

E²S

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

RALEIGH, NC 27609

(919) 781-7798

October 8, 2010

Mr. Zinith Barbee
Hydrogeologist
Solid Waste Section
1646 Mail Service Center
Raleigh, NC 27699-1646



Re: Permit Modification Notification Request
Hoke County LCID Landfill
LCID Permit No. 47-A

Dear Mr. Barbee:

This submittal is for a modification to the Hoke County LCID Landfill. Five (5) copies of the Plans and Application, a disk containing digital copies of the Plans and Application, and the application fee are provided.

The modification requests that the storage area for the material to be ground be increased to one (1) acre. Up to 1800 tons (6000 yd³) of processed and unprocessed material will be stored at any given time. No more than 1800 tons (6000 yd³) will be processed in the three month period. With respect to erosion control considerations, the greater storage area was originally considered in the recent renewal submittal.

Hoke County has conducted a market study and had found that more than 700 tons of the LCID debris could be obtained if the commercial debris is also accepted at the facility. No more than 700 tons is anticipated to be placed in the LCID Landfill itself.

This modification also requests that slopes be 2:1 (H:V) or flatter during the excavation of the LCID cell and for the temporary cover. Final cover and slopes, however, should be 3:1 (H:V) or flatter.

Please contact me if you have any questions about this submittal.

Sincerely,

A handwritten signature in black ink, appearing to read "T. Patrick Shillington".

T. Patrick Shillington, P.E.
President



ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

HALEIGH, NC 27809

(919) 781-7790

October 8, 2010

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Raleigh, NC 27699-1646

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Sincerely,

T. Patrick Shillington, P.E.
President

Permit Application Renewal

For

Hoke County LCID Landfill

Permit No. 47A-LCID-1996

SR-1302 Raeford, NC

Owner

Hoke County

Solid Waste Office

P.O. Box 179

Raeford, NC 28376



April 5, 2010

Revised September 17, 2010

Engineering & Environmental Science Company (E²S)

3008 Anderson Drive, Suite 102

Raleigh, NC 27609

Office (919) 781 – 7798

Fax (919) 781 - 7796

Applicant Signature Page

Name of facility HOKIE COUNTY LCFA LANDFILL

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision and that the information provided in this application is true, accurate, and complete to the best of my knowledge.

I understand that North Carolina General Statute 130A-22 provides for administrative penalties of up to fifteen thousand dollars (\$15,000.00) per day per each violation of the Solid Waste Management Rules. I further understand that the Solid Waste Management Rules may be revised or amended in the future and that the facility siting and operations of this solid waste management facility will be required to comply with all such revisions or amendments.

[Signature]
Signature
SOLID WASTE DIRECTOR
Title

TON RUSSELL
Print Name
HOKIE COUNTY
Business or organization name

10/8/2016
Date
10/8/2016
Date

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- Attachment C: Erosion Control Approval Letter and Evaluation**
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- Sheet 1: Hoke County NCDOT Map**
- Sheet 2: Facility Site Setting**
- Sheet 3: Existing Conditions**
- Sheet 4: Final Layout**
- Sheet 5: Cross-Section A-A'**
- Sheet 6: Cross-Section B-B'**
- Sheet 7: Cross-Sections C-C' and D-D'**

1.0 Introduction

The existing LCID Landfill (Permit No. 47A-LCID-1996) is located on a 20 acre tract of land that is adjacent to the closed Solid Waste Landfill. A transfer station and several office and maintenance builds are on this parcel of land where the closed Solid Waste Landfill is located. Attachment A provides the local government (Hoke County) approval letter and Attachment B contains the deed description.

The LCID Landfill was originally permitted in 1994 and operated by the City of Raeford. Responsibility for the LCID Landfill operations was subsequently transferred to Hoke. Initial permitting of this site was for a Construction Demolition Debris Landfill but was subsequently changed to a LCID Landfill during the permitting process.

Presently, the foot print of the LCID Landfill is about 1.2 Acres. Proposed maximum extent of the landfill is 4.3 Acres.

In addition to the LCID Landfill, a wood and yard/landscape waste grind operation that will occupy about 1.5 acres of the site is proposed. The finished product will be sold as decorative landscaping material and for a renewable energy source. As much as 1800 tons (6000 yd³) of processed and unprocessed material will be stored at any given time at the site; however, no more than 1800 tons (6000 yd³) will be processed in a three month period.

2.0 Anticipated Lifetime of Project

The anticipated lifetime of the LCID Landfill is anticipated to last to 2025. The remaining capacity of the landfill is approximately 50,025 cubic yards. The following provides calculations for the life of the LCID landfill:

Total LCID Capacity Remaining:	50,215 yd ³
Projected Average Annual Weight:	700 tons/year
*Projected Average Annual Volume:	700 tons/year x 2,000 lbs/ton ÷ 600lbs/yd ³ = 2,333 yd ³ /year
**Annual Volume Consumed by Monthly Soil Cover & Final Cover:	892 yd ³
Total Annual Consumed Volume:	2,333 yd ³ + 892 yd ³ = 3,225 yd ³
Projected Remaining Life of Landfill:	50,215 yd ³ ÷ 3,225 yd ³ /year = 15.5 years

*600 lbs/yd³ is estimated weight/volume ration for LCID waste

**See earthwork calculations for annual soil volume

3.0 Earthwork Calculations

For one (1) 5 year operation an area of 123 ft by 182 ft will be consumed. An average depth of 10 ft will be excavated. Total soil volume excavated is:

$$123 \text{ ft} \times 182 \text{ ft} \times 10 \text{ ft} \times (1 \text{ yd}^3 / 27 \text{ ft}^3) = 8,291.1 \text{ yd}^3$$

The LCID debris will be covered on a monthly basis with the debris being placed in four individual layers with the plan area of about 31 ft by 45 ft. The last layer will have the 2 ft final cover while the lower 3 layers will have a 1 ft monthly soil cover. The vertical sides of each cell will also have 1 ft monthly soil cover.

$$\begin{aligned} &\text{Require Final Soil Cover} \\ &123 \text{ ft} \times 182 \text{ ft} \times 2 \text{ ft} \times (1 \text{ yd}^3 \div 27 \text{ ft}^3) = 1,658.2 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} &\text{Monthly Cover} \\ &[123\text{ft} \times 182\text{ft} \times 3\text{ft} + 2 \times 123\text{ft} \times 4\text{ft} \times 1\text{ft} + 2 \times 182\text{ft} \times 14\text{ft} \times 1\text{ft}] \times (1 \text{ yd}^3 / 27 \text{ ft}^3) \\ &= 2,803.6 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} &\text{Net Excess Soil per 5-year Period} \\ &8,291.1 \text{ yd}^3 - 1,658.2 \text{ yd}^3 - 2,803.6 \text{ yd}^3 \\ &= 3,829.3 \text{ yd}^3 \end{aligned}$$

$$\begin{aligned} &\text{Approximate Annual Volume Consumed by Monthly Soil Cover \& Final Soil Cover} \\ &(1,658.2 \text{ yd}^3 + 2,803.6 \text{ yd}^3) \div 5 \text{ years} \\ &= 892 \text{ yd}^3 / \text{years} \end{aligned}$$

4.0 Erosion Control Evaluation

Erosion control was provided during the original permitting of the landfill (see Land Quality approval letter dated May 31, 1994 in Attachment C).

With the new area of disturbance added for the grinding/stockpile area, the stormwater basin was re-evaluated. Based on this evaluation, the existing basin meets the erosion control requirements of the Land Quality Section. The calculations are provided in Attachment C.

Evaluation was also conducted for stormwater discharge leaving the top of the disposal area. This evaluation indicates suitable low surface water velocities at the 3:1 (H:V) slopes.

5.0 Description of Compliance with Rule 15A NCAC 1313.0564

Attachment D contains the Hydrogeologic Study that was conducted in the 1994 by E²S for the initial permitting of this site.

6.0 Description of Compliance with Rule 15A NCAC 1313.0564

1. The facility is located outside of the 100 year flood plain per the Hoke County Flood Insurance Maps
2. The facility is active with the property vegetated in grass outside of the LCID Landfill area. Facility or practices do not cause or contribute to the taking of any endangered or threatened species of plants, fish, or wildlife.
3. This facility or practices will not cause destruction or adverse modification of critical habitat of endangered species or threatened species as identified in CFR Part 17.
4. The facility is not located in an area that will damage or destroy and archaeological or historical site.
5. The facility is more than 2 miles from a state park, recreation scenic area, or any other lands such as state nature and historic preserves. This facility and practices will not effect the above mentioned.
6. The facility is not located in a wetland or near a wetland as defined in the Clean Water Act, Section 404(b).
7. Sufficient on-site suitable soils are available for the landfill cover. A net volume of soil will be provided which will be used for fill at other Hoke County projects.
8. The LCID Landfill meets the following criteria:
 - a) All stormwater is directed to the stormwater basin. From this basin the water must travel at least 2000ft to the nearest stream. The facility and practices will not violate the requirements of the NPDES, Section 402 of the Clean Water Act.
 - b) The facility will not cause a discharge of dredged or fill material into the waters of the state per the requirements, Clean Water Act, Section 404.
 - c) The facility will not cause non-point source pollution of waters of the state that violate assigned water quality standards.
 - d) The waste base is at least 10ft above the seasonally high water table.
 - e) Not Applicable, the facility is larger than 2 acres.

9. The Facility meets the following buffer requirements:
 - a) The waste boundary is more than 1400ft from a surface water of the state. (50ft is required)
 - b) A 100ft buffer is provided from the waste boundary and the property line. The waste boundary is more than 2900ft from any residence and 1050ft from the Hoke County office facilities. No water supply wells are within ½ mile of the site.

10. The facility is approved by Hoke County, the local government having zoning jurisdiction (See Attachment A).

7.0 Operation Plan

7.1 Responsible Individual and Operation Time

Hours of Operation: 8:00AM to 5:00PM Monday- Friday
8:00AM to 3:00PM Saturday

Responsible Individual: Mr. Don Russell
Solid Waste Office
Hoke County
P.O. Box 179
Raeford, NC 28376
Phone: (910) 875 - 3111

7.2 Land Use After Closure

Public access will not be allowed once the LCID Landfill is closed.

7.3 Description of Systematic Usage, Operation, Orderly Development, and Closure

Access Roads: An asphalt paved road that leads from the public roadway system to the weight scales. From the weight scales to the LCID Landfill, the road is exposed ground. The soils at the exposed ground meet the definition of a Class C Soil Base per NCDOT Specifications. This portion of the access road is periodically smoothed to remove the wash board effect caused by vehicle wheel loads. During the drier times of the year, the ground is wetted with a water truck to minimize dusting.

Material Handling: As each load of LCID debris enters the site and is dumped the type of waste is visually examined. Waste primarily consisting of wood and landscape or yard waste will be dumped at the grinding area. This type of waste is further sorted between wood and yard/landscape waste (leaves, small branches). This material is then ground

Page 5
Hoke County LCID Landfill

with a tub grinder. The processed material will be directly loaded onto a truck from the tub-grinder. Temporary storage of material at the site may occur if insufficient trucks are available during the grinding process. An end loader will then load the trucks when they are available. The ground material will be sold for landscaping needs and as renewable fuel. Up to 200 tons of processed material may be stored at the site for use at this facility for soil amendments for on-site vegetation growth.

The grinding operations will be conducted periodically during the year. Hoke County will not own the tub grinder but will contract or outsource this activity. The wood and yard/landscape waste will be stockpiled until it is economical for a contractor to mobilize at the site. As much as 1800 tons (6000 yd³) of processed and unprocessed material will be stored at any given time, however no more than 1800 tons (6000 yd³) will be processed in the three month period. The grinding operation will take about one to two weeks.

Debris containing brick and concrete will be deposited at the LCID Landfill area. The LCID Landfill deposition will continue at its present location and proceed towards the stormwater basin. Each cell is excavated about 10ft below ground with the soil stockpiled in front of the excavation. The LCID waste material is deposited to about 5ft above existing surrounding ground levels. Excavated slopes and temporary fill slopes will be 2:1 (H:V) or flatter. Excess soil not used for cover will be stockpiled for later use at other Hoke County projects.

At closure at least 24 inches of soil cover will be placed over the LCID debris and revegetated with grass. The top of the LCID surface will be constructed to shed stormwater as sheet water flow off the deposition area. Final slopes along the perimeter of the disposal area will be 3:1 (H:V) or flatter.

Within the grinding area and stockpile area, the ground will be graded to promote positive drainage towards the stormwater basin. The area will be revegetated in grasses. The stormwater basin will remain in-place once the site is closed.

Stormwater Runoff: The runoff from the LCID Landfill area and the Grinding/Stockpile area all drain to the stormwater basin. The basin is checked once monthly for any operational defects, and when deficiencies are noted, they are corrected within a timely manner. Sediment accumulation is removed from the basin and incorporated into the soil used for landfill cover.

Leachate Management: Leachate production should be minimal to non-existing.

Additional Operational Requirements per 15A NCAC 13B.0566:

- (1) Operational plans shall be approved and followed as specified for the facility.
- (2) The facility shall only accept those wastes which it is permitted to receive.

Hoke County LCID Landfill

- (3) The waste shall be restricted to the smallest area feasible and compacted as densely as practical into cells.
- (4) Adequate soil cover shall be applied monthly, or when the active area reaches one acre in size, whichever occurs first.
- (5) 120 calendar days after completion of any phase of disposal operations, or upon revocation of a permit, the disposal area shall be covered with a minimum of 2 feet of suitable soil cover sloped to allow surface water runoff in a controlled manner. The Division may require further action in order to correct any condition which is or may become injurious to the public health, or a nuisance to the community.
- (6) Adequate erosion control measures, structures, or devices shall be utilized to prevent silt from leaving the site and to prevent excessive on site erosion.
- (7) Provisions for a ground cover sufficient to restrain erosion must be accomplished within 30 working days or 120 calendar days upon completion of any phase of landfill development.
- (8) The facility shall be adequately secured by means of gates, chains, berms, fences, etc. to prevent unauthorized access except when an operator is on duty. An attendant shall be on duty at all times while the landfill is open for public use to assure compliance with operational requirements and to prevent acceptance of unauthorized wastes.
- (9) Access roads shall be of all-weather construction and properly maintained.
- (10) Surface water shall be diverted from the working face and shall not be impounded over waste.
- (11) Solid waste shall not be disposed of in water.
- (12) Open burning of solid waste is prohibited.
- (13) The concentration of explosive gases generated by the facility shall not exceed:
 - (a) Twenty-five percent of the lower explosive limit for the gases in facility structures.
 - (b) The lower explosive limit for the gases at the property boundary.
- (14) Leachate shall be properly managed on site through the use of current best management practices.
- (15) Should the Division deem it necessary, ground water or surface water monitoring, or both, may be required as provided for under Rules .0601 and .0602 of this Subchapter.

- (16) A sign shall be posted at the facility entrance showing the contact name and number in case of an emergency and the permit number. The permit number requirement is not applicable for facilities not requiring an individual permit.

Disposal of Dead Animal Requirements per 02 NCAC 52C .0102:

1. Dead animals will be disposed of by methods approved by the State Veterinarian and will be buried at least three feet below the surface of the ground.

Burial Standards

1. The bottom of the hole where dead animals are to be buried will be approximately 27 feet above the seasonal high water table. Dead animals will be disposed of by methods approved by the State Veterinarian and will be buried at least three feet below the surface of the ground.
2. Standing water in the hole does not preclude animal burial as the bottom of the hole is approximately 27 feet above the seasonal high water table.
3. There must be at least 3 feet of soil covering any buried animal. This can be interpreted to mean soil mounded over the animals above the adjacent ground level.
4. The burial site must be at least 300 feet from any existing stream or public body of water.
5. The burial site must be at least 300 feet from any existing public water supply well.
6. The burial site must be at least 100 feet from any other type of existing well.
7. The burial site shall be located so as to minimize the effect of stormwater runoff.
8. A record of the location of the approved site (GPS latitude and longitude coordinates if available), the burial history of each burial site to include the date, species, head count and age must be kept by the owner and reported to the Local Health Director who will in turn report this information to the appropriate State agency - DENR Division of Water Quality, Groundwater Section

7.4 Type, Source, and Quantity of Waste to be accepted

- Type of Waste: Industrial asphalt, concrete (with incidental Rebar), brick, block, unpainted wood, land clearing debris, inert debris.
- Source of Waste:
1. City & County Public Works projects
 2. Private developers
 3. Commercial developers
 4. State Department of Transportation
 5. Residential Homeowners
- Quantity of Waste: 700 Ton/Year (2,333 yd³) for the LCID Landfill. For the grinding process, no more than 1800 tons (6000 yd³) of processed and unprocessed wood and landscape waste will be stored on site at any given time. No more than 1800 tons (6000 yd³) of waste will be processed in a three month period.

7.5 Emergency Contingency Plan

Equipment used in the operation of the landfill shall be used to control accidental fires. This equipment shall include a backhoe and dump truck. If necessary, additional equipment will be acquired from other Hoke County Departments.

In the case of fire, the following actions shall be taken:

1. Notify the Hoke County and City of Raeford Fire Department and the North Carolina Division of Waste Management/Fayetteville Regional office.
2. Separate the burning material from the remaining waste as soon as possible.
3. Attempt to smother the fire with soil if possible.
4. At the last resort, water should be used to extinguish the fire. Should it be necessary to use water, downslope collection berms should be constricted to collect the water. All efforts should be made to prevent contaminated water from directly flowing into creeks.

In the case of a hazardous spill, the following action shall be taken:

1. Notify the Fayetteville Regional Office and the Hoke County and Raeford Fire Department.
2. Isolate the spilled material and wait for instruction from Hoke County and Raeford Fire Department.

Emergency Numbers:

911 - The Raeford/Hoke County Emergency Communications Center is the Public Safety Answering Point (PSAP) for all emergency calls in the City of Raeford and Hoke County. The Communications Center is a centralized communications facility that utilizes an enhanced 911 (E-911) system that is wireless Phase II compliant. The Communications Center is staffed 24 hours per day.

