**Morton & Morton**
Design Services, PLLC

December 13, 2017

Durham City-County Planning Department
Mr. Patrick O. Young, AICP
Planning Director
101 City Hall Plaza
Durham, North Carolina 27701

Re: Watershed Protection Overlay Designation Removal
For Property at 2801 Olive Branch Road

Dear Mr. Young,

The purpose of this letter is to formalize the request of the property owner to have the Durham City-County Planning Department administratively interpret the Falls Reservoir watershed protection overlay boundary as it is related to the subject property pursuant to UDO paragraph 4.11.3. The subject property is currently listed with Durham City-County Planning Department as residing within the F/J-B watershed protection overlay designation. Per UDO paragraph 4.11.2 that area is described as follows:

"From the edge of F/J-A Overlay to five miles from the normal pool of the Falls Reservoir and the Jordan Reservoir, or to the ridge lines that define their drainage basins, whichever is less"

The subject property was likely included in the F/J-B watershed protection area when these overlays were initially mapped because this parcel was once part of a larger parcel that did cross over the ridgeline of the Falls Reservoir drainage basin.

Our extensive examination of the property shows that the entirety of the subject property legally described as "LOT Tract 2, Property of Virginia Lynn Heirs" is in fact not within the ridgeline of the Falls Lake drainage basin. Instead this property drains to Brier Creek and Sycamore Creek which both drain to Crabtree Creek and ultimately to the Neuse River at a point down-stream from Falls Lake. To illustrate this finding I would like to present the following documents:

1. Watershed Delineation Map for Leesville Congregation of Jehovah's Witnesses, dated 11/20/2017 by Lloyd Walker (Survey License No. L-1333). The third note states: "The purpose of this map is to depict that the subject parcel is within the Brier Creek and Sycamore Creek Watershed, and both drain to Crabtree Creek below Falls Lake."

2. Due Diligence Report and Feasibility Study for Leesville Kingdom Hall dated October 2011 by Frederic D. Rash, PE of The Wooten Company. An excerpt from pages 3-4 of the report states: "Geographically, the site is located relatively close to Falls Lake and divided by two sub-drainage basins, Brier Creek and Sycamore Creek. Brier Creek and Sycamore Creek both drain to Crabtree Creek below Falls Lake; therefore, Falls Lake Rules would not apply to development at this site. Available records indicate the site is located on a property that was subdivided nearly a decade ago. The original property contain a topographic ridge dividing the northern portion draining into the Falls Lake basin; while the lower portion of the property (the subject Property) drains to Crabtree Creek below Falls Lake."

3. Letter from Danny Smith, Supervisor, Water Quality Section, Raleigh Regional office of NC Water Resources dated August 31, 2016. The letter reference three drainage features on the property. Regarding Features A and B, the letter states: "They are tributaries of Sycamore Creek." Regarding Feature C, the letter states: "It is a tributary of Little Brier Creek. Both streams flow south to Crabtree Creek".

These documents clearly show that the subject property is not located within the ridgeline of the Falls Lake drainage basin. Therefore on behalf of the owner, I am requesting that an administrative interpretation be made of the subject property as it relates to the Critical Area and/or Protected Area Regulations for the Falls Lake Watershed. The owner's objective is that a review of these findings will lead to a removal of the F/J-B designation and the associated development restrictions for this property by the Durham Board of Commissioners.

If you have any questions or need additional information, please contact me at your convenience at 919-740-1881.

Sincerely,

Jeanell Morton

Jeanell Morton, PE
President
Morton & Morton Design Services
NC Firm License P-0568

**DUE DILIGENCE REPORT AND FEASIBILTY STUDY**

# LEESVILLE KINGDOM HALL

**2801 OLIVE BRANCH ROAD**
**DURHAM COUNTY, NORTH CAROLINA**

PREPARED FOR:

**NORTH CAROLINA REGIONAL BUILDING COMMITTEE #4**

**TWC#: 3161-A**

**OCTOBER 2011**

NORTH CAROLINA PROFESSIONAL SEAL 020983 ENGINEER FREDERIC D. RASH
10-24-11

FREDERIC D. RASH, PE


THE WOOTEN COMPANY
ENGINEERING | PLANNING | ARCHITECTURE

# Leesville Kingdom Hall – Congregation of Jehovah's Witnesses
# 2801 Olive Branch Road – Due Diligence Report and Feasibility Study

***Goal of Study***

The purpose of this study is to evaluate the feasibility of developing a raw land site including a 5,000 sq ft building and its associated parking lot facility. A second (future) building and parking lot facility of equal size are also anticipated with the full build-out of the property. The proposed building(s) would serve as a place of worship, assembly, and meeting space for members of the congregation. The objectives of this study include an evaluation of:

- Zoning, Land Use Restrictions and Land Development
- Stormwater Requirements and Watershed Restrictions
- Landscape Requirements
- Geotechnical Requirements
- Septic Field Requirements
- Site Access and NCDOT Requirements

The Owner will use this analysis and other considerations as to whether to proceed with purchasing of the property and move forward with development.

***Methodology***

Leesville Congregation of Jehovah's Witnesses and NC Regional Building Committee #4 has retained The Wooten Company to prepare this study. The Wooten Company and NC Regional Building Committee #4 along with its other design consultants comprise the design team for the due diligence study of the site. We have conducted a preliminary review of Durham City/County development regulations. We have also reviewed available design information provided by the Owner and/or other members of the design team. We have engaged in direct conversation with key Staff of the local authority having jurisdiction (AHJ) and the North Carolina Department of Transportation (NCDOT) to verify applicable development requirements.

The information collected in this study has been compiled and summarized in this document. It is recommended that this information be utilized as a reference during preparation of a schematic design.

***Property***

The subject site consists of an approximately 15.57 acre parcel located at 2801 Olive Branch Road in Durham County, North Carolina. The property parcel identification is Durham County PIN# 0779-03-03-3479. The approximate location is shown on a excerpt taken from the 7.5 minute USGS Quadrangle map and is attached in Appendix A. the Owner provided a copy of a boundary survey map entitled "Survey for Highland Builders Tract 2, Virginia Lynn Heirs," dated August 4, 2004 prepared by Cawthorne, Moss & Panciera, P.C. The survey map is attached in Appendix B.

The site is undeveloped and is heavily wooded with plenty of foliage and underbrush. There is an unpaved path, or trail aligned west to east through the middle of the site. The site is bordered by Olive Branch Road and residential properties to the west and vacant, undeveloped properties to the north, east, and south. The properties west of Olive Branch Road are primarily of residential use. The properties to the north and south appear to farmland use.

There is approximately 18 feet of vertical relief across the site based upon Durham County GIS topographic information. The ground surface generally slopes outward from a knoll located near the center of the property towards the outer property lines. There is a drainage swale near the northwest corner of the property.

***Programming***

The Standard Kingdom Hall showing the typical room finishes is illustrated on Sheet No. A6.3 provided by the Owner and attached in Appendix C. The facility proposes a total seating capacity of 275 seats. The tabulation provided below outlines the building space programmed by the Owner for the initial 5,000 SF building:

| Net Area (SF) | Space |
|---|---|
| 95 | Vestibule |
| 571 | Lobby |
| 109 | Coats Rack/Storage |
| 37 | Utility |
| 45 | Baby Care – Area located in Women's Lavatory |
| 143 | Lavatory - Women |
| 144 | Lavatory – Men |
| 49 | HCA Toilet |
| 255 | Meeting Room #1 (28 Seats) |
| 203 | Meeting Room #2 (20 Seats) |
| 105 | Literature/Magazines Area |
| 73 | Mechanical Chase |
| 2,219 | Auditorium (227 Seats) |
| 342 | Platform |
| 96 | Platform Ramp/Storage |
| 60 | Storage |

Total Gross Area: 5,000 SF
Total Seating Area: 2,677 SF (275 Seat Capacity)
Covered Drive-Thru located off of Vestibule/Lobby: 625 SF

**ZONING, LAND USE RESTRICTIONS AND LAND DEVELOPMENT**

The property is located within the Rural Tier of Durham County outside the Durham City Limits. Land development is subject to the Durham City-County development regulations. The development codes are referenced in the Durham City-County Unified Development Code (UDO). The zoning classification for the property is Rural Residential (RR). Use Regulations require new development at properties zoned RR requesting a facility intended for use as a place of worship to obtain a Minor Special Use Permit from the Board of Adjustment prior to submission of plans for development review.

The minor special use permit (MSUP) requests are heard by the Board of Adjustment as a quasi-judicial public hearing. The application and supporting information is a form of written testimony, used to show how UDO considerations are addressed and to provide evidence that the required findings for approval can be made. Durham City-County Planning Department requires a Pre-submittal conference prior to submission of the MSUP. A number of ordinance sections are reviewed during consideration of the MSUP request. A copy of the Special Use Application is attached in Appendix D for additional reference.

The anticipated development review process including the Minor Special Use Permit for this project is anticipated to require the following steps:

1. Minor Special Use Permit – Board of Adjustment;
2. Minor Site Plan for review and approval by the Development Review Board (DRB);
3. Construction Plan for Review by City/County;
4. Zoning Compliance Approval from Durham City-County Planning Department;
5. Stormwater and Erosion Control Plan Approval from Durham Co. Engineering;
6. Land Disturbing Permit Approval by Durham Co. Engineering Department;
7. Building Permits from Durham County Inspections

***Dimensional Standards***

| | |
|---|---|
| Street Yard | 50 FT |
| Side Yard each side | 25 FT |
| Side Yard both sides | 50 FT |
| Rear Yard | 50 FT |
| Building Height | 35 FT Max |

***Parking Requirements and Restrictions***

| | Minimum Required |
|---|---|
| 1 per 28 SF of available seating area | 96 Spaces (including 4 HCA) |
| Bicycle storage at 5% of provided Motor Vehicle Parking | 5 bicycles (one rack) |

Restrictions
Parking not permissible in street yard
Parking not permissible in side yards

## STORMWATER REQUIREMENTS AND WATERSHED RESTRICTIONS

The site is located within the Neuse River Basin and is subject to the Neuse River Buffer Riparian Rules. The property is also located within a designated watershed overlay district; Falls/Jordan Lake – B (Protected Area) and therefore is subject to more restrictive development requirements outlined in the Durham City/County UDO and further discussed below.

The site does not appear to have any regulated environmental resource features (flood plain, streams, or wetlands) that would require avoidance or permitting if impacted. There are no blue lines or water bodies indicated on the latest USGS 7.5 minute quadrangle map or NRCS Soils Map. The site has approximately 18 feet of vertical relief based upon Durham County GIS topographic information. There is a drainage swale near the northwest corner of the property. The ground surface generally slopes outward from a knoll located near the center of the property towards the outer property lines.

Geographically, the site is located relatively close to Falls Lake and is divided by two sub-drainage basins, Brier Creek and Sycamore Creek. Brier Creek and Sycamore Creek both drain to Crabtree Creek below Falls Lake; therefore, Falls Lake Rules would not apply to development at this site. Available records indicate the site is located on a property that was subdivided nearly a decade ago. The original property contained a topographic ridge dividing the northern portion draining into the Falls Lake basin; while the lower portion of the property (the subject Property) drains to Crabtree Creek below Falls Lake.

The action of subdividing a property would not by itself update or re-map the watershed protection overlay district boundary. Therefore the Falls/Jordan Lake – B (Protected Area) watershed overlay designation remains applicable to the subject property even though it does not drain into Falls Lake. It should be noted that there is a process to revise the watershed protection overlay boundary from an individual property. It would involve preparing a written justification to the City-County Planning Administrator to demonstrate that the subject property is more than five (5) miles from the normal pool of the Falls Lake Reservoir and located outside of the topographic ridge line that drains to it. If the Planning Administrator supports the request, it must then be presented to the County Board of Commissioners along with a request for a resolution authorizing the Planning Administrator to bring the matter to the State. Once the State approves the request, Durham County can individually exempt the site from the more restrictive watershed protection requirements outlined in the UDO. If the State does not approve the request, the Owner/Developer has the option to request rezoning of the property to remove the overlay district. Such a rezoning request would need to be heard by Governing Body (County Board of Commissioners) as a quasi-judicial hearing.

Before considering a request for exemption from the Watershed Overlay District it is important to understand what the limitations are for development in the designated Falls/Jordan Lake – B Protected Area overlay district. It may in fact be feasible to develop the site in compliance with the requirements and restrictions as programmed without having to request an exemption.

First, regardless of the watershed protection overlay requirements, development at this site is subject to the Durham County Neuse River Basin Nutrient Sensitive Waters Management Strategy Stormwater Plan Requirements. The developed site would be considered as commercial development that must meet the nutrient load nitrogen export limit of 3.6 lb/ac/yr. If the computed post development nitrogen export is less than 10.0 lb/ac/yr, reduction of nitrogen to achieve the export load required by the rule can be accomplished via one or a combination of methods described below:

1. Install an engineered stormwater control device, or best management practice device (BMP), such as a constructed wetlands, bio-retention, wet detention to remove enough nitrogen to bring the development down to 3.6 lb/ac/yr;
2. Pay a one-time offset payment calculated based upon the residual loading times the total site acreage times a 30 year period multiplied times the current mitigation bank rate to bring the nitrogen down to the 3.6 lb/ac/yr;
3. or do a combination of BMPs and offset payment to achieve a 3.6 lb/ac/yr nitrogen export

In addition to limiting nitrogen the new development must manage stormwater runoff to maintain the post-development peak flow rate for the 1-year, 24-hour storm at or below the pre-development peak flow rate. Typically, an engineered stormwater control device, or best management practice device (BMP) would be required to control the increased stormwater runoff volume and rate resulting from the new development. If water quality treatment isn't necessary, the BMP would be designed for detention only. If it can be demonstrated that the post-development peak flow rate does not increase by more than ten percent (10%) above the pre-development rate, BMPs would not be required.

Development in the watershed overlay protected area has the following additional restrictions:

1. Low Density Option requires a maximum built-upon-area impervious surface coverage of 24% without requirement of engineered stormwater controls (BMPs);
2. High Density Option would allow impervious surface area up to 70% but BMPs are required.

