Revised
~~12-20-95~~
~~3-01-96~~
~~5-10-96~~
6-06-96

# The Expansion of the White Street Sanitary Landfill

## Greensboro, North Carolina

## Site Study

Received

April 7, 1995

Prepared by

HDR Engineering, Inc.
of North Carolina
128 S. Tryon Street, Suite 1400
Charlotte, NC 28202-5001

APPROVED
DIVISION OF SOLID WASTE MANAGEMENT
DATE ______ BY ______

HDR

HDR Engineering, Inc.
of North Carolina

CENTRAL FILES

# SITE STUDY

# FOR

# THE EXPANSION OF THE

# WHITE STREET SANITARY LANDFILL

# CITY OF GREENSBORO

# GREENSBORO, NORTH CAROLINA

**APRIL 7, 1995**

**Revised December 15, 1995**
**Revised March 1, 1996**

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 16395 JOSEPH C. READLING 3-1-96

NORTH CAROLINA LICENSED GEOLOGIST SEAL CHARLES GORDON LEE

**Prepared for:**

**City of Greensboro, North Carolina**

**Prepared by:**

**HDR Engineering, Inc. of North Carolina**
**128 South Tryon Street, Suite 1400**
**Charlotte, North Carolina**

# TABLE OF CONTENTS

## TABLE OF CONTENTS cont'd.

**SECTION** **PAGE**

## TABLE OF CONTENTS cont'd.

**SECTION** **PAGE**

## LIST OF TABLES

## LIST OF FIGURES

# SECTION 1.0
# INTRODUCTION

## 1.1 Purpose

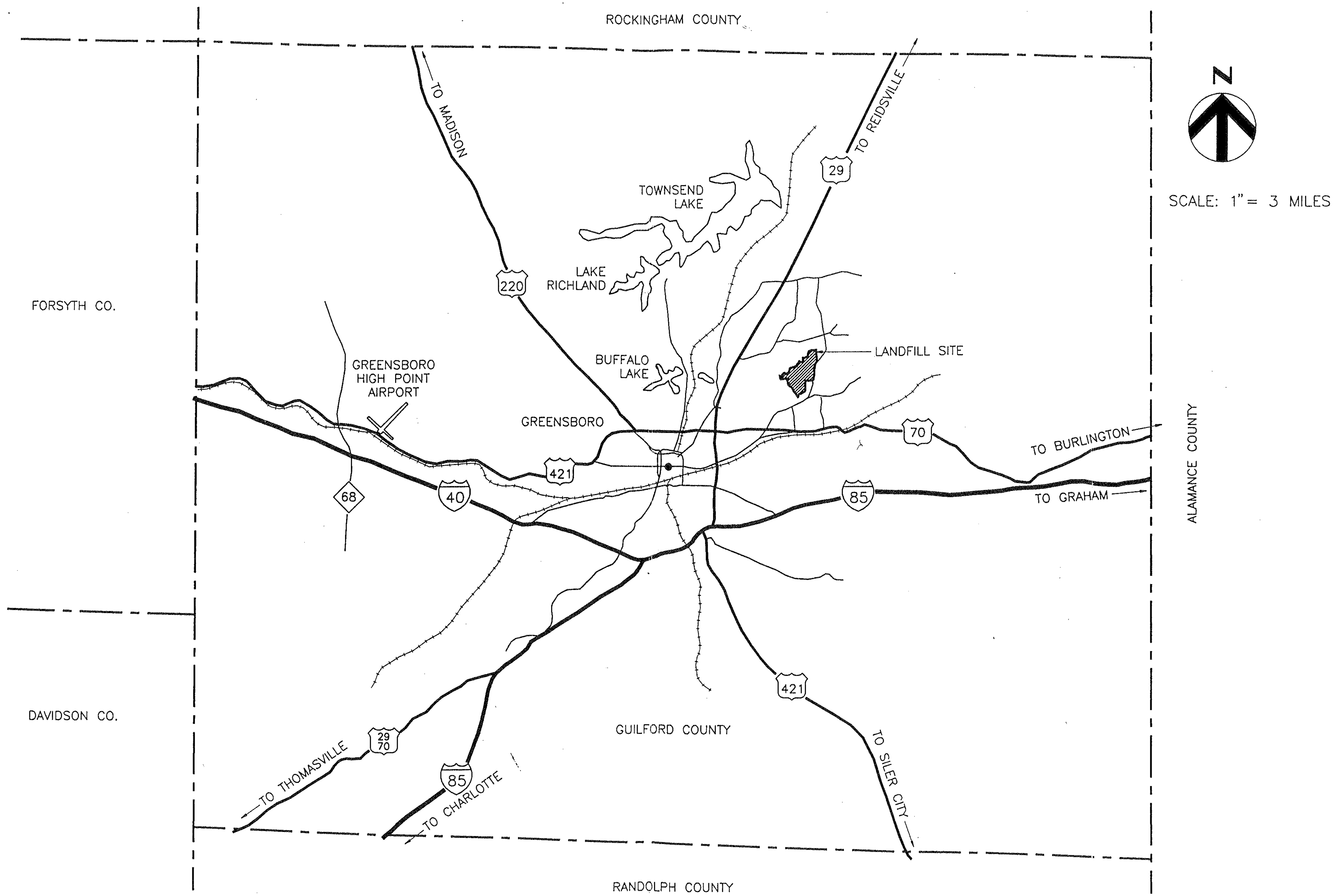
The purpose of this Site Study is to demonstrate that the area of the White Street Sanitary Landfill which the City of Greensboro intends to develop, known as Phase III, is suitable for establishing a municipal solid waste landfill (MSWLF) unit as defined by Rule .1618.

## 1.2 Background

The City of Greensboro, North Carolina, owns and operates the White Street Sanitary Landfill (Solid Waste Permit No. 41-03) located in the northeast quadrant of the City, at the east end of White Street (see Figure 1-1 -- Location Map). The White Street Sanitary Landfill is used for the disposal of municipal solid waste (MSW) generated within the City of Greensboro and Guilford County.

Waste disposal activities in the area now known as the White Street Sanitary Landfill began in 1943, and primarily consisted of burning of garbage and trash on the site. Burning operations ceased in the mid-1960's, and since that time waste has been buried on site. The current landfill property covers an area of approximately 767 acres. As constructed, the City of Greensboro's White Street Sanitary Landfill is divided into two Phases. Phase I is an 85 acre site that stopped receiving waste prior to 1978. The current active fill area, Phase II, consists of approximately 120 acres.

It is the City's intent to develop a lined unit (Phase III) in accordance with Rule .1600 in which municipal solid waste be disposed after the closure of Phase II. The area which the City intends to develop as Phase III encompasses the current borrow area for Phase II (south of White Street). Additional City properties are located east of the current borrow area and have been acquired and is part of the landfill property.




HDR

HDR Engineering, Inc.

WHITE STREET SANITARY LANDFILL
LOCATION MAP

| | |
|---|---|
| Date | 2/95 |
| Figure | 1-1 |

FILENAME: LOCMAP

A common titling system is used to identify the areas around the landfill and to reduce errors in terminology. The following are a list of names that are given to the various areas:

- **Proposed Facility** - Includes all property, structures, and appurtenances owned by the City and designated as landfill property, exclusive of areas Phase I and Phase II (see definitions below). The boundary of the proposed facility expansion is the line from which both the local and regional study areas have been defined, and is adjacent to the current landfill facility.

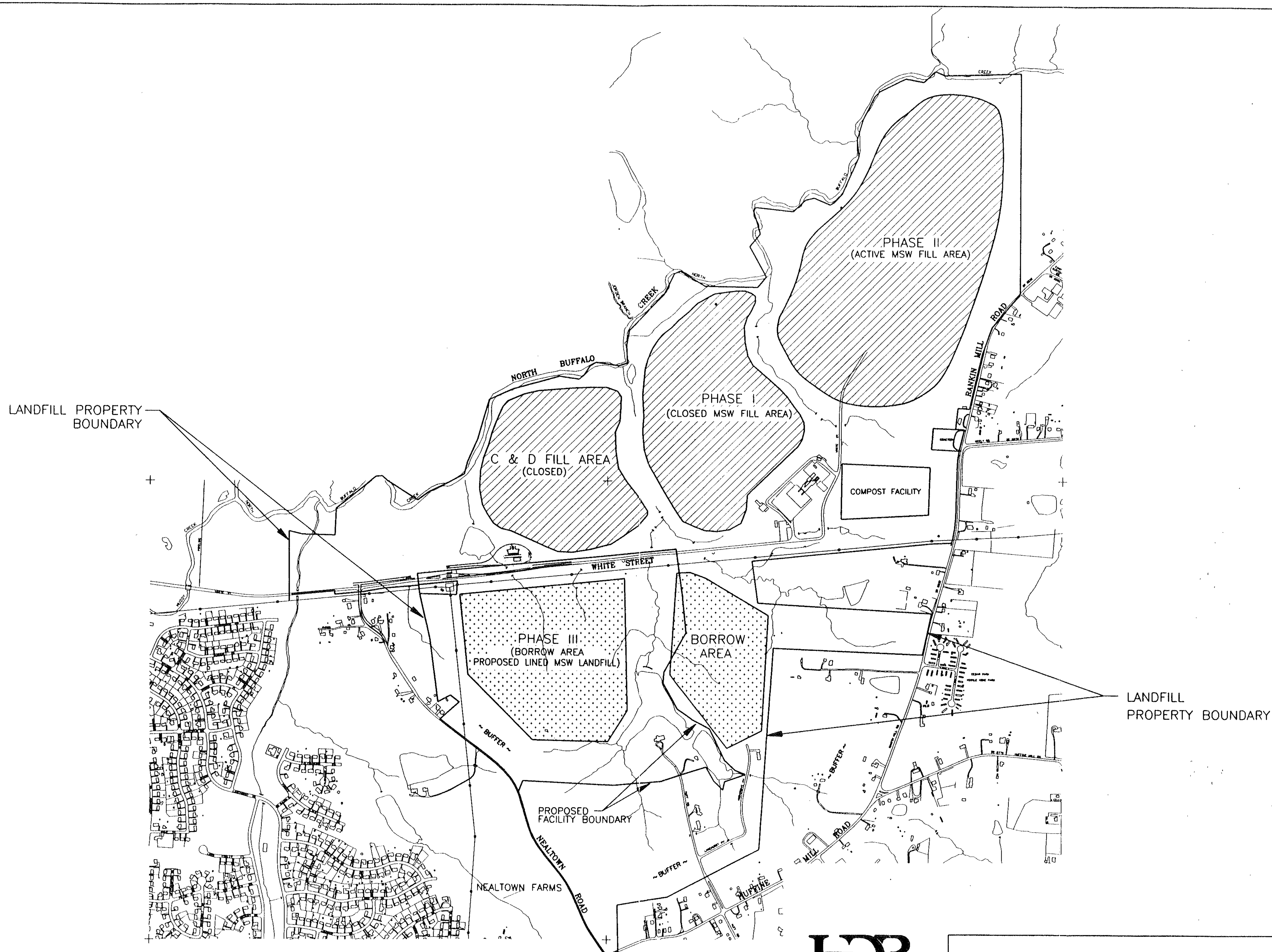
- **Phase I** - See Figure 1-2 for the delineation of the area which has been designated as Phase I. This area stopped receiving waste prior to 1978.

- **Phase II** - See Figure 1-2 for the delineation of the area which has been designated as Phase II. This area comprises the current active fill area, and is the subject of the Transition Plan which has been submitted to the North Carolina Department of Environmental Health and Natural Resources (NC DEHNR).

- **Phase III** - See Figure 1-2 for the delineation of the area which has been designated as Phase III. This is the area in which the City proposes to construct its new lined facility.

## 1.3 General

In accordance with the new Subtitle D regulations for solid waste disposal and North Carolina Solid Waste Management Rules, the City has applied for and received an Amendment to Permit # 41-03 for the modification and vertical expansion of the White Street Sanitary Landfill. This permit will allow the City to continue disposal operations in the Phase II unit until March 4, 1997. As part of the Transition Plan submitted to the State on April 9, 1994, the City requested an extension of the current permit from March 4, 1997 to January 1, 1998 in order to bring the side slopes up to the 5% minimum post-settlement allowed under Subtitle D. Based on comments and discussions with NC DEHNR, the City is revising the Transition Plan to reflect the diminishing waste stream and the City's desire to close the unit with a more environmentally friendly cap. The request for the nine month extension of permitted filling is pending approval by NC DEHNR.




HDR

HDR Engineering, Inc.

WHITE STREET SANITARY LANDFILL
LANDFILL PROPERTY DEVELOPMENT

REVISED 2/96

Date 2/95

Figure 1-2

FILENAME: FIG1-2

In accordance with Rule .1618 (c)(5), local government approval of the proposed Phase III site has been obtained and is presented in Appendix A. The site of the proposed facility is on a tract of land adjacent to the current White Street Sanitary Landfill. It is the City's intent that the first cell of the Phase III unit will be completed and ready to receive municipal solid waste generated within the City of Greensboro and Guilford County upon the closure of operations in Phase II.

## SECTION 2.0
## CHARACTERIZATION STUDIES

### 2.1 Regional

The North Carolina Solid Waste Management Rules and Solid Waste Management Law requires that a regional characterization study be conducted of the proposed MSWLF facility site. This study addresses the characteristics of the area within a two-mile perimeter as measured from the proposed facility boundary. In accordance with Rule .1618, the most recent (photorevised 1968) U.S.G.S. Topographic Map, 7.5 Minute Series, horizontal scale of one inch equals 2,000 feet, is presented herein as Figure 2-1. This Map depicts the general topography and features of the regional study area. Additional information concerning the characteristics associated with the proposed MSWLF facility site and the region which lies within a two-mile perimeter of the proposed facility boundary is presented in the sections that follow.

#### 2.1.1 Landfill Facility Location

Municipal solid waste generated by the City of Greensboro and Guilford County is currently disposed of in the area known as Phase II of the White Street Sanitary Landfill. Phase II is an unlined facility. The City of Greensboro is proposing to develop a lined MSWLF facility (known as Phase III); the successful accomplishment of this task will ensure both the City and County with continuous MSW disposal capacity.

The City of Greensboro has identified approximately 146 acres of land (identified as the facility boundary) adjacent to the existing White Street Sanitary Landfill (see Figures 2-3 and 2-4A) for the development of Phase III. The site which has been selected for the purposes of developing lined landfill disposal capacity lies within the area defined on the north by White Street, on the west by Nealtown Road, on the south by Huffine Mill Road, and on the east by Rankin Mill Road.

### 2.1.2 Public Water Supply Wells, Surface Water Intakes and Service Areas

According to the records maintained by NC DEHNR (see Appendix B), there are public water supply wells serving five facilities within the regional study area. Public water supply wells currently serve the former North Buffalo Chapel (now Memorial Presbyterian Church), Briggs Memorial Baptist Church and Day Care facility located on Rankin Mill Road, the NC DOT Bridge Unit facility located on Camp Burton Road, the Camp Burton State Prison facility located on Camp Burton Road, and the Cedar Park Mobile Home Park located on Rankin Mill Road. Figure 2-1 indicates the location of each public water supply well. The nearest public supply well is at the Cedar Park Mobile Home Park, located approximately 4,000 feet from the center of the proposed expansion area. The proximity of other wells to the proposed lined area of Phase III ranges up to approximately 8,500 feet.

Regarding surface water intakes, records maintained by NC DEHNR (see Appendix B) indicate that there are only four surface water intakes serving the City of Greensboro. These intakes are located at Lake Brandt, Lake Higgins, Lake Townsend, and Lake Jeanette; none of which are within the two-mile regional study area.

City water service areas were determined from City water line maps. These areas encompass residences and businesses located to the west of the proposed facility. In addition, city water services are supplied to residences and businesses along the Highway 70 corridor, and to neighborhoods surrounding Rankin Mill Road heading east to the point where Huffine Mill Road splits from Rankin Mill Road (see Figure 2-1).

### 2.1.3 Residential Subdivisions

The site proposed for the development of Phase III of the White Street Sanitary Landfill is located in the northeast quadrant of the City of Greensboro, adjacent to the current fill area known as Phase II. Public access to the facility is at the east end of White Street.

According to City planning maps, there are nine areas designated as residential subdivisions within the regional study area. These subdivisions include Kings

Forest, Woodmeer Park, Nealtown Farms, Glendale Hills, East White Oaks, Penrose Estates, Forest Hills, Turner Gant Woods Habitat for Humanity (Proposed), and Woodbriar Estates (see Figure 2-1).

### 2.1.4 Waste Transportation Routes

The proposed site for the development of Phase III of the White Street Sanitary Landfill is located approximately 1.5 miles from the nearest State Highway (Highway 29), providing access to major thoroughfares. The primary waste transportation routes which are currently used to gain access to the White Street Sanitary Landfill include Highway 29, White Street, Summit Avenue, Market Street, Camp Burton Road, Wendover Avenue, Huffine Mill Road, Rankin Mill Road, Nealtown Road, and small sections of Cone Blvd.and Phillips Avenue. While it is anticipated that these transportation routes will continue to serve as the primary means of access to the White Street Sanitary Landfill, there has been discussion of prohibiting traffic along several residential streets. Growth plans for the area, including the outer loop that will be constructed adjacent to the landfill, may provide alternate routes in the future.

### 2.1.5 Public Use Airports and Runways

According to Federal Aviation Administration officials at the U.S. Department of Transportation office in College Park, Georgia, and State of North Carolina Department of Transportation, Division of Aviation officials who have been notified of the pending application for a permit (see Appendix B), there are no public use airports or runways located within a two-mile perimeter as measured from the boundary of the proposed facility. Both officials contacted have noted that there is one airport, the Air Harbor Airport, located within 5 miles of the proposed facility. However, for the purposes of this site study, there are no public use airports or runways located within the regional study area.

## 2.2 Local

The North Carolina Solid Waste Management Rules and Solid Waste Management Law requires that a local characterization study be conducted of the proposed MSWLF facility within a 2,000-foot perimeter as measured from the proposed facility boundary.

In accordance with Rule .1618, an aerial photograph taken on November 9, 1994, is presented as Figure 2-2; a map illustrating the local study area is presented as Figure 2-3. Both the map and photograph are at a scale of one inch equals 400 feet.

Additional information concerning the characteristics associated with the proposed MSWLF facility and the local area which lies within a 2,000-foot perimeter of the proposed facility boundary is presented in the sections that follow.

### 2.2.1 Disposal Site Property and On-Site Easements

Since 1987, the City of Greensboro has acquired approximately 274 acres of property in anticipation of developing a lined landfill disposal facility (see Figure 2-4). The proposed Phase III facility boundary comprises approximately 146 acres of this area (see Figure 2-4A) and is located to the south and upgradient of the current active fill area (Phase II). With the exception of a portion of the uncompleted Forest Lake Subdivision which had been developed as a country club and three residential units located along Highgrove Avenue and Huff Street, the property is undeveloped.

Duke Power owns a substation located at the northwest corner of the site and two power line easements along the northern and western boundaries of the site. The MSWLF units will not encroach upon these easements. The width of these easements and their ownership are indicated on Figure 2-4.

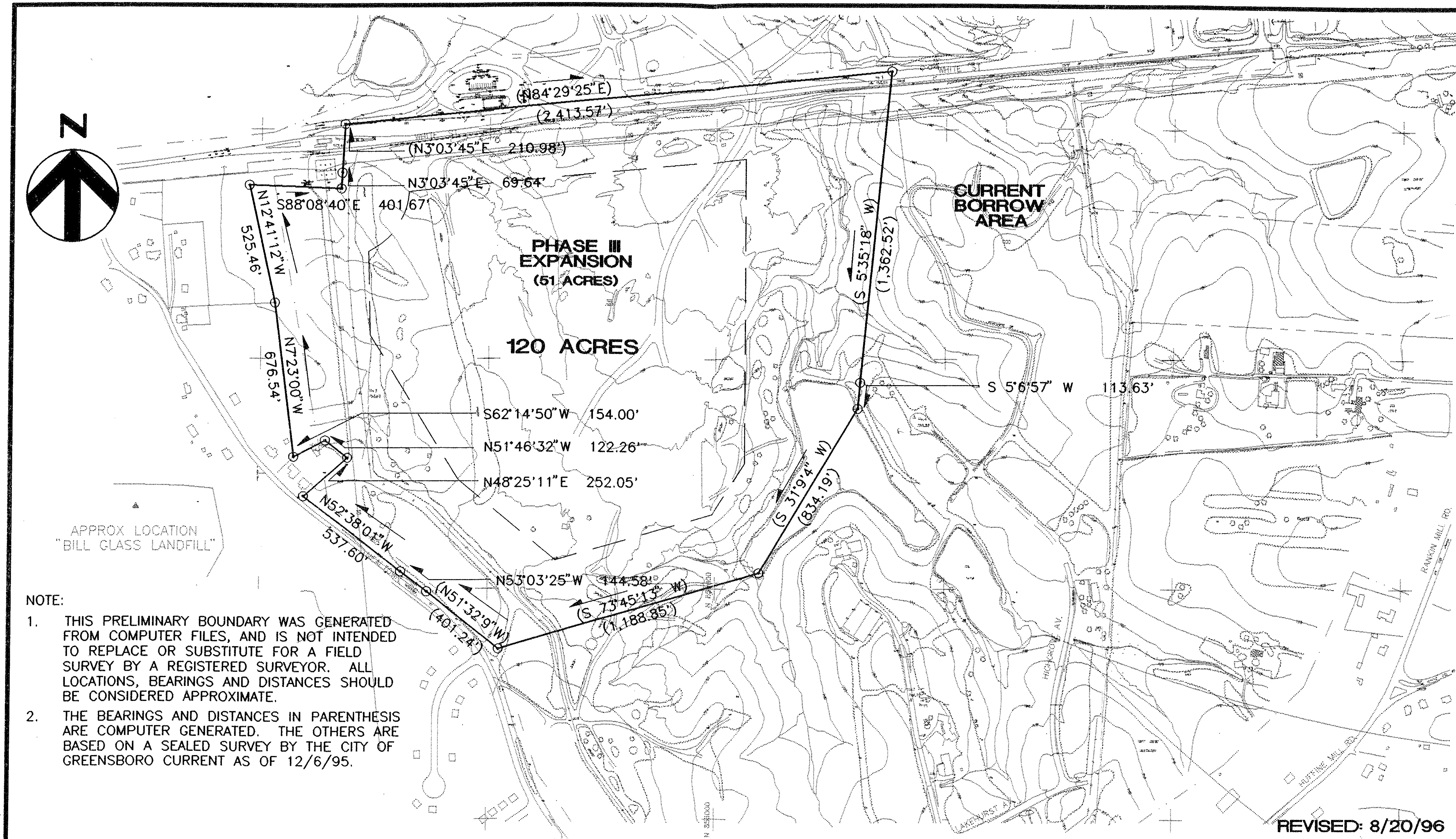
Within the proposed MSWLF facility boundaries, structural development consists of a gravel road and two buildings which were formerly part of the Forest Lake Country Club facility. Demolition of these buildings is anticipated.

The City has drained the two manmade lakes which previously existed within the proposed facility property boundary just to the east of the proposed landfill footprint. This drainage occurred between June 15 and June 22, 1995.

The proposed facility which is under the City's control (see Figure 2-4A) is considered to be adequate in both size and hydro-geological characteristics for the development of an environmentally sound lined landfill facility.

| Title Block | Figure |
|---|---|
| **WHITE STREET SANITARY LANDFILL BOUNDARY SURVEY** | **2-4** |
| **Description of Contents** | |
| Proposed boundary of the landfill facility. | |

→ Survey excludes Duke Power northern right-of-way.
≠ other figures
wd. affect 300 ft. buffer




NOTE:

1. THIS PRELIMINARY BOUNDARY WAS GENERATED FROM COMPUTER FILES, AND IS NOT INTENDED TO REPLACE OR SUBSTITUTE FOR A FIELD SURVEY BY A REGISTERED SURVEYOR. ALL LOCATIONS, BEARINGS AND DISTANCES SHOULD BE CONSIDERED APPROXIMATE.
2. THE BEARINGS AND DISTANCES IN PARENTHESIS ARE COMPUTER GENERATED. THE OTHERS ARE BASED ON A SEALED SURVEY BY THE CITY OF GREENSBORO CURRENT AS OF 12/6/95.

-400 0 200 400 800

SCALE: 1"=400'

FILENAME: P:\GBORO\PHASE3FB.DWG

REVISED: 8/20/96

HDR

HDR Engineering, Inc.

GREENSBORO
WHITE STREET LANDFILL

PHASE III FACILITY BOUNDARY

GREENSBORO NORTH CAROLINA

Date 5/8/96

Figure 2-4A

### 2.2.2 Existing Land Use and Zoning

The proposed facility property within the City limits is zoned CU-HI (Conditional Use - Heavy Industry). The proposed facility property which has been acquired outside of the City limits for the development of Phase III of the White Street Sanitary Landfill has been annexed and rezoned to CU-HI (Conditional Use - Heavy Industry) -- see Appendix A.

Within 2,000 feet of the proposed facility boundary, land use consists of AG (Agricultural), CU-HI (Conditional Use - Heavy Industry), LI (Light Industrial District), LB (Limited Business District), GB (General Business District), GO-M (General Office Moderate Intensity District -- 12.0 units per acre or less), RS-5 (Residential Single Family District -- 7.0 units or less per acre), RS-9 (Residential Single Family District -- 4.0 units or less per acre), RS-12 (Residential Single Family District -- 3.0 units or less per acre), RS-30 (Residential Single Family District -- 1.3 units or less per acre), RS-30-MH (Residential Single Family Mobile Home District -- 1.3 units or less per acre), and RM-12 (Residential Multifamily District -- 12.0 units per acre or less). Figure 2-5 depicts the existing zoning within 2,000 feet of the proposed facility boundary.

### 2.2.3 Private Residences and Schools

The nearest private residences are located to the south of the proposed facility boundary on Nealtown and Huffine Mill Roads. The required buffer zone of 500 feet will be maintained from the residences to the boundary of the proposed MSWLF unit.

With regards to schools, there is only one school located within the local study area. Mt. Zion School is located on Huffine Mill Road between Mt. Zion Street and Anderson Street, and is approximately 600 feet from the landfill property and 2,600 from the boundary of the proposed MSWLF unit.

Figures 2-2 and 2-3 depict the location of private residences and schools which are located within two thousand feet of the proposed facility boundary.

| Title Block | Figure |
|---|---|
| **WHITE STREET SANITARY LANDFILL LOCAL LAND USE AND ZONING MAP** | **2-5** |

| **Description of Contents** |
|---|
| Map (scale of one inch = 400 feet) of area which includes the landfill facility and a 2,000 foot perimeter measured from the proposed boundary of the landfill facility which depicts the following: ***Add North directional arrow to map.***<br>► Existing land use and zoning for property included in the landfill facility and a 2,000 foot perimeter measured from the proposed boundary of the landfill facility.<br>DONE! |

### 2.2.4 Potential Sources of Contamination

On November 1, 1995, HDR retained the services of Environmental Data Resources, Inc. (EDR) to provide environmental risk management data for the Phase III area of the White Street Landfill by searching Federal, State, and local databases to identify sites with potential environmental concerns. The results of EDR's search is summarized in the attached EDR-Radius Map (with GeoCheck) report in Appendix B. The following is a summary of EDR's findings based on HDR's evaluation of the data.

Twenty-Three databases were investigated with a search radius of 2,640 feet (½ mile) from the Phase III property. Sites with adequate address information were mapped on a United States Geological Survey 1-degree Digital Elevation Model map. Those sites with insufficient data to be mapped (i.e., orphan sites) were listed on an orphan summary list with their available address, database, and facility ID information. Each orphan site was individually evaluated as to its minimum distance from the site using a Greensboro street map. Only those sites which were determined to be located within the search distance radius of ½-mile were considered significant.

#### 2.2.4.1 Local Environmental Findings

Commercial and industrial buildings within the local study area are confined to facilities located on Huffine Mill, Rankin, and Keely Roads. The commercial and/or industrial operations which do exist in this area are not known to be or expected to become actual sources of contamination.

The EH Glass County landfill (the "Bill Glass" landfill) was reported (and mapped) as a State Hazardous Waste site, and is also listed on the EPA's Facility Index System (FINDS), and on CERCLIS (Comprehensive Environmental Response, Compensation, and Liability Information System). The site is located off Nealtown Road approximately 1,000 feet west of the site. The site was first listed on June 1, 1981, with a preliminary assessment completed on August 1, 1984. A subsequent screening site inspection was completed on July 29, 1988. The EPA has determined that no further action was necessary concerning this site and that no hazards were identified. The site is not listed on the National priority List (NPL).

The old "Bill Glass" landfill was operated by the Glass family between the early 1960's and the mid 1970's (according to local sources and aerial photographs). The boundary shown on Figures 2-3 and 2-5 was taken from a 1972 aerial photo. During our site investigation, two monitoring wells were placed on the landfill property nearest the "Bill Glass" landfill (borings B2 and B36). No methane was detected in the monitoring well located nearest to Nealtown Road (boring B36).

At boring B2, methane was detected. Further exploration around boring B2 revealed that Vick's products (cough drops and other miscellaneous products) had been disposed of at the site. The Winston-Salem DEHNR was notified of the situation and Proctor and Gamble has cleaned up the contaminated area.

A review of the orphan summary list revealed that the White Street Landfill is listed on the UST (underground storage tank), RCRIS-SQG (Resource Conservation and Recovery Information System-Small Quantity Generator), LUST (leaking underground storage tank), SHWS (state hazardous waste site), SWF/LF (solid waste facility/landfill), FINDS (Facility Index System), and CERCLIS-NFRAP (Comprehensive Environmental Response, Compensation, and Liability Information System) databases. According to City records, a diesel underground storage tank was removed near the maintenance facility in 1990. Petroleum-impacted soil was discovered during closure activities and, subsequently, several tons of soil were removed and properly disposed of in accordance with State requirements. The LUST incident was reported to the Winston-Salem Regional Office of the Division of Environmental Management. One registered 10,000-gallon double-walled fiberglass tank (gasoline) and one registered 20,000-gallon double-walled fiberglass tank (diesel) currently exist at this location. The tanks were installed in May and December of 1990, respectively. The Phase III area is upgradient of both the Phase I/II landfills and the UST site.

The City of Greensboro's North Buffalo Creek Wastewater Treatment Facility was cited under different names. The only additional orphan site within the search radius, North Buffalo Pollution Control, is listed as a state hazardous waste site (SHWS). The North Buffalo Waste Water Treatment Facility was reported on the RCRIS-SQG database. This facility reportedly generates, transports, stores, treats, and/or disposes small quantities (i.e., small quantity generator) of hazardous waste as defined by the Resource Conservation and

Recovery Act (RCRA). The site is located approximately 4,800 feet (0.9 miles) west of the landfill on White Street.

Effluent from the WWTP is discharged into North Buffalo Creek, which flows through the northern portion of the local study area. Despite the proximity of the treatment facility, contamination as a result of the operation of the WWTP is not anticipated, as both the WWTP and Creek are located downgradient from the Phase III site.

#### 2.2.4.2 Remediation

Site remediation (on behalf of the Procter & Gamble Manufacturing Company) consisting of the excavation, transportation, and disposal of non-hazardous waste material from city-owned property located adjacent to the proposed Phase III landfill was performed by Rollins Environmental Site Services between April and early June of 1995. The waste streams consisted of product manufactured by Richardson Vicks, Inc. ("RVI Product") and other waste materials ("OWM"). An Action Plan prepared by Rollins Environmental was accepted by the North Carolina Department of Environment, Health, and Natural Resources Solid Waste Section on March 31, 1995. The "RVI Product" was removed from the site and destroyed by Proctor and Gamble. The "OWM" was properly disposed of in Phase II. No further investigation or remedial efforts have been performed on the subject site since completion of waste removal and disposal.

#### 2.2.4.3. Conclusions

Although there are areas of known local contamination within a ½-mile radius of the site, based on the relative distance to the site and local hydrogeologic characteristics, it is not expected that any of these sites will impact the proposed expansion site.

### 2.2.5 Potable Wells

Potable water needs within the local study area are primarily met by City water services. However an estimated 29 homes are located outside of the City limits and are dependent upon private wells for their potable water needs (see Figure 2-3). These homes are located along Rankin Mill and Keeley Roads, at distances of approximately 2,600 to 4,600 feet from the proposed MSWLF unit boundary. The nearest public water supply well is located about 4,000 feet east of the Phase III area, at the Cedar Park Mobile Home Park (see Figures 2-1 and 2-3).

### 2.2.6 Historic Sites

An informational search of the records maintained by the State Department of Cultural Resources did not reveal any known structures of historical or architectural importance located within the local study area (see Appendix B). On the recommendation of the Department, further review of the area was performed to determine whether or not there were any archaeological sites within the proposed facility boundaries. The results of the archaeological survey are also included in Appendix B. The findings indicate that there are no prehistoric or historic archaeological resources within the proposed facility boundary, however one area within the local study area which is of potential significance was identified. Further investigation of this finding is not expected to be conducted due to the fact that the area in question is located outside of the Landfill property boundaries, and therefore shall not be disturbed by landfill activities.

### 2.2.7 Surface Water Drainage Patterns, Watersheds and Floodplains

The surface water drainage patterns within the local study area can be divided into two distinct areas. The two areas are roughly divided by Nealtown Road, Huffine Mill Road and Rankin Mill Road. The roads run along the ridgeline that separates the water that drains through the existing landfill site and those that drain away from the existing and proposed landfill areas.

Surface water falling west of Nealtown Road collects and flows north to North Buffalo Creek upstream of the landfill. Water falling south of Huffine Mill Road flows generally east to South Buffalo Creek. Water falling east of Rankin Mill Road flows north to North Buffalo Creek downstream of the landfill. The water falling within the area bounded by the roads and North Buffalo Creek flows north through the existing landfill site.

North Buffalo Creek drains a watershed that is not classified for use as a source of potable water.

According to Army Corps of Engineers Maps and FEMA Maps (FEMA Maps are included in Appendix B) on file with the City of Greensboro, the proposed facility is not located in a 100-year floodplain.

## SECTION 3.0
## SITE HYDROGEOLOGIC REPORT

The North Carolina Solid Waste Management Rules and Solid Waste Management Law require that a site hydrogeologic report be prepared which assesses the geologic and hydrogeologic characteristics of the proposed site to determine: the suitability of the site for solid waste management activities; which areas of the site are most suitable for MSWLF units; and the general groundwater flow paths and rates for the uppermost aquifer. This information is presented in the sections that follow.

### 3.1 Geology and Hydrology Setting

#### 3.1.1 Regional Setting

The White Street Landfill (the landfill) is located in the upland portion of the southern Piedmont physiographic province (Fenneman, N.M., 1938, Physiography of the Eastern United States: New York, McGraw-Hill). The physiography of the Piedmont is characterized by gentle to rough, hilly terrain that becomes more hilly towards the mountains and is dissected by a mature drainage system. The topography is developed on deeply weathered, belted metamorphic and igneous rocks that generally date from late Precambrian to Paleozoic in age.

The landfill lies near the western margin of the Carolina Slate Belt, a regionally defined terrain that extends from Virginia to Georgia and includes volcanic and sedimentary rocks of Late Precambrian to Cambrian age that, in the Greensboro area, are metamorphosed to lower greenschist facies and intruded by a variety of plutons (North Carolina Geological Survey, 1985, Geologic map of North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section). The Carolina Slate Belt, Kings Mountain Belt to the southwest, and the Charlotte Belt to the west are all part of a larger terrain known as the Carolina Terrain. Rock relationships, fossil evidence, and geochemical data from the Carolina Terrain indicate that it was primarily formed in a subduction-related, tectonically active volcanic arc separate from the North American Craton (Butler, J. Robert, and Secor, Donald T., Jr., 1991, in Horton, J. Wright, Jr., and Zullo, Victor A., eds., The Geology of the

Carolinas: Carolina Geological Society Fiftieth Anniversary Volume: Knoxville, The University of Tennessee Press, p. 59-78). The Carolina Terrain was probably sutured to North America during the Taconic Orogeny, 470-440 million years ago (Middle Ordovician), at which time deformation and associated metamorphism of the Slate Belt also peaked.

Groundwater in the Piedmont occurs both intergranularly in the unconsolidated saprolite and within fractures in the bedrock. Typically, although not always, the water table is within the saprolite. Water supply wells are completed in bedrock.

Porosity in the saprolite is usually relatively high, with measured values commonly in the 40 to 50% range. "Effective" porosity is lower, typically ranging from 20 to 30%. In bedrock, porosity is normally only 3 to 5%, but the fractures are often well connected and hydraulic conductivity is comparable to or higher than that found in the saprolite. As the saprolite and bedrock are hydraulically connected, the contrast between porosities allows the saprolite to act as a groundwater reservoir for wells that pump from the bedrock. Sustained well yields for average, well-constructed bedrock wells in the Piedmont average about 12 to 24 gallons per minute (Daniel, Charles C., III, and Payne, R.A., 1990, Hydrogeologic Unit Map of the Piedmont and Blue Ridge Provinces of North Carolina, U.S.G.S. Water-Resources Investigations Report 90-4035).

The water table in the Piedmont under natural conditions is a subdued image of the surface topography. Recharge takes place on interfluvial areas, then travels downward and laterally to discharge along perennial creeks and rivers. Thus, the vertical component of groundwater flow is directed downward in interfluvial recharge areas, comprising perhaps 80 to 90% of land surface, and then has an upward component of flow as groundwater approaches discharge areas at streams.

### 3.1.2 Local Setting

No detailed geologic mapping is available in the literature for the landfill and Greensboro area. The following general discussion is based upon the State geologic map (North Carolina Geological Survey, 1985, Geologic Map of North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section), which in turn used the regional mapping of Mundorff (Mundorff, M.J., 1948, Geology and Ground Water in the

Greensboro area, North Carolina: North Carolina Department of Conservation and Development, Bulletin Number 55) and Carpenter (Carpenter, P. Albert, III, 1982, Geologic Map of Region G, North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section, Regional Geology Series 2).

In the general mapping by the above referenced sources, the area of the landfill is depicted as lying in a large area of metamorphosed granitic rock, described on the State map as "Metamorphosed granitic rock, Late Proterozoic to Late Cambrian, megacrystic, well foliated, locally contains hornblende." Nearby mapped units include metamorphosed gabbro and diorite ("foliated to massive"), felsic metavolcanic rocks ("metamorphosed dacitic to rhyolitic flows and tuffs, light gray to greenish gray; interbedded with mafic and intermediate metavolcanic rock, meta-argillite, and metamudstone"), and mafic metavolcanic rock ("metamorphosed basaltic flows and tuffs, dark green to black; interbedded with felsic and intermediate metavolcanic rock and metamudstone). As noted by both Mundorff and Carpenter, these lithologies are often found together and their mapping is based upon predominance of lithologies in each area. Mundorff further notes that the granitic rocks are "Cut by innumerable mafic schistose or slaty dikes which resemble the greenstone schist," i.e. the mafic metavolcanic rocks. Mapping by Burt et.al.. (Burt, E.R., Carpenter, P.A., III, McDaniel, R.D., and Wilson, W.F., 1978, Diabase Dikes of the Eastern Piedmont of North Carolina: North Carolina Department of Natural Resources and Community Development, Geological Survey Section, Information Circular 23) indicates that the nearest Jurassic diabase dike is found more than 4 miles south of the landfill.

Concerning local hydrology, the rocks underlying the landfill area are shown by Mundorff as "sheared granite - light pink to gray, mostly coarse-grained, sheared biotite granite. Water occurs in fractures and joints. Adequate yields for domestic supplies at most places. Moderate supplies for municipal and industrial users at some places, inadequate supplies at others." Daniel and Payne (Daniel, Charles C., III, and Payne, R.A., 1990, Hydrogeologic Unit Map of the Piedmont and Blue Ridge Provinces of North Carolina, U.S.G.S. Water-Resources Investigations Report 90-4035) describe the hydrogeological unit at the landfill as "light colored, massive to foliated, metamorphosed bodies of varying assemblages of felsic intrusive rock types, local shearing and jointing are common." Their well yield graph indicates average groundwater yields of 19 gallons per minute from average water supply wells completed in these rocks.

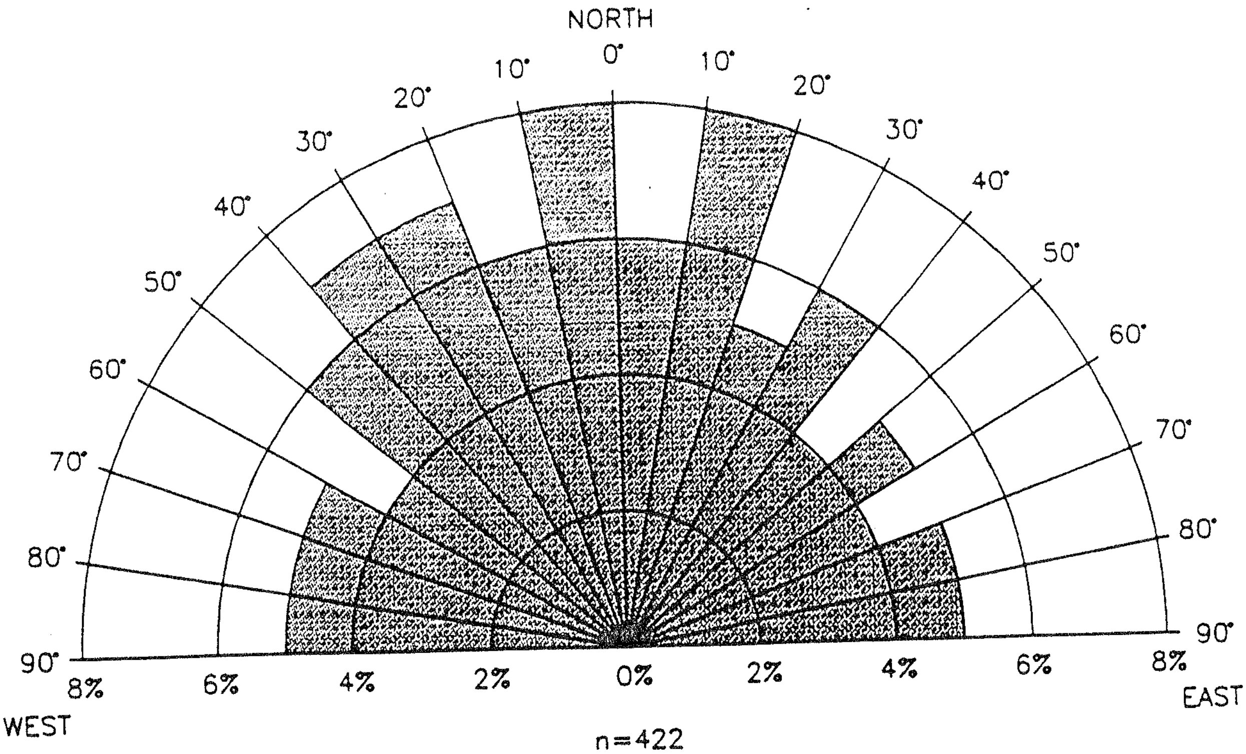
### 3.1.3 Fracture Trace and Foliation Analysis

A fracture trace analysis was prepared following the procedure recommended by Gerritsen and Murray, 1992 (Gerritsen, S.S. and Murray, E.L., 1992, "Fracture Trace Techniques for Contamination Assessments in the Piedmont," *in* Daniel, C.C., III, R.K. White, and P.A. Stone, Ground Water in the Piedmont: Clemson, South Carolina, Clemson University Press). An overlay was placed over the U.S.G.S. 1:24,000 topographic maps that encompass a two-mile radius of the site (the Lake Brandt, Browns Summit, Greensboro, and McLeansville Quads). Then, the straight line segments of streams and tributary valleys were plotted. The strikes of these lines, 422 segments in all, were then recorded and a rose diagram produced (Figure 3-1).

The resulting rose diagram shows a wide range of straight line valley segment orientations. The strongest peak occurs at an orientation of between north 10 degrees west and north 20 degrees east. A subsidiary peak orientation is located at north 40 to 30 degrees west. The strongest null is found at north 40 to 70 degrees east.

As is discussed below, the area for the proposed Phase III landfill cell is underlain by relatively shallow bedrock. Rock has been encountered by heavy equipment and exposed during the excavation of the former borrow pit and other related landfill operations. In addition, where the surficial soil has been removed and saprolite exposed, remnant bedrock textures are also found. Details of the geology as interpreted by HDR are discussed below, but a significant result of this mapping is an evaluation of rock contacts and foliation trends.

The mapping indicates that the study area is divided roughly in half, with felsic to intermediate gneiss, and associated saprolite occurring to the west and southwest, and massive white granite and associated saprolite occurring to the east and northeast. The entire Phase III area is cross-cut by a number of metamorphosed NNE-trending mafic, rhyolitic, dioritic, and greenstone dikes.




# ROSE DIAGRAM OF LINEAR STREAM SEGMENT TRENDS IN THE AREA SURROUNDING LANDFILL

HDR

HDR Engineering, Inc.

GREENSBORO WHITE STREET SANITARY LANDFILL

GUILFORD COUNTY NORTH CAROLINA

Date 2/95

Figure 3-1

FILENAME:GBORO\ROSEDIA

These intrusives are less prominent in the older, darker-colored metamorphic terrain as opposed to the granite. Foliation directions in the felsic gneiss were very consistent, with all measurements falling between N65E and N70E.

## 3.2 Site Physiographic and Hydrologic Features

### 3.2.1 Physiography

As noted in Section 2 of this Study, the site proposed for development of Phase III is located south of White Street and is bounded on the west by Nealtown Road, on the south by Huffine Mill Road, and to the east by Rankin Mill Road. Each of these roads are located on ridges that form drainage divides. To the south, Huffine Mill Road runs along a ridge which locally forms the divide between the Buffalo Creek drainage to the south, and the North Buffalo Creek drainage to the north. Both Nealtown Road and Rankin Mill Road are on ridges that separate north-flowing tributaries of North Buffalo Creek. Thus, all surface water on the site ultimately flows north to North Buffalo Creek.

The original topographic configuration of the site is illustrated on the accompanying U.S.G.S. topographic map, Figure 2-1, the topography of which dates from 1968. The dominant features of the area include a central perennial drainage which was impounded into two small lakes by previous land owners. (These two lakes were drained by the City between June 15 and June 22, 1995.) The area proposed as the footprint for the Phase III cell is located to the west of this central drainage, and was a ridge area drained by three north-draining ephemeral drainages. Further to the east is a simple ridge (the proposed borrow area) that divides the central drainage from another, smaller perennial drainage near the eastern edge of the site. Elevations of the study area range from over 810 feet msl along Huffine Mill Road, to less than 710 feet msl where the central drainage crosses under White Street.

In recent years, the topography of the area south of White Street and west of the central drainage (the Phase III site) has been modified, as landfill operations have used this area for borrow. The topography of this area as of November 1994, when field activities were conducted for this study, is illustrated in the many detailed site topographic maps that accompany this report. As much as 25 feet of soil/saprolite has been removed in certain areas; but, it is important to note that the major hydrogeologic investigations in the Phase III area, including advancement of soil test borings, rock coring, and monitoring well/piezometer installation, were conducted prior to resuming borrow activities at the expansion site. Borrow activities continued in the area for about ten months after the investigations were completed, but were stopped based on NCDEHNR and HDR advice.

Ground water level measurements taken on a monthly basis since December of 1994 have been used to try to gauge the effect of changes in topography due to borrow activities or changes in surface water hydrology due to drainage of the lakes. The two effects are difficult to distinguish from one another, since the causes occurred at about the same time and both are expected to produce a lowering of the water table. To date, the effect of these manmade events appears to be a very small one, and is only evident along the eastern margin of the Phase III area, near the central drainage. There, a 2-4 foot (approx.) lowering is evident in observation wells which are immediately adjacent to the former lakes, suggesting that the changes in topography due to borrow activities have had little or no effect upon the hydrogeology of the Phase III site. The local effect of lake drainage does not appear to extend beneath the proposed landfill footprint.

### 3.2.2 Hydrology

North Buffalo Creek flows within 1,000 feet of the local study area in which Phase III is proposed for development. As noted above, all surface water from the site flows to North Buffalo Creek. The City of Greensboro discharges treated wastewater effluent into the Creek, which is a tributary to the Haw River. Presently, the stream quality is typical of an urbanized area with multiple municipal and industrial discharges, according to data from a gaging station east of the landfill. Comparison of water quality upstream of the existing landfill to that downstream tends to indicate water quality as being generally better downstream than upstream of the landfill.

In the area proposed for Phase III development, surface water drainage has been modified by use of the area for borrow. Various channels and catch basins have been constructed in the area to control run-off and erosion. These features then convey the collected surface water beneath White Street to ultimate discharge into North Buffalo Creek.

As is discussed in detail below, the water table in the study area is a subdued image of the surface topography. As such, groundwater flow is away from upland areas and toward perennial streams. In the study area, groundwater is discharging into the central drainage which separates the Phase III landfill footprint from the borrow area, and, probably, into the basins previously occupied by the man-made lakes. A substantial portion of the groundwater in the study area flows north and northwest directly to North Buffalo Creek.

### 3.2.3 Field Observations

Field observations made throughout the past year support the general descriptions of site physiography and hydrology presented above. Here, we present some specific detailed observations.

As noted above and discussed in some detail below, areas of exposed bedrock now exist in the area of the proposed landfill unit. These rocky areas are most common along the western ridge in that area associated with the presence of some resistant mafic or rhyolitic dikes, which appear to be much less susceptible to the effects of chemical weathering. The thickness of saprolite ranges from 0.5 to 38.5 feet across the Phase III area, with most locations having between 10 and 25 feet of saprolite above bedrock.

One benefit of the borrow activities undertaken by the City in the Phase III area was that the removal of soil/saprolite allowed HDR to conduct geologic mapping in much greater detail than would have otherwise been possible. The geologic map and cross-sections included below are an outgrowth of that effort.

During the monthly field visits, water level measurements were obtained by GNRA personnel at all existing observation wells and piezometers. There are no existing or abandoned water wells in the study area. The nearest public water supply water well is located about 4,000 feet east of the Phase III site, at the Cedar Park Mobile Home Park.

A reconnaissance of the study area was conducted by an HDR geologist to locate any springs or seeps. No such features were found during this survey.

## 3.3 Synthesis of Site Geology

Between late October 1994 and early January 1995, GNRA personnel bored and installed 42 observation wells in the general area proposed for Phase III. (The locations of these wells are shown on Figure 3-2 and designated as B-1, B-2, OW-1, OW-2, etc.) Of these wells, 23 are screened in saprolite, 19 are screened in rock. The saprolite wells were drilled by hollow stem auger to auger refusal. The bedrock wells were drilled to auger refusal with hollow stem augers, then completed using either air hammer (15 wells) or rock coring (6 wells). Of the 42 completed wells, 30 were completed with measured static water level within 10 feet of the well screen ("shallow" wells that are appropriate for determining the location of the water table), while the remaining 12 wells were completed with the static water level more than 10 feet above the screened interval ("deep" wells that reflect potentiometric conditions at depth). There are five pairs of shallow and deep wells, which are useful for determining the local vertical groundwater gradient. Appendix C presents the boring and well completion logs. Table 3-1 lists the soil boring depths and standard penetration test results (SPT) for all borings so tested. Table 3-2 gives details concerning well construction. Finally, Table 3-3 presents the results of water level measurements at each well since installation through October 1995.

### 3.3.1 Description of Soils and Saprolite

The U.S. Soil Conservation Service (USCS) mapped soils in Guilford County in the late 1960's, before the White Street Landfill began operation. The SCS map shows that the vast majority of soils present when mapping took place were fine sandy loams of the Enon series. As mentioned above, the area of proposed Phase III has been extensively stripped of soil as it has been used as a borrow area.

Thus, the surface soils mapped by the SCS are now largely gone. This section, instead, describes the remnant soils and the associated saprolite at the site.

During the extensive drilling described above, many SPT samples were described. These descriptions are presented in the boring logs in Appendix C. From this array of samples, 30 were selected for laboratory sieve analysis and USCS classification. Of these, 14 were used to determine Atterberg limits. These data are presented in Appendix D.

Figure 3-2

# TABLE 3-1

## Soil Boring Depth and SPT Resistance Data
## Site Hydrogeologic Investigation
## White Street Sanitary Landfill Expansion
## Greensboro, North Carolina

| Boring Number | Auger Refusal Depth (feet) | Standard Penetration Test Values | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 5.0 - 6.5 | 10.0 -11.5 | 15.0 -16.5 | 20.0 - 21.5 | 25.0 - 26.5 | 30.0 -31.5 | 35.5 - 36.5 |
| B - 1 | 13 | 15-25-36 | 50/4" | | | | | |
| B - 1d | 13 | 15-25-36 | 50/4" | | | | | |
| B - 2 | 18.5 | 6-15-22 | 6-12-10 | 6-12-25 | | | | |
| B - 3 | 15.3 | 4-9-8 | 50/3" | 50/4" | | | | |
| B - 4 | 11 | 15-20-25 | 50/6" | | | | | |
| B - 5 | 16 | 9-32-18 | 12-11-12 | 50/3" | | | | |
| B - 6 | 17 | 12-11-13 | 10-12-19 | 11-20-50/5" | | | | |
| B - 7 | 24.5 | 11-10-12 | 16-26-50/5" | 27-50/6" | 22-22-24 | 50/0.5" | | |
| B - 8 | 11 | 19-50/5" | 50/5" | | | | | |
| B - 8a | 12 | n/a | | | | | | |
| B - 9 | 36.5 | 18-24-50/3" | 18-50/5" | 34-50/5" | 50/6" | 50/4" | 34-50/6" | 50/2" |
| B-9d** | 52* | 18-39-40 | 29-50/3" | 50/1" | 50/1" | 50/1" | 36-50/6" | 50/0" |
| low SPTs → B - 10 | 32.5 | 3-5-7 | 3-4-6 | 2-3-4 | 3-4-4 | 3-4-6 | 10-18-50/2" | |
| B - 11 | 16.5 | 3-6-8 | 7-12-42 | 50/5" | | | | |
| B - 12 | 11 | 6-12-16 | 7-50/6" | | | | | |
| B - 13 | 23 | 5-7-13 | 6-6-10 | 5-6-7 | 15-25-50/5" | | | |
| B - 14 | 16.5 | 6-7-8 | 9-18-23 | 7-12-46 | | | | |

## TABLE 3-1 (continued)

**Soil Boring Depth and SPT Resistance Data**
**Site Hydrogeologic Investigation**
**White Street Sanitary Landfill Expansion**
**Greensboro, North Carolina**

| Boring Number | Auger Refusal Depth (feet) | Standard Penetration Test Values | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 5.0 - 6.5 | 10.0 -11.5 | 15.0 -16.5 | 20.0 - 21.5 | 25.0 - 26.5 | 30.0 -31.5 | 35.5 - 36.5 |
| B - 15 | 19.5 | 7-11-13 | 11-40-50/5" | 50/4" | | | | |
| B - 15a | 3 | n/a | | | | | | |
| B - 15b | 7 | 3-4-5 | | | | | | |
| low SPTs → B - 16 | 36 | 3-5-9 | 3-5-6 | 3-8-11 | 7-6-7 | 9-12-17 | 12-16-23 | 32-50/3" |
| B - 17 | 14 | 3-4-5 | 3-6-12 | | | | | |
| B - 17d | 12.5 | n/a | | | | | | |
| B - 18 | 13 | 3-4-6 | 4-6-11 | | | | | |
| B - 19 | 11 | 12-24-30 | 10-50/5" | | | | | |
| B - 20 | 16 | 12-24-32 | 20-33-50/5" | 50/4" | | | | |
| B - 21 | 11 | 12-50/4" | 40-50/6" | | | | | |
| B - 22 | 31 | 17-50/6" | 15-24-30 | 24-50/6" | 24-32-38 | 24-28-50/5" | 24-36-50/5" | |
| B - 22d | 28.5 | n/a | | | | | | |
| B - 23 | 31 | 10-19-30 | 15-50/6" | 9-50/6" | 35-50/5" | 50/2" | 50/2" | |
| B - 24 | 12 | 33-50/6" | 33-38-50/5" | | | | | |
| B - 25 | 38.5 | 50/6" | 41-50/5" | 18-36-32 | 50/6" | 50/6" | 34-50/5" | 50/3" |
| B - 25d | 29 | n/a | | | | | | |
| B - 26 | 6.5 | 11-39-50/4" | | | | | | |

## TABLE 3-1 (continued)

### Soil Boring Depth and SPT Resistance Data
### Site Hydrogeologic Investigation
### White Street Sanitary Landfill Expansion
### Greensboro, North Carolina

| Boring Number | Auger Refusal Depth (feet) | Standard Penetration Test Values | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 5.0 - 6.5 | 10.0 -11.5 | 15.0 -16.5 | 20.0 - 21.5 | 25.0 - 26.5 | 30.0 -31.5 | 35.5 - 36.5 |
| B - 27 | 13 | 50/6" | 50/5" | | | | | |
| B - 28 | 0.5 | n/a | | | | | | |
| B - 29 | 2 | n/a | | | | | | |
| B - 29a | 8 | 34-50/5" | | | | | | |
| B - 30 | 32 | 6-10-15 | 8-12-17 | 11-17-25 | 12-28-50/5" | 35-50/4" | 50/6" | |
| B - 31 | 25 | 50/4" | 50/2" | 50/1" | 50/1" | | | |
| B - 32 | 21.5 | 24-50/6" | 50/1" | 50/1" | 50/1" | | | |
| B - 33 | 15 | 18-30-50/3" | 12-16-30 | 50/3" | | | | |
| B - 34 | 7 | 50/6" | | | | | | |
| B - 34d | 7 | n/a | | | | | | |
| B - 35 | 7 | 30-50/1" | | | | | | |
| B-36 | 21.5 | 10-18-27 | 11-18-50/6" | 18-19-22 | 50/3" | | | |
| OW-1 | 32 | 10-9-16 | 6-9-11 | 3-3-6 | 6-12-30 | 50/4" | 25-36-45 | |
| OW-2 | 25* | 11-21-28 | 26-27-38 | 21-36-50/6" | 50/4" | 50/0" | | |
| OW-3 | 11* | 50/6" | 50/3" | | | | | |

*Roller cone refusal

**SPT taken at 3.0'-4.5'; 8.0'-9.5'; 13.0'-14.5'; 18.0'-19.5'; 23'.0-24.5'; 28.0'-29.5'; 33.0'-34.5'.

**TABLE 3-2**
**Observation Well Construction Details**
**Site Hydrogeologic Investigation**
**White Street Sanitary Landfill Expansion**
**Greensboro, North Carolina**

| WELL NUMBER | WELL DEPTH (Feet) | BOREHOLE DIAMETER (Inches) | SCREEN INTERVAL (Feet) | TOP OF SAND (Feet) | TOP OF BENTONITE (Feet) | RISER STICK-UP (Feet) |
|---|---|---|---|---|---|---|
| B-1 | 33.0 | 6.25 | 23.0 - 33.0 | 21.50 | 19.5 | 2.41 |
| B-1d | 43.00 | 5.75 | 38.0 - 43.0 | 36.0 | 34.0 | 2.08 |
| B-2 | 18.50 | 6.25 | 8.0 - 18.0 | 6.0 | 4.0 | 3.02 |
| B-3 | 15.50 | 6.25 | 5.5 - 15.5 | 4.0 | 2.0 | 2.98 |
| B-4 | 25.00 | 6.25 | 15.0 - 25.0 | 13.0 | 11.0 | 3.1 |
| B-5 | 28.00 | 6.25 | 18.0 - 28.0 | 16.0 | 14.0 | 1.99 |
| B-6 | 61.00 | 6.25 | 51.0 - 61.0 | 48.0 | 45.0 | 2.69 |
| B-7 | 24.50 | 6.25 | 14.5 - 24.5 | 13.0 | 11.0 | 0.66 |
| B-8 | 63.00 | 6.25 | 48.0 - 63.0 | 46.5 | 44.5 | 1.65 |
| B-9 | 36.50 | 6.25 | 26.5 - 36.5 | 25.0 | 23.0 | 2.73 |
| B-9d | 67.00 | 5.75 | 62.0 - 67.0 | 60.0 | 58.0 | 2.90 |
| B-10 | 32.5 | 6.25 | 22.5 - 32.5 | 21.5 | 19.5 | 2.82 |
| B-11 | 16.50 | 6.25 | 6.5 - 16.5 | 5.0 | 3.0 | 2.84 |
| B-12 | 28.00 | 6.25 | 13.0 - 28.0 | 11.0 | 9.0 | 2.78 |
| B-13 | 53.00 | 6.25 | 43.0 - 53.0 | 41.0 | 38.0 | 1.76 |
| B-14 | 16.50 | 6.25 | 6.5 - 16.5 | 5.0 | 3.0 | 3.11 |
| B-15 | 19.50 | 6.25 | 9.5 - 19.5 | 8.0 | 6.0 | 3.04 |
| B-16 | 36.00 | 6.25 | 26.0 - 36.0 | 23.5 | 21.5 | 2.95 |
| B-17 | 28.00 | 6.25 | 18.0 - 28.0 | 16.5 | 14.5 | 1.90 |
| B-17d | 53.00 | 5.75 | 48.0 - 53.0 | 46.0 | 44.0 | 1.95 |
| B-18 | 49.00 | 6.25 | 39.0 - 49.0 | 38.0 | 36.0 | 2.80 |
| B-19 | 33.00 | 6.25 | 22.9 - 32.9 | 21.5 | 19.5 | 2.5 |
| B-20 | 63.50 | 6.25 | 53.5 - 63.5 | 52.0 | 50.0 | 1.5 |
| B-21 | 11.00 | 6.25 | 6.0-11.0 | 4.5 | 2.5 | 3.02 |

Notes:
1. All wells installed by G. N. Richardson and Associates, October 1994-January 1995.
2. Total depth and screen interval depths measured from ground surface at time of drilling
3. For borehole diameters, the first value (6.25) represents diameter produced using 4.25-inch ID hollow stem augers and the second value (5.75) represents the diameter produced using a standard NQ core barrel or 5.75-inch air hammer.

**TABLE 3-2 (continued)**
**Observation Well Construction Details**
**Site Hydrogeologic Investigation**
**White Street Sanitary Landfill Expansion**
**Greensboro, North Carolina**

| WELL NUMBER | WELL DEPTH (Feet) | BOREHOLE DIAMETER (Inches) | SCREEN INTERVAL (Feet) | TOP OF SAND (Feet) | TOP OF BENTONITE (Feet) | RISER STICK-UP (Feet) |
|---|---|---|---|---|---|---|
| B-22 | 31.00 | 6.25 | 21.0 - 31.0 | 18.5 | 16.5 | 2.94 |
| B-22d | 46.50 | 5.75 | 41.5 - 46.5 | 39.5 | 37.5 | 1.88 |
| B-23 | 31.00 | 6.25 | 21.0 - 31.0 | 19.5 | 17.5 | 3.00 |
| B-24 | 12.00 | 6.25 | 7.0 - 12.0 | 5.5 | 3.5 | 2.95 |
| B-25 | 38.50 | 6.25 | 28.5 -38.5 | 27.0 | 25.0 | 3.42 |
| B-25d | 52.00 | 5.75 | 47.0 - 52.0 | 45.0 | 43.0 | 3.0 |
| B-26 | 6.50 | 6.25 | 1.5 - 6.5 | 1.0 | 0.0 | 3.35 |
| B-27 | 33.00 | 6.25 | 23.0 - 33.0 | 21.0 | 19.0 | 1.89 |
| B-28 | 16.80 | 6.25 | 6.8 - 16.8 | 4.8 | 2.8 | 3.36 |
| B-29a | 8.00 | 6.25 | 1.5 - 6.5 | ~~1.5~~ 1.0 | 0.0 | 2.86 |
| B-30 | 32.00 | 6.25 | 22.0 - 32.0 | 20.5 | 18.5 | 3.15 |
| B-31 | 25.00 | 6.25 | 15.0 - 25.0 | 13.5 | 11.5 | 3.00 |
| B-32 | 21.50 | 6.25 | 11.5 - 21.5 | 10.0 | 8.0 | 3.11 |
| B-33 | 15.0 | 6.25 | 5.0 - 15.0 | 3.5 | 1.5 | 3.11 |
| B-34 | 7.00 | 6.25 | 2.0 - 7.0 | 1.0 | 0.0 | 2.95 |
| B-34d | 48.50 | 5.75 | 33.5 - 48.5 | 31.6 | 28.0 | 1.52 |
| B-35 | 7.00 | 6.25 | 2.0 - 7.0 | 1.0 | 0.0 | 2.75 |
| B-36 | 20.00 | 6.25 | 3.0 - 20.0 | 2.0 | 0.5 | 1.00 |
| OW-1 | 45.00 | 5.75 | 25.0 - 45.0 | 24.0 | 22.0 | 3.05 |
| OW-2 | 40.00 | 5.75 | 20.0 - 40.0 | 19.0 | 17.0 | 2.95 |
| OW-3 | 48.00 | 5.75 | 28.0 - 48.0 | 27.0 | 25.0 | 3.00 |
| MW-11 | 100.50 | 5.75 | 19.5-100.5 Open hole | -- | -- | 3.20 |
| MW-13 | 32.5- | 5.75 | 16.0-31.0 | 14.0 | 12.5 | 2.62 |

Notes:
1. All wells installed by G. N. Richardson and Associates, October 1994 - January 1995.
2. Total depth and screen interval depths measured from ground surface at time of drilling
3. For borehole diameters, the first value (6.25) represents diameter produced using 4.25-inch ID hollow stem augers and the second value (5.75)represents the diameter produced using a standard NQ core barrel or 5.75-inch air hammer.

## Table 3-3
## Groundwater Table Depths
## Site Hydrogeological Investigation
## White Street Sanitary Landfill Expansion
## Greensboro, North Carolina

| Boring No. | Ground Elev. | Top Casing Elev. | Ref. Loc. | Total Well Depth | Riser Stickup | 12/27/94 GW Elev. | 12/29/94 GW Elev. | 1/10/95 GW Elev. | 1/25/95 GW Elev. | 3/11/95 GW Elev. | 4/18/95 GW Elev. | 5/22/95 GW Elev. | 6/22/95 GW Elev. | 7/20/95 GW Elev. | 8/18/95 GW Elev. | 9/15/95 GW Elev. | 10/31/95 GW Elev. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-1 | 760.80 | 763.21 | toc | 33.00 | 2.41 | 745.35 | -- | 746.01 | 746.62 | 747.57 | 746.09 | 745.61 | 745.63 | 746.20 | 745.56 | 746.14 | 747.30 |
| B-1d | 760.47 | 762.55 | toc | 43.00 | 2.08 | 755.27 | -- | 754.45 | 721.52 | 725.29 | 729.12 | 731.73 | 733.63 | 735.31 | 736.58 | 737.87 | 739.66 ? |
| B-2 | 774.56 | 777.58 | toc | 18.50 | 3.02 | 765.49 | -- | 766.21 | 767.59 | 768.84 | | | | Removed | | | |
| B-3 | 749.67 | 752.65 | toc | 15.50 | 2.98 | 747.56 | -- | 748.59 | 748.62 | 748.74 | 747.08 | 746.54 | 746.98 | 747.16 | 746.29 | 746.08 | 747.47 |
| B-4 | 756.33 | 759.43 | grd | 25.00 | 3.10 | -- | -- | 742.40 | 742.14 | 744.76 | 740.19 | 739.63 | 740.03 | 740.3 | 739.55 | 739.55 | 741.58 |
| B-5 | 758.14 | 760.13 | grd | 28.00 | 1.99 | -- | -- | 732.42 | 731.78 | 733.41 | 733.52 | 733.3 | 733.5 | 733.9 | 733.71 | 733.76 | 734.18 |
| B-6 | 753.52 | 756.21 | grd | 61.00 | 2.69 | -- | -- | 700.68 | 701.69 | 729.73 | 734.34 | 733.9 | 733.58 | 734.09 | 734 | 733.66 | 734.81 ? |
| B-7 | 773.09 | 773.75 | toc | 24.50 | 0.66 | 754.01 | -- | 751.61 | 752.20 | 753.88 | 753.59 | 752.87 | 752.46 | 752.48 | 752.2 | 751.74 | 751.57 |
| B-8 | 754.93 | 756.58 | toc | 63.00 | 1.65 | 737.67 | -- | 737.26 | 735.23 | 738.95 | 737.58 | 737.13 | 736.73 | 734.99 | 733.44 | 733.07 | 734.09 |
| B-9 | 759.04 | 761.77 | toc | 36.50 | 2.73 | 744.05 | 744 | 744.28 | 744.66 | 745.12 | 744.81 | 744.39 | 743.7 | 741.11 | 740.03 | 739.51 | 739.61 |
| B-9d | 759.51 | 762.41 | toc | 67.00 | 2.90 | 742.17 | 743.02 | 743.9 | 744.43 | 745.37 | 744.5 | 744.29 | 743.8 | 740.6 | 739.04 | 738.97 | 739.13 |
| B-10 | 778.09 | 780.91 | toc | 32.50 | 2.82 | 753.82 | -- | 753.88 | 753.99 | 754.2 | 754.75 | 754.91 | 754.85 | 754.84 | 754.89 | 754.72 | 754.55 |
| B-11 | 769.20 | 772.04 | toc | 16.50 | 2.84 | 754.15 | 754.11 | 753.97 | 754.63 | 755.91 | 755.09 | 754.16 | 753.82 | 754.71 | 753.89 | 753.98 | 753.93 |
| B-12 | 776.06 | 778.84 | toc | 28.00 | 2.78 | 761.92 | 751.8 | 768.68 | 768.67 | 770.96 | 767.75 | 767.14 | 767.34 | 769.17 | 767.41 | 767.83 | 770.22 |
| B-13 | 791.91 | 793.67 | grd | 53.00 | 1.76 | -- | -- | 763.2 | 763.46 | 764.29 | 764.93 | 764.78 | 764.39 | 764.25 | 764.04 | 763.52 | 763.34 |
| B-14 | 787.40 | 790.51 | toc | 16.50 | 3.11 | 779.43 | -- | 780.45 | 780.47 | 781.91 | 780.79 | 780.30 | 780.49 | 782.56 | 780.82 | 781.2 | 782.72 |
| B-15 | 774.15 | 777.19 | toc | 19.50 | 3.04 | 760.22 | -- | 760.24 | 761.12 | 761.03 | 761.32 | 761.29 | 761.30 | 761.36 | 760.76 | 760.45 | 761.66 |
| B-16 | 782.71 | 785.66 | toc | 36.00 | 2.95 | 761.31 | 761.31 | 761.2 | 761.37 | 761.92 | 762.31 | 761.94 | 761.69 | 761.84 | 761.11 | 760.3 | 761.71 |
| B-17 | 787.71 | 789.61 | grd | 28.00 | 1.90 | -- | 763.52 | 774.12 | 774.33 | 775.23 | 775.05 | 774.33 | 773.88 | 774.27 | 773.68 | 773.55 | 773.81 |
| B-17d | 787.71 | 789.66 | est/g | 53.00 | 1.95 | -- | 753.62 | 760.57 | 761.29 | 762.54 | 762.76 | 761.8 | 760.75 | 761.55 | 760.13 | 760.15 | 761.09 |
| B-18 | 771.60 | 774.40 | grd | 49.00 | 2.80 | -- | 753.16 | 757.22 | 757.81 | 758.82 | 757.5 | 756.82 | 756.33 | 757.2 | 755.97 | 755.77 | 756.20 |
| B-19 | 775.78 | 778.28 | grd | 33.00 | 2.50 | -- | -- | 757.04 | 756.56 | 758.34 | 758.65 | 758.56 | 758.88 | 758.8 | 758.71 | 758.63 | 759.82 |
| B-20 | 770.68 | 772.18 | grd | 63.50 | 1.50 | -- | -- | 744.72 | 744.95 | 745.73 | 743.23 | 742.89 | 743.3 | 743.34 | 742.33 | 742.78 | 744.74 |

## Table 3-3
## Groundwater Table Depths
## Site Hydrogeological Investigation
## White Street Sanitary Landfill Expansion
## Greensboro, North Carolina

| Boring No. | Ground Elev. | Top Casing Elev. | Ref. Loc. | Total Well Depth | Riser Stickup | 12/27/94 GW Elev. | 12/29/94 GW Elev. | 1/10/95 GW Elev. | 1/25/95 GW Elev. | 3/11/95 GW Elev. | 4/18/95 GW Elev. | 5/22/95 GW Elev. | 6/22/95 GW Elev. | 7/20/95 GW Elev. | 8/18/95 GW Elev. | 9/15/95 GW Elev. | 10/31/95 GW Elev. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B-21 | 756.82 | 759.84 | toc | 11.00 | 3.02 | 751.23 | 751.3 | 751.8 | 751.69 | 752.54 | 751.59 | 751.25 | 751.27 | 751.68 | 751.11 | 751.21 | 752.09 |
| B-22 | 754.92 | 757.86 | toc | 31.00 | 2.94 | 746.36 | 745.34 | 746.20 | 746.31 | 747.02 | 745.11 | 744.52 | 744.32 | 744.54 | 743.85 | 743.66 | 744.27 |
| B-22d | 754.92 | 756.80 | est/g | 46.50 | 1.88 | -- | 740.26 | 746.14 | 746.21 | 746.90 | 745.03 | 744.41 | 744.13 | 744.36 | 743.70 | 743.43 | 744.05 |
| B-23 | 765.26 | 768.26 | toc | 31.00 | 3.00 | 751.51 | -- | 751.20 | 751.02 | 748.63 | 747.61 | 746.78 | 748.34 | 747.55 | 746.12 | 746.47 | 748.84 |
| B-24 | 750.08 | 753.03 | toc | 12.00 | 2.95 | 740.39 | -- | 740.78 | 740.98 | 741.88 | 740.19 | 740.18 | 740.38 | 740.70 | 740.00 | 740.06 | 740.90 |
| B-25 | 744.54 | 747.96 | toc | 38.50 | 3.42 | 737.90 | -- | 738.82 | 739.52 | 741.32 | 737.30 | 737.09 | 738.09 | 738.16 | 736.58 | 736.93 | 739.11 |
| B-25d | 744.54 | 747.54 | est/g | 52.00 | 3.00 | -- | -- | 737.00 | 737.69 | 739.19 | 735.82 | 735.44 | 735.82 | 736.40 | 735.02 | 735.17 | 736.85 |
| B-26 | 739.20 | 742.55 | toc | 6.50 | 3.35 | 733.78 | -- | 734.80 | 734.53 | 735.98 | 732.60 | 733.28 | 733.13 | 733.13 | 732.48 | 732.61 | 734.50 |
| B-27 | 734.82 | 736.71 | grd | 33.00 | 1.89 | -- | -- | 717.84 | 717.84 | 718.05 | 717.76 | 717.76 | 717.75 | 717.74 | 717.72 | 717.70 | 717.80 |
| B-28 | 739.33 | 742.69 | grd | 16.80 | 3.36 | -- | -- | 735.15 | 735.73 | 736.77 | 732.84 | 733.07 | 733.96 | 736.21 | 733.82 | 734.81 | 737.73 |
| B-29a | 743.61 | 746.47 | toc | 8.00 | 2.86 | 736.86 | -- | 739.89 | 738.60 | 739.44 | 736.34 | 736.37 | 736.58 | 737.13 | 735.38 | 735.41 | 737.95 |
| B-30 | 739.11 | 742.26 | toc | 32.00 | 3.15 | 724.28 | -- | 724.37 | 725.42 | 727.38 | 725.67 | 724.65 | 724.17 | 725.58 | 725.10 | 725.23 | 726.21 |
| B-31 | 747.10 | 750.10 | toc | 25.00 | 3.00 | 741.23 | 741.08 | 741.68 | 742.13 | 743.76 | 739.77 | 739.53 | 739.72 | 740.24 | 738.76 | 738.80 | 740.63 |
| B-32 | 741.65 | 744.76 | toc | 21.50 | 3.11 | 724.82 | -- | 727.29 | 727.86 | 731.43 | 729.76 | 729.61 | 729.58 | 730.49 | 729.89 | 729.58 | 728.74 |
| B-33 | 757.22 | 760.33 | toc | 15.00 | 3.11 | 752.72 | 752.65 | 752.68 | 753.07 | 754.47 | 752.30 | 751.70 | 751.51 | 752.38 | 751.12 | 751.26 | 748.45 |
| B-34 | 730.97 | 733.92 | toc | 7.00 | 2.95 | 726.60 | -- | 730.31 | 728.68 | 729.82 | 724.80 | 724.63 | 724.76 | 726.32 | 724.59 | 723.92 | 726.67 |
| B-34d | 730.97 | 732.49 | toc | 48.50 | 1.52 | -- | -- | 708.06 | 725.36 | 727.43 | 722.97 | 722.11 | 722.42 | 724.13 | 722.18 | 721.82 | 724.68 |
| B-35 | 744.00 | 746.75 | toc | 7.00 | 2.75 | -- | 742.73 | 741.51 | 742.88 | 743.22 | 742.53 | 742.24 | 742.48 | 742.27 | 741.36 | 741.88 | 743.13 |
| B-36 | 782.00 | 783.00 | toc | 20.00 | 1.00 | -- | -- | 764.21 | 764.76 | 766.46 | 766.28 | 765.64 | 765.19 | 765.57 | 765.05 | 764.94 | 764.24 |
| OW-1 | 768.00 | 771.05 | toc | 45.00 | 3.05 | 742.62 | -- | -- | -- | -- | -- | 764.58 | 764.27 | 764.18 | 764.00 | 763.50 | 763.31 |
| OW-2 | 767.00 | 769.95 | toc | 40.00 | 2.95 | 750.03 | -- | 771.05 | 742.96 | 749.08 | 749.36 | 748.93 | 748.34 | 748.10 | 771.05 | 748.26 | 747.31 |
| OW-3 | 759.00 | 762.00 | toc | 48.00 | 3.00 | 744.04 | -- | 769.95 | 750.71 | 751.41 | 751.22 | 751.15 | 750.97 | 750.00 | 749.55 | 749.15 | 749.17 |
| MW-11 | 739.00 | 742.20 | toc | 100.50 | 3.20 | 718.08 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW-13 | 739.00 | 741.62 | toc | 32.50 | 2.62 | 718.50 | -- | -- | 721.08 | -- | -- | -- | -- | -- | -- | -- | -- |

Correlation of these tested samples with boring logs and surface geology indicates that 15 samples are from saprolite derived from "granite," eight samples are from saprolite derived from "felsic gneiss," five samples are from "mafic intrusive dikes," and two samples were from "greenstone dikes that intrude the granite. Although Atterberg limits were completed on only 14 of the samples, the following are the Unified Soil Classification System names for these samples:

Granite Saprolite (average fines content = 27%)
Silty SAND (SM) - 12 samples
Silty Clayey SAND (SC-SM) - 2 samples
Poorly Graded SAND with Silt (SP-SM) - 1 sample

Felsic Gneiss Saprolite (average fines content = 47%)
Silty SAND to Silty Clayey SAND (SM to SC-SM) - 4 samples
Sandy SILT (ML) - 3 samples
Sandy Elastic SILT (MH) - 1 sample)

Mafic Intrusive Saprolite (average fines content = 62%)
Elastic SILT with Sand (MH) - 2 samples
Sandy SILT (ML) - 1 sample
Silty Clayey SAND (SC-SM) - 1 sample
Silty SAND (SM) - 1 sample

Greenstone Dike Saprolite (fines content = 50%)
Clayey SAND (SC) - 1 sample
Sandy Lean CLAY (CL) - 1 sample

Not surprisingly, there is a good correlation between parent rock type and the saprolite produced by its weathering. The coarser grained, quartz-rich granite weathers to the coarsest material, while the mafic intrusives and greenstone intrusives weather to the finest material. The relatively quartz-rich but fine-grained felsic gneiss produces a saprolite with an intermediate texture.

As a function of depth, it is generally true that saprolite soils from the site grade from more highly weathered finer, clayey soils near the ground surface to less weathered coarser silty and sandy soils at depth.

### 3.3.2 Description of Rock Units - Site Geology

Each boring was drilled until at least hollow stem auger refusal depth. For purposes of this report, this depth is also correlated with the top of bedrock at the site. Using these data, a bedrock surface contour map was prepared by HDR and is here presented as Figure 3-3. As can be seen on this map, bedrock is relatively shallow along the west and southwest portions of the site, as shown by the presence of two bedrock ridges, one trending north-south and another trending northeast-southwest along the eastern part of the site. A bedrock valley separates the two ridges. Some of this bedrock has recently been exposed by excavation in the west-central portions of the Phase III area.

In both surface outcrops and in borings, several rock units have been identified at the site. HDR has prepared a geologic map (Figure 3-4) for the site based upon surface rock outcrops, saprolite character, and data from the borings. Three hydrostratigraphic cross-sections are presented herein on Figures 3-5A and 3-5B. Seven rock and saprolite types are identified on the map and cross-sections.

1 Granite (GR): white, coarse-grained, hornblende-bearing, typically massive, metamorphosed.

2 Felsic Gneiss (FG): tan to gray, medium to fine-grained, biotite-bearing, foliated

3 Rhyolite Intrusive (RI): white, fine-grained, porphyritic, massive

4 Diorite (DI): medium gray, medium-grained, equigranular, metamorphosed.

5 Mafic Intrusive (MD): light gray to dark green and bluish green, fine-grained, possibly metamorphosed basalt/gabbro.

6 Basalt/Gabbro (BG): dark gray to black, fine to medium grained, unaltered.

7 Greenstone Dikes (GD): light to dark green and bluish green, fine to medium-grained, sheared parallel to intrusive contacts in places, possibly extensively metamorphosed diorite or mafic intrusive.

Figure 3-4 - Geologic Map

Figure 3-3 indicates that the deepest weathering has occurred in the granite near its contact with the metamorphic rocks. However, rock hardness is not readily correlated with rock type, as quite resistant granite is found at the east of the site, and both deeply weathered and resistant rocks are found in the western half of the site.

Generally, the granite occupies the east and northeast portion of the site, while the felsic gneiss is found in the western and southwestern portions of the area. The mafic intrusives, basalt/gabbro and greenstone dikes are most obvious in the light-colored granite, but also cross-cut the felsic gneiss. Field relations indicate that the granite is intrusive into the older gneiss. The fine-grained rhyolite intrusive cross-cuts the granite and the felsic gneiss.

Field relations do not suggest generalized shearing or fracturing along the linear, generally northeast-trending, mafic or felsic intrusive features which are found as both dikes and sills. But, the results of the slug testing and rock coring efforts appear to indicate that the saprolitic portions of some dikes (B-1, B-34d) are well fractured, and may represent localized preferred conduits for groundwater flow. Based upon the hardness of the rhyolite and basalt/gabbro now exposed at the surface, these units are very likely to be barriers to groundwater flow. At depth, the dike bedrock appears to be essentially impermeable. Hydraulic conductivities also appear to be somewhat higher in granite versus the felsic gneiss. Metamorphic foliation orientations in the granitic gneiss were extremely consistent across the site, trending between N65E to N70E. Groundwater flow in the metamorphic portions of the uppermost aquifer would be expected to have a slightly higher velocity parallel to foliation.

### 3.3.3 Cross-Sections

Figures 3-5A and 3-5B show three hydrostratigraphic cross-sections. The lines of section are shown on Figure 3-4. The dips on rock contacts are not generally available, but field observations suggest a steep northerly dip to these features. In an unusual occurrence in the northern portion of the Phase III area, the granite/gneiss contact dips about 30 degrees to the east, with granite overlying gneiss. Remember also that the vertical exaggeration of the cross sections creates steeper apparent dips, so they are drawn nearly vertically in these sections.

Contacts between mafic, rhyolite, diorite, and greenstone intrusives with the country rock are generally near vertical.

## 3.4 Synthesis of Site Hydrogeology

### 3.4.1 Aquifer Characteristics

As discussed above, the typical texture of soils at the landfill are sandy silts (ML or MH) to silty sands (SM). These are very common soil textures in the Piedmont of North Carolina, and experience suggests the following characteristics for these types of aquifer materials:

total porosity = 40-50%, with effective porosity of about 20-25%
hydraulic conductivity = .5-5 ft/day.

Eleven slug tests have been performed in the study area. The results of these tests are presented in Appendix E. Slug tests were conducted on wells completed in saprolite, shallow and deep rock, in granite, gneiss, mafic dikes, and in diorite. The results of these tests are provided in Table 3-4.

Hydraulic conductivities calculated from slug testing ranged from immeasurably low in deep bedrock dikes to 17.69 ft/day. Hydraulic conductivity in the granitic saprolite averaged about 0.68 ft/day, as compared to gneissic saprolite at about 0.13 ft/day. The highest conductivity measured was on a fractured saprolite dike (diorite) at B-34. As expected, hydraulic conductivities decreased from the shallow saprolite aquifer downward to the deep rock aquifer. Slug test results appear to indicate that the saprolitic portions of the dikes have a relatively high conductivity, but that, at depth, they become extremely tight hydrostratigraphic units. In general, the slug test results also indicate that the degree of fracturing is an important control over hydraulic conductivity.

The permeability of the unsaturated saprolite is lowest near the original ground surface, where finer grained clay-rich soils (silty clays, clayey silts, clayey sands, etc.) are common. Remolded permeability measurements for these soils (see Appendix D) ranged from 2.1 to 2.8 x $10^{-7}$ cm/sec, values which suggest that

## Table 3-4

## Aquifer Characteristics

| Boring No. | Rock Type | Aquifer | Total Porosity (%) | Slug Test (cm/sec) |
|---|---|---|---|---|
| B-1 | Mafic Dike | Shallow Rock[s] | 5[e] | $6.39 \times 10^{-4}$ |
| B-1d | Mafic Dike | Deep Rock[d] | 0-5[e] | $<10^{-7}$* |
| B-14 | Gneiss | Saprolite Silt+Clay | 50[e] | $4.47 \times 10^{-5}$ |
| B-17d | Gneiss | Deep Rock[d] | 0-5[e] | $1.60 \times 10^{-4}$ |
| B-22 | Granite | Saprolite Sand | 45[a] | $4.15 \times 10^{-4}$ |
| B-22d | Granite | Shallow Rock[s] | 0-5[e] | $3.06 \times 10^{-5}$ |
| B-25 | Granite | Saprolite PWR | 45[a] | $7.24 \times 10^{-5}$ |
| B-25d | Granite | Shallow Rock[s] | 0-5[e] | $5.58 \times 10^{-5}$ |
| B-31 | Granite | Half Rock/Half Sap | 45[a] | $6.11 \times 10^{-5}$ |
| B-34 | Diorite Dike | Saprolite Sand+Silt | 45[a] | $6.24 \times 10^{-3}$ |
| B-34d | Diorite Dike | Deep Rock[d] | 0-5[e] | $<10^{-7}$* |

| Average Hydraulic Conductivities (K values) | | Effective Porosity (%) |
|---|---|---|
| Saprolite Aquifer (average) | $1.86 \times 10^{-3}$ cm/sec or 5.27 ft/day | 20[n] |
| Shallow Rock Aquifer | $2.42 \times 10^{-4}$ cm/sec or 0.69 ft/day | 5 (est.) |
| Deep Bedrock Aquifer | $5.34 \times 10^{-5}$ cm/sec or 0.15 ft/day | 0.1[n] |
| Dike Saprolite Aquifer | $6.24 \times 10^{-3}$ cm/sec or 17.69 ft/day | 15[n] |
| Granite Saprolite Aquifer | $2.44 \times 10^{-4}$ cm/sec or 0.69 ft/day | 20[n] |
| Gneiss Saprolite Aquifer | $4.47 \times 10^{-5}$ cm/sec or 0.13 ft/day | 15[n] |

Notes:

* Hydraulic conductivity too small to measure using the slug test method; at depth these dikes are extremely tight. K values well below $10^{-7}$ cm/sec (estimated).

a = Average total porosity value from laboratory testing of saprolite samples from SB-46, SB-50, SB-53 (see Appendix D).

d = Deep rock aquifer = screen top greater than 25 feet below auger refusal depth.

e = Estimated based on values presented in Table 2.4, Freeze & Cherry, 1979.

s = Shallow rock aquifer = screen top less than 25 feet below auger refusal depth.

n = Effective porosity values taken from USEPA's RCRA Facility Investigation Guidance Document (1987), page 10-49.

they would be suitable for use as daily cover or possibly as clay liner material (if augmented by bentonite). At greater depth in the lower portions of the unsaturated zone, it is expected that the coarser grained soils will have hydraulic conductivities in the $10^{-4}$ to $10^{-5}$ cm/sec range. This range is comparable to the slug test results described above for the saprolite aquifer.

### 3.4.2 Stabilized Water Table Elevations

Static water levels were obtained from each of the 46 piezometers at the time of installation, at 24 hours, and at monthly intervals thereafter. Following completion of the first set of stabilized readings (12/27/94), water level measurements were obtained by GNRA personnel on a monthly schedule. Stabilized water table elevations are presented in Table 3-3.

### 3.4.3 Estimated Seasonal High Water Table

A review of Table 3-3, which includes monthly water-table elevations for December 1994 through October 1995 at Phase III, indicates that the highest water table elevations during the last year predominantly occurred in March 1995. Since early spring (i.e., March through April) is typically the wettest (i.e., highest) season of the year in the Piedmont, a water table potentiometric surface elevation map depicting static water table elevations measured at the Phase III area on March 11, 1995, was developed to represent this period (see Figure 3-6).

An evaluation of historic static water table elevation data from the existing groundwater monitoring wells installed at Phases I and II of the White Street Landfill was performed to determine the estimated seasonal high for the future Phase III expansion area (Table 3-5)

In order to compare the March 11, 1996, Phase III measurements against previous events monitored at the landfill, monitoring well data from 1992 through the present were reviewed to determine the highest monitoring event for this period. This data as presented in Table 3-5 reveals that the April 1993 monitoring event represents the highest potentiometric levels in the on-site monitoring wells for Phase I and II of the landfill. When comparing this "high" event with the static elevations recorded on March 11, 1995, at Phase III, it was determined that the water table at the Phase III area on this date was less than 1.0 foot lower

**TABLE 3-5**
**LONG-TERM WATER TABLE ELEVATIONS**
**AT PHASE I AND PHASE II**
White Street Landfill
Greensboro, North Carolina

(I) = Phase I
(II) = Phase II

| WELL NO. | DATE MEASURED | TOTAL WELL DEPTH | CASING ELEVATION | WATER LEVEL | WATER TABLE ELEVATION | SCREEN LENGTH | DATE INSTALLED |
|---|---|---|---|---|---|---|---|
| MW-1 | 10/9/92 | 23.10 | 776.11 | 9.49 | 766.62 | 10.00 | 5/9/89 |
| (I-1) | 4/22/93 | | | 7.87 | 768.24 | | |
| | 9/29/93 | | | 11.68 | 764.43 | | |
| | 3/16/95 | | | 7.87 | 768.24 | | |
| | | | | | | | |
| MW-2 | 10/8/92 | 22.00 | 768.58 | 4.97 | 763.61 | 10.00 | 5/11/89 |
| (I-2) | 4/22/93 | | | 4.56 | 764.02 | | |
| | 9/29/93 | | | 5.24 | 763.34 | | |
| | 3/16/95 | | | 4.74 | 763.84 | | |
| | | | | | | | |
| MW-3 | 10/8/92 | 13.50 | 764.65 | 5.70 | 758.95 | 10.00 | 6/2/89 |
| (I-3) | 4/22/93 | | | 11.39 | 753.26 | | |
| | 9/29/93 | | | 14.03 | 750.62 | | |
| | 3/16/95 | | | 11.79 | 752.86 | | |
| | | | | | ~~764.65~~ | | |
| MW-4 | 10/9/92 | 17.00 | 759.83 | 3.46 | 756.37 | 10.00 | |
| (I-4) | 4/22/93 | | | 1.38 | 758.45 | | |
| | 9/29/93 | | | 6.36 | 753.47 | | |
| | 3/16/95 | | | 2.18 | 757.65 | | |
| | | | | | | | |
| MW-5 | 10/8/92 | 24.00 | 701.42 | 11.04 | 690.38 | 10.00 | 6/14/89 |
| (I-5) | 4/22/93 | | | 9.51 | 691.91 | | |
| | 9/29/93 | | | 13.15 | 688.27 | | |
| | 3/16/95 | | | 12.19 | 689.23 | | |
| | | | | | | | |
| MW-6 | 10/9/92 | 26.00 | 692.34 | 18.83 | 673.51 | 10.00 | 6/14/89 |
| (II-1) | 4/22/93 | | | 16.23 | 676.11 | | |
| | 9/29/93 | | | 19.63 | 672.71 | | |
| | 3/16/95 | | | 16.51 | 675.83 | | |
| | | | | | | | |
| MW-7 | 10/8/92 | 30.00 | 690.05 | 19.82 | 670.23 | 10.00 | 6/13/89 |
| (II-2) | 4/22/93 | | | 18.07 | 671.98 | | |
| | 9/29/93 | | | 20.41 | 669.64 | | |
| | 3/16/95 | | | 19.13 | 670.92 | | |
| | | | | | | | |
| MW-8 | 10/8/92 | 36.00 | 688.05 | 15.58 | 672.47 | 10.00 | 6/12/89 |
| (II-3) | 4/22/93 | | | 14.34 | 673.71 | | |
| | 9/29/93 | | | 16.88 | 671.17 | | |
| | 3/16/95 | | | 15.57 | 672.48 | | |
| | | | | | | | |
| MW-9 | 10/9/92 | 29.00 | 703.27 | 10.94 | 692.33 | 10.00 | 6/12/89 |
| (II-4) | 4/22/93 | | | 4.97 | 698.30 | | |
| | 9/29/93 | | | 15.38 | 687.89 | | |
| | 3/16/95 | | | 6.30 | 696.97 | | |
| | | | | | | | |
| MW-10 | 10/9/92 | 14.00 | 714.31 | 11.42 | 702.89 | 10.00 | 6/12/89 |
| (II-5) | 4/22/93 | | | 8.67 | 705.64 | | |
| | 9/29/93 | | | 13.26 | 701.05 | | |
| | 3/16/95 | | | 9.32 | 704.99 | | |
| | | | | | | | |
| MW-11 | 10/9/92 | 100.50 | 742.20 | 19.34 | 722.86 | Open Rock | 4/11/89 |
| | 4/22/93 | | | 18.15 | 724.05 | | |
| | 9/29/93 | | | 22.30 | 719.90 | | |
| | | | | | | | |
| | | | | | | | |

**TABLE 3-5, cont.**

**LONG-TERM WATER TABLE ELEVATIONS**

**AT PHASE I AND PHASE II**

White Street Landfill | (I) = Phase I

Greensboro, North Carolina | (II) = Phase II

| WELL NO. | DATE MEASURED | TOTAL WELL DEPTH | CASING ELEVATION | WATER LEVEL | WATER TABLE ELEVATION | SCREEN LENGTH | DATE INSTALLED |
|---|---|---|---|---|---|---|---|
| MW-12 | 10/9/92 | 100.00 | 765.00 | 20.44 | 744.56 | Open Rock | 4/14/89 |
| | 4/22/93 | | | 14.05 | 750.95 | | |
| | 9/29/93 | | | 23.40 | 741.60 | | |
| II-6 | 3/16/95 | | 698.47 | 9.57 | 688.90 | 10.00 | NA |
| II-7 | 9/21/94 | | 684.08 | 13.28 | 670.80 | 10.00 | NA |
| II-8 | 3/16/95 | | 707.09 | 12.31 | 694.78 | 10.00 | NA |
| MW-13 | 12/27/94 | 33.97 | 741.62 | 23.12 | 718.50 | 15.00 | 1/6/93 |
| | 1/25/95 | | | 20.54 | 721.08 | | |
| | 3/16/95 | | | 16.25 | 725.37 | | |
| MW-14 | 3/16/95 | | 765.30 | 24.50 | 740.80 | 15.00 | 1/6/93 |

on average than the highest recorded event within the last four years. This "high" event ranges from 0 to 2.68 feet higher than the March 1995 readings, with only one reading being more than 2 feet higher. One anomalous reading from September 1993 was 6.09 feet higher than the March 1995 water levels, but this is probably a bad measurement. Therefore, the March 11th data appears to be a good representation of the seasonal high water table. These elevations plus 5 feet were used to develop the base grade map (see Figure 3-7). An extra foot of separation could be added for the design study bottom of liner drawing to provide an extra margin of safety.

