



Soil & Environmental Consultants, PA

11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
www.SandEC.com

North Chatham Investments, Inc.
Attn: Mr. Travis Blake
9668 Hwy 15-501
Chapel Hill, NC 27517

March 30, 2006
Project #: 10148.S1

Detailed Soil Series Report

Ref: Polk's Centre, 39 Acre Parcel Adjacent to 15-501 & Polk's Landing-
Chatham County, NC.

Executive Summary:

Soil & Environmental Consultants, PA (S&EC) has performed a limited soil/site evaluation on the above mentioned property in Chatham County, NC. This report discusses the soil evaluation, the dominant soil series on-site, and the general permeability classes based on the soil series.

This report is being prepared as a "draft report" for review and comment and it does not have all of the required information needed to complete a design of a reuse spray irrigation system. NC Licensed Soil Scientist Larry Sink and Soil Scientists In Training Mark Allen, Chris Murray and Derrick Smith completed the fieldwork during March 2006.

Introduction:

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. This site is in the piedmont region of central Chatham County. The corresponding upland soil series identified on the tract are all named and the criteria for each series as described by the Natural Resource Conservation Service (NRCS) is provided. These soils are divided into groups based on like soil characteristics of the site.

Soil/Site Conditions: Non impacted area

Based on the hand-auger borings, the upland soils on this tract are similar to the Wedowee and Helena soil series. The low lying or flood plain soil areas are similar to the Chewacla and Wehadkee soil series. S&EC did not include data for the flood plain soil series due to the assumption that re-use water will not be sprayed in these areas. Please keep in mind that the attached soil descriptions

are NOT the descriptions for your specific site but rather the general pedon description provided by NRCS for that soil series.

The attached AutoCAD map shows the location and extent of each soil series. The boundaries between soil series were flagged in the field and recorded with GPS receivers.

The Wedowee soil series consists of very deep, well-drained soils, which formed in residuum weathered from crystalline rocks on piedmont ridge tops and side slopes. Organic matter content and natural fertility is low and the shrink-swell potential is low. These soils are extremely acid to very strongly acid. Typically these soils have a sandy loam surface over a sandy clay loam to clay (Bt horizon) subsoil. The BC horizon is a sandy clay loam, while the C horizon consists of a sandy loam material. No evidence of a "perched" or seasonal high water table was noted within three feet from land surface in these areas. S&EC did not collect any soil samples for lab data on the cation exchange capacity (CEC) and pH values for these soils. However, based on information related to similar soils, (as provided by USDA/NRCS) the soils at the site could have a CEC range of 3 to 10 meq/100 grams and pH from 3.6 to 5.5 (unlimed values). S&EC has identified approximately 24 acres of this soil type.

The Helena soil series consists of very deep, moderately well-drained soil, which formed in residuum weathered from a mixture of felsic, intermediate, or mafic igneous or high-grade metamorphic rocks on broad piedmont ridges and side slopes. Organic matter content and natural fertility is low and the shrink-swell potential is moderate to high. These soils are extremely acid to very strongly acid. Typically these soils have a sandy loam surface over a clay (Bt horizon) subsoil. The BC horizon is a sandy clay loam, while the C horizon consists of a sandy loam material. S&EC noted a "perched" or seasonal high water table in these areas which ranged from 22 to 30 inches below land surface. S&EC did not collect any soil samples for lab data on the cation exchange capacity (CEC) and pH values for these soils. However, based on information related to similar soils, (as provided by USDA/NRCS) the soils at the site could have a CEC range of 7 to 13 meq/100 grams and pH from 3.5 to 6.5 (unlimed values). S&EC has identified approximately 9.4 acres of this soil type.

The next step in the reuse wastewater permitting process will be to determine the rate that the wastewater can be applied to the site. Determination of the average rate at which clean water will pass through each of the described units will have to be performed. This is accomplished by running multiple tests called Hydraulic Conductivity measurements for each horizon in each mapped unit. Once these rates of water movement are established, hydraulic conductivity data is given to the hydrologist. The hydrologist analyzes the detailed soils

information, conductivity results and his own test results with the aid of a computerized model to determine the application rate for each map unit. S&EC provides this explanation so that you will realize that we can currently only compare **projected permeabilities**. S&EC cannot establish an accurate loading rate at this point. Permeability classes are located on the last page of each NRCS Profile description.