The new building and its associated parking is anticipated to occupy approximately 1 acre of impervious surface area. Additional impervious area may be necessary depending upon where the Owner desires to the site the building (i.e., a longer internal access drive). There appears to be adequate land area available to construct the proposed building and its parking lot and the future building and parking and remain below the 24 percent impervious coverage limitation to develop under the 'low density option.'

In summary, it should be feasible to develop this property under the low density option requirements of the Falls/Jordan Protected Area watershed overlay without having to construct BMPs for treatment of stormwater runoff as long as the available acreage of the site is not reduced (i.e. subdivision) and nitrogen export requirements are satisfied as described above. Furthermore, if the post development peak flow rate does not increase more than 10 percent above the pre-development peak, BMP(s) for control (detention) of stormwater runoff should not be required for the development of this site. It is recommended that the schematic design consider the full build out to fully address these requirements and better plan the layout of the project.

**LANDSCAPE REQUIREMENTS**

Landscaping requirements are outlined in the UDO and include boundary (or perimeter buffer) requirements, street trees, and vehicle use area plantings. The requirements for each are based upon several considerations including intensity of the proposed development, its zoning classification relative to the adjacent property(ies)/development zoning classification, location of the development relative to right-of-way, configuration of parking lots and their location relative to right-of-way, streets and adjacent properties. For this project it is anticipated that the boundary buffer requirements would require a 20 ft wide, 40% opaque buffer consisting of a mixture of canopy trees, evergreen trees, deciduous trees, deciduous and evergreen under story and shrubs. Credit may be given for use of existing vegetation; however, it must be demonstrated that the natural buffer meets minimum opacity standards and that the root zones of the trees will be protected and not affected by development activity. Otherwise supplemental plantings in accordance to the boundary buffer plant tabulations provided within the UDO are required. Vehicle use area plantings depend primarily upon the layout of the parking lot and its location relative to the lot lines and street(s).

Only a very small portion of the property has frontage along Olive Branch Road (approximately 110 linear feet). Therefore, street trees along the public right-of-way are anticipated to be minimal. The approval of a Minor Special Use Permit may include more restrictive requirements. For example the City/County may require that the internal driveway be planted to street tree standards as a condition of the minor special use permit approval.

**GEOTECHNICAL REQUIREMENTS**

The Owner furnished a subsurface geotechnical report prepared by Terratech Engineers, Inc. A copy of the report is attached in Appendix E. The following provides comments on the adequacy of the investigation and recommendations provided for use in site design and any additional recommendations or special considerations for site design based upon these data.

The report prepared by Terratech is comprehensive. Topsoil appears to be approximately 6 inches thick with some potential for variation up to 12 inches. Alluvial soils or cultivated soils were encountered in some of the upper levels of borings. Durham Triassic Basin soils were encountered just beneath at these locations and at or near ground surface at almost all of the other test bore locations. One test bore location indicated presence of highly plastic clay soils (Boring 8). Plastic soils are recommended to be undercut and replaced with suitable back fill media. No apparent, significant presence of rock appears evident. No significant soft soils appear evident; however, it is anticipated there will be some soft soils encountered and undercut required during excavation for roadway drainage ditches, trenching for utilities, and deeper excavations for building foundations.

Groundwater was not encountered during any of the test bores, and dewatering during construction is not anticipated to be a major requirement. It should be noted that the type of soils have a potential for perched groundwater conditions. Therefore, the potential for dewatering during deeper excavations cannot be completely ruled out. Also, the likelihood of dewatering increases during the wetter months (winter and early spring). Although groundwater was not encountered in any of the test bores, it should be noted that geotechnical evaluation was performed during the typically drier season of late summer or early autumn. Seasonal fluctuations in the groundwater table are normal. If it becomes necessary to propose BMPs for management of stormwater additional evaluation of the seasonal high water table (SHWT) would be necessary to support the design. The SHWT evaluation would be in accordance to the requirements contained within the NC Division of Water Quality BMP Manual.

It should be noted that the geotechnical engineer has provided some general guidelines for reducing equipment mobility problems and dealing with soft, wet, surface soils. Largely, these guidelines suggest limiting construction activities during wet weather, and optimizing control of surface drainage at the site.

In general, the geotechnical engineer's recommendations for site grading, including excavation considerations, fill placement and compaction, pavement subgrade; pavement thickness design, foundation design, etc., appear relatively straight forward. There are no special considerations recommended that would result in increased costs of typical construction for these activities.

**SEPTIC FIELD REQUIREMENTS**

Water and sewer options are limited to on-site well and septic due to the zoning and watershed restrictions outlined in the UDO. The Owner has furnished a preliminary soils report prepared by Soil & Environmental Consultants, PA (S&EC). A copy of the report is attached in Appendix F. S&EC performed the preliminary evaluation in order to determine areas of soil on site that have potential for subsurface wastewater disposal. Based upon the findings contained in the S&EC report, adequate contiguous areas of land are available on site suitable for low pressure pipe septic systems (approximately 4.18 acres) and subsurface drip, pretreatment low pressure pipe, or low pressure pipe septic systems (approximately 7.2 acres). These areas are illustrated on a color exhibit contained in the report. The layout of the site (proposed and future) elements would need to consider preserving suitable area for the septic system and repair areas as required by 15A NCAC 18A.1900 "Laws and Rules for Sewage Treatment and Disposal Systems." The S&EC report estimates suitable area needed to accommodate the proposed worship building (septic and repair area) is approximately ½ acre. At lease one (1) acre of suitable area should be preserved to accommodate the future build-out of a second similarly sized facility at the site.

## SITE ACCESS AND NCDOT REQUIREMENTS

The property is located adjacent to Olive Branch Road (NCSR 1905) approximately ¼ mile north of Leesville Road (NCSR 1906) and one-third mile south of Carpenter Pond Road (NC SR 1901). A driveway attachment permit approval from NCDOT Division 5, District 2 would be required to access the site from Olive Branch Road. The District Engineer's office has conducted a preliminary review and correspondence received from Adrian Atkinson confirmed that roadway improvements to Olive Branch Road, including widening of the existing lanes or addition of turn lanes would not be required. NCDOT did caveat their preliminary review on the premise that Durham City-County Planning could require improvements to Olive Branch Road or sidewalk along the right-of-way frontage of the site as one of the committed elements associated with the approval of the Minor Special Use Permit. If required, such improvements would fall under the jurisdiction of NCDOT and reviewed under a 2-Party Right of Way Encroachment Agreement. A copy of this correspondence is attached in Appendix F.

There is no opportunity for a secondary access to the site, only a single driveway attachment is practical due to the limited frontage ~ 110 ft along Olive Branch Road. It is assumed that the site driveway will be a privately maintained street approved with the minor special use permit and minor site plan for the development. During site plan development, traffic circulation and parking/vehicle use areas should be planned in accordance to the requirements outlined in the UDO. The layout should consider the preferred orientation of the building, stormwater drainage, and septic system and repair areas.

## APPENDICES

Appendix A – USGS Quadrangle Map

Appendix B – Boundary Survey

Appendix C – Standard Kingdom Hall – Room Finishes - Floor Plan

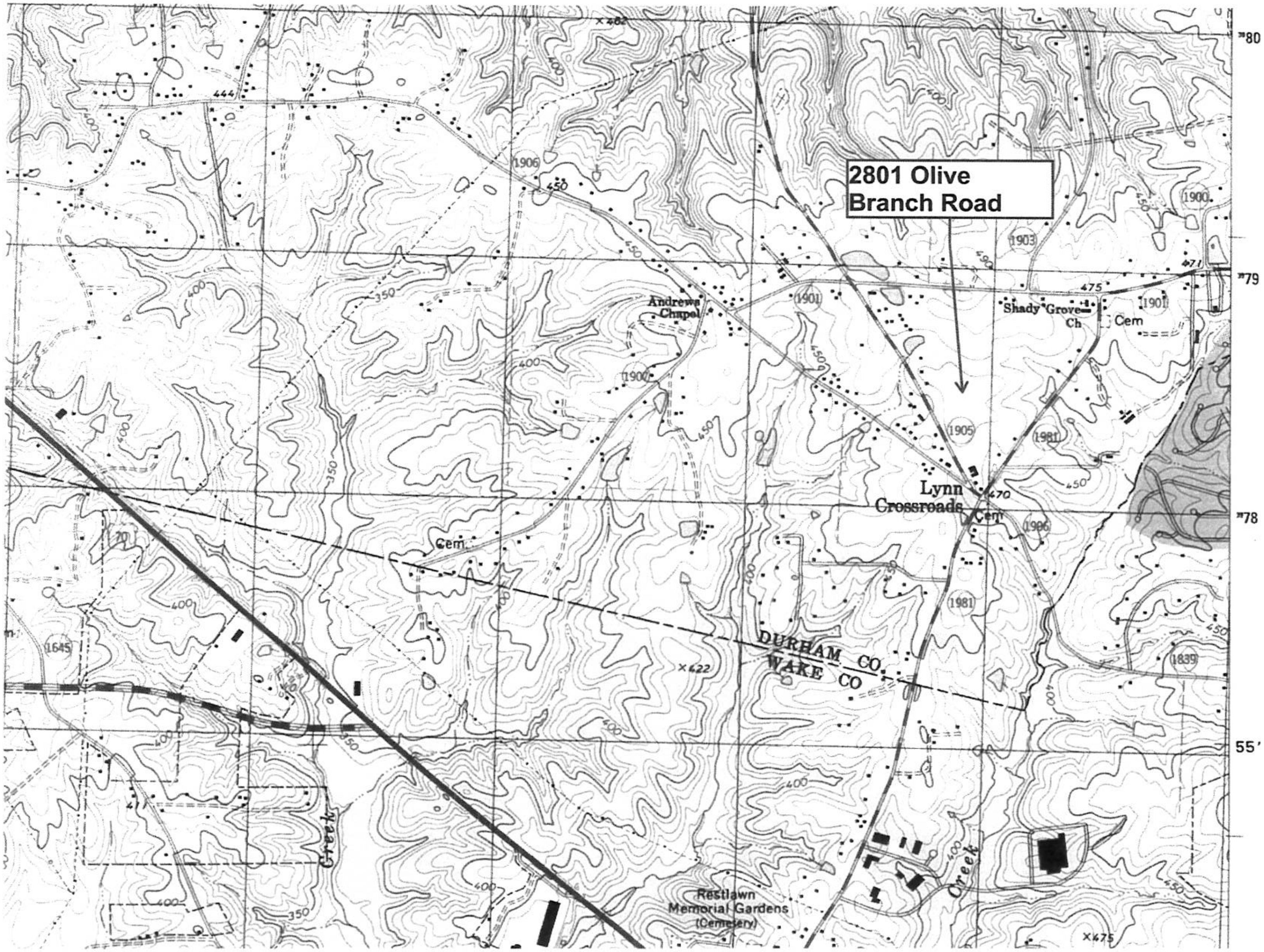
Appendix D – Durham City-County Minor and Major Special Use Permit (SUP) Application