### 3.4.4 Water Level Fluctuations

Examination of the water level data (see August/September/October 1995 levels) shows a small lowering of 2-4 feet of the water table in areas along the eastern margin of the Phase III area as a result of drainage of the two lakes which previously existed in the central valley, and as a result of excavation in the B-26, B-24, B-33, and B-31 area of the site (see Drawing D-1 for piezometer locations). It appears that this drainage and excavation has primarily affected water levels in piezometers located nearest to the former lake (B-9 and B-8), with very minor effects possibly also occurring in B-7, B-24, B-26, B-31, and B-33. As indicated above, the effect of lake drainage is probably a much more significant factor in causing the localized lowering of the water table than excavation activities were.

General excavation across much of the Phase III footprint has taken place over the last ten months, since the observation wells/piezometers were installed. As much as 25 feet of soil has been removed in certain areas. The hydrogeologic investigations of the Phase III site were conducted prior to borrow activities as indicated previously. However, based on NCDEHNR and HDR advice, borrow activities have been discontinued in the Phase III area.

Monthly water level measurements continue to be obtained in order to characterize the nature and extent of man's impact on the water table. In spite of the change in topography and surface water hydrology, the data does not indicate a discernible change in water levels beneath the Phase III landfill footprint.

No other man-made activities or natural processes appear to have the potential to cause water table fluctuations on site.

### 3.4.5 Groundwater Flow

As noted above, Figure 3-6 depicts the water table at the landfill. This map is based upon water levels measured on March 11, 1995, at the "shallow" wells, those wells screened within 10 feet of the water table.

As shown on this map, groundwater flow is, not surprisingly, generally strongly influenced by surface topography. Flow is generally away from areas of recharge, represented by the highest areas of natural topography, towards the discharge areas found along the streams. Discharge is taking place locally along the central drainage at the east side of the Phase III area. A significant portion of groundwater flow is moving northward and northwestward toward discharge into North Buffalo Creek.

In the case of the vertical component of groundwater flow, recharge takes place on interfluvial areas, then travels downward and laterally to discharge along the creeks. Thus, the vertical component of groundwater flow is directed downward in inter-fluvial recharge areas, comprising perhaps 80 to 90% of land surface, and then has an upward component of flow as groundwater draws near discharge areas at streams.

The most influential hydrogeological features for the Phase III Area are the unnamed creek east of the site, the topographic ridge/divide along Nealtown Road and Huffine Mill Road to the west and south of the Phase III area, and North Buffalo Creek. As a result of these features, groundwater flow in the surficial aquifer generally trends to the northeast as shown on Figure 3-6. The horizontal potentiometric gradients for the surficial aquifer range from 0.004 to 0.056. The horizontal potentiometric gradients for the shallow and deep rock aquifers range from 0.023 to 0.033 and from 0.018 to 0.022, respectively.

A comparison of hydraulic head differences for nested well pairs in the Phase III area, based upon the most recent water level measurements from October 31, 1995, indicates a downward gradient in the vertical direction for every well pair.

Strong downward gradients are indicated for the two wells located in the upper and middle portions of the recharge area, whereas the four pairs located at lower elevation or near the creek showed very slight downward gradients, indicating nearly horizontal flow. Vertical gradient information for the nested piezometers is given below.

| Well Pairs | $\Delta H/\Delta L$ | Hydraulic Gradient |
|---|---|---|
| B-1/1d | 7.64/12.83 | 0.595 ft/ft (downward) |
| B-17/17d | 12.72/27.50 | 0.463 ft/ft (downward) |
| B-25/25d | 2.26/16.00 | 0.141 ft/ft (downward) |
| B-34/34d | 1.99/36.50 | 0.055 ft/ft (downward) |
| B-9/9d | 0.48/32.53 | 0.015 ft/ft (downward) |
| B-22/22d | 0.22/18.00 | 0.012 ft/ft (downward) |

The average linear velocity of groundwater flow can be calculated using the following formula:

$$V_x = \frac{Kdh}{n_e dl}$$

Where:
$V_x$ = average linear velocity
$K$ = hydraulic conductivity
$dh/dl$ = hydraulic gradient
$n_e$ = effective porosity

Using the effective porosities given in the RCRA Facility Investigation Guidance Document (1987), the hydraulic conductivities given in Table 3-4, and appropriate horizontal hydraulic gradients, a range of horizontal flow velocities of between 0.01 and 6.60 feet per day results for the uppermost (saprolite) aquifer (see Table 3-6). Note that the dike material (one slug test only) is at least an order of magnitude more conductive than saprolite developed in granite or gneiss, but recall also that, at depth, these dikes may become essentially impermeable (see Table 3-4, B-1d, and B-34d).

**Table 3-6**
**Summary of Calculated Groundwater Flow Velocities**

| Hydrostratigraphic Unit (Aquifer) | Hydraulic Gradient | Porosity (%) | Hydraulic Conductivity (ft/day) | Groundwater Flow Velocity (ft/day) |
|---|---|---|---|---|
| Saprolite | 0.004 - 0.056 | 20 | 5.27 | 0.11-1.48 |
| Granite Saprolite | 0.004 - 0.056 | 20 | 0.69 | 0.01 - 0.19 |
| Gneiss Saprolite | 0.004 - 0.056 | 15 | 0.13 | 0.0035 - 0.049 |
| Dike Saprolite | 0.004 - 0.056 | 15 | 17.69 | 0.47 - 6.60 |
| Shallow Bedrock | 0.023 - 0.033 | 5* | 0.69 | 0.32-0.46 |
| Deep Bedrock | 0.018 - 0.022 | 0.1 | 0.15 | 2.70 - 3.30 |
| * Estimated | | | | |

In the case of the deep bedrock aquifer, a published value of 0.1% for secondary porosity (Heath, 1980) and a hydraulic gradient of between 0.018 and 0.022 was used to calculate an estimated range of flow velocity at 2.7 to 3.3 ft per day. Given that the upper portion of the bedrock aquifer is more fractured and has a correspondingly higher secondary porosity (estimated at 5%), and a hydraulic gradient of 0.023 to 0.033, a third intermediate range of groundwater velocity of between 0.32 and 0.46 ft/day was calculated.

These data, along with the information given in Table 3-4, provide a framework for understanding the hydrogeologic flow regime that prevails in the subsurface beneath the study area. First, it is apparent that hydraulic conductivities are generally highest in the saprolite aquifer, lowest in the deep rock aquifer, and intermediate in the shallow rock aquifer. In saprolite, the granite appears to be more conductive than the gneiss, but where saprolite is developed in a sheared, foliated, or fractured dike, the measured conductivity (B-34) can be as much as an order of magnitude higher than in either gneiss or granite. In terms of groundwater flow velocity in saprolite, the same relative rates prevail with dike material having the highest value (up to 6.60 ft/day or 2,409 ft/year), granite having an intermediate value (up to 0.19 ft/day or 69 ft/year), and gneiss having the lowest pore velocity (up to 0.049 ft/day or only 18 ft/year). It is expected that flow rates should be higher parallel to the orientation of foliations in the gneiss (i.e., N65E-N70E).

The surficial/uppermost aquifer which exists in saprolite in the study area serves as the reservoir that recharges the underlying fractured rock aquifer (called shallow and deep herein). Hydraulic conductivities are lower in the rock aquifer, but actual pore water flow velocities can be relatively high due to the very low effective porosities. In rock, the available hydraulic head is forced to travel through a relatively small volume of fractures which act as conduits for flow. In shallow bedrock where an effective porosity of 5% is appropriate, flow velocities of up to 0.46 feet/day (168 ft/year) can prevail. In deep bedrock, effective porosities of 0.1% result in calculated velocities of up to 3.3 ft/day (1,200 ft/year), rates which are comparable to those found in the sheared saprolitic dike at B-34. This accounts for why recharge rates and yield for deep rock wells can be so high compared to saprolite wells, but it must be remembered that high yields in rock wells are absolutely dependent upon the existence of well connected fracture systems which allow flow of groundwater to the well to take place. The intent and purpose of this study is not to define the orientation of bedrock fracture systems or to completely characterize the bedrock aquifer on site, but it is useful to discuss the relationship between the uppermost (saprolite) aquifer and the bedrock aquifer, if only to provide a conceptual framework for designing a monitoring system.

Finally, it should be noted again that the various dikes at the site have highly variable hydrogeologic characteristics as a function of depth, degree of weathering, fracturing, and shearing, and rock type. As previously mentioned, the saprolite developed by weathering of a diorite dike at B-34 had the highest conductivity measured on site, but at depth this same dike was essentially impermeable. Indeed, the conductivity of the mafic dike at B-1d (deep rock) is so low that recharge after well development took between four and six months. This data suggests that these dikes would be extremely poor conduits for recharge between the uppermost saprolite aquifer and the bedrock aquifers. They may also act as barriers to horizontal flow depending upon the depths at which they become impermeable.

## 3.5 Summaries and Conclusions

### 3.5.1 Summary

The White Street Landfill site is situated in a typical North Carolina Piedmont setting. Groundwater is found in the sandy silt to silty sand saprolite that has formed from the weathering of the granite, felsic gneiss, and mafic, rhyolitic, diorite, and greenstone dikes, and in the fractured bedrock itself. Examination of the distribution of water table elevations between wells completed in saprolite and nearby wells completed in bedrock strongly indicates that where the water table is in the saprolite, the saprolite is hydraulically connected to the underlying bedrock. Groundwater flow in the saprolite and the shallow bedrock (the "uppermost aquifer") is primarily controlled by topography and the locations of discharge areas along streams. Variations in flow as a function of weathering, orientation of fractures, metamorphic fabric or the presence of cross-cutting dikes are secondary in terms of their relative influence. As such, groundwater flow is predictable and existing monitoring wells confirm the general flow of groundwater from highlands to stream valleys. As discussed elsewhere in this report, there are no groundwater supply wells near the landfill and the only current "receptors" of groundwater flow from the landfill site are the streams found at the site, which are local and regional groundwater discharge features.

### 3.5.2 Conclusions

Based upon data synthesized for this report, the proposed area of expansion appears geologically and hydrologically well suited for municipal solid waste landfilling activities.

North Carolina's Subtitle D rules require that a minimum 4-foot separation be maintained between the bottom of the landfill liner system and the seasonal high water table and the top of bedrock. Table 3-7 presents a summary of the vertical separation criteria and provides a comparison between base grade, top of bedrock, and seasonal high water table elevations.

**Table 3-7**

**Summary Table - Vertical Separation Criteria**

| Boring Number[a] | Ground Elevation[b] | Base Grade Elevation[c] | Top of Bedrock[d] | Seasonal High Water Table Elevation[e] |
|---|---|---|---|---|
| B-1 | 760.80 | 756.50 | 747.80 | 747.57 |
| B-7 | 773.09 | 764.90 | 748.59 | 753.88 |
| B-10 | 778.09 | 774.00 | 745.59 | 754.20 |
| B-11 | 769.20 | 768.10 | 752.70 | 755.91 |
| B-12 | 776.06 | 779.10 | 765.06 | 770.96 |
| B-16 | 782.71 | 771.15 | 746.71 | 761.92 |
| B-17 | 787.71 | 780.95 | 773.71 | 775.23 |
| B-18 | 771.60 | 772.10 | 758.60 | 758.82 |
| B-19 | 775.78 | 763.25 | 764.78 | 758.34 |
| B-20 | 770.68 | 759.10 | 754.68 | 745.73 |
| B-22 | 754.92 | 761.30 | 723.92 | 746.90 |
| B-23 | 765.26 | 761.60 | 734.26 | 748.63 |
| B-24 | 750.08 | 758.00 (749) | 738.08 | 741.88 |
| B-25 | 744.54 | 753.00 | 706.04 | 741.32 |
| B-26 | 739.20 | 755.00 (742) | 732.70 | 735.98 |
| B-28 | 739.33 | 741.25 | 738.83 | 736.77 |
| B-29A | 743.61 | 744.00 | 735.61 | 739.44 |
| B-31 | 747.10 | 751.90 | 722.10 | 743.76 |
| B-33 | 757.22 | 759.40 | 742.22 | 754.47 |

Handwritten beside the table: 754.01 (B-7), 754.91 (B-10), 762.31 (B-16), 759.82 (B-19), 751.51 (B-23), 737.73 (B-28), 739.89 (B-29A)

Notes:
(a) Borings located within the proposed landfill footprint (cell limits).
(b) Ground elevation at time of boring installation.
(c) See Figure 3-7, note removal of bedrock will be required in the vicinity of B-19, and B-28 to achieve 4 feet of separation between the bottom of clay liner and the top of rock.
(d) See Figure 3-3.
(e) March 11, 1995, water level readings. * Not long-term seasonal high W.T.

The uppermost aquifer occurs within the saprolite in the Phase III area. Therefore, depth to the water table is the primary limiting factor for excavation depths. In order to ensure adequate separation, a potentiometric contour map was generated utilizing seasonal high water table elevations (March 11, 1995) at each piezometer (see Figure 3-3). This potentiometric contour map was then used to develop the base grade for the bottom of the Phase III landfill cell (Figure 3-7). The base grades were drawn using the seasonal high water table elevations, plus 5 feet. This results in an extra foot of separation, thereby providing an extra margin of safety. As indicated on Table 3-7, the required separation between the high water table and bottom of the liner system will be maintained given the specified base grades. In addition, removal of some bedrock will be necessary in the western portion of the Phase III area in the vicinity of borings B-19 and B-28 to maintain the required 4 feet of separation between the bottom of the clay liner and the top of rock. Given the current elevations, it is also apparent that some filling will be necessary in the eastern portion of the Phase III area to build up the base grade to the specified elevations.

The groundwater flow regime in the uppermost aquifer is relatively uncomplicated and readily allows effective monitoring of waste units. In the uppermost aquifer, sandy silt and silty sand aquifer materials create relatively slow groundwater flow velocities, allowing time to deal with any detected impairment of groundwater quality before it has traveled very far.

In summary, based upon the geologic and hydrologic conditions at the landfill site, it appears that the proposed location is suitable for Subtitle D landfilling activities.

## SECTION 4.0
## LOCATION RESTRICTIONS

The purpose of this section is to demonstrate that the City of Greensboro's proposed White Street Sanitary Landfill is in compliance with the North Carolina Solid Waste Management Rules and Solid Waste Management Law and the location restrictions stated in Rule .1622 therein.

### 4.1 Airport Safety

Figure 4-1 shows all public-use airports which are open to the public without prior permission and without restrictions within the physical capacities of the available facilities, and are located within a 10,000 foot radius of the boundary of property proposed for the development of Phase III of the White Street Sanitary Landfill. As is evidenced by this Figure and from information received from the Federal Aviation Authority officials (see Appendix B), there are no airport runways used by turbine-powered aircraft within this area, nor are the any airport runways used only by piston-powered aircraft within this area. Therefore, the operation of the proposed facility will not increase the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants. This demonstrates that the proposed facility is in compliance with Rule .1622 (1).

### 4.2 Floodplain

According to Army Corps of Engineers Maps and FEMA Maps maintained by the City of Greensboro, the site proposed for the development of Phase III of the White Street Sanitary Landfill is not located in the 100-year flood plain and therefore is in compliance with Rule .1622 (2) (FEMA Maps are included in Appendix B).

### 4.3 Wetlands

A wetlands reconnaissance survey conducted by an HDR environmental scientist at the proposed project site and its adjacent areas revealed that there were no wetlands within the proposed landfill unit itself, but there were wetlands associated with two ponds on property adjacent to the expansion area. For further understanding of the implications of the presence of the ponds with regard to long-term planning of landfill operations, arrangements were made to have the site visited by the Corps of Engineers. COE repre-

| Title Block | Figure |
| --- | --- |
| **Airport Safety Compliance Demonstration Map** | **4-1** |
| **Description of Contents** | |
| Map dated 3/94, and labeled as Figure 1-1, Airport Safety Compliance Demonstration Map in the Transition Plan. -- Check locations against content of letter from FAA. DONE! | |

sentative John Thomas met with HDR personnel at the Greensboro landfill site on January 17, 1995, and examined the ponds, their inflow, and discharge. Mr. Thomas gave the opinion that there were jurisdictional wetlands associated with the ponds, and these wetlands would need to be acknowledged for future planning. However, these wetlands are not within the proposed disturbed area of the project, and there will not be any impact to any wetlands as a consequence of the current expansion project. The wetland areas which were previously identified as existing in narrow bands surrounding the former lakes have been eliminated. It is expected that stream margin wetlands will develop along the central drainage feature. In any case, development of the Phase III landfill will not impact these wetland areas. Adequate buffers will be provided to assure that such impacts do not occur (50-foot buffer). Figure 2-3 indicates the location of the pond and wetlands relative to the project area. Therefore, the proposed lined MSW landfill facility is in compliance with Rule .162293, as it is not located in, or impacting a portion of, an area defined as wetlands. The subsequent drainage of these ponds does not alter the fact that they were located outside of the Phase III unit boundary.

## 4.4 Fault Areas

Visual inspection and mapping of the area within and surrounding the proposed Phase III site and a search of the geological literature has not revealed any faults which have had displacement during the Holocene Epoch. In fact, there are only two capable faults in the entire eastern United States. Therefore, the proposed facility is in compliance with Rule .1622 (4), as it is not located within 200 feet of a fault that has had displacement in the period since the end of the Pleistocene Epoch to the present.

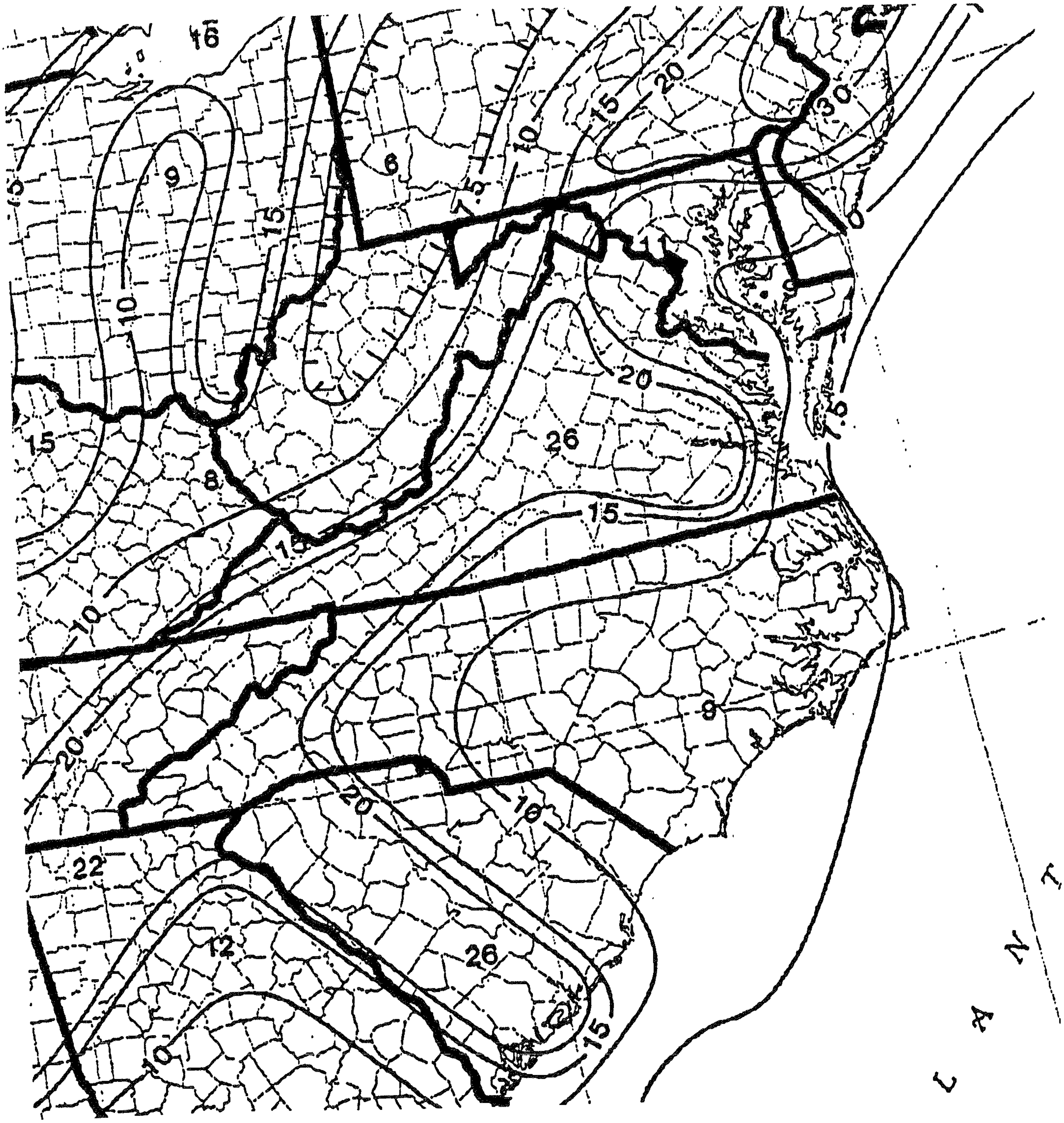
## 4.5 Seismic Impact Zones

A seismic impact zone is defined as an area with a 10% or greater probability that the maximum horizontal acceleration will exceed 0.10g (where "g" is earth's gravitational pull) in 250 years. Based upon review of U.S. Geological Survey mapping (Reference: U.S.G.S. Miscellaneous Field Studies Map MF-2120, Algermissen, et al., 1990), the proposed landfill is not located within a seismic impact zone. Based upon the mapping, there is a probability of less than 10% that the maximum horizontal acceleration will exceed .10g in 250 years. Therefore, the proposed facility is in compliance with Rule .1622 (5), as it is not located in a seismic impact zone (see Figure 4-2).

**FIGURE 4-2**
**SEISMIC MAP**

Source: U.S.G.S. Miscellaneous Field Studies Map MF-2120, Algermissen, et. al., 1990.

**FIGURE 4-2**
**SEISMIC MAP**




Source: U.S.G.S. Miscellaneous Field Studies Map MF-2120, Algermissen, et. al., 1990.

In spite of this fact, a seismic and slope stability analysis was performed by GNRA as a precaution. These analyses are provided in Appendix G.

## 4.6 Unstable Areas

Examination of the landfill site and knowledge of the geology and geomorphology of the surrounding area confirm that the landfill site is not an unstable area. The proposed landfill expansion site is situated in typical North Carolina Piedmont terrain. Slopes are stable, with no areas of landslides, avalanches, debris slides or flows, soil flection, block sliding, or rock fall. The soils that are present are typically sandy silts to silty sands that provide excellent foundation stability throughout the region. As generally the case throughout the Piedmont, no limestones or marbles are present at the site and, thus, Karst terrain cannot be present. Specifically, there are no on-site or local soil conditions that may result in significant differential settling, no on-site or local geologic or geomorphological features are conducive to unstable conditions, and neither on-site nor local human-made features or events (both surface and subsurface) should contribute to unstable conditions. Therefore, the proposed facility unit is in compliance with Rule .1622 (6).

## 4.7 Cultural Resources

In order to identify any potentially significant archaeological or historical resources within the proposed Phase III site, an informational search was performed by the North Carolina Department of Cultural Resources, Division of Archives and History. As a result of this search, it was determined that there are no structures of historical or architectural importance located within the site area (see Appendix B). On the recommendation of the Department further review of the area to determine whether or not there were any archaeological sites within the proposed facility boundaries. The results of the archaeological survey are included in Appendix B. the findings indicate that there are no prehistoric or historic archaeological resources within the proposed facility boundary; therefore the proposed facility is in compliance with Rule .1622 (7).

## 4.8 State Nature and Historic Preserve

In order to determine whether or not the proposed Phase III site encompassed or was surrounded by any lands in the State Nature and Historic Preserve an informational search was performed by the North Carolina Department of Cultural Resources (see

Appendix B). As a result of this search, it was determined that the development of Phase III would not have an adverse impact on any lands in the State Nature Historic Preserve, and therefore the proposed facility is in compliance with Rule .1622 (8).

## 4.9 Water Supply Watersheds

According to City of Greensboro records, the proposed facility property is not located in a General Watershed Area or a Watershed Critical Area (see Appendix B). Therefore the proposed facility is in compliance with Rule .1622 (9) as none of the environmental regulations pertaining to Water Supply Watershed Districts apply to the development of the site.

## 4.10 Endangered and Threatened Species

The landfill site was visited by a staff environmental scientist specifically for the purpose of surveying for protected species, both those listed by the contact agencies and those known by experience to have some potential for occurrence in the broader area.

Portions of the proposed site are wooded while other portions are currently being used as a borrow pit. Urban development and land uses exist in the immediate vicinity. In order to identify the potential for the development of the proposed Phase III facility for destroying or adversely modifying critical habitat for threatened or endangered species, an informational search was performed by the North Carolina Department of Environment, Health and Natural Resources, Division of Parks and Recreation (see Appendix B). The search revealed no records of any protected species in or near the project area.

Regarding protected species, the only federally-listed species of concern cited for Guilford County was the bald eagle, *Haliaeetus leucocephalus*. This distinctive bird was not seen at the site, nor were any characteristic eagle nests observed. Three federally listed special concern species were also considered while performing the site survey: loggerhead shrike (*Lanius ludovicianus*), Carolina darter (*Etheostoma collis*), and mole salamander (*Ambystoma talpoideum*). The loggerhead shrike prefers habitat where it can perch at a vantage point overlooking open country of meadows and fields; such conditions are not present at the project site, nor was the loggerhead shrike observed there. For the Carolina darter, there were no appropriate bodies of water at the project area to support the species. The mole salamander is rare throughout most of the state;

it is known to occupy underground burrows in pine savannas, hardwood forests, and swamps. Neither swamps nor pine savannas are present at the project locale; the hardwoods are sparse and immature and there were no appropriate breeding pools observed in the area. Though the mole salamander is listed as occurring in Guilford County, the populations are about 12 miles away. Therefore, it is unlikely that the species would be present at the landfill site. Given the absence of any protected species within the project area, the proposed facility is in compliance with Rule .1622 (10) as it will not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat.

## SECTION 5.0
## FACILITY REPORT

The purpose of this section is to present a conceptual plan for the development of the proposed new lined landfill facility known as Phase III of the City of Greensboro's White Street Sanitary Landfill. This report has been prepared in accordance with the requirements of Rules .1623 and .1619 (e)(1), (e)(2), (e)(3), and (e)(5) of the North Carolina Solid Waste Management Rules and Solid Waste Management Law.

### 5.1 Waste Stream

The waste which is received at the White Street Sanitary Landfill and that which is anticipated to be received in the future does not represent the entire waste stream generated within Guilford County. While no quantitative data is available, it is understood that some private industries within the County own and operate their own monofills. In addition, there are private haulers operating in Guilford County which do not rely on the White Street Sanitary Landfill for disposal services, but rather haul wastes to privately owned landfill facilities.

The City of Greensboro itself has been responsible for diverting a portion of the waste stream generated within Guilford County from disposal in the White Street Sanitary Landfill, and expects that such "diversion programs" will continue if not expand once the Phase III area of the landfill facility is operational. Each of these programs is briefly described below.

- **Yard Waste Composting** - Yard waste which is received at the White Street Sanitary Landfill is composted in an area which is separate from current and future municipal solid waste filling locations. In 1994 approximately 24,440 tons of yard waste was composted at the White Street Sanitary Landfill Composting operation.

- **Construction and Demolition Waste** - Construction and demolition (C&D) waste which is received at the White Street Sanitary Landfill is disposed of in an area which is separate from current and future municipal solid waste filling locations. In 1994 approximately 42,260 tons of C&D waste was diverted from the municipal solid waste fill area at the White Street Sanitary Landfill and will be recycled or disposed of in a separate C&D (Solid Fill) area.

- **Residential Recycling** - The City of Greensboro currently operates a city-wide curbside recycling program. In addition, there are fourteen recycling drop-off centers operated by the City. Materials collected for recycling include: newspaper; clipboard; corrugated cardboard; magazines; HDPE and PET plastics; clear, green and amber glass; aluminum and bimodal cans; and on a seasonal basis, telephone books. It is estimated that in 1994 a total of 14,042 tons of materials will be diverted from the municipal waste stream through residential recycling efforts.

- **Commercial Recycling** - The City of Greensboro currently operates a commercial recycling program. The materials collected from commercial materials include: white, mixed and computer paper; newspaper; corrugated cardboard; magazines; HDPE and PET plastics; aluminum and bimodal cans; and on a seasonal basis, telephone books. It is estimated that in 1994 a total of 4,511 tons of materials will be diverted from the municipal waste stream through commercial recycling efforts.

- **Programs for Special Wastes** - The City of Greensboro currently collects and recycles special wastes which have been banned from landfill disposal. Wastes which are managed through these programs include tires, white goods, used motor oil, household hazardous waste, and lead-acid batteries.

### 5.1.1 Waste Types

Waste which is received at the White Street Sanitary Landfill is categorized as residential, industrial, commercial, construction/demolition, and yard waste. The proposed Phase III facility will accept only residential, industrial, or commercial waste types. Separate areas of the White Street Sanitary Landfill have been designated to receive the construction/demolition waste and the yard waste which are brought to the facility. The yard waste is composted and the construction/demolition waste is either recycled or disposed of in a special C&D disposal area.

### 5.1.2 Disposal Rates

Municipal solid waste anticipated to be received at the White Street Sanitary Landfill for the period 1994 - 2023 are summarized in Table 5-1. As indicated, the MSW stream is projected to grow from approximately 243,560 tons in 1994 to an estimated 384,820 tons in 2023. On a monthly disposal rate basis, these estimates calculate out to be approximately 20,297 tons per month in 1994 to 32,068 tons per month in 2023.

Historically, the quantities of MSW received at the White Street Sanitary Landfill on a month to month basis have been relatively constant. Typically, MSW generation has been highest during the month of August (on average, representing 10% of the annual MSW waste received), and the months of November and December have been the lowest in terms of MSW generation (on average, each month yielding 7% of the annual MSW waste received).

For the purposes of this Report, it has been assumed that waste generation rates shall increase at a rate of 1.3% per year during the years 1994 -2000 (U.S. EPA estimate); after the year 2000 it has been assumed that generation rates shall increase by 2.0% per year. Tonnage projections were not based on per capita generation rates, as it is known that not all waste generated within Guilford County is disposed of in the White Street Sanitary Landfill. For comparative purposes, MSW projections were made using the population estimates for Guilford County and the MSW per capita generation rate of 5.52 pounds per person per day which was the estimated average for the state of North Carolina during fiscal year 1992-1993. As can be seen from the actual 1994 tonnage received at the White Street Sanitary Landfill, and that projected if the entire Guilford County population were to have disposed of 5.52 pounds of MSW per day, it apparent that a portion of the County's MSW stream is most likely being disposed of in a facility or facilities other than the White Street Sanitary Landfill; thus the rational for using the actual 1994 waste stream and linear MSW generation growth rates for estimating future waste stream quantities.

**TABLE 5-1**
**CITY OF GREENSBORO, WHITE STREET SANITARY LANDFILL**
**MUNICIPAL SOLID WASTE PROJECTIONS**

| Year | Guilford Co. Pop.[1] | MSW Tons/Year | MSW Tons/Day | MSW Tons/Year Using NC PCG Rate[4] |
|---|---|---|---|---|
| 1994[2] | 360,886 | 243,556 | 781 | 363,557 |
| 1995[3] | 364,252 | 246,720 | 791 | 366,947 |
| 1996 | 366,423 | 249,890 | 801 | 369,135 |
| 1997 | 368,594 | 253,050 | 811 | 371,322 |
| 1998 | 370,765 | 256,220 | 821 | 373,509 |
| 1999 | 372,936 | 259,390 | 831 | 375,696 |
| 2000 | 375,107 | 262,550 | 842 | 377,883 |
| 2001 | 376,667 | 277,650 | 890 | 379,454 |
| 2002 | 378,227 | 282,520 | 906 | 381,026 |
| 2003 | 379,788 | 287,400 | 921 | 382,598 |
| 2004 | 381,348 | 292,270 | 937 | 384,170 |
| 2005 | 382,908 | 297,140 | 952 | 385,742 |
| 2006 | 384,530 | 302,010 | 968 | 387,376 |
| 2007 | 386,152 | 306,880 | 984 | 389,010 |
| 2008 | 387,773 | 311,750 | 999 | 390,643 |
| 2009 | 389,395 | 316,620 | 1,015 | 392,277 |
| 2010 | 391,017 | 321,490 | 1,030 | 393,911 |
| 2011 | 392,639 | 326,360 | 1,046 | 395,545 |
| 2012 | 394,261 | 331,240 | 1,062 | 397,179 |
| 2013 | 395,882 | 336,110 | 1,077 | 398,812 |
| 2014 | 397,504 | 340,980 | 1,093 | 400,446 |
| 2015 | 399,126 | 345,850 | 1,108 | 402,080 |
| 2016 | 400,748 | 350,720 | 1,124 | 403,714 |
| 2017 | 402,370 | 355,590 | 1,140 | 405,348 |
| 2018 | 403,991 | 360,460 | 1,155 | 406,981 |
| 2019 | 405,613 | 365,330 | 1,171 | 408,615 |
| 2020 | 407,235 | 370,200 | 1,187 | 410,249 |
| 2021 | 408,857 | 375,080 | 1,202 | 411,883 |
| 2022 | 410,479 | 379,950 | 1,218 | 413,517 |
| 2023 | 412,100 | 384,820 | 1,233 | 415,150 |

Notes:

1) Population based on 1990 U.S. Census and NC Office of State Planning projections for the years 1995, 2000, 2005, and 2010. Straight line interpolation used for intervening and subsequent years.

2) Based on White Street Sanitary Landfill data recorded for residential, commercial and industrial waste (MSW) for period 1/1/94 - 12/31/94.

3) Using the MSW tonnage for 1994 as a base year, tonnage projections for subsequent years through 2000 calculated using the U.S. EPA projected increase in waste generation rate of 1.3%/year. Beyond the year 2000, waste generation rates reflect a 2.0% increase per year.

4) Waste projections using NC MSW per capita generation rate of 5.52 pounds per person per day (NC DEHNR, North Carolina Solid Waste Management Annual Report, July 1, 1992 - June 30, 1993) and Guilford County population projections.

### 5.1.3 Service Area

The White Street Sanitary Landfill will accept only those wastes which are generated within Guilford County and from municipalities whose boundaries cross into Guilford County. The waste stream received at the facility consists of approximately 79% municipal solid waste (residential, commercial and industrial) and 21% yard waste and construction/demolition waste. It is anticipated that this ratio of MSW to other wastes received at the proposed facility (Phase III) will remain relatively constant, as the service area will remain the same; namely, Phase III shall provide the City of Greensboro and Guilford County with lined landfill disposal capacity.

### 5.1.4 Waste Segregation

The proposed Phase III facility will only accept municipal solid waste for which it is permitted to receive. Any materials which pose health hazards, cause fire or which could impact negatively on the environment are deemed unacceptable. The Scale Attendant will request from the driver of the vehicle entering the landfill a description of the waste it is carrying to ensure that unacceptable waste is not allowed into the landfill. The Attendant will then visually check the vehicle as it crosses the scale. Signs will be conspicuously posted informing users of dumping procedures, the type of waste the facility is permitted to receive as well as those wastes banned from disposal at the facility, and shall indicate the location of the disposal area.

In accordance with Senate Bill 111, the following wastes are prohibited from disposal within a municipal solid waste landfill (MSWLF) unit:

- Scrap Tires
- Used Oil
- White Goods
- Lead Acid Batteries
- Yard Trash

In addition, operating criteria prohibit certain other materials from disposal at a MSWLF unit. These criteria address the following types of waste that are prohibited:

- Hazardous waste as defined within 15A NCAC 13A, including hazardous waste from conditionally exempt small quantity generators.

- Polychlorinated biphenyls (PCB) wastes as defined in 40 CFR 761.

- Bulk or non-containerized liquid wastes unless the waste is household waste other than septic waste and waste oil; or the waste is leachate or gas condensate derived from the MSWLF unit, whether it is a new or existing MSWLF unit or lateral expansion designed with a composite liner and leachate collection system.

- Containers holding liquid wastes unless the container is a small container similar in size to that normally found in household waste; the container is designed to hold liquids for use other than storage; or the waste is household waste.

- Wastewater treatment sludges unless they are used as a soil conditioner and incorporated or applied to the vegetative growth layer (at a depth no greater than six inches); or unless the disposal of sludges have been approved as a permit condition.

A truck spotter will direct incoming vehicles to the proper location to unload refuse at the working face. The primary function of the spotter will be to prevent unloading in areas that are not designated for disposal and to visually inspect all loads as they are dumped to assure compliance with posted operating rules. A traffic spotter located at the working face will direct vehicles to the location where the waste is to be unloaded.

Unacceptable waste which escapes the initial screening and is dumped at the working face will be removed immediately by the driver of the vehicle or by the City with the cost of the removal charged to the owner of the vehicle involved. Any vehicle owner or operator who knowingly dumps unacceptable waste may be barred from using the landfill.

All C&D debris will be maintained in a location separate from the Phase III location and shall not be commingled with the normal municipal wast stream. In addition, yard waste shall be composted in a location separate from the Phase III location and shall not be commingled with the normal municipal solid waste stream. Any white goods, tires, used oil, and lead acid batteries which are received at the landfill shall be collected for recycling. Should a generator of special non-hazardous wastes wish to use the proposed disposal facility, the generator must apply to the DEHNR to obtain written approval and certification that the waste is non-hazardous according to the current regulations governing the management of hazardous waste in the State. This written notification must be obtained before acceptance of a special waste will be considered.

### 5.1.5 Equipment Requirements

Equipment requirements may vary in accordance with the method or scope of landfill operations at any given time. Additional or different types of equipment may be provided as necessary to enhance operational efficiency. However, in order to ensure adequate operation of the proposed Phase III facility, arrangements shall be made to ensure that equipment is available for:

- preparing the site cells for municipal solid waste reception;
- spreading and compacting the waste in cells;
- excavating and transporting cover soil;
- spreading and compacting cover soil;
- site maintenance and clean-up work; and,
- extinguishing fires (and/or arrangements will be made to provide for fire protection).

Equipment requirements may vary in accordance with the method or scope of landfill operations at any given time. Additional or different types of equipment may be provided as necessary to enhance operational efficiency. However, it is expected that equipment needed to perform the tasks listed above shall include one or more compactors, bulldozers, graders, loaders, earthmovers, grinders, tractors, hauling trailers, dump trucks, tractors, and pick-up trucks. In addition, sufficient reserve equipment will be accessible to provide alternate equipment within twenty four (24) hours following equipment breakdown. The types and sizes of equipment currently in use at the White Street Sanitary Landfill are presented in Appendix F.

## 5.2 Landfill Capacity and Design

### 5.2.1 Total Operating Capacity

The proposed Phase III facility boundary encompasses approximately 146 acres. Phase III consists of an approximately 50-acre lined unit which will be divided into three construction cells. The first two cells are designed to hold approximately two years of waste each. The third cell, along with the airspace above Cells 1 and 2, is expected to provide an additional three years of capacity to Phase III. The total capacity of Phase III is, therefore, about seven years. The landfill system developed for Phase III is expected to contain common leachate and gas management facilities that will be operated during the regulated life of the proposed facility. The preliminary base grading (Figure 5-1) and final grade (Figure 5-2) plans are attached. More detailed drawings will be submitted to the Department with the Permit to Construct application. The plans provided here are intended to be of a conceptual level only.

The total gross operating capacity for the Phase III area is estimated to be 4,630,000 cubic yards. The net capacity for waste is 3,700,000 cubic yards. The expansion is comprised of three cells of approximately 20, 15, and 15 acres (see Figure 3-7). The volume translates to approximately 83 months of life, using 22,300 tons per month (the average monthly tonnage based on projections from 1998 to 2002), a compaction factor of 1,000 pounds per cubic yard, and a 4:1 waste-to-cover ratio.

### 5.2.2 Available Soil Resources and Required Soil Quantities

The available soil resources for the construction of the lateral expansion will come from a combination of on-site excavated soil and off-site resources. Permeability of on-site soils range from 1 x $10^{-3}$ cm/sec to 8 x $10^{-5}$ cm/sec; therefore, it is assumed that either an off-site source of clay material will be required to complete construction of the 24-inch thick soil component of the base liner or bentonite amendment will be required. The estimated quantity of clay soil (1 x $10^{-7}$ cm/sec permeability) that will be required is 170,000 cubic yards. The soil needed to construct structural fills and other appurtenances of the Phase III expansion, such as roads, drainage pathways, berms, and operational layers, will be provided from on-site sources and, if required, off-site sources. The requirement for structural fill is estimated at 400,000 cubic yards.

The majority of the soils required for operational procedures, such as daily and intermediate cover, are anticipated to come from the on-site borrow area located to the east of Phase III (see Figure 5-1). Approximately 940,000 cubic yards will be required for the life of the Phase III expansion.

The construction of the 18-inch thick soil liner component for the fill cap will require approximately 126,000 cubic yards of soil. The 18-inch thick vegetative support soil required is approximately 126,000 cubic yards. The 6-inch top soil layer requires approximately 42,000 cubic yards.

## 5.3 Containment and Environmental Control Systems

### 5.3.1 Construction Techniques

As constructed, the sequence of fill in Phase III will involve using multiple lifts, which will allow filling to occur uniformly across the site until the landfill unit is filled in progression. This construction technique will eliminate depression areas and facilitate movement of storm water off site, as less extreme elevation differences occur during construction when using multiple lifts. The efficient movement of storm water off site will also serve to lessen the likelihood of surface water infiltrating into the waste and the subsequent potential for leachate generation.

The landfill will be constructed as a series of daily cells, each of which will hold the waste received for one day. Cover material will be placed over the compacted waste at the end of each day. The solid waste will be evenly placed, spread and then compacted using the landfill compactor equipment in layers not to exceed 18 inches in depth. These layers will be applied to construct a lift of approximately ten (10) feet in depth after compaction.

| Title Block | Figure |
|---|---|
| **WHITE STREET SANITARY LANDFILL BASE GRADING PLAN** | **5-1** |
| **Description of Contents** | |
| Drawing of Base Grading Plan | |

| Title Block | Figure |
|---|---|
| **WHITE STREET SANITARY LANDFILL FINAL COVER PLAN** | **5-2** |
| **Description of Contents** | |
| Drawing of Final Cover Plan | |

An intermediate cover of approximately one foot will be placed and temporary grass cover planted over the lifts which have been taken out of operation for more than six (6) months. The daily and intermediate cover required to complete the area will be obtained from the borrow area located east and/or south of the proposed facility or offsite. An alternative daily cover may be used.

An intermediate cover of approximately one foot will be placed and temporary grass cover planted over the lifts which have been taken out of operation for more than six (6) months. The daily and intermediate cover required to complete the area will be obtained from the borrow area located east and/or south of the proposed facility or offsite. An alternative daily cover may be used.

Within Phase III as finished grade is attained, the area will receive a final soil cover of approximately 18 inches that has a minimum hydraulic permeability of $10^{-7}$cm/sec, a synthetic layer equivalent to the bottom liner material, and a minimum six (6) inches of top soil and planted with a vegetative cover of grass. The addition of a final cap over the fill area will further reduce infiltration of surface water and lessen the potential for leachate generation. Sediment and erosion control for the site shall be accomplished by filter basins and perimeter ditching.

### 5.3.2 Waste Disposal Controls

Solid waste transportation vehicles arrive at the working face at random intervals. There may be a number of vehicles unloading waste at the same time, while other vehicles are waiting. In order to maintain control over the off loading of waste, a certain number of vehicles will be allowed on the working face at a time. The actual number will be determined by the truck spotter. This procedure is used in order to minimize the potential of off loading non-acceptable waste and to control disposal activity. Operations at the working face will be conducted in a manner which will encourage the efficient movement of transportation vehicles to and from the working face, and to expedite the unloading of solid waste.

Solid waste unloading at the landfill will be controlled to prevent disposal in locations other than those specified by site management. Such control is also used to confine the working face to a minimum width, yet allow safe and efficient operations. The width of the working face will be maintained as small as practical in order to maintain the appearance of the site, control windblown waste, and minimize the amount of cover soil required each day. Normally, only one working face will be active on any given day, with all deposited waste in other areas covered by either daily, intermediate cover or final cover, as appropriate.

Use of portable signs with directional arrows and portable traffic barricades facilitates the unloading of wastes to the designated disposal locations. These signs and barricades will be placed along the access route to the working face of the landfill or other designated disposal areas which may be established.

### 5.3.3 Site Maintenance Controls

Many important factors must be considered in the operation of a sanitary landfill to ensure minimal adverse effects on the surrounding environments. Such maintenance includes the control of litter, birds, rodents, noise, and odors.

Litter control is a prime requisite in the proper operation of the landfill. To accomplish successful litter control, all municipal solid waste will be compacted as soon as practical after it is unloaded on the site. A cover will be applied daily. The working area will be kept as small as possible to minimize the potential for blowing debris. If required, litter fences will be placed in the vicinity of and down wind from work faces to catch blowing litter. Litter which has escaped from the work area will be picked up.

Odor omitted from the solid waste as it is deposited and compacted will normally be limited to areas within a short distance of the working face. All putrescible waste will be compacted and covered as soon as practical after it is dumped. Daily covering of the waste will control odors from this source and prevent them from becoming a nuisance.

The need for extensive disease vector control (control of rodents, flies, mosquitoes, or other animals, including insects, capable of transmitting disease to humans) will be minimized through proper site operation, including on-going compaction and application of daily and final cover. If vector problems develop that require control beyond the measures indicated above, pesticides and/or rodenticides will be employed as necessary by licensed professionals.

To reduce the nuisance of noise to neighbors, a buffer of trees and other vegetation will be maintained between the operating areas and other areas not designated for landfill operations. Equipment operators, drivers, and other operating personnel will be trained in the use of equipment in an effort to minimize noise generation.

## 5.4 Special Engineering Features

### 5.4.1 Alternative Cover Use

The regulations specify that the waste shall be covered daily 6 inches of soil or an alternate cover. Currently, the City uses either soil or an approved alternate cover on a daily basis. The alternate daily cover consists of a waterproof tarpaulin that is pulled over the waste in place of six inches of compacted soil. This alternate cover is used on a daily basis, except on weekends and holidays. On weekends and holidays the lift face is covered with six inches of compacted soil. It is the City's intent to continue the same daily cover practices for the proposed Phase III lift face.

### 5.4.2 Explosive Gas Control

Landfill gases are the product of solid waste decomposition under anaerobic conditions. The quantity and types of gas generated depend on the type of waste disposed of. The largest amount of gas generated is generally from waste containing a high percentage of readily degradable organic matter. The rate of generation depends mainly on the moisture content, temperature, and particle size of the waste and the age of the fill. High temperature and moisture content, along with small particle size, tend to result in higher gas production. Gas production from a landfill can last from two to 100 years, but generally peaks after approximately five years, if the moisture content is not limited. Landfill gases predominately consist of methane and carbon dioxide. Initially, the gas is mostly carbon dioxide with methane production beginning later; however, the gas eventually reaches approximately 50% methane by volume.

A gas detection system will be installed between Nealtown Road and the west side of the landfill. This system will monitor for gas migration along the perimeter of the landfill nearest any residential structures. All buildings and enclosed structures on the landfill will be monitored as part of a routine methane monitoring program.

### 5.4.3 Sedimentation and Erosion Control

The landfill will be constructed with maximum 4:1 side slopes and minimum 12.5:1 top slopes to promote runoff and prevent ponding over or in the waste. Perimeter drainage channels at the toe of the slope will provide runoff, erosion, and sediment control. The drainage channel allows for the movement of surface water from landfilling activities and provides a settling zone for sediments carried from the site. The channel is constructed to allow drainage via sediment basins through natural outfalls to North Buffalo Creek.

In addition to the drainage channel, sediment basins, silt fences, slope drains, and sediment traps, temporary and permanent seeding will be used to mitigate sedimentation and erosion control problems. All measures will be constructed or installed in accordance with standards specified in the North Carolina Erosion and Sediment Control Planning and Design Manual.

Sediment basins will also prevent the discharge of pollutants that violate requirements of the Clean Water Act, including, but not limited to, NPDES requirements, into the waters and wetlands of the United States.

The landfill will have a comprehensive surface and groundwater monitoring program to provide early detection of any leachate migration problems. In the event any constituents are detected above allowable limits, measures will be taken to begin assessing the extent of contamination and, if necessary, corrective actions will be taken to prevent the pollution of waters and wetlands of the United States, that violate any requirements of an area-wide or state-wide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act, as amended.

# APPENDICES

## APPENDIX A

## LOCAL GOVERNMENT APPROVALS

CITY OF GREENSBORO

NORTH CAROLINA

P.O. BOX 3136
GREENSBORO, NC 27402-3136

April 17, 1995

Mr. Dexter Mathews
Section Chief
Solid Waste Section
Division of Solid Waste Management
P.O. Box 27687
Raleigh, NC 27611

Dear Mr. Mathews:

As required by Section 15A NCAC 13B .1618(c)(5)(B), this letter confirms that the property under study for the development of a Subtitle D landfill meets all the requirements of the local zoning ordinance. It is zoned Conditional Use-Heavy Industrial. This zoning was completed in 1987 after the land was acquired by the City and annexed into its jurisdictional boundary.

If you have questions regarding this action, please contact me at 910-373-2144.

Sincerely,

Charles E. Mortimore

Charles E. Mortimore
Director of Planning

RECEIVED
APR 21 1995
HDR
CHARLOTTE, N.C.

**NOTICE OF PUBLIC HEARING ON THE EXPANSION OF THE WHITE STREET LANDFILL**

The Greensboro City Council will hold a public hearing to allow public input on the proposed site plan and expansion of the White Street Landfill. The meeting will be held on 17 January 1995, at 6:00 p.m., in the Council Chamber, Room 210, Melvin Municipal Office Building, 300 West Washington Street, Greensboro, NC 27401.

Members of the public are invited to attend and present comments.

Nancy J. McPeak
City Clerk

Publish 12-15-94

Any individual with a disability who needs an interpreter or other auxiliary aids or services for this meeting may contact Richard Harriman at 373-2261 or 333-6930 (TDD).

RECEIVED
APR 21 1995
HDR
CHARLOTTE, N.C.

12.80

STATE OF NORTH CAROLINA

COUNTY OF GUILFORD

PUBLISHER'S AFFIDAVIT

JOHN MARSHALL KILIMANJARO

of lawful age, being duly sworn according to law, doth depose and say that he is Editor of THE CAROLINA PEACEMAKER a newspaper published in the City of Greensboro and County of Guilford and State of North Carolina, and that notice, of which the annexed printed slip is a true copy, has been published in said newspaper, successively, for the period of 1 week, commencing on the 15th, day of December, 1994 and that the said newspaper in which such notice was published, was, at the time of each and every publication, a newspaper meeting all the requirements and qualifications of Section 1-597 of the General Statutes of North Carolina and was a qualified newspaper within the meaning of Section 1-597 of the General Statutes of North Carolina.

**NOTICE OF PUBLIC HEARING ON THE EXPANSION OF THE WHITE STREET LANDFILL**

The Greensboro City Council will hold a public hearing to allow public input on the proposed site plan and expansion of the White Street Landfill. The meeting will be held on 17 January 1995, at 6:00 p.m., in the Council Chamber, Room 210, Melvin Municipal Office Building, 300 West Washington Street, Greensboro, NC 27401.

Members of the public are invited to attend and present comments.

Any individual with a disability who needs an interpreter or other auxiliary aids or services for this meeting may contact Richard Harriman at 373-2261 or 333-6930 (TDD).

Nancy J. McPeak
City Clerk

Publish 12/15/94

2×2½=4

Subscribed and sworn to before me this 16th day of December, 1994

Notary Public

My Commission Expires:

Affiant

6770-021-018 B-1-1 50-45

# RESOLUTION ADOPTING PLAN FOR SOLID WASTE DISPOSAL

WHEREAS, the State of North Carolina, through the office of the Secretary of DEHNR, has indicated the need to analyze the current solid waste laws and rules since recent Supreme Court decisions have changed the ability of local governments to control waste flow and, therefore, the current laws and rules developed in the late 1980s by the State do not adequately address the issues impacting solid waste disposal;

WHEREAS, the City of Greensboro has developed a long-term commitment, through past decisions of City Councils from the early 1980s, to provide at the White Street Landfill an effective and efficient disposal service for the community which is presently self-supporting and does not require additional taxation;

WHEREAS, the City recognizes the need to continue to evaluate the performance of the facility and to assess alternatives that may provide for equal or better long-term solid waste disposal services for the community;

WHEREAS, current solid waste management rules require the closing of the active fill area now used because it is not a lined facility nor does it have a lechate collection system;

WHEREAS, the State has set the date of January 1, 1998, for closing such facilities;

WHEREAS, the City must continue to protect the interests of the community to ensure effective solid waste disposal services;

WHEREAS, the City values the contribution of all neighborhoods and does not desire to unfairly burden any section or segment of its population nor put anyone at personal or financial risk;

WHEREAS, the City Council desires to assist residents of Nealtown Farms, a City-sponsored, moderate-income housing development, in protecting their investment in their homes by establishing a policy and process whereby any financial losses sustained in the appraised values of homes compared with the initial purchase prices as a result of the proposed extension of the landfill facility, will be addressed by establishing a method of providing an equitable settlement for any such losses upon the sale of homes.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF GREENSBORO:

1. The City shall participate, as appropriate, in the revision of solid waste laws and rules of the State, including working with the Department of Environment, Health and Natural Resources and shall support appropriate legislative changes to these laws and rules.

2. The City shall undertake the detailed analysis of alternatives to the development of Phase III of the White Street Landfill Plan and shall periodically report progress to the community.

3. The City shall continue its efforts to permit Phase III of the White Street Landfill and shall submit the necessary documents to the State, the first of which is the State Study Application.

4. The City shall take all reasonable and appropriate action to ensure that the residents of the Nealtown development are minimally impacted by any activity extending the landfill facility, including:

a. The City shall establish a 500-foot vegetated buffer including a berm or berms and new landscape plantings.

b. The City Manager is directed to restrict the use of City trucks on Nealtown Road except for emergency vehicles.

5. The City shall assist residents of Nealtown Farms in protecting their investment by establishing a policy and process whereby any financial losses sustained in the appriased values of homes compared with the initial purchase prices as a result of the proposed extension of the landfill facility will be addressed by establishing a method of providing an equitable settlement for any such losses upon the sale of homes.

The foregoing resolution was adopted by the City Council of the City of Greensboro, N. C. on

20 March, 1995

Nancy J. McPeak
City Clerk

CITY OF GREENSBORO

NORTH CAROLINA

P.O. BOX 3136
GREENSBORO, NC 27402-3136


May 23, 1996

From: City of Greensboro Public Library
McGirt-Horton Branch
2509 Phillips Ave.
Greensboro, NC 27495

This is to certify that the Site Plan Application is available to the public through this branch of the Greensboro Public Library. It has been on display since April 1995.

# APPENDIX B

# RELATED CORRESPONDENCE

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

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Leesha L. Fuller, Regional Manager

DEHNR

December 13, 1994

Jennifer Miller
HDR Engineering, Inc.
128 S. Tryon Street, Suite 1400
Charlotte, N.C. 28202-5001

RE: Public Wells in Two-mile Study Area
Guilford County

Dear Ms. Miller:

Shown below are public well water systems located within the two-mile study area, White Street Sanitary Landfill.

1. Cedar Park Mobile Home Park, S.R. #2832, 1/4 mile North of S.R. #2821.
2. Briggs Memorial Kiddy Kollege, 1344 Rankin Mill Road.
3. Guilford Subsidiary II, 4250 Camp Burton Road.
4. Camp Burton Maintenance, S.R. #2825, Camp Burton Road.

If I can be of further assistance, please let me know.

Sincerely,

Charlie T. Vann

Charlie T. Vann
Environmental Engineer
PUBLIC WATER SUPPLY SECTION

CTV/kd

Enclosure

cc: Public Water Supply Section, Raleigh

RECEIVED
DEC 16 1994
HDR
CHARLOTTE, N.C.

585 Waughtown Street, Winston-Salem, NC 27107-2241 Telephone 910-771-4600 FAX 910-771-4633

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

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Leesha L. Fuller, Regional Manager

DEHNR

RECEIVED
DEC 6 1994
CHARLOTTE, N.C.

December 5, 1994

Ms. Jennifer Miller
H & D Engineering
128 South Tryon Street
Suite 1400
Charlotte, N.C. 28202

Dear Ms. Miller:

On December 1, 1994 I received a copy of the map which shows the two mile study area surrounding Greensboro's proposed White Street Sanitary Landfill.

There are no raw water intakes located inside of the two mile study area.

The latitude and longitude of Greensboro's raw water intakes and reservoirs are listed below.

| Source | Latitude | Longitude |
|---|---|---|
| Lake Brant | 36.10.15 | 79.50.15 |
| Lake Higgins | 36.10.15 | 79.52.45 |
| Lake Townsend | 36.11.15 | 79.43.45 |
| Lake Jeanette | 36.09.30 | 79.47.50 |

If I can be of further assistance please do not hesitate to call me.

Sincerely,

Bert King

Bert King
Water Plant Consultant

BK/kd

cc: Public Water Supply Section, Raleigh

U.S. Department
of Transportation
**Federal Aviation
Administration**

Airports District Office
FAA, Campus Building
1701 Columbia Avenue, Suite 2-260
College Park, GA 30337-2747
(404) 305-7153 FAX: (404) 305-7155

JAN 17 1995

Ms. Jennifer L. Miller
HDR Engineering, Inc.
128 S. Tryon Street, Suite 1400
Charlotte, NC 28202-5001

Dear Ms. Miller:

This is in response to your request of December 13, 1994, for airport locations within a two-mile study area of the White Street Landfill in Greensboro, North Carolina. Our search indicates that there is no airport within the two-mile study area centered on the centroid coordinates supplied. However, for your information, we have included airport locations within a 5-mile radius of the proposed landfill centroid location since landfills within a 5-mile radius of an airport may be considered objectionable under Federal Aviation Administration (FAA) criteria. There is one airport located in this area, which is Air Harbor in Greensboro.

The FAA uses the following criteria for determining non-compatibility, "Any waste disposal site located within a 5-mile radius of a runway end that attracts or sustains hazardous bird movement from feeding, water, or roosting area into, or across, the runways and/or approach and departure patterns of aircraft." Since this information was not supplied, we suggest that Mr. John Heisterburg, State Director, Animal Damage Control, U.S. Department of Agriculture be contacted for his input on the proposed site. You can contact Mr. Heisterburg at 6301 E. Angus Road, Raleigh, North Carolina, or telephone (919)672-4124.

When we receive Mr. Heisterburg's recommendation, a determination as to our "objections" or "no objections" will be made. If you have any questions concerning the above needed information, please do not hesitate to call.

Sincerely,

Thomas M. Roberts
Program Manager

RECEIVED
JAN 20 1995
N.C.

U.S. Department
of Transportation
**Federal Aviation
Administration**

Airports District Office
FAA/Campus Building, Suite 2-260
1701 Columbia Avenue
College Park, GA 30337-2747
(404) 305-7153 FAX: (404) 305-7155

April 26, 1995

Ms. Jennifer L. Miller
HDR Engineering, Inc.
128 S. Tryon Street, Suite 1400
Charlotte, NC 28202-5001

Dear Ms. Miller:

After further discussion with John Heisterberg, U.S. Department of Agriculture and Rick Barkes of the N. C. Division of Aviation, it has been determined that we do not object to the White Street landfill to be located in Greensboro, North Carolina.

If we can be of any future assistance, please do not hesitate to call.
Sincerely,

Thomas M. Roberts
Program Manager

CITY OF GREENSBORO
NORTH CAROLINA
P.O. BOX 3136
GREENSBORO, NC 27402-3136

January 9, 1995

Jennifer Miller
HDR Engineering, Inc.
128 S. Tryon Street, Suite 1400
Charlotte, NC 28202-5001

Dear Ms. Miller:

The property known as the City of Greensboro White Street Sanitary Landfill is not located in the the General Watershed Area or the Watershed Critical Area. Therefore, none of the Environmental Regulations pertaining to Water Supply Watershed Districts apply to the development of this site.

North Buffalo Creek traverses a portion of the White Street Sanitary Landfill site. Floodway areas, 100-year floodway fringe areas and 500-year flood areas are delineated on the Flood Insurance Rate Map, Community Number 375351, Panel Number 0010 C, Revised Date September 30, 1988. No filling is allowed within the designated floodway. Fill is allowed within the 100-year floodway fringe and 500-year flood areas. No buildings are permitted within the floodway. Buildings are permitted within the 100-year floodway fringe areas provided the finished floor elevation of the building is certified to be at least one foot above the 100-year flood elevation. Buildings are also permitted within the 500-year flood areas and no certification is required.

Expansions to the existing White Street Sanitary Landfill would be permitted provided the Flood Damage Prevention regulations (Section 30-7-5, Greensboro Development Ordinance) are met.

If I can be of further assistance please call me at (910) 373-2918.

Sincerely,

Susan Rabold

Susan Rabold
Department of Planning

RECEIVED
JAN 10 1995
HDR
CHARLOTTE, N.C.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, please contact Renee Gledhill-Earley, environmental review coordinator, at 919/733-4763.

Sincerely,

David Brook
Deputy State Historic Preservation Officer

DB:slw

Enclosures

cc: Division of Solid Waste, DEHNR

RECEIVED
DEC 12 1994
HDR
CHARLOTTE, N.C.

**North Carolina Department of Cultural Resources**

James B. Hunt, Jr., Governor
Betty Ray McCain, Secretary

Division of Archives and History
William S. Price, Jr., Director

December 7, 1994

Jennifer L. Miller
HDR Engineering, Inc. of North Carolina
Suite 1400
128 South Tryon Street
Charlotte, NC 28202-5001

Re: Study site for municipal solid waste landfill facility, Guilford County, ER 95-7930

Dear Ms. Miller:

Thank you for your letter of November 18, 1994, concerning the above project.

There are no known recorded archaeological sites within the project boundaries. However, the project area has never been systematically surveyed to determine the location of significance of archaeological resources. The topographic and hydrographic characteristics of the proposed project area indicate a high probability for the presence of prehistoric and historic archaeological resources.

We recommend that a comprehensive survey be conducted by an experienced archaeologist to identify the presence and significance of archaeological remains that may be damaged or destroyed by the proposed project. Potential effects on unknown resources should be assessed prior to the initiation of construction activities.

Enclosed is a list of archaeological consultants who have conducted or expressed an interest in conducting contract work in North Carolina. Individual files providing additional information on the consultants may be examined at the State Historic Preservation Office's Office of State Archaeology, 421 North Blount Street, Raleigh. If additional names are desired, you may consult the current listing of the members of the Society of Professional Archaeologists, or contact the society's current secretary/treasurer, David L. Carlson, Department of Anthropology, Texas A&M University, College Station, Texas 77843-4352, telephone 409/845-4044. Any of the above persons, or any other experienced archaeologist, may be contacted to conduct the recommended investigation.

We have conducted a search of our files and are aware of no structures of historical or architectural importance located within the planning area.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act of 1966 and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106, codified at 36 CFR Part 800.

State of North Carolina
Department of Environment,
Health and Natural Resources
Division of Parks & Recreation

James B. Hunt, Jr., Governor
Jonathan B. Howes, Secretary
Dr. Philip K. McKnelly, Director

DEHNR

RECEIVED
DEC 14 1994
HDR
CHARLOTTE, N.C.

December 8, 1994

Ms. Jennifer Miller
HDR Engineering, Inc.
128 South Tryon Street, Suite 1400
Charlotte, NC 28202-5001

SUBJECT: Rare Species, High Quality Natural Communities, and Significant Natural Areas in the Proposed Municipal Landfill Facility Project Area near Greensboro, Guilford County, North Carolina

Dear Ms. Miller:

The North Carolina Natural Heritage Program does not have records of known rare species, high quality natural communities, or significant natural areas occurring in or near the municipal landfill project area. To our knowledge, this project area has not been systematically inventoried and we cannot definitively state that rare species or significant natural areas do not occur there.

Enclosed is a list of rare species that are known to occur in Guilford County. If suitable habitat for any of these species occurs in the project area, then those species may be present at the project site. If it is necessary to be certain that this site does not contain rare species, a field survey would need to be conducted.

Please contact me at the address below or call me at (919) 733-7701 if you have any questions or need further information.

Sincerely,

Inge Smith

Inge Smith
Information Specialist
Natural Heritage Program

/iks

Enclosures

P.O. Box 27687, Raleigh, North Carolina 27611-7687 Telephone 919-733-4181 FAX 919-715-3085
An Equal Opportunity Affirmative Action Employer 50% recycled/ 10% post-consumer paper

# The EDR-Radius Map
## with GeoCheck™

White Street Solid Waste LF
White Street Solid Waste LF
Greensboro, NC 27402

Inquiry Number: 95251.1s

November 01, 1995

EDR Environmental Data Resources, Inc.

Creators of Toxicheck/®

***The* Source For Environmental Risk Management Data**

3530 Post Road
Southport, Connecticut 06490

**Nationwide Customer Service**

Telephone: 1-800-352-0050
Fax: 1-800-231-6802

# TABLE OF CONTENTS



***Thank you for your business.***
Please contact EDR at 1-800-352-0050
with any questions or comments.

# EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc. (EDR). The search met the specific requirements of ASTM Standard Practice for Environmental Site Assessments, E 1527-94, or custom distances requested by the user.

The address of the subject property for which the search was intended is:

WHITE STREET SOLID WASTE LF
GREENSBORO, NC 27402

No mapped sites were found in EDR's search of available ( "reasonably ascertainable ") government records either on the subject property or within the ASTM E 1527-94 search radius around the subject property for the following Databases:

**NPL:**------------------------- National Priority List
**Delisted NPL:**--------------- NPL Deletions
**RCRIS-TSD:**----------------- Resource Conservation and Recovery Information System
**CERCLIS:**-------------------- Comprehensive Environmental Response, Compensation, and Liability Information System
**CORRACTS:**----------------- Corrective Action Report
**State LF:**--------------------- List of Solid Waste Facility
**LUST:**------------------------ Incidents by Address
**UST:**-------------------------- Petroleum Underground Storage Tank Database
**RAATS:**---------------------- RCRA Administrative Action Tracking System
**RCRIS-SQG:**----------------- Resource Conservation and Recovery Information System
**RCRIS-LQG:**----------------- Resource Conservation and Recovery Information System
**HMIRS:**----------------------- Hazardous Materials Information Reporting System
**PADS:**------------------------ PCB Activity Database System
**ERNS:**------------------------ Emergency Response Notification System
**TRIS:**------------------------- Toxic Chemical Release Inventory System
**NPL Liens:**------------------ Federal Superfund Liens
**TSCA:**------------------------ Toxic Substances Control Act
**MLTS:**------------------------ Material Licensing Tracking System
**RODS:**------------------------ Records Of Decision
**CONSENT:**------------------- Superfund (CERCLA) Consent Decrees

Unmapped (orphan) sites are not considered in the foregoing analysis.

## Search Results:

Search results for the subject property and the search radius, are listed below:

## Subject Property:

The subject property was not listed in any of the databases searched by EDR.

# EXECUTIVE SUMMARY

## Surrounding Properties:

Sites with an elevation equal to or higher than the subject property are in the left hand column; those with a lower elevation are in the right hand column. Page numbers refer to the EDR Radius Map report where detailed data on individual sites may be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

**SHWS:** The State Hazardous Waste Sites records are the states' equivalent to CERCLIS. These sites may or may not already by listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. The data comes from the Department of Environment, Health, & Natural Resources' Inactive Hazardous Sites Program.

A review of the State Haz. Waste list, as provided by EDR, and dated 03/15/1995 has revealed that there is 1 State Haz. Waste site within approximately 0.5 Miles of the subject property.

| Equal/Higher Elevation | Page | Lower Elevation | Page |
|---|---|---|---|
| GLASS, EH COUNTY LANDFILL | 8 | | |

**CERCLIS-NFRAP:** As of February 1995. CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund Action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

A review of the CERC-NFRAP list, as provided by EDR, and dated 06/30/1995 has revealed that there is 1 CERC-NFRAP site within approximately 0.5 Miles of the subject property.

| Equal/Higher Elevation | Page | Lower Elevation | Page |
|---|---|---|---|
| ***GLASS EH CO LDFL*** | *8* | | |

**FINDS:** The Facility Index System contains both facility information and "pointers" to other sources of information that contain more detail. These include: RCRIS; Permit Compliance System (PCS); Aerometric Information Retrieval System (AIRS); FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]; CERCLIS; DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes); Federal Underground Injection Control (FURS); Federal Reporting Data System (FRDS); Surface Impoundments (SIA); TSCA Chemicals in Commerce Information System (CICS); PADS; RCRA-J (medical waste transporters/disposers); TRIS; and TSCA. The source of this database is the U.S. EPA/NTIS.

A review of the FINDS list, as provided by EDR, and dated 07/27/1994 has revealed that there is 1 FINDS site within approximately 0.5 Miles of the subject property.

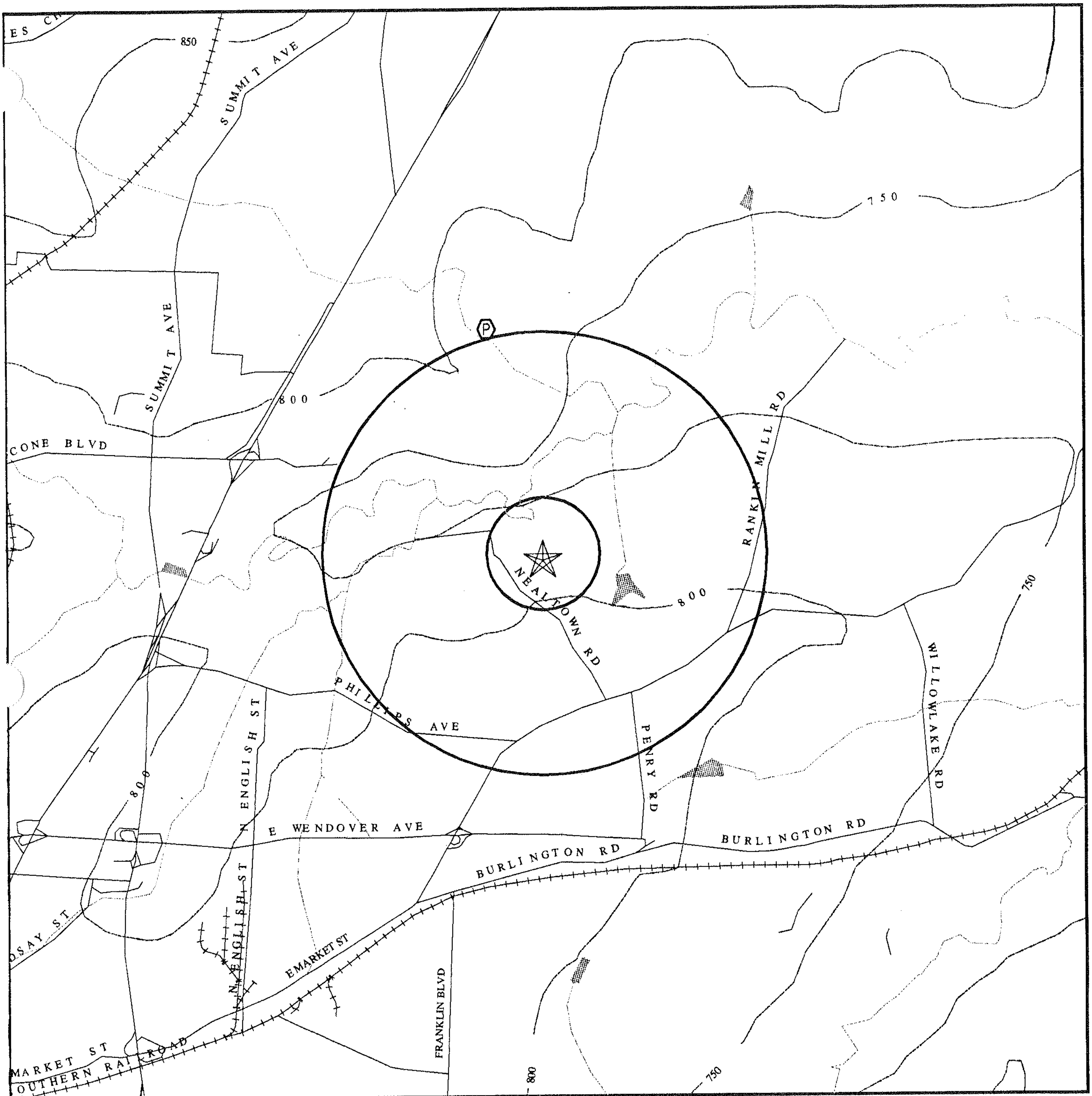
| Equal/Higher Elevation | Page | Lower Elevation | Page |
|---|---|---|---|
| ***GLASS EH CO LDFL*** | *8* | | |

# EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped:

| Site Name | Database(s) |
|---|---|
| SUPERIOR PRODUCTS COMPANY | SHWS |
| STRANDBERG ENGINEERING LABS | SHWS |
| HUBERT ATKINS PROPERTY #4 | SHWS |
| PFIZER INC/SKATE STADIUM | SHWS |
| INDUSTRIAL PLASTICS, INC. | SHWS |
| GUILFORD SPILL | SHWS |
| UNION OIL CO. SE TERM | SHWS |
| ASHLAND CHEMICAL CO | SHWS |
| CHEMICAL AND SOLVENTS, INC. | SHWS |
| AIR PRODUCTS AND CHEMICALS, INC. | SHWS |
| CONVERTERS INK COMPANY | SHWS |
| SED, INC. SWING COURT | SHWS |
| MORELAND MCKESSON COMPANY | SHWS |
| NORTH BUFFALO POLLUTION CONTROL | SHWS |
| GREENSBORO CITY LANDFILL | SHWS |
| GREENSBORO CITY LDFL | FINDS, CERC-NFRAP, SWF/LF |
| JOYCE DEMO LANDFILL | SWF/LF |
| FITZGERALD DEMO LANDFILL | SWF/LF |
| FITZGERALD DEMO LANDFILL | SWF/LF |
| L. BAYNES DEMO LANDFILL | SWF/LF |
| GROOME DEMO LANDFILL | SWF/LF |
| L. BAYNES DEMO LANDFILL | SWF/LF |
| ED MONTGOMERY DEMO LANDFILL | SWF/LF |
| ED MONTGOMERY DEMO LANDFILL | SWF/LF |
| GREENSBORO, CITY OF | SWF/LF |
| WILEY DAVID LANDFILL | SWF/LF |
| STEVE RIDENOUR RESIDENCE | LUST |
| CIBA-GEIGY CORP. | LUST |
| FAIRCLOTH RESIDENCE | LUST |
| BARBER PARK | LUST |
| BOBBY HARGETT TRUCKING | LUST |
| STATE ST. PROPERTIES | LUST |
| CITY OF GREENSBORO LANDFILL | LUST |
| EAST WHITE OAK CENTER | UST |
| MOUNT ZION ELEMENTARY SCHOOL | UST |
| LANDFILL FUELING | UST |
| NORTH BUFFALO WWTF | RCRIS-SQG |
| W. MARKET STREET CHIMNEY ROCK ROAD | ERNS |
| 3921 SPRING GARDEN STREET | ERNS |
| C & H WASTE ENERGY | FINDS |

# TOPOGRAPHIC MAP - 95251.1s - HDR Engineering, Inc.




Source: US Geological Survey 1-Degree Digital Elevation Model
Compiled 09/15/92

0 — 1/4 — 1/2 — 1 — 2
Miles

- Major Roads
- Contour lines (25 foot interval unless otherwise shown)
- Waterways
- Earthquake epicenter, Richter 5 or greater.
- (F)(S) Closest well according to (F)ederal or (S)tate database in quadrant.
- (P) Closest public water supply well.

| | | | |
|---|---|---|---|
| TARGET PROPERTY: | White Street Solid Waste LF | CUSTOMER: | HDR Engineering, Inc. |
| ADDRESS: | White Street Solid Waste LF | CONTACT: | Mr. John Isham |
| CITY/STATE/ZIP: | Greensboro NC 27402 | INQUIRY #: | 95251.1s |
| LAT/LONG: | 36.1059 / 79.733 | DATE: | November 01, 1995 |

# GEOCHECK VERSION 2.1
# SUMMARY

## GEOLOGIC AGE IDENTIFICATION†

| | |
|---|---|
| Geologic Code: | Pzg1 |
| Era: | Paleozoic |
| System: | Ordovian |
| Series: | Lower Paleozoic granitic rocks |

## ROCK STRATIGRAPHIC UNIT†

Category: Plutonic and Intrusive Rocks

## GROUNDWATER FLOW INFORMATION

General Topographic Gradient: General NNW
General Hydrogeologic Gradient: no hydrogeologic data available.

Note: In a general way, the water table typically conforms to surface topography.‡

## USGS TOPOGRAPHIC MAP ASSOCIATED WITH THIS SITE

Target Property: 2436079-A6 MCLEANSVILLE, NC

## FEDERAL DATABASE WELL INFORMATION

| WELL QUADRANT | DISTANCE FROM TP | LITHOLOGY | DEPTH TO WATER TABLE |
|---|---|---|---|

NO WELLS FOUND

## PUBLIC WATER SUPPLY SYSTEM INFORMATION (EPA-FRDS)

Searched by Nearest Well.

Location Relative to TP: 1 - 2 Miles North
PWS Name: MEMORIAL PRESBYTERIAN CH
GREENSBORO, NC 27405

Well currently has or has had major violation(s): No

## AREA RADON INFORMATION

GUILFORD COUNTY, NC

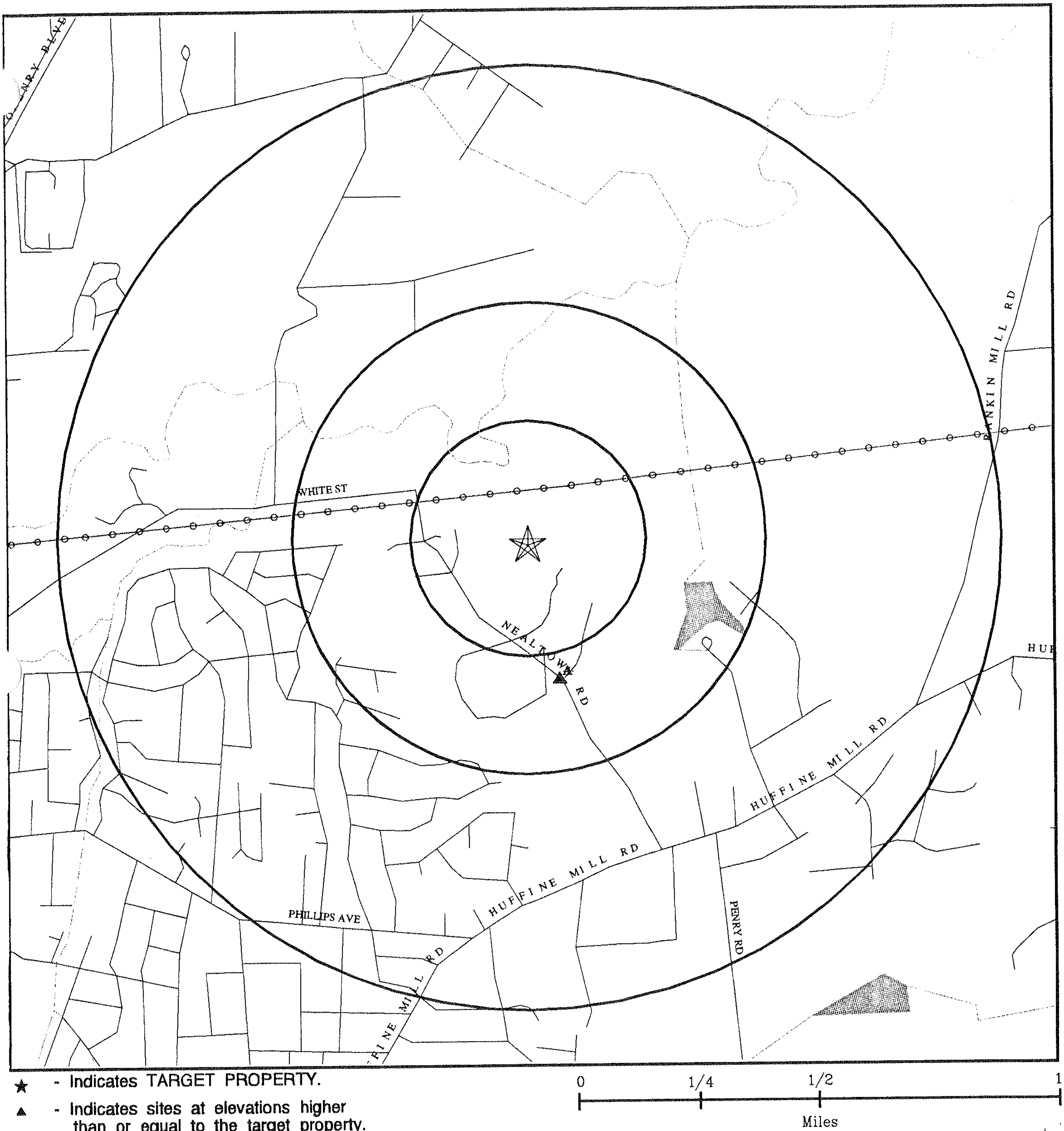
Number of sites tested: 30

| Area | Average Activity | % <4 pCi/L | % 4-20 pCi/L | % >20 pCi/L |
|---|---|---|---|---|
| Living Area - 1st Floor | 0.503 pCi/L | 100% | 0% | 0% |
| Living Area - 2nd Floor | Not Reported | Not Reported | Not Reported | Not Reported |
| Basement | 1.910 pCi/L | 90% | 10% | 0% |

† Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

‡ U.S. EPA Ground Water Handbook, Vol I: Ground Water and Contamination, Office of Research and development EPA/625/6-90/016a,Chapter 4, page 78, September 1990.

# OVERVIEW MAP - 95251.1s - HDR Engineering, Inc.




★ - Indicates TARGET PROPERTY.

▲ - Indicates sites at elevations higher than or equal to the target property.

◆ - Indicates sites at elevations lower than the target property.

- Coal Gasification Sites (if requested)

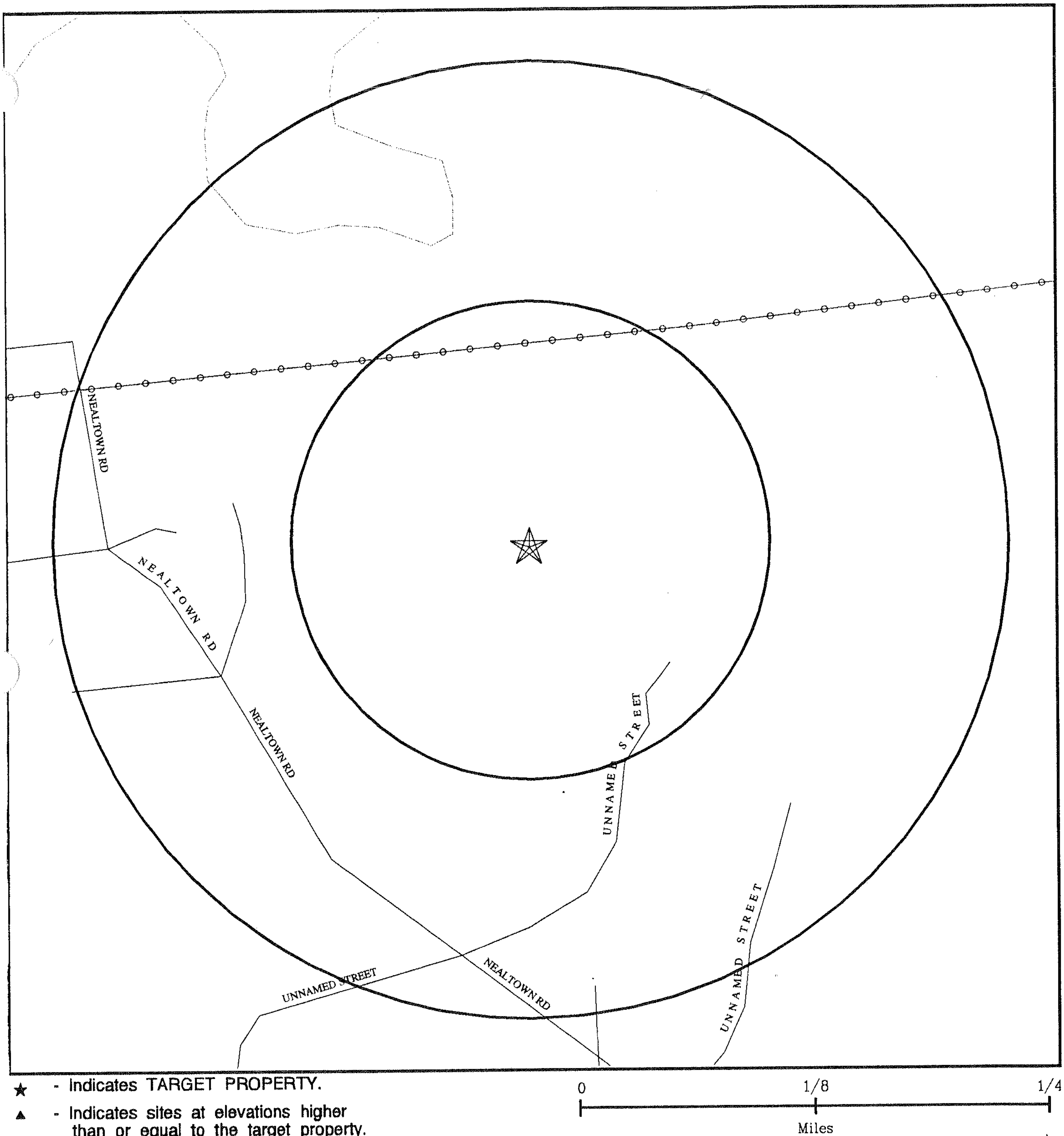
- National Priority List Sites

- Power transmission lines (USGS DLG, 1993)

- Oil & Gas pipelines (USGS DLG, 1993)

| | | | |
|---|---|---|---|
| TARGET PROPERTY: | White Street Solid Waste LF | CUSTOMER: | HDR Engineering, Inc. |
| ADDRESS: | White Street Solid Waste LF | CONTACT: | Mr. John Isham |
| CITY/STATE/ZIP: | Greensboro NC 27402 | INQUIRY #: | 95251.1s |
| LAT/LONG: | 36.1059 / 79.733 | DATE: | November 01, 1995 |

# DETAIL MAP - 95251.1s - HDR Engineering, Inc.




★ - Indicates TARGET PROPERTY.

▲ - Indicates sites at elevations higher than or equal to the target property.

◆ - Indicates sites at elevations lower than the target property.

- Coal Gasification Sites (if requested)

- Sensitive Receptors

- National Priority List Sites

- Power transmission lines (USGS DLG, 1993)

- Oil & Gas pipelines (USGS DLG, 1993)

| | | | |
|---|---|---|---|
| TARGET PROPERTY: | White Street Solid Waste LF | CUSTOMER: | HDR Engineering, Inc. |
| ADDRESS: | White Street Solid Waste LF | CONTACT: | Mr. John Isham |
| CITY/STATE/ZIP: | Greensboro NC 27402 | INQUIRY #: | 95251.1s |
| LAT/LONG: | 36.1059 / 79.733 | DATE: | November 01, 1995 |

# MAP FINDINGS SUMMARY SHOWING ALL SITES

| Database | Target Property | Search Distance (Miles) | < 1/8 | 1/8 - 1/4 | 1/4 - 1/2 | 1/2 - 1 | > 1 | Total Plotted |
|---|---|---|---|---|---|---|---|---|
| NPL | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| Delisted NPL | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RCRIS-TSD | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| State Haz. Waste | | 0.500 | 0 | 0 | 1 | NR | NR | 1 |
| CERCLIS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| CERC-NFRAP | | 0.500 | 0 | 0 | 1 | NR | NR | 1 |
| CORRACTS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| State Landfill | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| LUST | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| UST | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RAATS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RCRIS Sm. Quan. Gen. | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RCRIS Lg. Quan. Gen. | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| HMIRS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| PADS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| ERNS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| FINDS | | 0.500 | 0 | 0 | 1 | NR | NR | 1 |
| TRIS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| NPL Liens | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| TSCA | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| MLTS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| ROD | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| CONSENT | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| Coal Gas | | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

# MAP FINDINGS SUMMARY SHOWING ONLY SITES HIGHER THAN OR THE SAME ELEVATION AS TP

| Database | Target Property | Search Distance (Miles) | < 1/8 | 1/8 - 1/4 | 1/4 - 1/2 | 1/2 - 1 | > 1 | Total Plotted |
|---|---|---|---|---|---|---|---|---|
| NPL | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| Delisted NPL | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RCRIS-TSD | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| State Haz. Waste | | 0.500 | 0 | 0 | 1 | NR | NR | 1 |
| CERCLIS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| CERC-NFRAP | | 0.500 | 0 | 0 | 1 | NR | NR | 1 |
| CORRACTS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| State Landfill | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| LUST | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| UST | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RAATS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RCRIS Sm. Quan. Gen. | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| RCRIS Lg. Quan. Gen. | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| HMIRS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| PADS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| ERNS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| FINDS | | 0.500 | 0 | 0 | 1 | NR | NR | 1 |
| TRIS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| NPL Liens | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| TSCA | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| MLTS | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| ROD | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| CONSENT | | 0.500 | 0 | 0 | 0 | NR | NR | 0 |
| Coal Gas | | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

TP = Target Property

NR = Not Requested at this Search Distance

* Sites may be listed in more than one database

| Map ID<br>Direction<br>Distance<br>Elevation | Site | Database(s) | EDR ID Number<br>EPA ID Number |
|---|---|---|---|

**Coal Gas Site Search: EDR does not presently have coal gas site information available in this state.**

| | | | |
|---|---|---|---|
| A1<br>SSE<br>1/4-1/2<br>Higher | GLASS, EH COUNTY LANDFILL<br>1103 NEALTOWN RD<br>GREENSBORO, NC | SHWS | S101425919<br>N/A |
| A2<br>SSE<br>1/4-1/2<br>Higher | GLASS EH CO LDFL<br>1103 NEALTOWN RD<br>GREENSBORO, NC 27405 | FINDS<br>CERC-NFRAP | 1000385908<br>NCD980557607 |

CERCLIS-NFRAP Classification Data:

Site Incident Category: Not reported
Ownership Status: OTHER
EPA Notes: Not reported
Federal Facility: NO
NPL Status: NOT ON NPL

CERCLIS-NFRAP Assessment History:

| Assessment | | Completed | |
|---|---|---|---|
| Assessment: | PRELIMINARY ASSESSMENT | Completed: | 08/01/84 |
| Assessment: | DISCOVERY | Completed: | 06/01/81 |
| Assessment: | SCREENING SITE INSPECTION | Completed: | 07/29/88 |

CERCLIS-NFRAP Site Status:

EPA has conducted a preliminary assessment on this site and has determined that no further action is necessary and no hazard was identified

CERCLIS-NFRAP Alias Name(s):

GLASS EH CO LDFL

| City | EDR ID | Site Name | Site Address | Zip | Database(s) | Facility ID |
|---|---|---|---|---|---|---|
| GREENSBORO | 8705894 | W. MARKET STREET CHIMNEY ROCK ROAD | | | ERNS | |
| GREENSBORO | 94229639 | 3921 SPRING GARDEN STREET | | | ERNS | |
| GREENSBORO | S101525488 | STEVE RIDENOUR RESIDENCE | RT 1, BOX 177J | | LUST | 12694 |
| GREENSBORO | U001202539 | EAST WHITE OAK CENTER | 10TH STREET | 27405 | UST | 0-025706 |
| GREENSBORO | S101404038 | CIBA-GEIGY CORP. | SR 1565 | | LUST | 3208 |
| GREENSBORO | S100047582 | FAIRCLOTH RESIDENCE | SR. 3549 / 3317 | | LUST | 3525 |
| GREENSBORO | S101425350 | SUPERIOR PRODUCTS COMPANY | HWY 70A | | SHWS | |
| GREENSBORO | S101425349 | STRANDBERG ENGINEERING LABS | HIGHWAY 73 WEST | | SHWS | |
| GREENSBORO | S101425330 | HUBERT ATKINS PROPERTY #4 | RR 9 | | SHWS | |
| GREENSBORO | S101425340 | PFIZER INC/SKATE STADIUM | 4500 BLOCK OF HIGH POINT | | SHWS | |
| GREENSBORO | S101425331 | INDUSTRIAL PLASTICS, INC. | CLOVER / MCONNELL ROAD | | SHWS | |
| GREENSBORO | S101429111 | JOYCE DEMO LANDFILL | COMMERCIAL RD. | | SWF/LF | |
| GREENSBORO | S101404322 | BARBER PARK | 1500 DAN'S RD. | | LUST | 13585 |
| GREENSBORO | S101543141 | FITZGERALD DEMO LANDFILL | FLEMMING STREET | | SWF/LF | |
| GREENSBORO | S101429056 | FITZGERALD DEMO LANDFILL | FLEMMING STREET | | SWF/LF | |
| GREENSBORO | S101425927 | GUILFORD SPILL | GROOMETOWN ROAD | | SHWS | |
| GREENSBORO | U001192801 | MOUNT ZION ELEMENTARY SCHOOL | 1500 HUFFINE MILL RD | 27405 | UST | 0-010799 |
| GREENSBORO | S101574552 | BOBBY HARGETT TRUCKING | 818 W HWY 62 | | LUST | 8896 |
| GREENSBORO | S101425353 | UNION OIL CO. SE TERM | 6801 W MARKET ST | | SHWS | |
| GREENSBORO | S101543156 | L. BAYNES DEMO LANDFILL | MONTVIEW STREET | | SWF/LF | |
| GREENSBORO | S101429076 | GROOME DEMO LANDFILL | MONTVIEW STREET | | SWF/LF | |
| GREENSBORO | S101429114 | L. BAYNES DEMO LANDFILL | MONTVIEW STREET | | SWF/LF | |
| GREENSBORO | S101425308 | ASHLAND CHEMICAL CO | 2802 PATTERSON ST | | SHWS | |
| GREENSBORO | S101425313 | CHEMICAL AND SOLVENTS, INC. | 2804 PATTERSON ST | | SHWS | |
| GREENSBORO | S101425305 | AIR PRODUCTS AND CHEMICALS, INC. | 115 SOUTHERN OXYGEN RD | | SHWS | |
| GREENSBORO | S101525508 | STATE ST. PROPERTIES | STATE ST. | | LUST | 13999 |
| GREENSBORO | S101425875 | CONVERTERS INK COMPANY | SUITE 305 FRIENDSHIP CTR | | SHWS | |
| GREENSBORO | S101425346 | SED, INC. SWING COURT | SWING COURT | | SHWS | |
| GREENSBORO | S101543134 | ED MONTGOMERY DEMO LANDFILL | WADES STORE RD. | | SWF/LF | |
| GREENSBORO | S101429044 | ED MONTGOMERY DEMO LANDFILL | WADES STORE RD. | | SWF/LF | |
| GREENSBORO | 1000534963 | C & H WASTE ENERGY | WENDOVER ROAD | 27402 | FINDS | |
| GREENSBORO | S101425337 | MORELAND MCKESSON COMPANY | 3600 W WENDOVER AVE | | SHWS | |
| GREENSBORO | U001192051 | LANDFILL FUELING | 2000 WHITE ST | 27405 | UST | 0-009505 |
| GREENSBORO | 1000989415 | NORTH BUFFALO WWTF | 2199 WHITE ST | 27405 | RCRIS-SQG | |
| GREENSBORO | S100262534 | CITY OF GREENSBORO LANDFILL | 2000 WHITE ST | 27405 | LUST | 7878 |
| GREENSBORO | 1000208441 | GREENSBORO CITY LDFL | WHITE ST | 27405 | FINDS, CERC-NFRAP, SWF/LF | |
| GREENSBORO | S101425962 | NORTH BUFFALO POLLUTION CONTROL | WHITE STREET | | SHWS | |
| GREENSBORO | S101429074 | GREENSBORO, CITY OF | WHITE STREET | | SWF/LF | |
| GREENSBORO | S101425323 | GREENSBORO CITY LANDFILL | WHITE STREET | | SHWS | |
| GREENSBORO | S101429215 | WILEY DAVID LANDFILL | WILEY DAVIS ROAD | | SWF/LF | |

# GEOCHECK VERSION 2.1
# PUBLIC WATER SUPPLY SYSTEM INFORMATION

Searched by Nearest Well.

