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SEP 13 1999

CORRECTIVE ACTION PLAN

FOR

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
FORMER ASPHALTIC MATERIALS TESTING LABORATORY SITES
SITE # 6-48 (LEE PAVING)
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

Prepared For:

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September 7, 1999

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT JR.
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

DAVID MCCOY
SECRETARY

42260-99-6-577N

September 9, 1999

Jay Zimmerman
NCDENR
Division of Water Quality - Groundwater Section
3800 Barrett Drive, Suite 101
Raleigh, NC 27609

Subject: Corrective Action Plan
Asphaltic Materials Testing Laboratory
Priority Site # 6-48
Property: Lee Paving Property,
Pittsboro, Chatham Co., NC

Dear Mr. Zimmerman,

In 1989, the North Carolina Department of Transportation (NCDOT) began an assessment of asphaltic materials testing laboratory sites within the state. Due to the extent of time and cost for the NCDOT and the North Carolina Department of Environment and Natural Resources (NCDENR) to undertake such an assignment, the 1996 General Assembly provided limited funding for assessment of seventy-two sites located within the state. As you are aware a comprehensive site assessment report for the subject site has already been completed, submitted and reviewed by your office. The purpose of this letter is to submit a corrective action plan (CAP) under 15A NCAC 2L.0106(l).

Pursuant to Memorandum of Agreements (4/1/96, 7/1/96, 2/3/99 and the 1989 MOA) signed between NCDOT and NCDENR, the subject site was assessed and analyzed by agreed upon methods for these contaminants only: Carbon Tetrachloride, Trichloroethene, 1-1-1 Trichloroethane and their degradation compounds ("the target chlorinated solvents"). NCDENR has agreed to respond in writing within 90 days upon receipt of the CAP report.

PHONE (919) 733-2520 FAX (919) 733-9150

Due to the volume, complex nature and time frames of the completed site assessments across the state, additional testing was conducted during the subject site CAP development to accurately reflect present site conditions. Should you have questions or comments regarding the enclosed CAP, I may be reached at 336/334-4273.

Sincerely,

Thomas C. N

Thomas C. Niver, P.G., CHMM
Environmental Engineer, Safety & Loss Control

enclosure

cc: Duane MacEntee, NCDOT
Ted Bush, NCDENR
Fred Lamar, Attorney General's Office, Transportation
Mark Stewart, Lee Paving Company

DIVISION OF ENVIRONMENTAL MANAGEMENT

Certification for the Submittal of a Corrective Action Plan Under 15A NCAC 2L .0106(l)

Responsible Party: North Carolina Department of Transportation
Address: c/o Thomas C. Niver 801 Summit Avenue, Suite 2
City: Greensboro **State:** NC **Zip Code:** 27405

Site Name: NCDOT Asphalt Priority Site #6-48 (Lee Paving)
Address: S.R. 1714 (Sugar Lake Road)
City: Pittsboro **County:** Chatham **Zip Code:** 27312

Groundwater Section Incident Number: ______________

I, Ernest F. Parker, Jr., a Professional Engineer/Licensed Geologist (circle one) for S&ME, Inc. (firm or company of employment), do hereby certify that the information indicated below is enclosed as part of the required Corrective Action Plan (CAP) and that to the best of my knowledge the data, site assessments, engineering plans and other associated materials are correct and accurate.

SEP 13

(Each item must be initialed by hand by the certifying licensed professional).

1. EP A listing of the names and addresses of those individuals required to be notified to meet the notification requirements of 15A NCAC 2L .0114 (b) are enclosed. Copies of letters and certified mail receipts are also enclosed. A copy of the newspaper notice and the title of the newspaper(s) where it was published must be included, if applicable. CERTIFIED MAIL RECEIPTS WILL BE SUPPLIED AS RETURNED BY USPS.
2. EP A Professional Engineer or Licensed Geologist has prepared, reviewed, and certified all applicable parts of the CAP in accordance with 15A NCAC 2L .0103(e).
3. EP A site assessment is attached or on file with the appropriate Regional Office which provides the information required by 15A NCAC 2L .0106(g).
4. EP A description of the proposed corrective action and supporting justification is enclosed.
5. EP A schedule for the implementation of the CAP is enclosed.
6. EP A monitoring plan is enclosed which has the capacity to evaluate the effectiveness of the remedial activity and the movement of the contaminant plume, and which meets the requirements of 15A NCAC 2L .0110 and .0106(l).
7. EP The activity which resulted in the contamination incident is not permitted by the State as defined in 15A NCAC 2L .0106(e).

(OVER)

In addition, the undersigned also certifies that to the best of my knowledge and professional judgement and in accordance with the requirements of 15A NCAC 2L .0106(l), the following determinations have been made and are documented in the CAP:

8. ____ all IDENTIFIED sources of contamination and free product have been removed or controlled in accordance with 15A NCAC .0106(f) and (l). (See guidance document).

9. ____ the contaminants have the capacity to degrade and attenuate under the site-specific conditions.

10. ____ the time and direction of contaminant travel can be predicted with reasonable certainty.

11. ____ the migration of the contaminant will not result in any violation of the standards specified in 15A NCAC 2L .0202 at any existing or foreseeable receptor.

12. ____ the contaminants have not and will not migrate onto adjacent properties, or adjacent properties are served by public water supplies which cannot be influenced by contaminants migrating off-site, or adjacent landowners have consented in writing to a request allowing the contaminant upon their property. NCDOT IS IN NEGOTIATIONS WITH PROPERTY OWNER

13. ____ groundwater discharge of the contaminant plume to surface waters will not result in a violation of 15A NCAC 2B .0200. AT SELECTED MONITORING LOCATIONS

14. ____ the area of the contaminant plume has not been identified by a state or local government use planning process for resource development.

15. ____ all necessary access agreements needed to monitor groundwater quality have been or can be obtained. NCDOT IS IN NEGOTIATIONS WITH PROPERTY OWNER

(Please Affix Seal and Signature)

NOTE: Any modifications made to this form may result in the return of your submittal.

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EXECUTIVE SUMMARY

In 1989, the North Carolina Department of Transportation (NCDOT) began an assessment of asphaltic materials testing laboratory sites within the state. Pursuant to Memorandum of Agreements (MOAs) (January 1989, April 1, 1996, and July 1, 1996) signed by NCDOT and the North Carolina Department of Environment, Health and Natural Resources (NCDENR), 72 asphalt laboratory sites were assessed for the following contaminants only: carbon tetrachloride, trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and their degradation compounds. The assessments of these sites and NCDENR review were completed in 1997. Based on the findings of site assessments, NCDOT identified and recommended rankings for asphalt plant sites that may require environmental remediation. These rankings were subsequently approved by NCDENR. In 1998, NCDOT proceeded with the Corrective Action Plan (CAP) phase at 7 sites with the highest recommended priority.

On behalf of NCDOT, S&ME, Inc. (S&ME) is submitting this CAP to propose remedial actions for the chlorinated hydrocarbon contamination at the NCDOT asphalt laboratory site #6-48 (Lee Paving) located east of Pittsboro in Chatham County, North Carolina. The target contaminants identified at the subject site are TCE, 1,1,1-TCA, and their degradation products including cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethene (1,1-DCE), and 1,1-dichloroethane (1,1-DCA).

The subject site is the current location of a Lee Paving Company's asphalt production facility. An asphaltic materials testing laboratory located on the site was utilized by NCDOT. In 1989, 1,1,1-TCA and TCE were detected in the on-site supply well by NCDOT engineers. A Comprehensive Site Assessment (CSA) report for the chlorinated hydrocarbon contamination, prepared by Geraghty & Miller, Inc. (G&M), was submitted to NCDENR in June, 1997. In addition, a site-specific water-supply well survey report prepared by G&M was submitted to NCDENR on June 15, 1998. S&ME was authorized by NCDOT in September 1998 to commence the data collection for the development of this CAP.

Based on the data collected during CSA and CAP assessments, site conditions pertinent to the development of the CAP for the subject site are summarized:

- Results of soil assessments did not indicate areas representing a continuing source of target contaminants for groundwater contamination.

- The target groundwater plume appears to have two components: a saprolite component and a bedrock component. The vertical plume extent is currently defined. Hydraulic boundaries for the groundwater system present at the subject site have been identified.

- With the exception of the on-site supply well, groundwater samples collected from several selected water supply wells located within a 1,500-foot radius of the impacted area did not contain detectable concentrations of target contaminants.

- Degradation products of 1,1,1-TCA and TCE have been detected in groundwater. Results of surface water sampling suggest the presence of adequate overall attenuation capacity.

Natural attenuation is evaluated for its feasibility and effectiveness as a remedial alternative for the subject site. Site-specific hydrogeologic data are used to evaluate contaminant transport and potential impact. Based on the results of this evaluation, the target plume at the subject site is not anticipated to result in adverse impact on the currently identified potential receptors. The proposed remediation by natural attenuation is expected to be an effective remedial option for the subject site. A monitoring plan for the proposed corrective action plan has been designed to provide information validating that the proposed plan is protective of the public and the environment.

1.0 INTRODUCTION

1.1 PURPOSE OF CORRECTIVE ACTION PLAN

In 1989, the North Carolina Department of Transportation (NCDOT) began an assessment of asphaltic materials testing laboratory sites within the state. The 1996 General Assembly provided limited funding for the assessment of 72 sites. Pursuant to Memorandum of Agreements (MOAs) (January 1989, April 1, 1996, and July 1, 1996) signed by NCDOT and the North Carolina Department of Environment, Health and Natural Resources (NCDENR), the 72 asphalt laboratory sites were assessed for the following contaminants only: carbon tetrachloride, trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA), and their degradation compounds including chloroform, methylene chloride, methyl chloride, cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-dichloroethene (trans-1,2-DCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), vinyl chloride, and chloroethane (Appendix I). The assessments of these sites and NCDENR's review were completed in 1997 in accordance with the mandate by Joint Legislative Transportation Oversight Committee.

Based on the findings of the site assessments, NCDOT identified and recommended rankings for asphalt plant sites that may require environmental remediation. These rankings were subsequently approved by NCDENR. In 1998, NCDOT proceeded with the Corrective Action Plan (CAP) phase at 7 sites with the highest recommended priority. In a meeting on October 22, 1998, an agreement was reached between NCDOT and NCDENR on the scope of work for the CAP field work effort and administrative options for the preparation of CAPs at the subject asphalt plant sites. A copy of the letter of agreement is also included in Appendix I.

On behalf of NCDOT, S&ME, Inc. (S&ME) is submitting this CAP to address the remediation of chlorinated hydrocarbon contamination at the NCDOT asphalt priority site #6-48 (Lee Paving) located east of Pittsboro in Chatham County, North Carolina (Figure 1-1). The target contaminants at the subject site are carbon tetrachloride, TCE, 1,1,1-TCA, and their degradation products as listed above. This CAP has been prepared in accordance with 15A NCAC 2L Section .0106, the *Groundwater Section Guidelines for the Investigation and Remediation of Soil and Groundwater, Volume I* (NCDENR, Division of Water Quality, Groundwater Section, May 1998), and the October 22, 1998 agreement between NCDOT and NCDENR.

1.2 SUMMARY OF PREVIOUS INVESTIGATIONS / REPORTS

The subject site is the current location of a Lee Paving Company's asphalt production facility located in Chatham County, North Carolina. According to the CSA report and NCDOT personnel, an asphaltic materials testing laboratory was located on the site and was utilized by NCDOT. One or more of the following chlorinated solvents including carbon tetrachloride, TCE and 1,1,1-TCA were utilized in the laboratory. A preliminary site survey conducted by NCDOT in 1989 reported the detection of 1,1,1-TCA and TCE in the on-site supply well at 318 μg/L and 617 μg/L, respectively (Appendix II). Carbon tetrachloride was also detected at 3.19 μg/kg in a soil sample. A Comprehensive Site Assessment (CSA) report for the chlorinated hydrocarbon contamination, prepared for NCDOT by Geraghty & Miller, Inc. (G&M), was submitted to NCDENR in June 1997 (G&M CSA Report). In addition, a site-specific water-supply well survey report was prepared by G&M and submitted to NCDENR on June 15, 1998 (G&M Well Survey Report). To collect groundwater quality data for the preparation of this CAP, S&ME conducted groundwater sampling of the existing monitor wells on September 28 and 29, 1998. All tables and figures provided in the CSA report are also included in Appendix II. This section summarizes findings of these assessment activities at the subject site.

1.2.1 Site Description

The subject site is located off S.R. 1714 (Sugar Lake Road) in Chatham County, North Carolina (Figure 1-1). The asphalt plant is bordered by undeveloped land to the east and south with rural residential areas to the north and west. Nearby surface water bodies include an abandoned rock quarry located approximately 700 feet to the south and a south-flowing creek located approximately 500 feet to the east. The Haw River is located approximately 1.5 miles southwest of the site. The site topography is generally sloping gently to the south with a relatively steep slope descending to the creek near the eastern property boundary.

Two asphalt testing laboratories were identified at the site (Figure 1-2). The former NCDOT testing laboratory has been demolished and, as stated in the CSA report, the current laboratory is no longer used by NCDOT. The on-site supply well is located approximately 250 feet southeast of the current laboratory. Bottled water is currently supplied to the facility for drinking.

Approximate locations of the septic tank and drain field associated with the former asphalt testing laboratory are also presented in Figure 1-2.

1.2.2 Site Geology and Hydrogeology

The regional geology and site geology have been characterized in the CSA report and are summarized in this section. The subject site is located within the Piedmont Physiographic and Geologic Province of North Carolina. The Piedmont Province consists of several northeast-trending geologic belts. Based on the Geologic Map of North Carolina (North Carolina Geological Survey, 1985), the site is located in the Carolina Slate Belt. The regional geology is characterized by unconsolidated to consolidated sediments overlying the bedrock consisting of volcanic and sedimentary rocks that are metamorphosed to lower greenschist facies (Butler and Secor, 1991).

The CSA report characterized the site geology based on the boring logs derived from the monitor well monitor installation. The locations of the cross-sections and the geologic cross-sections, prepared by Geraghty & Miller for the CSA, are also included in this report (Figures 1-3 to 1-6). The subsurface material at the subject site is clayey silt overlying the bedrock. The boring logs of two deep monitor wells indicated that the top of bedrock was encountered between 26 feet below ground surface (bgs) at DW-2 to 42 feet bgs at DW-1. Further discussion of site-specific geology will be presented in Section 2.2 with additional geologic data collected during the development of this CAP.

Groundwater in this region may exist in two units: an overburden unit overlying the bedrock and a fractured bedrock unit. The CSA report indicates that groundwater in both saprolite aquifer and bedrock aquifer flows towards south and southeast. The hydraulic conductivity for the saprolite aquifer was estimated in the CSA with slug tests results of MW-4 and MW-5. The average hydraulic conductivity was reported to be 2.39×10^{-3} cm/sec or 6.76 ft/day. This estimated hydraulic conductivity seems to be higher than what is expected for the clayey silt formation described in the CSA. Based on the water level observed on April 29, 1997, the hydraulic gradient in the saprolite aquifer was reported in the CSA to be 0.061 ft/ft. Using an assumed effective porosity of 0.4 for clayey silt, the average linear groundwater flow velocity in the saprolite can be calculated as 3.64×10^{-4} cm/sec or 1.03 ft/day. A conceptual hydrogeologic model for the subject site is presented in Section 2.5 with additional information collected in the development of this CAP.

1.2.3 Extent of Contamination

All tables and figures provided in the CSA report are included in Appendix II. Findings of soil and groundwater assessment activities conducted by G&M in CSA and by S&ME in the 1998 groundwater sampling event are summarized in this section. Soil samples were collected during CSA from areas adjacent to each wall of the current laboratory building and in the vicinity of the former laboratory. A total of 18 soil samples were collected from 11 locations in the CSA soil assessment. Among 11 sampling locations, only samples collected from one location between the truck scale and the current laboratory building contained detectable concentrations of four target chlorinated compounds including 1,1,1-TCA, TCE, 1,1-DCA, and chloroform (Table 1).

The CSA report determined the action levels for the detected target compounds using an Organic Leachate Model provided in the 1993 "*Groundwater Section Guidelines*". Based on this approach, the CSA report stated that the detected target contaminant concentrations in the soil assessment were below the calculated action levels. The 1998 "*Groundwater Section Guidelines*", however, provides a list of maximum soil contaminant concentrations (Table 4 in the guidelines) and a soil-to-groundwater transport model for calculation of maximum soil contaminant concentrations (Figure 4 in the guidelines). The maximum soil contaminant concentration for 1,1-DCA provided in the 1998 guidelines is 4 mg/kg (soil-to-groundwater) and 1,560 mg/kg (residential). The maximum soil contaminant concentration for 1,1,1-TCA, TCE, and chloroform can be calculated using the following soil-to-groundwater transport model provided in the 1998 guidelines:

$$C_{soil} = C_{gw} [k_s + (\theta_w + \theta_a H')/P_b] df$$

where C_{soil} : maximum soil contaminant concentration

C_{gw} : applicable groundwater target concentration (per 2L Standards)

k_s : soil-water partition coefficient = $k_{oc}f_{oc}$

k_{oc} : soil organic carbon-water partition coefficient

f_{oc} : fraction of organic carbon in subsurface vadose soil (0.1% per guidelines)

θ_w : water-filled soil porosity – vadose soil (0.3 L_{water}/L_{soil} per guidelines)

θ_a : air-filled soil porosity – vadose soil (0.13 L_{air}/L_{soil} per guidelines)

P_b : dry bulk density (1.5 kg/L per guidelines)

H' : Henry's Law constant

df : dilution factor (20 per guidelines)

As indicated in Table 1, the concentrations of target contaminants detected in the CSA soil assessment are below the calculated soil-to-groundwater maximum contaminant concentrations with the exception of chloroform. Chloroform is a degradation product of carbon tetrachloride, one of the three target chlorinated solvents at all NCDOT asphalt priority sites. Carbon tetrachloride and its degradation products, including chloroform, have not been detected in any soil samples collected from any other locations. Therefore, chloroform detected in the CSA soil assessment may have a source other than the NCDOT asphalt testing activity which is the focus of this CAP. In addition, carbon tetrachloride, chloroform and other degradation products of carbon tetrachloride have not been detected in groundwater in any previous groundwater assessment event (Table 2) indicating a lack of correlation between the presence of chloroform in one soil sampling location and the groundwater quality at the subject site. As concluded in the CSA report, soil at the subject sites is not expected to represent a continuing source of target contaminants for groundwater contamination.

The CSA groundwater assessment revealed that groundwater at the site has been impacted with 1,1,1-TCA, TCE, and their degradation products including cis-1,2-DCE, 1,1-DCE, and 1,1-DCA (Figure 1-7). The most recent sampling event in which all existing monitor wells are sampled is the September 1998 event, conducted by S&ME as part of the CAP preparation (Figure 1-8). As indicated in the summary of groundwater quality data presented in Table 2, three target contaminants including 1,1,1-TCA, TCE, and 1,1-DCE have been detected at levels exceeding the 15A NCAC 2L Groundwater Quality Standards. With the exception of MW-3 and MW-4, the majority of target contaminant plume appears to exist in areas east to southeast of the former laboratory. This distribution pattern is consistent with the southeast groundwater flow direction indicated in the CSA report. Supported by the non-detectable contaminant concentrations in monitor wells MW-7, MW-8, and MW-9, southwest migration of contaminants beyond MW-3 and MW-4 is not anticipated since it is against groundwater flow direction. The on-site supply well and a deep monitor well DW-2 have both been found contaminated with target contaminants at concentrations in excess of 2L Groundwater Quality Standards. This is indicative that contaminated groundwater has migrated into the bedrock aquifer. Section 2.5 will present a conceptual hydrogeologic model to further discuss the potential contaminant transport at the subject site.

2.0 DATA COLLECTION FOR CORRECTIVE ACTION PLAN

Based on the findings of previous site assessments, S&ME first identified the data needs for the development of a CAP for the subject site. Data were collected to complete the assessment of site conditions and provide a conceptual model for the evaluation of remedial alternatives. This section describes the collection of additional data and the evaluation of site conditions.

2.1 LIMITED SOIL ASSESSMENT

S&ME conducted a limited soil assessment of the septic tank drain field associated with the former laboratory. The objective of this soil assessment was to verify that the septic system does not represent a continuing source of target chlorinated compounds. S&ME personnel located the septic tank and the associated drain field based on the sketch obtained from the Chatham County Health Department (Appendix III). The sketch indicates that the septic drain field for both former laboratory and current laboratory is located in the area between the current laboratory and the monitor well MW-8 (Figure 2-1). Five soil samples were collected from this area using hand augers. Three of these samples were collected from approximately 2 feet directly beneath a drain line, while the other two samples were collected approximately 5 feet away from the drain line at the depth of 4 feet. Only one soil sample (HA-4) contained detectable target contaminants including TCE (0.016 mg/kg) and 1,1-DCA (0.004 mg/kg). Both concentrations are below the calculated action levels for soil contaminant at 0.019 mg/kg for TCE and 4 mg/kg for 1,1-DCA (Table 1). Results of this limited soil assessment suggest that soil at the septic drain field associated with the former laboratory does not represent a continuing source of target contaminant for further groundwater contamination.

2.2 EVALUATION OF BEDROCK GEOLOGY

As discussed in Section 1.2, results of previous groundwater assessments indicate that contaminated groundwater has migrated into the bedrock. To better understand the complex bedrock geology at the subject site, S&ME mapped the fracture system at outcrops found in the creek east of the site and in the quarry south of the site. Down-hole video logging was then conducted at the on-site supply well and two deep wells, DW-1 and DW-2. The relative elevations of the nearby creek and quarry were also determined to help integrate these geologic data.

2.2.1 Fracture Mapping

S&ME mapped bedrock fractures found on one rock outcrop in the creek and, primarily, at the walls of the quarry. Figures 2-2 and 2-3 are photographs of the quarry walls. Figure 2-2 shows the north face of the quarry. Fractures in the photograph are highlighted in blue lines. The reflection in the water surface shows the fractures as they appear unmarked. This photograph shows that there are a number of fairly vertical fractures along with a lesser number of sub-horizontal fractures. The horizontal fractures appear to occur within the transition zone between saprolite and bedrock. Figure 2-2 also shows the variability of fracture density within bedrock. Vertical fracture spacing ranges from approximately 5 to 6 feet along the right side of the photograph to approximately 6 inches in the highly fractured zone just to the left of center. Some seepage is evident from the darker areas of the rock face above the water surface.

Figure 2-3 shows the northwest corner of the quarry. Several east-west vertical fractures are visible along with a nearly horizontal fracture located approximately 1/3 of the way from the ground surface to the water surface. The horizontal fracture appears to wrap around to the north face of the quarry.

The orientation of over 50 fractures was measured. Four distinct sets of fractures were observed: (1) a set of north-striking vertical fractures, (2) a set of east-striking vertical fractures, (3) a set of northeast-striking vertical fractures and (4) a set of sub-horizontal fractures dipping at approximately 20 degrees from horizontal.

Fracture orientation can be best observed when the data are plotted on stereo net projections. Figure 2-4 shows the fracture orientation plotted on a lower equal-area hemisphere projection. Curved lines represent the great circles formed by the intersection of the fracture surface with the lower hemisphere. The closer the great circles are to the center of the circle the steeper the orientation of the fracture. The closer the great circle to the outside edge of the hemisphere the more horizontal the fracture orientation. Figure 2-5 shows the intersection of poles of the fracture orientation shown in Figure 2-4. A pole is a perpendicular extension to the fracture surface.

Thus, poles plotted near the outer circle indicate nearly vertical fractures. Poles falling near the center of the circle indicate nearly horizontal fractures. The distribution of fractures can be inferred by examining the density of poles. The number of poles falling within a group of poles for the site area has been denoted with shading. Results of fracture mapping presented in Figure 2-5 indicate that most of the fractures at the site are nearly vertical and striking in the approximate north-south direction.

2.2.2 Video Logging

Video logging was initially performed at three deep open-rock wells. Deep monitor well DMW-1 is a bedrock well that has shown no impact in previous groundwater sampling events, while the on-site supply well and DMW-2 are bedrock wells that have been impacted with target contaminants. Coupled with the relative elevations of the creek and the quarry, observations of video logging are incorporated into the cross-section map presented in Figure 2-6. Well construction details for all monitor wells at the subject site are presented in Table 3.

- **DMW-1**

The water level in DMW-1 was measured at 25.8 feet below the top of casing (TOC) on February 8, 1999. The video log of DMW-1 showed the bottom of the casing to be 61.3 feet from TOC. The total well depth is 98.7 feet. The video log showed no major fractures to be visible in the walls of the borehole. The camera was retrieved and a 2-inch Rediflo® pump was lowered to the bottom of the well. The well was pumped until all of the water had been removed to the pump inlet. The pumping rate ranged between 2.4 to 3.6 gallon per minute (gpm). The well was again video logged and no water-bearing fractures were observed. There was no water inflow or dripping water observed. No change in the water level was noted in the adjacent well MW-2 during the pumping of DMW-1.

Additional testing of this well is not recommended with the results of video logging. The well only serves to demonstrate that the bedrock in certain areas of the site appears to be unfractured or that the fractures have been filled and are nonconductive. The lack of apparent recharge supports the observation of very slow water level recovery in this well previously reported in the CSA.

- **On-site supply well**

In the supply well, the video log showed that the depth to water in the well was 31.9 feet from TOC. The bottom of the casing was 35.3 feet below TOC. A fracture was noted at approximately 59 feet and the top of the pump was encountered at 78 feet. The bottom of the well was noted at 84.3 feet with some sediment resting on the well bottom.

The pump discharge was disconnected from the pressure tank and attached to a straight run of poly pipe with an attached water meter. The pump was started and the drop of water level was observed with the video camera. When the water level dropped below the bottom of the casing, a large inflow of water was noted issuing into the well from behind the well casing. Based on the relative elevations, this point appears to be between the reported top of bedrock at DMW-1 and DMW-2 (Figure 2-6). Pumping was continued for approximately 1 hour. Water level in the well continued to drop, finally dropping below 57 feet. A strong inflow of water was noted at 57.5 feet where a vertical joint was observed. Pumping was discontinued at this point. The pumping rate during the test was approximately 15.3 gpm. Additional flow was suspected in a second fracture located at approximately 74 feet. A very small inflow of water was also suspected at the bottom of the well.

Water levels in a nearby well MW-1were monitored during the test and dropped from 31.43 feet below TOC at the beginning of the test to 33.18 feet at the termination of pumping.

Three water-bearing zones were identified in this well: a zone near the bottom of the well casing at 35.3 feet, a zone at approximately 57.5 feet, and a zone at approximately 74 feet. There may be a minor recharge at the bottom of the well.

- **DMW-2**

DMW-2 is a deep well located in the southeast corner of the site that has shown impact of target contaminants in previous groundwater assessments. The video log showed the depth to water at 29.5 feet and the bottom of the casing extended to 42.2 feet. The total well depth is 66 feet. The well was dewatered using a Rediflo® pump operated at a pumping rate of approximately 3.6 to 2.7 gpm. Only one water inflow was observed in a fracture identified at 61.3 feet. Inflow was estimated at 0.4 gpm by timing the rate of water level recovery in the well after the pump was turned off. Water level in a nearby well, MW-11, was measured during the test and was found to be unchanged during the pumping of DMW-2.

This well intercepts one hydraulically conductive fracture near the bottom of the well at approximately 61.3 feet. The yield of this well is very low and again shows the variability of bedrock conditions when compared to the supply well.

In summary, results of video logging at three bedrock wells suggest that, at least in the east-west direction, the extent of fracturing in the bedrock is highly variable. The video logs also support the observation of predominant north-striking vertical fractures demonstrated in the fracture mapping. The large flow observed at the bottom of the casing in the supply well suggests that saprolite-bedrock interface may serve as a major contaminant transport pathway.

2.3 EVALUATION OF VERTICAL PLUME EXTENT

2.3.1 Additional Monitor Well

A Type III bedrock well (DMW-3) was installed to further characterize the target plume in the bedrock aquifer. DMW-3 was installed approximately 150 feet south of the on-site supply well (Figure 1-2). The location and the depth of this well were selected in an attempt to intercept the north-striking fractures expected to orient between the supply well and the quarry. The well construction record is provided in Appendix III.

A 10-inch borehole was advanced to 31 feet below ground surface (bgs) with the top of the bedrock was first encountered at 30.7 feet bgs. The soils above the bedrock are silty clay ranging from ground surface to 15 feet bgs, followed by clayey silt between 15 feet to 25 feet bgs and sandy silt from 25 feet bgs to the top of the bedrock. An 8-inch PVC surface casing was set to 31 feet bgs and the annular space was grouted to the surface. A 6-inch borehole was then advanced to the well terminal depth of 125 feet bgs.

The borehole was video logged to identify fractures intercepted at this location. The depth to water was observed to be 27.9 feet below TOC. The bedrock formation appears to be metamorphosed andesitic to granitic rock. Discrete fractures were identified at 32.4 feet, 72.9 feet and 93.6 feet bgs. Another fracture was suspected between 115 feet to 125 feet bgs. The fracture orientation was identified as in a north-south direction. The relative depths of these fractures are presented in Figure 2-6. The first fracture encountered at 32.4 feet bgs appears to occur within the saprolite-bedrock interface which was also observed in supply well and on the quarry wall. The fractures at 72.9 feet bgs and below 115 feet bgs both are deeper than the deepest fracture previously observed in the supply well. This well, therefore, is expected to provide adequate data for the characterization of the target plume in the bedrock aquifer.

DMW-3 is only screened at the bottom providing a monitoring point for the lower portion of the bedrock aquifer. Upon the completion of video logging and packer sampling, the well was completed with a 2-inch PVC screen set across 115 feet to 125 feet bgs and a 2-inch PVC riser pipe extending from 115 feet bgs to the ground surface. The annular space was filled with #2 filter sand from 125 feet to 113 feet bgs followed by a 2-foot bentonite seal. The remainder of the annular space was then grouted to the surface.

2.3.2 Sampling of Discrete Fractures

Due to the presence of multiple discrete fractures in supply well and DMW-3, packer sampling was conducted in both wells to gather groundwater quality data more accurately reflecting the vertical distribution of contaminants in the bedrock aquifer. Results of packer sampling at these two wells are presented in Table 4.

Groundwater samples were collected from four sampling intervals in the supply well. Although a small water inflow near the bottom of the supply well was suspected during video logging, packer sampling indicated that there is no conductive fracture present in this well below 80 feet bgs. During packer sampling this section of the well was rapidly dewatered with no apparent recharge. The analytical result of the sample collected at the bottom of this well is not presented in Table 4 since it does not represent the actual groundwater quality in the bedrock aquifer. Among the target contaminants detected in the supply well, TCE and 1,1-DCE were present at concentrations exceeding the 2L Standards. It is noted that the concentrations of both compounds did not decrease with respect to depth. A vertical plume extent was, therefore, not determined by this sampling event.

Four sampling intervals in DMW-3 were also identified using the video log of this well. Concentrations of target contaminants detected in this well are significantly lower that those observed in the supply well. TCE is the only target contaminant present in excess of the 2L Standard. A decreasing trend of contaminant concentrations, including TCE concentration, with respect to sampling depth is demonstrated in this sampling event. The TCE concentration detected in the sample collected from the bottom portion of the well, between 115 feet to 125 feet bgs, is below the 2L Standard suggesting a vertical plume extent.

2.4 SURFACE WATER SAMPLING

In order to assess potential impact on surface water bodies, water samples were collected from the creek and the quarry to determine background and downgradient surface water quality. Water samples were collected in the quarry near the north face where the concentrated fracture set had been observed. Discrete water samples were collected at four depths: 1 ft, 6 ft, 12 ft, and 27 ft below the water surface. The total depth near the north face is approximately 30 feet. S&ME personnel observed groundwater seeps along several fractures above the water surface. However, the seepage rate was too low for sampling. Water samples in the creek were collected at three locations: 500 feet upstream relative to the subject site; immediately upstream of the culvert crossing under Sugar Lake Road; and a downstream location just southwest of the southwestern corner of the quarry. Sampling locations and sampling results are presented in Figure 2-7. Only the sample collected at the culvert contained detectable concentrations of target contaminants: TCE at 6.4 μg/L and 1,1,1-TCA at 1.7 μg/L.

As discussed in Section 2.2 with the video logging observations and the relative elevations presented in Figure 2-6, groundwater in the saprolite aquifer is expected to flow primarily within the saprolite-bedrock interface and discharge into the creek. Results of creek sampling support this proposed hydrogeologic component. More importantly, the data suggest that the creek may provide sufficient attenuation capacity so the water quality in the creek downstream from the quarry is not adversely impacted by the target plume present at the subject site.

2.5 CONCEPTUAL CONTAMINANT TRANSPORT MODEL

Based on the additional data discussed above, a potentiometric contour map (Figure 2-8) and a flow net (Figure 2-9) are developed to facilitate the interpretation of subsurface hydrology at this site. In the construction of Figures 2-8 and 2-9, elevations of creek bed and quarry water surface are incorporated. In addition, estimated from the fracture mapping, hydraulic conductivity of the bedrock aquifer in the north-south direction is assumed to be four times higher than the conductivity in the east-west direction. As demonstrated in Figure 2-9, groundwater in bedrock fractures in the area between supply well and MW-11, the area with highest contaminant concentrations, will most likely flow toward the quarry located to the south. A conceptual hydrogeologic and contaminant transport model for the subject site is described below:

- Groundwater underneath the suspected source area appears to exist in two distinct aquifers: the saprolite aquifer and the bedrock aquifer. Groundwater flow and contaminant transport in each aquifer are controlled by specific geologic features associated with each aquifer.

- Groundwater movement in the saprolite aquifer is expected to occur primarily at the saprolite-bedrock interface where the flow is controlled by the nearly horizontal fracture system serving as a contaminant transport pathway. The potentiometric map indicates a southeastern flow in the saprolite aquifer (Figure 2-8). The detection of contaminants in monitor well MW-11 to the east of the source area also suggests an eastern contaminant transport in the saprolite aquifer.

- Groundwater flow in the bedrock is constrained to within discrete fractures. The fracture mapping indicates that the predominant fracture set has a north-south strike and dips almost vertically. For this reason, it is expected that the hydraulic conductivity and, thus, groundwater flow to be fairly anisotropic in bedrock, with the maximum hydraulic conductivity and flow occurring in a north-south direction.

- The small stream located to the east is the likely discharge feature for groundwater flowing in the saprolite aquifer. This proposed hydraulic boundary is consistent with the elevations indicated in Figure 2-6 and the potentiometric map presented in Figure 2-8. This is also supported by the detection of contaminants in the surface water sampling of the creek.

- The quarry is fortuitously located in that it is directly downgradient of the suspected source area in the direction of highest bedrock hydraulic conductivity. In addition, because of its dimension, the quarry intersects many fractures and, therefore, integrates flow over a large volume of the bedrock aquifer. A flow net (figure 2-9) is constructed to demonstrate the proposed groundwater flow system in the bedrock. The flow net accounts for north-south anisotropy in hydraulic conductivity, as inferred from the fracture mapping and video logging. The quarry is expected to serve as the ultimate discharge feature for groundwater flowing in the bedrock aquifer underneath the suspected source area.

2.6 WATER SUPPLY WELL SURVEY

The area surrounding the subject site is predominantly rural residential and undeveloped. Water supply wells located on properties within a 1,500-foot radius of the site were surveyed by Geraghty & Miller, Inc. during the CSA (Figure 2-10 and Table 5). Four residential supply wells (# 7, 9, 53, and 62 in Figure 2-10) were sampled by Geraghty and Miller on October 2, 1997. Target contaminants were not detected above the laboratory quantitation limits in any sample and the sampling report was submitted to NCDENR on June 15, 1998. During the preparation of this CAP, S&ME personnel sampled two additional residential wells (# 2 and 23 in Figure 2-10) on June 17, 1999. No target contaminants were detected above the laboratory quantitation limits. The laboratory analytical reports for June 1999 sampling event are provided in Appendix IV.

3.0 EXPOSURE ASSESSMENT

As indicated in Section 1.1, previous MOAs between NCDENR and NCDOT stated that the target contaminants to be addressed in the CSA and the CAP at NCDOT asphalt priority sites are carbon tetrachloride, TCE, 1,1,1-TCA, and their degradation products. At this subject site, chlorinated solvents were utilized in the past in the NCDOT asphaltic materials testing lab. As presented in the previous section, the target chlorinated contaminants detected in soil samples did not exceed regulatory action levels, with the exception of chloroform detected at one location. However, the historical groundwater quality data presented in Table 2 indicate that carbon tetrachloride and its degradation products including chloroform, methylene chloride, and chloromethane were not detected in any monitor well above the quantitation limits. Therefore, the potential human exposure is expected to be primarily through the exposure to groundwater contaminated with TCE, 1,1,1-TCA, and their degradation products including cis-1,2-DCE, 1,1-DCE, 1,1-DCA, chloroethane, and vinyl chloride.

3.1 PHYSICAL AND CHEMICAL CHARACTERISTICS OF TARGET CONTAMINANTS

Physical and chemical characteristics of the chlorinated aliphatic hydrocarbons considered as the target contaminants of concern at this site are presented in Table 6. Also included in this table is the maximum concentration of each compound detected during CSA and CAP investigations. In the pure form, the target chlorinated compounds may move downward in a subsurface environment because of their specific gravities. However, the maximum detected concentration of each compound presented in Table 6 only represents less than 0.1% of its solubility in water. In addition, a vertical plume extent has been defined and a presence of target contaminants as free-phase products is not suggested. The potential human exposure to the target contaminants is, therefore, expected to be only through the dissolved phase of target compounds present in the groundwater.

The persistence of the target chlorinated compounds in an aquifer is dependent upon the environmental conditions under which they exist. Chemical transformation and aerobic/anaerobic biodegradation of target chlorinated hydrocarbons have been documented in many literatures. The end products of a complete degradation of each target contaminant are non-hazardous substances including ethene, carbon dioxide, water, and chloride. A more complete literature review and discussion of various degradation processes of target contaminants is presented in Section 4.2.3.

3.2 POTENTIAL PATHWAYS FOR HUMAN EXPOSURE

An exposure pathway consists of the following elements: contaminant source, release mechanism, transport medium, exposure point, and exposure route. All of these elements must be present for an exposure pathway to be considered complete, or operable. A complete exposure pathway simply indicates that the potential for presentation of a contaminant to a receptor exists. The potential for an adverse effect is a function of both the exposure pathway and the level of exposure presented to a receptor. Potential pathways for human exposure typically include inhalation, skin contact, and ingestion of contaminants present in the groundwater.