Hoke County Emergency Management is located at:

429 East Central Avenue

PO Box 299

Raeford, NC 28376

(910) 875-4126

FAX: (910) 875-3726

NCDENR- Fayetteville Regional Office

225 Green Street, Suite 714, Fayetteville, NC 28301-5043

Telephone: (910) 433-3300

FAX: (910) 486-0707

Attachment A: Local Government Approval



Hoke County Planning & Inspection

Post Office Box 1556 – 423 E. Central Avenue
Raeford, North Carolina 28376
(910) 875-8407 – Fax (910) 875-1072

North Carolina Department of Environment and Natural Resources
Division of Waste Management
Zenith Barbee, Hydrogeologist

To Whom It May Concern:

The Hoke County LCID Landfill has been grandfathered in to all Hoke County zoning ordinances. Additionally, the landfill also meets all requirements in the Hoke County Land Use plan. The Planning and Zoning Department has no problems with this request. If you have any questions or concerns please feel free to contact me.

Regards,

A handwritten signature in cursive script, reading "Conrad G. Garrison".

Conrad G. Garrison
Planning and Zoning Director
Hoke County Government

423 E. Central Avenue
Raeford, NC 28376
910-875-8407
910-875-1072 (Fax)
cgarrison@hokecounty.org

Attachment B: Deed Description

by

After

Instrument was prepared by

R. PALMER WILLCOX

Description for the index

[Redacted box]

NORTH CAROLINA GENERAL WARRANTY DEED

DEED made this 13th day of December, 19 93, by and between

GRANTOR

GRANTEE

ROBERT H. GATLIN, widower

COUNTY OF HOKE
P. O. Box 217
Raeford, N. C. 28376

In appropriate block for each party: name, address, and, if appropriate, character of entity, e.g. corporation or partnership.

The designation Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine or neuter as required by context.

WITNESSETH, that the Grantor, for a valuable consideration paid by the Grantee, the receipt of which is hereby acknowledged, has and by these presents does grant, bargain, sell and convey unto the Grantee in fee simple, all that certain lot or parcel of land situated in the City of Raeford Township,

County, North Carolina and more particularly described as follows:

certain tract or parcel of land in Raeford Township, Hoke County, North Carolina situated about two miles north of Raeford, N.C. and about 1400 feet northwest of the west terminus of N.C.S.R. No. 1321, adjoining the lands of Robert H. Gatlin on the southeast, Canal Land and Timber Company on the northeast and northwest and by the County of Hoke on the southwest, being further described as follows:

Beginning at a concrete monument, said monument being the westernmost corner of the Robert Gatlin Tract No. II as described in Deed Book 208, Page 58 in the Hoke County Registry, the northernmost corner of the County of Hoke "landfill tract" described in Deed Book 161, Page 373 in the Hoke County Registry and a common corner with the tract of land conveyed from Robert H. Gatlin to Cape Fear Wood Corporation (now Canal Land and Timber Company) in Deed Book 94, Page 163, said monument also being a corner of the Federal Paper Board Company tract as shown and recorded in Plat Cabinet 1, Slide 81, Map Book 4, Page 23; thence as a common line of Robert H. Gatlin and said Cape Fear Wood Corp. tract, N29-39-00E 1046.64 feet to an axle with a pine pointer, common corner with said Cape Fear Wood Corp. tract; thence continuing as a common line of Robert Gatlin and said Cape Fear Wood Corp. tract, S71-09-45E to an iron rod in said line; thence S00-00-00W 1261.51 feet to an iron rod in the common line of Robert Gatlin and the aforementioned County of Hoke "landfill" tract; thence as a common line with Robert Gatlin and the County of Hoke, N55-00-00W 758.19 feet to the beginning containing 13.00 acres and being a portion of the Robert H. Gatlin Tract No. II as described in Deed Book 208, Page 58 in the Hoke County Registry.

Attachment C: Erosion Control Approval Letter and Evaluation

State of North Carolina
Department of Environment,
Health and Natural Resources
Fayetteville Regional Office

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Andrew McCall, Regional Manager



May 31, 1994

RECEIVED JUN 02 1994

Mr. Michael Wood, County Manager
County of Hoke
PO Box 266
Raeford, NC 28376

Re: Approval of Soil Erosion and Sediment
Control Plan
Landfill Closure Borrow Site
Hoke County, NC

Dear Mr. Wood:

The review of the above referenced erosion control plan has been completed.

The plan has been found to be acceptable subject to the following stipulations:

1. Enclosed is a Certificate of Plan Approval which must be displayed at the job site.
2. This project is subject to the National Pollutant Discharge Elimination System (NPDES) for point source stormwater discharges from construction activities. Enclosed is a copy of the necessary permit application. Please contact Ken Averitte, Environmental Technician, at (910) 486-1541 for further assistance regarding this permit.
3. In order to ensure the early coordination and implementation of the erosion control plan for this project, it is requested that a preconstruction conference be held. As a minimum, representatives of the owner, engineer, contractor, and this office should attend, subject to the availability of staff. Please notify Gerald Lee of this office as to when this conference is scheduled.

Approval of Soil Erosion and Sediment Control Plan
Page 2

4. The developer is responsible for obtaining any and all permits and approvals necessary for the development of this project prior to the commencement of this land-disturbing activity. This could include the Division of Environmental Management under storm water regulations, the US Army Corps of Engineers under Article 404 jurisdiction, local county or town agencies under their local ordinances, or others that may be required. This approval cannot supersede any other permit or approval; however, in the case of a Cease and Desist Order from the Corps of Engineers, that Order would only apply to wetland areas. All other lands must still be in compliance with the Sedimentation Pollution Control Act.
5. If any area on site falls under the jurisdiction of Section 404 of the Clean Water Act, the developer is responsible to the orders of the US Army Corps of Engineers. Any erosion control measures that fall within jurisdictional wetland area must be relocated to the transition point between the wetlands and the highlands to assure that the migration of sediment will not occur. If that relocation presents a problem or contradicts any requirements of the Corps of Engineers, it is the responsibility of the developer to inform the Land Quality Section's Regional Office so that an adequate contingency plan can be made to assure sufficient erosion control on-site. Failure to do so will be considered a violation of this approval.
6. Following the completion of the project, you should notify this office to schedule a final inspection. The purpose of this inspection is to ensure that all erosion control requirements have been met.

This approval is subject to the satisfactory performance of the erosion control measures under field conditions. Should it be determined that the requirements of the Sedimentation Pollution Control Act of 1973 (GS 113A,51-66) are not being met, revisions to the plan and its implementation will be required.

This permit allows for a land disturbance, as called for on the application plan, not to exceed 18 acres and/or the limits of the submitted plans. Exceeding these limits will be a violation of this permit and would require a revised plan and additional application fee. Amendments to the plan should be submitted to this office under the same procedures as followed for the original plan.

Title 15, Section 4B.0017 (A) of the North Carolina Administrative Code requires that a copy of the approved plan be on file at the job site and that inspections of the project be made by this office to ensure compliance with the approved plan.

Approval of Soil Erosion and Sediment Control Plan
Page 3

We look forward to working with you on this project. -

Sincerely,

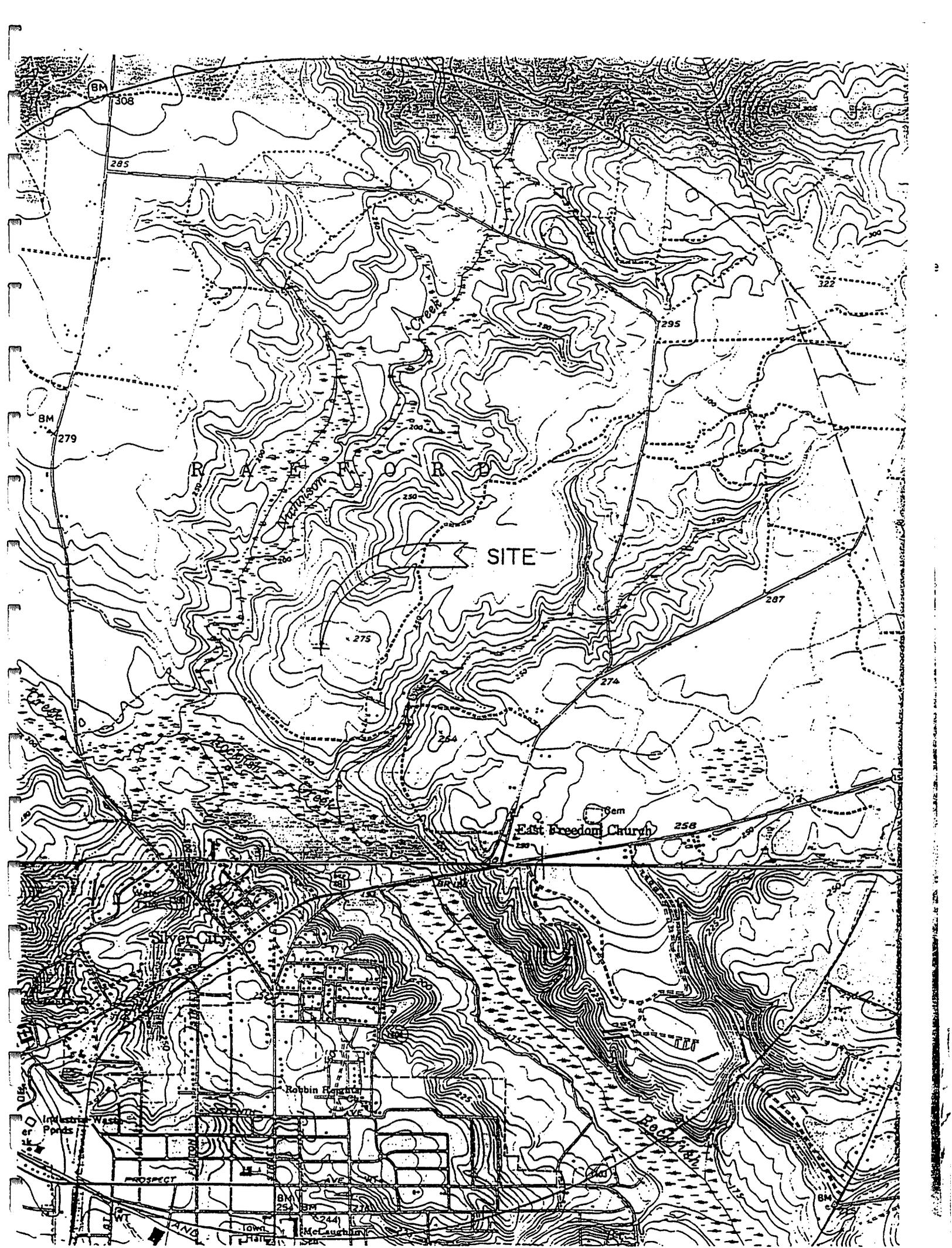
A handwritten signature in cursive script, appearing to read "Gerald Lee".

Gerald Lee
Assistant Regional Engineer
Land Quality Section

GL/bt

Enclosure

cc: Daniel W. Sundberg, ASLA
Billy Cox
Ken Averitte



BM 308

285

BM 279

R A R O R D

SITE

East Freedom Church

Robbin House

PROSPECT

BM 254

McLauchry

BM 322

Erosion Control Evaluation

Based on site observations, the site is predominantly grass covered, Ditches or swales are stable and in erosion relief. Exposed areas primarily consist of the haul road and the area where the active placement of LCID is occurring.

Future disturbance and exposed ground will occur where the proposed grinding and stockpile Area will be conducted.

With new area to be disturbed, this evaluation is for the existing sediment basin.

Also, this evaluation is conducted for the side slopes of the mound formed by LCID Landfill. Evaluation of the existing ditches is not conducted since they are grass covered and stable.

The Rational Design method is used for the evaluation. $A C = 0.15$ is used for the sandy soils that are grass covered. $A C = 0.40$ is used for exposed ground.

Table 8.03b
Value of Runoff Coefficient
(C) for Rational Formula

Land Use	C	Land Use	C
Business:		Lawns:	
Downtown areas	0.70-0.95	Sandy soil, flat, 2%	0.05-0.10
Neighborhood areas	0.50-0.70	Sandy soil, ave., 2-7%	0.10-0.15 0.15-0.20
Residential:		Sandy soil, steep, 7%	0.13-0.17 0.18-0.22
Single-family areas	0.30-0.50	Heavy soil, flat, 2%	0.25-0.35
Multi units, detached	0.40-0.60	Heavy soil, ave., 2-7%	
Multi units, Attached	0.60-0.75	Heavy soil, steep, 7%	0.30-0.60 0.20-0.50
Suburban	0.25-0.40	Agricultural land:	
Industrial:		Bare packed soil	0.30-0.60
Light areas	0.50-0.80	Smooth	0.20-0.50
Heavy areas	0.60-0.90	Rough	0.20-0.40
Parks, cemeteries	0.10-0.25	Cultivated rows	0.10-0.25
Playgrounds	0.20-0.35	Heavy soil no crop	
Railroad yard areas	0.20-0.40	Heavy soil with crop	0.15-0.45 0.05-0.25
Unimproved areas	0.10-0.30	Sandy soil no crop	0.05-0.25
Streets:		Sandy soil with crop	0.10-0.25
Asphalt	0.70-0.95	Pasture	
Concrete	0.80-0.95	Heavy soil	0.15-0.45
Brick	0.70-0.85	Sandy soil	0.05-0.25
Drives and walks	0.75-0.85	Woodlands	0.05-0.25
Roofs	0.75-0.85		

NOTE: The designer must use judgement to select the appropriate C value within the range for the appropriate land use. Generally, larger areas with permeable soils, flat slopes, and dense vegetation should have lowest C values. Smaller areas with slowly permeable soils, steep slopes, and sparse vegetation should be assigned highest C values.

Source: American Society of Civil Engineers

Raleigh, North Carolina 35.8706N, 78.7864W										
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	5.58	4.46	3.74	2.58	1.62	0.94	0.66	0.40	0.24	0.14
10	7.08	5.66	4.78	3.46	2.25	1.33	0.95	0.58	0.34	0.021
25	7.78	6.19	5.24	3.88	2.58	1.54	1.11	0.68	0.41	0.24
100	8.64	6.86	5.78	4.43	3.05	1.85	1.36	0.84	0.51	0.30

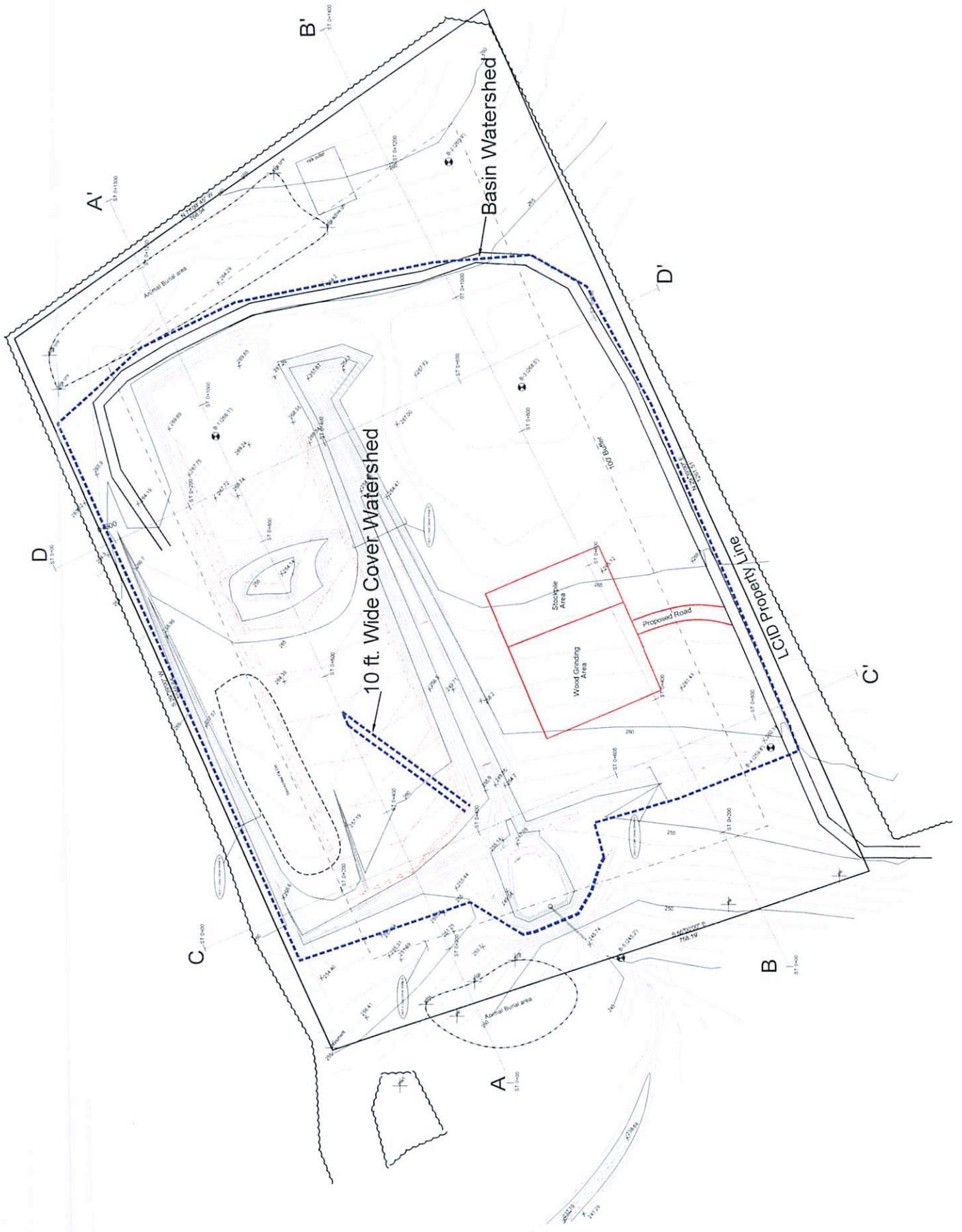
Fayetteville, North Carolina 35.0583N, 78.8583W										
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.11	4.88	4.09	2.83	1.77	1.04	0.74	0.44	0.26	0.15
10	7.96	6.36	5.36	3.88	2.53	1.54	1.10	0.66	0.39	0.23
25	8.94	7.13	6.02	4.46	2.97	1.83	1.32	0.80	0.47	0.28
100	10.44	8.29	6.99	5.35	3.69	2.29	1.69	1.03	0.62	0.36