**PWS SUMMARY:**

| | | | | | |
|---|---|---|---|---|---|
| PWS ID: | NC0241457 | PWS Status: | Active | Distance from TP: | 1 - 2 Miles |
| Dir relative to TP: | North | Date Initiated: | June / 1977 | Date Deactivated: | Not Reported |
| PWS Name: | MEMORIAL PRESBYTERIAN CH<br>GREENSBORO, NC 27405 | | | | |

Addressee / Facility Type: System Owner/Responsible Party
Facility Name: HAMMOND CARTLEDGE OR PASTOR
2116 MCKNIGHT MILL RD
GREENSBORO, NC 27405

Addressee / Facility Type: System Owner/Responsible Party
Facility Name: MEMORIAL PRESBYTERIAN CH
2116 MCKNIGHT MILL RD
GREENSBORO, NC 27405

| | | | |
|---|---|---|---|
| Facility Latitude: | 36 07 15 | Facility Longitude: | 079 44 15 |
| City Served: | GREENSBORO | | |
| Treatment Class: | Untreated | Population Served: | Under 101 Persons |

Well currently has or has had major violation(s): No

# GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

**Elapsed ASTM days:** Provides confirmation that this EDR report meets or exceeds the 90-day updating requirement of the ASTM standard.

**FEDERAL ASTM RECORDS:**

**CERCLIS:** Comprehensive Environmental Response, Compensation, and Liability Information System
Source: EPA/NTIS
Telephone: 703-416-0702
CERCLIS: CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 06/30/95
Date Made Active at EDR: 09/13/95
Date of Data Arrival at EDR: 08/09/95
Elapsed ASTM days: 35

**ERNS:** Emergency Response Notification System
Source: EPA
Telephone: 202-260-2342
ERNS: Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 12/31/94
Date Made Active at EDR: 05/25/95
Date of Data Arrival at EDR: 04/11/95
Elapsed ASTM days: 44

**NPL:** National Priority List
Source: EPA
Telephone: 703-603-8852
NPL: National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, it is EDR's policy to plot NPL sites greater than approximately 500 acres in size as areas (polygons). Sites smaller in size are point-geocoded at the site's address.

Date of Government Version: 09/01/95
Date Made Active at EDR: 10/25/95
Date of Data Arrival at EDR: 10/17/95
Elapsed ASTM days: 8

**RCRIS:** Resource Conservation and Recovery Information System
Source: EPA/NTIS
Telephone: 703-308-7907
RCRIS: Resource Conservation and Recovery Information System. RCRIS includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA).

Date of Government Version: 05/31/95
Date Made Active at EDR: 08/22/95
Date of Data Arrival at EDR: 06/28/95
Elapsed ASTM days: 55

# GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

**FEDERAL NON-ASTM RECORDS:**

**CONSENT:** Superfund (CERCLA) Consent Decrees
Source: EPA Regional Offices
Telephone: Varies
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: Varies — Date of Next Scheduled Update: 09/01/95

**CORRACTS:** Corrective Action Report
Source: EPA
Telephone: 703-308-7907
CORRACTS: CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 04/10/95 — Date of Next Scheduled Update: 02/01/96

**FINDS:** Facility Index System
Source: EPA/NTIS
Telephone: 800-908-2493
FINDS: Facility Index System. FINDS contains both facility information and "pointers" to other sources that contain more detail. These include: RCRIS, PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), FATES (FIFRA [Federal Insecticide Fungicide Rodenticide Act] and TSCA Enforcement System, FTTS [FIFRA/TSCA Tracking System]), CERCLIS, DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), FRDS (Federal Reporting Data System), SIA (Surface Impoundments), CICIS (TSCA Chemicals in Commerce Information System), PADS, RCRA-J (medical waste transporters/disposers), TRIS and TSCA.

Date of Government Version: 07/27/94 — Date of Next Scheduled Update: 01/28/96

**HMIRS:** Hazardous Materials Information Reporting System
Source: U.S. Department of Transportation
Telephone: 202-366-4555
HMIRS: Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 12/31/94 — Date of Next Scheduled Update: 02/28/96

**MLTS:** Material Licensing Tracking System
Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/01/95 — Date of Next Scheduled Update: 02/18/96

**NPL LIENS:** Federal Superfund Liens
Source: EPA
Telephone: 202-260-8969
NPL LIENS: Federal Superfund Liens. Under the authority granted the USEPA by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner receives notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/91 — Date of Next Scheduled Update: 01/31/96

**PADS:** PCB Activity Database System
Source: EPA
Telephone: 202-260-3992
PADS: PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 10/14/94 — Date of Next Scheduled Update: 01/16/96

**RAATS:** RCRA Administrative Action Tracking System
Source: EPA
Telephone: 202-564-4104
RAATS: RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA.

Date of Government Version: 04/17/95 Date of Next Scheduled Update: 02/17/96

**ROD:** Records Of Decision
Source: NTIS
Telephone: 703-416-0703
Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 03/31/95 Date of Next Scheduled Update: 03/03/96

**TRIS:** Toxic Chemical Release Inventory System
Source: EPA/NTIS
Telephone: 202-260-2320
TRIS: Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/92 Date of Next Scheduled Update: 02/10/96

**TSCA:** Toxic Substances Control Act
Source: EPA/NTIS
Telephone: 202-260-1444
TSCA: Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site. USEPA has no current plan to update and/or re-issue this database.

Date of Government Version: 01/31/95 Date of Next Scheduled Update: 03/02/96

## STATE OF NORTH CAROLINA ASTM RECORDS:

**LUST:** Incidents by Address
Source: Department of Environment, Health & Natural Resources
Telephone: 919-733-1315
LUST: Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 06/30/95
Date Made Active at EDR: 08/31/95
Date of Data Arrival at EDR: 07/24/95
Elapsed ASTM days: 38

**SHWS:** Inactive Hazardous Sites Inventory
Source: Department of Environment, Health & Natural Resources
Telephone: 919-733-2801
SHWS: State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: 03/15/95
Date Made Active at EDR: 06/12/95
Date of Data Arrival at EDR: 05/11/95
Elapsed ASTM days: 32

**SWF/LS:** List of Solid Waste Facility
Source: Department of Environment, Health & Natural Resources
Telephone: 919-733-0692
SWF/LS: Solid Waste Facilities/Landfill Sites. SWF/LS type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Section 2004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 07/24/95
Date Made Active at EDR: 08/31/95
Date of Data Arrival at EDR: 08/14/95
Elapsed ASTM days: 17

**UST:** Petroleum Underground Storage Tank Database
Source: Department of Environment, Health & Natural Resources
Telephone: 919-733-1308
UST: Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 07/15/95
Date Made Active at EDR: 09/05/95
Date of Data Arrival at EDR: 08/04/95
Elapsed ASTM days: 32

### Historical and Other Database(s)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

**Former Manufactured Gas (Coal Gas) Sites:** The existence and location of Coal Gas sites is provided exclusively to EDR by Real Property Scan, Inc. ©Copyright 1993 Real Property Scan, Inc. For a technical description of the types of hazards which may be found at such sites, contact your EDR customer service representative.

**Disclaimer Provided by Real Property Scan, Inc.**

The information contained in this report has predominantly been obtained from publicly available sources produced by entities other than Real Property Scan. While reasonable steps have been taken to insure the accuracy of this report, Real Property Scan does not guarantee the accuracy of this report. Any liability on the part of Real Property Scan is strictly limited to a refund of the amount paid. No claim is made for the actual existence of toxins at any site. This report does not constitute a legal opinion.

**DELISTED NPL:** Delisted NPL Sites
Source: EPA
Telephone: 703-603-8769
DELISTED NPL: The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

**NFRAP:** No Further Remedial Action Planned
Source: EPA/NTIS
Telephone: 703-416-0702
NFRAP: As of February 1995, CERCLIS sites designated "No Further Remedial Action Planned" (NFRAP) have been removed from CERCLIS. NFRAP sites may be sites where, following an initial investigation, no contamination was found, contamination was removed quickly without the need for the site to be placed on the NPL, or the contamination was not serious enough to require Federal Superfund action or NPL consideration. EPA has removed approximately 25,000 NFRAP sites to lift the unintended barriers to the redevelopment of these properties and has archived them as historical records so EPA does not needlessly repeat the investigations in the future. This policy change is part of the EPA's Brownfields Redevelopment Program to help cities, states, private investors and affected citizens to promote economic redevelopment of unproductive urban sites.

**FRDS:** Federal Reporting Data System
Source: EPA/Office of Drinking Water
FRDS provides information regarding public water supplies and their compliance with monitoring requirements, maximum contaminant levels (MCL's), and other requirements of the Safe Drinking Water Act of 1986.

**Area Radon Information:** The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

**Oil/Gas Pipelines/Electrical Transmission Lines:** This data was obtained by EDR from the USGS in 1994. It is referred to by USGS as GeoData Digital Line Graphs from 1:100,000-Scale Maps. It was extracted from the transportation category including some oil, but primarily gas pipelines and electrical transmission lines.

**Sensitive Receptors:** There are individuals who, due to their fragile immune systems, are deemed to be especially sensitive to environmental discharges. These typically include the elderly, the sick, and children. While the exact location of these sensitive receptors cannot be determined, EDR indicates those facilities, such as schools, hospitals, day care centers, and nursing homes, where sensitive receptors are likely to be located.

**USGS Water Wells:** In November 1971 the United States Geological Survey (USGS) implemented a national water resource information tracking system. This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on more than 900,000 wells, springs, and other sources of groundwater.

**Flood Zone Data:** This data, available in select counties across the country, was obtained by EDR in 1994 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

**Epicenters:** World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

An Archeological Evaluation of
the Proposed White Street Landfill
Expansion Site, Greensboro,
Guilford County, North Carolina

REPORTS IN ARCHEOLOGY

WAKE FOREST
UNIVERSITY

ARCHEOLOGY LABORATORIES

# An Archeological Evaluation of the Proposed White Street Landfill Expansion Site, Greensboro, Guilford County, North Carolina

by

**Bruce S. Idol**
**Wake Forest University**
**Archeology Laboratories**

J. Ned Woodall, Principal Investigator

Report prepared for HDR Engineering, Inc.
State Clearinghouse No. ER95-7930
HDR Project No. 06770-021-018

March, 1995

## Abstract

Personnel from the Wake Forest University Archeology Laboratories conducted an archeological survey at the proposed White Street Sanitary Landfill expansion site in Greensboro, Guilford County, North Carolina, for HDR Engineering, Inc., of Charlotte, North Carolina. The work was begun on January 20, 1995. Investigations in the project area revealed the presence of five previously unrecorded prehistoric sites and the documentation of one historic residential site. Four of the five prehistoric sites yielded diagnostic artifacts informing upon their chronological and cultural affiliations.

One small prehistoric site, AL 5, contains a shallow but apparently intact cultural stratum. Artifacts diagnostic of the Middle to Late Woodland were found, and the site has not been disturbed by construction or land-clearing activities. Despite the low probability of the presence of culturally deposited features, this site may yield important information about the function of small, non-ceramic Woodland sites in upland locations. AL 5 is potentially eligible for inclusion on the National Register of Historic Places, and further testing is recommended to assess this site.

The other four prehistoric sites have either been subjected to the effects of bulldozing and land-clearing activities or are secondary deposits from colluvial processes. These four sites do not appear eligible for National Register status, and no further work is recommended.

The historic structure has been completely destroyed and redeposited by bulldozing. Artifacts from the area indicate that the structure has no pre-1890 component. These factors and information gathered from local informants indicate that the structure had no important role in the development of the local community, and because it does not appear eligible for the National Register, no further work is recommended.

## Acknowledgements

This document was made possible by the contributions and support of several individuals who gave their time to this project. I would like to thank my fellow field-crew members: Roger Kirchen, who brought a wealth of experience and insight to the project, and Shellie Ellis, for her help with the fieldwork and for applying her computer skills to the finished report. I would also like to express my appreciation to the project's principal investigator, Ned Woodall, for his advice and encouragement during every phase of the project, and for his time in editing this document.

I would like to thank Michael Wolfe of HDR Engineering for providing us with maps and for his assistance during the project. I would also like to thank Mrs. Walter Chavis for her friendly comments and words of encouragement, and a special thanks to Mrs. Pearline Richardson and family, whose memories of the area were shared in front of a wood stove hot enough to drive the chill out of a sub- ten degree February day.

## Table of Contents

# List of Figures

## Introduction

Beginning January 20, 1995, personnel from the Wake Forest University Archeology Laboratories conducted an archeological survey within the proposed area for expansion of the White Street Sanitary Landfill in Greensboro, Guilford County, North Carolina. The work was carried out for HDR Engineering, Inc., of Charlotte, North Carolina. The required fieldwork for this project was performed by Shellie D. Ellis, Roger W. Kirchen, and Bruce S. Idol.

The project area consists of two tracts of land south of White Street and between Nealtown Road to the west and Huffine Mill/Rankin Mill Road to the east. The two tracts are roughly separated by Lake McFadden, and include approximately 60.75 hectares (150 acres) within the aforementioned boundaries. The project area is located within the McCleansville Quadrangle of the U.S. Geological Survey 7.5 minute map series.

The primary purposes of this survey were to locate any archeological sites within the project area and to provide a preliminary evaluation in terms of their eligibility to the National Register of Historic Places. In evaluating sites under criterion (d) of 36CFR60.6, the significance, or lack of significance of the cultural resources were determined by the likelihood that they could address any of the following research problems:

A. The chronological sequence of artifact styles in the Piedmont of North Carolina. Stratified, multi-component sites will be considered significant.

B. The location or age of Paleo-Indian occupations in the Piedmont of North Carolina. All Paleo-Indian sites will be considered significant unless the remains have been redeposited.

C. The age of Archaic projectile point styles in the Piedmont of North Carolina. Single-component Archaic sites with intact sub-surface features suitable for radiometric age determination will be considered significant.

D. The formal characteristics of Archaic burial patterns. All Archaic sites with undisturbed sub-surface remains which may include human burials will be considered significant.

E. The function(s) of Woodland sites. All Woodland sites with evidence of undisturbed sub-surface remains which may include human burials will be considered significant.

F. The role of historic commercial or residential sites in the evolution and development of the local or regional community. All historic commercial or residential sites with an age greater than 50 years thought to have had a profound role in the development of the local and/or regional area will be considered significant.

As stated, the principal goal of this project was to inventory cultural resources within the proposed expansion area which would be jeopardized by clearing, construction, earth-moving, and any secondary effects of these activities. The identification of these resources was made in accordance with presently accepted regional research goals which give consideration to the guidelines by the National Historic Preservation Act of 1966, Section 106, and 36CFR800.

Table 1 -- Archeological Sites, White Street Landfill Expansion Site, Greensboro, Guilford County, North Carolina

| Site | Surface Artifacts | Total Shovel Tests | Positive Shovel Tests | Total Artifacts | Components | National Register Recommendation |
|---|---|---|---|---|---|---|
| AL 1 | Yes | 1 | 0 | 7 | Late Archaic | Ineligible |
| AL 2 | Yes | 14 | 3 | 100 | Early/Middle Archaic | Ineligible |
| AL 3 | No | 6 | 2 | 18 | Unknown Prehistoric | Ineligible |
| AL 4 | Yes | 7 | 4 | 22 | Middle Archaic | Ineligible |
| AL 5 | Yes | 24 | 12 | 88 | Middle/Late Woodland Archaic (?) | Potentially Eligible |
| AL 6 | Yes | 0 | 0 | 70 | 20th Century/Late 19th Century (?) | Ineligible |

## Management Summary

The survey of the proposed White Street landfill expansion area recorded six sites, including five prehistoric and one historic period site. One of the five prehistoric sites, AL 5, yielded discrete debitage concentrations and diagnostic artifacts of the Middle to Late Woodland period on a ridgetoe slope which appears to be relatively un-eroded. Based on data revealed by the survey, the site may contain artifact concentrations and/or features and has the potential to inform upon past behavior in upland Woodland period sites. This site appears to be potentially eligible for inclusion on the National Register of Historic Places, and additional testing is recommended to assess this potential. Any construction or land-clearing activities which may compromise the integrity of the site should be avoided until further testing is conducted.

Three of the remaining prehistoric sites ( AL 1, AL 2, AL 4) have had their integrity compromised by earth-moving and land-clearing activities, and have been subjected to moderate to heavy deflation. It appears unlikely that any of these sites contain undisturbed cultural deposits of any kind. A fourth site, AL 3, contains artifacts which have likely been redeposited by colluvial processes. Since these sites appear to have little potential to provide important information about the past, they do not appear to satisfy the criteria for inclusion on the National Register, and no further work is recommended.

The historic period site, AL 6, consists of the redeposited remains of a residential structure and its associated refuse. The site has been completely demolished by the creation of the active borrow area. Artifacts collected from the site area indicate that the occupation of the structure dates to no earlier than 1890. This site does not appear to have had any significant role in the development of the local community, and it does not appear to satisfy the criteria for inclusion on the National Register. No further work is recommended.

## The Project Area

The project area consists of two roughly contiguous tracts of land south of White Street and the active landfill area, east of Nealtown Road, and west of Huffine Mill/ Rankin Mill Road in Greensboro, Guilford County, North Carolina (Figure 1). The survey area contains approximately 60.75 hectares (150 acres), with an estimated 40 - 50 percent of the area already impacted by bulldozing, earth-moving, or tree-clearing activities. A large segment of land within the project area immediately south of White Street is being used as an active borrow area for the landfill across the street (Figures 2a, b), and has been scraped to the C-horizon. This area was not systematically surveyed by the field crew. Other examples of disturbance include the scraping of access roads, the creation of large piles of brush (timber), and large areas of artificial deforestation (Figures 3a, b). Within the eastern survey tract lies the remains of a dirt road, associated with 20th century refuse and covered with secondary growth pines. Only tire ruts remain of the road itself, and the impact the road had on the area as a whole is unknown. A number of small refuse piles were encountered throughout the forested portions of the project area.

In addition, two bodies of water lie within the project area; one, a small lake, is near the southern boundary of the project area; the other, a small pond, lies within the upper northeast portion of the survey tract. Several small creeks dissect the project area, tending to flow in a southeastern direction.

### Geology

Guilford County is situated in the Piedmont physiographic province of central North Carolina, bounded by the fall line and coastal plain to the east and by the Blue Ridge scarp to the west (Figures 4a, b). The Piedmont, a broad physiographic zone, stretches from New Jersey to Alabama, and roughly parallels the Appalachian mountains. The Piedmont is characterized by rolling topography created by erosion and its features include rounded hills, long, low ridges, gently sloping valleys, and graded streams. The elevation range for the project area is 219 - 244 meters (710 - 800 feet) above sea level.

Guilford County lies within the Central Piedmont Granite Belt, typically composed of biotite granite with schists and gneisses (Murdock 1947). This bedrock produces shallow soils with a surface layer of red-yellow-brown silty and sandy clay, subject to moderate to heavy erosion. The southeastern corner of Guilford County lies within the Carolina Slate Belt and includes rocks of rhyolitic and andesitic composition (Dorwin 1977). Intrusive veins of quartz are common throughout the Piedmont zone, and were observed within the project area.

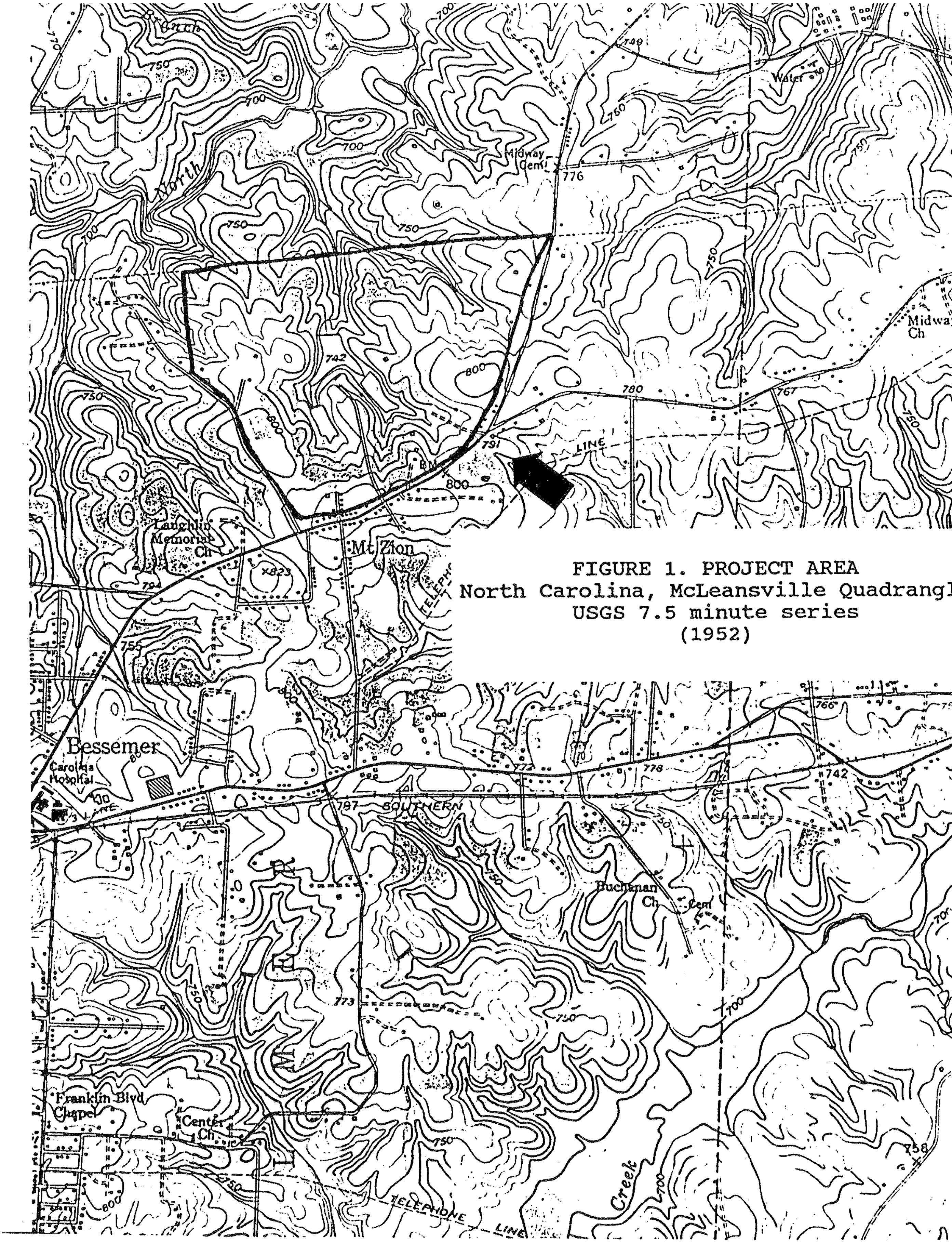
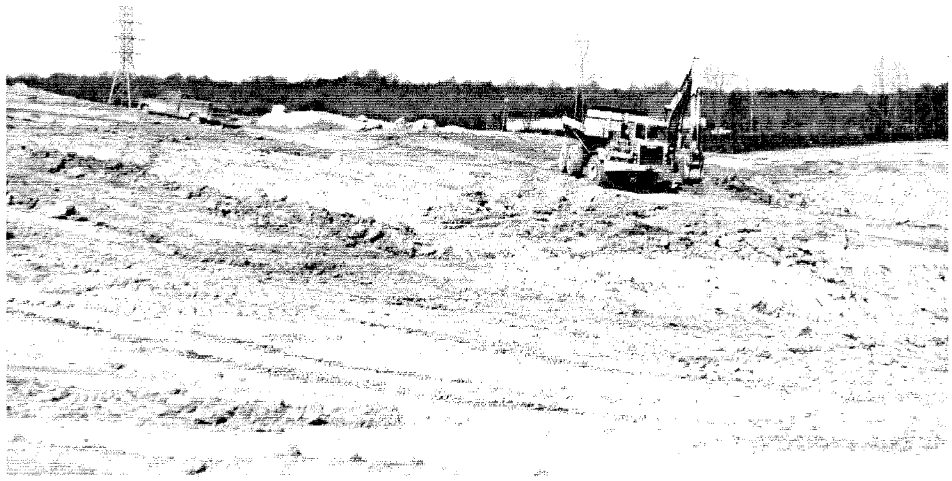



FIGURE 1. PROJECT AREA
North Carolina, McLeansville Quadrangle
USGS 7.5 minute series
(1952)



a

Figure 2: a, b, active borrow area
south of White Street

a

b

Figure 3: a, b, deforested areas

The project area is mainly comprised of Enon-Mecklenburg association soils, which are described as well-drained, sandy clay loam, clay, and clay loam subsoil on uplands, with high-potential for shrinking and swelling, "formed in residuum weathered from dark-colored rocks such as diorite, gabbro, horneblende schist, or mixed acidic and basic rocks . . . on broad, smooth interstream divides and long, narrow side slopes, two to 15 percent." Upland soils within the project area include Enon fine sandy loam, Mecklenburg sandy clay loam, and Wilkes sandy loam (Stephens 1977).

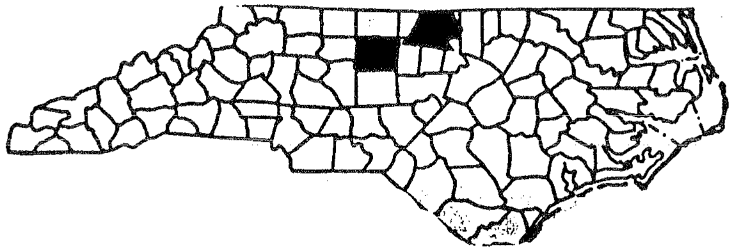
Flora and Fauna

The climax vegetation associated with the project region since the beginning of the Holocene, ca. 10,000 years Before Present (B.P.) is oak-hickory forest, comprised of several species of oak and hickory, with sourwood, dogwood, red maple, and persimmon in the understory. Regional fauna include white-tailed deer, wild turkey, birds, rabbits, racoons, opossums and other small mammals, fish, and various amphibians (Shelford 1963). Because of its possible implications for site location and assemblage variability, a brief synopsis of climatic conditions from the middle Holocene to the present is given here.

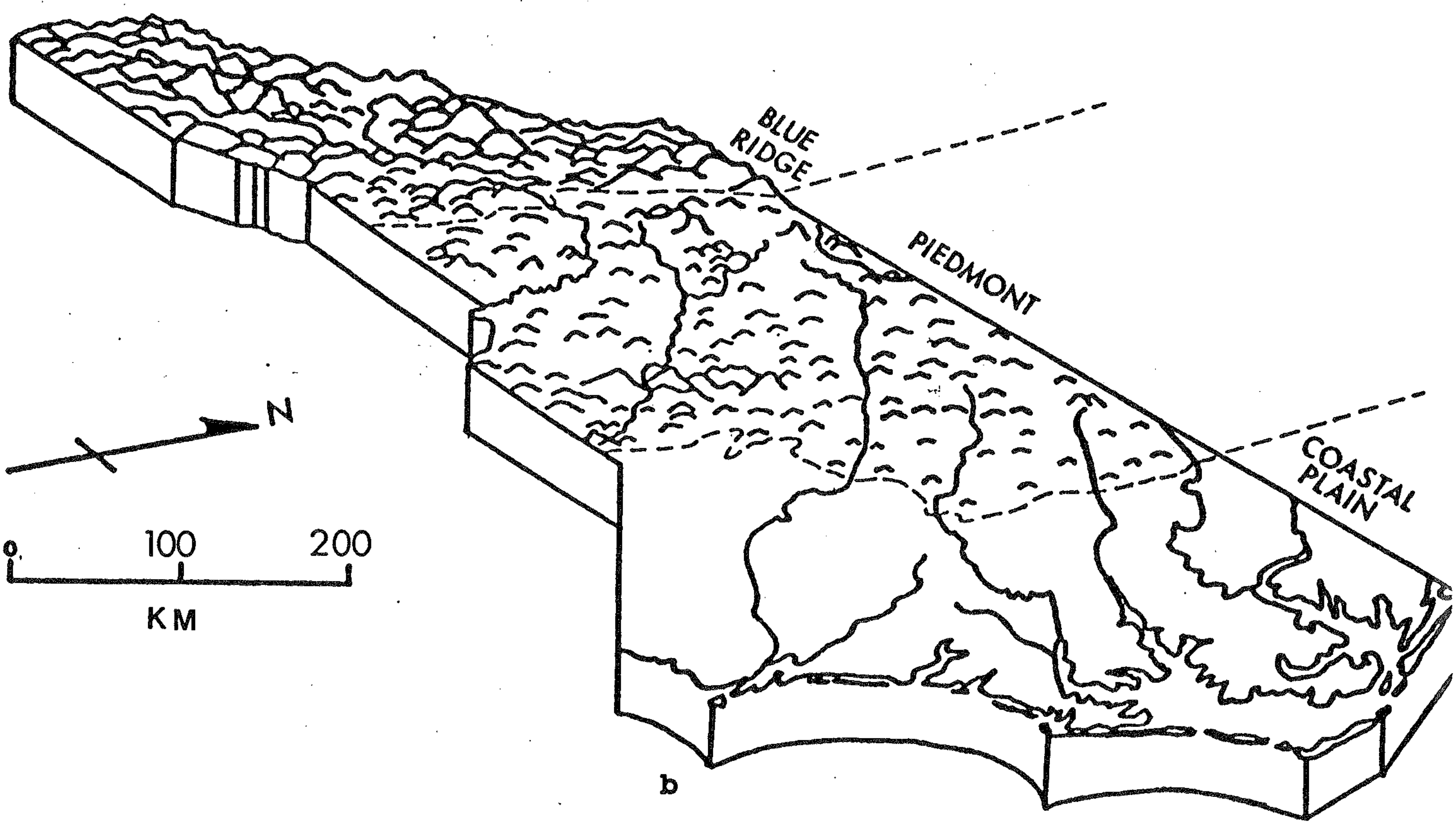
The middle Holocene is placed roughly during the period 8,500 to 4,000 years B.P. Generally, this period is said to coincide with the Hypsithermal, or Climatic Optimum, when warm and dry conditions prevailed (Claggett 1982:99). Oak savannah and prairie conditions have been noted for the Coastal Plain of Florida and Georgia, but it is uncertain what this means for the Southeast as a whole (Watts 1971). Evidence from upland Georgia fails to support the assertion that there was a precipitation decrease and a corresponding temperature increase. Oak-hickory forests (and associated modern fauna) became the dominant climax condition (Guilday 1967:232). Pollen records indicate generally warmer and drier conditions west of the Appalachian mountains; coastal plains and the southern Appalachians are believed to be warm but wet. Coastal plains in the Southeast were dominated by species of pine by 5,000 years B.P. (Delcourt and Delcourt 1985:20).

The late Holocene (4,000 B.P. - Present) saw the continued dominance of oak-hickory forest cover in the Piedmont uplands. Longleaf pine covered the coastal plains, with hardwood stands clustered along streams and in swamps (Claggett 1982:100). Aboriginal burning practices designed to increase availability of game may have contributed to the spread of pine forests (Waselkov 1978) (Patterson and Sassaman 1988).

At the time of the survey, the project area consisted of a mix of pine and open-canopy hardwood forest. Areas of dense secondary growth pine were encountered,especially on ridge top areas and ridge slopes. The open canopy hardwood forest consists of oak, hickory, poplar, holly, gum, and cedar. Along low-lying areas and creek drainages and in areas where the forest has been thinned by tree-cutting, dense thickets of honeysuckle, grass, and greenbrier have developed (Figures 5a, b, c).



a




b

Figure 4: Regional Maps. a, North Carolina County Map; b, North Carolina Physiographic Map.

## Climate

The climate of Guilford County is temperate and humid due to moist maritime air from the Atlantic or Gulf of Mexico; there is protection from cold extremes by mountains in the west. Precipitation is relatively evenly distributed throughout the year; roughly two years out of ten are droughty during the growing season (Stephens 1977).

a

b

Figure 5: a, open canopy hardwood forest
b, dense secondary pine forest

c

Figure 5: c, secondary growth, greenbrier thicket

## Prehistoric Overview

North Carolina prehistory covers a span of at least 10,000 years Before Present (B.P.), and the following is a synopsis of that period. Our knowledge of North Carolina prehistory is based largely upon archeological investigations within the Piedmont region, which were initiated by Joffre Coe of the University of North Carolina in the 1930s. Excavating deeply stratified sites, Coe was able to formulate a relative cultural sequence based upon lithic and ceramic morphological types, and that information is still a point of departure for North Carolina archeological studies (Coe 1964). Since the 1930s radiometric dating has assigned these chronological sequences to absolute dates.

The prehistoric period is generally divided into three cultural stages, defined by economic and subsistence strategies. These strategies relate to changes in technology, reflected by the artifacts themselves.

The first stage is referred to as the Paleo-Indian stage and the time of its first representation in North Carolina is unknown, although ca. 12,000 to 10,000 years B.P. is likely. The Paleo-Indian stage is represented by a continent-wide distribution of fluted, lanceolate, projectile points (Clovis) associated west of the Mississippi river with extinct pleistocene megafauna. In North Carolina, Clovis is followed by the Hardaway point, an earred, fluted blade which diversifies into several related forms (Coe 1964; Oliver 1981, 1983). It dates to the late Paleo-Indian period.

The Archaic stage begins with the advent of Holocene conditions ca. 10,000 years B.P., with associated changes in many plant and animal species. Subsistence strategies shifted to a reliance on modern fauna, increased use of riverine and plant resources, and an apparent population increase is represented by more and larger habitation sites. The Archaic is marked by increasing regional diversification in artifact forms, the use of ground stone tools, and networks of exchange. In North Carolina the early Archaic is represented by a variety of Kirk point styles, the Middle Archaic by Stanly, Morrow Mountain I and II, Guilford, and Halifax points and the late Archaic by Savannah river points, followed by Gypsy points. The Archaic period in North Carolina is placed between 10,000 and 2,000 years before present.

Within the Southeastern U.S. region as a whole, several important changes in subsistence and settlement patterns developed during the middle to late Archaic, most notably the cultivation of wild plant foods along river bottoms. Domesticated plants appear to have been introduced later, and were grafted on to pre-existent subsistence regimes (Yarnell 1982; Smith 1992). The succeeding Woodland stage saw increased use of tropical cultigens such as maize, squash, and beans. Pottery began to be used ca. 2,000 years B.P. The earliest pottery-bearing sites have yielded radiocarbon dates of 240 B.C. +/- 95 (Claggett and Cable 1982) and 266 B.C. +/- 80 (Davis 1987). It was during this stage that small, triangular projectile points appear, likely coinciding with the adoption of the bow and arrow (Coe 1964), and a shift in settlement preferences from uplands to the floodplains is documented, perhaps because it was easier to till alluvial soils for crops.

The adoption of new food-obtaining/processing technology and subsistence practices (i.e., horticulture) never totally replaced the Archaic gathering and hunting strategies, but rather the two coincided until Contact times (Barnette 1978; Mikell 1987; Claggett and Cable 1982; Beckerman 1986).

The Woodland terminates ca. A.D. 1650 when the introduction of European diseases such as smallpox and measles effectively destroyed native polities in the Piedmont.

## Historic Overview

Early European settlers, traders, and explorers like John Lawson were the first to describe the area of present day Guilford County, detailing their observations on local wildlife and commenting on the customs and behaviors of the aboriginal peoples they encountered. These first European visitors mentioned large native settlements to the northeast and south of present day Guilford County, which were likely the remnant populations which still existed for a time after the European arrival (Robinson 1980).

The Guilford County area was first settled by a contingent of German Lutherans (and Calvinists) who arrived around 1744, followed by English Quakers and Ulster-Scot Presbyterians. These groups traveled overland from Pennsylvania and Maryland and from eastern North Carolina. Settlers moved slowly westward from the coast because of the absence of east-west running rivers and the desolate pine barrens which marked the boundary between the Piedmont and the Coastal Plain (Robinson 1980). The best land in the Guilford County area was the first to be claimed, and after the initial surge settlement of the area grew slowly (Stoeson 1993).

Guilford County, named for Lord Francis North, first Earl of Guilford, was created in 1771 after colonial administrative inadequacies and perceived injustices by inhabitants of the western Piedmont prompted action from Governor Tryon, who was feeling pressure from the increasingly powerful Regulator movement growing in the North Carolina "backcountry." Shortly after the creation of Guilford County, Tryon's militia fought an armed Regulator army a few miles east of the Guilford County line. In 1774 Guilford Courthouse became the county seat and by 1781 contained a population of about 300 persons (Robinson 1980).

During the Revolutionary War, American General Nathanael Greene chose the site of Guilford Courthouse to face the pursuing British forces under Cornwallis. The battle which occurred on March 15, 1781 severely weakened the British army, which departed for Virginia.

"Greensborough" (named for General Greene) was founded in 1808 as the new county seat for Guilford County. In 1856 railroad lines linking Goldsboro and Charlotte were running through Greensboro, and during the Civil War the Confederate government initiated the building of a rail line linking Greensboro with Danville, Virginia, which provided a major transportation and supply route for the Confederate armies. After Richmond fell in 1865, Confederate president Jefferson Davis fled through Greensboro, where he authorized the surrender of the remaining Confederate armies in the field (Robinson 1980).

After the war, the rail lines through Greensboro promoted industrialization. Supported by a growing economic base which included textile mills and retail outlets, Greensboro developed into a small city in the 1920s. In 1923 the city's charter was

revised to allow annexation of out-lying areas, quadrupling the size of the city, to North Carolina's third largest.
Also during the early 1900s black community housing moved east to West Market Street near the campus of North Carolina A&T, the result of new segregation ordinances (Stoeson 1993).

During World War II, the U.S. Army Air Forces built a training center in northeast Greensboro. This segment of the city is still sometimes referred to as the ORD (from Overseas Replacement Depot). The 1950s began to result in urban sprawl (Stoeson 1993).

The 1960s and 1970s were years of slow social change, as one after another Greensboro institution became desegregated. In 1960 a black student sit-in at the Greensboro Woolworth's sparked a nation-wide trend. Hospitals were desegregated in 1962. By 1980 Greensboro had expanded to 60.5 square miles in size, and incorporated the Bessemmer community near the project area.

The Neal family owned much of the land in the project area, and first built near the present landfill area in the early 1900s. Small agricultural plots once existed within the landfill expansion area boundaries, and corn and tobacco were raised.

## Previous Research

Archeological studies in Guilford County include contracted and academic research. Joffre Coe recorded a small number of sites in Guilford County during 1935 and 1937, including some on or near North Buffalo and Reedy Fork creeks (field notes on file, University of North Carolina-Greensboro). Joseph Mountjoy and other researchers recorded a number of sites in the 1970s, mainly to the southeast of the project area (field notes on file, University of North Carolina-Greensboro).

In the late 1970s survey and testing of the area affected by the Greensboro-High Point Airport expansion were carried out (Dorwin 1977; Woodall 1978). Dorwin's surface reconnaissance survey covered 340 acres, and he suggested certain hypotheses for testing: Archaic and non-ceramic sites occur from the floodplains to the adjacent ridgetops; diagnostic artifacts for Archaic sites do not occur in specific natural settings; Woodland sites with diagnostic artifacts are found only on floodplains. Woodall's testing of three of these sites led to the tentative rejection of two behavioral models, i.e. that small upland sites represent a transition between Archaic and Woodland adaptations and that the small upland sites differ from their floodplain counterparts only in size (which is associated with the amount of nearby arable land). Rather,small upland Woodland sites are more likely limited activity loci related to resource extraction in certain environmental settings, which may explain why Woodland and Archaic components are often clustered.

The University of North Carolina- Chapel Hill located two small sites in its survey of the Horsepen Creek outfall lines (Ward 1979). Archaeological Research Consultants, Inc. recorded two sites in its 15 acre survey for the Benjamin Parkway extension and Old Oak Ridge Road relocation (Hammond 1981). These researchers note the propensity for near continuous distributions of lithic debitage along major creek margins.

Historic site investigations include excavations at the site of David Caldwell's house (Baroody 1980) and at 31Gf200, site of an early twentieth century tenant's house (Keller 1990). In addition, investigations at the Blandwood mansion, home of Governor John Morehead, revealed several features related to the 1846 mansion and its dependencies (Skowronek 1980).

## Research Methods

*(See Map, Appendix I)

Much of the active borrow area south of White Street had been subjected to severe earth-moving activities at the time of the survey. A large area had been cut and scraped to the C-horizon; photographs were taken and this area was inspected but not systematically surveyed by the field crew. As the survey progressed, forest cover to the east and southeast of the active borrow area was removed by heavy machinery and subjected to some incidental scraping of the surface. This area was considered to have greater than 60 percent surface visibility, and was surveyed by the field crew after a hard rain.

The rest of the project area was inspected by examining the surface for signs of cultural activity in areas where it was determined that at least 60 percent of the surface was unobscured by groundcover or thick colluvium. This applied to much of the extreme western portion of the project area where land-clearing activities and scraped access roads exposed much of the surface. Shallow colluvial deposits on slope bottoms were inspected as well.

In those areas where surface visibility was determined to be less than 60 percent, shovel tests measuring approximately .5 square meters were excavated at 30 meter intervals. These shovel tests were dug to depths sufficient to expose subsoil and all removed soil was screened through 1/4 inch mesh to recover cultural materials. The floors and walls were troweled and inspected for cultural features and/or strata. All positive shovel tests and shovel tests used to evaluate site boundaries were described by depth, stratigraphy, Munsell color, texture, and artifacts recovered. Any artifacts recovered were placed in sealable plastic bags and labelled. When a shovel test was positive, other shovel tests were dug approximately 10 meters away in each direction, and site limits were determined by two consecutive negative shovel tests or by major changes in slope. In situations where site boundaries were determined by surface distribution of artifacts, a single shovel test was used to evaluate site stratigraphy and gather an artifact sample. When the opportunity presented itself, tree throw was examined for signs of cultural strata and/or activities. Shovel tests were not excavated in areas exhibiting greater than 15 percent slope, severe erosion, or severe disturbance. Sketch maps were made of the distribution of shovel tests used to evaluate a site in relation to site topography, and site locations were superimposed upon topographic survey maps ( 1 ft.= 100 ft. scale) provided by HDR Engineering, Inc. Photographs were taken of sites and the survey area in general. In this project, three prehistoric and one historic site were initially encountered by surface reconnaissance. Two prehistoric sites were discovered using shovel tests.

After fieldwork for the project was completed, all artifacts and documentation were returned to the Archeology Laboratories at Wake Forest University for analysis and permanent curation.

Artifacts were washed and classified, and each site's artifact inventory was examined in order to evaluate the historic or prehistoric components present and determine the range of raw materials and activities which were represented. A photograph of diagnostic artifacts from the prehistoric sites was made, and a North Carolina State Archaeological Site Form was completed for each site.

## Results of Survey

Field investigations at the proposed White Street landfill expansion area resulted in the discovery of five previously unrecorded prehistoric sites and one historic site (See Appendix II). All sites are located on the McCleansville, North Carolina Quadrangle, USGS 7.5 minute series map.

**AL 1**

AL 1 is located approximately 50 meters from the northwest corner of the fenced project area within the active borrow area south of White Street (Figure 6). The site is situated on the northwest end of a low, northwest trending ridge which drops gently to the southwest, west, and east, and reaches its highest point 20 meters to the southeast of AL 1. At the time of the survey the site was located between two extensive brush piles comprised of cut timber, created from the clearance of the active borrow area to the east. The site surface had been cleared of trees and brush but had not been subjected to deep churning, although some topsoil had undoubtedly been removed and the site area had seen some erosion. Surface visibility at the time of the survey was excellent (Figure 7).

The site consists of a low-density scatter of lithic tools and debitage, extending roughly 21 meters east/west and 23 meters north/south, on a 0 - 5 percent slope. Although slopes were inspected, all artifacts with a single exception were found on the ridge itself. One shovel test was placed in the approximated middle of the surface scatter; no artifacts were recovered. The soil at AL 1 is Enon fine sandy loam, marked at this location by a B horizon revealed stratigraphically as follows: 0 - 9cm, dark yellowish brown clayey sand (10 YR 4/4), 9 - 15cm, light yellowish brown sandy clay (10 YR 5/6).

The two projectile points found on the surface include a small, ovate rhyolite point with bifacial retouch, convex base, and excurvate sides. The other is a broken Savannah River point, the distal end sheared off at the blade's midsection. The presence of the Savannah River point indicates a late Archaic site component. Broad-bladed Savannah River points are found throughout a large portion of the southeastern U.S., and associated radiocarbon dates range from ca. 5,000 years B.P. to 2500 B.P. (Oliver 1983).

AL 1 has been subjected to disturbance resulting from land clearing activities, and lacks substantial underlying stratigraphy. The artifact density on the surface is extremely low. It appears unlikely that any undisturbed cultural deposits are present. Because AL 1 does not appear to have any potential to yield important information about the past, it appears ineligible for inclusion on the National Register, and no further work is recommended.

Artifacts Recovered (Surface Only)

Lithic debitage

1 flake (quartz)
2 flakes (porphyritic rhyolite)
2 flakes (rhyolite; 1 heavily weathered, 1 gray)

Lithic tools

1 Savannah River point (heavily weathered rhyolite)
1 ovate bifacial point (porphyritic rhyolite)

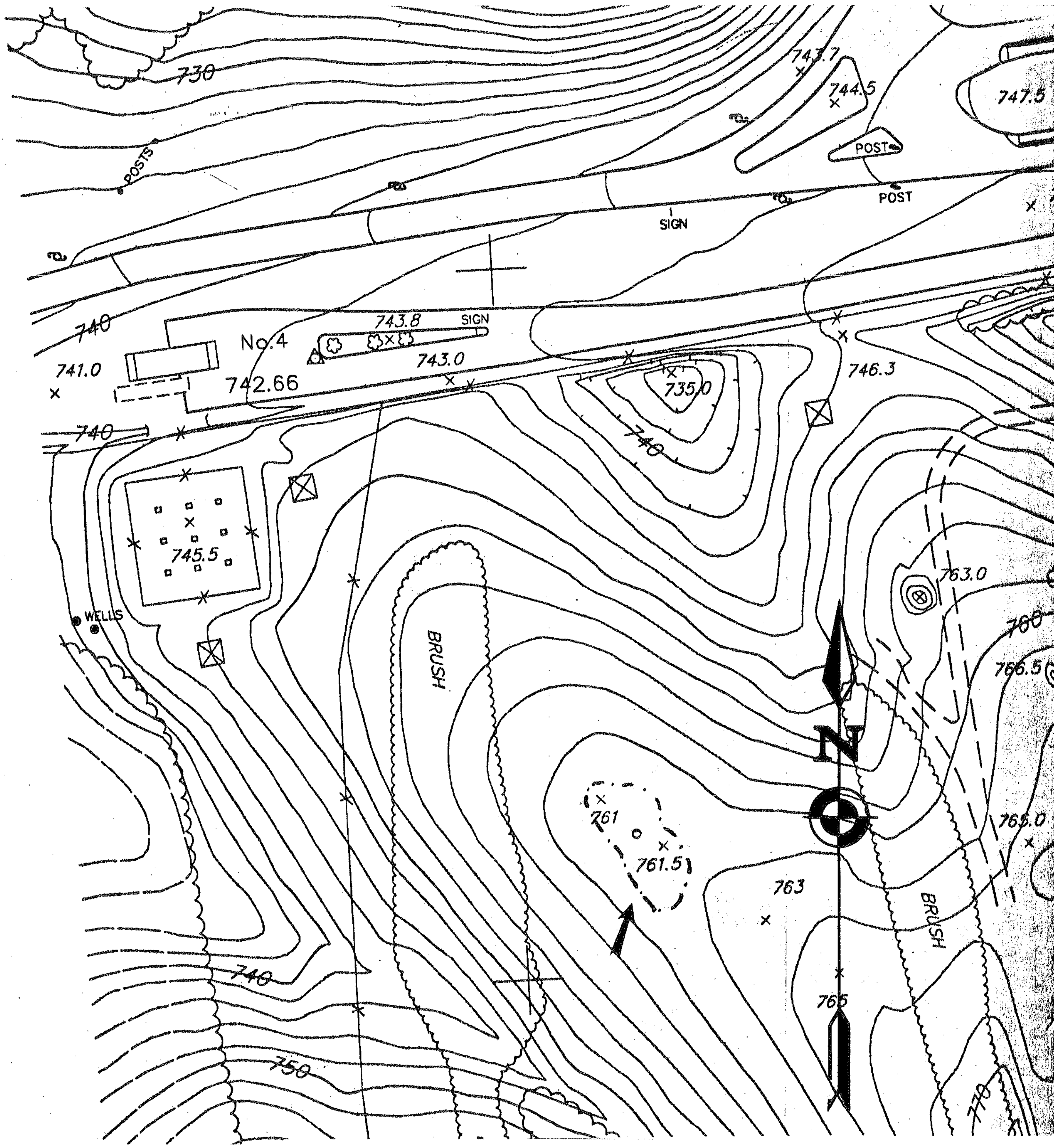



Figure 6. **Site AL-1**
Shovel test, negative - O

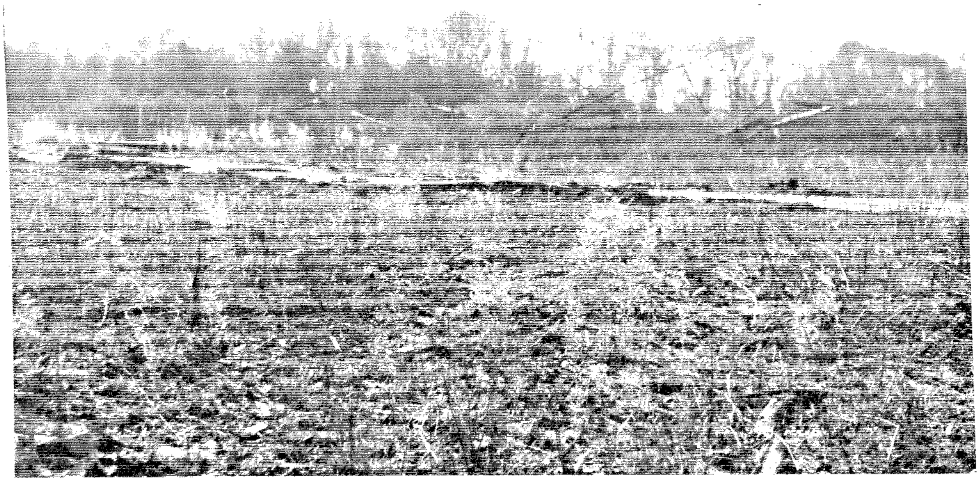


Figure 7: Site AL-1, View to West

**AL 2**

AL 2 is located adjacent to the project boundary fence's second access gate heading south off of Nealtown road, on the project area's western border (Figure 8). The size of the site is difficult to assess under the circumstances in which it was found; tree clearing activities and the scraping of four access roadways through the site area have severely compromised any horizontal integrity the site may have possessed (Figures 9a, b, c). All artifacts found on the surface were collected from washed road surfaces and the edges of two of the access roads, some as far as 120 meters down the northernmost access road slope. A few artifacts were found in the roadway paralleling the boundary fence. The other two roadways contained no artifacts. For convenience's sake, the site is divided into two discrete loci, based on surface finds. Interestingly, all projectile points recovered from the site were found in the second locus. Surface visibility was good to fair over a small part of the site area, while the rest was covered by brush piles and a tangle of secondary growth (greenbriers). Shovel tests and examination of tree-throw were used to further evaluate the site.

The site is situated along a gentle north/south trending ridge, which slopes gently to the east at 0 - 5 percent. A series of shovel tests were excavated along and between all access roads. Tests on the highest portion of the ridge (Locus 1) each produced a single quartz flake, with stratigraphy as follows: 0 - 8 cm, dark brown (organic) loam (10 YR 3/3), 8 - 14 cm, yellowish red clay (5 YR 4/6). The soil type is difficult to assess, but probably is Enon sandy loam or Mecklenburg sandy clay loam. Shovel tests to the south produced red clay subsoil at 2 cm below surface. Undisturbed areas were sampled where possible (east of the ridge) with shovel tests, but only one produced lithic flakes (adjacent to the northern road, in locus 2). These tests revealed similar stratigraphy: 0 - 16 cm, dark yellowish brown clayey sand (10 YR 4/4) over yellowish red clay subsoil (5 YR 4/6).

A total of seven projectile points were found in locus 2, including two complete and two broken Guilford points, a stemmed quartz point resembling Halifax, and two points (Kirk?), one of which has been reworked as a scraper. Kirk points are assigned to the chronological period 10,000 - 8,000 years B.P. (Early Archaic), and are recognized almost everywhere east of the Mississippi river (Dincauze 1976) (Griffin 1964). Guilford and Halifax points are generally assigned to the period, 6,000 - 5,000 years B.P. (Middle Archaic). Debitage consisted of rhyolite/andesite, quartz, and vitric tuff.

Although diagnostic artifacts were found at AL 2, the site has been severely impacted by land clearing activities and some erosion. The low density of artifacts in the area and the shallowness of cultural strata suggest that intact artifact concentrations and cultural features are not likely to be present. AL 2 does not appear likely to yield substantial information about

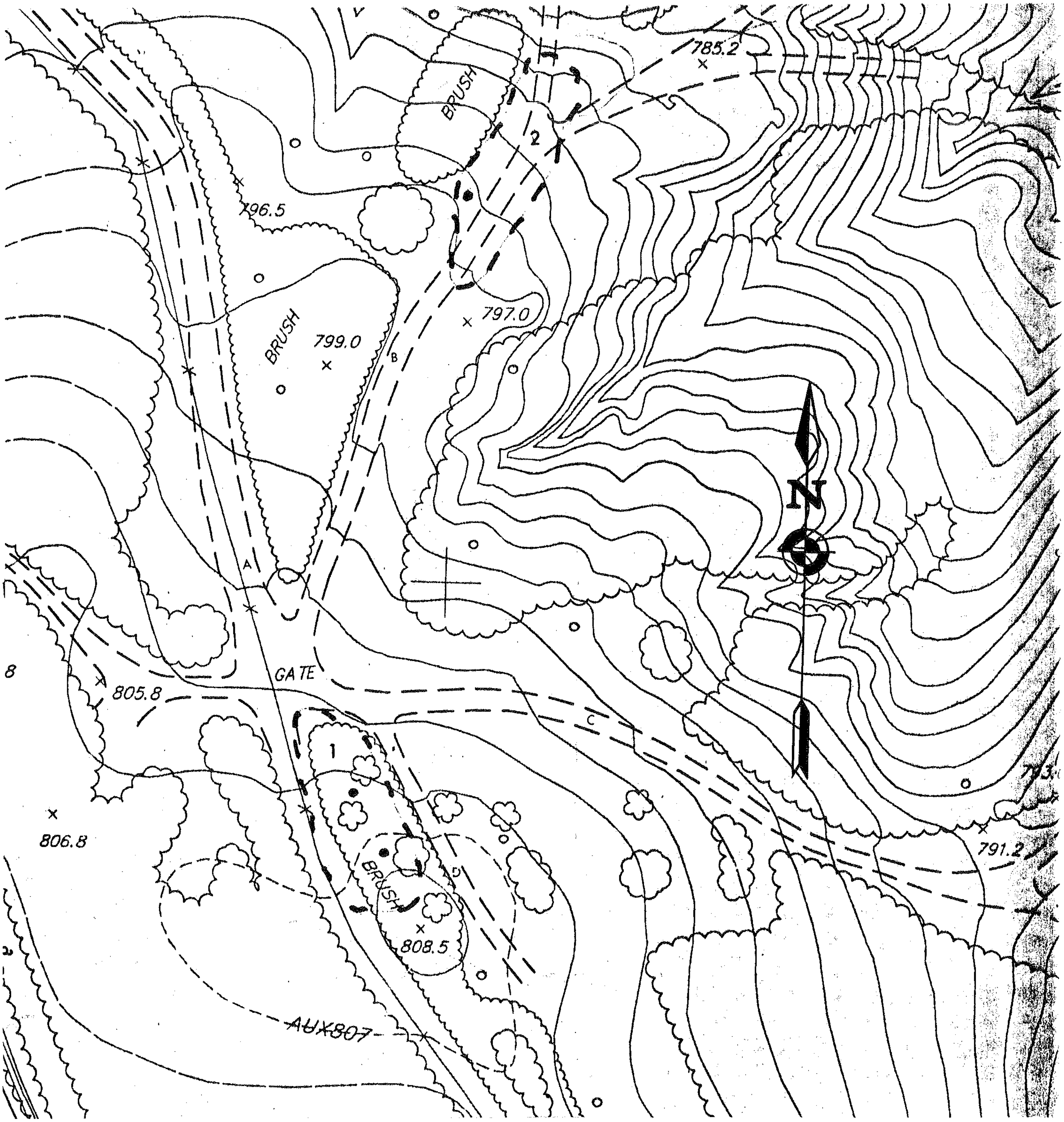



Figure 8. **Site AL-2**, Loci 1, 2
Shovel tests, positive -●
Shovel tests, negative -○

past behavior, and it does not seem eligible for the National Register. No further work is recommended.

<u>Artifacts Recovered</u> (Shovel tests and surface)

<u>Shovel Tests</u>

ST 1: flake (quartz)
ST 2: flake, possible unifacial retouch (quartz)
ST 3: 5 flakes (3 vitric tuff, 2 rhyolite)

<u>Surface</u>

Debitage:

17 flakes (quartz)
8 flakes (porphyritic rhyolite)
30 flakes (vitric tuff)
28 flakes (weathered rhyolite/andesite
2 pieces miscellaneous quartz
1 flake (fine-grained rhyolite)

Tools:

Guilford point; rhyolite; distal tip broken; basal notch present
length: 76mm width: 22mm thickness: 7mm

Guilford point; rhyolite/andesite; slight basal notch
length: 64mm width: 21mm thickness: 7mm

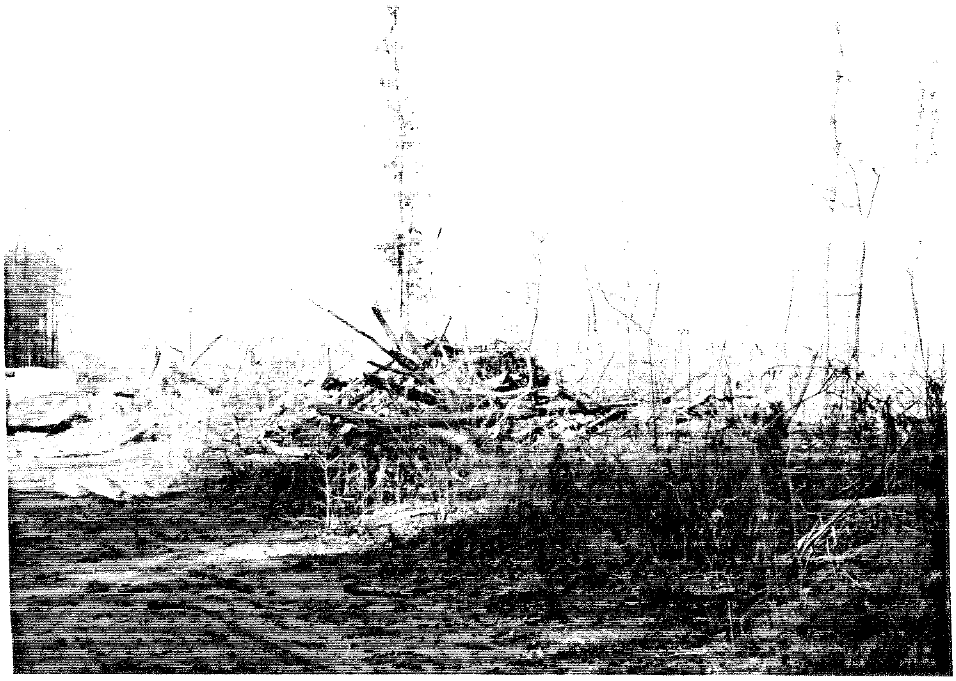
Guilford? point; rhyolite; midsection only
length: 35mm width: 20mm thickness: 7mm

Guilford point; broken near midsection; distal missing
length: 44mm width: 19mm thickness: 8mm

Halifax? point; quartz, stemmed
length: 38mm width: 20mm thickness: 6mm

Kirk? point; rhyolite; corner-notched and stemmed; not serrated; distal portion modified into a scraper
length: 36mm width: 38mm thickness: 3.5mm

Kirk? point; vitric tuff; corner-notched stemmed; distal portion missing.
length: 30mm width: 28.5mm thickness: 3.5mm



a

b

Figure 9: a, Site AL-2, locus 1, View to North
b, Site AL-2, locus 2, View to North

c

Figure 9: c, Site AL-2, View to West

**AL 3**

AL 3 is located approximately 215 meters south of AL 2 (locus 1). The site is situated on the eastern slope (0 - 5 percent) of a gentle western rise on the western boundary of the project area (Figure 10). The site area includes an access road paralleling the boundary fence, and artifacts found here were included with the site's assemblage. The site extends from the boundary fence approximately 28 meters oriented northwest/southeast under a brush pile and into undisturbed pine forest (Figure 11). The site extends approximately 12 meters to the south and north sides, as determined by shovel tests. Two shovel tests were positive, yielding a few flakes in the upper layer of Mecklenburg sandy clay loam (heavily leached here to form a silty layer) described as follows: 0 - 24cm, olive brown sandy silt (2.5 Y 4/4), 24 - 30cm, light brown olive sandy clay (2.5 Y 5/4), 30 - 37cm, becoming mottled with yellowish brown clay (10 YR 5/6) with oxidized iron which added red/orange smears to the profile. Augering revealed uniform yellowish clay to 80 cm. Shovel tests to the north, south, and east showed an absence of the fine silty layer. It appears that AL 3 consists of a few artifacts which are confined to a well-defined colluvial layer. No diagnostic specimens were recovered.

It is possible that AL 3 contains artifacts which have washed down from a low western ridge outside the project area. Even were the deposit undisturbed and primary, the small area to which the deposit is confined and the low incidence of artifact recovery make the presence of undisturbed cultural features highly unlikely. AL 3 does not appear likely to yield important information about past occupations of the area, and does not appear eligible for inclusion on the National Register. No further work is recommended.

<u>Artifacts Recovered</u>

Surface (road wash):

13 flakes (11 quartz, 2 rhyolite)

Shovel tests:

ST 1: 2 small flakes ( quartz, rhyolite)

ST 2: 3 small flakes (2 quartz, 1 rhyolite)

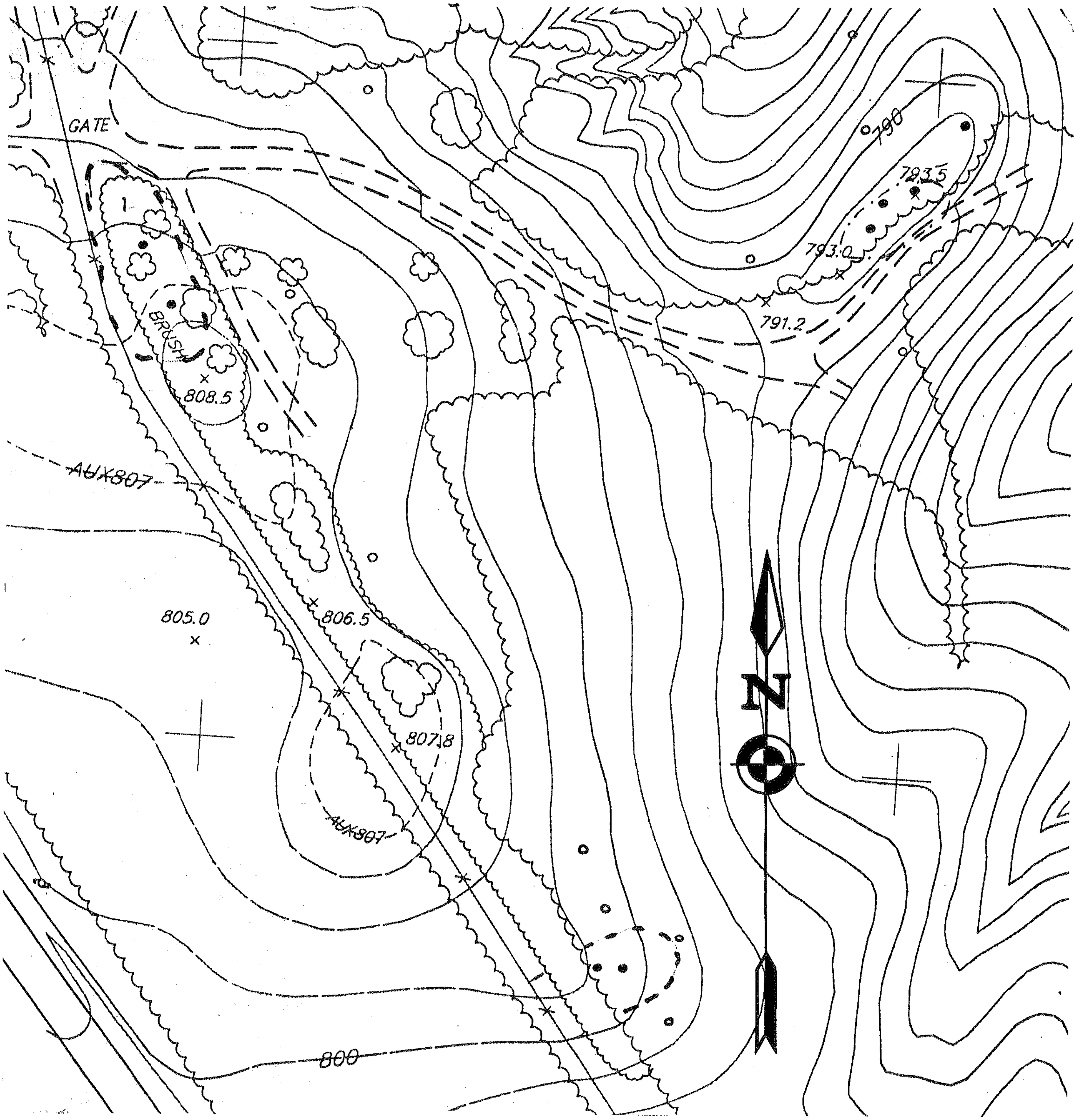



Figure 10. **Site AL-3**
Shovel test, positive ●
Shovel test, negative ○

Figure 11: Site AL-3, View to Northwest

**AL 4**

This site is located on the north side of access road "C", approximately 165 meters to the southeast of AL 2. AL 4 is situated on a ridge crest which falls to the north, and more gently to the south, slope 2 - 10 percent (Figure 12). The site area has been heavily disturbed by bulldozing and land clearing activities; the access road cuts directly through it, just missing the highest part of the ridge (Figures 13a, b). The area where artifacts were recovered is largely covered with fallen trees. Surface visibility conditions on the ridgetop were poor, and some artifacts were found in the access road. Site boundaries were determined to be 20 meters east/west and 18 meters north/south. A series of shovel tests were placed across the ridge (where conditions at the time of the survey permitted) and on the three areas away from the ridge. Positive shovel tests on the ridge itself yielded quartz debitage, the distal end of a Guilford point, and the distal end of a large bifacial quartz point (all less than 10 cm below surface). The soil is Mecklenburg sandy clay loam consisting of light brown sandy loam (10 YR 6/6) 0 - 12cm, over reddish yellow clay (7.5 YR 5/6) at 20 cm. Clay subsoil was encountered at 5 - 10 cm in all negative tests on slopes and to the east. Several quartz cobbles were observed on the ridge area but all appeared to be unsuitable for stone tool manufacture, and may represent a disturbed vein outcrop.

Despite the occurrence of artifacts which indicate a middle Archaic presence, the few artifacts at the site are confined to the highly disturbed and sharply delineated ridgetop area with a corresponding shallow soil matrix. It is unlikely that significant artifact concentrations and undisturbed cultural features are present. AL 4 does not appear eligible for National Register status, and no further work is recommended.

<u>Artifacts Recovered</u>

Surface (washed road surface):
- 8 flakes (2 rhyolite, 6 quartz and misc. quartz)
- 1 preform (abort) biface (quartz)
- length: 33mm width: 18.5mm thickness: 10mm

Shovel tests:
- ST 1: 3 flakes (2 quartz, 1 rhyolite)
  1 distal end of Guilford point
- ST 2: 1 flake (quartz)
  1 quartz bifacial blade (Guilford?)
  length: 51mm width: 28mm thickness: 7mm
- ST 3: 4 flakes (quartz)
- ST 4: 2 flakes (quartz), 1 piece misc. quartz

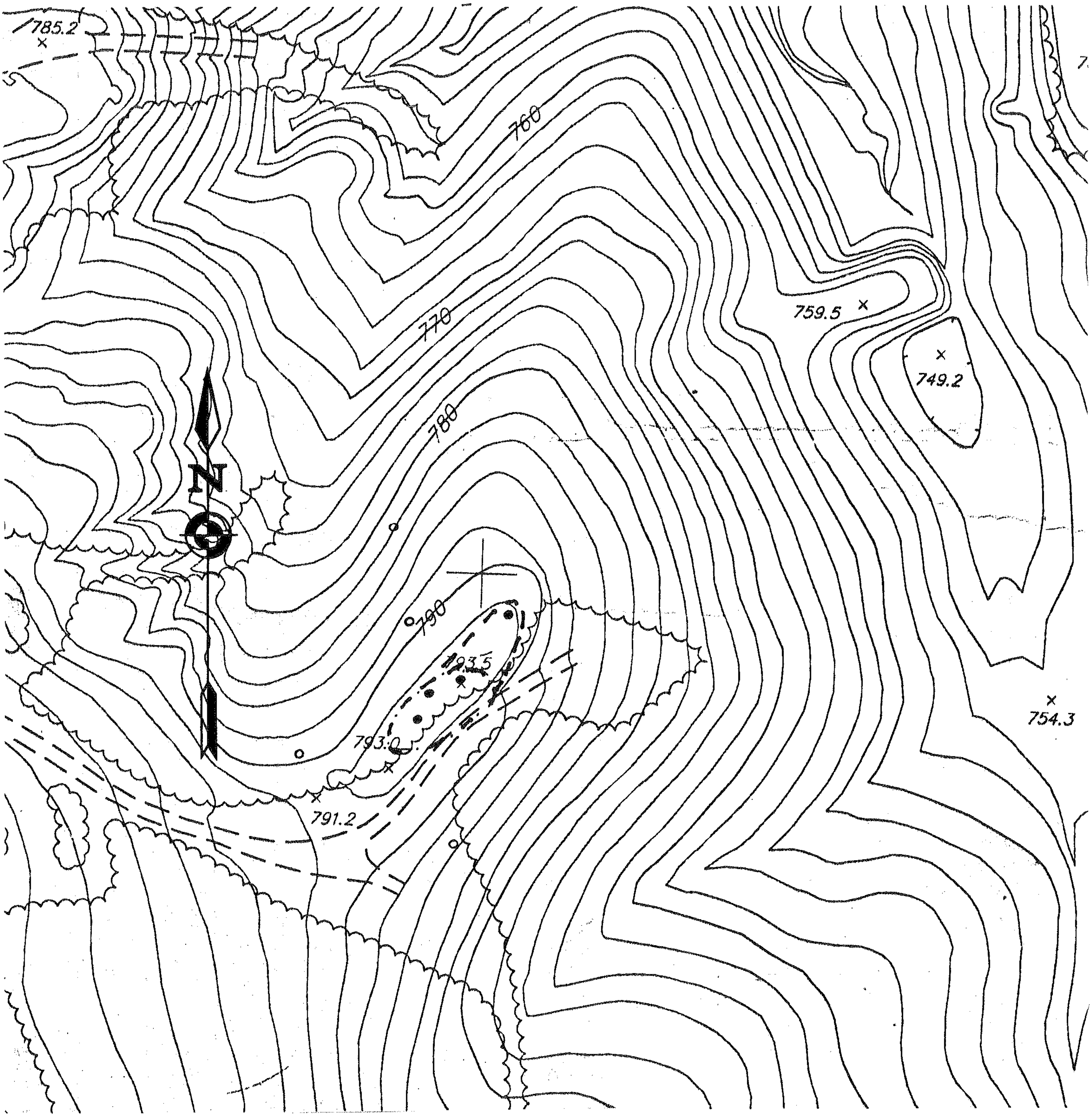



Figure 12. **Site AL-4**
Shovel test, positive -●
Shovel test, negative -O

a

b

Figure 13: a, Site AL-4, View to North
b, Site AL-4, View to East

**AL 5**

AL 5 is situated along a ridge slope which becomes a pronounced ridgetoe on its downslope western terminus (Figure 14). The site's landform slopes to the north and to the south. A small creek/spring outlet lies 30 meters to the north of the ridgetoe portion of the site, and a larger, winding creek lies between 15 meters and 45 meters to the south. The slope of the site is 0 - 5 percent (Figures 15a, b). A power line runs east/west to the north of the site, as well as a natural gas pipeline (Figure 16a). The area to the west of AL 5 consists of a steadily rising slope which has been subjected to substantial mechanical disturbance, creating sandy washes which reach just past the borrow area fence adjacent to the site (Figure 16b). The large creek to the south of the site originates in the western disturbed area and flows through a large concrete pipe under the bulldozed roadway/ fence boundary. The creek's course appears entirely unaltered.A quartz outcrop lies immediately to the west of the site area, but no evidence of prehistoric utilization was observed at the outcrop. In the area of the ridgetoe itself lies a small refuse pile consisting of rusted gasoline/oil cans.

AL 5 is in a primary oak- hickory hardwood forest with no surface visibility except around the roots of trees. The site limits were defined entirely by shovel tests. The soil at AL 5 is Enon sandy loam, which varies in depth over the site's range from 10 - 29 cm below surface. Typical stratigraphy consists of dark brown organic humus (10 YR 3/2) over olive brown sandy loam (2.5 Y 4/4) or olive coarse sand (5 Y 5/3) over light olive brown sandy clay (2.5 Y 5/4). The clay subsoil was soft and had high moisture content, but in at least two shovel tests was hard and compact. Shovel testing was supplemented in two instances by augering, which revealed sandy clay to 80 cm below surface.

A total of 24 shovel tests were excavated; 12 were positive. Shovel tests on southern and northern slopes and on the flat floodplain area of the large creek confirmed that the site was confined to the ridgetoe and eastern ridge area. No artifacts were recovered below 20 cm and usually occurred above 15 cm. Shovel tests seem to indicate that discrete and variable artifact densities are present within localized areas. Two projectile points were recovered from the ridgetoe area and another was recovered from the surface of the power line road to the north of the site. All conform to the Pee Dee Triangular type and are made from dark, fine-grained rhyolite. All micro-flakes at the site were of similar raw material. An Archaic presence may be responsible for coarser-grained material at the site, including the crude biface.

The presence of Pee Dee Triangular projectile points is diagnostic of the Late Woodland period in North Carolina, ca. A.D. 1000 - 1740. AL 5 is possibly a single-component site from this period, and appears to have the potential to inform upon Late Woodland behavior in small upland, non-ceramic sites. Although the probability of finding sub- plowzone features would seem to be low in a site of this nature, the site appears to have seen little

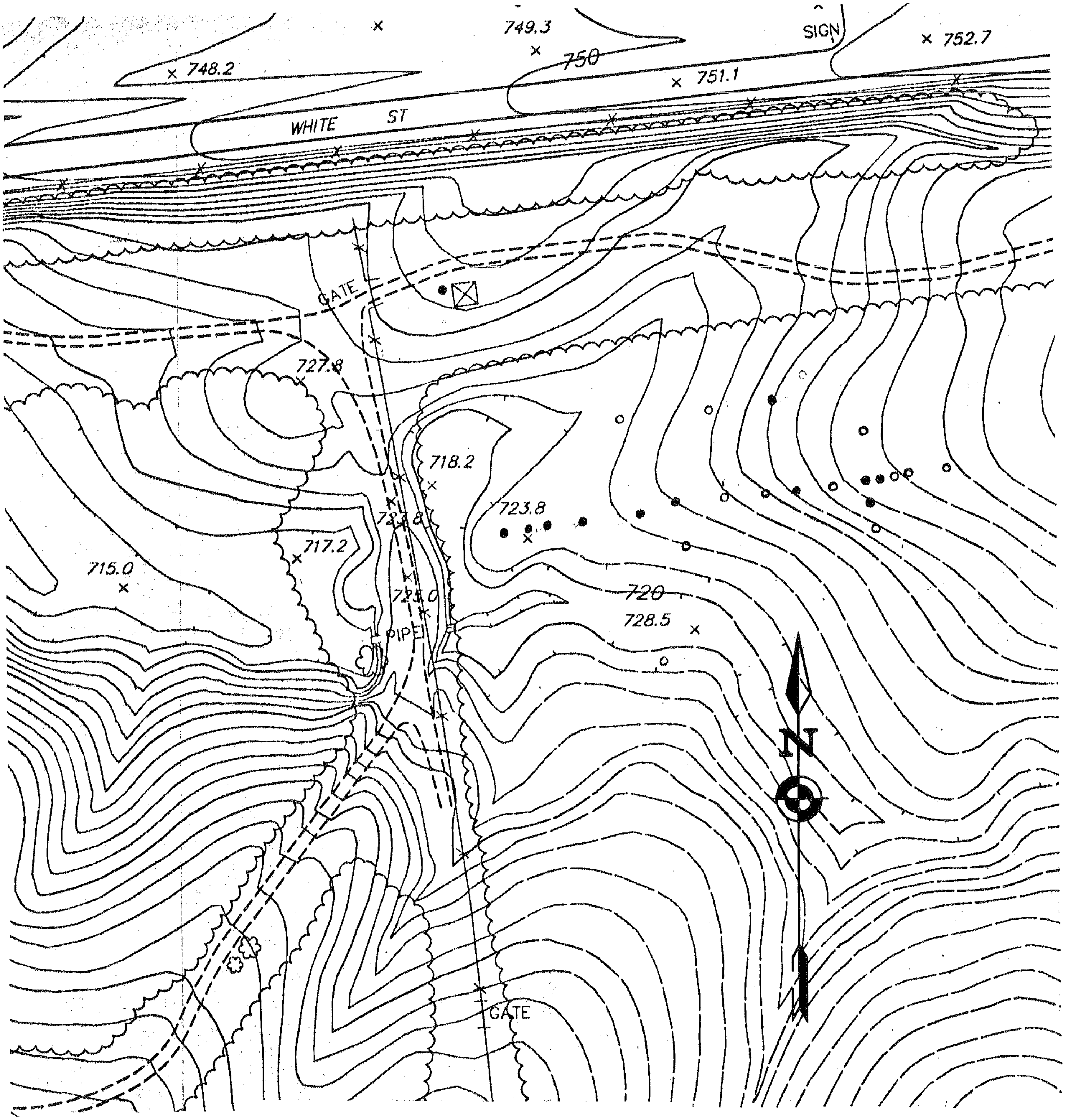



Figure 14: **Site AL-5**
Shovel tests, positive ●
Shovel tests, negative ○

deflation and has not been disturbed by construction activities. Since AL 5 appears to have the potential to provide important information about Woodland activities in an upland biome, it is potentially eligible for inclusion on the National Register, and further testing is recommended to assess this potential.

<u>Artifacts Recovered</u>

ST 1: 3 flakes (quartz)
2 pieces misc. quartz

ST 2: 2 flakes (quartz)

ST 3: 10 flakes (quartz)
2 fine-grained rhyolite thinning flakes
1 weathered rhyolite flake (found on surface in vicinity)
1 crude biface (weathered rhyolite)
2 projectile points, Pee Dee Triangular (one with broken distal tip; length: 19mm, width: 17mm, thickness: 2mm; one proximal fragment, both are dark fine-grained rhyolite)
3 pieces misc. quartz
1 possible manuport cobble

ST 5: 1 flake (rhyolite)

ST 6: 1 flake (quartz)

ST 8: 11 flakes (10 quartz, 1 rhyolite)
1 piece misc. quartz

ST 10: 7 flakes (6 quartz, 2 on surface) (1 rhyolite)

ST 11: 1 shotgun shell

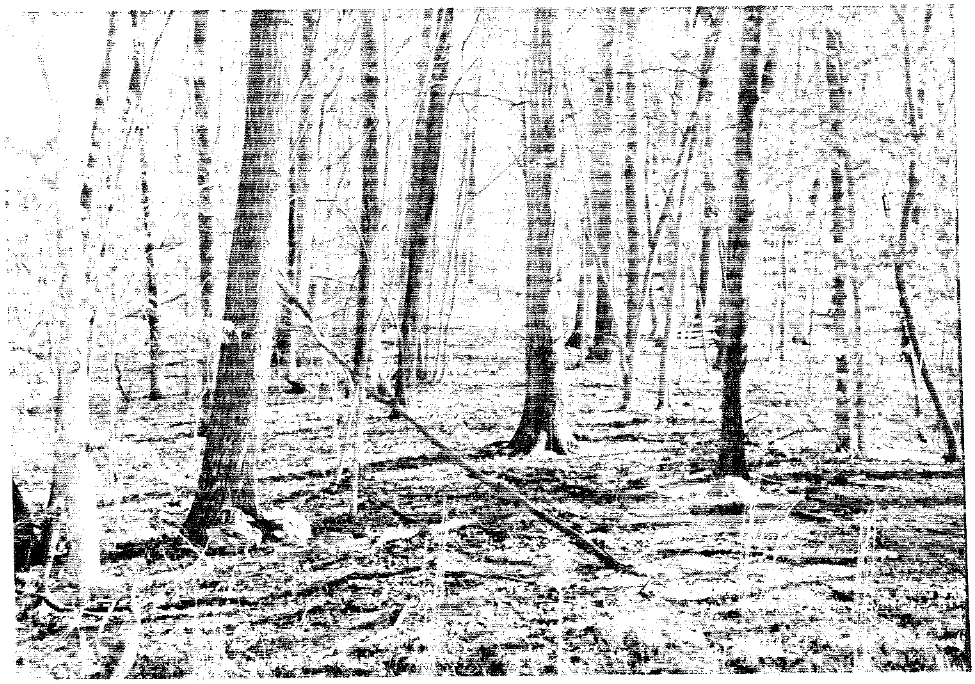
ST 15: 14 flakes, micro-flakes (extremely fine-grained black/gray rhyolite) (3 secondary)
10 flakes (fine-grained rhyolite) (4 secondary)
4 flakes (gray rhyolite) (1 secondary)
2 flakes (weathered rhyolite)

ST 16: 2 flakes (rhyolite)

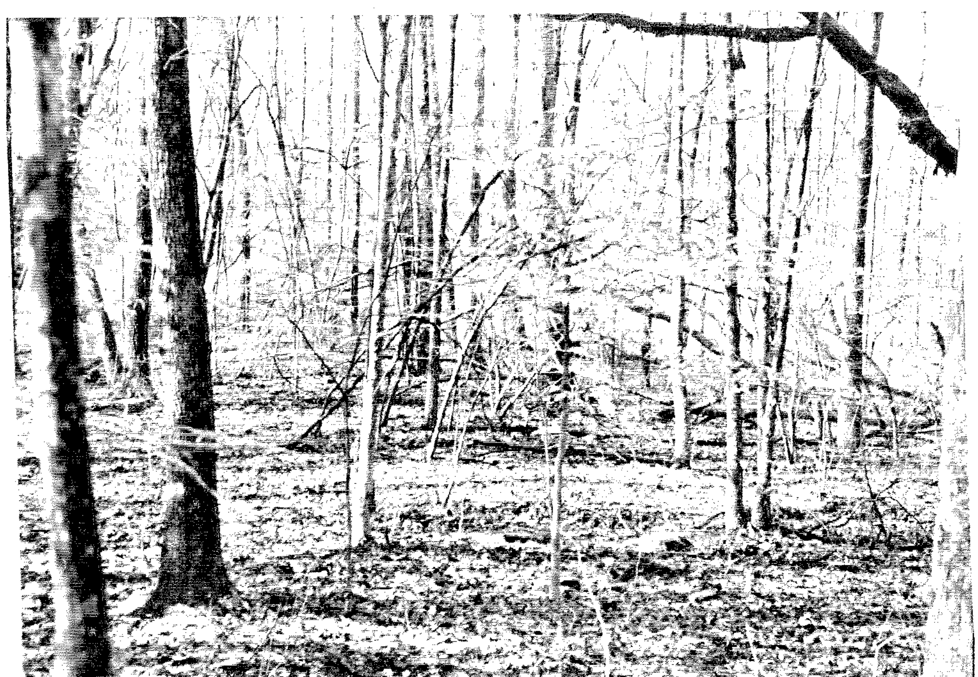
ST 22: 1 flake (rhyolite)

ST 23: 2 flakes (rhyolite)

ST 24: 1 flake (fine-grained rhyolite)

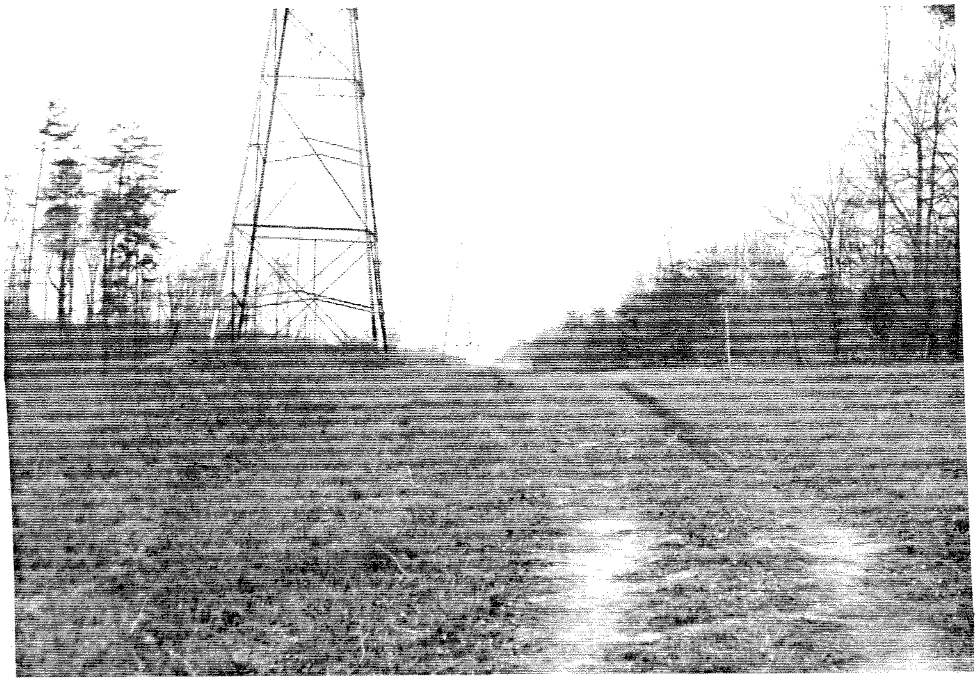


a



b

Figure 15: a, Site AL-5, View to East
b, Site AL-5, View to West



a

b

Figure 16: a, Power line north of AL-5, View to East
b, Disturbed area west of AL-5, View to Southwest

**AL 6**

AL 6 contains the remains of a structure completely destroyed and redeposited by the construction of the active borrow area (Figure 17). No standing architecture existed at the time of the survey, although some construction materials were found along with household trash scattered over an approximately 90 meter by 20 meter area near the southern edge of the active borrow area on a 2-10 percent south-facing slope (Figures 18a, b). These included non-perforated construction bricks, tin sheeting, wooden slats, and possible foundation stones. Local informants confirmed that the structure had been a house and was probably built before 1935. They also related that they had heard that the house was built during "slavery times" (Richardson family, personal communication). None of the artifacts recovered points to an occupation before 1890, and most artifacts indicate a mid-twentieth century occupation. Surface collection of the site surface was intensive but non-random: glass and ceramic artifacts were considered most important. Based on artifacts recovered from the site and information supplied by local informants, this residential site does not appear to have had a profound role in the development of the local community or regional area. The structure's remains and associated refuse have been deposited at least a short distance from where the structure originally stood, and the area has been completely covered with back dirt from the borrow area. This site does not appear eligible for National Register status, and no further work is recommended.

<u>Artifacts Recovered</u> (Surface only)

<u>Ceramics</u> (sherds)

- 8 lead-glazed earthenware (ironstone); white under-glaze
- 1 lead-glazed earthenware; grayish under-glaze (bowl or jar)
- 1 lead-glazed earthenware; white exterior under-glaze; metallic blue interior under-glaze
- 3 lead-glazed earthenware; white under-glaze; floral transfer print
- 1 lead-glazed earthenware; light blue under-glaze
- 1 lead-glazed earthenware; aqua under-glaze
- 1 lead-glazed earthenware; pink under-glaze; floral swirl pattern incorporated in body near the neck
- 1 lead-glazed earthenware; gray and white under-glaze
- 1 lead-glazed earthenware; red on white under-glaze
- 1 lead-glazed earthenware; blue and pink on white under-glaze
- 1 lead-glazed earthenware; violet on white under-glaze
- 1 porcelain (toilet bowl fragment?)
- 1 porcelain doorknob fragment
- 2 brick fragments

<u>Glass</u> (sherds unless otherwise indicated)

- 1 cobalt blue bottle, Bromo-Seltzer, with metal cap; neck-finish: small mouth external thread, 27mm diameter; base profile: round, 43mm diameter; height 125mm. This style was

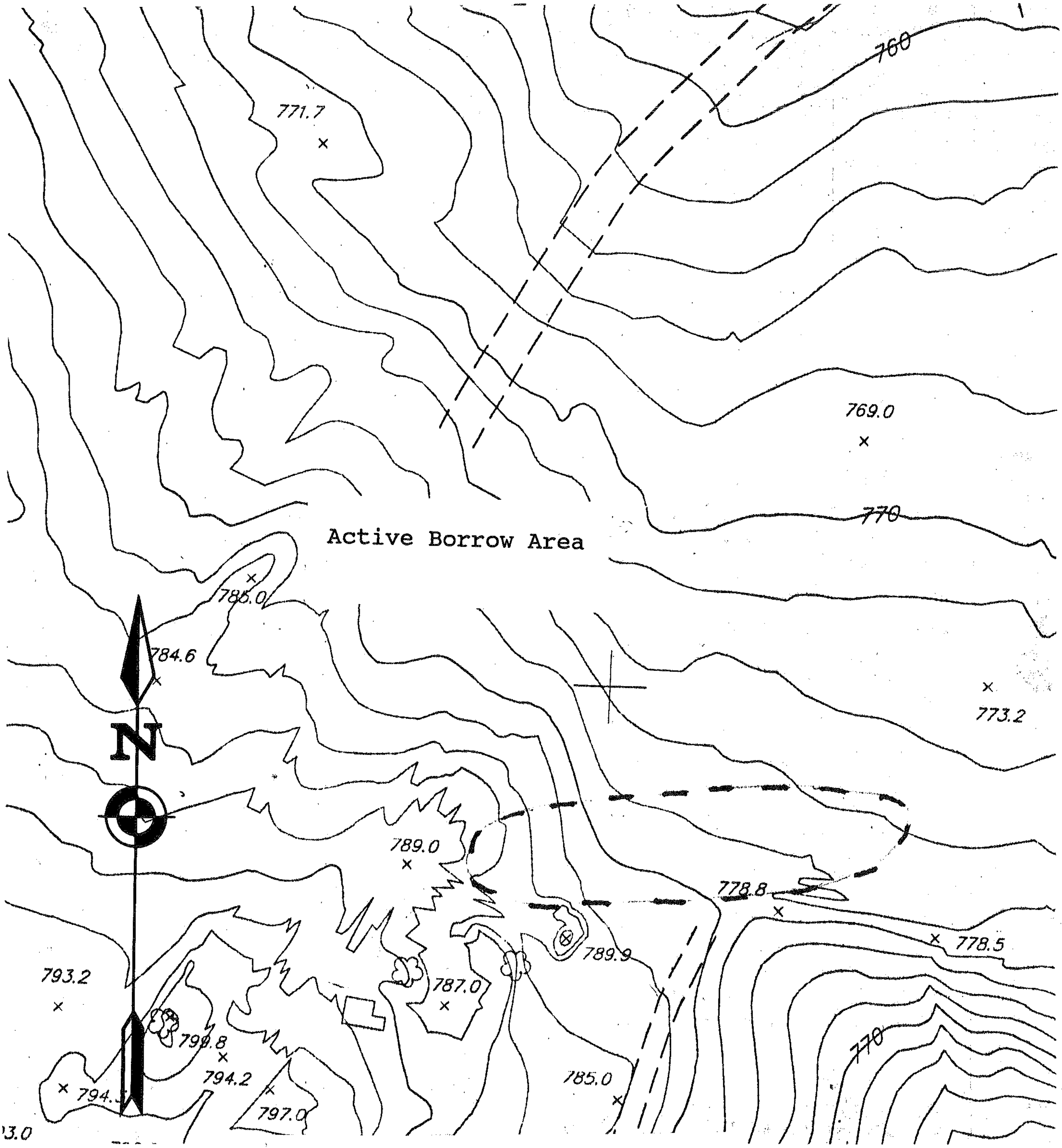



Figure 17. **Site AL-6**

manufactured between 1928 - 1986 (Fike 1987:111)

1 cobalt blue jar? base, Vick's Vaporub "56", 42mm diameter

2 cobalt blue Vick's Vaporub jar neck sherds

4 cobalt blue "Blue or cobalt glass was used for medicine, cosmetics, soda water, and for specialty use from the 1890s to the 1960s", (Fike 1987: 13).