Appendix E – Terratech Geotechnical Report

Appendix F – S&EC Preliminary Soil and Site Evaluation

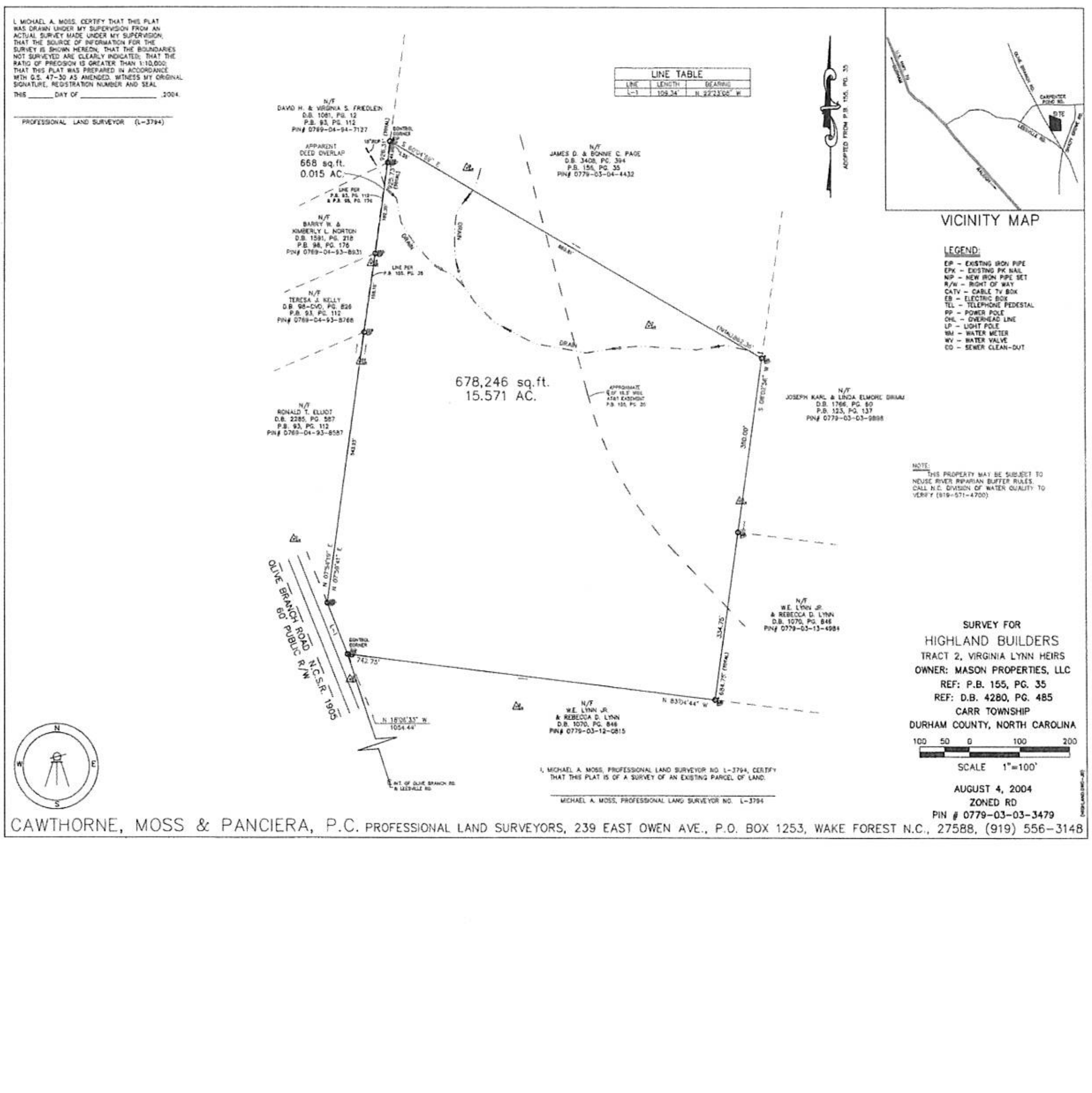
Appendix G – NCDOT correspondence

# APPENDIX A

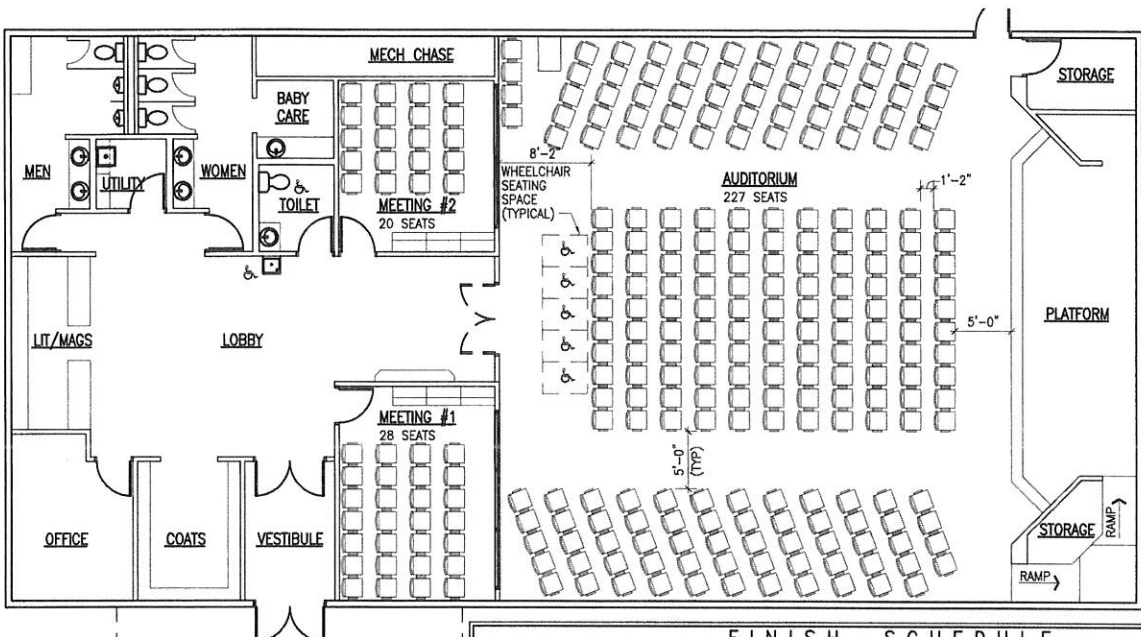


2801 Olive
Branch Road
Lynn
Crossroads
Shady Grove Ch
Cem
Andrews Chapel
DURHAM CO
WAKE CO
Restlawn
Memorial Gardens
(Cemetery)
Creek
80
79
78
55′

# APPENDIX B


I, MICHAEL A. MOSS, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION; THAT THE SOURCE OF INFORMATION FOR THE SURVEY IS SHOWN HEREON; THAT THE BOUNDARIES NOT SURVEYED ARE CLEARLY INDICATED; THAT THE RATIO OF PRECISION IS GREATER THAN 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER AND SEAL
THIS ______ DAY OF __________________ ,2004.
PROFESSIONAL LAND SURVEYOR (L-3794)
LINE TABLE
LINE | LENGTH | BEARING
L-1 | 109.34' | N 22°23'06" W
ADOPTED FROM P.B. 155, PG. 35
VICINITY MAP
LEGEND:
EIP - EXISTING IRON PIPE
EPK - EXISTING PK NAIL
NIP - NEW IRON PIPE SET
R/W - RIGHT OF WAY
CATV - CABLE TV BOX
EB - ELECTRIC BOX
TEL - TELEPHONE PEDESTAL
PP - POWER POLE
OHL - OVERHEAD LINE
LP - LIGHT POLE
WM - WATER METER
WV - WATER VALVE
CO - SEWER CLEAN-OUT
N/F
DAVID H. & VIRGINIA S. FRIEDLEIN
D.B. 1061, PG. 12
P.B. 93, PG. 112
PIN# 0769-04-94-7127
CONTROL CORNER
APPARENT DEED OVERLAP
668 sq.ft.
0.015 AC.
LINE PER P.B. 93, PG. 112 & P.B. 98, PG. 176
N/F
BARRY W. & KIMBERLY L. NORTON
D.B. 1591, PG. 218
P.B. 98, PG. 176
PIN# 0769-04-93-8931
LINE PER P.B. 105, PG. 35
N/F
TERESA J. KELLY
D.B. 98-CVD, PG. 826
P.B. 93, PG. 112
PIN# 0769-04-93-8768
N/F
RONALD T. ELLIOT
D.B. 2285, PG. 587
P.B. 93, PG. 112
PIN# 0769-04-93-8587
N/F
JAMES D. & BONNIE C. PAGE
D.B. 3408, PG. 394
P.B. 156, PG. 35
PIN# 0779-03-04-4432
DRAIN
678,246 sq.ft.
15.571 AC.
N/F
JOSEPH KARL & LINDA ELMORE DIRAM
D.B. 1766, PG. 60
P.B. 123, PG. 137
PIN# 0779-03-03-9898
360.00'
334.75'
N/F
W.E. LYNN JR. & REBECCA D. LYNN
D.B. 1070, PG. 846
PIN# 0779-03-13-4984
OLIVE BRANCH ROAD N.C.S.R. 1905
60' PUBLIC R/W
CONTROL CORNER
742.75'
N 83°04'44" W
N 18°06'33" W
1054.44'
N/F
W.E. LYNN JR. & REBECCA D. LYNN
D.B. 1070, PG. 846
PIN# 0779-03-12-0815
NOTE:
THIS PROPERTY MAY BE SUBJECT TO NEUSE RIVER RIPARIAN BUFFER RULES. CALL N.C. DIVISION OF WATER QUALITY TO VERIFY (919-571-4700)
SURVEY FOR
HIGHLAND BUILDERS
TRACT 2, VIRGINIA LYNN HEIRS
OWNER: MASON PROPERTIES, LLC
REF: P.B. 155, PG. 35
REF: D.B. 4280, PG. 485
CARR TOWNSHIP
DURHAM COUNTY, NORTH CAROLINA
100 50 0 100 200
SCALE 1"=100'
I, MICHAEL A. MOSS, PROFESSIONAL LAND SURVEYOR NO. L-3794, CERTIFY THAT THIS PLAT IS OF A SURVEY OF AN EXISTING PARCEL OF LAND.
MICHAEL A. MOSS, PROFESSIONAL LAND SURVEYOR NO. L-3794
AUGUST 4, 2004
ZONED RD
PIN # 0779-03-03-3479
CAWTHORNE, MOSS & PANCIERA, P.C. PROFESSIONAL LAND SURVEYORS, 239 EAST OWEN AVE., P.O. BOX 1253, WAKE FOREST N.C., 27588, (919) 556-3148

# APPENDIX C




| FINISH SCHEDULE | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ROOM OR SPACE | | WALLS | FLOOR | BASE | ROOM OR SPACE | | WALLS | FLOOR | BASE |
| **NAME** | **SQUARE FEET** | **SURFACE FINISH** | **SURFACE FINISH** | **SURFACE FINISH** | **NAME** | **SQUARE FEET** | **SURFACE FINISH** | **SURFACE FINISH** | **SURFACE FINISH** |
| VESTIBULE | 95 | VINYL | TILE | TILE OR WOOD | MEETING #1 | 255 | VINYL | CARPET | WOOD OR CARPET |
| LOBBY | 571 | VINYL | TILE | TILE OR WOOD | MEETING #2 | 203 | VINYL | CARPET | WOOD OR CARPET |
| COATS | 109 | VINYL | TILE | TILE OR WOOD | LITERATURE | 105 | VINYL | CARPET | – |
| UTILITY ROOM | 37 | PAINT | TILE | TILE OR WOOD | MECH CHASE | 73 | | SEALED | – |
| BABY CARE | 45 | VINYL | TILE | TILE | AUDITORIUM | 2219 | VINYL | CARPET | WOOD OR CARPET |
| WOMEN'S ROOM | 143 | TILE & VINYL | TILE | TILE | PLATFORM | 342 | VINYL | CARPET | WOOD OR CARPET |
| MEN'S ROOM | 144 | TILE & VINYL | TILE | TILE | RAMP/ STORAGE | 96 | VINYL | CARPET | WOOD OR CARPET |
| ♿ TOILET | 49 | TILE & VINYL | TILE | TILE | STORAGE | 60 | PAINT | SEALED | – |

GENERAL NOTES:

1. TOTAL BUILDING AREA – 5000 SQ FT (NOT INCLUDING DRIVE THRU)
2. TOTAL SEATING CAPACITY – 275

1 / A6.3 FLOOR PLAN – FINISHES

SCALE: 1/8"=1'-0"

NO DATE REVISION B

SHEET TITLE: ROOM FINISHES

PROJECT TITLE: STANDARD KINGDOM HALL DESIGN 04

DWN BY: CKD BY:

SCALE: 1/8"=1'-0"

DATE:

CAD #: 04-A6-03

SHEET No. A6.3

## APPENDIX D

Rev. 04/2010

DURHAM
1 8 6 9
CITY OF MEDICINE

Durham City-County Planning Department

# MINOR AND MAJOR SPECIAL USE PERMIT (SUP) APPLICATION

(A Pre-submittal conference must be held prior to submission)

| Tracking Information (Staff Only) | | |
|---|---|---|
| Case Number: | Date/Time rec'd: | Rec'd by: |

## About this Application

ONLY COMPLETE APPLICATIONS CAN BE ACCEPTED

*Minor special use permits* are heard by the Board of Adjustment as a quasi-judicial public hearing. *Major special use permits* are heard by the Governing Body (City Council if City, Board of Commissioners if County) as a quasi-judicial public hearing.

**Submittal:** Applications are due by noon on the submittal deadline date. Deadlines are discussed at the pre-submittal meeting and are available online at http://www.durhamnc.gov/departments/planning/boa/. Applications should be submitted in-person, and fees are due at time of submittal.

The application is a form of written testimony, and used both to show how Ordinance considerations are addressed and to provide evidence that the required findings for approval can be made. In addition to the application materials, the applicant may provide any other written, drawn or photographed material to support his/her request and as permitted by the Board of Adjustment or Governing Body, as applicable. Any such additional material submitted will become part of the application, and as such cannot be returned.

Attendance at the hearing is required. Applicants may represent themselves or may be represented by someone appropriate for quasi-judicial public hearings. The applicant has the **burden of proof** and must provide sufficient evidence in order for the required findings to be made. The public hearing will allow the applicant, proponents, opponents and anyone else the opportunity to testify in regards to the request. An application may be approved, approved with conditions, continued for more information, or denied. **Decisions can be appealed to Superior Court within 30 days.**

**Contact Information:** If you have any questions, please contact the City-County Planning Department at 560-4137 between 8:00 a.m. and 5:00 p.m. on weekdays.

| Application Requirements | Applicant Initial | Staff Initial |
|---|---|---|
| **Record of the pre-submittal meeting (copies provided at the meeting)** | | |
| **Fee** | | |
| **Completed application and responses: ORIGINAL signatures required** | | |
| **SITE PLAN (full size and 11x17 already submitted for review) or PLOT PLAN, as determined at pre-submittal meeting** | | |
| **Responses to general findings and review factors: Section 3.9.8A and B of the UDO** | | |
| **Responses to Additional Findings and/or Review Factors, as applicable** | | |
| **Responses to Limited Use Standards, as applicable** | | |
| **Floorplan, as applicable** | | |
| **Elevations, as applicable** | | |
| **Note: Additional supporting documents may also be submitted** | | |

Case #____________

| **Property Information** | |
|---|---|
| Site Address: | PIN(s): |
| Zoning District(s) : | PID(s): |
| Overlay District(s): | SUP Type: ☐ Minor (msup) ☐ Major (MSUP) |
| Current Use: | ☐ City ☐ County ☐ Both |

| **Property Owner** | |
|---|---|
| Name(s) (Print): | Telephone: |
| Contact Person: | Email: |
| ______________________ Owner Signature | ______________ Date |

| **Applicant** | |
|---|---|
| Name(s): | |
| Contact Person: | Telephone: |
| Address: | Fax: |
| City/State/ZIP: | Email: |
| ***I certify that all of the information presented by me in this application is accurate to the best of my knowledge, information, and belief.*** | |
| ______________________ Applicant Signature | ______________ Date |

| **Agent (if different than applicant)** | |
|---|---|
| Name: | |
| Contact Person: | Telephone: |
| Address: | Fax: |
| City/State/ZIP: | Email: |

**Complete and respond to the following with an attachment (suggested), or in the space provided:**

Applicant's Name: I, ______________________________, do hereby petition the City of Durham/County of Durham for a Special Use Permit to allow the following:

**Section 3.9.8 of the UDO: Criteria for Approval of Major and Minor Special Use Permits**

**A. General Findings**

Applications for minor or major special use permits shall be approved only if the Board of Adjustment or Governing Body, as applicable, finds that the use as proposed, or the use as proposed with conditions, is:

**1.** In harmony with the area and not substantially injurious to the value of properties in the general vicinity;
*Applicant's Response:*

**2.** In conformance with all special requirements applicable to the use;
*Applicant's Response:*

**3.** Will not adversely affect the health or safety of the public; and
*Applicant's Response:*

**4.** Will adequately address the review factors identified below.
*Applicant's Response:*

**B. Review Factors**
The applicant shall demonstrate that the review factors listed below have been adequate addressed.

**1. Circulation**
Number and location of access points to the property and the proposed structures and uses, with particular reference to automotive, bicycle, mass transit and pedestrian safety and convenience, traffic flow and control, and access in case of fire or catastrophe.
*Applicant's Response:*

**2. Parking and Loading**
Location of off-street parking and loading areas.
*Applicant's Response:*

**3. Service Entrances and Areas**
Locations of refuse and service areas with particular reference to ingress and egress of service vehicles.
*Applicant's Response:*

**4. Lighting**
Locations of exterior lighting with reference to glare, traffic safety, economic effect and compatibility with other property in the area.
*Applicant's Response:*

**5. Signs**
Appropriateness of signs considering location, color, height, size, and design within the context of other property in the area.
*Applicant's Response:*

**6. Utilities**
Location and availability of utilities.
*Applicant's Response:*

**7.Open Spaces**
Location of required yards and other open spaces and preservation of existing trees and other natural features.
*Applicant's Response:*

**8. Environmental Protection**
Preservation of tree cover, Durham Inventory Sites, floodplain, stream buffers, wetlands, steep slopes, open space and other natural features, and protection of water quality.
*Applicant's Response:*

**9. Screening, Buffering and Landscaping**
Installation of screening, buffering, fencing and landscaping where necessary to protect adjacent property.
*Applicant's Response:*

**10. Effect on Adjacent Property**
Effects of the proposed use on nearby properties, including, but not limited to, the effects of noise, odor, lighting, and traffic.
*Applicant's Response:*

**11. Compatibility**
The level of general compatibility with nearby properties and impacted neighborhoods, including but not limited to the appropriateness of the scale, design, and use in relationship to other properties.
*Applicant's Response:*

**12. Consistency with Policy**
Consistency with the Comprehensive Plan and applicable development tier guidelines, overlay purposes, and zoning district intent statements in Article 4, Zoning Districts.
*Applicant's Response:*

**13. Other Factors**
Any other review factors which the approving authority considers to be appropriate to the property in question.