As an example of this comparison, the Wedowee's most restrictive permeability class is 0.6 to 2.0 inches per hour, while the Helena's most restrictive layer has a permeability class of 0.06 to 0.2 inches per hour. These numbers cannot be used to assume application rates, but can be used to make general comparisons. Since treated wastewater is used for irrigation, the permeability class or drainage rate for the soil series are generally calculated at a percentage (6 to 10%) of the permeability of the most restrictive horizon in the soil. Likewise, based on the NRCS information, and utilizing the attached Table 1 for typical ranges of soil infiltration rates, an estimated value may be obtained based on the surface texture and site slope within the irrigated areas. The infiltration rate for Table 1 was obtained from the Sprinkler Irrigation Association, Sprinkler Irrigation (1969).

Conclusion:

The attached detailed GPS map gives an indication of the dominate soil types on this parcel. The accompanying NRCS data can be used as a general guide to project permeabilities within each soil unit. Typical infiltration rates can be obtained based on the NRCS data and site slope. However, as noted above, additional site work is needed. The next step would be to get actual numbers from field observations to accurately determine application rates. This process is normally required on all large wastewater systems.

This report discusses the general location of soils for on-site surface wastewater dispersal, and does not constitute or imply any approval or granting of a permit as needed by the client from the State of North Carolina. S&EC is a professional consulting firm that specializes in the delineation of soil areas for wastewater disposal. 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 the governing agencies.

If you have any questions or require additional information please give us a call.

Prepared by:



54

Larry T. Sink
Larry Sink

NC Licensed Soil Scientist

Chris Murray

Chris Murray
Soil Scientist in Training

Table 1

Typical ranges of soil infiltration rates by soil texture and slope.

| Texture | Basic Infiltration Rate (in/hr)* | | |
|-------------------------------------|----------------------------------|-----------|----------|
| | Slope | | |
| | 0-3% | 3-9% | 9+% |
| sands | 1.0+ | 0.7+ | 0.5+ |
| loamy sands | 0.7-1.5 | 0.5-1.0 | 0.4-0.7 |
| sandy loams and fine sandy loams | 0.5-1.0 | 0.4-0.7 | 0.3-0.5 |
| very fine sandy loam and silt loam | 0.3-0.7 | 0.2-0.5 | 0.15-0.3 |
| sandy clay loam and silty clay loam | 0.2-0.4 | 0.15-0.25 | 0.1-0.15 |
| clay and silty clay | 0.1-0.2 | 0.1-0.15 | < 0.1 |

Source: Sprinkler Irrigation Association, Sprinkler Irrigation (1969)

* For adequate vegetative cover, these rates may be 25-50% greater. For poor surface conditions, rates may be as much as 50% less.

Established Series

Rev. WBP:PGM

07/1999

WEDOWEE SERIES

The Wedowee series consists of very deep, well drained, moderately permeable soils that formed in residuum from weathered crystalline rock of the Piedmont Plateau. These soils are on narrow ridges and on side slopes of uplands. Slope is dominantly less than 25 percent but ranges from 0 to 60 percent. Near the type location, the average annual temperature is about 63 degrees F. and average annual precipitation is about 53 inches.

TAXONOMIC CLASS: Fine, kaolinitic, thermic Typic Kanhapludults

TYPICAL PEDON: Wedowee sandy loam, on a convex 12 percent slope, in forest. (Colors are for moist soil.)