Wilmington, North Carolina 34.2683N, 77.9061W										
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.39	5.92	4.96	3.42	2.15	1.28	0.91	0.56	0.33	0.19
10	9.70	7.75	6.54	4.74	3.08	1.94	1.39	0.87	0.51	0.30
25	10.98	8.75	7.40	5.48	3.65	2.38	1.73	1.08	0.64	0.38
100	12.92	10.27	8.65	6.63	4.56	3.18	2.37	1.49	0.89	0.53

Washington, North Carolina 35.5333N, 77.0167W										
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.41	5.12	4.29	2.96	1.86	1.10	0.78	0.47	0.27	0.16
10	8.38	6.70	5.65	4.09	2.66	1.64	1.19	0.72	0.42	0.25
25	9.48	7.55	6.38	4.73	3.15	1.99	1.46	0.88	0.52	0.31
100	11.16	8.87	7.47	5.72	3.94	2.58	1.93	1.18	0.70	0.42

Manteo Airport, North Carolina 35.9167N, 75.7000W										
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	6.46	5.16	4.32	2.99	1.87	1.08	0.79	0.48	0.29	0.17
10	8.47	6.77	5.71	4.14	2.69	1.62	1.20	0.74	0.44	0.27
25	9.56	7.62	6.44	4.77	3.17	1.96	1.47	0.91	0.54	0.33
100	11.26	8.95	7.54	5.77	3.98	2.54	1.95	1.21	0.73	0.44

Cape Hatteras, North Carolina 35.2322N, 75.6225W										
ARI* (years)	5 min.	10 min.	15 min.	30 min.	60 min.	120 min.	3 hr.	6 hr.	12 hr.	24 hr.
2	7.20	5.75	4.82	3.33	2.09	1.29	0.94	0.58	0.34	0.20
10	9.41	7.52	6.35	4.60	2.99	1.93	1.43	0.89	0.53	0.31
25	10.66	8.49	7.18	5.31	3.54	2.33	1.75	1.09	0.65	0.38
100	12.53	9.95	8.39	6.42	4.42	3.03	2.32	1.45	0.88	0.51



Basin Evaluation;

Total watershed is 14.05 acres, Total exposed ground is 2.58 acres consisting of 1.5 acres for the proposed grinding/stockpile Area, 0.72 acres for the haul road and 0.36 acres for the active LCID portion of the landfill.

$$C_{ave} = \frac{2.58(0.40) + 11.47(0.15)}{14.05} = 0.196$$

Time of Concentration

Time of concentration is conducted for only the sheet water flow. The average ground slope is 0.02 ft/ft, and the length of travel is at least 100 ft. Using the equation

$$T_c = \frac{L}{60 \left[\frac{I \times C}{43200} \right]^{2/3}} \quad \begin{array}{l} T_c = \text{time of conc. (min.)} \\ L = \text{Length, ft} \\ I = \text{Rain Intensity } \frac{\text{in}}{\text{hr}} \\ C = \text{runoff Coef.} = 0.196 \end{array}$$

$$\alpha = \frac{1.49 \sqrt{S}}{n} = \frac{1.49 \sqrt{0.02}}{0.15} = 1.40$$

n = manning's coef. ≈ 0.15 for short grass

S = slope, ft/ft

Check Flow rate of primary conduit with
water level at 253 ft; level at the secondary
spillway

Weir control

$$Q = CLh^{3/2}$$

$$h = 253 - 248.9 = 4.1 \text{ ft}$$

$$C = 3.1 \text{ sharp crested weir}$$

$$L = \pi(1.5) = 4.71 \text{ ft}$$

$$Q = (3.1)(4.71)(4.1)^{3/2} = \underline{\underline{121 \text{ cfs}}}$$

Orifice Control

$$Q = CA(2gh)^{0.5}$$

$$C = 0.6$$

$$A = \frac{\pi(1.5)^2}{4} = 1.767 \text{ ft}^2$$

$$Q = (0.6)(1.767) \left[2(32.2)(4.1) \right]^{0.5} \quad h = 253 - 248.9 = 4.1 \text{ ft}$$

$$= \underline{\underline{17.2 \text{ cfs}}}$$

Barrel Control

$$Q = A \left(\frac{2gH}{1 + K_m + K_p L} \right)^{0.5}$$

$$A = \frac{\pi(1)^2}{4} = 0.785$$

$$H = 253 - 245.94 = 7.06$$

km³ |

L = 48

$$K_p = \frac{5037 n^2}{d^{4/3}}$$

$$d = 12''$$

$$n = 0.034 - \text{CMP}$$

$$Q = 0.785 \left[\frac{(2)(32.2)(7.46)^{0.5}}{1 + 0.107(48)} \right]$$

$$= \underline{\underline{6.44 \text{ cfs}}}$$

$$K_p = \frac{5037(0.034)^2}{12^{4/3}} = 0.107$$

o barrel condition controls

- Since the barrel flow will not significantly increase with additional water height - use this value 6.4 cfs to evaluate discharge at secondary spillway

$$Q = CL h^{3/2}$$

C = 2.8 head over crest weir

$$L = 22 \text{ ft}$$

$$h = \left(\frac{Q}{CL} \right)^{2/3}$$

$$2\text{-year: } 7.8 - 6.4 = 1.4 \text{ cfs}$$

$$h = \left(\frac{1.4}{(2.8)(22)} \right)^{2/3} = 0.08 \text{ ft}$$

$$10\text{-year: } 10.7 - 6.4 = 4.3 \text{ cfs}$$

$$h = \left(\frac{4.3}{2.8(22)} \right)^{2/3} = 0.17 \text{ ft}$$

25-year: $12.3 - 6.4 = 5.9 \text{ cfs}$

$$h = \left(\frac{5.9}{2.5(22)} \right)^{2/3} = 0.21 \text{ ft}$$

Check water velocity over secondary spillway
for 10-year rain event, Assume vertical sides.

$$V = \frac{4.3}{(22)(0.17)} = 1.1 \text{ ft/sec} \therefore \text{Velocity less than } 2 \text{ ft/sec}$$

Outlet Stone Protection for Primary Spillway:

Max. Flowrate is 6.4 cfs - From Figure 8.066 of
ESCPDM (see Attached), the $D_{50} = 0.25'$ and
 $L_a = 16 \text{ ft}$. Existing stone extends more than 20 ft
from the outlet and consists of Class B erosion
control stone $D_{50} = 0.75'$. Outlet Protection O.K.

Required Basin Surface Area:

$$(Q_{in} \times 435) = (10.7)(435) = 4654.5 \text{ ft}^2$$

at top of riser - surface area is 75' by 95' or 7125 ft²

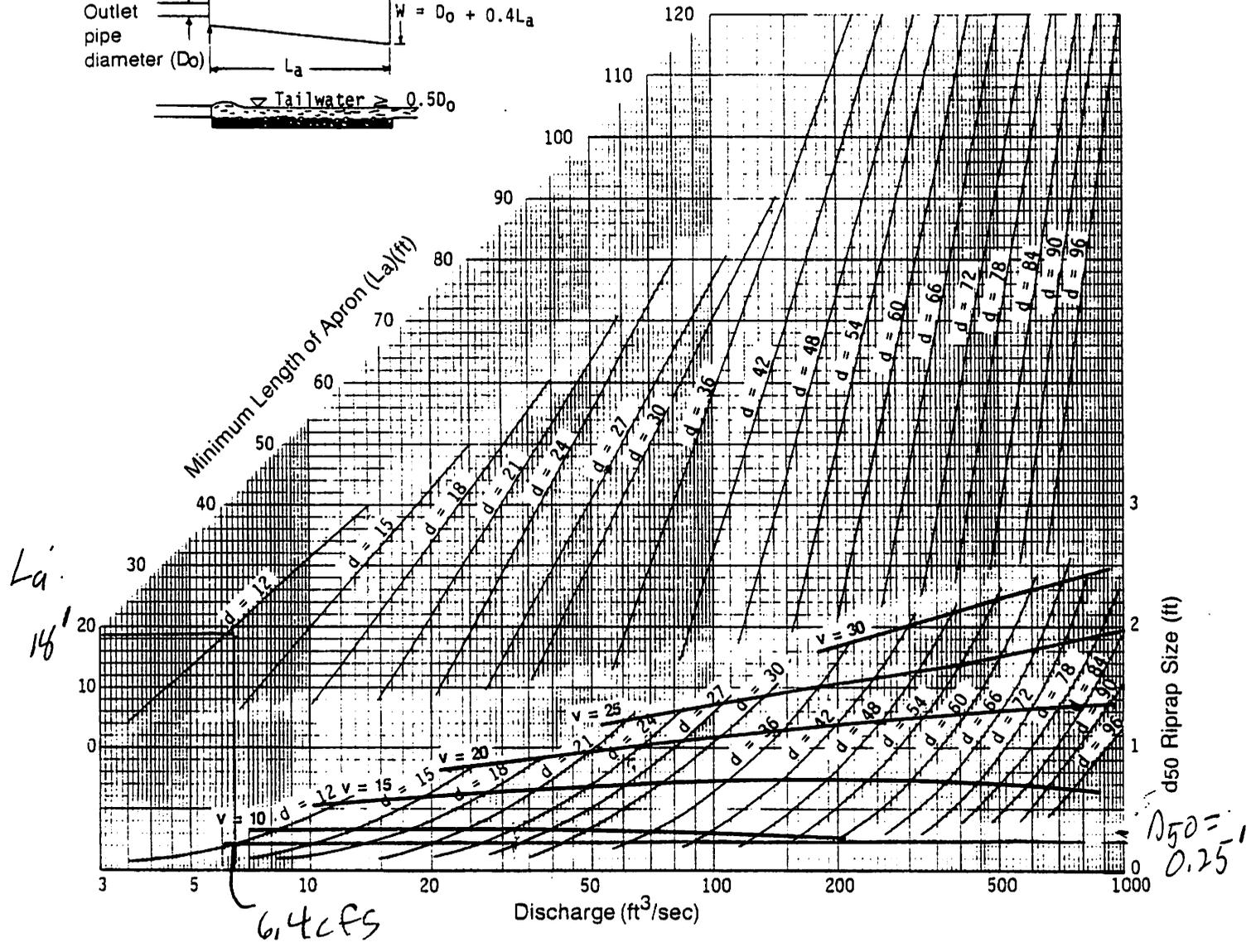
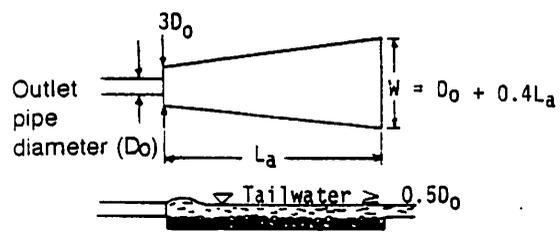
Require Storage Volume

$$\text{Area Disturbed} \times 3600 = 2.58 \times 3600 = 9288 \text{ ft}^3$$

Actual Volume

Elev.	Area	Average Area	Depth	Vol.	Comp. Vol.
246	4356	—	—	—	—
247	5369	4862.5	1	4862.5	4862.5
248	7044	6231.5	1	6231.5	11,094 ft ³

∴ At El. 248 before discharge through top of pipe - Storage volume is 11,094 ft³ and is greater than required volume of 9248 ft³.



Curves may not be extrapolated.

Figure 8.06b Design of outlet protection from a round pipe flowing full, maximum tailwater condition ($T_w \geq 0.5$ diameter).

Side Slope Drainage Evaluation,

The side slopes are proposed at 2:1 (H:V).
Runoff from the top of the LCIW Landfill,
will drain down this slopes.

For evaluation purposes, a 10ft wide strip
is evaluated which would provide the most
area for drainage.

Max area is 2035 ft^2 (0.0467 acres)

Coeff of runoff = 0.15 assume $t = 5 \text{ min}$ although
the time of concentration would be larger, use
the Rain intensity for the 25-year rain event, $I_{25} = 8.96 \text{ in/hr}$

$$Q = (0.0467)(0.15)(8.96) = 0.0628 \text{ cfs}$$

Check the maximum flow rate allowed to maintain
a water velocity of 2 ft/s or less on the 2:1 (H:V)
slope

$$V = \frac{1.49}{n} r^{2/3} \sqrt{S}$$

$$2 = \frac{1.49}{0.15} d^{2/3} \sqrt{0.5}$$

$$d = 0.152 \text{ ft}$$

$$S = 0.5 \text{ for } 2:1 \text{ (H:V) slope}$$

$$A = 10(d) \quad r = \frac{A}{w_p} = \frac{10d}{10} = d$$

$$w_p = 10$$

$$n = 0.15 \text{ for short grass}$$

Flow rate for this depth is

$$Q = VA = (2)(1.52) = 3.04 \text{ cfs} \quad A = 10(0.152) \\ = 1.52$$

∴ 2:1 (H:V) side slopes OK.

Attachment D: Hydrogeologic Study

E²S

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

RALEIGH, NC 27609

(919) 781-7798

December 15, 1994

Mr. Dan Sundberg
Hobbs, Upchurch & Associates
P.O. Box 1737
Southern Pines, NC 28387

RE: Clarification Letter
Construction and Demolition
Debris Landfill Clarifications
Hoke County, North Carolina

Dear Mr. Sundberg:

The following discusses three topics: (1) the removal of the existing piezometers, (2) the proposed location of the monitoring wells, and (3) the effect of the proposed construction on the groundwater table.

REMOVAL OF EXISTING PIEZOMETERS

The existing piezometers will be removed by one of two alternatives:

1. A slurry of neat concrete paste will be injected under pressure through the top of the piezometer pipe as the pipe is slowly removed from the ground.
2. Using hollow stem augers with the drill rig, the piezometer location will be redrilled and cement grout will be injected through the hollow stem as the augers are removed from the ground.

PROPOSED MONITORING WELL LOCATIONS

The locations for the monitoring wells have been altered for 5-year increments of disposal. Also, they will be situated to monitor the water perched above the semi-aquitard. The approximate surface elevation of this semi-aquitard at the various test locations is as follows:

<u>Boring No.</u>	<u>Semi-Aquitard Surface Elevation, ft.</u>	<u>Depth Below Ground Surface</u>
B-1	228	38.0
B-2	238	27.0
B-3	231	31.0
B-4	217	42.0
B-5	225	19.5

Groundwater levels in these piezometers were measured on March 24, 1994, and again on December 7, 1994. On December 7, 1994, the water level depths and elevations were also determined at the three groundwater monitoring wells for the adjacent solid waste landfill. The following table displays the results:

Well No.	Top of Casing Elev., ft.	Depth to Groundwater, ft.		Water level Elevation, ft.	
		3/24/94	12/7/94	3/24/94	12/7/94
1	266.31	dry	dry	---	---
2	261.21	24.89	25.10	236.32	236.11
3	268.89	36.02	33.61	232.87	235.28
4	265.63	dry	(1) N/A	---	---
5	246.16	19.06	(1) N/A	227.06	---
SWL No.					
1	251.19	54.26	53.56	194.20	197.63
2	204.65	---	17.74	---	186.91
3	217.00	---	28.09	---	188.91

(1) Wells disturbed by construction activity.

In general, two groundwater conditions are present. The upper groundwater condition appears to be a result of water perched at or above the more clayey sands. These clayey sands were encountered after depths of 22 feet to 38 feet below ground level.

This semi-aquitard with variable soil texture did not appear to cause water to perch at B-1 and B-4. The semi-aquitard appears to slope downward in a southeasterly direction. The lower groundwater table appears to also move in a southeasterly direction, based on the topography and on the monitoring well measurement at the adjacent solid waste landfill (See attached figure).

The proposed monitoring wells for the 5-year limits of the Construction and Demolition Debris Landfill are shown on sheet 3 of 10 prepared by Hobbs, Upchurch & Associates. An upgradient and downgradient well is proposed to monitor the upper groundwater conditions. A Type III well is proposed downgradient to monitor the lower groundwater conditions. It is estimated that the two shallow wells will have about two to five feet of water.

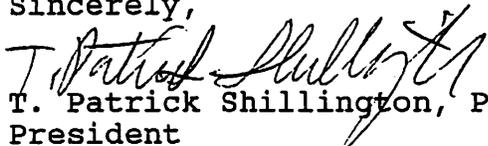
It is recommended that the deep well be installed first so that the upper groundwater table can be verified as present before the installation of the two shallow wells. It is possible that the upper groundwater condition may not be encountered, and if this occurs, it may be advantageous not to install the shallow well. Also, it would be necessary to install a Type III well at the upgradient well location, in lieu of the proposed shallow well.

PROPOSED CONSTRUCTION EFFECTS ON GROUNDWATER

It is anticipated that the groundwater table and perched groundwater conditions will not be substantially affected by the landfill construction. Infiltration of precipitation will be minimized at this site due to promotion of runoff both around and within the landfill. The only area where surface water accumulation will occur will be at the sediment basin. Mounding of the water table beneath the sediment basin is possible, but the basin will only accumulate water during precipitation. Therefore, water recharge would be minimal and infrequent, and water table mounding beneath the sediment basin would be minimal.

We appreciate serving Hobbs, Upchurch & Associates on this project. Please contact us if you need further clarifications.

Sincerely,


T. Patrick Shillington, P. E.
President

Attachment: Figure



ATTACHMENT:

Figure

**HYDROGEOLOGIC STUDY
CONSTRUCTION AND DEMOLITION
DEBRIS LANDFILL
HOKE COUNTY, NORTH CAROLINA**

April 9, 1994

Prepared For:

**Hobbs, Upchurch & Associates
P. O. Box 1737
Southern Pines, NC 28388**

Prepared By:

**Engineering & Environmental
Science Company
3008 Anderson Dr., Ste. 102
Raleigh, NC 27609**

E²S

ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY

3008 ANDERSON DRIVE, SUITE 102

RALEIGH, NC 27609

(919) 781-7798

April 9, 1994

Mr. Dan Sundberg
Hobbs, Upchurch & Associates
P.O. Box 1737
Southern Pines, NC 28388

RE: Hydrogeologic Study
Construction & Demolition Debris Landfill
Hoke County, North Carolina

Dear Mr. Sundberg:

Engineering & Environmental Science Company (E²S) has completed the Hydrogeologic Study for the proposed Construction and Demolition Debris Landfill at the above referenced site. This Study was requested and authorized by Mr. Dan Sundberg of Hobbs, Upchurch & Associates, Inc. Following is a brief discussion of the project, subsurface conditions and evaluations and recommendations. More detailed information is contained in this report.