**NOTE:** Please address the requirements of any applicable "Limited Use Standards" or other special requirements of the use as an attachment of the application.

**Read and sign below:**

In granting a Minor or Major Use Permit, conditions may be placed to assure that adequate mitigation measures are associated with the use. The conditions shall become part of the special use permit approval. Violations of any of the conditions shall be treated in the same manner as other violations of the Ordinance. Furthermore, Special Use Permits shall become null and void in any of the following cases (Section 3.9.13 of the UDO):

A. If a site plan is not approved within 12 months of the date of permit approval.

B. If an approved site plan or building permit expires.

C. If a building permit is not issued within two years of the date of approval, in cases where a site plan is not required.

D. If a substantial violation of the conditions of the permit, as determined by the
Planning Director or designee occurs. The addition of language to the special use permit regarding such voiding shall not be required.

______________________________ ______________
**Applicant Signature** **Date**

# APPENDIX E

TERRATECH ENGINEERS • INC
Geotechnical Engineering
Environmental Consulting
Construction Materials Testing

**Report of Preliminary Subsurface Investigation**

**and Geotechnical Engineering Evaluation**

**Leesville Kingdom Hall**

**Durham County, North Carolina**

**prepared for**

**North Carolina Regional Building Committee #4**

Prepared by

TerraTech Engineers, Inc.
NC Engineering Corporation C-1356
4905 Professional Court
Raleigh, NC 27609
919-876-9799

TERRATECH
ENGINEERS • INC
Geotechnical Engineering
Environmental Consulting
Construction Materials Testing

October 10, 2011

N.C. Regional Building Committee #4
4509 Lawrence Daniel Road
Matthews, NC 28104
jjacek@carolina.rr.com

Attention: Mr. Jon J. Jacek

**Report of Preliminary Subsurface Investigation**
**and Engineering Evaluation**
**Leesville Kingdom Hall**
**Durham County, North Carolina**
**Our Project Number 121-11-65800**

Gentlemen:

TerraTech Engineers, Inc. has completed the authorized subsurface investigation and engineering evaluation for the proposed Leesville Kingdom Hall building in Durham County, North Carolina. The enclosed report describes our investigative procedures and presents the results of our testing and evaluation, along with design and construction recommendations for this project.

We appreciate the opportunity to work with you on this subsurface investigation and engineering evaluation, and are prepared to follow up with the recommended construction materials testing services. If you have any questions concerning this report, please contact us.

Sincerely,

TerraTech Engineers, Inc. (C-1356)

Dustin S. Walker, P.E.
Geotechnical Engineer

Glen A. Malpass, P.E.
Senior Geotechnical Engineer

DSW/sk

## SCOPE OF SERVICES

The scope of this subsurface investigation was outlined in our proposal number 4948-N dated August 8, 2011. The primary objectives of this investigation were to evaluate the subsurface conditions within the area of proposed construction and to make recommendations regarding site preparation and foundation design. More specifically, this investigation included the following objectives:

(1) To evaluate the existing subsurface soil and ground water conditions within the area of proposed construction.

(2) To make recommendations concerning site preparation, and to discuss the excavation characteristics of the encountered materials.

(3) To recommend foundation types which can safely and economically support the proposed structures.

(4) To evaluate the allowable bearing pressure of the foundation subsoils encountered within the proposed building areas for support of shallow foundations.

(5) To provide recommendations for a design modulus of subgrade reaction value for the planned concrete slab-on-grade.

(6) To make recommendations concerning control of ground water during construction and on a permanent basis, if it appears necessary.

(7) To provide recommendations for material types and thicknesses for the planned pavement systems in the drives and parking lots.

(8) To make recommendations for achieving high density structural fill capable of satisfactorily supporting the proposed construction.

(9) To make pertinent recommendations concerning quality control measures during construction.

## INVESTIGATIVE PROCEDURES

### Field Investigation

The subsurface investigation consisted of the requested ten soil test borings. The test borings were performed at the approximate locations shown on the Test Boring Plan, Figure 1, included in the Appendix. The test borings were performed to a depth of 15 feet below the existing ground surface.

The test borings were located in the field by a representative of TerraTech Engineers, Inc. by measuring distances and angles from existing site reference points. In general, the locations of the test borings should be considered approximate. Ground surface elevations were not known at the time of this investigation.

Standard penetration testing (ASTM D-1586) was performed at selected intervals in the soil test borings. The standard penetration resistances, in conjunction with soil classifications, provide an indication of a soil's engineering characteristics.

Detailed descriptions of the soils encountered in the test borings are provided in the Test Boring Records included in the Appendix. Ground water conditions, standard penetration resistances, and other pertinent information are also included. Please note that the stratification lines on the Test Boring Records are approximate boundaries between soil types. The in-situ transitions are likely to be more gradual.

### Laboratory Investigation

The laboratory investigation consisted of a physical examination and classification of all samples obtained from the drilling operation. Classification of the soil samples was performed in general accordance with ASTM D-2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D-2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of error.

## GENERAL SITE AND SUBSURFACE CONDITIONS

### Site Location and Description

The subject site is located east of Olive Chapel Road, north of the Olive Chapel Road and Leesville Road intersection in Durham County, North Carolina. The subject parcel is currently undeveloped and mostly wooded. There are walking trails and a vehicular trail that runs through the property. The ground surface generally slopes from a knoll located near the center of the property towards the outer property lines. We observed a drainage swale near the northwest corner of the property near test boring B-10. Maximum relief across the site is approximately 18 feet.

### Regional Geology

Based on a review of geologic maps, it appears that the site is located within a geologic unit known as the Durham Triassic Basin. The Durham Triassic Basin, one of several trough shaped basins in the Piedmont, was created approximately 200 million years ago when faulting activity caused long, narrow areas to drop several thousands of feet relative to the surrounding area. Soil and rock materials were then eroded from the surrounding areas and deposited in fresh water lakes within the basin to form sedimentary rocks. The sedimentary rocks in this area typically consist of sandstones, siltstones, shales, conglomerates, and fanglomerates. Isolated calcareous zones are present in the fine-grained rocks, and occasional coal beds are interbedded with the shales and siltstones. Conglomerates and fanglomerates are typically found along the western and eastern edges of the basin.

Basic igneous rocks, typically classified as diabase, have been intruded in the form of dikes and sills into the sedimentary rocks of the Durham Triassic Basin. The majority of the diabase dikes are tens of feet in width and trend in a northwesterly direction. In general, the diabase is more resistant to weathering than the surrounding sedimentary rocks, so that many low hills are composed of diabase.

Soils in the Durham Triassic Basin have been formed by the in-place weathering of the underlying rock, which accounts for their classification as "residual" soils. The residual soils typically consist of clayey silts, sandy silts, and silty sands. However, pockets of relatively plastic silts and clays have been encountered within less plastic, coarser grained soils, in many instances. Boulders are commonly encountered within the residual soil mass in this area.

The residual soils typically become less weathered, coarser grained, and much harder with increased depth. When the residual materials have a standard penetration resistance of 100 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the underlying rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process. The degree of weathering is most advanced at the ground surface, where fine grained soil may be present. The weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface in the area has generally been found to range from about 10 to 60 feet below the ground surface.

Stream valleys in this area often contain alluvial (water deposited) soils, depending on ground surface topography, stream flow characteristics, and other factors. By nature, alluvial soils can be highly variable depending upon the energy regime at the time of deposition. Coarse materials such as sand or gravel are deposited in higher energy environments, while fine grained materials such as silt and clay are deposited in low energy environments. Alluvial soils may also contain significant amounts of organic materials, and are frequently in a loose, saturated condition. In many cases, fine grained alluvial soils will be highly compressible and have relatively low shear strength.

**General Subsurface Conditions**

Topsoil was encountered in test boring B-10 to an approximate depth of 6 inches. The majority of our test borings were performed in areas where access trails were cleared for mobilization of our drilling equipment. In these areas the topsoil was stripped while clearing. Based on our experience with similar sites, topsoil thicknesses generally range from 6 to 12 inches. However, topsoil thicknesses are highly variable, and could be higher than the thicknesses measured on other sites.

Cultivated soil was encountered in test boring B-7 to a depth of approximately 3 feet. The cultivated soil consisted of clayey sand (SC). The standard penetration resistance in the cultivated soil was 4 blows per foot.

Alluvial soil was encountered beneath the topsoil at test boring B-10. The alluvial soil consisted of silty sand (SM). The standard penetration resistance in the alluvial soils was 3 blows per foot.

Soils typical of the Durham Triassic Basin were encountered below the cultivated soil at test boring B-7, below the alluvial soils at test boring B-10, and from the ground surface in the remaining borings. The residual soils generally classified as sandy clay (CL) and sandy silt (ML). Highly plastic clay soils (CH) were encountered in test boring B-8 in the upper 3 feet. Standard penetration resistances in the residual soils generally ranged from 4 to 36 blows per foot.

Ground water was not encountered at the time of our investigation. However, water levels will fluctuate depending upon seasonal variations in precipitation and other factors, and may occur at higher elevations at other times.

For more detailed descriptions of subsurface soil and ground water conditions, please refer to the Test Boring Records included in the Appendix.

## PROPOSED CONSTRUCTION

Project information has been supplied by Mr. Jon Jacek of the N.C. Regional Building Committee. We have been provided a proposed site plan which indicates the property boundaries.

We understand that a single story, wood-framed building with a concrete slab-on-grade foundation system will be constructed at the site. Structural loading conditions are not currently known. Based on our experience on similar projects, we have assumed that the loading conditions will include a maximum column load of 30 kips and maximum wall loads of 3 kips per lineal foot. If actual loading conditions are greater than these assumed maximums, please contact us and we will review our recommendations for applicability to the actual loading conditions. Site grading plans have not been provided to us. Maximum relief across the site is approximately 18 feet. We anticipate that mass grading will include cut and fill on the order of 5 to 10 feet.

We have estimated that traffic volumes for the parking and driveway areas will not exceed 500 automobiles per day and 4 dumpster or delivery trucks per week. If actual traffic volumes are greater, please notify us and we will review our recommendations for applicability to the higher traffic volumes.

## EVALUATIONS AND RECOMMENDATIONS

The following recommendations are based on the information available on the proposed structure, the data obtained from our soil test borings, and our experience with soils and subsurface conditions similar to those encountered at this site. Because the test borings represent a very small statistical sampling of subsurface conditions, it is possible that conditions may be encountered during further investigation and construction that are substantially different from those indicated by the borings. In these instances, adjustments to the design and construction may be necessary depending on actual conditions.

### General Site Preparation

Trees, grass, topsoil, roots, and other deleterious materials should be removed from the proposed construction area. Special attention should be given to the removal of tree stumps within the proposed construction area. Site clearing, grubbing, and stripping should be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive mixing of topsoil and organic debris with clean underlying soils.

Alluvial soils were encountered in test boring B-10 to a depth of approximately 3 feet below the existing ground surface elevation. Alluvial soils are highly variable, but typically consist of loose, saturated soils that are difficult to manage. In areas where soft, loose and/or saturated alluvial soils are present, remedial measures should be expected. Typically, the most comprehensive remedial measure is the excavation of the alluvial soils and backfilling the excavation with suitable fill soils in accordance with the structural fill section of this report. However, the type of remedial measures will be dependent upon the conditions encountered, and the type of construction planned in the areas where alluvial soils are present.

After completion of site clearing and stripping, we recommend that proofrolling operations be performed. All areas of the site which are to receive fill should be proofrolled prior to placement of structural fill. Areas of proposed excavation should be proofrolled after rough finished subgrade is achieved. Proofrolling should be performed using a loaded dump truck weighing at least 15 tons. Proofrolling should be accomplished by performing at least 3 passes in each of two perpendicular directions within entire construction areas, and 10 feet beyond. Proofrolling should be observed by our representative to determine if remedial measures are necessary. Any unsuitable materials that may be present, and any low consistency soils that are encountered which cannot be adequately densified in place, should generally be removed and replaced with well compacted fill material placed in accordance with the Structural Fill section of this report. Proofrolling should facilitate the identification of soft surficial soils, but should not be expected to reveal soft conditions more than 2 feet below the ground surface at the time of proofrolling. Footing excavation examinations will be required to evaluate the presence of deeper soft soils which could adversely affect foundation support. Footing excavation examinations are discussed later in this report.