A--0 to 4 inches; dark grayish brown (10YR 4/2) sandy loam; weak fine granular structure; very friable; strongly acid; clear smooth boundary. (1 to 5 inches thick)

E--4 to 10 inches; yellow (10YR 7/6) loam; weak fine granular structure; very friable; strongly acid; gradual smooth boundary. (0 to 6 inches thick)

BE--10 to 14 inches; brownish yellow (10YR 6/6) loam; weak fine subangular blocky structure; friable; strongly acid; clear smooth boundary. (0 to 6 inches thick)

Bt--14 to 24 inches; strong brown (7.5YR 5/6) sandy clay; moderate medium subangular blocky structure; friable; common distinct clay films on faces of peds; strongly acid; gradual smooth boundary. (8 to 24 inches thick)

BC--24 to 32 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium distinct very pale brown (10YR 7/4) and yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; friable; few faint clay films on faces of peds; strongly acid; gradual smooth boundary. (6 to 12 inches thick)

C--32 to 60 inches; mottled strong brown (7.5YR 5/6), very pale brown (10YR 7/4), and yellowish red (5YR 5/8) saprolite of sandy clay loam texture; rock structure; friable; strongly acid.

TYPE LOCATION: Randolph County, Alabama. One mile north of Rock Mills on north side of State Highway 22.

RANGE IN CHARACTERISTICS: Depth to hard rock is more than 60 inches. Reaction ranges from extremely acid to strongly acid throughout except where lime has been added. Flakes of mica range from none to few in the A horizon and the upper part of the

the B horizon and from none to common in the lower part of the B horizon and the C horizon.

The A horizon has hue of 7.5YR to 2.5Y, value of 3 to 6 and chroma of 2 to 8. It is coarse loamy sand, coarse sandy loam, sandy loam, fine sandy loam, loam; or their gravelly analogues. In eroded areas, the A horizon is sandy clay loam or clay loam, or their gravelly analogues. Content of coarse fragments, dominantly gravel size, range from 0 to 35 percent by volume.

The E horizon, present in most pedons, has hue of 7.5YR to 2.5Y, value of 4 to 7, and chroma of 3 to 8. Texture and coarse fragment content are the same as the A horizon.

The BE horizon, present in most pedons, has hue of 5YR to 10YR, value of 4 to 7 and chroma of 3 to 8. It is loam, fine sandy loam, sandy loam, sandy clay loam or clay loam.

The Bt horizon typically has hue of 7.5YR or 10YR, value of 4 to 6 and chroma of 6 to 8, but includes hue of 5YR with the same range in value and chroma. Mottles in shades of brown, yellow, and red are in the lower part of the Bt horizon in most pedons and in the upper part of the Bt horizon in some pedons. Texture of the Bt horizon is sandy clay loam, clay loam, sandy clay or clay. Clay content of the particle-size control section averages 35 to 45 percent.

The BC horizon has hue of 2.5YR to 10YR, value of 5 to 7 and chroma of 4 to 8. Mottles in shades of red, brown, and yellow range from none to common. It is sandy clay loam, clay loam, loam or fine sandy loam.

The C horizon is multicolored, highly weathered gneiss, granite, or schist saprolite with a crushed texture of sandy clay loam, clay loam, loam, fine sandy loam, sandy loam, or sandy clay.

COMPETING SERIES: These include the Appling, Bethlehem, Cecil, Madison, Nankin, Pacolet, and Tumbleton series in the same family. Appling and Cecil soils have thicker Bt horizons. Additionally, Cecil soils have dominant hue of 5YR or redder throughout the Bt horizon. Bethlehem soils have a paralithic contact within 20 to 40 inches of the surface. Madison soils have hue of 5YR or redder dominant in the Bt horizon and have many flakes of mica in the lower part of the solum. Nankin and Tumbleton soils developed in unconsolidated clayey and loamy sediments and have a solum thickness of more than 40 inches. Pacolet soils have Bt horizons with hue of 2.5YR or redder.

GEOGRAPHIC SETTING: Wedowee soils are on sloping to steep uplands of the Southern Piedmont MLRA. Slopes are mainly 5 to 25 percent, but range from 0 to 60 percent. The soils have formed in residuum from weathered acid crystalline rocks. The climate is warm and humid. Average annual precipitation ranges from 42 to 56 inches and average annual temperature ranges from 58 to 65 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: In addition to the competing Appling, Cecil, Madison, and Pacolet series, these are the Durham, Louisburg, and Worsham

series. Durham soils are fine-loamy. Louisburg soils do not have a continuous Bt horizon and are coarse-loamy. Worsham soils are poorly drained.

