



# Maryland's Ground Water: What we know and don't know, and what we need

Chesapeake Environmental Protection Association  
2014 Forum

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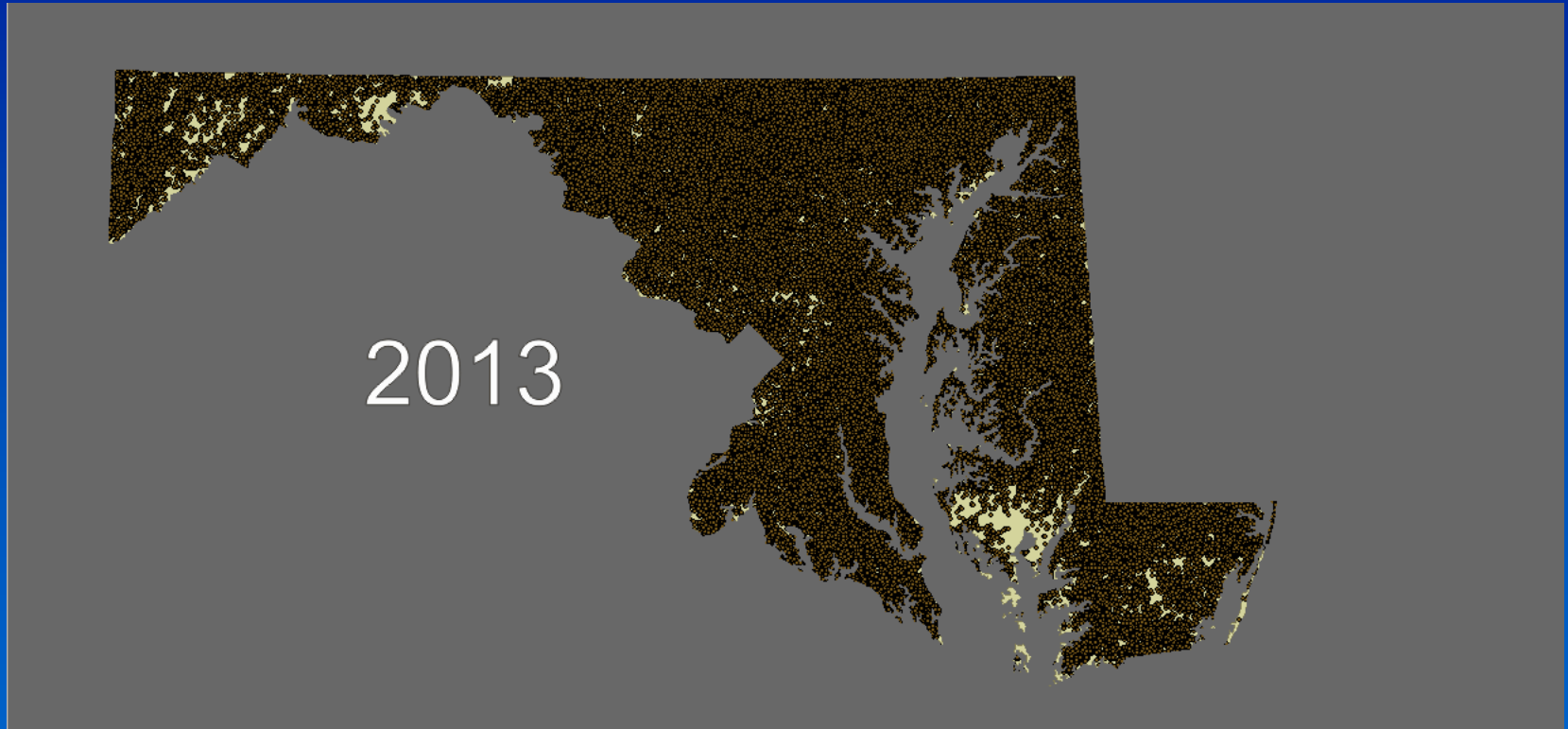


