabilized polyethylene, at least four feet in height.

2.1.8 Fertilizer

Commercial grade, dry, granular fertilizer that is free flowing and uniform in composition. Unless specified otherwise by Baker, granular fertilizer shall be 20 percent nitrogen, 10 percent phosphorous, and 10 percent potash. A minimum of 50 percent of the nitrogen shall be water insoluble.

2.1.9 Lime

Commercial grade hydrated limestone containing not less than 50 percent of total oxides, percent calcium, and percent magnesium oxide, gradation as follows: Minimum 75 percent passing 100-mesh sieve and 100 percent passing 200-mesh sieve.

2.1.10 Aluminum Sulfate

Commercial grade.

2.1.11 Cover

The cover will be one continuous piece of plastic laminate material that can be securely fastened at the edges.

PART 3 EXECUTION

3.1 ASSEMBLING THE TREATABILITY UNIT

Assembly of the treatability unit will include subgrade preparation, installation of the unit components, and placement of the contaminated soil within the treatability unit. Subgrade preparation and unit installation will occur prior to the excavation of contaminated soil. The contaminated soil will be placed directly into the complete and ready unit immediately following excavation.

3.1.1 Subgrade Preparation

Subgrade preparation will consist of grading the native soil underneath each treatability cell to achieve a 4 percent slope as shown in the construction drawings. If necessary, borrow material from an on-Base borrow pit may be used, or excavation below the existing grade may occur, to achieve this slope. All borrow and excavation activities must meet the requirements specified in Section 02315, "Excavation and Fill", and the details included on the construction drawings must be adjusted accordingly. The As-Built Drawings will show all deviations in the subgrade preparation plan.

The leachate collection trench will be excavated following the initial grading (see Section 02315, Excavation and Fill). Once excavated, the subgrade within each trench will be graded with 4 percent slopes to facilitate leachate collection in the center of the trench. The construction drawings show details of the trench grading.

3.1.2 Installation of the Unit Components

Installation of the unit components (i.e., the berm, liner, piping, gravel, and sand layer) may begin immediately following subgrade preparation and the construction of the inner berm that separates the two treatability cells.

3.1.2.1 Berm Construction

4-foot earthen berms shall be construction using clean soil from an on-Base borrow pit. An inner berm shall be constructed to separate the two treatability cells prior to liner placement. In addition, an outer berm will be constructed around both cells as shown in the construction drawings. The berms will be compacted to 95% of ASTM D 698.

3.1.2.2 Liner and Geotextile

Following construction of the inner berm, geotextile and liner installation shall proceed as indicated on the construction drawings and as specified in Section 02661, "Pond and Reservoir Liners". Rocks and sharp objects located in the subgrade will be removed. The geotextile will be installed first so that one continuous piece covers the subgrade, inner berm, and trench. The liner will be placed over the geotextile. All pre-welded liner seams will be inspected during installation as per the manufacturer's recommendations. The geotextile fabric will protect the geomembrane against damage from subsurface conditions. Excess geomembrane and geotextile fabric will be left along the edges of the continuous sheet to form anchor trenches. Anchor trenches shall be formed using the soil of the outer berm.

3.1.2.3 Piping and Gravel

Two pieces of 4-inch HDPE perforated piping, as indicated on the construction drawings, shall be filter wrapped and placed within each leachate collection trench. The pipes shall be placed on either side of a 12-inch, vertically-place non-perforated HDPE pipe. The 12-inch pipe shall be fitted with an end cap that will be sealed and watertight. The 4-inch pipes may be connected to the 12-inch pipe by welding, glue, or fittings. Gravel shall be placed within the trench to a 2-foot depth. This gravel shall cover the 4-inch pipes and surround the 12-inch pipe to hold the piping system in place.

3.1.2.4 Sand Layer

The clean sand shall be placed in a 12-inch layer as shown in the construction drawings. Following placement, the sand layer shall be smoothed and leveled and periodically gaged to ensure an even 12-inch lift. The 12-inch contaminated soil layer shall be placed over this sand layer.

