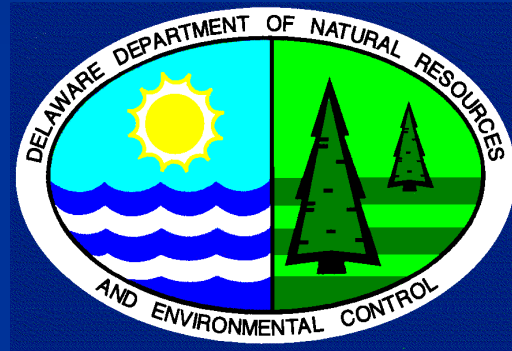


DE Envirothon Aquatics Training: Groundwater – Surface Water Connection



Chris Brown, Hydrologist
Delaware DNREC
Tank Management Section

At an Eco-Station, consider the following:



- Where is the water & where is it going?
- How does the water fit into the eco-system?
- “Read the land” - what does the topography tell you?
- Be ready to interpret air photos, topo maps, or sets of water quality data (surface or groundwater)
- What may influence the flow of the water?
- What may affect the water quality, and key parameters (D.O., temperature, etc.)
- How have (or could) humans affect the water quality?

Key Online Resources

Groundwater & Surface Water

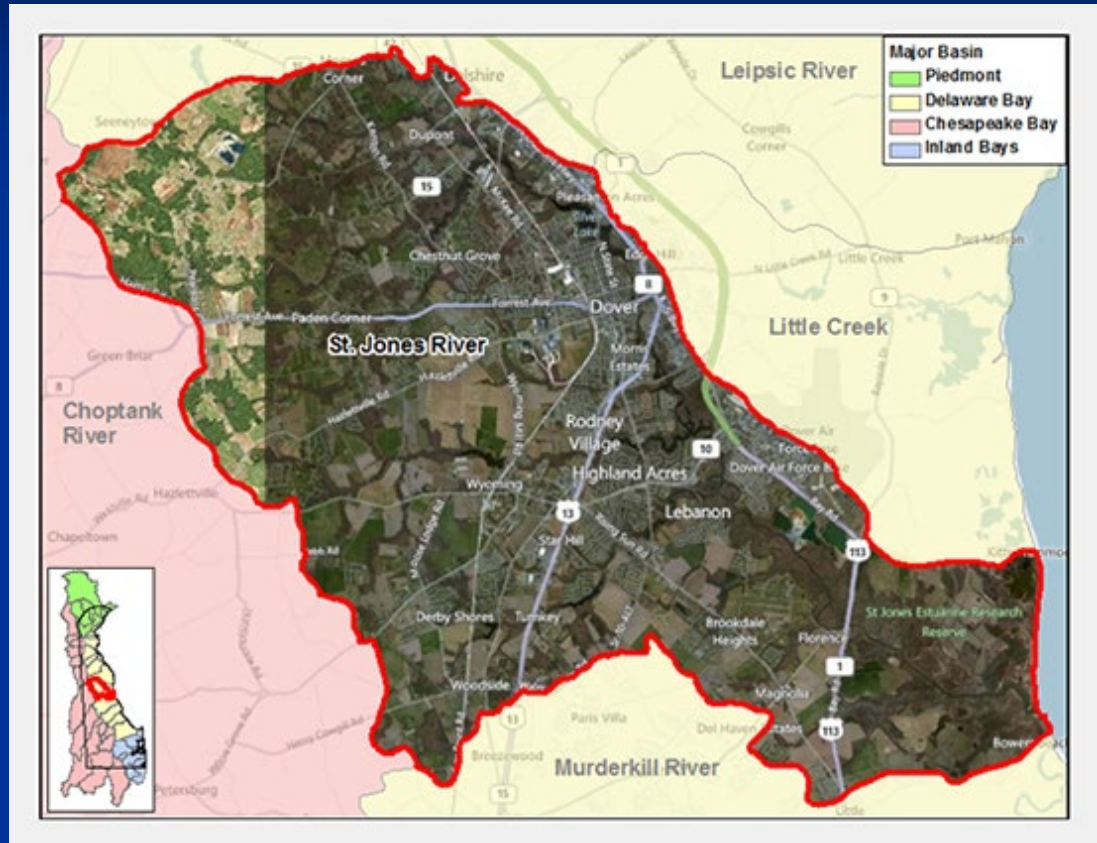
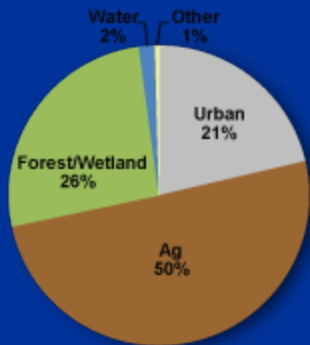
- USGS – <http://education.usgs.gov/> -
- USGS Circular 1139 “Groundwater and Surface Water”
- USGS – “Groundwater & the Rural Homeowner”
- DE GS – www.dgs.udel.edu
 - Water Resources & Water Conditions tabs
- DE Environmental Observing System – www.deos.udel.edu/geobrowser.html “DEOS Geobrowser”
- National Estuarine Research Reserve System -
- <http://cdmo.baruch.sc.edu/> – Research & Monitoring data
 - CDMO – Get Data – Data Export
- Google Earth & Air Photos

Agencies, Laws, Regulations, Guidance...