As reported in the CSA, the subject facility is currently provided with bottled water for drinking. This measure eliminates the potential for direct human exposure through consumption. The primary potential exposure pathways for the on-site personnel, therefore, are skin contact, inhalation and/or accidental ingestion of contaminated groundwater. The depth to groundwater at this site has been reported to be from approximately 8 feet to more than 30 feet. Underground utility lines tend to be buried less than 5 feet bgs and, therefore, the utility work may not pose significant exposure hazard to the personnel. However, future excavation in the contaminated areas and groundwater sampling are the identified activities that may potentially expose workers. Employees of the asphalt plant or other contracted laborers performing underground work and/or groundwater monitoring should be advised of the potential hazards and personal protective gear may be considered to minimize potential exposure.

As indicated in Section 2.5, the target groundwater plume appears to have a potential to discharge to the creek and the quarry. The areas between the site and the creek and the quarry are undeveloped and no supply wells are located in these areas. It is expected that a groundwater monitoring program can be developed and implemented to provide sufficient protection to the population in the surrounding area.

4.0 DEVELOPMENT OF CORRECTIVE ACTION PLAN

4.1 OBJECTIVE OF CORRECTIVE ACTION PLAN

The primary objective of this Corrective Action Plan (CAP) is to protect the human health and the environment from the potential impact of target plume present at the subject site. S&ME evaluated three remedial alternatives for their feasibility and effectiveness as a remediation option for the subject site. Based on the site conditions and the alternative evaluation, we propose this CAP for the remediation of contaminated groundwater to conditions consistent with the 15A NCAC 2L Groundwater Quality Standards through natural processes of degradation and attenuation of the target contaminants. Target contaminants of concern to be addressed in this CAP are TCE, 1,1,1-TCA, cis-1,2-DCE, 1,1-DCE, 1,1-DCA, chloroethane, and vinyl chloride. This CAP has been prepared following the guidelines specified in 15A NCAC 2L Section .0106 subpart (*l*).

4.2 EVALUATION OF REMEDIATION ALTERNATIVES

This section presents the evaluation of three remedial alternatives generally considered to be feasible for the remediation of groundwater impacted with chlorinated solvents. Based on S&ME's past experience, *in situ* air sparging, *ex situ* stand-alone pump and treat, and natural attenuation are evaluated for their feasibility and cost-effectiveness as a remedial option for the subject site.

4.2.1 Evaluation of Air Sparging

Air sparging has been considered as an applicable remedial approach at many sites contaminated with volatile organic compounds (VOCs). This technique involves the injection of air beneath the groundwater table to remove contaminants by stripping dissolved VOCs and promoting volatilization of trapped and adsorbed phase VOCs. In order to address the contaminants stripped into the vadose zone, air sparging is often used in conjunction with vapor extraction to remove the stripped and volatilized contaminants. However, it may be difficult to implement vapor extraction at the subject site due to the dense clayey silt formation observed in the saprolite. Without effective control of contaminants stripped by air sparging, potential exposure through inhalation of gas-phase contaminants may become a concern.

The implementation of air sparging requires the injection of air below the water table creating air channels in the subsurface. The removal of contaminants takes place primarily in the immediate vicinity of the air channels. Diffusion and convection still limit the contaminant mass transfer in areas away from the air channels. The density of air channels is, therefore, a critical factor affecting the efficiency of remediation. The mass removal rate of an air sparging system is typically high in the early phase of operation and later declining to a much lower steady-state level. While air sparging can be fairly effective in remediating a highly contaminated aquifer, its application is not expected to be cost-effective for the target plume with relatively low contaminant concentrations present at the subject site. In addition, it is difficult to effectively sparge discrete bedrock fractures. The sparging efficiency will largely depend on how the sparge well intercepts bedrock fractures and the connection of these fractures. Based on the low contaminant concentrations detected at the subject site and the restriction of site-specific geologic conditions, air sparging is not expected to be a cost-effective remedial alternative for the subject site.

4.2.2 Evaluation of Pump and Treatment

Pump and treat is the most conventional groundwater remediation technique. A pump and treat system physically extracts groundwater to the surface, removes contaminants in an aboveground treatment unit, and discharges the treated water back into the ground or to a surface water body. Once groundwater has been pumped to the surface, contaminants can be reduced to very low levels with established technologies. However, in many cases pumping the contaminated groundwater has been shown to be expensive with limited effectiveness.

Pump and treat systems can be designed to meet two very different objectives: (1) containment of plume, and (2) restoration of groundwater quality. The conceptual transport model presented in Section 2.5 suggests that future migration of the target plume is expected to be limited under the influence of saprolite-bedrock interface and bedrock fractures. The creek and the quarry are expected to act as hydraulic boundaries for groundwater present at the subject site. Therefore, hydraulic containment by pumping is not considered necessary at the subject site. The experience in the industry indicates that groundwater restoration with a pump and treat system can be cost prohibitive at certain sites. Typically, contaminant concentrations in the extracted groundwater exhibit an exponential decay with respect to the volume of groundwater removed. As contaminant concentrations in groundwater decrease, the efficiency of this technique declines and eventually the system may only provide marginal remediation for restoring groundwater quality. Therefore, the completion of a remediation program relying on a pump and treat system may require long-term operation and maintenance. Similar to the concern presented in the evaluation of air sparging, the efficiency of removing contaminated groundwater from the bedrock aquifer will largely depend upon the extent of hydraulic connection between the pumping system and the discrete contaminated fractures. It is unlikely that a single point extraction system can achieve the required removal efficiency. Based on the hydraulic boundaries and the contaminant transport pattern presented in the conceptual model and the low contaminant concentrations detected in the target plume, a pump and treat system is not expected to be a cost-effective remediation alternative for the subject site.

4.2.3 Natural Attenuation of Target Chlorinated Hydrocarbons

Based on information presented in the CSA report and previous sections in this report, natural attenuation appears to be a feasible alternative for groundwater remediation at the subject site. The following site-specific conditions suggest that an evaluation of natural attenuation as a remedial option is warranted:

- With the exception of chloroform, no continuing source of target contaminants has been identified. Chloroform has been detected only at one soil sampling location and its detection can not be related to groundwater quality.

- The direction of target plume migration is toward the south and southeast. A creek and a quarry appear to serve as hydraulic boundaries in the direction of plume migration. No other receptor is currently located in the area immediately downgradient of the target plume area.

- Bottled water is currently provided to the facility for drinking and should be continued as necessary.

- Degradation products of 1,1,1-TCA and TCE including cis-1,2-DCE, 1,1-DCE, and 1,1-DCA have been detected in groundwater at the subject site.

- The downstream creek sample and the quarry water sample did not contain detectable concentrations of target contaminants suggesting adequate overall attenuation capacity.

The chlorinated solvents present in groundwater at the site may be degraded via anaerobic reductive dechlorination, aerobic biodegradation and abiotic hydrolysis. This section provides a summary of literatures describing the various degradation processes of the target contaminants.

The highly chlorinated solvents such as TCE and 1,1,1-TCA are degradable under anaerobic conditions (McCarty and Semprini, 1994). Anaerobic degradation occurs through a process termed reductive dechlorination where the chlorinated hydrocarbon serves as an electron acceptor and the chloride moiety is removed and replaced by a hydrogen, forming a less chlorinated and more reduced intermediate compound. The process of reductive dechlorination has been demonstrated for a wide range of chlorinated solvents including perchloroethene (PCE), carbon tetrachloride, TCE , 1,1,1-TCA, cis- and trans-1,2-DCE, 1,1-DCE and vinyl chloride (Freedman and Gossett 1989; De Bruin et al. 1992; McCarty and Semprini, 1994). The susceptability to reductive dechlorination varies with the extent of chlorination. The more chlorinated compounds such as TCE and 1,1,1-TCA are more easily reduced while DCE and vinyl chloride are less susceptible to reductive dechlorination. Chlorinated ethenes and ethanes are anaerobically biodegraded through the following sequences:

(1) PCE → TCE → cis-1,2-DCE → vinyl chloride → ethene
(2) 1,1,1-TCA → 1,1-DCA → chloroethane

Reductive dechlorination of PCE produces the degradation product TCE which may be further reduced to cis-1,2-DCE, then to vinyl chloride and eventually to ethene. However, the rate of reductive dechlorination is typically slower for cis-1,2-DCE and vinyl chloride and these products may accumulate in groundwater. While the more reduced degradation products such as DCE, DCA, chloroethane and vinyl chloride are more resistant to reductive dechlorination, these compounds are much better substrates for aerobic biodegradation (Murray and Richardson 1993). McCarty and Semprini (1994) demonstrated that vinyl chloride and cis-1,2-DCE could serve as primary substrates for microbial growth under aerobic conditions. In laboratory microcosm studies with previously uncontaminated surface soils and aquifer sands, Klier et al. (1999) demonstrated that naturally occurring microorganisms could aerobically degrade cis-1,2-DCE, trans-1,2-DCE and 1,1-DCE without added nutrients or other supplements. Recently, Bradley and Chapelle (1998) reported very rapid degradation of vinyl chloride and 1,2-DCE (a mixture of cis- and trans-) in streambed sediments with 98% mineralized to CO_2 in eight days. The initial concentration of total chlorinated compound was reported as 1.4 μM in that study.

In addition to biological degradation, chlorinated ethanes such as 1,1,1-TCA and chloroethane may also undergo abiotic (chemical) degradation reactions. 1,1,1-TCA may be abiotically transformed via two different pathways leading to the production of 1,1-DCE and acetic acid (McCarty 1996). Typically, approximately 80% of the 1,1,1-TCA is converted to acetic acid and 20% to 1,1-DCE. The rate of each chemical transformation may be expressed using a first-order reaction where the decay rate varies as a function of temperature. Reported 1,1,1-TCA half-lives varying from 0.95 year at 20 °C to 12 years at 10 °C (McCarty 1996). Abiotic hydrolysis of chloroethane to ethanol is sufficiently rapid (half-life ~ 0.12 year) that chloroethane does not usually persist at environmentally significant concentrations.

Typical rates for anaerobic reductive dechlorination, aerobic biodegradation and abiotic hydrolysis are reported in Table 7. Much of the data in Table 7 are taken from a review of reported degradation rates for petroleum hydrocarbons and chlorinated solvents by Suarez and Rifai (in press). All the abiotic rates measured in the laboratory are reported at 20 °C, which is in the temperature range typically expected for groundwater in this area. The abiotic degradation rates can be reasonably transferred to field conditions since the rates for these reactions are not significantly affected by most environmental conditions other than temperature.

4.2.4 Impact Assessment for the Proposed Natural Attenuation

Based on the conceptual hydrogeologic model, the groundwater at the subject site is expected to ultimately discharge to the quarry or the eastern creek. Therefore, a conservative calculation using TCE as a model compound was performed to estimate the contaminant attenuation and the potential impact that contaminated groundwater may have on these surface-water bodies. TCE is selected as a model compound because it is the predominant contaminant at the site and its standard in surface-water quality standards 15A NCAC 2B .0200 (2B Standards) is explicitly specified.

- **Estimate of Hydraulic Conductivity**

Hydraulic conductivity is a required component in estimating contaminant transport in an aquifer. The hydraulic conductivity for the saprolite aquifer provided in the CSA report was obtained from slug tests. The reported hydraulic conductivity is 2.39E-03 cm/sec or 6.76 ft/day. This conductivity seems to be slightly higher than what is expected for the clayey silt formation described in the CSA. The higher than expected hydraulic conductivity may reflect the more transmissive property of the saprolite-bedrock interface. The transmissivity of the bedrock aquifer is estimated based on the drawdown in 48DW-2 that was observed during the video logging (Appendix V). The bulk hydraulic conductivity for the bedrock aquifer can then be calculated using an estimated fracture density (Table 8). The bulk hydraulic conductivity for the bedrock aquifer is estimated to be 4.71E-04 cm/sec or 1.33 feet/day.

- **Estimate TCE concentration**

The estimated TCE concentrations in the quarry and the creek as the result of potential groundwater discharge are presented in Table 9. The calculation presented in Table 9 is fairly conservative because the only attenuation mechanism accounted for is the mixing effect in the quarry and the creek. It should be noted that this impact assessment assumes the worst-case scenario, while, in reality, other attenuation processes including biodegradation, chemical hydrolysis, and physical reaction (volatilization) will all contribute to the overall attenuation capacity of the subject site.

To estimate TCE concentration in the quarry, the quarry is assumed to receive groundwater discharge only from the bedrock aquifer because very little saprolite is present at the quarry (Figures 2-2 and 2-3). We also assume that the entire TCE mass present in the bedrock aquifer under the subject site instantaneously discharges into the quarry, the most conservative impact assessment scenario for the quarry. The estimated TCE concentration in groundwater, 790 μg/L, is the maximum TCE concentration ever been observed at the site (Tables 2 and 4). This concentration was detected in the sample collected from the on-site supply well, at the completion of purging the packer interval between 70 feet to 80 feet bgs (Table 4). The saturated thickness of the bedrock aquifer is estimated to be 100 feet. Once again, this is a very conservative estimate because the packer sampling data suggest that the highest TCE concentration (790 μg/L) does not represent the concentration in the entire bedrock aquifer. The depth of the quarry was measured to be 30 feet near the north face. Based on the calculation presented in Table 9, the TCE concentration in the quarry will be 21.5 μg/L under the proposed worst-case scenario.

Table 9 also presents the calculations estimating TCE concentration in the eastern creek based on the mass loading rate resulted from groundwater discharge. This calculation considers mixing in the creek as the only attenuation effect, while volatilization can be expected to be a significant attenuation mechanism under field conditions. The surface-water recharge for the creek is calculated based on an estimated surface drainage area, as delineated in Figure 4-1, and a documented annual surface run-off rate (Weaver, 1998). A 10-foot saturated thickness for the saprolite aquifer is used in the calculation. This is a reasonable estimate because the groundwater discharge along the creek is expected to occur at the saprolite-interface as indicated in Figure 2-6. As discussed in the conceptual model, the bedrock aquifer is expected to be significantly more conductive in the north-south direction with the observed fracture orientation. The west-east transmissivity in the bedrock, therefore, is estimated to account for approximately 20% of the overall transmissivity in the bedrock aquifer. These contaminant attenuation calculations provide an estimated TCE concentration in the creek at 8.55 μg/L. This estimate appears to be consistent with the TCE concentration detected in the creek sample collected at the culvert (6.4 μg/L). However, concentrations of target contaminants in the downstream creek sample were reported below detection limits suggesting that, under the field conditions, the creek will provide sufficient attenuation capacity.

The surface water quality standard (2B Standards) for TCE is 92.4 μg/L for general fresh waters (Class C) and 3.08 μg/L for surface-water bodies classified as WS-I. Given the fact that there is no surface hydraulic connection between the quarry and other surface waters, water quality standards is not expected to be applicable to the quarry. Nonetheless, the predicted TCE concentration in the quarry is still below the standard for Class C general fresh waters.

The eastern creek, after merging with several other creeks, eventually discharges into Haw River approximately 1.5 miles southwest of the subject site (Figure 1-1). The section of Haw River where the creek discharges is classified as a Class WS-I surface water body. The impact assessment calculation presented in this section appears to closely simulate the actual contaminant transport evidenced by the fact that the calculated TCE concentration in the creek is consistent with the TCE concentration detected in the surface-water sampling. Therefore, the non-detect finding in the downstream creek sample indicates that, under the actual field conditions, the creek will provide adequate attenuation capacity. The water quality in the creek downstream of the quarry will subsequently comply with the surface water quality standards for Class WS-I.

4.3 PROPOSED CORRECTIVE ACTION PLAN

Based on site conditions and alternative evaluation, the corrective action plan proposed for the subject site is based on natural processes of degradation and attenuation of target contaminants, as stipulated in 15A NCAC 2L .0106 (*l*).

4.3.1 On-Site Supply Well

The groundwater quality data indicate that the on-site supply well has been contaminated with target chlorinated contaminants. The subject facility is currently supplied with bottled water for drinking. However, the well may still be used for cleaning trucks, toilets, and other on-site activities. The video log of this well reveals that the well intercepts several bedrock fractures and groundwater flowing within the saprolite-bedrock interface also flows into this well. It is recommended to properly abandon this well or convert this well into a monitor well for future monitoring. The 6-inch open rock well can be converted into a 2-inch monitor well by screening from the well bottom (84 feet bgs) to approximately 70 feet bgs. The annular space will be filled with sand at the screening interval and then sealed with bentonite and grout from above the sand pack to the ground surface. Alternate water supply for the facility may be provided by trucking in water, installing another supply well in non-contaminated areas, or connecting to public water supply system.

4.3.2 Proposed Groundwater Monitoring Plan

The feasibility and effectiveness of natural attenuation have been presented in the previous section. Based on the current groundwater quality data and the impact assessment discussed in Section 4.2.4, a groundwater monitoring plan is proposed in this section. It is also recommended that the eastern creek, the quarry, and selected residential wells to be included in the monitoring plan. The proposed monitoring locations are presented in Figure 4-2. The deep well DW-1 is not included in the proposed monitoring plan because the video log revealed that the well does not intercept major conductive fractures in the bedrock. The on-site supply well will be included in the monitoring plan if it is converted into a monitor well.

For each sampling event, water levels in monitor wells will be measured to determine the groundwater gradients. Groundwater samples will be submitted to a certified laboratory and analyzed for volatile organic chemicals (VOCs) using EPA Method 601. The following chlorinated compounds are the target chemicals to be monitored in this proposed CAP monitoring program: TCE, cis-1,2-DCE, trans-1,2-DCE, 1,1-DCE, 1,1,1-TCA, 1,1-DCA, vinyl chloride, chloroethane, and chloroform. It is also recommended that the monitoring program include annual monitoring of following geochemical parameters: DO, ORP, nitrate (NO_3^-), reduced iron (Fe^{+2}), sulfate (SO_4^{-2}), dissolved methane, dissolved ethane, dissolved ethene, and chloride. The annual sampling of geochemical parameters is designed to assess the development of environmental conditions relevant to the *in situ* degradation of target contaminants.

Surface water samples in the creek and the quarry will be collected at the proposed locations indicated in Figure 4-2. A creek sample will be collected just downstream of the southwestern corner of the quarry. The quarry sample will be collected from the area near the north face where concentrated fractures set had been observed. The sample will be collected from approximately 3 feet above the quarry bottom where less volatilization of the target contaminants and higher concentration may be expected. These surface water samples will also be analyzed for VOCs using EPA Method 601.

It is also recommended that residential supply wells located on properties of Sasser, Byrd, and Mitchel (# 2, 20, and 23 in Figure 2-10) to be included in this monitoring plan if permission is granted.

A semi-annual groundwater and surface-water sampling schedule is proposed for the first two years to verify the plume distribution and account for potential variations in sampling results. An annual sampling schedule is recommended for the remainder of the corrective action program. An annual monitoring report will be completed after each year of the monitoring program. The annual report will analyze the development of the target plume and the effectiveness of natural attenuation. Monitoring will continue until concentrations of all target chlorinated contaminants listed above at all monitoring points are below the 15A NCAC 2L Groundwater Quality Standards and 2B Surface Water Quality Standards for two successive annual sampling events. At such time, NCDOT will request for the permission to terminate the monitoring program.

4.3.3 Evaluation of Proposed Corrective Action Plan

Based on the conceptual hydrogeologic model and the assessment of potential impact, the proposed CAP is evaluated in accordance with the following conditions stipulated in 15A NCAC 2L Section .0106 (*l*):

(1) sources of contamination and free product have been removed or controlled

Results of soil assessment during CSA and CAP preparation did not identify an area representing a continuing source for groundwater contamination. The highest concentration of any target contaminant ever detected in groundwater is 890 μg/L for TCE (Table 2). This concentration is less than 0.1% of the solubility of TCE. The presence of free product at this site is not anticipated. The vertical plume extent has been characterized and distribution of contaminant concentration did not suggest the presence of DNAPL.

(2) the contaminant has the capacity to degrade or attenuate under the site-specific conditions

As discussed in Section 4.2.3, the chlorinated compounds present in groundwater at the site may be naturally attenuated via various biological, chemical, and physical processes. The detection of degradation products of TCE and 1,1,1-TCA suggests that the target contaminant can be degraded under the field conditions.

(3) the time and direction of contaminant travel can be predicted with reasonable certainty

Hydraulic conductivity for the saprolite aquifer was estimated to be 6.76 ft/day in the CSA, and the hydraulic conductivity for the bedrock aquifer is estimated, from the video logging, to be 1.33 ft/day with the highest conductivity in the north-south direction. Based on the conceptual hydrogeologic model and surface-water sampling result, the eastern creek and the quarry have been identified as the ultimate discharge features for groundwater at the site.

(4) contaminant migration will not result in any violation of applicable groundwater standards at any existing or foreseeable receptor

The quarry and the eastern creek are likely to establish a hydraulic boundary limiting the potential of further migration of contaminants. There is no surface connection between the quarry and other surface water bodies. The surface water quality standard (2B Standard) is, therefore, not expected to be applicable to the quarry. Nonetheless, the impact assessment calculations suggest that the water quality in the quarry will still comply with the 2B Standards for the Class C general fresh waters. Results of the surface water sampling indicate that the water quality in the creek at the proposed monitoring location should comply with the 2B Standards for the WS-I waters. Based on the conceptual model, adverse impact on the downgradient residential wells is not anticipated.

(5) migration of contaminants onto adjacent properties

The property on which the quarry is located and the property to the east of the creek are currently undeveloped. With the creek and the quarry serving as hydraulic boundaries, migration of contaminant plume onto other properties beyond the creek and the quarry is not anticipated.

(6) protection of surface waters

As discussed above, a conservative assessment of potential impact on the surface-water quality as the result of groundwater discharge suggests that the surface-water quality standards will not be violated at proposed monitoring locations.

(7) that the person making the request will put in place a groundwater monitoring program sufficient to track the degradation and attenuation of contaminants and contaminant by-products .....

The proposed monitoring plan is based on the evaluation of potential contaminant transport and impact assessment. The monitoring plan described in Section 4.3.2 is expected to provide information satisfactory to this rule.

(8) that all necessary access agreements needed to monitor groundwater quality pursuant to Subparagraph (7) of this Paragraph have been or can be obtained;

The access agreements needed to implement the proposed monitoring plan will be obtained and submitted for the implementation of this CAP.

(9) that public notice of the request has been provided in accordance with Rule .0114(b) of this section;

The public notification of the request for approval and implementation of the proposed corrective action plan have been prepared in accordance with Rule .0114(b). (Appendix VI)

(10) that the proposed corrective action plan would be consistent with all other environmental laws.

S&ME has prepared this CAP with the intention of maintaining consistency with 15A NCAC Subchapter 2L.

In addition to meeting the requirements listed above, S&ME contacted NCDENR Division of Water Resources, Water Supply Planning Section to confirm the current planning of the groundwater use in the projected groundwater impact area. Based on a letter issued by Water Supply Planning Section on August 10, 1999 (Appendix VII), there are no municipal water supply wells in the vicinity of the subject site. A search of State Water Supply Plan for Chatham County (Appendix VII) reveals that the source of future water supply for Chatham County is Jordan Lake. Currently, the public water supply is available for the area approximately 1.5 miles north of the subject site. Therefore, the need to develop the groundwater at the subject site for the public use is not anticipated.

Based on the evaluation provided in this section, the proposed natural attenuation is expected to be a feasible remedial action for the subject site.

4.4 LIMITATIONS

Certain conditions may limit the effectiveness of natural attenuation at the subject site:

- Assumptions have been made to estimate hydrogeologic parameters and evaluate contaminant transport. Potential discrepancies between actual site conditions and estimated parameters may limit the accuracy of predicted plume development.

- Future infrastructure development of the asphalt plant may cause certain changes in site conditions. Other contaminants may potentially be released during future plant operations and consequently affect the natural attenuation processes.

- Attenuation of target contaminants within the impacted area may reach asymptotic levels above the target clean up levels set forth by 2L Standards. Should future monitoring data indicate asymptotic attenuation progress, a petition by NCDOT to revise target cleanup standards or the proposed corrective actions may be considered.

4.5 PERMITS

Currently, no permits are deemed required to implement the proposed CAP adapting natural attenuation at the subject site.

4.6 COST

The cost for implementing the proposed CAP is primarily associated with the required monitoring program. Based on the proposed monitoring program, the estimated cost for the implementation of this CAP include:

- $3,000 for the conversion of the supply well into a monitor well, or $1,000 to properly abandon the well
- $30,000 per year for the first two years for monitoring and reporting
- $15,000 per year after year 2 for monitoring and reporting

Cost for providing alternate water supply to the facility, pending on the selected option, is not included in this estimate.

4.7 SCHEDULE

Upon approval of the proposed CAP, NCDOT will begin the implementation of the proposed corrective actions and monitoring program.

5.0 REFERENCES

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Table 1. Evaluation of Soil Contamination Detected in CSA [1]
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Chemical	Detected Concentration	Calculated Action Levels (G&M CSA Report) (Organic Leachate Model)	MSCC (Soil-to-Groundwater)	MSCC (Residential)
1,1,1-TCA	0.062 ~ 0.084	8.1491	1.398 [2]	NA
TCE	0.0058 ~ 0.011	0.0328	0.019 [2]	NA
1,1-DCA	0.0041 ~ 0.0046	45.472	4 [3]	1560 [3]
chloroform	0.0031	0.00021	0.001 [2]	NA

(1) Soil contaminant concentrations reported in the CSA report (Geraghty & Miller, 1997). Concentrations presented in mg/kg.

(2) Soil-to-Groundwater MSCC (Maximum Soil Contaminant Concentration) is calculated using the transport model provided in the 1998 Groundwater Section Guidelines. Paramters used in the calculation for each compound are:

1,1,1-TCA : $C_{gw} = 0.2$ $f_{oc} = 135$ H' = 0.16728
TCE : $C_{gw} = 0.0028$ $f_{oc} = 94.3$ H' = 0.422
chloroform : $C_{gw} = 0.00019$ $f_{oc} = 43.65$ H' = 0.0032

(3) MSCC for 1,1-DCA is provided in the 1998 Groundwater Section Guidelines.

NA : Not Applicable

Table 2. Summary of CSA Groundwater Quality Data and September 1998 CAP Sampling Results *
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Analyte	2L Standards (µg/L)	MW-1		MW-2		MW-3		MW-4		MW-5	
		Dec-96	Sep-98	Dec-96	Sep-98	Jun-96	Sep-98	Jun-96	Sep-98	Dec-96	Sep-98
1,1,1-TCA	200	96	140	BQL	BQL	20	17	4	12	BQL	BQL
TCE	2.8	**64**	**140**	BQL	BQL	**7**	**5**	BQL	BQL	BQL	BQL
cis-1,2-DCE	70	BQL	BQL	BQL	BQL	2	BQL	BQL	BQL	BQL	BQL
1,1-DCE	7	**23**	**40**	BQL	BQL	**15**	**9**	2	6	BQL	BQL
1,1-DCA	700	4	3	BQL	BQL	1	BQL	BQL	BQL	BQL	BQL
vinyl chloride	0.015	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
chloroethane	2800	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Total Target Compounds		187	323	BQL	BQL	45	31	6	18	BQL	BQL

Analyte	2L Standards (µg/L)	MW-6		MW-7		MW-8		MW-9		MW-10	
		Feb-97	Sep-98	Feb-97	Sep-98	Feb-97	Sep-98	Feb-97	Sep-98	Mar-97	Sep-98
1,1,1-TCA	200	BQL	BQL	BQL	BQL	BQL	destroyed	BQL	BQL	BQL	BQL
TCE	2.8	BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL
cis-1,2-DCE	70	BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL
1,1-DCE	7	BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL
1,1-DCA	700	BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL
vinyl chloride	0.015	BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL
chloroethane	2800	BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL
Total Target Compounds		BQL	BQL	BQL	BQL	BQL		BQL	BQL	BQL	BQL

Analyte	2L Standards (µg/L)	MW-11		MW-12		MW-13		DMW-1		DMW-2		On-site Supply Well	
		Mar-97	Sep-98	Apr-97	Sep-98	Apr-97	Sep-98	Feb-97	9/28/98	Apr-97	Sep-98	Aug-96	Sep-98
1,1,1-TCA	200	84	**240**	BQL	BQL	BQL	BQL	BQL	BQL	41	53	120	**230**
TCE	2.8	**470**	**890**	BQL	BQL	BQL	BQL	BQL	BQL	**250**	**470**	**140**	**320**
cis-1,2-DCE	70	2	10	BQL	BQL	BQL	BQL	BQL	BQL	6	5	BQL	5
1,1-DCE	7	**33**	**74**	BQL	BQL	BQL	BQL	BQL	BQL	**44**	**61**	**29**	**60**
1,1-DCA	700	2	6	BQL	BQL	BQL	BQL	BQL	BQL	7	8	6	8
vinyl chloride	0.015	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
chloroethane	2800	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL	BQL
Total Target Compounds		591	1220	BQL	BQL	BQL	BQL	BQL	BQL	348	597	295	623

* Only the target contaminants are presented in this summary. Chemical concentrations (µg/L) exceeding 2L standards are highlighted.

Table 3. Well Construction Details for All Monitor Wells (1)
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Well ID	Date of Installation	Measuring Point Elevation (ft)	Total Depth (ft bgs)	Surface Casing Depth (ft bgs)	Depth of Screened Zone (ft bgs)
48MW-1	11/14/96	995.2	50	36	46-36
48MW-2	11/14/96	993.8	50	40	50-40
48MW-3	11/14/96	997.71	56	40	50-40
48MW-4	11/13/96	998.21	36	26	36-26
48MW-5	11/12/96	1001.68	43	33	43-33
48MW-6	1/15/97	987.97	44	34	44-34
48MW-7	1/16/97	986.02	34	24	34-24
48MW-8	1/16/97	998.93	32	22	32-22
48MW-9	1/16/97	990.91	22	11	22-11
48MW-10	3/3/97	994.99	40	30	40-30
48MW-11	3/3/97	988.48	29	19	29-19
48MW-12	4/17/97	972.71	37.5	27.5	37.5-27.5
48MW-13	4/17/97	967.76	32.5	22.5	32.5-22.5
48DW-1	1/15/97	994.67	100	63	100-63*
48DW-2	4/24/97	991.84	66	43	66-43*
48DW-3	7/26/99	988.65	125	31	125-115

(1) Construction details for all monitor wells, with the exception of 48DW-3, are provided in Table 5-1 of the CSA report (Geraghty & Miller, 1997). 48DW-3 was installed by S&ME and the construction details of this well are provided in Appendix III of this report. All elevation data are referenced to an assumed datum of 1,000 feet.

* Indicates an open-rock well from the bottom of the borehole to the bottom of the surface casing.

Table 4. Packer Sampling of Supply Well and DMW-3*
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Supply Well (May 1999)

Analyte	2L Standards (µg/L)	Packer Interval: 44 to 54 (ft) Purged Volume (gal)			Packer Interval: 56 to 66 (ft) Purged Volume (gal)			Packer Interval: 70 to 80 (ft) Purged Volume (gal)		
		14	28	42	18	48	78	20	50	80
TCE	2.8	240	120	90	260	210	210	1500	780	790
1,1,1-TCA	200	180	130	120	130	120	90	170	180	150
cis-1,2-DCE	70	4	1.8	2.8	2.6	1.7	1.8	2.4	7.6	5.1
1,1-DCE	7	28	20	25	32	33	16	44	26	28
1,1-DCA	700	7.8	5.1	7.6	7.6	6.4	6.6	7.7	8.1	7.9

DW-3 (July 1999)

Analyte	2L Standards (µg/L)	Packer Interval: 28 to 38 (ft) Purged Volume 20 gal	Packer Interval: 68 to 78 (ft) Purged Volume 18 gal	Packer Interval: 90 to 100 (ft) Purged Volume 60 gal	Packer Interval: 115 to 125 (ft) Purged Volume 60 gal
TCE	2.8	90	7.4	5.4	2.1
1,1,1-TCA	200	17	0.8	BQL	BQL
cis-1,2-DCE	70	BQL	BQL	BQL	BQL
1,1-DCE	7	0.7	BQL	BQL	BQL
1,1-DCA	700	0.9	BQL	BQL	BQL

* Only target contaminants are presented. Concentrations are expressed in µg/L.

TABLE 5. Summary of Adjacent Property Owners and Supply Wells [1]
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Property ID Number (See Fig. 2-10)	Registered Property Owner	Property Owner Address	Current Use	Well Sampled [2]
1	Roy Stewart (Site Property)	P.O. Box 1109 Sanford, NC 27350	Commercial	No
2	Erskine Heatherley, Jr.	96 Deer Run Pittsboro, NC 27312	Residential	No
3	Patricia Ellis & Deborah Sasser	154 Deer Run Pittsboro, NC 27312	Residential	No
4	James E. McKendry	190 Deer Run Pittsboro, NC 27312	Residential	No
5	James L. Harris	459 Mays Chapel Rd. Pittsboro, NC 27312	Residential	No
6	Bradley E. Holloway	Mt. Gilead Woods Pittsboro, NC 27312	Residential	No
7	Sara Corden	577 Silver Berry Rd. Pittsboro, NC 27312	Residential	Yes
8	Raymond J. Ingram	521 Silver Berry Rd. Pittsboro, NC 27312	Residential	No
9	Mildred Cason	768 E. Perry Rd. Pittsboro, NC 27312	Residential	No
10	Mildred Cason	768 Perry Rd. Pittsboro, NC 27312	Residential	Yes
11	David P. Martinez	103 Rabbit Run Pittsboro, NC 27312	Residential	No
12	David P. Martinez & Graci J.	103 Rabbit Run Pittsboro, NC 27312	Residential	No
13	Roy F. & Aliene Keck	173 Rabbit Run Pittsboro, NC 27312	Residential	No
14	Dexter V. Perry Dexter V. Perry Trust	614 Sanderson Drive Durham, NC 27704	Residential	No
15	James D. & Ann B. Marlow	P.O. Box 193 Bynum, NC 27228	Residential	No

1. Inventory aata provided in the CSA report (Geraghty & Miller, 1997).
2. --- : Property is outside the 1,500-foot radius or no water supply well present.

TABLE 5. (Cont'd) Summary of Adjacent Property Owners and Supply Wells [1]

Property ID Number (See Fig. 2-10)	Registered Property Owner	Property Owner Address	Current Use	Well Sampled [2]
16	William F. & Deborah K. Lancaster	1026 Mt. Gilead Church Rd. Pittstobo, NC 27312	Residential	No
17	Claron N. Hatley c/o Susan Ickes & James Hatley	15 Ashwood Knoll Rochester, NY 14624	Residential	--
18	William Hatley	3109 Commonwealth Ave. Charlotte, NC 28205	Residential	--
19	Deborah McNeil Deaton	131 Crossing Ave. Belmont, NC 28012	Residential	--
20	Doris Earl mcNeil	1824 Stoney Ridge Dr. Charlotte, NC 28214	Residential	No
21	Sugar Lake Land Company	981 Old Graham Rd. Pittsboro, NC 27312	Residential	--
22	Federal Paper BD Co. Inc.	P.O. Box 146 Southern Pines, NC 28388	Commercial	No
23	Timothy R. Mitchel	681 Mt. Gilead Church Rd. Pittsboro, NC 27312	Residential	No
24	Dennis C. & Phillis C. Campbell	Rt. 4 Box 588 Pittsboro, NC 27312	Residential	No
25	Alvis Page	1085 Mt. Gilead Church Rd. Pittsboro, NC 27312	Residential	No
26	James & Marjorie Burnette	419 Hardee Street Durham, NC 27703	Residential	No
27	Samuel Burnette	Route 4, Box 578 Pittsboro, NC 27312	Residential	No
28	Page Willene Bright	Route 4, Box 576 Pittsboro, NC 27312	Residential	No
29	Phillilp W. Corn	P.O. Box 1002 Cary, NC 27512	Residential	No
30	Louise Heardon & Helen Toney	108 Cole Street Chapel Hill, NC 27516	Residential	No

TABLE 5. (Cont'd) Summary of Adjacent Property Owners and Supply Wells [1]

Property ID Number (See Fig. 2-10)	Registered Property Owner	Property Owner Address	Current Use	Well Sampled [2]
31	Paul Dean & Virginia Bailey	101 Rabbit Run Pittsboro, NC 27312	Residential	No
32	Pat & Elward Horton	911 Whippoorwill Lane Chapel Hill, NC 27514	Residential	--
33	Paggy Jean Porter	464 Old Farrington Road Chapel Hill, NC 27514	Residential	--
34	Karl W. & Inger Rabe	114 Rabbit Run Pittsboro, NC 27312	Residential	--
35	Garry & Patricia Anderson	79 Silver Berry Road Pittsboro, NC 27312	Residential	--
36	Richard & Christine Fish	208 Rabbit Run Pittsboro, NC 27312	Residential	--
37	Tony Michael	Route 4, Silver Berry Road Pittsboro, NC 27312	Residential	--
38	David & Deborah Walton	167 Silver Berry Road Pittsboro, NC 27312	Residential	--
39	John & Cynthia Heuer	Route 4, Box 559-D Pittsboro, NC 27312	Residential	--
40	Richard & Christy Fish	208 Rabbit Run Pittsboro, NC 27312	Residential	--
41	Albert Lindsay	Route 4, Box 559-1 Pittsboro, NC 27312	Residential	--
42	Thomas & Helen Dean	300 Rabbit run Pittsboro, NC 27312	Residential	No
43	Gail Darden & Albert Lindsay	Route 4, Box 559-1 Pittsboro, NC 27312	Residential	--
44	Phillip Allen	483 Silver Berry Road Pittsboro, NC 27312	Residential	No
45	James Poole	376 Silver Berry Road Pittsboro, NC 27312	Residential	--

TABLE 5. (Cont'd) Summary of Adjacent Property Owners and Supply Wells [1]

Property ID Number (See Fig. 2-10)	Registered Property Owner	Property Owner Address	Current Use	Well Sampled [2]
46	Carolyn Campbell, John Davis, John & Janet Campbell	502 Belmont Street Chapel Hill, NC 27514	Residential	--
47	Kimberly Gay Preble	21 Medowbrook Drive Durham, NC 27712	Residential	--
48	Anna Lee Leonard	544 Silver Berry Road Pittsboro, NC 27312	Residential	--
49	David & Robyn Halliday	604 Silver Berry Road Pittsboro, NC 27312	Residential	--
50	Terry & Linda Lindsey	746 Silver Berry Road Pittsboro, NC 27312	Residential	--
51	Bobbi & Jean Riddle	94 Sweet Gum Pittsboro, NC 27312	Residential	--
52	Phreddie Delois Popp	Route 4, Box 394 Pittsboro, NC 27312	Residential	No
53	M.S. Brantley	7 Crosswinds Estates Pittsboro, NC 27312	Residential	Yes
54	Phreddie Delois Popp	Route 4, Box 394 Pittsboro, NC 27312	Residential	--
55	Mark Flynn	334 Deer Run Pittsboro, NC 27312	Residential	--
56	Michael & Patti Davis	458 Deer Run Pittsboro, NC 27312	Residential	--
57	Doris & Kathleen Flynn	287 Deer Run Pittsboro, NC 27312	Residential	No
58	William & Janet Wyatt	365 Deer Run Pittsboro, NC 27312	Residential	--
59	John & Jacqueline O'Gorman	421 Deer Run Pittsboro, NC 27312	Residential	--
60	Wayne Michael Wade	Route 4, Box 592 Pittsboro, NC 27312	Residential	No

TABLE 5. (Cont'd) Summary of Adjacent Property Owners and Supply Wells [1]

Property ID Number (See Fig. 2-10)	Registered Property Owner	Property Owner Address	Current Use	Well Sampled [2]
61	Maria Russon	Route 5, Box 597 Pittsboro, NC 27312	Residential	No
62	Ronald & Phillis Graham	500 Sugar Lake Road Pittsboro, NC 27312	Residential	Yes
63	Daniel & Marion Munn	Route 4, Box 603-A Pittsboro, NC 27312	Residential	--
64	Robert Paul Kolin	580 Sugar Lake Road Pittsboro, NC 27312	Residential	--
65	Douglas Wakeman	624 Sugar Lake Road Pittsboro, NC 27312	Residential	--
66	Thomas & Saranne Wilson	562 Sugar Lake Road Pittsboro, NC 27312	Residential	--
67	Theadore & Julie Taydus	495 Sugar Lake Road Pittsboro, NC 27312	Residential	--
68	Archie & Shana Hankins	555 Sugar Lake Road Pittsboro, NC 27312	Residential	--
69	John Judd & Annette Reaves	P.O. Box 992 Pittsboro, NC 27312	Residential	--
70	Pat & Elward Horton	911 Whippoorwill Lane Chapel Hill, NC 27514	Residential	--

TABLE 6. Physical And Chemical Properties Of Target Contaminants [(1)]
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Chemical	Molecular Weight	Specific Gravity	Vapor Pressure (mm Hg)	Solubility (mg/L)	15A NCAC 2L (µg/L)	Max. Detected [(2)] (µg/L)
1,1,1-TCA	133.4	1.325	124 (25°C)	950 (25°C)	200	240
1,1-DCA	98.96	1.18	234 (25°C)	5060 (25°C)	700	8.1
chloroethane	64.52	0.92	5740 (20°C)	5740 (20°C)	2800	BQL
TCE	131.39	1.456	72.6 (25°C)	1100 (25°C)	2.8	890
cis-1,2-DCE	96.94	1.27	410 (30°C)	6300 (25°C)	70	10
1,1-DCE	96.94	1.21	591 (25°C)	5000 (25°C)	7	74
vinyl chloride	62.5	0.91	2660 (25°C)	1100 (25°C)	0.015	BQL

(1) Data sources: Hawley's Condensed Chemical Dictionary by Richard J. Lewis, Sr., 1997; Remediation Engineering Design Concept by Suthan S. Suthersan, 1997; and Pocket Guide To Chemical Hazards by USDHHS, Center for Disease Control and Prevention, 1997.