1 green glass Coca-cola body

1 emerald green

1 dark green

1 green

1 clear neck, Nu-Grape

1 clear milk bottle neck

1 clear salt/pepper shaker, metal top

1 bottle-half, body with neck, mold-made, square-sided, Excelsior type base (Fike 1987:10), cologne or perfume?

1 clear, beaded neck, "most likely a prescription, chemical, or household product", (Fike 1987:14).

1 clear, neck finish: wide mouth external thread

1 clear, glass handle?

1 clear bottle with cork stopper; neck finish: broken, unidentified; diameter- 27mm; base profile: round, 45mm diameter; height - 93mm. Based on body form, appears to be for cream or pomade (paste medicine) (Fike 1987:15)

1 clear bottle fragment, Conti sauce; neck finish: small mouth small mouth external thread, squared sides.

1 clear bottle base-fragment, Arey's (?) Wines

3 white (cold cream)

1 amber (beer?)

1 violet tinted

1 aqua (Mason jar fragment?)

2 dark aqua

<u>Plastic</u>

1 two-hole button

1 cup fragment

<u>Metal</u>

2 metal rings (chain?)

1 spark plug

2 bolts

2 nuts

<u>Bone</u>

1 left femur, proximal, <u>Bos taurus</u> (domestic cattle)

2 unidentified mammal long bone fragments

1 scapula or ilium fragment, large mammal

1 chicken bone (<u>Gallus gallus</u>)

<u>Other</u>

1 12-gauge shotgun shell

a

b

Figure 18: a, Site AL-6, View to Southeast
b, Site AL-6, View to North

## Discussion

The Archaic period in Piedmont North Carolina lasts from 10,000 years B.P. to ca. 2,000 years B.P. Several gradual shifts in lithic tool morphology are recognized for this time period, as well as general shifts in subsistence strategies and settlement patterns (Beckerman 1983). It must be pointed out that labels attached to various archeological units are merely that --- no behavioral significance is implied. It is often the case that isolation of more specific behavioral episodes than those labelled by typological definitions of artifact assemblages is not possible (Zvelibil et al. 1992:204). These archeological labels confound attempts to view changing artifact styles as part of a continuum, instead implying that discrete technological "jumps" occurred.

Caldwell's (1958) model of Archaic lifeways contains a central element which appears to hold true for the Piedmont region: subsistence strategies revolving around a broad-based economy focused on upland resources, i.e., mast and mast-feeders. No large-scale intensive use of a single location for the purpose of exploiting a concentrated and predictable resource is noted for the North Carolina Piedmont. It is uncertain to what extent inter-group interaction was constrained, but it appears unlikely that it was constrained by any ecologically- based spatial tethering of the groups involved.

Most models of Archaic period behavior emphasize the adaptive nature of technologies (Claggett 1982:164). It is inferred that sites are located where they are because of their importance in the subsistence economy, that certain tool forms perform certain tasks better than other tool forms, etc. Behavioral and natural taphonomic processes interfere with direct inferences about behavior however, and typically very general assumptions about how site assemblages articulate with larger subsistence strategies are all that can be offered (Claggett 1982:164). It has even been advocated that archeology should adopt a "non-site" approach, based on the assertion that " human behavior does not generate spatially or temporally discrete archeological residues" (Zvelibil et al. 1992:194).

Additional difficulties with studying Archaic sites in upland locations are the factors of clay up-lift and high probability of deflation. Good hunting locations tend to remain so for extensive periods of time, creating overlapping patterns of debitage, which further obscures discrete behavioral episodes. Reasons for site interassemblage variability are therefore poorly understood for Archaic period sites in Piedmont upland locations. Except for the use of locally occurring quartz, tool-makers utilized cryptocrystalline raw materials from the Carolina Slate Belt, but efforts to assign specific site assemblages to specific sources within the Slate Belt have been few (Abbott 1987).

Although the Late Woodland in the North Carolina Piedmont is characterized by increasing reliance on horticulture, hunting remained an important activity throughout the period. It has been proposed (Woodall 1978) that small, non-ceramic Late Woodland sites in upland locations represent special activity loci, or places where activities related to specialized food or other resource procurement occurred. This basic assumption underlies most interpretations of small upland sites. More tenuous are assumptions about specific conditions related to the patterns generated within site assemblages. For instance, what conditions affected the type and variety of lithic raw material used? Under what conditions were tools manufactured, refurbished, or discarded on sites? What do inter- and intrasite patterns indicate about hunting strategies, and how do these strategies articulate with subsistence economies as a whole?

One approach to answering these questions involves the identification of specific reduction strategies and the subsequent interpolation from these to the particular behavior pattern which produced them. At AL 5 for example, the size and amount of lithic flakes indicates that tools were being made from either very small cobbles or rough preforms carried to the site. Tool refurbishment is indicated by the presence of thinning flakes, although these may have been struck off during the initial reduction sequence. The three projectile points recovered from the site were all broken, either during the final stages of manufacture, reworking, or from use.

Single component sites are ideal settings for the study of discrete patterns of behavior at the site level, and long term goals for Late Woodland archeology should include attention to the determination of how small, upland, special activity sites fit in with large, lowland settlements.

## Conclusion

The archeological survey of the proposed White Street landfill expansion area has identified six archeological sites, including five prehistoric and one historic site. Four of the five prehistoric sites and the historic site appear to have little potential to provide information about past behavior in the region, and do not appear eligible for inclusion on the National Register.

One prehistoric site identified by the survey, AL 5, does appear to have the potential to provide significant information about the past. AL 5 is a small but apparently un-deflated site containing discrete clusters of lithic debitage and Late Woodland triangular projectile points. It is believed that AL 5 contains a single Late Woodland component. Although the size and location of the site make it unlikely that sub- plowzone features are present, the survey indicated that intact artifact deposits and distributions are likely to be present. AL 5 has the potential to provide additional data about small Late Woodland special activity sites in upland locations, and may be eligible for National Register status. Further testing is recommended to assess the potential of this site for inclusion on the National Register.

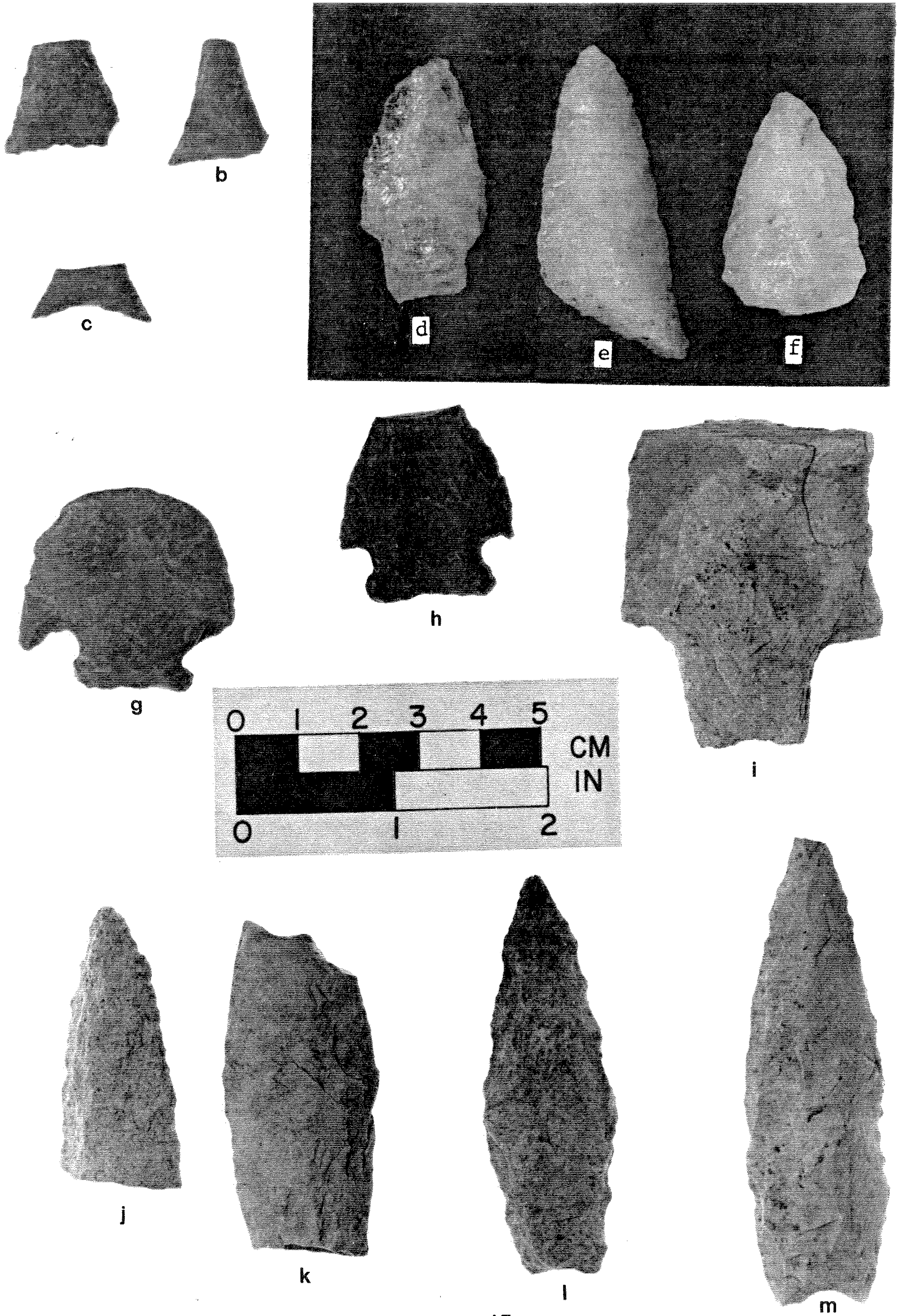

b
c
d
e
f
h
g
0 1 2 3 4 5 CM
IN
0 1 2
i
j
k
l
m

Figure 19: Selected Artifacts Recovered by Survey

a - c, Pee Dee Triangular, d, Halifax,
e, quartz blade, f, aborted preform, g,h, Kirk,
i, Savannah River Stemmed, j - m, Guilford

## References Cited


Abbott, Lawrence E., Jr.
1987 An Investigation of Lithic Resources Within Certain Sites in Davidson County, North Carolina. Unpublished M.A. thesis, Wake Forest University.

Barnette, Karen R.
1978 Woodland Subsistence-Settlement Patterns in the Great Bend Area, Yadkin River Valley, North Carolina. Unpublished M.A. thesis, Wake Forest University.

Baroody, John C.
1980 Archaeological Investigations at the Site of David Caldwell's Log College. Ms. on File, Greensboro Public Library.

Beckerman, Ira C.
1986 Prehistoric Settlement and Subsistence in Piedmont, North Carolina. Unpublished Ph. D. dissertation, Pennsylvania State University.

Caldwell, Joseph R.
1958 Trend and Tradition in the Prehistory of the eastern States. American Anthropological Association Memoir Number 88.

Claggett, Stephen R.
1981 Archaic Stage Adaptations in the Piedmont: An Evaluation of Four Models Using Data from North-Central North Carolina. Unpublished M.A. thesis, Wake Forest University.

Claggett, Stephen R. and John S. Cable (assemblers)
1982 The Haw River Sites: Archaeological Investigations at Two Stratified Sites in the North Carolina Piedmont. Commonwealth Associates, Inc.

Coe, Joffre L.
1935 Field notes on file. Department of Anthropology, University of North Carolina at Greensboro.

1937 Field notes on file. Department of Anthropology, University of North Carolina at Greensboro.

1964 The Formative Cultures of the Carolina Piedmont. Transactions of the American Philosophical Society, Volume 54 (5).

Davis, John D.
1987 Early Woodland of the North Carolina Piedmont: New Information from the E. Davis Site. Paper presented at the 44th Southeastern Archaeological Conference, Charleston, South Carolina.

Delcourt, Hazel R. and Paul A. Delcourt
1985 Quaternary Palynology and Vegetational History of the Southeastern United States. In Pollen Records of Late-Quaternary North American Sediments, edited by Vaughan M. Bryant, Jr., and Richard G. Holloway, Pp. 1 - 37, American Association of Stratigraphic Palynologists Foundation.

Dincauze, Dena F.
1976 The Neville Site. Peabody Museum Monographs Number 4. Cambridge, Massachusetts, Harvard University.

Dorwin, John T.
1977 Archeological Survey of the Greensboro/High Point Airport Expansion, Guilford County, North Carolina. MS on File, North Carolina Office of State Archaeology, Raleigh.

Fike, Richard E.
1987 The Bottle Book: A Comprehensive Guide to Historic, Embossed Medicine Bottles. Salt Lake City: Gibbs M. Smith, Inc.

Fripp, Gayle Hicks
1983 Greensboro:A Chosen Center. California: Windsor Publications.

Griffin, James B.
1964 The Northeast Woodland Area, in Prehistoric Man in the New World, Jesse D. Jennings and Edward Norbeck (eds.), pp. 223 - 258. Chicago: University of Chicago Press.

Guilday, John E.
1967 The Climatic Significance of the Hosterman's Pit Local Fauna, Centre County, Pennsylvania. American Antiquity 32 (2): 231 - 232.

Hammond, Michael
1981 Archaeological Reconnaissance of the Benjamin Parkway Old Oak Ridge Relocation, Guilford County, North Carolina. Ms. on File. Raleigh: Office of State Archaeology.

Keller, John E.
1990 Data Recovery at 31Gf200, Bryan Boulevard Extension, Guilford County, North Carolina. Raleigh: Report prepared for the North Carolina Department of Transportation.

Mikell, Gregory A.
1987 The Donnaha Site: Late Woodland Period Subsistence and Ecology. Unpublished M.A. thesis, Wake Forest University.

Mountjoy, Joseph B.
1974 Field notes on File. Department of Anthropology, University of North Carolina at Greensboro.

Murdock, Thomas G.
1947 The Geology and Mineral Resources of Guilford County. Raleigh: North Carolina Department of Conservation and Development, Division of Mineral Resources.

Oliver, Billy L.
1981 The Piedmont Tradition: Refinement of the Savannah River Stemmed Projectile Point Type. Unpublished M.A. thesis, University of North Carolina- Chapel Hill.

1983 Formative Cultures - 20 Years Later: Refinement of the North Carolina Chronological Sequence. In Piedmont Archaeology. Archaeological Society of Virginia Special Publication No. 10, pp. 125 - 147.

Patterson, William A. III, and Kenneth E. Sassaman.
1988 Indian fires in the Prehistory of New England. In Holocene Human Ecology in Northeastern North America, George P. Nicholas, (ed.), pp. 107 - 135. New York: Plenum Press.

Richardson, Pearline and family
1995 Personal Communication, February, 1995.

Robinson, Blackwell P.
1980 Guilford County's First 150 Years. In The History of Guilford County, North Carolina, Volume 1, Sydney M. Cone, Jr., editor.

Shelford, Victor E.
1963 The Ecology of North America. Urbana: University of Illinois.

Skowronek, Russell K.
1980 Archaeological Investigations at the Blandwood Dependencies, Greensboro, Guilford County, North Carolina. Ms. on File. Raleigh: Office of State Archaeology.

Smith, Bruce D.
1992 Rivers of Change: Essays on Early Agriculture in Eastern North America. Smithsonian Institution, Washington, D.C.

Stephens, Ronald B.
1977 Soil Survey of Guilford County, North Carolina. United States Department of Agriculture, Soil Conservation Service.

Stoeson, Alexander R.
1993 Guilford County: A Brief History. Division of Archives and History, Raleigh.

United States Geological Survey (USGS)
1952 McLeansville Quadrangle, North Carolina-Guilford County 7.5 minute series topographical map.

Ward, Trawick.
1979 Archaeological Investigations of the Horsepen Creek Project, Guilford County. Ms. on File, Office of State Archaeology, Raleigh.

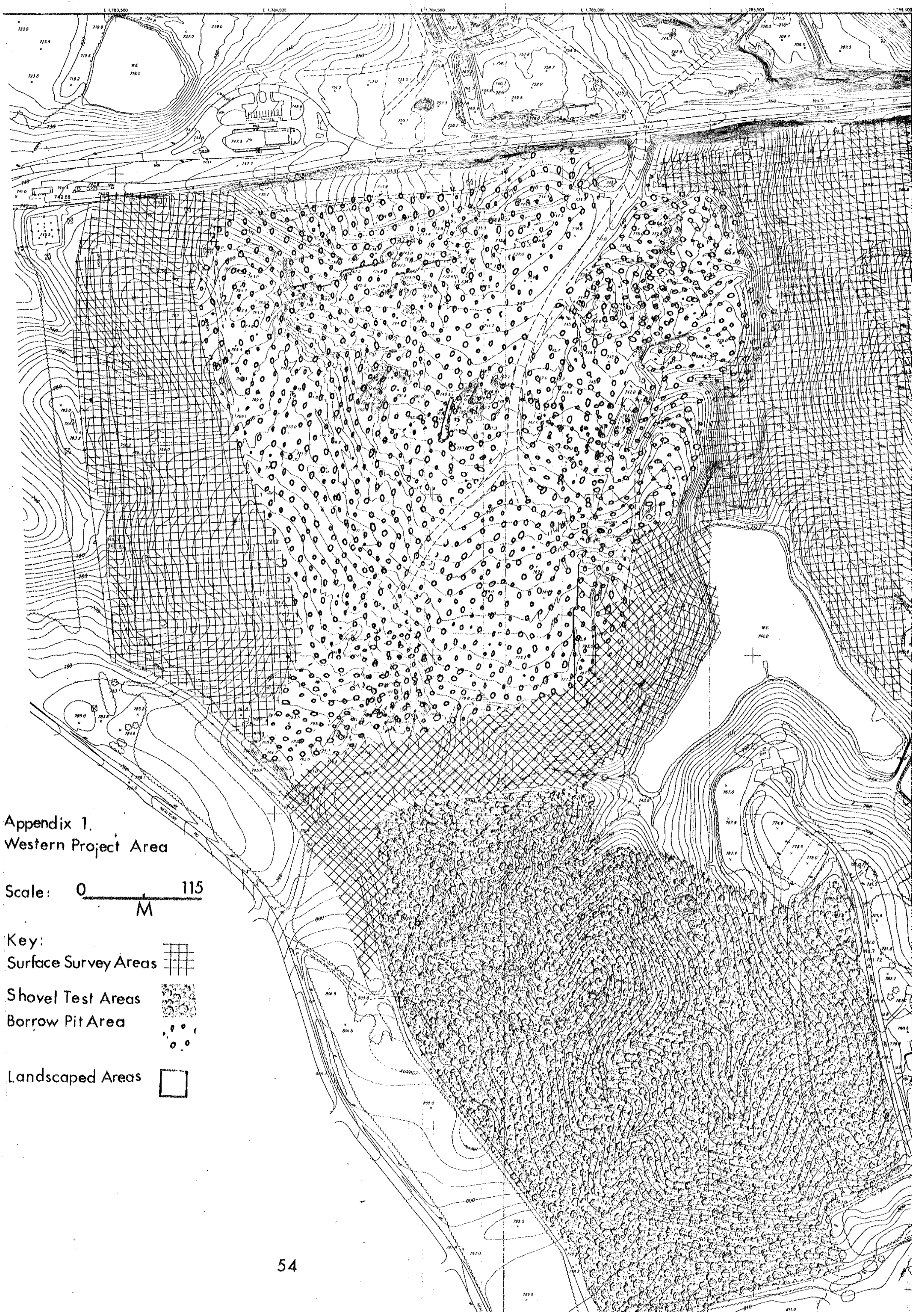
Waselkov, Gregory A.
1978 Evolution of Deer Hunting in the Eastern Woodlands. Mid-Continental Journal of Archaeology 3 (1): 15 - 34.

Watts, W.A.
1971 Postglacial and Interglacial Vegetation History of Southern Georgia and Central Florida. Ecology 52: 666-690.

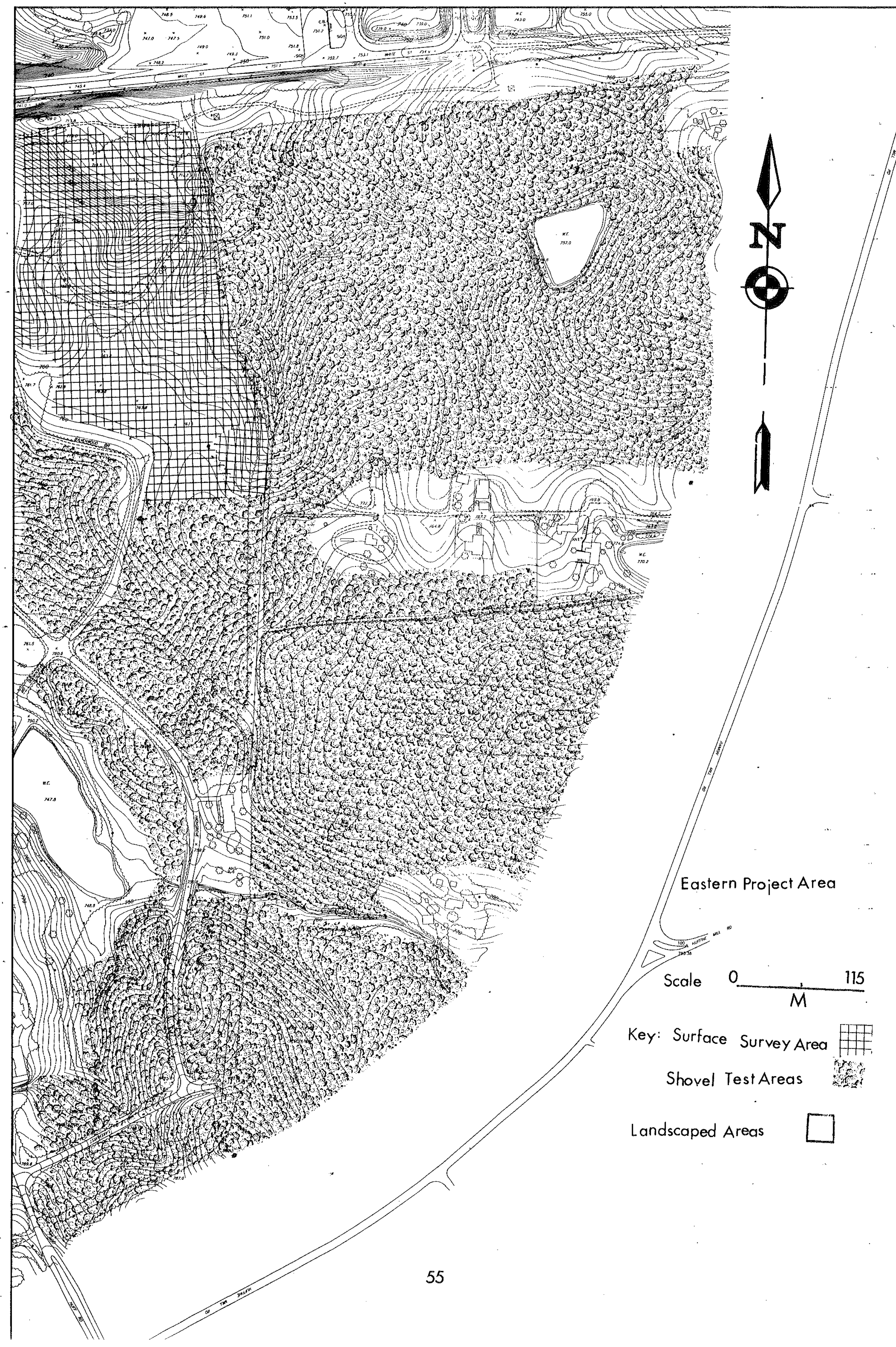
Woodall, J. Ned
1978 Test Excavations at the Greensboro-High Point Airport. Ms. on File, Wake Forest University Archeology Laboratories.

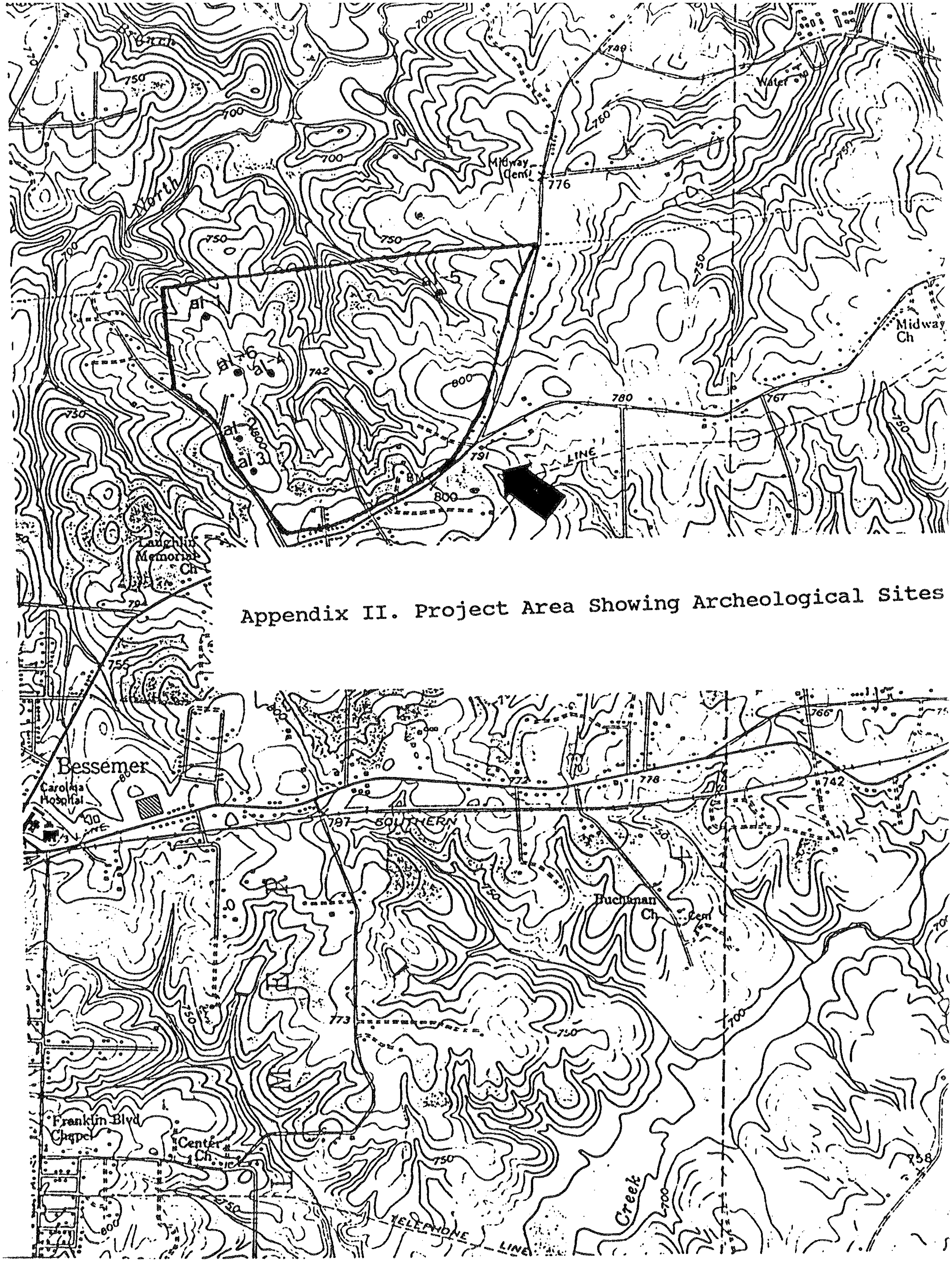
Yarnell, Richard A.
1982 Problems of Interpretation of Archaeological Plant Remains of the Eastern Woodlands. Southeastern Archaeology 1 (1): 1 - 7.

Zvelibil, Marek, Green, Stanton W., and Mark G. Macklin.
1992 Archaeological Landscapes, Lithic Scatters, and Human Behavior. In Space, Time, and Archaeological Landscapes, Jacqueline Rossignol and LuAnn Wandsnider (eds.) pp. 193 - 226. New York: Plenum Press.




Appendix 1.
Western Project Area


N
Eastern Project Area
Scale 0 115
M
Key: Surface Survey Area
Shovel Test Areas
Landscaped Areas




Appendix II. Project Area Showing Archeological Sites

# APPENDIX C

# BORING LOGS

# APPENDIX C

# BORING LOGS

# FIELD BOREHOLE LOG

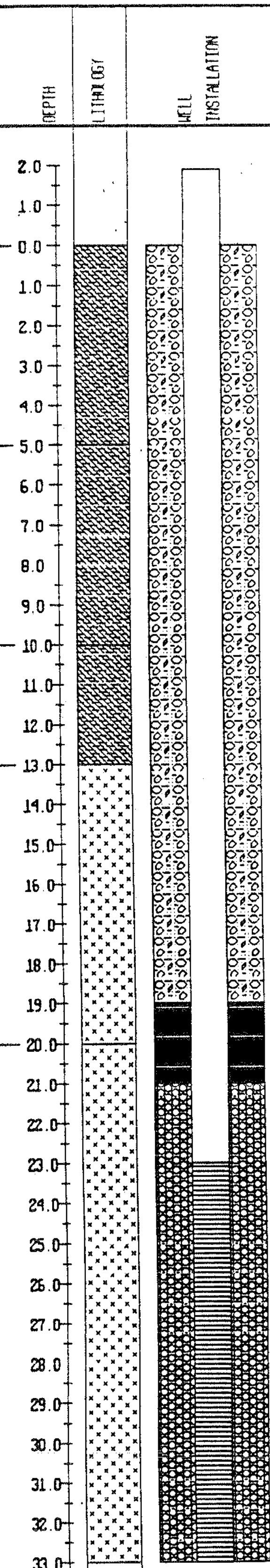
| BOREHOLE NUMBER |
|---|
| B-1 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/15/94
DATE COMPLETED 12/15/94

TOP OF CASING ELEVATION 763.21
TOTAL DEPTH 33.0 FT
GROUND SURFACE ELEVATION 760.80
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 27 | 18.32 |
| Time | 5:15 pm | - |
| Date | 12/15/94 | 12/20/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 2 3 5 | Ss | S1 | M | S | 15" | HSA | SILTY CLAY: reddish orange; very uniform, some manganese staining and rooting, medium plasticity, soft moist. |
| 5.0 | 15 25 36 | Ss | S2 (A-4) | D | H | 16" | | CLAYEY SILT: has appearance of mafic very weathered rock; similar to a metagabbro; LAB USC: Silty Clayey Sand. |
| 10.0 | 50/4 | Ss | S3 (A-4) | D | VH | 4" | | CLAYEY SILT: weathered to competent mafic rock; auger refusal at 13 feet below grade; LAB USC: Clayey Sand (SC). |
| 13.0 | | | | | | | AH | MAFIC INTRUSIVE: competent mafic intrusive rock; drilled with an air hammer. |
| 15.0 | | G | | D | | | | |
| 18.0 | ▼ | | | D | | | | |
| 20.0 | | G | | W | | | | MAFIC INTRUSIVE: competent mafic intrusive rock, dark bluish black; drilled with an air hammer; water seam at 31.0 feet; Boring Terminated at 33.0 feet |
| 28.0 | | G | | W | | | | |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-1d

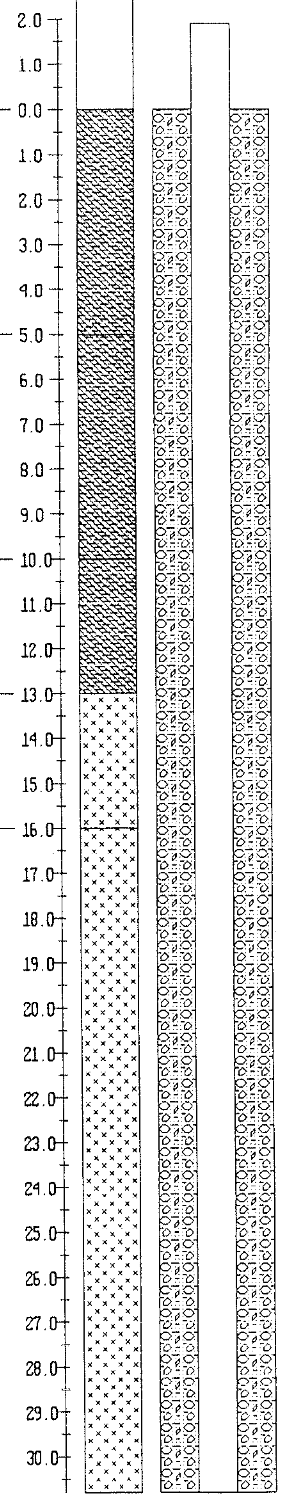
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HSA/AIR ROTARY/CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/16/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762.55
TOTAL DEPTH 43.0 FT
GROUND SURFACE ELEVATION 760.47
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.31 | 4.87 |
| Time | - | 3:18 pm |
| Date | 12/20/94 | 12/27/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 2 3 5 | Ss | S1 | | | | | SILTY CLAY: reddish orange; very uniform; some manganese staining and roots, medium plasticity, soft and moist. |
| 5.0 | 15 25 36 | Ss | S2 | | | | | CLAYEY SILT: has appearance of mafic very weathered rock; similar to a mafic intrusive. |
| 10.0 | 50/.6 | Ss | S3 | | | | | CLAYEY SILT: weathered to competent mafic rock; Auger Refusal at 13 feet. |
| 13.0 | | | | | | | | WEATHERED MAFIC INTRUSIVE: drilled with air rotary from 13 to 16 feet. |
| 15.0 | | | | W | | | | |
| 16.0 | | | | | | | | MAFIC INTRUSIVE: competent rock; Rock Core from 16 to 31 feet. |

Depth scale: 2.0 to 30.0



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-1d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HSA/AIR ROTARY/CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/16/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762.55
TOTAL DEPTH 43.0 FT
GROUND SURFACE ELEVATION 760.47
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.31 | 4.87 |
| Time | - | 3:18 pm |
| Date | 12/20/94 | 12/27/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 31.0 – 43.0 | | | | | | | | MAFIC INTRUSIVE: competent rock; Air Hammer from 31 to 43 feet; Boring Terminated at 43 feet. | 31.0 – 43.0 | | |

Depth scale: 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0, 40.0, 41.0, 42.0, 43.0, 44.0, 45.0, 46.0, 47.0, 48.0, 49.0, 50.0

# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-2 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/15/94 DATE COMPLETED 12/19/94

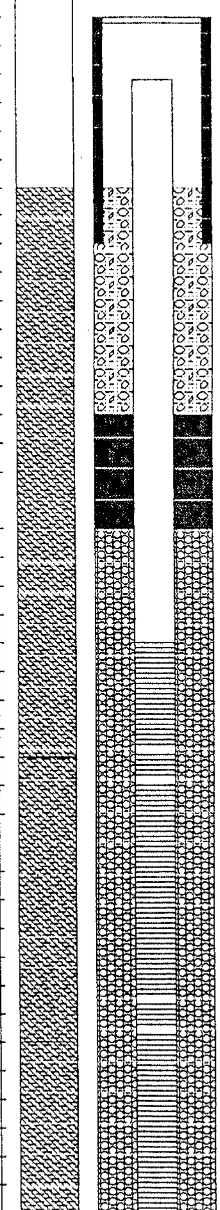
TOP OF CASING ELEVATION 777.58
TOTAL DEPTH 18.5 FT
GROUND SURFACE ELEVATION 774.56
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(Ft) | Dry | 9.83 |
| Time | 1:00 pm | - |
| Date | 12/15/94 | 12/20/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | CLAYEY SILT: dark gray to green; fine grained; micaceous; interbedded with lt. yellow tan silty sand granite; equigranular with biotite and feldspar. FELSIC GNEISS |
| 5.0 | 6 15 22 | Ss | S1 | M | VH | 16" | | |
| 10.0 | 6 12 10 | Ss | S2 | M | H | 16" | | CLAYEY SILT: dark gray to green brown; micaceous with sugary white feldspar vein 1.5 inches thick. FELSIC GNEISS |
| 15.0 | 6 12 25 | Ss | S3 | W | VH | 15" | | CLAYEY SILT: light greenish brown to yellow brown; micaceous; homogeneous; trace orange staining; FELSIC GNEISS Auger Refusal at 18.5 feet. |

Depth scale: 3.0, 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

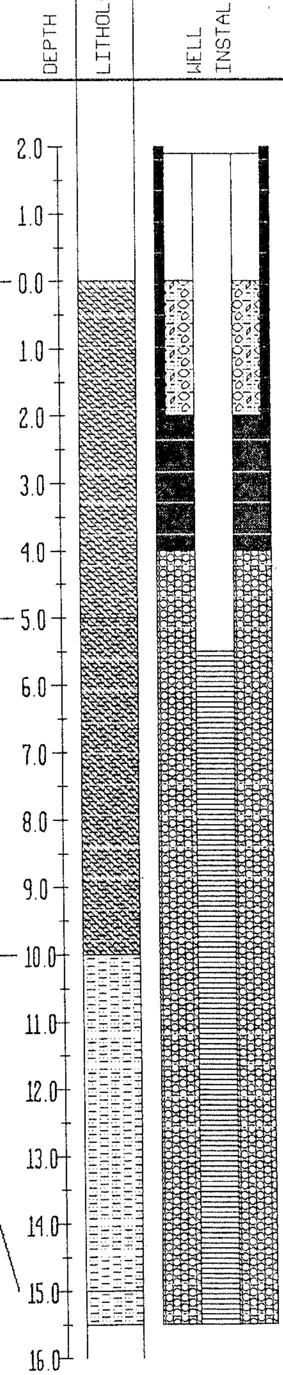
BOREHOLE NUMBER B-3

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/15/94 DATE COMPLETED 12/15/94

TOP OF CASING ELEVATION 752.65
TOTAL DEPTH 15.5 FT
GROUND SURFACE ELEVATION 749.67
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.09 | 4.06 |
| Time | - | - |
| Date | 12/17/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | CLAYEY SILT: moist; dark brown. |
| 5.0 | 4 9 8 | Ss | S1 | M | F | 13" | | CLAYEY SILTY SAND: mottled medium gray to orange brown; with 0.5 to 1 inch manganese nodules (black crystals with orange rinds) and a lg. (1 to 1.5 inch) quartz fragment; moist; soft. |
| 10.0 | 50/3 | Ss | S2 | M | VH | 3" | HSA | SANDY SILT: medium to dark gray with clay laminae; very fine textured hornblende/feldspar schist; some orange staining; dry. FELSIC GNEISS |
| 13.0 | | | | W | | | | |
| 15.0 | 50/4 | Ss | S3 | W | VH | 5" | | SANDY SILT: dark gray amphibole interbedded with quartz veins; auger refusal at 15.3'. |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-4

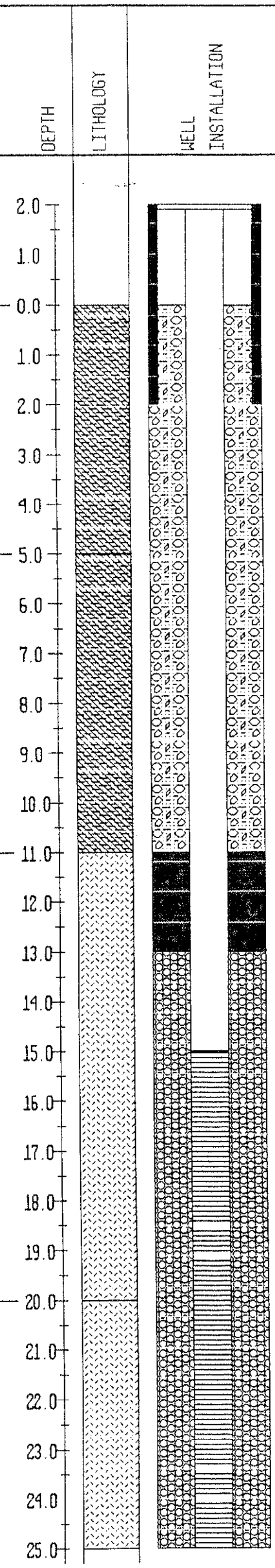
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/15/94 DATE COMPLETED 1/6/95

TOP OF CASING ELEVATION 759.43
TOTAL DEPTH 25.0 FT
GROUND SURFACE ELEVATION 756.33
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 13.93 AB | 14.19 |
| Time | 9:40 am | 2:00 pm |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | CLAYEY SILT: (ML) yellow brown to tan; homogeneous; trace manganese. |
| 5.0 | 15 20 25 | Ss | S1 | D | VH | 16" | | CLAYEY SILT: (ML) yellow brown to tan homogeneous; trace manganese staining; trace sand; Auger Refusal at 11.0 feet. |
| 10.0 | 50/6 | Ss | S2 | D | VH | 8" | | |
| 11.0 | | | | | | | AH | ~~GRANITE~~: dark gray weathered material; some feldspar; drilled with air hammer; water seam at 18.0 feet. CLASSIFIED AS FELSIC GNEISS BY HDR |
| 15.0 | | G | | | | | | |
| 18.0 | | G | | W | | | | |
| 20.0 | | G | | | | | | ~~GRANITE~~: dark gray; some mafics; some mica in cuttings; Boring Terminated at 25.0 feet. CLASSIFIED AS FELSIC GNEISS BY HDR |

DEPTH scale: 2.0, 1.0, 0.0, 1.0 … 25.0



# FIELD BOREHOLE LOG

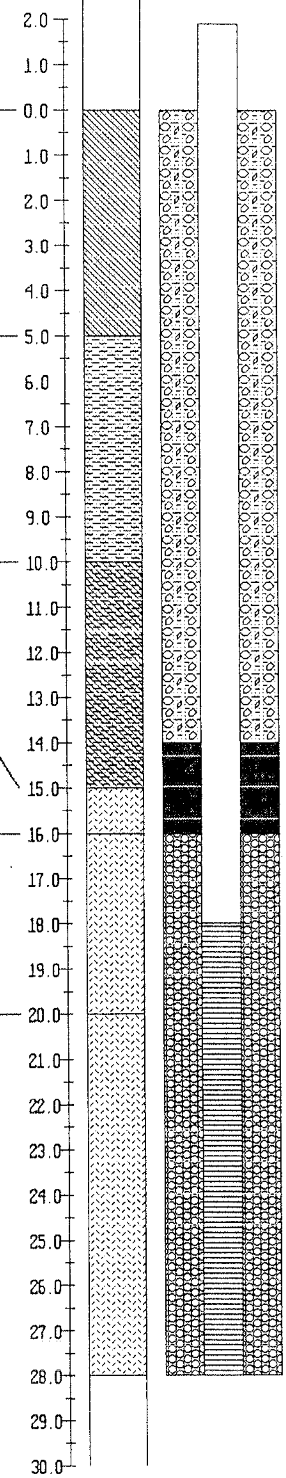
BOREHOLE NUMBER: B-5

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 1/6/95

TOP OF CASING ELEVATION 760.13
TOTAL DEPTH 28.0 FT
GROUND SURFACE ELEVATION 758.14
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD-While Drilling AB-After Boring | | |
| Depth (ft) | 18.24 | 16.36 |
| Time | 11:30am | - |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | CLAYEY SAND: yellow orange; felsic granite. |
| 5.0 | 9 32 18 | Ss | S1 | M | VH | 12" | | SILTY SAND: gray silty fine sand; trace clay; some manganese staining; clear quartz rock fragments 1/8" to 1/4" thick; firm; dry; weathered mafics. |
| 10.0 | 12 11 12 | Ss | S2 | D | H | 15" | | CLAYEY SILT: light greenish gray intermediate felsic; with horizontal iron and manganese staining; damp. |
| 14.0–15.0 | 50/3 | Ss | S3 | D | VH | 3" | | GRANITE: weathered to competent; Auger Refusal at 16.0 feet. |
| 16.0 | | | | | | | AH | GRANITE: competent granitic sand rock drilling with an air hammer. |
| 17.0 | | G | S4 | D | | | | |
| 20.0 | | G | S5 | D | | | | GRANITE: tannish gray to white granitic sand rock; some mafics including biotite; water seam encountered at 22.0 feet; Boring Terminated at 28 feet. |
| 21.0 | | G | S6 | D | | | | |
| 22.0 | | G | S7 | D | | | | |
| 25.0 | | G | S8 | M | | | | |



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-6 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 1/5/95

TOP OF CASING ELEVATION 756.21
TOTAL DEPTH 61.0 FT
GROUND SURFACE ELEVATION 753.52
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(Ft) | DRY at 61' | 55.53 |
| Time | 11:00 am | 11:40 am |
| Date | 1/5/95 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–10.0 | 12, 11, 13 (at 5.0) | Ss | S1 (A-4) | | | 16" | | SANDY CLAY: yellow orange to light tan; medium to coarse grained sandy clay to clayey sand; feldspar relict phenocrysts; feldspar quartz schist; no mafics or accessories; damp; Lab USC: Silty Sand (SM). |
| 10.0–15.0 | 10, 12, 19 (at 10.0) | Ss | S2 (A-4) | | | 18" | | CLAYEY SAND: yellow orange; grades from sandy clay to clayey sand; felsic (feldspar quartz schist) trace biotite; damp; Lab USC: Silty Sand (SM). |
| 15.0–17.0 | 11, 20, 50/5 (at 15.0) | Ss | S3 (A-4) | | | 17" | | SANDY CLAY: yellow tan sandy clay to clayey sand; weathered grading to competent rock; auger refusal at 17.0 feet; Lab USC: Silty Sand (SM). |
| 17.0–29.0+ | | | | | | | | GRANITE: very felsic; some biotite; trace chlorite. |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0

LITHOLOGY | WELL INSTALLATION

# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-6

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 1/5/95

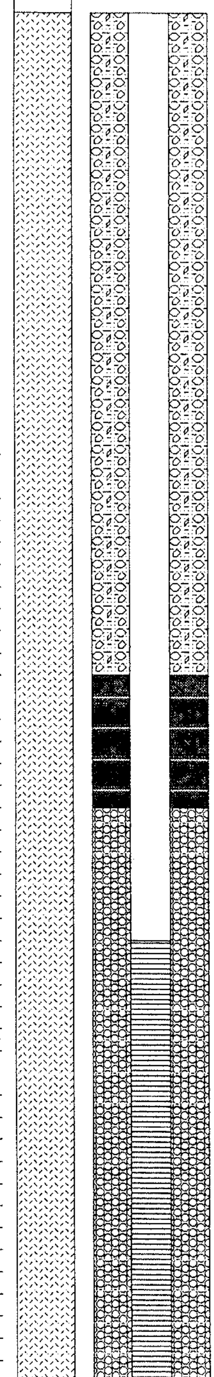
TOP OF CASING ELEVATION 756.21
TOTAL DEPTH 61.0 FT
GROUND SURFACE ELEVATION 753.52
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | DRY at 61' | 55.53 |
| Time | 11:00 am | 11:40 am |
| Date | 1/5/95 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 30.0 | | | | | | | | GRANITE: white; very felsic; some biotite; trace chlorite; Boring Terminated at 61.0 feet. | 30.0 |

Depth scale: 30.0 to 63.0 ft (1.0 ft intervals)

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-7

| | |
|---|---|
| PROJECT NUMBER | 94016 |
| PROJECT NAME | CITY OF GREENSBORO |
| LOCATION | GREENSBORO, NORTH CAROLINA |
| DRILLING COMPANY | ENGINEERING TECTONICS |
| RIG TYPE & NUMBER | MOBILE DRILL ATV RIG |
| DRILLING METHOD | HOLLOW STEM AUGER |
| WEATHER | SUNNY |
| FIELD PARTY | DAVID BARRON |
| GEOLOGIST | G. SIMMERMAN |
| DATE BEGUN | 12/16/94 |
| DATE COMPLETED | 12/16/94 |

| | |
|---|---|
| TOP OF CASING ELEVATION | 773.75 |
| TOTAL DEPTH | 24.5 FT |
| GROUND SURFACE ELEVATION | 773.09 |
| SHEET | 1 OF 1 |

STATIC WATER LEVEL (BLS)

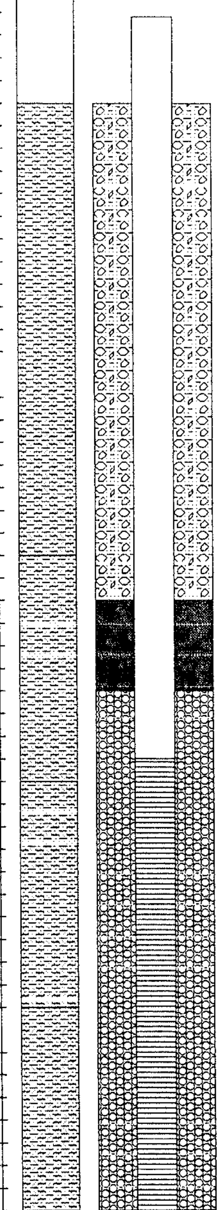
WD-While Drilling AB-After Boring

| | WD | AB |
|---|---|---|
| Depth(ft) | 19.08 | 19.10 |
| Time | - | - |
| Date | 12/20/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD |
|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA |
| 5.0 | 11 10 12 | Ss | S1 (A-2-4) | M | H | | |
| 10.0 | 16 26 50/5 | Ss | S2 (A-2-4) | D | VH | | |
| 15.0 | 27 50/6 | Ss | S3 (A-2-4) | D | VH | | |
| 20.0 | 22 22 24 | Ss | S4 (A-2-4) | D | VH | | |
| 24.5 | 50/0.5 | Ss | S5 | W | VH | | |

| DEPTH | LITHOLOGY DESCRIPTION |
|---|---|
| 0.0 | SILTY SAND: lt. tan orange; medium to coarse grained; trace clay; very granular sand (quartz feldspar quartzite) trace iron and manganese staining; damp; LAB USC: Silty Clayey Sand (SC-SM). |
| 10.0 | SILTY SAND: same as above but slightly darker; with iron and manganese staining and notable feldspar grains; LAB USC: Silty Clayey Sand (SC-SM). |
| 15.0 | SILTY SAND: whitish tan; fresh; hard and dry; Silty Clayey Sand (SC-SM). |
| 20.0 | SILTY SAND: whitish tan to lt. orange with white feldspar throughout; hard; dry; LAB USC: Silty Clayey Sand (SC-SM) Auger Refusal at 24.5 feet. |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-8

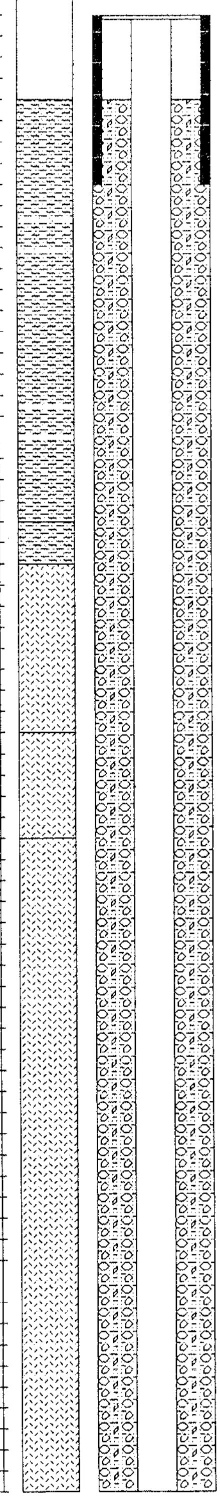
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 756.58
TOTAL DEPTH 63.0 FT
GROUND SURFACE ELEVATION 754.93
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 17.26 | 17.67 |
| Time | 4:55 pm | 1:30 pm |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY SAND: lt. orange to white tan; quartz and feldspar; medium to coarse grained; dry; trace of weathered biotite; weathered granite. |
| 5.0 | 19 50/5 | Ss | S1 | D | VH | 9" | | |
| 10.0 | 50/5 | Ss | S2 | D | VH | 5" | | SILTY SAND: same as above; hard white; dry; auger refusal at 11'. |
| 11.0 | | G | S3 | D | | | AH | GRANITE: weathered; tan to white saprolite; soft seam at 14.0 feet. |
| 15.0 | | G | S4 | M | | | | GRANITE: gray brown; hard; fine grained; water seam at 17.0 feet. |
| 17.0 | | | | | | | | GRANITE: hard; white to gray; water seam at 53.0 feet; Boring Terminated at 63.0 feet. |
| 20.0 | | G | S5 | D | | | | |

DEPTH scale: 2.0 to 33.0



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-8

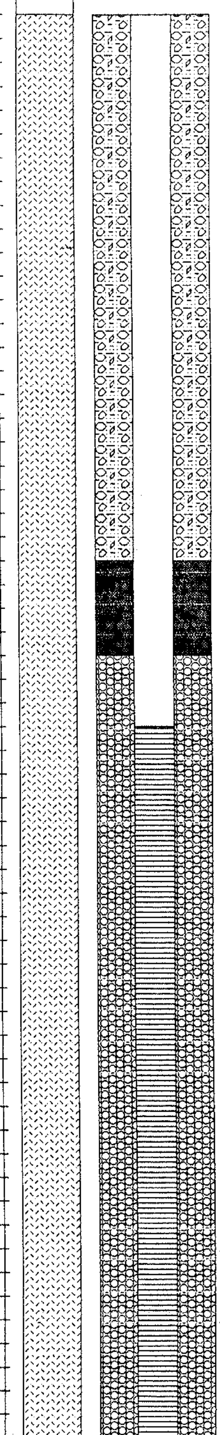
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 756.58
TOTAL DEPTH 63.0 FT
GROUND SURFACE ELEVATION 754.93
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(Ft) | 17.26 | 17.67 |
| Time | 4:55 pm | 1:30 pm |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 33.0 | | | | | | | | GRANITE: hard; white to gray; water seam at 53.0 feet; Boring Terminated at 63.0 feet. | 33.0 |
| 34.0 | | | | | | | | | 34.0 |
| 35.0 | | G | | | | | | | 35.0 |
| 36.0 | | | | | | | | | 36.0 |
| 37.0 | | | | | | | | | 37.0 |
| 38.0 | | | | | | | | | 38.0 |
| 39.0 | | | | | | | | | 39.0 |
| 40.0 | | | | | | | | | 40.0 |
| 41.0 | | | | | | | | | 41.0 |
| 42.0 | | | | | | | | | 42.0 |
| 43.0 | | | | | | | | | 43.0 |
| 44.0 | | | | | | | | | 44.0 |
| 45.0 | | | | | | | | | 45.0 |
| 46.0 | | | | | | | | | 46.0 |
| 47.0 | | | | | | | | | 47.0 |
| 48.0 | | | | | | | | | 48.0 |
| 49.0 | | | | | | | | | 49.0 |
| 50.0 | | | | | | | | | 50.0 |
| 51.0 | | | | | | | | | 51.0 |
| 52.0 | | | | | | | | | 52.0 |
| 53.0 | | | | | | | | | 53.0 |
| 54.0 | | | | | | | | | 54.0 |
| 55.0 | | | | | | | | | 55.0 |
| 56.0 | | | | | | | | | 56.0 |
| 57.0 | | | | | | | | | 57.0 |
| 58.0 | | | | | | | | | 58.0 |
| 59.0 | | | | | | | | | 59.0 |
| 60.0 | | | | | | | | | 60.0 |
| 61.0 | | | | | | | | | 61.0 |
| 62.0 | | | | | | | | | 62.0 |
| 63.0 | | | | | | | | | 63.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-8A |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION -
TOTAL DEPTH 12.0 FT
GROUND SURFACE ELEVATION -
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | DRY | - |
| Time | - | - |
| Date | 12/16/94 | - |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 0.0 | | | | | | | | SILTY SAND: lt. orange to white tan; quartz and feldspar; medium to coarse grained; dry; trace of weathered biotite; weathered granite; AUGER REFUSAL AT 12.0 FT. | 0.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 2.0 | | | | | | | | | 2.0 | | |
| 3.0 | | | | | | | | | 3.0 | | |
| 4.0 | | | | | | | | | 4.0 | | |
| 5.0 | | | | | | | | | 5.0 | | |
| 6.0 | | | | | | | | | 6.0 | | |
| 7.0 | | | | | | | | | 7.0 | | |
| 8.0 | | | | | | | | | 8.0 | | |
| 9.0 | | | | | | | | | 9.0 | | |
| 10.0 | | | | | | | | | 10.0 | | |
| 11.0 | | | | | | | | | 11.0 | | |
| 12.0 | | | | | | | | | 12.0 | | |
| 13.0 | | | | | | | | | 13.0 | | |
| 14.0 | | | | | | | | | 14.0 | | |
| 15.0 | | | | | | | | | 15.0 | | |
| 16.0 | | | | | | | | | 16.0 | | |
| 17.0 | | | | | | | | | 17.0 | | |
| 18.0 | | | | | | | | | 18.0 | | |
| 19.0 | | | | | | | | | 19.0 | | |

# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-9

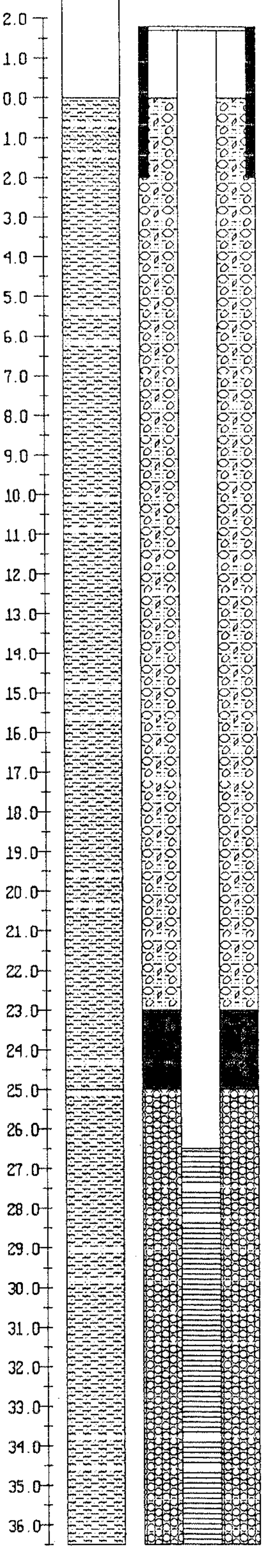
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION 761.77
TOTAL DEPTH 36.5 FT
GROUND SURFACE ELEVATION 759.04
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 15.41 | 14.99 |
| Time | – | – |
| Date | 12/16/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY SAND: orange tan to white silty sand; quartz, feldspar granite with trace biotite; interspersed with manganese modules; Lab USC: Silty Sand (SM). |
| 5.0 | 18 21 50/3 | Ss | S1 | D | | 16" | | |
| 10.0 | 18 50/5 | Ss | S2 | D | | 14" | | |
| 15.0 | 34 50/5 | Ss | S3 (A-2-4) | M | | 12" | | |
| 20.0 | 50/6 | Ss | S4 | M | | 4" | | |
| 25.0 | 50/4 | Ss | S5 | W | | 12" | | SILTY SAND: orange tan to white silty sand; quartz, feldspar granite with trace biotite; thin, 1/8" clay lens; wet; Auger Refusal at 36.5 feet. |
| 30.0 | 34 50/6 | Ss | S6 | W | | 12" | | |
| 35.0 | 50/2 | Ss | S7 | W | | 3" | | |

DEPTH / LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-9d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD: ROLLER CONE/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762.41
TOTAL DEPTH 67.0 FT
GROUND SURFACE ELEVATION 759.51
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) WD=While Drilling AB=After Boring | | |
|---|---|---|
| Depth(Ft) | 17.34 | 16.49 |
| Time | 5:00 pm | - |
| Date | 12/27/94 | 12/29/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 3 8 11 | Ss | S1 | | | | | SILT AND SAND: brown to white orange mottled silt and coarse sand; moist; weathered rock. |
| 3.0 | 18 39 40 | Ss | S2 | | | | | SILT AND SAND: same as above with more sand; some dark staining; wet at 23 feet. |
| 8.0 | 29 50/3 | Ss | S3 | | | | | |
| 13.0 | 50/1 | Ss | S4 | | | | | |
| 18.0 | 50/1 | Ss | S5 | | | | | |
| 23.0 | 50/1 | Ss | S6 | W | | | | |
| 28.0 | 36 50/6 | Ss | S7 | | | | | WEATHERED GRANITE: weathered granitic sand rock; very weathered at top to a gray brown mottled silty sand with relict structure; soft zone at 36 feet. |
| 33.0 | 50/0 | Ss | S8 | | | | | |

# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-9d |

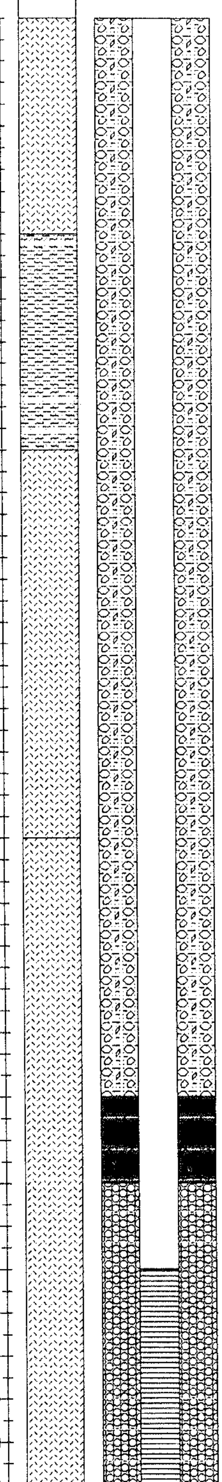
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST P. SCHEER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 762.41
TOTAL DEPTH 67.0 FT
GROUND SURFACE ELEVATION 759.51
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 17.34 | 16.49 |
| Time | 5:00 pm | - |
| Date | 12/27/94 | 12/29/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 33.0–38.0 | 50/6 | Ss | S8 | | | | | WEATHERED GRANITE: weathered granitic sand rock; very weathered at top to a gray brown mottled silty sand with relict structure; soft zone at 36 feet. | 33.0–38.0 |
| 38.0–43.0 | | | | | | | | SILTY SAND: below weathered rock is brown to greenish silty sand; slightly moist. | 38.0–43.0 |
| 43.0–52.0 | | | | | | | | WEATHERED GRANITE: weathered granite, difficult drilling; Roller Cone Refusal at 52 feet. | 43.0–52.0 |
| 52.0–67.0 | | | | | | | | GRANITE: light tan to white, some biotite and horneblende; rock core from 52.0 to 67.0 feet; Boring Terminated at 67.0 feet. | 52.0–67.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-10 |

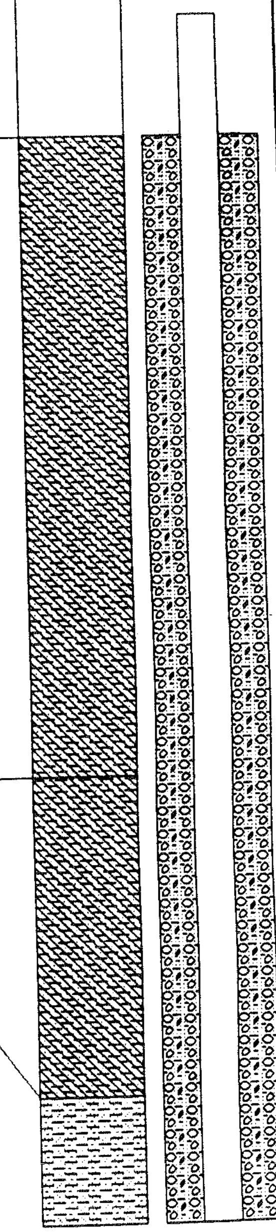
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

TOP OF CASING ELEVATION - 780.91
TOTAL DEPTH 32.5 FT
GROUND SURFACE ELEVATION - 778.09
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | | |
| Time | - | |
| Date | - | |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | CGI | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | |
| 1.0 | | | | | | | | |
| 0.0 | | | | | | | | SILT AND CLAY: red-brown; homogeneous; some tan areas; trace to some white mica present |
| 1.0 | | | | | | | | |
| 2.0 | | | | | | | | |
| 3.0 | | | | | | | | |
| 4.0 | | | | | | | | |
| 5.0 | | Ss | S1 | | | | | |
| 6.0 | | | | | | | | |
| 7.0 | | | | | | | | |
| 8.0 | | | | | | | | |
| 9.0 | | | | | | | | |
| 10.0 | 3<br>4<br>6 | Ss | S2 | | | | | SILT AND CLAY: similar to above but with minor sand |
| 11.0 | | | | | | | | |
| 12.0 | | | | | | | | |
| 13.0 | | | | | | | | |
| 14.0 | | | | | | | | SILT AND SAND: whitish tan to orange; some quartz and feldspar; two manganese stains (horizontal) |
| 15.0 | 2<br>3<br>4 | Ss | S3 | | | | | |
| 16.0 | | | | | | | | |
| 17.0 | | | | | | | | |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-10

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/16/94 DATE COMPLETED 12/16/94

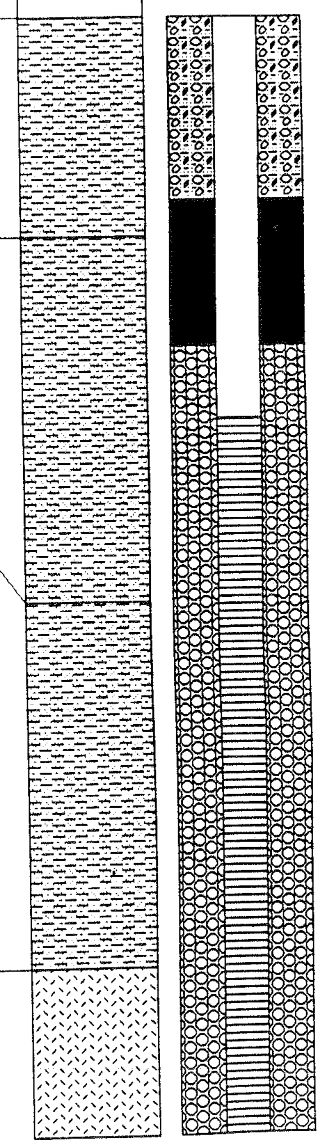
TOP OF CASING ELEVATION - 780.91
TOTAL DEPTH 32.5 FT
GROUND SURFACE ELEVATION - 778.09
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | | |
| Time | - | |
| Date | - | |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | CGI | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 17.0–19.8 | | | | | | | | SILT AND SAND whitish tan to orange, some quartz and feldspar; two manganese stains (horizontal) |
| 19.8–24.0 | 3 4 4 | Ss | S4 | W | | 12" | | SILT AND SAND whitish tan to lt. orange relict granite structure; small fracture at 45 degree angle; minor manganese staining; trace mica; some feldspar; trace potassium feldspar; moist |
| 24.0–30.0 | 3 4 6 | Ss | S5 | | | 15" | | SILT AND SAND: lt. tan, relict granite structure; 3 horizontal manganese stains and one at a 45 degree angle; some feldspar and mica; more biotite near bottom of sample; one folded biotite or manganese stained layer |
| 30.0–32.0 | 10 18 50/2 | Ss | [illegible] | | | 12" | | GRANITE weathered to competent; very felsic; biotite abundant; one folded biotite layer; auger refusal |

Depth scale (ft): 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 32.0

LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-11 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/19/94

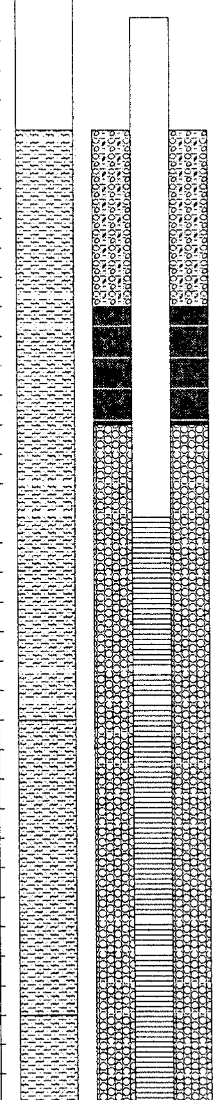
TOP OF CASING ELEVATION 772.04
TOTAL DEPTH 16.5 FT
GROUND SURFACE ELEVATION 769.20
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 14.75 | 14.87 |
| Time | - | - |
| Date | 12/20/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY SAND: lt. tan to red brown; some clay; one 2" thick layer of silty clay to clayey silt with a manganese stain at a 45 degree angle; this grades into weathered granitic sand rock; some mica; very weathered. |
| 5.0 | 3<br>6<br>8 | Ss | S1 | D | | 14" | | |
| 10.0 | 7<br>12<br>42 | Ss | S2 | D | | 16" | | SILTY SAND: weathered sand rock; lt. brown to tan; some thin dark laminae near horizontal. |
| 15.0 | 30<br>50/5 | Ss | S3 | W | | 6" | | SILTY SAND: lt. brown to tan; weathered granitic rock; some k-spar; lots of feldspar; trace to some mica; auger refusal at 16.5 feet. |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0 … 20.0

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-12

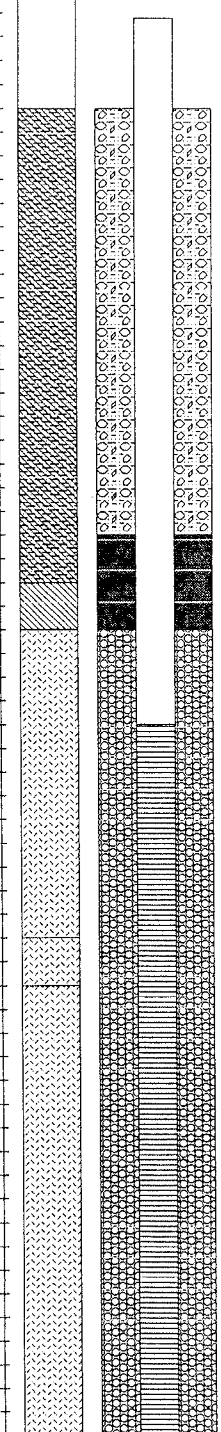
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 778.84
TOTAL DEPTH 28.0 FT
GROUND SURFACE ELEVATION 776.06
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(Ft) | 14.14 AB | 7.42 |
| Time | 11:45 am | 12:15 pm |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY CLAY: red brown; some sand; one 1" thick layer of dark possibly weathered biotite; one manganese stain at a 10 degree angle; some very weathered feldspar. |
| 5.0 | 6<br>12<br>16 | Ss | S1 | | | | | |
| 7.0 | | | | | | | AR | |
| 8.0 | | | | | | | | CLAY: clean white clay grading downward into granitic sand rock; Auger Refusal at 11.0 feet. |
| 10.0 | 7<br>50/6 | Ss | S2 | | | | | |
| 11.0 | | | | | | | AH | GRANITE: hard; white. |
| 17.0 | | | | W | | | | GRANITE: orange with clay; water bearing seam. |
| 18.5 | | | | | | | | GRANITE: hard; white. Boring Terminated at 28 feet. |

Depth scale: 2.0, 1.0, 0.0, 1.0 … 28.0



# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-13

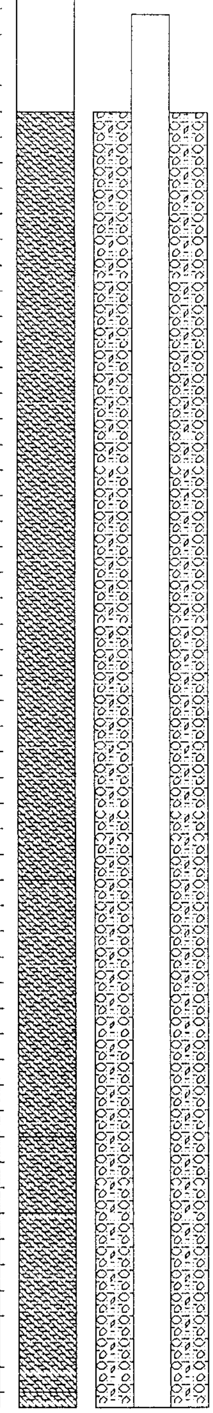
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 1/9/95

TOP OF CASING ELEVATION 793.67
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 791.91
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 28.71 | 28.45 |
| Time | 10:40 am | 4:00 pm |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 |
| 1.0 | | | | | | | | | 1.0 |
| 0.0 | | | | | | | HSA | SILTY CLAY: red-brown; homogeneous; some granitic sand rock at top and bottom of sample. | 0.0 |
| 1.0 | | | | | | | | | 1.0 |
| 2.0 | | | | | | | | | 2.0 |
| 3.0 | | | | | | | | | 3.0 |
| 4.0 | | | | | | | | | 4.0 |
| 5.0 | 5<br>7<br>13 | Ss | S1 | | | 12" | | | 5.0 |
| 6.0 | | | | | | | | | 6.0 |
| 7.0 | | | | | | | | | 7.0 |
| 8.0 | | | | | | | | | 8.0 |
| 9.0 | | | | | | | | | 9.0 |
| 10.0 | 6<br>6<br>10 | Ss | S2 | | | 12" | | | 10.0 |
| 11.0 | | | | | | | | | 11.0 |
| 12.0 | | | | | | | | | 12.0 |
| 13.0 | | | | | | | | | 13.0 |
| 14.0 | | | | | | | | | 14.0 |
| 15.0 | 5<br>6<br>7 | Ss | S3 | | | 14" | | SILTY CLAY: lt. golden brown; very uniform; one manganese stain at a -45 degree angle and one near horizontal; trace mica. | 15.0 |
| 16.0 | | | | | | | | | 16.0 |
| 17.0 | | | | | | | | | 17.0 |
| 18.0 | | | | | | | | | 18.0 |
| 19.0 | | | | | | | | | 19.0 |
| 20.0 | 15<br>25<br>50/5 | Ss | S4 | | VH | 16" | | SILTY CLAY: lt. tan; some foliation at 45 degree angle; layered with red silty clay and weathered blue gray rock; some appearance of folded foliation; Auger Refusal at 23.0 feet. | 20.0 |
| 21.0 | | | | | | | | | 21.0 |
| 22.0 | | | | | | | | SILTY CLAY: very fine; brown in color; drilled with air hammer. | 22.0 |
| 23.0 | | | | | | | | | 23.0 |
| 24.0 | | | | | | | | | 24.0 |
| 25.0 | | | | | | | | | 25.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-13 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 1/9/95

TOP OF CASING ELEVATION 793.67
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 791.91
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 28.71 | 28.45 |
| Time | 10:40 am | 4:00 pm |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25.0 | | | | | | | | SILTY CLAY: brown; coarsening downward with increasing rock chip content in grab samples. | 25.0 | | |
| 38.0 | | | | | | | | GNEISS: feldspathic/granitic gneiss; water seam at 46 to 47 feet; Boring Terminated at 53 feet. | 38.0 | | |

Depth scale: 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0, 40.0, 41.0, 42.0, 43.0, 44.0, 45.0, 46.0, 47.0, 48.0, 49.0, 50.0, 51.0, 52.0, 53.0

# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-19

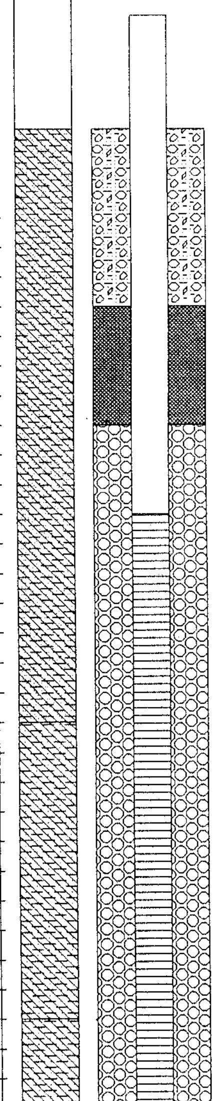
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/19/94

TOP OF CASING ELEVATION 790.51
TOTAL DEPTH 16.5 FT
GROUND SURFACE ELEVATION 787.40
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 8.24 | 7.97 |
| Time | - | 2:30pm |
| Date | 12/20/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY CLAYEY SAND: lt. tan; moist to wet; homogeneous; no mica; trace quartz; LAB USC: Sandy Silt (ML). |
| 5.0 | 6 7 8 | Ss | S1 (A-7) | | | 16" | | |
| 10.0 | 9 18 23 | Ss | S2 (A-6) | W | | 12" | | SILTY CLAY: lt. brown; one white sandy clay seam at an angle less than 10 degrees; some mica; LAB USC: Sandy Silt (ML). |
| 15.0 | 7 12 46 | Ss | S3 (A-4) | | | 13" | | SILTY CLAY: brown; some biotite; one horizontal sandy clay seam; horiz. foliation; auger refusal at 16.5 feet; LAB USC: Silty Clayey Sand (SC-SM). |

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-15

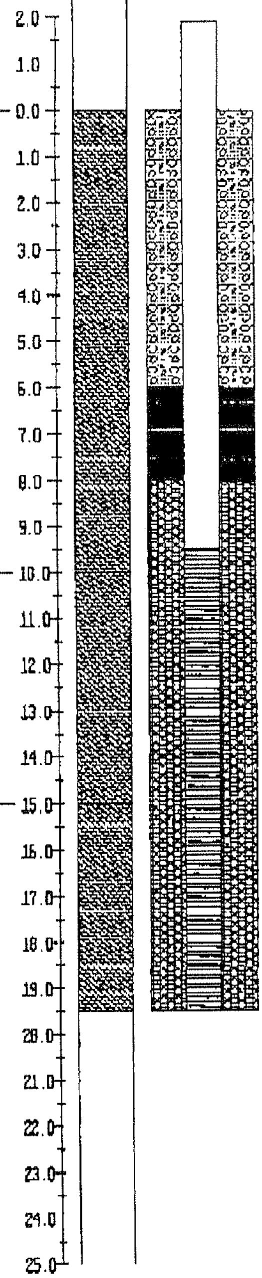
PROJECT NUMBER 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION: 777.19
TOTAL DEPTH 19.5 FT
GROUND SURFACE ELEVATION: 774.15
SHEET: 1 OF 1

STATIC WATER LEVEL (BLS)
WD=While Drilling AB=After Boring

| | WD | AB |
|---|---|---|
| Depth (Ft) | 14 | 13.93 |
| Time | - | - |
| Date | 12/21/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SILTY CLAY: red brown; horizontal to less than 10 degree foliation; some 1/4" thick felsic bands; more mafic near top of sample, gneissic bands. |
| 5.0 | 7<br>11<br>13 | Ss | S1 | D | | 13" | | |
| 10.0 | 11<br>40<br>50/5 | Ss | S2 | M | | 8" | | SILTY CLAY: dark green to black; amphibole present; very weathered foliation at a ~30 degree angle; trace biotite; amphibolite gneiss. |
| 14.0 | | | | W | | | | |
| 15.0 | 50/4 | Ss | S3 | | | 4" | | SILTY CLAY: weathered to competent dark rock; micaceous; foliated;<br><br>auger refusal at 19.5 feet. |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-16

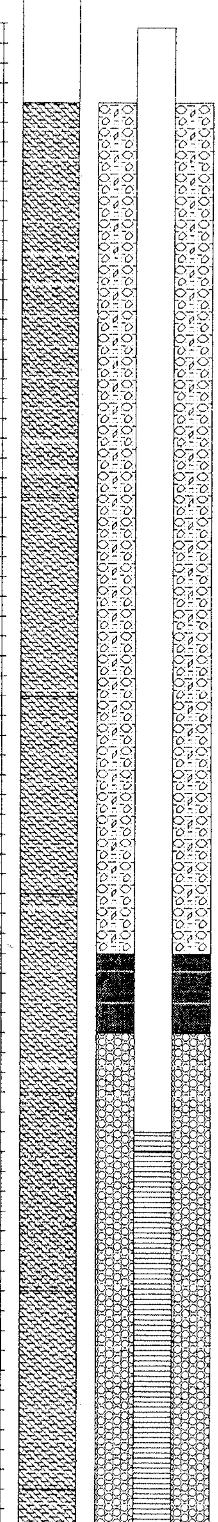
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/19/94

TOP OF CASING ELEVATION 785.66
TOTAL DEPTH 36.0 FT
GROUND SURFACE ELEVATION 782.71
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth (ft) | 24.35 | 24.46 |
| Time | - | - |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY CLAYEY SAND: brown to green; some iron staining; very weathered mafic rock; amphiboles in sample. Lab USC: Sandy Silt (ML) |
| 5.0 | 3 5 9 | Ss | S1 (A-5) | D | | 12" | | |
| 10.0 | 3 5 6 | Ss | S2 | D | | 15" | | SILTY CLAY: lt. tan with green; amphibole present; iron stains at horizontal and at -45 degree angle; homogeneous. |
| 15.0 | 3 8 11 | Ss | S3 (A-7) | M | | 16" | | SILTY CLAY: lt. tan with green; weathered amphiboles; one manganese stain near horizontal. Lab USC: Elastic Silt with Sand (MH) |
| 20.0 | 7 6 7 | Ss | S4 | W | | 16" | | SILTY CLAY: green; 1/4" white sandy; rest is weathered mafic rock. |
| 25.0 | 9 12 17 | Ss | S5 (A-7) | W | | 16" | | SILTY CLAY: green; three horizontal manganese stains; several small ovals of very weathered biotite; overall weathered mafic rock; LAB USC: Elastic SILT with SAND (MH) |
| 30.0 | 12 16 23 | Ss | S6 | W | | 16" | | SILTY CLAY: two manganese stains at 45 degree angle; bottom of sample has a horizontal foliation; some amphiboles. |
| 35.0 | 32 50/3 | Ss | S7 | W | | 7" | | SILTY CLAY: dk. green; weathered mafic rock; auger refusal. |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

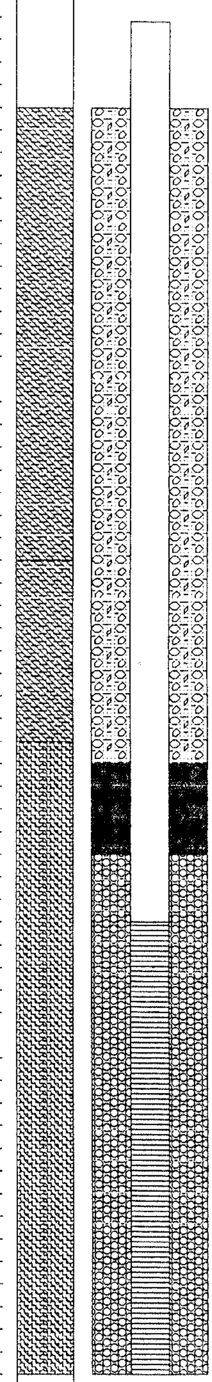
BOREHOLE NUMBER: B-17

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER/CORE
WEATHER SUNNY, COOL
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 789.61
TOTAL DEPTH 28.0 FT
GROUND SURFACE ELEVATION 787.71
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| | WD-While Drilling | AB-After Boring |
| Depth (ft) | 22.29 | 13.59 |
| Time | - | - |
| Date | 12/29/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY CLAY: brown; two horizontal manganese stains; one of these is 1/4" thick; one thin vertical manganese stain; dark nodes of biotite in bottom of the sample; LAB USC: Sandy SILT (ML). |
| 5.0 | 3, 4, 5 | Ss | S1 (A-4) | | | 15" | | |
| 10.0 | 3, 6, 12 | Ss | S2 (A-4) | | | 13" | | SILTY CLAY: brown; some sand; homogeneous; one manganese stain at a less than 10 degree angle; LAB USC: Silty Sand (SM). Auger Refusal at 14.0 feet. |
| 13.0 | | | | | | | AH | |
| 14.0 | | | | | | | C | GRANITE GNEISS: very hard, granite to granite gneiss, drilled by NQ rock core; one very fractured section at 14.1 feet, fresh break at 23.0 feet; no fractures from 23.5 to 28.5 feet; first 10 foot core run recovered 96%; second 5 foot core run recovered 71%; Boring Terminated at 28.0 feet. |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-17d

PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER/AIR ROTARY
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 12/28/94 DATE COMPLETED: 12/28/94

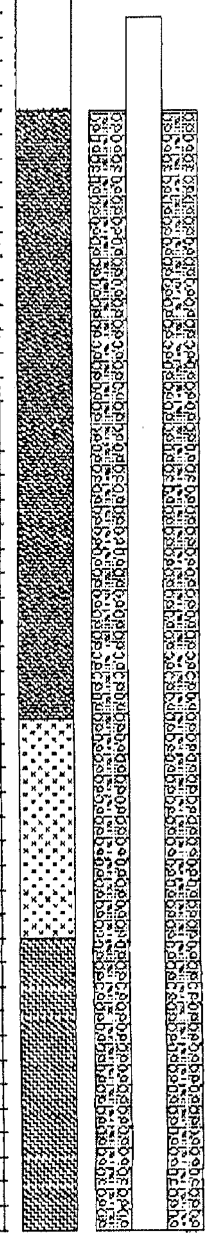
TOP OF CASING ELEVATION: 789.66
TOTAL DEPTH: 53.0 FT
GROUND SURFACE ELEVATION: 787.71
SHEET: 1 OF: 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 29.09 | 34.09 |
| Time | 11:05am | - |
| Date | 1/10/95 | 12/29/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | HSA | SILTY CLAY: brown; some manganese stains; dark nodes of biotite in bottom of the sample; |
| 5.0 | | | | D | | | | |
| 7.5 | | | | | | | | Auger Refusal at 12.5 feet. |
| 10.0 | | | | D | | | | |
| 12.5 | | | | | | | AH | MAFIC INTRUSIVE: blue in color; competent rock. |
| 15.0 | | | | D | | | | |
| 17.0 | | | | | | | | GNEISS: granite gneiss with dark biotite banding. |
| 20.0 | | | | D | | | | |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-17d

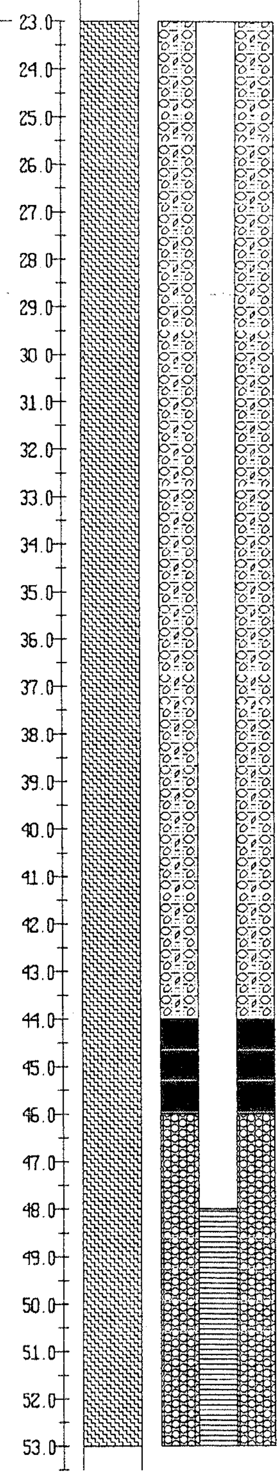
PROJECT NUMBER 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN 12/28/94 DATE COMPLETED 12/28/94

TOP OF CASING ELEVATION 789.66
TOTAL DEPTH 53.0 FT
GROUND SURFACE ELEVATION 787.71
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 29.09 | 34.09 |
| Time | 11:05am | - |
| Date: | 1/10/95 | 12/29/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 23.0 | | | | | | | | GNEISS: more felsic than above; slightly moist at 33.5 feet; a second water seam at 50 feet; 53 feet below grade is a water seam with the most water production; Boring Terminated at 53.0 ft. |
| 24.0 | | | | | | | | |
| 25.0 | | | | D | | | | |
| 26.0 | | | | | | | | |
| 27.0 | | | | | | | | |
| 28.0 | | | | | | | | |
| 29.0 | | | | | | | | |
| 30.0 | | | | D | | | | |
| 31.0 | | | | | | | | |
| 32.0 | | | | | | | | |
| 33.0 | | | | M | | | | |
| 34.0 | | | | | | | | |
| 35.0 | | | | D | | | | |
| 36.0 | | | | | | | | |
| 37.0 | | | | | | | | |
| 38.0 | | | | | | | | |
| 39.0 | | | | | | | | |
| 40.0 | | | | D | | | | |
| 41.0 | | | | | | | | |
| 42.0 | | | | | | | | |
| 43.0 | | | | | | | | |
| 44.0 | | | | | | | | |
| 45.0 | | | | D | | | | |
| 46.0 | | | | | | | | |
| 47.0 | | | | | | | | |
| 48.0 | | | | | | | | |
| 49.0 | | | | | | | | |
| 50.0 | | | | W | | | | |
| 51.0 | | | | | | | | |
| 52.0 | | | | | | | | |
| 53.0 | | | | W | | | | |

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-18

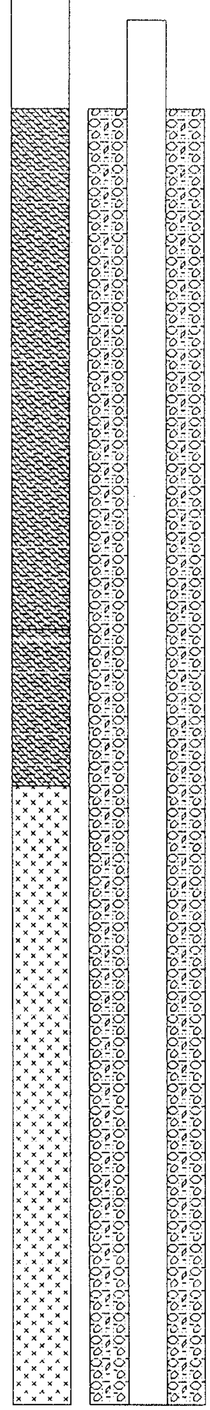
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY, COOL
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 774.40
TOTAL DEPTH 49.0 FT
GROUND SURFACE ELEVATION 771.60
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 15.64 | 14.38 |
| Time | - | - |
| Date | 12/29/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTENCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–13.0 | | | | | | | | SILTY CLAY: brown; one near vertical iron stain; bottom of sample varies from dk. green clay to white clay. |
| 5.0 | 3 4 6 | Ss | S1 | D | | 12" | | |
| 9.0–10.0 | | | | | | | | SILTY CLAY: weathered white granitic sand rock; some quartz; no mica. Auger Refusal at 13 feet. |
| 10.0 | 4 6 11 | Ss | S2 | D | | 12" | | |
| 13.0 | | | | | | | | MAFIC INTRUSIVE: air hammer drilling blue mafic rock; Boring Terminated at 49'. |
| 17.5 | ▼ (water level) | | | | | | | |

Depth scale: 2.0, 1.0, 0.0, 1.0 … 24.0



# FIELD BOREHOLE LOG

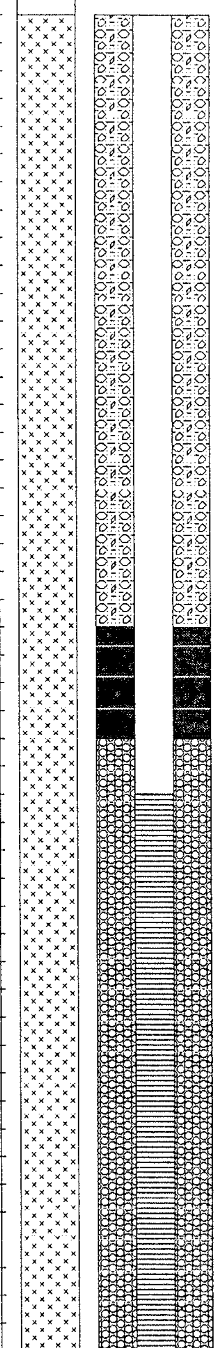
| BOREHOLE NUMBER |
|---|
| B-18 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR HAMMER
WEATHER SUNNY, COOL
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/19/94 DATE COMPLETED 12/27/94

TOP OF CASING ELEVATION 774.40
TOTAL DEPTH 49.0 FT
GROUND SURFACE ELEVATION 771.60
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 15.64 | 14.38 |
| Time | - | - |
| Date | 12/29/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 25.0 | | | | | | | | MAFIC INTRUSIVE: air hammer drilling blue mafic rock; Boring Terminated at 49'. | 25.0 | | |
| 26.0 | | | | | | | | | 26.0 | | |
| 27.0 | | | | | | | | | 27.0 | | |
| 28.0 | | | | | | | | | 28.0 | | |
| 29.0 | | | | | | | | | 29.0 | | |
| 30.0 | | | | | | | | | 30.0 | | |
| 31.0 | | | | | | | | | 31.0 | | |
| 32.0 | | | | | | | | | 32.0 | | |
| 33.0 | | | | | | | | | 33.0 | | |
| 34.0 | | | | | | | | | 34.0 | | |
| 35.0 | | | | | | | | | 35.0 | | |
| 36.0 | | | | | | | | | 36.0 | | |
| 37.0 | | | | | | | | | 37.0 | | |
| 38.0 | | | | | | | | | 38.0 | | |
| 39.0 | | | | | | | | | 39.0 | | |
| 40.0 | | | | | | | | | 40.0 | | |
| 41.0 | | | | | | | | | 41.0 | | |
| 42.0 | | | | | | | | | 42.0 | | |
| 43.0 | | | | | | | | | 43.0 | | |
| 44.0 | | | | | | | | | 44.0 | | |
| 45.0 | | | | | | | | | 45.0 | | |
| 46.0 | | | | | | | | | 46.0 | | |
| 47.0 | | | | | | | | | 47.0 | | |
| 48.0 | | | | | | | | | 48.0 | | |
| 49.0 | | | | | | | | | 49.0 | | |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-19

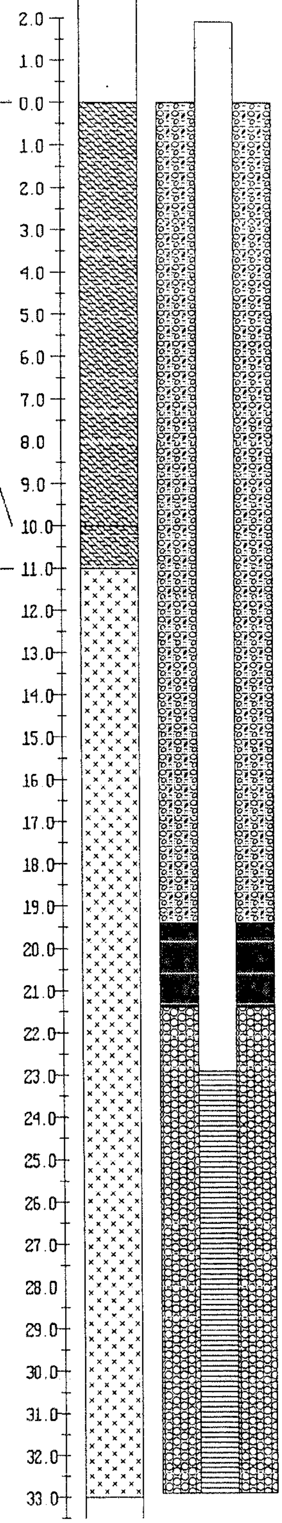
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY/ROLLERCONE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/20/94 DATE COMPLETED 1/2/95

TOP OF CASING ELEVATION 778.28
TOTAL DEPTH 33.0 FT
GROUND SURFACE ELEVATION 775.78
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(Ft) | 18.74 | 19.22 |
| Time | - | - |
| Date | 1/10/94 | 1/25/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | |
| 1.0 | | | | | | | | |
| 0.0 | | | | | | | | SILTY CLAY: dk. green to brown; weathered mafic rock; some manganese staining; no foliation. |
| 1.0 | | | | | | | | |
| 2.0 | | | | | | | | |
| 3.0 | | | | | | | | |
| 4.0 | | | | | | | | |
| 5.0 | 12 24 30 | Ss | S1 | | | 15" | | |
| 6.0 | | | | | | | | |
| 7.0 | | | | | | | | |
| 8.0 | | | | | | | | SILTY CLAY: weathered mafic rock; individual amphiboles seen; no foliation; auger refusal at 11.0'. |
| 9.0 | | | | | | | | |
| 10.0 | 10 50/5 | Ss | S2 | | | 12" | | |
| 11.0 | | | | | | | | MAFIC INTRUSIVE: hard mafic rock; boring terminated at 33 feet. |
| 12.0 | | | | | | | | |
| 13.0 | | | | | | | | |
| 14.0 | | | | | | | | |
| 15.0 | | | | | | | | |
| 16.0 | | | | | | | | |
| 17.0 | | | | | | | | |
| 18.0 | | | | | | | | |
| 19.0 | | | | | | | | |
| 20.0 | | | | | | | | |
| 21.0 | | | | | | | | |
| 22.0 | | | | | | | | |
| 23.0 | | | | | | | | |
| 24.0 | | | | | | | | |
| 25.0 | | | | | | | | |
| 26.0 | | | | W | | | | |
| 27.0 | | | | | | | | |
| 28.0 | | | | | | | | |
| 29.0 | | | | | | | | |
| 30.0 | | | | | | | | |
| 31.0 | | | | | | | | |
| 32.0 | | | | | | | | |
| 33.0 | | | | | | | | |

DEPTH / LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-20 |

PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER/AIR ROTARY
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 12/20/94 DATE COMPLETED: 1/3/95

TOP OF CASING ELEVATION 772.18
TOTAL DEPTH 63.5 FT
GROUND SURFACE ELEVATION 770.68
SHEET: 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD-While Drilling AB-After Boring | | |
| Depth(Ft) | 25.96 | 25.73 |
| Time | 1:10pm | - |
| Date | 1/10/95 | 1/25/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD |
|---|---|---|---|---|---|---|---|
| 5.0 | 12<br>24<br>32 | Ss | S1 (A-4) | | | | |
| 10.0 | 20<br>33<br>50/5 | Ss | S2 (A-2-4) | | | | |
| 15.0 | 50/4 | Ss | S3 | | | | |

## LITHOLOGY DESCRIPTION

SILTY CLAY: bottom of sample is weathered mafic rock with amphiboles in a honeycomb of thin felsic veins; some iron staining; vertical foliation; above this in the sample is 5" thick layer of granitic sand rock; some quartz; trace to no mica; contact between the sand rock and the mafic is at a 45 degree angle; above the sand rock is more weathered mafic rock with a similar contact between; Lab USC: Sandy Lean Clay (CL).