- Too many? Not enough?
- Be aware of, but don't get bogged down the details.
- It starts with Laws, Statutes, Codes.
- Federal (these are just a few):
 - Environmental Protection Agency
 - Often delegate authority to states, territories, tribes
 - US Geological Survey – science and research
 - US Army Corps Engineers
 - Dept. of Interior
- State of Delaware (these are just a few):
 - Dept. of Natural Resources and Environmental Control
 - Dept. of Agriculture
 - DE Geological Survey – science and research
 - Counties, cities, towns

Watersheds

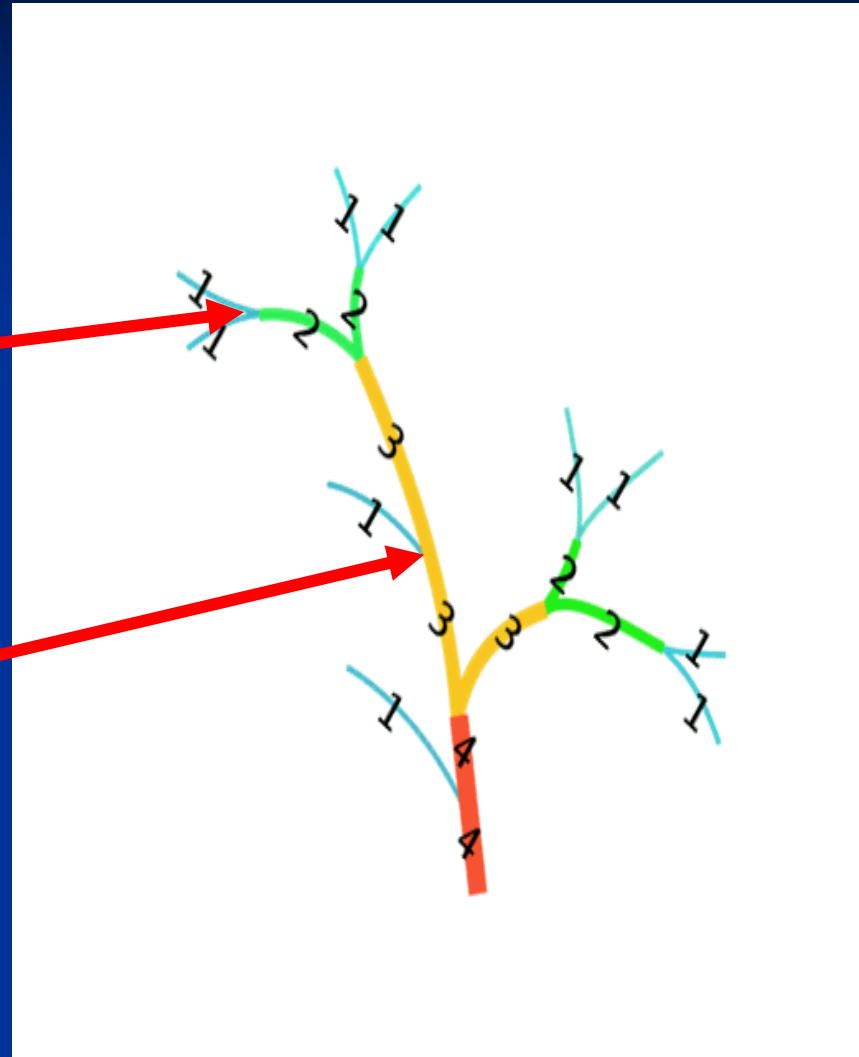
- An area of land where all the streams and rainfall go to a common outlet (St. Jones River).
- Includes the lakes, streams, wetlands and the underlying groundwater.
- Land use in a watershed impacts water quality and health—agriculture, urban, wetland.



