✓ 04.10-8/20/98-00213

DRAFT

SAMPLE STRATEGY PLAN

CORRECTIVE ACTION PLAN/ NATURAL ATTENUATION EVALUATION OPERABLE UNIT NO. 10, SITE 35 CAMP GEIGER AREA FUEL FARM

MARINE CORPS BASE
CAMP LEJEUNE, NORTH CAROLINA

CONTRACT TASK ORDER 0323

AUGUST 20, 1998

Prepared for:

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

Under the:

LANTDIV CLEAN Program
Contract N62470-89-D-4814

Prepared by:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

This Draft Sample Strategy Plan (SSP) was prepared by Baker Environmental, Inc. (Baker) in support of the Corrective Action Plan (CAP) and Natural Attenuation Evaluation (NAE) for Operable Unit (OU) No. 10 (Site 35) Marine Corp Base (MCB), Camp Lejeune, North Carolina.

The Draft Feasibility Study (FS) and Proposed Remedial Action Plan (PRAP) prepared for Site 35 have identified natural attenuation, coupled with periodic monitoring as the remedial alternative for groundwater contamination in areas where active remediation was not proposed. To date, none of the proposed remedial alternatives presented, have been approved by federal or state regulators. To gain approval from federal and state regulators, proof must be provided that natural attenuative processes are reducing groundwater contamination at rates that are protective of human health and the environment. The primary objective of the NAE field investigation is to gather data regarding the potential for natural attenuation to be a viable treatment alternative at Site 35.

The objective of the Sample Strategy Plan (SSP) is to identify sample media, locations and analytical parameters needed to evaluate the natural attenuative processes at Site 35. Background information and the rationale behind the SSP have also been included .

2.0 SITE BACKGROUND

This section and includes a brief history of investigation and remedial activities that have occurred at Site 35 since 1994, and a brief description of the nature and extent of groundwater contamination at Site 35.

2.1 Site History

Although several investigations have been conducted at Site 35, the first site-wide Remedial Investigation (RI) was conducted by Baker Environmental, Inc. (Baker) in 1994 to assess the nature and extent of groundwater contamination associated with the former Camp Geiger Fuel Farm. Extensive organic groundwater contamination was observed in both the upper and lower portion of the surficial aquifer. However, the extent of this organic contamination south of Fifth Street and north of Brinson Creek was not established during this investigation. During this investigation natural attenuation was not considered as a viable remedial alternative at this site and data supporting natural attenuation as a remedial alternative was not gathered.

The Interim Remedial Action (IRA) Feasibility Study (FS) for Shallow Groundwater in the Vicinity of the Former Fuel Farm was developed from the RI data gathered in 1994. This IRA/FS culminated in the signing of the Interim Record of Decision (ROD) for Surficial Groundwater for a Portion Operable Unit No. 10, Site 35 in September of 1995 and identified in-situ air sparging (IAS) as the selected remedy to treat contaminated groundwater in the vicinity of the former Camp Geiger Fuel Farm.

Between the fall of 1995 and spring of 1996 petroleum contaminated soil from areas located on the east side of F Street near building G-480 and within the footprint of the former Camp Geiger Fuel Farm above-ground storage tanks (ASTs) was excavated and treated off-site. Camp Geiger streets are shown on Figures 1 and 2.

During the spring of 1996 the Supplemental Groundwater Investigation (SGI) was conducted. The objectives of the SGI were to determine if groundwater contamination had migrated across side of Brinson Creek onto private property and assess the extent of groundwater contamination south of Fifth Street. The Draft FS and PRAP for Site 35 were developed from the data collected during the

SGI, and identified monitored natural attenuation as an appropriate technology for the remediation of contaminated groundwater located up gradient of any IAS system. However, SGI data was insufficient to fully determine if natural attenuative processes were sufficient to protect human health and the environment.

An in-situ air sparging pilot evaluation was conducted in August and July of 1996 in Area B, depicted in Figures 1 and 2, to assess the viability of IAS as an alternative for remediating shallow groundwater contamination. The report recommended that an IAS trench be constructed on south side of the US Highway 17 Bypass Right-of-Way (ROW).

In February of 1997 the levels of groundwater contamination in an area located on the south side of the US Highway 17 bypass ROW near the intersection of G and Fourth Streets were assessed. The purpose of this investigation was to determine the optimal location of a pilot-scale IAS trench system.

In August of 1997 the Final RAC design for an IAS system was submitted by Baker. The design provided for an IAS system that was to be constructed in two phases. Construction of Phase I was completed and began operations in early 1998. This system is currently undergoing a six month field test which began in mid-February. The preliminary results of Phase I operations indicate the IAS trench is effectively remediating groundwater that moves through the IAS trench. Baker is preliminarily recommending that the operation and monitoring of the IAS system be continued for an additional 3 months to fully assess system operations and the impact of the system operations on natural attenuative processes.

To assess natural attenuative processes in the vicinity of E and Fourth Streets and preliminarily assess the impacts the impact of the IAS system on natural attenuative processes, a Natural Attenuation Assessment (NAA) was performed during the first half of 1998. Groundwater samples were collected from eight shallow and nine intermediate monitoring wells and analyzed for natural attenuation parameters during three rounds of sampling that occurred in January, April and June of 1998. Data gathered during these rounds will be used to support the development of the CAP/NAE.

As part of the construction of the US Highway 17 Bypass a total of 50 permanent monitoring wells were abandoned at Site 35 in mid-June of 1998 by the North Carolina Department of Transportation

(NC DOT). This restricted the ability to monitor fuel and solvent-related "hot spots" and downgradient monitoring wells located within and adjacent to the US Highway 17 Bypass ROW.

2.2 Summary of Nature and Extent of Contamination

The groundwater contamination associated with Site 35, Camp Geiger Fuel Farm, is limited to the surficial aquifer. A confining unit that separates the surficial aquifer from the Castle Hayne aquifer appears to prevent contamination from migrating vertically into the Castle Hayne aquifer. The extent of groundwater contamination in the surficial aquifer at Site 35 extends over approximately 100 acres of Camp Geiger. The primary constituents of this contamination are fuel and solvent compounds. Based on the results of the RI and the SGI, fuel-related contamination is prevalent in the upper portion of surficial aquifer and solvent-related contamination is prevalent in the lower portion of surficial aquifer.