3.1.3 Placement of the Contaminated Soil

The contaminated soil shall be placed within the treatability unit immediately following excavation from the area of concern. This will eliminate the need for soil stockpiling. The backhoe that is used for excavation will be used for soil placement. Unloading of each backhoe bucket will alternate between the control cell and the experimental cell to ensure a representative soil mixture in each cell (e.g., the initial bucket of excavated soil will be deposited in the control cell, the next bucket of excavated soil will be deposited in the experimental cell, etc.). The soil shall be placed without the backhoe entering the treatability cells. To accomplish this, portions of the outer berm may be constructed after soil placement has occurred.

Care shall be taken during soil placement activities to minimize the potential for spillage, tracking, or other means of deposition of contaminated materials outside the work area. Contaminated materials which become spilled on roads, streets, or other areas outside the limits of excavation shall be immediately cleaned up to the satisfaction of the NTR.

Immediately following soil placement, the contaminated soil in both cells shall be thoroughly pulverized and homogenized then mixed using a rototiller. This initial mixing will further ensure that each cell contains a representative soil sample. The contaminated soil layers will then be smoothed, leveled, and periodically gaged to ensure 12-inch lifts. Mixing of the contaminated soil shall not affect the underlying sand layer. If the sand layer is contacted, mixing shall stop until the sand layer is replaced to its original position. The full 12 inches of contaminated soil shall receive adequate mixing.

3.1.4 Initial Characterization Sampling

One initial characterization sample shall be collected as the contaminated soil is being excavated and placed within the treatability cells. This sample will provide baseline analytical results for the study. Sample collection and shipping will meet the requirements specified in Section 01430, "Waste Sampling Requirements."

3.2 OPERATING THE TREATABILITY UNIT

Operation of the treatability unit shall include periodic soil sample collection and shipping; soil tilling; and nutrient, pH, moisture, and temperature adjustment. Operation procedures are subject to change as the study progresses. Baker will provide notification of all operation changes.

Operation and maintenance may also include addition of a carbon source such as municipal sewage sludge or agricultural waste. Baker will provide specifications for this carbon source following the initial characterization sampling.

No soil tilling or nutrient, pH, moisture, or temperature adjustment will occur in the control cell during the operation and maintenance period.

3.2.1 Soil Sample Collection and Shipping

Three types of samples shall be collected for the study: an initial characterization sample, operation and maintenance characterization samples, and a final confirmation sample. The Contractor shall ship the samples to the analytical laboratory and indicate on the shipping documentation that analytical results will be sent directly to Baker Environmental, Inc. All sample collection and shipping activities shall meet the requirements specified in Section 01430, "Waste Sampling Requirements."

3.2.2 Soil Tilling

Tilling of the contaminated soil in the experimental cell shall be conducted at least weekly using a rototiller. Tilling shall affect the full 12 inches of contaminated soil, but shall not affect the underlying sand layer. If the sand layer is contacted, tilling will stop and the sand layer will be replaced to its original position. The rototiller may also be used to mix additives (such as fertilizer, water, and lime) throughout the contaminated soil layer.

3.2.3 Nutrient Addition

Nutrient addition will consist of mixing a dry, granular fertilizer into the contaminated soil in the experimental cell. The amount of fertilizer and the frequency of application will be determined by Baker after the initial soil characterization. Mixing may be accomplished using a rototiller.

The fertilizer shall be delivered to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with certificates indicating the above information. Store in cool, dry locations away from contaminants.

3.2.4 pH Adjustment

The pH adjustment shall consist of mixing lime (for pH raising) or aluminum sulfate (for pH lowering) into the contaminated soil in the experimental cell. The amount and frequency of application will be determined by Baker after the initial soil characterization. Mixing may be accomplished by using a rototiller.

The lime shall be delivered to the site in original unopened containers bearing the manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal lays. Instead of containers, lime may be furnished in bulk with certificates indicating the above information. Store in cool, dry locations away from contaminants.