(2) The maximum concentration detected in CSA and CAP investigations. Groundwater quality data are presented in Tables 2 and 3.

TABLE 7. REPORTED DEGRADATION RATES FOR CHLORINATED SOLVENTS (yr^{-1})
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, NC
S&ME Project No. 1040-98-107

Compound	Condition	# of Reports	Range	Mean	References
1,1,1-TCA	Abiotic (20 °C)	3	0.31 - 0.34	0.32	a,b,c
	Anaerobic (Field)	10	0 - 47	10.6	d
	Aerobic	NA			
TCE	Abiotic (20 °C)	NA			
	Anaerobic (Field)	32	0 - 8.4	1.1	d
	Aerobic	NA			
DCE	Abiotic (20 °C)	NA			
	Anaerobic (Field)	33	0.03 - 47	2.6	d
	Aerobic	2	0 - 126	37	e
Vinyl Chloride	Abiotic (20 °C)	NA			
	Anaerobic (Field)	4	0.15 - 2.6	0.91	d
	Aerobic	6	16 - 250	66	d,f

NA : not available

References :

a : Haag and Mill (1988)
b : Cline and Delfino (1989)
c : Jeffers, Ward, Woytowitch, and Wolfe (1989)
d : Suarez and Raifai (in press)
e : Klier, West, and Donberg (1999)
f : Bradley and Chapelle (1998)

Table 8. Estimate Bulk Hydraulic Conductivity of Bedrock Aquifer
NCDOT Asphalt Site 6-48 (Lee Paving)
Pittsboro, Chatham County, North Carolina
S&ME Project No. 1040-98-107

Based on water drawdown observed during pumping of DW-2 in the event of video logging.

Estimated transmissivity: 2.87E-05 m^2/sec or 9737 ft^2/yr

Estimate bulk transmissivity for bedrock aquifer

K_{bulk} = Transmissivity of single fracture * N (Density of conductive fracture)

N : Density of conductive fracture = 0.05 ft^{-1} (estimated)

Estimated K_{bulk} = 1.33 ft/day or 4.71E-04 cm/sec

Table 9. Assessment of Contaminant Attenuation and Potential Impact
NCDOT Asphalt Site 6-48 (Lee Paving)
S&ME Project No. 1040-98-107

A. Estimate of TCE Concentration in Quarry

I. Estimated volume of contaminated groundwater in bedrock under the subject site:

Assume contaminated bedrock aquifer at the site :

400 ft (east-west) from former lab to the creek

250 ft (north-south) from former lab to Sugar Lake Road

100 ft saturated thickness

bedrock porosity: 0.02

Estimated goundwater volume = 5.66E+06 liter

II. "Maximum" TCE concentration in bedrock aquifer: 790 µg/L

III. Volume of quarry water

700 ft (W) x 350 ft (L) x 30 ft (H) = 2.08E+08 liter

Calculated TCE concentration in the quarry = 21.5 µg/L

B. Estimate TCE Concentration in the Creek

I. Mass Loading from Saprolite Aquifer

Saprolite	
Cavg.* (ug/L)	515.0
T** (ft^2/day)	67.6
w (ft)	250.0
grad_h	0.015
Q (ft^3/day)	253.5
Q (L/day)	7179.1
Mass Loading (g/day)	**3.70**

II. Mass Loading from Bedrock Aquifer

Bedrock	
Cavg.	790.0
T*** (east-west)	26.6
w (ft)	250.0
grad_h	0.015
Q (ft^3/day)	99.8
Q (L/day)	2824.9
Mass Loading (g/day)	**2.23**

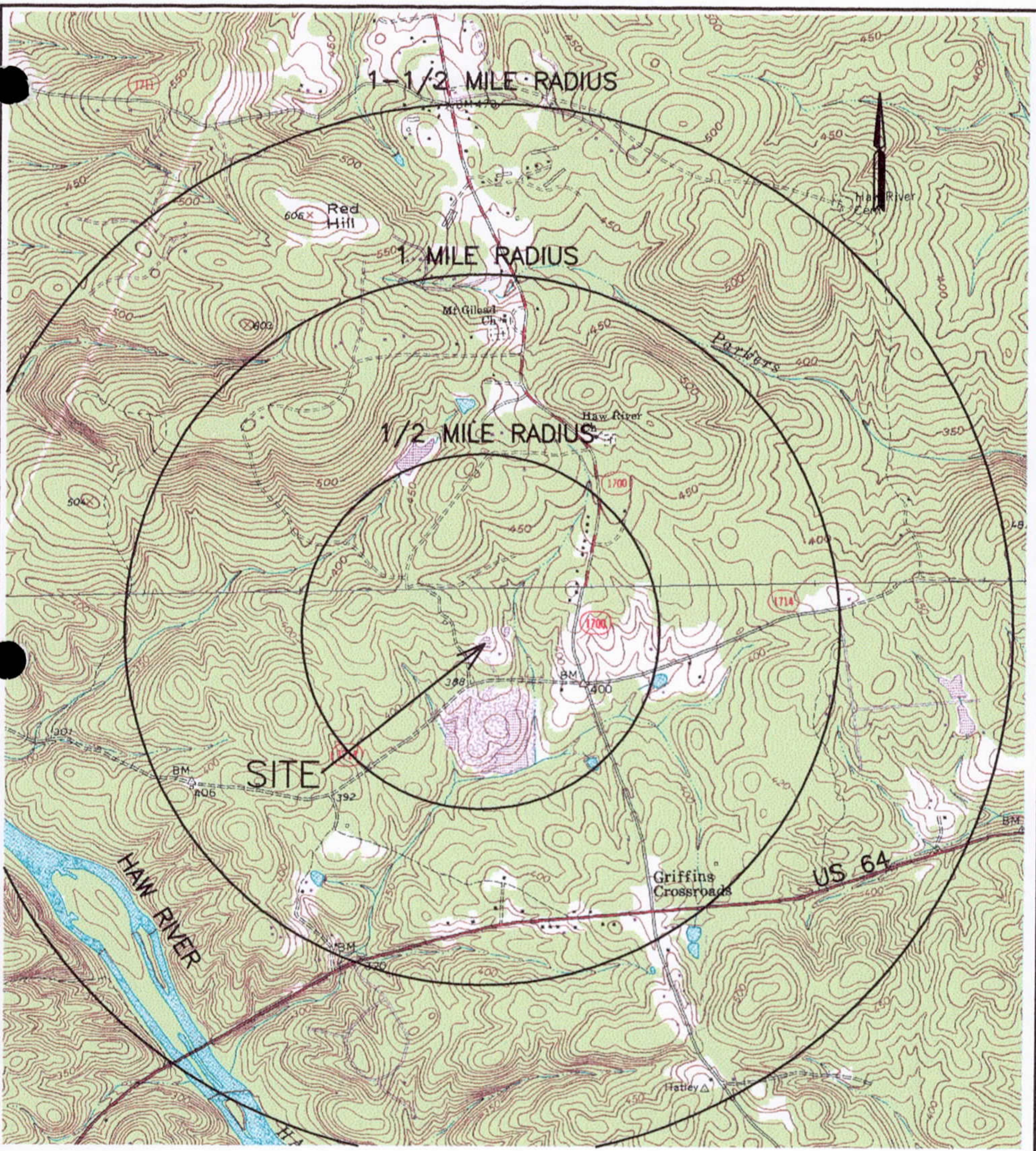
Total Mass Loading 5.93 (g/day)

* Average TCE concentration estimated from MW-1 and MW-11.
** Estimate transmissivity in saprolite : K=6.76 ft/day from CSA slug test; estimated 10 ft average saturated thickness.
*** Estimated transmissivity in bedrock : bulk hydraulic conductivity 1.33 ft/day; estimated 100 ft saturated thickness
(Based on fracture density observed in fracture mapping, estimated transmissivity in bedrock : north-south : east-west = 4:1. Therefore, transmissivity in the east-west directino accounts for 20% of overall transmissivity.)
Gradient in saprolite : from MW-1 to the creek bottom at the culvert.
Gradient in bedrock : from DW-2 to the creek bottom at the culvert.

III. TCE concentration in the creek

Minimum Attenuation	
Watershed (ft^2)	7400000
Annual Discharge* (in)	14.5
Flow (ft^3/yr)	8941667
Flow (L/day)	693300.5
TCE (µg/L)	8.55

*Weaver, J. Curtis, "Low-flow Characteristics and Discharge Profiles for Selected Stream in the Neuse River Basin, North Carolina" *US Geological Survey Water-Resources Investigations Report 98-4135*, Raleigh, NC, 1998



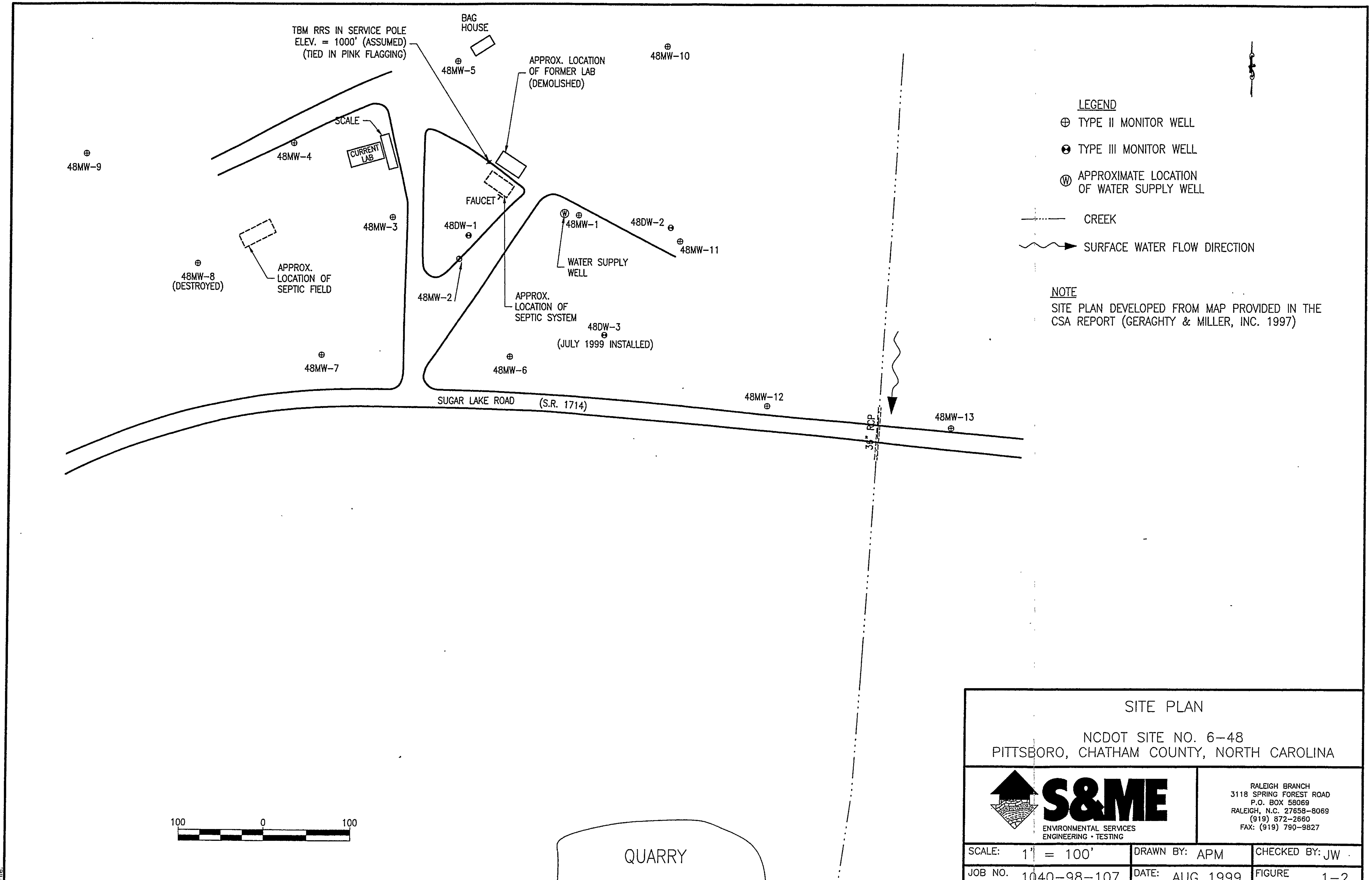
1000 0 1000 2000 3000

SCALE IN FEET

MERRY OAKS, NC USGS QUADRANGLE DATED 1969 (PHOTOREVISED 1981)
FARRINGTON, NC USGS QUADRANGLE DATED 1978 (PHOTOREVISED 1981)

SITE LOCATION MAP NCDOT SITE NO. 6-48 PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA	S&ME ENVIRONMENTAL SERVICES ENGINEERING • TESTING	Job No. 1040-98-107 Scale: 1" = 2000' Fig No. 1-1

File: 107-98-OC 02.DWG



SITE PLAN

NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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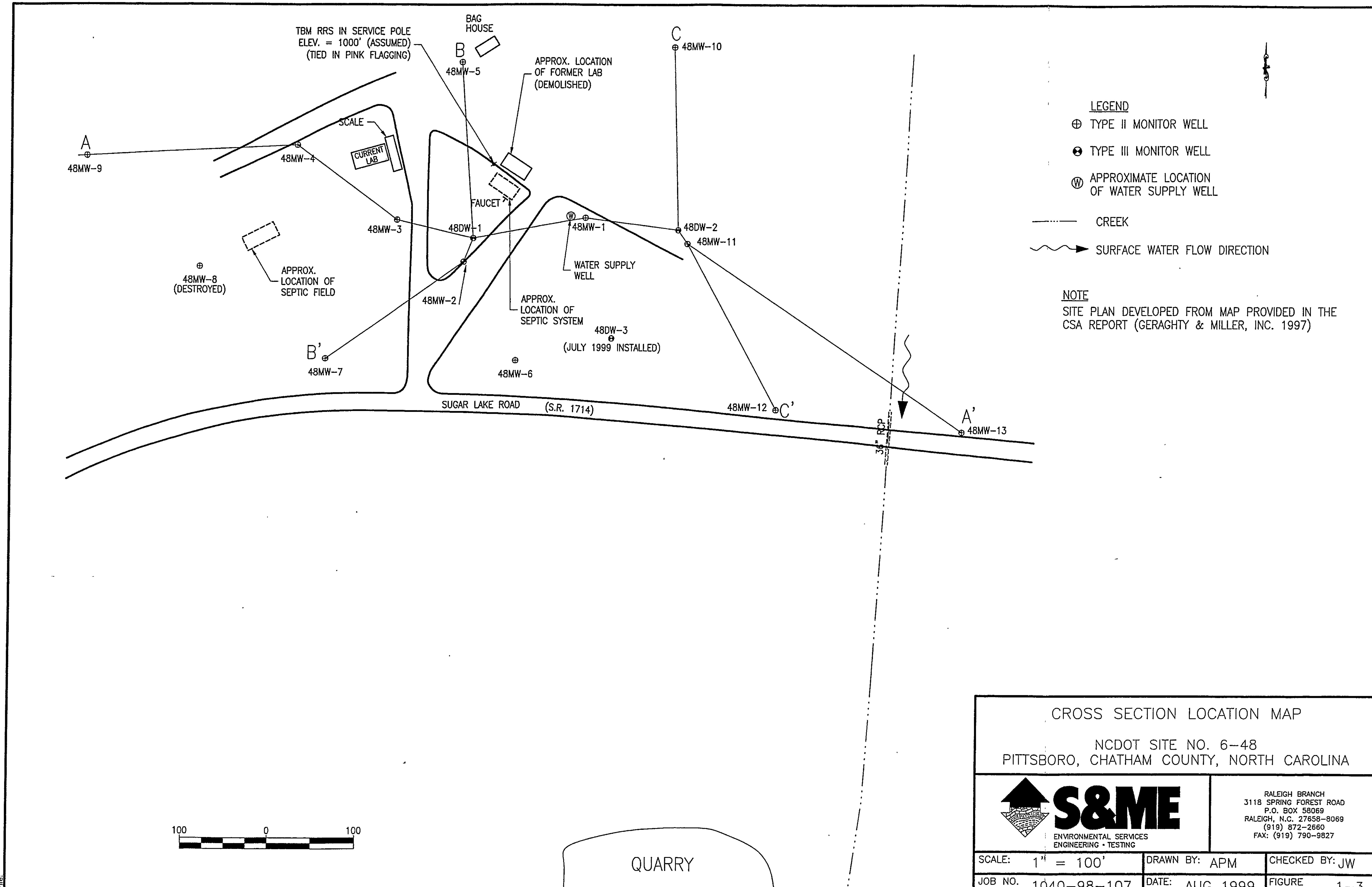
FAX: (919) 790-9827

SCALE: 1" = 100'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-2

File:



CROSS SECTION LOCATION MAP

NCDOT SITE NO. 6-48
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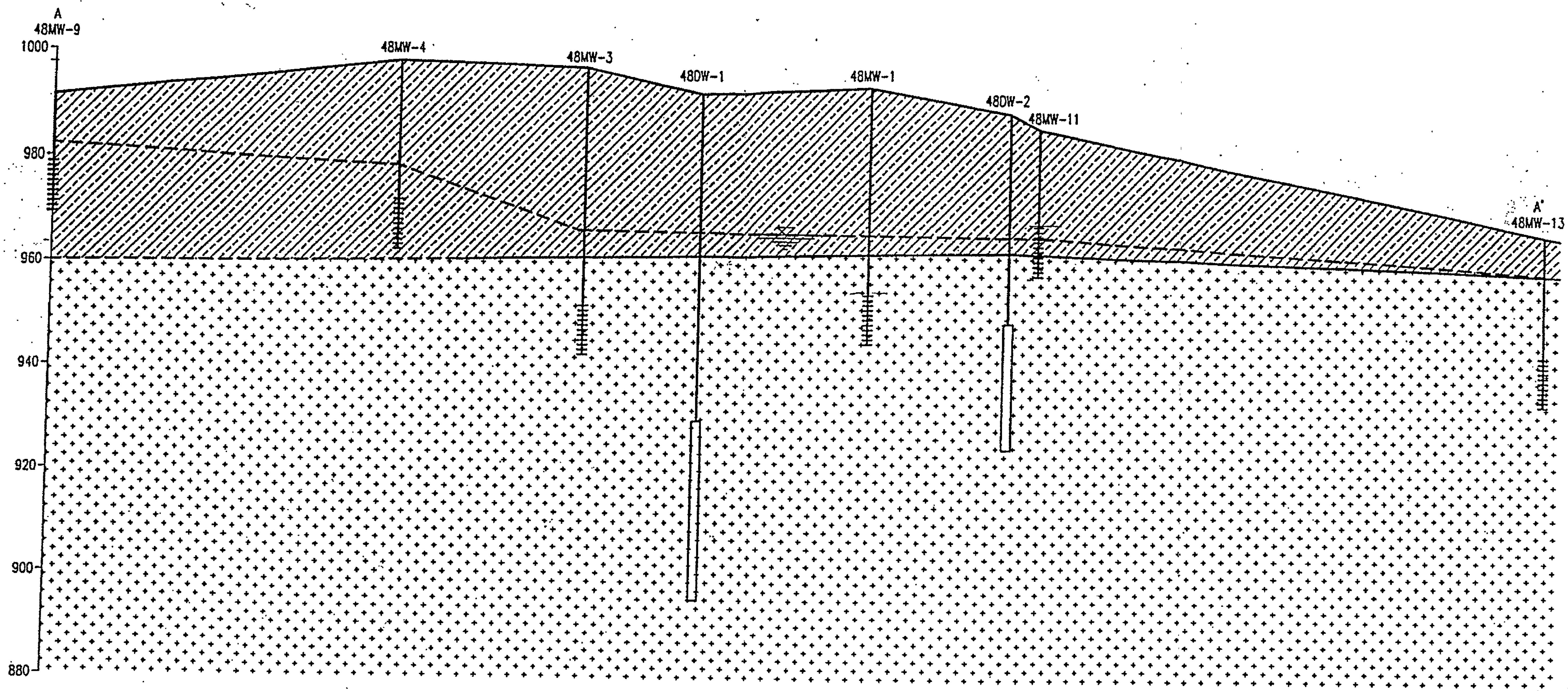
SCALE: 1" = 100'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-3

File:



NOTE:
THIS FIGURE IS A REPRODUCTION OF FIGURE 8-2 IN THE CSA REPORT FURNISHED BY NCDOT. (GERAGHTY & MILLER, INC, 1997)

LEGEND

BEDROCK	SCREENED ZONE
SILT	OPEN ROCK WELLS
WATER LEVEL ELEV. MEASURED 4/29/97	

HOR 0 80' 160' 240'

VER 0 20' 40' 60'

GEOLOGIC CROSS-SECTION A-A'
(WEST-EAST)
NCDOT SITE NO. 6-48
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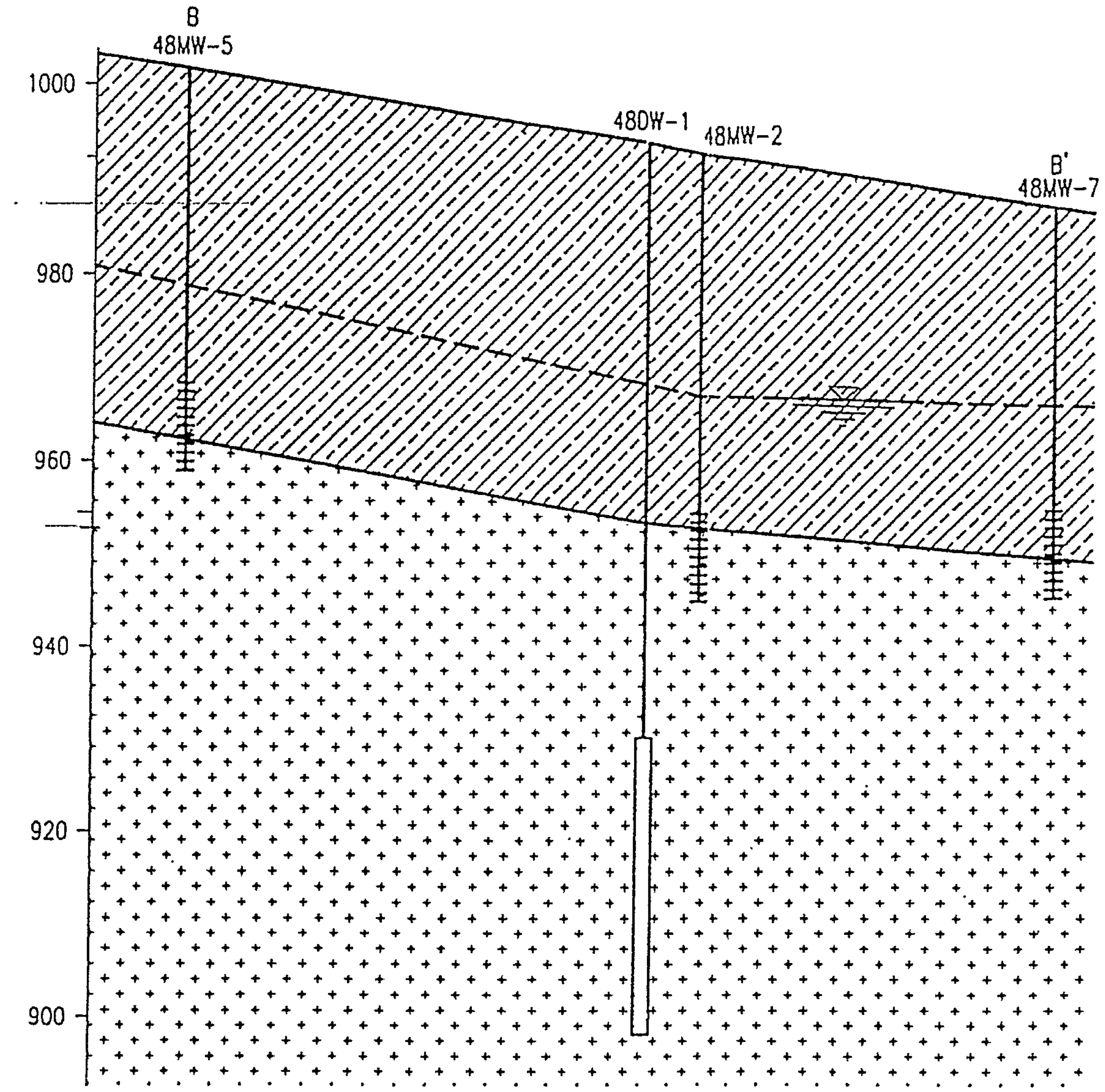
SCALE: AS NOTED	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-4

File:



LEGEND

BEDROCK	SCREENED ZONE
SILT	OPEN ROCK WELLS
WATER LEVEL ELEV. MEASURED 4/29/97	

HOR 0 80' 160' 240'

VER 0 20' 40' 60'

NOTE:
THIS FIGURE IS A REPRODUCTION OF FIGURE 8-3 IN THE CSA REPORT FURNISHED BY NCDOT. (GERAGHTY & MILLER, INC, 1997)

GEOLOGIC CROSS-SECTION B-B'
(NORTH-SOUTH)
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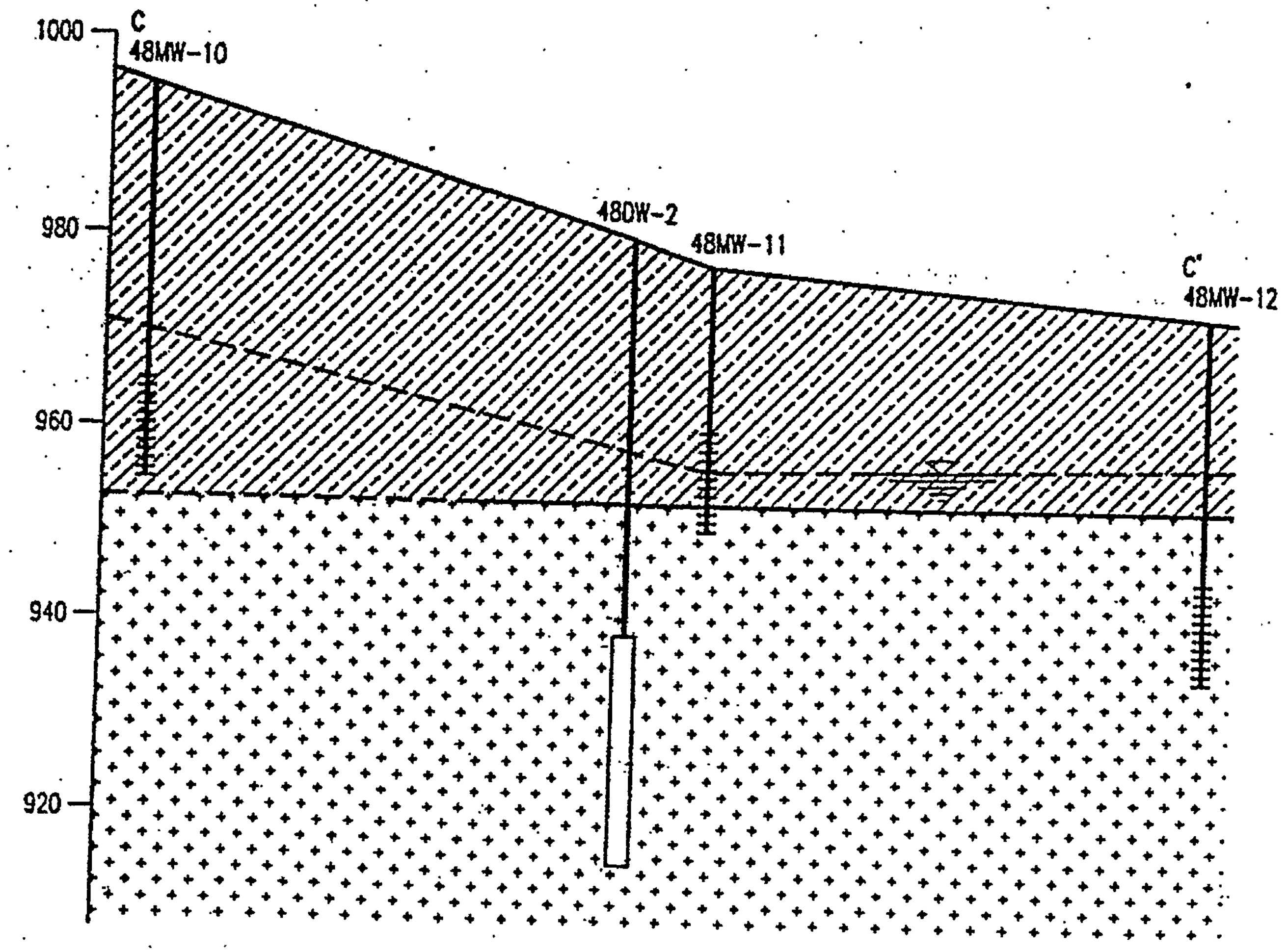
SCALE: AS NOTED	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-5



LEGEND

- SILT
- BEDROCK
- WATER LEVEL ELEV. MEASURED 4-29-97
- SCREENED ZONE
- OPEN ROCK WELLS

NOTE:
THIS FIGURE IS A REPRODUCTION OF FIGURE 8-4 IN THE CSA REPORT FURNISHED BY NCDOT. (GERAGHTY & MILLER, INC, 1997)

HOR 0 80' 160' 240'

VER 0 20' 40' 60'

GEOLOGIC CROSS-SECTION C-C'
(NORTH-SOUTH)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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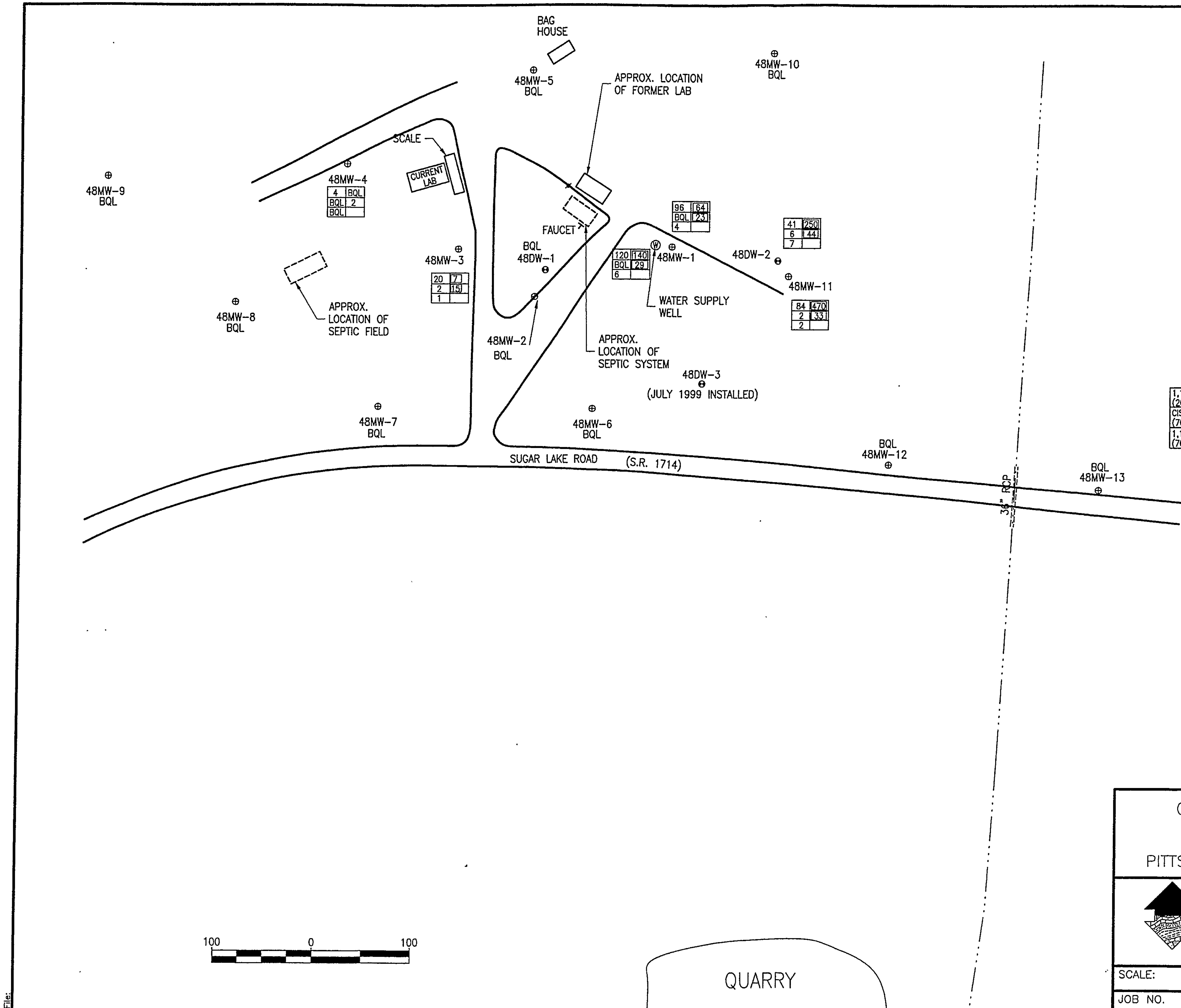
SCALE: AS NOTED	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-6

File:



LEGEND

⊕ TYPE II MONITOR WELL

TYPE III MONITOR WELL

Ⓦ APPROXIMATE LOCATION OF WATER SUPPLY WELL

—··— CREEK

NOTE:
BOXES ADJACENT TO WELLS INDICATE CONTAMINANT CONCENTRATIONS AS SHOWN BELOW.

NUMBER IN PARENTHESES ARE THE NCAC 15A 2L GROUNDWATER STANDARDS.