2.2.1 Upper Surficial Aquifer

Although fuel-related groundwater contamination is prevalent in the upper surficial aquifer, solvent and fuel-related contaminant plumes overlap in this portion of the aquifer. Based on RI data, these mixed solvent and fuel-related contaminant plumes are generally located in an area north of Fifth Street and east of E Street. The RI data indicates that there are two "hot spot " areas (maximum levels over 1,000 ug/l) of fuel-related groundwater contamination that overlap four smaller plumes with lower levels of solvent-related contamination. Maximum contamination in these solvent-related plumes is approximately 100 ug/l. The fuel-related "hot spot" areas are located along F Street, just northeast of Building G-480 and in the immediate vicinity of the former Camp Geiger Fuel Farm. The limits of fuel- and solvent-related contamination in the upper surficial aquifer, based on RI data, are depicted in Figure 1. Contaminated soil in the vicinity of these "hot spots" was removed in 1996.

2.2.2 Lower Surficial Aquifer

Based on the results of the RI and the SGI, solvent-related contamination is prevalent in the lower portion of surficial aquifer. However, solvent and fuel-related groundwater contaminant plumes also overlap in this portion of the surficial aquifer north of Fifth Street. The RI data indicates that north of Fifth Street there are two "hot spot" areas (maximum levels over 1,000 ug/l) of solvent-related

groundwater contamination that overlap three plumes of fuel-related groundwater contamination. Maximum fuel-related contamination in these areas is approximately 100 ug/l. The two solvent-related "hot spot" areas are centered near the intersection of E and Fourth Streets, and in the vicinity of Buildings TC-470, TC-473 and TC-474.

South of Fifth Street, groundwater contamination in the lower surficial aquifer is exclusively solvent-related. No source areas were identified south of Fifth Street during the RI and SGI. However, based on groundwater flow patterns it appears the solvent-related groundwater contamination south of Fifth Street originates in the vicinity of buildings G-552, G-553 and G-554. The limits of solvent and fuel-related contamination in the lower portion of the surficial aquifer are depicted in Figure 2.

3.0 FIELD INVESTIGATION

The field investigation associated with the NAE will consist of a groundwater investigation and a limited soil investigation.

3.1 Groundwater Investigation

As was previously noted, multiple overlapping solvent- and fuel-related contaminant plumes are present in both the upper and lower portions of the surficial aquifer in an area north of Fifth Street. The focus of the NAA conducted earlier this year and the proposed NAE, is on two representative "hot spots" and associated contaminant plumes located north of Fifth Street. The focused "hot spot" and associated contaminant plume located in the lower surficial aquifer is centered in the vicinity of E and Fourth Streets. The focused "hot spot" and associated contaminant plume in the upper surficial aquifer is centered along F Street northeast of building G-480.

During the field investigation phase of the NAE, groundwater samples will be collected from 4 temporary monitoring wells, 10 new permanent monitoring wells and 11 existing permanent wells. Data collected from these wells will be used to meet the location specific objectives noted below. Tables 1 and 2 provide a specific purpose for each monitoring well to be sampled.

3.1.1 Lower Surficial Aquifer

Location-specific objectives associated with groundwater contamination in the lower surfical aquifer are as follows:

- Determine if site-related contamination in the lower surficial aquifer is discharging to Brinson Creek and assess the impact of the Brinson Creek wetlands on contaminant levels.

- Monitor contaminant loss and natural attenuative processes in the "hot spot" area located near Fourth and E Streets.

- Assess natural attenuative processes in the solvent-related contamination south of Fifth Street originating from a potential source area near buildings G-552, G-553 and G-554.

- Collect sufficient data in support of site-wide contaminant, electron acceptor, and metabolic by-product isopleth drawings.

To meet the first objective groundwater samples will be collected from three new intermediate monitoring wells in the wetland adjacent to Brinson Creek and one existing permanent well located upgradient of Brinson Creek. The location of these wells are shown on Figure 1.

To achieve the second objective noted above, existing monitoring wells IR35-MW09, -MW30B, and -MW37B will be sampled.

Two achieve the third objective noted above, groundwater samples will be collected from three temporary monitoring wells, four new permanent monitoring wells and three existing permanent monitoring wells (IR35-MW39B, -MW34B and -MW40B).

Data generated from all of the new and existing monitoring wells will be used to develop isopleth drawings of site-wide contaminant, electron acceptor, and metabolic by-products. Samples from two additional wells IR35-MW32 and -MW43B will provide further support this effort.

3.1.2 Upper Surficial Aquifer

Location specific objectives associated with groundwater contamination in the upper surfical aquifer are as follows:

- Determine if site-related contamination in the upper surficial aquifer is discharging to Brinson Creek and assess the impact on Brinson Creek wetlands on contaminant levels.

- Assess natural attenuative processes in the fuel-related contaminant plume located between Fourth and Third Streets and along F Street.

The first objective will be met through the installation and sampling of two shallow monitoring wells located in the wetland adjacent to Brinson Creek. A single existing well, IR35-MW23A, will also be sampled to support this objective.

To achieve the second objective noted above samples will collected from one temporary monitoring well and one new monitoring well that will be installed in the former source area located along F Street north of Fourth Street. A single existing well, IR35-MW14A, will also be sampled to support this objective.

3.1.3 Groundwater Analyses

A summary of all analytical methods is presented in Table 3. Samples collected from temporary monitoring wells will be analyzed immediately and the results will be made available via facsimile within 24 hours. Raw data from permanent wells will be provided by the laboratory within 28 days. All samples to be analyzed will be shipped via overnight courier to Quanterra Laboratories of Knoxville, Tennessee.

In addition to fixed-base laboratory analysis that will be performed, all groundwater samples will be analyzed at the wellhead for the following parameters:

- Ferrous iron by method 8146.
- Sulfate by method 8051.
- Total alkalinity by method 8203.
- Chloride by method 8113.

A Hach DR2010 spectrophotometer will be used to analyze for ferrous iron, sulfate, and chloride in the field. Method 8203 (total alkalinity) is a manual titration method. In addition to chemical analysis, conductivity, pH, redox potential and dissolved oxygen will be monitored at each well.

3.2 Soil Investigation

A total of four subsurface soil samples will be collected and analyzed for total organic carbon by the Walkley-Black method. Levels of natural organic carbon are used to determine the contaminant transport velocity. These samples will be collected from two background borings. From each boring a sample will be collected from the upper and lower portions of the surficial aquifer. Table 4 provides sample designations for these samples.

3.3 Field Investigation Methods

Temporary and permanent monitoring well installation methods, well development methods, and soil and groundwater sampling methods that will be used during the NAE field investigation are described in the following documents:

- RI/FS Work Plan (Baker, 1993).
- RI/FS Sample and Analysis Plan (Baker, 1993).
- Letter amendment to the above documents submitted to LANTDIV on March 13, 1996.