Soils in the upper 3 feet in the area of test boring B-8 include highly plastic clays that are highly susceptible to softening under the action of construction equipment traffic in combination with wet weather. Mitigation of equipment mobility problems and management of soft surface soils will be greatly dependent on the season in which construction is performed, and prevailing weather conditions. Some general guidelines for reducing equipment mobility problems and dealing with soft, wet, surface soils are as follows:

(1) Perform construction during seasons that provide the greatest potential for dry weather (i.e. summer and fall).

(2) Optimize surface water drainage at the site. This should include keeping off site surface water from flowing onto the site.

(3) Do not operate construction equipment on the site during wet conditions. Rutting the surface will only aggravate the problem.

(4) Use construction equipment that is well suited for the intended job under the site conditions. Heavy rubber-tired equipment typically requires better site conditions than light, track-mounted equipment.

(5) Whenever possible, wait for dry weather conditions to prevail. Construction schedules that do not realistically allow for rain days may only make problems worse. Pressure to perform earthwork under a tight schedule is frequently counterproductive.

Ultimately, it may be necessary to take steps to aggressively improve construction mobility if construction must proceed under unfavorable conditions. Methods for coping with equipment mobility problems may range from removing several feet of soft, wet soils, to utilizing crushed stone materials and stabilization fabrics. Other potential remedial methods include cement modification of soils, lime stabilization, use of surge stone, etc. The optimal approach should be determined by our representative based on the conditions present at the time of construction.

If the surface soils at the site become softened from exposure to inclement weather, the exposed soils should be dried, if necessary, and compacted to a minimum of 95 percent of their standard Proctor maximum dry density prior to fill placement operations or building construction.

During site preparation, burn pits, trash pits, or buried debris may be encountered. On sites near developed areas, this is not an unusual occurrence. All too frequently such buried material occurs in isolated areas which are not detected by the soil test borings. Any buried waste construction debris or trash which is found during the construction operation should be thoroughly excavated, and the waste material should be removed from the site.

As noted above, cultivated soils are present in portions of the site. The cultivated soils encountered in our test borings generally had a low organic content. However, cultivated soils can be highly variable and may be different from what was encountered in our test borings. If highly organic cultivated soils are encountered during site grading, we recommend that they be removed from the planned construction area and 10 feet beyond, and replaced with compacted structural fill materials. Our representative should be present during the removal process to verify that adequate removal is accomplished.

Site grading is expected in the road widening areas of the entrance drives. Based on our experiences on similar projects, we anticipate that soft soils will be encountered in ditch lines along the road. In addition, we expect the presence of soft backfill soils over existing utility lines in these areas. Therefore, some remedial measures should be anticipated to manage these conditions.

## Excavation Characteristics

For the purpose of discussing excavation characteristics; the materials found in the test borings consist of residual soils, cultivated soils and alluvial soils.

The existing residual soils, cultivated soils and alluvial soils encountered at the project site should generally be excavatable with conventional soil excavation equipment, such as scrapers, loaders, etc. Although none of the test borings encountered very hard soils (standard penetration resistances greater than 50 blows per foot), very hard soils could be encountered and may prove to be difficult to excavate using scrapers. These hard soils may require the use of heavy dozers or loaders to effectively achieve excavation. It is possible that hard soils may require ripping in some instances.

None of our test borings encountered partially weathered rock or rock. Based on our experiences on nearby sites, and the results of our borings, we do not anticipate that these materials will be encountered during mass grading of the site. However, the thickness and the continuity of partially weathered rock in the geology can vary widely even over a relatively short distance. Additionally, it would not be unusual to find lenses of partially weathered rock within more weathered residual soils. If partially weathered rock is encountered during site preparation, we anticipate that ripping will be required to effectively achieve excavation. Ripping can probably best be achieved with a single-tooth ripper mounted on a large tractor such as a Caterpillar D-8 or larger. In small area excavations, such as footing and utility trenches, excavation of partially weathered rock may require the use of heavy excavators or pneumatic jackhammers.

It is important to note that the depth to rock or partially weathered rock may vary quite rapidly over relatively short distances. It would not be unusual for rock or partially weathered rock to occur at higher elevations between or around the soil test borings.

## Earth Slopes

Temporary construction slopes should be designed in strict compliance with the most recent OSHA regulations. The test borings indicate that most soils at the site are Type B as defined in the OSHA regulations. The Type B soils will require that temporary construction slopes be no steeper than 1 horizontal to 1 vertical for excavation depths of up to 20 feet. Flatter slopes may be required, depending upon the conditions encountered. A competent person as defined by OSHA guidelines should be present to determine the type of material during trench excavations. Temporary construction slopes should be closely observed for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. If potential stability problems are observed, the geotechnical engineer should be immediately contacted. The responsibility for excavation safety and stability of construction slopes should lie solely with the contractor.

We recommend that permanent cut or fill slopes be no steeper than 2.5 (H) to 1.0 (V) to maintain long term stability and to provide ease of maintenance. Slopes constructed steeper than 2.5 (H) to 1.0 (V) could be highly susceptible to erosion, will be difficult to maintain, and could experience large scale slope failure in some instances. The crest or toe of cut or fill slopes should be no closer than 15 feet to any building foundation. The crest or toe should be no closer than 5 feet to the edge of any pavements.

## Volume Change Potential of Plastic Clay Soils

Based on the results of our test borings and our laboratory testing, highly plastic clays are present in isolated locations at the site. These soils are expected to have a moderate to high potential for volume change due solely to changes in their moisture content. These soils tend to shrink when they dry and swell when they become wet. As noted herein, highly plastic clay soils were encountered to an approximate depth of 3 feet in test borings B-8. Volume changes of plastic clay soils can lead to settlement of shallow foundations, voids beneath floor slabs, floor slab settlement, pavement settlement, and heave of lightly loaded structures such as floor slabs and pavements. While the use of drains around the perimeter of pavements and buildings can help reduce the potential for problems associated with volume change of highly plastic clays, it is our opinion that the most reasonable method of managing this potential for volume change is to remove the highly plastic clay soils within the expected zone of influence for support of the buildings and pavements. Since significant moisture content changes in these types of soils are typically limited to the upper 3 feet below the exterior ground surface, we recommend that all highly plastic clay soils be removed from the planned building and pavement areas in the upper 3 feet below the planned finished subgrade elevations. In areas where highly plastic clay soils are removed, low plasticity silts or clays should be used as structural fill to return to the subgrade elevation. Sandy soils are not recommended as fill in these areas, since a perched ground water condition could develop that could adversely affect the underlying plastic clay soils.

## Ground Water Control

Ground water was not encountered in our soil test borings. Therefore, we do not anticipate that ground water control measures will be required during mass grading of the site. However, ground water levels will fluctuate and could occur at significantly higher elevations at some time in the future. Also, the existing conditions in portions of the site near test borings B-1, B-7, and B-10 are conducive to the development of a perched ground water condition during times of wet weather. A perched ground water condition develops when a more permeable soil is underlain by a less permeable soil (sand underlain by clay). If possible, the site grading operations should occur during the summer months. If grading operations have to occur during the winter and early spring, it may be necessary to excavate dewatering trenches in the sandy soils at the ground surface to drain the water perched above the clay/silt layer. Once the water level is lowered sufficiently to allow the compaction of the surface soils and placement of fill materials, the temporary dewatering trenches can be removed. Depending upon the finished grades selected, trenches used for dewatering may be converted into permanent drains, where practical. This would involve installation of a perforated plastic pipe surrounded by a layer of washed stone wrapped in a filter fabric, with the pipe being designed to discharge into the storm sewer system, or directly onto the ground surface in the lower areas of the site. The need for permanent drains, and the appropriate method of constructing permanent drains, should be evaluated by our project engineer at the time of site grading operations.

We must emphasize that dewatering requirements will be dictated by ground water conditions at the time of construction. The contractor should use a technique or combination of techniques, which achieves the desired result under actual field conditions.

## Foundation Design

Based on the results of our test borings, and the above recommended site preparation procedures, it is our opinion that the proposed buildings may be supported on shallow foundation systems. We recommend that the foundations be designed for an allowable soil bearing pressure of 2,000 pounds per square foot. A minimum width of 24 inches for continuous wall footings and isolated column footings should be used to help prevent localized shear failure. Footings should bear at a minimum depth of 18 inches below the exterior ground surface to avoid potential problems due to frost heave.

Portions of the footings for this project will bear on new structural fill material. For this reason, we must emphasize the importance of quality control during the placement of structural fill. Performance of building foundations which are supported by structural fill material, will depend largely on achieving the recommended level of compaction on fill materials. Compacted soil densities less than the recommended percentage of the standard Proctor maximum dry density could result in excessive foundation settlement.

Detailed footing examinations should be performed in each column footing excavation and at 20 foot intervals in the wall footing excavations prior to placement of reinforcing steel. These examinations should be performed by our representative to confirm that the design allowable soil bearing pressure is available and to verify that highly plastic clay soils have been adequately removed. If soft or otherwise unsuitable soils are encountered during the examination, recommendations for remedial measures should be provided by our project geotechnical engineer. In areas where soft or unsuitable soils are removed, washed stone should not be used as backfill.

Exposure to the environment may weaken the soils at the foundation bearing surface, if they are exposed for extended periods of time. If the foundation bearing surface becomes softened due to inclement weather conditions, the soft soils should be removed prior to placement of concrete.

## Concrete Slabs-On-Grade

Based on the test boring results and our past experience, we recommend that a design modulus of subgrade reaction value of 100 pci be used for concrete slabs-on-grade. This recommended value assumes that the low plasticity fill soils and subgrade soils will be compacted to a minimum of 98 percent of their standard Proctor (ASTM D-698) maximum dry density in the upper 12 inches.

Construction activities and exposure to the environment often cause deterioration of the prepared slab-on-grade subgrade. Therefore, we recommend that the subgrade soils be evaluated by our representative immediately prior to floor slab construction. This evaluation may include a combination of visual observations, hand rod probing, proofrolling observations, and field density tests to verify that the subgrade has been properly prepared. If soft areas are encountered, recommendations for remedial measures should be provided by the Geotechnical Engineer.

In order to provide a stable base for construction activity, we recommend that all slab-on-grade construction be underlain by a minimum 4 inch thickness of compacted ABC stone.

**Flexible Pavement Design**

Based on the above described site preparation recommendations, we anticipate that the pavement area subgrade soils will generally consist of sandy clay. These materials may reasonably have a California Bearing Ratio (CBR) ranging from approximately 3 to 8, if compacted to at least 100% of the standard Proctor maximum dry density.

For purposes of pavement design, we have used a California Bearing Ratio of 5 for the pavement subgrade soils and the loading condition described previously in this report. Based on the AASHTO design method, a 20 year design life, and our past experience, we suggest the following design pavement section:

| | |
|---|---|
| Driveways: | 2 inches Asphaltic Concrete Surface Course<br>8 inches Aggregate Base Course |
| Parking Areas: | 2 inches Asphaltic Concrete Surface Course<br>6 inches Aggregate Base Course |

The asphaltic concrete surface course should be a type SF9.5A bituminous concrete mixture in accordance with Section 645 of the NCDOT Standard Specifications (2006). Aggregate base course stone should be in accordance with Section 520 of the NCDOT Standard Specifications. Proper subgrade compaction, adherence to the NCDOT specifications, and compliance with project plans and specifications are critical to the performance of the constructed pavement.

The recommended pavement sections are designed to support the traffic volumes expected after completion of the planned construction. If construction traffic is allowed to use the recommended pavement section, or if a staged approach is used where traffic will use a pavement section less than the full design section that is recommended herein, some damage requiring repair should be expected.

Based on our past experience, we recommend that a Portland cement concrete pavement be used in dumpster areas, and in other areas where heavy trucks are turning while traveling at slow speeds. We suggest the use of a 6 inch thick section of Portland cement concrete having a 28 day design compressive strength of 4,500 psi above a 4 inch thick section of compacted ABC stone. The concrete pavement may be designed as a "plain concrete pavement" with no reinforcing steel, or reinforcing steel may be used at joints. Construction joints and other design details should be in accordance with guidelines provided by the Portland Cement Association and the American Concrete Institute.

**Suitability of Excavated Material for Reuse as Structural Fill**

Based on the field and laboratory investigation performed, the majority of the residual soils, cultivated soils and alluvial soils at the site should generally be suitable for use as structural fill on the site. Highly plastic clays were encountered in test boring B-8. As previously mentioned, these soils have a potential for volume change based solely on changes in their moisture content. We recommend that these soils only be reused as fill in areas that are deeper than 3 feet below the final subgrade elevation.

**Structural Fill**

In order to achieve high density structural fill, the following recommendations are offered:

(1) Materials selected for use as structural fill should be free of vegetable matter, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 3 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill: (SM), (SC), (ML), and (CL). Due to the possibility of creating a condition conducive to development of a perched ground water condition, the following soil types should only be used in locations where at least 3 feet of silt or clay will be placed above them: (SW), (SP), (SP-SM), and (SP-SC). The following soil types are considered unsuitable in the upper 3 feet of the final subgrade elevation: (MH) and (CH). The following soil types are considered unsuitable: (OL), (OH), and (Pt).

(2) Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally not be more than 4 percentage points above or more than 4 percentage points below optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

(3) Suitable fill material should be placed in thin lifts (lift thickness depends on type of compaction equipment, but in general, lifts of 8 inches loose measurement are recommended). The soil should be compacted by mechanical means such as sheepsfoot rollers. Proofrolling with rubber tired, heavily loaded vehicles may be desirable at approximately every third lift to bind the lifts together and to seal the surface of the compacted area thus reducing potential for absorption of surface water following a rain. This sealing operation is particularly important at the end of the work day and at the end of the week.

Within small excavations such as behind retaining walls or in footing excavations, we recommend the use of "wacker packers" or sled tamps to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

(4) We recommend that structural fill be compacted to a minimum of 95% of the standard Proctor maximum dry density (ASTM Specification D-698). Additionally, the in-place maximum dry density of structural fill should be no less than 90 pcf. The upper 12 inches of floor slab subgrades should be compacted to at least 98% of the standard Proctor maximum dry density (ASTM D-698). Fill placement in pavement areas should be performed in accordance with the NCDOT Standard Specifications.