Source: www.delawarewatersheds.org

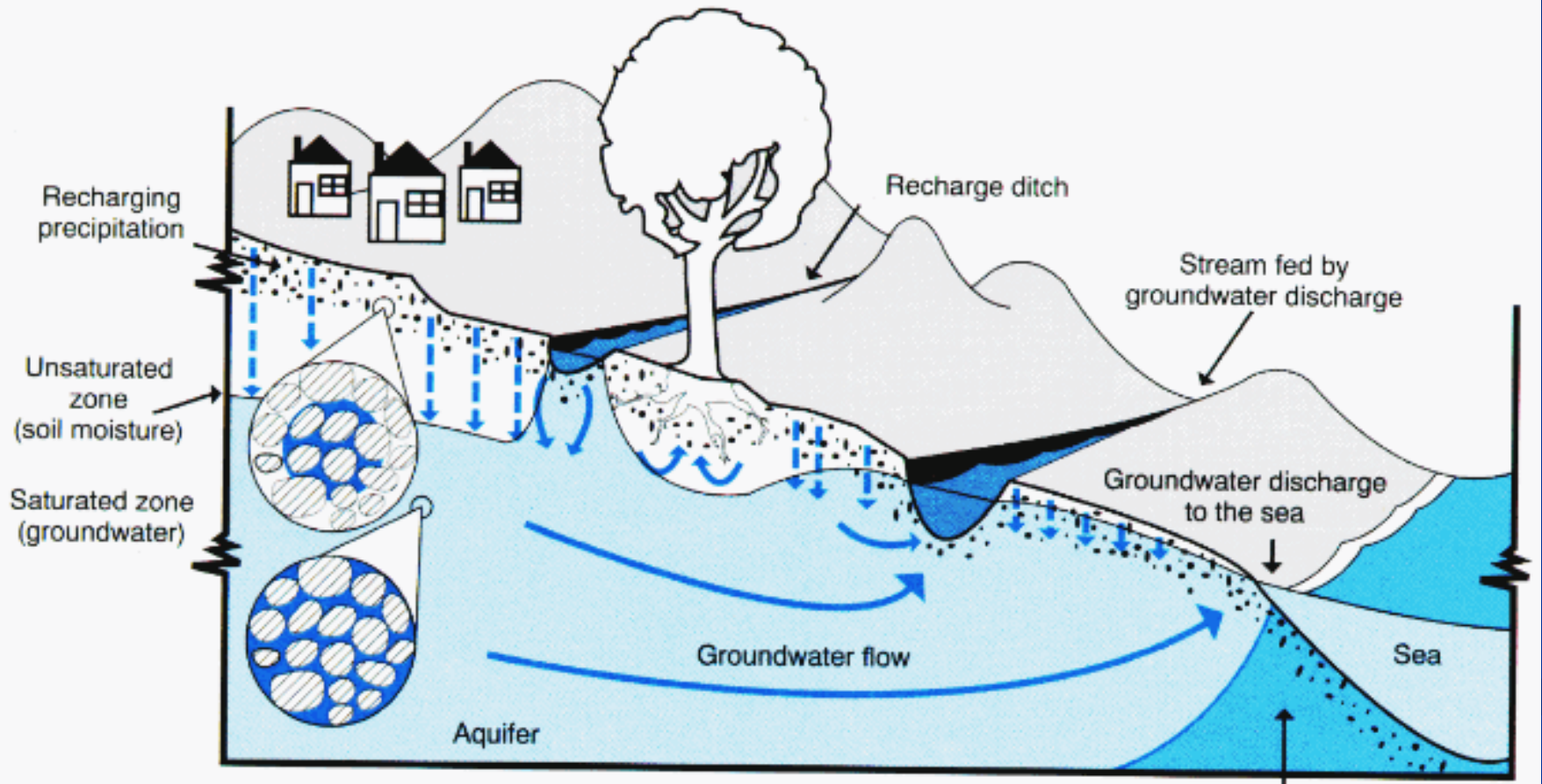
Stream Orders

- Hierarchy of streams
- 1st Order-headwaters of a stream
- When two streams of same order meet, the downstream segment gets the next highest numbered order
- When two streams meet and they are not the same order, then the highest numbered order is maintained on the downstream segment.



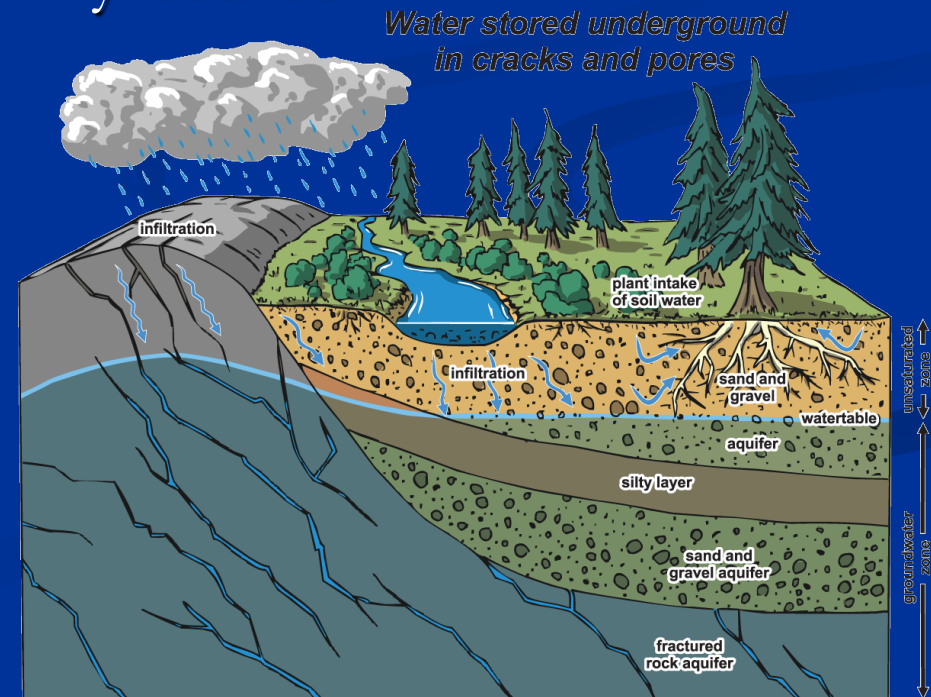
Groundwater - Part of the Hydrologic Cycle

Groundwater flow



Aquifer

- Geologic formation, either sediment or rock, capable of bearing water and supplying water to wells
- Coastal Plain aquifers consist of sediment
- Piedmont aquifers are generally bedrock



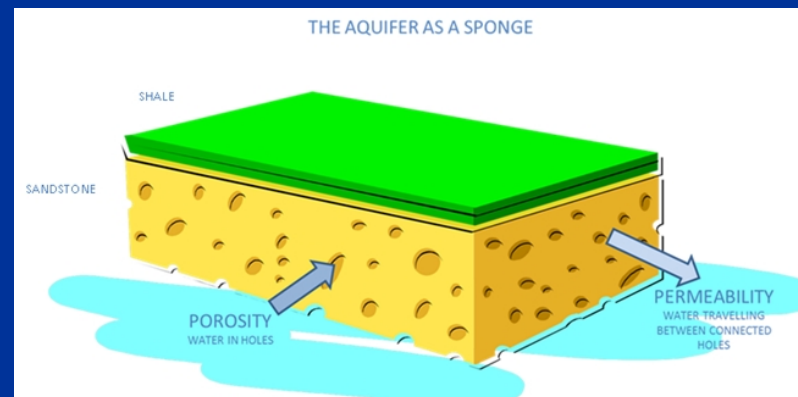
Groundwater Flow: Where? And How Fast?