3.2.5 Moisture Adjustment

At least on a weekly basis, the moisture content of the contaminated soil in the experimental cell will be adjusted by spraying the collected leachate. Periodically, leachate collected within the HDPE sump will be

pumped using a 2-inch submersible pump. The pump discharge will be connected to a 25-foot flexible hose that will be used to sprinkle the leachate onto the biocell. The leachate will be applied evenly across the entire cell. At the optimal moisture content, the soil be exhibit a friable, but not saturated, consistency, and a moisture content of 40 to 75 percent the maximum holding capacity. A moisture tester will be used to determine the appropriate moisture content in the field. When the leachate supply is exhausted, potable water from an on-Base supply will be used for moisture adjustment. Excess leachate will be periodically pumped into 55-gallon drums that are securely fastened. The Contractor shall be responsible for the sampling and disposal of all leachate collected during the study.

3.2.6 Temperature Adjustment

Most likely the optimal soil temperature will be between 68 and 77 degrees Fahrenheit. Under the current schedule, the treatability study will be conducted during the winter and early spring. The average temperature at MCB, Camp Lejeune during this time period is 44 to 53 degrees Fahrenheit. As a result, a biocell cover may be required to trap heat and increase the soil temperature. This cover shall be a plastic laminate tarp that will be securely anchored at all edges around the cell. One cover may be used for both the experimental cell and the control cell. Soil temperature will be measured on a weekly basis and recorded in both the experimental and control cells. If necessary, additional cover layers may be used.

3.3 DECOMMISSIONING OF THE TREATABILITY UNIT

Decommissioning of the unit will include disposal of the treated soil, and disassembly and disposal of the treatability unit components.

3.3.1 Disposal of the Treated Soil

If the biological treatment achieves the specified remediation levels for PAHs, the treated soil shall be disposed at the on-Base landfill. These remediation levels are:

Naphthalene	30,000 ppb
2-Methylnaphthalene	30,000 ppb
Carbazole	500 ppb
Benzo(a)anthracene	700 ppb
Chrysene	1,000 ppb
N-Nitrosodiphenylamine	200 ppb

If biological treatment does not achieve the specified remediation levels, the soil will be tested for TCLP and RCRA characteristics. Based on these analyses, the soil will be disposed at either a hazardous or non-hazardous waste disposal facility.

3.3.2 Disassembly and Disposal of the Treatability Unit Components

The treatability unit components shall be disassembled and disposed at the on-Base landfill. If biological treatment does not achieve the specified remediation levels, the treatment components shall be pressure washed prior to disposal.

-- End of Section --

APPENDIX B
BORING LOGS AND WELL CONSTRUCTION RECORDS

BAKER

TEST BORING LOG

BOREHOLE NUMBER: 3-TA-SB48/49/50

SHEET: 1 OF 1

PROJECT NUMBER: 62470-274
PROJECT NAME: SITE 3 - OLD CREOSOTE PLANT
LOCATION: MCB CAMP LEJEUNE, NC
DRILLING COMPANY: PARRATT-WOLFF, INC.
RIG TYPE & NUMBER: TRUCK RIG - CME 55
DRILLING METHOD: HOLLOW STEM AUGERS
WEATHER: SUNNY, HOT
GEOLOGIST: M.K. DEJOHN
ENV. SCIENTIST: -
DATE BEGUN: 6/15/95 DATE COMPLETED: 6/15/95

GROUND SURFACE ELEVATION: 32.19' msl
TOTAL DEPTH: 9.0' bgs

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/6"	RECOVERY	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH
32.00	0.0		S-1	HA	-	-	-	-			0.0
31.00	1.0				17					SAND: Fine grained, little to some silt, layers of stones and clay, dark gray, damp, dense to medium dense	1.0
30.00	2.0		S-2	SS	13 17 15	1.7	0.9	2.0			2.0
29.00	3.0				5						3.0
28.00	4.0		S-3	SS	7 5 6	1.6	0.7	1.0			4.0
27.00	5.0				4					SANDY CLAY: Fine grained, little silt, gray, damp, medium dense; strong creosote odor	5.0
26.00	6.0		S-4	SS	4 5 6	2.0	0.7	1.1			6.0
25.00	7.0				10					SAND: Fine grained, some silt, trace to little clay, gray w/brown staining, moist to wet, medium dense; strong odor and free product floating on water surface	7.0
24.00	8.0		S-5	SS	13 14 12	2.0	0.7	8.0			8.0
23.00	9.0									BOTTOM OF BOREHOLE @ 9.0'	9.0
22.00	10.0									NOTES: 1) Groundwater encountered at 9' during drilling.	10.0
21.00	11.0										11.0
20.00	12.0										12.0
19.00	13.0										13.0
18.00	14.0										14.0
17.00	15.0										15.0
16.00	16.0										16.0
15.00	17.0										17.0
14.00	18.0										18.0
13.00	19.0										19.0
12.00	20.0										20.0
11.00	21.0										21.0
10.00	22.0										22.0
9.00	23.0										23.0
8.00	24.0										24.0
7.00	25.0										25.0
6.00	26.0										26.0
5.00	27.0										27.0
4.00	28.0										28.0