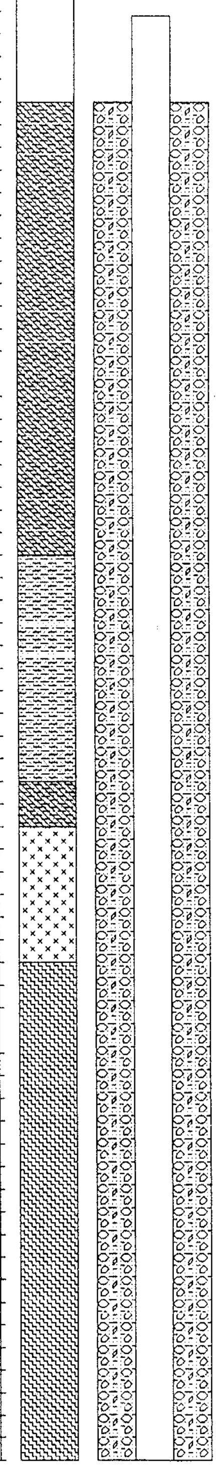
SILTY SAND: dk. brown granitic sand rock; some quartz; some biotite; upper 4" of sample is dk. green and has more clay; weathered contact has biotite; vertical foliation in bottom of spoon; Lab USC: Silty Clayey Sand (SC-SM).

SILTY CLAY: weathered mafic micaceous rock; auger refusal at 16.0'.

MAFIC INTRUSIVE: hard mafic rock; drilling with air hammer; cuttings are green in color.

GNEISS: cuttings are grayish; progressively more banding noted in samples as we progress downward.

DEPTH | LITHOLOGY | WELL INSTALLATION



DEPTH scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0, 26.0, 27.0, 28.0, 29.0, 30.0

# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-20 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 1/3/95

TOP OF CASING ELEVATION 772.18
TOTAL DEPTH 63.5 FT
GROUND SURFACE ELEVATION 770.68
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 27.46 | 25.73 |
| Time | 1:10pm | |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30.0 | | | | | | | | GNEISS: cuttings are grayish; progessively more banding noted in samples as we progress downward. | 30.0 | | |
| 45.0 | | | | | | | | GNEISS: felsic; banding visible in cuttings. | 45.0 | | |
| 59.5 | | | | W | | | | GNEISS: felsic; water seam at 59.5 feet; Boring Terminated at 63.5 feet. | 59.5 | | |

Depth scale: 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0, 40.0, 41.0, 42.0, 43.0, 44.0, 45.0, 46.0, 47.0, 48.0, 49.0, 50.0, 51.0, 52.0, 53.0, 54.0, 55.0, 56.0, 57.0, 58.0, 59.0, 60.0, 61.0, 62.0, 63.0, 64.0, 65.0

# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-21

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 12/22/94

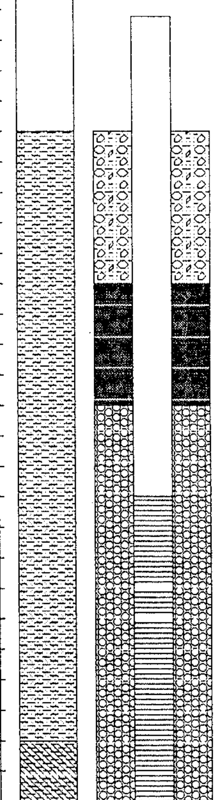
TOP OF CASING ELEVATION 759.84
TOTAL DEPTH 11.0 FT
GROUND SURFACE ELEVATION 756.82
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.02 | 5.13 |
| Time | 11:55am | - |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–9.0 | | | | | | | | SILTY SAND: white granitic sand rock; weathered feldspar and quartz; some kaolinitic clay; one 2" thick section iron stained. GRANITE |
| 5.0 | 12 50/4 | Ss | S1 | | | 8" | | |
| 10.0 | 40 50/6 | Ss | S2 | | | 7" | | SILTY CLAY: mafic weathered rock; some mica and iron staining; auger refusal at 11.0 ft. |

DEPTH scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0

LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-22

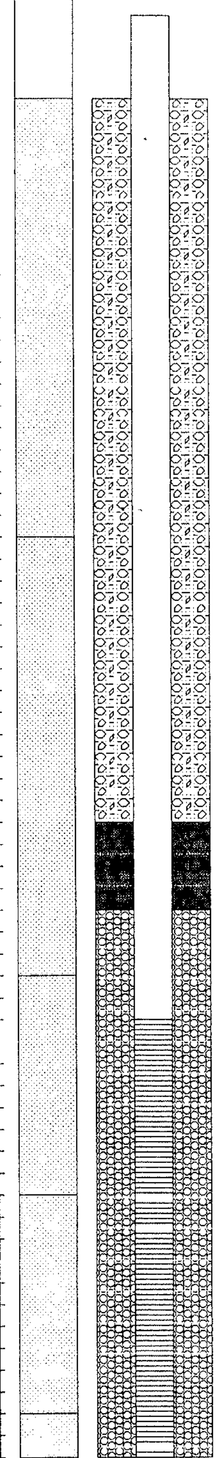
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/20/94 DATE COMPLETED 12/20/94

TOP OF CASING ELEVATION 757.86
TOTAL DEPTH 31.0 FT
GROUND SURFACE ELEVATION 754.92
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 10.27 | 8.56 |
| Time | - | - |
| Date | 12/20/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–10.0 | | | | | | | | SAND: white granitic sand rock; quartz; no mica; some feldspar; Lab USC: Silty Clayey Sand (SC-SM). |
| 5.0 | 17 50/6 | Ss | S1 (A-2-4) | | | 13" | | |
| 10.0 | 15 24 30 | Ss | S2 | | | 16" | | SAND: granitic sand rock; some kaolin, quartz and iron staining; muscovite and biotite present; Lab USC: Silty Clayey Sand (SC-SM). |
| 15.0 | 24 50/6 | Ss | S3 (A-2-4) | | | 13" | | |
| 20.0 | 24 32 38 | Ss | S4 | W | | 11" | | SAND: granitic sand rock; same as above with more biotite. |
| 25.0 | 24 28 50/5 | Ss | S5 (A-2-4) | W | | 12" | | SAND: granitic sand rock; abundant quartz and biotite; some muscovite and iron staining; Lab USC: Silty Clayey Sand (SC-SM). |
| 30.0 | 24 36 50/5 | Ss | S6 | W | | 6" | | SAND: granitic sand rock, same as above with pale green clay and less mica; auger refusal at 31.0'. |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-22d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 756.80
TOTAL DEPTH 46.5 FT
GROUND SURFACE ELEVATION 754.92
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(Ft) | 14.66 | 8.72 |
| Time | - | - |
| Date | 12/29/94 | 1/10/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 0.0 | | | | | | | | SAND: white to tan granitic sand rock; quartz; mica; some feldspar. | 0.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 2.0 | | | | | | | | | 2.0 | | |
| 3.0 | | | | | | | | | 3.0 | | |
| 4.0 | | | | | | | | | 4.0 | | |
| 5.0 | | | | | | | | | 5.0 | | |
| 6.0 | | | | | | | | | 6.0 | | |
| 7.0 | | | | | | | | | 7.0 | | |
| 8.0 | | | | | | | | | 8.0 | | |
| 9.0 | | | | | | | | | 9.0 | | |
| 10.0 | | | | | | | | | 10.0 | | |
| 11.0 | | | | | | | | | 11.0 | | |
| 12.0 | | | | | | | | | 12.0 | | |
| 13.0 | | | | | | | | | 13.0 | | |
| 14.0 | | | | W | | | | SAND: granitic sand rock; biotite present; wet at 14 feet; abundant water at 23.0 feet; auger refusal at 28.5 feet. | 14.0 | | |
| 15.0 | | | | | | | | | 15.0 | | |
| 16.0 | | | | | | | | | 16.0 | | |
| 17.0 | | | | | | | | | 17.0 | | |
| 18.0 | | | | | | | | | 18.0 | | |
| 19.0 | | | | | | | | | 19.0 | | |
| 20.0 | | | | | | | | | 20.0 | | |
| 21.0 | | | | | | | | | 21.0 | | |
| 22.0 | | | | | | | | | 22.0 | | |
| 23.0 | | | | | | | | | 23.0 | | |
| 24.0 | | | | | | | | | 24.0 | | |
| 25.0 | | | | | | | | | 25.0 | | |
| 26.0 | | | | | | | | | 26.0 | | |
| 27.0 | | | | | | | | | 27.0 | | |
| 28.0 | | | | | | | | | 28.0 | | |

# FIELD BOREHOLE LOG

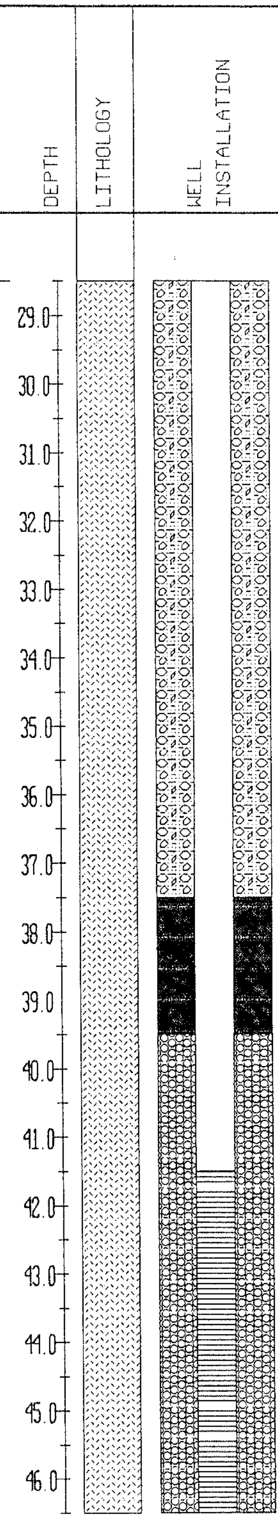
| BOREHOLE NUMBER |
|---|
| B-22d |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 756.80
TOTAL DEPTH 46.5 FT
GROUND SURFACE ELEVATION 754.92
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 14.66 | 8.72 |
| Time | - | - |
| Date | 12/29/94 | 1/10/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 29.0–46.0 | | | | | | | | GRANITE: highly weathered tan to white granite with biotite; soft seam at 45 to 46 feet. |



# FIELD BOREHOLE LOG

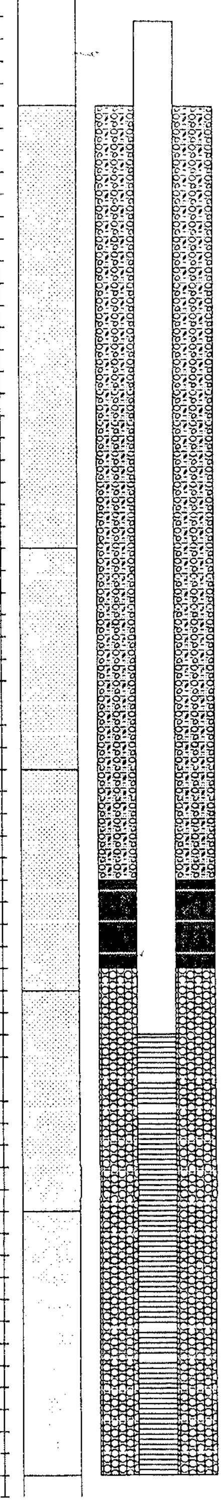
BOREHOLE NUMBER: B-23

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/21/94

TOP OF CASING ELEVATION 768.26
TOTAL DEPTH 31.0 FT
GROUND SURFACE ELEVATION 765.26
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) WD=While Drilling AB=After Boring | | |
|---|---|---|
| Depth(Ft) | 13.75 | 14.06 |
| Time | - | - |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–10.0 | | | | | | | | SAND: white to tan granitic sand rock; abundant biotite in bottom of sample; trace k-spar; some quartz. |
| 5.0 | 10 19 30 | Ss | S1 | | | 15" | | |
| 10.0–15.0 | 15 50/6 | Ss | S2 | | | 13" | | SAND: granitic sand rock; has biotite, quartz and clay; upper portion of sample is lt. tan and has gneissic banding. |
| 15.0–20.0 | 9 50/6 | Ss | S3 | | | 11" | | SAND: granitic sand rock; same as above with no banding. |
| 20.0–25.0 | 35 50/5 | Ss | S4 | M | | 8" | | SAND: granitic sand rock; overlain by a manganese stained clay (1" thick) and quartz fragments; moist. |
| 25.0–31.0 | 50/2 | Ss | S5 | M | | 2" | | SAND: granitic sand rock; sample has biotite feldspar and quartz; auger refusal at 31.0 feet. |
| 27.0 | | | | W | | | | |
| 30.0 | 50/2 | Ss | S6 | | | 2" | | |



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-24 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/22/94

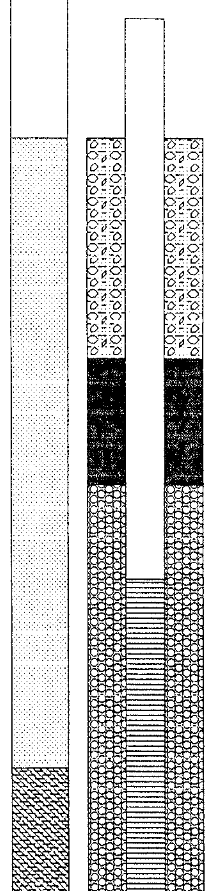
TOP OF CASING ELEVATION 753.03
TOTAL DEPTH 12.0 FT
GROUND SURFACE ELEVATION 750.08
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 9.69 | 9.30 |
| Time | - | - |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–9.9 | | | | | | | | SAND: large grained white to lt. tan granitic sand rock; abundant quartz and trace to little mica; Lab USC: Poorly Graded Sand with Silt (SP-SM). |
| 5.0 | 33 50/6 | Ss | S1 (A-2-4) | | | 9" | | |
| 9.9–12.0 | | | | | | | | SILT AND CLAY: weathered mafic rock; blue in color; some mica and iron stains; auger refusal at 12 ft. Lab USC: Silty Clayey Sand (SC-SM). |
| 10.0 | 33 38 50/5 | Ss | S2 (A-4) | W | | 14" | | |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-25

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/21/94

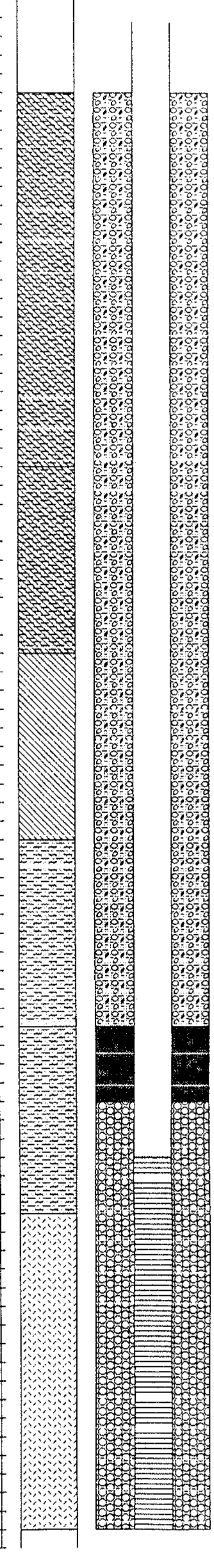
TOP OF CASING ELEVATION 747.96
TOTAL DEPTH 38.5 FT
GROUND SURFACE ELEVATION 744.54
SHEET 1 OF 1

STATIC WATER LEVEL (BLS)
WD=While Drilling AB=After Boring

| | | |
|---|---|---|
| Depth(ft) | 6.64 | 5.72 |
| Time | 12:33 | - |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SILTY CLAY: white; weathered sand rock; slight pink hue; abundant quartz; trace mica. |
| 5.0 | 50/6 | Ss | S1 | | | 6" | | |
| 10.0 | 41<br>50/5 | Ss | S2 | | | 10" | | SILTY CLAY: white very weathered granitic sand rock; abundant quartz and feldspar; some biotite; no structure. |
| 15.0 | 18<br>36<br>32 | Ss | S3 | W | | 10" | | CLAY: wet; weathered kaolinitic claystone; white; iron stained at a -45 degree angle; some biotite and quartz also present at top of sample. |
| 20.0 | 50/6 | Ss | S4 | | | 3" | | SILTY SAND: whitish to light tan granitic sand rock; quartz and feldspar abundant; some areas of kaolin clay. |
| 25.0 | 50/6 | Ss | S5 | | | 5" | | SILTY SAND: lt. tan; weathered granitic sand rock; lg. quartz and feldspar crystals; some biotite; no structure; wet. |
| 30.0 | 34<br>50/5 | Ss | S6 | | | 9" | | GRANITE: weathered to competent; abundant quartz; some biotite and feldspar; auger refusal at 38.5 ft. |
| 35.0 | 50/3 | Ss | S7 | | | 3" | | |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

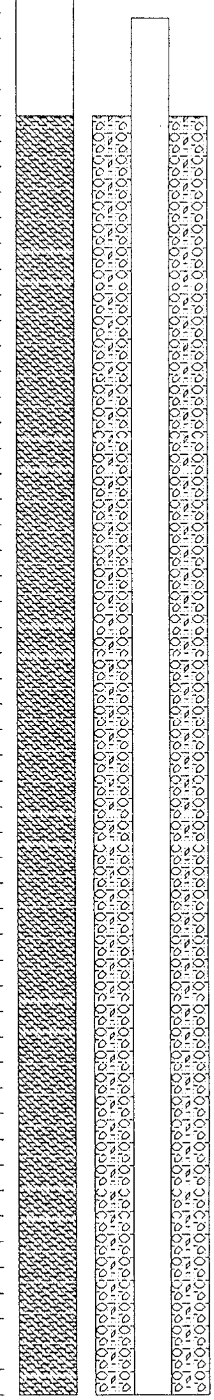
BOREHOLE NUMBER: B-25d

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/ROCK CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 747.54
TOTAL DEPTH 52.0 FT
GROUND SURFACE ELEVATION 744.54
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 7.54 | 6.85 |
| Time | 9:55am | - |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 0.0 | | | | | | | | SILTY CLAY: dark blue to green; weathered mafic rock. | 0.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 2.0 | | | | | | | | | 2.0 | | |
| 3.0 | | | | | | | | | 3.0 | | |
| 4.0 | | | | | | | | | 4.0 | | |
| 5.0 | | | | | | | | | 5.0 | | |
| 6.0 | | | | | | | | | 6.0 | | |
| 7.0 | | | | | | | | | 7.0 | | |
| 8.0 | | | | | | | | | 8.0 | | |
| 9.0 | | | | | | | | | 9.0 | | |
| 10.0 | ▼ | | | | | | | | 10.0 | | |
| 11.0 | | | | | | | | | 11.0 | | |
| 12.0 | | | | | | | | | 12.0 | | |
| 13.0 | | | | | | | | | 13.0 | | |
| 14.0 | | | | | | | | | 14.0 | | |
| 15.0 | | | | W | | | | | 15.0 | | |
| 16.0 | | | | | | | | | 16.0 | | |
| 17.0 | | | | | | | | | 17.0 | | |
| 18.0 | | | | | | | | | 18.0 | | |
| 19.0 | | | | | | | | | 19.0 | | |
| 20.0 | | | | | | | | | 20.0 | | |
| 21.0 | | | | | | | | | 21.0 | | |
| 22.0 | | | | | | | | | 22.0 | | |
| 23.0 | | | | | | | | | 23.0 | | |
| 24.0 | | | | | | | | | 24.0 | | |
| 25.0 | | | | | | | | | 25.0 | | |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-25d

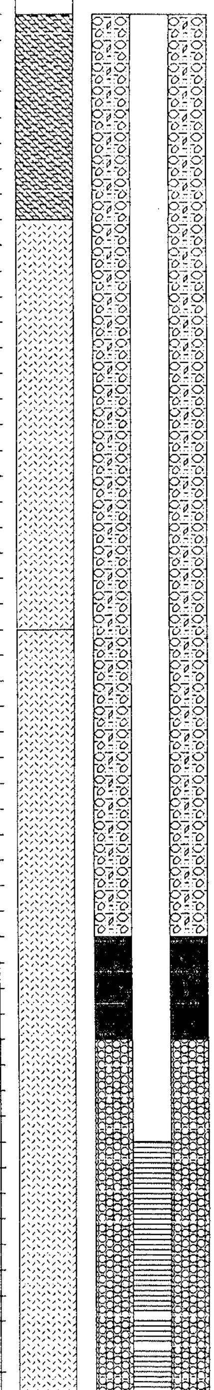
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/ROCK CORE/AIR HAMMER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 747.54
TOTAL DEPTH 52.0 FT
GROUND SURFACE ELEVATION 744.54
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 7.54 | 6.85 |
| Time | 9:55am | - |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 25.0–29.0 | | | | | | | | SILTY CLAY: dark blue to green; weathered mafic rock; auger refusal at 29 feet. | 25.0–29.0 |
| 29.0–37.0 | | | | | | | | GRANITE: weathered; drilled with a rollercone bit. | 29.0–37.0 |
| 37.0–52.0 | | | | | | | | GRANITE: weathered to competent granitic sand rock; drilled with rock core in three runs - 3' run (2' recovery), 5' run (5' recovery), 7' run (3' recovery); Reamed out with air hammer drilling. | 37.0–52.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-26

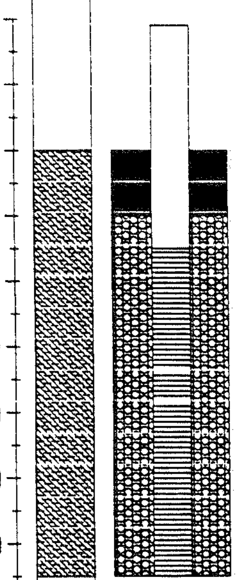
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/21/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION 742.55
TOTAL DEPTH 6.5 FT
GROUND SURFACE ELEVATION 739.20
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 2.36 | 4.92 |
| Time | 10:09 | 12:15PM |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SILT AND CLAY: blue green; weathered mafic rock; some iron staining-especially in lower 8" of sample; auger refusal at 6.5' Green Stone Dike |
| 5.0 | 11 | Ss | S1 | | | 16" | | |
| | 39 | | | | | | | |
| 6.0 | 50/4 | | | | | | | |

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER B-27

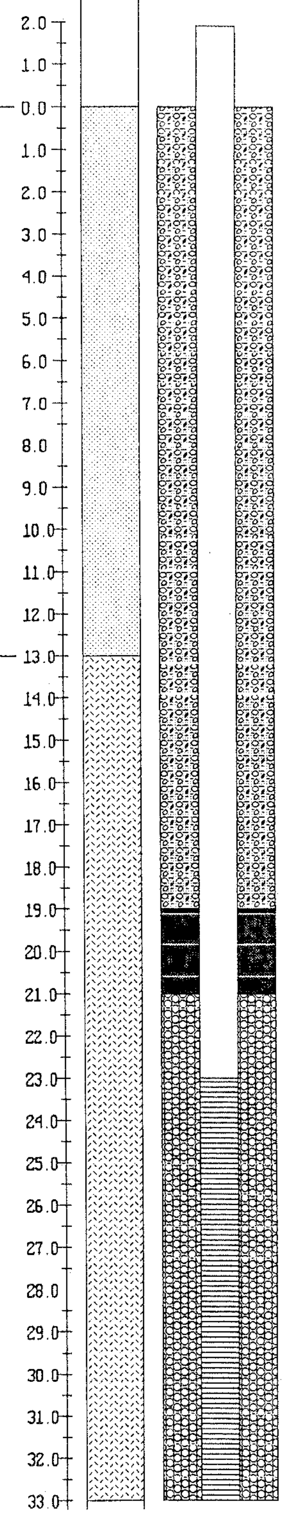
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/21/94 DATE COMPLETED 1/2/95

TOP OF CASING ELEVATION 736.71
TOTAL DEPTH 33.0 FT
GROUND SURFACE ELEVATION 734.82
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 19.18 | 16.98 |
| Time | - | - |
| Date | 1/2/95 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | |
| 1.0 | | | | | | | | |
| 0.0 | | | | | | | | SAND: weathered granitic sand rock; some biotite; some greenish biotite; trace of potassium feldspar; auger refusal at 13 feet. |
| 5.0 | 50/6 | Ss | S1 | | | | | |
| 10.0 | 50/5 | Ss | S2 | | | | | |
| 13.0 | | | | | | | | GRANITE: white granite drilled with air hammer; water seam at 28 feet. |
| 27.0 | | | | W | | | | |
| 33.0 | | | | | | | | |

DEPTH / LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

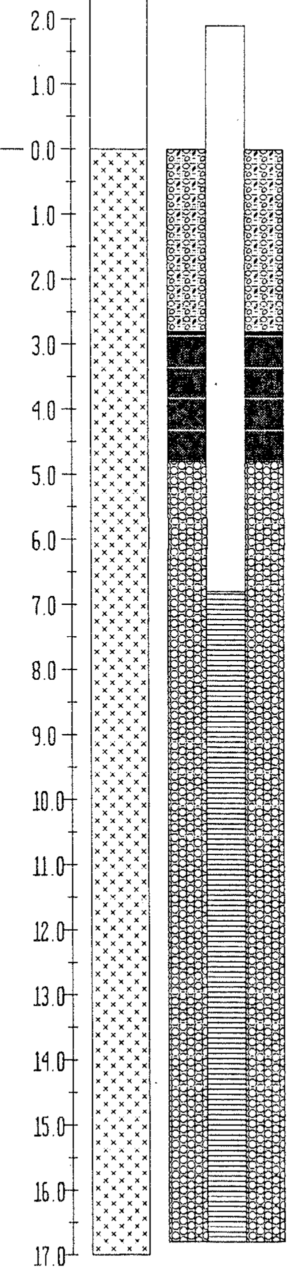
BOREHOLE NUMBER: B-28

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD AIR HAMMER
WEATHER SUNNY
FIELD PARTY RONNY BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 1/2/95 DATE COMPLETED 1/2/95

TOP OF CASING ELEVATION 742.69
TOTAL DEPTH 16.8 FT
GROUND SURFACE ELEVATION 739.33
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 4.73 | 4.18 |
| Time | - | - |
| Date | 1/2/95 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | AH | MAFIC INTRUSIVE: mafic intrusive; dark brown to dark gray; drilled with an air hammer; some water sat 9.0 feet, dry at 11.0 feet, wet at 12.5 feet; auger refusal at 0.5'. |
| 9.0 | | | | M | | | | |
| 12.0 | | | | W | | | | |



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-29 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION -
TOTAL DEPTH 2.0 FT
GROUND SURFACE ELEVATION -
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AD=After Boring | | |
| Depth(ft) | DRY | - |
| Time | - | - |
| Date | 12/22/94 | - |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 0.0 | | | | | | | | WEATHERED MAFIC INTRUSIVE: auger refusal at 2.0 feet. | 0.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 2.0 | | | | | | | | | 2.0 | | |
| 3.0 | | | | | | | | | 3.0 | | |
| 4.0 | | | | | | | | | 4.0 | | |
| 5.0 | | | | | | | | | 5.0 | | |
| 6.0 | | | | | | | | | 6.0 | | |
| 7.0 | | | | | | | | | 7.0 | | |
| 8.0 | | | | | | | | | 8.0 | | |
| 9.0 | | | | | | | | | 9.0 | | |
| 10.0 | | | | | | | | | 10.0 | | |
| 11.0 | | | | | | | | | 11.0 | | |
| 12.0 | | | | | | | | | 12.0 | | |
| 13.0 | | | | | | | | | 13.0 | | |
| 14.0 | | | | | | | | | 14.0 | | |
| 15.0 | | | | | | | | | 15.0 | | |
| 16.0 | | | | | | | | | 16.0 | | |

# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-29A

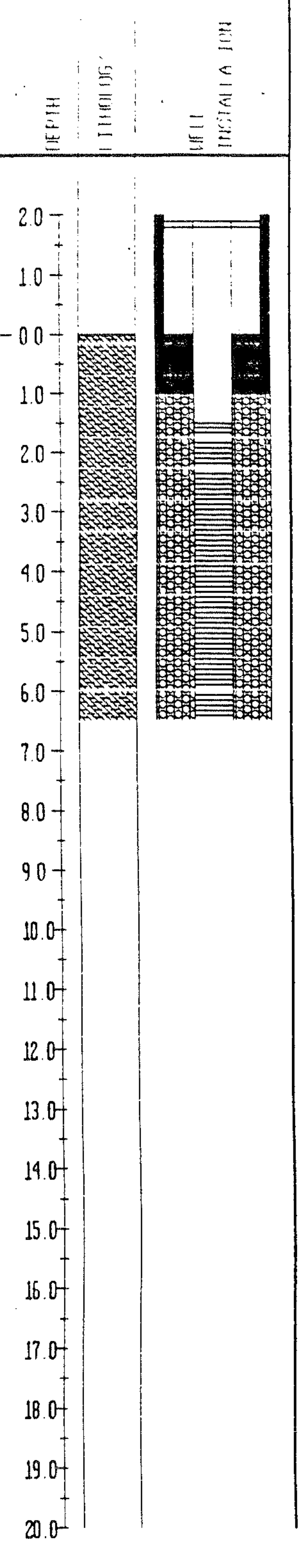
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J FINKBEINER
DATE BEGUN
DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION - 746.47
TOTAL DEPTH 8.0 FT
GROUND SURFACE ELEVATION - 743.61
SHEET 1 OF 1

| STATIC WATER LEVEL (ELE) | |
|---|---|
| WD=While Drilling AB=After Boring | |
| Depth (Ft) | - |
| Time | - |
| Date | - |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SILTY CLAY: very weathered mafic rock; no structure. |
| 5.0 | 34<br>50/5 | Ss | S1 | | | | | |
| 7.0 | | | | | | | | auger refusal at 8.0 feet |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-30

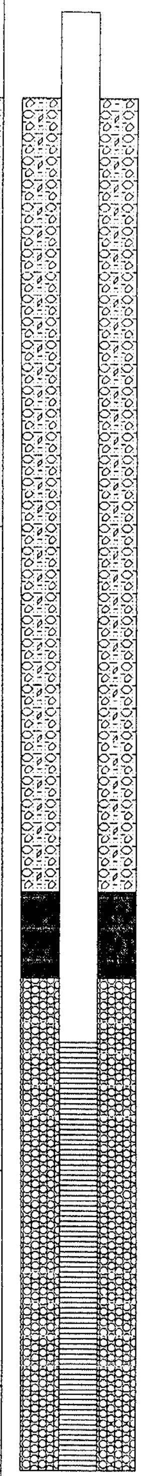
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION 742.26
TOTAL DEPTH 32.0 FT
GROUND SURFACE ELEVATION 739.11
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 14.83 | 14.74 |
| Time | 5:26 | - |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SAND: white granite sand rock; some biotite and some quartz; Lab USC: Silty Clayey Sand (SC-SM). |
| 5.0 | 6 10 15 | Ss | S1 (A-4) | D | | 14" | | |
| 10.0 | 6 12 17 | Ss | S2 | D | | 14" | | SAND: white granite sand rock with biotite and quartz; no structure; Lab USC: Silty Clayey Sand (SC-SM). |
| 15.0 | 11 17 25 | Ss | S3 (A-2-4) | D | | 13" | | |
| 20.0 | 12 28 50/2 | Ss | S4 | M | | 12" | | SAND: white to tan granite sand rock; some biotite; quartz. |
| 25.0 | 35 50/4 | Ss | S5 (A-2-4) | W | | 7" | | SAND: white granite sand rock; quartz; feldspar; biotite almost forms bands, although somewhat discontinuous; also some green biotite; Lab USC: Silty Clayey Sand (SC-SM). |
| 30.0 | 50/6 | Ss | S6 | W | | 5" | | SAND: white granite sand rock; some biotite, and a few biotite layers; auger refusal at 32 feet. |

WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-31 |

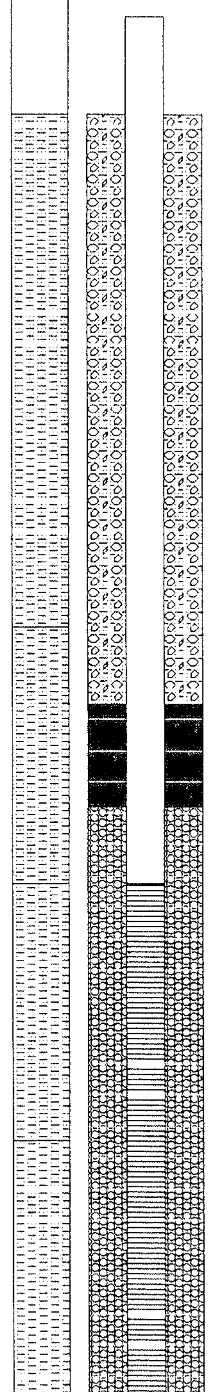
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 12/22/94 DATE COMPLETED 12/22/94

TOP OF CASING ELEVATION 750.1
TOTAL DEPTH 25.0 FT
GROUND SURFACE ELEVATION 747.1
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.87 | 5.42 |
| Time | 5:35 | - |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 |
| 1.0 | | | | | | | | | 1.0 |
| 0.0 | | | | | | | | SANDY SILT: Weathered lt. brown granite sand rock; abundant biotite. | 0.0 |
| 1.0 | | | | | | | | | 1.0 |
| 2.0 | | | | | | | | | 2.0 |
| 3.0 | | | | | | | | | 3.0 |
| 4.0 | | | | | | | | | 4.0 |
| 5.0 | 50/4 | Ss | S1 | | | 3" | | | 5.0 |
| 6.0 | | | | | | | | | 6.0 |
| 7.0 | | | | | | | | | 7.0 |
| 8.0 | | | | | | | | | 8.0 |
| 9.0 | | | | | | | | | 9.0 |
| 10.0 | 50/2 | Ss | S2 | | | 2" | | SANDY SILT: Weathered granite sand rock; with quartz. | 10.0 |
| 11.0 | | | | | | | | | 11.0 |
| 12.0 | | | | | | | | | 12.0 |
| 13.0 | | | | | | | | | 13.0 |
| 14.0 | | | | | | | | | 14.0 |
| 15.0 | 50/1 | Ss | S3 | | | 1" | | SANDY SILT: Brown granite sand rock with some quartz. | 15.0 |
| 16.0 | | | | | | | | | 16.0 |
| 17.0 | | | | | | | | | 17.0 |
| 18.0 | | | | | | | | | 18.0 |
| 19.0 | | | | | | | | | 19.0 |
| 20.0 | 50/1 | Ss | S4 | | | 1" | | SANDY SILT: Brown granite sand rock in cohesive chunks; auger refusal at 25 feet. | 20.0 |
| 21.0 | | | | | | | | | 21.0 |
| 22.0 | | | | | | | | | 22.0 |
| 23.0 | | | | | | | | | 23.0 |
| 24.0 | | | | | | | | | 24.0 |
| 25.0 | | | | | | | | | 25.0 |

LITHOLOGY WELL INSTALLATION



# FIELD BOREHOLE LOG

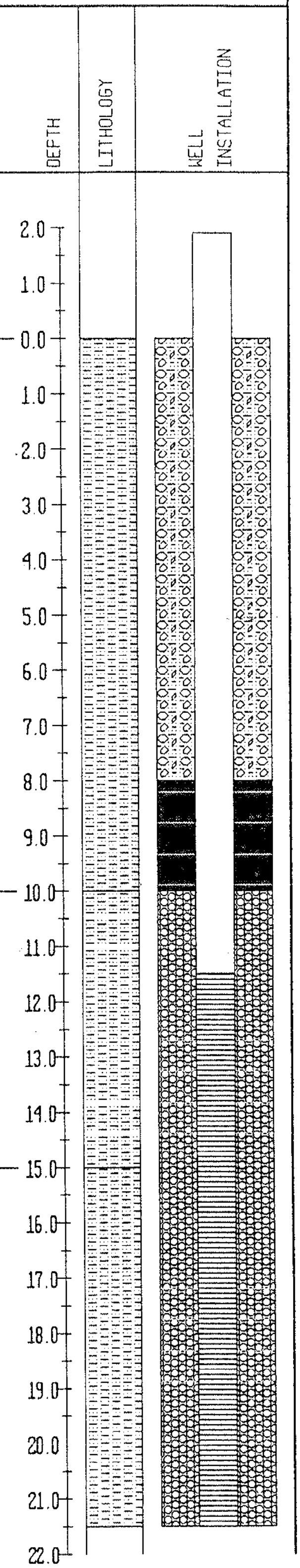
BOREHOLE NUMBER: B-32

PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 12/22/94　　DATE COMPLETED: 12/22/94

TOP OF CASING ELEVATION: 744.76
TOTAL DEPTH: 21.5 FT
GROUND SURFACE ELEVATION: 741.65
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth (ft) | 17.03 | 14.36 |
| Time | 5:20 | 1:35 |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SANDY SILT: Light tan granite sand rock; little mica; no structure. |
| 5.0 | 24 50/6 | Ss | S1 | | | 12" | | |
| 10.0 | 50/1 | Ss | S2 | | | 1" | | SANDY SILT: Light tan granite sand rock; no structure. |
| 15.0 | 50/1 | Ss | S3 | | | 1" | | SANDY SILT: Light tan granite sand rock; some quartz; little biotite; auger refusal at 21.5 feet. |
| 20.0 | 50/1 | Ss | S4 | | | 0" | | |



# FIELD BOREHOLE LOG

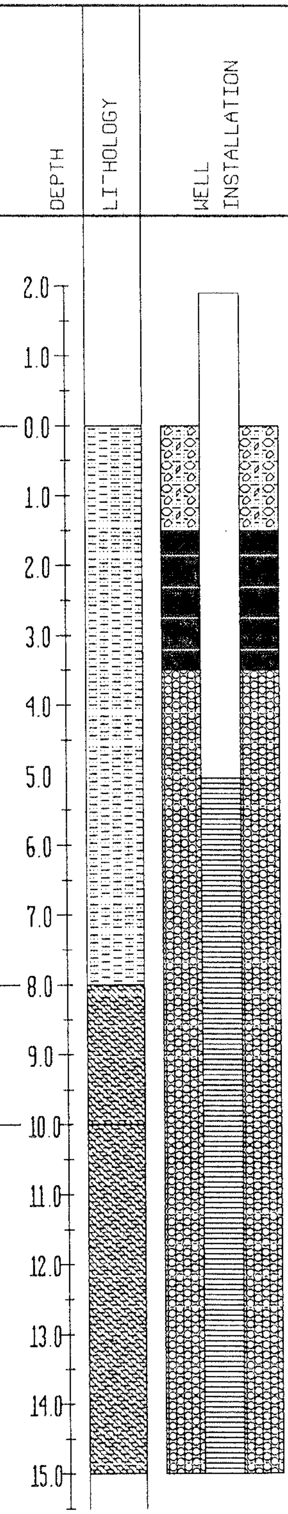
BOREHOLE NUMBER: B-33

PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: G. SIMMERMAN
DATE BEGUN: 12/27/94 DATE COMPLETED: 12/27/94

TOP OF CASING ELEVATION 760.33
TOTAL DEPTH 15.0 FT
GROUND SURFACE ELEVATION 757.22
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.11 | 4.54 |
| Time | 12:21 | 1:50 |
| Date | 12/27/94 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–8.0 | | | | | | | | SANDY SILT: tannish white, coarse grained; biotite flakes locally; white weathered feldspar clay; some iron staining; granitic; moist. |
| 5.0 | 18<br>30<br>50/3 | Ss | S1 | | | 13" | | |
| 8.0 | | | | W | | | | CLAYEY SILT: mafic dike; water at 8.0 feet. |
| 10.0 | 12<br>16<br>30 | Ss | S2 | | | 13" | | CLAYEY SILT: Dark bluish green to light tan green; some very fine whitish mineral grains visible; locally orangerind iron staining; moist to wet; weathered mafic intrusive; auger refusal at 15.0 ft. |
| 15.0 | 50/3 | Ss | S3 | | | 8" | | |



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-34 |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/28/94 DATE COMPLETED 12/28/94

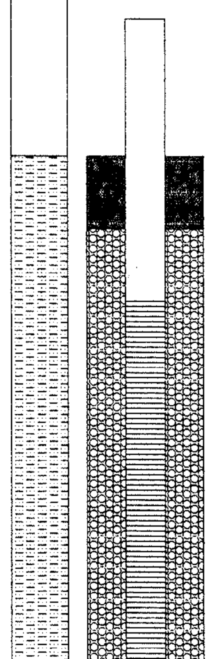
TOP OF CASING ELEVATION 733.92
TOTAL DEPTH 7.0 FT
GROUND SURFACE ELEVATION 730.97
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 2.58 | 3.61 |
| Time | - | 11:05 |
| Date | 1/2/95 | 1/10/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | | | | | | | | SANDY SILT: weathered mafic rock; trace to some mica; auger refusal at 7.0 ft. |
| 5.0 | 50/6 | Ss | S1 | W | | 13" | | |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

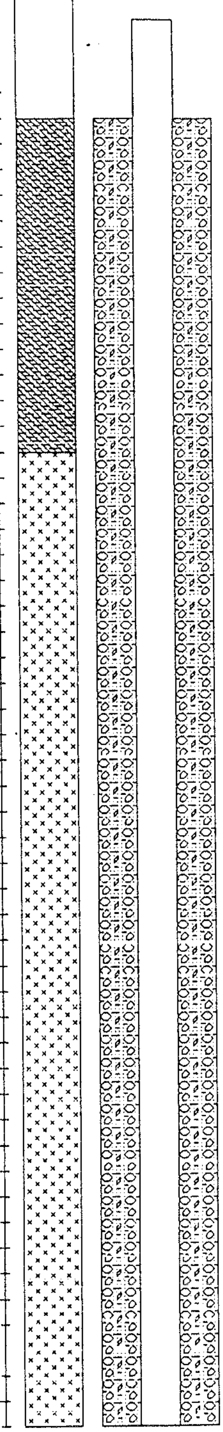
| BOREHOLE NUMBER |
|---|
| B-34d |

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER BIT/AIR ROTARY/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 732.49
TOTAL DEPTH 48.5 FT
GROUND SURFACE ELEVATION 730.97
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.61 | 3.54 |
| Time | - | - |
| Date | 1/25/95 | 3/11/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH | LITHOLOGY | WELL INSTALLATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 0.0 | | | | | | | | SILTY CLAY: blue green; weathered mafic rock; trace to some mica. | 0.0 | | |
| 1.0 | | | | | | | | | 1.0 | | |
| 2.0 | | | | | | | | | 2.0 | | |
| 3.0 | | | | | | | | | 3.0 | | |
| 4.0 | | | | | | | | | 4.0 | | |
| 5.0 | ▼ | | | | | | | | 5.0 | | |
| 6.0 | | | | | | | | | 6.0 | | |
| 7.0 | | | | | | | | MAFIC INTRUSIVE: numerous 30 degree angle fractures in rock core; Rock core from 7.0 to 22 feet below grade; core run #1 from 7.0 ft. to 10 ft. - core blockage at 10 ft. Core #2 from 10 ft. to 20 ft.; Core run #3 from 20 ft. to 22 ft.; boring reamed out to 48.5 ft. with air hammer. | 7.0 | | |
| 8.0 | | | | | | | | | 8.0 | | |
| 9.0 | | | | | | | | | 9.0 | | |
| 10.0 | | | | | | | | | 10.0 | | |
| 11.0 | | | | | | | | | 11.0 | | |
| 12.0 | | | | | | | | | 12.0 | | |
| 13.0 | | | | | | | | | 13.0 | | |
| 14.0 | | | | | | | | | 14.0 | | |
| 15.0 | | | | | | | | | 15.0 | | |
| 16.0 | | | | | | | | | 16.0 | | |
| 17.0 | | | | | | | | | 17.0 | | |
| 18.0 | | | | | | | | | 18.0 | | |
| 19.0 | | | | | | | | | 19.0 | | |
| 20.0 | | | | | | | | | 20.0 | | |
| 21.0 | | | | | | | | | 21.0 | | |
| 22.0 | | | | | | | | | 22.0 | | |
| 23.0 | | | | | | | | | 23.0 | | |
| 24.0 | | | | | | | | | 24.0 | | |
| 25.0 | | | | | | | | | 25.0 | | |



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| B-34d |

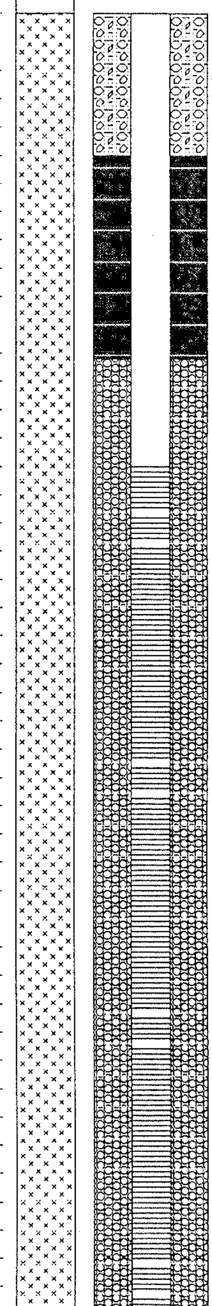
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER BIT/AIR ROTARY/ROCK CORE
WEATHER SUNNY
FIELD PARTY DAVID BARRON
GEOLOGIST G. SIMMERMAN
DATE BEGUN 12/29/94 DATE COMPLETED 12/29/94

TOP OF CASING ELEVATION 732.49
TOTAL DEPTH 48.5 FT
GROUND SURFACE ELEVATION 730.97
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 5.61 | 3.54 |
| Time | - | - |
| Date | 1/25/95 | 3/11/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 26.0 | | | | | | | | MAFIC INTRUSIVE: numerous 30 degree angle fractures in rock core; Rock core from 7.0 to 22 feet below grade; core run #1 from 7.0 ft. to 10 ft. - core blockage at 10 ft. Core #2 from 10 ft. to 20 ft.; Core run #3 from 20 ft. to 22 ft.; boring reamed out to 48.5 ft. with air hammer. | 26.0 |
| 27.0 | | | | | | | | | 27.0 |
| 28.0 | | | | | | | | | 28.0 |
| 29.0 | | | | | | | | | 29.0 |
| 30.0 | | | | | | | | | 30.0 |
| 31.0 | | | | | | | | | 31.0 |
| 32.0 | | | | | | | | | 32.0 |
| 33.0 | | | | | | | | | 33.0 |
| 34.0 | | | | | | | | | 34.0 |
| 35.0 | | | | | | | | | 35.0 |
| 36.0 | | | | | | | | | 36.0 |
| 37.0 | | | | | | | | | 37.0 |
| 38.0 | | | | | | | | | 38.0 |
| 39.0 | | | | | | | | | 39.0 |
| 40.0 | | | | | | | | | 40.0 |
| 41.0 | | | | | | | | | 41.0 |
| 42.0 | | | | | | | | | 42.0 |
| 43.0 | | | | | | | | | 43.0 |
| 44.0 | | | | | | | | | 44.0 |
| 45.0 | | | | | | | | | 45.0 |
| 46.0 | | | | | | | | | 46.0 |
| 47.0 | | | | | | | | | 47.0 |
| 48.0 | | | | | | | | | 48.0 |
| 49.0 | | | | | | | | | 49.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-35

PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER
WEATHER: SUNNY
FIELD PARTY: DAVID BARRON
GEOLOGIST: G. SIMMERMAN
DATE BEGUN: 12/28/94 DATE COMPLETED: 12/28/94

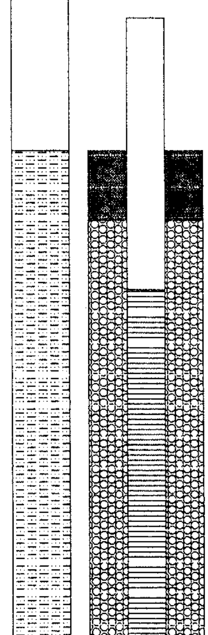
TOP OF CASING ELEVATION: 746.75
TOTAL DEPTH: 7.0 FT
GROUND SURFACE ELEVATION: 744.00
SHEET 1 OF 1

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 2.49 | 1.12 |
| Time | 11:05am | - |
| Date | 1/10/95 | 1/25/95 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0–7.0 | | | | | | | | SANDY SILT: light tan to orange tan; some clay and biotite; notable white feldspar and quartz; auger refusal at 7.0 feet. |
| 5.0 | 30 50/1 | Ss | S1 | | | 3" | | |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: B-36

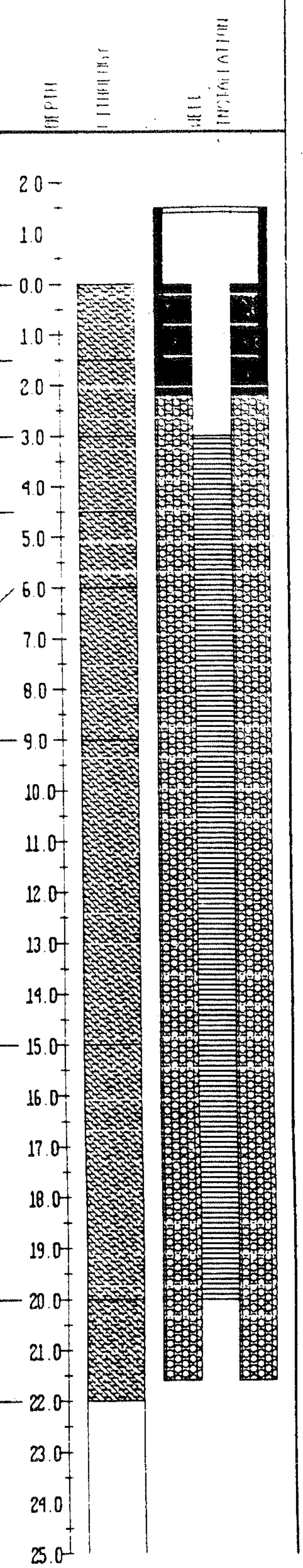
PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: HOLLOW STEM AUGER
WEATHER: SUNNY, COOL
FIELD PARTY: RONNY BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN:
DATE COMPLETED: 1/5/95

TOP OF CASING ELEVATION: 783.0
TOTAL DEPTH: 22.0 FT
GROUND SURFACE ELEVATION: 782.0
SHEET 1 OF 1

STATIC WATER LEVEL BLS
WD=While Drilling AB=After Boring

| | |
|---|---|
| Depth(ft) | - |
| Time | - |
| Date | - |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 2, 3, 3 | Ss | S1 | | | 9" | HSA | SILTY CLAY: brown; Mn stained, v. uniform; trace amphiboles |
| 1.5 | 10, 9, 15 | Ss | S2 | | | 10" | | SILTY CLAY: tan to green; v uniform |
| 3.0 | 12, 16, 40 | Ss | S3 | | | 12" | | SILTY CLAY: brown to green; subvertical Mn stain |
| 4.5 | 17, 24, 31 | Ss | S4 | | | 10" | | SILTY CLAY: mica; brown, tan, green; Mn stained |
| 6.0 | 10, 18, 27 | Ss | S5 | | | 12" | | SILTY CLAY: mica; Mn stained at 30 and 45 degree angles |
| 7.5 | 18, 27, 19 | Ss | S6 | | | 12" | | |
| 9.0 | 11, 18, 50/6 | Ss | S7, S8 | | | 10" | | SILTY CLAY: lower portion of sample abundant biotite, appears to be foliated. GNEISS |
| 15.0 | 18, 19, 22 | Ss | S9 | | | 12" | | SILTY CLAY: medium brown; Mn stained from 0 to 10 degree angles; micaceous near top |
| 20.0 | 50/3 | Ss | S10 | M | | 3" | | CLAYEY SILTY SAND: red brown to white; weathered granitic sand rock |
| 22.0 | | | | | | | | Boring Terminated at 22.0 feet |



# FIELD BOREHOLE LOG

BOREHOLE NUMBER OW-1

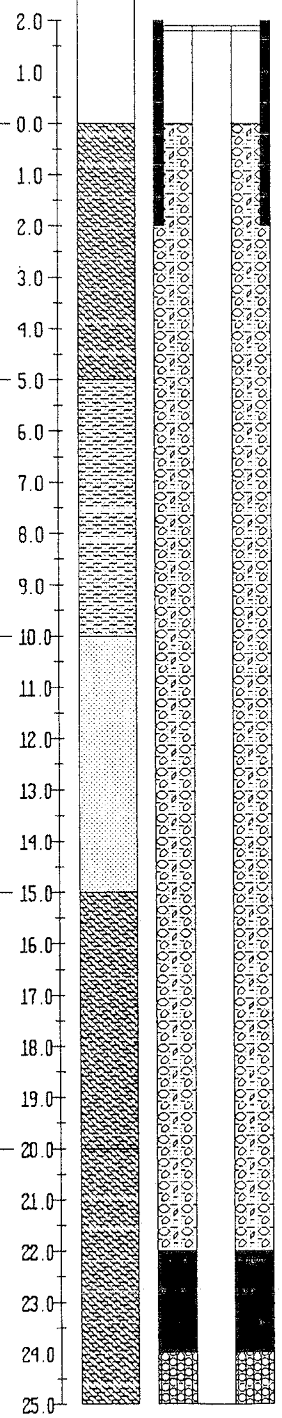
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 10/24/94 DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 771.05
TOTAL DEPTH 45.0
GROUND SURFACE ELEVATION 768
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 20.93 DB | 25.38 |
| Time | 8:45 | - |
| Date | 10/25/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 2 5 5 | Ss | S1 | | | | | SILTY CLAY: brown to tan; some manganese staining; roots in upper six inches. |
| 5.0 | 10 9 16 | Ss | S2 | | | | | SILTY SAND: with some clay; brown to light tan; some very weathered potassium feldspar and plagioclase; possibly some very weathered amphibole. |
| 10.0 | 6 9 11 | Ss | S3 | | | | | SAND: brown to tan; minor clay; horizontal manganese staining; one 2 inch thick layer of mica rich brown clay (mica schist). |
| 15.0 | 3 3 6 | Ss | S4 | W | | | | SILTY CLAY: weathered greenstone; some horizontal manganese stains; wet. |
| 20.0 | 6 12 30 | Ss | S5 | | | | | SILTY CLAY: dark green to black; weathered mafic rock; iron stained near top; dry. |
| 25.0 | 50/4 | Ss | S6 | | | | | |

DEPTH | LITHOLOGY | WELL INSTALLATION



# FIELD BOREHOLE LOG

| BOREHOLE NUMBER |
|---|
| OW-1 |

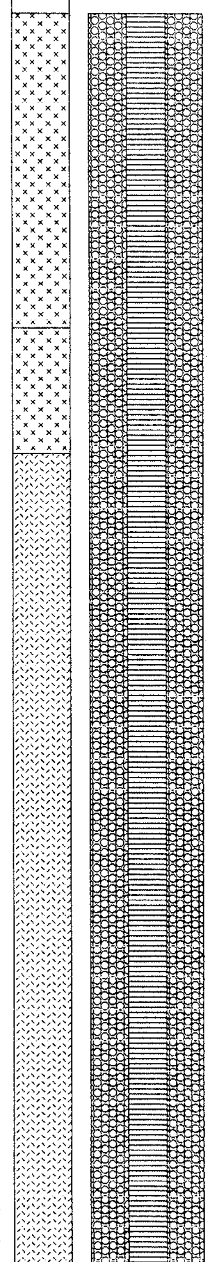
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD HOLLOW STEM AUGER/AIR ROTARY
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 10/24/94 DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 771.05
TOTAL DEPTH 45.0
GROUND SURFACE ELEVATION 768
SHEET 2 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 20.93 DB | 25.38 |
| Time | 8:45 | - |
| Date | 10/25/94 | 12/27/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 25.0 | 50/4 | Ss | S6 | | | | | MAFIC INTRUSIVE: weathered; dark greenish black | 25.0 |
| 30.0 | 25 36 45 | Ss | S7 | | | | | MAFIC INTRUSIVE: weathered; minor iron staining; some very fine felsic streaks; Auger Refusal at 32 feet. | 30.0 |
| 32.0–33.0 | | | | | | | | GRANITE: bedrock; white with some black staining, significant quartz and feldspar; Boring Terminated at 45 feet. | 32.0–33.0 |
| 45.0 | | | | | | | | | 45.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-2

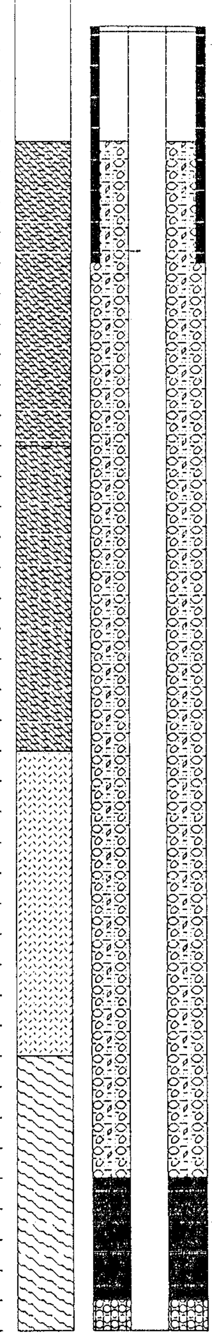
PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE WITH AIR/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN 10/25/94 DATE COMPLETED 10/25/94

TOP OF CASING ELEVATION 769.95
TOTAL DEPTH 40.0
GROUND SURFACE ELEVATION 767
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 22.94 WD | 16.8 |
| Time | 12:45 | - |
| Date | 10/25/94 | 11/3/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 2.0 | | | | | | | | | 2.0 |
| 1.0 | | | | | | | | | 1.0 |
| 0.0 | 6<br>5<br>4 | Ss | S1 | | | | | SILTY CLAY: brown to tan; some broken glass in split spoon. | 0.0 |
| 1.0 | | | | | | | | | 1.0 |
| 2.0 | | | | | | | | | 2.0 |
| 3.0 | | | | | | | | | 3.0 |
| 4.0 | | | | | | | | | 4.0 |
| 5.0 | 11<br>21<br>28 | Ss | S2 | | | | | SANDY SILTY CLAY: light tan; some very weathered rock at 5 feet; some feldspar clay. | 5.0 |
| 6.0 | | | | | | | | | 6.0 |
| 7.0 | | | | | | | | | 7.0 |
| 8.0 | | | | | | | | | 8.0 |
| 9.0 | | | | | | | | | 9.0 |
| 10.0 | 26<br>27<br>38 | Ss | S3 | | | | | GRANITE: very weathered; potassium feldspar and plagioclase; some manganese staining; little to no biotite; some weathered chlorite present. | 10.0 |
| 11.0 | | | | | | | | | 11.0 |
| 12.0 | | | | | | | | | 12.0 |
| 13.0 | | | | | | | | | 13.0 |
| 14.0 | | | | | | | | | 14.0 |
| 15.0 | 31<br>36<br>50/6" | Ss | S4 | | | | | GREENSTONE: tan/brown; some iron staining; weathered; minor feldspar clay. | 15.0 |
| 16.0 | | | | | | | | | 16.0 |
| 17.0 | | | | | | | | | 17.0 |
| 18.0 | | | | | | | | | 18.0 |
| 19.0 | | | | | | | | | 19.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-2

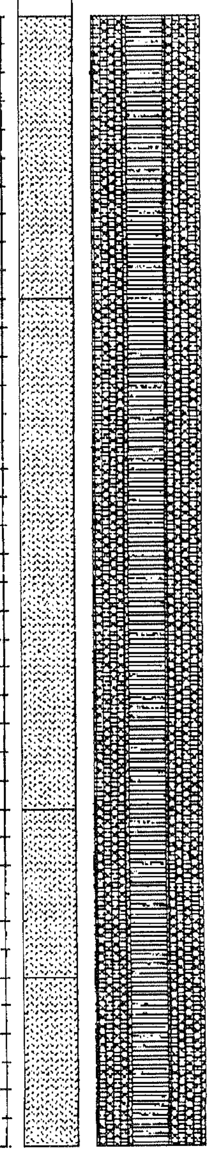
PROJECT NUMBER: 94016
PROJECT NAME: CITY OF GREENSBORO
LOCATION: GREENSBORO, NORTH CAROLINA
DRILLING COMPANY: ENGINEERING TECTONICS
RIG TYPE & NUMBER: MOBILE DRILL ATV RIG
DRILLING METHOD: ROLLER CONE WITH AIR/AIR HAMMER
WEATHER: SUNNY
FIELD PARTY: RON BARRON
GEOLOGIST: J. FINKBEINER
DATE BEGUN: 10/25/94 DATE COMPLETED: 10/25/94

TOP OF CASING ELEVATION: 769.95
TOTAL DEPTH: 40.0
GROUND SURFACE ELEVATION: 767
SHEET: 2 OF: 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 22.94 WD | 16.8 |
| Time | 12:45 | - |
| Date | 10/25/94 | 11/3/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTENCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 20.0 | 50/4" | Ss | S5 | | | | | GRANITE: potassium feldspar; plagioclase, some amphibole | 20.0 |
| 25.0 | 50/0" | Ss | S6 | | | | | GRANITE: some water; Roller Cone refusal at 25 feet. | 25.0 |
| 34.0 | | | | | | | | GRANITE: harder than above. | 34.0 |
| 37.0 | | | | | | | | GRANITE: very hard; good water bearing fracture at 38 feet. Boring Terminated at 40 feet. | 37.0 |
| 40.0 | | | | | | | | | 40.0 |

LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-3

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE WITH AIR/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN
DATE COMPLETED 10/25/94

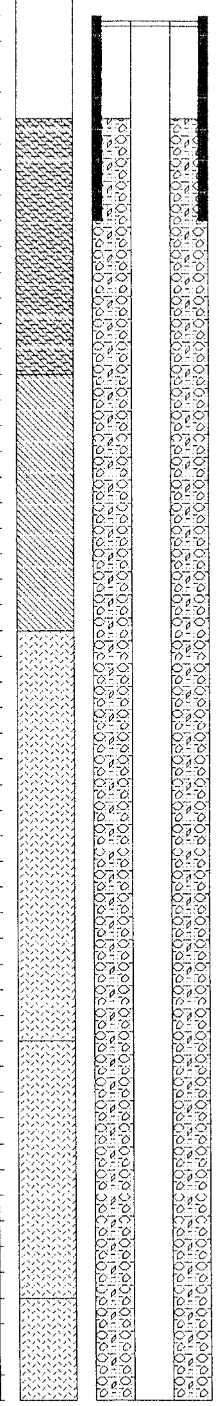
TOP OF CASING ELEVATION 762
TOTAL DEPTH 48.0
GROUND SURFACE ELEVATION 759
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 23 DRY WD | 15.11 |
| Time | | |
| Date | 10/25/94 | 11/3/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 9 8 6 | Ss | S1 | | | | | CLAY AND SILT: buff to tan; some roots in split spoon. |
| 5.0 | 50/6 | Ss | S2 | | | | | SAND AND CLAY: light tan; minor mica; some very weathered rock; some feldspar clay; hard drilling @ 7 feet. |
| 10.0 | 50/3 | Ss | S3 | | | | | GRANITE: very weathered; quartz; feldspar; roller bill refusal at 11.0 feet. |
| 18.0 | | | | | | | | GRANITE: hard; feldspar; potassium feldspar. |
| 23.0 | | | | | | | | GRANITE: possibly granodiorite; rock is granitic but has more mafic constituents than above. |

Depth scale: 2.0, 1.0, 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0, 24.0, 25.0

DEPTH / LITHOLOGY / WELL INSTALLATION



# FIELD BOREHOLE LOG

BOREHOLE NUMBER: OW-3

PROJECT NUMBER 94016
PROJECT NAME CITY OF GREENSBORO
LOCATION GREENSBORO, NORTH CAROLINA
DRILLING COMPANY ENGINEERING TECTONICS
RIG TYPE & NUMBER MOBILE DRILL ATV RIG
DRILLING METHOD ROLLER CONE WITH AIR/AIR HAMMER
WEATHER SUNNY
FIELD PARTY RON BARRON
GEOLOGIST J. FINKBEINER
DATE BEGUN
DATE COMPLETED 10/25/94

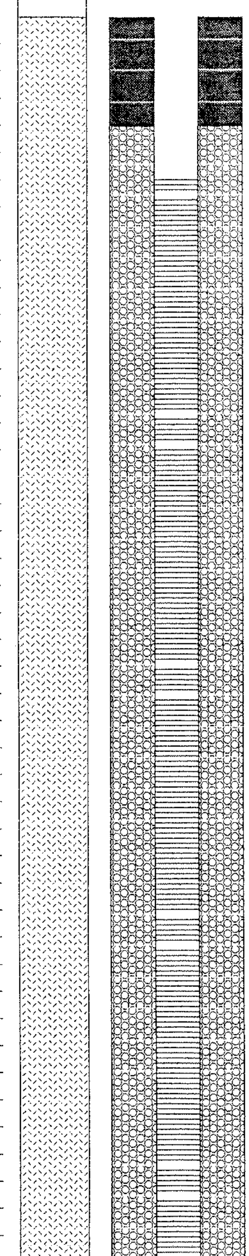
TOP OF CASING ELEVATION 762
TOTAL DEPTH 48.0
GROUND SURFACE ELEVATION 759
SHEET 1 OF 2

| STATIC WATER LEVEL (BLS) | | |
|---|---|---|
| WD=While Drilling AB=After Boring | | |
| Depth(ft) | 23 DRY WD | 15.11 |
| Time | | |
| Date | 10/25/94 | 11/3/94 |

| DEPTH | BLOW COUNTS | SAMPLING METHOD | SAMPLE NUMBER | MOISTURE | CONSISTANCY | SAMPLE RECOVERY | DRILL METHOD | LITHOLOGY DESCRIPTION | DEPTH |
|---|---|---|---|---|---|---|---|---|---|
| 25.0 – 48.0 | | | | | | | | GRANITE: possibly granodiorite; rock is granitic but has more mafic constituents than above; water bearing zones at 28, 33 and 44 feet below grade; each zone produces more water than the one above it. | 25.0 – 48.0 |
| 48.0 | | | | | | | | Boring Terminated at 48 feet. | 48.0 |

Depth scale: 25.0, 26.0, 27.0, 28.0, 29.0, 30.0, 31.0, 32.0, 33.0, 34.0, 35.0, 36.0, 37.0, 38.0, 39.0, 40.0, 41.0, 42.0, 43.0, 44.0, 45.0, 46.0, 47.0, 48.0, 49.0, 50.0

LITHOLOGY / WELL INSTALLATION



| OWNER | BORING NUMBER |
|---|---|
| City of Greensboro | B-11 (GSO-11) |
| **PROJECT NAME** Greensboro Landfill | **ARCHITECT-ENGINEER** MW-11 |

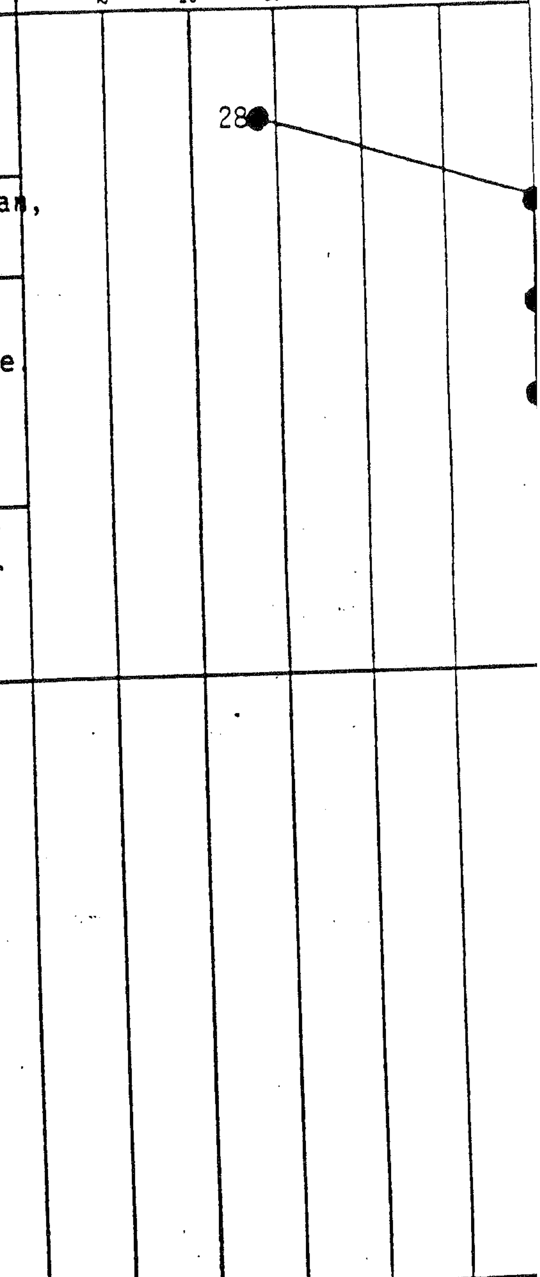
| SITE LOCATION | JOB. NO. |
|---|---|
| Greensboro, NC | 88-387-E |

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1, 2, 3, 4, 5)

PLASTIC LIMIT % X ---- WATER CONTENTS % ⊕ ---- LIQUID LIMIT % △ (10, 20, 30, 40, 50)

● STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

| DEPTH IN FEET | SAMPLE NO. | SAMPLE TYPE | SAMPLE DEPTH FROM-TO | DESCRIPTION OF MATERIAL<br>SURFACE ELEVATION |
|---|---|---|---|---|
| | 1 | ss | 2.5<br>4.0 | SILT, w/little sand, brown, black, tan, mottled, firm, (ML). NOTE: Residual Soil/Saprolite with trace quartz rock fragments. |
| 5 | 2 | ss | 5.0<br>6.5 | CLAYEY SILT, w/trace sand, brown, tan, v/hard, (ML). NOTE: Residual Soil/ Saprolite. |
| | 3 | ss | 7.5<br>9.0 | SANDY SILT, w/trace clay, green, brown, black, tan, v/hard, (ML). NOTE: Saprolite/Weathered greenstone. |
| 10 | 4 | ss | 10.0<br>11.5 | |
| 15 | 5 | ss | 15.0<br>16.5 | NOTE: Layered weathered greenstone/ schist (sample described from auger cuttings). |
| 20 | | | | Auger Refusal at 17.5'. |
| 25 | | | | |
| 30 | | | | |




THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU. THE TRANSITION MAY BE GRADUAL

| WATER TABLE DATA — DEPTH BELOW SURFACE | BORING STARTED 4-11-89 | | BORING COMPLETED 4-13-89 | |
|---|---|---|---|---|
| Dry (BAR) ● 0 HRS.<br>15.81' ● Below TOC HRS.<br>7-12-89 | RIG B-50 | FOREMAN R. Barron | APP'D BY ABN | AUGER 6" HSA |

**ENGINEERING TECTONICS, P. A.**

Division of Health Services

# WELL COMPLETION RECORD

COMPLETE ALL INFORMATION REQUESTED BELOW FOR EACH WELL INSTALLED, AND RETURN FORM TO THE N.C. D[illegible]RTMENT OF HUMAN RESOURCES, SOLID AND HAZARDOUS WASTE MANAGEMENT BRANCH, P.[illegible] BOX 2091, RALEIGH, N.C. 27602

NAME OF SITE: Greensboro Landfill

PERMIT NO.: Well No. 11

ADDRESS: Off White Street in Greensboro, NC

OWNER (print): City Of Greensboro

DRILLING CONTRACTOR: Engineering Tectonics, P.A.

REGISTRATION NO.: 835

Casing Type: SCH 80 PVC dia. 4 in.
Casing Depth: from 0 to 19.5 ft. - dia. 4 in.
Screen Type: Bedrock Open Hole dia. 2 in.
Screen Depth: from - to - ft. - dia. - in.

Grout Depth: from 0 to 19.5 ft. - dia. 6 in.
Bentonite Seal: from - to - ft. - dia. - in.
Sand/Gravel PK: from - to - ft. - dia. - in.
Total Well Depth: from 0 to 100.5 ft. - dia. 2 in.

Date Measured 7 / 12 / 89

Static Water Level: 19.81 feet from top of casing

Casing is 1.40 feet above land surface

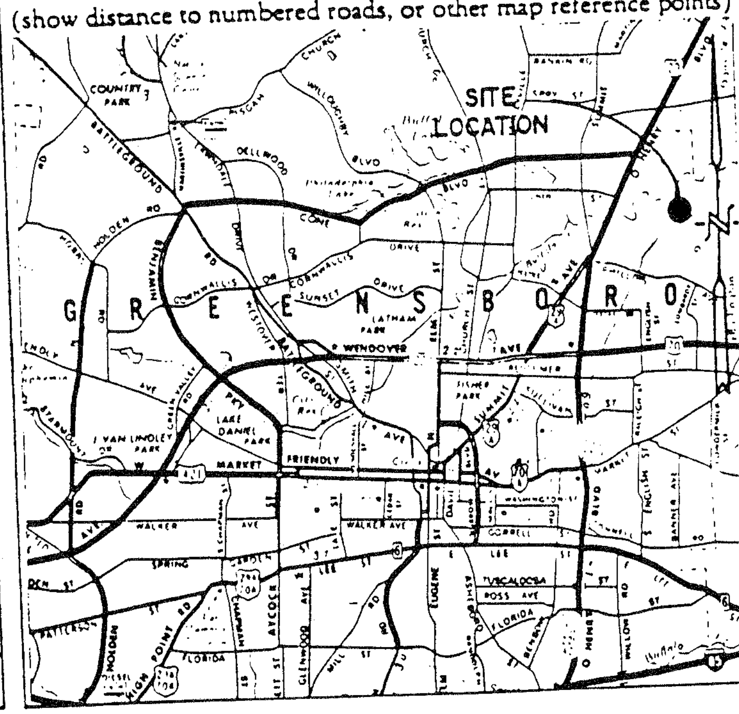
Yield (gpm): Moderate Method of Testing: Bail

## DRILLING LOG

| DEPTH FROM | TO | FORMATION DESCRIPTION |
|---|---|---|
| | | See Attached Boring Log/Core Log |

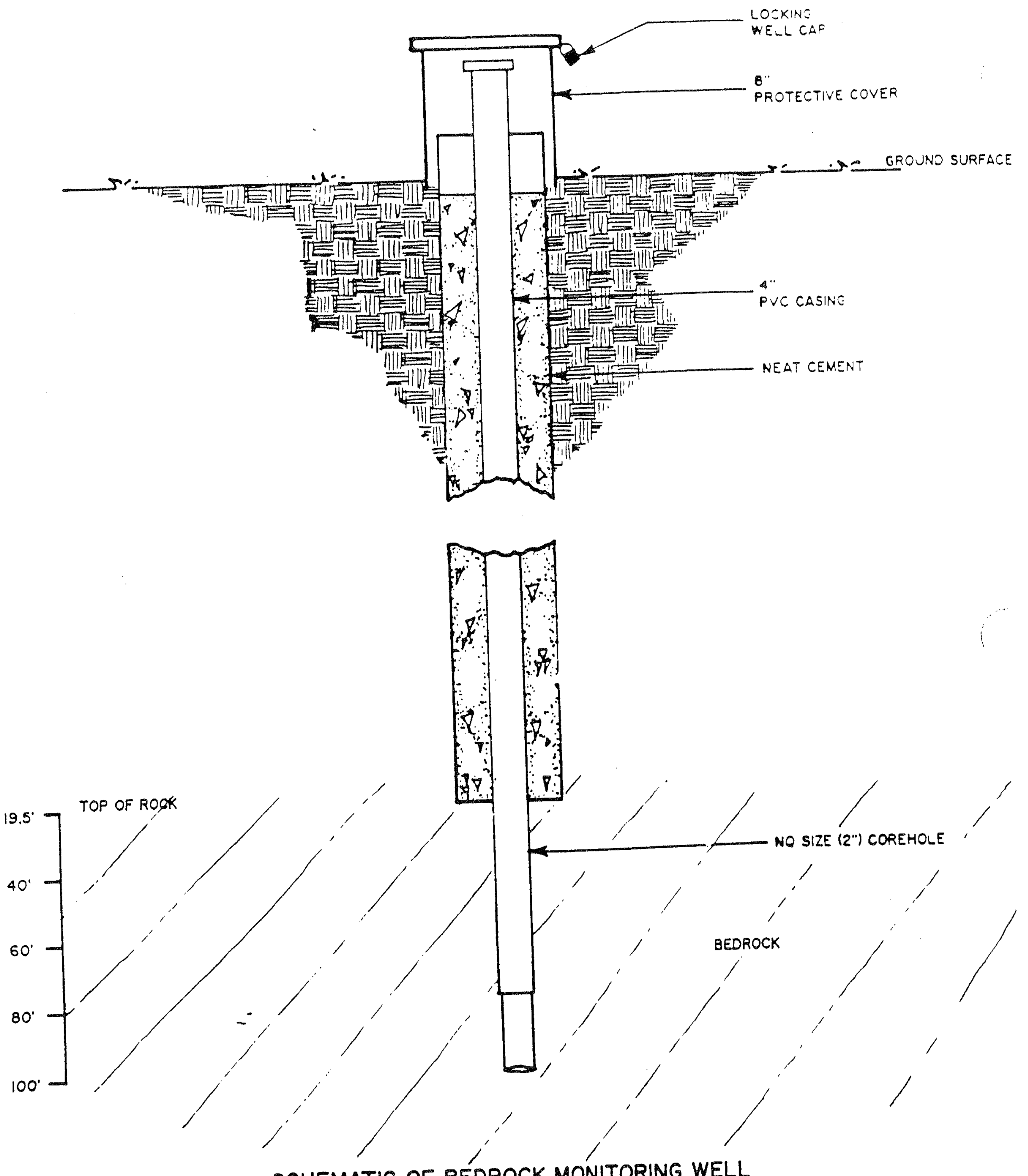
## LOCATION SKETCH

(show distance to numbered roads, or other map reference points)




REMARKS:

DATE: 7-14-89 SIGNATURE:




SCHEMATIC OF BEDROCK MONITORING WELL
MW - 11
NOT TO SCALE

| PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018 | |
|---|---|---|
| LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: MW-13 | PAGE: 1 OF 1 |
| BORING LOG | | DATE: 1/6/93 |

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-01<br>SS-02 | 4'<br>8'<br>12'<br>16'<br>20'<br>24'<br>28'<br>32' | 53<br>82+ | SS<br>SS | | | 0-1.0' TOPSOIL; 0-0.5' THEN ORANGE SLIGHTLY SANDY SILT 1-2.5' ORANGE CLAYEY, MICACEOUS SANDY SILT; 1.5-2.5' VERY HARD, BROWN AND BLACK SLIGHTLY SANDY, SLIGHTLY CLAYEY SILT, PARTIALLY WEATHERED ROCK<br><br>3.5-5.0' BROWN AND BLACK, FINE-GRAINED SLIGHTLY SANDY SILT, VERY HARD PARTIALLY WEATHERED ROCK<br>AUGER REFUSAL AT 5.0'<br>MUD ROTARY DRILLING 5.0-18.5' BG<br><br>CORE DRILLED FROM 18.5-32.5' OBTAINED 14.0' OF NX CORE (SEE CORE LOG) | SAPROLITE<br><br>PARTIALLY WEATHERED ROCK<br><br>BEDROCK |
| | 36'<br>40' | | | | | TD = 32.5' | |

BOREHOLE COMPLETION: XXX

WATER DEPTH: 718.5 DATE:

DRILLING METHOD: 6 1/4" HOLLOW-STEM AUGER, TRICONE BIT

LOGGED BY: CHARLES G. LEE, PG

KEY:
- SI - SCREEN
- SS - SPLITSPOON
- SPT - SOIL PENETRATION TEST-N NUMBER
- ST - SHELBY TUBE
- T - TYPE
- WL - WATER LEVEL

HDR

| PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018 | |
|---|---|---|
| LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: B-46 | PAGE: 1 |
| BORING LOG | | DATE: 10/6/95 |

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ST-46 | | NA | ST | | | PARTIALLY WEATHERED ROCK AND SAPROLITE (GRANITIC), 24" RECOVERY | GRANITIC INTRUSIVE |
| SS-46/1 | 4' | 6 | SS | | | WHITE AND GRAY CLAYEY SAND (SC), PARTIALLY WEATHERED ROCK (QUARTZ/ FELDSPAR), DRY | |
| | 8' | | | | | T.D. 5.0' | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: WASH BORING TO 1' BLS, ST AND SS SAMPLING

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: B-47 | PAGE: 1

# BORING LOG

DATE: 10/6/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| BP-47 | | | PB | | | PARTIALLY WEATHERED GRANITIC ROCK AND SAPROLITE, ABUNDANT FELDSPAR, BRITTLE, DRY, MOTTLED | GRANITIC INTRUSIVE |
| SS-47/1 | 4' | 50+ | SS | | | WHITE AND GRAY PARTIALLY WEATHERED ROCK AND CLAYEY SAND (SAPROLITE), GRANITIC TEXTURE, DRY, BRITTLE | |
| | 8' | | | | | T.D. 5.0' | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA | DATE: 10/6/95

DRILLING METHOD: PB SAMPLER AND SS SAMPLER

LOGGED BY: J. ISHAM

KEY:

PB - PITCHER BARREL
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL    PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C.    BORING NUMBER: B-48    PAGE: 1

BORING LOG    DATE: 10/6/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-48/1 | | 16 | SS | | | LIGHT GREEN CLAYEY SAND (SC), PHANERITIC TEXTURE, SOFT, FINE GRAINED, DRY | MAFIC INTRUSIVE |
| SS-48/2 | 4' | 33 | SS | | | LIGHT GREEN SAND (SM) WITH MINOR CLAY, SOFT, IRON OXIDE STAINED FRACTURE TRACES, DRY | |
| | | | | | | T.D. 5.0' | |
| | 8' | | | | | | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA    DATE:

DRILLING METHOD: WASH BORING (6"), SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL — PROJECT NO: 06770-021-018

LOCATION: WHITE STREET, GREENSBORO, NC — BORING NUMBER: B-49 — PAGE: 1

BORING LOG — DATE: 10/6/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-49/1 | | 25 | SS | | | LIGHT GREEN SILT (ML), UNIFORM PHANERITIC TEXTURE, SOFT, SLIGHTLY CLAYEY, IRON OXIDE STAINING, NEARLY VERTICAL VEIN FILLINGS | INTERMEDIATE IGNEOUS INTRUSIVE (DIORITE) |
| SS-49/2 | 4' | 50+ | SS | | | | |
| | | | | | | T.D. 5.0' | |
| | 8' | | | | | | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA — DATE:

DRILLING METHOD: WASH BORING (6'), SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI – SCREEN
SS – SPLITSPOON
SPT – SOIL PENETRATION TEST–N NUMBER
ST – SHELBY TUBE
T – TYPE
WL – WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL — PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. — BORING NUMBER: B-50 — PAGE: 1

# BORING LOG

DATE: 10/9/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-50/1 | | 20 | SS | | | LIGHT BROWN TO TAN CLAYEY SAND(SC), RELICT GNEISSIC BANDING, MOTTLED, MOIST, NEARLY VERTICAL FOLIATION (QUARTZ, BIOTITE, FELDSPAR) | SHELBY TUBE FROM GROUND SURFACE TO 3' BLS. |
| SS-50/2 | 4' | 50/4" | SS | | | WEATHERED GRANITIC ROCK FRAGMENTS, 2" RECOVERED (GNEISSIC FOLIATION) | FELSIC GRANITIC GNEISS |
| | | | | | | T.D. 6.0' AUGER REFUSAL | |
| | 8' | | | | | | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 6.0' BELOW LAND SURFACE

WATER DEPTH: NA — DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS AND ST SAMPLERS

LOGGED BY: J. ISHAM

KEY:

- SI – SCREEN
- SS – SPLITSPOON
- SPT – SOIL PENETRATION TEST-N NUMBER
- ST – SHELBY TUBE
- T – TYPE
- WL – WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, NC | BORING NUMBER: B-51 | PAGE: 1

BORING LOG | DATE: 10/9/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-51/1 | | 6 | SS | | | REDDISH-ORANGE TO BROWN CLAY (CL) ROOTED, NO STRUCTURE | FILL MATERIAL |
| SS-51/2 | 4' | 50/5" | SS | | | BROWN CLAYEY SAND (SC), WEATHERED GNEISS FRAGMENTS, FOLIATION IN ROCK SAMPLES, DRY, BRITTLE | FELSIC GRANITIC GNEISS |
| SS-51/3 | | 31 | SS | | | GREEN SILTY CLAY (CL), VERY BRITTLE, DRY, MINOR HORIZONTAL PARTINGS, MOTTLED | MAFIC INTRUSIVE |
| SS-51/4 | 8' | 31 | SS | | | GREEN SILTY CLAY (CL), PHANERITIC TEXTURE, VERY DRY, BRITTLE, WEATHERED | |
| | 12' | | | | | T.D. 10.0' | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA | DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL — PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. — BORING NUMBER: B-52 — PAGE: 1

# BORING LOG

DATE: 10/9/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| | | | | | | LIGHT BROWN TO TAN SANDY CLAY (CL), MOIST, ROCK FRAGMENTS, NO STRUCTURE | FILL MATERIAL |
| SS-52/1 | | 6 | SS | | | | |
| SS-52/2 | 4' | 26 | SS | | | GREEN SILTY CLAY (CL), PHANERITIC TEXTURE, MOTTLED WHITE AND BLACK, SOFT, DRY | INTERMEDIATE IGNEOUS INTRUSIVE (DIORITE) |
| SS-52/3 | | 22 | SS | | | LIGHT GREEN TO BROWN SILTY CLAY (CL), VERTICAL IRO-STAINED FRACTURES, PHANERITIC TEXTURE, SOFT, DRY | |
| SS-52/4 | 8' | 22 | SS | | | SAME AS ABOVE, SLIGHTLY BRITTLE IN NATURE | |
| | 12' | | | | | T.D. 10.0' | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA — DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
- SI - SCREEN
- SS - SPLITSPOON
- SPT - SOIL PENETRATION TEST-N NUMBER
- ST - SHELBY TUBE
- T - TYPE
- WL - WATER LEVEL

HDR

| PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021 -018 | |
|---|---|---|
| LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: B-53 | PAGE: 1 |
| BORING LOG | | DATE: 10/6/95 |

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| ST-53 | | | ST | | | GREENISH-BROWN PARTIALLY WEATHERED ROCK AND SAPROLITE (SILTY SAND), IRON STAINING, NEARLY VERTICAL FRACTURES, CLAY PARTINGS BETWEEN FRACTURES | MAFIC INTRUSIVE |
| | 4' | | | | | GREENISH-BROWN PARTIALLY WEATHERED ROCK AND SAPROLITE (SILTY SAND), IRON STAINING, CLAY PARTINGS BETWEEN FRACTURES | |
| SS-53/1 | | 9 | SS | | | | |
| | 8' | | | | | SAME AS ABOVE WITH LAYERING OF SILTY CLAY (CL) AND WEATHERED ROCK, MOIST | |
| SS-53/2 | | 8 | SS | | | | |
| | 12' | | | | | T.D. 10.0' | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: WASH BORING (6"), ST AND SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

| PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018 | |
|---|---|---|
| LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: B-54 | PAGE: 1 |
| BORING LOG | | DATE: 10/6/95 |

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-54/1 | | 10 | SS | | | LIGHT TAN TO WHITE CLAY SAND (SC), RELICT PHANERITIC TEXTURE, MOTTLED, SOFT, SLIGHTLY BRITTLE, DRY | GRANITIC INTRUSIVE |
| SS-54/2 | 4' | 25 | SS | | | SAME AS ABOVE, MORE WEATHERED ROCK FRAGMENTS | |
| | | | | | | T.D. 5.0' | |
| | 8' | | | | | | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 5.0' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL    PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C.    BORING NUMBER: B-55    PAGE: 1 OF 1

# BORING LOG

DATE: 10/9/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-55/1 | | 11 | SS | | | GREENISH-GRAY CLAYEY SAND (SC), RELICT PHANERITIC TEXTURE, ABUNDANT MAFIC MINERALS KAOLINITE ABUNDANT, IRON STAINING, DRY | GNEISS |
| SS-55/2 | 4' | 17 | SS | | | GREENISH-GRAY CLAYEY SAND (SC), DRY | |
| SS-55/3 | | 40 | SS | | | GREENISH-GRAY CLAYEY SAND (SC), DRY, WEATHERED ROCK FRAGMENTS | |
| | 8' | | | | | TD = 8.5 FT. | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 8.5 FT BELOW LAND SURFACE

WATER DEPTH: NA    DATE:

DRILLING METHOD: 3 1/4" HOLLOW-STEM AUGER, SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: B-56 | PAGE: 1

# BORING LOG

DATE: 10/6/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-56/1 | | 3 | SS | | | REDDISH-ORANGE AND YELLOW SILTY CLAY (CL), SLIGHTLY MICACEOUS, MANGANESE OXIDE STAINING | |
| SS-56/2 | 4' | 10 | SS | | | TAN TO BROWN CLAYEY SAND (SC), MANGANESE VEINLETS, MOTTLED, 2.5" GRANITIC VEIN AT 4.0', DRY, SOFT | FELSIC |
| SS-56/3 | | 4 | SS | | | REDDISH-ORANGE SILTY CLAY (CL), VERTICAL MANGANESE VEINS, DRY, SOFT, SLIGHTLY MICACEOUS, MOTTLED | GNEISS |
| SS-56/4 | 8' | 4 | SS | | | | |
| | | | | | | T.D. 10.0' | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA | DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGER, SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETR... TEST-N NUM...
ST - SHELBY TU...
T - TYPE
WL - WATER LEV...