■ Porosity

- Void spaces within sediment or rock
- Between sediment grains
- Fractures in rock
- Interconnected

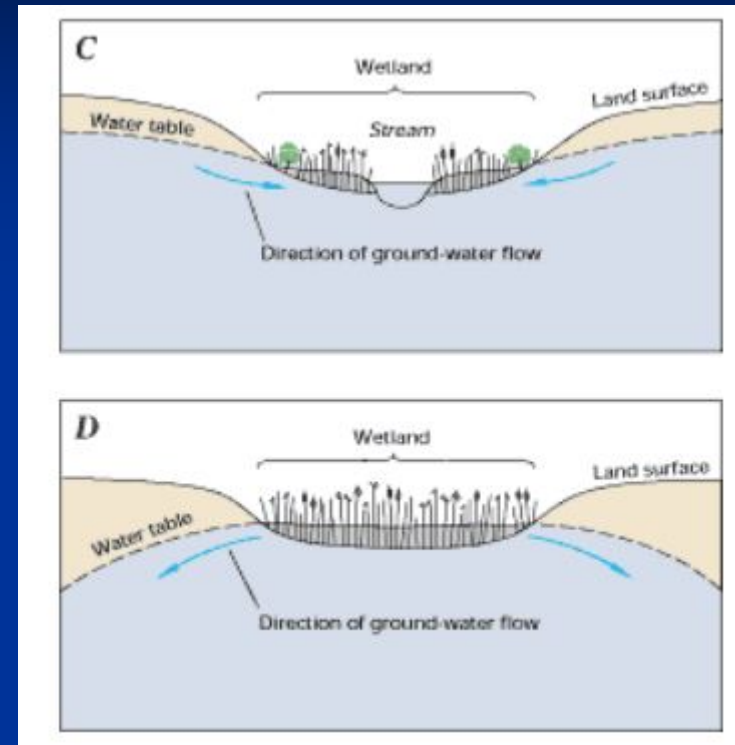
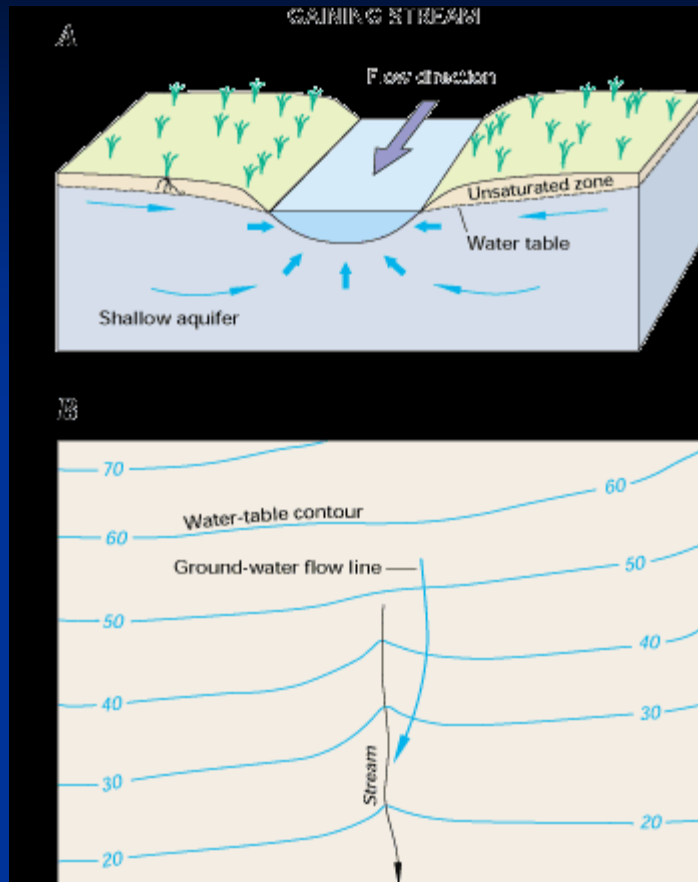
■ Permeability

- Hydraulic Conductivity
- Ability of material to transmit a fluid
- Sand & Gravel – High
- Clay - Low



Groundwater Flow: Why and Where?

- From high to low elevation – even a few inches
- From high to low pressure – pumping wells
- In humid regions, like the mid-Atlantic, flow is generally toward a surface water body
- Wells and recharge will influence flow



Common Scenarios in Delaware:
Surface & Groundwater Connection



Groundwater seepage along Indian River Bay



Areas free of ice that result from warm ground water (15 degrees C) discharging into cold surface water (5 degrees C) in the Inland Bays