4.0 INVESTIGATION DERIVED WASTE (IDW)

During this investigation drill cuttings will be generated from borehole advancement. These cuttings will be containerized in 55 gallon drums or a roll-off box. Development and purge water will be stored in a 5,000-gallon tanker or 1,000-gallon polyethylene tank.

A composite of the drill cuttings will be collected from the roll-off box and analyzed for Target Compound Leaching Procedure (TCLP) Volatiles and RCRA Hazardous Waste Characteristics in order to assess disposal options. A single sample will be collected from the tanker or polyethylene tank used to store IDW during the investigation. This sample will be analyzed for Contract Laboratory Protocol (CLP) Volatile Organic Compounds (VOCs). Based on the analytical results and the prior approval of LANTDIV and MCB Camp Lejeune, liquid IDW will be transported to an on base facility for treatment and disposal.

5.0 SCHEDULE

A schedule of deliverables and mile stone dates associated with the NAE/CAP are presented below.

Deliverables	Milestone Dates
Final SSP	9/2/98
Draft CAP/NAE	2/2/99
Draft Long-Term Monitoring Plan	3/15/99
Final CAP/NAE	3/15/99
Final Long-Term Monitoring Plan	6/1/99

TABLES

TABLE 1
RATIONALE FOR GROUNDWATER SAMPLING STRATEGY PLAN, LOWER SURFICAL AQUIFER
SITE 35, CAMP GEIGER FUEL FARM
CORRECTIVE ACTION PLAN AND NATURAL ATTENUATION EVALUATION
MARINE CORP BASE, CAMP LEJEUNE, NORTH CAROLINA
CTO 323

WELL NUMBER	STATUS	TYPE	PLUME CONSTITUIENTS	PURPOSE
Sentinel Wells and Wetland Wells				
IR35-MW63B	New	Perm.	Solvents & BTEX	Monitors discharge to Brinson Creek.
IR35-MW64B	New	Perm.	Solvents & BTEX	Monitors discharge to Brinson Creek.
IR35-MW65B	New	Perm.	Solvents & BTEX	Monitors discharge to Brinson Creek.
IR35-MW47B	Existing	Perm.	Solvents & BTEX	Provides data immediately up gradient of sentinel wells and data down gradient of contamination in the vicinity of 4th & E Sts. and 4th & F Sts.
4th and E Street Hot Spot				
IR35-MW30B	Existing	Perm.	Solvents	Defines and evaluates limits of source area near 4th and E Sts.
IR35-MW09D	Existing	Perm.	Solvents & BTEX	Provides up gradient data for potential source area near 4th and E Sts.
IR35-MW37B	Existing	Perm.	Solvents & BTEX	Provides up gradient data for potential source area near 4th and E Sts.
Potential Source Area Near Building G-553				
IR35-TW40B	New	Temp.		Location of permanent well MW66B will be based on the results from this well.
IR35-MW66B	New	Perm.	Solvents	Monitor area of higher concentration near building G-553.
IR35-TW41B	New	Temp.	Solvents	Used to initially determine an area of zero contamination. Location of permanent well MW67 will be based on the analytical results from this well.
IR35-MW67B	New	Perm.	Solvents	Provides background & flow data for area of high concentration near building G-553.
IR35-TW42B	New	Temp.	Solvents	Used to initially determine an area of zero contamination. Location of permanent well MW68 will be based on the analytical results from this well.
IR35-MW68B	New	Perm.	Solvents	Provides background & flow data for area of high concentration near building G-553.
IR35-MW39B	Existing	Perm.	Solvents	Defines limits of area of high concentration near building G-553.
IR35-MW40B	Existing	Perm.	Solvents	Provides data along flow lines down gradient of high concentration area near building G-553.
IR35-MW34B	Existing	Perm.	Solvents	Provides data along flow lines down gradient of high concentration area near G-553.
IR89-MW42B	New	Perm.	Solvents	Replacement well, defines lateral boundary for area of high concentration near building G-553 and establishes boundary between Site 89 and Site 35 contamination.
Interior Plume Definition				
IR89-MW43B	Existing	Perm.	Solvents	Needed to develop accurate isopleths of electron receptors and metabolic by-products.
IR35-MW32B	Existing	Perm.	Solvents & BTEX	Needed to develop accurate isopleths of electron receptors and metabolic by-products.

TABLE 2
RATIONALE FOR GROUNDWATER SAMPLING STRATEGY, UPPER SURFICAL AQUIFER
SITE 35, CAMP GEIGER FUEL FARM
CORRECTIVE ACTION PLAN AND NATURAL ATTENUATION EVALUATION
MARINE CORP BASE, CAMP LEJEUNE, NORTH CAROLINA
CTO 323

WELL NUMBER	STATUS	WELL TYPE	PLUME CONSTITUIENTS	PURPOSE
Sentinel and Wetland Wells				
IR35-MW61A	New	Perm.	Solvents & BTEX	Sentinel well, monitors discharge to Brinson Creek.
IR35-MW62A	New	Perm.	Solvents & BTEX	Sentinel well, monitors discharge to Brinson Creek.
IR35-MW23A	Existing	Perm.	BTEX	Provides data on BTEX source area near 3rd and F Sts.and data up gradient of sentinel wells
BTEX Hot Spot Area Along F Street				
IR35-TW42B	New	Temp.	BTEX	Used to initially determine contamination in source area. Location of permanent well MW69 will be based on the analytical results from this well.
IR35-MW69A	New	Perm.	BTEX	Provides data on BTEX source area near 3rd and F Sts.
IR35-MW14A	Existing	Perm.	BTEX	Provides indication of lateral contamination for source area near 3rd and F Sts.