## **Ground-water issues facing Maryland:**

- Declining water levels (Coastal Plain)
- Drought: wells going dry (mostly central Maryland)
- Water-quality problems (private wells untested areas)

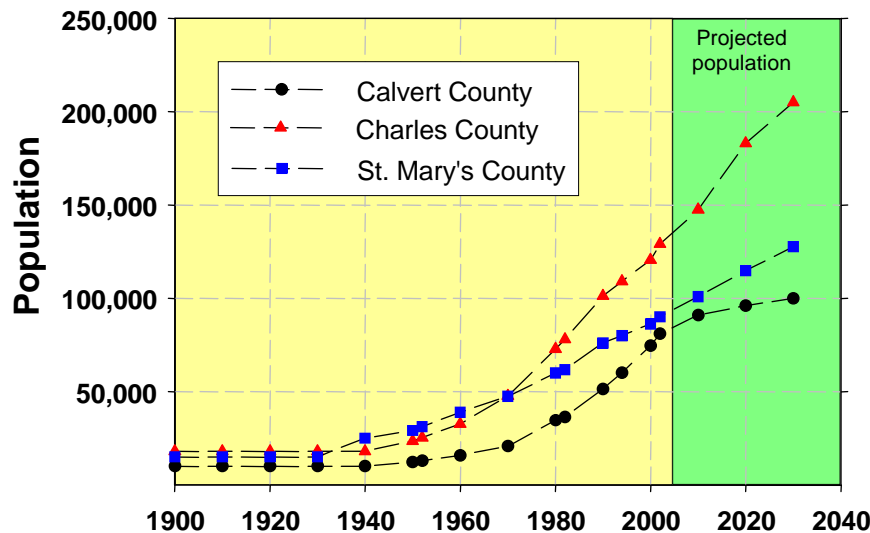
➤ **Are we running out of water?**

# Growth in number of wells in Maryland, 1945-2013

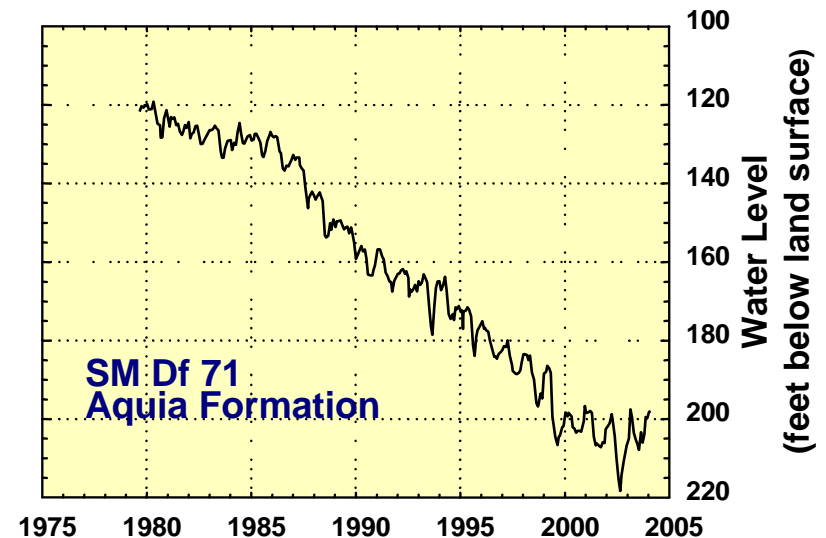