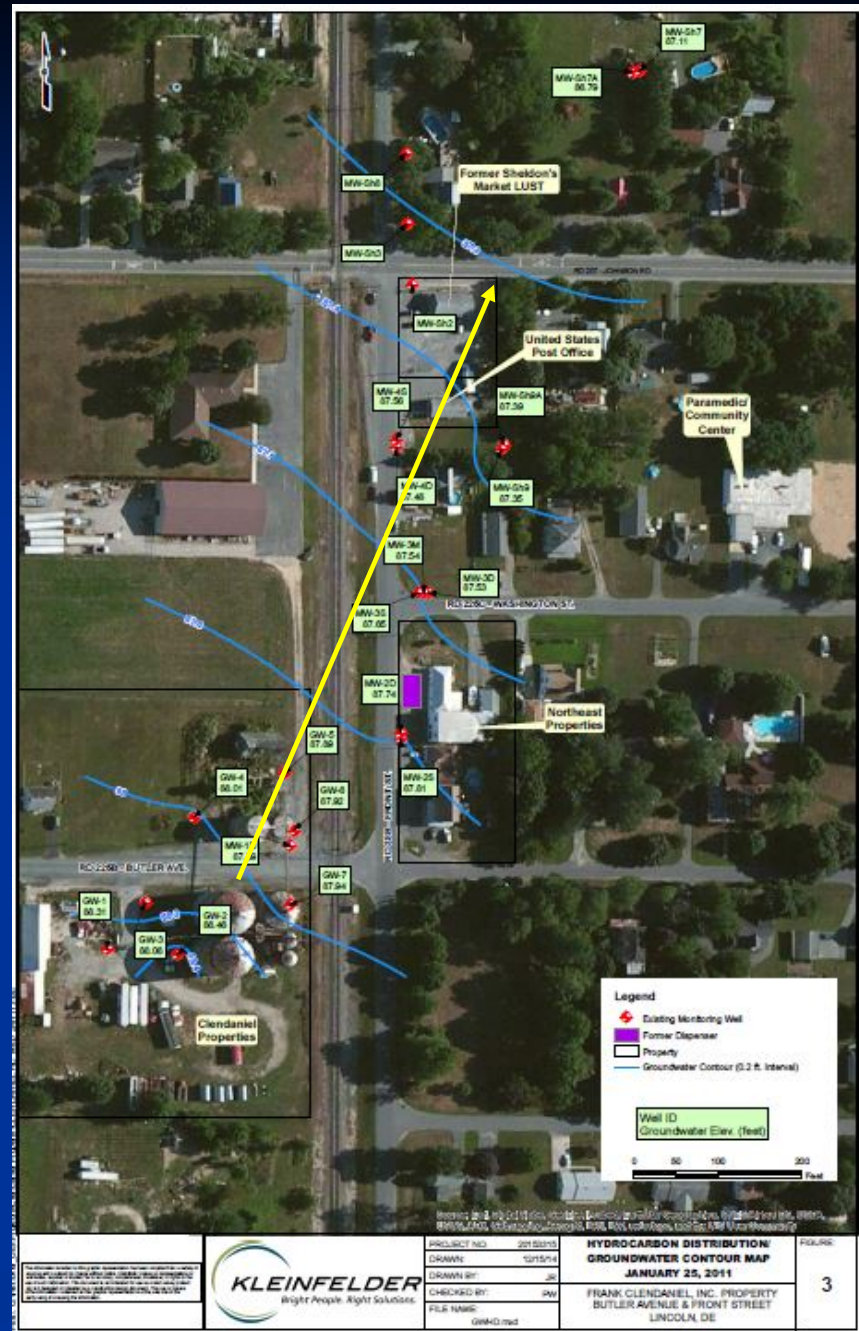
AUG 18 2005



APR 17 2007

Groundwater Flow Direction

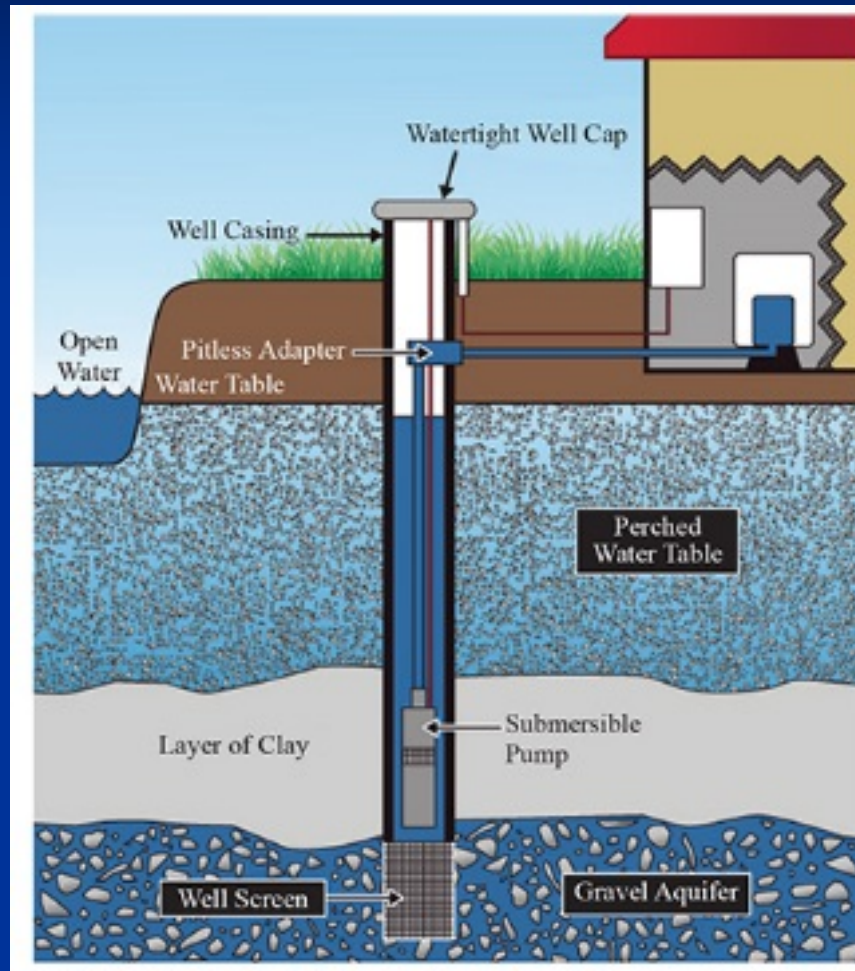
- Lines of equal elevation of water table
- Much like on a topographic map
- Flow from higher elevation to lower elevation