TABLE 3
GROUNDWATER SAMPLE SUMMARY
SITE 35, CAMP GEIGER FUEL FARM
CORRECTIVE ACTION PLAN AND NATURAL ATTENUATION EVALUATION
MARINE CORP BASE CAMP LEJEUNE, NORTH CAROLINA
CTO 323

Monitoring Well Designation	Sample Designation	VOAs, Method 8260 (HCL)	Dissolved Gas, Method RSK 175 (HCL)	Nitrate, IC Method 300.0	TOC, Walkey-Black (H_2SO_4)	TON, EPA Method 352.2/350.2 (H_2SO_4)	Nitrate/Nitrite, IC Method 300.0	Ammonia, EPA Method 350.2 (H_2SO_4)	Ortophosphate, IC Method E300.0	Duplicate Volume	Turnaround time
Sentinel and Wetland Wells											
IR35-MW61A	IR35-GW61-98C	X	X	X							28D
IR35-MW62A	IR35-GW62-98C	X	X	X							28D
IR35-MW63B	IR35-GW63IW-98C	X	X	X							28D
IR35-MW64B	IR35-GW64IW-98C	X	X	X							28D
IR35-MW65B	IR35-GW65IW-98C	X	X	X							28D
IR35-MW23A	IR35-GW23-98C	X	X	X							28D
IR35-MW47B	IR35-GW47IW-98C	X	X	X							28D
4th and E Street Hot Spot Area											
IR35-MW30B	IR35-GW30IW-98C	X	X	X						X	28D
IR35-MW09D	IR35-GW09IW-98C	X	X	X							28D
IR35-MW37B	IR35-GW37IW-98C	X	X	X	X	X	X	X	X	X	28D
Potential Source Area Near Building G-553											
IR35-TW40B	IR35-TW40B-98C	X									1 D
IR35-MW66B	IR35-GW66IW-98C	X	X	X							28D
IR35-TW41B	IR35-TW41B-98C	X									1 D
IR35-MW67B	IR35-GW67IW-98C	X	X	X	X	X	X	X	X		28D
IR35-TW42B	IR35-TW42B-98C	X									1 D
IR35-MW68B	IR35-GW68IW-98C	X	X	X	X	X	X	X	X		28D
IR35-MW39B	IR35-GW39IW-98C	X	X	X							28D
IR35-MW40B	IR35-GW40IW-98C	X	X	X							28D
IR35-MW34B	IR35-GW34IW-98C	X	X	X							28D
IR89-MW42B	IR35-GW42IW-98C	X	X	X							28D
BTEX Hot Spot Area Along F Street											
IR35-TW43A	IR35-TW43A-98C	X									1 D
IR35-MW69A	IR35-GW69-98C	X	X	X							28D
IR35-MW14A	IR35-GW14-98C	X	X	X							28D
Interior Plume Definition											
IR89-MW43B	IR35-GW43IW-98C	X	X	X							28D
IR35-MW32B	IR35-GW32IW-98C	X	X	X						X	28D
Holding Times		14D	14D	48Hrs	28D	28D	48Hrs	28D	48Hrs		

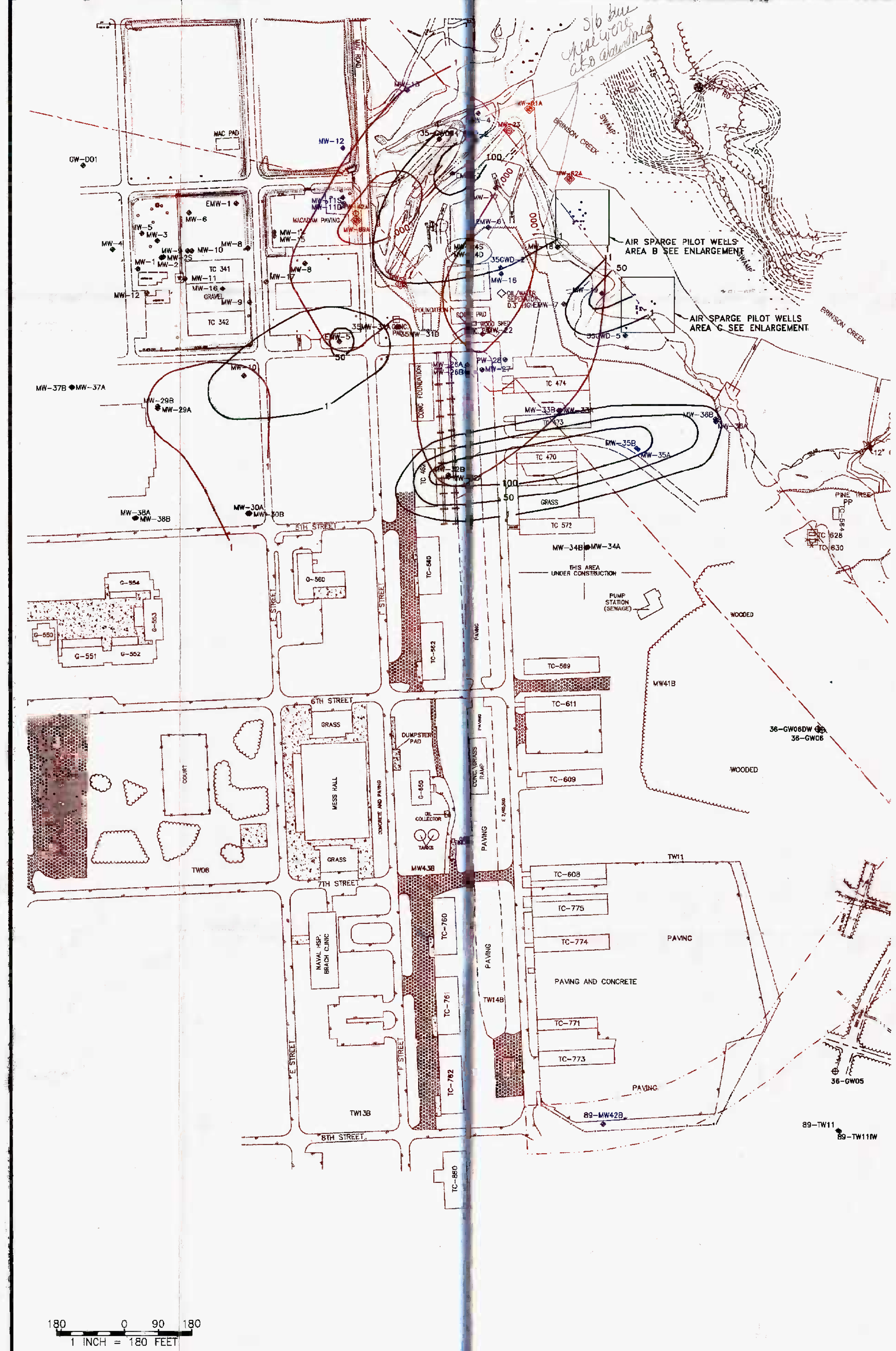
TOC = Total Organic Carbon
TON = Total Organic Nitrogen