1,1,1-TCA (200)	TCE (2.8)
CIS-1,2-DCE (70)	1,1-DCE (7)
1,1-DCA (700)	

ABBREVIATIONS

1,1,1-TCA = 1,1,1-TRICHLOROETHANE
TCE = TRICHLOROETHENE
CIS-1,2-DCE = CIS-1,2-DICHLOROETHENE
1,1-DCE = 1,1-DICHLOROETHENE
1,1-DCA = 1,1-DICHLOROETHANE

( ) 15A NCAC 2L STANDARD

☐ CONCENTRATION EXCEEDING 2L STANDARD

BQL BELOW QUANTITATION LIMIT

CHEMICAL CONCENTRATION IN μg/L

GROUNDWATER QUALITY DATA IN CSA
(AUGUST 1996 - APRIL 1997)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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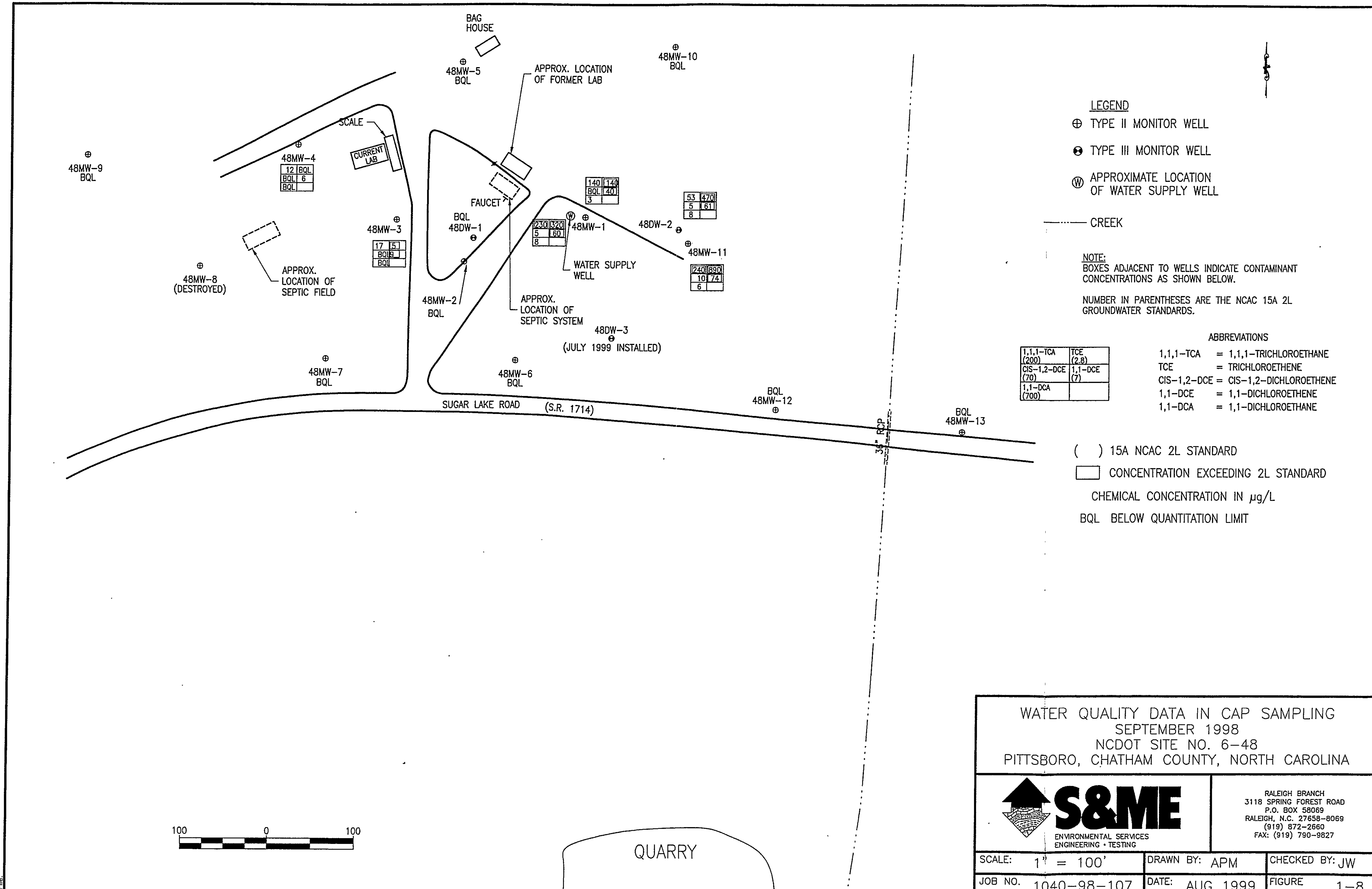
SCALE: 1" = 100'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-7

File:



WATER QUALITY DATA IN CAP SAMPLING
SEPTEMBER 1998
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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SCALE: 1" = 100'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 1-8

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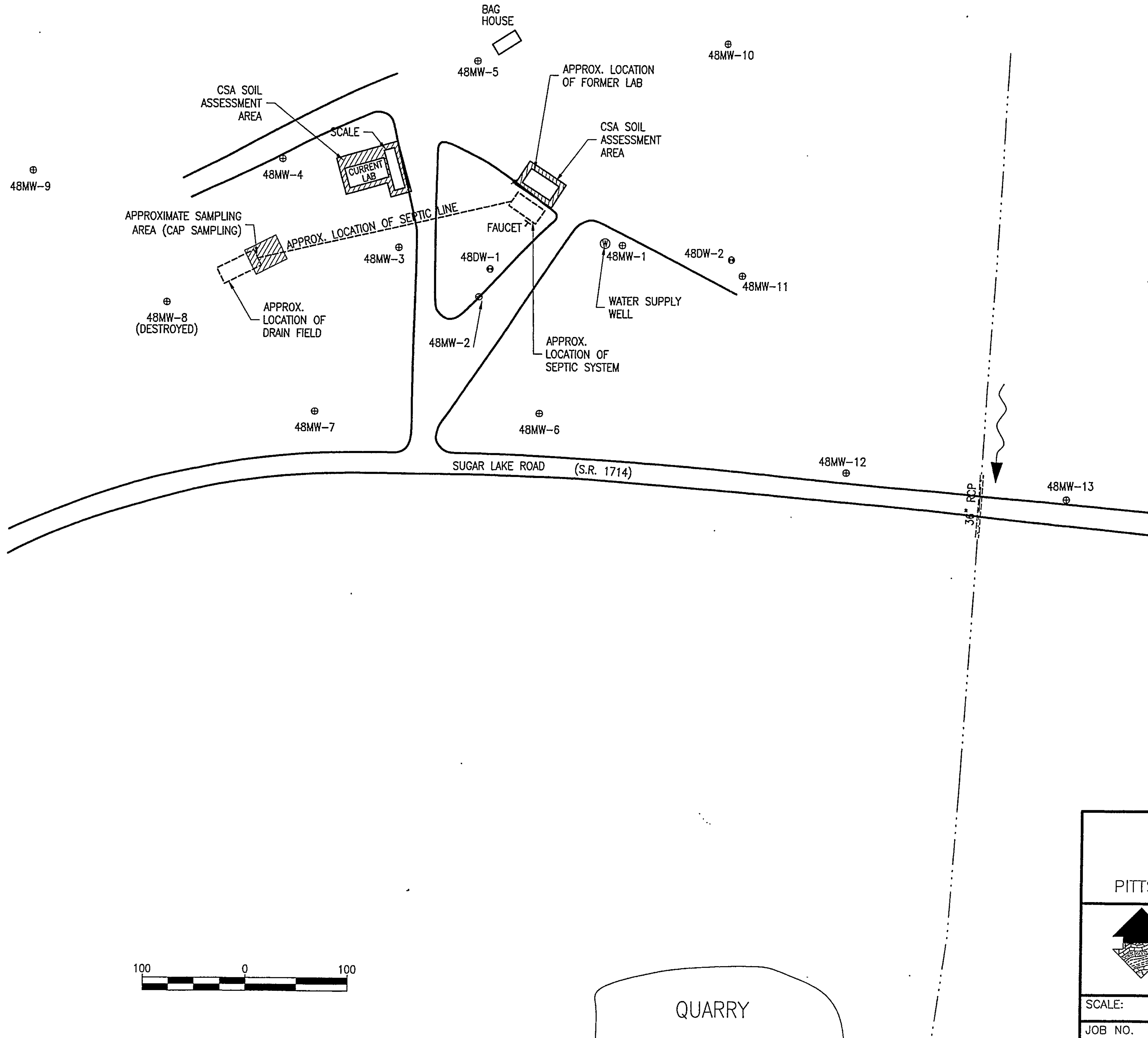

LEGEND

- ⊕ TYPE II MONITOR WELL
- TYPE III MONITOR WELL
- Ⓦ APPROXIMATE LOCATION OF WATER SUPPLY WELL
- CREEK
- FLOW DIRECTION

NOTES

SITE PLAN DEVELOPED FROM MAP PROVIDED IN THE CSA REPORT (GERAGHTY & MILLER, INC. 1997)

CSA SOIL ASSESSMENTS INCLUDE 4 SAMPLES FOR FORMER LAB AND 7 SAMPLES FOR CURRENT LAB

CAP SOIL ASSESSMENT INCLUDES 5 SAMPLES FOR SEPTIC SYSTEM

LOCATIONS OF SOIL ASSESSMENT

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SCALE: 1" = 100'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG 1999	FIGURE 2-1

File:

BEDROCK FRACTURES
(NORTHERN QUARRY WALL)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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Scale: NTS
Date: AUG 1999
Job No. 1040-98-107

Approved By: JW
Drawn By APM
Fig No. 2-2

File:

BEDROCK FRACTURES
(NORTHWESTERN QUARRY WALL)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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Scale: NTS	Approved By: JW
Date: AUG 1999	Drawn By APM
Job No. 1040-98-107	Fig No. 2-3

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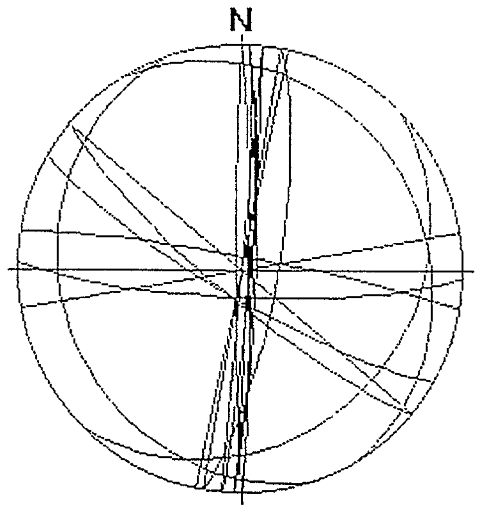
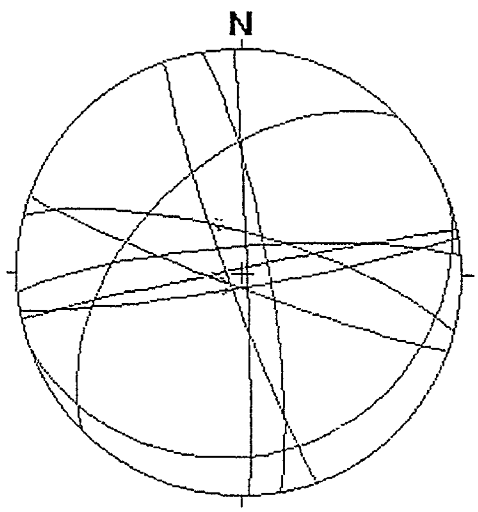


Fracture orientations for northern (south-facing) quarry wall shown as lower-hemisphere projections of fracture planes and poles.



Fracture orientations on western quarry walls represented as fracture planes and poles to the planes

FRACTURE MAPPING

NCDOT SITE NO. 6-48
PITTSBORO, NORTH CAROLINA

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Job No. 1040-98-107
Scale: NTS
Fig No. 2-4

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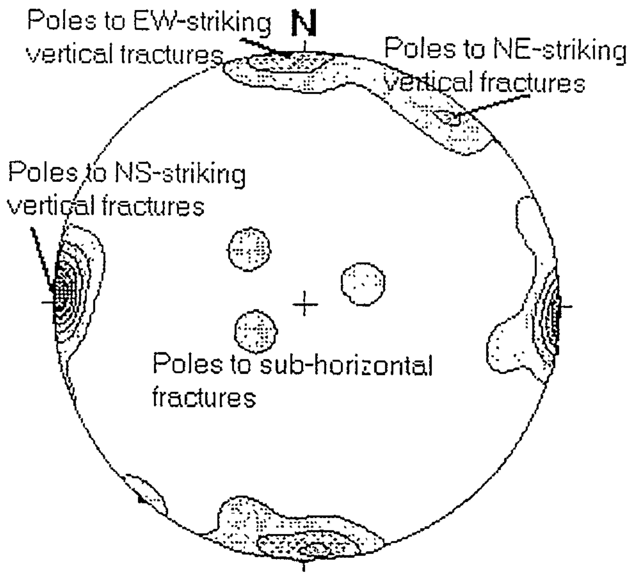
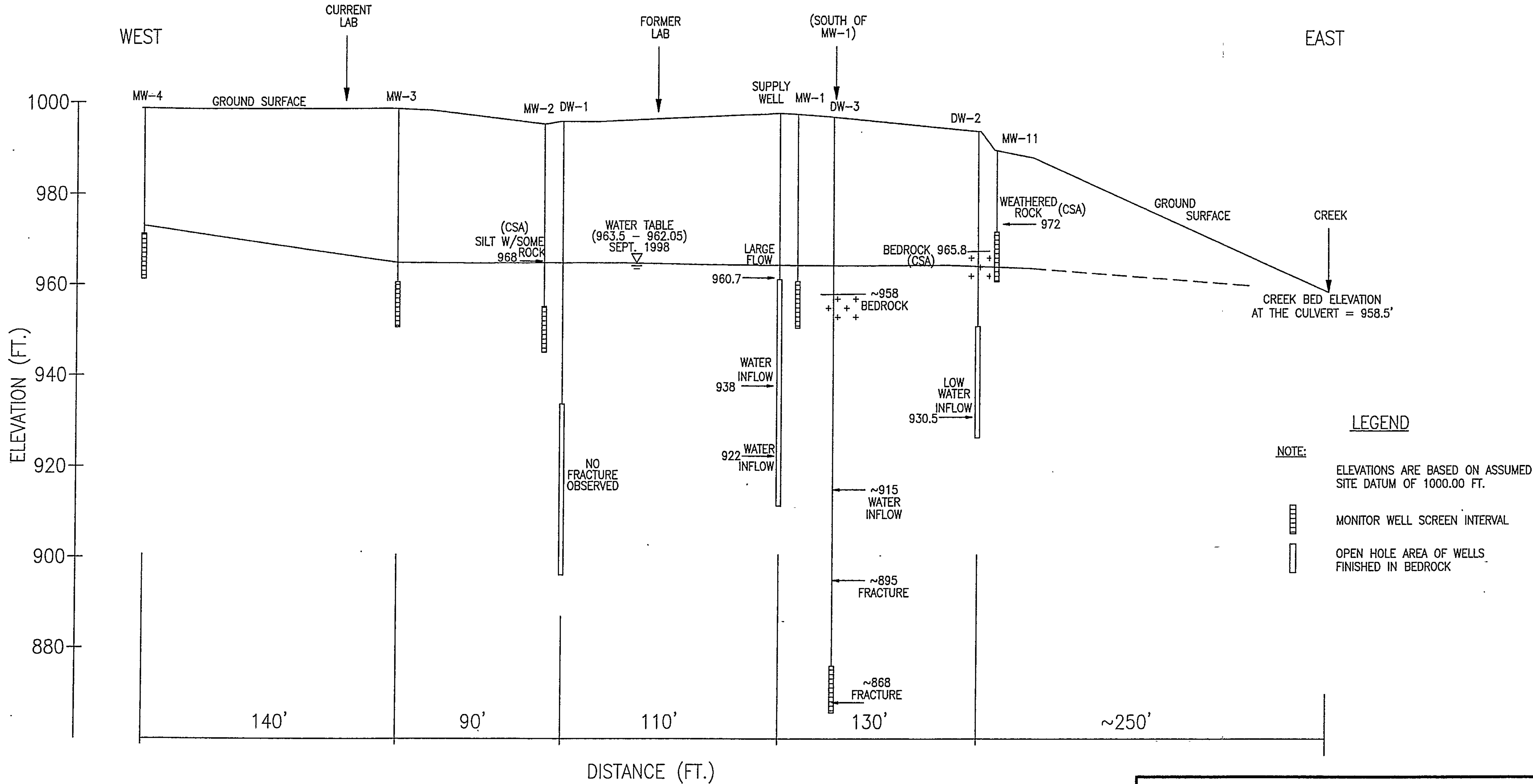


Contour plot of density of poles to fracture planes measured on northern quarry wall. This figure indicates that there are four primary fracture sets, as indicated by the annotations.

FRACTURE MAPPING NCDOT SITE NO. 6-48 PITTSBORO, NORTH CAROLINA	S&ME ENVIRONMENTAL SERVICES ENGINEERING • TESTING	Job No. 1040-98-107 Scale: NTS Fig No. 2-5

File:



CROSS SECTION WITH VIDEO LOGGING OBSERVATION

NCDOT SITE NO. 6-48
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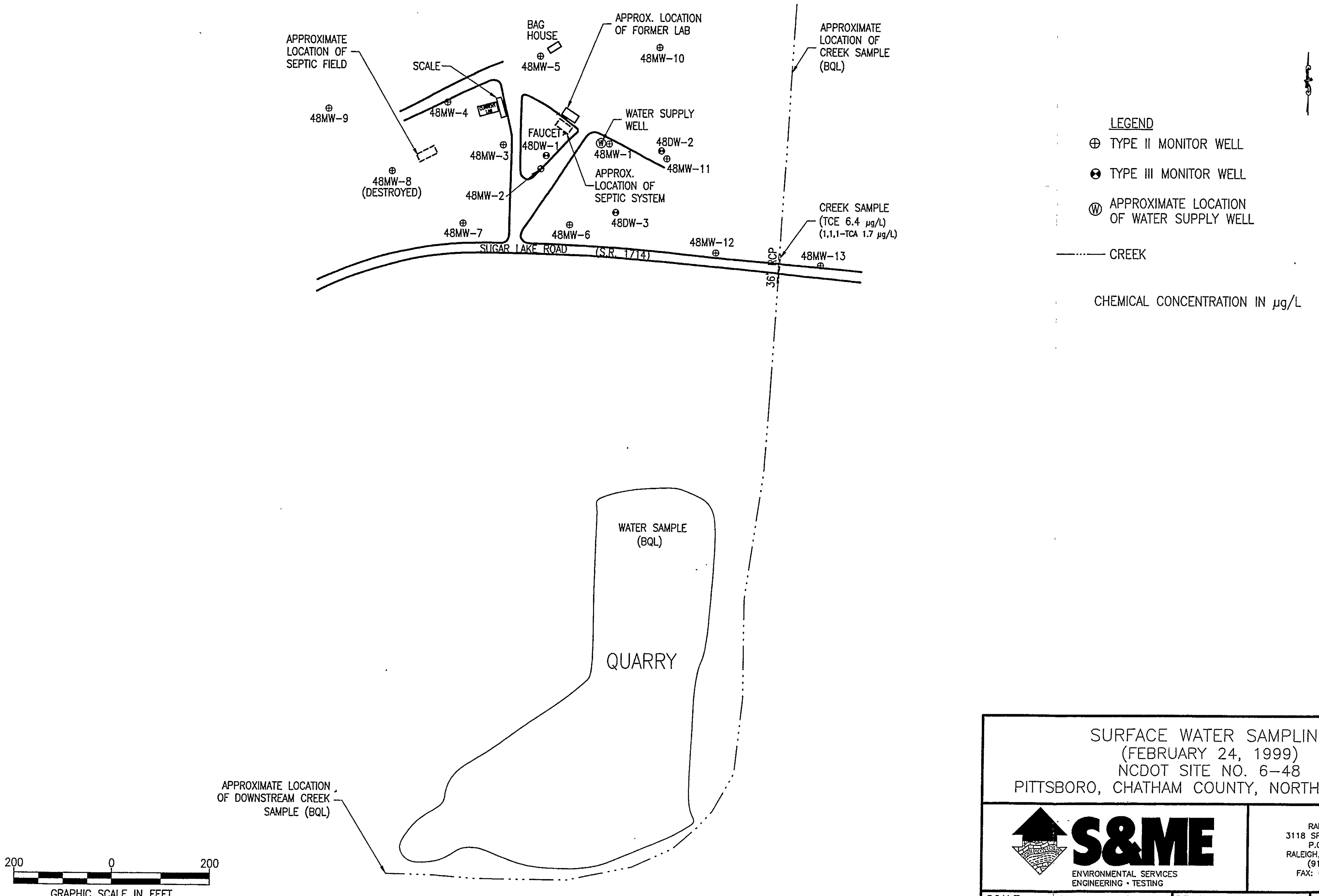
SCALE: AS SHOWN	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG. 1999	FIGURE 2-6

File:



SURFACE WATER SAMPLING
(FEBRUARY 24, 1999)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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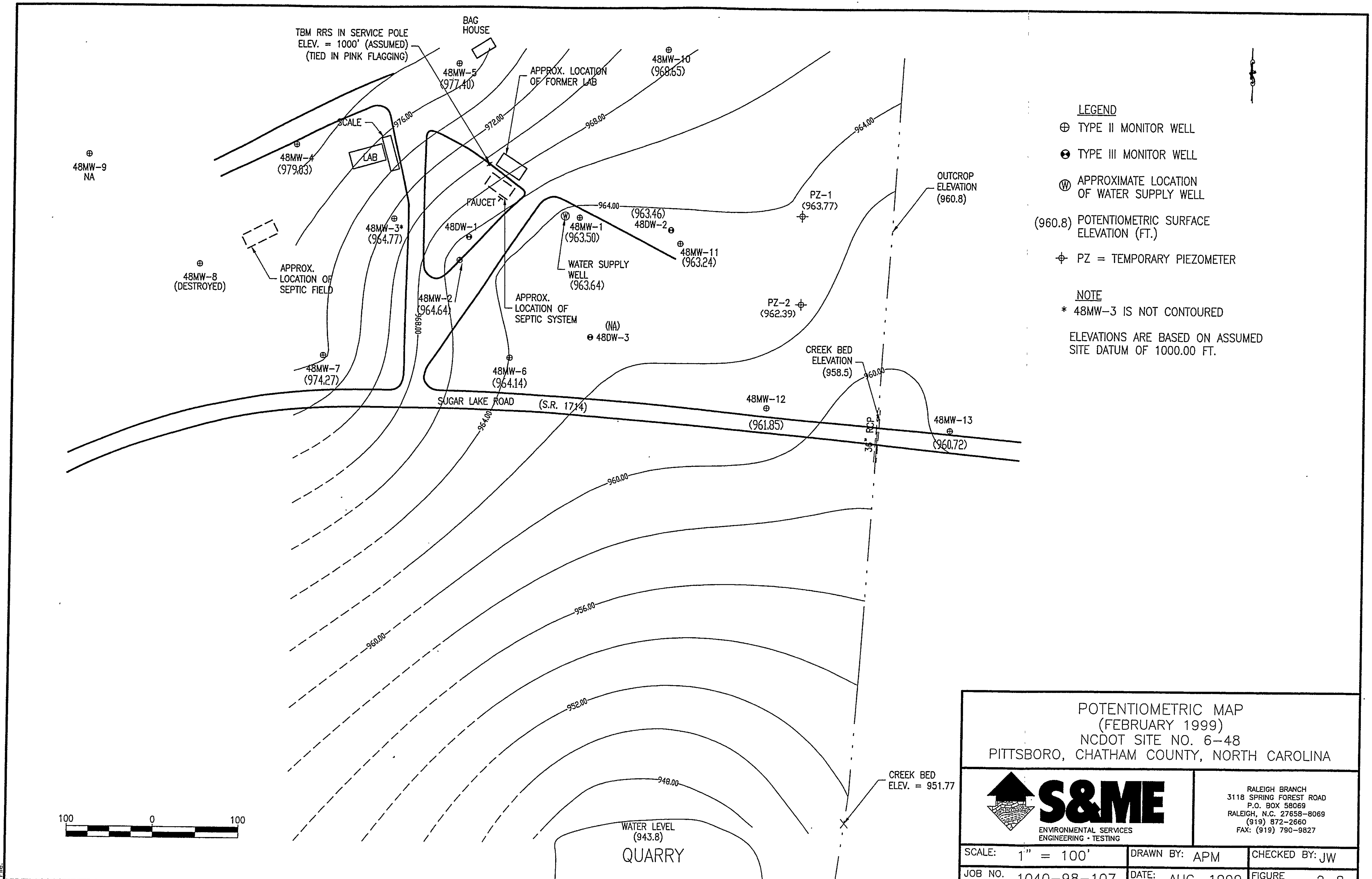
SCALE:	1" = 200'	DRAWN BY:	APM	CHECKED BY:	JW
JOB NO.	1040-98-107	DATE:	AUG. 1999	FIGURE	2-7

File:



POTENTIOMETRIC MAP
(FEBRUARY 1999)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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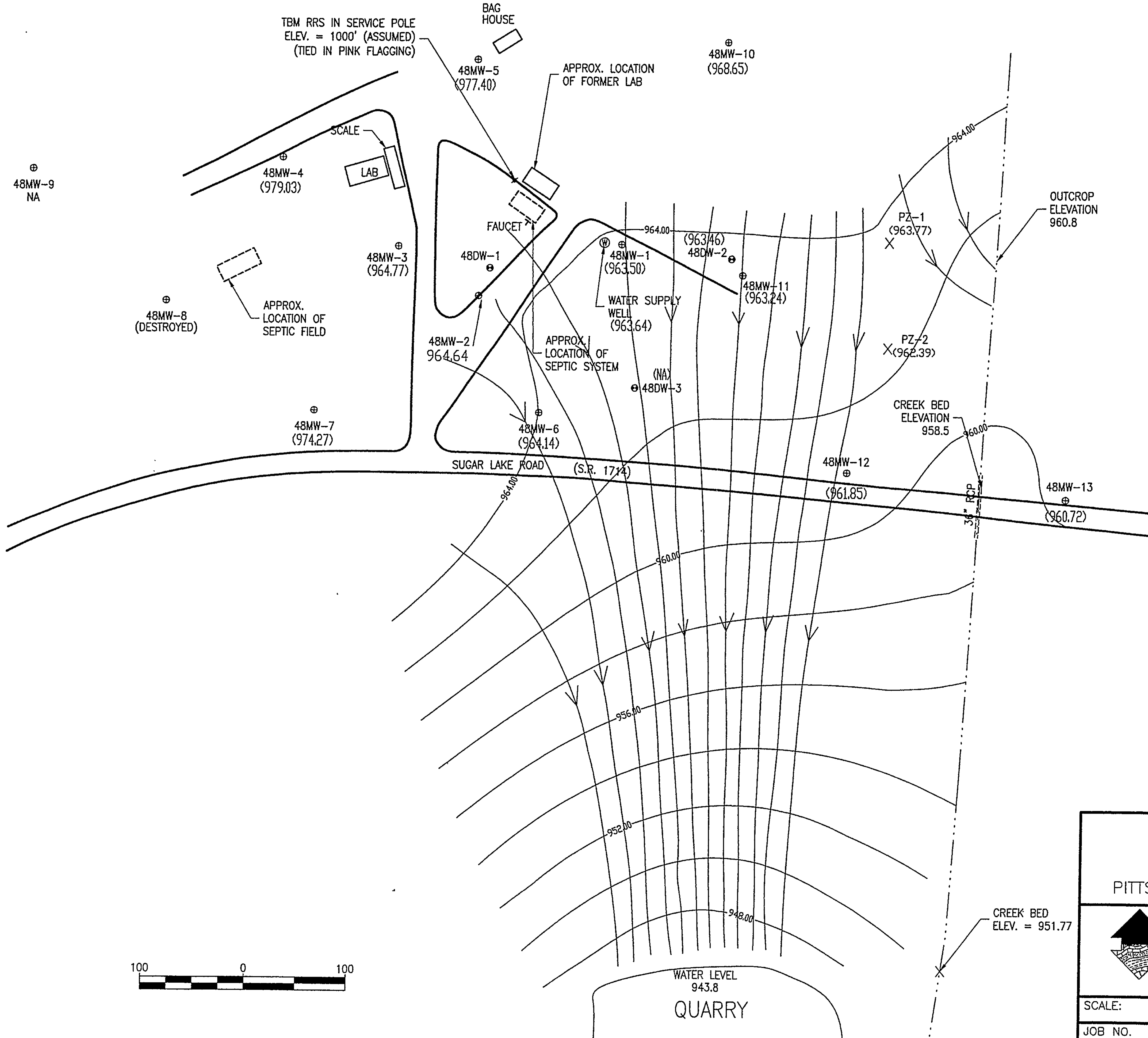
FAX: (919) 790-9827

SCALE:	1" = 100'	DRAWN BY:	APM	CHECKED BY:	JW
JOB NO.	1040-98-107	DATE:	AUG. 1999	FIGURE	2-8

File:



LEGEND

- ⊕ TYPE II MONITOR WELL
- ⊖ TYPE III MONITOR WELL
- Ⓦ APPROXIMATE LOCATION OF WATER SUPPLY WELL
- ( ) POTENTIOMETRIC SURFACE ELEVATION (FT.)
- POTENTIOMETRIC CONTOURS
- FLOWLINE

NOTE:

POTENTIOMETRIC CONTOUR INTERVAL = 2.0 FT.

ASSUMED $K_{NORTH-SOUTH} / K_{WEST-EAST} = 4.0$

(ESTIMATED FROM FRACTURE MAPPING)

ELEVATIONS ARE BASED ON ASSUMED SITE DATUM OF 1000.00 FT.

FLOWNET FOR BEDROCK AQUIFER
(FEBRUARY 1999)
NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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SCALE: 1" = 100'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG. 1999	FIGURE 2-9

File:

NOTE:
PROPERTY #s 7,9,53,62 WERE SAMPLED IN OCTOBER 1997

PROPERTY #s 2 AND 23 WERE SAMPLED IN JUNE 1999

FIGURE TAKEN FROM GERAGHTY & MILLER, INC. "COMPREHENSIVE SITE ASSESSMENT, SITE NO. 48, LEE PAVING COMPANY, PITTSBORO, NORTH CAROLINA", JUNE 1997

* DENOTES PROPERTY WITH WATER SUPPLY WELL

ADJACENT PROPERTIES MAP

SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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SCALE: 1" = 600'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG. 1999	FIGURE 2-10

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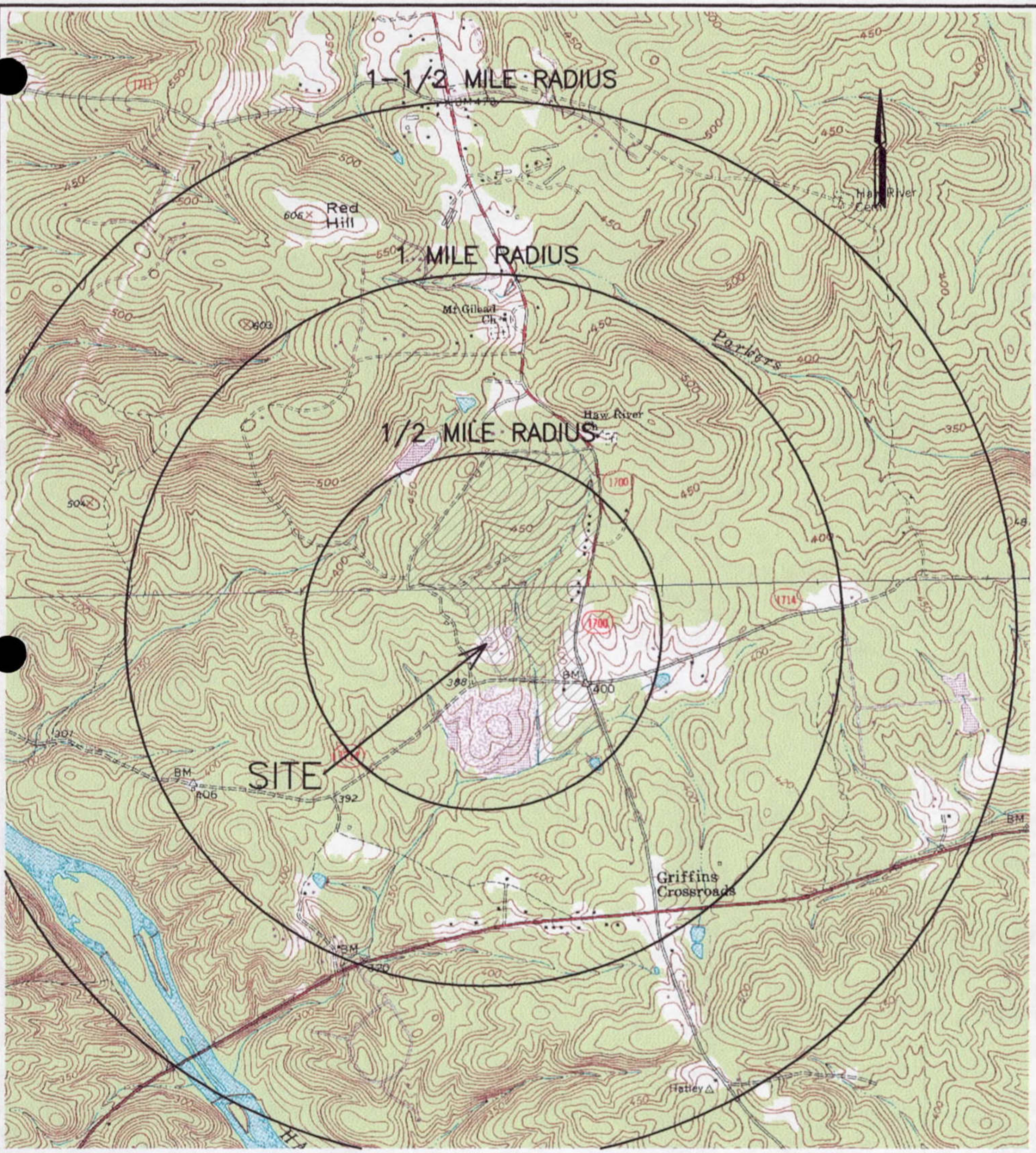

MERRY OAKS, NC USGS QUADRANGLE DATED 1969 (PHOTOREVISED 1981)
FARRINGTON, NC USGS QUADRANGLE DATED 1978 (PHOTOREVISED 1981)

ESTIMATED DRAINAGE AREA FOR THE CREEK
SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

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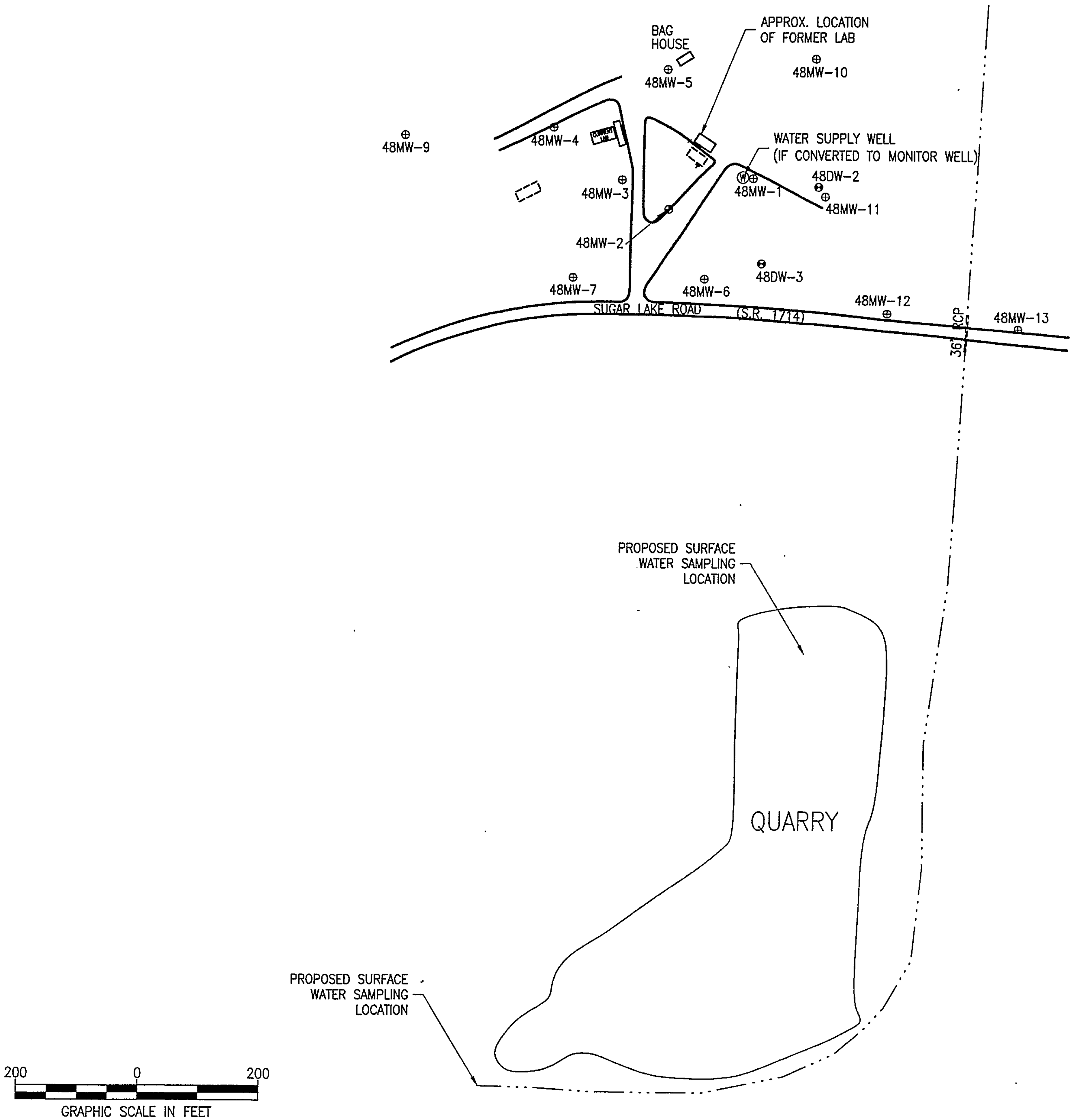
Job No. 1040-98-107
Scale: 1" = 2000'
Fig No. 4-1

File: 107-98-OCT-FIG02.DWG



LEGEND

⊕ TYPE II MONITOR WELL

TYPE III MONITOR WELL

Ⓦ APPROXIMATE LOCATION OF WATER SUPPLY WELL

—··— CREEK

NOTE:
48DW-1 IS NOT INCLUDED IN THE PROPOSED MONITORING PLAN

PROPOSED MONITORING LOCATIONS

NCDOT SITE NO. 6-48
PITTSBORO, CHATHAM COUNTY, NORTH CAROLINA

S&ME
ENVIRONMENTAL SERVICES
ENGINEERING · TESTING

RALEIGH BRANCH
3118 SPRING FOREST ROAD
P.O. BOX 58069
RALEIGH, N.C. 27658-8069
(919) 872-2660
FAX: (919) 790-9827

SCALE: 1" = 200'	DRAWN BY: APM	CHECKED BY: JW
JOB NO. 1040-98-107	DATE: AUG. 1999	FIGURE 4-2

APPENDIX I

NCDENR AND NCDOT LETTERS OF AGREEMENT

STATE OF NORTH CAROLINA

WAKE COUNTY

AGREEMENT

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

-AND -

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

THIS AGREEMENT is made and entered into by and between the NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT (hereinafter referred to as NRCD) and the NORTH CAROLINA DEPARTMENT OF TRANSPORTATION (hereinafter referred to as DOT).

WITNESSETH:

THAT WHEREAS, as a result of finding of contamination of the underground water at the Vulcan Material Company, Enka Plant in Buncombe County, DOT recognizes that a possibility of contamination of the water supply exists at a number of other asphalt plant locations across the State.

NOW, THEREFORE, in order to identify the possible contamination sites, NRCD and DOT agree:

(1) That DOT will conduct, in consultation with NRCD, an initial screening study of all potential contamination sites according to site characteristics such as proximity to surface waters, slope, soil permeability etc., time and duration of site use, and chemicals used;

(2) That DOT will survey the specific sites by taking soil and water samples and conducting appropriate laboratory analysis to determine the extent of contamination;

(3) That DOT will develop, and submit to NRCD for approval, specific site evaluation plans, and will begin the surveys of the sites upon approval by NRCD;

(4) That NRCD recognizes, with the exception of the three DOT-owned sites, that the DOT neither owns, leases nor has control of the sites in question and is dependent upon the cooperation of the owners and lessees to conduct the surveys. (All current sites, with the exception of three DOT-owned sites, are leased or owned by asphalt companies. All abandoned sites are owned by quarry operators, private individuals, and others). DOT agrees to pursue the acquisition of permission for site access from current owners and lessees. In the event such permission is denied, NRCD will, as a last resort, exercise its authority to secure administrative search warrants, if necessary, to gain access to the sites for investigative purposes.