DRAINAGE AND PERMEABILITY: Well drained. Runoff is medium to rapid and internal drainage is medium. Permeability is moderate.

USE AND VEGETATION: Most areas are wooded. Common trees include loblolly pine, Virginia pine, red oak, white oak, post oak, hickory, blackgum, maple, and dogwood. Principal crops grown are cotton, corn, tobacco, small grain, hay, peaches, pecans, and pasture.

DISTRIBUTION AND EXTENT: The Piedmont of Alabama, Georgia, North Carolina, South Carolina and Virginia. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Raleigh, North Carolina

SERIES ESTABLISHED: Randolph County, Alabama; 1969.

REMARKS: Wedowee soils were formerly mapped as thin solum phases of the Appling series. The 5/90 revision changed the classification to Typic Kanhapludults in recognition of the low activity clay content of the argillic horizon.

Revised: RLV 11/24/97

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to a depth of 14 inches (A, E, and BE horizons)

Argillic and kandic horizon - the zone from approximately 14 to 24 inches (Bt horizon)

TABULAR SERIES DATA:

| SOI-5 | Soil Name | Slope | Airtemp | FrFr/Seas | Precip | Elevation |
|--------|-----------|-------|---------|-----------|--------|-----------|
| AL0046 | WEDOWEE | 0- 60 | 58- 65 | 175-225 | 42- 56 | 300-1200 |
| AL0138 | WEDOWEE | 0- 60 | 58- 65 | 175-225 | 42- 56 | 300-1200 |
| AL0146 | WEDOWEE | 0- 60 | 58- 65 | 175-225 | 42- 56 | 300-1200 |

| SOI-5 | FloodL | FloodH | Watertable | Kind | Months | Bedrock | Hardness |
|--------|--------|--------|------------|------|--------|---------|----------|
| AL0046 | NONE | | 6.0-6.0 | | - | 60-60 | |
| AL0138 | NONE | | 6.0-6.0 | | - | 60-60 | |
| AL0146 | NONE | | 6.0-6.0 | | - | 60-60 | |

| SOI-5 | Depth | Texture | 3-Inch | No-10 | Clay% | -CEC- |
|--------|-------|-------------------|--------|--------|-------|-------|
| AL0046 | 0-10 | SL FSL L | 0- 0 | 80-100 | 5-20 | 2- 8 |
| AL0046 | 0-10 | SCL CL | 0- 0 | 90-100 | 20-30 | 2- 8 |
| AL0046 | 10-14 | L SCL | 0- 0 | 90-100 | 14-30 | 3- 10 |
| AL0046 | 14-32 | SC CL C | 0- 0 | 95-100 | 35-45 | 3- 10 |
| AL0046 | 32-60 | SCL CL SL | 0- 0 | 70-100 | 15-30 | 3- 8 |
| AL0138 | 0-10 | BY-SL BY-L | 10- 20 | 70- 90 | 5-20 | 2- 8 |
| AL0138 | 10-14 | L SCL | 0- 5 | 90-100 | 14-30 | 3- 10 |
| AL0138 | 14-32 | SC CL C | 0- 0 | 95-100 | 35-45 | 3- 10 |
| AL0138 | 32-60 | SCL CL SL | 0- 0 | 70-100 | 15-30 | 3- 8 |
| AL0146 | 0-10 | GR-SL GR-FSL GR-L | 0- 5 | 50- 80 | 6-20 | 2- 8 |
| AL0146 | 0-10 | GR-SCL GR-CL | 0- 5 | 50- 80 | 20-30 | 2- 8 |
| AL0146 | 10-14 | L SCL | 0- 0 | 90-100 | 14-30 | 3- 10 |

| | | | | | | | | |
|--------|-------|-----------|----|---|--------|-------|----|----|
| AL0146 | 14-32 | SC CL C | 0- | 0 | 95-100 | 35-45 | 3- | 10 |
| AL0146 | 32-60 | SCL CL SL | 0- | 0 | 70-100 | 15-30 | 3- | 8 |