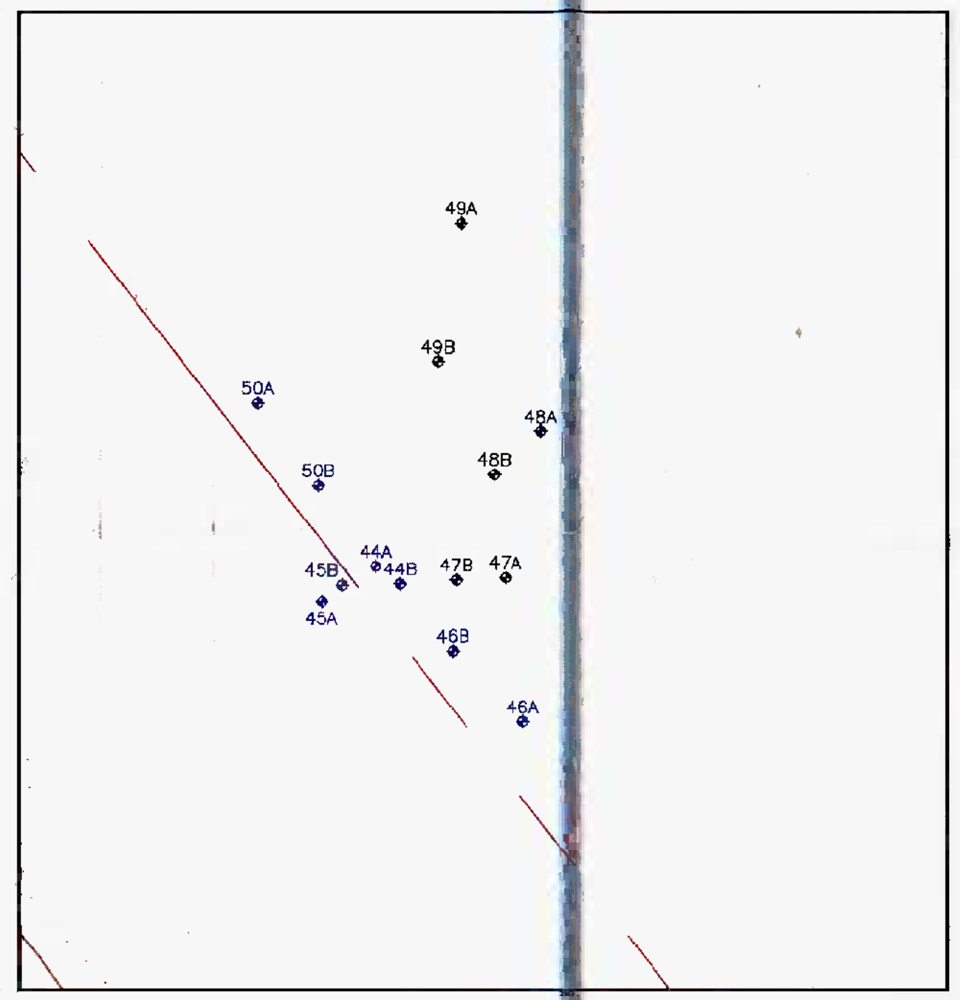
TABLE 4
SOIL SAMPLE SUMMARY
SITE 35, CAMP GEIGER FUEL FARM
CORRECTIVE ACTION PLAN AND NATURAL ATTENUATION EVALUATION
MARINE CORP BASE, CAMP LEJEUNE, NORTH CAROLINA

Soil Boring Location	Sample Designation	TOC	Turn	Comment
IR35-TW67B	IR356-TW67IW-XX	X	28D	Sample to taken from the upper portion of the surfical aquifer
IR35-TW67B	IR356-TW67IW-XX	X	28D	Sample to taken from the lower portion of the surfical aquifer
IR35-TW68B	IR356-TW68IW-XX	X	28D	Sample to taken from the upper portion of the surfical aquifer
IR35-TW68B	IR356-TW68IW-XX	X	28D	Sample to taken from the lower portion of the surfical aquifer

TOC = Total Organic Carbon
Turn = Turnaround Time
Notes:
1. Two samples will be taken from each borehole.
2. Samples collected from the upper portion of the surficial aquifer should be taken just beneath the water table.
3. Samples collected from the lower portion of the surficial aquifer should be taken just above the confining unit.

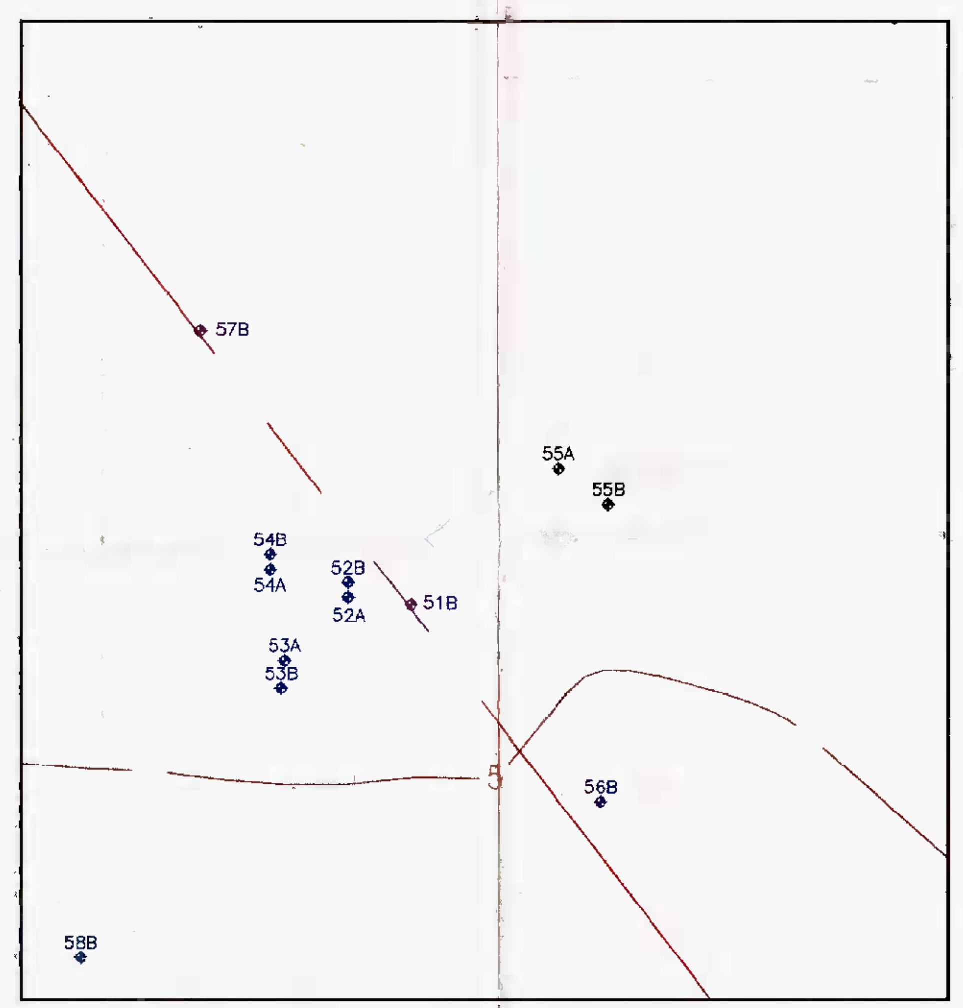
FIGURES





AIR SPARGE PILOT WELLS IN AREA B

20 0 10 20
1 INCH = 20 FEET



AIR SPARGE PILOT WELLS IN AREA C

20 0 10 20
1 INCH = 20 FEET

NOTES:

1.) MONITORING WELLS WITH AN "A" DESIGNATION AFTER THE WELL NUMBER (MW-32A)ARE SCREENED ACROSS THE WATER TABLE AND CONSIDERED SHALLOW WELLS.

2.) MONITORING WELLS WITH A "B" DESIGNATION AFTER THE WELL NUMBER (MW32B) ARE SCREENED IN THE LOWER PORTION OF THE SURFICIAL AQUIFER AND CONSIDERED INTERMEDIATE WELLS.

3.) MONITORING WELLS SHOWN WITH NO DESIGNATION AFTER THE WELL NUMBER (MW10) ARE CLUSTER WELLS WITH TWO MONITORING WELLS (SHALLOW AND AND INTERMEDIATE INSTALLED IN THE SAME BOREHOLE.) THIS DRAWING REFERS TO THE SHALLOW MONITORING WELL.

4.) MONITORING WELLS MW10A, EMW05, EMW06, MW31A, MW16A, MW18A, MW46A, AND MW38A WERE SAMPLED AND ANALYZED FOR NATURAL ATTENUATION PARAMETERS DURING THREE ROUNDS OF SAMPLING THAT OCCURRED JAN. 1998 THROUGH JUNE 1998.

LEGEND

LIMITS (1 PPM ISOPETH) OF FUEL-RELATED GROUNDWATER CONTAMINATION BASED ON DATA GATHERED DURING 1994 REMEDIAL INVESTIGATION

LIMITS (1 PPM ISOPETH) OF SOLVENT-RELATED GROUNDWATER CONTAMINATION BASED ON DATA GATHERED DURING 1994 REMEDIAL INVESTIGATION AND THE 1996 SUPPLEMENTAL GROUNDWATER INVESTIGATION

US 17 JACKSONVILLE BYPASS RIGHT-OF-WAY LIMITS

US 17 JACKSONVILLE BYPASS EASEMENT LIMITS

MW-23 — EXISTING SHALLOW MONITORING WELLS TO BE SAMPLED DURING THE NATURAL ATTENUATION EVALUATION (NAE)

MW-61A — PROPOSED PERMANENT SHALLOW MONITORING WELL LOCATIONS. THESE WELLS ARE TO BE INSTALLED DURING THE NAE. ACTUAL LOCATION WILL BE BASED ON ANALYTICAL RESULTS FROM TEMPORARY WELLS.

TW-42A — PROPOSED TEMPORARY SHALLOW MONITORING WELL LOCATIONS. THESE WELLS ARE TO BE INSTALLED DURING THE NAE.

36-GW14 — SHALLOW MONITORING WELL

MW-31A — EXISTING SHALLOW MONITORING WELLS (SCREENED IN THE UPPER PORTION OF THE SURFICIAL AQUIFER)

MW-31B — EXISTING INTERMEDIATE MONITORING WELLS (SCREENED IN THE LOWER PORTION OF THE SURFICIAL AQUIFER)

GWD-5 — EXISTING DEEP MONITORING WELLS (SCREENED IN THE UPPER PORTION OF THE CASTLE HAYNE AQUIFER)