# Population Pressures & Declining Water Levels

## Historic and projected population in Southern Maryland



## Water level in Aquia Formation, St. Mary's County

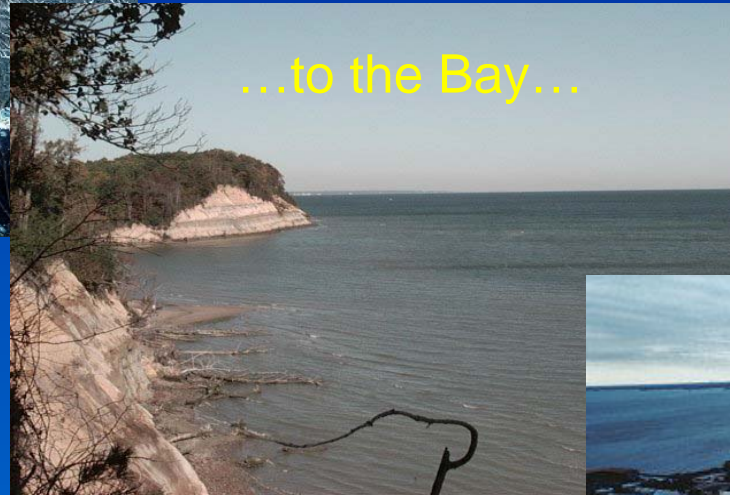


# Maryland: “America In Miniature”

From the Mountains...



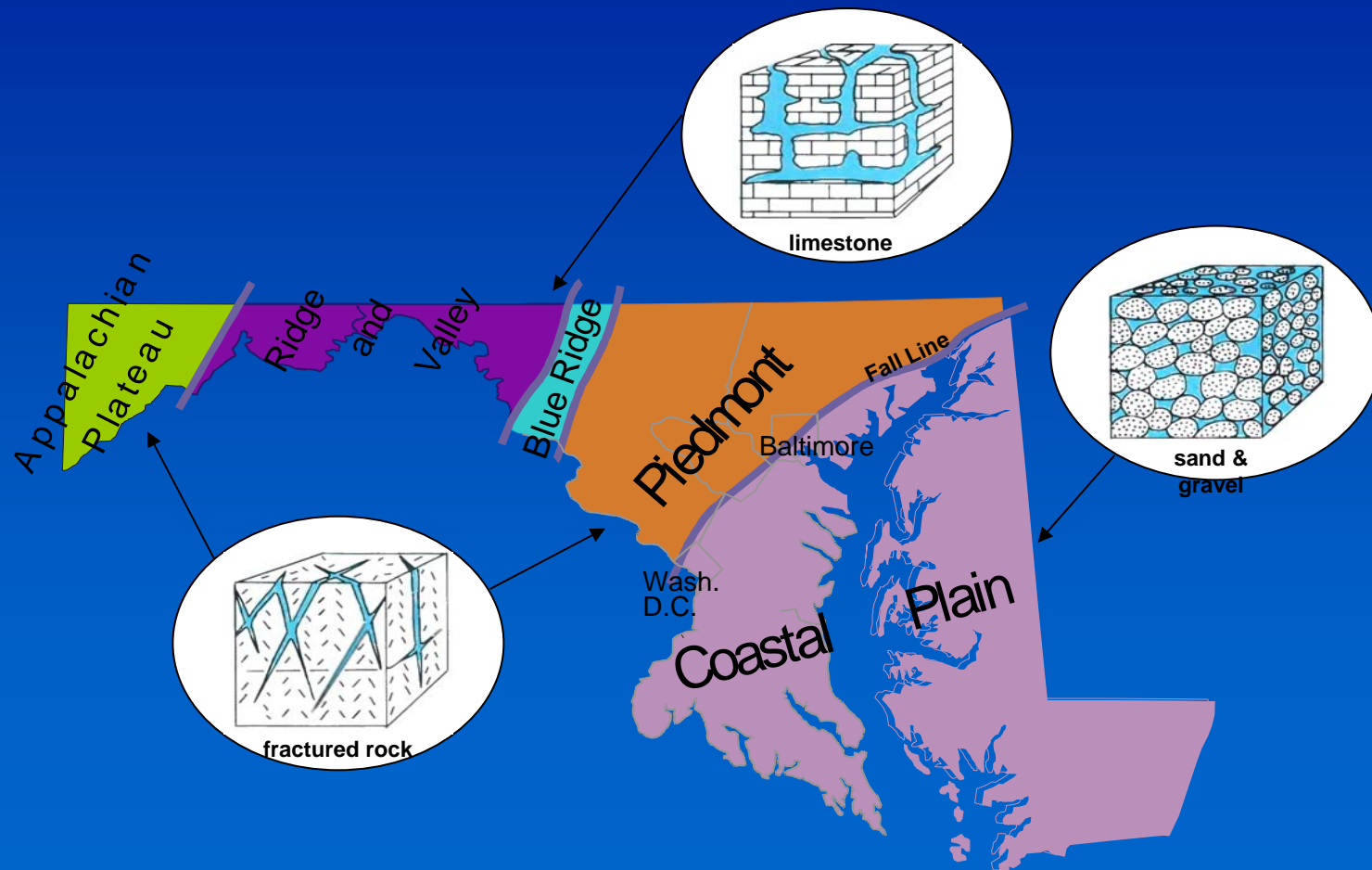
...to the Bay...