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER: 3-MW02IW

SHEET: 1 OF 4

PROJECT NUMBER: 62470-212
PROJECT NAME: SITE 3 - OLD CREOSTE PLANT
LOCATION: MCB CAMP LEJEUNE, NC
DRILLING COMPANY: HARDIN-HUBER, INC.
RIG TYPE & NUMBER: MOBILE B-80
DRILLING METHOD: MUD ROTARY
WEATHER: SUNNY, HOT, HUMID
GEOLOGIST: J.E. ZIMMERMAN
ENV. SCIENTIST: M.D. SMITH
DATE BEGUN: 1/16/94 DATE COMPLETED: 1/16/94

GROUND SURFACE ELEVATION: 32.50' msl
TOP OF CASING ELEVATION: 35.19' msl

WELL DETAILS (FT)

STICKUP:	2.5
INNER CASING (10"I.D.):	20.0
LENGTH OF RISER (2"I.D.):	71.5
LENGTH OF SCREEN (2"I.D.):	15.0
THICKNESS OF GROUT:	61.0
THICKNESS OF SEAL:	5.5
THICKNESS OF SAND PACK:	20.0

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE	BLOWS/0.5'	RECOVERY	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH	WELL INSTALLATION
36.00	1.0										1.0	
35.00	2.0										2.0	
34.00	3.0										3.0	
33.00	4.0										4.0	
32.00	0.0		S-1	SS	-	-	0.2	0.2		SILTY SAND: Fine grained, trace root material/burnt soil/charcoal/wood, dark brown, damp, very loose.	0.0	
31.00	1.0		S-2	SS	14 9 9 8	1.6	0.2	0.2		SILTY SAND: Fine grained, trace clay, buff/light brown, damp, medium dense	1.0	
30.00	2.0										2.0	
29.00	3.0		S-3	SS	5 7 7 8	1.6	0.2	0.2			3.0	
28.00	4.0										4.0	
27.00	5.0		S-4	SS	8 9 8 9	1.6	0.2	0.2		SAND: Fine grained, trace silt, occasional trace clay, light gray, damp to wet, medium dense/loose	5.0	
26.00	6.0										6.0	
25.00	7.0		S-5	SS	5 7 7 8	1.5	0.2	0.2			7.0	
24.00	8.0										8.0	
23.00	9.0		S-6	SS	9 9 10 12	0.8	0.2	0.2			9.0	
22.00	10.0										10.0	
21.00	11.0		S-7	SS	5 5 7 8	1.4	0.2	0.2			11.0	
20.00	12.0										12.0	
19.00	13.0		S-8	SS	7 5 4 3	2.0	0.2	0.2		creosote odor evident	13.0	
18.00	14.0										14.0	
17.00	15.0		S-9	SS	3 7 12 16	1.2	0.2	0.2			15.0	
16.00	16.0										16.0	
15.00	17.0		S-10	SS	3 3 3 4	2.0	0.4	0.4		SILTY CLAY: trace fine grained sand, greenish gray, moist, soft/very soft, creosote odor and contamination present	17.0	
14.00	18.0										18.0	
13.00	19.0		S-11	SS	WOH WOH 1 3	2.0	0.4	0.4			19.0	
12.00	20.0										20.0	
11.00	21.0										21.0	
10.00	22.0										22.0	
9.00	23.0										23.0	
	24.0										24.0	

