Capital: Raleigh
Largest City: Charlotte

Total Area: 139,509 Km²
Ranked 28th in the US
Width: 340 Km
Length: 900 Km
Population: 8,049,313
Ranked 10th in the US

From http://en.wikipedia.org/wiki/North_Carolina
What is the REP?

- A Groundwater Resource Evaluation Program for the Piedmont and Blue Ridge Mountains Provinces of North Carolina, covering 30,500 sq. miles and 65 Counties

- Funded by NC Legislature in SFY 2000-2001 to ensure the long term availability, sustainability and the quality of groundwater in the state

- A long-term study to improve scientific understanding of North Carolina’s crystalline bedrock aquifer hydrogeology

- Joint program between NCDWQ and USGS
What the REP Does?

- Characterizes regional aquifer properties:
  - Physical hydrogeological characteristics
  - Groundwater quality – hydrochemistry
- Identifies areas vulnerable to contamination
- Understands groundwater-surface water interactions
- Develops groundwater assessment/remediation strategies and supports new policies/regulations
- Performs special studies
Why Do We Need the REP?

- Estimated over 5 million people in the Piedmont and Mountains Region rely on groundwater for potable use.
- The hydrogeology of the regolith-fractured bedrock system is very complex and has not been studied intensively.
- There is a general lack of detailed studies on groundwater quality (most previous detailed groundwater studies in the Piedmont and Mountains focused on groundwater quantity, not groundwater quality).
- Previous regional hydrogeologic investigations were focused on the Coastal Plain.
Until 1990 almost all studies were conducted on the Coastal Plain.
REP Study Objectives

- Develop a comprehensive groundwater database for the N.C. Piedmont & Mountains Region
  - Existing and project-generated groundwater quantity and quality data
- Establish baseline of groundwater quality characteristics
- Establish a statewide ambient groundwater monitoring program
- Define the hydrogeologic framework for each physiographic province
  - Delineate “hydrogeologic terranes”
  - Develop comprehensive conceptual models
  - Determine relationships between geology and groundwater
    - Chemistry
    - Occurrence
REP Study Objectives cont’d

- Refine present knowledge of recharge and discharge processes
  - Estimate regional water budgets
  - Assess the relationships between groundwater recharge and discharge and their effects on surface water quality
- Amend the state groundwater standards (15A NCAC 2L) in accordance with study results
- Improve NCDENR’s (DWQ and DWM) ability to manage pollution incidents, well and permitting programs
REP Study Objectives cont’d

- Provide educational outreach and training opportunities
- Help improve the general public’s knowledge of the groundwater resource
  - Technical publications
  - On-site training and demonstrations
  - Educational presentations and displays
REP Study Methodology

- Analyze existing databases
  - Identify trends and data deficiencies
- Develop Standard Operation Procedures (SOP) and Work Plans
  - Ensure data consistency and reliability
- Locate stations with long-term access
  - Government- or University-owned properties
- Consider site access and logistics to locate wells
REP Study Methodology Continued

- Identify potential hydrogeologic research station locations
- Identify hydrogeologic terranes and drainage basins, considering “transferability” of information
- Evaluate weak/strong - low angle/vertical foliation affects on the development of the transition zone and fracture system
- Consider depth of weathering/topographic setting
REP Study Methodology cont’d

- Get access agreements signed
- Devise drill plan and schedule
- Conduct Geologic mapping and surface geophysics
- Install research station borings and wells
  - Continuous wireline coring
    - One core from each well cluster
  - Wells were installed with air rotary and mud rotary techniques
  - Well Clusters along an assumed linear flow path from topographical high to low settings, wells at each cluster in different zones
    - Saprolite
    - Transition Zone
    - Bedrock (open hole)
REP Coring and Drilling Activities
A typical cross-section of a well transect:
3-4 wells (regolith, transition zone, bedrock) in each cluster; 300-600 ft apart between clusters; 20 ft apart between two wells; linear transect parallel to an assumed flow-path.
REP Study Methodology cont’d

- On site testing and data collection
  - Core and well construction logging
  - Rock and groundwater sampling (for field and lab analyses)
  - Surface geophysical survey and borehole geophysical logging
  - Aquifer testing (slug and pumping)
  - Tracer studies
  - Age dating
  - Traditional water level and quality monitoring
  - Real-time satellite telemetry for water levels and quality parameters

- Data analysis
  - Flow path studies
  - Statistical analyses
  - Refining conceptual models
Sampling, Geophysics and Telemetry

Borehole geophysics

Surface geophysics

Groundwater sampling

Satellite telemetry
REP Study Methodology cont’d

- Publish findings
  - Peer-reviewed journals
  - Professional conferences
  - USGS and NC State publications and open-file reports
  - Web-based documents

- Refine NCDENR guidance documents
  - Contaminant site assessments
  - Well construction
  - Permits
REP Team/Resources

- NCDWQ Aquifer Protection Section hydrogeologists
- USGS hydrogeologists and groundwater specialists
- Aquifer Protection Section drilling crews
  - CME-75; Schramm; Geoprobe
  - Pumps and other equipments
- Local university faculty
- Other investigators interested in “piggy-backing” their experiments
Approximate Locations of Current REP Stations
in Different Geologic Belts of Piedmont and Blue Ridge Provinces of North Carolina

Langtree Peninsula Research Station

Davidson College
Lake Campus

20-acre site/2000x750 ft flow scales, 7 CH, 6 cluster/29 wells
NCSU – Lake Wheeler Road Station

3 cluster + 3 add. wells, 1000 ft transect from topo high to low settings, 1 S.W. gage
2-2000 ft flow-path well transects, 7 well clusters, 20 MWs, 15 Pzs, 2 SW gages
About 20 acre site, 1200 ft long flow path transect, 3 clusters, 10 MWs, 5 Pzs
Location Map of Tater Hill Hydrogeological Research Station
Watauga County, NC
Example of a well cluster

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http://h2o.enr.state.nc.us/aps/gpu/documents