The Orange County Observation Well Network

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I. Introduction

- Groundwater sole water source for approximately 40 percent of Orange County citizens.
- Surface water supplies are finite and service areas are unlikely to increase.
- Droughts!!! Don’t take supplies for granted.

II. Background Information

- Water Resources Project (2001)
- Water Resources Initiative (Adopted by BOCC in 2005) identified "Critical Areas to Address", including:
  - Impact of drought on groundwater and surface water availability.
  - Impact of groundwater base flow on water supplies and aquatic life.
  - Further research on elevated radon findings.

III. Goals of the Observation Well Network

- Consistent with items identified by the Water Resources Project (2001) and the Water Resources Initiative adopted by the BOCC in 2005, goals are:

1. **Groundwater Quantity-**“early warning system”
2. Delineation of **groundwater base flow.**
3. Research g**roundwater quality,** including:
   - **Radon and arsenic** in groundwater.

IV. Current Situation

- Only two observation wells exist in the County:
  - NC-126 USGS regolith (shallow) well on UNC-CH campus- Needs to be replaced.
  - NCDENR-DWR Caldwell bedrock (deeper) well off Guess Road.
- Guilford County has an observation well network and Wake County is developing one.

V. Orange County Geology

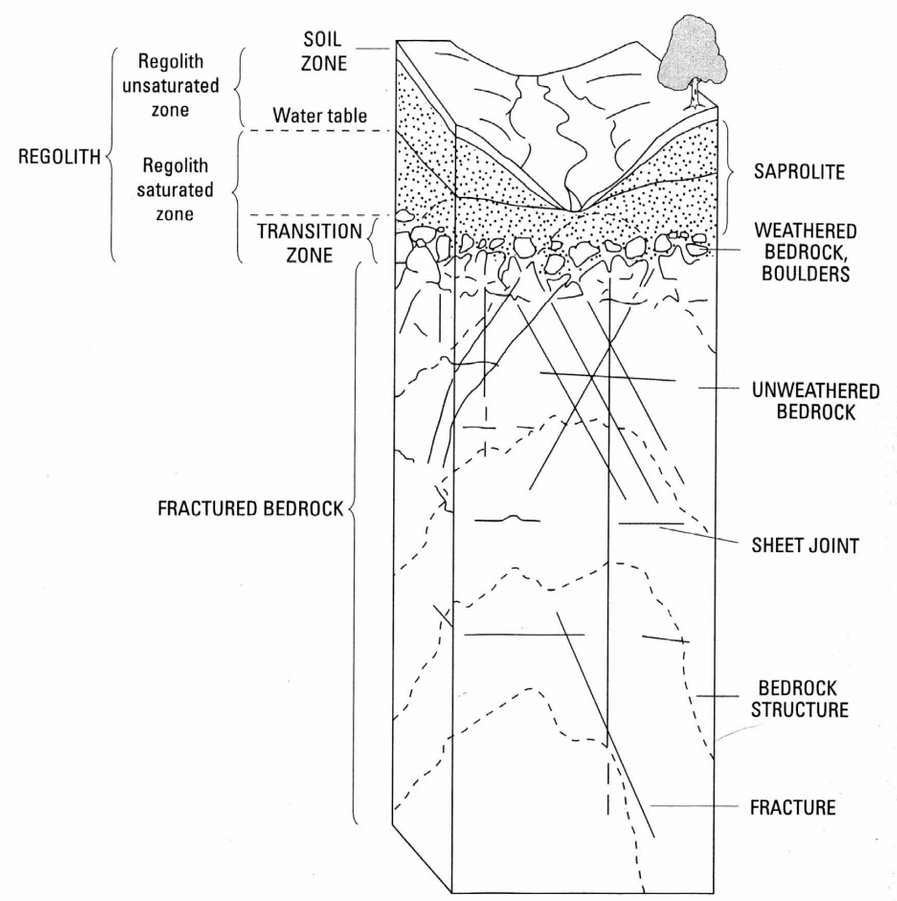
- Cunningham and Daniel (2001) described the groundwater system in Orange County as a "regolith-fractured crystalline rock aquifer system".

A. Regolith

Unconsolidated material which overlies fractured crystalline bedrock- includes soil, weathered rock, etc.

Principal components of the groundwater system in the Piedmont Province of North Carolina

(from Harned and Daniel, 1992)