The proposed Construction & Demolition Landfill is located on approximately 20 acres of land that is immediately north of the existing Solid Waste Landfill operated by the City of Raeford and Hoke County. The exact base depth of the Construction and Demolition Debris Landfill has not been established at this time. However, maximum excavation will be approximately 10 ft. to 20 ft.

Subsurface soils predominantly consist of granular soils having varying amounts of silt and clay fines. Two groundwater conditions were noted. The upper groundwater condition appears to be a result of water perched in the more clayey sands that were encountered generally after depths of 22 ft. to 42 ft. below ground level (Elevation 227 ft. to 237 ft.). The limits of excavation for the demolition landfill should be several feet above the perched water level.

The lower groundwater table was found at elevation 194.2 ft. at the adjacent exist well for the Solid Waste Landfill. This water level is approximately 4 to 6 ft. higher than the surface water level at the intersection of Nicholson and Rockfish Creeks. The lower groundwater table appears to move in a southeast direction towards the intersection of Nicholson Creek and Rockfish Creek with a hydraulic gradient of approximately 0.003 ft./ft.

There is insufficient information to accurately determine the direction of the upper groundwater due to the variable permeability and possible lateral extent of the semi-aquitard. Because of the semi-pervious nature of this semi-aquitard, it is anticipated that this perched water will eventually percolate downward to the lower groundwater table.

Since groundwater perched above this layer will eventually reach the lower groundwater table, it is recommended that only the lower groundwater table be monitored. One additional well for up gradient testing is proposed along the west side of the demolition landfill. Depending on the water level measured in the new well relative to the existing well, one additional well may be required near the northeast corner of the demolition landfill.

We appreciate serving Hobbs, Upchurch & Associates on this project. Please contact us, if you have any questions about this Hydrogeologic Study.

Sincerely,

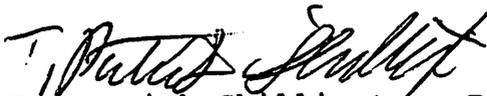

T. Patrick Shillington, P. E.
President



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Attachment A: Figures
Attachment B: Tables
Attachment C: Boring Logs

1.0 INTRODUCTION

The proposed Construction & Demolition Landfill is located on approximately 20 acres of land that is immediately north of the existing Solid Waste Landfill operated by the City of Raeford and Hoke County (see Figure 1, Attachment A). For this evaluation, Hobbs, Upchurch & Associates has provided preliminary drawings of the proposed construction.

Initially the site will provide borrow material for the adjacent Solid Waste Landfill. Approximately 5 ft. to 10 ft. of cut in some areas will be conducted for borrow material. Falling head permeability tests and Standard Proctor moisture density relationship tests were previously conducted on the shallow soils and were provided by Engineering & Environmental Science Company in the report dated November 22, 1993.

The exact base depth of the Construction and Demolition Debris Landfill has not been established at this time. However, excavation to establish the base of the landfill will be approximately 10 ft. to 20 ft. Cut slopes and fill slopes will be approximately 2:1 (H:V).

2.0 FIELD AND LABORATORY TESTING

Five (5) soil borings were drilled in the proposed Construction and Demolition Landfill to depths of 25 ft. to 50 ft. below the existing site grades. The borings were drilled at the approximate locations shown on the enclosed Figure No. 2. The locations and elevations of the borings were determined by Hobbs, Upchurch & Associates.

The borings were advanced using hollow-stem auger drilling techniques. Split-spoon samples were obtained at 5.0 ft. intervals and were obtained in accordance with the Standard Method for Penetration and Split-Barrel Sampling of Soils (ASTM D-1586). At Boring B-5, one Shelby tube sample was taken in accordance with ASTM D-1587. The soils were sampled and logged in the field by a Geotechnical Engineer.

Upon completion of each boring, temporary piezometers were installed. The piezometers consisted of 10 ft. to 15 ft. lengths of No. 10 PVC screen (2" dia.) surrounded with sand extending from the bottom of the boring to the top of the screen. Solid PVC Pipe (2" dia.) connected to the screen continued to the ground surface. Water levels at each piezometer were measured to the nearest 0.01 ft. The water level was also measured in the existing groundwater monitoring well, for the Solid Waste Landfill. During the determination of water levels, downhole permeability tests were conducted in three (3) piezometers by hand bailing the well and

then monitoring the rise in water with time. Table 1 shows the test results and Figure No. 3 shows the measured water level elevations at each boring and the existing monitoring well.

Representative samples from each boring were sealed in glass jars and were returned to the E²S laboratory. The soil samples were classified in accordance with the Unified Soil Classification System. To aid in the evaluation and classification of the soils, moisture content, Atterberg Limits and wash No. 200 sieve tests were conducted. Falling head permeability and density tests were conducted on the undisturbed soil sample taken from Boring B-5. Laboratory test results are shown on Table No. 2.

3.0 FIELD AND LABORATORY TEST RESULTS

3.1 SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered in the borings are presented in the Boring Logs in Attachment C. Strata divisions shown on the boring logs were estimated based on visual examination of the recovered boring samples. In the field, strata changes could occur gradually and/or at slightly different levels than indicated. Generalized subsurface conditions, based on the finds of the borings, are described below.

Beneath approximately 6 inches of topsoil, the underlying soils predominantly consisted of granular materials having non-plastic silt or low-plastic clay fines. These soils were classified as SM, SM-SC, SC, and SM-SP soil types. The less fines content soils (SM-SP) commonly were found after depths of 17 ft. below ground surface. At Boring B-5, the SM-SP soils were encountered after 4 ft. below ground level.

Some minor random cohesive (CL & ML) layers and seams were encountered in some of the borings and were commonly layered with the granular SC soil types.

The majority of the granular soils were medium dense with standard penetration resistance values of 11 blow per foot (bpf) to 38 bpf. Loose granular soils (Standard Penetration Resistance values ranging from 8 bpf to 10 bpf) typically were found near the ground surface and dense to very dense granular soils (47 to 77 blows per foot) were found in association with a trace of gravel in the soil matrix.

Groundwater conditions were noted during drilling and also measured several days after drilling. Table No. 1 shows the static groundwater levels measured several days after drilling. At that time, Borings B-1 and B-4 were dry, Borings B-2, B-3 and B-5 had water levels ranging from 19.06 ft. to 36.02 ft. below the top of

the piezometer casing. The existing well outside of the demolition landfill had a water level 54.26 ft. below the top of the casing.

Although groundwater was not found in Borings B-1 and B-4, water was noted on the drilling rods during drilling at depths of 40 ft. and 42 ft. below ground level.

3.2 TEST RESULTS

Based on the laboratory test results, the following soil types, have the indicated range of percent volume water (moisture contents), fines content and Atterberg Limit Test results:

<u>Soil Type</u>	<u>Moisture Content, %</u>	<u>% Fines (<#200)</u>	<u>Atterberg Limits, %</u>		
			<u>LL</u>	<u>PL</u>	<u>PI</u>
SM-SP	4.3-12.0	9.9-12.9	None Plastic		
SM	11.6-21.7	19.8-25.4	25	22	3
SM-SC	12.1-12.9	21.3-28.4	26-30	21	5-9
SC-CL	12.9-29.0	*28.4-29.2	33-48	20-26	22-12

* Only applies to SC soil types.

Figure No. 4 shows the various depths of these material types at the various boring locations.

Laboratory testing also included one permeability test on the SC-CL soil type at Boring B-5. The permeability and dry density were 6.7×10^{-6} cm/s and 117.0 pcf, respectively.

In the field, horizontal coefficient of permeability of the water bearing soils in Borings B-2, B-3 and B-5 were estimated. These water bearing zones were underlain by the SC soil types that typically have a lower vertical coefficient of permeability (6.7×10^{-6} cm/s).

In general, the SM and SM-SP soils had a horizontal coefficient of permeability of 2.6×10^{-4} cm/s to 5.5×10^{-4} cm/s in Borings B-2 and B-5. The SM-SC soils at Boring B-3 had a coefficient of permeability of 1.7×10^{-5} cm/s.

4.0 EVALUATIONS AND RECOMMENDATIONS

4.1 GENERAL HYDROGEOLOGY

Subsurface soils predominantly consist of granular soils having varying amounts of silt and clay fines. The more clayey sands have cohesive clay layers.

Two groundwater conditions were noted. The upper groundwater condition appears to be a result of water perched at or above the more clayey sands that were encountered generally after depths of 22 ft. to 38 ft. below ground level.

This semi-aquitard appeared variable in texture and permeability. In Borings B-2, B-3 and B-5, static groundwater was observed above these less permeable zones at approximately 21 ft. to 38 ft. below ground surface. During drilling at Borings B-1 and B-4, water was noted immediately above these less permeable zones at depths of 38 ft. to 42 ft. below ground level. However, no water was noted in these piezometers several days after drilling.

The laboratory and field observations and testing generally indicate that the semi-aquitard had a higher clay content and higher plasticity index where perched water was noted in the piezometers than at the areas where no perched ground water was noted. Conditions that may also influence the presents of perched water is lateral extent of the semi-aquitard. These layers may not be connected and the lateral extent of each zone could vary.

The following table lists the elevations of the anticipated minimum groundwater depth at each boring. The observed water levels in the three piezometers and the depth of the suspected semi-aquitard at other locations were used for the water level elevations.

<u>Boring No.</u>	<u>Water Elev., ft.</u>
B-1	229
B-2	237
B-3	233
B-4	228
B-5	227

The semi-aquitard was estimated to have a vertical coefficient of permeability of 6.7×10^{-6} cm/s for the undisturbed sample taken at Boring B-5. This sample also had a dry density of 117.0 pound per cubic foot and a volume percent water (moisture content) of 15.5. Volume percent water also varied from 14.0 to 18.5 percent at other borings. The porosity was determined at 0.293.

Based on the down hole permeability tests at Boring B-2, B-3 and B-5, the overlying more pervious soils have a horizontal coefficient of permeability of 2×10^{-4} cm/s to 1×10^{-5} cm/s. Volume percent water varied from 21.6 to 21.9 percent within this layer. Assuming saturated conditions, the porosity is estimated at approximately 0.22.

There is insufficient information to accurately determine the direction of the upper groundwater, due to the variable permeability and possible lateral extent of the semi-aquitard. Because of the semi-pervious nature of this semi-aquitard, it is anticipated that this perched water will eventually percolate downward to the lower groundwater table.

The lower groundwater table was found at elevation 194.2 ft. at the exist well. This water level is approximately 4 to 6 ft. higher than the surface water level at the intersection of Nicholson and Rockfish Creeks (see Figure No. 5). Based on the existing monitoring well and utilization of the USGS Nicholson Creek Quadrangle Map, the lower groundwater table appears to move in a southeast direction towards the intersection of Nicholson Creek and Rockfish Creek with a hydraulic gradient of approximately 0.003 ft./ft.

4.2 PROPOSED MONITORING WELL SYSTEM

At the Construction & Demolish^{tion} Debris Landfill site, two groundwater systems were encountered. The upper groundwater system is a result of a semi-aquitard. Since groundwater perched above this layer will eventually reach the lower groundwater table, it is recommended that the lower groundwater table be monitored. The well should be cased and sealed at and above the semi-aquitard.

Based on the estimated directional trend of the lower groundwater table, the existing up gradient monitoring well for the existing Solid Waste Landfill can be used for the down gradient monitoring for the Construction & Demolition Debris Landfill. One additional well for up gradient testing is proposed along the west side of the demolition landfill (see Figure No.6).

The proposed new up gradient well will provide better data for determining the exact flow direction of the lower ground water. If the water level in this new well is lower than the existing monitoring well, then groundwater movement is in a more westerly direction, and this new well is more in line and down gradient from the demolition landfill than the existing monitoring well. Should this situation occur, a third up gradient well should be installed near the northeast corner of the demolition landfill.

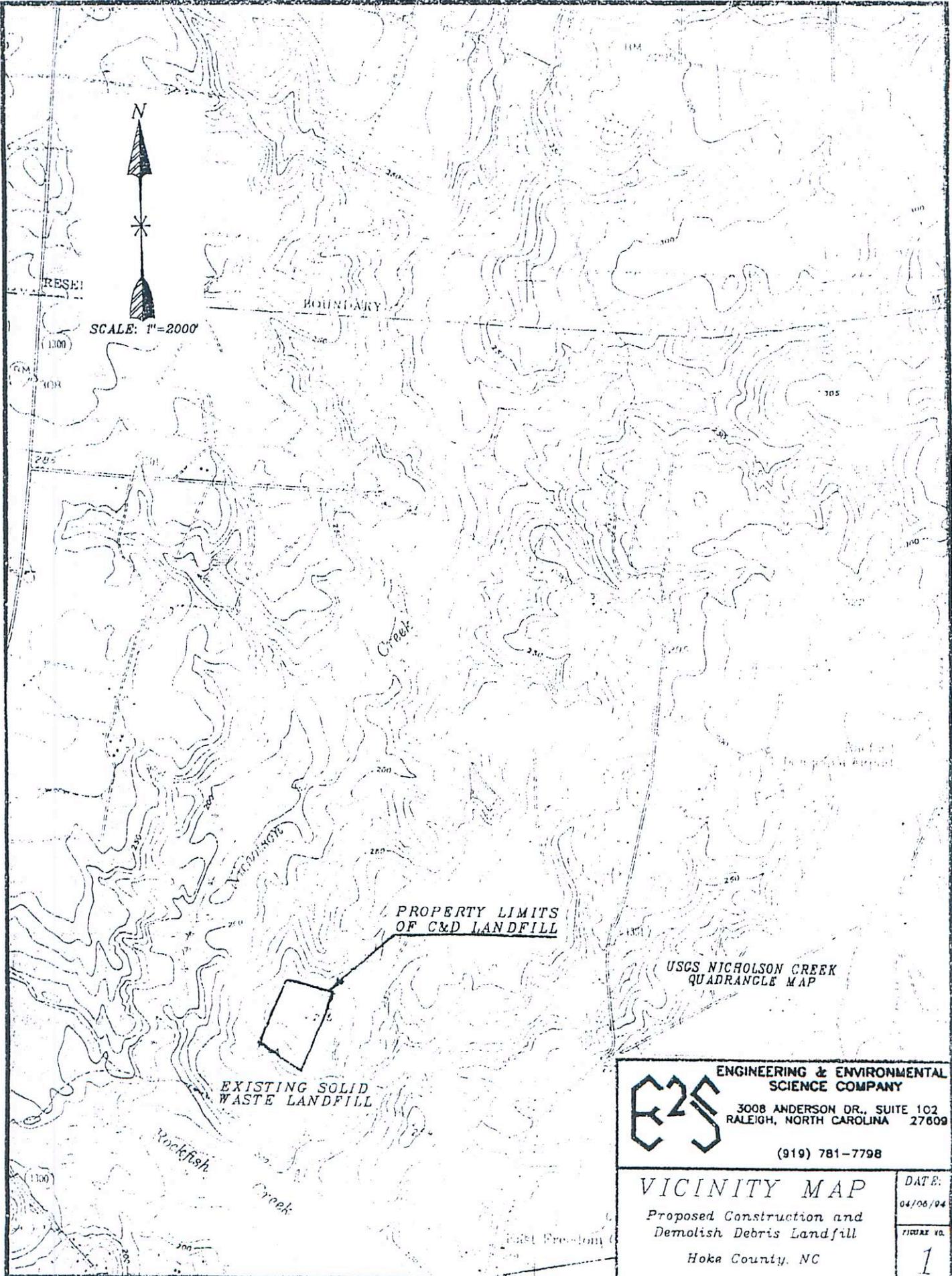
4.3 SOIL COVER MATERIALS

With the existing adjacent Solid Waste Landfill closure, evaluation of the coefficient of permeability of the surficial soils was conducted by E²S and the information was provided in the report dated November 22, 1993. Degree of compaction to achieve a coefficient of permeability of at least 1×10^{-5} cm/sec. is 98 percent of standard Proctor maximum dry density (ASTM-D-698). Testing was conducted on the shallow SM, SM-SC and SC soil types. These soils commonly were found from below the topsoil to depths of at least 17 ft. below ground level.

To achieve 98 percent compaction, in-place density of these soils will need to be compacted to a dry density of 114.8 to 119.1 pounds per cubic foot. This correlates to a porosity of approximately 0.298 to 0.280.