(5) Upon completion of the surveys and a determination of the contaminations levels, DOT will submit to NRCD for its approval a priority listing for any remedial work necessary and remedial action plans for those sites. The Department of Transportation will not commence remediation until approved by NRCD. Any action taken by the DOT in making surveys and making

priority listings for remedial work and preparing and submitting remedial action plans shall not affect the determination of liability or responsibility as to third parties.

(6) NRCD will take no action in this matter that does, or may, constitute a conflict with its obligations to enforce water quality laws and regulations, as delegated to it by the United States Environmental Protection Agency. No actions taken pursuant to this Agreement, or information derived therefrom, shall preclude or bar DEM from initiating and pursuing any enforcement actions deemed necessary in regard to these sites.

(7) Entering into this Memorandum of Agreement does not constitute an admission of liability on the part of DOT.

This the 10 day of January, 1989.

NORTH CAROLINA DEPARTMENT OF NATURAL RESOURCES AND COMMUNITY DEVELOPMENT

BY: [signature]
William W. Cobey, Jr., Secretary

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

BY: [signature]
James E. Harrington, Secretary

42260-96-4-141N

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT JR.
GOVERNOR

DIVISION OF HIGHWAYS
P.O. BOX 25201. RALEIGH. N.C. 27611-5201

GARLAND B. GARRETT JR.
SECRETARY

April 24, 1996

Arthur Mouberry
Chief, Groundwater Section
North Carolina Department of Environment, Health and Natural Resources
P.O. Box 29535
Raleigh, NC 27626-0535

Re: NCDOT Asphaltic Materials Testing Priority Sites
Interim Screening Investigation Letter of Agreement

Dear Mr. Mouberry,

On April 16, 1996 a meeting was held between the North Carolina Department of Environment, Health and Natural Resources (NCDEHNR) and the North Carolina Department of Transportation (NCDOT) to discuss an interim screening investigation at the subject asphalt sites. An agreement between NCDEHNR and NCDOT was reached on the scope of the work to be followed during the interim screening investigation. As discussed in the meeting, none of the subject sites are owned by the NCDOT. Site activity by NCDOT personnel was limited to ASTM asphalt extraction testing in the laboratories. Following the screening investigation, it is our understanding that for sites having no soil impacts (based on published guidance by NCDEHNR Groundwater Section), and no groundwater impacts (based on Title 15A, Subchapter 2L, NCAC), NCDOT will submit an interim screening investigation letter report of findings requesting no further action which will be reviewed and approved by NCDEHNR. NCDEHNR has agreed to respond in writing within two to three weeks upon receipt of each letter report. The following summarizes the scope of work that will be uniformly executed at each of the asphalt laboratory sites based on this meeting.

The objective of this interim screening investigation is to focus on the identification of contaminants in soil and groundwater associated with the asphaltic materials testing activities. These contaminants consist of chlorinated solvents such as Carbon Tetrachloride, Trichlorethylene, Trichlorethane, and related degradation compounds. The suspected area of contamination at each of the priority asphalt sites is within the vicinity of the former/current asphaltic materials testing labs. Soil and groundwater samples will be collected at each site as described below.

A soil-vapor survey using manual soil probes; and field soil-vapor screening instruments (i.e. a portable gas chromatograph) will be utilized to initially identify localized "hot spots" of chlorinated solvent contamination. Following the soil-vapor survey, an array of six to ten soil borings using direct push technology (DPT) will be installed at each site in the vicinity of the asphaltic materials testing lab.

For sites at which use of DPT is unsuccessful (i.e. based on local geology), conventional drilling methods will be employed. If conventional drilling methods are used, and a change in the sampling plan becomes necessary, NCDOT will initiate discussion with NCDEHNR Groundwater Section to determine a revised sampling arrangement. At all boring locations, adequate measures will be taken to avoid the transfer of contamination from one sampling zone to another.

From these boring locations soil samples will be collected at shallow depths below the ground surface at two depth intervals. These soil borings will be installed at locations in the vicinity of the asphaltic laboratory building, which have been visually identified as suspect contamination areas and at the "hot spots" identified from the soil-vapor survey. Sampling depths will typically be from zero to five feet and five to ten feet below ground surface. Soil samples will be collected at each depth interval and shipped to an analytical laboratory for analysis of volatile organic compounds (VOC) using United States Environmental Protection Agency (EPA) test method 8021.

Eight to ten groundwater samples will be collected from the boring locations. These groundwater samples will be collected by advancing the probe approximately ten feet below the groundwater table. Samples will be obtained by methods that will minimize agitation. At two of the boring locations, down gradient of the suspected area of contamination, the sampling point will be further advanced to intermediate depths below the water table to characterize the vertical extent of contamination. Groundwater samples will be analyzed for VOC's by Standard Method 6230-D. Three temporary piezometers will be installed at selected locations to evaluate the hydraulic gradient at each of the sites.

An interim screening investigation letter report will follow each investigation if it is demonstrated that there are no unacceptable levels of groundwater contamination present based on the 2L groundwater quality standards or soil contamination based on published guidance by the NCDEHNR Groundwater Section. For sites that do not meet this criteria, additional investigations will be conducted and comprehensive site assessments will be prepared.

If after review of this letter of agreement you find it necessary to make changes please notify me immediately. We would like to begin the site investigations as quickly as possible, therefore your prompt response is requested. Should you have questions or comments I may be reached at (910)334-4273.

Sincerely,

Thomas C. [signature]

Thomas C. Niver, P.G., CHMM
Environmental Engineer, Safety & Loss Control

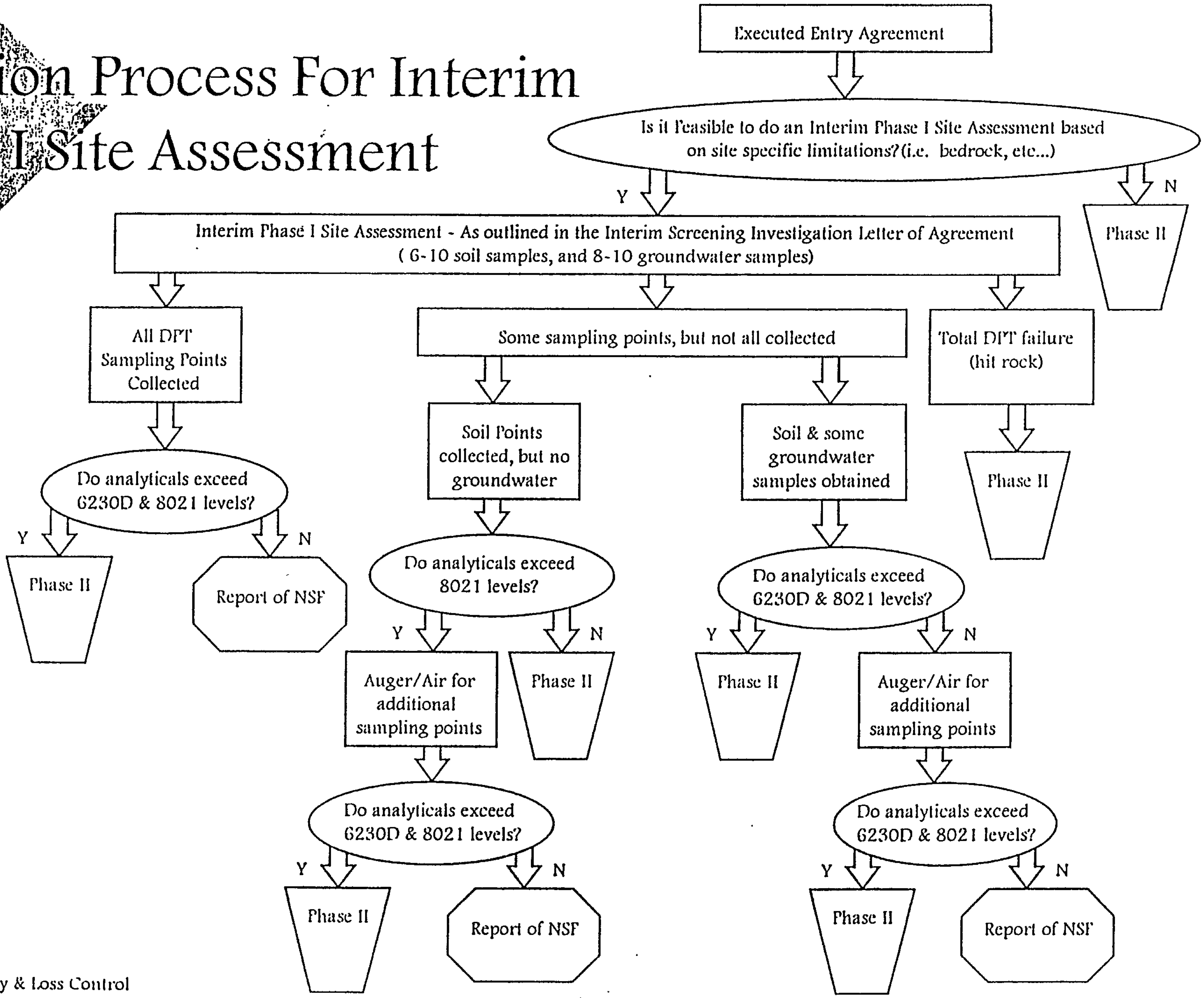
Accepted by:

Arthur Mouberry [signature]

Arthur Mouberry, P.E.
Chief, Groundwater Section

cc: Paul Roberts, NCDOT
Ted Bush, NCDEHNR
Jay Zimmerman, NCDEHNR
Frederic D. Rash, Geraghty & Miller, Inc.
Rudy Smithwick, Catlin & Associates, Inc.

Decision Process For Interim Phase I Site Assessment



4160054

42260-96-9-174N

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT JR.
GOVERNOR

DIVISION OF HIGHWAYS
P.O. BOX 25201. RALEIGH. N.C. 27611-5201

GARLAND B. GARRETT JR.
SECRETARY

July 3, 1996

Mr. Arthur Mouberry, P.E.
Groundwater Section Chief
North Carolina Department of Environment. Health, and Natural Resource
P.O. Box 29535
Raleigh, NC. 27626-0535

RE: Laboratory Analytical Methods for Phase II Investigation Letter of Agreement

Dear Mr. Mouberry,

On June 13, 1996 a meeting was held between the North Carolina Department of Environment. Health, and Natural Resources (DEHNR) and the North Carolina Department of Transportation (NCDOT). This meeting was held to discuss the execution of laboratory analytical methods for comprehensive site assessments (CSA's) at asphaltic materials testing priority sites 22-72. As discussed in the meeting, NCDOT is prepared to execute the second phase (Phase II) of investigation at several sites where the interim screening investigation has been completed. or did not provide conclusive information. This letter represents the agreement between DEHNR and NCDOT to use the proposed analytical methods, as defined below. to conduct CSA's at the asphaltic materials testing priority sites 22-72.

NCDOT Consultants will follow the Division of Water Quality (DWQ) Groundwater Section Guidelines For The Investigation and Remediation of Soils and Groundwater for the Phase II investigation. As stated within the guidelines. vertical and horizontal delineation of groundwater will use U.S. Environmental Protection Agency (EPA) Methods 601 and 602 for volatile organic compounds; for the vertical and horizontal delineation of soil. EPA Method 8021 will be used. Groundwater samples will be collected and analyzed for VOC's by Standard Method 6230-D. prior to plume delineation. for sites where groundwater analytical results were not obtained from the Interim Phase I Site Investigation.

In addition. soil and groundwater may be collected and analyzed for VOC's by EPA Method 8260-B. These samples will be collected from locations centralized within the contaminant plume for compound confirmation. If Standard Method 6230-D and/or EPA Method 8021 analytical results show concentrations of polycyclic aromatic compounds (PAH), soil and groundwater samples may be collected and analyzed. The soil samples will be analyzed by EPA Method 8270-B, and groundwater samples will be analyzed by EPA Method 625 for confirmation of semi-volatile compounds, for base neutral compounds only.

If after review of this letter of agreement you find it necessary to make changes, please notify me immediately. We have already initiated Phase II investigations at some sites, therefore your prompt response is appreciated. Should you have any questions or comments I may be reached at (910)334-4273.

Sincerely,

Thomas C. Niver, P.G., CHMM
Environmental Engineer, Safety & Loss Control

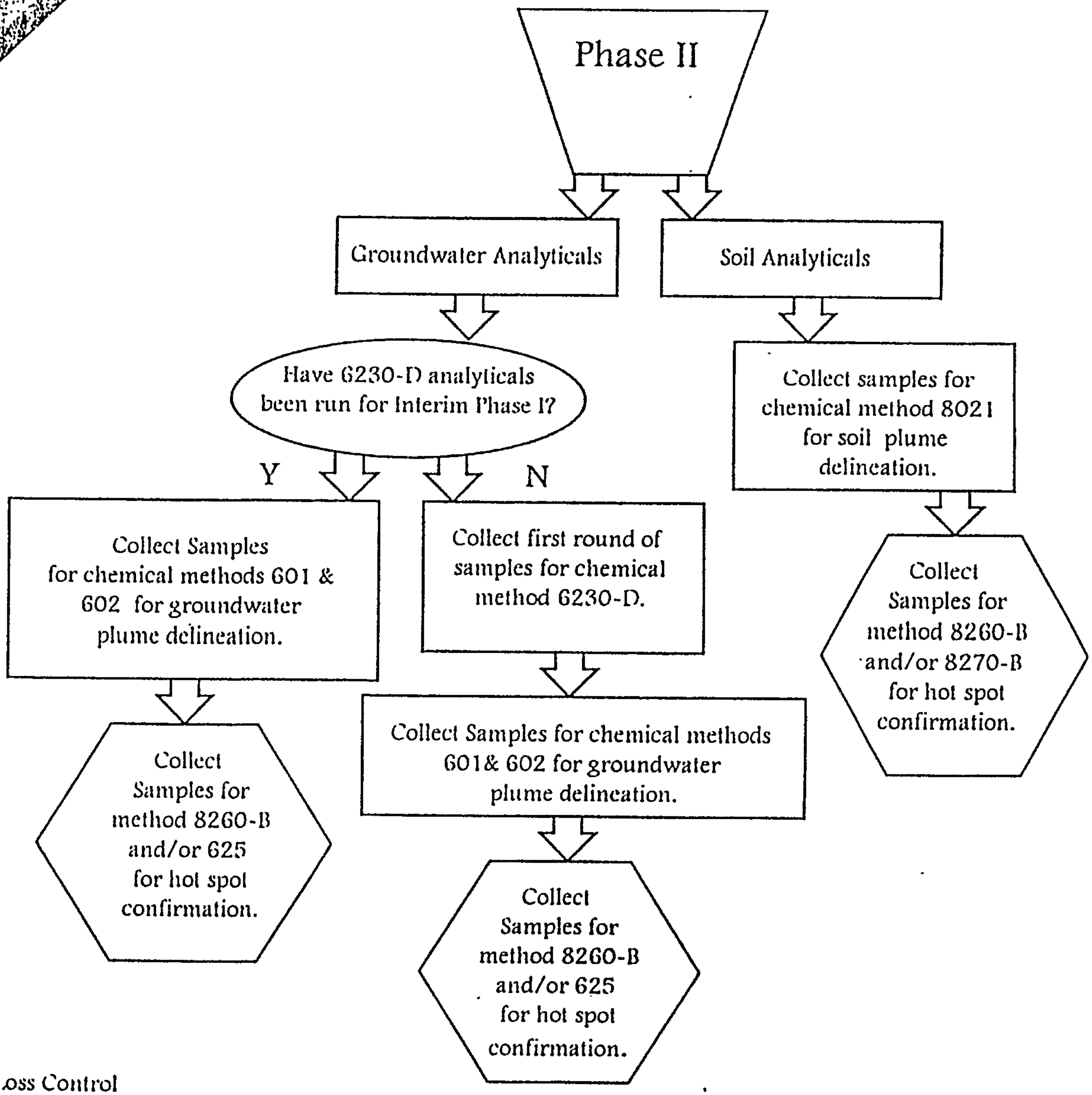
Accepted by:

Arthur Mouberry, P.E.
Groundwater Section Chief

Enclosures
dmm\TCN

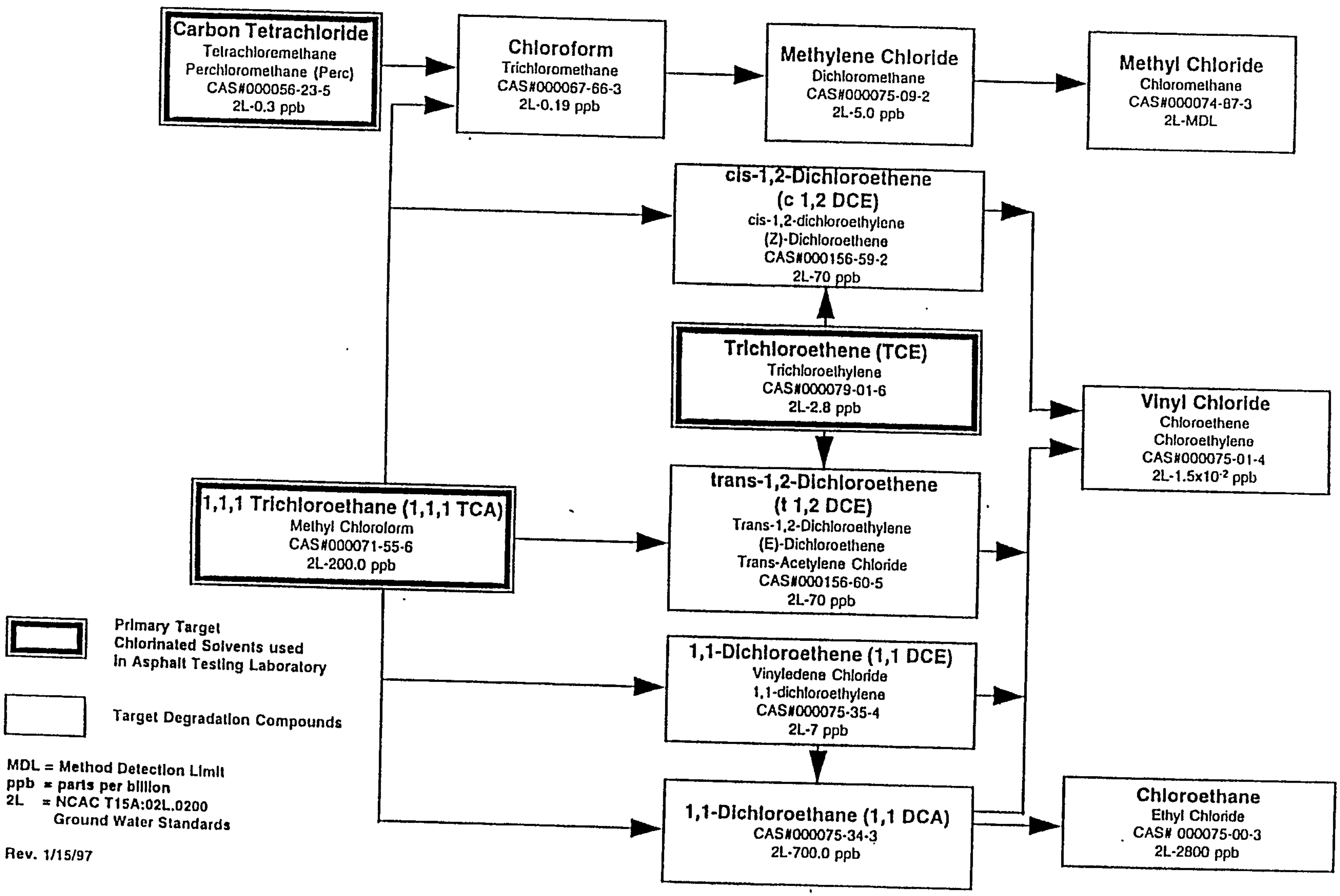
cc: Paul Roberts, North Carolina DOT
Duane MacEntee, North Carolina DOT
Ted Bush, North Carolina DEHNR
Frederic D. Rash, Geraghty & Miller, Inc.
Rudy Smithwick, Catlin & Associates, Inc.

Phase II Analyticals For Soil & Groundwater



NCDOT Target Chlorinated Solvent Transformation Pathways

Transformation Pathways for Various Volatile Target Chlorinated Solvents in Soil-Groundwater Systems from Smith and Dragun, 1984.



MDL = Method Detection Limit
ppb = parts per billion
2L = NCAC T15A:02L.0200 Ground Water Standards

Rev. 1/15/97

42260-98-10-565N

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
JAMES B. HUNT JR.
GOVERNOR
P.O. BOX 25201, RALEIGH, N.C. 27611-5201
E. NORRIS TOLSON
SECRETARY

February 3, 1999

Arthur Mouberry
Chief, Groundwater Section
North Carolina Department of Environment and Natural Resources
Division of Water Quality
P.O. Box 29535
Raleigh, NC 27626-0535

Re: NCDOT Asphaltic Materials Testing Priority Sites
Corrective Action Planning Letter of Agreement
Sites #1-7, 67

Dear Mr. Mouberry,

On October 22, 1998 a meeting was held between the North Carolina Department of Environment and Natural Resources (NCDENR) and the North Carolina Department of Transportation (NCDOT) to discuss procedures and administrative options for the preparation of corrective action plans (CAPs) at the subject asphalt sites. An agreement between NCDENR and NCDOT was reached on administrative understandings and scopes of the work to be used during the CAP field work efforts. As discussed in the meeting, none of the subject sites are owned by the NCDOT. Site activity by NCDOT personnel was limited to ASTM asphalt extraction testing in the laboratories. This agreement will be adjusted as necessary to reflect future agreed upon understandings during the CAP process. The following summarizes the administrative agreements and scopes of work that will be uniformly executed at each of the referenced asphalt laboratory sites.

1. NCDENR, Division of Water Quality, Groundwater Section will respond in writing within 90 days upon receipt of each complete CAP submittal.

2. The comprehensive site assessments (CSAs) and corresponding NCDENR reviews of the CSAs for the referenced sites are accepted as written for all sites where there is not reason to believe that plume conditions have significantly changed. As agreed during the CSA phase of the projects, additional information may be necessary to complete the CSAs for some sites.

This additional information would be gathered during the CAP phase of any project where it is required.

3. Owners of some properties which require additional CSA information may not allow permanent monitoring points. Therefore, rapid assessment techniques using direct push technology (e.g. Geoprobe) to determine plume boundaries will be an available option in lieu of data from permanent monitoring points at these locations. Applications for long-term monitoring situations will be discussed with the NCDENR technical review person on a case-by-case basis.

4. Water supply wells can be used as monitoring points to assess the vertical extent of groundwater as long as the wells are constructed in accordance with the 2C Well Construction Standards and NCDOT and NCDENR agree that characteristics are sufficiently known to support the use of the wells.

5. The vertical extent of groundwater contamination can be established by isolating the contaminated fractures through borehole geophysics and discrete interval sampling as long as a lower fracture is demonstrated to be non-contaminated by "target chlorinated compounds". Applications for interval sampling situations will be discussed with the NCDENR technical review person on a case-by-case basis. It is understood by NCDOT and NCDENR that concurrence of both agencies is necessary to determine when a fracture is actually "isolated" and what is necessary to "demonstrate" that a lower fracture is not contaminated.

6. Upon completion of site specific data collection requirements for CAP preparation, it is our understanding that NCDENR and NCDOT will meet on a site by site basis to review the field data and discuss CAP remedy options on a as needed basis.

7. The elimination of health risks by the abandonment of water supply wells will increase the opportunity for CAP options to include cleanup to alternate groundwater standards [2L.0106(k)], natural attenuation [2L.0106(l)], or variance requests. In some cases deed recordations may be required on those properties with the intent of warning current and future owners of quality concerns with the groundwater on their property.

8. For sites where it can be demonstrated that no significant changes in site conditions have occurred since data collection, the historical analytical data generated during the previously accepted CSAs will be used to identify the type of contamination present in the drill cuttings/mud, purge water and aquifer pump test waters generated as a result of field environmental investigations and/or cleanup operations. This will also include the area of the zone of hydraulic influence from the aquifer test as well as dilution factors. The historical data will be evaluated to determine if the investigative derived waste (IDW) exhibits a characteristic that would classify the material as hazardous (based on 40 C.F.R. § 261.24) and thus subject to the regulation as a hazardous waste. If the evaluation concludes that the IDW may be contaminated by hazardous waste constituents and may exhibit a characteristic that would classify the material as hazardous, NCDOT will contact the Division of Waste Management, Hazardous Waste Section to determine regulatory status of the IDW. Should

the evaluation conclude that the IDW is non-hazardous, NCDOT will dispose of this material on-site in an area where shallow groundwater impacts are present and in a manner consistent with the requirements of Vol. 1 of the "Groundwater Section Guidelines for the Investigation and Remediation of Soil and Groundwater". It is understood that there may be some situations where on-site disposal "in an area where shallow groundwater impacts are present" is not acceptable if that groundwater is overlain by clean soils.

9. As part of the corrective action design effort, a groundwater sampling event will be conducted utilizing Standard Method 6230D to provide a more thorough and current indication of the chemical contaminants on each of the sites requiring corrective action on which the analytical data is greater than one year old. Standard Method 6230D will also be utilized during the CAP implementation phase.

   NCDENR will not be in a position to fully "close out" a site unless there is reasonable assurance that no environmental pollutants remain at the site. This assurance applies to target compounds potentially related to the asphalt testing operations as well as any other constituents. NCDOT will continue monitoring until such time that NCDOT can demonstrate that all target compounds potentially related to NCDOT's asphalt testing operations remain below the applicable requirements for a period of four consecutive quarterly monitoring events. NCDOT will then request the issuance of a "no further action" letter for their portion of the site cleanup.

10. EPA method 8021 will be used for soil VOC analyses as performed in the CSA.

If after review of this letter of agreement you find it necessary to make changes please notify me immediately. We would like to continue the CAP process as quickly as possible, therefore your prompt response is requested. Should you have questions or comments I may be reached at (910)334-4273.

Sincerely,

Thomas C. Niver, P.G., CHMM
Environmental Engineer, Safety & Loss Control

Accepted by:

Arthur Mouberry, P.E.
Chief, Groundwater Section

cc: Ted Bush, NCDEHNR
Duane MacEntee, NCDOT
Mike Poplin, Vulcan Materials Company

APPENDIX II

PRELIMINARY SITE SCREENIGN REPORT

AND

TABLES AND FIGURES IN THE CSA REPORT

Site #48

ASPHALT PLANT SAMPLING FORM

Date 4-27-89 Person Sampling Greg Kissel

Current Owner Lee Paving Sample Type (Soil) (Water) 29KW, 29KS

OSEP Code # (CN-PN-SN) Cnty/plnt/sample Chatham/Lee #3/29KW, 29KS

Location of Plant Sugar Lake Road E. of Pittsboro off US-64.

General Slope of Land (from sample point) 10%

Soil Type (Loamy, Granular, Rocky, Clay, Sandy, Other) Clay

Approximate Time & Durations of DOT site use 1968 – present

Previous or Simultaneous Use of site by other than DOT parties? (Y/N) Yes

Froehling, Robertson, Soils & Materials, Corp of Engineers, Law

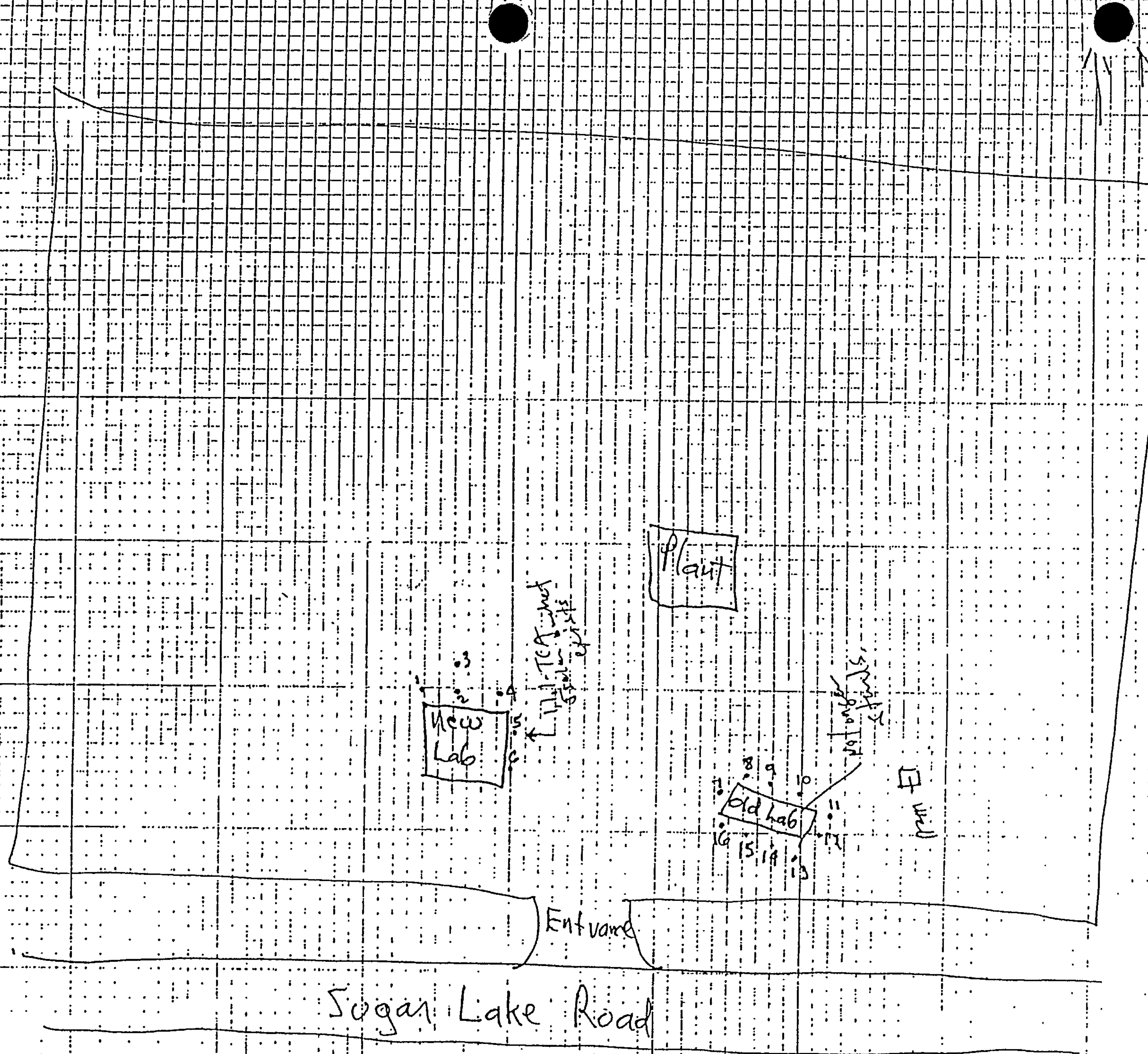
In the event that multiple screening samples are conducted with a VOA or similar instrument, list the sample numbers and results here.

Sample #	Reading	Sample #	Reading	Sample #	Reading
1	trace	7	<1	13	trace
2	30 ppm	8	trace	14	5
3	trace	9	5	15	15
4	trace	10	15	16	trace
5	10 ppm	11	5		
6	15 ppm	12	trace		

Comments: Well 300' from new lab site. Water pulled from well. Holes 5 & 6 hard to get to. Located between Lab and scales – about 20" of room to get between. Old lab has some low level contamination surrounding it. New lab contaminated beside door to lab and beside E wall near trico collection site. Weob lab results 4-28-89 318 ug/l T. Ethane and 617 T. Ethylene ug/l in water. (wel[illegible] 3.19 ppb C Tetrachloride in soil.

Note: A copy of any lab analysis should be attached to this form.

Take 6t to
Gillhead Church Rd
to Sugar Lake Rd
Talk to Paul at Plant –
operates contract lab – family
for me



STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
P.O. BOX 25201
RALEIGH 27611-5201

JAMES G. MARTIN
GOVERNOR

JAMES E. HARRINGTON
SECRETARY

DIVISION OF HIGHWAYS

GEORGE E. WELLS, P.E.
STATE HIGHWAY ADMINISTRATOR

DATE 4-27-89

MEMORANDUM TO: TO WHOM IT MAY CONCERN

The Department of Transportation is conducting a survey of properties on which State asphalt testing laboratories were located to determine if any contaminants or other materials that may be potentially hazardous to the environment remain on any portion of these properties. The property which you now own may have been a site for one of the department's asphalt testing laboratories. By executing this letter, you, the undersigned owner, hereby grants permission for Department of Transportation personnel, or their authorized agents, to enter upon your property to the extent necessary to investigate the presence of contaminants or potentially hazardous substances. The investigation is limited solely to the taking of soil samples using hand-powered methods and the collection of water samples from on-site water supplies.

After completion of the site investigation and analysis of soil and water samples, the department agrees to share with you the results and conclusions of the investigation. If contaminants or potentially hazardous substances directly resulting from the past operations of these asphalt testing laboratories are detected, you will be advised as to the measures the Department will take to clean up or render harmless those contaminants or hazardous substances.

Thank you for your cooperation in this matter.

[signature]
PROPERTY OWNER OR
COMPANY REPRESENTATIVE

Lee Paving
P.O. Drawer 1109
Sanford N.C. 27330-1109
ADDRESS
919-776-433-8
TELEPHONE NO.

"Doc" Allen VP

DOT Asphalt Lab Contamination
1/24/90

Sample Date(yy/mm/dd): 89/4/27
Division: 8 County: 52
Tester: GGK

ınt Owner: Lee Paving

Address: Pittsboro, N. C.
Site Location: Sugar Lake Road E. of Pittsboro off U. S. 64

Sample Taken (y/n): Y
Sample Type(w/s): S
Sample#: 29ks

Soil Type: Clay

mg/kg=ppm mg/l=ppm ug/kg=ppb ug/l=ppb

Trichloroethylene (TCE): <0.5 ppm
Trichloroethane (TCA): <0.5 ppb
Carbon Tetrachloride (CCl4): 3.19 ppb

Comments: Well 300' from new job site. Water pulled from well. Holes 5 & 6 hard to get to. Located between lab and scales about 20" of room to get between. Old lab has some low level contamination surrounding it. New lab contaminated beside door to lab and beside E wall near trico collection site.

NC DOT OSEP Asphalt Plant Sampling
(Plants with some contamination)

~~35~~ 46

Sample Date(yy/mm/dd): 89/04/27
Division: 08 County: 52
Tester: GGK

nt Owner: Lee Paving

Address: Pittsboro, N. C.
Site Location: Sugar Lake Road E. of Pittsboro off U. S. 64

Chatham / R.R.O.

Sample Taken (y/n): Y
Sample Type(w/s): s
Sample#: 29ks

Soil Type: Clay

mg/kg=ppm mg/l=ppm ug/kg=ppb ug/l=ppb
Trichloroethylene (TCE): <0.5 ppm
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Carbon Tetrachloride (CCl_4): 3.19 ppb

Comments: Well 300' from new job site. Water pulled from well. Holes 5 & 6 hard to get to. Located between lab and scales about 20" of room to get between. Old lab has some low level contamination surrounding it. New lab contaminated beside door to lab and beside E wall near trico collection site.