...to the Ocean

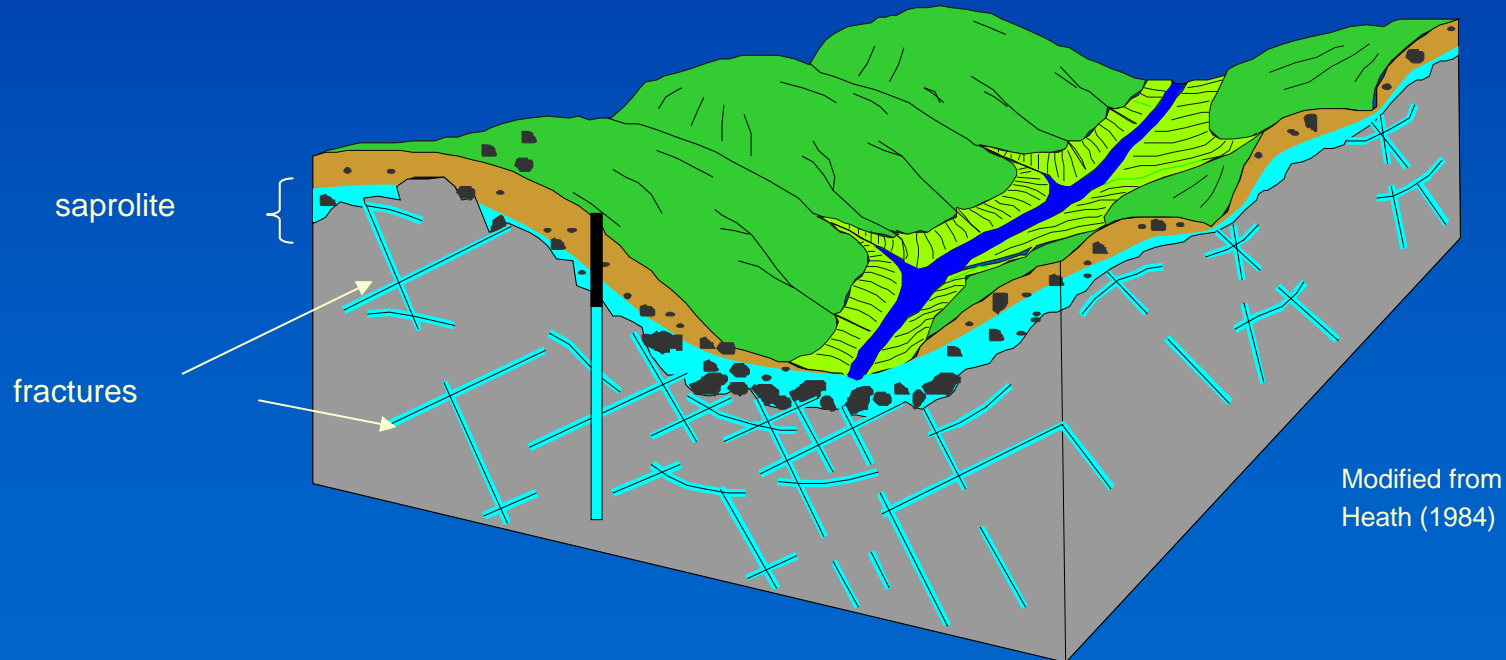


# Physiographic Provinces and Aquifer Types in Maryland



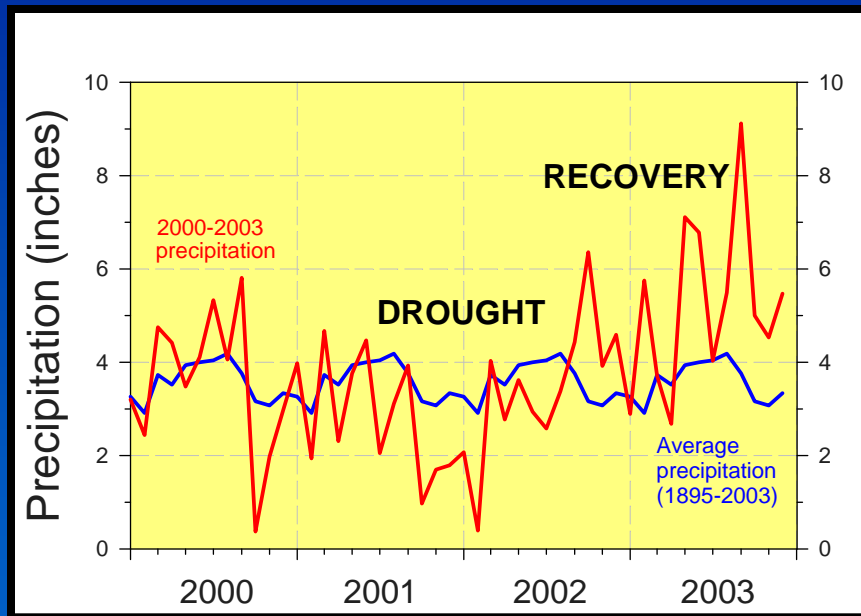