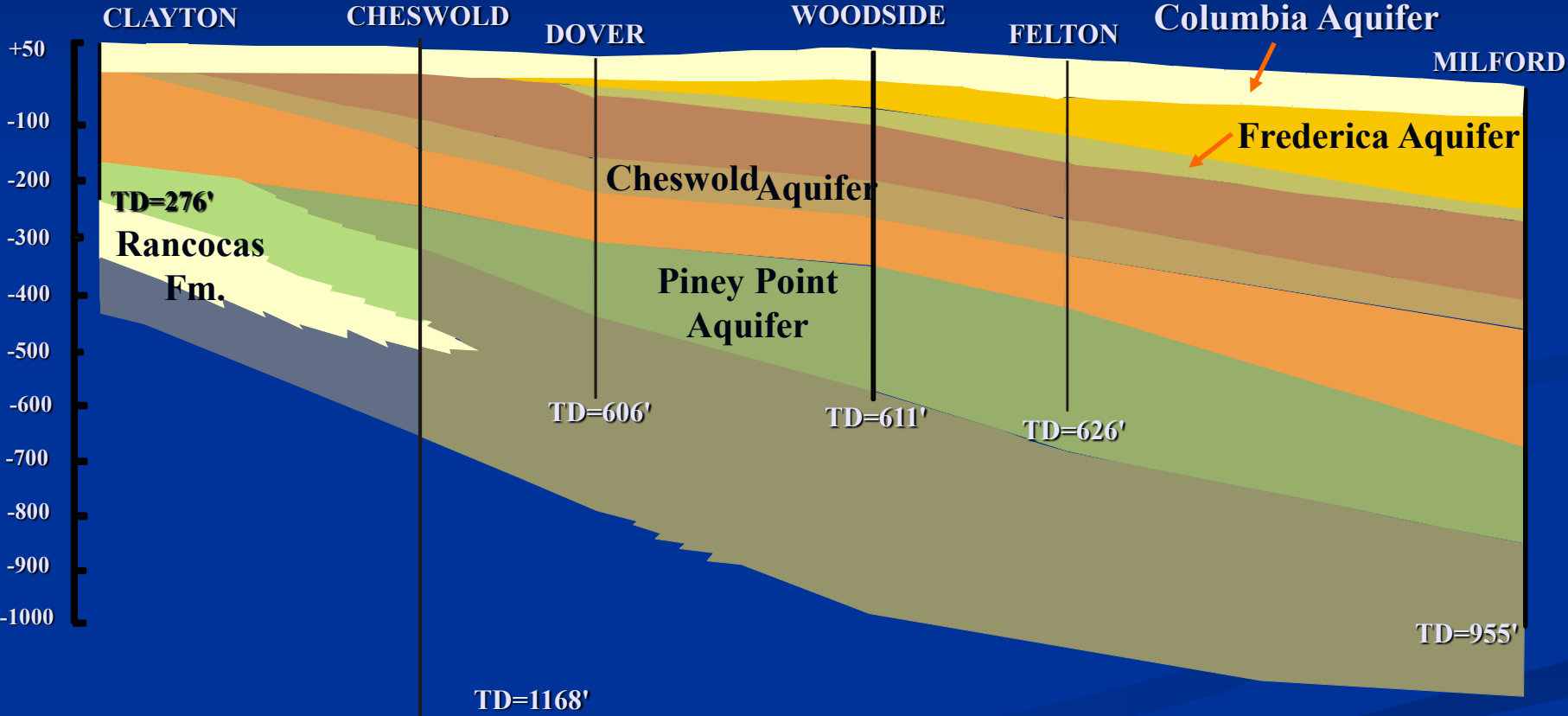
WELLS



TYPICAL WELL

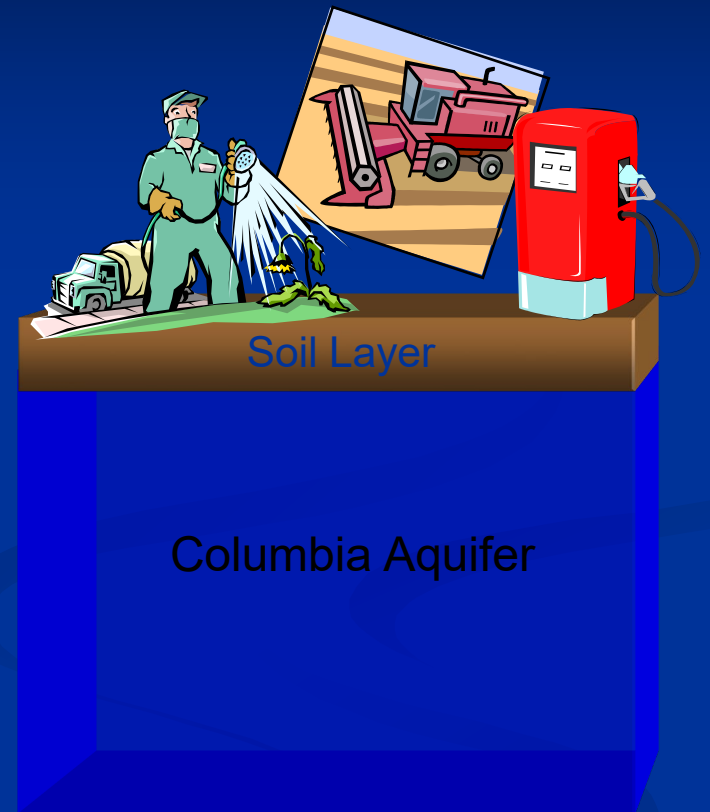


GENERALIZED GEOLOGIC CROSS SECTION OF KENT COUNTY



Columbia Aquifer

- *Most susceptible to contamination*
- *Most adversely affected*
- *Most heavily used aquifer*
 - *Irrigation*
 - *Public water supply*
 - *Domestic water supply*
 - *75% of stream flow*



When the Columbia Aquifer is Contaminated -

- Several locations in town have shallow well contamination
- Not all contaminant sources determined
- How to protect new drinking water supply wells?
- “Institutional Controls” by regulatory agency
- Groundwater Management Zone
- The wells with known contamination are replaced.