HD...

PROJECT: GREENSBORO SOLID WASTE LANDFILL    PROJECT NO: 6770-021-018

LOCATION: WHITE STREET, GREENSBORO, N.C.    BORING NUMBER: B-57    PAGE: 1

# BORING LOG

DATE: 10/9/95

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-57/1 | | 9 | SS | | | GREENISH-GRAY CLAYEY SAND (SC), RELICT PHANERITIC TEXTURE, ABUNDANT MAFIC MINERALS, KAOLINITE ABUNDANT, IRON STAINING, DRY | |
| SS-57/2 | 4' | 48 | SS | | | GREENISH-GRAY CLAYEY SAND (SC), DRY | MAFIC INTRUSIVE - GREENSTONE DIKE |
| SS-57/3 | | 11 | SS | | | GREENISH-GRAY CLAYEY SAND (SC), DRY | |
| | 8' | | | | | | |
| SS-57/4 | | 50/3" | SS | | | SAME AS ABOVE, WEATHERED ROCK FRAGMENTS | |
| | | | | | | T.D. 10.0' | |
| | 12' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 10.0' BELOW LAND SURFACE

WATER DEPTH: NA    DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGER, SS SAMPLER

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRA[TION] TEST-N NUMB[ER]
ST - SHELBY TU[BE]
T - TYPE
WL - WATER LEV[EL]

| PROJECT: GREENSBORO SOLID WASTE LANDFILL | PROJECT NO: 6770-021-018 | |
|---|---|---|
| LOCATION: WHITE STREET, GREENSBORO, N.C. | BORING NUMBER: B-58 | PAGE: 1 |
| BORING LOG | | DATE: 10/6/95 |

| NUMBER | DEPTH | SPT | T | WL | SI | DESCRIPTION (USCS) | COMMENTS |
|---|---|---|---|---|---|---|---|
| SS-58/1 | | 6 | SS | | | REDDISH-BROWN SANDY CLAY (CL), SOFT, MOIST, SLIGHTLY PLASTIC | BAG SAMPLE FROM UPPER 5' |
| SS-58/2 | 4' | 10 | SS | | | TAN TO LIGHT BROWN SILTY SAND (SM), UNIFORM PHANERITIC TEXTURE, DRY | GRANITIC INTRUSIVE |
| SS-58/3 | | 50+ | SS | | | PARTIALLY WEATHERED GRANITIC ROCK, BRITTLE, DRY, MOTTLED APPEARANCE | AUGER REFUSAL |
| | 8' | | | | | T.D. 7.5' | |
| | 12' | | | | | | |
| | 16' | | | | | | |
| | 20' | | | | | | |
| | 24' | | | | | | |
| | 28' | | | | | | |
| | 32' | | | | | | |
| | 36' | | | | | | |
| | 40' | | | | | | |

BOREHOLE COMPLETION: 7.5' BELOW LAND SURFACE

WATER DEPTH: NA DATE:

DRILLING METHOD: 3 1/4" HOLLOW STEM AUGERS, SS SAMPLERS

LOGGED BY: J. ISHAM

KEY:
SI - SCREEN
SS - SPLITSPOON
SPT - SOIL PENETRATION TEST-N NUMBER
ST - SHELBY TUBE
T - TYPE
WL - WATER LEVEL

HDR

# APPENDIX D

# SOIL LABORATORY DATA

# APPENDIX E

# SLUG TEST DATA

**HDR Engineering, Inc.**

Client: White Street Landfill

Project: Rising Head Tests

Project No. 06770-021-018
Sheet 1/1
Date: 11/27/95
Well B-1
Reference: Bouwer, 1989

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 19.63 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 10 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 33 | |
| Yo = Relative Ht. of Water at Time Zero = | 0.31 | |
| Yt = Relative Ht. of Water at Time t = | 0.085 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 0.8333 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)
Req = 0.083

Evaluation of A & B
Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

Determination of ln Term

ln Re/Rw = 2.343951

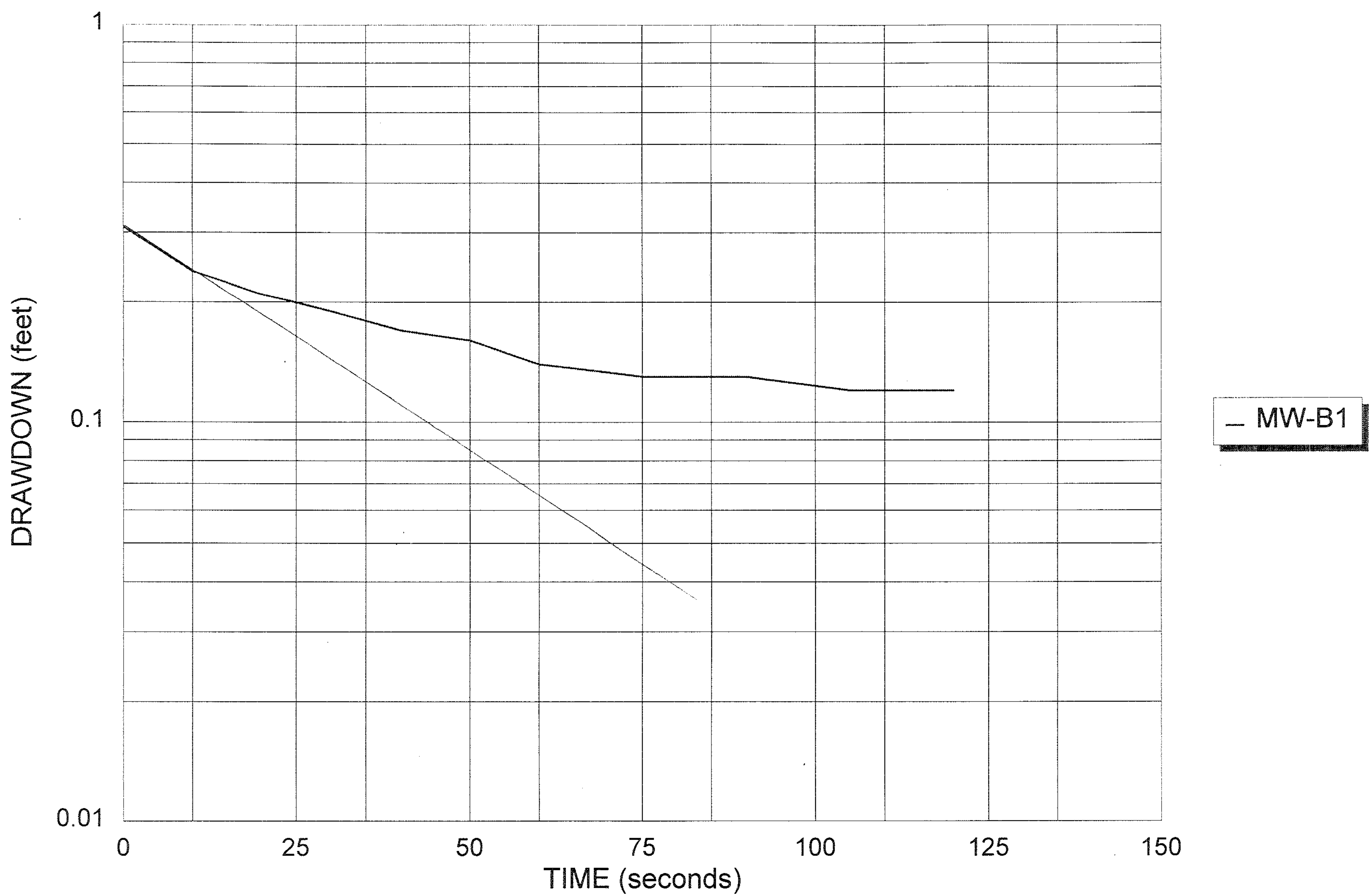
Determination of Hydraulic Conductivity

**K = 0.001254 feet/min.**

**1.805276 feet/day** = $6.369 \times 10^{-4}$ cm/sec

# RISING HEAD TEST: MW-B1

## Greensboro White Street Landfill



**HDR Engineering, Inc.**

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-1 |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 19.56 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 10 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 33 | |
| Yo = Relative Ht. of Water at Time Zero = | 0.25 | |
| Yt = Relative Ht. of Water at Time t = | 0.05 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 2.5 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

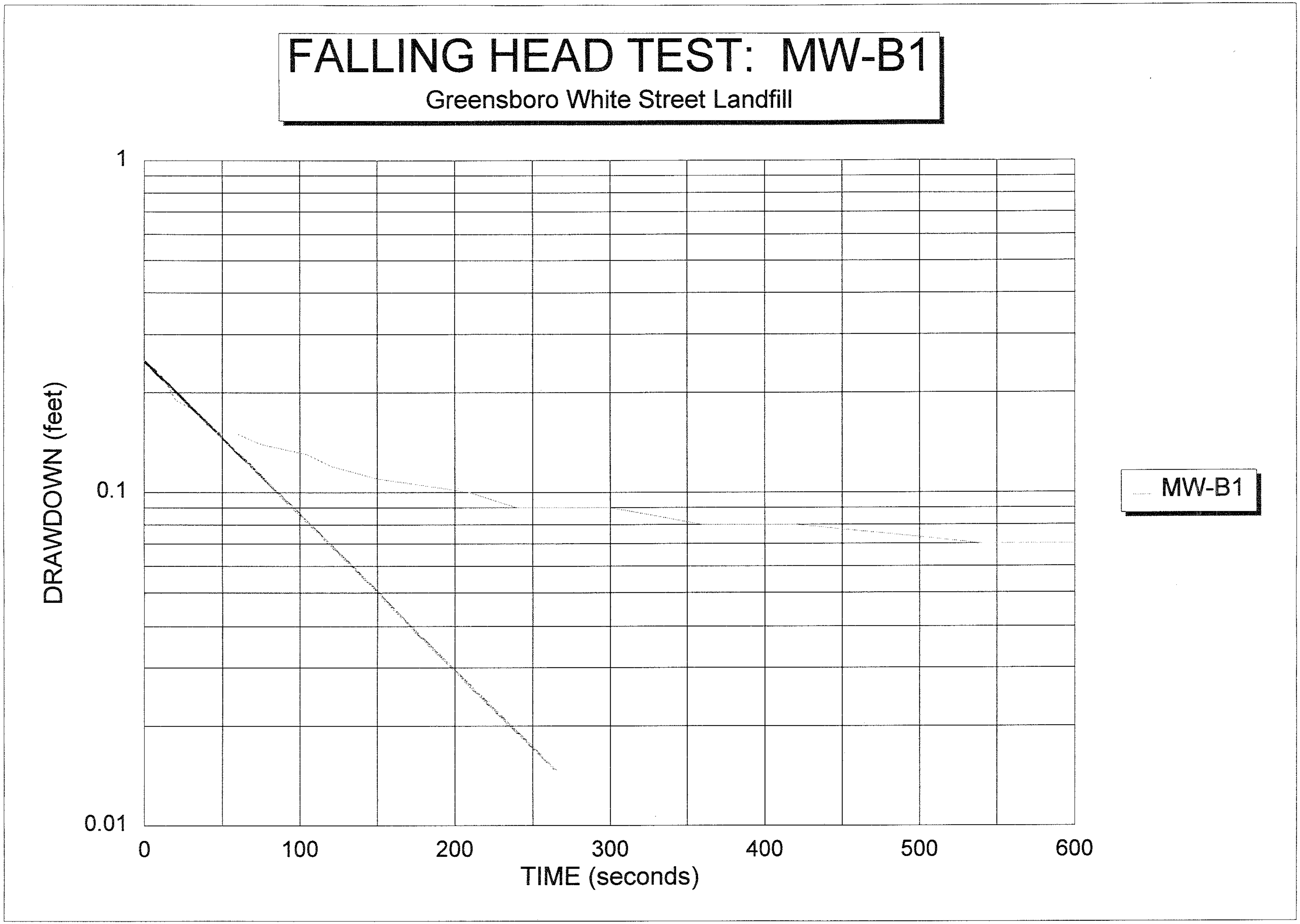
Determination of ln Term

ln Re/Rw = 2.342056

Determination of Hydraulic Conductivity

**K = 0.000519 feet/min.**

**0.74786 feet/day** $2.64 \times 10^{-4}$ cm/sec


FALLING HEAD TEST: MW-B1
Greensboro White Street Landfill
DRAWDOWN (feet)
1
0.1
0.01
0
100
200
300
400
500
600
TIME (seconds)
MW-B1

**HDR Engineering, Inc.**

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-14 |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where:** **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 11.73 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 10 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 16 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.24 | |
| Yt = Relative Ht. of Water at Time t = | 0.7 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 5 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

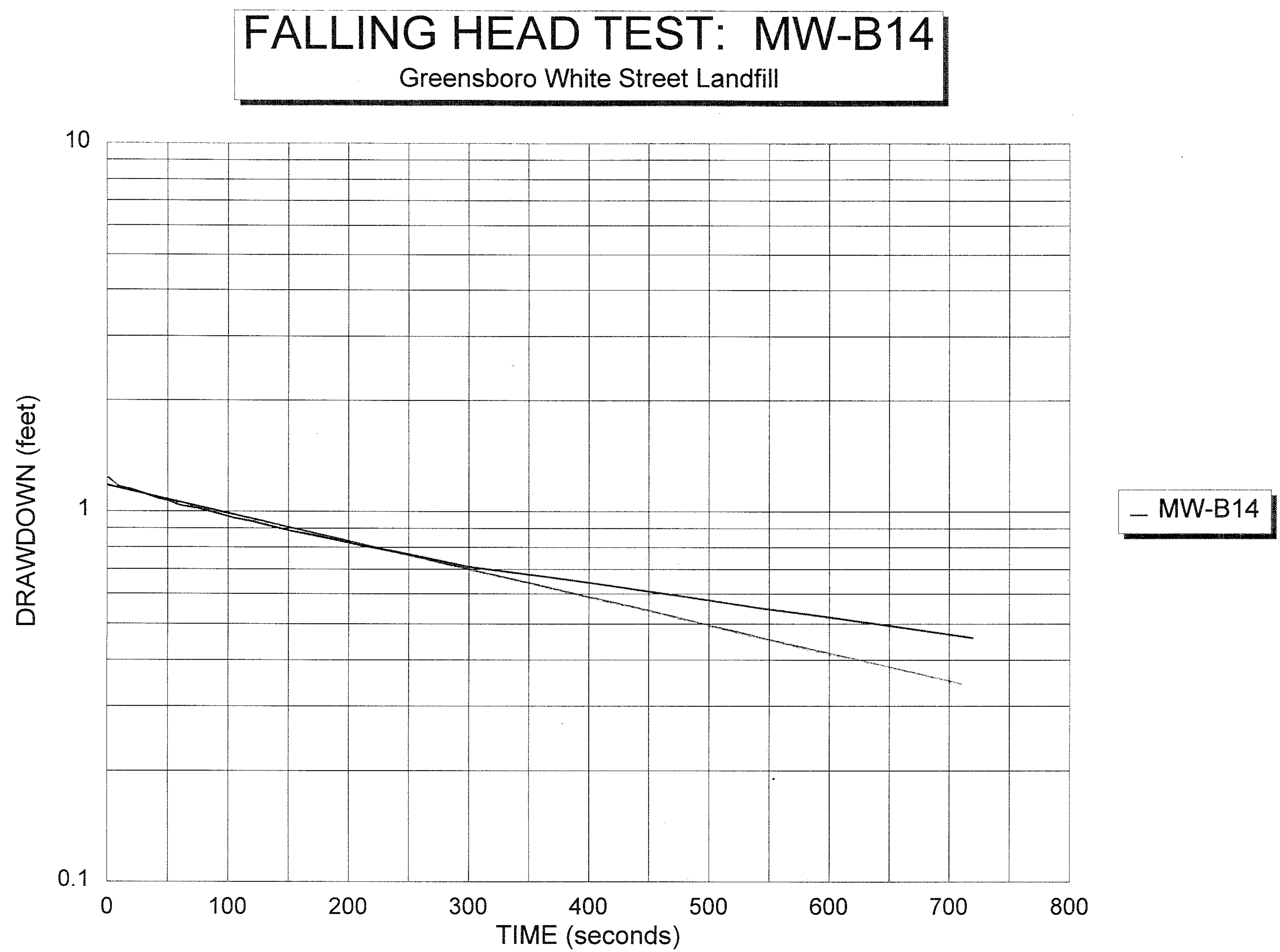
Determination of ln Term

ln Re/Rw = 2.233889

Determination of Hydraulic Conductivity

**K = 0.000088 feet/min.**

**0.126711 feet/day** = $4.47 \times 10^{-5}$ cm/sec


FALLING HEAD TEST: MW-B14
Greensboro White Street Landfill
10
1
0.1
DRAWDOWN (feet)
0
100
200
300
400
500
600
700
800
TIME (seconds)
MW-B14

**HDR Engineering, Inc.**

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-17d |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where:** **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 27.96 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 5 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 53 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.76 | |
| Yt = Relative Ht. of Water at Time t = | 0.8 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 3.33 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

| | |
|---|---|
| A = | 1.9 |
| B = | 0.38 |

Determination of ln Term

ln Re/Rw = 1.93288

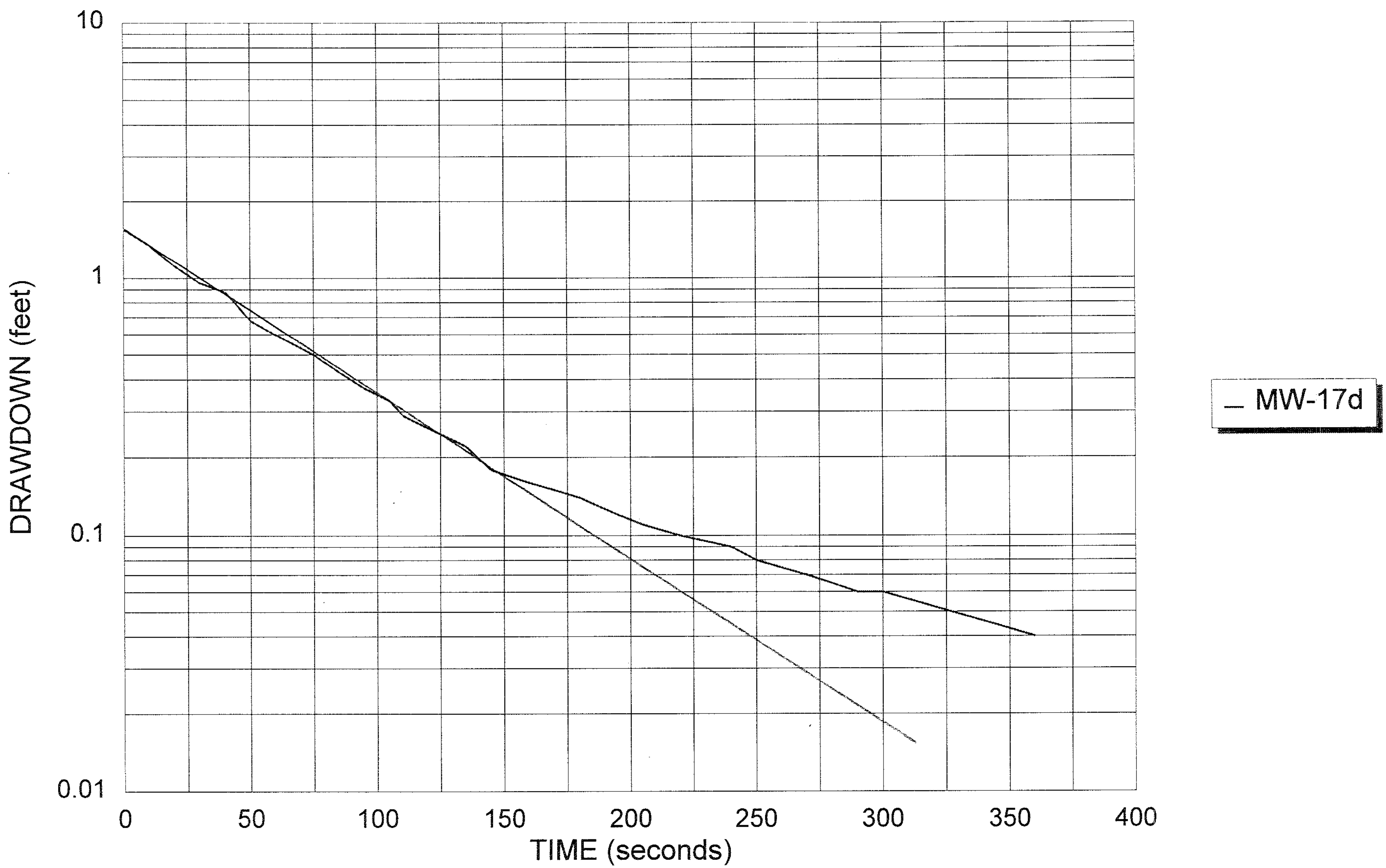
Determination of Hydraulic Conductivity

**K = 0.000315 feet/min.**

**0.454002 feet/day** = $1.60 \times 10^{-4}$ cm/sec

# FALLING HEAD TEST: MW-17d

Greensboro White Street Landfill



## HDR Engineering, Inc.

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Rising Head Tests | Date: | 11/27/95 |
| | | Well | B-22 |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where:** **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 20.89 | (water in |
| Le = Screen Interval Open to Aquifer = | 10 | casing) |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 31 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.62 | |
| Yt = Relative Ht. of Water at Time t = | 0.09 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 2.92 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

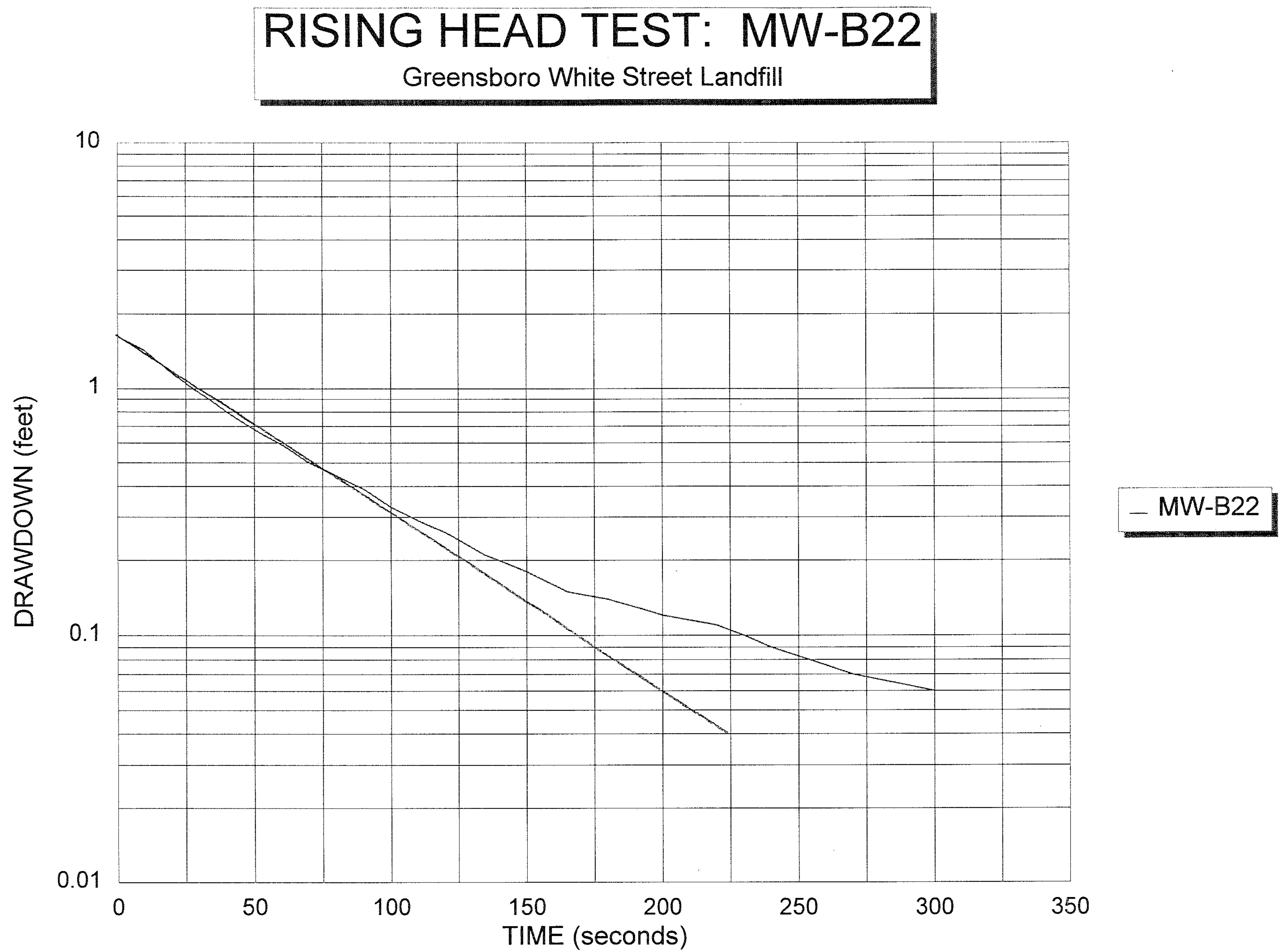
Determination of ln Term

ln Re/Rw = 2.396367

Determination of Hydraulic Conductivity

**K = 0.000817 feet/min.**

**1.176557 feet/day** = $4.15 \times 10^{-4}$ cm/sec


RISING HEAD TEST:  MW-B22
Greensboro White Street Landfill
DRAWDOWN (feet)
10
1
0.1
0.01
0
50
100
150
200
250
300
350
TIME (seconds)
MW-B22

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-22 |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where:** **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 20.87 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 10 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 31 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.56 | |
| Yt = Relative Ht. of Water at Time t = | 0.75 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 0.83 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

Determination of ln Term

ln Re/Rw = 2.395788

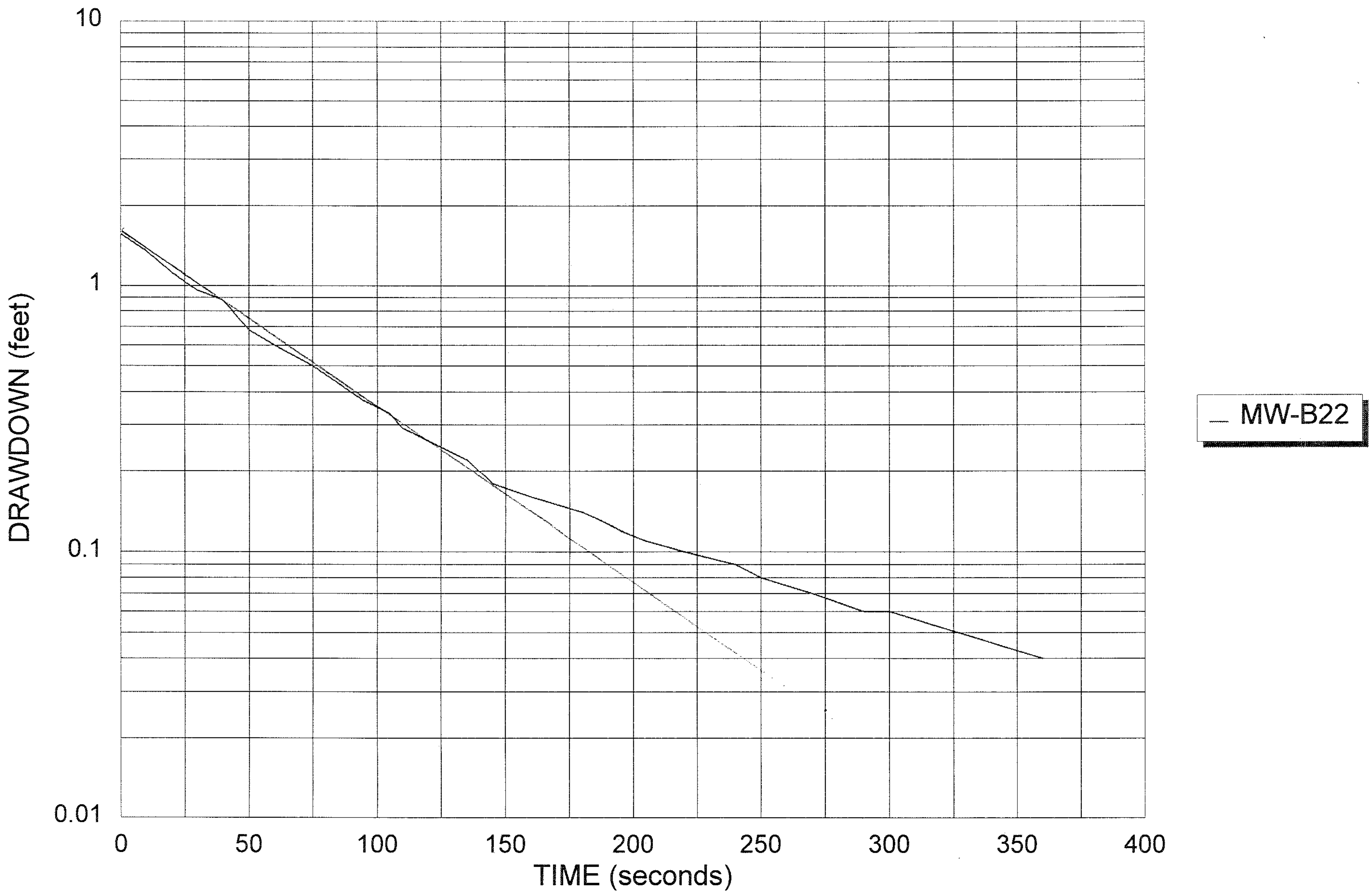
Determination of Hydraulic Conductivity

**K = 0.000728 feet/min.**

**1.048548 feet/day** $3.70 \times 10^{-4}$ cm/sec

# FALLING HEAD TEST: MW-B22

Greensboro White Street Landfill



**HDR Engineering, Inc.**

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-22d |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 36.53 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 5 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 46 | |
| Yo = Relative Ht. of Water at Time Zero = | 2.07 | |
| Yt = Relative Ht. of Water at Time t = | 2 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 0.83 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

A = 1.9

B = 0.38

Determination of ln Term

ln Re/Rw = 2.106352

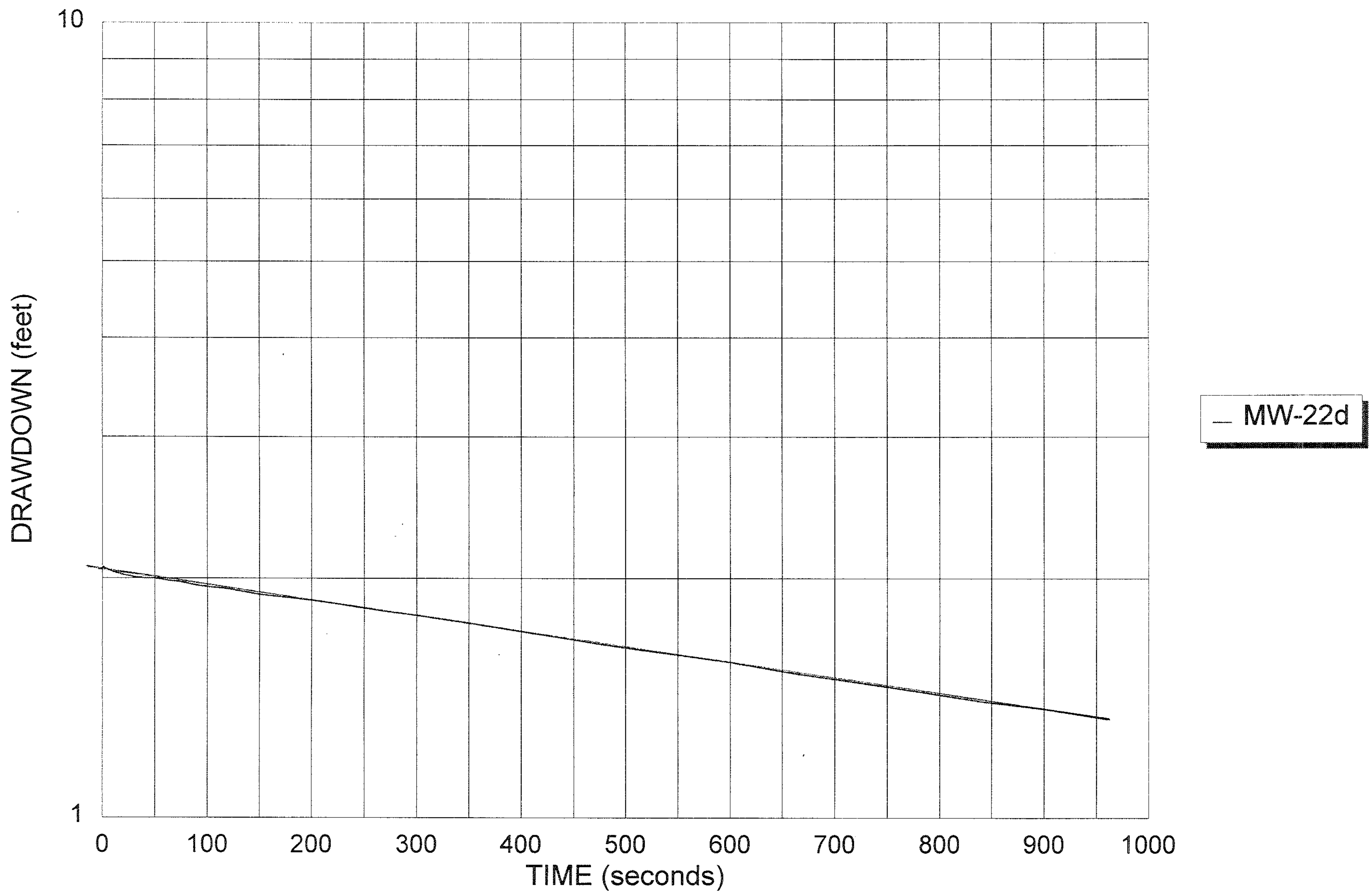
Determination of Hydraulic Conductivity

**K = 0.00006 feet/min.**

**0.086606 feet/day** = $3.06 \times 10^{-5}$ cm/sec

# FALLING HEAD TEST: MW-B22d

Greensboro White Street Landfill



## HDR Engineering, Inc.

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-25s |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where:** **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 32.39 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 10 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 38 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.95 | |
| Yt = Relative Ht. of Water at Time t = | 0.6 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 7.5 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

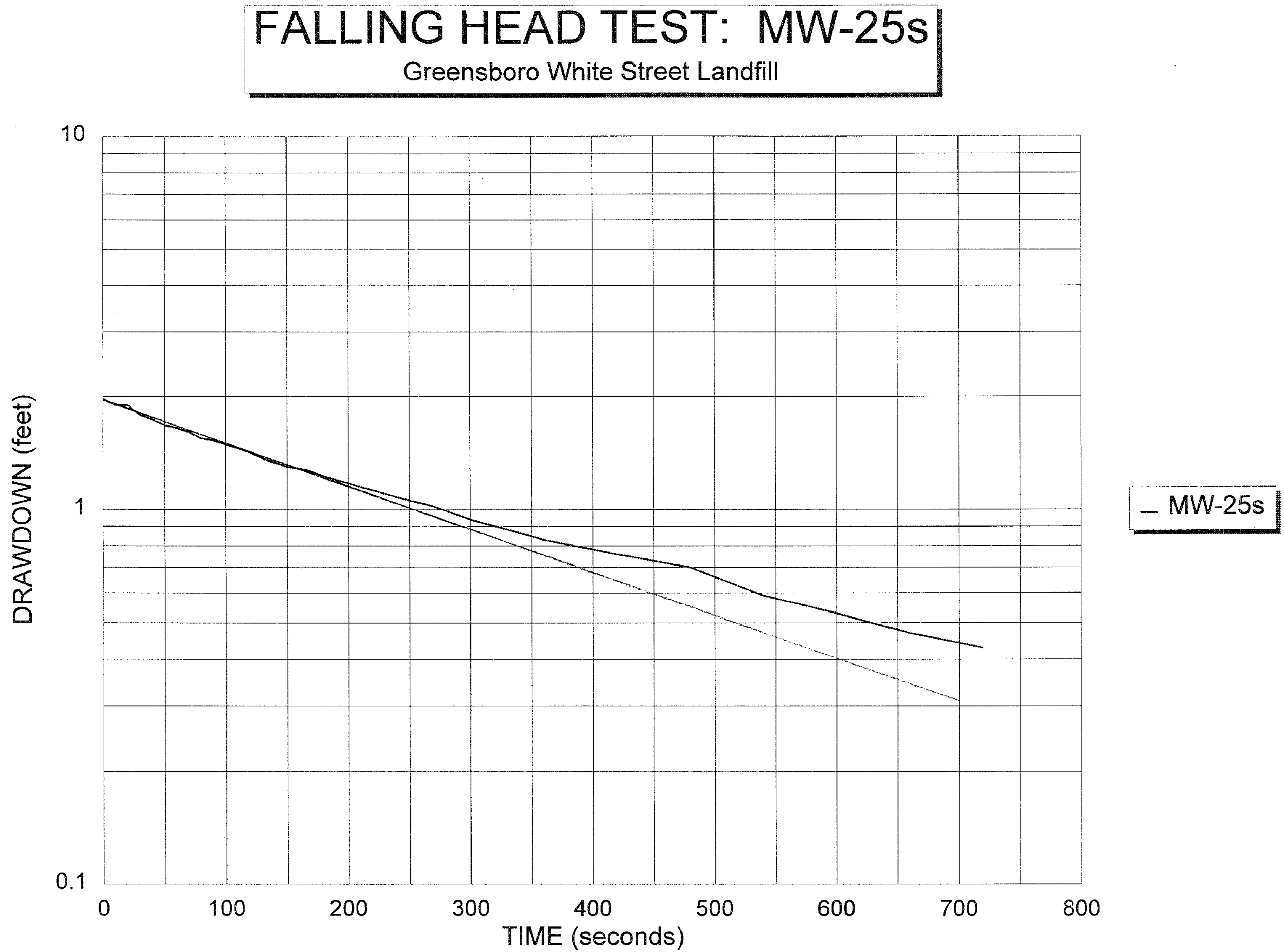
Determination of ln Term

ln Re/Rw = 2.633092

Determination of Hydraulic Conductivity

K = **0.000143** **feet/min.**

**0.205249** **feet/day** = $7.24 \times 10^{-5}$ cm/sec


FALLING HEAD TEST: MW-25s
Greensboro White Street Landfill
DRAWDOWN (feet)
10
1
0.1
0
100
200
300
400
500
600
700
800
TIME (seconds)
MW-25s

# HDR Engineering, Inc.

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-25d |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 42.05 | (water in casing) |
| Le = Screen Interval Open to Aquifer = | 5 | |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 52 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.9 | |
| Yt = Relative Ht. of Water at Time t = | 0.9 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 10 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

| | |
|---|---|
| A = | 1.9 |
| B = | 0.38 |

Determination of ln Term

ln Re/Rw = 2.132193

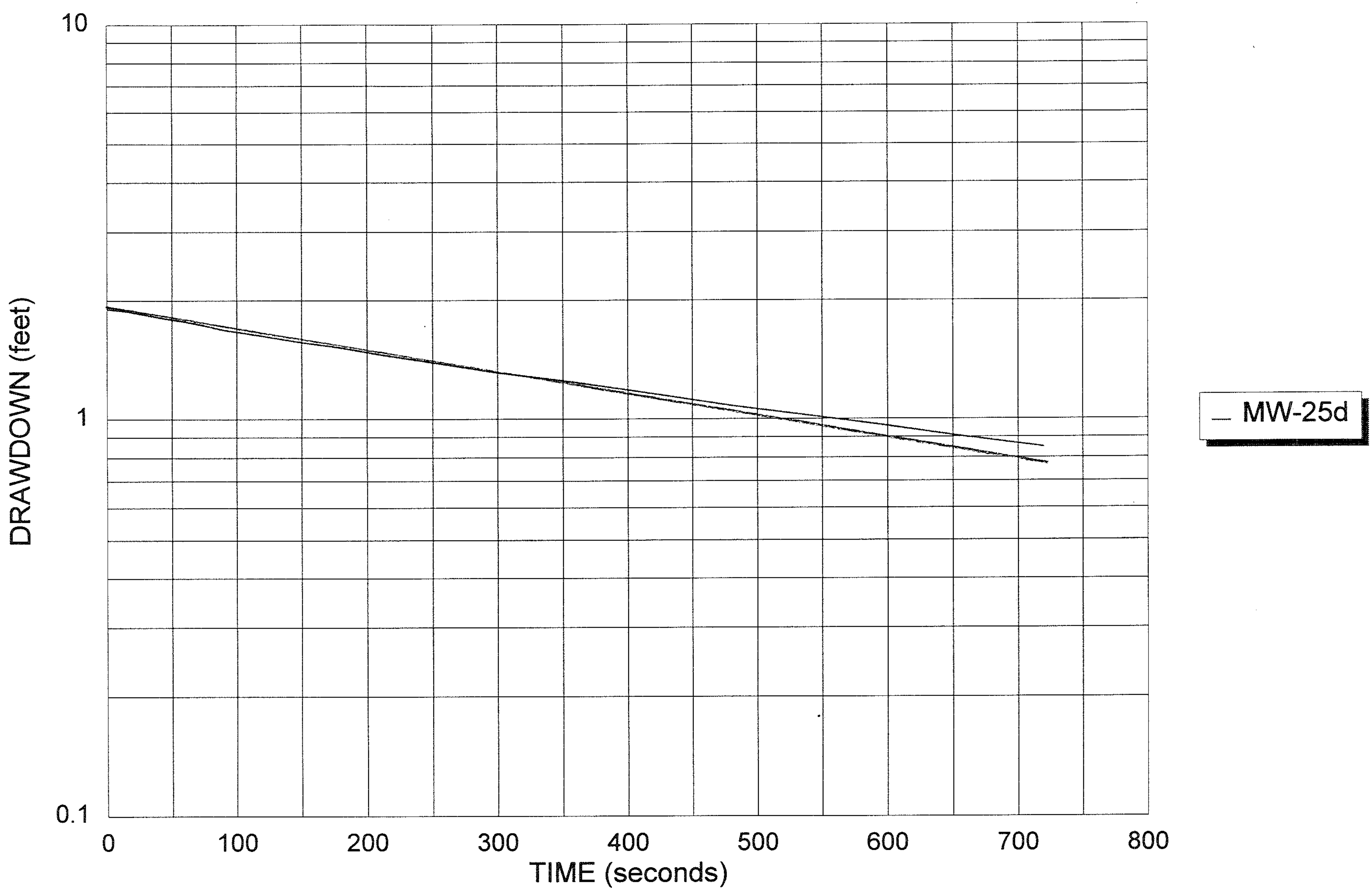
Determination of Hydraulic Conductivity

**K = 0.00011 feet/min.**

**0.158049 feet/day** = 5.58 x10$^{-5}$ cm/sec

# FALLING HEAD TEST: MW-25d

Greensboro White Street Landfill



**HDR Engineering, Inc.**

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Falling Head Tests | Date: | 11/27/95 |
| | | Well | B-31 |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where:** **Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 16.92 | (water in |
| Le = Screen Interval Open to Aquifer = | 10 | casing) |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 25 | |
| Yo = Relative Ht. of Water at Time Zero = | 1.97 | |
| Yt = Relative Ht. of Water at Time t = | 0.5 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 9.17 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 26.66667

from attached graph of A & B

| | |
|---|---|
| A = | 2.25 |
| B = | 0.48 |

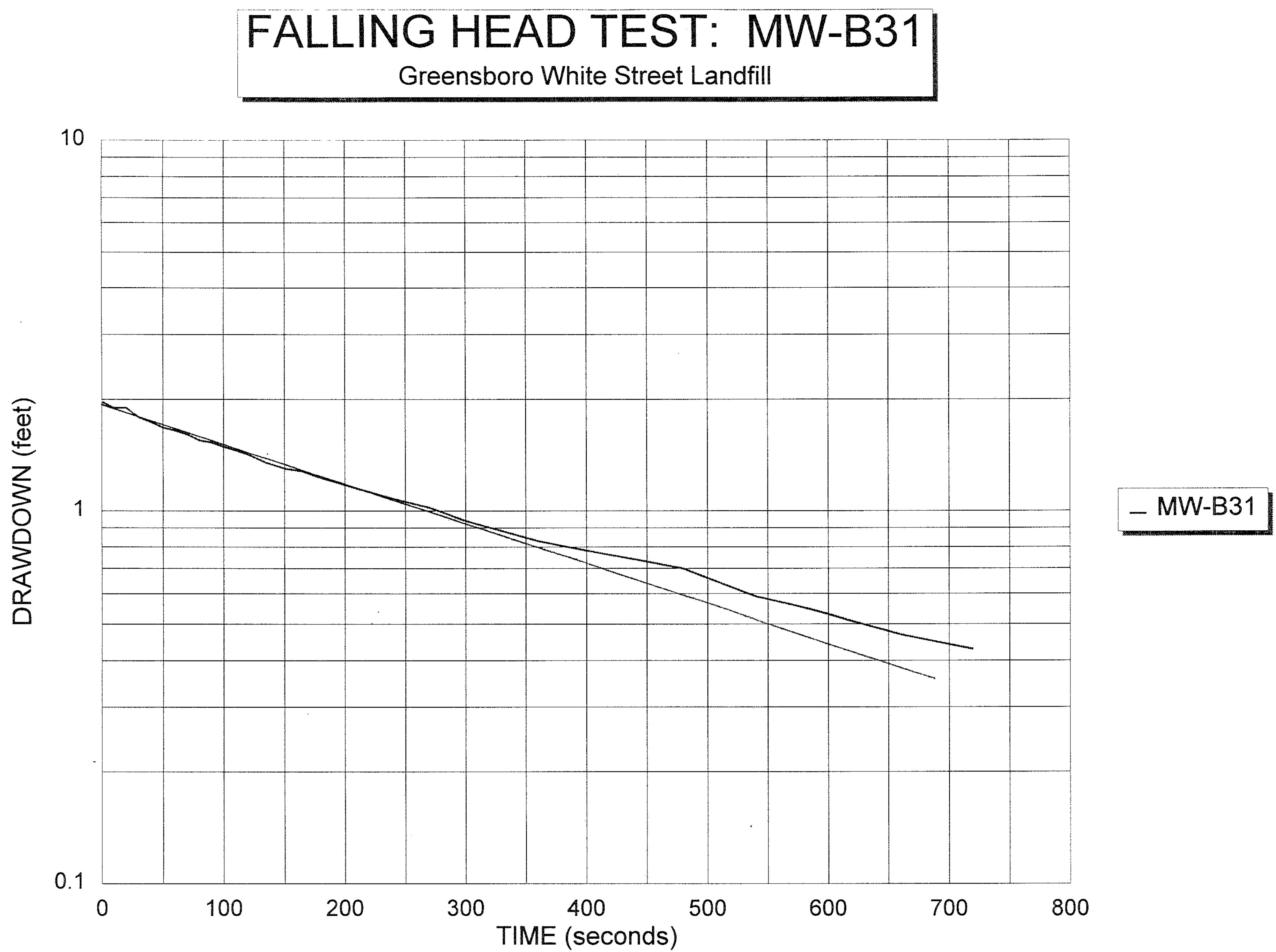
Determination of ln Term

ln Re/Rw = 2.334245

Determination of Hydraulic Conductivity

**K = 0.00012 feet/min.**

**0.173125 feet/day** = $6.11 \times 10^{-5}$ cm/sec


FALLING HEAD TEST: MW-B31
Greensboro White Street Landfill
10
1
0.1
DRAWDOWN (feet)
0
100
200
300
400
500
600
700
800
TIME (seconds)
MW-B31

**HDR Engineering, Inc.**

| | | | |
|---|---|---|---|
| Client: | White Street Landfill | Project No. | 06770-021-018 |
| | | Sheet | 1/1 |
| Project: | Rising Head Tests | Date: | 11/27/95 |
| | | Well | B-34 |
| | | Reference: | Bouwer, 1989 |

**Hydraulic Conductivity, K = ((Req^2)ln(Re/Rw)/2Le)*(1/T)*ln(Yo/Yt)**

**Where: Req = [(Rc^2) + n(Rw^2 - Rc^2)]exp^1/2 (Correction for sand pack)**

**ln(Re/Rw)=[1.1/ln(Lw/Rw)+(A+Bln[(H-Lw)/Rw])/Le/Rw]exp^-1**

| | | |
|---|---|---|
| Lw = Ht. of Water Column in Well = | 3.4 | (water in |
| Le = Screen Interval Open to Aquifer = | 5 | casing) |
| Rw = Radius of Well Including Sand Pack = | 0.375 | |
| Rc = Radius of Casing = | 0.083 | |
| H = Aquifer Thickness to First Aquitard = | 7 | |
| Yo = Relative Ht. of Water at Time Zero = | 0.744 | |
| Yt = Relative Ht. of Water at Time t = | 0.06 | |
| n = Porosity = | 0.35 | |
| T = Time (in minutes) = | 0.2 | |

A & B are Constants to be Determined

Correction for Sand Pack (not necessary in this case)

Req = 0.083

Evaluation of A & B

Le/Rw = 13.33333

from attached graph of A & B

| | |
|---|---|
| A = | 1.9 |
| B = | 0.38 |

Determination of ln Term

ln Re/Rw = 1.416599

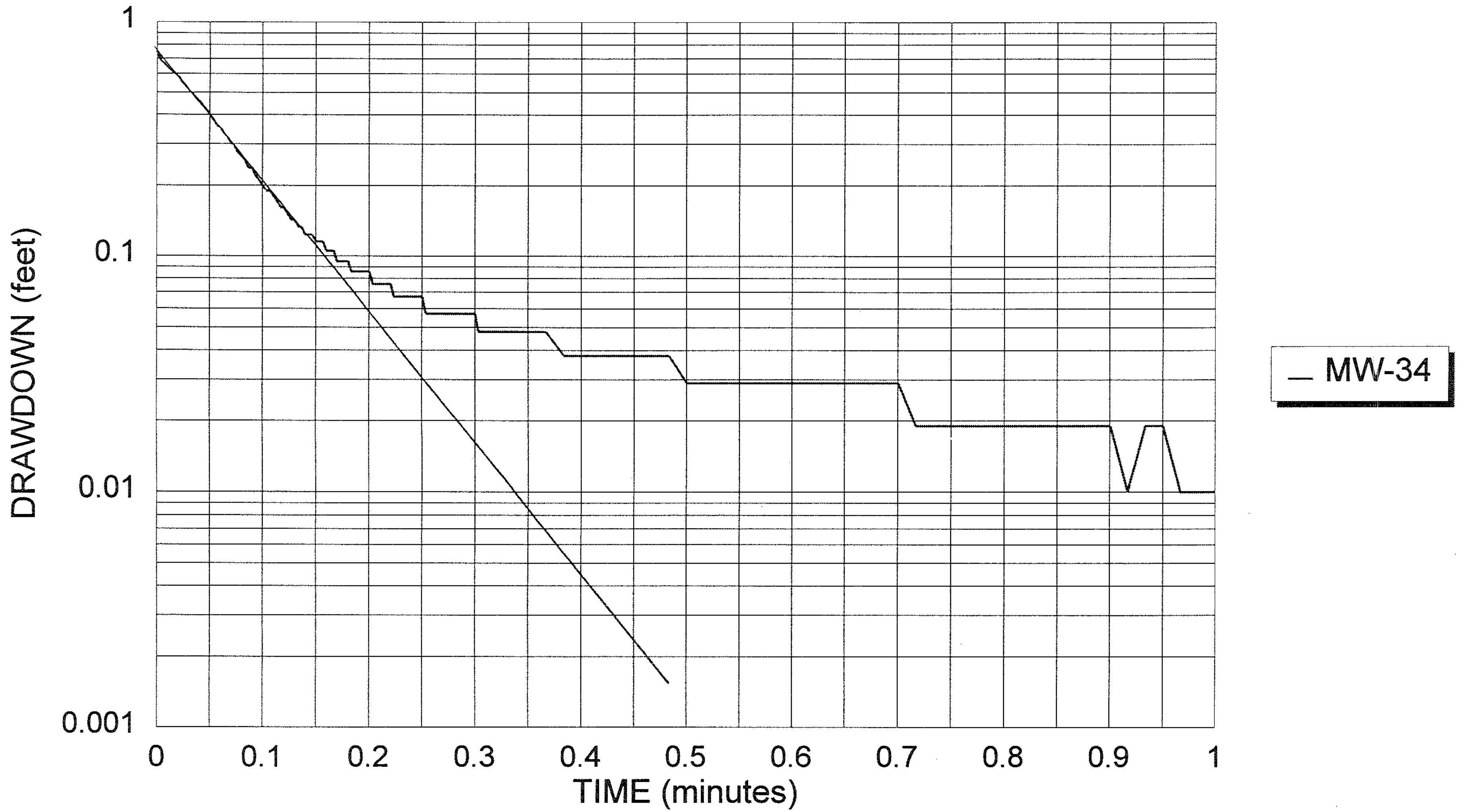
Determination of Hydraulic Conductivity

**K = 0.012285 feet/min.**

**17.69046 feet/day** $6.24 \times 10^{-3}$

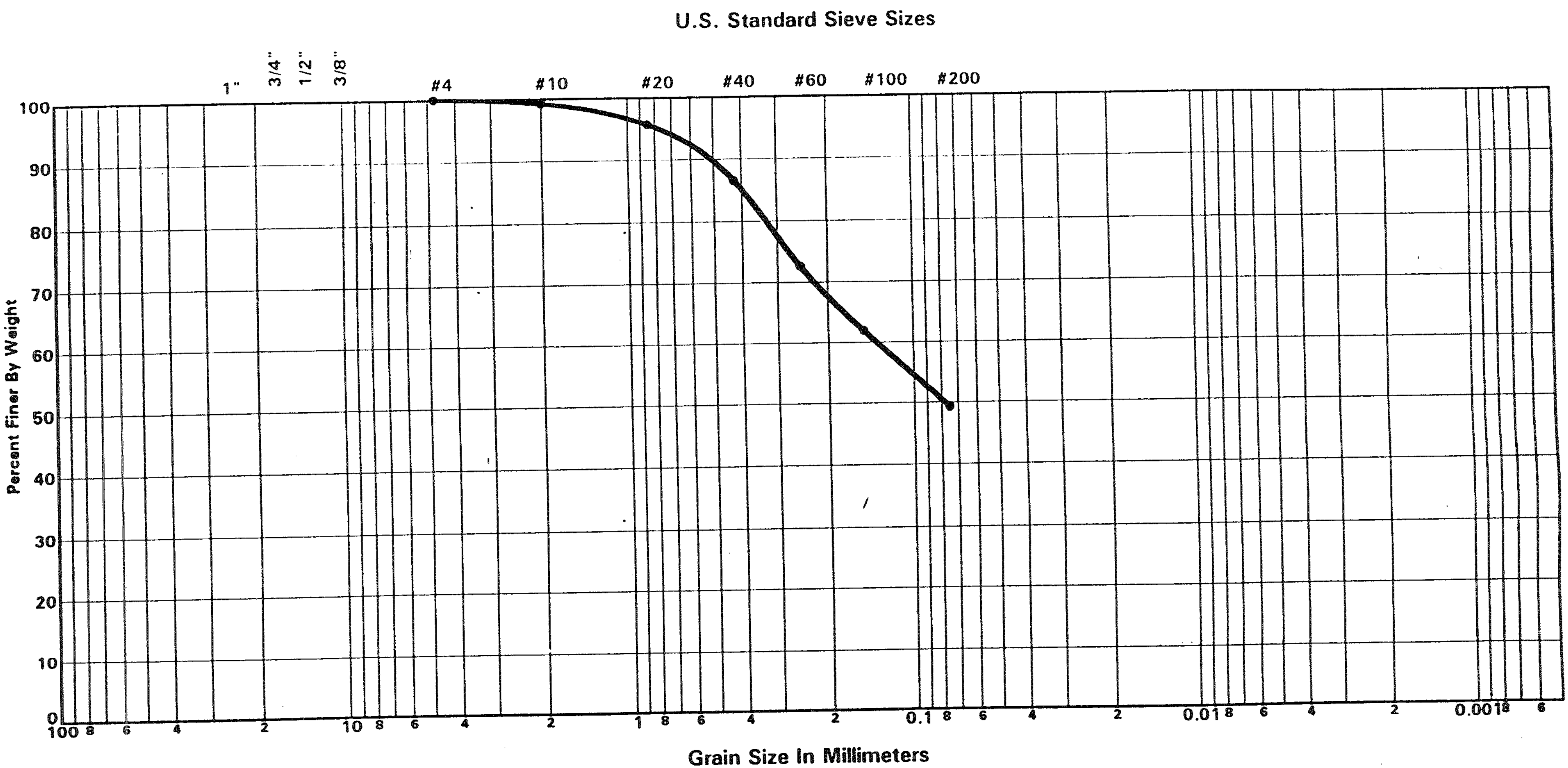
# RISING HEAD TEST: MW-34

Greensboro White Street Landfill



# APPENDIX D

# SOIL LABORATORY DATA




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.

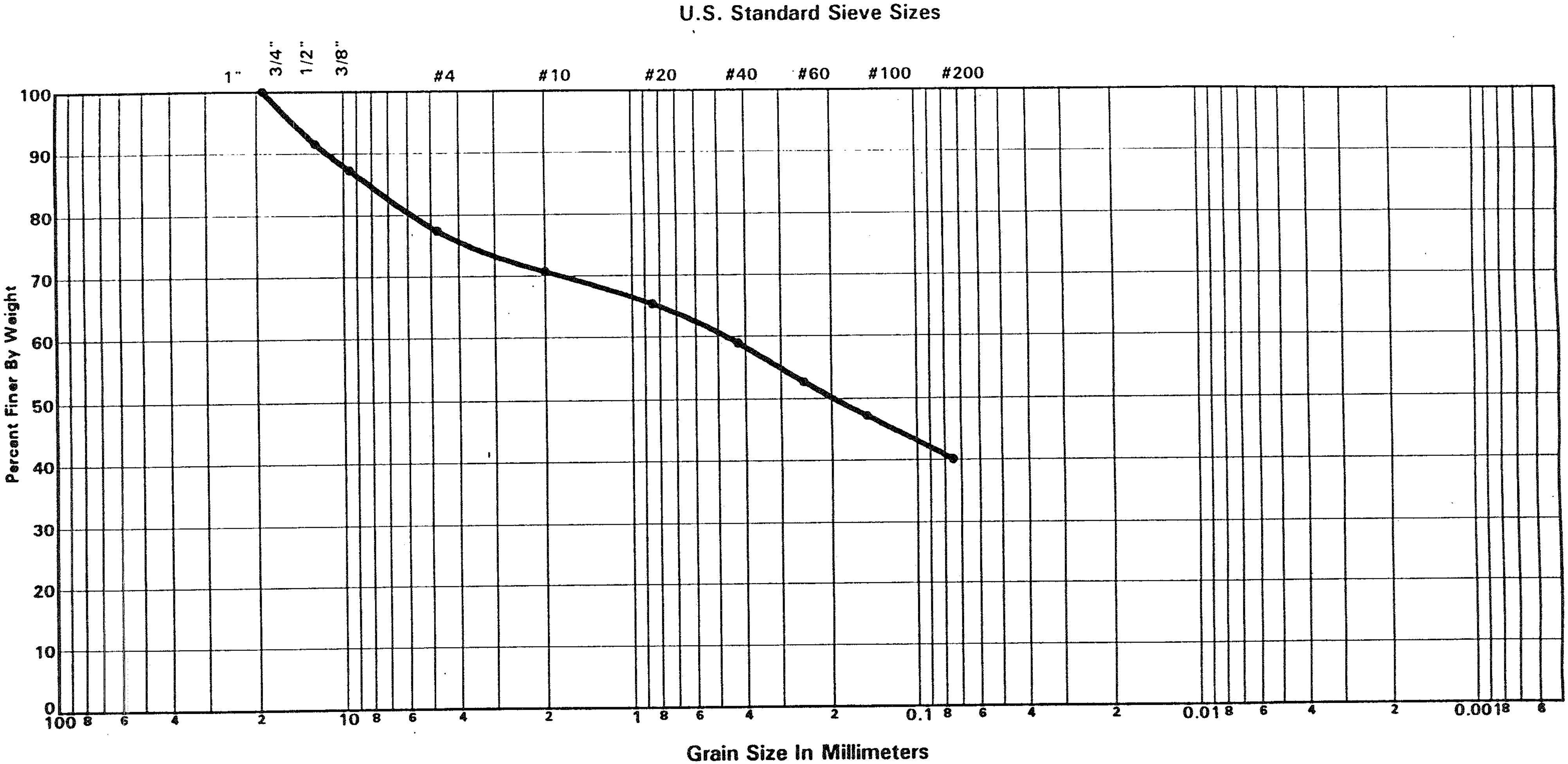
| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-1<br>S-2 | 5' | 10.9 | 25.1 | 20.8 | 4.3 | Green MAFIC ROCK<br>SILTY CLAYEY SAND (SC-SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-1<br>S-3 | 10' | 13.8 | 29.1 | 19.6 | 9.5 | Brown Green MAFIC ROCK<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

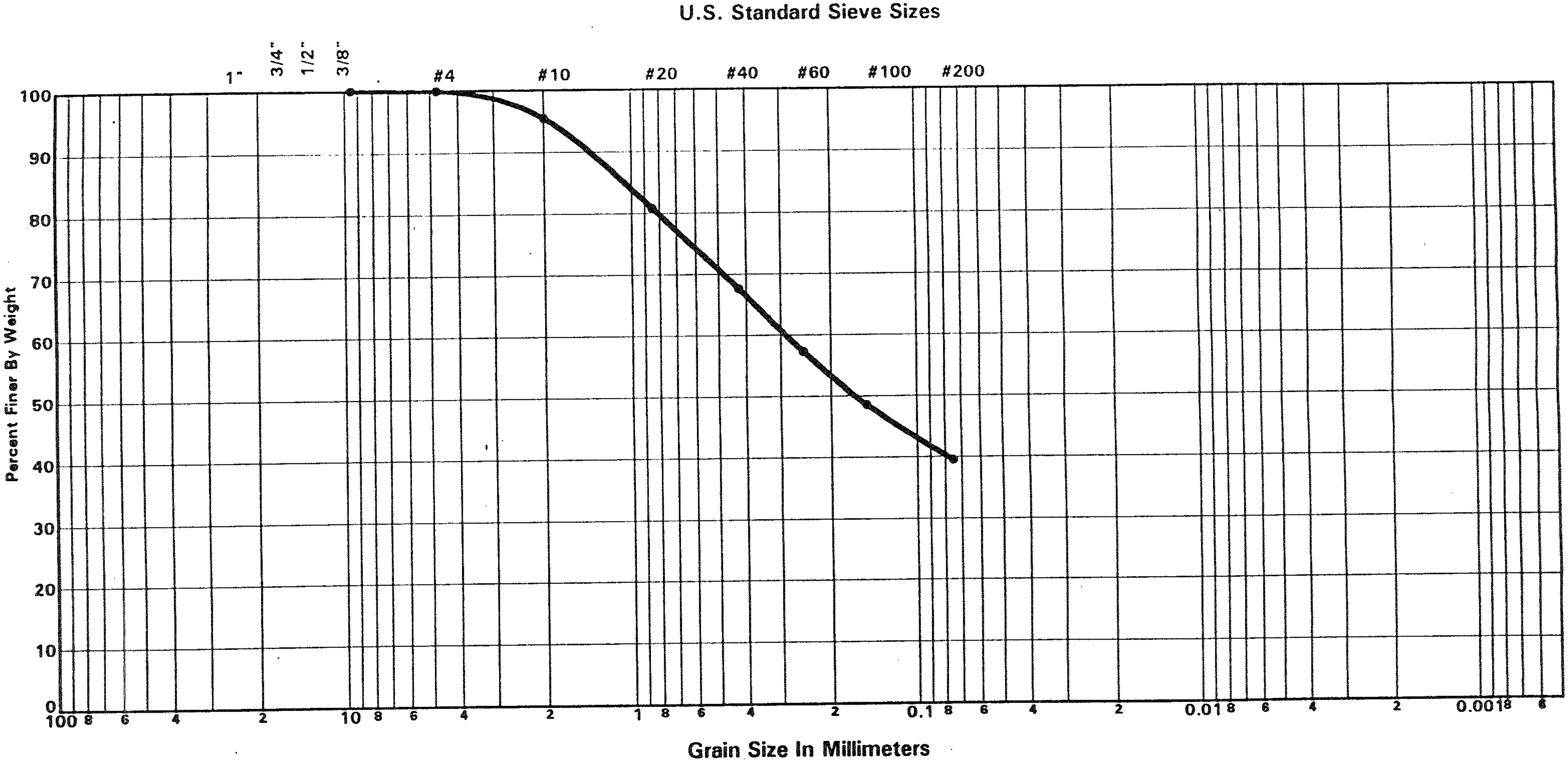
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-6<br>S-1 | 5' | 18.9 | 28.5 | 22.6 | 5.9 | Yellow Tan GRANITE<br>F-M SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

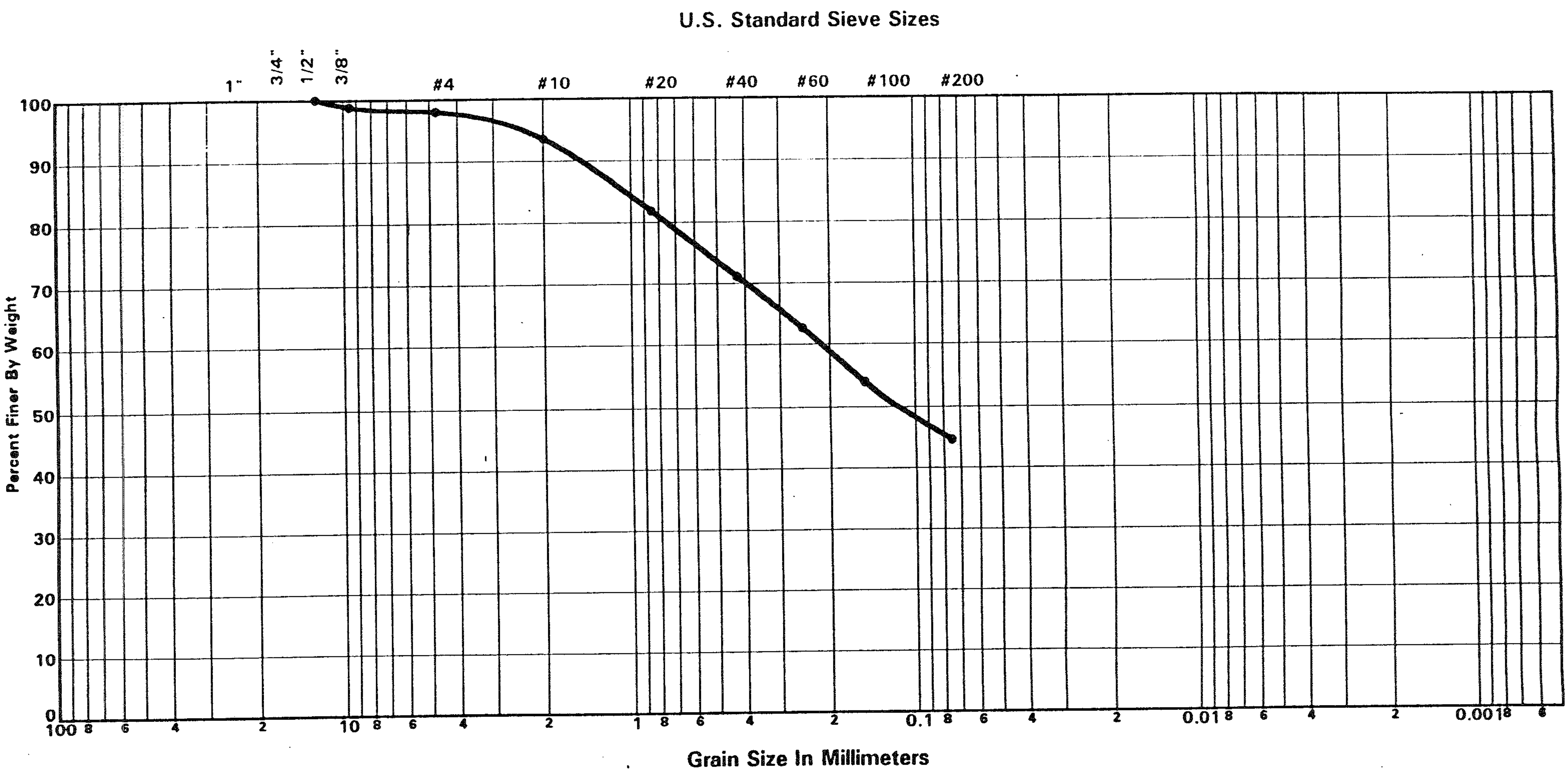
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-6<br>S-2 | 10' | 16.5 | 26.1 | 21.0 | 5.1. | Yellow Tan GRANITE<br>SILTY CLAYEY SAND (SC-SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

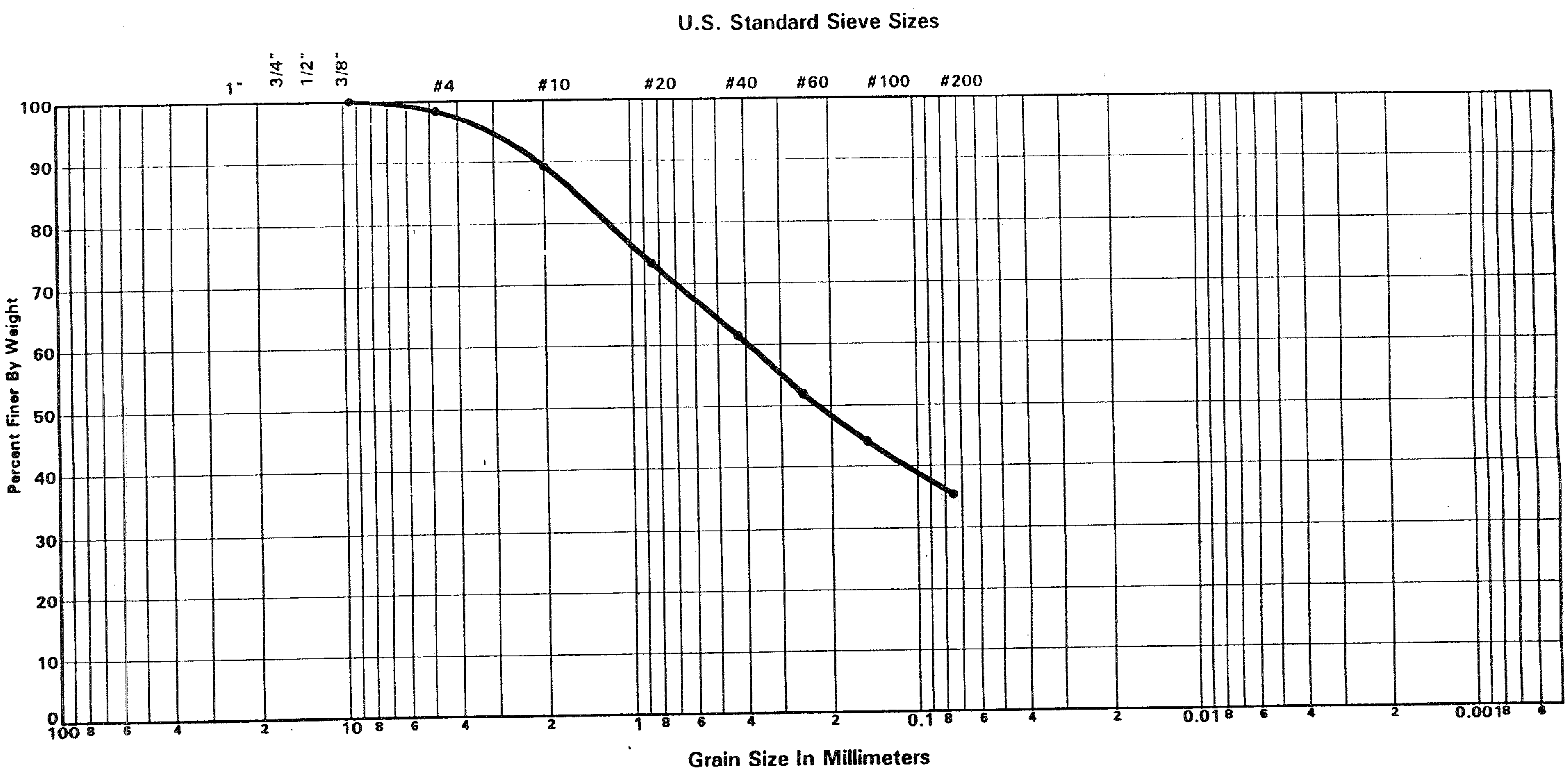
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-6<br>S-3 | 15' | 10.9 | NP | NP | NP | Tan Brown GRANITE<br>SILTY CLAYEY SAND (SC-SM) |

**Project:** Greensboro Landfill, Greensboro, North Carolina

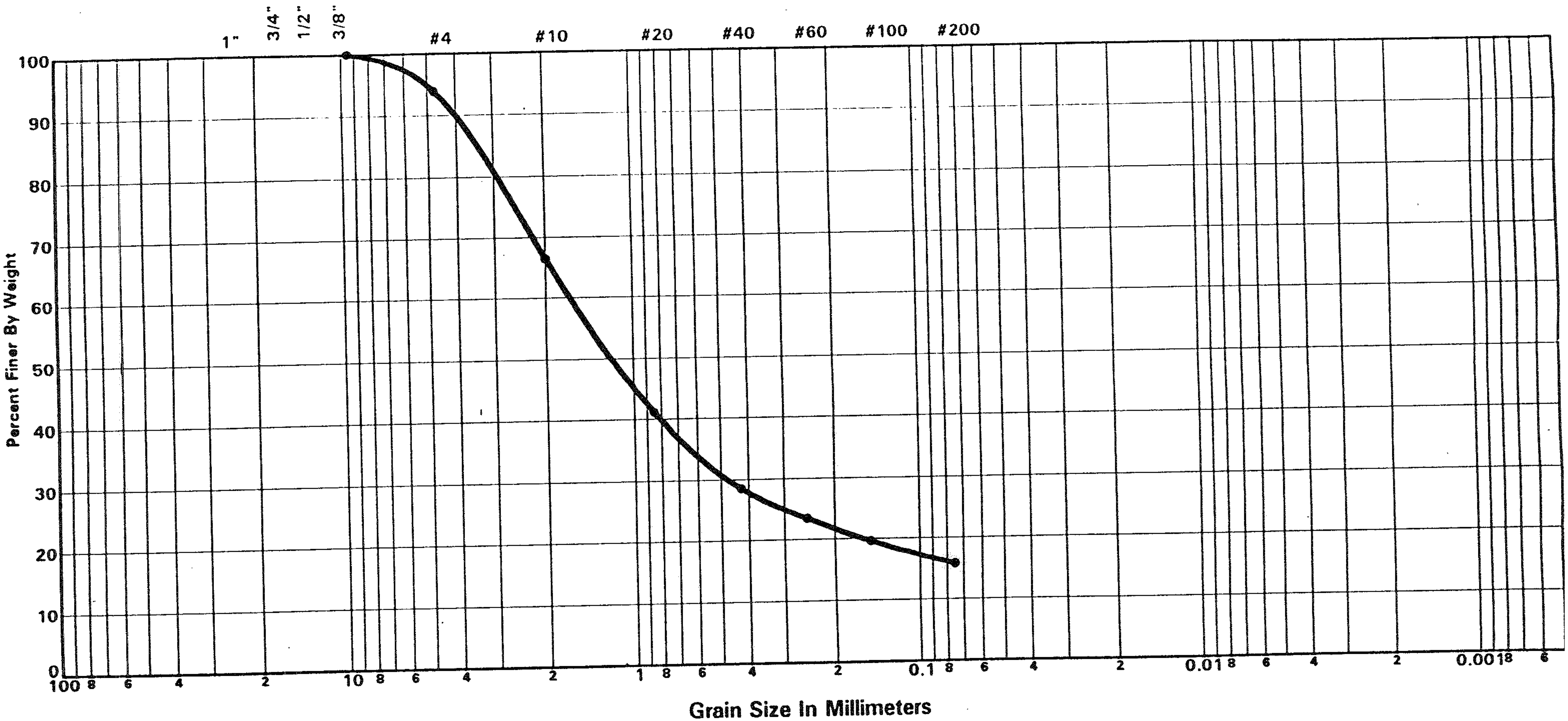
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-7<br>S-1 | 5' | 7.0 | NP | NP | NP | Tan Brown Fine-Coarse SAND<br>GRANITE<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

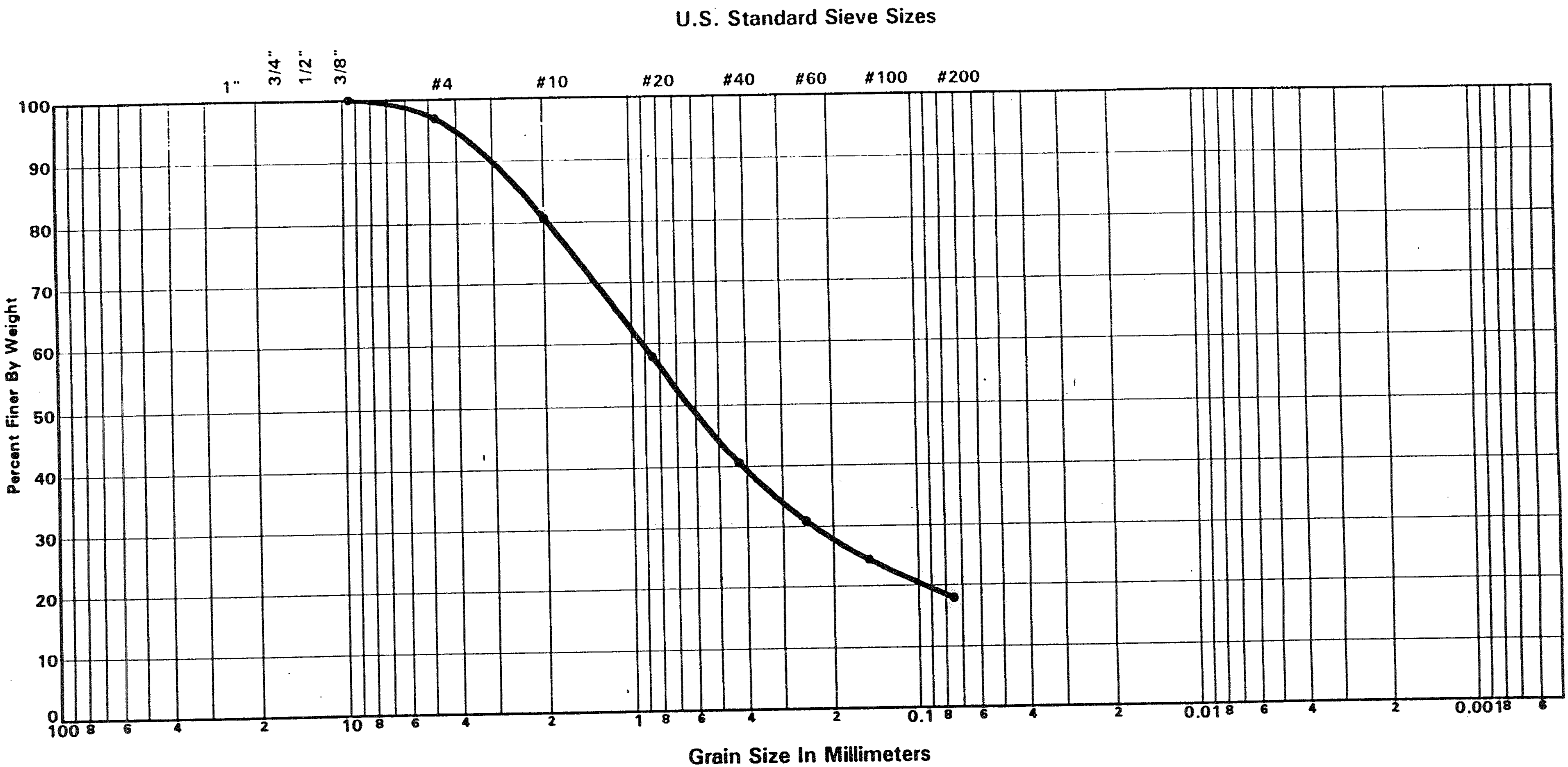
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.