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER: 3-MW02IW

SHEET: 2 OF: 4

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH	WELL INSTALLATION
	20.0									SILTY CLAY: trace fine grained sand, greenish gray, moist, soft/very soft, creosote odor and contamination present	20.0	
	21.0										21.0	
	22.0										22.0	
	23.0									SAND: fine to medium grained, trace silt, occasional some to little clay, gray/greenish gray, wet, medium dense/ loose/dense	23.0	
	24.0										24.0	
	25.0										25.0	
	26.0		S-12	SS	7 7 8 9	0.6	0.1	0.1			26.0	
	27.0										27.0	
	28.0										28.0	
	29.0										29.0	
	30.0										30.0	
	31.0		S-13	SS	3 3 3 5	1.2	0.1	0.1			31.0	
	32.0										32.0	
	33.0										33.0	
	34.0										34.0	
	35.0										35.0	
	36.0		S-14	SS	2 3 10 13	1.1	0.3	0.3			36.0	
	37.0										37.0	
	38.0										38.0	
	39.0										39.0	
	40.0										40.0	
	41.0		S-15	SS	3 6 6 14	1.8	0.3	0.3			41.0	
	42.0										42.0	
	43.0										43.0	
	44.0										44.0	
	45.0									Shell fragments w/micrite cement (0.8')	45.0	
	46.0		S-16	SS	13 13 15 20	1.6	0.3	0.3			46.0	
	47.0										47.0	
	48.0										48.0	
	49.0										49.0	
	50.0										50.0	
	51.0		S-17	SS	20 17 17 40	1.1	0.3	0.3			51.0	
	52.0										52.0	

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER: 3-MW2IW

SHEET: 3 OF: 4

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION
18-00	50.0		S-18	SS	20 17 17 40	1.1	0.3	0.3		SAND: fine to medium grained, trace silt, trace shell fragments, gray to white/ greenish gray, wet, dense/very dense
19-00	51.0									
20-00	52.0									
21-00	53.0									
22-00	54.0									
23-00	55.0		S-19	SS	30 74 100 /5"	1.1	-	-		
24-00	56.0									
25-00	57.0									
26-00	58.0									
27-00	59.0									
28-00	60.0		S-20	SS	20 34 50 40	0.8	-	-		
29-00	61.0									
30-00	62.0									
31-00	63.0									
32-00	64.0									
33-00	65.0		S-21	SS	42 100 /4"	0.7	0.7	0.7		
34-00	66.0									
35-00	67.0									
36-00	68.0									
37-00	69.0									
38-00	70.0		S-22	SS	100 /5" 100 /1"	0.8	0.7	0.7		
39-00	71.0									
40-00	72.0									
41-00	73.0									
42-00	74.0									
43-00	75.0		S-23	SS	46 100 /5"	0.8	0.7	0.7		
44-00	76.0									
45-00	77.0									
46-00	78.0									
47-00	79.0									
48-00	80.0									
49-00	81.0									
	82.0									

DEPTH	WELL INSTALLATION
50.0	
51.0	
52.0	
53.0	
54.0	
55.0	
56.0	
57.0	
58.0	
59.0	
60.0	
61.0	
62.0	
63.0	
64.0	
65.0	
66.0	
67.0	
68.0	
69.0	
70.0	
71.0	
72.0	
73.0	
74.0	
75.0	
76.0	
77.0	
78.0	
79.0	
80.0	
81.0	
82.0	