| SOI-5 | Depth | -pH- | O.M. | Salin | Permeab | Shnk-Swll |
|--------|-------|----------|-------|-------|----------|-----------|
| AL0046 | 0-10 | 3.6- 5.5 | .5-3. | 0- 0 | 2.0- 6.0 | LOW |
| AL0046 | 0-10 | 3.6- 5.5 | .5-3. | 0- 0 | 0.6- 2.0 | LOW |
| AL0046 | 10-14 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0046 | 14-32 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0046 | 32-60 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0138 | 0-10 | 3.6- 5.5 | 0.-1. | 0- 0 | 2.0- 6.0 | LOW |
| AL0138 | 10-14 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0138 | 14-32 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0138 | 32-60 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0146 | 0-10 | 3.6- 5.5 | .5-3. | 0- 0 | 2.0- 6.0 | LOW |
| AL0146 | 0-10 | 3.6- 5.5 | .5-3. | 0- 0 | 0.6- 2.0 | LOW |
| AL0146 | 10-14 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0146 | 14-32 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |
| AL0146 | 32-60 | 3.6- 5.5 | 0.-.5 | 0- 0 | 0.6- 2.0 | LOW |

HELENA SERIES

The Helena series consists of very deep, moderately well drained, slowly permeable soils that formed in residuum weathered from a mixture of felsic, intermediate, or mafic igneous or high-grade metamorphic rocks such as aplitic granite or granite gneiss that is cut by dykes of gabbro and diorite, or mixed with hornblende schist or hornblende gneiss. These soils are on broad ridges and toeslopes of the Piedmont uplands. Slope is dominantly between 2 to 10 percent but ranges from 0 to 15 percent. Mean annual precipitation is 46 inches, and mean annual temperature is 61 degrees F, near the type location.

TAXONOMIC CLASS: Fine, mixed, semiactive, thermic Aquic Hapludults

TYPICAL PEDON: Helena sandy loam - in a cultivated field on a 4 percent slope. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 8 inches; grayish brown (10YR 5/2) sandy loam; weak, medium, and coarse granular structure; very friable; many fine roots; moderately acid; abrupt smooth boundary. (4 to 10 inches thick)

E--8 to 12 inches; light yellowish brown (10YR 6/4) sandy loam; weak medium granular structure; very friable; few fine roots; few fine black concretions; strongly acid; clear wavy boundary. (0 to 10 inches thick)

BE--12 to 19 inches; brownish yellow (10YR 6/6) sandy clay loam; moderate medium prismatic structure that parts to moderate medium angular blocky; friable; sticky, plastic; few fine roots; few fine pores; few faint clay films on faces of peds; few medium quartz gravel; common fine faint pale brown (10YR 6/3) iron depletions; very strongly acid; clear wavy boundary. (0 to 7 inches thick)

Bt1--19 to 24 inches; yellowish brown (10YR 5/8) clay; weak coarse angular blocky structure; firm; sticky, plastic; few fine roots; few fine pores; few faint clay films on faces of peds; few fine prominent light brownish gray (10YR 6/2) iron depletions; very strongly acid; clear wavy boundary.

Bt2--24 to 39 inches; yellowish brown (10YR 5/8) clay; weak coarse subangular blocky and angular blocky structure; very firm, sticky, very plastic; few fine roots; few fine pores; common distinct clay films on faces of peds; many medium prominent gray (10YR 6/1) iron depletions; very strongly acid; clear wavy boundary.

Bt3--39 to 43 inches; light yellowish brown (10YR 6/4) clay loam; weak medium subangular blocky structure; extremely firm, sticky, very plastic; common distinct clay films on faces of peds; few brown concretions; common medium distinct light gray

(10YR 7/1) iron depletions; very strongly acid; clear wavy boundary. (Combined thickness of the Bt horizon is 17 to 42 inches.)