(5) An experienced soil engineering technician should take adequate density tests throughout the fill placement operation to verify that the specified compaction is achieved. It is particularly important that this be accomplished during the initial stages of the compaction operation to enable adjustments to the compaction operation, if necessary.

## ADDITIONAL SERVICES RECOMMENDED

Additional foundation engineering, testing, and consulting services recommended for this project are summarized below:

(1) Site Preparation Observations: Site preparation should be observed by our representative to determine if remedial measures are necessary in certain instances. Removal of any unsuitable materials should be observed by our representative to verify that adequate but not excessive removal is accomplished.

(2) Quality Control of Fill Placement and Compaction: We recommend that an experienced engineering technician witness all required filling operations and take sufficient in-place density tests to verify that the specified degree of compaction has been achieved.

(3) Footing and Slab Evaluations: Footing and slab areas for this project should be evaluated by our representative. The purpose of these evaluations will be to verify that the design soil bearing pressure is available and that subgrade areas are properly prepared.

(4) Pavement Components Testing and Inspection: Pavement components should be tested and inspected during and following construction to verify compliance with project plans and specifications.

The attached Appendix completes this report.

Sincerely,

TerraTech Engineers, Inc. (C-1356)

NORTH CAROLINA PROFESSIONAL 10/1/11 SEAL 035115 ENGINEER DUSTIN S. WALKER

Dustin S. Walker, P.E.
Geotechnical Engineer

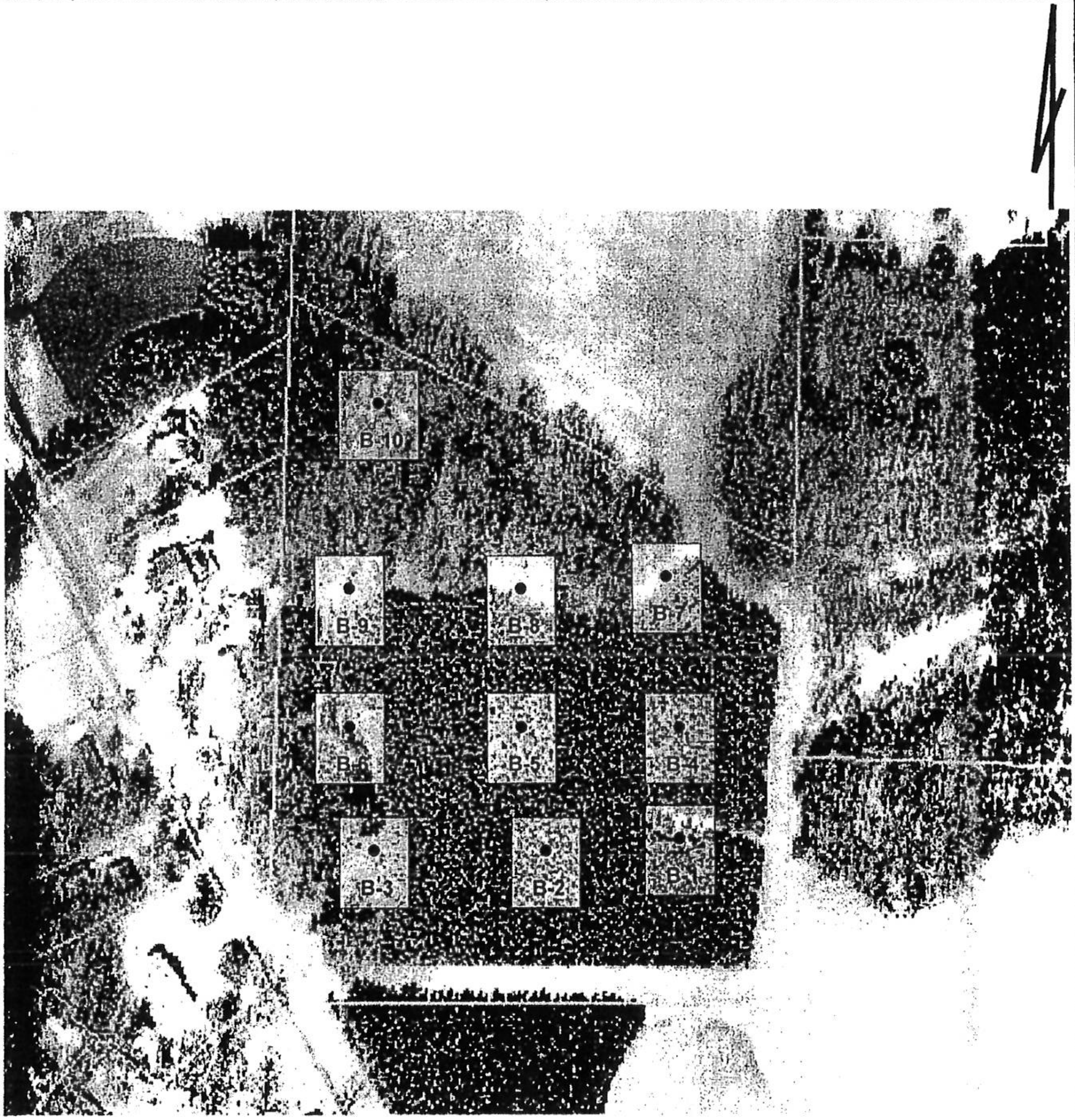
Glen A. Malpass, P.E.
Senior Geotechnical Engineer

DSW/sk

Enclosures

# APPENDIX

TERRATECH
ENGINEERS, INC




Not to Scale

Locations are approximate

**Figure 1. Boring Location Plan**

TerraTech Engineers, Inc. (C-1356)
4905 Professional Court
Raleigh, NC 27609
919-876-9799

Project: Leesville Kingdom Hall
Durham County, North Carolina
Our Project Number 121-11-65800

TERRATECH
ENGINEERS • INC

# Symbols and Nomenclature

| | |
|---|---|
| ▮ | Undisturbed Sample (UD) |
| ● | Standard penetration resistance (ASTM D-1586) |
| 100/2" | Number of blows (100) to drive the spoon a number of inches (2) |
| W-O-H, R | Weight of Hammer, Weight of Rods |
| AX, BX, NX | Core barrel sizes for rock cores |
| 65% | Percentage of rock core recovered |
| RQD | Rock quality designation - % of core 4 or more inches long |
| ▼ | Water table at least 24 hours after drilling |
| ▼ | Water table one hour or less after drilling |
| △ | Loss of drilling water |
| A | Atterberg Limits test performed |
| C | Consolidation test performed |
| GS | Grain size test performed |
| T | Triaxial shear test performed |
| P | Proctor compaction test performed |
| 18 | Natural moisture content (percent) |

## Penetration Resistance Results

| Sands | Number of Blows, N | Relative Density |
|---|---|---|
| | 0-4 | very loose |
| | 5-10 | loose |
| | 11-20 | firm |
| | 21-30 | very firm |
| | 31-50 | dense |
| | over 50 | very dense |

| Silts and Clays | Number of Blows, N | Approx. Consistency |
|---|---|---|
| | 0-1 | very soft |
| | 2-4 | soft |
| | 5-8 | firm |
| | 9-15 | stiff |
| | 16-30 | very stiff |
| | 31-50 | hard |
| | over 50 | very hard |

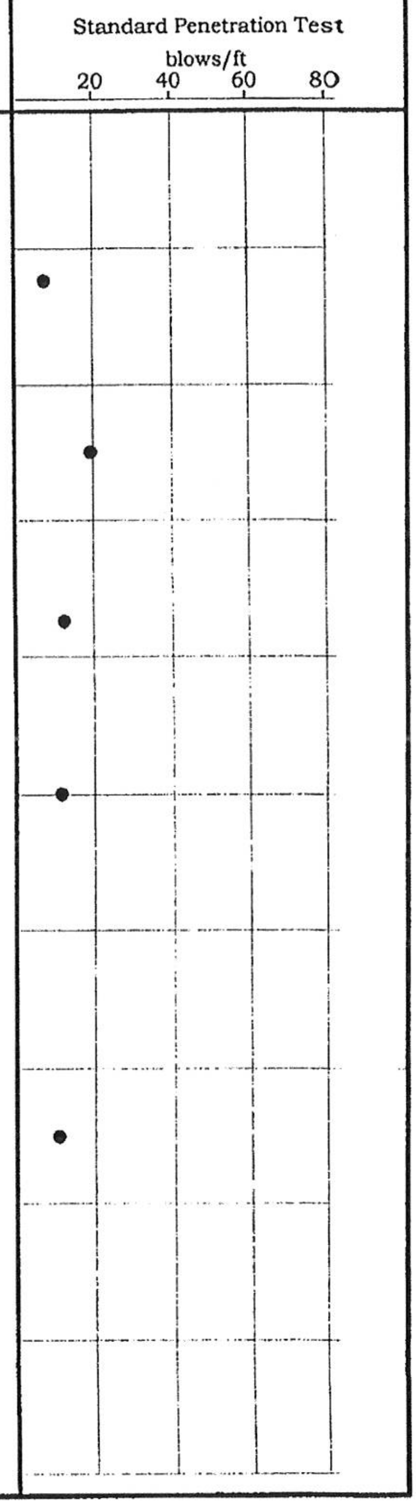
## Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D-1586. The standard penetration resistance is the number of blows of a 140 pound hammer falling 30 inches to drive a 2 inch O.D., 1.4 inch I.D. split spoon sampler one foot. Core drilling performed in accordance with ASTM D-2113. Undisturbed sampling performed in accordance with ASTM D-1587.

# TEST BORING RECORD

TERRATECH
ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts |
|---|---|---|---|---|
| 1 | Loose brown and orange clayey fine to medium sand (SC) (RESIDUUM) | | | |
| 2 | | | | 3-4-4 |
| 3 | | -3 | | |
| 4 | Very stiff to stiff brown, gray and red fine to medium sandy clay (CL) | | | |
| 5 | | | | 6-9-11 |
| 6 | | | | |
| 7 | | | | 3-6-7 |
| 8 | | -8 | | |
| 9 | Stiff gray and brown fine to medium sandy silt (ML) | | | |
| 10 | | | | 3-4-8 |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | -15 | | 4-5-6 |
| 16 | BORING TERMINATED | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | | | | |




Water Level 24 hr.: Boring Backfilled Upon Completion
Water Level 1 hr.: Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

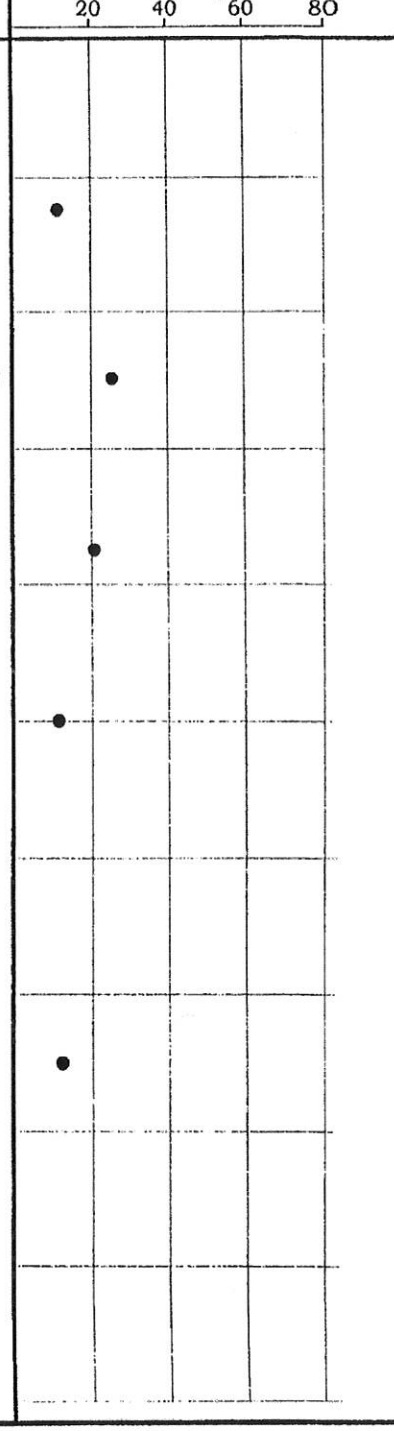
**Boring Number:** B-1
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

# TEST BORING RECORD

TERRATECH ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts |
|---|---|---|---|---|
| 0–5.5 | Stiff to very stiff brown and orange fine to medium sandy clay (CL) (RESIDUUM) | -5.5 | | 2-5-7<br>8-11-15 |
| 5.5–8 | Very stiff brown, gray and red fine to medium sandy clay (CL) | -8 | | 6-9-12 |
| 8–15 | Stiff tan, gray and red fine to medium sandy silt (ML) | -15 | | 4-5-7<br>3-5-8 |
| 15 | BORING TERMINATED | | | |

Standard Penetration Test blows/ft




Water Level 24 hr.: Boring Backfilled Upon Completion
Water Level 1 hr.: Not Encountered