36-GW06DW — DEEP MONITORING WELL

EMW-6 — EXISTING MONITORING WELLS ABANDONED DURING CONSTRUCTION OF US HIGHWAY 17 BYPASS

REVISIONS			NORTH	
	DRAWN	GLB/WJH		
	REVIEWED	MDS		
	S.O.#	62470-323-0000-07000		
	CADD#	323600WP		

SITE 35, CAMP GEIGER FUEL FARM, NAE
MARINE CORPS BASE CAMP LEJEUNE
CAMP LEJEUNE, NORTH CAROLINA

BAKER ENVIRONMENTAL, Inc.
Coraopolis, Pennsylvania

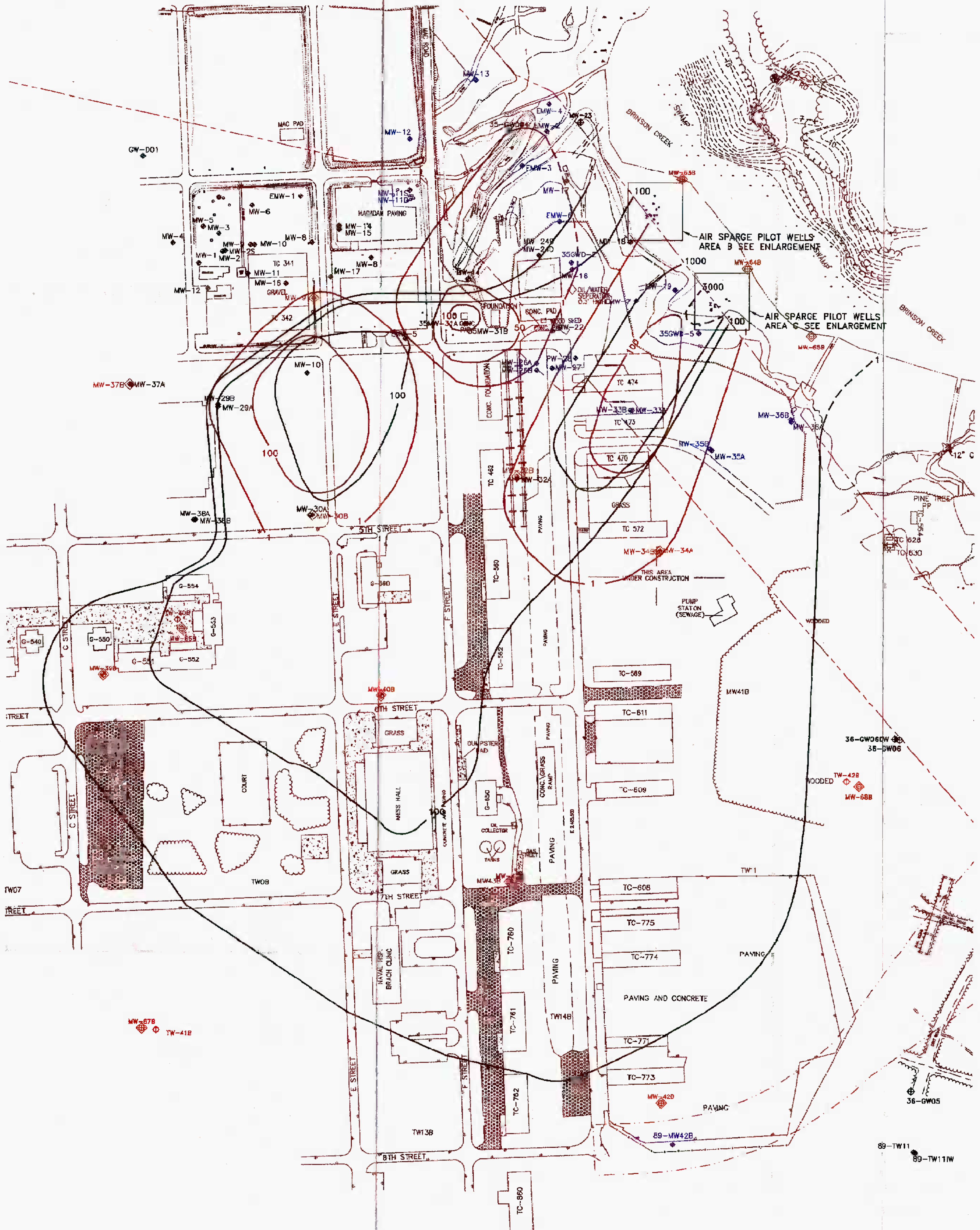
Baker

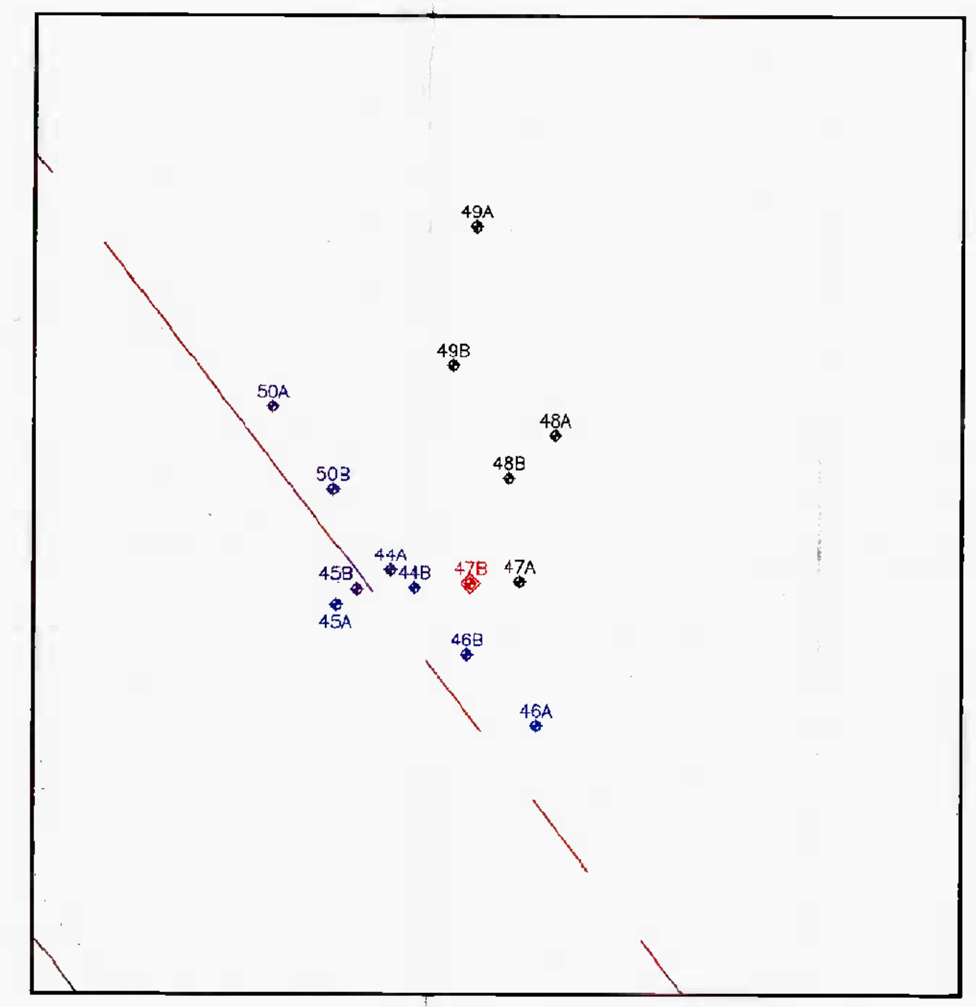
PROPOSED SAMPLING LOCATIONS
IN THE UPPER PORTION OF
THE SURFICIAL AQUIFER
CONTRACT TASK ORDER – 0323