BCg--43 to 46 inches; light gray (10YR 7/1) clay loam; weak coarse subangular blocky structure; friable, sticky, plastic; many coarse prominent strong brown (7.5YR 5/6) soft masses of iron accumulation; very strongly acid; clear wavy boundary. (0 to 14 inches thick)

C--46 to 60 inches; strong brown (7.5YR 5/8) sandy loam saprolite; many coarse prominent light gray (10YR 7/1) streaks; massive; friable; few coarse veins of gray clay; common fragments of granitic rock; very strongly acid.

TYPE LOCATION: Durham County, North Carolina; 0.4 mile west of Mangum Store on SR 1603; 400 feet north on a farm road and 400 feet east in a cultivated field.

RANGE IN CHARACTERISTICS: Solum thickness ranges from 40 to more than 60 inches. Depth to bedrock is greater than 5 feet. The soil is extremely acid to strongly acid except where the surface has been limed. Limed soils are typically moderately acid or slightly acid in the upper part. Gravel fragments range from 0 to 35 percent, by volume, throughout the profile. Some pedons may have few to common dark concretions in the upper part of the profile.

The A or Ap horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 to 4. It is loamy sand, loamy coarse sand, coarse sandy loam, fine sandy loam, sandy loam, or loam in the fine-earth fraction. In eroded phases the Ap horizon is clay loam or sandy clay loam in the fine-earth fraction.

The E horizon, where present, has hue of 10YR to 5Y, value of 5 to 8, and chroma of 2 to 4. Texture is loamy sand, loamy coarse sand, coarse sandy loam, fine sandy loam, sandy loam, or loam in the fine-earth fraction.

The BE or BA horizon, where present, has hue of 7.5YR to 5Y, value of 5 to 8, and chroma of 3 to 8. It is sandy clay loam or clay loam in the fine-earth fraction.

The Bt horizon has hue of 7.5YR to 5Y, value of 5 to 8, and chroma of 3 to 8. In some pedons, the lower Bt horizon has 5YR hues or is multicolored in shades of yellow, brown, gray, or red. Iron depletions with chroma of 2 or less occur within 24 inches of the upper boundary of the Bt horizon. Soft masses of iron accumulation in shades of yellow, brown, or red may also be present. Texture is dominantly clay loam, sandy clay, or clay in the fine-earth fraction, but some pedons have thin subhorizons of sandy clay loam.

The Btg horizon, where present, has hue of 10YR or 2.5Y, value of 4 to 7, and chroma of 1 or 2. Soft masses of iron accumulation in shades of yellow, brown, or red commonly are present. Texture is clay loam, sandy clay, or clay in the fine-earth fraction. Some pedons have thin subhorizons of sandy clay loam.

The BC and BCg horizons, where present, have colors similar to the Bt horizon or the Btg horizon, respectively. Texture is clay loam, sandy clay loam, loam, fine sandy loam, or sandy loam in the fine-earth fraction.

The C horizon has hue of 5YR to 5Y, value of 5 to 8, and chroma of 3 to 8, or is multicolored in shades of gray, yellow, brown, red or white. The Cg horizon, where present, has hue of 10YR to 5Y, value of 5 to 7, and chroma of 1 or 2 and is typically multicolored in shades of yellow or brown. The C and Cg horizons are saprolite that has a texture of sandy loam, fine sandy loam, sandy clay loam, or loam in the fine-earth fraction. Bodies or seams of clay loam or clay are in some pedons.

COMPETING SERIES: These are the Annemaine, Beason, Cid, Craven, Creedmoor, Dogue, Eulonia, Gritney, Lignum, Maubila, Nemours, Nevarc, Peawick, Sacul, and Telfair series. Annemaine, Benson, Craven, Dogue, Eulonia, Gritney, Maubila, Nemours, Nevarc, Peawick, Sacul, and Wolftever soils lack a C horizon of saprolite. In addition, Annemaine, Eulonia, Nemours, Newco, and Sacul soils have redder hue, and Beason, Craven and Dogue soils contain more silt. Also, Peawick soils commonly have aluminum saturation greater than 50 percent. Cid soils have a lithic contact between depths of 20 and 40 inches. Creedmoor soils have a higher coefficient of linear extensibility, more exchangeable aluminum than Helena, and the C horizon is weathered Triassic saprolite. Lignum and Prosperity soils have paralithic contact within 40 to 60 inches.