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER: 3-MW02IW

SHEET: 1 OF: 1

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH	WELL INSTALLATION
80.00	80.0										80.0	
81.00	81.0										81.0	
82.00	82.0										82.0	
83.00	83.0										83.0	
84.00	84.0										84.0	
85.00	85.0										85.0	
86.00	86.0										86.0	
87.00	87.0										87.0	
88.00	88.0										88.0	
89.00	89.0										89.0	
90.00	90.0										90.0	
91.00	91.0										91.0	
92.00	92.0										92.0	
93.00	93.0										93.0	
94.00	94.0										94.0	
95.00	95.0										95.0	
96.00	96.0										96.0	
97.00	97.0										97.0	
98.00	98.0										98.0	
99.00	99.0										99.0	
100.00	100.0										100.0	
101.00	101.0										101.0	
102.00	102.0										102.0	
103.00	103.0										103.0	
104.00	104.0										104.0	
105.00	105.0										105.0	
106.00	106.0										106.0	
107.00	107.0										107.0	
108.00	108.0										108.0	
109.00	109.0										109.0	
110.00	110.0										110.0	
111.00	111.0										111.0	
112.00	112.0										112.0	
	80.0		S-23	SS	36 100 /5"	0.6	0.7	0.7		SAND: Fine grained, trace silt, greenish gray, wet, very dense		
	85.0		S-24	SS	46 100 /4"	0.8	0.7	0.7				
	87.0									BOTTOM OF BOREHOLE @ 87.0' NOTES: 1) Groundwater encountered @ 9.0' during drilling		

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER: 3-MW02DW

SHEET: 1 OF 5

PROJECT NUMBER: 62470-274
PROJECT NAME: SITE 3 - OLD CREOSTE PLANT
LOCATION: MCB CAMP LEJEUNE, NC
DRILLING COMPANY: PARRATT-WOLFF, INC.
RIG TYPE & NUMBER: TRUCK RIG (I.D. #115)
DRILLING METHOD: MUD ROTARY
WEATHER: HOT, HUMID
GEOLOGIST: J.E. ZIMMERMAN/M.K. DEJOHN
ENV. SCIENTIST: M.D. SMITH
DATE BEGUN: 6/20/95 DATE COMPLETED: 6/28/95

GROUND SURFACE ELEVATION: 32.19' msl
TOP OF CASING ELEVATION: 34.06' msl

WELL DETAILS (FT)

STICKUP:	1.87
OUTER CASING (6"I.D.):	
LENGTH OF RISER (2"I.D.):	125.0
LENGTH OF SCREEN (2"I.D.):	15.0
THICKNESS OF GROUT:	108.0
THICKNESS OF SEAL:	14.0
THICKNESS OF SAND PACK:	18.0

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH	WELL INSTALLATION
36:00	4.0										4.0	
35:00	3.0										3.0	
34:00	2.0										2.0	
33:00	1.0										1.0	
32:00	0.0		S-1	SS	-	-	0.1	0.1		SILTY SAND: fine grained, trace root material, occasional trace clay, dark grayish brown, damp, very loose/medium dense; creosote odor detected at 1-3'	0.0	
31:00	1.0										1.0	
30:00	2.0		S-2	SS	9 8 8 7	1.6	0.1	0.1			2.0	
29:00	3.0										3.0	
28:00	4.0		S-3	SS	10 10 8 8	1.6	0.4	0.4		SAND: fine grained, trace silt, occasional trace clay, dark brownish gray/buff/light gray, damp/moist/wet, medium dense/loose; creosote odor present	4.0	
27:00	5.0										5.0	
26:00	6.0		S-4	SS	2 4 8 7	1.8	0.1	0.1			6.0	
25:00	7.0										7.0	
24:00	8.0		S-5	SS	3 5 7 7	1.5	0.1	0.1			8.0	
23:00	9.0										9.0	
22:00	10.0		S-6	SS	4 5 5 5	1.3	0.2	0.2			10.0	
21:00	11.0										11.0	
20:00	12.0		S-7	SS	3 5 7 3	1.5	0.2	0.2			12.0	
19:00	13.0										13.0	
18:00	14.0		S-8	SS	3 5 7 7	2.0	0.2	0.2			14.0	
17:00	15.0										15.0	
16:00	16.0		S-9	SS	2 2 2 2	1.6	0.2	0.2			16.0	
15:00	17.0										17.0	
14:00	18.0		S-10	SS	3 4 2 2	1.5	0.2	0.2			18.0	
13:00	19.0										19.0	
12:00	20.0		S-11	SS	3 2 1 1	1.4	0.2	0.2			20.0	
11:00	21.0										21.0	
10:00	22.0		S-12	SS	WOH 2 1 1	2.0	0.2	0.2		SILTY CLAY: dark greenish gray, damp, soft/very soft, creosote odor present	22.0	
9:00	23.0										23.0	
8:00	24.0										24.0	