TerraTech Engineers, Inc.
4905 Professional Court
Raleigh, NC 27609

**Boring Number:** B-2
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

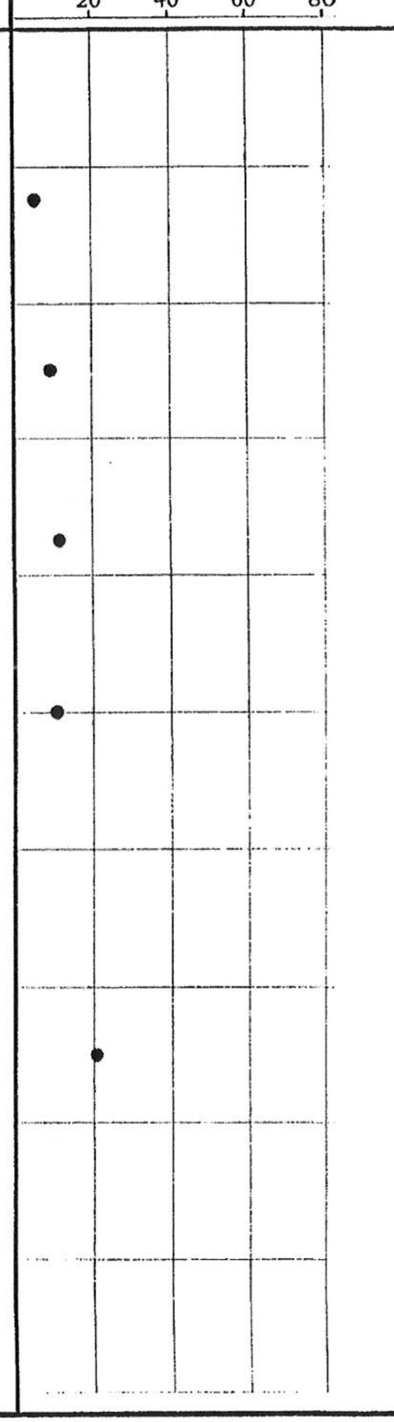
# TEST BORING RECORD

TERRATECH ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts |
|---|---|---|---|---|
| 0–3 | Firm brown fine to medium sandy clay (CL) (RESIDUUM) | -3 | | 2-3-3 |
| 3–8 | Stiff tan and gray fine to medium sandy silt (ML) | -8 | | 3-5-5<br>5-5-7 |
| 8–15 | Firm to very firm tan, gray and red silty fine to coarse sand (SM) | -15 | | 4-5-6<br>5-8-13 |
| 15 | BORING TERMINATED | | | |

Standard Penetration Test

blows/ft

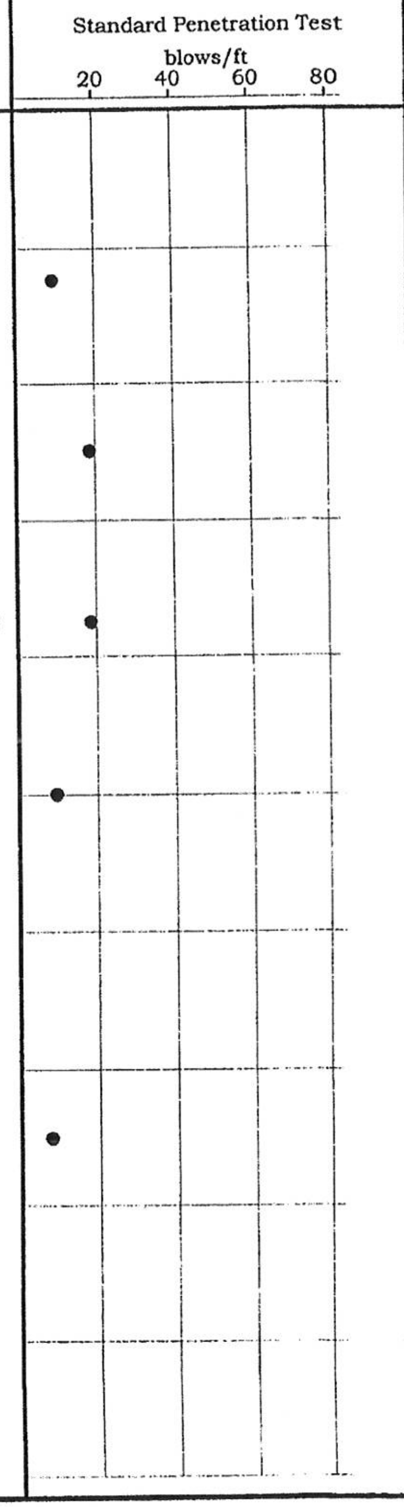



| | | |
|---|---|---|
| Water Level 24 hr.: Boring Backfilled Upon Completion | TerraTech Engineers, Inc. | Boring Number: B-3 |
| Water Level 1 hr.: Not Encountered | 4905 Professional Court | Project Number: 121-11-65800 |
| | Raleigh, NC 27609 | Date Drilled: 10/3/11 |
| | | Sheet: 1 of 1 |

# TEST BORING RECORD

TERRATECH
ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts |
| --- | --- | --- | --- | --- |
| 1 | Stiff brown fine to medium sandy clay (CL) (RESIDUUM) | | | |
| 2 | | | | 2-3-7 |
| 3 | | -3 | | |
| 4 | | | | |
| 5 | Very stiff brown, gray and orange fine to medium sandy clay (CL) with trace small roots | | | 4-8-11 |
| 6 | | | | |
| 7 | | | | 6-7-12 |
| 8 | | -8 | | |
| 9 | | | | |
| 10 | Stiff gray and tan fine to medium sandy silt (ML) | | | 3-4-6 |
| 11 | | | | |
| 12 | | -12 | | |
| 13 | Firm brown, maroon and gray fine to medium sandy silt (ML) | | | |
| 14 | | | | |
| 15 | BORING TERMINATED | -15 | | 2-3-5 |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | | | | |




**Water Level 24 hr.:** Boring Backfilled Upon Completion
**Water Level 1 hr.:** Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

**Boring Number:** B-4
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

# TEST BORING RECORD

TERRATECH
ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts | Standard Penetration Test blows/ft (20, 40, 60, 80) |
|---|---|---|---|---|---|
| 1 | Stiff brown fine to medium sandy clay (CL) (RESIDUUM) | | | | |
| 2 | | | | | |
| 3 | | -3 | | 2-4-9 | ● |
| 4 | Very stiff brown, gray and red fine to medium sandy clay (CL) | | | | |
| 5 | | | | 10-13-14 | ● |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | 8-11-15 | ● |
| 9 | | | | | |
| 10 | | | | 9-12-12 | ● |
| 11 | | | | | |
| 12 | | -12 | | | |
| 13 | Stiff gray and tan fine sandy silt (ML) | | | | |
| 14 | | | | | |
| 15 | | -15 | | 2-4-6 | ● |
| 16 | BORING TERMINATED | | | | |
| 17 | | | | | |
| 18 | | | | | |
| 19 | | | | | |
| 20 | | | | | |

**Water Level 24 hr.:** Boring Backfilled Upon Completion
**Water Level 1 hr.:** Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

**Boring Number:** B-5
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

# TEST BORING RECORD

TERRATECH
ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts | Standard Penetration Test blows/ft 20 40 60 80 |
|---|---|---|---|---|---|
| 1–3 | Stiff brown fine to medium sandy clay (CL) (RESIDUUM) | -3 | | 1-3-6 | |
| 3–5.5 | Hard gray and brown fine to coarse sandy clay (CL) | -5.5 | | 6-17-19 | |
| 5.5–8 | Very stiff gray and white fine to coarse sandy silt (ML) with quartz fragments | -8 | | 5-7-9 | |
| 8–12 | Stiff gray and tan fine sandy silt (ML) | -12 | | 4-6-9 | |
| 12–15 | Stiff red brown fine to medium sandy silt (ML) | -15 | | 2-3-6 | |
| 15–20 | BORING TERMINATED | | | | |

**Water Level 24 hr.:** Boring Backfilled Upon Completion

**Water Level 1 hr.:** Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

**Boring Number:** B-6

**Project Number:** 121-11-65800

**Date Drilled:** 10/3/11

**Sheet:** 1 of 1

# TEST BORING RECORD

TERRATECH ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts |
|---|---|---|---|---|
| 0–3 | Very loose brown clayey fine to medium sand (SC) (cultivated soil) | -3 | | 1-2-2 |
| 3–8 | Very stiff brown, orange and red fine to medium sandy clay (CL) (RESIDUUM) | -8 | | 4-9-9<br>5-9-9 |
| 8–15 | Stiff gray, brown and red fine to medium sandy silt (ML) | -15 | | 6-5-5<br>1-3-4 |
| 15 | BORING TERMINATED | | | |

Standard Penetration Test blows/ft: 20, 40, 60, 80

Water Level 24 hr.: Boring Backfilled Upon Completion
Water Level 1 hr.: Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

**Boring Number:** B-7
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

# TEST BORING RECORD

TERRATECH ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts | Standard Penetration Test blows/ft (20 40 60 80) |
|---|---|---|---|---|---|
| 1–3 | Stiff brown, orange and red fine to medium sandy clay (CH) with trace small roots (RESIDUUM) | -3 | | 3-5-6 | |
| 3–5.5 | Very stiff brown, gray and orange fine to medium sandy clay (CL) | -5.5 | | 3-7-10 | |
| 5.5–12 | Very stiff to stiff gray, red and tan fine to coarse sandy silt (ML) | -12 | | 6-7-10<br>3-5-7 | |
| 12–15 | Firm maroon, brown and gray fine to coarse sandy silt (ML) | -15 | | 3-4-4 | |
| 15 | BORING TERMINATED | | | | |

**Water Level 24 hr.:** Boring Backfilled Upon Completion
**Water Level 1 hr.:** Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

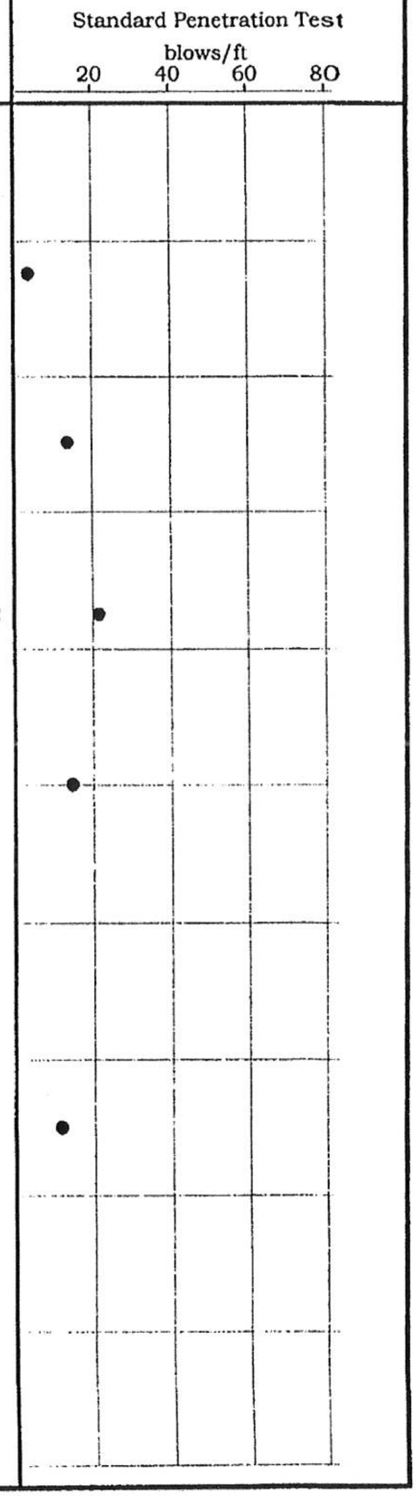
**Boring Number:** B-8
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

# TEST BORING RECORD

TERRATECH
ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts |
|---|---|---|---|---|
| 0–3 | Soft brown and orange fine to medium sandy clay (CL) with trace roots (RESIDUUM) | -3 | | 1-2-2 |
| 3–8 | Stiff to very stiff brown, gray and orange-red fine to medium sandy clay (CL) | -8 | | 2-7-7<br>7-10-12 |
| 8–15 | Stiff tan, gray and red fine to medium sandy silt (ML) | -15 | | 3-7-8<br>3-5-7 |
| 15 | BORING TERMINATED | | | |

Depth: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20




| | | |
|---|---|---|
| **Water Level 24 hr.:** Boring Backfilled Upon Completion<br>**Water Level 1 hr.:** Not Encountered | **TerraTech Engineers, Inc.**<br>**4905 Professional Court**<br>**Raleigh, NC 27609** | **Boring Number:** B-9<br>**Project Number:** 121-11-65800<br>**Date Drilled:** 10/3/11<br>**Sheet:** 1 of 1 |

# TEST BORING RECORD

TERRATECH
ENGINEERS • INC

| Depth | Description | Elev. | Water Level | Blow Counts | Standard Penetration Test blows/ft 20 40 60 80 |
|---|---|---|---|---|---|
| | Topsoil (Approximately 6 inches) | -0.5 | | | |
| 1, 2 | Very loose dark gray silty fine to coarse sand (SM) (ALLUVIUM) | | | 4-2-1 | |
| 3 | | -3 | | | |
| 4, 5, 6, 7, 8, 9, 10, 11 | Stiff to very stiff gray fine to medium sandy silt (ML) (RESIDUUM) | | | 2-4-5<br>4-4-5<br>2-6-12 | |
| 12 | | -12 | | | |
| 13, 14 | Very stiff red brown fine to medium sandy silt (ML) | | | | |
| 15 | | -15 | | 3-5-12 | |
| 16, 17, 18, 19, 20 | BORING TERMINATED | | | | |

**Water Level 24 hr.:** Boring Backfilled Upon Completion
**Water Level 1 hr.:** Not Encountered

**TerraTech Engineers, Inc.**
**4905 Professional Court**
**Raleigh, NC 27609**

**Boring Number:** B-10
**Project Number:** 121-11-65800
**Date Drilled:** 10/3/11
**Sheet:** 1 of 1

# APPENDIX F

S&
EC
Soil & Environmental Consultants, PA
11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
www.SandEC.com

October 20, 2011
Project #11744.S1

NC RBC 4
Attn: Alese King
9660 Falls of Neuse Road, Suite 138 #463
Raleigh, NC 27615

**Re: Preliminary Soil/Site Evaluation on the proposed Olive Branch Road Kingdom Hall Property, a 16+/-Acre Site located at 2801 Olive Branch Road – Durham County, NC.**

Dear Ms. King:

Soil & Environmental Consultants, PA (S&EC) performed a preliminary soil and site evaluation on the above referenced tract. This was performed at your request as part of the preliminary planning process in order to determine areas of soil that have potential for subsurface wastewater disposal. Fieldwork was performed in October of 2011.