GEOGRAPHIC SETTING: The Helena soils are on broad ridges, toe slopes and heads of drains in the Piedmont uplands. Slopes are mostly between 2 and 10 percent and range from 0 to 15 percent. The soil formed in residuum weathered from a mixture of felsic, intermediate, or mafic igneous or high-grade metamorphic rocks such as aplitic granite or granite gneiss that is cut by dykes of gabbro and diorite, or mixed with hornblende schist or hornblende gneiss. Mean annual precipitation ranges from 37 to 69 inches, and mean annual temperature ranges from 58 to 65 degrees F.

GEOGRAPHICALLY ASSOCIATED SOILS: These are Appling, Cecil, Cullen, Durham, Enon, Hard Labor, Iredell, Louisburg, Mecklenburg, Pacolet, Prosperity, Rion, Santuc, Sedgefield, Vance, Wedowee, Wilkes, and Worsham series. Appling, Cecil, Hard Labor, Pacolet, and Wedowee soils have kaolinitic mineralogy. Cullen and Vance soils are well drained. Durham and Rion soils have less than 35 percent clay in the Bt horizon. Enon, Iredell, Mecklenburg, Sedgefield, and Wilkes soils have base saturation of more than 35 percent. In addition, Wilkes soils are loamy and shallow. All of these except for Iredell, Sedgefield, and Worsham soils are on landscape positions that have better surface drainage. Iredell, Prosperity, Santuc, and Sedgefield soils are in similar landscape positions to Helena. Worsham soils are in heads of drains and upland drainageways. Santuc soils have a fine-loamy particle size class

DRAINAGE AND PERMEABILITY: Moderately well drained; medium to rapid runoff; slow permeability. There is a perched water table in late winter and early spring.

USE AND VEGETATION: About two-thirds of this soil is used for crops and pasture. Common crops are tobacco, corn, soybeans, small grain, and vegetables. Less common

are cotton and hay. The remaining acreage is in forests of mixed hardwood and pine. Native species include loblolly pine, shortleaf pine, Virginia pine, sweetgum, willow oak, red oak, white oak, yellow-poplar, and American elm. Understory species include sourwood, flowering dogwood, winged elm, eastern cedar, hophornbean, eastern redbud, and sassafras.

DISTRIBUTION AND EXTENT: Piedmont of Alabama, Georgia, North Carolina, South Carolina, and Virginia. The series is of large extent; the area is more than 300,000 acres.

MLRA OFFICE RESPONSIBLE: Raleigh, North Carolina

SERIES ESTABLISHED: Person County, North Carolina, 1928.

REMARKS: The August 1991 revision changed depth to bedrock from "more than 48 inches to more than 60 inches" to be consistent with one depth to bedrock class as shown on the Soil Interpretation Records for Helena.

Diagnostic horizons and features recognized in this pedon are:

Ochric epipedon - the zone from the surface of the soil to 12 inches (Ap and E horizons)

Argillic horizon - the zone between depths of 12 and 46 inches below the surface (BE, Bt1, Bt2, Bt3 and BCg horizons)

Aquic conditions - periodic episaturation and redox depletions within 24 inches of the upper boundary of the argillic horizon (beginning in the Bt1 horizon)

Revised: RLV 8/14/98

MLRA = 136

ADDITIONAL DATA:

TABULAR SERIES DATA:

SOI-5 Soil Name Slope Airtemp FrFr/Seas Precip Elevation

NC0058 HELENA 0- 15 58- 65 85-240 37- 69 350- 900

NC0176 HELENA 0- 15 58- 65 185-240 37- 69 350- 900

NC0266 HELENA 0- 15 58- 65 185-240 37- 69 350- 900

| SOI-5 | FloodL | FloodH | Watertable | Kind | Months | Bedrock | Hardness |
|--------|--------|--------|------------|---------|---------|---------|----------|
| NC0058 | NONE | | 1.5-2.5 | PERCHED | JAN-APR | 60-60 | |
| NC0176 | NONE | | 1.5-2.5 | PERCHED | JAN-APR | 60-60 | |
| NC0266 | NONE | | 1.5-2.5 | PERCHED | JAN-APR | 60-60 | |