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER
3-MW02DW
SHEET 2 OF 5

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH	WELL INSTALLATION
12:00	20.0										20.0	
11:00	21.0										21.0	
10:00	22.0		S-12	SS	WOH 2 1 1	2.0	0.3	0.3		SAND: Fine grained, trace silt, occasional trace clay, dark brownish gray/buff/light gray, damp/moist/wet, medium dense/loose, creosote odor present	22.0	
9:00	23.0									SILTY CLAY: dark greenish gray, damp, soft/very soft, creosote odor present	23.0	
8:00	24.0										24.0	
7:00	25.0		S-13	SS	10 27 38 27	0.7	0.2	0.2		SAND: Fine grained, trace silt, occasional some to little clay, gray/greenish gray/ dark greenish gray, wet, very dense/loose/ medium dense/dense; creosote odor present to 47'	25.0	
6:00	26.0										26.0	
5:00	27.0										27.0	
4:00	28.0										28.0	
3:00	29.0										29.0	
2:00	30.0		S-14	SS	2 4 5 6	2.0	0.2	0.2			30.0	
1:00	31.0										31.0	
0:00	32.0										32.0	
1:00	33.0										33.0	
2:00	34.0										34.0	
3:00	35.0		S-15	SS	8 12 16 13	1.7	0.2	0.2			35.0	
4:00	36.0										36.0	
5:00	37.0										37.0	
6:00	38.0										38.0	
7:00	39.0										39.0	
8:00	40.0		S-16	SS	1 2 1 2	1.4	0.2	0.2			40.0	
9:00	41.0										41.0	
10:00	42.0										42.0	
11:00	43.0										43.0	
12:00	44.0										44.0	
13:00	45.0		S-17	SS	3 3 7 11	1.4	0.2	0.2			45.0	
14:00	46.0										46.0	
15:00	47.0										47.0	
16:00	48.0										48.0	
17:00	49.0										49.0	
18:00	50.0		S-18	SS	7 14 26 32	1.5	0.2	0.2			50.0	
19:00	51.0										51.0	
20:00	52.0										52.0	

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER
3-MW02DW
SHEET 3 OF 5

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH	WELL INSTALLATION
18:00	50.0										50.0	
19:00	51.0		S-18	SS	7 14 26 32	1.4	0.2	0.2		SAND: Fine to medium grained, trace silt, *trace to little shell fragments*, dark greenish gray/gray/white, wet, dense/ very dense	51.0	
20:00	52.0										52.0	
21:00	53.0										53.0	
22:00	54.0										54.0	
23:00	55.0		S-19	SS	14 34 53 63	1.3	0.2	0.2			55.0	
24:00	56.0										56.0	
25:00	57.0										57.0	
26:00	58.0										58.0	
27:00	59.0										59.0	
28:00	60.0		S-20	SS	14 18 18 23	1.2	0.2	0.2			60.0	
29:00	61.0										61.0	
30:00	62.0										62.0	
31:00	63.0										63.0	
32:00	64.0										64.0	
33:00	65.0		S-21	SS	24 60 82 100/4"	1.3	0.2	0.2			65.0	
34:00	66.0										66.0	
35:00	67.0										67.0	
36:00	68.0										68.0	
37:00	69.0										69.0	
38:00	70.0		S-22	SS	18 33 81 100/4"	1.3	0.2	0.2			70.0	
39:00	71.0										71.0	
40:00	72.0										72.0	
41:00	73.0										73.0	
42:00	74.0										74.0	
43:00	75.0		S-23	SS	18 34 63 92	1.4	0.3	0.3			75.0	
44:00	76.0										76.0	
45:00	77.0										77.0	
46:00	78.0										78.0	
47:00	79.0										79.0	
48:00	80.0		S-24	SS	22 56 98 100/4"	1.2	0.3	0.3			80.0	
49:00	81.0										81.0	
50:00	82.0										82.0	