ATTACHMENT A

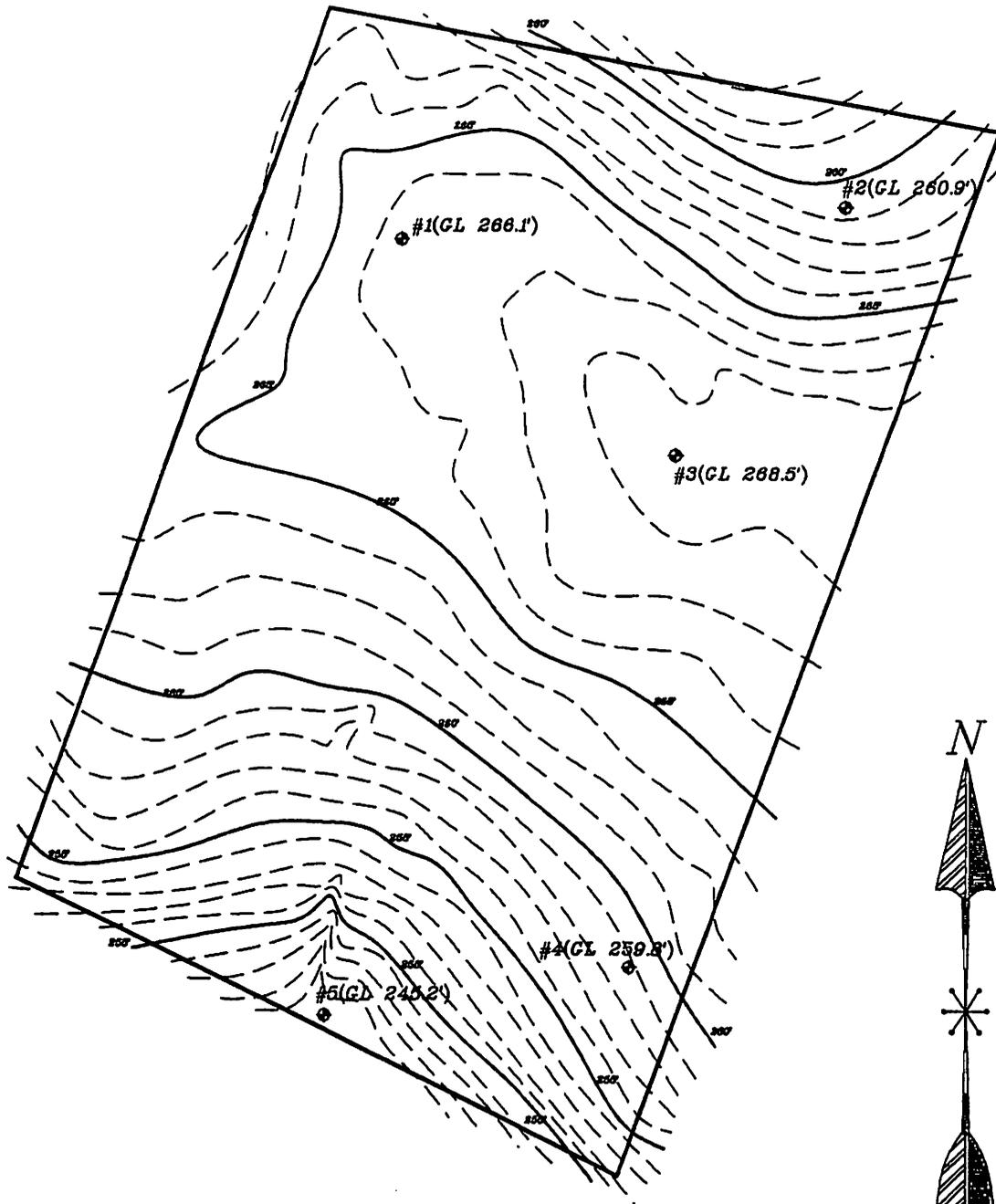
Figures



EES ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY
 3008 ANDERSON DR., SUITE 102
 RALEIGH, NORTH CAROLINA 27609
 (919) 781-7798

VICINITY MAP
 Proposed Construction and Demolish Debris Landfill
 Hoke County, NC

DATE: 04/06/04
 FIGURE NO. 1



NOTE: GL 268.5' INDICATES GROUND LEVEL
AT EACH BORING ELEVATION

SCALE: 1"=200'



ENGINEERING & ENVIRONMENTAL
SCIENCE COMPANY

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BORING LOCATION

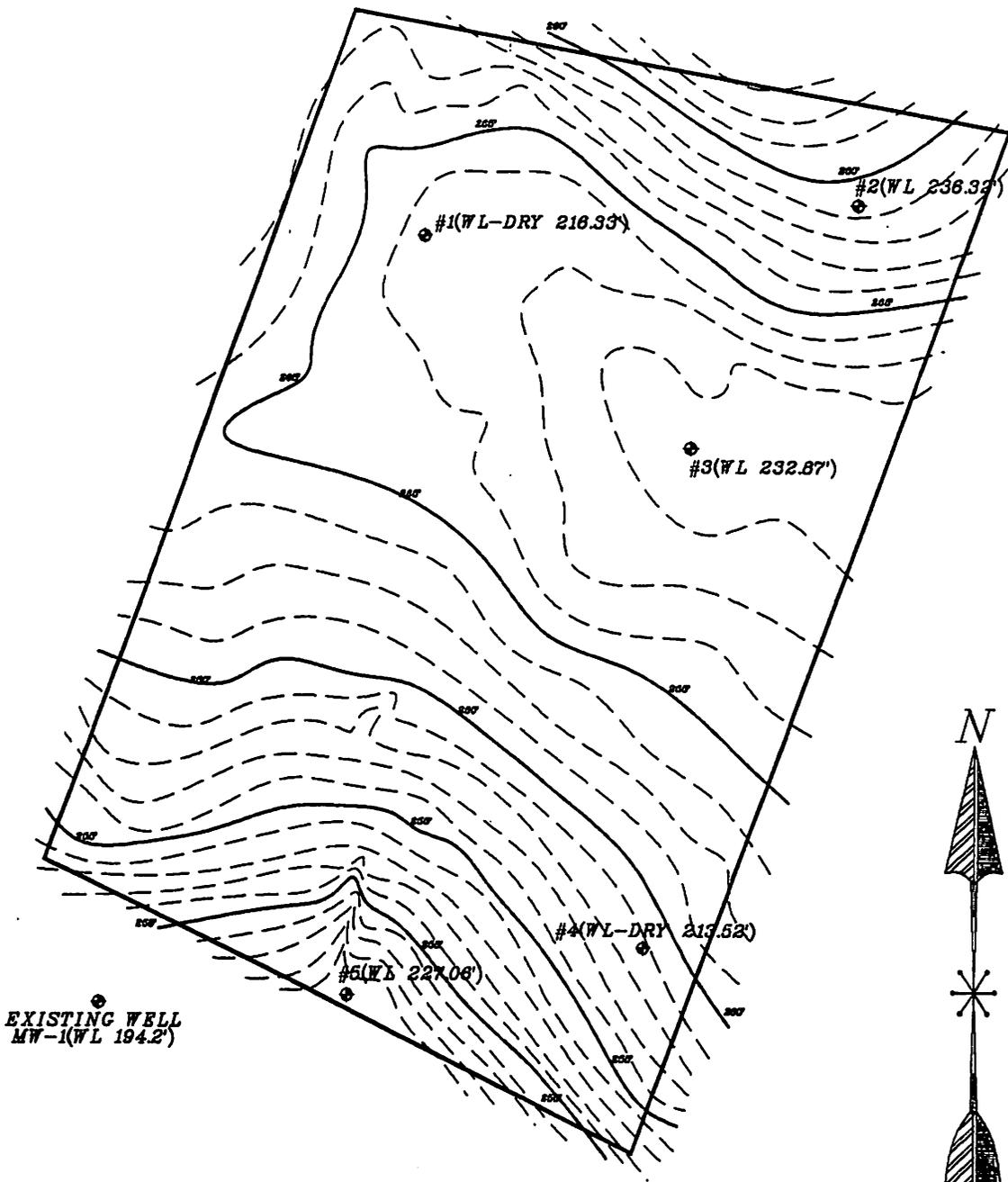
Demolition Landfill

Hoke County, NC

DATE:
04/01/94

FIGURE NO.

2



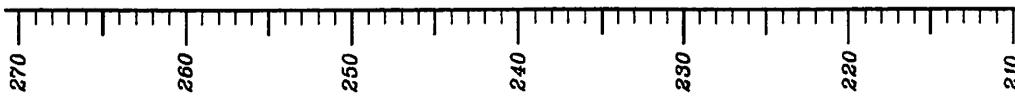
EXISTING WELL
MW-1(WL 194.2')

NOTE: WL 194.2' INDICATED WATER
ELEVATION

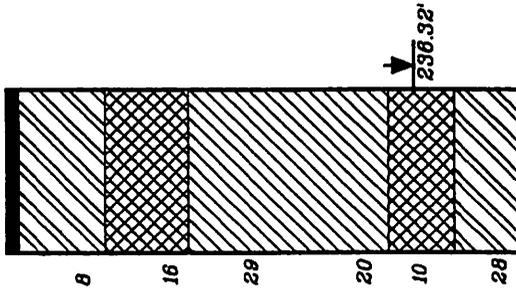
SCALE: 1"=200'

	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY	
	3008 ANDERSON DR., SUITE 102 RALEIGH, NORTH CAROLINA 27609 (919) 781-7798	
WATER ELEVATIONS		DATE: 04/01/94
Demolition Landfill Hoke County, NC		FIGURE NO. 3

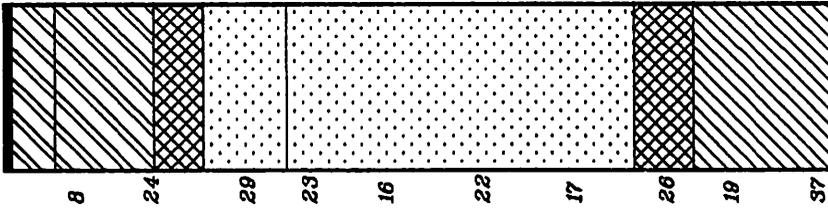
ELEVATION
(ft.)



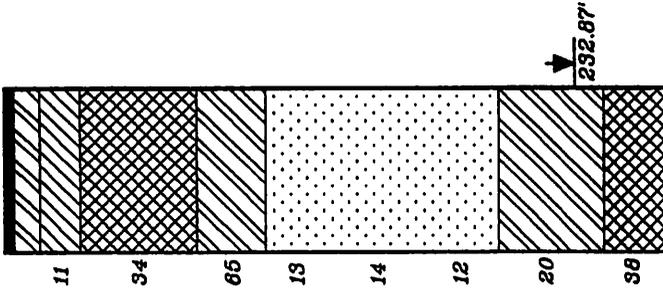
B-2



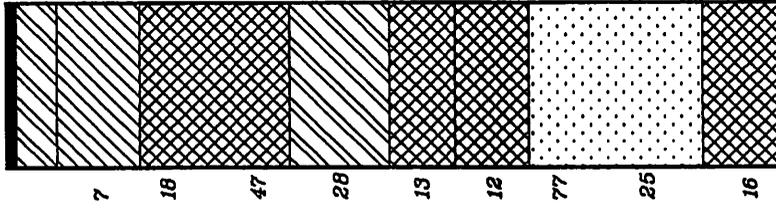
B-1



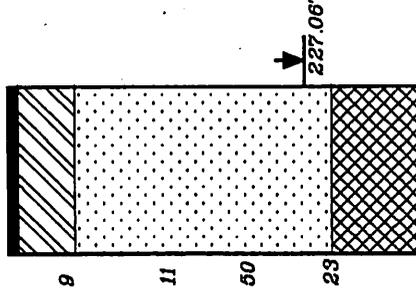
B-3



B-4



B-5



NOTES:
NUMBER ON LEFT OF BORING REPRESENTS
STANDARD PENETRATION TEST (BLOWS PER FOOT)

↓ INDICATES MEASURED WATER LEVEL

LEGEND

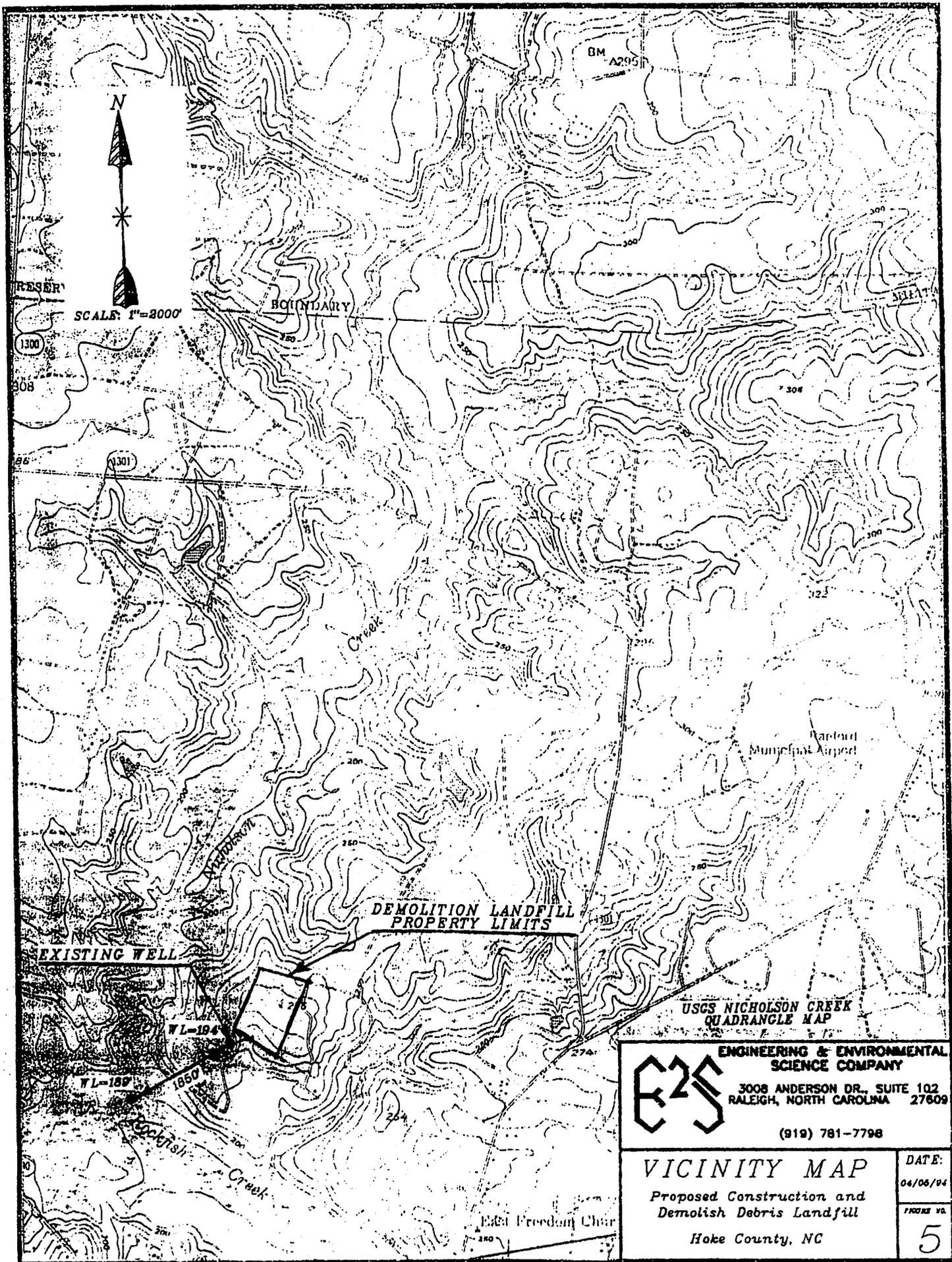
SOIL TYPE	MOISTURE CONTENT %	% FINES ATTERBERG LIMITS %		NONE PLASTIC
		LL	PL	
TOPSOIL				
SM-SP	4.3-12.0	9.9-12.9		
SM	11.6-21.7	19.8-25.4	26	3
SM-SC	12.1-12.9	21.9-22.4	26-30	21 6-9
SC & CL	12.9-29.0	22.4-29.2	35-48	20-48 22-12

* ONLY APPLIES TO SC SOIL TYPES

E2S
ENGINEERING & ENVIRONMENTAL
SCIENCE COMPANY
3008 ANDERSON DR., SUITE 102
RALEIGH, NORTH CAROLINA 27609
(919) 781-7798

STRATAGRAPHIC CROSS-SECTION
Demolition Landfill
Hoke County, NC

DATE: 04/07/94
FIGURE NO. 4

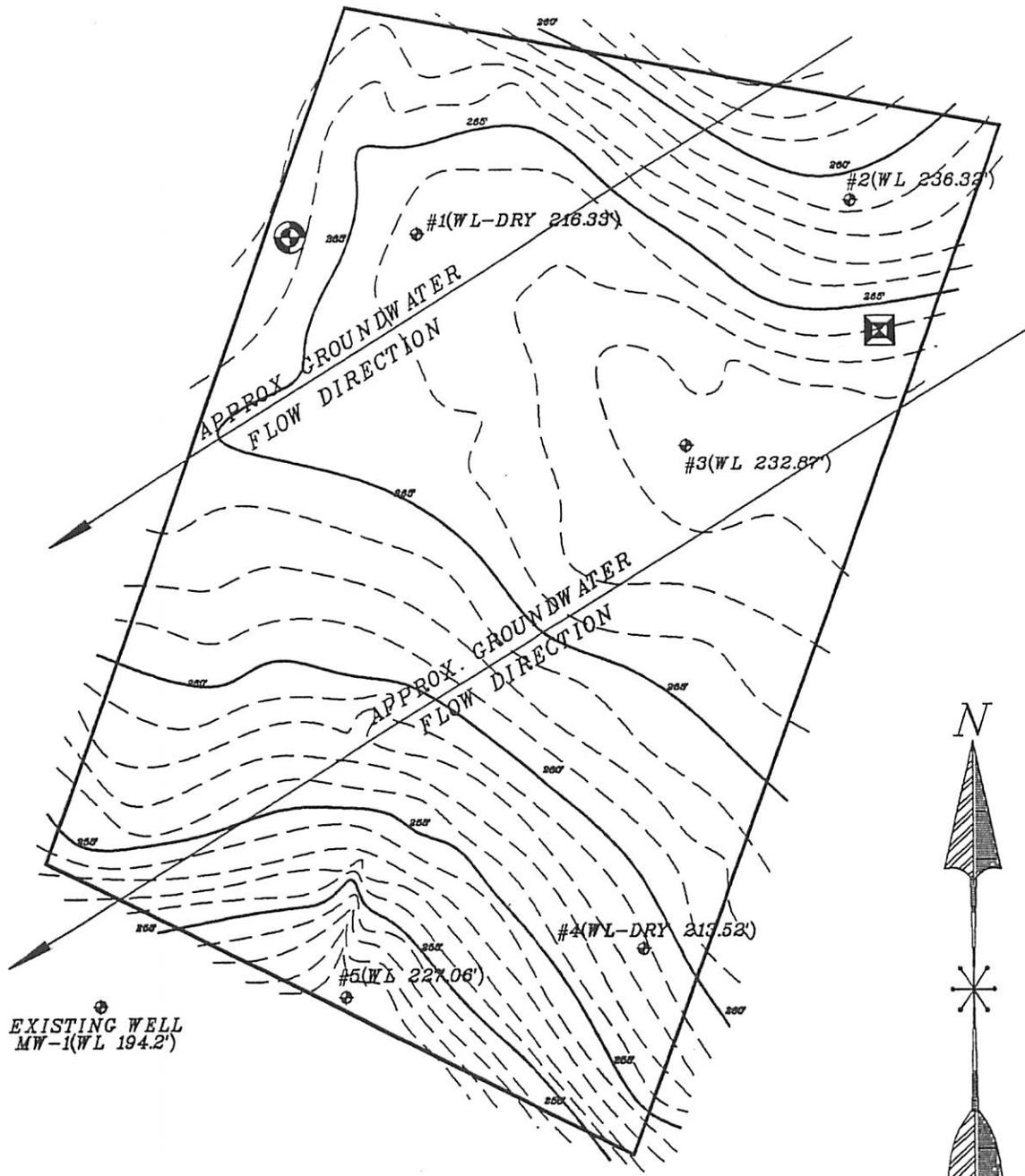


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 (919) 781-7798

VICINITY MAP
 Proposed Construction and
 Demolish Debris Landfill
 Hoke County, NC