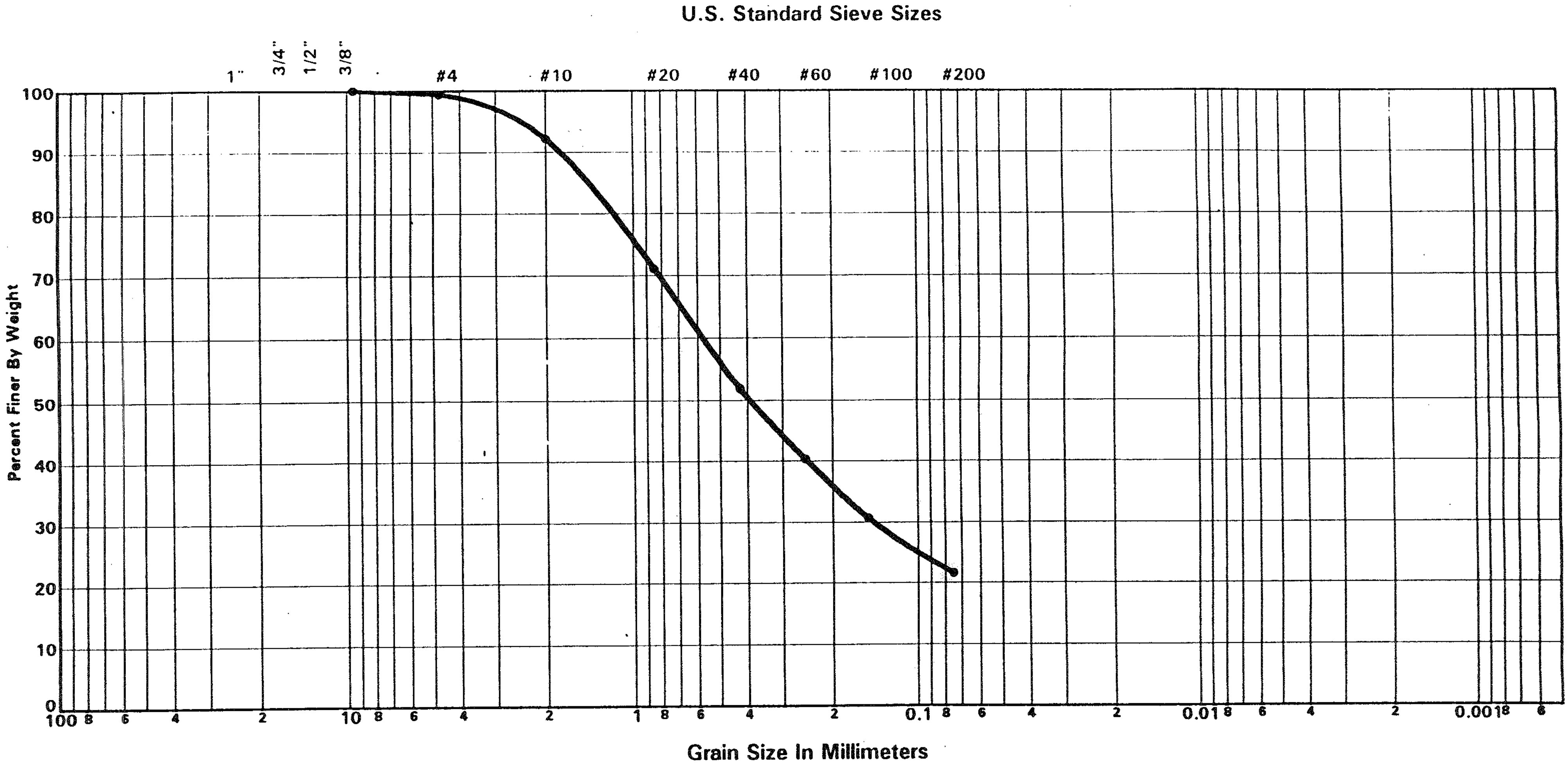
| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-7<br>S-2 | 10' | 6.5 | NP | NP | NP | GRANITE<br>Tan Brown Medium-Coarse SAND<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-7<br>S-3 | 15' | 6.1 | NP | NP | NP | GRANITE<br>Tan Brown Fine-Medium SAND<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

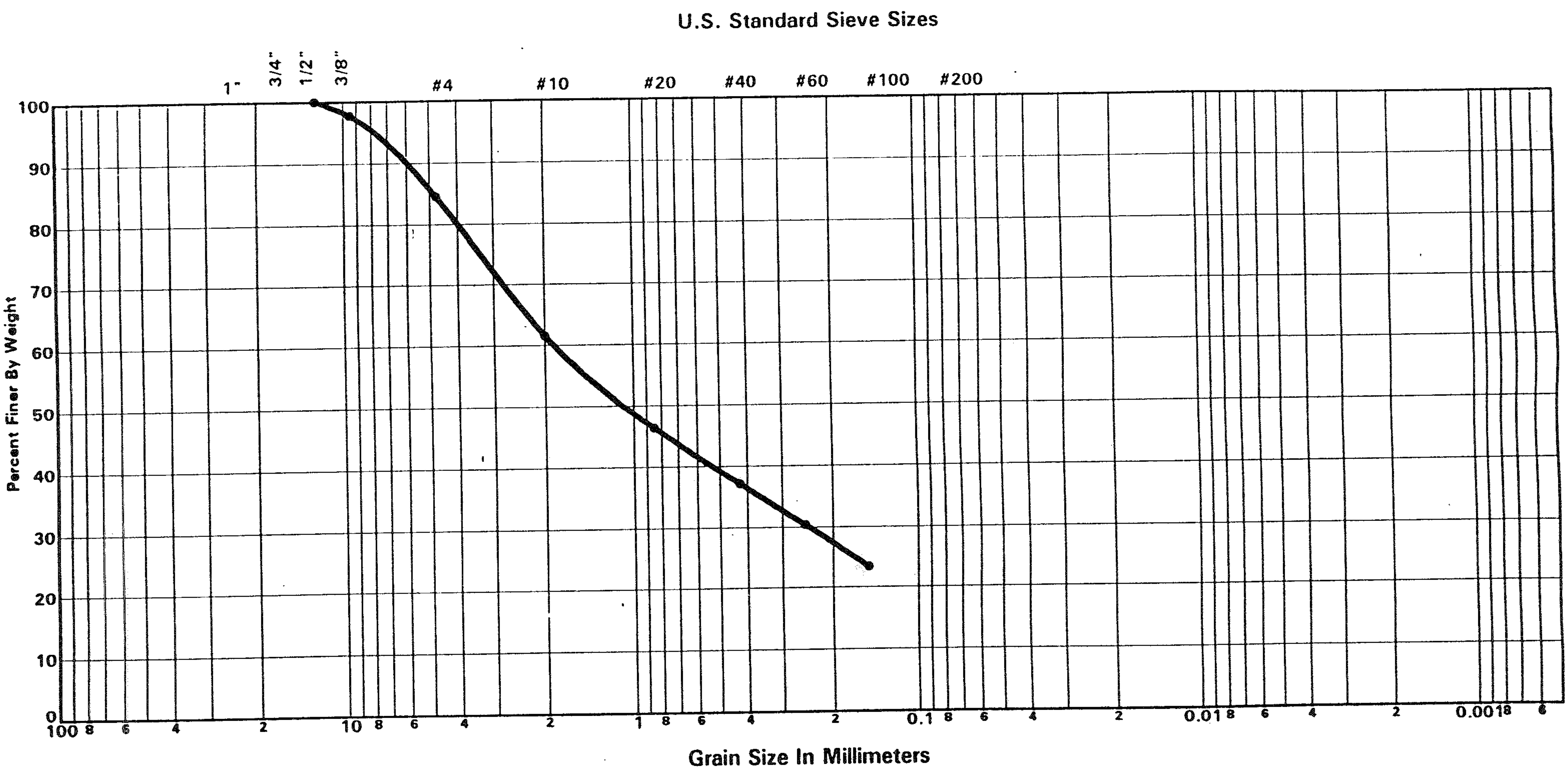
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-7 S-4 | 20' | 8.1 | NP | NP | NP | GRANITE Tan Brown Fine-Medium SAND SILTY SAND (SM) |

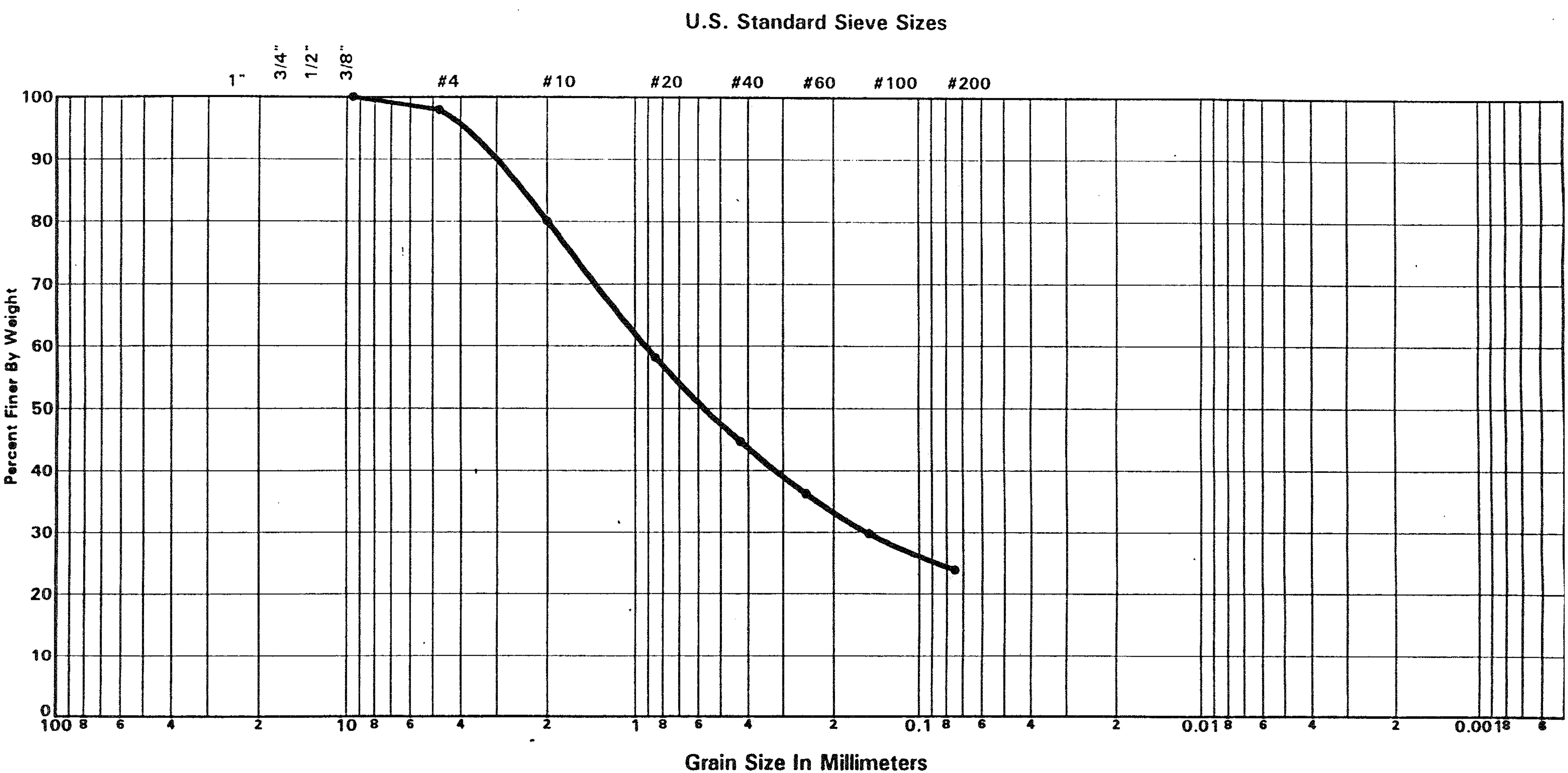
**Project:**
Greensboro Landfill
Greensboro, North Carolina

**Job No.:** 1-95-085 CA A-2-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-9<br>S-3 | 15' | 7.0 | NP | NP | NP | GRANITE<br>Tan Brown Fine-Medium SAND<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

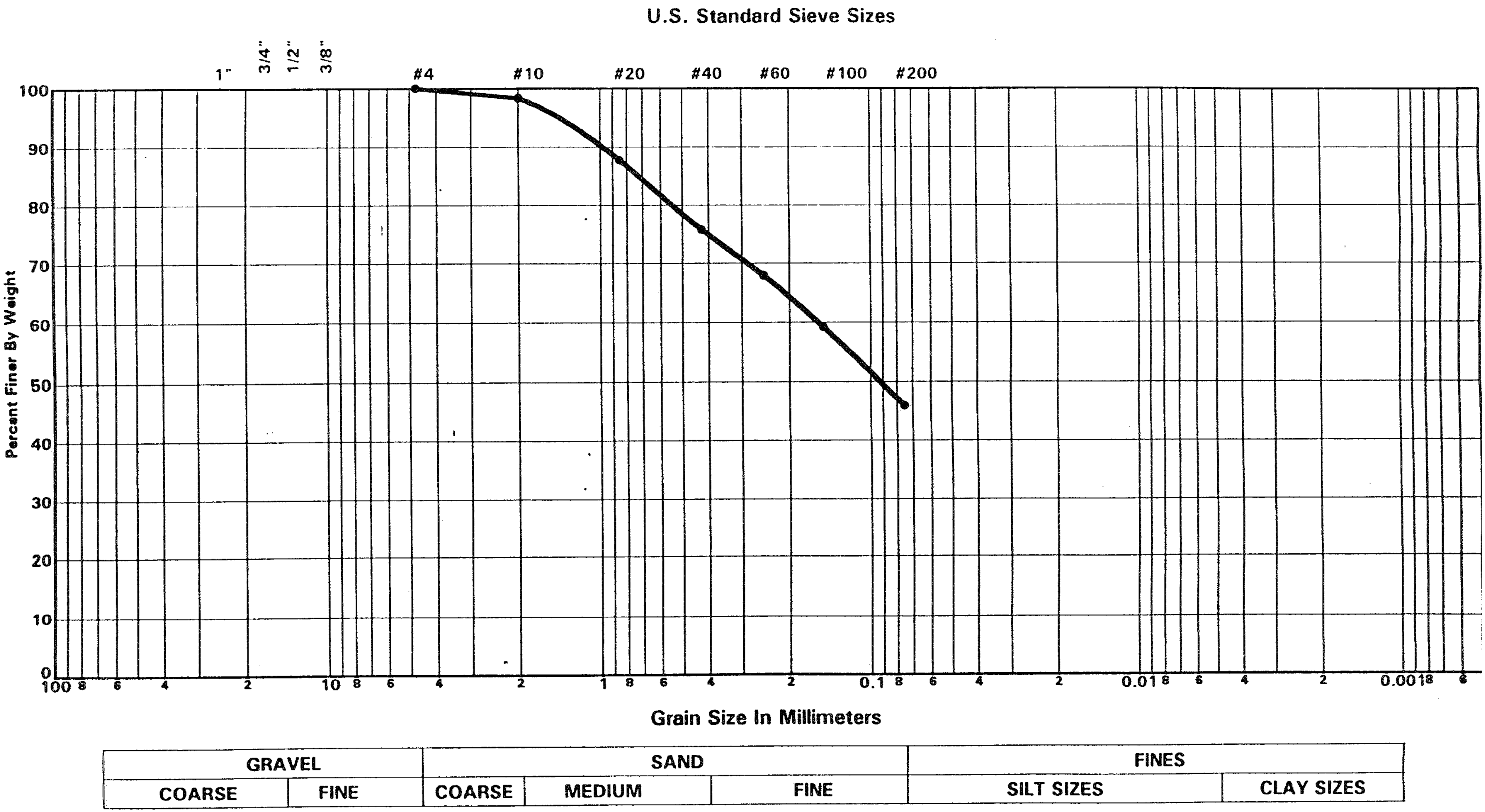
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-10<br>S-2 | 10' | 37.6 | 39.2 | 37.7 | 1.5 | Light Tan SILTY SAND GNEISS |

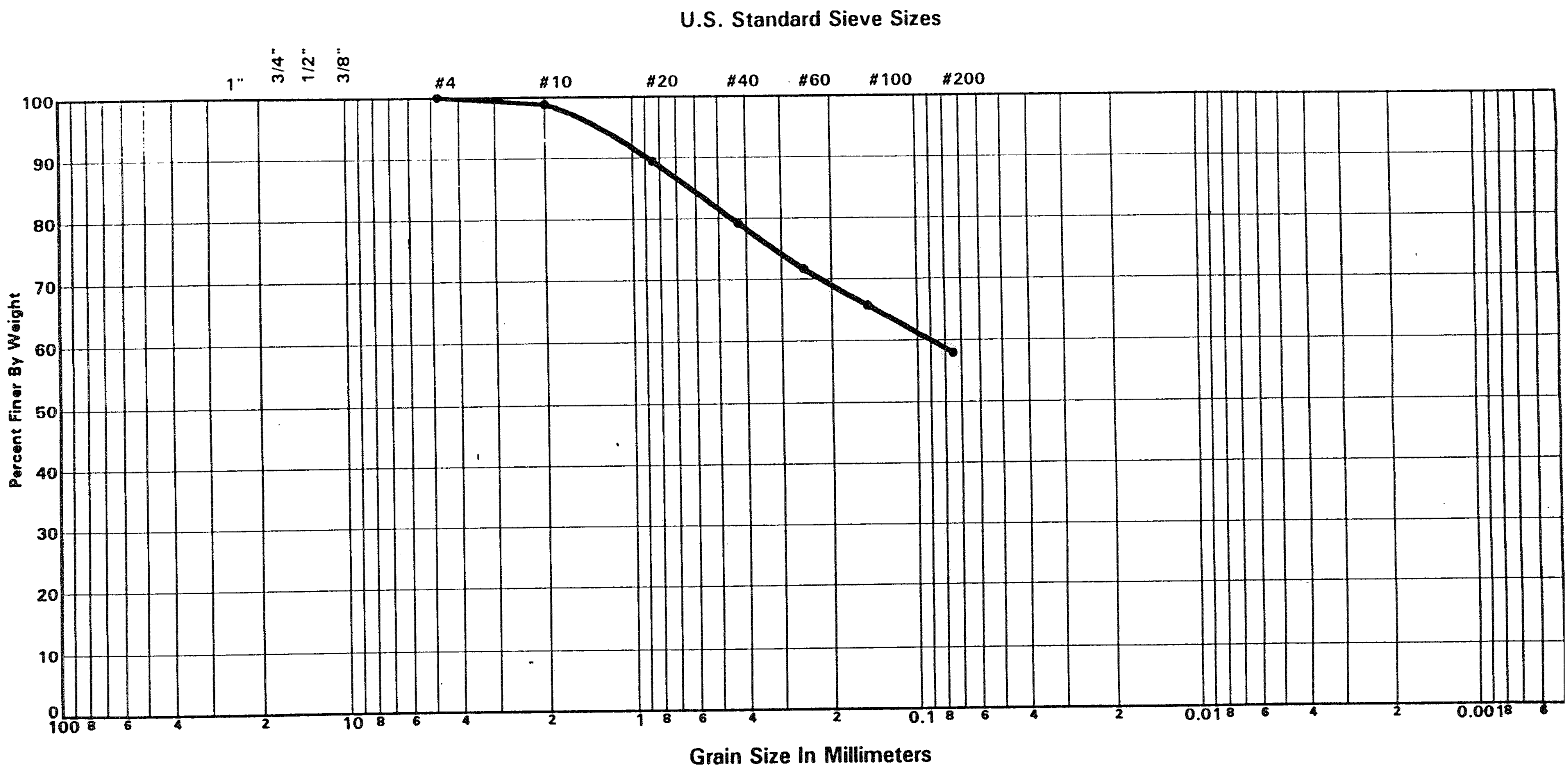
**Project:**
Greensboro Landfill
Greensboro, North Carolina

**Job No.:** 1-95-085 CA    A-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-10<br>S-4 | 20' | 27.5 | 53.0 | 34.7 | 18.3 | Orange GNEISS<br>SANDY ELASTIC SILT (MH) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

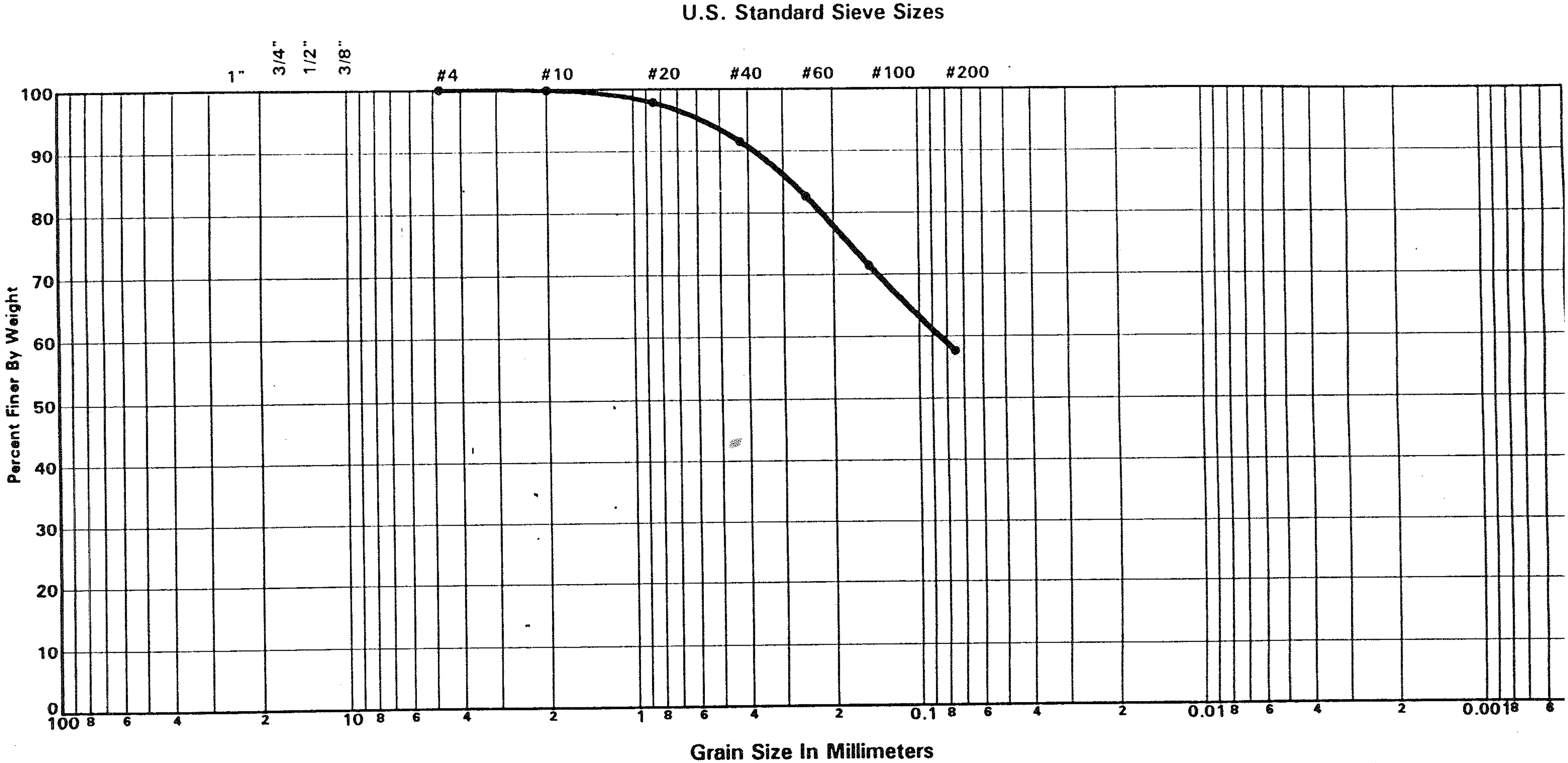
**Job No.:** 1-95-085 CA

A-7

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-14 S-1 | 5' | 24.9 | 42.2 | 26.3 | 15.9 | Tan SANDY SILT (ML) GNEISS |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

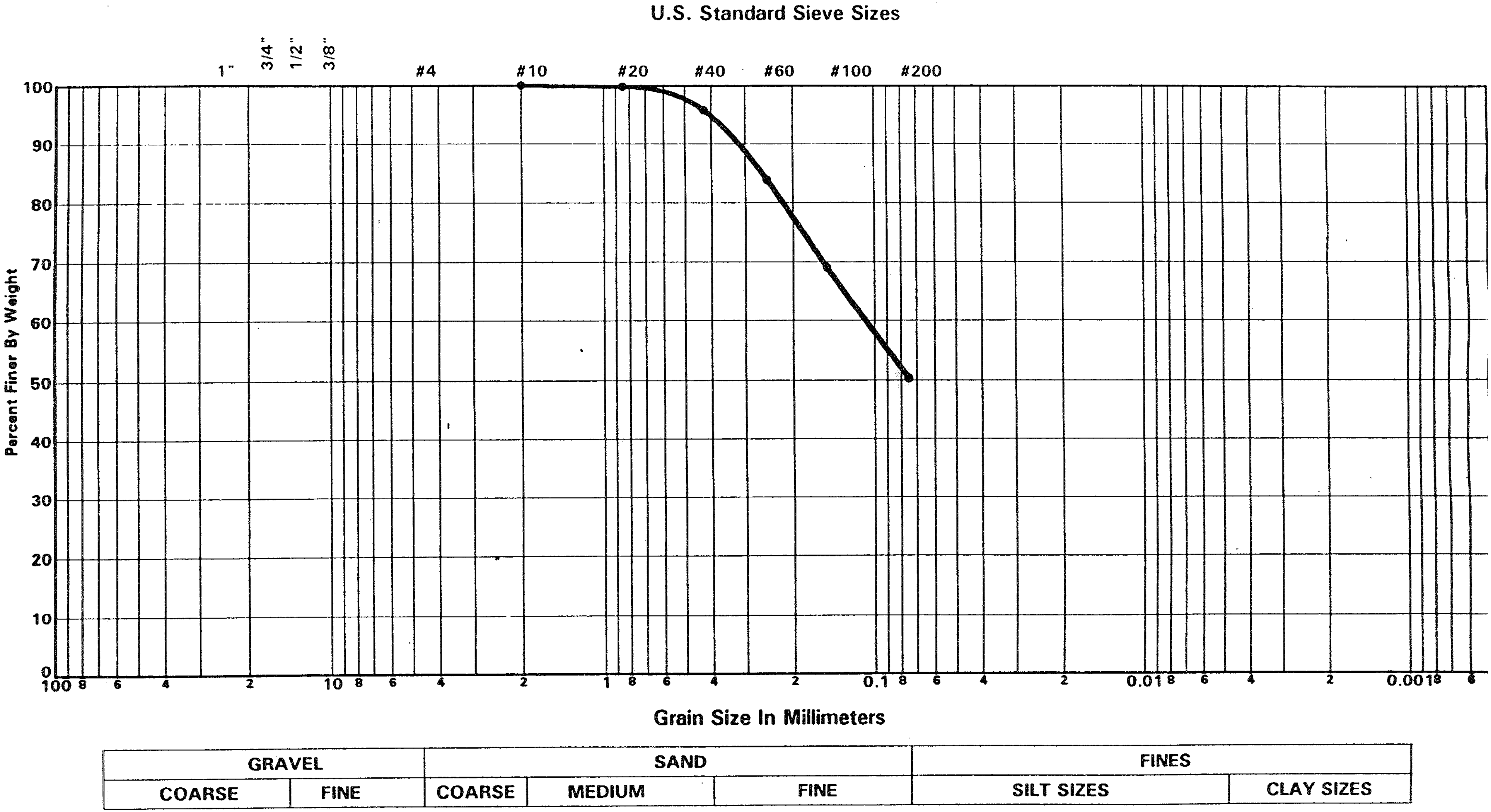
**Job No.:** 1-95-085 CA

A-7

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-14 S-2 | 10' | 22.0 | 38.8 | 25.8 | 13.0 | Green Brown GNEISS SANDY SILT (ML) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

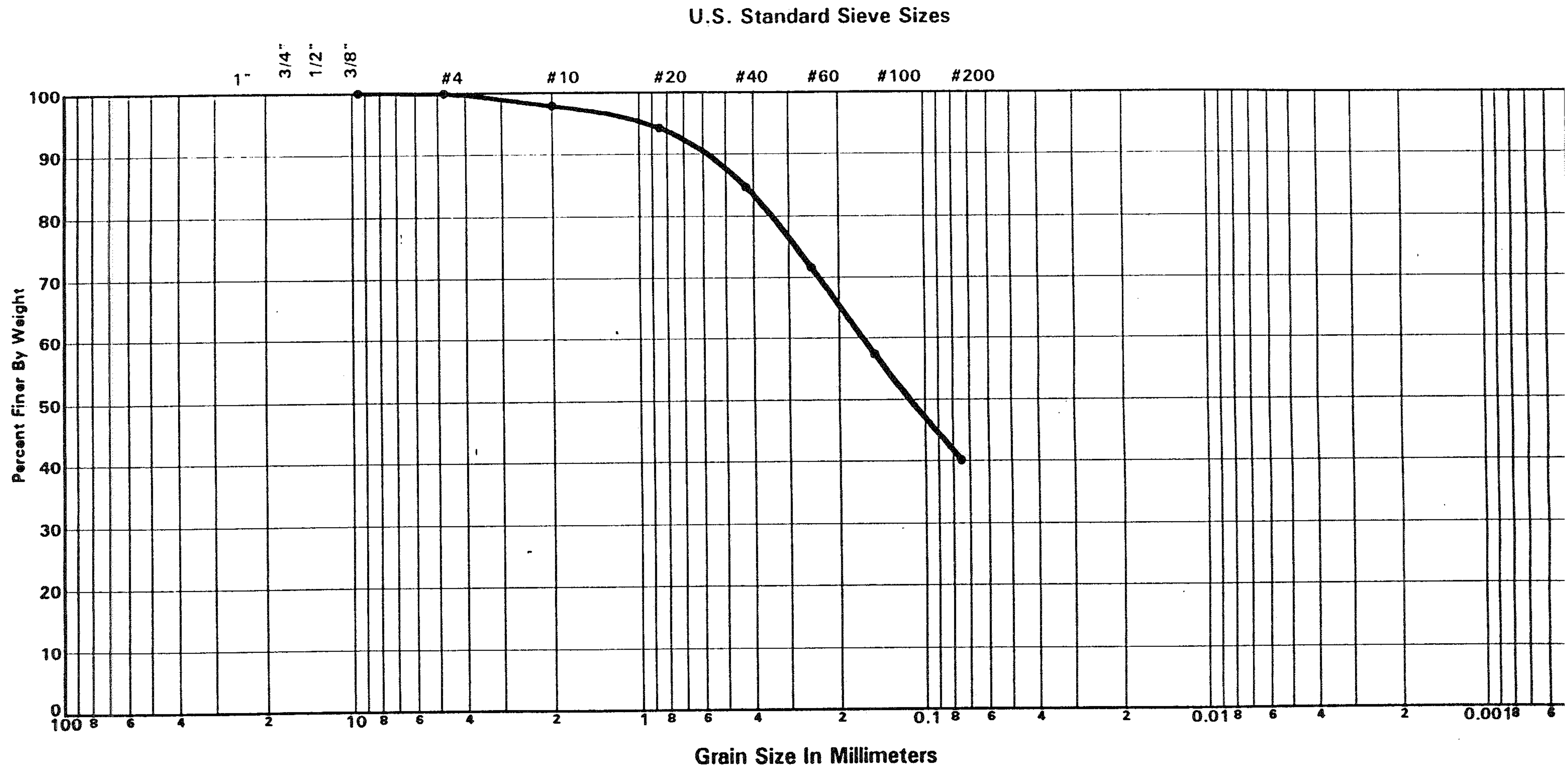
**Job No.:** 1-95-085 CA

A-6

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-14<br>S-3 | 15' | 22.8 | 33.5 | 27.5 | 6.0 | Green Brown GNEISS<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

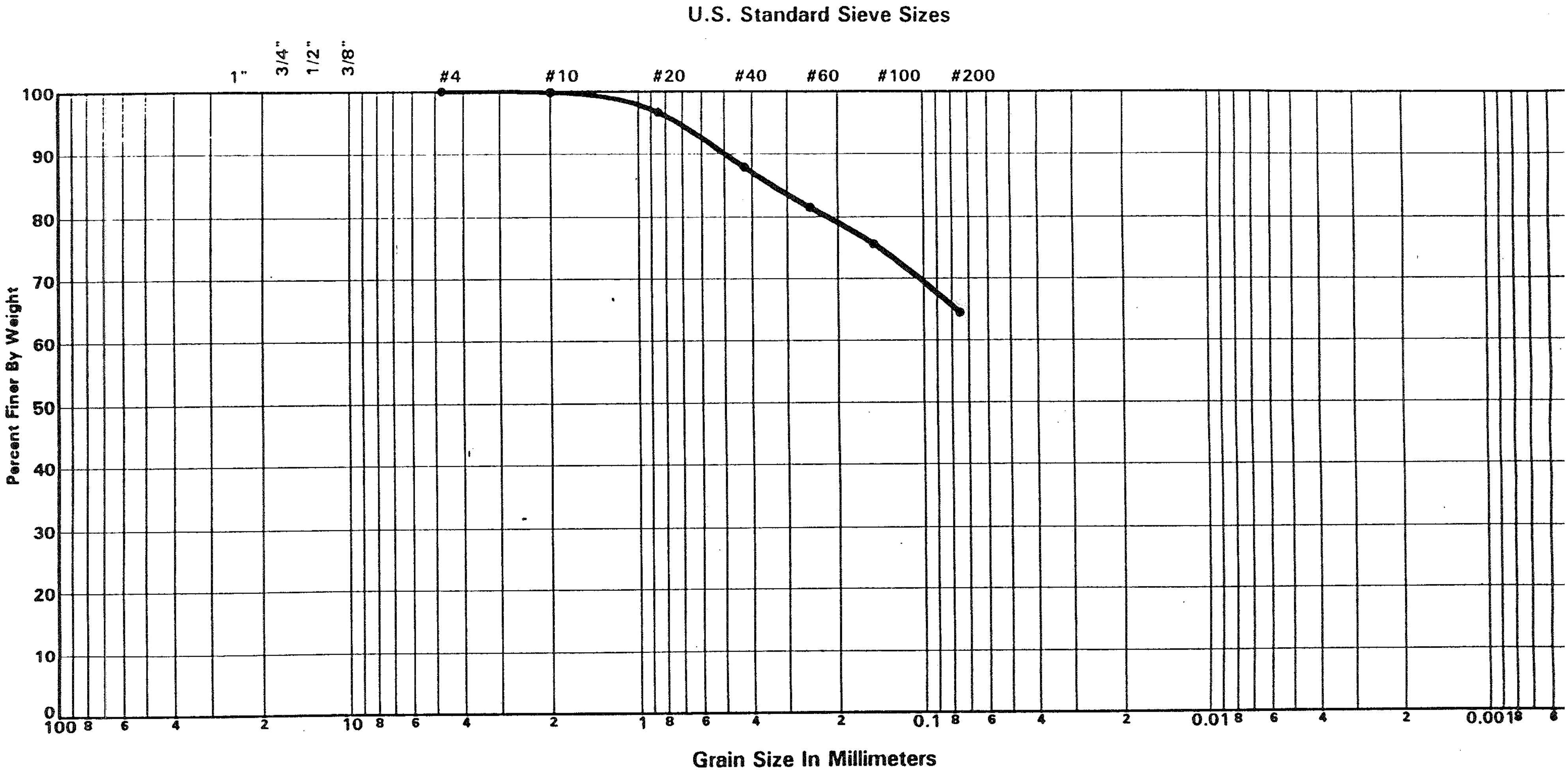
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-16<br>S-1 | 5' | 25.3 | 48.8 | 40.2 | 8.6 | Green Tan MAFIC ROCK<br>SANDY SILT (ML) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

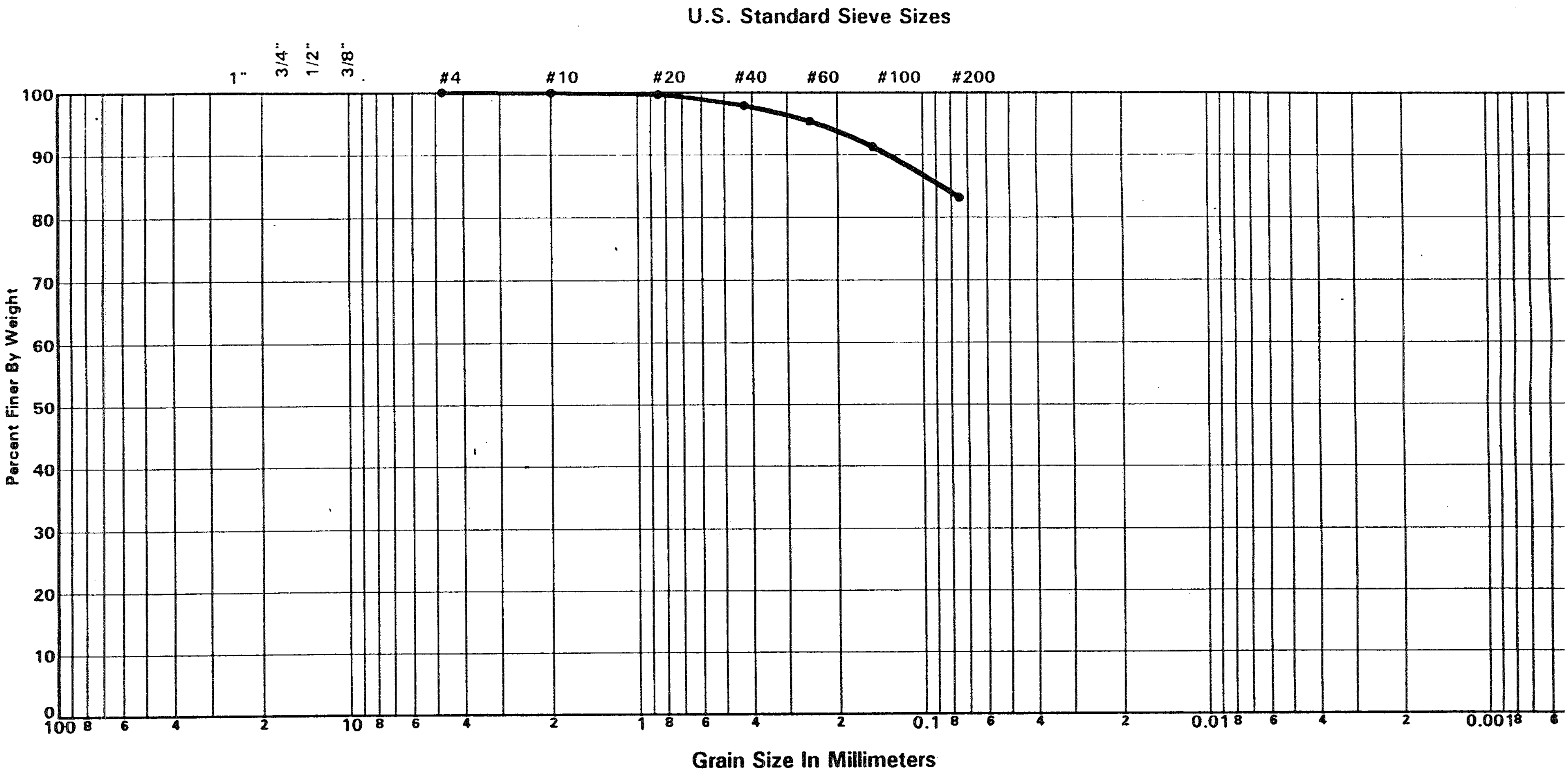
**Job No.:** 1-95-085 CA

A-5

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-16<br>S-3 | 15' | 33.6 | 52.4 | 31.1 | 21.3 | Yellow Brown MAFIC ROCK<br>ELASTIC SILT WITH SAND (MH) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

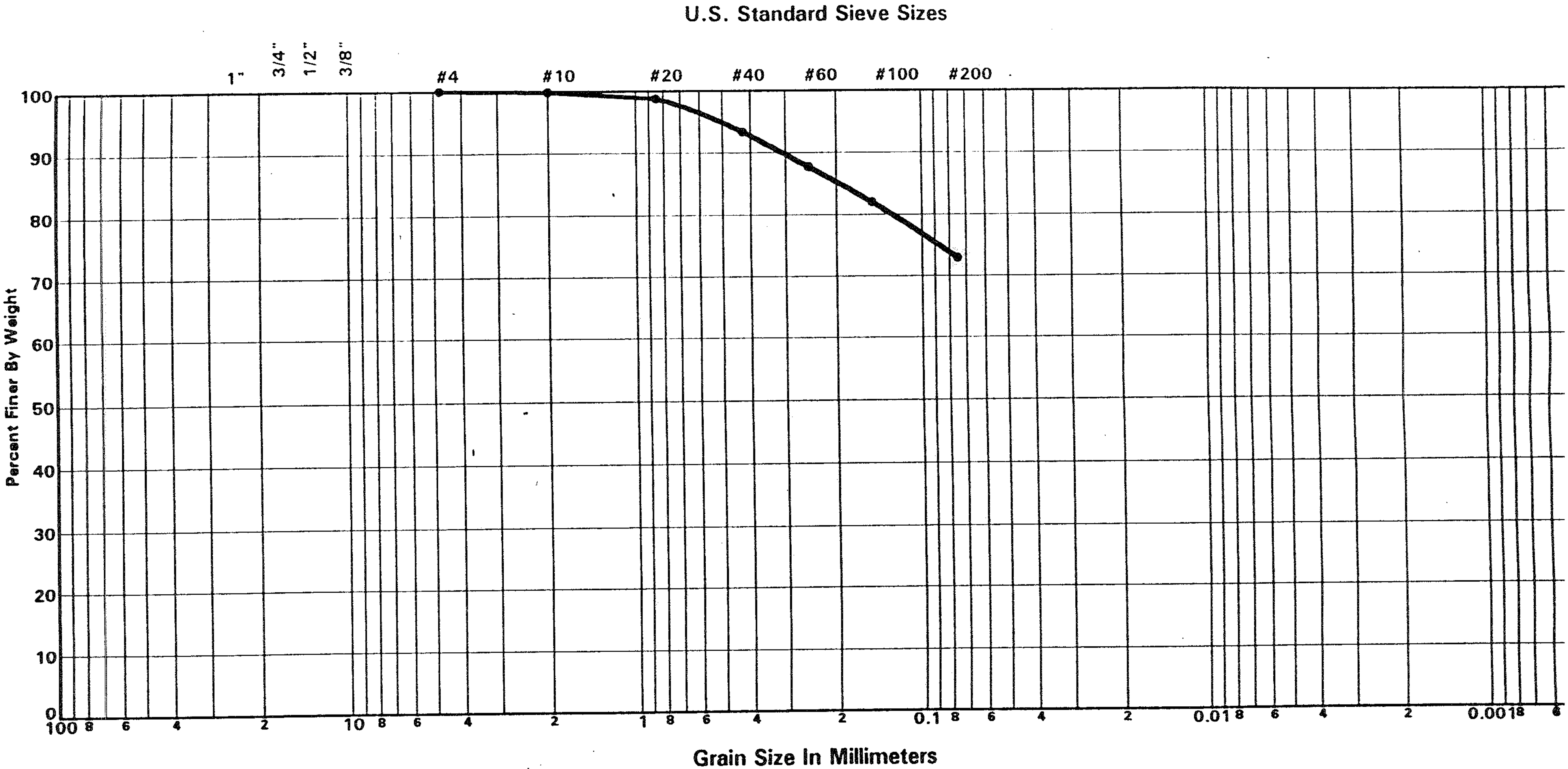
**Job No.:** 1-95-085 CA

A-7

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-16 S-5 | 25' | 32.9 | 52.7 | 34.0 | 18.7 | brown Green MAFIC ROCK ELASTIC SILT WITH SAND (MH) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

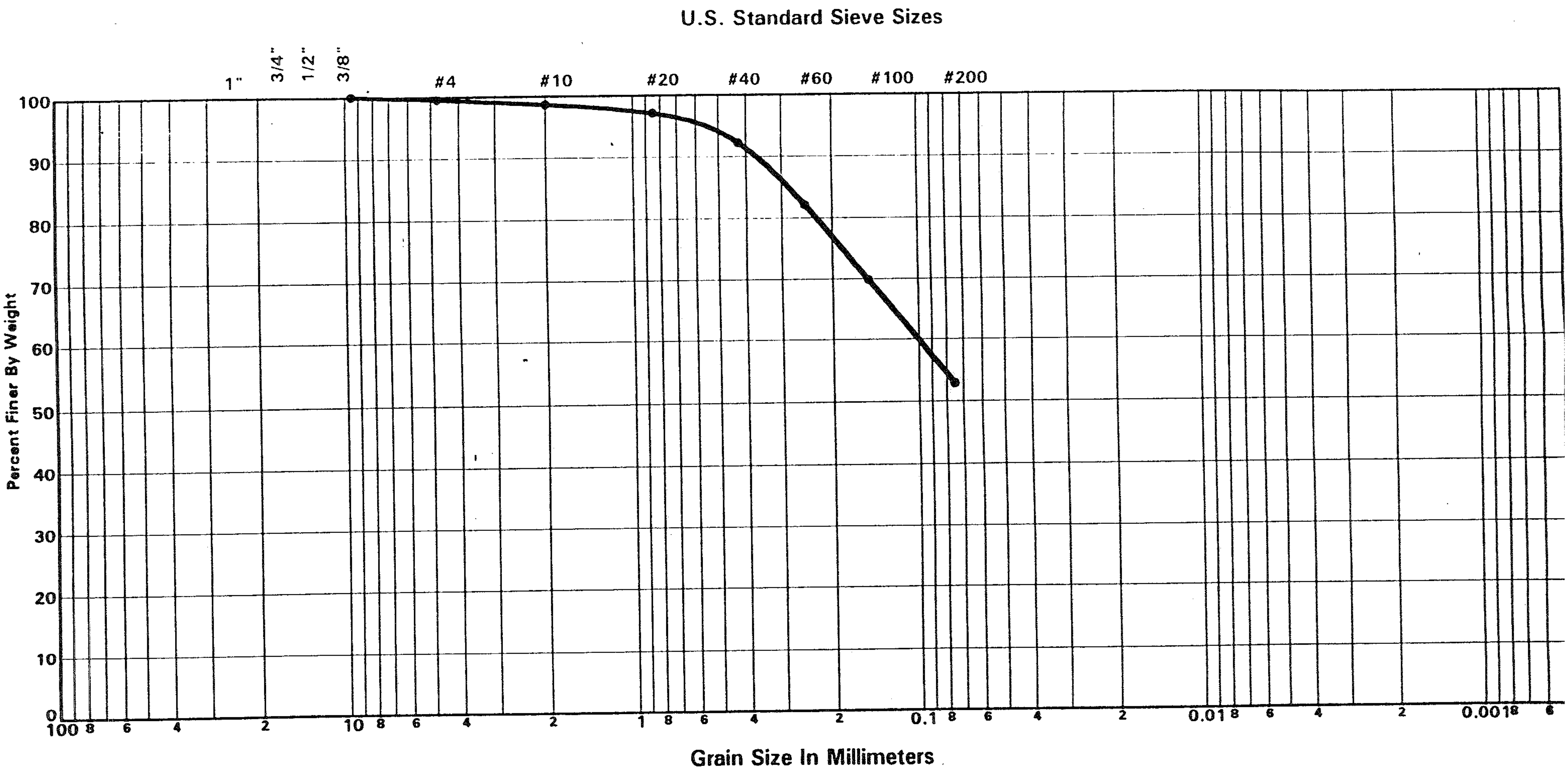
**Job No.:** 1-95-085 CA

A-7

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-17<br>S-1 | 5' | 34.0 | NP | NP | NP | Yellow Red Brown Sandy SILT GNEISS<br>SANDY SILT (ML) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

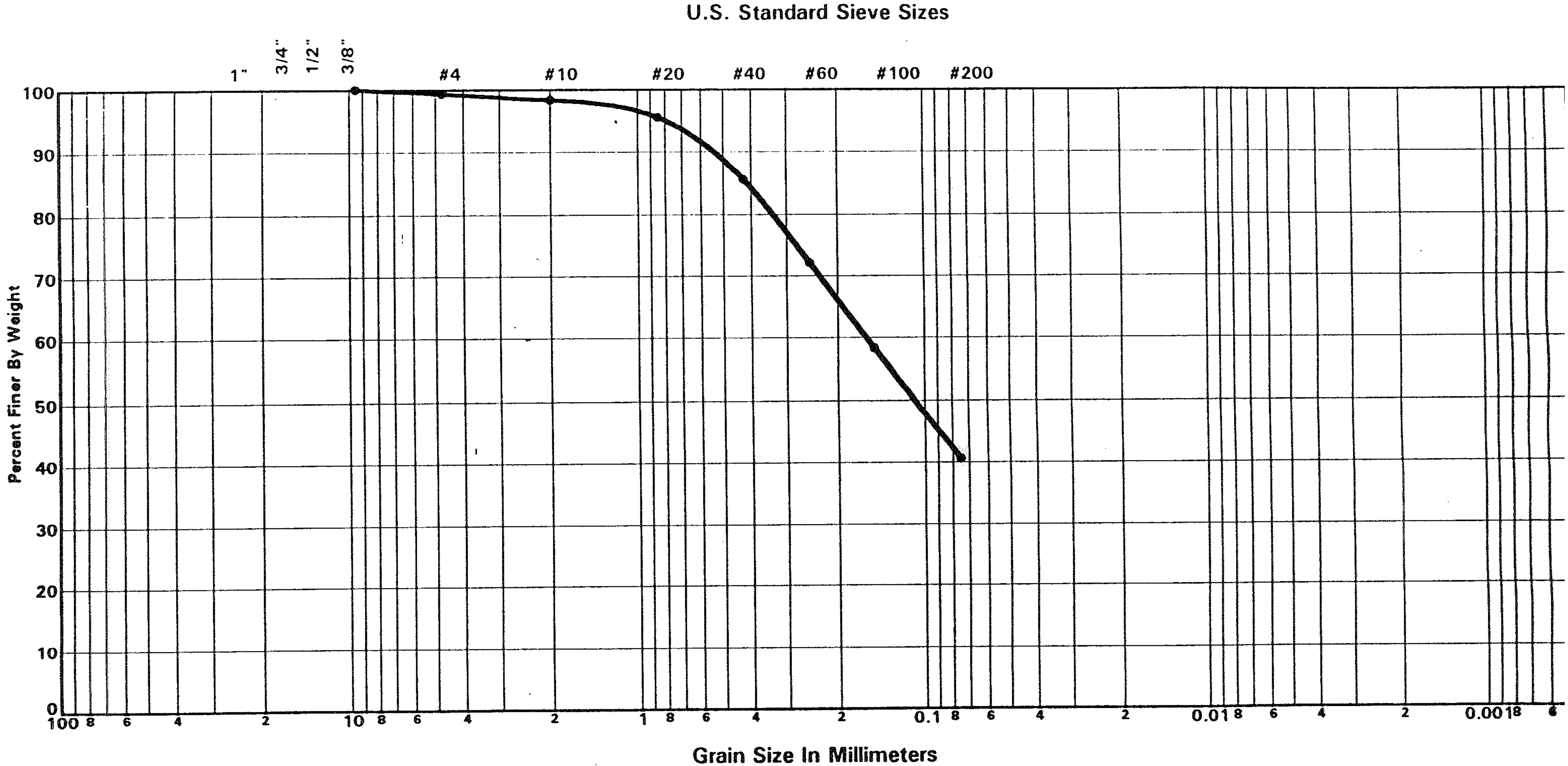
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-17<br>S-2 | 10' | 24.2 | 21.9 | 23.3 | NP | Yellow Brown<br>SILTY SAND (SM) GNEISS |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

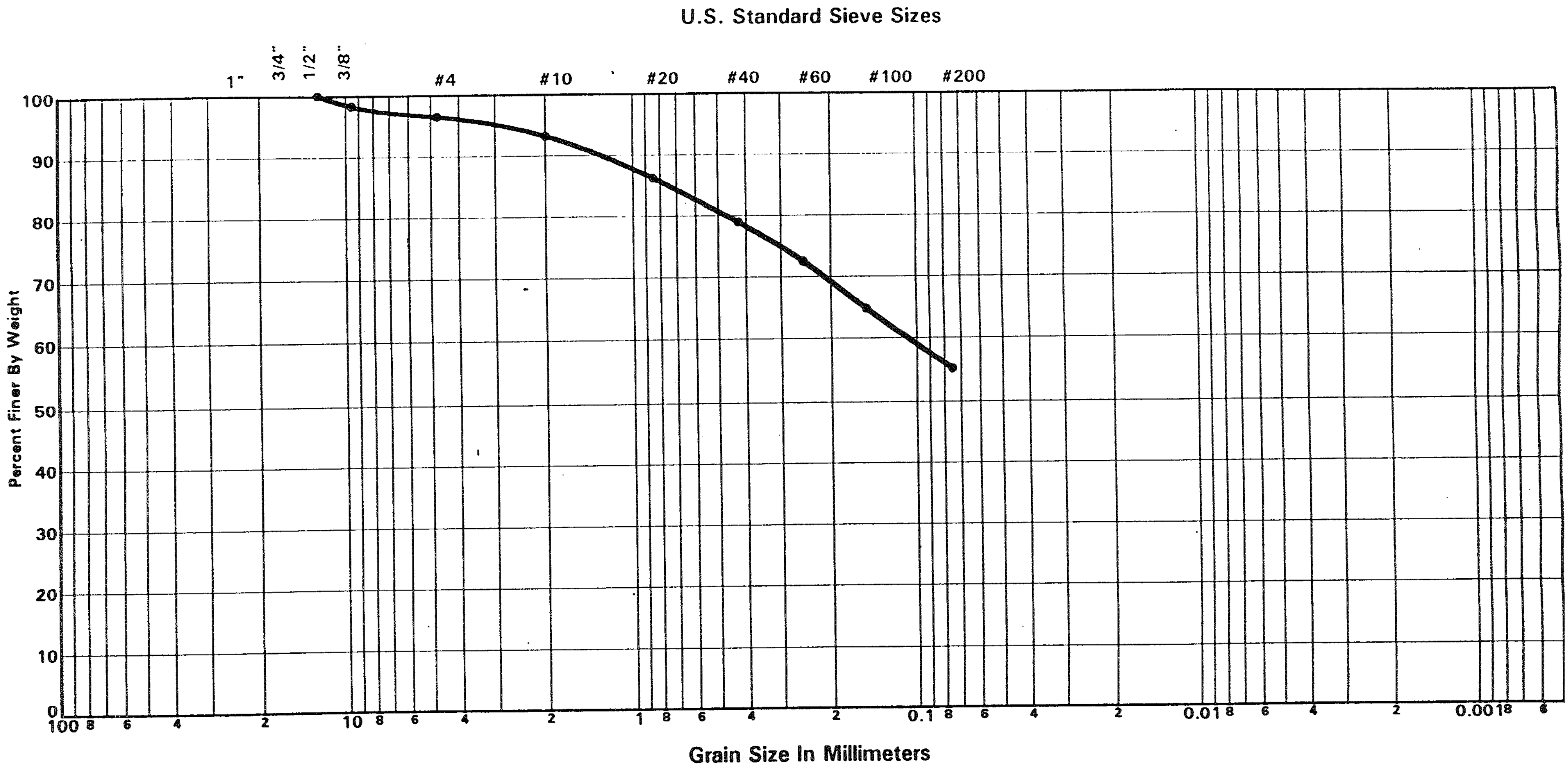
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-20<br>S-1 | 5 | 15.3 | 27.4 | 19.2 | 8.2 | Green Brown<br>SANDY LEAN CLAY (CL) GREENSTONE DIKE |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

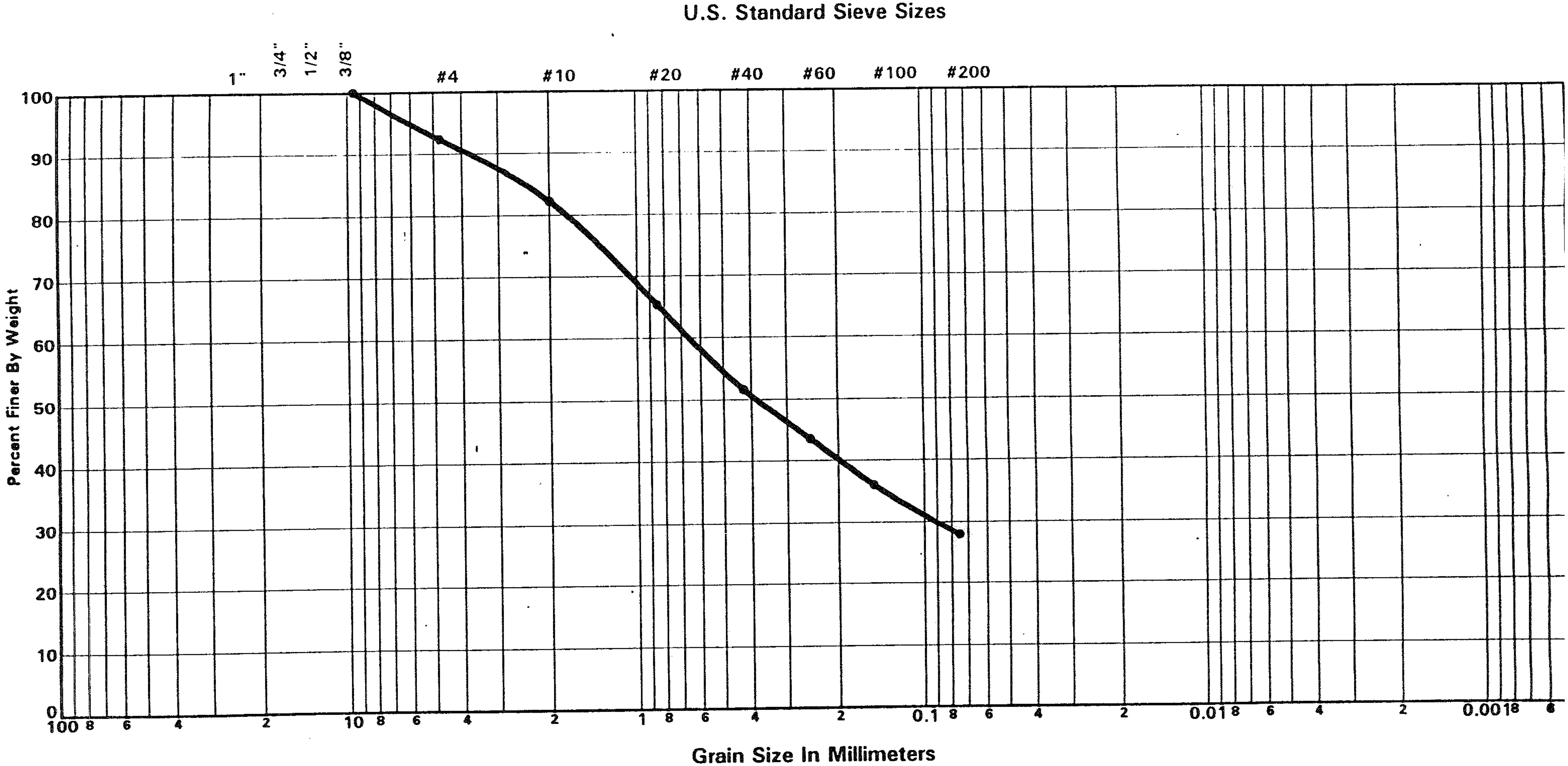
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-20<br>S-2 | 10' | 9.2 | NP | NP | NP | GNEISS<br>Brown Fine-Medium<br>SILTY CLAYEY SAND (SC-SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

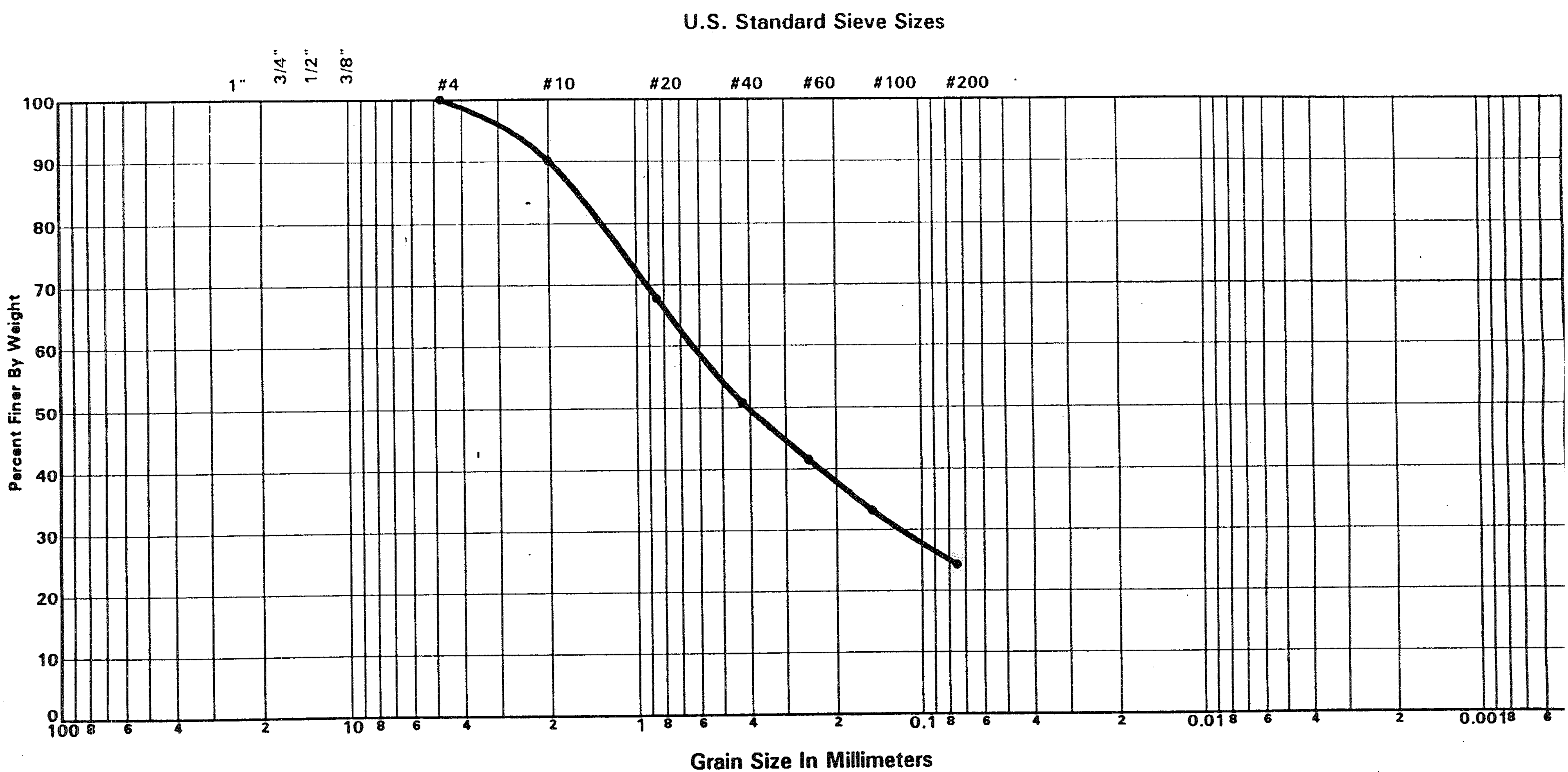
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-22<br>S-1 | 5' | 9.5 | NP | NP | NP | Tan Fine-Medium SAND<br>GRANITE<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

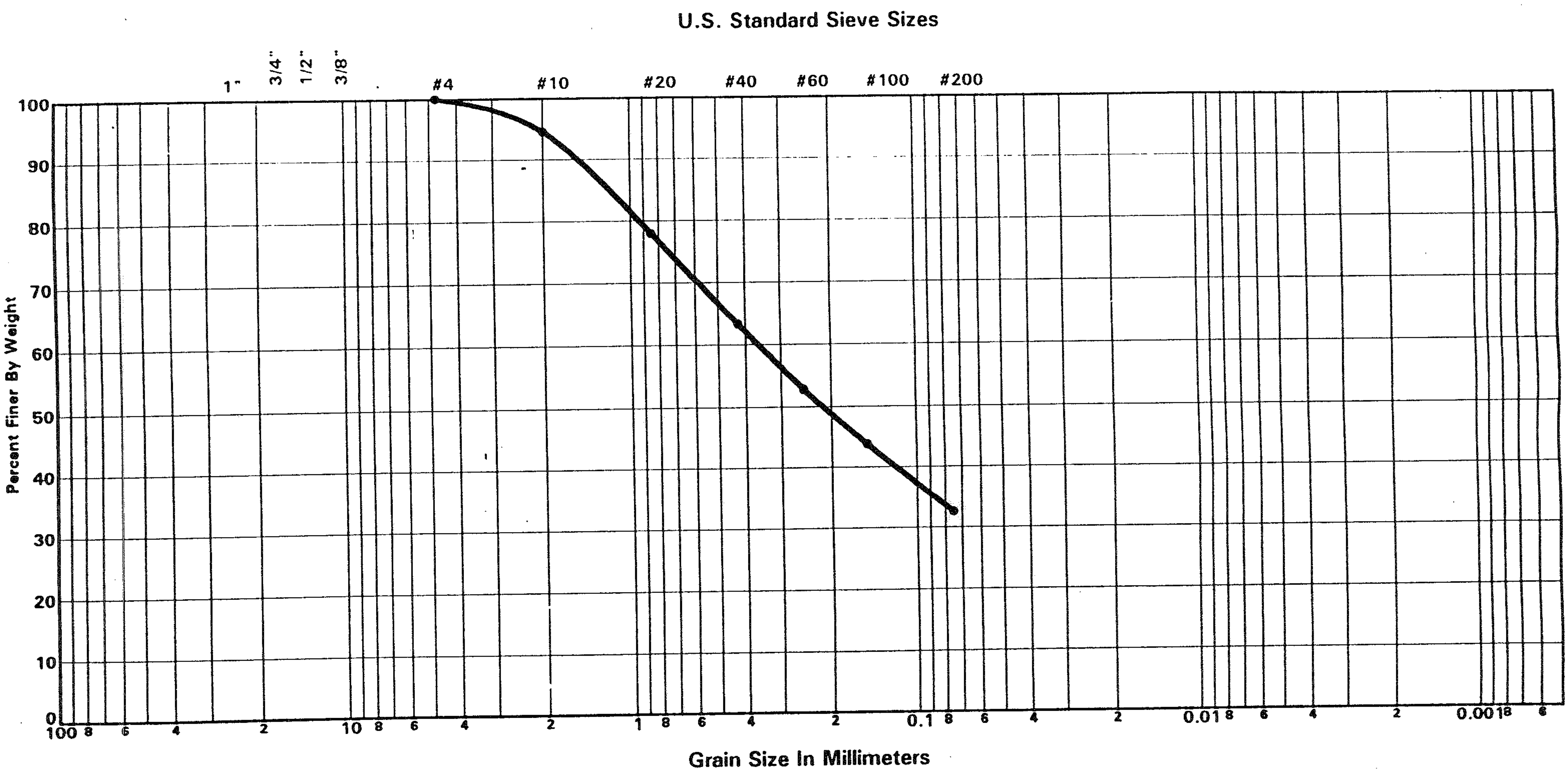
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-22<br>S-3 | 15' | 9.7 | NP | NP | NP | GRANITE<br>Tan Fine-Medium SAND<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

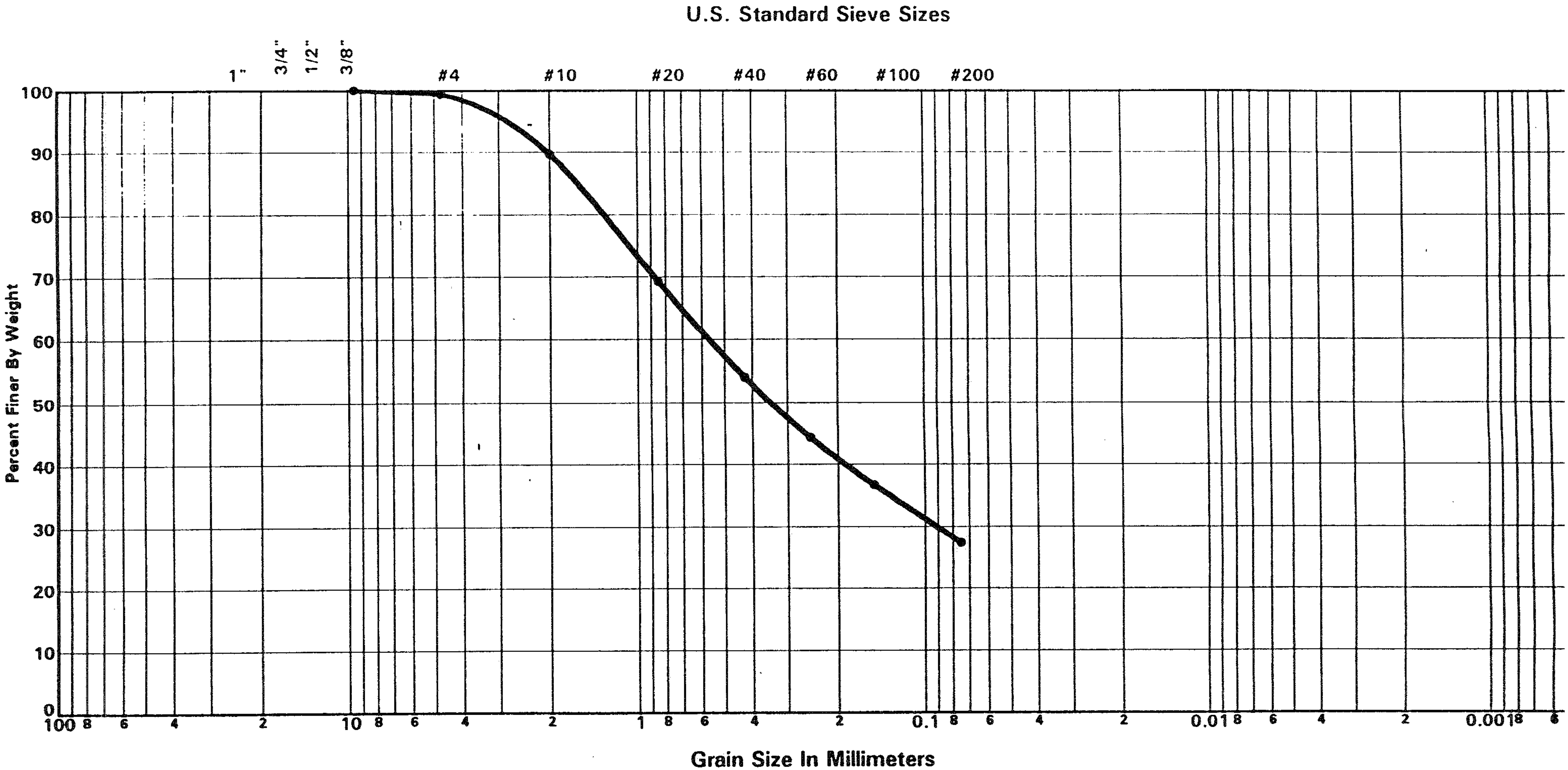
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-22<br>S-5 | 25' | 12.4 | NP | NP | NP | Tan Brown Fine-Medium SAND GRANITE<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

**Job No.:** 1-95-085 CA

A-2-4

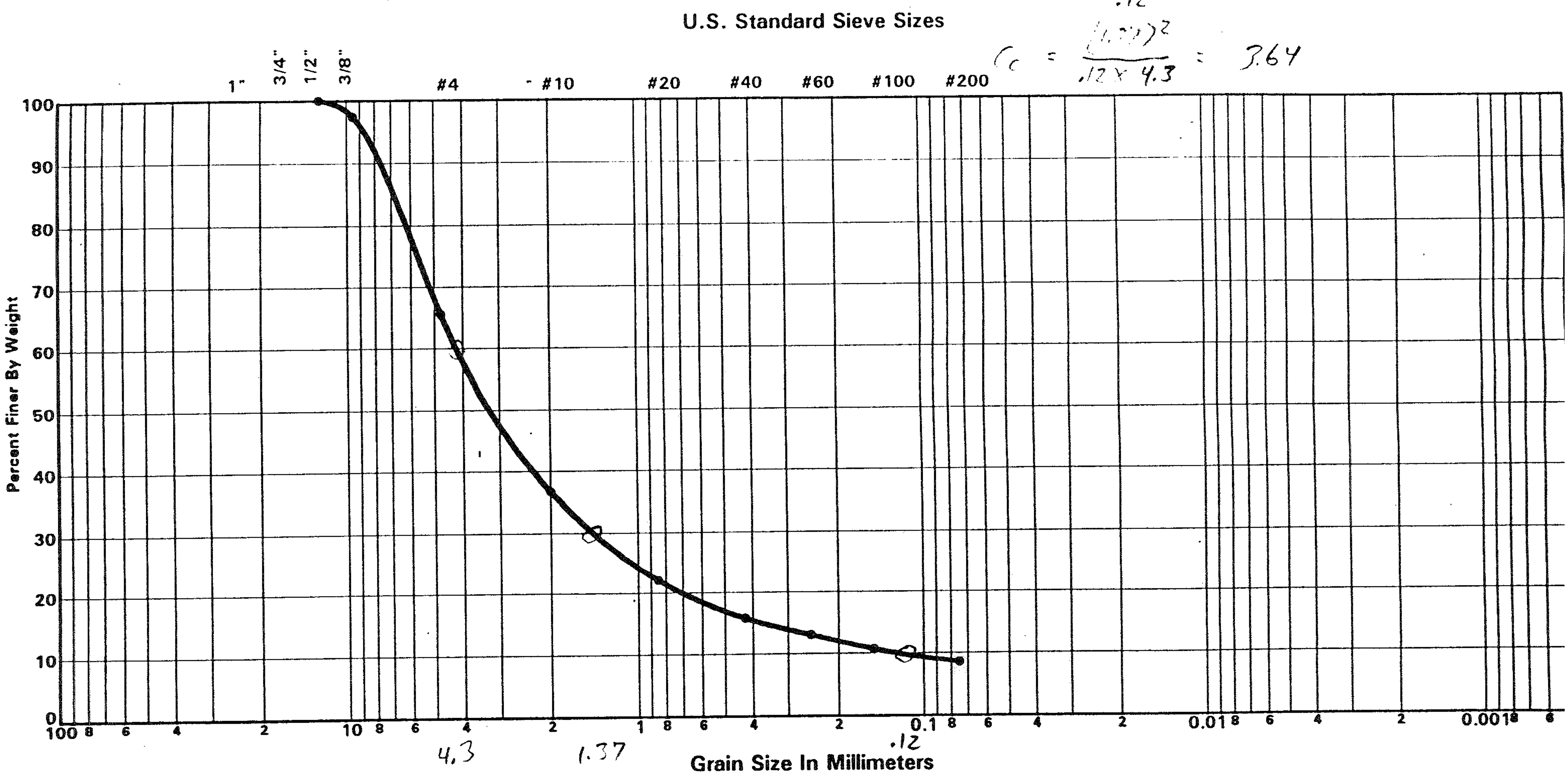
**Date:** 1/30/95

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.

$C_u = \frac{4.3}{.12} = 35.83$

$C_c = \frac{(1.37)^2}{.12 \times 4.3} = 3.64$

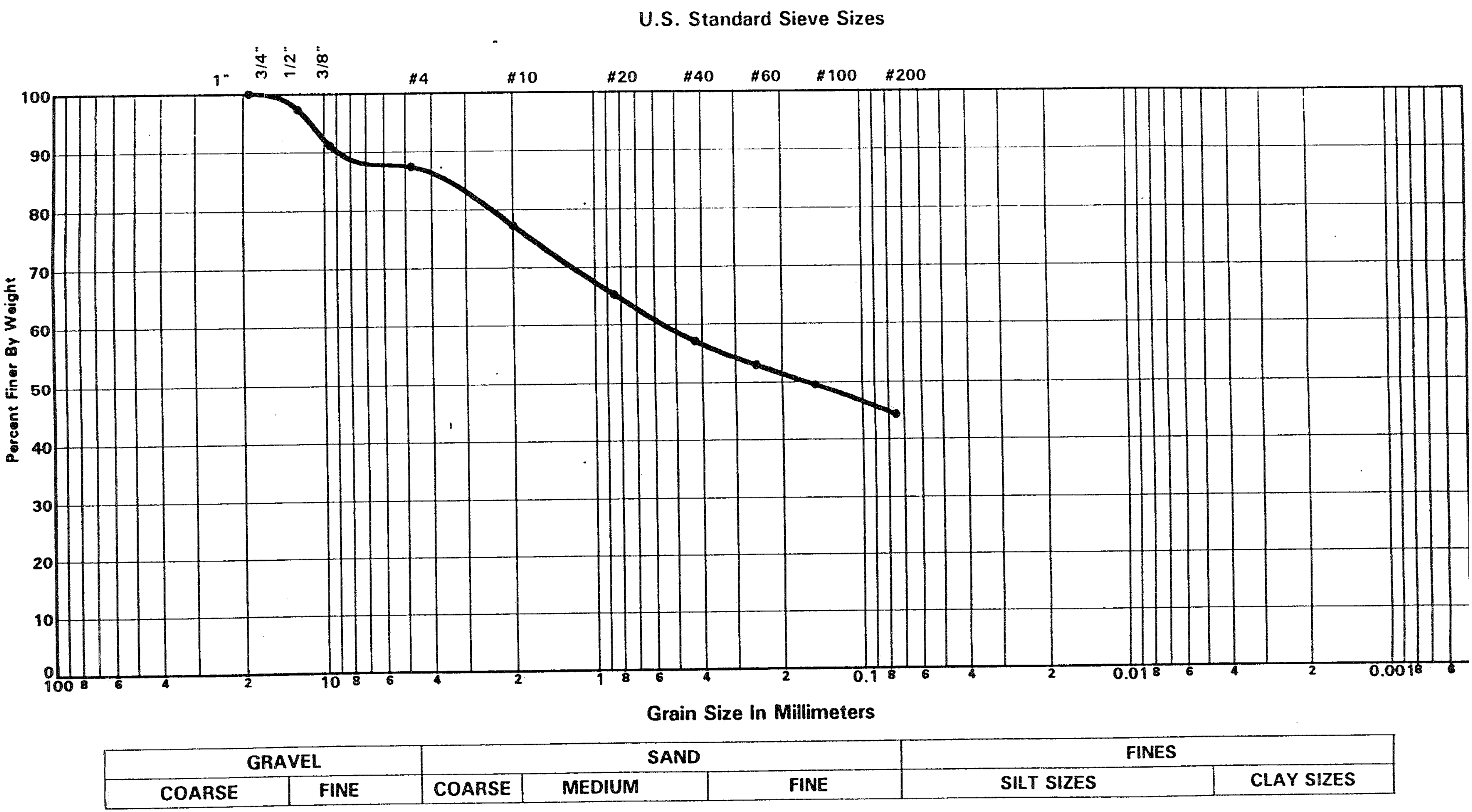



| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-24<br>S-1 | 5' | 6.6 | NP | NP | NP | Brown Tan SAND GRANITE<br>POORLY GRADED SAND WITH SILT (SP-SM) |
| **Project:**<br>Greensboro Landfill<br>Greensboro, North Carolina | | | | | | **Job No.:** 1-95-085 CA<br>A-2-4<br>**Date:** 1/30/95 |

## GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-24<br>S-2 | 10' | 8.2 | NP | NP | NP | Brown Fine SAND<br>CLAYEY SAND (SC) GREENSTONE DIKE |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

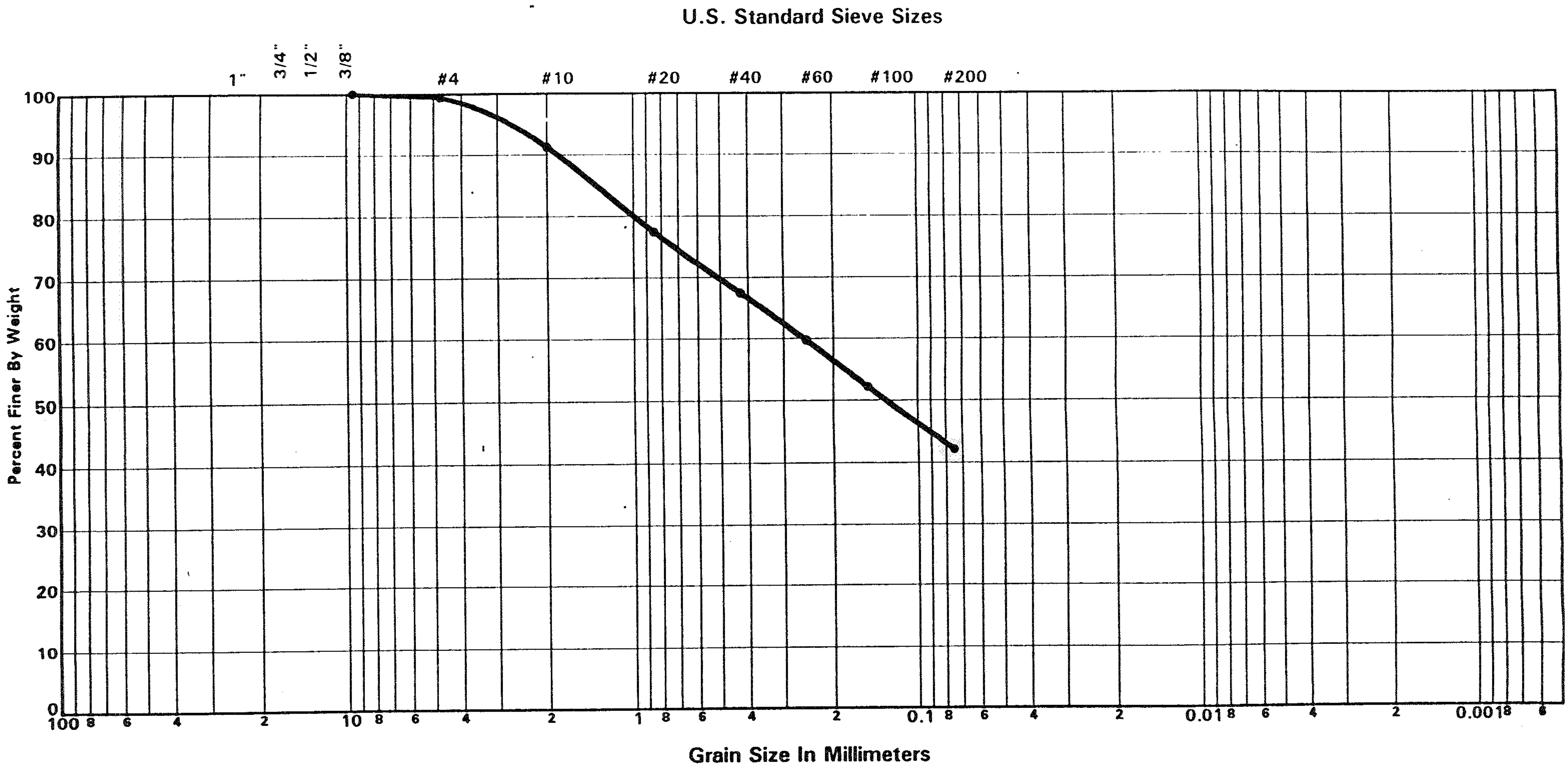
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-30 S-1 | 5' | 17.7 | NP | NP | NP | Tan Fine-Medium SAND<br>GRANITE<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

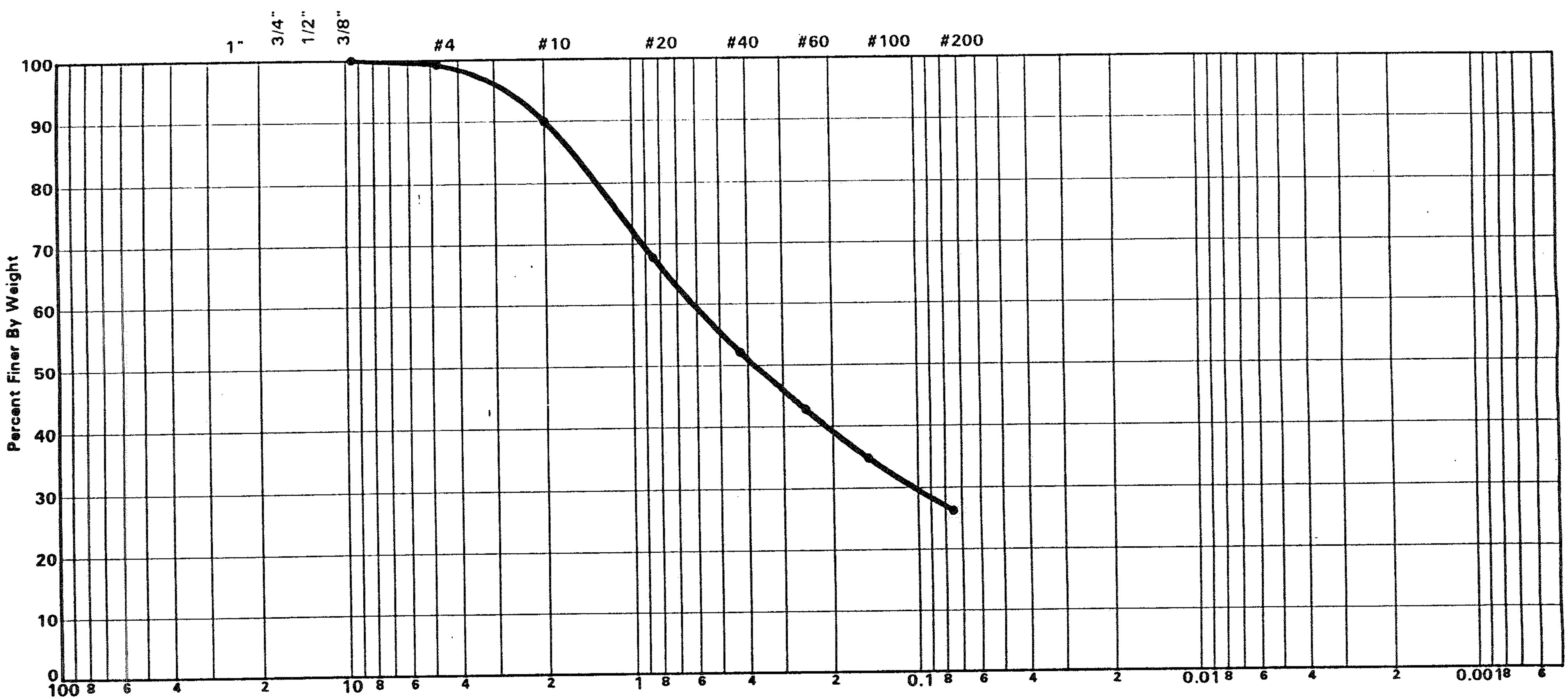
**Job No.:** 1-95-085 CA

A-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-30<br>S-3 | 15' | 8.2 | NP | NP | NP | GRANITE<br>Tan Fine-Medium SAND<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

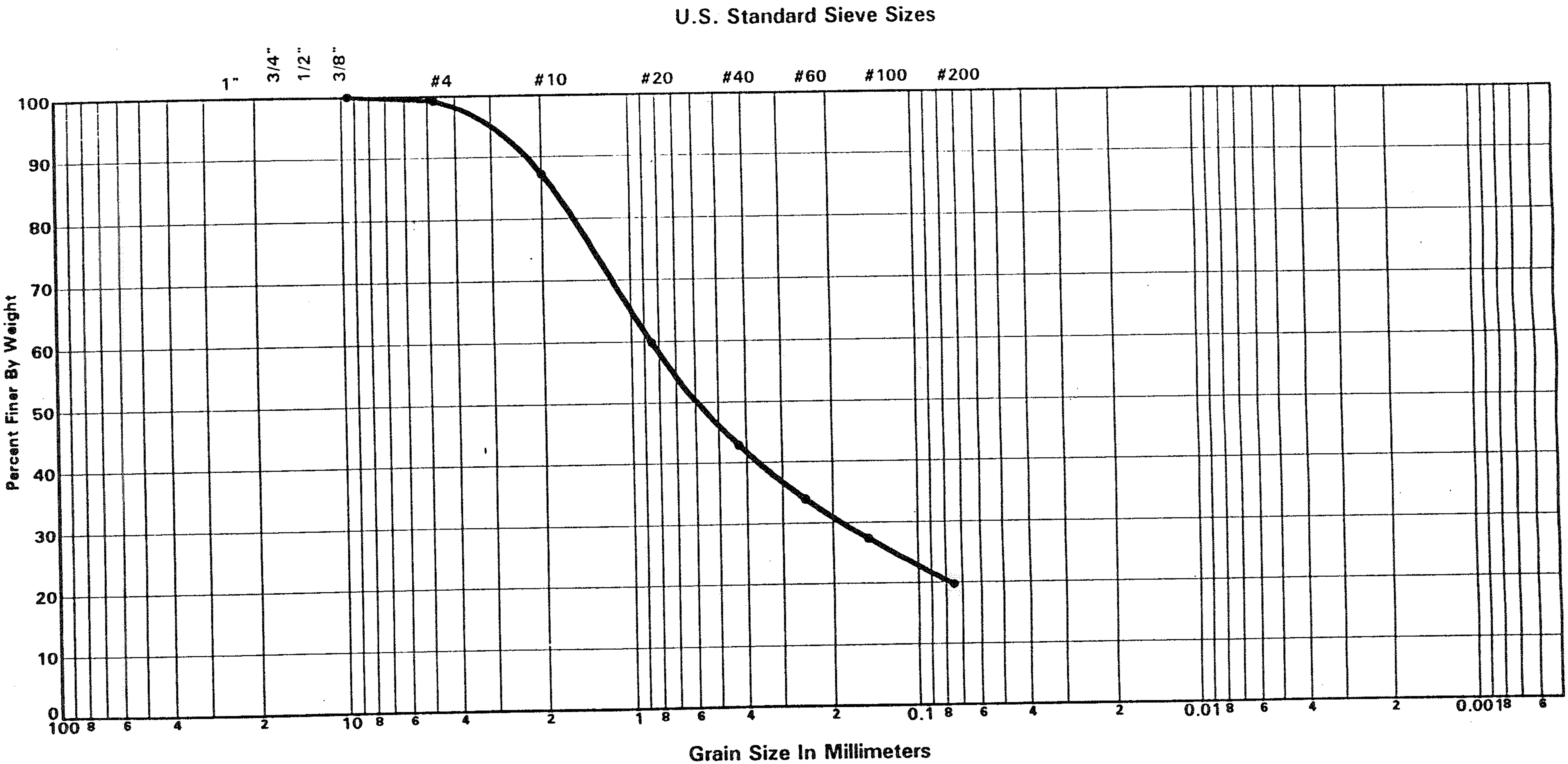
**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.




| GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|
| COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

# GRAIN SIZE DISTRIBUTION

GeoTechnologies, Inc.

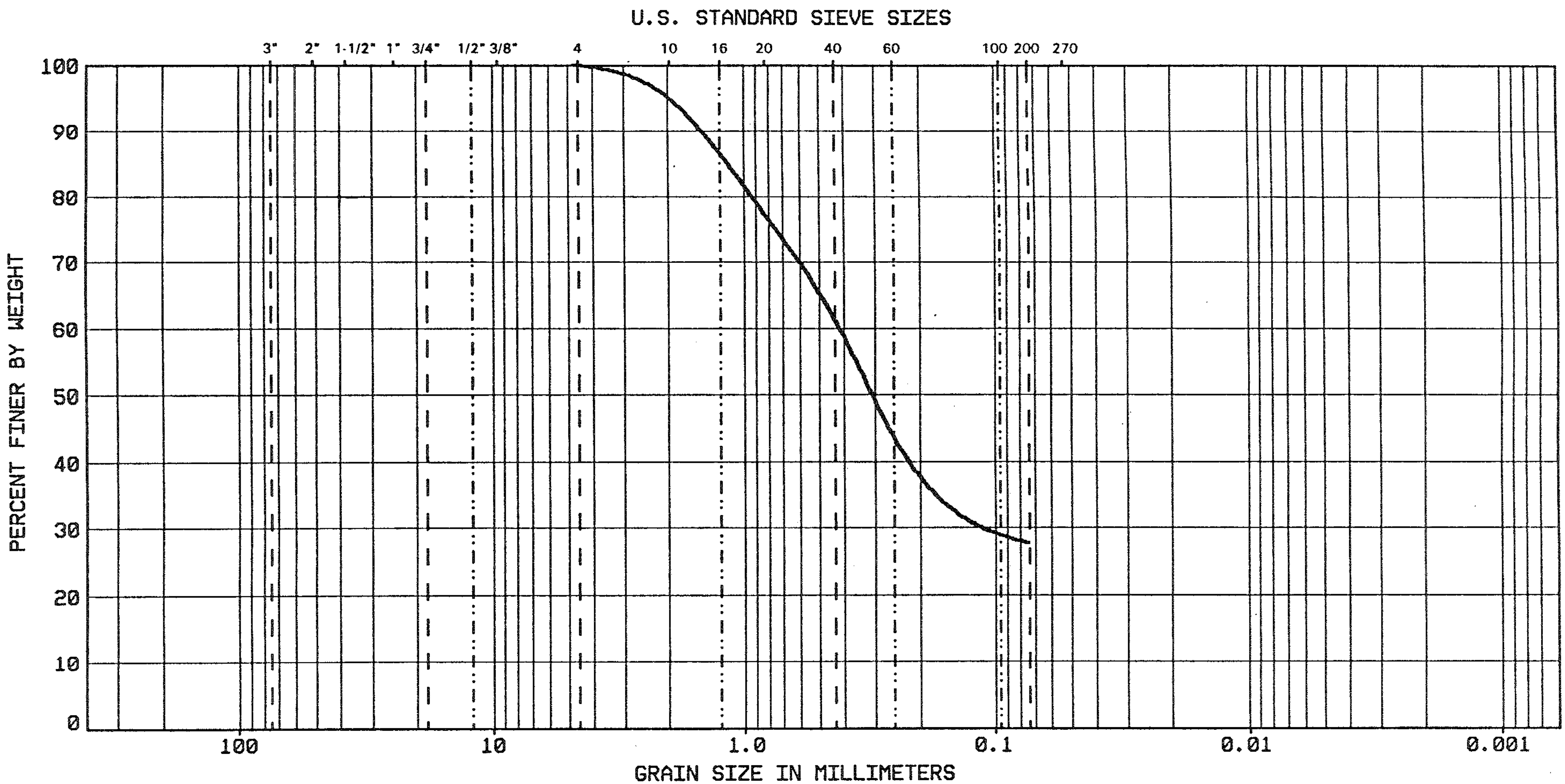
| Boring No. | Elev./Depth | Nat. W.C. | L.L. | P.L. | P.I. | Soil Description or Classification |
|---|---|---|---|---|---|---|
| B-30<br>S-5 | 25' | 10.2 | NP | NP | NP | GRANITE<br>Tan Fine-Medium SAND<br>SILTY SAND (SM) |

**Project:**
Greensboro Landfill
Greensboro, North Carolina

**Job No.:** 1-95-085 CA

A-2-4

**Date:** 1/30/95



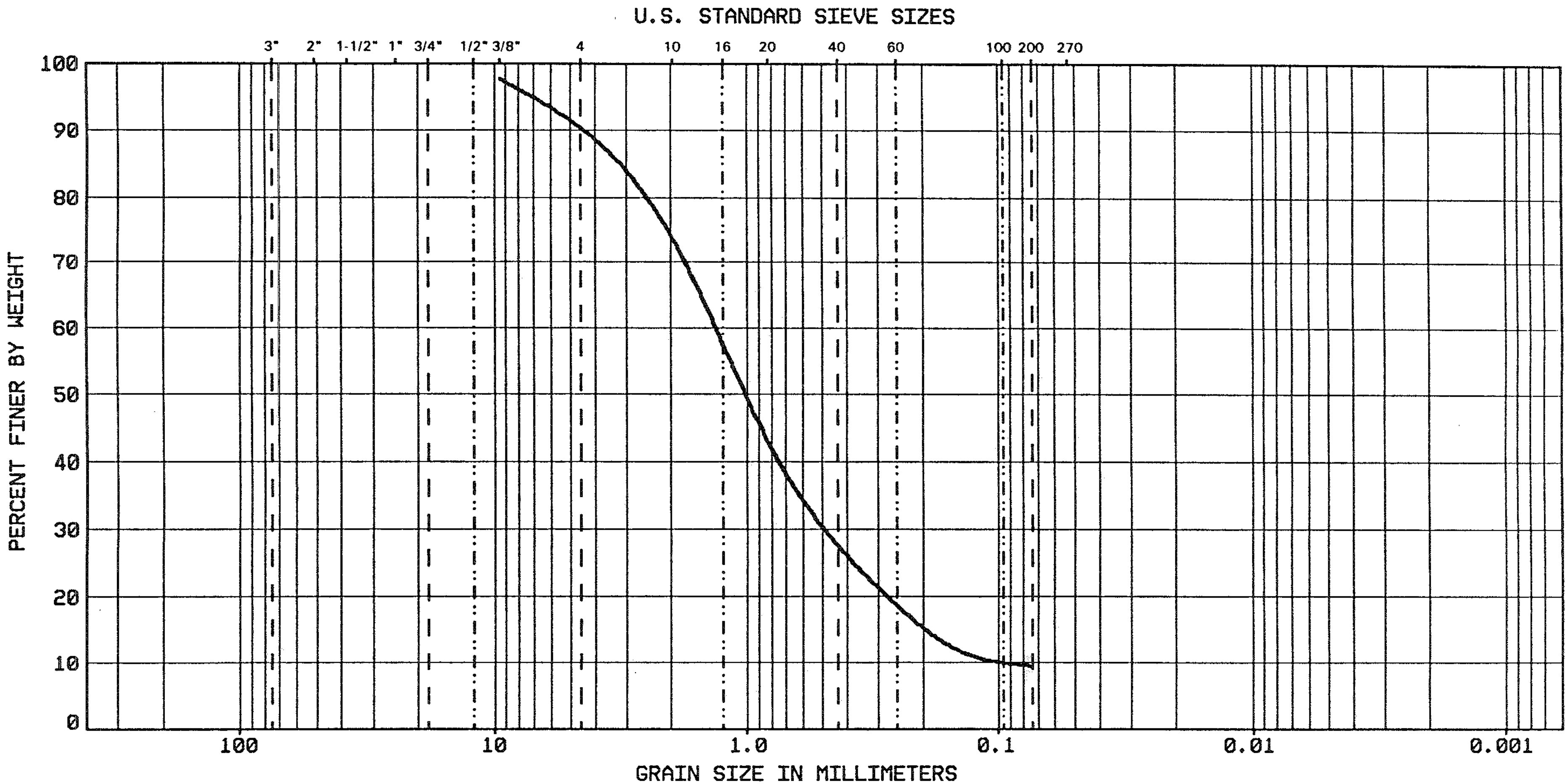

| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO. | DEPTH(FT) | NMC % | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-46 | 1.0-3.0 | 21.4 | 36 | NP | NP | Tan-Brown Silty Coarse to Fine SAND(SM) |

**GRAIN SIZE DISTRIBUTION**

*JOB NO. 011-95-177*

**TRIGON**



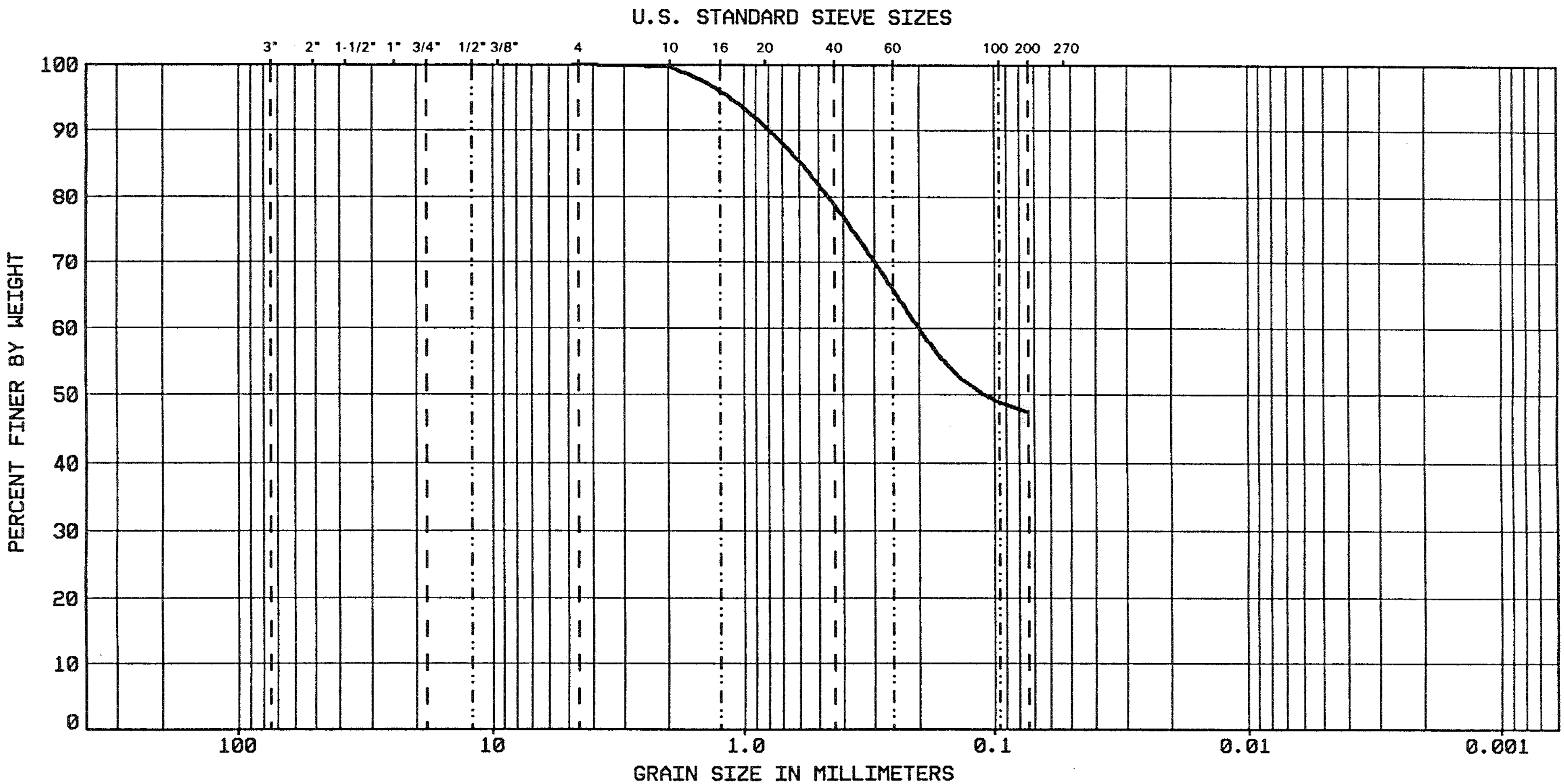

| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO. | DEPTH(FT) | NMC % | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-47 | 1.0-4.0 | 6.8 | 24 | NP | NP | White-Tan-Brown Sli. Mic. Silty Coarse to Fine SAND(SM) |

## GRAIN SIZE DISTRIBUTION

*JOB NO. 011-95-177*

**TRIGON**



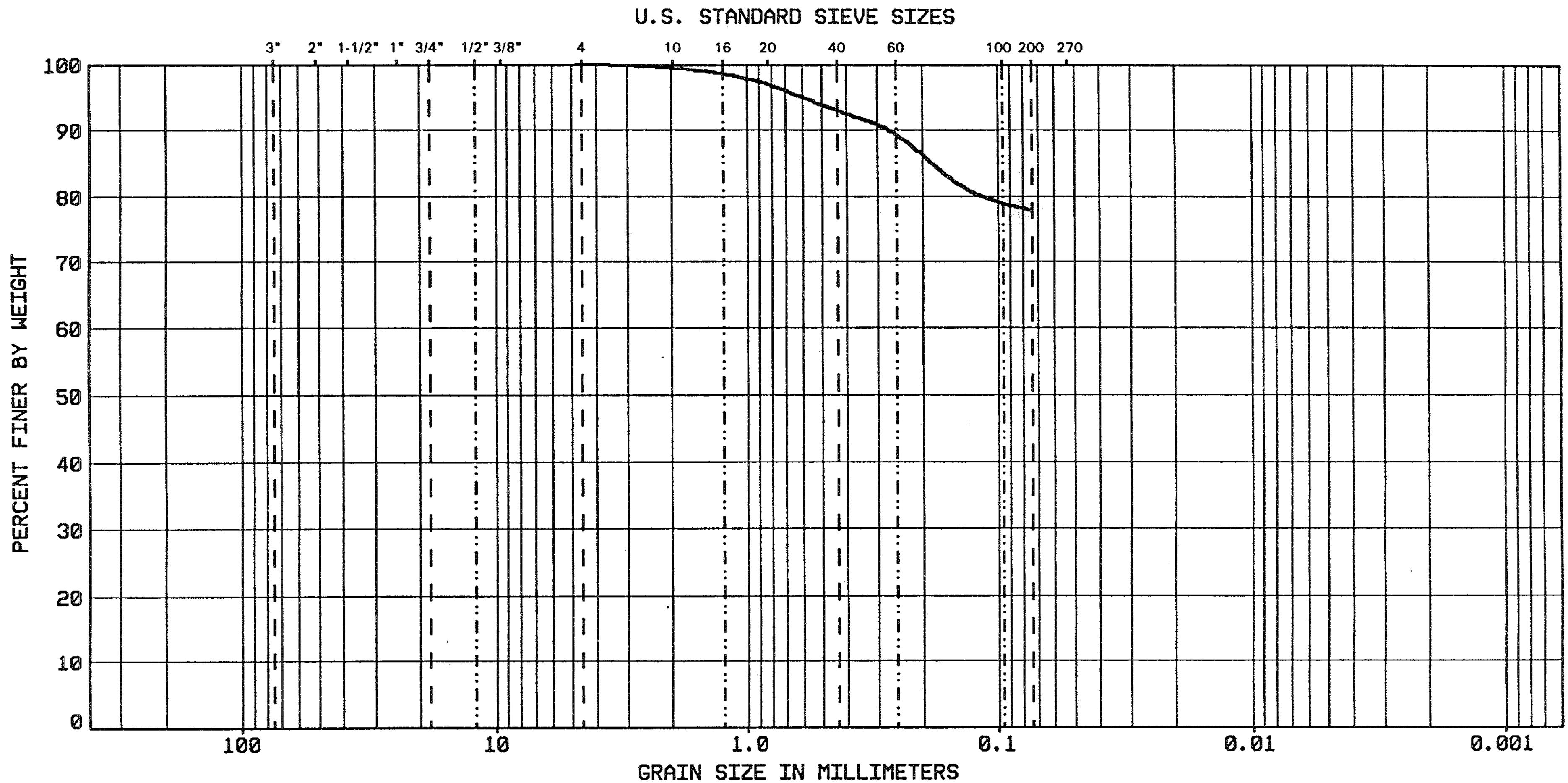

| BOUL DERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO. | DEPTH(FT) | NMC % | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-50 | 0.0-3.0 | 12.8 | 31 | NP | NP | Tan Silty Medium to Fine SAND(SM) |