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER
3-MW020W
SHEET: 4 OF 5

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH
48-00	80.0										80.0
49-00	81.0										81.0
50-00	82.0										82.0
51-00	83.0										83.0
52-00	84.0										84.0
53-00	85.0										85.0
54-00	86.0										86.0
55-00	87.0										87.0
56-00	88.0										88.0
57-00	89.0										89.0
58-00	90.0										90.0
59-00	91.0										91.0
60-00	92.0										92.0
61-00	93.0										93.0
62-00	94.0										94.0
63-00	95.0										95.0
64-00	96.0										96.0
65-00	97.0										97.0
66-00	98.0										98.0
67-00	99.0										99.0
68-00	100.0										100.0
69-00	101.0										101.0
70-00	102.0										102.0
71-00	103.0										103.0
72-00	104.0										104.0
73-00	105.0										105.0
74-00	106.0										106.0
75-00	107.0										107.0
76-00	108.0										108.0
77-00	109.0										109.0
78-00	110.0										110.0
79-00	111.0										111.0
80-00	112.0										112.0
			S-24	SS	22 56 98 100/4"	1.2	0.3	0.3		SAND: fine to medium grained, trace silt, trace shell fragments, dark greenish gray/ gray/white, wet, very dense	
			S-25	SS	28 42 96 100/4"	1.5	0.3	0.3			
			S-26	SS	15 20 25 54	2.0	0.8	0.8		SAND and SILT: fine grained, little clay, trace shell fragments, dark green, damp, dense	
			S-27	SS	17 19 31 54	2.0	-	-		SHELL FRAGMENTS: some silt, little clay, gray, moist, very dense SILT: some shell fragments, little to some clay, gray, damp, hard	
			S-28	SS	21 28 18 32	2.0	0.4	0.4		SAND and SILT: little to some clay, trace shell fragments, taupe, moist, hard	
			S-29	SS	- 27 34	2.0	0.4	0.4			

WELL INSTALLATION

BAKER

WELL CONSTRUCTION LOG

BOREHOLE NUMBER
3-MW02DW
SHEET: 5 OF 5

ELEVATION	DEPTH	SOIL SAMPLES	SAMPLE NO.	SAMPLE METHOD	BLOWS/0.5'	RECOVERY (FT)	PID (PPM) BG	PID (PPM) PS	LITHOLOGY	DESCRIPTION	DEPTH
78:00	110.0										110.0
79:00	111.0									SAND and SILT: Fine grained, trace to some clay, trace shell fragments, taupe, moist, hard	111.0
80:00	112.0										112.0
81:00	113.0										113.0
82:00	114.0										114.0
83:00	115.0		S-30	SS	17 21 33 34	2.0	0.5	0.6		SHELL FRAGMENTS: little silt and clay, gray, wet, very dense	115.0
84:00	116.0										116.0
85:00	117.0										117.0
86:00	118.0										118.0
87:00	119.0		S-31	SS	22 40 35 35	1.0	0.6	0.6			119.0
88:00	120.0										120.0
89:00	121.0										121.0
90:00	122.0										122.0
91:00	123.0										123.0
92:00	124.0		S-32	SS	17 17 23 41	0.8	0.6	0.6		SAND: Fine to medium grained, little silt, trace shell fragments and clay, dark gray, wet, dense to very dense	124.0
93:00	125.0										125.0
94:00	126.0										126.0
95:00	127.0										127.0
96:00	128.0										128.0
97:00	129.0		S-33	SS	100/4"	0.3	0.6	0.6			129.0
98:00	130.0										130.0
99:00	131.0										131.0
100.00	132.0										132.0
101.00	133.0										133.0
102.00	134.0		S-34	SS	200/6"	0.5	0.6	0.6			134.0
103.00	135.0										135.0
104.00	136.0										136.0
105.00	137.0										137.0
106.00	138.0										138.0
107.00	139.0										139.0
108.00	140.0									BOTTOM OF BOREHOLE @ 140'	140.0
109.00	141.0									NOTES 1) Groundwater encountered @ 6.0' during drilling	141.0
110.00	142.0										142.0

WELL INSTALLATION