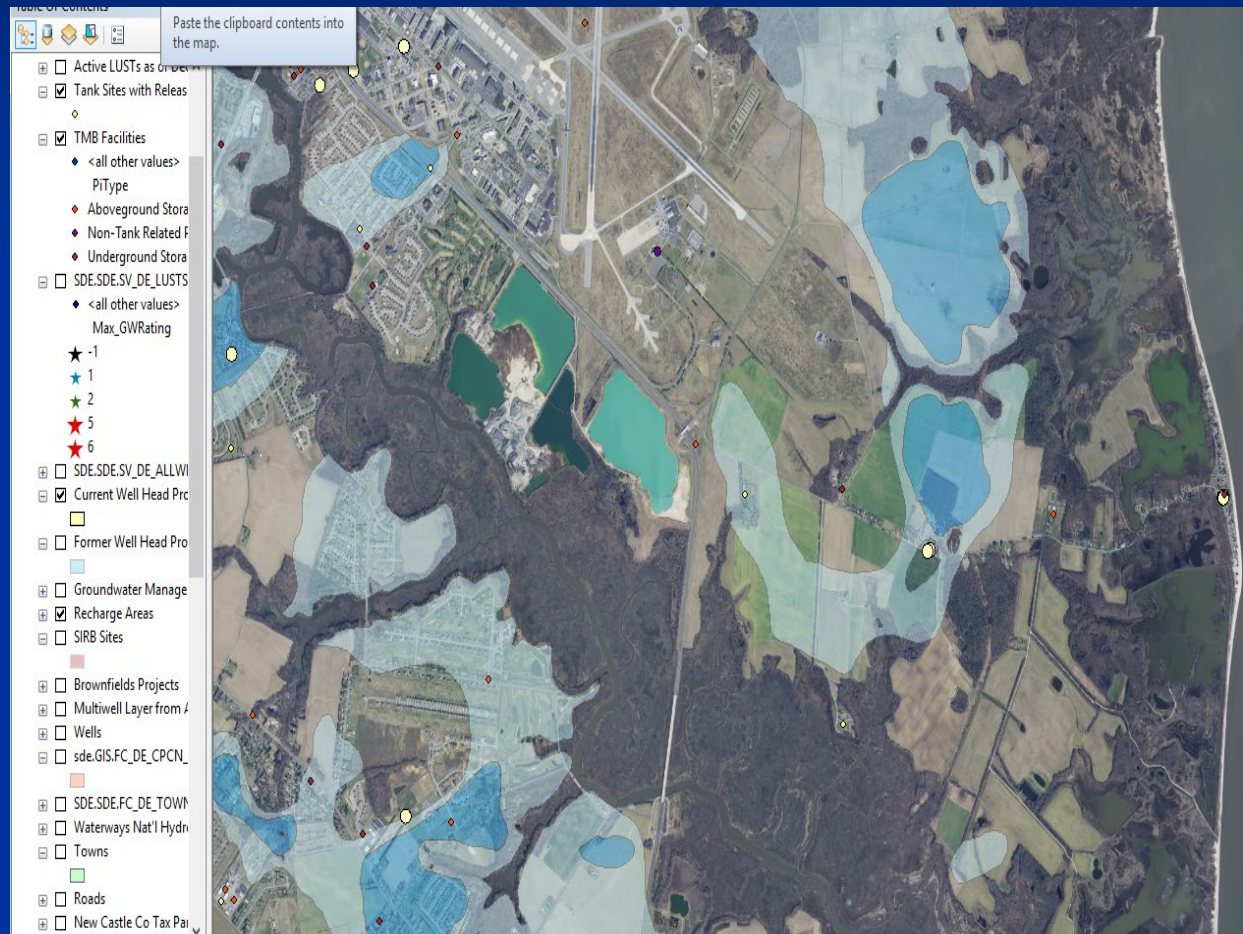
Making the Connection

- Remember the groundwater-surface water connection
- and the **GROUND SURFACE** - groundwater connection...



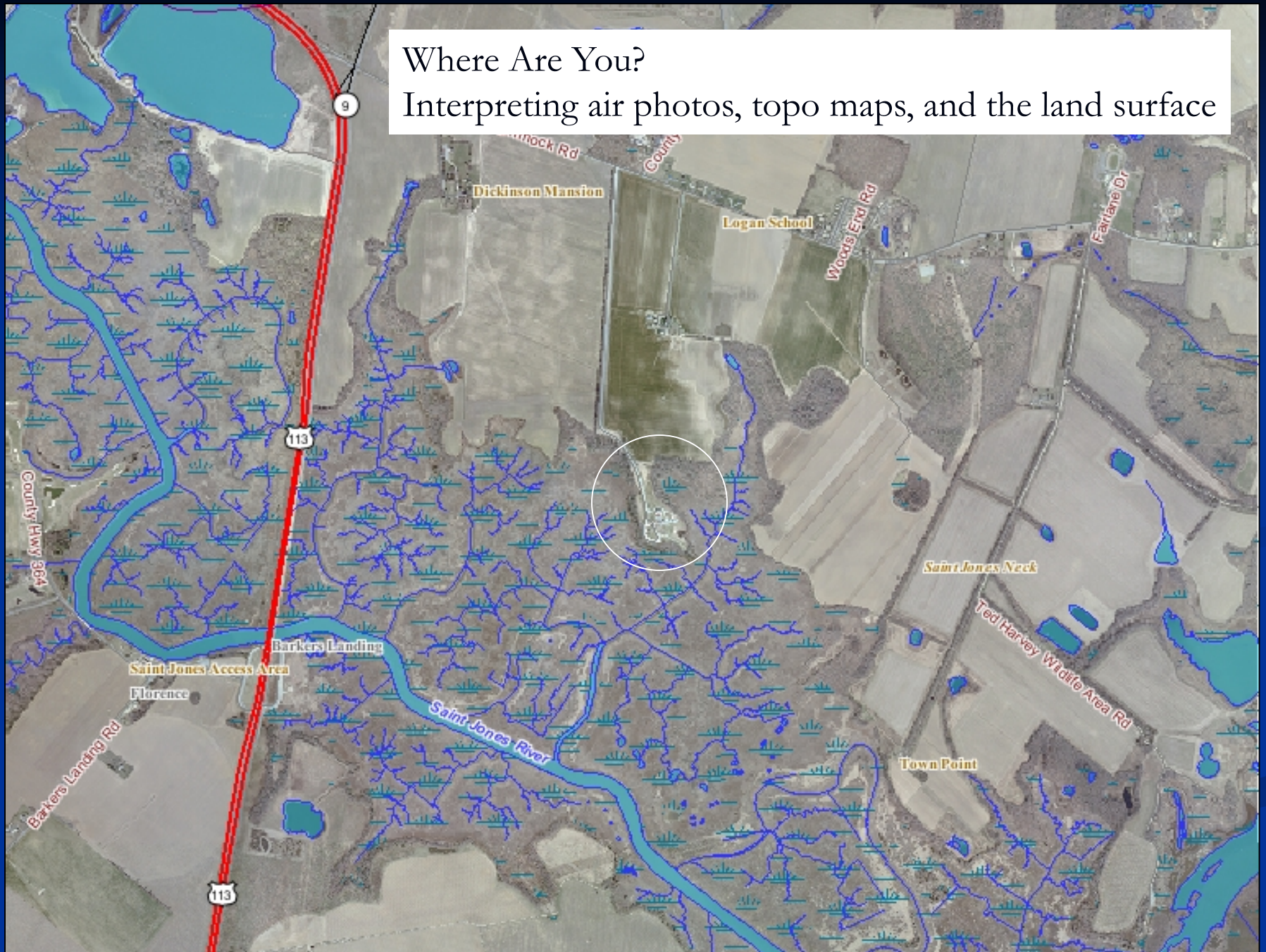
Geographic Information Systems and Databases