**GRAIN SIZE DISTRIBUTION**

*JOB NO. 011-95-177*

**TRIGON**




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

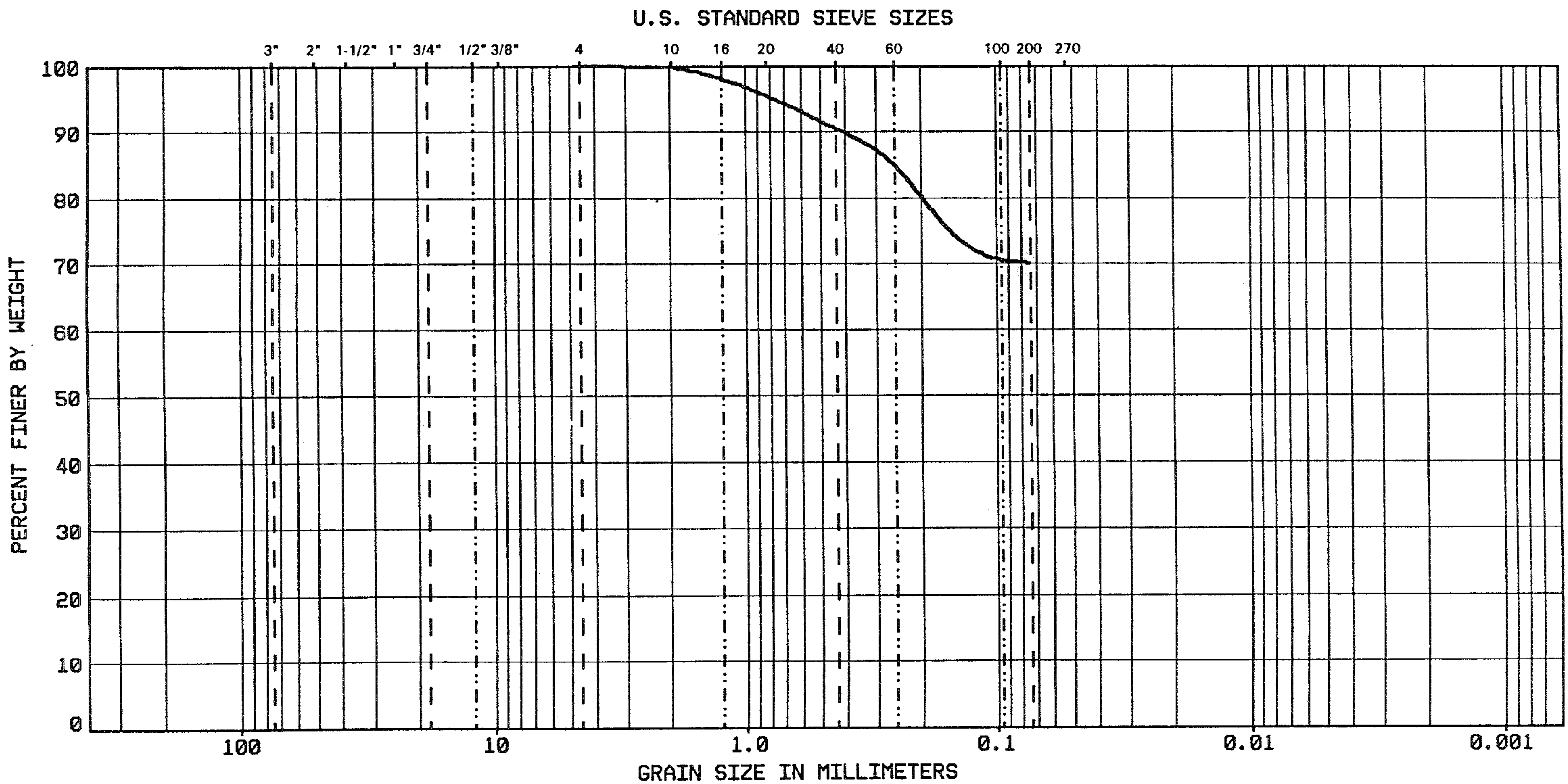
| BORING NO. | DEPTH(FT) | NMC % | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-53 | 0.5-3.0 | 47.9 | 58 | 47 | 11 | Tan-Brown Medium to Fine Sandy Clayey SILT(MH) |

A-7

## GRAIN SIZE DISTRIBUTION

*JOB NO. 011-95-177*

**TRIGON**




| BOUL DERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

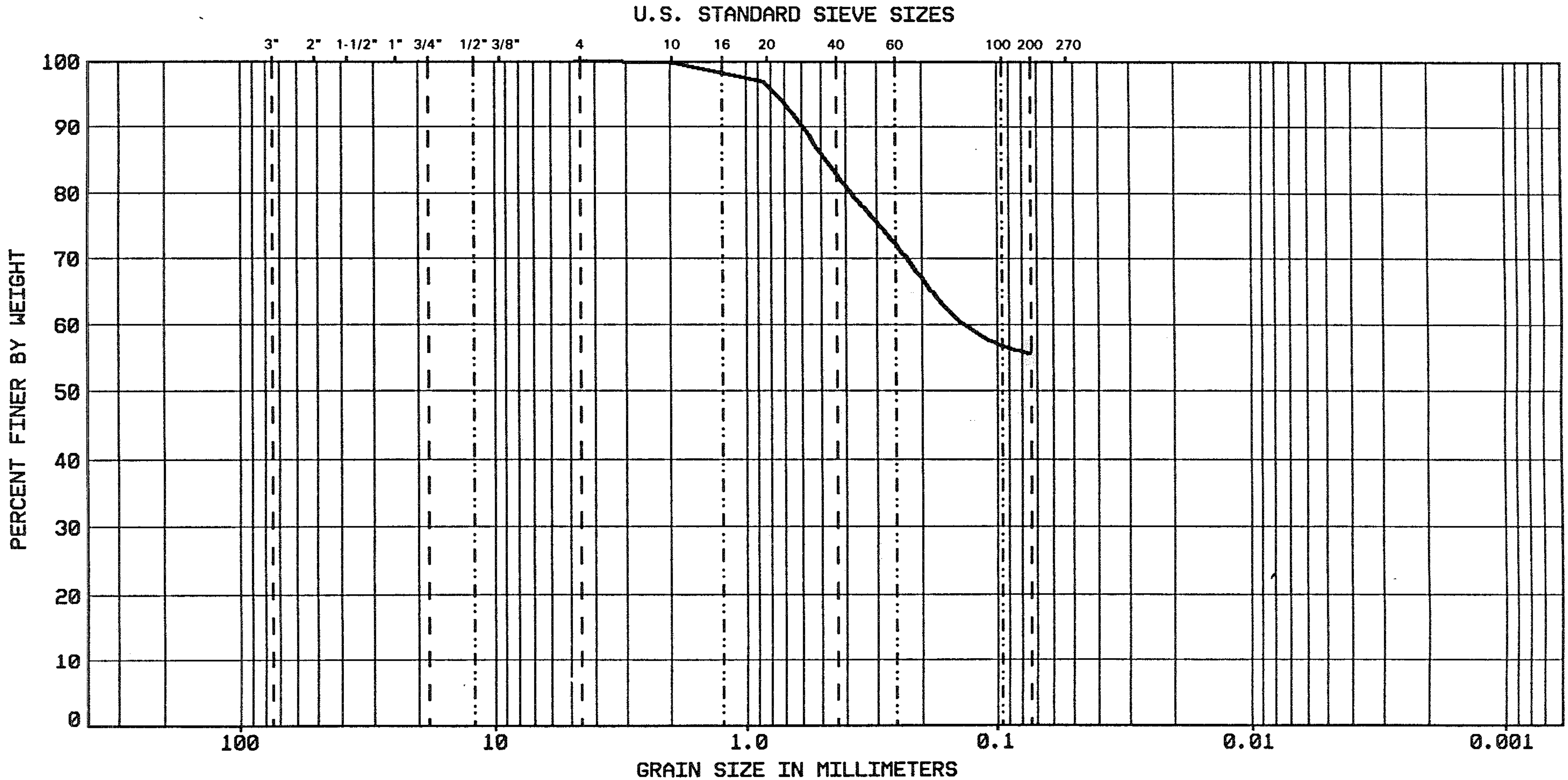
| BORING NO. | DEPTH(FT) | NMC % | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-55/56 | 0.0-5.0 | 33.6 | 45 | 40 | 5 | Orange-Brown Slightly Clayey Medium to Fine Sandy SILT (ML) |

A-5

## GRAIN SIZE DISTRIBUTION

*JOB NO. 011-95-177*

**TRIGON**




| BOUL DERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO. | DEPTH(FT) | NMC % | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-57/58 | 0.0-5.0 | 10.4 | 24 | NP | NP | Grey-Tan Medium to Fine Sandy SILT (ML) |

# GRAIN SIZE DISTRIBUTION

*JOB NO. 011-95-177*

**TRIGON**

## SUMMARY OF LABORATORY TEST DATA[1]

| Boring No. | Sample Depth (ft.) | Sample Type[2] | Natural Moisture Content (%) | USCS Class. | Atterberg Limits | | | Standard Proctor Curve | | Undisturbed Data | | Permeability* (cm/sec) | Porosity (%) | Percent Passing Sieve No. 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L.L. | P.L. | P.I. | Max. Dry Density (pcf) | Opt. Water Content (%) | Dry Unit Weight (pcf) | Moisture Content (%) | | | |
| B-46 | 1.0 - 3.0 | UD | | SM | 36 | NP | NP | | | 90.6 | 21.4 | ~~5.0 E-7~~ | ~~42.8~~ | 27.8 |
| B-47 | 1.0 - 4.0 | PB | | SM | 24 | NP | NP | | | 143.8 | 6.8 | 1.0 E-6 | 17.1 | 9.5 |
| B-50 | 0 - 3.0 | UD | | SM | 31 | NP | NP | | | 115.2 | 12.8 | ~~6.0 E-7~~ | 31.9 | 47.6 |
| B-53 | 0.5 - 3.0 | UD | | MH | 58 | 47 | 11 | | | 75.6 | 47.9 | ~~4.1 E-7~~ | 57.0 | 77.9 |
| B-55<br>B-56 | 0 - 5.0 | Bag | 33.6 | ML | 45 | 40 | 5 | 87.9 | 32.5 | | | ~~2.1 E-7~~ | | 70.1 |
| B-57 | 0 - 5.0 | Bag | 10.4 | ML | 24 | NP | NP | 124.7 | 12.8 | | | ~~2.8 E-7~~ | | 55.6 |
| B-58 | 0 - 5.0 | Bag | 21.1 | | | | | | | | | | | |

[1]Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary.
[2]SS = Split Spoon Sample (ASTM D-1586)
UD = Undisturbed Sample (ASTM D-1587)
PB = Pitcher Barrel
* = Permeability Tests rerun after using improper equipment

TRIGON ENGINEERING CONSULTANTS, IN
GREENSBORO, NORTH CAROLIN

JOB NUMBER: 011-95-177
Page 1 of __

# SUMMARY OF LABORATORY TEST DATA[1]

RE-TEST DATA

| Boring No. | Sample Depth (ft.) | Sample Type[2] | Natural Moisture Content (%) | USCS Class. | Atterberg Limits | | | Standard Proctor Curve | | Undisturbed Data | | Permeability (cm/sec) | Porosity (%) | Percent Passing Sieve, No. 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L.L. | P.L. | P.I. | Max. Dry Density (pcf) | Opt. Water Content (%) | Dry Unit Weight (pcf) | Moisture Content (%) | | | |
| | | | | | | | | | | | | | | |
| B-46 | 1.0 - 3.0 | UD | | | | | | | | | | 2.7 E-6 | 45.0 | |
| | | | | | | | | | | | | | | |
| B-50 | 0.5 - 3.0 | UD* | | | | | | | | | | 2.6 E-6 | | |
| | | | | | | | | | | | | | | |
| B-53 | 0.5 - 2.0 | UD* | | | | | | | | | | 3.7 E-7 | | |
| | | | | | | | | | | | | | | |
| B-55<br>B-56 | 0 - 5.0 | Bag** | | | | | | | | | | 3.3 E-7 | | |
| | | | | | | | | | | | | | | |
| B-57 | 0 - 5.0 | Bag** | | | | | | | | | | 3.9 E-7 | | |
| | | | | | | | | | | | | | | |

[1]Graphic Presentations of Results of Triaxial, Consolidation, CBR, Proctor, Grain Size, and other tests follow this summary.
[2]SS = Split Spoon Sample (ASTM D-1586)
UD = Undisturbed Sample (ASTM D-1587)
PB = Pitcher Barrel
*New UD
**New Remolded Sample

TRIGON ENGINEERING CONSULTANTS, INC
GREENSBORO, NORTH CAROLINA

JOB NUMBER: 011-95-177
Page 1 of 1

# Porosity Calculations

RETESTED B-46 1.0-3.0

$W_s$ = 100.00

$W_p$ = 166.0

$W_{pw}$ = 664.1

$T_1$ = 22°

$W_{pws}$ = 726.3

$T_x$ = 22°

$$G_s = \frac{.9996(100)}{100 + 664.1 - 726.3} = 2.64$$

$$n = \left(1 - \frac{90.6}{(2.64)(62.4)}\right) \times 100 = 45.0\ \%$$

B-46 1.0-3.0

$W_s$ = 100.00

$W_p$ = 166.0

$W_{pw}$ = 664.0

$T_1$ = 21°

$W_{pws}$ = 724.7

$T_x$ = 21°

$$G_s = \frac{.9998(100)}{100 + 664.0 - 724.7} = 2.54$$

$$n = \left(1 - \frac{90.6}{(2.54)(62.4)}\right) \times 100 = 42.8\ \%$$

B-47 1.0-4.0

$W_s$ = 100.0

$W_p$ = 166.0

$W_{pw}$ = 664.0

$T_1$ = 23°

$W_{pws}$ = 728.0

$T_x$ = 23°

$$G_s = \frac{.9993(100)}{100 + 664 - 728.0} = 2.78$$

$$n = \left(1 - \frac{143.8}{(2.78)(62.4)}\right) \times 100 \quad 17.1\ \%$$

**B-50 0-3.0**

$W_s$ = 100.0

$W_p$ = 165.3

$W_{pw}$ = 663.5

$T_i$ = 23°

$W_{pws}$ = 726.6

$T_x$ = 23°

$$G_s = \frac{.9993(100)}{100 + 663.5 - 726.6} = 2.71$$

$$n = \left(1 - \frac{115.2}{(2.71)(62.4)}\right) \times 100 = 31.9\%$$

**B-53 0.5-3.0**

$W_s$ = 100.0

$W_p$ = 165.3

$W_{pw}$ = 663.5

$T_i$ = 21°

$W_{pws}$ = 728.0

$T_x$ = 21°

$$G_s = \frac{.9998(100)}{100 + 663.5 - 728.0} = 2.82$$

$$n = \left(1 - \frac{75.6}{(2.82)(62.4)}\right) \times 100 = 57.0\%$$

# APPENDIX F

# CURRENT EQUIPMENT INVENTORY

## CITY OF GREENSBORO, WHITE STREET SANITARY LANDFILL
## CURRENT EQUIPMENT INVENTORY

| Description | Make/Model | No. | Comment |
|---|---|---|---|
| Landfill Compactor | 826C Cat<br>826C Cat<br>826C Cat 1994 | 1<br>1<br>1 | |
| Bulldozer | D8N Cat<br>D8N Cat | 1<br>1 | |
| Grader | 140G Cat | 1 | |
| Loader | WA250-1 Komatsu 1994<br>FR20B Fiat Allis | 1<br>1 | |
| Earthmover | 627E Cat<br>627E Cat | 1<br>1 | Pans |
| Excavator | K916LC-2 Kobelco | 1 | |
| Tractor | White | 2 | Lowboy trailer |
| Dump Truck | D400D Cat<br>D400D Cat | 1<br>1 | |
| Pick-Up | F250D HD Ford 1994<br>C70 Chevrolet<br>2500 Chevrolet 1989 | 1<br>1<br>1 | <br>Fuel Truck<br> |
| Other (specify): | 900 Ford<br>Cheyenne 1993 Chevrolet | 1<br>1 | Water Truck<br>Maint. |

# APPENDIX G

# GNRA SEISMIC AND SLOPE STABILITY ANALYSIS

G · N · Richardson & Associates
CONSULTING ENGINEERING

December 7, 1995

Joseph C. Readling, P.E.
HDR Engineering, Inc.
128 South Tryon Street, Suite 1400
Charlotte, NC 28202-5001

**RE:** **Seismic and Slope Stability Analysis**
**White Street Landfill**
**Greensboro, North Carolina**

Dear Joe:

This report was prepared in response to your request. The report is consistent with our letter proposal dated November 3, 1995 and meets 40 CFR 258 requirements as expressed in the EPA guidance document EPA/600/R-95/051.

**Site Specific Seismic Considerations**

On October 9, 1993, RCRA Subtitle D regulations (40 CFR Part 258) governing landfills receiving municipal solid waste (MSW) went into effect. These regulations require that

- Section 258.13 : landfills cannot be sited within 200-feet of a fault that has been active during the Holocene Epoch (past 11,000 years) unless it can be demonstrated that a lesser set back is safe.

- Section 258.14 : landfills must be designed for seismic conditions if they are within a seismic impact zone defined as having a peak bedrock acceleration exceeding 0.1 g based on a 90% probability of non-exceedance over a 250 year time period.

The recent EPA guidance for seismic design guidance for municipal solid waste landfills (EPA/600/R-95/051) clearly indicates that only two faults east of the Rocky Mountains have been shown to be active. The region of capable faults is shown on Figure 1 and extends eastward only to the Meers fault in Oklahoma. Thus the Greensboro site satisfies the requirements of 258.13.

The peak bedrock acceleration at the Greensboro site is obtained from USGS MF-2120 which is partially reproduced on Figure 2. This indicates that a peak bedrock acceleration of 0.10g can be assigned to the Greensboro site. This peak acceleration represents a 90% probability of not being exceeded in 250 years. This corresponds to a site earthquake having a return period exceeding 2400 years.

417 N. BOYLAN AVENUE • RALEIGH, NORTH CAROLINA 27603 • TEL. 919-828-0577 • FAX 919-828-3899

The peak bedrock acceleration must be modified for site conditions to predict the peak ground surface acceleration at the site. The site amplification or attenuation of the peak bedrock acceleration can be evaluated using one-dimensional wave propagation analysis either specifically performed for the site or based on parametric studies. Since the Greensboro site is only marginally associated with a seismic impact zone, the site amplification or attenuation is estimated using the parametric relationships shown on Figure 3. Soil borings performed by Engineering Tectonics under the direction of GNRA personnel indicate that much of the Greensboro site is underlain by primarily dense to stiff sandy silts (ML or MH) to silty sands (SM). Due to the limited overburden at the site after borrow activities, the ground surface acceleration is taken from Figure 3 as equal to the peak bedrock acceleration of 0.10g.

**Liquefaction Evaluation**

The first step in any liquefaction evaluation is to assess whether the potential for liquefaction of cohesionless soils exists at a site. A variety of screening techniques exists to distinguish sites that are clearly safe with respect to liquefaction from those sites that require more detailed study (EPA/600/R-95/051). The following five screening criteria are most commonly used to make this assessment:

- <u>Geologic age and origin</u>. Liquefaction potential decreases with increasing age of a soil deposit. Pre-Holocene age soil deposits generally do not liquefy, though liquefaction has occasionally been observed in Pleistocene-age deposits.

  *The deposits beneath the Greensboro site are of the Late Precambrian to Cambrian period and greatly predate the Pleistocene.*

- <u>Fines content and plasticity index</u>. Liquefaction potential decreases with increasing fines content and increasing plasticity index, PI. Soils having greater than 15 percent (by weight) finer than 0.005 mm, a liquid limit greater than 35 percent, and an in-situ water content less than 0.9 times the liquid limit generally <u>do not</u> liquefy (Seed and Idriss, 1982).

  *Grain size distributions performed by Geotechnologies and Trigon indicate that most of the soil layers have in excess of 20% fines.*

- <u>Saturation</u>. Although partially saturated soils have been reported to liquefy, at least 80 to 85 percent saturation is generally deemed to be a necessary condition for soil liquefaction. In many locations, the water table is subject to seasonal oscillation. In general, it is prudent that the highest anticipated seasonal water table elevation be considered for initial screening.

- <u>Depth below ground surface</u>. While failures due to liquefaction of end-bearing piles resting on sand layers up to 100 ft (30 m) below the ground surface have been reported, surface effects from liquefaction is generally not likely to occur more than 50 ft (15 m) below the ground surface.

- Soil Penetration Resistance. According to the data presented in Seed and Idriss (1985), liquefaction has not been observed in soil deposits having normalized Standard Penetration Test (SPT) blowcount larger than 22. Marcuson, et al. (1990) suggest a normalized SPT value of 30 as the threshold value above which liquefaction will not occur. However, Chinese experience, as quoted in Seed et al. (1983), suggests that in extreme conditions liquefaction is possible in soils having normalized SPT blowcounts as high as 40.

  *Based on the work performed by Engineering Tectonics, normalized blowcounts in the soils underlying the landfill are generally in excess of 30. Soils where normalized blowcounts were less than 30 were found to be above the water table.*

If three or more of the above criteria indicate that liquefaction is not likely, the potential for liquefaction may be considered to be small. If, however, based on the above initial screening criteria, the potential for liquefaction of a cohesionless soil layer beneath the site of a planned landfill (new construction or lateral expansion) cannot be dismissed, more rigorous analysis of liquefaction potential is needed.

Based on the above screening criteria it is apparent that liquefaction is not likely at the White Street Landfill and a more rigorous analysis of this potential is not necessary.

**Slope Stability Evaluation**

EPA guidance, EPA/600/R-95/051, requires that the completed landfill have minimum factors of safety against slope failures of 1.5 statically and 1.0 dynamically. The slope stability evaluations for the Greensboro Landfill were obtained using the computer program STABL5. A block failure was assumed for the analysis such that the liner formed a major portion of the block. The STABL5 search algorithm looked for the lowest factor of safety for a failure block defined by the geomembrane surface and a plane up through the refuse. Additional slope stability analyses were performed assuming circular failure surfaces through the refuse.

Slope stability evaluations were performed at three sections through the final proposed refuse contours. The sections were selected at locations of maximum steepness of final cover combined with liner slopes to produce minimum slope factors of safety. The locations of the slope stability cuts are shown on Figure 4.

Computer output for the STABL5 studies is presented in Attachment 1 for static and dynamic loadings. The minimum factors of safety are 1.4 for static conditions and 1.1 for dynamic loading conditions (see Table 1). Note that the minimum static factor of safety was not met ($1.4<1.5$). However, a second analysis of the same failure surface with a slightly increased cohesion value for the waste (c = 300 psf versus c = 200 psf) produced an adequate factor of safety of 1.5. The waste parameters used in the second analysis are still considered to be quite conservative for municipal solid waste.

The slope stability analyses were performed assuming the minimum interface friction angle of the liner system is 10 degrees. This low friction angle is representative of smooth HDPE and rounded sands or a nonwoven geotextile. This assumption is conservative for the proposed liner system (geomembrane over 2 feet of compacted clay liner). The project specifications should indicate that the minimum interface friction angle of the liner system shall be 10 degrees and require contractor verification. This would require direct shear testing of the geomembrane/geosynthetic material interface.

A veneer stability analysis of the final cover was performed assuming a minimum interface friction angle of 25 degrees and is included in Attachment 2. This interface friction angle is appropriate for geotextile/soil or geotextile/textured geomembrane interfaces. The minimum seismic veneer slope stability factor of safety using this assumption is 1.26. This exceeds EPA guidelines.

**Summary**

This seismic impact evaluation clearly demonstrates that the lined landfill proposed in Greensboro will satisfy all of the criteria expressed in 40 CFR 258. No site liquefaction or interface friction failures are anticipated for this project.

Cordially,
**G.N. Richardson & Associates**

Pieter K. Scheer, EIT
Staff Engineer

Gregory N. Richardson, Ph.D., P.E.
President

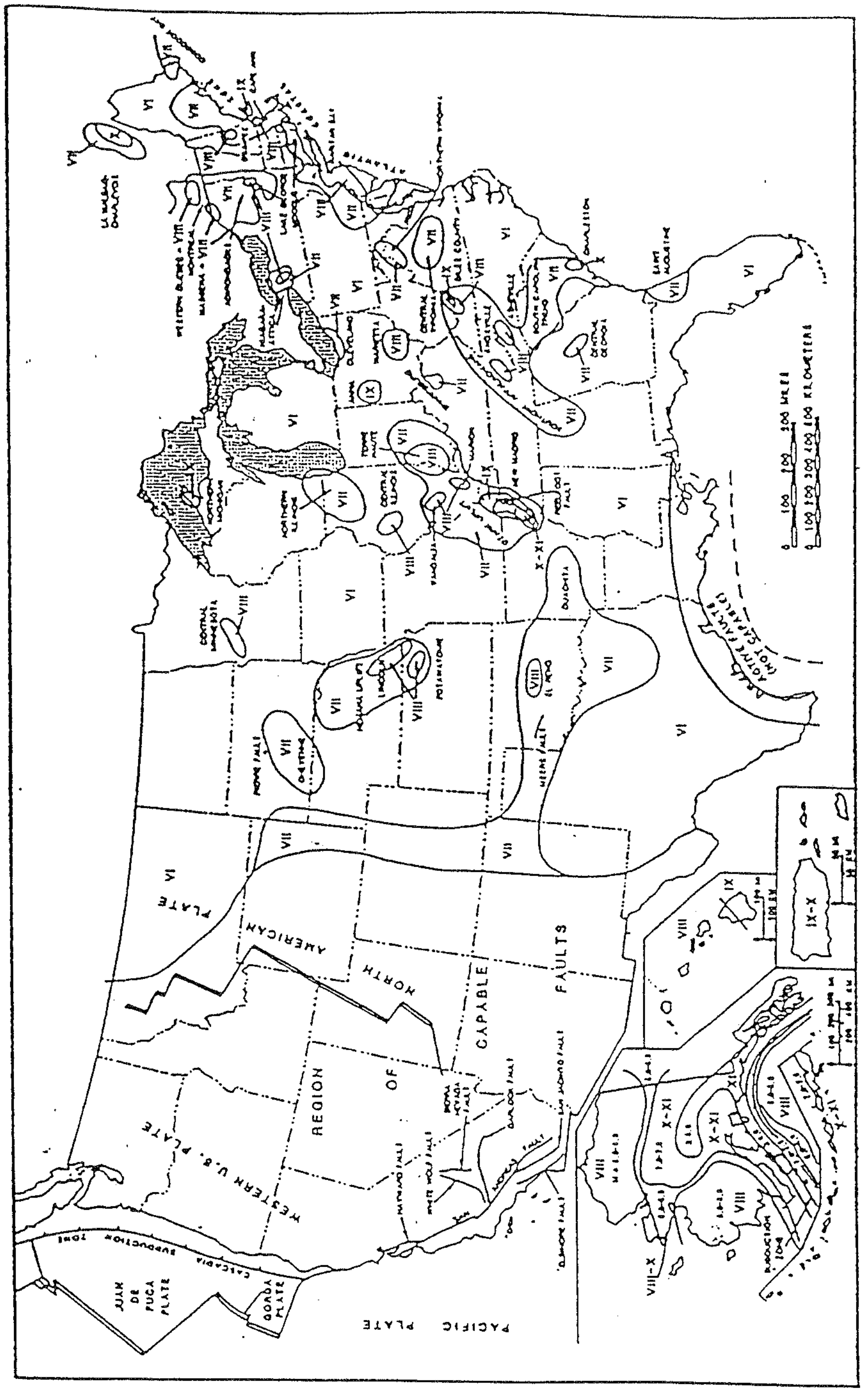
## References

Algermissen, S.T., Perkins, D.M., P.C. Thenhaus, S.L. Hanson, and B.L. Bender (1990), "Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico," U.S. Geological Survey Map MF-2120.

Krinitzsky, E.L., Gould, J.P., and P.H. Edinger (1993), Fundamentals of Earthquake-Resistant Construction, John Wiley & Sons, New York.

Richardson, G.N., Kavazanjian, E., and N. Matasovi (1995), RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities, EPA/600/R-95/051, U.S. Environmental Protection Agency, Washington, D.C.

Seed, H.B. and Idriss, I.M. (1982), "Ground Motions and Soil Liquefaction During Earthquakes," Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.

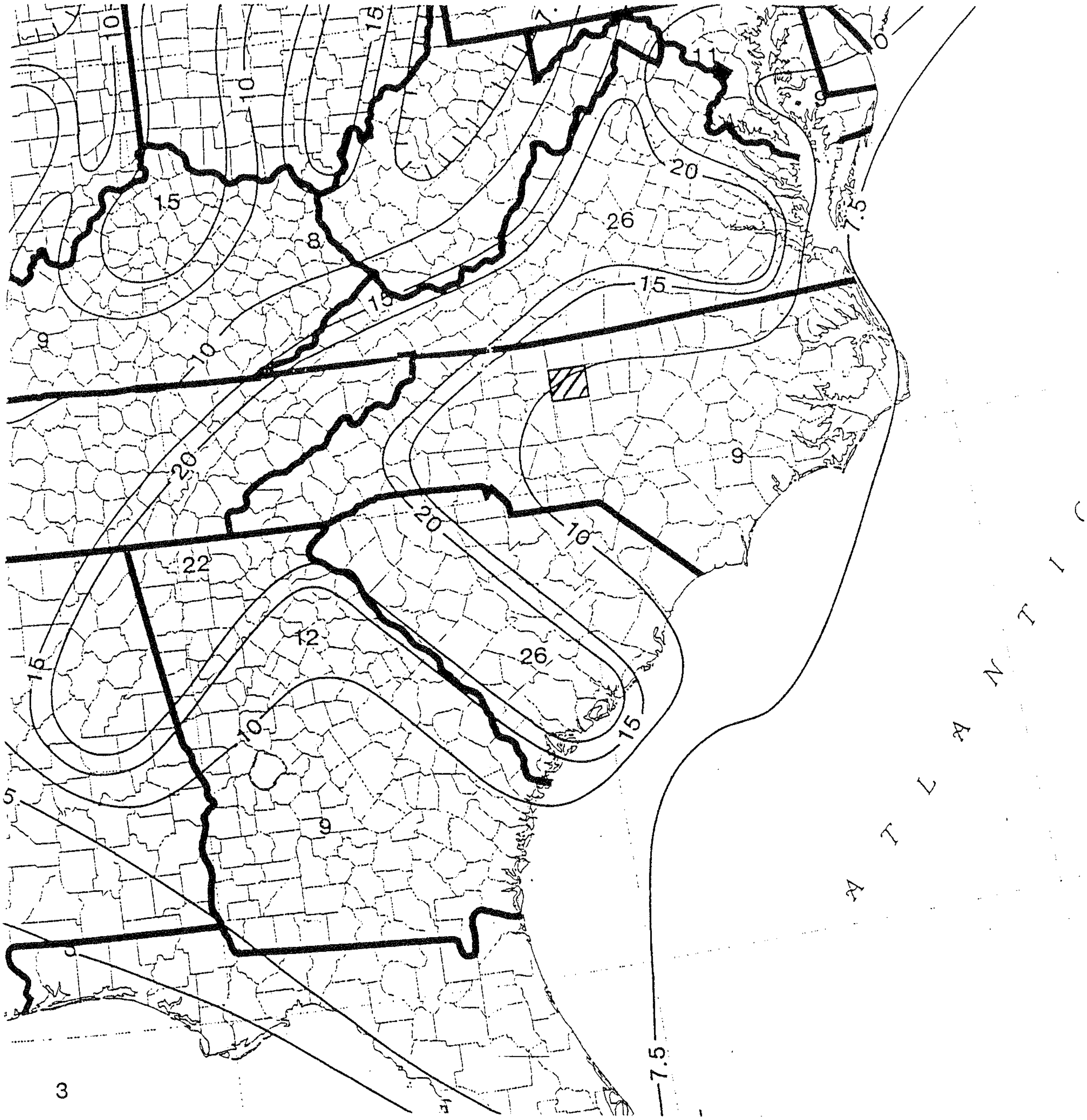



CAPABLE FAULTS MAP
(KRINITZSKY et al., 1993)

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services

417 N. Boylan Avenue Raleigh, North Carolina
(919) 828-0577 Fax 828-3899

| SCALE: | DRAWN BY: | CHECKED BY: | DATE: | PROJECT NO. | FIGURE NO. |
|---|---|---|---|---|---|
| AS SHOWN | | PKS | 12/6/95 | HDRGN-2 | 1 |

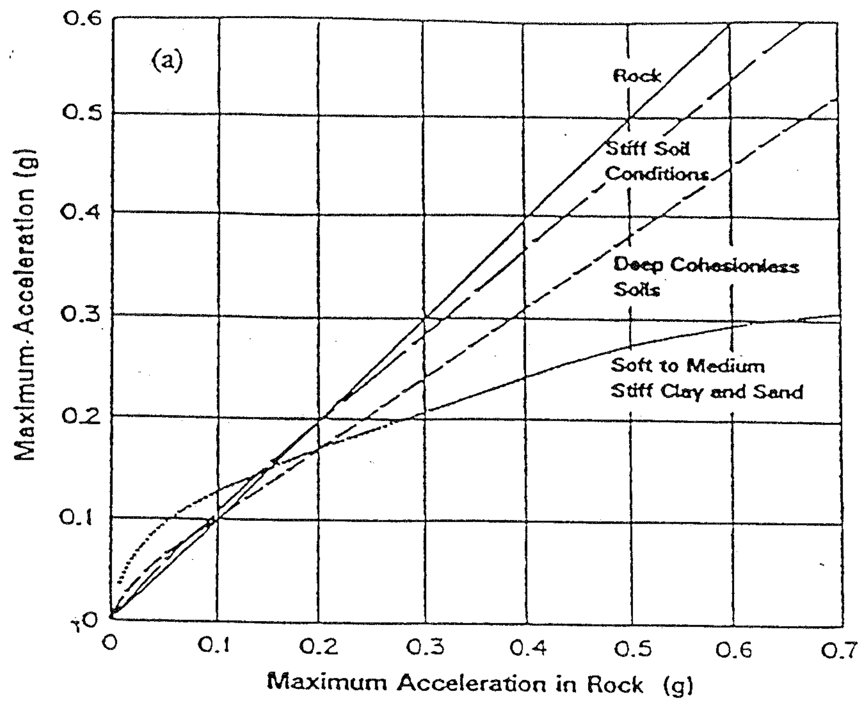



USGS MF-2120
PEAK BEDROCK ACCELERATIONS AS A PERCENT OF GRAVITY (90% PROBABILITY OF NOT BEING EXCEEDED IN 250 YEARS)


G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services

417 N. Boylan Avenue Raleigh, North Carolina
(919) 828-0577 Fax 828-3899


| SCALE: | DRAWN BY: | CHECKED BY: | DATE: | PROJECT NO. | FIGURE NO. |
|---|---|---|---|---|---|
| 1"=625,000 FT | | PKS | 12/6/95 | HDRGN-2 | 2 |

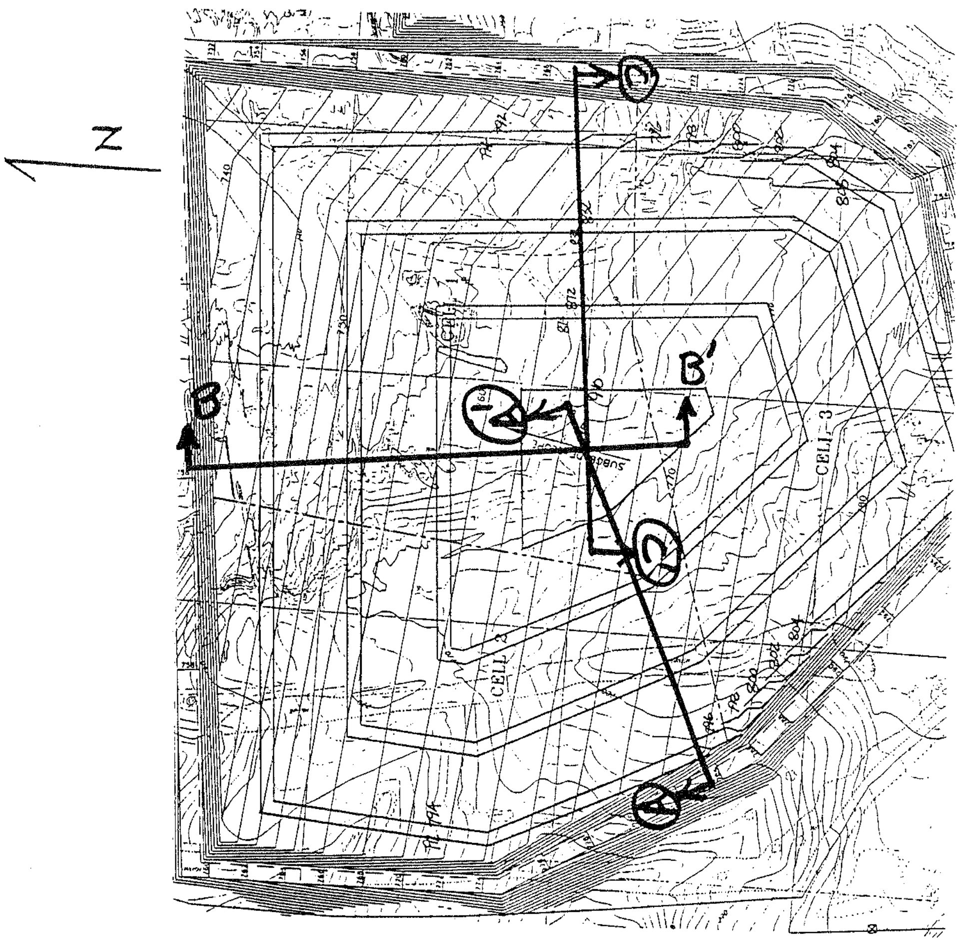



SITE AMPLIFICATION/ATTENUATION RELATIONSHIPS (SEED & IDRISS, 1982)


G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services

417 N. Boylan Avenue Raleigh, North Carolina
(919) 828-0577 Fax 828-3899


| SCALE: | DRAWN BY: | CHECKED BY: | DATE: | PROJECT NO. | FIGURE NO. |
|---|---|---|---|---|---|
| N/A | | PKS | 12/6/95 | HDRGN-2 | 3 |




LOCATION OF SLOPE STABILITY
CROSS SECTIONS

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services

417 N. Boylan Avenue Raleigh, North Carolina
(919) 828-0577 Fax 828-3899

| SCALE: | DRAWN BY: | CHECKED BY: | DATE: | PROJECT NO. | FIGURE NO. |
|---|---|---|---|---|---|
| 1"=400' | | PKS | 12/6/95 | HDRGN-2 | 4 |

**Table 1 Results of Slope Stability Analyses**
**White Street Landfill**
**Greensboro, NC**

| | | Failure Type | |
|---|---|---|---|
| Cross Section | Failure Type | Static | Dynamic* |
| A | Block | 1.9 | 1.4 |
| | Circular | 2.0 | 1.6 |
| B | Block | 1.5 | 1.2 |
| | Circular | 2.0 | 1.6 |
| C | Block | 1.4 | 1.1 |
| | Block # | 1.5 | ----- |
| | Circular | 2.0 | 1.6 |
| Cover Veneer | Infinite Slope** | 1.87 | 1.26 |

* Horizontal and Vertical Coefficients = +0.05g (= ½ Peak Ground Surface Acceleration)

** Interface Friction Angle = 25°

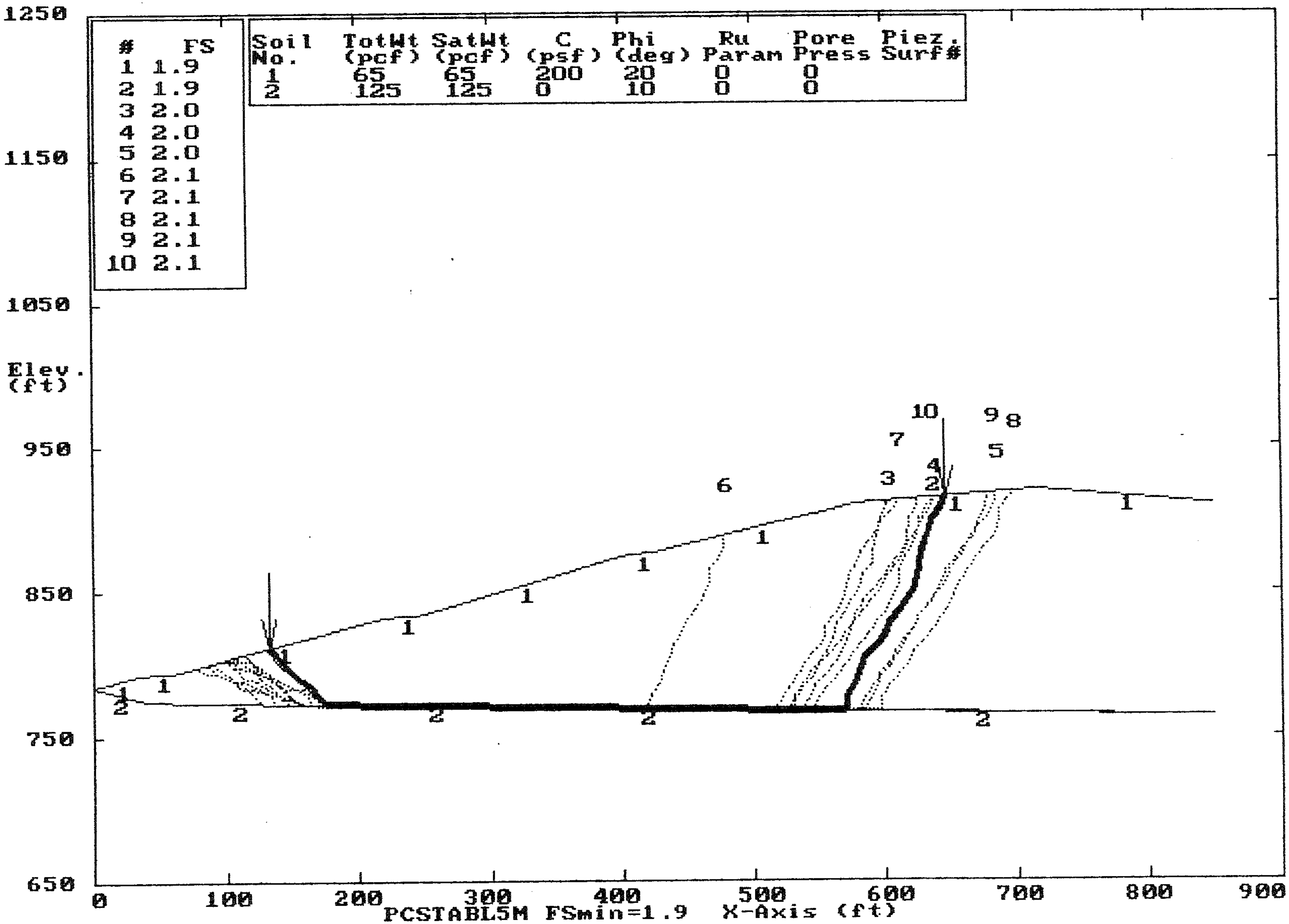
# c (MSW) = 300 psf

Attachment 1

Computer Output

Static and Dynamic Loadings

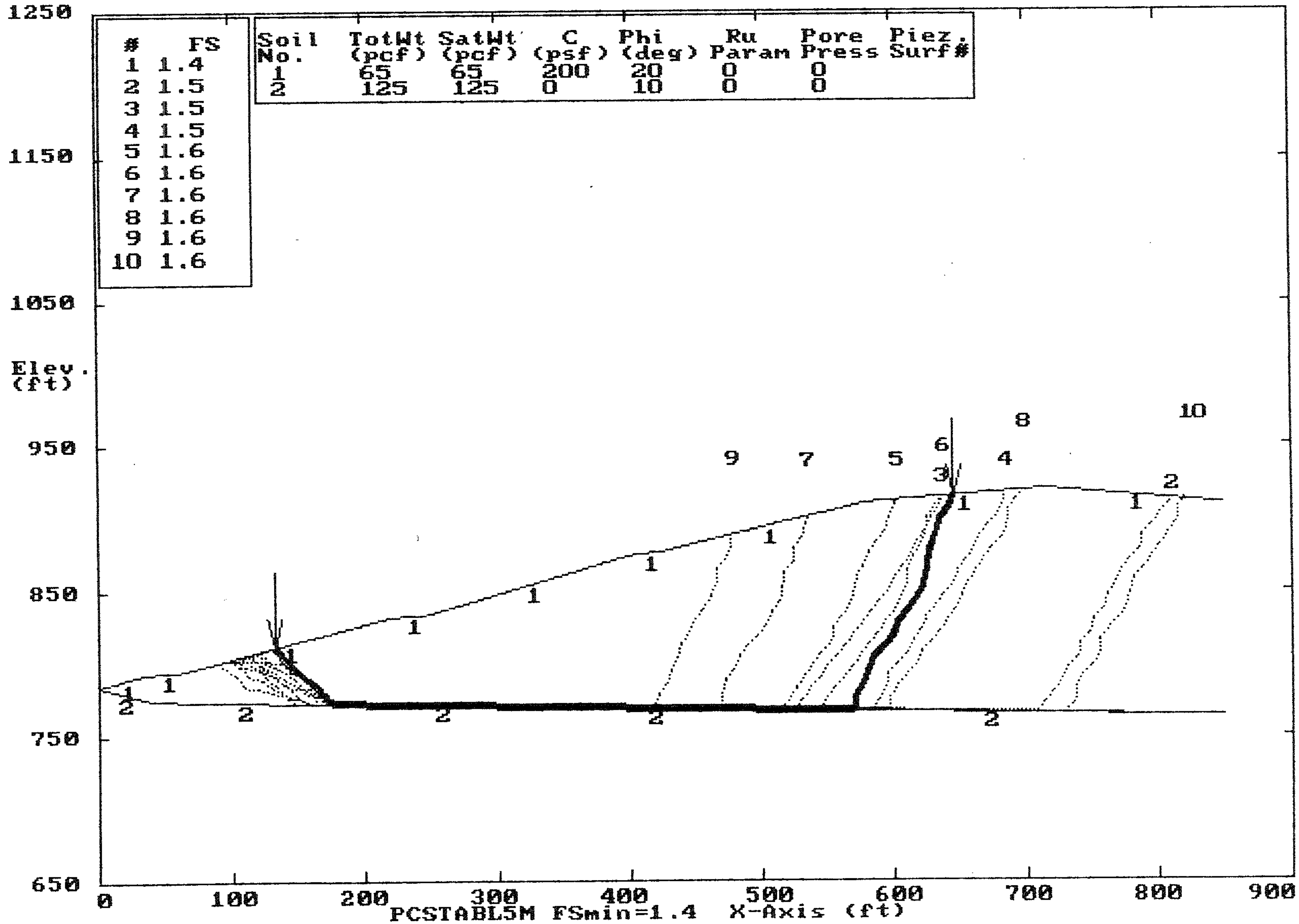
Greensboro Landfill - Section A-A' Block Stability Along Liner - STATIC
Ten Most Critical. A:GNAA.PLT By: PKS 12-07-95 1:28pm



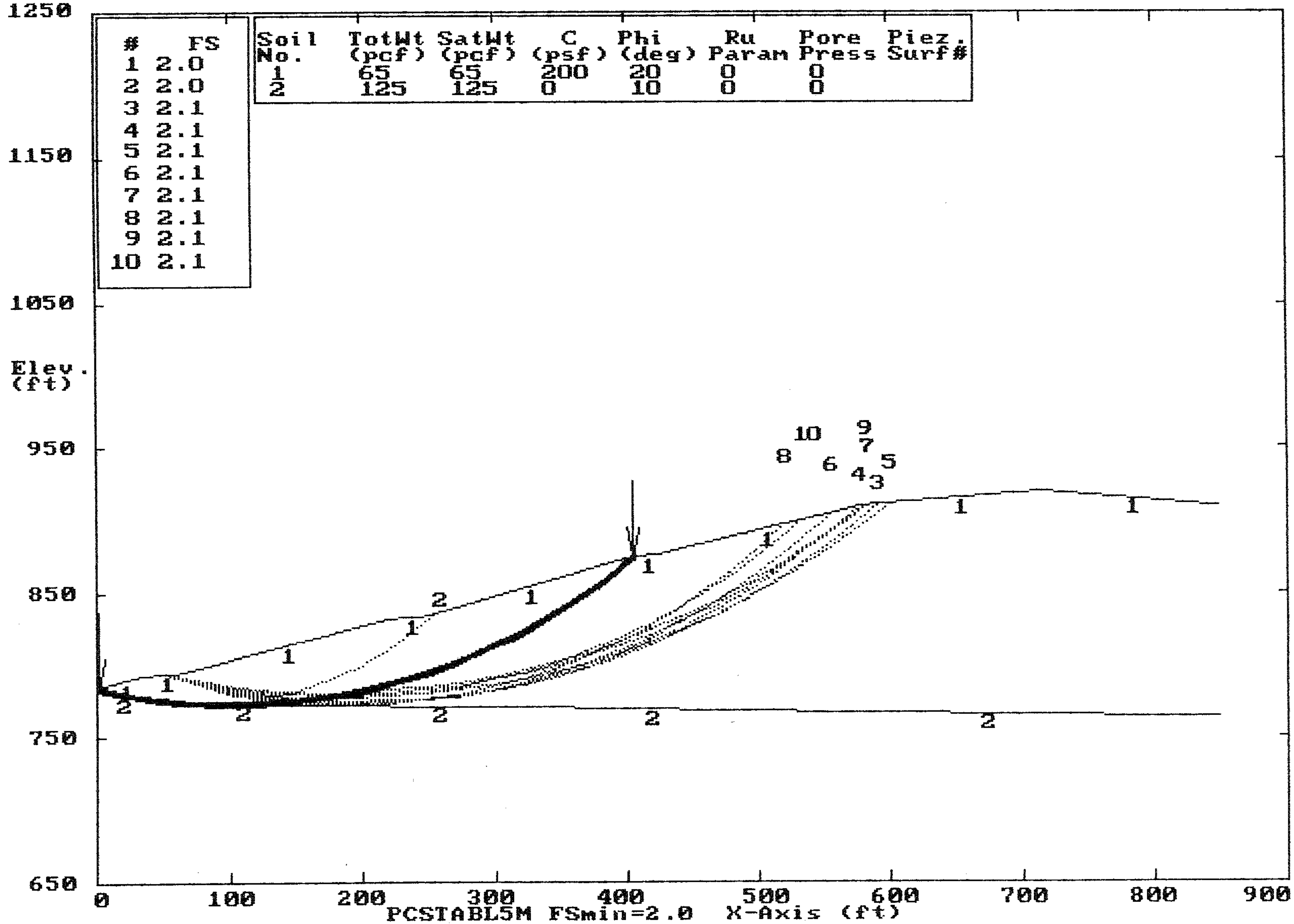

| # | FS |
|---|---|
| 1 | 1.9 |
| 2 | 1.9 |
| 3 | 2.0 |
| 4 | 2.0 |
| 5 | 2.0 |
| 6 | 2.1 |
| 7 | 2.1 |
| 8 | 2.1 |
| 9 | 2.1 |
| 10 | 2.1 |

| Soil No. | TotWt (pcf) | SatWt (pcf) | C (psf) | Phi (deg) | Ru Param | Pore Press | Piez. Surf# |
|---|---|---|---|---|---|---|---|
| 1 | 65 | 65 | 200 | 20 | 0 | 0 | |
| 2 | 125 | 125 | 0 | 10 | 0 | 0 | |

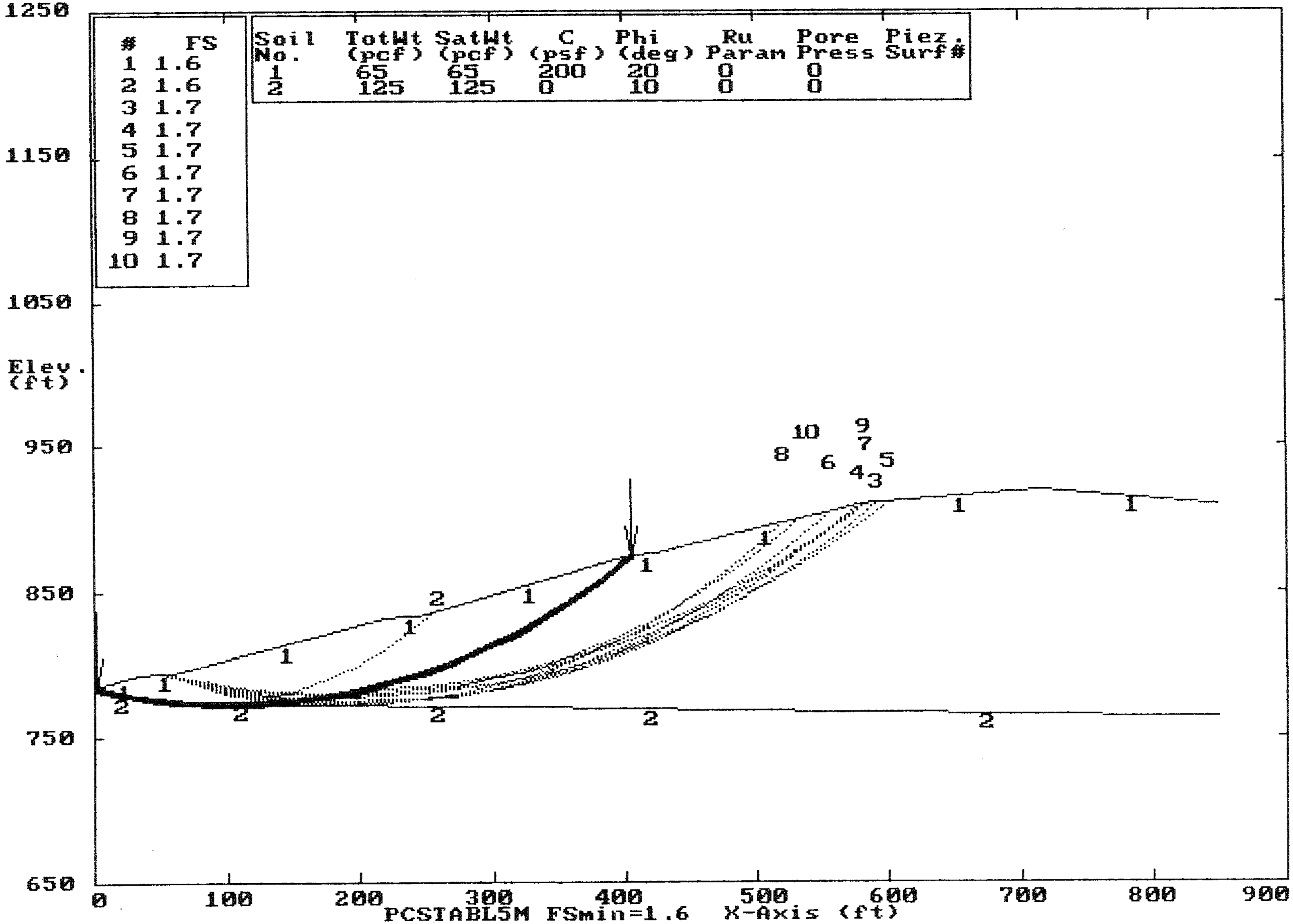
Greensboro Landfill - Section A-A' Block Stability Along Liner - EQUAKE
Ten Most Critical. A:GNAAE.PLT By: PKS 12-07-95 1:31pm



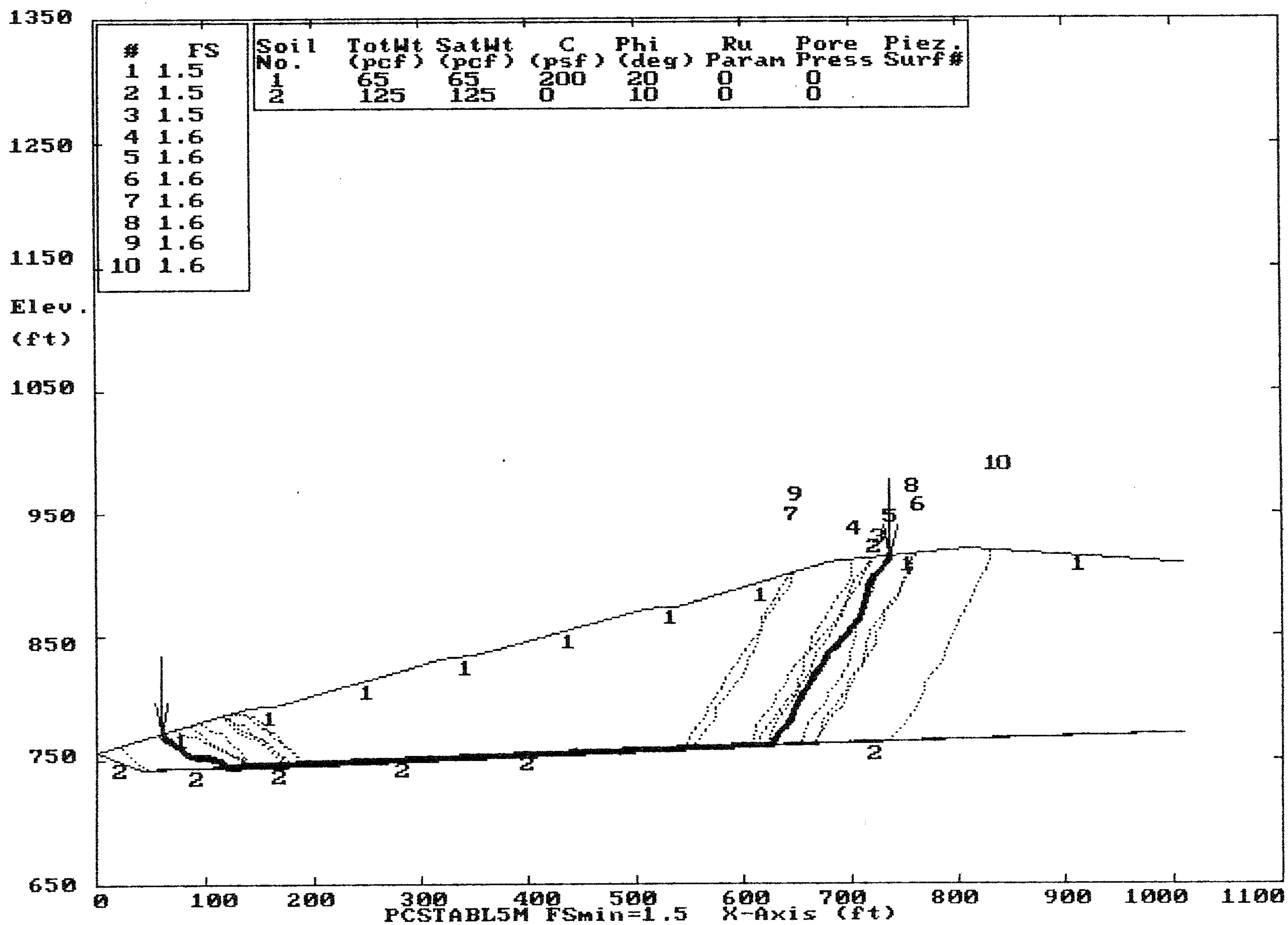
Greensboro Landfill - Section A-A' Circular Stability - STATIC
Ten Most Critical. A:GNAAC.PLT By: PKS 12-07-95 1:37pm



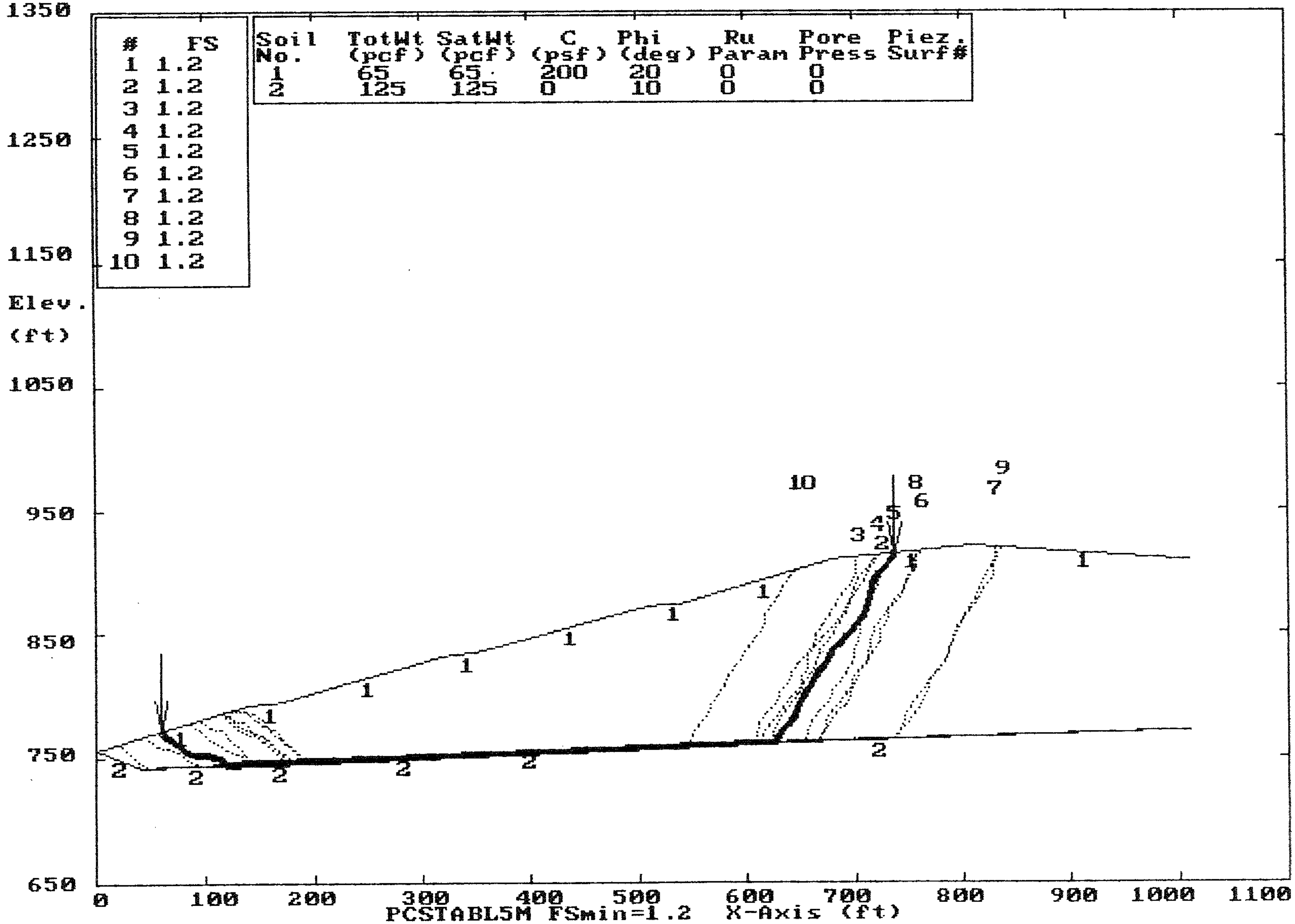
Greensboro Landfill - Section A-A' Circular Stability - EQUAKE
Ten Most Critical. A:GNAACE.PLT By: PKS 12-07-95 1:42pm



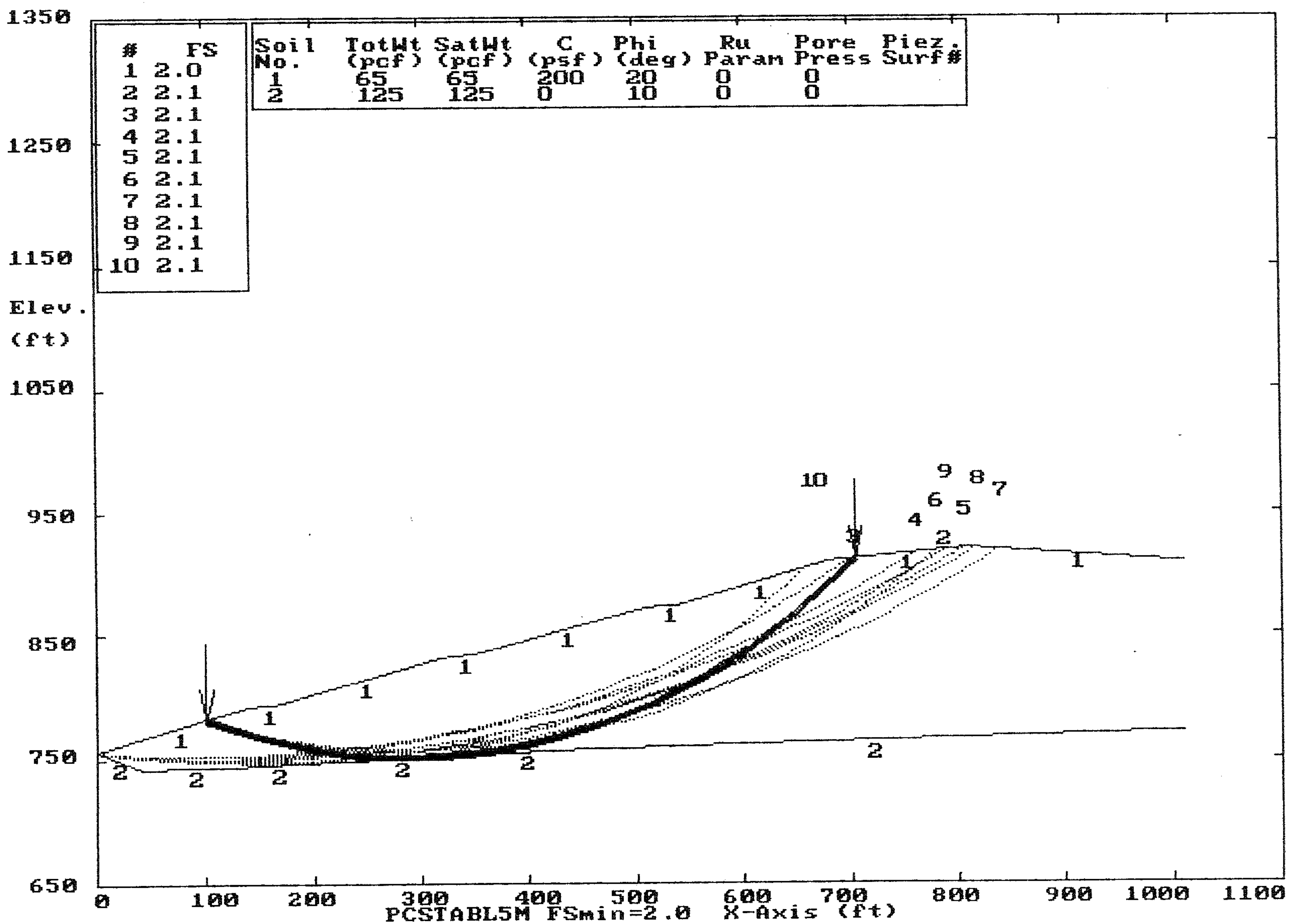
Greensboro Landfill - Section B-B' Block Stability Along Liner - STATIC
Ten Most Critical. A:GNBB.PLT By: PKS 12-07-95 2:06pm



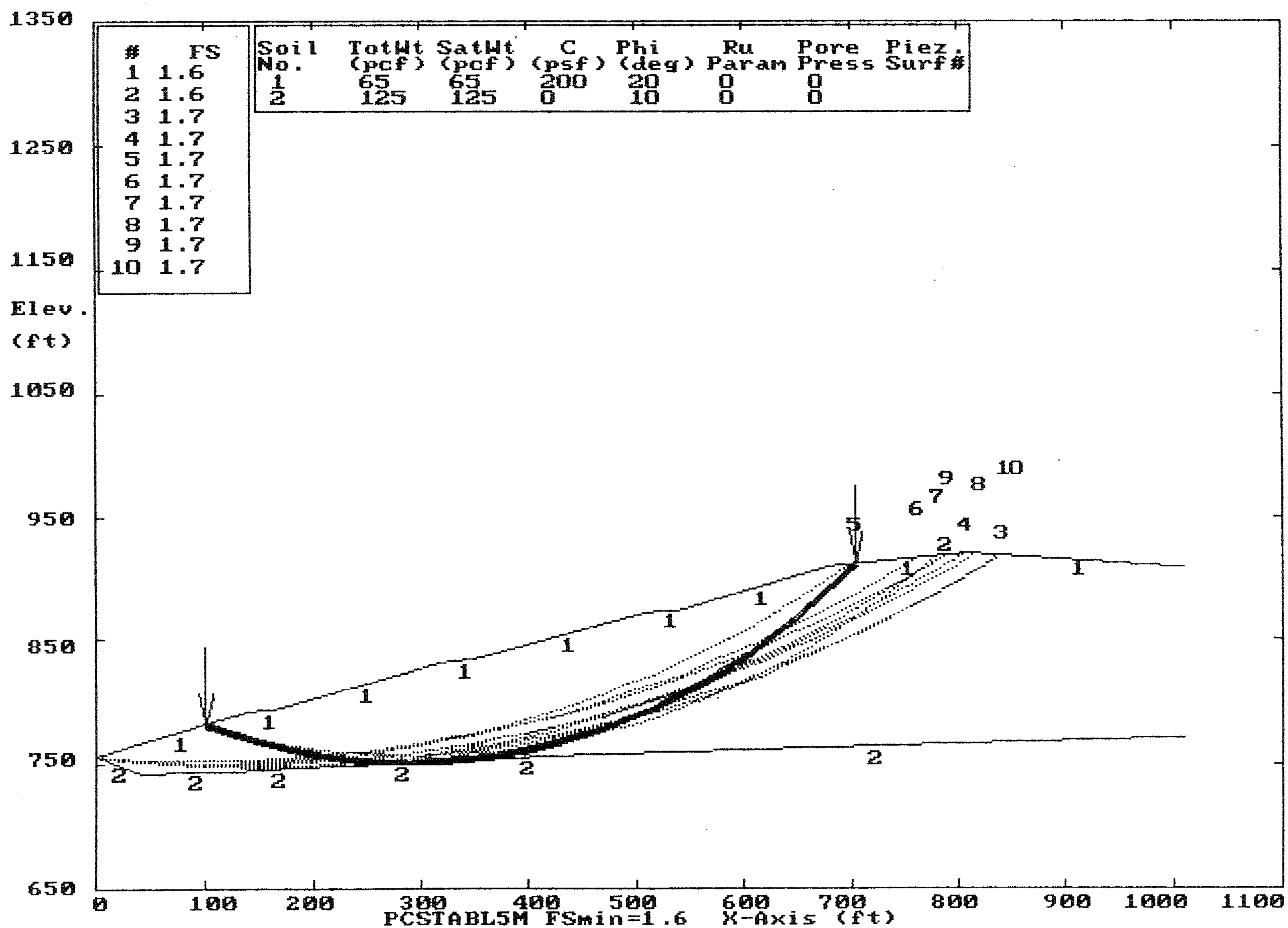
Greensboro Landfill - Section B-B' Block Stability Along Liner - EQUAKE
Ten Most Critical. A:GNBBE.PLT By: PKS 12-07-95 2:09pm

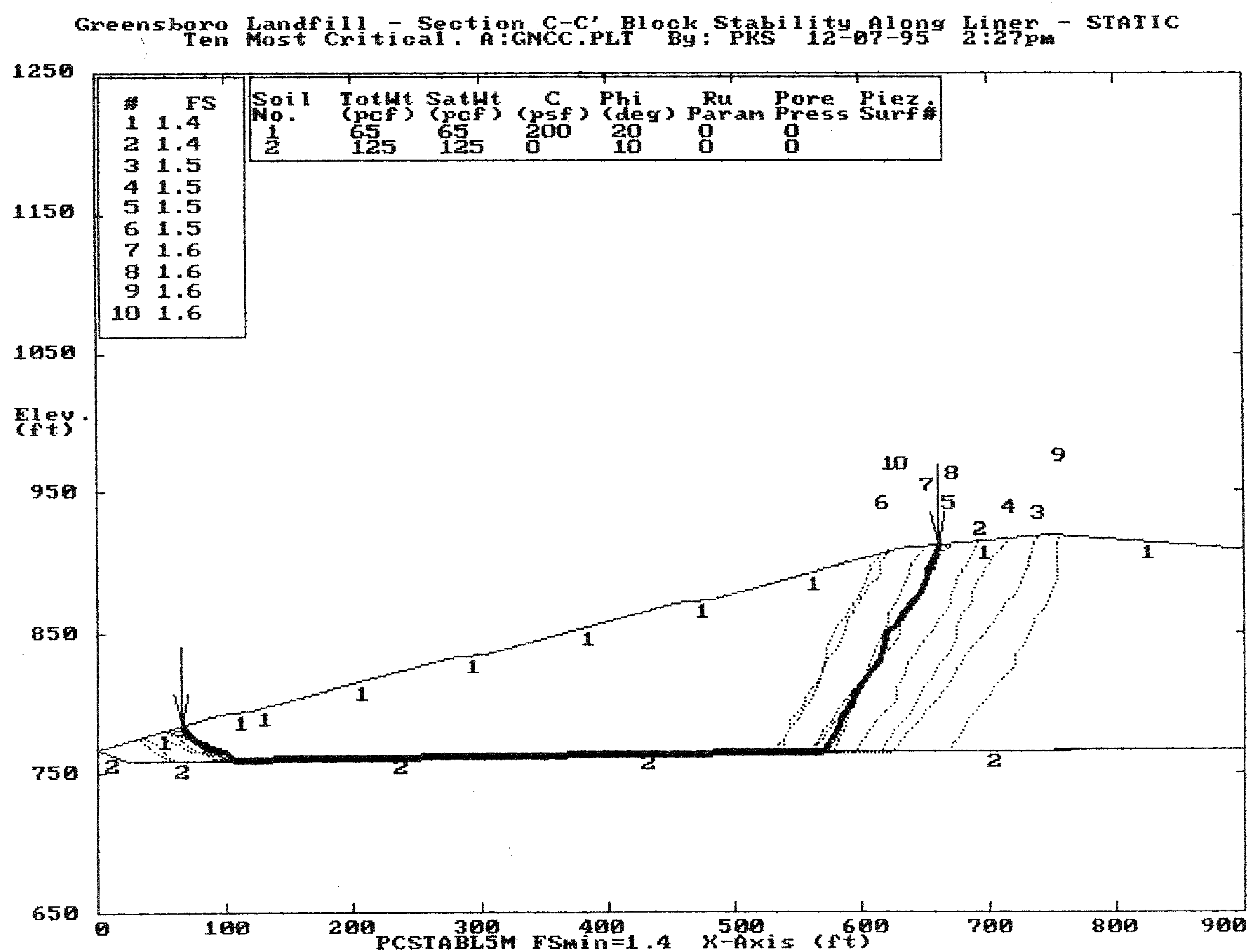


Greensboro Landfill - Section B-B' Circular Stability - STATIC
Ten Most Critical. A:GNBBC.PLT By: PKS 12-07-95 2:02pm



Greensboro Landfill - Section B-B' Circular Stability - EQUAKE
Ten Most Critical. A:GNBBCE.PLT By: PKS 12-07-95 2:00pm



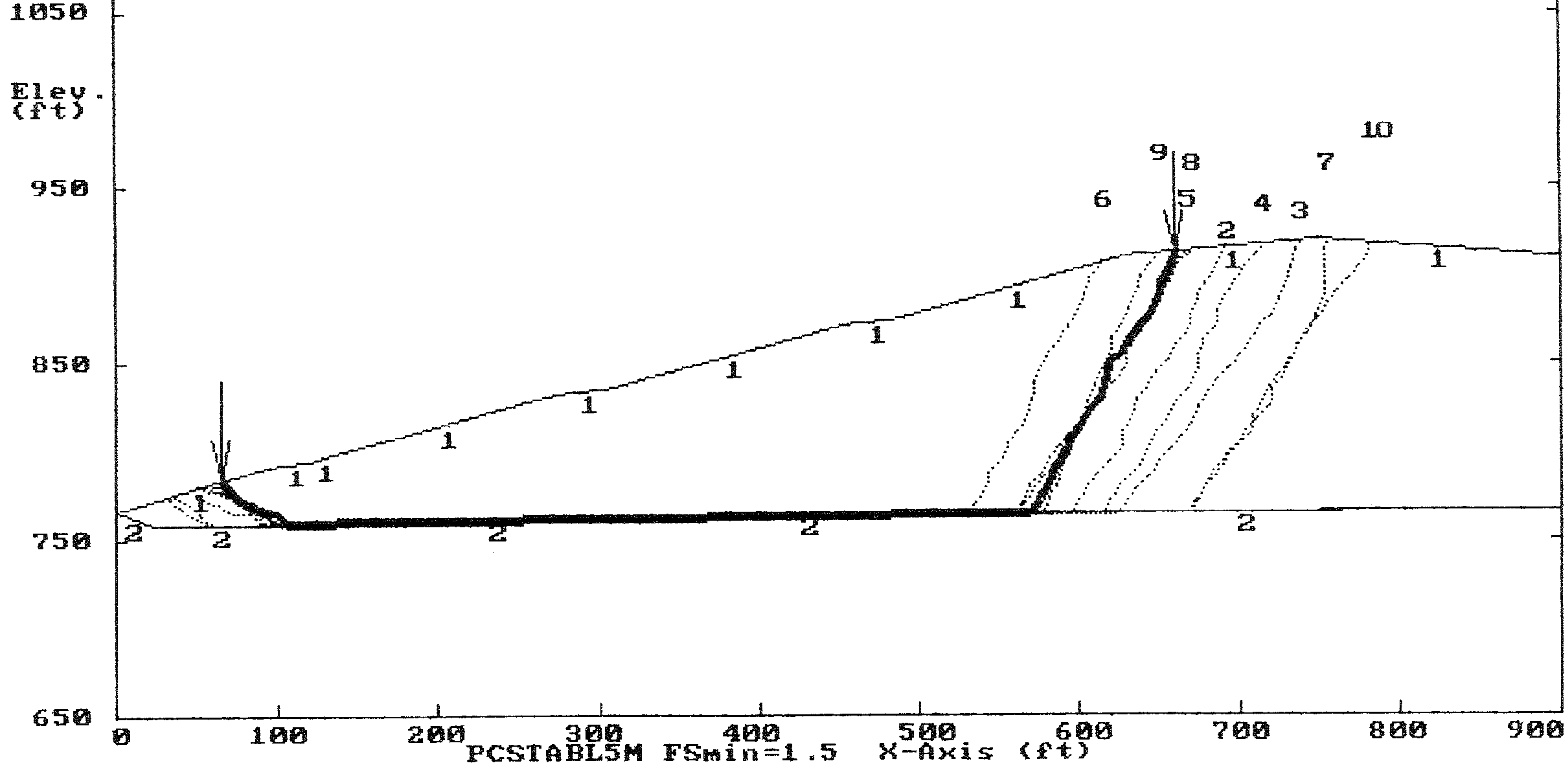

Greensboro Landfill - Section C-C' Block Stability Along Liner - STATIC
Ten Most Critical. A:GNCC.PLT By: PKS 12-07-95 2:27pm
1250
1150
1050
Elev. (ft)
950
850
750
650
# FS
1 1.4
2 1.4
3 1.5
4 1.5
5 1.5
6 1.5
7 1.6
8 1.6
9 1.6
10 1.6
Soil No. | TotWt (pcf) | SatWt (pcf) | C (psf) | Phi (deg) | Ru Param | Pore Press | Piez. Surf#
1 | 65 | 65 | 200 | 20 | 0 | 0
2 | 125 | 125 | 0 | 10 | 0 | 0
0
100
200
300
400
500
600
700
800
900
PCSTABL5M FSmin=1.4 X-Axis (ft)

Greensboro Landfill - Section C-C' Block Stability Along Liner - STATIC
Ten Most Critical. A:GNCC1.PLT By: PKS 12-07-95 4:17pm

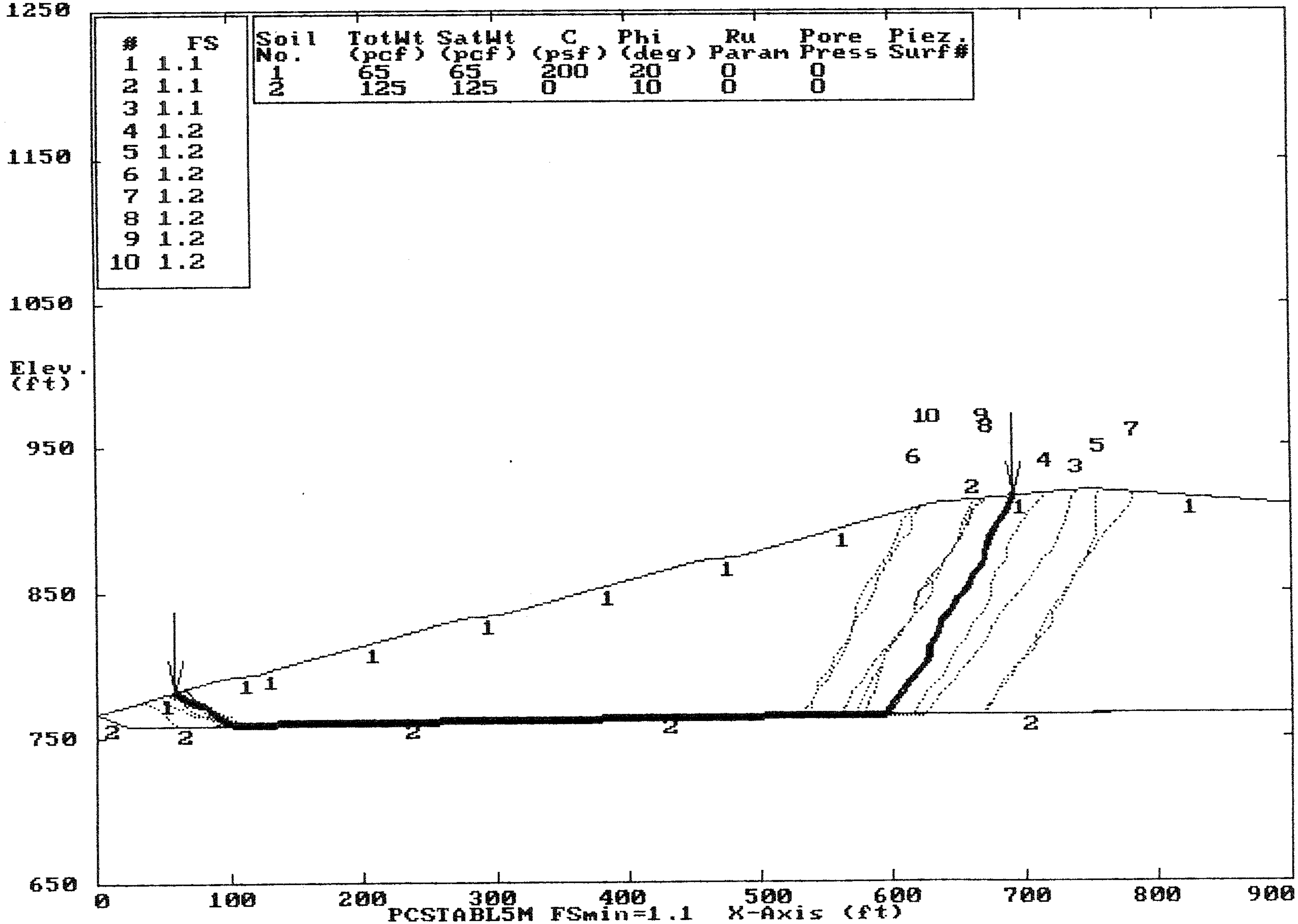
| # | FS |
|---|---|
| 1 | 1.5 |
| 2 | 1.5 |
| 3 | 1.5 |
| 4 | 1.5 |
| 5 | 1.6 |
| 6 | 1.6 |
| 7 | 1.6 |
| 8 | 1.6 |
| 9 | 1.6 |
| 10 | 1.7 |

| Soil No. | TotWt (pcf) | SatWt (pcf) | C (psf) | Phi (deg) | Ru Param | Pore Press | Piez. Surf# |
|---|---|---|---|---|---|---|---|
| 1 | 65 | 65 | 300 | 20 | 0 | 0 | |
| 2 | 125 | 125 | 0 | 10 | 0 | 0 | |

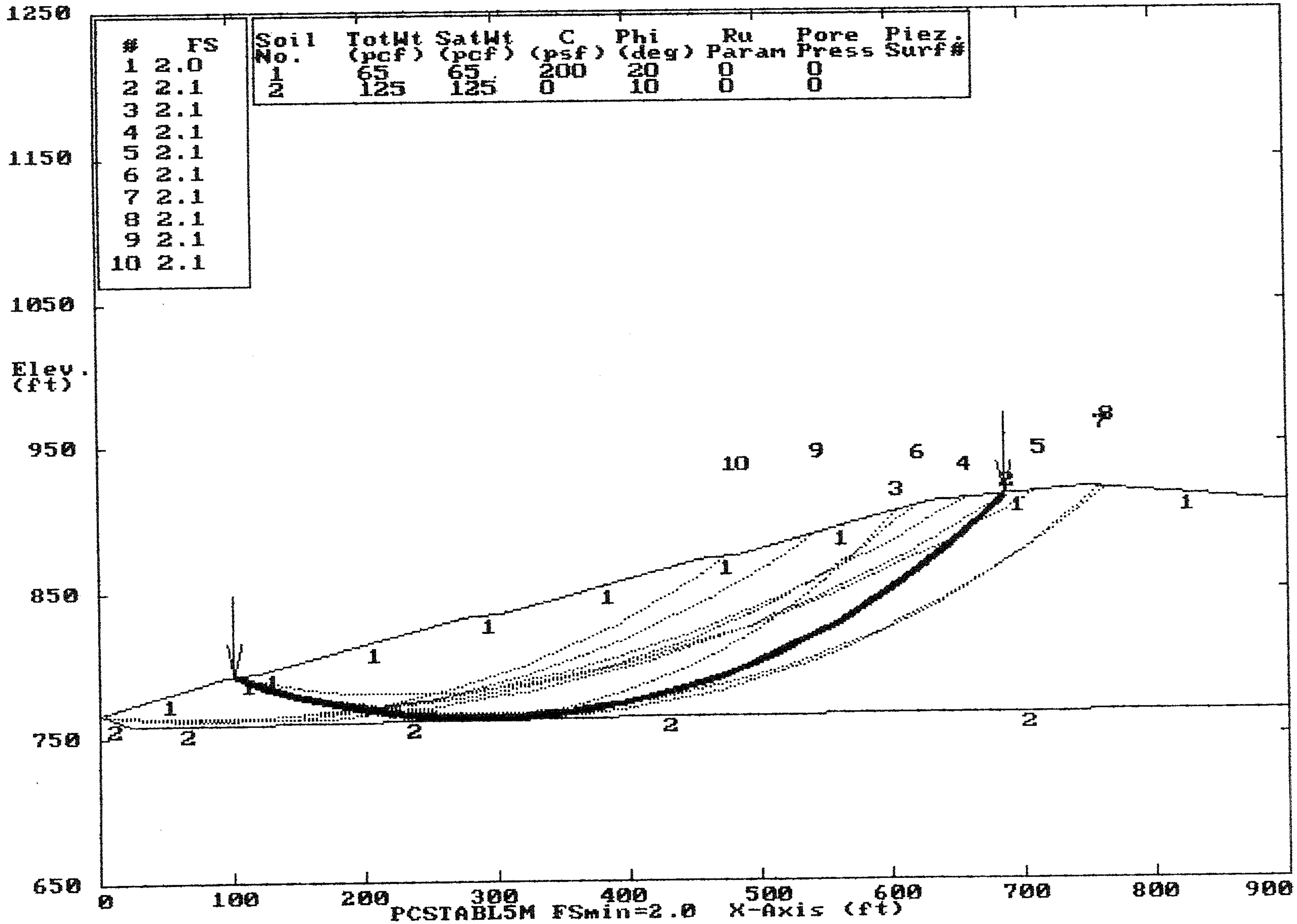
C = 300 psf

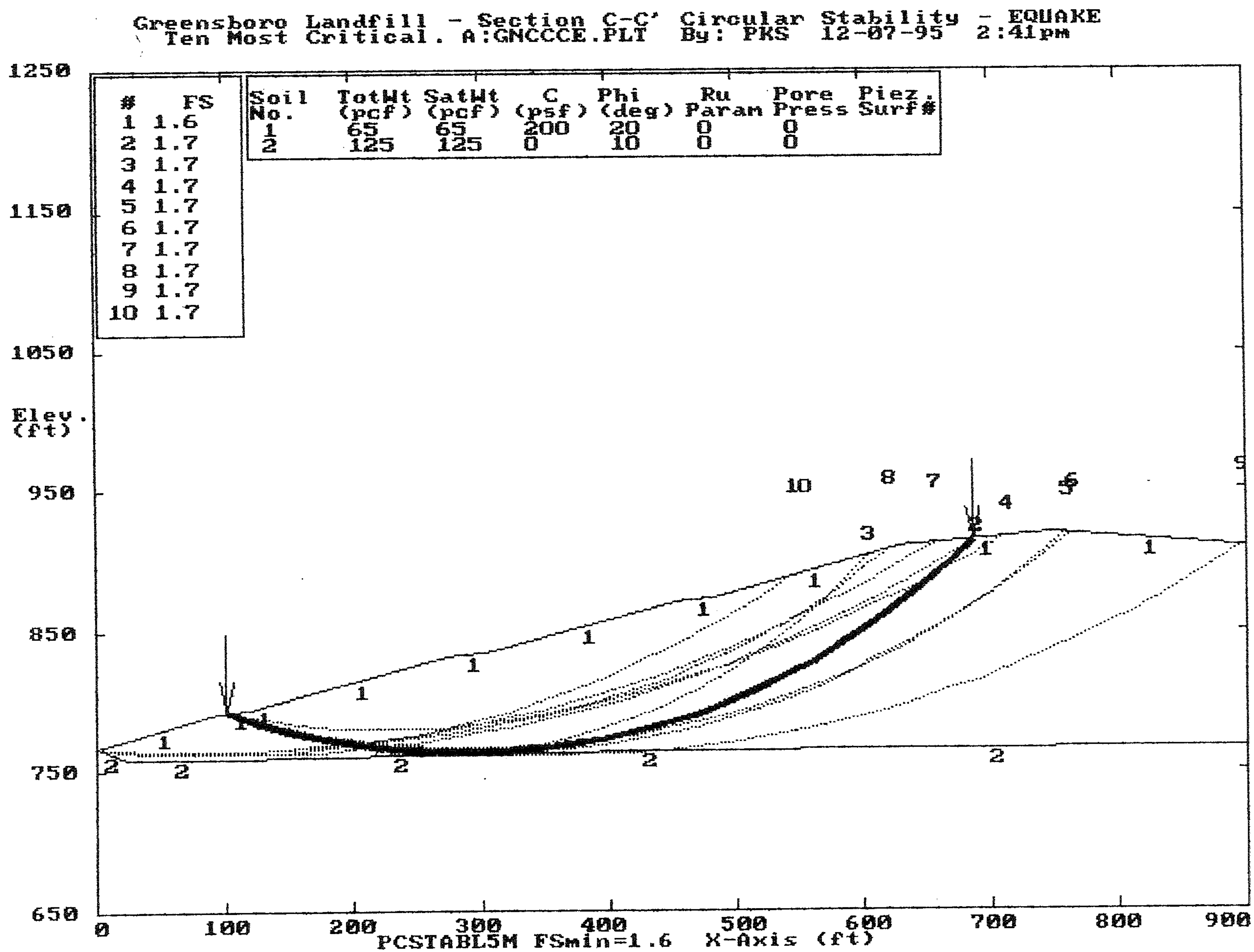


Greensboro Landfill - Section C-C' Block Stability Along Liner - EQUAKE
Ten Most Critical. A:GNCCE.PLT By: PKS 12-07-95 2:16pm



Greensboro Landfill - Section C-C' Circular Stability - STATIC
Ten Most Critical. A:GNCCC.PLT By: PKS 12-07-95 2:34pm





Greensboro Landfill - Section C-C' Circular Stability - EQUAKE
Ten Most Critical. A:GNCCCE.PLT By: PKS 12-07-95 2:41pm
# FS
1 1.6
2 1.7
3 1.7
4 1.7
5 1.7
6 1.7
7 1.7
8 1.7
9 1.7
10 1.7
Soil No. | TotWt (pcf) | SatWt (pcf) | C (psf) | Phi (deg) | Ru Param | Pore Press | Piez. Surf#
1 | 65 | 65 | 200 | 20 | 0 | 0
2 | 125 | 125 | 0 | 10 | 0 | 0
Elev. (ft)
1250
1150
1050
950
850
750
650
0
100
200
300
400
500
600
700
800
900
PCSTABL5M FSmin=1.6 X-Axis (ft)

# Attachment 2

# Veneer Stability Analysis of Final Cover

| | | | |
|---|---|---|---|
| PROJECT | HDR-GBORO LF | SHEET | 1 OF 2 |
| | | JOB NO. | HDRGN-2 |
| SUBJECT | Final Cover Stability Evaluation | DATE | 12/6/95 |
| | | COMPUTED BY | PKS |
| | | CHECKED BY | |

— Objective: To evaluate the stability of the final cover veneer against sliding.

— Analysis: Treat the final cover as an infinite slope and use the following equation (Matasović, 1991):

$$FS = \frac{[c/(\gamma \cdot z \cdot \cos^2\beta) + \tan\phi[1-\gamma_w(z-d_w)/(\gamma \cdot z)] - k_s \cdot \tan\beta]}{k_s + \tan\beta}$$

where: FS = Factor of Safety
$k_s$ = Seismic Coefficient (= 0 for Static Stability)
$\gamma$ = Unit Weight of Slope Material(s)
$\gamma_w$ = Unit Weight of Water
c = Cohesion
$\phi$ = Interface Friction Angle of Assumed Failure Surface
z = Depth To Failure Surface
$d_w$ = Depth To Seepage Surface (= z if slope is Dry)
$\beta$ = Slope Angle of Cover

— Reference:

Matasović, N. (1991), "Selection of Method for Seismic Slope Stability Analysis," Proc. 2nd International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, St. Louis, Vol. 2, pp. 1057-1062.

— Requirements: $FS_{min}$ (Static) = 1.5

$FS_{min}$ (Dynamic) = 1.0 (If Applicable)

G.N. RICHARDSON & ASSOCIATES, INC.
Engineering and Geological Services
417 N. BOYLAN AVENUE RALEIGH, N.C. 27603
PHONE-919-828-0577 FAX-919-828-3899