DATE:
 04/06/04
 PROJECT NO.
 5

E2S



SCALE: 1"=200'

NOTES:

- ⊕ INDICATES PROPOSED WELL LOCATION
- ⊠ INDICATES POSSIBLE WELL LOCATION

	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY	
	3008 ANDERSON DR., SUITE 102 RALEIGH, NORTH CAROLINA 27609 (919) 781-7798	
PROPOSED MONITORING WELL LOCATION		DATE: 04/01/04
Demolition Landfill Hoke County, NC		FIGURE NO. 6

E2S

ATTACHMENT B

Tables

Table No. 1: Water Level Elevations & Downhole Permeability Tests Results

<u>Boring No.</u>	<u>Elevation, ft.</u>	<u>Water, ft.</u>	<u>Elevation, ft.</u>	<u>Down Hole Perm., cm/s</u>
B-1	266.31	Dry-49.98	>216.33	
B-2	261.21	24.89	236.32	2.6x10 ⁻⁴
B-3	268.89	36.02	232.87	1.7x10 ⁻⁵
B-4	260.63	Dry-47.11	>213.52	
B-5	246.12	19.06	227.06	5.5x10 ⁻⁴
Existing Well	248.50	54.26	194.2	

TABLE NO. 2: Laboratory Test Results

<u>Boring No.</u>	<u>Sample Depth, ft.</u>	<u>Moisture Content, %</u>	<u>% Passing No. 200 Sieve</u>	<u>Atterber Limits, %</u>		
				<u>LL</u>	<u>PL</u>	<u>PI</u>
B-1	3.5- 5.0	14.8	19.8	25	22	3
	8.5- 9.5	15.6				
	9.5-10.0	14.9				
	13.5-15.0	4.3	10.6			
	23.5-25	8.4	9.9			
	33.5-35	21.9	10.1			
	38.5-40	17.7	25.2	33	21	12
	48.5-50	12.0	12.9			
B-2	8.5-10.0	12.9	28.4	41	25	16
	13.5-15.0	12.1	21.3	31	24	16
	28.5-30.0	14.0		40	22	18
B-3	23.5-25.0	9.1	11.0			
	33.5-35.0	21.7	25.4	26	21	5
	38.5-40.0	15.1	25.2	39	20	19
B-4	3.5- 5.0	11.6				
	8.5-10.0	13.4	29.2			
	23.5-25.0	5.2	29.0			
	38.5-40	7.0	11.7			
	43.5-45	18.5	21.6			
B-5	13.5-15	8.0	10.9			
	18.5-20	21.6		48	26	22
		<u>Wet Density, pcf</u>	<u>Moisture Content, %</u>	<u>Dry Density pcf</u>	<u>Coef. of Perm. cm/s</u>	
B-5	23' - 25'	135.2	15.5	117.0	6.7x10 ⁻⁶	

ATTACHMENT C

Boring Logs

CLIENT: Hobbs Upchurch & Associates BORING NO.: B-1 DATE: 02/16/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: 4 1/2" HSA FOREMAN: Sanford Sweating
 ROCK CORE DIA.: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		%VM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSP	PIEZOMETER DIAGRAM EL 266.31'
				BLOWS/6 in.	RECOVERY %				
SURFACE ELEVATION: <u>266.1 ft.</u>									
	TOPSOIL								
	Loose, gray silty medium SAND(SM), moist	0.5'							
5	Medium dense, brown silty fine SAND(SM), moist	3.0'	1	3 3-3	90				
10	Very stiff, brown, gray, & maroon silty CLAY(CL), moist with sandy zones (SC)	9.5'	2	4 6-18	95				
15	Medium dense, light brown silty medium to coarse SAND(SM-SP), moist, trace of mica	12.0'	3	9 14-15	100				
20	Medium dense, brown minor maroon, and light gray silty fine SAND(SM-SP), moist, trace of mica	17.0'	4	6 11-12	85				
25			5	7 8-8	90				
30	Sand grades to coarse after 28'		6	8 9-13	85				
35	(CONTINUED ON NEXT PAGE)		7	8 8-9	90				

BORING METHOD
 HSA - HOLLOW STEM AUGER
 CFA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

ORGANIC VAPOR METER,
 PARTS PER MILLION
 **STANDARD PENETRATION TEST

GROUND WATER

▽ NOTED ON RODS 40 FT. ▽ AFTER _____ HRS. _____ FT.
 ▽ AT COMPLETION DRY FT. ▽ AFTER _____ HRS. _____ FT.
 ▽ AFTER 864 HRS. DRY FT. ▽ AFTER _____ HRS. _____ FT.

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-1 DATE: 02/16/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: 4 1/2" HSA FOREMAN: Sanford Sweeting
 ROCK CORE DIA: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		%OV. M. PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER PSF	PIEZOMETER DIAGRAM
				BLOWS/6 in.	RECOVERY %				
SURFACE ELEVATION: <u>266.1 ft</u>									
38.0'	Medium dense, brown minor maroon, and light gray silty fine to coarse SAND(SM-SP), moist, trace of mica								
40	Medium dense, gray clayey medium SAND(SC), very moist, trace of mica	38.0'	8	9 11-15	100				
45	Medium dense to dense, brown and light gray silty fine to medium SAND(SM-SP), very moist	42.0'	9	8 9-10	85				
50		50.0'	10	10 12-23	80				
55	LEGEND								
									-SOIL BACKFILL -2" PVC SOLID PIPE -SAND PACK -2" PVC No.10 SCREEN
60									
65									
70									

BORING METHOD

HSA - HOLLOW STEM AUGER
 CFA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

*ORGANIC VAPOR METER,
 PARTS PER MILLION

=STANDARD PENETRATION TEST

GROUND WATER

NOTED ON RODS 40 FT. AFTER _____ HRS. _____ FT.
 AT COMPLETION DRY FT. AFTER _____ HRS. _____ FT.
 AFTER 846 HRS. DRY FT. AFTER _____ HRS. _____ FT.

625

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-2 DATE: 02/16/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: A 1/2" HSA FOREMAN: Sanford Swasting
 ROCK CORE DIA: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSP	PIEZOMETER DIAGRAM EL. 261.21'
				BLOWS/6 ft.	RECOVERY %				
	SURFACE ELEVATION: <u>260.9 ft.</u>								
	TOPSOIL	0.5'							
5	Loose, brown silty fine to medium SAND(SM), moist to very moist		1	3 4-4	80				
10	Medium dense, brown and reddish-brown clayey fine SAND(SC), moist, trace of mica	8.0'	2	6 8-8	90				
15	Medium dense, brown and reddish-brown clayey silty fine to medium SAND(SM-SC), moist to very moist	11.0'	3	10 12-17	100				
20			4	8 10-10	95				
25	Medium dense, reddish-brown and light gray silty coarse SAND(SM), wet, trace of mica	23.0'	5	4 4-6	95				
30	Medium dense, reddish-brown and light gray clayey coarse SAND(SC), moist, trace of mica, random CLAY(CL) layers	27.0'	6	35 9-19	95				
		31.0'							

LEGEND:

-  -SOIL BACKFILL
-  -SAND PACK
-  -2" PVC SOLID PIPE
-  -2" PVC No.10 SCREEN

BORING METHOD

HSA - HOLLOW STEM AUGER
 CFA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

*ORGANIC VAPOR METER,
 PARTS PER MILLION
 **STANDARD PENETRATION TEST

GROUND WATER

▽ NOTED ON RODS 27.0 FT. ▽ AFTER _____ HRS. _____ FT.
 ▽ AT COMPLETION _____ FT. ▽ AFTER _____ HRS. _____ FT.
 ▽ AFTER 882 HRS. 24.6 FT. ▽ AFTER _____ HRS. _____ FT.

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-3 DATE: 02/17/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: 4 1/2" HSA FOREMAN: Sanford Sweating
 ROCK CORE DIA: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		*O ₂ M, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSP	PIEZOMETER DIAGRAM EL. 268.89'
				BLOWS/6 in.	RECOVERY %				
	SURFACE ELEVATION: <u>268.5 ft.</u>								
	----- <u>Topsoil</u> -----	0.8'							
	Loose, brown silty fine to medium SAND(SM), moist	2.5'							
5	----- <u>Medium dense, reddish-brown clayey silty fine SAND(SM-SC), moist</u> -----		1	5 5-8	90				
	----- <u>Dense, brown, minor reddish-brown mottling clayey fine SAND(SC), moist</u> -----	6.0'							
10			2	9 11-23	80				
	----- <u>Dense, light gray and light brown, minor red silty fine SAND(SM), moist, trace of mica</u> -----	12.0'							
15			3	15 25-10	80				
	----- <u>Medium dense, reddish-brown and light gray silty coarse SAND(SM-SP), very moist</u> -----	17.0'							
20			4	6 6-7	100				
	----- <u>Minor light gray clayey SAND(SC) seams after 27'</u> -----								
25			5	5 6-8	100				
	----- <u>Medium dense, maroon and light gray silty clayey micaceous fine SAND(SM-SC), very moist</u> -----	31.0'							
30			6	4 6-8	95				
	(CONTINUED ON NEXT PAGE)								
35			7	3 4-18	90				

BORING METHOD
 HSA - HOLLOW STEM AUGER
 CFA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

*ORGANIC VAPOR METER, PARTS PER MILLION
 **STANDARD PENETRATION TEST

GROUND WATER

▽ NOTED ON RODS 33 FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AT COMPLETION _____ FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AFTER 660 HRS. 35.8 FT. ▼ AFTER _____ HRS. _____ FT.

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-3 DATE: 02/17/04
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: 4 1/2" HSA FOREMAN: Sanford Sweating
 ROCK CORE DIA: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		%VM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSP	PIEZOMETER DIAGRAM
				BLOWS/6 in.	RECOVERY %				
	SURFACE ELEVATION: <u>268.5 ft.</u>								
38.0	Dense, gray minor brown and dark red mottling clayey medium to coarse SAND(SC), moist, trace of mica	38.0							
40			8	14	90				
42.0				15-23					
45									LEGEND
50									
55									
60									
65									
70									

BORING METHOD
 HSA - HOLLOW STEM AUGER
 CFA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

*ORGANIC VAPOR METER,
 PARTS PER MILLION
 **STANDARD PENETRATION TEST

GROUND WATER

▽ NOTED ON RODS 33 FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AT COMPLETION _____ FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AFTER 880 HRS. 35.6 FT. ▼ AFTER _____ HRS. _____ FT.

825

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-4 DATE: 02/17/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: A 1/2" HSA FOREMAN: Sanford Sweating
 ROCK CORE DIA: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia.

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		%VM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSP	PIEZOMETER DIAGRAM EL. 260.63'
				BLOWS/6 ft.	RECOVERY %				
	SURFACE ELEVATION: <u>259.8 ft.</u>								
	TOPSOIL	0.5'							
	Loose, brown silty fine SAND(SM), moist	2.5'							
5	Loose, reddish-brown silty clayey fine SAND(SM-SC), moist		1	3 3-4	95				
10	Medium dense to very dense, brown and reddish-brown clayey medium SAND(SC), moist	8.0'	2	8 12-16	75				
15			3	11 22-25	65				
20	Medium dense to dense, brown and light gray silty medium to coarse SAND(SM), moist	17.0'							
25	Medium dense, gray and maroon clayey coarse SAND(SC), moist	23.0'	4	9 13-15	95				
			5	4 6-7	100				
30	Medium dense, alternating layers of reddish brown silty medium SAND(SM), maroon clayey SILT(ML), and light gray clayey fine SAND(SC), moist	27.0'							
			6	11 6-6	100				
35	Very dense, reddish-brown silty fine to medium SAND(SM-SP), moist, trace of gravel Gravel content increases after 34ft. (CONTINUED ON NEXT PAGE)	31.0'	7	8 27-50	40				

BORING METHOD

HSA - HOLLOW STEM AUGER
 CPA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

*ORGANIC VAPOR METER,
 PARTS PER MILLION
 **STANDARD PENETRATION TEST

GROUND WATER

▽ NOTED ON RODS 42 FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AT COMPLETION _____ FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AFTER 832 HRS. DRY FT. ▼ AFTER _____ HRS. _____ FT.

23

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-4 DATE: 02/17/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: 4 1/2" HSA FOREMAN: Sanford Sweeting
 ROCK CORE DIA.: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		%OV. PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TSP	PIEZOMETER DIAGRAM
				BLOWS/6 ft.	RECOVERY %				
SURFACE ELEVATION: <u>259.8 ft.</u>									
40	Medium dense, reddish-brown silty fine to medium SAND(SM-SP), moist, trace of gravel	42.0'	8	30 15-10	80				
45	Medium dense, gray clayey medium SAND(SC), wet, trace of mica		9	7 7-9	100				
47.0'									
50									LEGEND
55									
60									
65									
70									

BORING METHOD
 HSA - HOLLOW STEM AUGER
 CPA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

o ORGANIC VAPOR METER, PARTS PER MILLION
 o STANDARD PENETRATION TEST

GROUND WATER

▽ NOTED ON RODS 42 FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AT COMPLETION _____ FT. ▼ AFTER _____ HRS. _____ FT.
 ▼ AFTER 832 HRS. DRY FT. ▼ AFTER _____ HRS. _____ FT.

CLIENT: Hobbs, Upchurch & Associates BORING NO.: B-5 DATE: 02/17/94
 PROJECT NAME: Demolition Landfill JOB NO.: _____
 PROJECT LOCATION: Hoke County, NC STATION: _____
 BORING METHOD: 4 1/2" HSA FOREMAN: Sanford Sweeting
 ROCK CORE DIA: N/A INSPECTOR: Pat Shillington
 SHELBY TUBE O.D.: 3" Dia

DEPTH (ft)	DESCRIPTION & REMARKS	STRATUM DEPTH, ft.	SAMPLE NUMBER	**SPT		*OVM, PPM	MOISTURE CONTENT, %	CALIBRATED PENETROMETER TEST	PIEZOMETER DIAGRAM EL. 246.12'
				BLOWS/8 ft.	RECOVERY %				
	SURFACE ELEVATION: <u>245.2 ft.</u>								
	----- TOPSOIL -----	0.5'							
	Loose, gray silty medium SAND(SM), moist, trace of fine pebbles								
5		4.0'	1	3 8-3	100				
	Loose to dense, reddish-brown silty fine SAND(SM-SP), moist								
10			2	10 5-8	90				
	Sand grades to medium after 7'								
15			3	15 25-25	85				
	Trace of gravel after 14'								
20		19.5'	4	8 8-15	90				
	Very stiff to hard, gray silty CLAY(CL), moist, trace of sand								
25		25.0'	5					+4.0	

NOTES:
 Sample 5 is Shelby Tube Sample

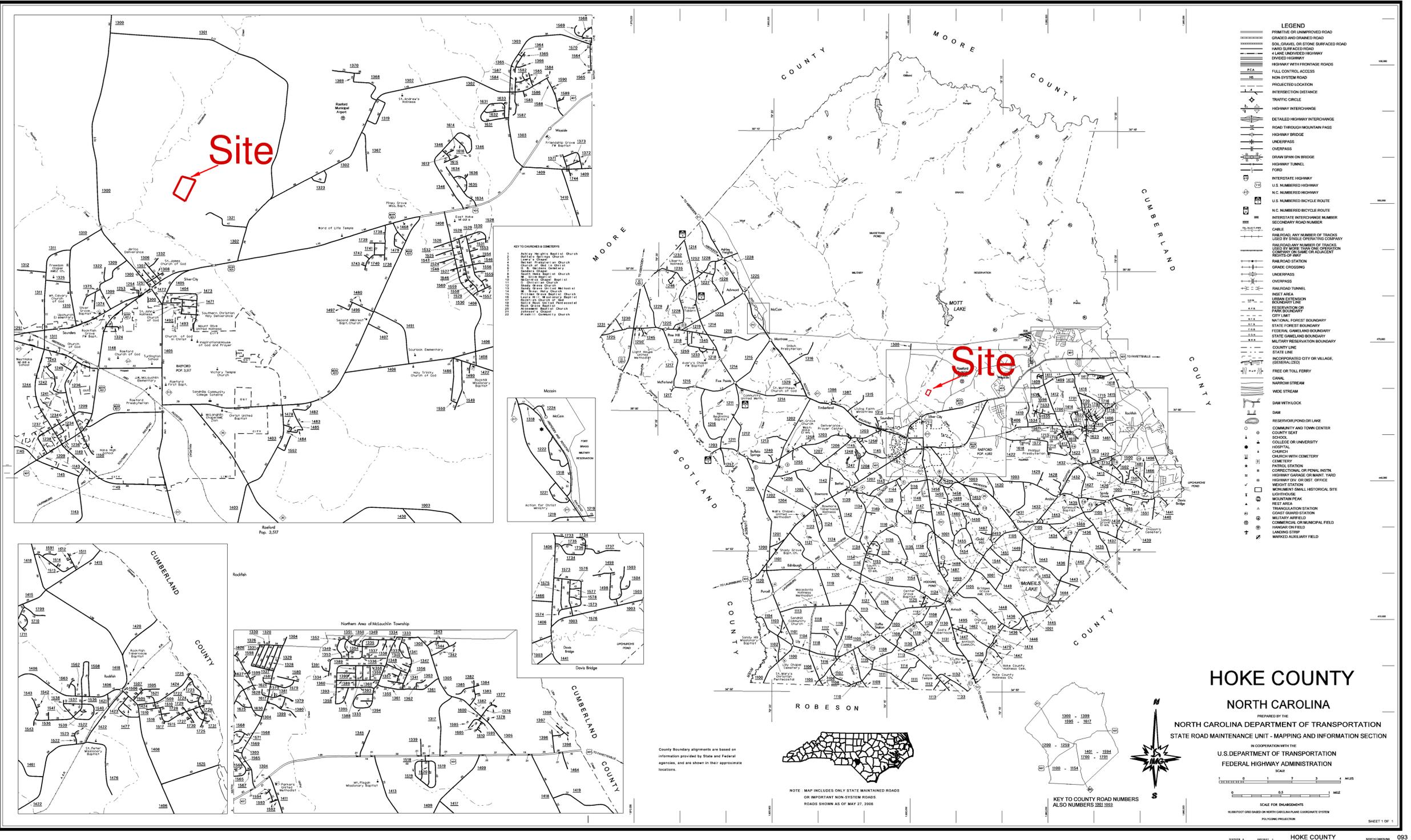
LEGEND

-  -SOIL BACKFILL
-  -2" PVC SOLID PIPE
-  -SAND PACK
-  -2" PVC No.10 SCREEN

BORING METHOD
 HSA - HOLLOW STEM AUGER
 CFA - CONTINUOUS FLIGHT AUGER
 DC - DRIVEN CASING
 MD - MUD DRILLING
 RC - ROCK CORING

GROUND WATER
 ▽ NOTED ON RODS 18.0 FT. ▽ AFTER _____ HRS. _____ FT.
 ▽ AT COMPLETION _____ FT. ▽ AFTER _____ HRS. _____ FT.
 ▽ AFTER 828 HRS. 18.14 FT. ▽ AFTER _____ HRS. _____ FT.