V. Orange County Geology, cont.

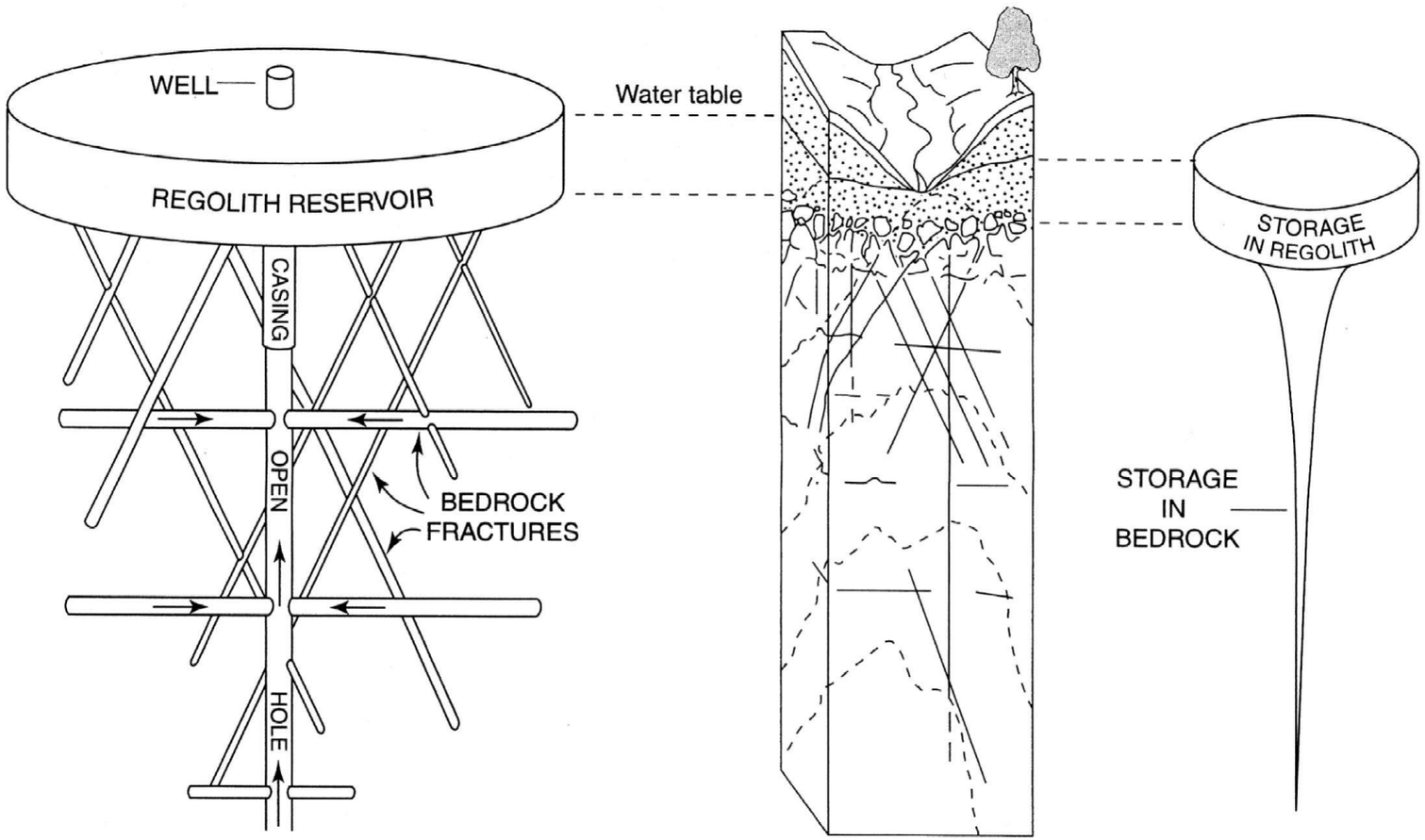
B. Bedrock

Groundwater in bedrock limited by the number and characteristics of the fractures present.

Bottom Line: Majority of groundwater storage occurs in the regolith, but water supply wells utilize water located in bedrock fractures (“pipelines”).

The reservoir pipeline conceptual model of the Piedmont groundwater system

(modified from Heath, 1984)



V. Orange County Geology, cont.

- NCGS geologic mapping of Orange County ongoing. Four main quadrangles complete:
  - White Cross, Hillsborough, Efland and Chapel Hill quadrangles.
- **Nine main bedrock lithologies** are present in the recently mapped area of Orange County.

VI. Observation Well Design

- Objectives determine well design.
- Observation wells can monitor:
  - Natural stresses (drought, terrane differences, etc)
  - Man-made stresses (Over-pumping, interference, etc)

VI. Observation Well Design, cont.

A. Primary Goal of Observation Well Network:

Monitor natural stresses on the quantity of groundwater available in storage which are caused by **variations in climatic conditions**.

Observation Well Network should mainly utilize **climatic effects (regolith or shallow) observation wells** to monitor the response of groundwater storage to variations in climate that occur over time.

VI. Observation Well Design, cont.

B. Secondary Goal of Observation Well Network:

Monitor variations in groundwater levels across the nine main bedrock lithologies.

Terrane effect (bedrock) observation wells should be completed in each of the nine main bedrock lithologies.

VI. Observation Well Design, cont.

- The **bedrock wells** should also be utilized to gain **water quality** information, including:
  - Arsenic and radon concentrations in groundwater
  - Groundwater quality near biosolids application areas

VII. Summary

- Combination of bedrock and regolith wells proposed. Wells should be spread across the County and bedrock wells should be located in each of the nine main bedrock lithologies.
- A bedrock and regolith well pair could be installed in the same location where possible.
- Network will be able to monitor the quantity of groundwater in storage as well as monitor variations in groundwater levels in different bedrock lithologies.

VIII. Additional Information

- No land purchases are anticipated to be necessary for the observation well network.
- Existing wells will be utilized where possible.
- Partners and cooperative arrangements are possible and should be explored:
  - USGS -DWQ (inc. Duke Forest wells)
  - DWR -NCGS
  - Area Universities -State Climatologists Office
- Some County school sites may be suitable well locations.