- DNREC maintains layers of well locations, well head protection area, recharge areas, and contaminated sites. It is valuable for determining risk to points of exposure and critical resources.
- Many agencies maintain databases.



Where Are You?

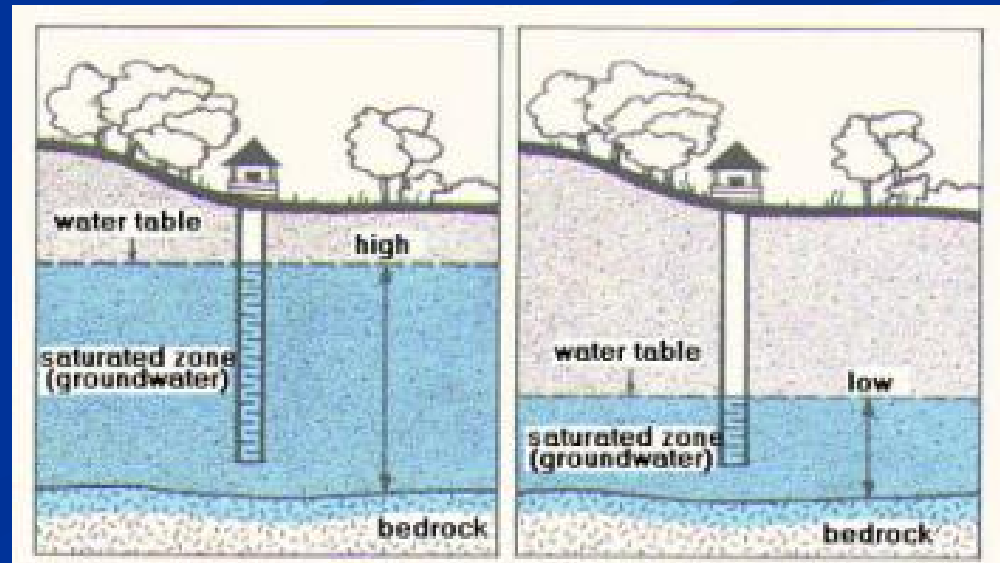
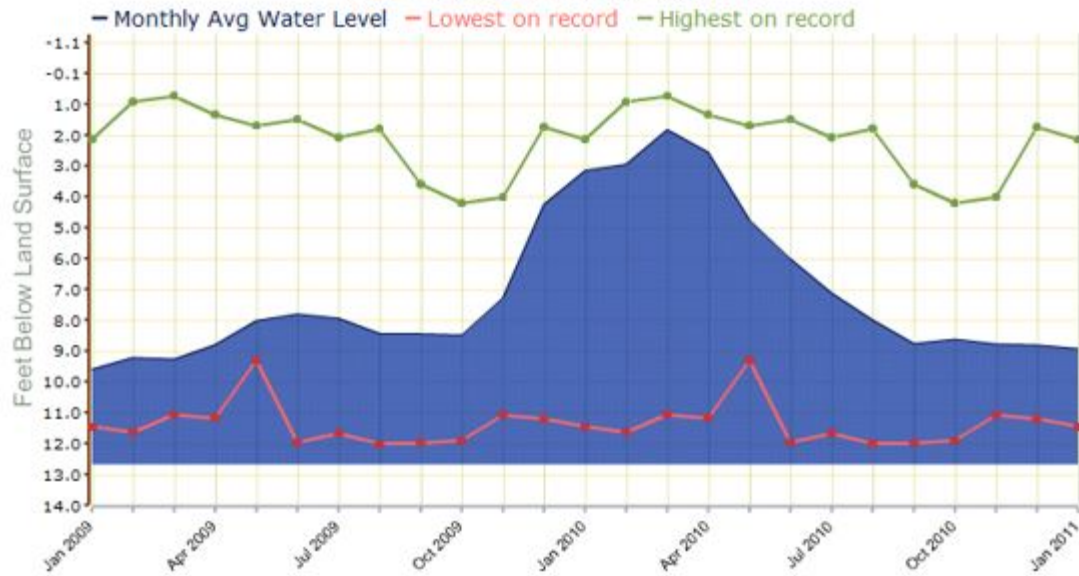
Interpreting air photos, topo maps, and the land surface





Below chart data begin date: end date:

Hb14-12, Columbia Aquifer



Yearly Files Export Data Graph Data Current Conditions

Choose how you would like to select your dates: Custom Dates (Enter below) Preselected Options (24 hours, etc.)

From: 07/31/2010

To: 11/30/2010

Parameter:

Dissolved Oxygen (mg/L)

Graph!

Delaware - Scotton Landing - Dissolved Oxygen concentration in milligrams per Liter From: 07/31/2010 To: 11/30/2010