NORTH CAROLINA

GROUNDWATER CONTAMINATION INCIDENT MANAGEMENT

SITE PRIORITY RANKING SYSTEM

Groundwater Incident File # N/A Site Rank 117

Incident Name Lee Paving Co., Sugar Lake Road Site Ranking Performed by [illegible]

Date Ranking Performed 29 Nov 89

Region/County RRO / Chatham

I. Contaminants Involved

carbon tetrachloride (3,3,18)

(If more space is required, use back of form)

II. Exposure Assessment — Points Awarded

A. Contaminated Drinking Water Supplies

1. Private, domestic supply well(s) containing substances in concentrations exceeding Class GA underground water quality standards; award to each impacted well the matrix value(s) from the Sax Toxicity - persistence matrix, shown in Attachment A to explanatory notes, for the contaminants found in each well, and sum the values from all impacted wells — 54

2. Public or institutional water well containing substances in concentrations exceeding Class GA underground water quality standards; award to each impacted well the matrix value(s) form

the Sax Toxicity - persistence matrix, shown in Attachment A to the explanatory notes, for the contaminants found in each well, and sum the values from all impacted wells 0

3. If a water supply well identified in items II.A.1 and II.A.2 cannot be replaced by an existing public water supply source, award 5 points per irreplaceable well 15

B. Threat to Uncontaminated Drinking Water Wells

1. Private, domestic water supply well located within 1,500 feet downgradient hydrogeologically of the contaminant source; award 5 points per well 0

2. Public or institutional water supply well located within 1/2 mile downgradient hydrogeologically of the contaminant source; award 10 points per well 0

3. If any well identified in items II.B.1. and II.B.2. is located within 250 feet downgradient hydrogeologically of the contaminant source; award an additional 10 points per threatened well 0

III. <u>Contaminant Hazard Assessment</u>

A. The assessment of hazard is based on Sax Toxicity and the persistence of the <u>most hazardous</u> substance detected in an investigation and the amount, estimated or actual, discharged

1. The highest matrix value for the contaminants involved in the incident from the Sax Toxicity-persistence matrix (shown in Attachment A to the explanatory notes) 18

2. The value for the amount discharged is based on gallons of material, where other volumetric or weight measures are used to characterize a material, the relationship 1 ton $\approx$ 1 cubic yard $\approx$ 4 drums $\approx$220 gallons will be used to determine the number of gallons discharged and is assigned according to the following table:

no discharge	-	0	
≤ 10 gallons	-	1	
>10 but ≤ 100 gallons	-	2	
>100 but ≤ 1000 gallons	-	5	
>1000 gallons	-	10	10

IV. Source Assessment

A. Primary Source - Uncontrolled or unabated Primary Sources such as, but not limited to, dump sites, stockpiles, lagoons, land applications, septic tanks, landfills, underground or above ground storage tanks, and transportation accidents

1. Suspected or confirmed source remains in active use, continues to receive petroleum products, raw materials, wastewater or solid waste, and continues to discharge contaminants; award 20 points — 0

2. Active use of suspected or confirmed source has been discontinued or the source resulted from a one-time release of contaminants, such as a spill resulting from a transportation accident, but the source continues to release contaminants into the environment as with a closed landfill or a transportation accident where no remediation of contaminated soil or product has been accomplished; award 10 points — 10

B. Secondary Source

1. Free product thickness ≥ 1/4 inch detected on the water table in observation or monitoring well; award 50 points — 0

2. Soil exhibits partial or full saturation with contaminant, or product vapors in excess of 100 ppm as measured by organic vapor detection equipment; award 20 points — 0

V. Hydrogeological Assessment

A. Depth to Water Table - The depth is measured vertically from the deepest point of penetration of the contaminant to the highest level of the seasonal high water table; if the depth is not known, it should be estimated from the best available data; and a value assigned from the following table:

Depth	Assigned Value
≥ 50 feet	0
< 50 to ≥ 30 feet	2
< 30 to ≥ 20 feet	4
< 20 to ≥ 10 feet	6
Contaminant has reached groundwater	8
Contaminant has entered the fractured bedrock aquifer	10

10

B. Average Horizontal, Linear Groundwater Velocity - From the relationship for steady state, average velocity, v = K/n dh/dl, an estimate of movement of conservative contaminats may be made. The horizontal, saturated hydraulic conductivity (K) may be determined by aquifer test or estimated by field or laboratory tests or as a last resort, from generalized tables of aquifer materials, shown in Attachment A to the explanatory notes, K = 1×10^{-5} ft/day. The porosity (n) of aquifer materials may be determined from laboratory tests or estimated from aquifer test or generalized tables, shown in the Attachment A to the explanatory notes, n = 0.44. From the monitoring of water level elevations in wells penetrating the aquifer of concern or estimates based on interpretations of the topography of the site area, the gradient of the water table may be estimated, dh/dl = 42/1320 ft/ft. From the computed velocity a rank value may be assigned as follows:

7.32×10^{-7} ft/day

Average Velocity ($\bar{v}$ = k/n dh/dl)	Assigned Value
$<2.74 \times 10^{-3}$ ft/day	0
$\geq 2.74 \times 10^{-3}$ to $< 1.0 \times 10^{-2}$ ft/day	1
$\geq 1.0 \times 10^{-2}$ to 1.0×10^{-1} ft/day	3
$\geq 1.0 \times 10^{-1}$ to 1.0 ft/day	5
≥ 1.0 ft/day	10

0

VI. Site Rank (sum of assigned values) 117

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

5155 I SW
(BYNUM)

Farrington

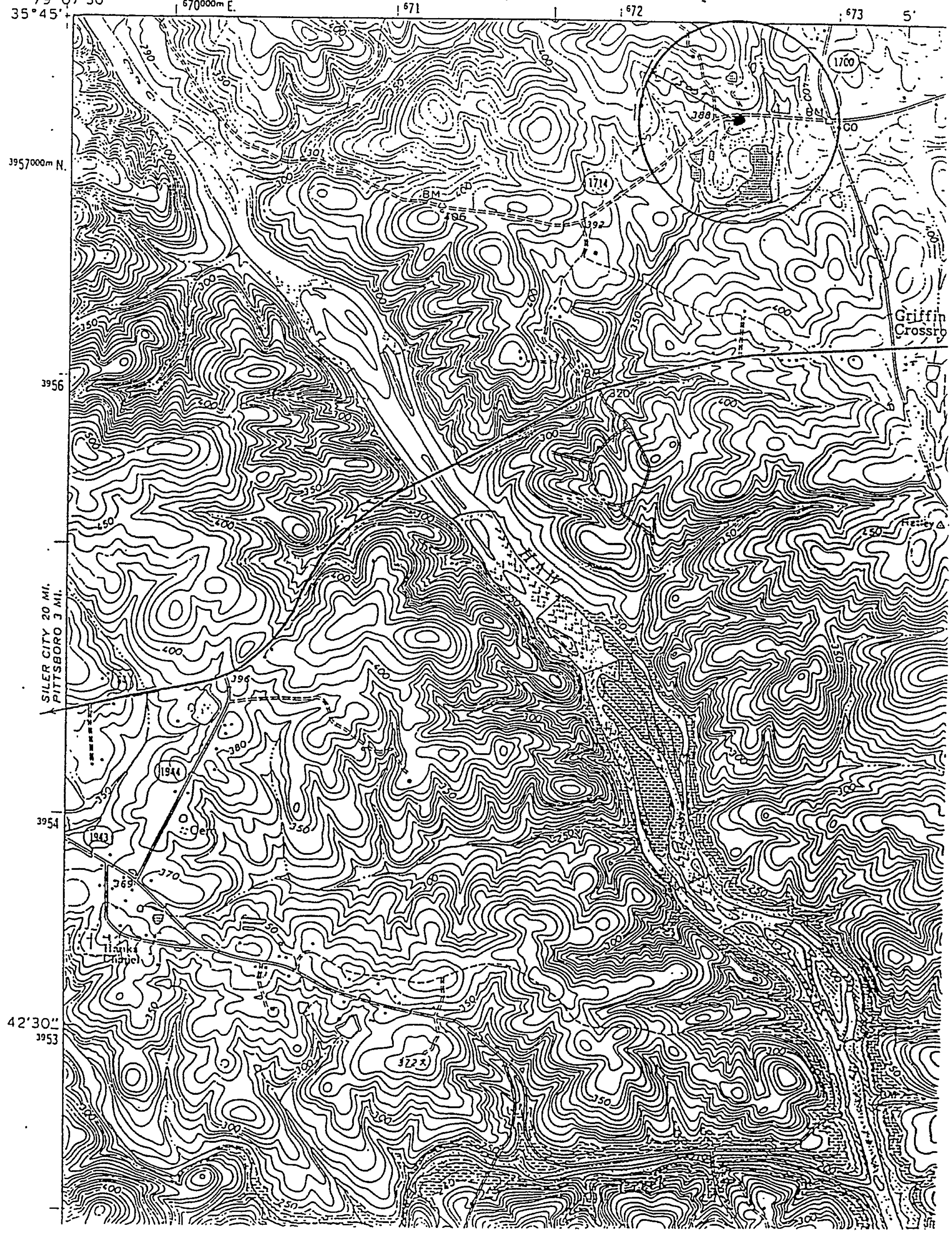

Table 2-1. Summary of Adjacent Property Owners, Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Property ID Number (See Fig. 2-3)	Registered Property Owner	Property Owner Address	Current Use
1	Roy Stewart (Site Property)	P.O. Box 1109 Sanford, NC 27350	Commercial
2	Erskine Heatherly, Jr.	Not Listed	Residential
3	Patricia Ellis & Deborah Sasser	154 Deer Run Pittsboro, NC 27312	Residential
4	James E. McKendry	190 Deer Run Pittsboro, NC 27312	Residential
5	James L. Harris	459 Mays Chapel Rd. Pittsboro, NC 27312	Residential
6	Bradley E. Holloway	Mt. Gilead Woods Pittsboro, NC 27312	Residential
7	Sara Corden	577 Silver Berry Rd. Pittsboro, NC 27312	Residential
8	Raymond J. Ingram	521 Silver Berry Rd. Pittsboro, NC 27312	Residential
9	Mildred Cason	768 E. Perry Rd. Pittsboro, NC 27312	Residential
10	Mildred Cason	768 E. Perry Rd. Pittsboro, NC 27312	Residential
11	David P. Martinez	103 Rabbit Run Pittsboro, NC 27312	Residential
12	David P. Martinez & Graci J.	103 Rabbit Run Pittsboro, NC 27312	Residential
13	Roy F. & Alienc Keck	173 Rabbit Run Pittsboro, NC 27312	Residential
14	Dexter V. Perry Dexter V. Perry Trust	614 Sanderson Drive Durham, NC 27704	Residential

Table 2-1. Summary of Adjacent Property Owners, Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Property ID Number (See Fig. 2-3)	Registered Property Owner	Property Owner Address	Current Use
15	James D. & Ann B. Marlow	P. O. Box 193 Bynum, NC 27228	Residential
16	William F. & Deborah K. Lancaster	1026 Mt. Gilead Church Rd. Pittsboro, NC 27312	Residential
17	Claron N. Hatley c/o Susan Ickes & James Hatley	15 Ashwood Knoll Rochester, NY 14624	Residential
18	William Hatley	3109 Commonwealth Ave. Charlotte, NC 28205	Residential
19	Deborah McNeil Deaton	131 Crossing Ave. Belmont, NC 28012	Residential
20	John Etna Byrd/ Doris Earl Byrd McNeil	5106 Wilkinson Charlotte, NC 28208	Residential
21	Sugar Lake Land Company	981 Old Graham Rd. Pittsboro, NC 27312	Residential
22	Federal Paper BD Co. Inc.	P.O. Box 146 Southern Pines, NC 28388	Commercial
23	Timothy R. Mitchel	771 Mt. Gilead Church Rd. Pittsboro, NC 27312	Residential
24	Dennis C. & Phillis C. Campbell	Rt. 4 Box 588 Pittsboro, NC 27312	Residential
25	Alvis Page	1085 Mt. Gilead Church Rd. Pittsboro, NC 27312	Residential
26	James & Marjorie Burnette	419 Hardee Street Durham, NC 27703	Residential
27	Samuel Burnette	Route 4, Box 578 Pittsboro, NC 27312	Residential
28	Page Willene Bright	Route 4, Box 576 Pittsboro, NC 27312	Residential

Table 2-1. Summary of Adjacent Property Owners, Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Property ID Number (See Fig. 2-3)	Registered Property Owner	Property Owner Address	Current Use
29	Phillip W. Corn	PO Box 1002 Cary, NC 27512	Residential
30	Louise Heardon & Helen Toney	108 Cole Street Chapel Hill, NC 27516	Residential
31	Paul Dean & Virginia Bailey	101 Rabbit Run Pittsboro, NC 27312	Residential
32	Pat & Elward Horton	911 Whippoorwill Lane Chapel Hill, NC 27514	Residential
33	Paggy Jean Porter	464 Old Farrington Road Chapel Hill, NC 27514	Residential
34	Karl W. & Inger Rabe	114 Rabbit Run Pittsboro, NC 27312	Residential
35	Garry & Patricia Anderson	79 Silver Berry Road Pittsboro, NC 27312	Residential
36	Richard & Christine Fish	208 Rabbit Run Pittsboro, NC 27312	Residential
37	Tony Michael	Route 4, Silver Berry Road Pittsboro, NC 27312	Residential
38	David & Deborah Walton	167 Silver Berry Road Pittsboro, NC 27312	Residential
39	John & Cynthia Heuer	Route 4, Box 559-D Pittsboro, NC 27312	Residential
40	Richard & Christy Fish	208 Rabbit Run	Residential
41	Albert Lindsay	Route 4, Box 559-J Pittsboro, NC 27312	Residential
42	Thomas & Helen Dean	300 Rabbit Run Pittsboro, NC 27312	Residential

Table 2-1. Summary of Adjacent Property Owners, Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Property ID Number (See Fig. 2-3)	Registered Property Owner	Property Owner Address	Current Use
43	Gail Darden & Albert Lindsay	Route 4, Box 559-J Pittsboro, NC 27312	Residential
44	Phillip Allen	483 Silver Berry Road Pittsboro, NC 27312	Residential
45	James Poole	376 Silver Berry Road Pittsboro, NC 27312	Residential
46	Carolyn Cambell, John Davis, John & Janet Cambell	502 Belmont Street Chapel Hill, NC 27514	Residential
47	Kimberly Gay Preble	21 Medowbrook Drive Durham, NC 27712	Residential
48	Anna Lee Leonard	544 Silver Berry Road Pittsboro, NC 27312	Residential
49	David & Robyn Halliday	604 Silver Berry Road Pittsboro, NC 27312	Residential
50	Terry & Linda Lindsey	746 Silver Berry Road Pittsboro, NC 27312	Residential
51	Bobbi & Jean Riddle	94 Sweet Gum Pittsboro, NC 27312	Residential
52	Phreddie Delois Popp	Route 4, Box 394 Pittsboro, NC 27312	Residential
53	Jonathan Riedling	7 Crosswinds Estates Pittsboro, NC 27312	Residential
54	Phreddie Delois Popp	Route 4, Box 394 Pittsboro, NC 27312	Residential
55	Mark Flynn	334 Deer Run Pittsboro, NC 27312	Residential
56	Michael & Patti Davis	458 Deer Run Pittsboro, NC 27312	Residential

Table 2-1. Summary of Adjacent Property Owners, Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Property ID Number (See Fig. 2-3)	Registered Property Owner	Property Owner Address	Current Use
57	Doris & Kathleen Flynn	287 Deer Run Pittsboro, NC 27312	Residential
58	William & Janet Wyatt	365 Deer Run Pittsboro, NC 27312	Residential
59	John & Jacqueline O'Gorman	421 Deer Run Pittsboro, NC 27312	Residential
60	Wayne Michael Wade	Route 4, Box 592 Pittsboro, NC 27312	Residential
61	Maria Russon	Route 5, Box 597 Pittsboro, NC 27312	Residential
62	Ronald & Phillis Graham	500 Sugar Lake Road Pittsboro, NC 27312	Residential
63	Daniel & Marion Munn	Route 4, Box 603-A Pittsboro, NC 27312	Residential
64	Robert Paul Kolin	580 Sugar Lake Road Pittsboro, NC 27312	Residential
65	Douglas Wakeman	624 Sugar Lake Road Pittsboro, NC 27312	Residential
66	Thomas & Saranne Wilson	562 Sugar Lake Road Pittsboro, NC 27312	Residential
67	Theadore & Julie Taydus	495 Sugar Lake Road Pittsboro, NC 27312	Residential
68	Archie & Shana Hankins	555 Sugar Lake Road Pittsboro, NC 27312	Residential
69	John Judd & Annette Reaves	PO Box 992 Pittsboro, NC 27312	Residential
70	Pat & Elward Horton	911 Whippoorwill Lane Chapel Hill, NC 27514	Residential

Source: Chatham County Tax Department.

Table 5-1. Monitor-Well Construction Details, Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Well Number	Date of Installation	Measuring Point Elevation (ft)	Total Drilled Depth (ft bls)	Surface Casing Depth (ft bls)	Depth of Screened Zone (ft bls)
48MW-1	11/14-11/15/96	995.20	50	36	46-36
48MW-2	11/14/96	993.80	50	40	50-40
48MW-3	11/16-11/14/96	997.71	56	40	50-40
48MW-4	11/13/96	998.21	36	26	36-26
48MW-5	11/12-11/13/96	1001.68	43	33	43-33
48MW-6	1/15/97	987.97	44	34	44-34
48MW-7	1/16/97	986.02	34	24	34-24
48MW-8	1/16/97	998.93	32	22	32-22
48MW-9	1/16/97	990.91	22	11	22-11
48MW-10	3/3/97	994.99	40	30	40-30
48MW-11	3/3/97	988.48	29	19	29-19
48MW-12	4/17/97	972.71	37.5	27.5	37.5-27.5
48MW-13	4/17-4/22/97	8/24/02	32.5	22.5	32.5-22.5
48DW-1	1/15-1/17/97	994.67	100	63*	100-63**
48DW-2	4/24-4/25/97	991.84	66	43*	66-43**

ft Elevation referenced to an arbitary datum of 1,000 feet.
ft bls Feet below land surface.
* Indicates that 6-inch steel casing was used as the surface casing.
** Indicates an open-rock well from the total depth drilled to the bottom of the surface casing.

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Table 8-1. Summary of Soil-Vapor Survey Data, Site No. 48, Lee Paving Company, Sampled on August 28, 1996, Pittsboro, North Carolina.

Sample I.D.	Sample Depth (ft bls)	Soil-Vapor Concentration (ppm)
SV-1	3.5	0.0
SV-2	3.0	0.0
SV-3	3.0	0.0
SV-4	3.0	111.0
SV-5	3.0	86.0
SV-6	3.0	14.0
SV-7	3.0	14.0
SV-8	3.0	398.0
SV-9	3.5	71.0
SV-10	3.5	271.0
SV-11	3.5	314.0
SV-12	3.5	131.0
SV-13	3.0	128.0
SV-14	3.5	235.0
SV-15	3.0	199.0

Samples were collected using the Microseeps™ soil gas sampling system and screened using a Thermo Environmental Instruments Model 580B portable photoionization detector.

ft bls — Feet below land surface.
ppm — Parts per million.

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Table 8-2. Summary of Geoprobe™ Soil Analytical Data for Site No. 48, Lee Paving Company, Sampled on August 29, 1996, Pittsboro, North Carolina.

Constituents	Calculated Soil Clean-Up Level	Sample ID: / Lab ID: / Date Sampled:	SS-1-4 / 14364 / 8/29/96	SS-1-10 / 14365 / 8/29/96	SS-2-4 / 14366 / 8/29/96	SS-2-10 / 14367 / 8/29/96	SS-3-4 / 14368 / 8/29/96	SS-3-10 / 14369 / 8/29/96	SS-4-4 / 14370 / 8/29/96	REP-01-SS* / 14378 / 8/29/96
Volatile Organics (USEPA 8021) µg/kg dw										
n-Butylbenzene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
sec-Butylbenzene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
tert-Butylbenzene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Ethylbenzene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
p-Isopropyltoluene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Naphthalene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
1,2,4-Trimethylbenzene	-		< 1.4	< 1.3	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
1,3,5-Trimethylbenzene	-		< 2.8	< 2.7	< 2.8	< 2.9	< 2.9	< 2.9	< 2.8	< 2.8
m/p-Xylene	-		< 2.8	< 2.7	< 2.8	< 2.9	< 2.9	< 2.9	< 2.8	< 2.8
o-Xylene	-		< 2.8	< 2.7	< 2.8	< 2.9	< 2.9	< 2.9	< 2.8	< 2.8

Constituents	Calculated Soil Clean-Up Level	Sample ID: / Lab ID: / Date Sampled:	SS-4-10 / 14371 / 8/29/96	SS-5-1.5 / 14372 / 8/29/96	SS-5-5 / 14373 / 8/29/96	SS-6-1 / 14374 / 8/29/96	SS-7-3 / 14375 / 8/29/96	SS-8-4 / 14376 / 8/29/96	SS-9-4 / 14377 / 8/29/96
Volatile Organics (USEPA 8021) µg/kg dw									
n-Butylbenzene	-		< 1.5	< 1.1	54	< 1.3	< 1.3	< 1.2	< 1.2
sec-Butylbenzene	-		< 1.5	< 1.1	14	< 1.3	< 1.3	< 1.2	< 1.2
tert-Butylbenzene	-		< 1.5	< 1.1	29	< 1.3	< 1.3	< 1.2	< 1.2
Ethylbenzene	-		< 1.5	< 1.1	1.4	< 1.3	< 1.3	< 1.2	< 1.2
p-Isopropyltoluene	-		< 1.5	< 1.1	29	< 1.3	< 1.3	< 1.2	< 1.2
Naphthalene	-		< 1.5	< 1.1	78	< 1.3	< 1.3	< 1.2	< 1.2
1,2,4-Trimethylbenzene	-		< 1.5	< 1.1	54	< 1.3	< 1.3	< 1.2	< 1.2
1,3,5-Trimethylbenzene	-		< 3.0	< 2.2	29	< 2.6	< 2.6	< 2.3	< 2.4
m/p-Xylene	-		< 3.0	< 2.2	5.8	< 2.6	< 2.6	< 2.3	< 2.4
o-Xylene	-		< 3.0	< 2.2	5.7	< 2.6	< 2.6	< 2.3	< 2.4

µg/kg dw Micrograms per kilogram on a dry weight basis.
* Field duplicate sample of sample collected at location SS-4-4.
< Constituent was not detected above the quantitation limit.

Table 8-3. Summary of Hand-Auger Analytical Data for Site No. 48, Lee Paving Company, Sampled on December 6, 1996, Pittsboro, North Carolina.

Constituents	Calculated Soil Cleanup Level	Sample ID: Lab ID: Date Sampled:	48SS-10-04 18086 12/6/96	48SS-10-08 18087 12/6/96	48REP-01-SS* 18092 12/6/96	48SS-11-04 18088 12/6/96	48SS-11-08 18089 12/6/96
Volatile Organics (USEPA 8021) µg/kg dw							
Benzene	-		5.4	6.3	5.7	<1.3	<1.4
Chloroform	-		**3.1**	**3.1**	**3.1**	**<1.3**	**<1.4**
1,1-Dichloroethane	**45,473**		**4.6**	**4.1**	**4.2**	**<1.3**	**<1.4**
1,1-Dichloroethene	**63**		**<1.4**	**<1.4**	**1.5**	**<1.3**	**<1.4**
1,2-Dichloropropane	-		3.4	<1.4J[1]	2.8J[1]	<1.3	<1.4
trans-1,3-Dichloropropane	-		5.4	<1.4	<1.4	<1.3	<1.4
Diisopropyl ether (DIPE)	-		<1.4	5.6	5.4	<1.3	<1.4
Ethyl benzene	-		7.6	42	32	<1.3	<1.4
Isopropylbenzene	-		8.9	46	41	<1.3	<1.4
p-Isopropyltoluene	-		61	110	120	<1.3	<1.4
Naphthalene	-		81	96	120	<1.3	<1.4
Toluene	-		5.7	5.8	6.0	<1.3	<1.4
1,1,1-Trichloroethane	**8,149**		**84**	**62J[1]**	**16J[1]**	**<1.3**	**<1.4**
Trichloroethene	**32.8**		**11**	**5.8J[1]**	**2.0J[1]**	**<1.3**	**<1.4**
Trichlorofluoromethane	-		3	4J[1]	1.9J[1]	<1.3	<1.4
1,2,4-Trimethylbenzene	-		39	88	110	<1.3	<1.4
1,3,5-Trimethylbenzene	-		26	110	120	<2.7	<2.8
m/p-Xylene	-		21	10J[1]	83J[1]	<2.7	<2.8
o-Xylene	-		22	97	81	<2.7	<2.8

µg/kg dw Micrograms per kilogram on a dry weight basis.

* Field duplicate of soil sample collected at location 48SS-10-08.

< Constituent was not detected above the quantitation limit.

1 Constituent concentration is qualified as estimated (J) because the field duplicate sample criteria were not met.

Table 9-1. Summary of Groundwater Elevation Data for Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Well Number	North Top of Casing Elevation*	Date	Depth to Water (ft)	Groundwater Elevation*
48MW-1	995.20	12/4/96	31.39	963.81
		2/3/97	31.13	964.07
		3/6/97	31.31	963.89
		4/29/97	27.98	967.22
48MW-2	993.80	12/4/96	28.45	965.35
		2/3/97	28.17	965.63
		3/6/97	28.25	965.55
		4/29/97	25.62	968.18
48MW-3	997.71	12/4/96	32.33	965.38
		2/3/97	32.12	965.59
		3/6/97	32.38	965.33
		4/29/97	29.89	967.82
48MW-4	998.21	12/4/96	19.69	978.52
		2/3/97	18.64	979.57
		3/6/97	19.05	979.16
		4/29/97	15.81	982.40
48MW-5	1001.68	12/4/96	25.31	976.37
		2/3/97	23.10	978.58
		3/6/97	23.23	978.45
		4/29/97	22.07	979.61
48MW-6	987.97	2/3/97	21.95	966.02
		3/6/97	21.88	966.09
		4/29/97	20.32	967.65
48MW-7	986.02	2/3/97	9.68	976.34
		3/6/97	9.90	976.12
		4/29/97	8.04	977.98
48MW-8	989.41	2/3/97	9.84	979.57
		3/6/97	10.22	979.19
		4/29/97	6.73	982.68
48MW-9	990.91	2/3/97	11.17	979.74
		3/6/97	11.59	979.32
		4/29/97	8.51	982.40
48MW-10	994.99	3/6/97	26.27	968.72
		4/29/97	24.70	970.29

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Table 9-1. Summary of Groundwater Elevation Data for Site No. 48, Lee Paving Company, Pittsboro, North Carolina.

Well Number	North Top of Casing Elevation*	Date	Depth to Water (ft)	Groundwater Elevation*
48MW-11	988.48	3/6/97	24.91	963.57
		4/29/97	21.34	967.14
48MW-12	972.71	4/29/97	8.66	964.05
48MW-13	967.74	4/29/97	7.37	960.37
48DW-1	994.67	2/3/97	70.35	924.32
		3/6/97	53.05	941.62
		4/29/97	31.05	963.62
48DW-2	991.84	4/29/97	24.73	967.11

* Elevations referenced to an arbitrary datum of 1,000 feet.

Table 9-2. Summary of Water-Supply Well PW-1 Groundwater Analytical Data for Site No. 48, Lee Paving Company, Sampled on August 29, 1996, Pittsboro, North Carolina.

Constituents	NCAC 2L Groundwater Standard	Sample ID: Lab ID: Date Sampled:	PW-1 14405 8/29/96
Volatile Organics (SM 6230D) µg/L			
1,1-Dichloroethane	700		6
1,1-Dichloroethene	7		29
Methyl tert-butyl ether	200		2
Toluene	1000		1
1,1,1-Trichloroethane	200		120
Trichloroethene	2.8		140

µg/L Micrograms per liter.

NCAC 21 North Carolina Administrative Code, Title 15A, Chapter 2L, Groundwater Quality Standards, February 8, 1994.

[box] Constituent concentration exceeds the 15A NCAC 2L standard.

Table 9-3. Summary of Groundwater Analytical Data for Site No. 48, Lee Paving Company, Sampled on December 4, 5, and 6, 1996, Pittsboro, North Carolina.

Constituents	NCAC 2L Groundwater Standard	Sample ID: / Lab ID: / Date Sampled:	48MW-1GW 18096 12/5/96	48MW-2GW 18095 12/5/96	48MW-3GW 18098 12/4/96	48REP-01-GW* 18100 12/5-6/96	48MW-4GW 18099 12/4/96	48MW-5GW 18097 12/6/96
Volatile Organics (SM 6230D) µg/L								
Benzene	1		0.6	<0.5	<0.5	1	<0.5	1
1,1-Dichloroethane	**700**		**4**	**<0.5**	**1**	**<0.5**	**<0.5**	**<0.5**
1,1-Dichloroethene	**7**		**23**	**<0.5**	**15**	**<0.5**	**2**	**<0.5**
cis-1,2-Dichloroethene	**70**		**<2.5**	**<0.5**	**2**	**<0.5**	**<0.5**	**<0.5**
Ethylbenzene	29		<0.5J[1]	<0.5	<0.5	3	<0.5	3
Isopropylbenzene	NS		<0.5	<0.5	<0.5	1	<0.5	1
p-Isopropyltoluene	NS		<0.5J[1]	<0.5	<0.5	14	<0.5	14
Methyl-tert butyl ether (MTBE)	200		3J[1]	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	21		0.7J[1]	<0.5	1	8	<0.5	8
n-Propylbenzene	NS		<0.5J[1]	<0.5	<0.5	9	<0.5	9
Toluene	1,000		<0.5J[1]	0.9	0.8	1	0.6	1
1,1,1-Trichloroethane	**200**		**96J[1]**	**<0.5**	**20**	**<0.5**	**4**	**<0.5**
Trichloroethene	**2.8**		**64J[1]**	**<0.5J[1]**	**7J[1]**	**<0.5J[1]**	**<0.5J[1]**	**<0.5J[1]**
1,2,4-Trimethylbenzene	NS		<0.5J[1]	<0.5	<0.5	16	<0.5	15
1,3,5-Trimethylbenzene	NS		<0.5J[1]	<0.5	<0.5	4	<0.5	4
m/p-Xylene	530		<0.5J[1]	<0.5	<0.5	4	<0.5	4
o-Xylene	530		<0.5J[1]	<0.5	<0.5	2	<0.5	2

µg/L Micrograms per liter.
NCAC 2L North Carolina Administrative Code, Title 15A, Chapter 2L, Groundwater Quality Standards, February 8, 1994.
NS Numerical 15A NCAC 2L Standard has not been established; therefore, detectable concentrations of these substances in groundwater are considered to be in excess of North Carolina Water Quality Standards.
[ ] : Constituent concentration exceeds the 15A NCAC 2L Standard.
* Field duplicate sample of groundwater sample 48MW-3GW.
< Constituent was not detected above the quantitation limit.
1 Constituent concentration is qualified as estimated (J) due to continuing calibration data outside QC limit.

Table 9-4. Summary of Groundwater Analytical Data for Site No. 48, Lee Paving Company, Sampled on March 6, 1997, Pittsboro, North Carolina.

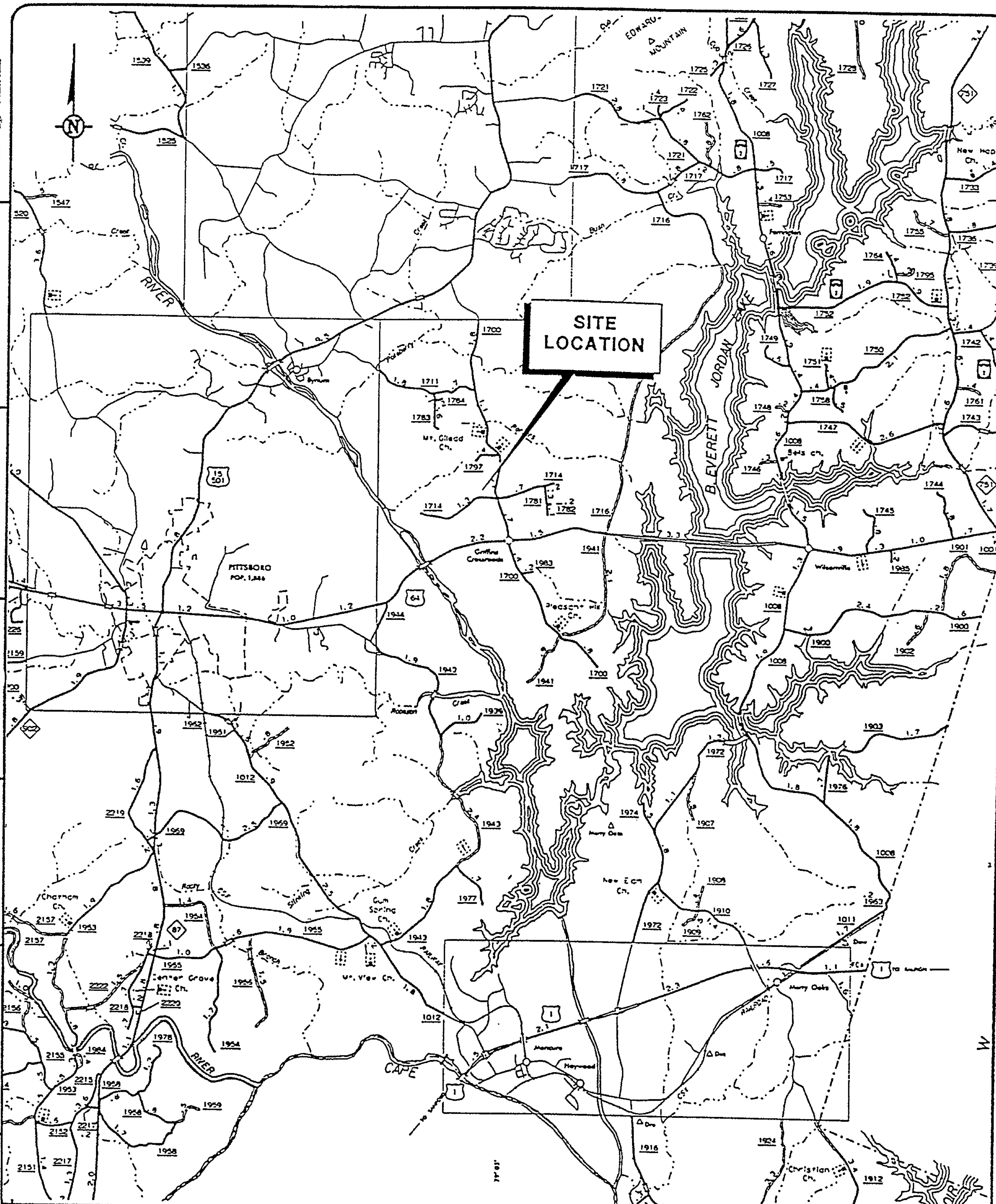
Constituents	NCAC 2L Groundwater Standard	Sample ID: Lab ID: Date Sampled:	48MW-10 21223 3/6/97	48REP-01-GW* 21227 3/6/97	48MW-11 21224 3/6/97
Volatile Organics (USEPA 601) µg/L					
1,1-Dichloroethane	700		<1	<1	2
1,1-Dichloroethene	7		<1	<1	[33]
cis-1,2-Dichloroethene	70		<1	<1	2
Tetrachloroethene	0.7		<1	<1	[2]
1,1,1-Trichloroethane	200		<1	<1	84
Trichloroethene	2.8		<1	<1	[470D]
Volatile Organics (USEPA 602) µg/L			ND	ND	ND

µg/L Micrograms per liter.
NCAC 2L North Carolina Administrative Code, Title 15A, Chapter 2L, Groundwater Quality Standards, February 8, 1994.
[ ] Constituent concentration exceeds the 15A NCAC 2L Standard.
* Field duplicate sample of sample collected at 48MW-10.
< Constituent was not detected above the quantitation limit.
ND Constituents were not detected above the quantitation limits.
D Constituent concentration detected was quantitated using a secondary dilution.

Table 9-5. Summary of Monitor-Well Analytical Data for Site No. 48, Lee Paving Company, Sampled on April 29, 1997, Pittsboro, North Carolina.

Constituents	NCAC 2L Groundwater Standard	Sample ID: Lab ID: Date Sampled:	48DW-2 23802 4/29/97	48MW-12 23801 4/29/97	48REP-01-GW* 23805 4/29/97	48MW-13 23800 4/29/97
Volatile Organics (USEPA Method 601) µg/L						
1,1-Dichloroethane	700		7	<1	<1	<1
1,1-Dichloroethene	7		[44]	<1	<1	<1
cis-1,2-Dichloroethene	70		6	<1	<1	<1
Tetrachloroethene	0.7		[1]	<1	<1	<1
1,1,1-Trichloroethane	200		41	<1	<1	<1
Trichloroethene	2.8		[250D]	<1	<1	<1
Volatile Organics (USEPA Method 602) µg/L			ND	ND	ND	ND

µg/L Micrograms per liter.
NCAC 2L North Carolina Administrative Code, Title 15A, Chapter 2L, Groundwater Quality Standards, February 8, 1994.
[ ] Constituent concentration exceeds the 15A NCAC 2L Standard.
* Field duplicate sample of sample collected at 48MW-12.
< Constituent was not detected above the quantitation limit.
ND Constituents were not detected above the quantitation limits.
D Constituent concentration detected was quantitated using a secondary dilution.