| SOI-5 | Depth | Texture | 3-Inch | No-10 | Clay% | -CEC- |
|--------|-------|---------------------|--------|--------|-------|-------|
| NC0058 | 0-12 | SL FSL L | 0- 5 | 90-100 | 5-20 | 1- 6 |
| NC0058 | 0-12 | SCL CL | 0- 5 | 95-100 | 20-35 | 4- 8 |
| NC0058 | 12-19 | SCL CL | 0- 5 | 95-100 | 20-35 | 4- 7 |
| NC0058 | 19-43 | CL SC C | 0- 5 | 95-100 | 35-60 | 7- 13 |
| NC0058 | 43-60 | VAR | - | - | - | - |
| NC0176 | 0-12 | GR-FSL GR-L GR-COSL | 0- 5 | 50- 75 | 5-20 | 1- 6 |
| NC0176 | 0-12 | GR-LCOS GR-LS GR-S | 0- 5 | 50- 75 | 3-12 | 1- 4 |
| NC0176 | 0-12 | GR-CL GR-SCL | 0- 5 | 50- 75 | 20-35 | 4- 8 |
| NC0176 | 12-19 | SCL CL SL | 0- 5 | 95-100 | 20-35 | 4- 7 |
| NC0176 | 19-43 | CL SC C | 0- 5 | 95-100 | 35-60 | 7- 13 |

| | | | | | | |
|--------|-------|---------|----|---|--------|-------------|
| NC0176 | 43-60 | VAR | - | - | - | - |
| NC0266 | 0-12 | LS LCOS | 0- | 5 | 90-100 | 3-12 1- 4 |
| NC0266 | 12-19 | SCL CL | 0- | 5 | 95-100 | 20-35 4- 7 |
| NC0266 | 19-43 | CL SC C | 0- | 5 | 95-100 | 35-60 7- 13 |
| NC0266 | 43-60 | VAR | - | - | - | - |

| SOI-5 | Depth | -pH- | O.M. | Salin | Permeab | Shnk-Swll |
|--------|-------|----------|-------|-------|-----------|-----------|
| NC0058 | 0-12 | 3.5- 6.5 | .5-2. | 0- 0 | 2.0- 6.0 | LOW |
| NC0058 | 0-12 | 3.5- 6.5 | .5-1. | 0- 0 | 0.2- 0.6 | LOW |
| NC0058 | 12-19 | 3.5- 5.5 | 0.-.5 | 0- 0 | 0.2- 0.6 | MODERATE |
| NC0058 | 19-43 | 3.5- 5.5 | 0.-.5 | 0- 0 | 0.06- 0.2 | HIGH |
| NC0058 | 43-60 | - | - | - | - | - |
| NC0176 | 0-12 | 4.5- 6.5 | .5-2. | 0- 0 | 2.0- 6.0 | LOW |
| NC0176 | 0-12 | 4.5- 6.5 | .5-2. | 0- 0 | 6.0- 20 | LOW |
| NC0176 | 0-12 | 4.5- 6.5 | .5-1. | 0- 0 | 0.2- 0.6 | LOW |
| NC0176 | 12-19 | 4.5- 5.5 | 0.-.5 | 0- 0 | 0.64 0.6 | MODERATE |
| NC0176 | 19-43 | 4.5- 5.5 | 0.-.5 | 0- 0 | 0.06- 0.2 | HIGH |
| NC0176 | 43-60 | - | - | - | - | - |
| NC0266 | 0-12 | 3.5- 6.5 | .5-2. | 0- 0 | 6.0- 20 | LOW |
| NC0266 | 12-19 | 3.5- 5.5 | 0.-.5 | 0- 0 | 0.2- 0.6 | MODERATE |
| NC0266 | 19-43 | 3.5- 5.5 | 0.-.5 | 0- 0 | 0.06- 0.2 | HIGH |
| NC0266 | 43-60 | - | - | - | - | - |