*ORGANIC VAPOR METER, PARTS PER MILLION
 **STANDARD PENETRATION TEST



HOKE COUNTY NORTH CAROLINA

PREPARED BY THE
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
STATE ROAD MAINTENANCE UNIT - MAPPING AND INFORMATION SECTION

IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

SCALE
1" = 1 MILE

SCALE FOR ENLARGEMENTS
1" = 0.5 MILE

HOKE COUNTY

Sheet Index
 Sheet 1 of 7: County Map
 Sheet 2 of 7: Facility Site Setting
 Sheet 3 of 7: Existing Conditions
 Sheet 4 of 7: Final Layout
 Sheet 5 of 7: Cross Section A-A'
 Sheet 6 of 7: Cross Section B-B'
 Sheet 7 of 7: Cross Sections C-C' and D-D'

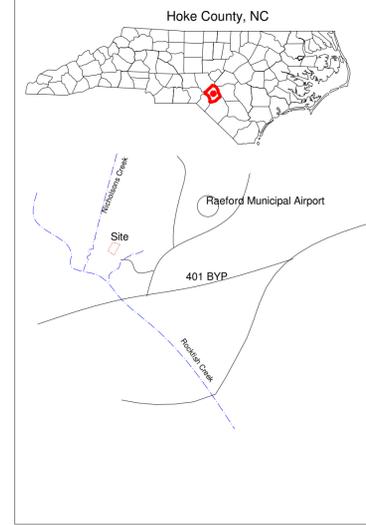
Owner/Operator
 Hoke County Solid Waste
 PO BOX 179
 Raeford, NC 28376
 Contact: Don Russell
 Phone: (910) 875 - 3111

Site Address
 Steele Road
 Raeford, NC 28376

	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY 3008 Anderson Drive Raleigh, NC 27609 (919) 781-7798	DATE: 03/2/10 DRAWN: CPM
	Hoke County DOT Map Hoke County LCID Landfill LCID Permit 47-A Raeford, NC	REVISED: 10/8/10 SCALE: See Drawing Sheet No. 1 of 7



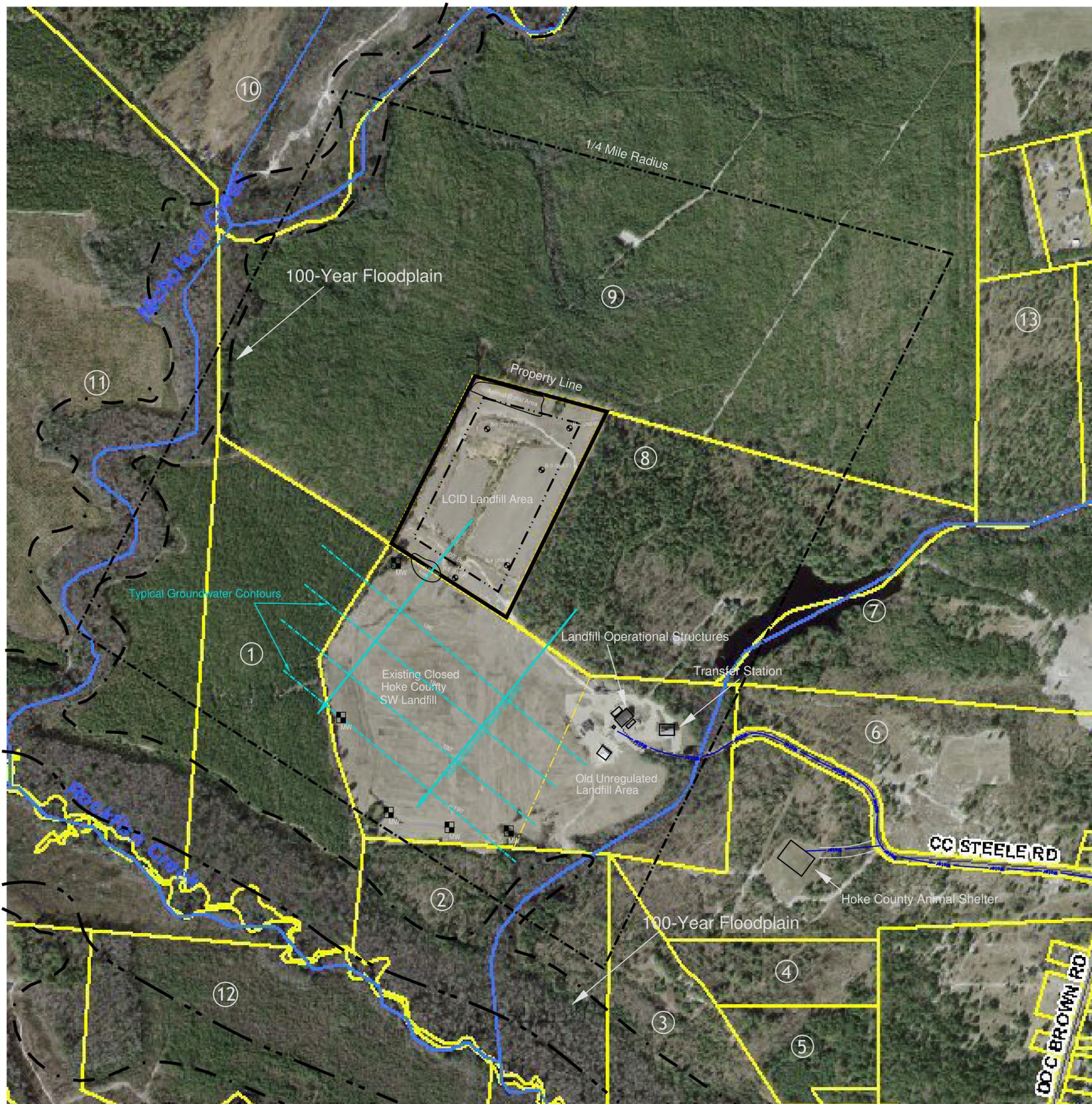
Hoke County LCID Landfill Aerial Photograph



Vicinity Map (NTS)

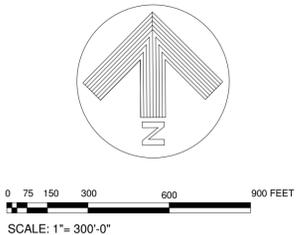
Legend

- LCID Property Boundary
- 100-Yr Floodplain
- AE Floodplain
- 100 Ft. Buffer
- 1/4-Mile Radius
- Streams
- Property Lines
- Former Piezometer Location
- SW Monitoring Well Location
- Existing Water Line
- Animal Burial Area
- Typical Groundwater Contours

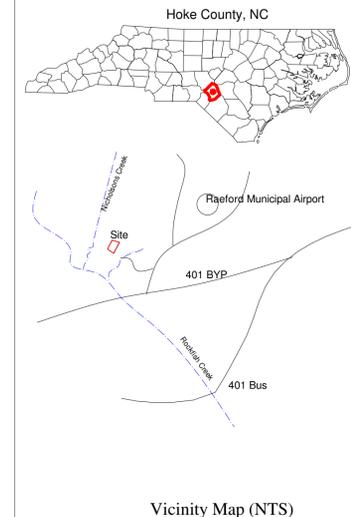


Adjacent Property Owners		
PIN #	OWNER	ADDRESS
1	County Of Hoke	Raeford, NC 28376
2	County Of Hoke	Raeford, NC 28376
3	Boahn, George F & Boahn, FraNCes	3025 Boahn Ct. Raeford, NC 28376-9456
4	Graham, Jessie Jones	317 Stevens St. Raeford, NC 28376-1834
5	Allen, Mary Helen & Waller, Donna	31 Concord St. Rochester, NY 14605
6	County of Hoke	P O Box 210 Raeford, NC 28376-0266
7	Poole, Joseph C & Poole, Marinell	P O Box 850 Raeford, NC 28376
8	Richards, Frank H & Richards, Linda	P O Box 1567 Raeford, NC 28376
9	Loblolly Group, LLC	P O Box 1853 Spartanburg, Sc 29304
10	Baker, Edgar M & Baker, Marianne	2000 Vass R.d. Raeford, NC 28376-8554
11	Conservation Fund	1655 N Ft Myer Dr Ste 1300 Arlington, VA 22209
12	Hough, Karen Brown	906 Reed St. Raeford, NC 28376
13	Griesser, Katherine	668 Skydive Dr. Raeford, NC 28376

- Notes:
- 2007 Aerial Photograph obtained from Hoke County GIS.
 - Typical groundwater elevations are based on monitoring well testing and sampling for the closed solid waste landfill.
 - 100 year floodplain is based on USDHUD Flood Boundary Map Community Panel No. 370397-0003A



	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY 3008 Anderson Drive Raleigh, NC 27609 (919) 781-7798	DATE: 03/2/10 DRAWN: CPM
	Facility Site Setting Hoke County LCID Landfill LCID Permit 47-A Raeford, NC	REVISED: 10/8/10 SCALE: See Drawing
	Hoke County Solid Waste PO BOX 179 Raeford, NC 28376	Sheet No. 2 of 7



VEGETATION PLAN

1. Spread topsoil over disturbed areas and leave surface reasonably smooth and uniform.
2. Scarify surface to prepare a seedbed four to six inches deep. Use such equipment as tilling, disking, tracing or the teeth on a front end loader.
3. Mix lime and fertilizer with the soil during seedbed preparation.
4. Seed on freshly prepared seedbed following the application rates for the appropriate season.
5. Mulch all seeded areas immediately.
6. Tack mulch on slopes 3:1 (Horizontal to Vertical) or steeper by spraying with emulsified asphalt. Use an anchoring tool such as a farming disc set in a vertical position on slopes less than 3:1. Mulch netting may also be used on slopes.
7. Inspect seeded areas and make repairs within the planting season. If vegetation is over 60% damaged, repeat steps 2 through 5.
8. Permanent revegetation shall be accomplished at the specified times of the year. Temporary vegetative shall be applied outside of the optimal times for establishment of permanent vegetation.
9. Seeding Schedule.

TEMPORARY SEEDING SCHEDULE

Seeding Date: August 15 to April 15

	Rate
Rye (grain)	120 lbs./acre
10-10-10 Fertilizer	1000 lbs./acre
Lime	2000 lbs./acre
Mulch	4000 lbs./acre

Seeding Date: April 15 to August 15

	Rate
German Millet	40 lbs./acre
10-10-10 Fertilizer	750 lbs./acre
Lime	2000 lbs./acre
Mulch	4000 lbs./acre

PERMANENT SEEDING SCHEDULE

Seeding Date: February 15 to April 30
September 1 to October 31

	Rate
Pensacola Bahiagrass	50 lbs./acre
Sericea Lespedeza	60 lbs./acre
10-10-10 Fertilizer	1000 lbs./acre
Lime	3000 lbs./acre
Mulch	4000 lbs./acre

Note 1: Fertilizer and lime application rates may deviate from above if soils are analyzed for optimum rates.

Note 2: Mulch shall be tacked with emulsified asphalt at rate of 14 to 28 gallons/1000 sq. ft. on slopes of 3:1 (H:V) or steeper.

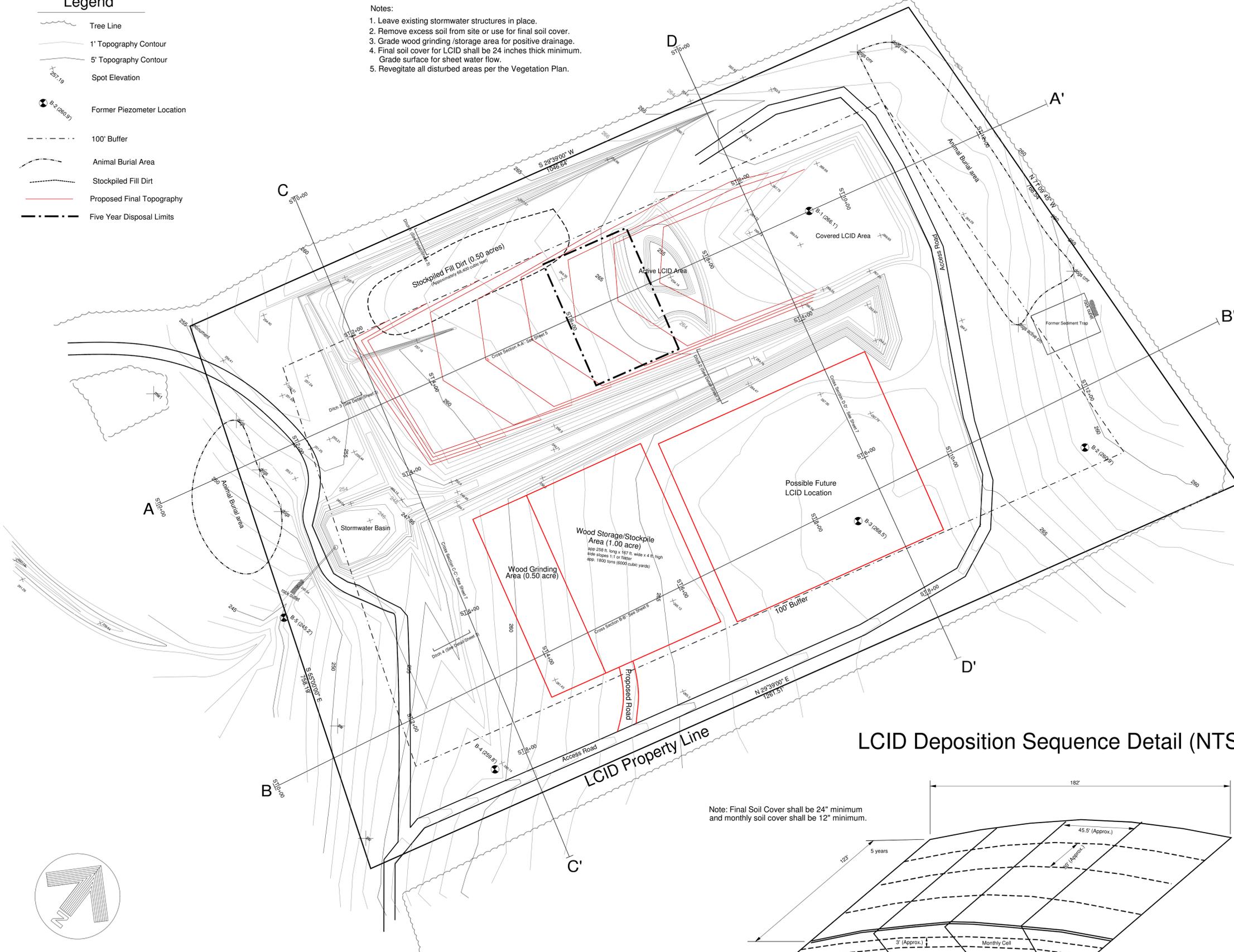
Note 3: Use Unscarified Sericea seed from September 1 to March 1 for permanent seeding period.

Note 4: Pensacola Bahiagrass and Sericea Lespedeza are to be planted separately with Sericea Lespedeza planted farthest from the lake shore line and Pensacola Bahiagrass planted along the sloped shore line.

Closure Considerations

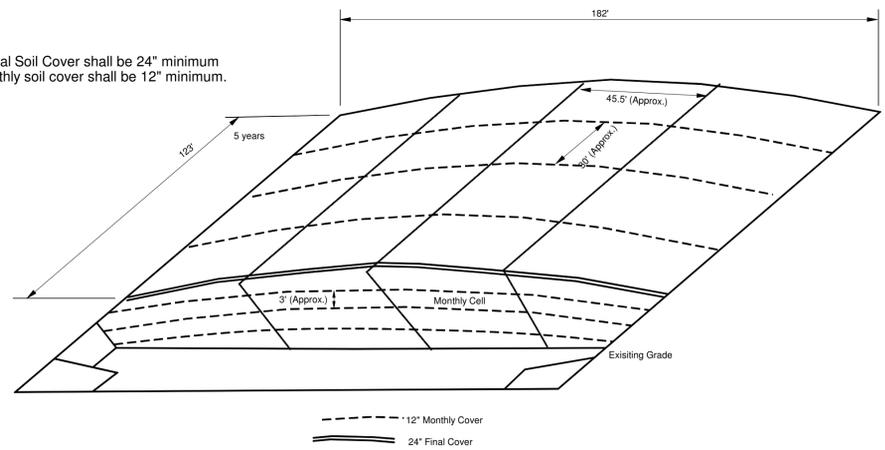
- Notes:
1. Leave existing stormwater structures in place.
 2. Remove excess soil from site or use for final soil cover.
 3. Grade wood grinding /storage area for positive drainage.
 4. Final soil cover for LCID shall be 24 inches thick minimum. Grade surface for sheet water flow.
 5. Revegetate all disturbed areas per the Vegetation Plan.