SCALE: AS SHOWN | DATE: AUGUST 1998

SHEET NO. 1 OF 2

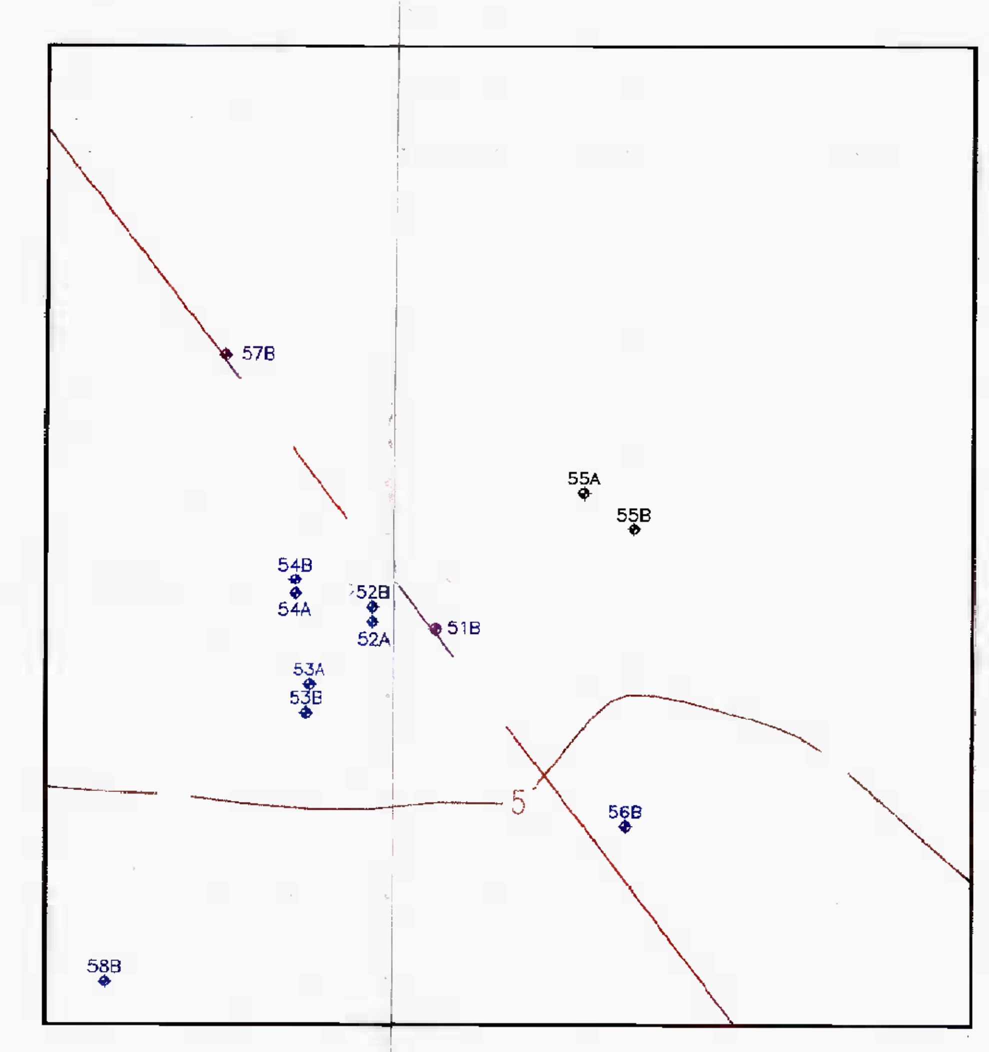
00213BBB1X





AIR SPARGE PILOT WELLS IN AREA B

20 0 10 20
1 INCH = 20 FEET



AIR SPARGE PILOT WELLS IN AREA C

20 0 10 20
1 INCH = 20 FEET

NOTES:

1.) MONITORING WELLS WITH AN "A" DESIGNATION AFTER THE WELL NUMBER (MW-32A)ARE SCREENED ACROSS THE WATER TABLE AND CONSIDERED SHALLOW WELLS.

2.) MONITORING WELLS WITH A "B" DESIGNATION AFTER THE WELL NUMBER (MW32B) ARE SCREENED IN THE LOWER PORTION OF THE SURFICIAL AQUIFER AND CONSIDERED INTERMEDIATE WELLS.

3.) MONITORING WELLS SHOWN WITH NO DESIGNATION AFTER THE WELL NUMBER (MW10) ARE CLUSTER WELLS WITH TWO MONITORING WELLS (SHALLOW AND AND INTERMEDIATE INSTALLED IN THE SAME BOREHOLE.) THIS DRAWING REFERS TO THE SHALLOW MONITORING WELL.

4.) MONITORING WELLS MW10A, EMW05, EMW06, MW31A, MW16A, MW18A, MW46A, AND MW38A WERE SAMPLED AND ANALYZED FOR NATURAL ATTENUATION PARAMETERS DURING THREE ROUNDS OF SAMPLING THAT OCCURRED JAN. 1998 THROUGH JUNE 1998.

LEGEND

Symbol	Description
(red line)	LIMITS (1 PPM ISOPETH) OF FUEL-RELATED GROUNDWATER CONTAMINATION BASED ON DATA GATHERED DURING 1994 REMEDIAL INVESTIGATION
(black line)	LIMITS (1 PPM ISOPETH) OF SOLVENT-RELATED GROUNDWATER CONTAMINATION BASED ON DATA GATHERED DURING 1994 REMEDIAL INVESTIGATION AND THE 1996 SUPPLEMENTAL GROUNDWATER INVESTIGATION
(yellow)	US 17 JACKSONVILLE BYPASS RIGHT-OF-WAY LIMITS
(yellow)	US 17 JACKSONVILLE BYPASS EASEMENT LIMITS
MW-61A	EXISTING INTERMEDIATE MONITORING WELLS TO BE SAMPLED DURING THE NATURAL ATTENUATION EVALUATION (NAE)
MW-64B	PROPOSED INTERMEDIATE SHALLOW MONITORING WELL LOCATIONS. THESE WELLS ARE TO BE INSTALLED DURING THE NAE.
TW-41B	PROPOSED TEMPORARY INTERMEDIATE MONITORING WELL LOCATIONS. THESE WELLS ARE TO BE INSTALLED DURING THE NAE.
36-GW14	SHALLOW MONITORING WELL
MW-31A	EXISTING SHALLOW MONITORING WELLS (SCREENED IN THE UPPER PORTION OF THE SURFICIAL AQUIFER)
MW-31B	EXISTING INTERMEDIATE MONITORING WELLS (SCREENED IN THE LOWER PORTION OF THE SURFICIAL AQUIFER)
GWD-5	EXISTING DEEP MONITORING WELLS (SCREENED IN THE UPPER PORTION OF THE CASTLE HAYNE AQUIFER)
36-GW06DW	DEEP MONITORING WELL
EMW-6	EXISTING MONITORING WELLS ABANDONED DURING CONSTRUCTION OF US HIGHWAY 17 BYPASS

REVISIONS			NORTH
	DRAWN	GLB/WJH	
	REVIEWED	MDS	
	S.O.#	62470-323-0000-07000	
	CADD#	323601WP	

SITE 35, CAMP GEIGER FUEL FARM, NAE
MARINE CORPS BASE CAMP LEJEUNE
CAMP LEJEUNE, NORTH CAROLINA

BAKER ENVIRONMENTAL,Inc.
Coraopolis, Pennsylvania

Baker

PROPOSED SAMPLING LOCATIONS IN THE LOWER PORTION OF THE SURFICIAL AQUIFER CONTRACT TASK ORDER - 0323

SCALE AS SHOWN

DATE AUGUST 1998

SHEET NO. 2 OF 2