DRAFTE: MEIKLE | APPROVED: F. RASH | CHECKED: | DRAWING: 48 | FILE NO.: | PRJCT NO.: NC0360.061 | APRIL97 | DWG DA

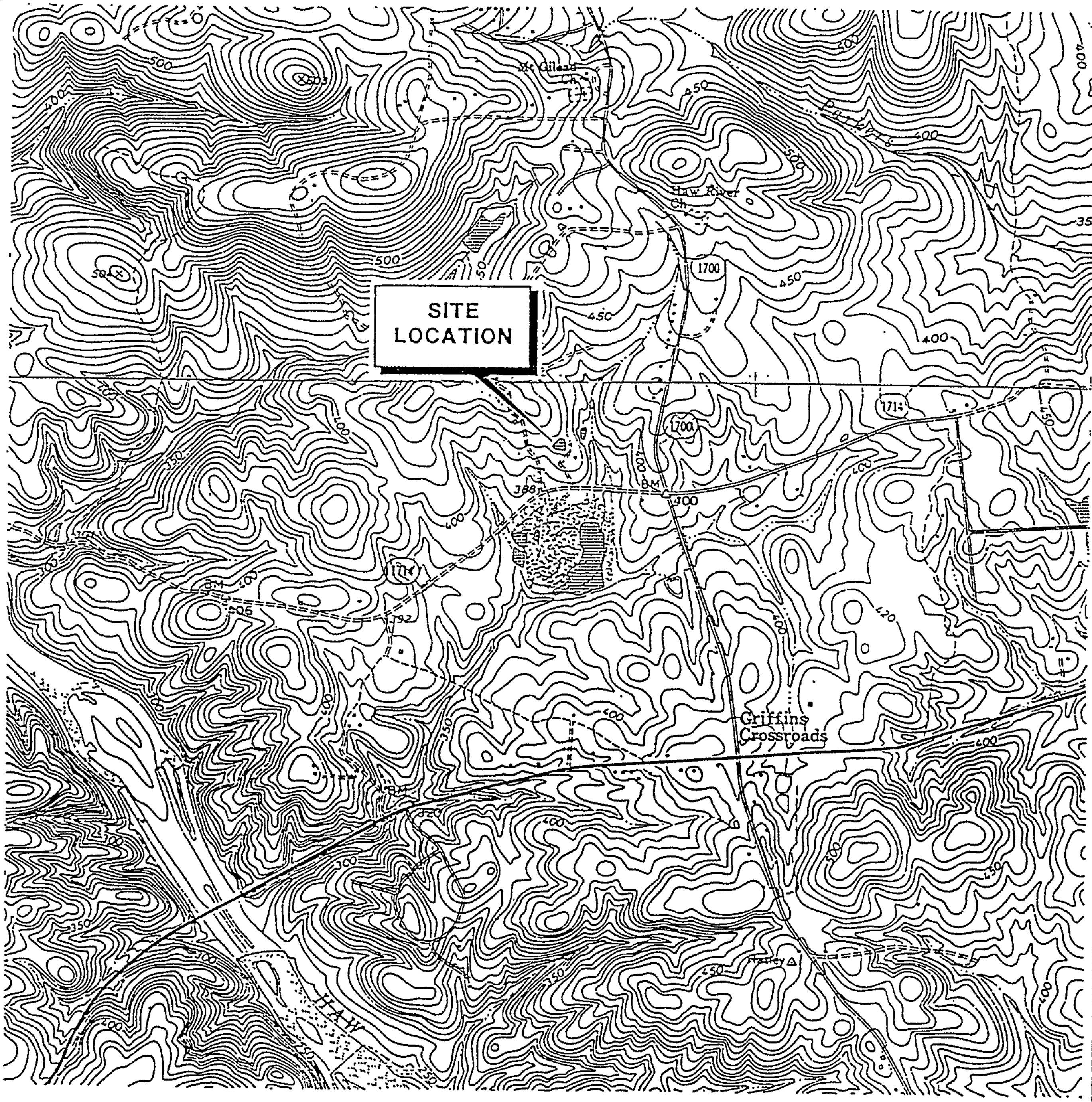
GERAGHTY & MILLER, INC.
Environmental Services

SCALE 1 INCH = 2.0 MILES

COUNTY ROAD MAP

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
SITE #48
PITTSBORO, NORTH CAROLINA

FIGURE 2-1



1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000

County
Location

SCALE 1:24000
Contour Interval 10 Feet Datum is Mean Sea Level
U.S.G.S. 7.5 Minute Series Farrington, N.C.
and Merry Oaks, N.C. Topographic Quadrangle

N

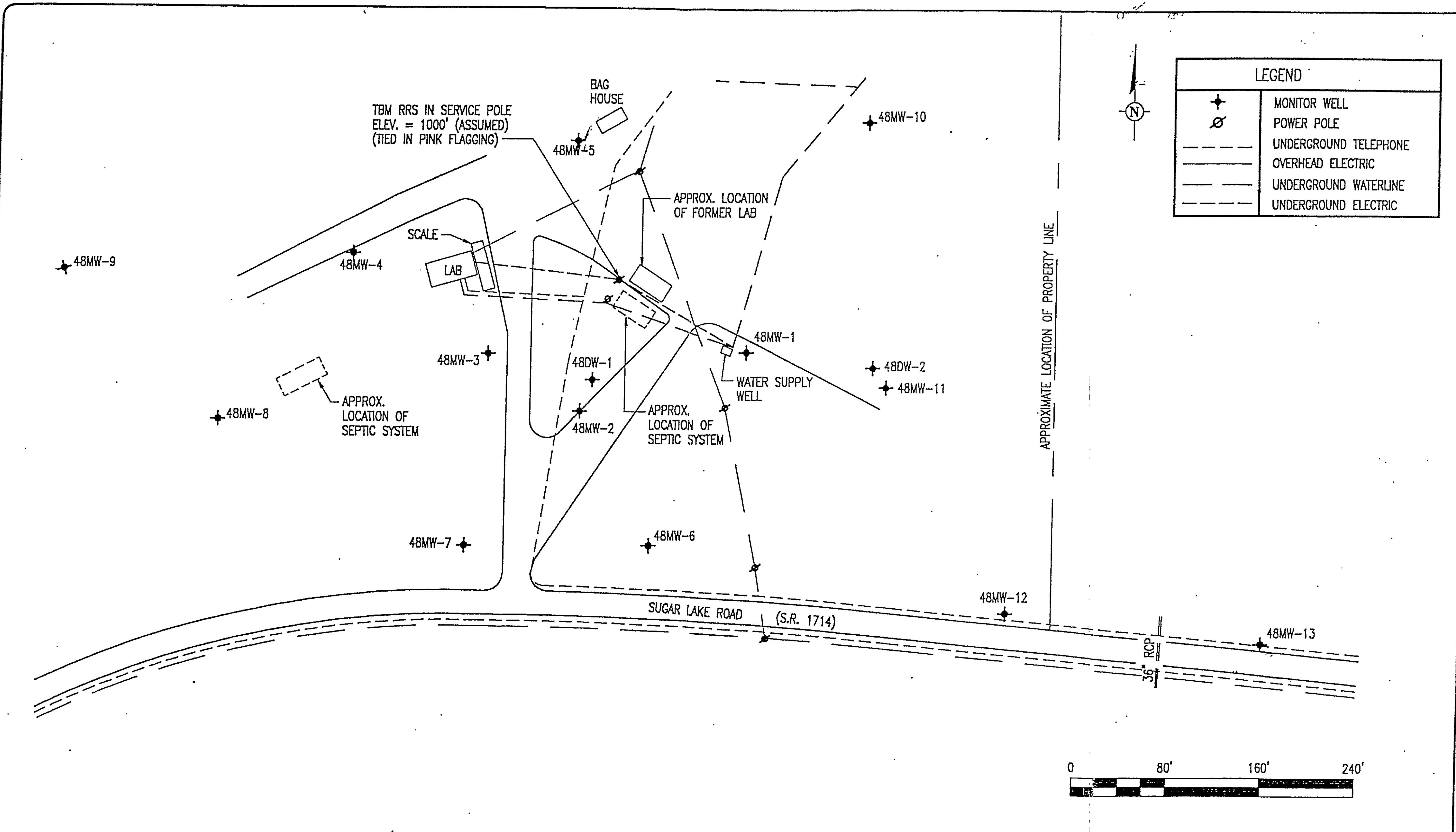
GERAGHTY
& MILLER, INC.
Environmental Services

SITE LOCATION MAP

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
SITE #48
PITTSBORO, NORTH CAROLINA

FIGURE
2-4

DRAFTER: A. WARREN | APPROVED: F. RASH | CHECKED: M. HUDSON | DRAWING: TOPO-NC | FILE NO.: SYM | PRJCT NO.: NC0360.191 | DWG DATE: 03SEPT96

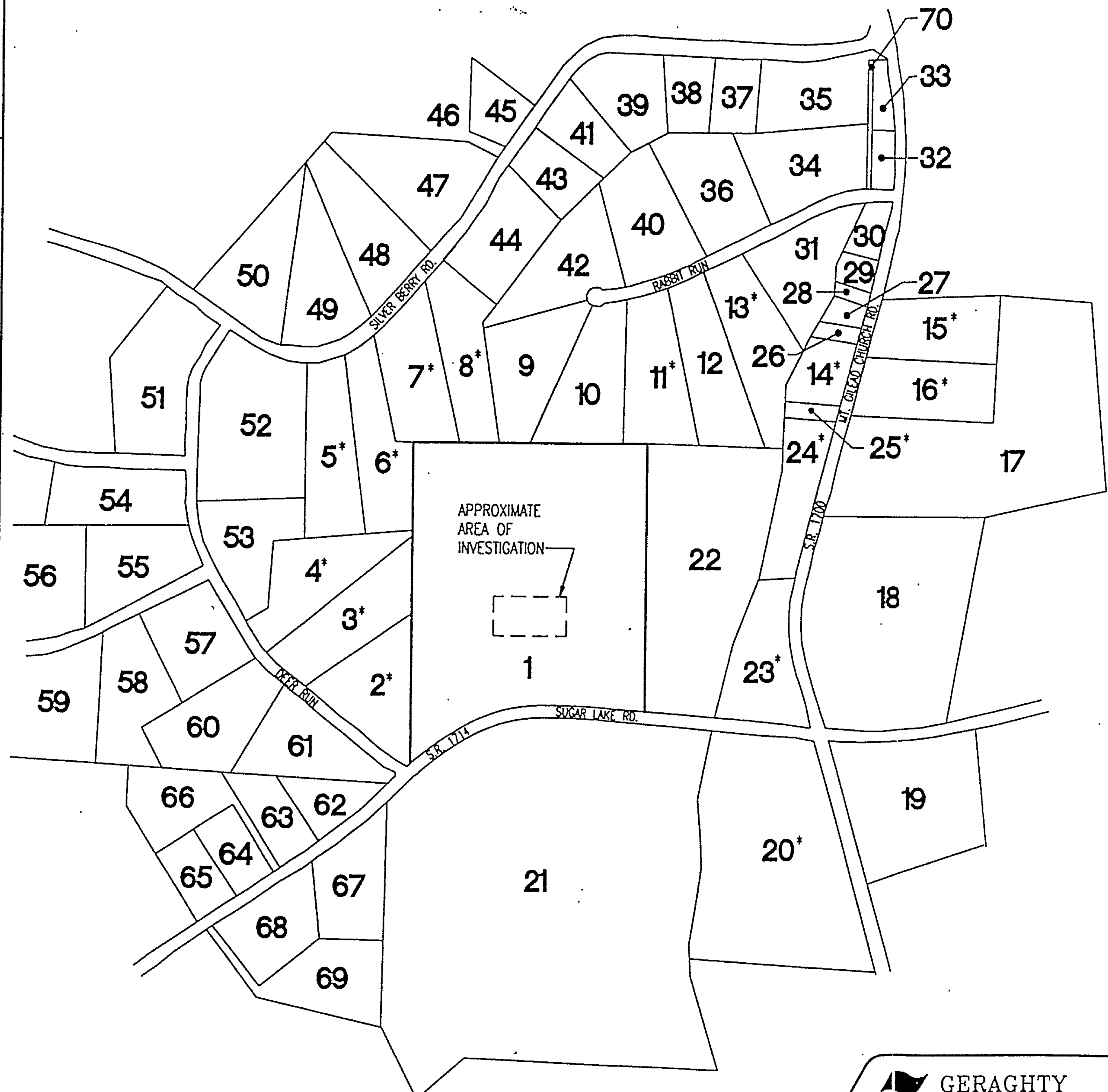


GERAGHTY & MILLER, INC.
Environmental Services

SITE MAP
NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
2-2

DRAFTER: D. GARRIGUES | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-SITE | FILE NO.: 4800 | PRJCT NO.: 38575 | DWG DATE: 5/14/97



LEGEND

1	ROY STEWART (SITE PROPERTY)	37	TONY MICHAEL
2	ERSKINE HEATHERLY, JR.	38	DAVID & DEBORAH WALTON
3	PATRICIA ELLIS & DEBORAH SASSER	39	JOHN & CYNTHIA HEUER
4	JAMES E. MCKENDRY	40	RICHARD & CHRISTY FISH
5	JAMES L. HARRIS	41	ALBERT LINDSAY
6	BRADLEY E. HOLLOWAY	42	THOMAS & HELEN DEAN
7	SARA CORDEN	43	GAIL DARDEN & ALBERT LINDSAY
8	RAYMOND J. INGRAM	44	PHILLIP ALLEN
9	MILDRED CASON	45	JAMES R. POOLE
10	MILDRED CASON	46	CAROLYN CAMBELL, JOHN DAVIS, JOHN & JANET CAMBELL
11	DAVID P. MARTINEZ	47	KIMBERLY GAY PREBLE
12	DAVID P. & GRACI J. MARTINEZ	48	ANNA LEE LEONARD
13	ROY F. & ALIENE KECK	49	DAVID & ROBYN HALLIDAY
14	DEXTER V. PERRY-DEXTER V. PERRY TRUST	50	TERRY & LINDA LINDSEY
15	JAMES D. & ANN B. MARLOW	51	BOBBI & JEAN RIDDLE
16	WILLIAM F. & DEBORAH K. LANCASTER	52	PHREDDIE DELOIS POPP
17	CLARON N. HATLEY	53	JONATHAN RIEDLING
18	WILLIAM HATLEY	54	PHREDDIE DELOIS POPP
19	DEBRAH MCNEIL DEATON	55	MARK FLYNN
20	JOHN ETNA BYRD/DORIS EARL BYRD MCNEIL	56	MICHAEL & PATTI DAVIS
21	SUGAR LAKE LAND COMPANY	57	DORIS & KATHLEEN FLYNN
22	FEDERAL PAPER BD CO.INC.	58	WILLIAM & JANET WYATT
23	TIMOTHY R. MITCHEL	59	JOHN & JACQUELINE O'GORMAN
24	DENNIS C. & PHYLLIS C. CAMPBELL	60	WAYNE MICHAEL WADE
25	ALVIS PAGE	61	MARIA RUSSON
26	JAMES & MARJORIE BURNETTE	62	RONALD & PHILLIS GRAHAM
27	SAMUEL BURNETTE	63	DANIEL & MARION MUNN
28	PAGE WILLENE BRIGHT	64	ROBERT PAUL KOLIN
29	PHILLIP W. CORN	65	DOUGLAS WAKEMAN
30	LOUISE HEARDON & HELEN TONEY	66	THOMAS & SARANNE WILSON
31	PAUL DEAN & VIRGINIA BAILEY	67	THEADORE & JULIE TAYDUS
32	PAT & ELWARD HORTON	68	ARCHIE & SHANA HANKINS
33	PEGGY JEAN PORTER	69	JOHN JUDD & ANNETTE REAVES
34	KARL W. & INGER RABE	70	PAT & ELWARD HORTON
35	GARRY & PATRICIA ANDERSON		
36	RICHARD & CHRISTINE FISH		

INFORMATION OBTAINED FROM CHATHAM COUNTY TAX MAP OFFICE

* DENOTES PROPERTY WITH WATER SUPPLY WELL

0 600' 1200' 1800'

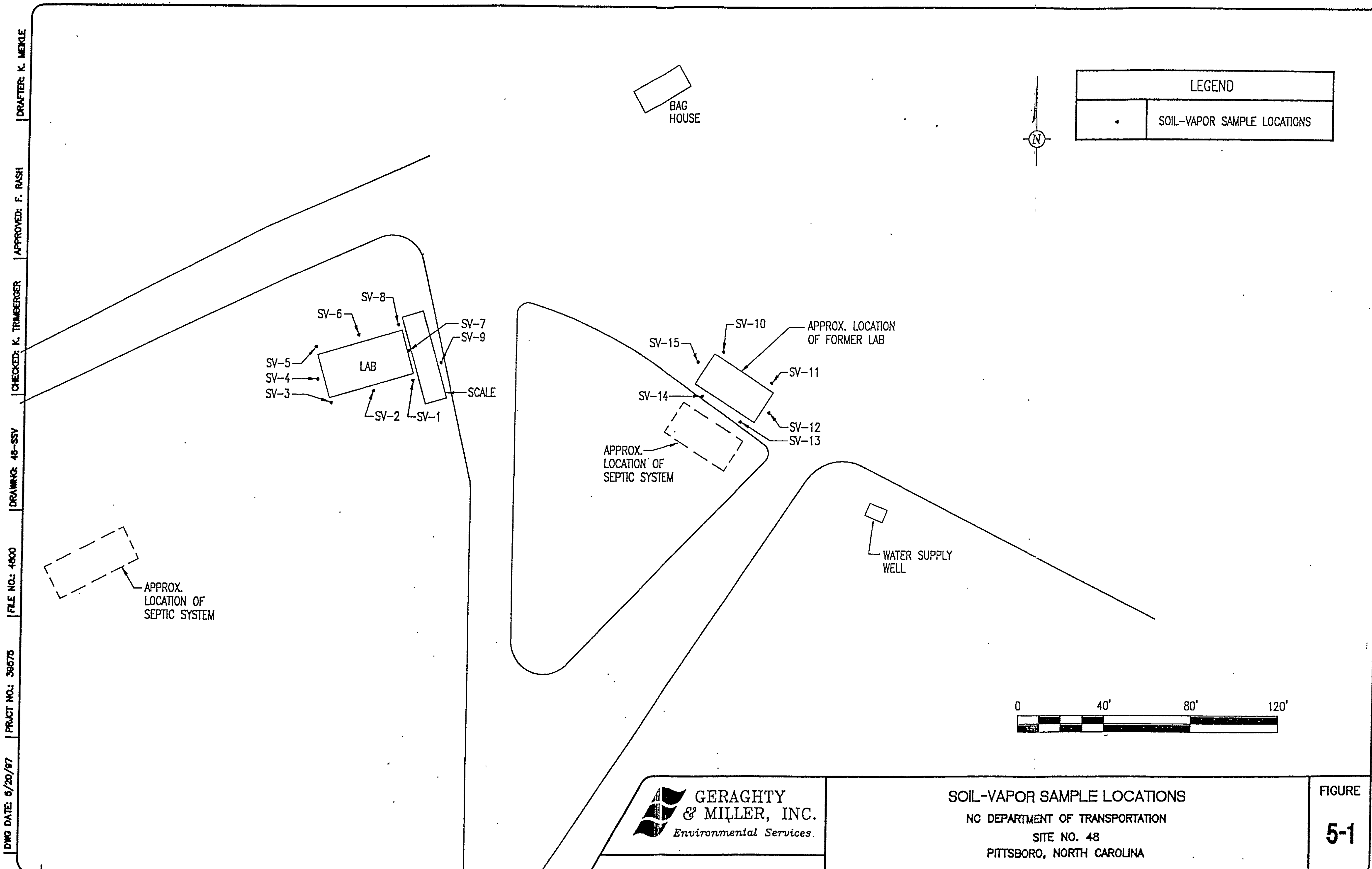
GERAGHTY & MILLER, INC.
Environmental Services

ADJACENT PROPERTIES MAP

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE 2-3

DRAFTER: D. GARRIGUES | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-TAX | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/22/97

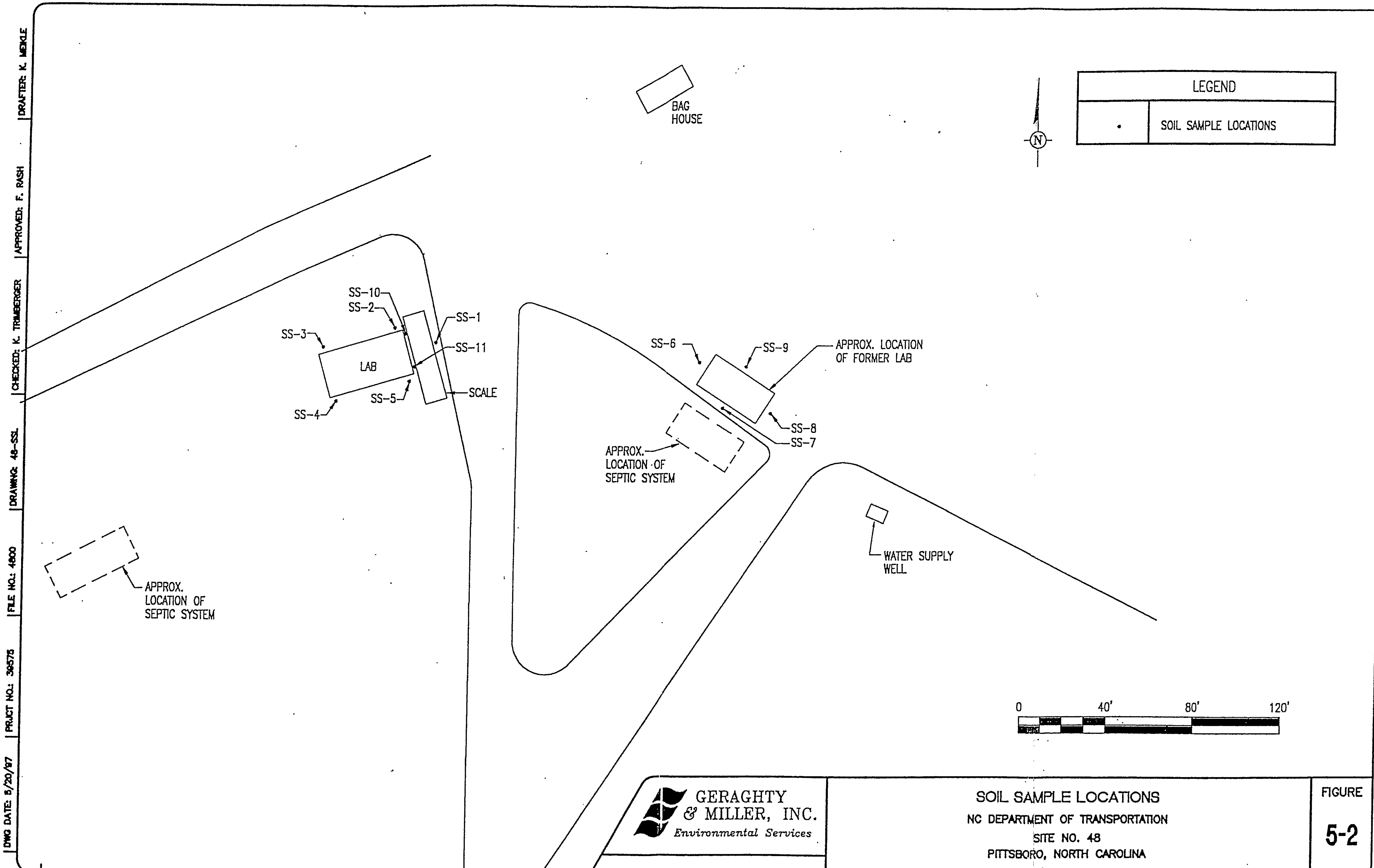


DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-SSV | FILE NO.: 4800 | PRJCT NO.: 38575 | DWG DATE: 5/20/97

GERAGHTY & MILLER, INC.
Environmental Services

SOIL-VAPOR SAMPLE LOCATIONS
NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
5-1

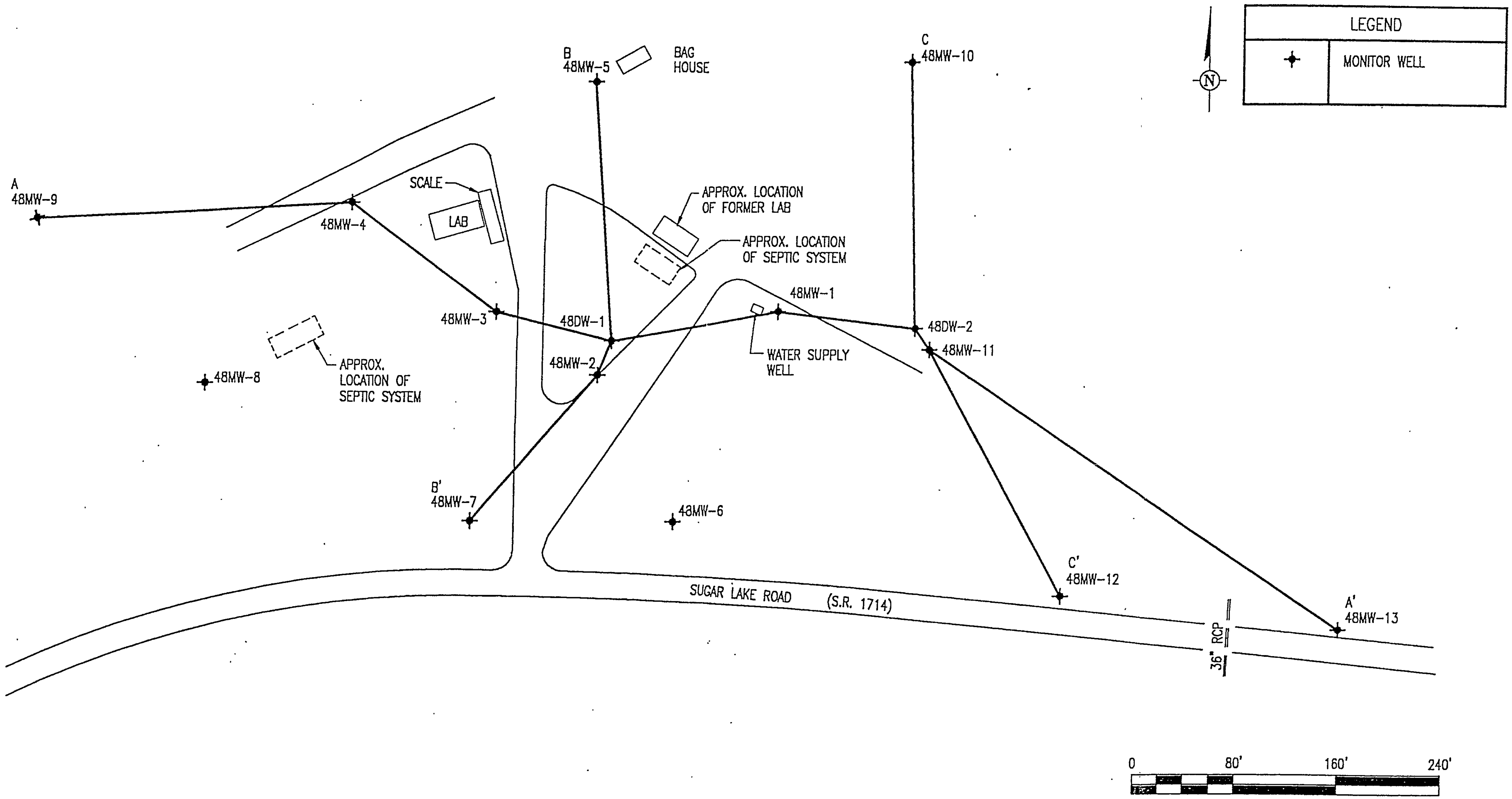


DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-SSL | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/20/97

GERAGHTY & MILLER, INC.
Environmental Services

SOIL SAMPLE LOCATIONS
NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
5-2

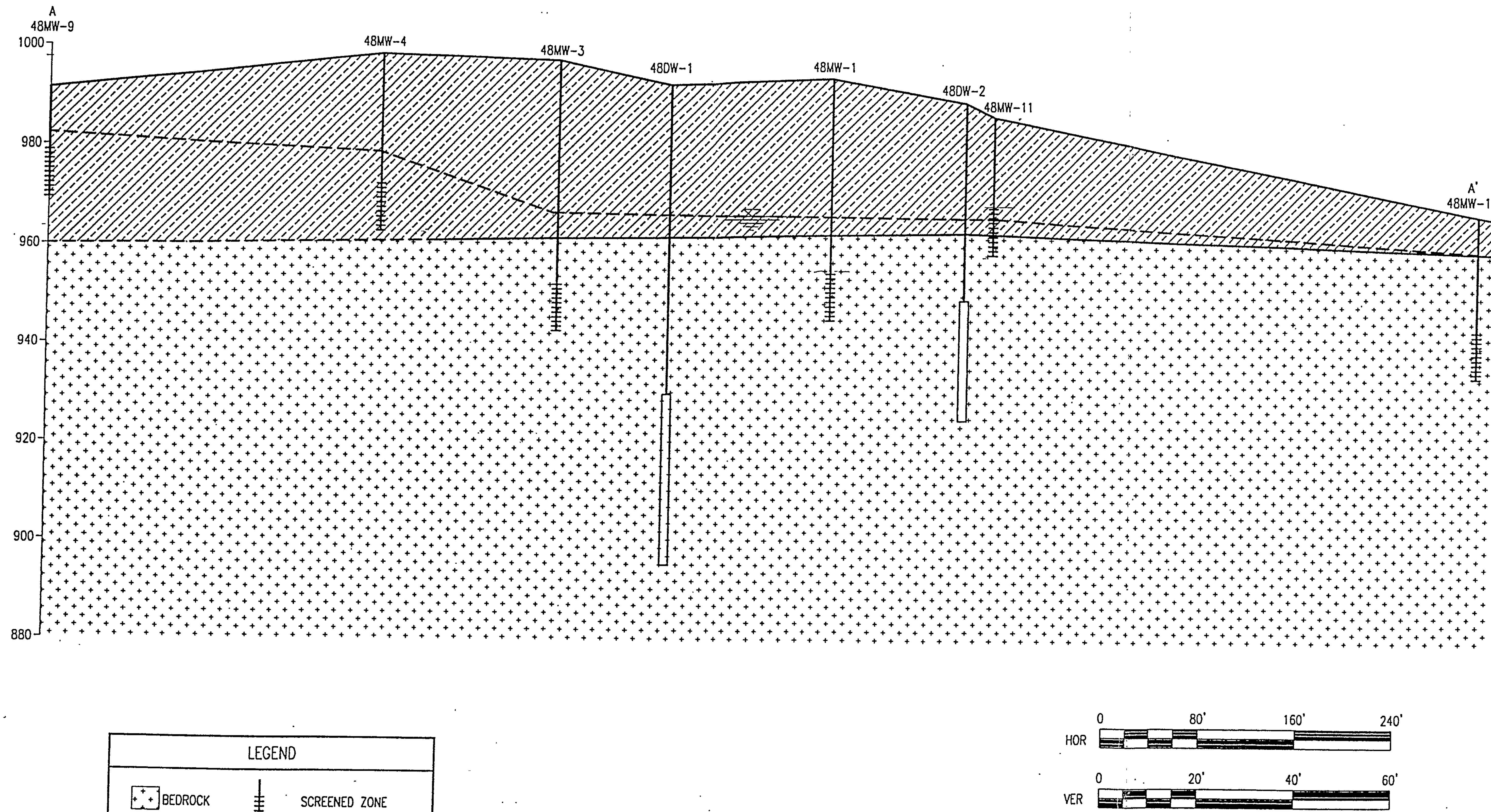


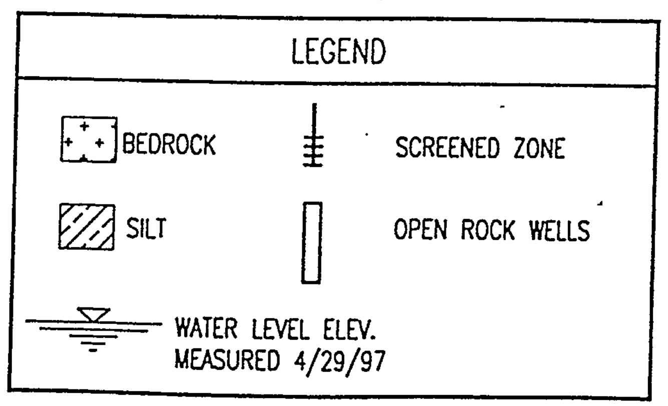
DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-CROSS | FILE NO.: 4800 | PRJCT NO.: 30575 | DWG DATE: 5/20/97

GERAGHTY & MILLER, INC.
Environmental Services

CROSS-SECTION LOCATION MAP
NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
8-1





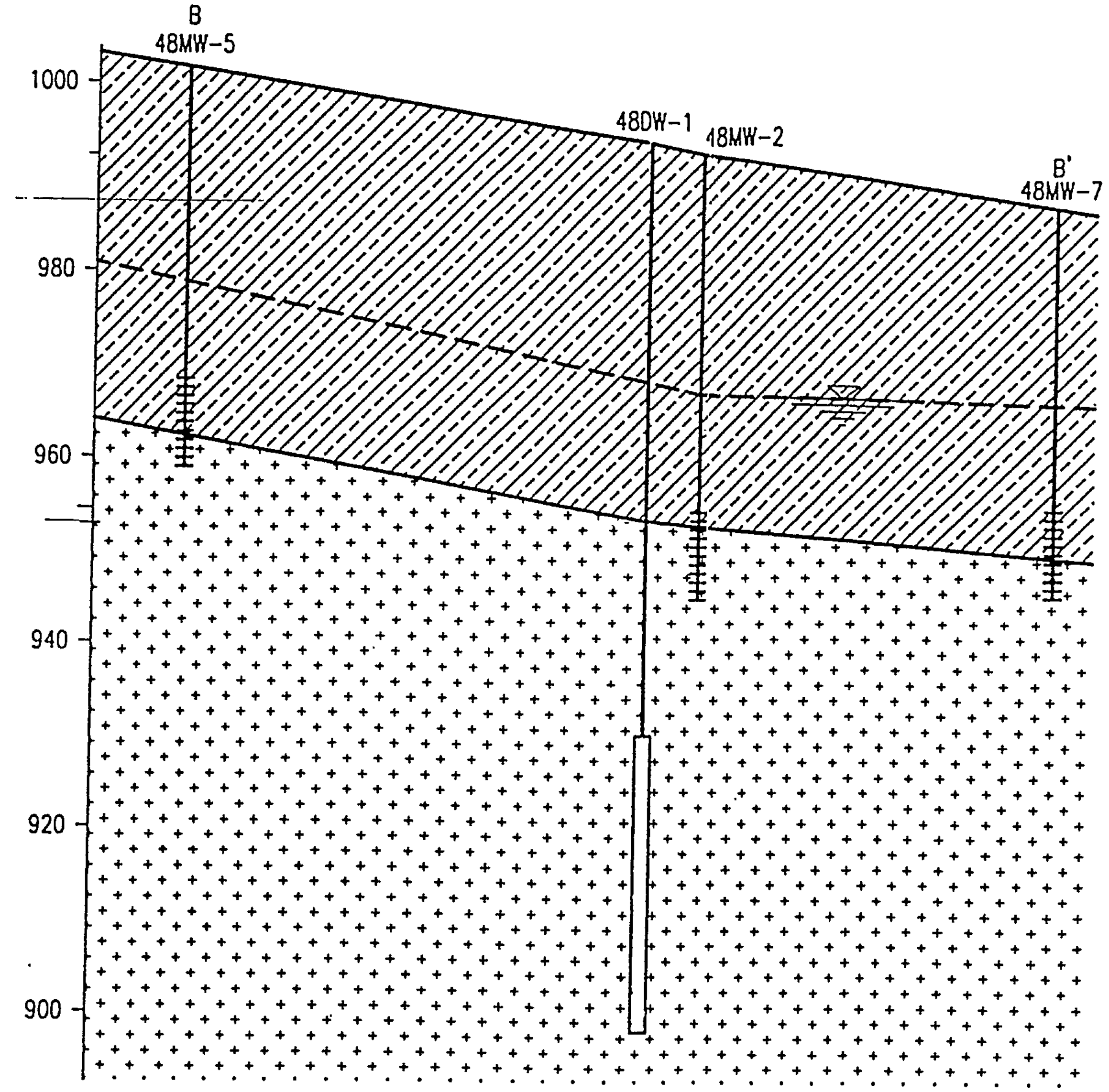
GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGIC CROSS-SECTION A-A'

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
8-2

DRAFTER: K. MEIKLE
APPROVED: F. RASH
CHECKED: K. TRIMBERGER
DRAWING: 48-A-A
FILE NO.: 4800
PRJCT NO.: 39575
DWG DATE: 5/20/97



LEGEND

BEDROCK

SILT

WATER LEVEL ELEV. MEASURED 4/29/97

SCREENED ZONE

OPEN ROCK WELLS

HOR 0 80' 160' 240'

VER 0 20' 40' 60'

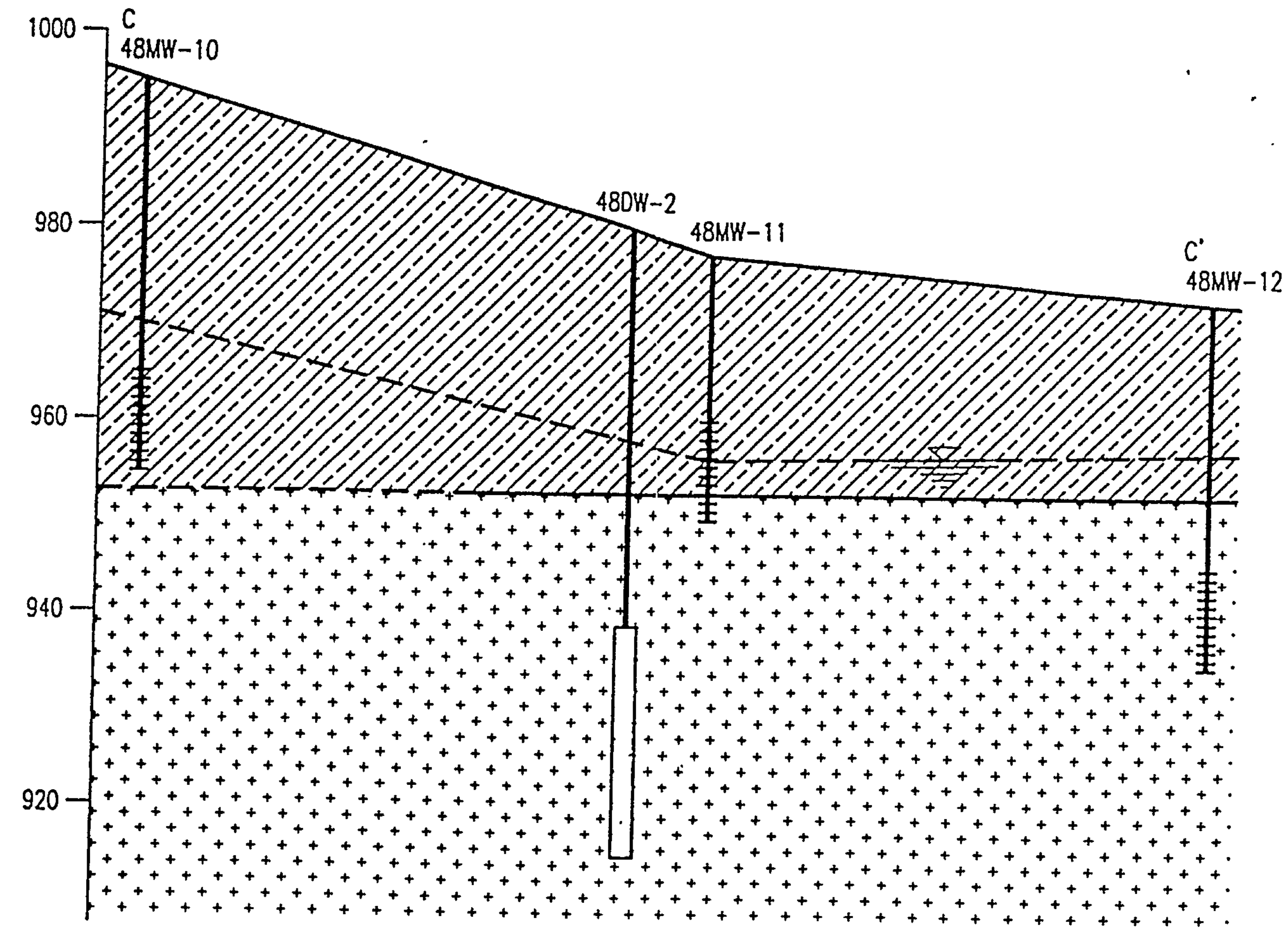
GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGIC CROSS-SECTION B-B'

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

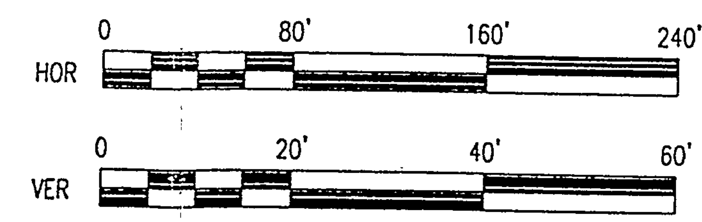
FIGURE 8-3

DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-8-B | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/20/97



LEGEND

SILT — SCREENED ZONE
BEDROCK — OPEN ROCK WELLS
WATER LEVEL ELEV. MEASURED 4-29-97



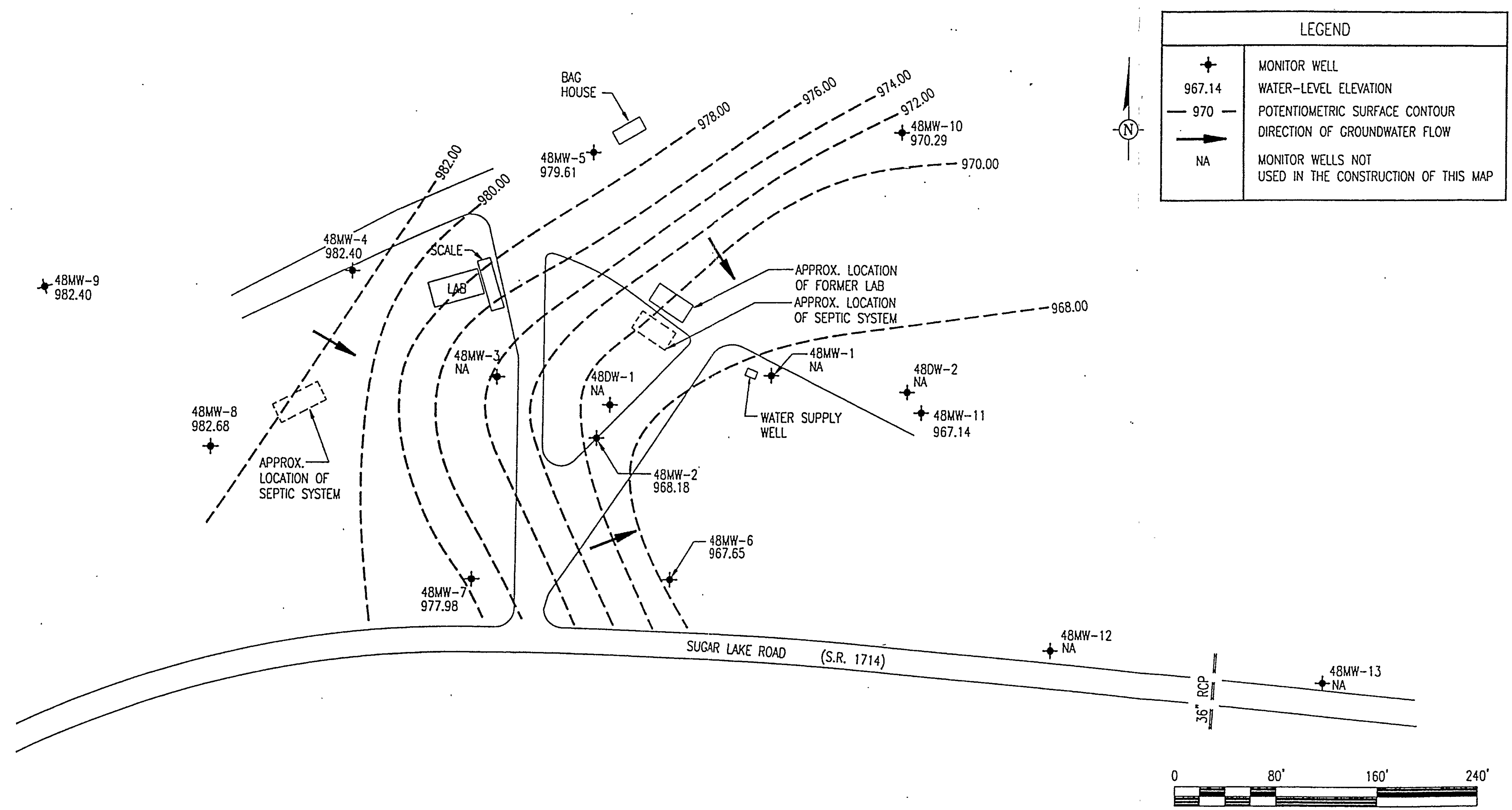
GERAGHTY & MILLER, INC.
Environmental Services