S&EC traversed the property and observed landforms (slope, drainage patterns, past use, etc.) as well as soil conditions (depth, texture, structure, seasonal wetness, restrictive horizons, etc.) through the use of hand auger borings. The site was evaluated during dry soil conditions. From these observations, an evaluation of the site was developed, relative to subsurface disposal of wastewater. Soil boundaries were approximated in the field and were sketched onto the accompanying Soil Suitability Map. The soil/site evaluation criteria used is that contained in 15 A NCAC 18A .1900 "Laws and Rules for Sewage Treatment and Disposal Systems".

**FINDINGS**

The accompanying AutoCAD sketch map indicates the areas with potential use for subsurface wastewater disposal. The hatched unit on the attached map indicates an area of soil which is at least 24 inches deep to prohibitive soil characteristics and this area has potential for a low pressure pipe (LPP) septic system. The cross-hatched units on the attached map indicates areas of soil which are 18 to 24 inches deep to prohibitive soil characteristics and these areas have potential for a subsurface drip, pretreatment low pressure pipe, and/or low pressure pipe septic system.

The site plan for this property must ensure that adequate soil area for system and repair is unaffected by site elements (building placement, parking, wells, playgrounds, athletic fields, etc.) on that, or adjacent sites. The area ultimately designated by the health department on the site plan for the septic system and repair must remain undisturbed (no mechanical clearing, excavation, heavy traffic or other significant site disturbing activities) until authorized by the health department. A site with initially adequate useable soil area may be rendered unusable as a result of improper site planning and/or disturbance. A field layout of the proposed septic systems may be required as part of the site plan development process.

## GENERAL WASTEWATER CONSIDERATIONS

Once potentially useable areas are located through vertical borings, the next consideration is the horizontal extent of those areas. The size and configuration of the useable soil area dictate the utility of that area. The size of a subsurface disposal field is determined by: 1) the design flow from the source (5 gallons/seat for churches with a kitchen & 3gallons per seat without a kitchen), and 2) the long term acceptance rate (LTAR) of the soil (based on the hydraulic conductivity of the soil, a function of the soil's texture, mineralogy, structure, porosity, etc.). The configuration must be such that an efficient layout of disposal lines (on contour) is possible. An additional consideration is the required setbacks for the system from various elements such as wells (100'), streams and ponds (50') or more (depending on watershed regulations), property lines (10'), top of embankment (15'), watershed buffers, etc. (see Attachment 1).

The utility of a potential useable soil area for a subsurface system is most accurately determined by an on-ground layout of the proposed system. The total area needed for system and repair areas will depend upon the system type, the layout of that system and the total design flow (factors mentioned above). **A typical suitable soil area needed for a 235 seat church without a kitchen (705 gallons per day), is approximately 15,000 to 20,000 sq ft and would need to accommodate 2,800-3,000 linear feet of Low Pressure Pipe line (system and repair). These estimates reference Laws and Rules for Sewage Treatment and Disposal Systems for North Carolina and use a LTAR of 0.1 gpd/ft$^2$ for Low Pressure Pipe septic systems.** The local health department will determine the ultimate LTAR after their site evaluation. S&EC will be glad to assist in any system layout or sizing calculations if requested.

This report discusses the general location of potentially useable soils for on-site subsurface wastewater disposal and, of course, does not constitute or imply any approval or permit as needed by the client from the local heath department. S&EC is a professional consulting firm that specializes in the delineation of soil areas for wastewater disposal, and the layout and design of wastewater treatment systems. As a professional consulting firm, S&EC is hired for its professional opinion in these matters. The rules governing wastewater treatment (interpreted and governed by local and state agencies) are evolving constantly, and in many cases, affected by the opinions of individuals employed by these governing agencies. Because of this, S&EC cannot guarantee that areas delineated and/or systems designed will be permitted by the governing agencies. As always, S&EC recommends that anyone making financial commitments on a tract be fully aware of individual permit requirements on that tract prior to final action.

A septic system permit will be required prior to obtaining a building permit. This will involve a detailed evaluation by the local health department. Only after developing this information can a final determination be made concerning specifics of system design and site utilization.

Soil & Environmental Consultants, PA is pleased to be of service in this matter and we look forward to assisting in any site analysis needs you may have in the future. Please feel free to call with any questions or comments.

Sincerely,

10/20/11

LICENSED SOIL SCIENTIST

STATE OF NORTH CAROLINA

Ricky Pontello
NC Licensed Soil Scientist #1232

Encl: Attachment 1
Soil Suitability Map

## Attachment 1

.1950 Location of Sanitary Sewage Systems

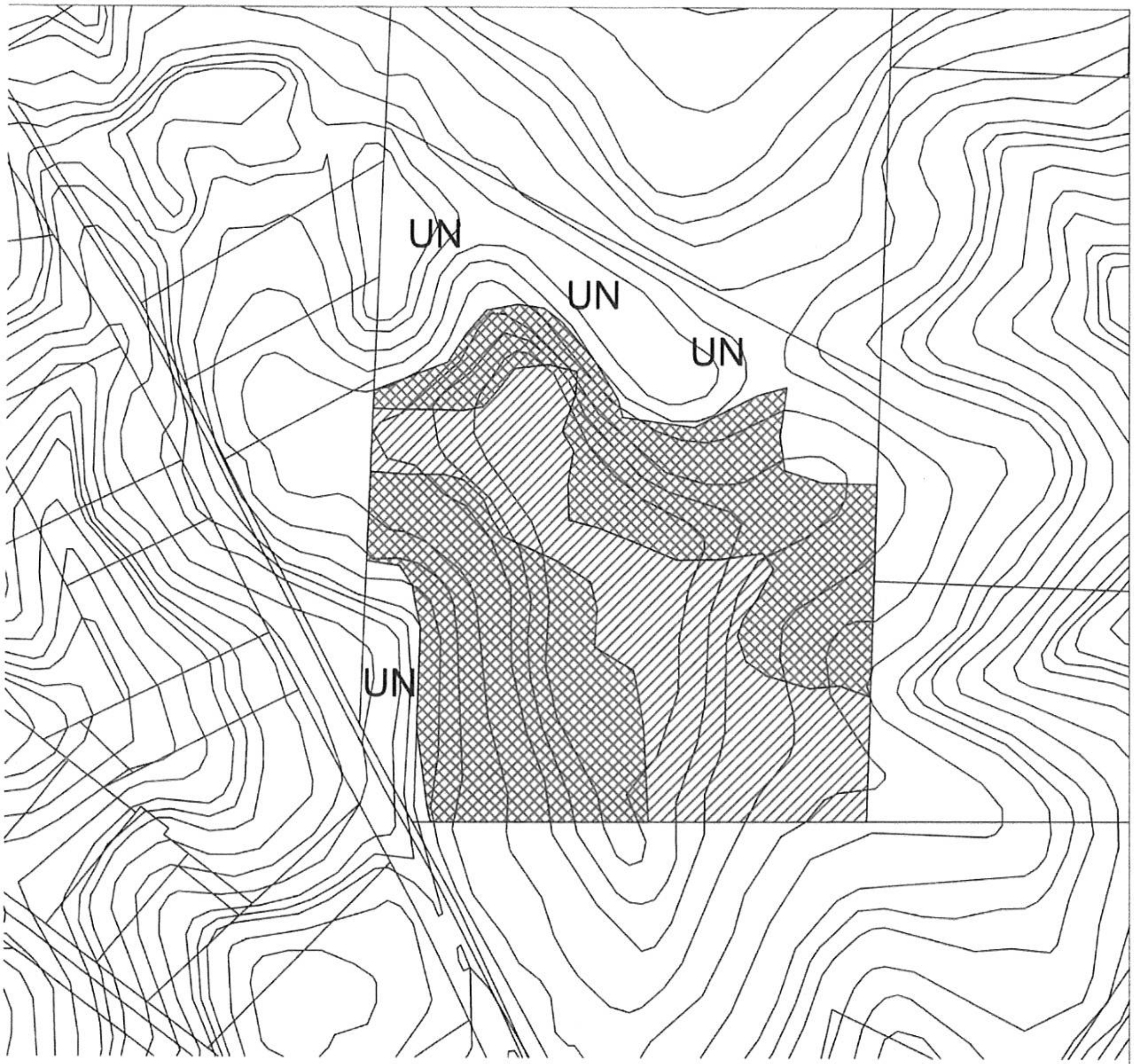
(c) Every sanitary sewage treatment and disposal system shall be located at least the minimum horizontal distance from the following:

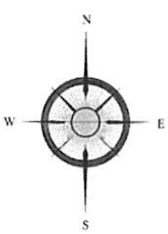
| | | |
|---|---|---|
| (1) | any private water supply source including a well or spring | 100 feet |
| (2) | any public water supply source | 100 feet |
| (3) | streams classified as WS-I | 100 feet |
| (4) | water classified as S.A. | 100 feet from mean high water mark |
| (5) | Other coastal waters | 50 feet from mean high water mark |
| (6) | any other stream, canal, marsh, or other surface waters | 50 feet |
| (7) | any Class I or Class II reservoir | 100 feet from normal pool elevation |
| (8) | any permanent storm water retention pond | 50 feet from flood pool elevation |
| (9) | any other lake or pond | 50 feet from normal pool elevation |
| (10) | any building foundation | 5 feet |
| (11) | any basement | 15 feet |
| (12) | any property line | 10 feet |
| (13) | top of slope of embankments or cuts of 2 feet or more vertical height | 15 feet |
| (14) | any water line | 10 feet |
| (15) | drainage systems: | |
| | (A) Interceptor drains, foundation drains and storm water diversions | |
| | (i) upslope | 10 feet |
| | (ii) sideslope | 15 feet |
| | (iii) downslope | 25 feet |
| | (B) Groundwater lowering ditched and devices | 25 feet |
| (16) | any swimming pool | 15 feet |
| (17) | any other nitrification field (except repair area) | 20 feet |

(b) Ground absorption, sewage treatment and disposal systems may be located closer than 100 feet from a private well supply, except springs and uncased wells located downslope and used as a source of drinking water, repairs, space limitations and other site-planning considerations but shall be located the maximum feasible distance and, in no case, less than 50 feet.

(c) Nitrification fields and repair areas shall not be located under paved areas or areas subject to vehicular traffic. If effluent is to be conveyed under areas subject to vehicular traffic, ductile iron or its equivalent pipe shall be used. However, pipe specified in Rule .1955 (e) may be used if a minimum of 30 inches of compacted cover is provided over the pipe.

Note: Systems over 3000 GPD or an individual nitrification fields with a capacity of 1500 GPD or more have more restrictive setback requirements, see .1950 (a) (17) (d) for specifics.




GRAPHIC SCALE
1" = 100'

100 0 100 200

## LEGEND

| | |
|---|---|
| (single hatch) | Areas contain soils with 24 inches or more of useable material and have the potential for low pressure pipe septic systems. Total area =181,990 sq.ft. |
| (cross hatch) | Areas contain soils with 18 to 24 inches or more of useable material and have the potential for subsurface drip, pretreatment low pressure pipe, and/or low pressure pipe septic systems. Total area =314,040 sq.ft. |
| UN | Unsuitable areas due to soil wetness condition, soil depth, clay mineralogy, and/or landscape position. |

**SUITABLE FOR PRELIMINARY PLANNING PURPOSES ONLY. SITE WILL REQUIRE APPROVAL BY THE COUNTY HEALTH DEPARTMENT. THIS MAP SHOULD BE USED AS A GENERAL GUIDE. SOME ADJUSTMENTS WILL BE NECESSARY IN THE FIELD DUE TO SOIL VARIABILITY AND TOPOGRAPHIC IRREGULARITIES. THIS MAP ONLY REFLECTS EXISTING SOIL SUITABILITY FOR ON-SITE SEPTIC TANK SYSTEMS. SOME OTHER CONSIDERATIONS THAT AFFECT SITE SUITABILITY THAT SHOULD BE CONSIDERED IN DEVELOPMENT DESIGN ARE:

1) 10' SETBACK FROM PROPERTY LINE
2) 100' SETBACK FROM ANY WELL
3) 25' SETBACK FROM DRAINAGE DITCHES.

SEE ACCOMPANYING S&EC REPORT.

PRELIMINARY SOIL/SITE EVALUATION.
SOIL LINES WERE DELINEATED IN THE FIELD BY S&EC PERSONNEL. THE SOIL LINES WERE SKETCHED ONTO THE MAP BASED ON TOPOGRAPHY AND OTHER SITE FEATURES.

NOT A SURVEY.
TOPOGRAPHIC AND CADASTRAL INFORMATION IS FROM THE DURHAM COUNTY GEOGRAPHIC INFORMATION SERVICE.

| | |
|---|---|
| Project: 2801 OLIVE BRANCH ROAD | Location: DURHAM CO., NC |
| Sheet Title: PRELIMINARY SUBSURFACE SOIL EVALUATION | Client: KINGDOM HALL |

S&EC **Soil & Environmental Consultants, PA**

# APPENDIX G

## Fred Rash

**From:** Atkinson, Adrian A [aaatkinson@ncdot.gov]
**Sent:** Wednesday, October 05, 2011 10:01 AM
**To:** Fred Rash
**Subject:** RE: 2801 Olive Branch Road - site

Fred,

A preliminary review of the provided information does not indicate a need to require a turn lane at this time. If this project progresses to the point of site development, it will be reviewed at that time based on the additional details for the site plan.

Adrian Atkinson
NCDOT
Durham District Office
919.220.4750

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**From:** Fred Rash [mailto:frash@thewootencompany.com]
**Sent:** Friday, September 30, 2011 4:26 PM
**To:** Atkinson, Adrian A
**Subject:** 2801 Olive Branch Road - site

Hi Adrian,

Per our discussion earlier today the due diligence is for the subject site located at 2801 Olive Branch Road. The site is located approximately ¼ mi north of Leesville Rd and 1/3 mi south of Carpenter Pond Rd. It only has a small amount of frontage along Olive Branch Road – which would limit driveway access options. I have also attached copy of the survey and a couple of screen views courtesy of Google Earth. The development would propose a place of worship with non peak hour traffic as discussed. Thank you for your assistance.

Best regards,

Fred Rash, PE, LEED AP
Project Engineer
The Wooten Company
120 North Boylan Avenue
Raleigh, NC 27603
919.828.0531
Fax 919.834.3589
www.thewootencompany.com

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