- Legend**
- Tree Line
 - 1' Topography Contour
 - 5' Topography Contour
 - Spot Elevation
 - Former Piezometer Location
 - 100' Buffer
 - Animal Burial Area
 - Stockpiled Fill Dirt
 - Proposed Final Topography
 - Five Year Disposal Limits

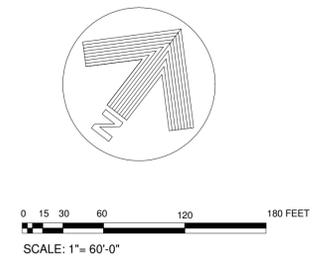


LCID Deposition Sequence Detail (NTS)

Note: Final Soil Cover shall be 24" minimum and monthly soil cover shall be 12" minimum.

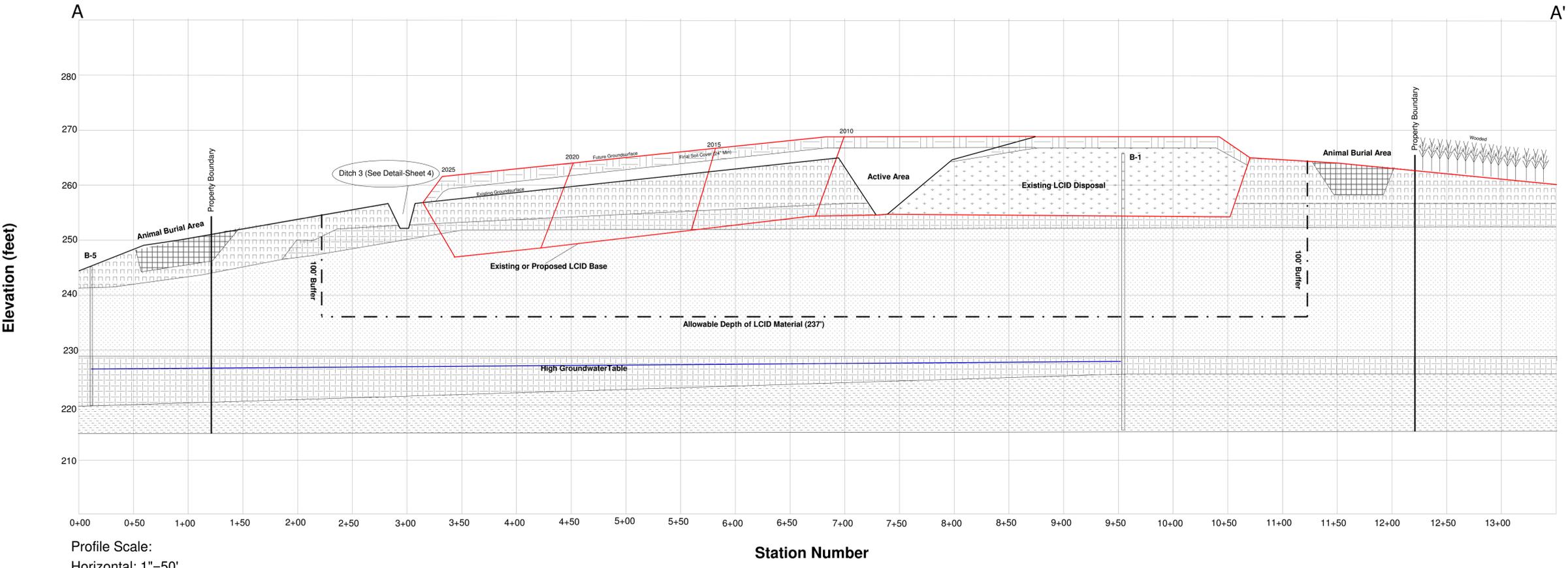


Note: Excavated slopes for the cell and slope for temporary cover shall be 2:1 (H:V) or flatter. Final cover slopes along the perimeter of the waste boundary shall be 3:1 (H:V) or flatter.



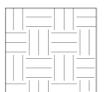
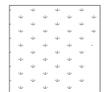
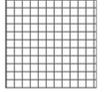
	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY 3008 Anderson Drive Raleigh, NC 27609 (919) 781-7798	DATE: 03/2/10 DRAWN: CPM REVISION: 10/8/10 SCALE: See Drawing Sheet No. 4 of 7
	Final Layout Hoke County LCID Landfill Raeford, NC	Hoke County Solid Waste PO BOX 179 Raeford, NC 28376

Hoke County LCID Landfill Cross-Section



Profile Scale:
 Horizontal: 1"=50'
 Vertical 1"=10'

Soils Legend

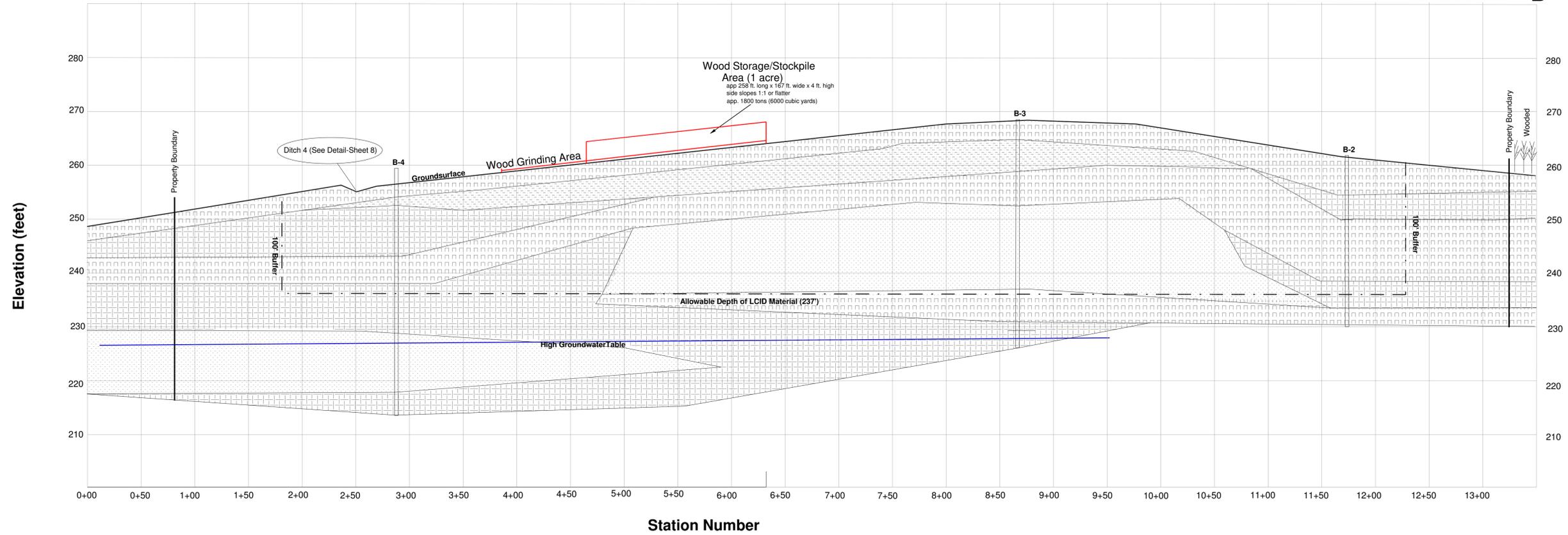
	Final Soil Cover		SM-SP		SM-SC
	LCID Material		SC & CL		
	Animal Burial		SM		

	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY 3008 Anderson Drive Raleigh, NC 27609 (919) 781-7798	DATE: 04-05-2010 DRAWN: CPM
	Cross Section A-A' Hoke County LCID Landfill LCID Permit 47-A Raeford, NC	REVISED: 10/10/08 SCALE: See Drawing
	Hoke County Solid Waste PO BOX 179 Raeford, NC 28376	Sheet No. 5 of 7

B

Hoke County LCID Landfill Cross-Section

B'



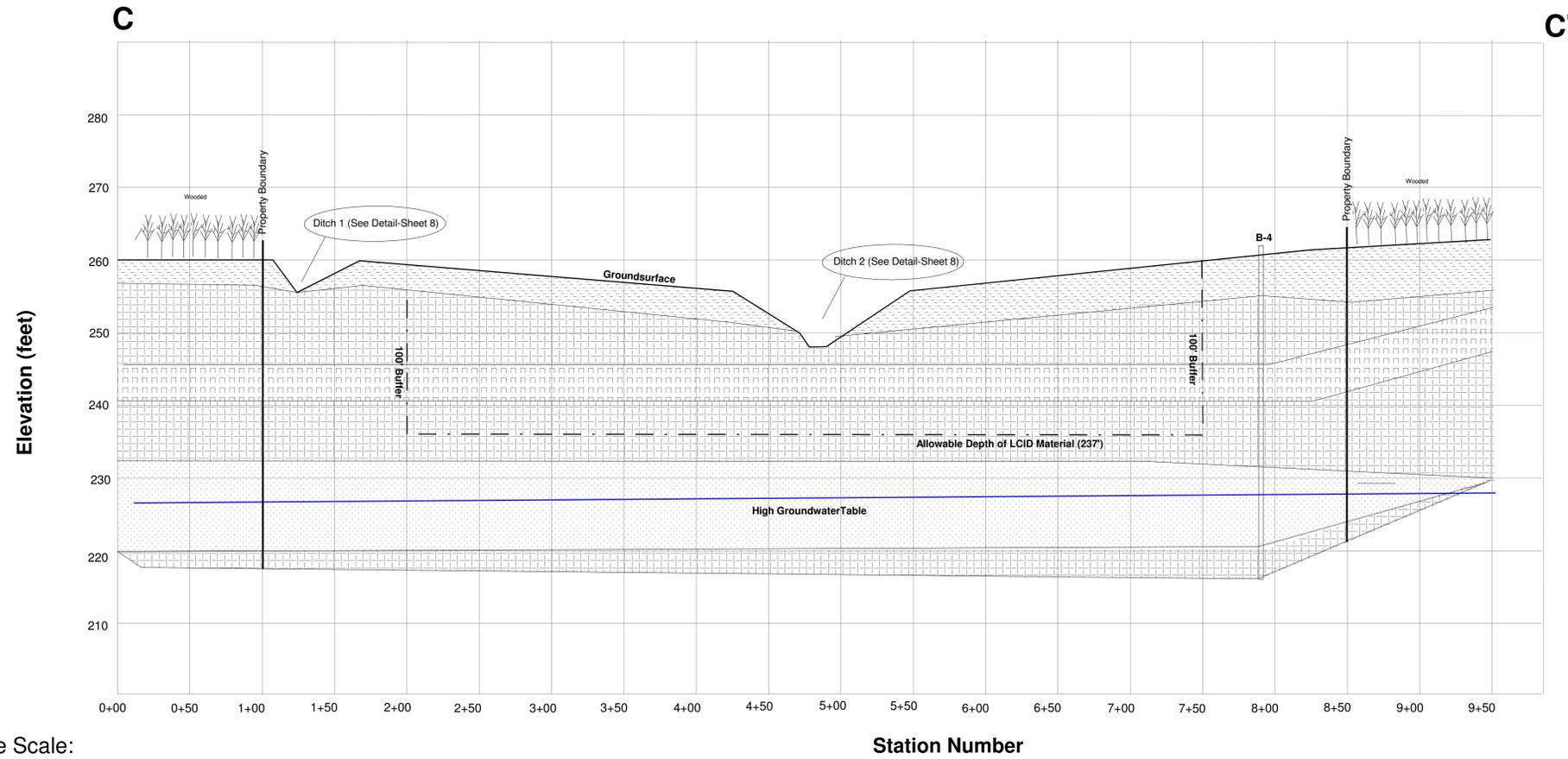
Profile Scale:
 Horizontal: 1"=50'
 Vertical 1"=10'

Soils Legend

	Final Soil Cover		SM-SP
	LCID Material		SC & CL
	SM-SC		SM

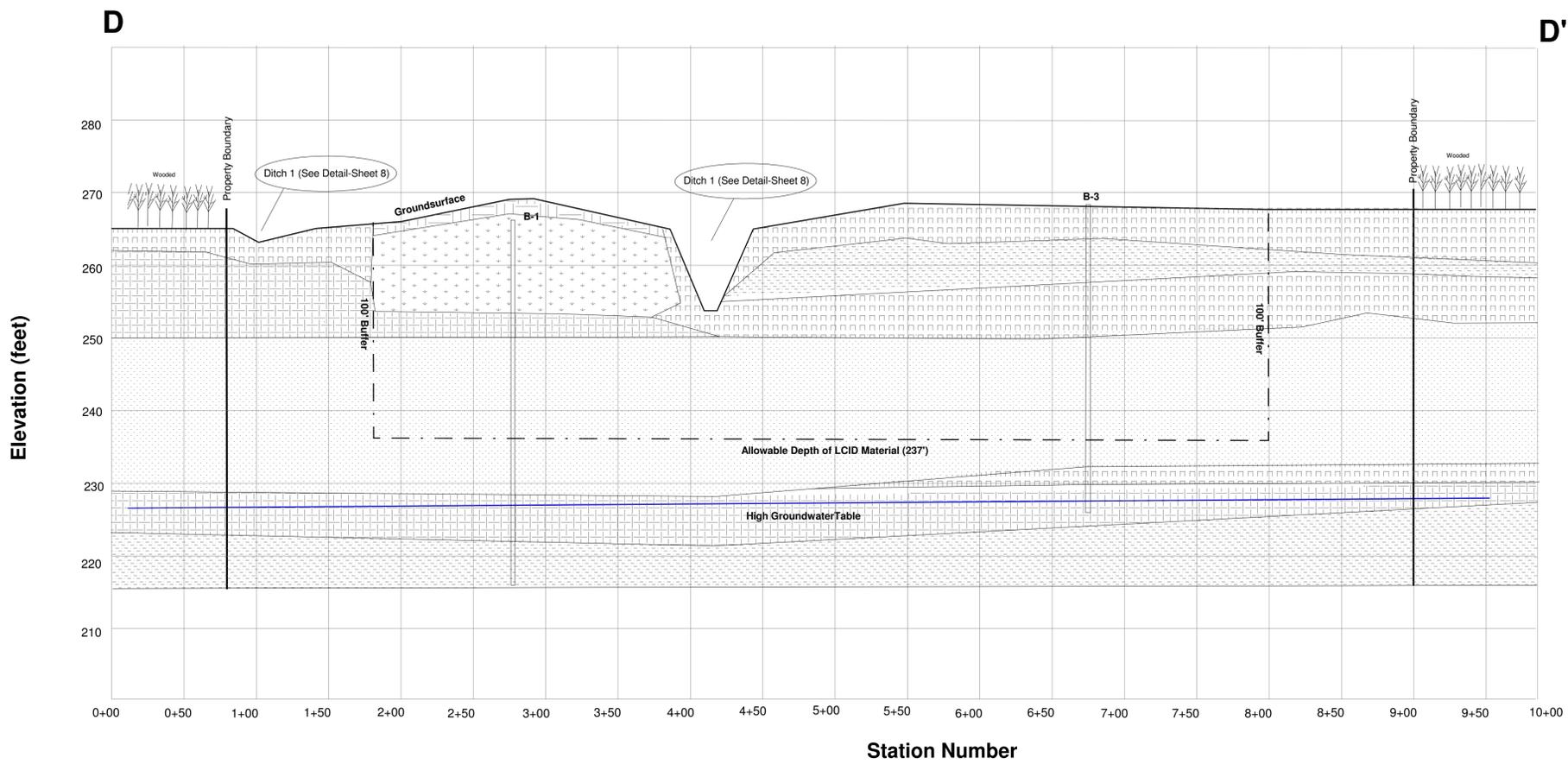
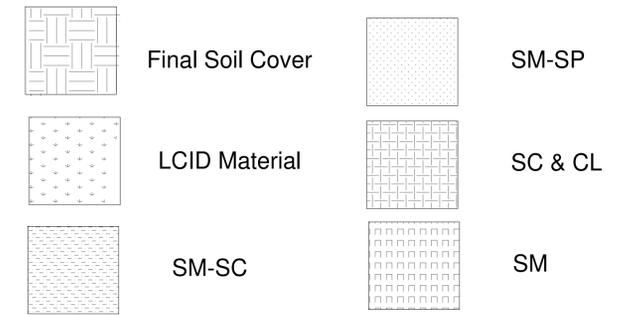
Note: Red indicates proposed or future conditions.

	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY 3008 Anderson Drive Raleigh, NC 27609 (919) 781-7798	DATE: 04-05-2010 DRAWN: CPM
	Cross Section B-B' Hoke County LCID Landfill LCID Permit 47-A Raeford, NC	REVISED: 10/8/10 SCALE: See Drawing
	Hoke County Solid Waste PO BOX 179 Raeford, NC 28376	Sheet No. 6 of 7



Profile Scale:
 Horizontal: 1"=50'
 Vertical 1"=10'

Soils Legend



	ENGINEERING & ENVIRONMENTAL SCIENCE COMPANY 3008 Anderson Drive Raleigh, NC 27609 (919) 781-7798	DATE: 04-05-2010
		DRAWN: CPM
Cross Sections C-C' & D-D' Hoke County LCID Landfill LCID Permit 47-A Raeford, NC		REVISED: 10/8/10
Hoke County Solid Waste PO BOX 179 Raeford, NC 28376		SCALE: See Drawing
		Sheet No. 7
		of: 7