GEOLOGIC CROSS-SECTION C-C'

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE **8-4**

DRAFTER: K. MEIKLE
APPROVED: F. RASH
CHECKED: K. TRIMBERGER
DRAWING: 48-C-C
FILE NO.: 4800
PRJCT NO.: 39575
DWG DATE: 5/22/97



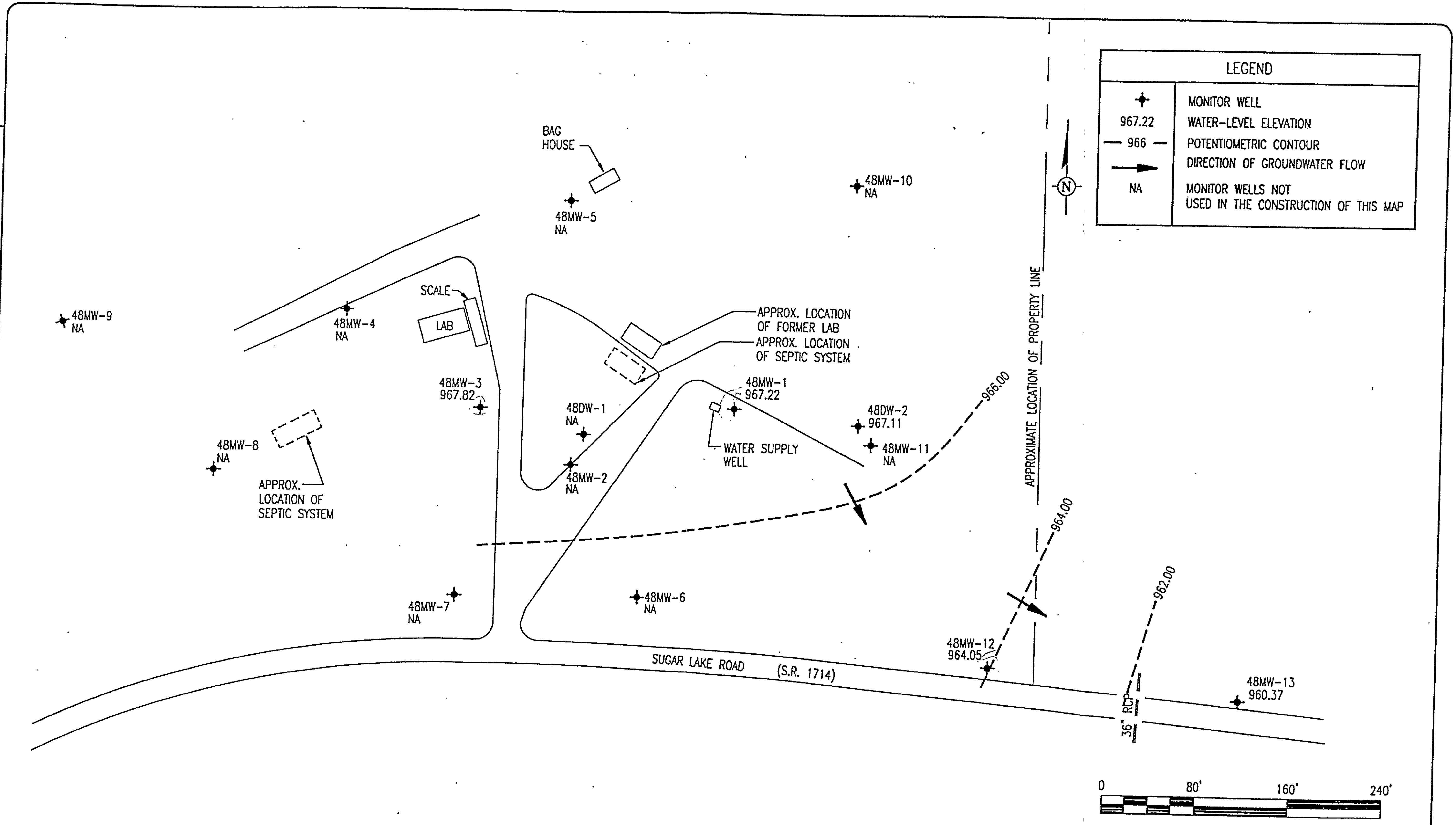
DWG DATE: 6/4/97 | PRJCT NO.: 39575 | FILE NO.: 4800 | DRAWING: 48-POT91 | CHECKED: K. TRIMBERGER | APPROVED: F. RASH | DRAFTER: K. MEIKLE

GERAGHTY & MILLER, INC.
Environmental Services

POTENTIOMETRIC CONTOUR MAP-SHALLOW WELLS
APRIL 29, 1997

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
9-1



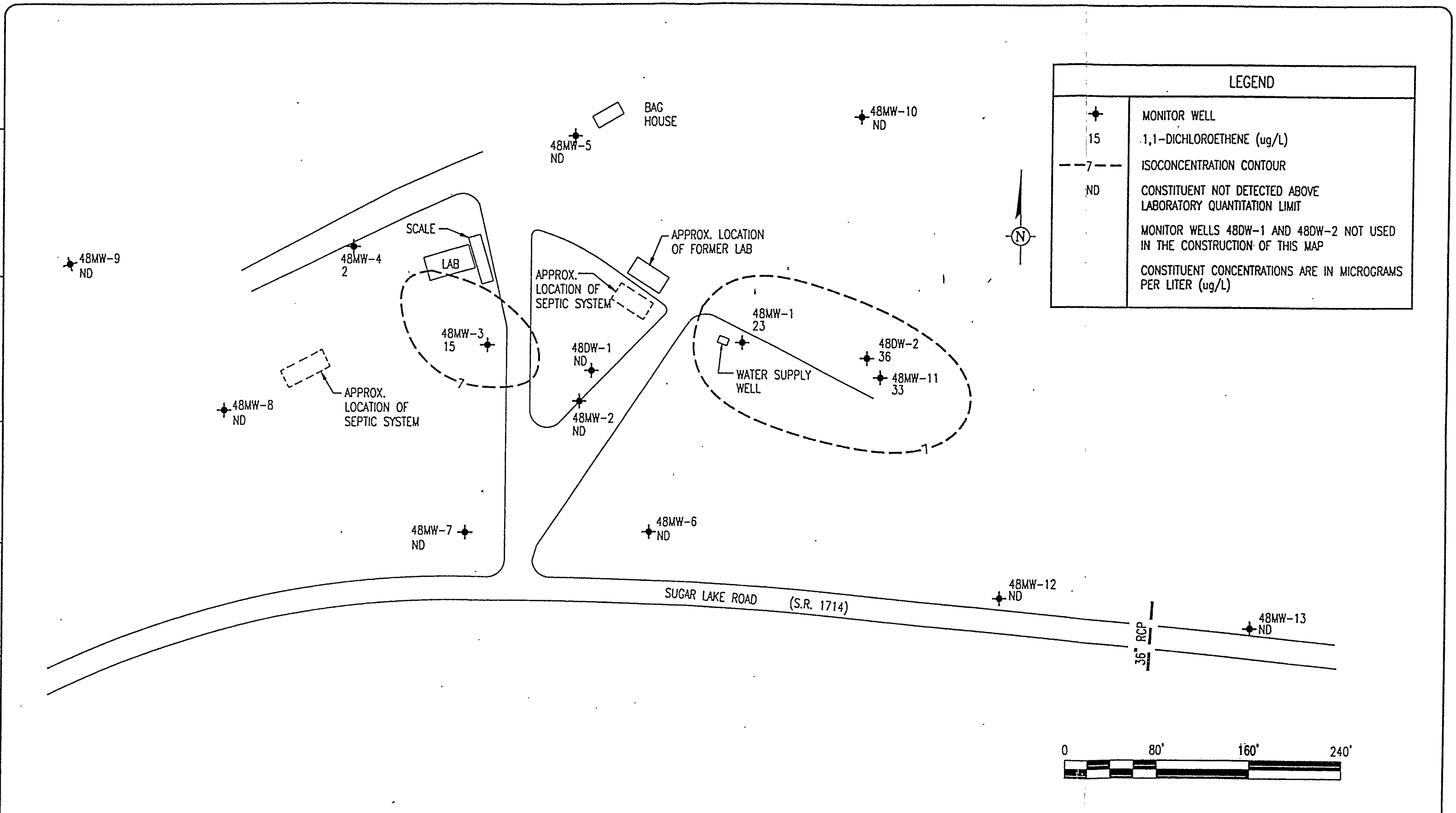
DRAFTER: K. MEIKLE
APPROVED: F. RASH
CHECKED: K. TRIMBERGER
DRAWING: 48-POT92
FILE NO.: 4800
PRJCT NO.: 39575
DWG DATE: 6/4/97

GERAGHTY & MILLER, INC.
Environmental Services

POTENTIOMETRIC CONTOUR MAP-BEDROCK WELLS
APRIL 29, 1997

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE
9-2



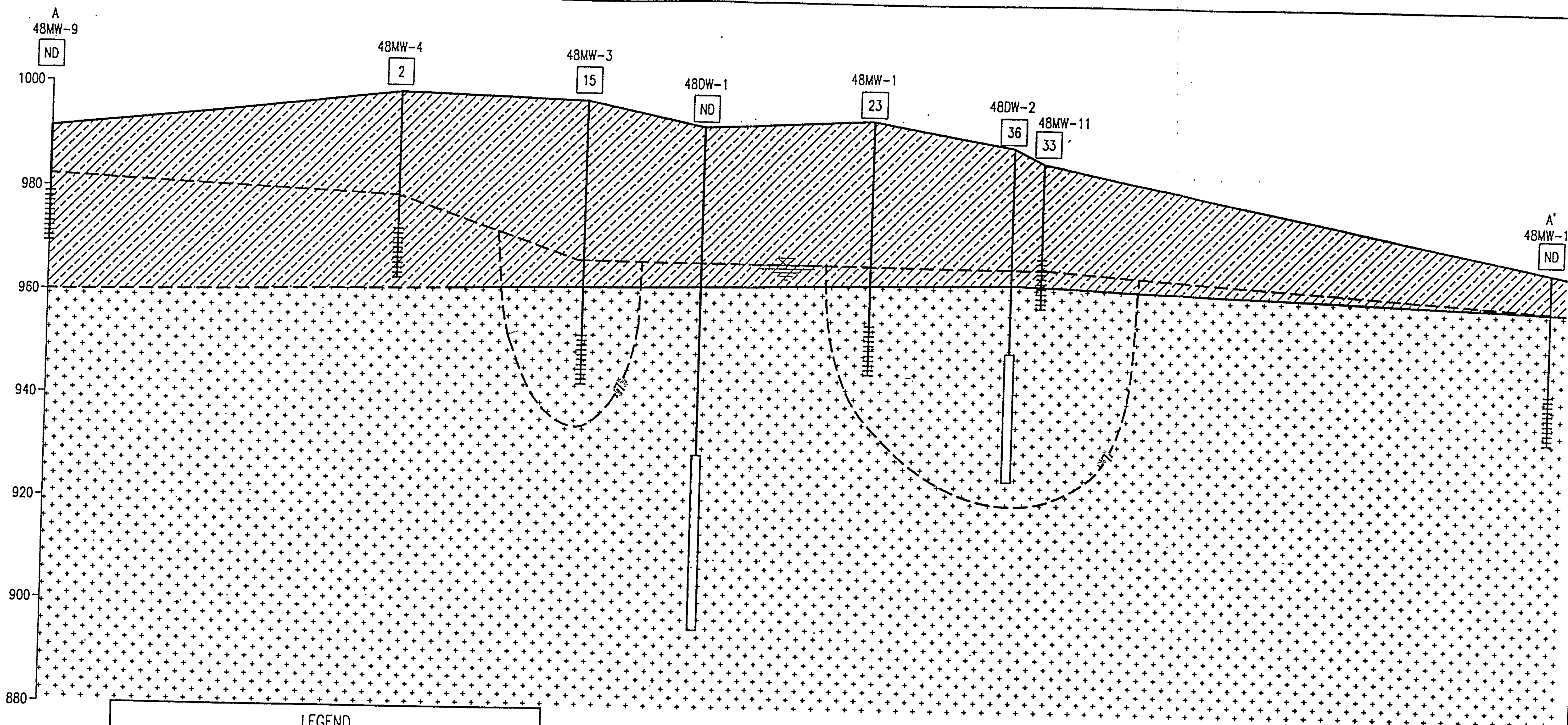
DRAFTER: K. MERKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-IS00 | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/20/97

GERAGHTY & MILLER, INC.
Environmental Services

ISOCONCENTRATION MAP FOR 1,1-DICHLOROETHENE IN GROUNDWATER

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE **9-3**



LEGEND

- BEDROCK
- SILT
- SCREENED ZONE
- OPEN ROCK WELLS
- WATER LEVEL ELEV. MEASURED 4/29/97
- ISOCONCENTRATION CONTOUR (ug/L)
- 2 GROUNDWATER CONCENTRATION (ug/L)
- ND CONSTITUENT NOT DETECTED

CONSTITUENT CONCENTRATIONS ARE IN MICROGRAMS PER LITER (ug/L)

GERAGHTY & MILLER, INC. *Environmental Services*

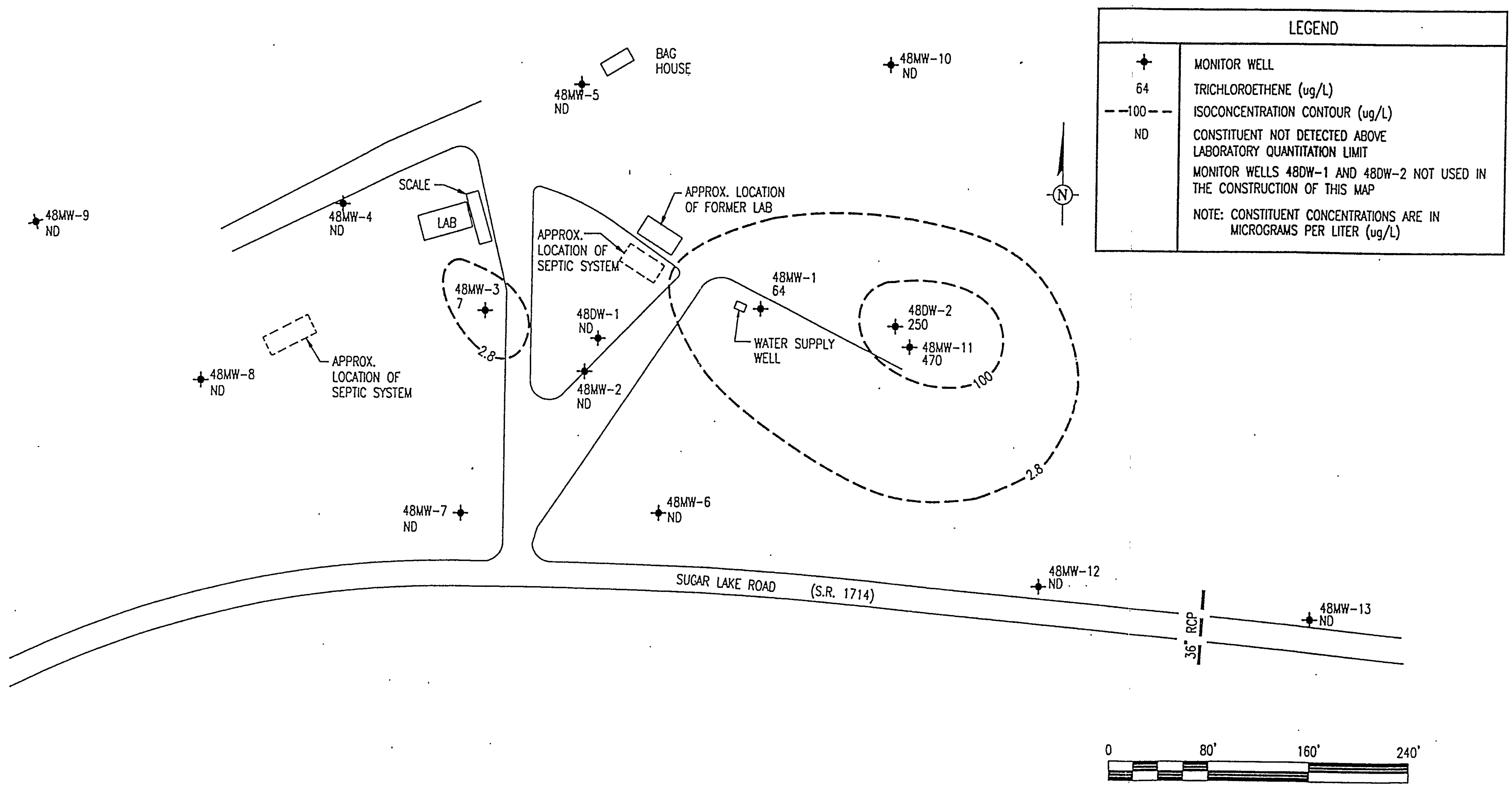
1,1-DICHLOROETHENE ISOCONCENTRTATION CONTOUR CROSS-SECTION

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE 9-4

DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-A-AD | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/22/97

DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRUMBERGER | DRAWING: 48-ISOT | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/20/97



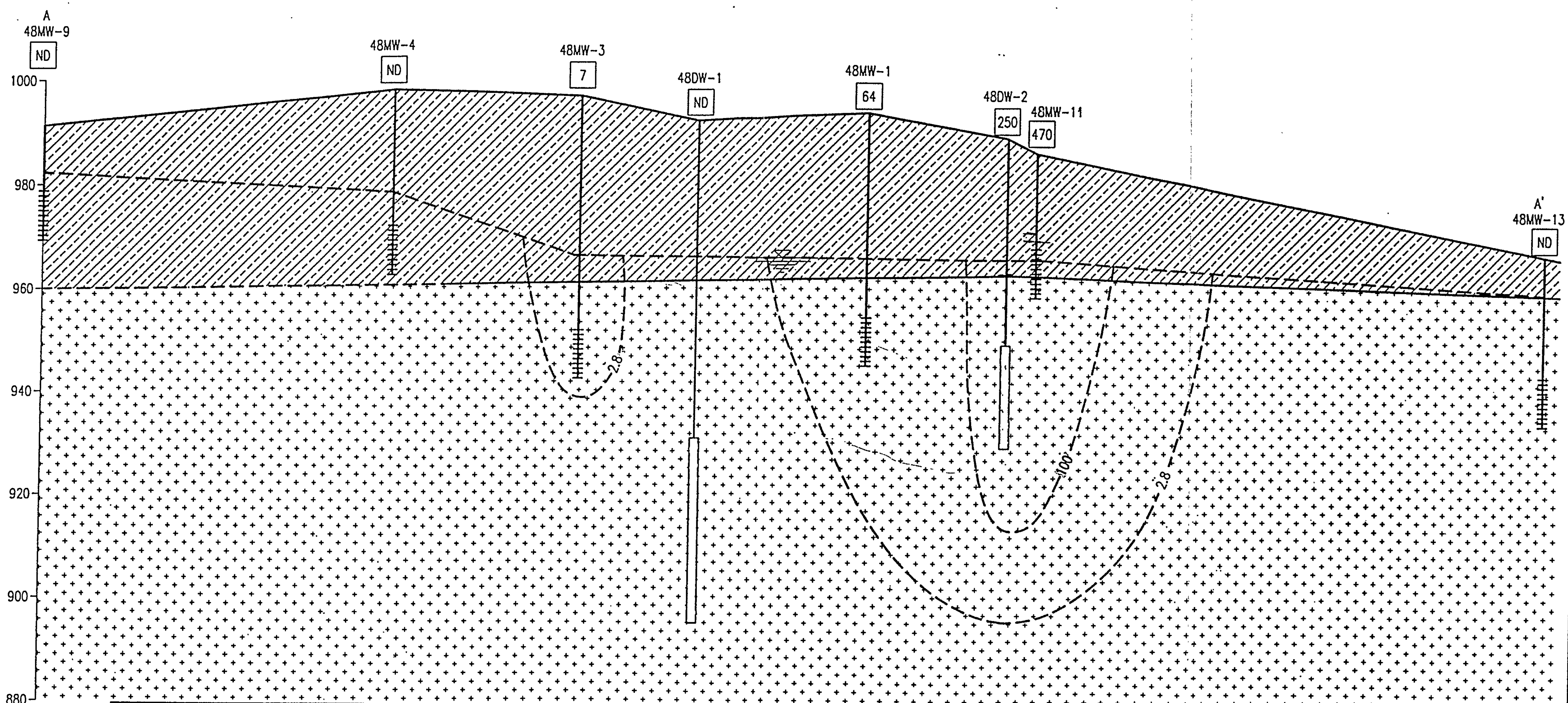
GERAGHTY & MILLER, INC.
Environmental Services

ISOCONCENTRATION MAP FOR TRICHLOROETHENE IN GROUNDWATER

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE 9-5

DRAFTER: K. MEIKLE | APPROVED: F. RASH | CHECKED: K. TRIMBERGER | DRAWING: 48-A-AT | FILE NO.: 4800 | PRJCT NO.: 39575 | DWG DATE: 5/22/97



LEGEND

BEDROCK

SILT

SCREENED ZONE

OPEN ROCK WELLS

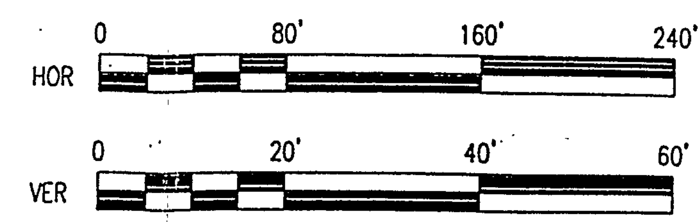
WATER LEVEL ELEV. MEASURED 4/29/97

--2.8-- ISOCONCENTRATION CONTOUR (ug/L)

7 GROUNDWATER CONCENTRATION (ug/L)

ND CONSTITUENT NOT DETECTED

CONSTITUENT CONCENTRATIONS ARE IN MICROGRAMS PER LITER (ug/L)



GERAGHTY & MILLER, INC.
Environmental Services

TRICHLOROETHENE ISOCONCENTRTATION CONTOUR CROSS-SECTION

NC DEPARTMENT OF TRANSPORTATION
SITE NO. 48
PITTSBORO, NORTH CAROLINA

FIGURE 9-6

APPENDIX III

COUNTY RECORD FOR SEPTIC SYSTEM

AND

WELL CONSTRUCTION LOGS OF 48DW-3

Lot	Block	Map
Lee Paving Co.		SR 1714

The District Health Department

CASWELL - CHATHAM - LEE - PERSON COUNTIES

Water Supply and Sewage Disposal

IMPROVEMENTS PERMIT No. 670

Date 3-20-80

Owner: Lea Paving Co.

Location: SR 1714 Across from Sugar Lake

Contractor:

Water Supply: Private ______ Public ______

Office Building

Sewage Disposal Facilities: No. bedrooms ______ Dishwasher, Disposal, washing machine, other automatic appliances ______

Size of tank: 1200 gal Bypass Nitrification line: 240' X 3' shallow line - 18-24"

Other disposal facility: trench depth

Water supply and sewage disposal facilities location, installation and protection must meet state and local regulations.

Septic tank should be pumped out every 3 to 5 years and shall be maintained by owner in such a manner as not to create a public health hazard. Septic tank and nitrification line MUST BE INSPECTED AND APPROVED BY A MEMBER OF THE DISTRICT HEALTH DEPARTMENT STAFF BEFORE ANY PORTION OF THE INSTALLATION IS COVERED AND PUT INTO USE.

Date approved:

Well:

Sewage Disposal:

By:

Signed [signature] Sanitarian

Counter signed [signature] (Owner or his representative)

Certificate of Completion

Date Approved: 5/20/80 By: [signature] Sanitarian

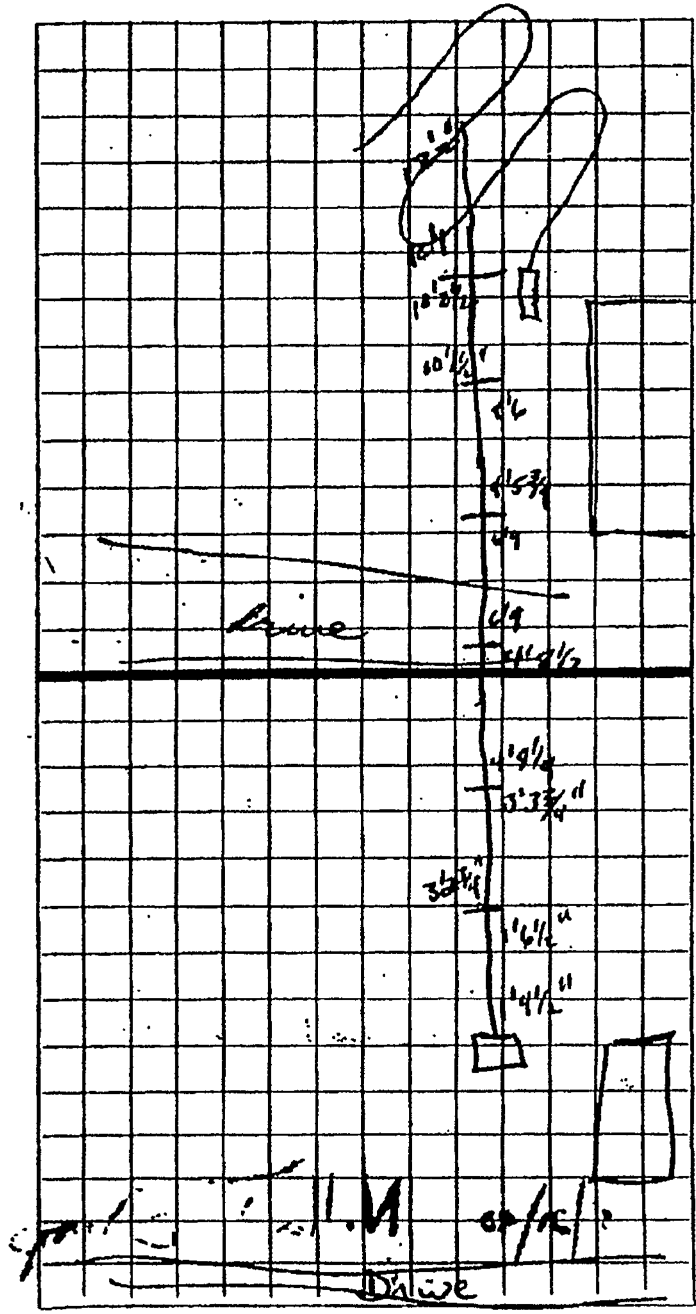
(OVER)

Location of well and sewage disposal facilities sketched on back.

David Dry 1-26-99
790-9827
S&ME Env. Consulting

NOTE: Make sketch of installation showing lot size and shape, location of house, septic tanks, privies, water supplies, etc. Note special problems existing on lot. Write in measurements in order that installations may be located at later date. Note location of water supplies on adjacent lots.

(1) (2)



Lee [illegible]

SR 1714

Lot	Block	Map

The District Health Department

CASWELL - CHATHAM - LEE - PERSON COUNTIES

Water Supply and Sewage Disposal

IMPROVEMENTS PERMIT No. G-70

Date 3-20-80

Owner: Lee Paving Co.

Location: SR 1714 across from Sugar Lake

Contractor: ______

Water Supply: Private ______ Public ______

Office Building

Sewage Disposal Facilities: No. bedrooms ______ Dishwasher, Disposal, washing machine, other automatic appliances ______

Size of tank: 1200 gal [illegible] Nitrification line: 240'X3'

shallow line - 18-24"

Other disposal facility: Trench depth

Water supply and sewage disposal facilities location, installation and protection must meet state and local regulations.

Septic tank should be pumped out every 3 to 5 years and shall be maintained by owner in such a manner as not to create a public health hazard. Septic tank and nitrification line MUST BE INSPECTED AND APPROVED BY A MEMBER OF THE DISTRICT HEALTH DEPARTMENT STAFF BEFORE ANY PORTION OF THE INSTALLATION IS COVERED AND PUT INTO USE

Date approved: ______

Well: ______

Sewage Disposal: ______

By: ______

Signed [signature] Sanitarian

Countersigned [signature] (Owner or his representative)

Certificate of Completion

Date Approved: 5/21/80 By: [signature] Sanitarian

(OVER)

Location of well and sewage disposal facilities sketched on back.

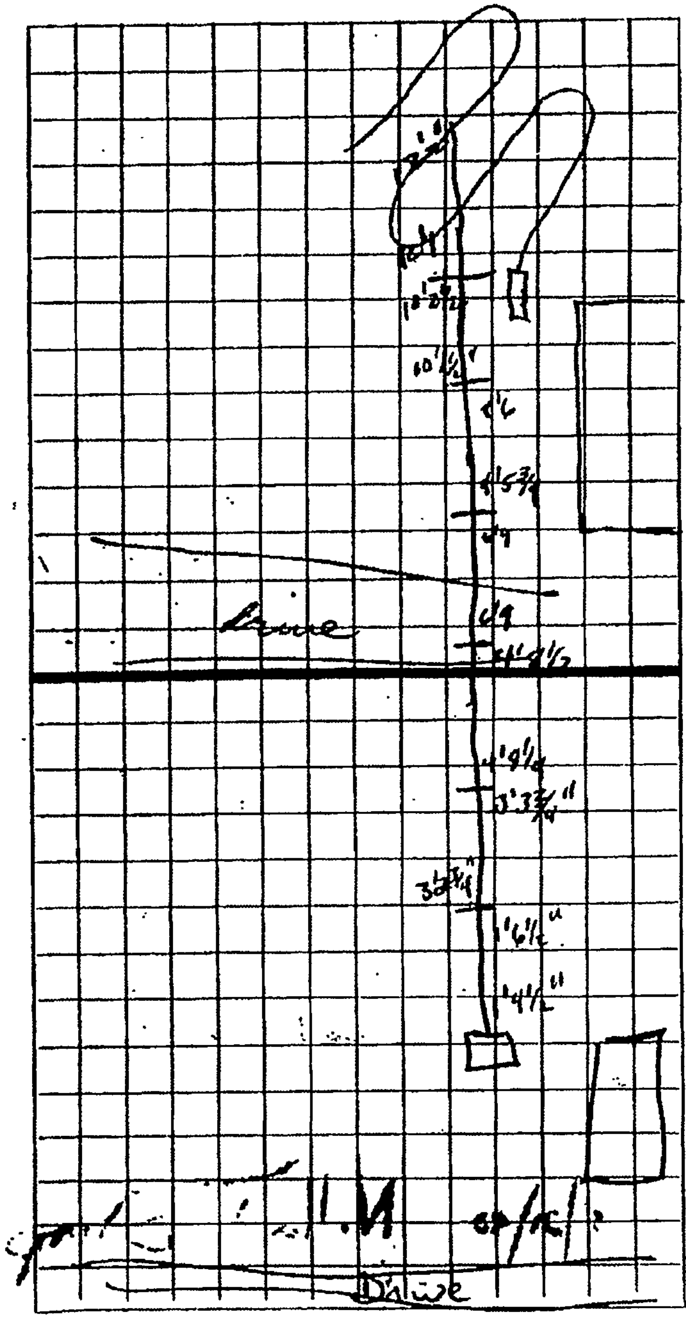
David Dry 1-26-99

790-9827

S&ME Env. Consulting

NOTE: Make sketch of installation showing lot size and shape, location of house, septic tanks, privies, water supplies, etc. Note special problems existing on lot. Write in measurements in order that installations may be located at later date. Note location of water supplies on adjacent lots.

(1) (2)



COMPLETION REPORT OF WELL No. 48 DMW-3

PROJECT: **NCDOT Site 6-48**
PROJECT NO: **1040-98-107**
PROJECT LOCATION: **Pittsboro, North Carolina**

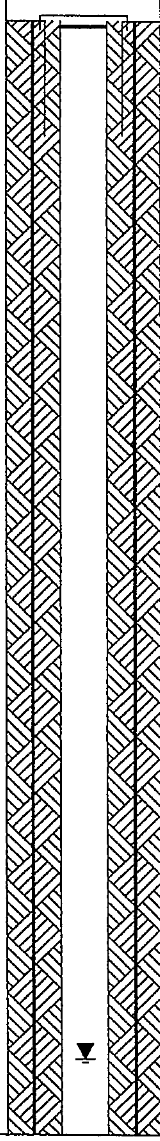
WATER LEVEL: **27.96**

LATITUDE:
LONGITUDE:
TOP OF CASING ELEVATION:
DATUM:
LOGGED BY: **KPJ**

DRILLING CONTRACTOR: **Graham & Currie**
DRILLING METHOD: **Air Rotary**
DATE DRILLED: **7/27/99**

STRATA: DESCRIPTION	STRATA: DEPTH (ft.)
Dark Brown Organic Sandy Silty **Clay**	0
Orange Red Hard Slightly Silty **Clay**	
Orange Tan Firm Silty **Clay**	5
Light Brown to Tan Firm Slightly Silty **Clay**	10
Tan to Light Tan Loose Very Fine Very Slightly Sandy Clayey **Silt**	15
	20
Dark Tan to Brown Loose Fine Slightly Sandy **Silt**	25

WELL DETAILS



DEPTH (ft.)	LEGEND	ELEVATION (ft.)
0.00	GS	
0.20		

WELL CONSTRUCTION DETAILS

PROTECTIVE CASING
Diameter: **8-inch**
Type: **Flush-mount**
Interval: **0.0'-1.5' BLS**

RISER CASING
Diameter: **2-inch**
Type: **PVC**
Interval: **0.2'-115' BLS**

OUTER CASING
Diameter: **6-inch**
Type: **PVC**
Interval: **0.0'-31' BLS**

GROUT
Type: **Bentonite Grout**
Interval: **0.5-111' BLS**

SEAL
Type: **Bentonite Chips (3/8")**
Interval: **111'-113' BLS**

FILTERPACK
Type: **#2 Filter Sand**
Interval: **113'-125' BLS**

SCREEN
Diameter: **2-inch**
Type: **PVC**
Interval: **115'-125' BLS**

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL
- STATIC WATER LEVEL

TOC	TOP OF CASING
GS	GROUND SURFACE
BS	BENTONITE SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
TD	TOTAL DEPTH
CG	CEMENT GROUT

S&ME
ENGINEERING • TESTING
ENVIRONMENTAL SERVICES

COMPLETION REPORT OF WELL No. 48 DMW-3

PROJECT: **NCDOT Site 6-48**
PROJECT NO: **1040-98-107**
PROJECT LOCATION: **Pittsboro, North Carolina**

GROUND SURFACE ELEVATION:
LOGGED BY:
CHECKED BY: **KPJ**

STRATA DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
							(See Page 1)
Rock as Andesite (Diabase Dike)		30		30.70			
		35					
		40					
		45					
		50					
		55					
		60					
		65					

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL
- STATIC WATER LEVEL

TOC	TOP OF CASING
GS	GROUND SURFACE
BS	BENTONITE SEAL
FP	FILTER PACK
TSC	TOP OF SCREEN
BSC	BOTTOM OF SCREEN
TD	TOTAL DEPTH
CG	CEMENT GROUT

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COMPLETION REPORT OF WELL No. 48 DMW-3

MONITORING WELL PITSBORO.GPJ S&ME.GDT 8/18/99

PROJECT:	**NCDOT Site 6-48**
PROJECT NO:	**1040-98-107**
PROJECT LOCATION:	**Pittsboro, North Carolina**

GROUND SURFACE ELEVATION:
LOGGED BY:
CHECKED BY: **KPJ**

STRATA: DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
							(See Page 1)
Rock as Andesite (Diabase Dike) *(continued)*		70 75 80 85 90 95 100 105					

LEGEND

FILTER PACK		TOC	TOP OF CASING
BENTONITE		GS	GROUND SURFACE
CEMENT GROUT		BS	BENTONITE SEAL
CUTTINGS / BACKFILL		FP	FILTER PACK
STATIC WATER LEVEL		TSC	TOP OF SCREEN
		BSC	BOTTOM OF SCREEN
		TD	TOTAL DEPTH
		CG	CEMENT GROUT

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PROJECT: **NCDOT Site 6-48**
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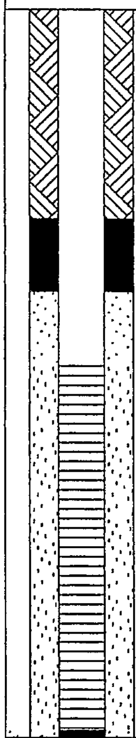
STRATA DESCRIPTION	SYMBOL	DEPTH (ft.)	WELL DETAILS	DEPTH (ft.)	LEGEND	ELEVATION (ft.)	WELL CONSTRUCTION DETAILS
							(See Page 1)
Rock as Andesite (Diabase Dike) *(continued)*		110		111.00			
		115					
		120					
		125		124.80 125.00	BSC TD		

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL
- STATIC WATER LEVEL

TOC	TOP OF CASING
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