# Piedmont Ground Water Characteristics

- Fracture flow
- Unconfined aquifers
- Often low well yields

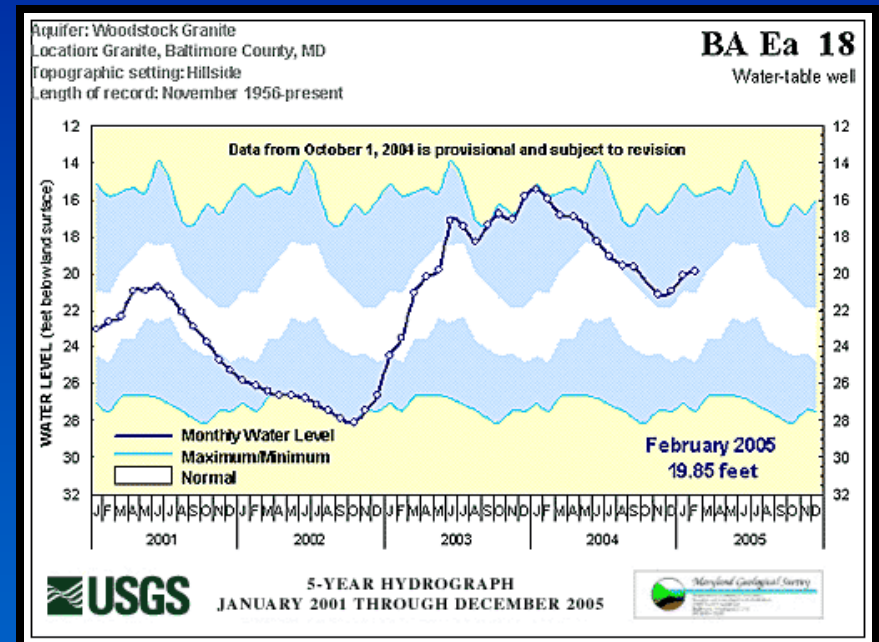




# Unconfined aquifers and drought



Precipitation

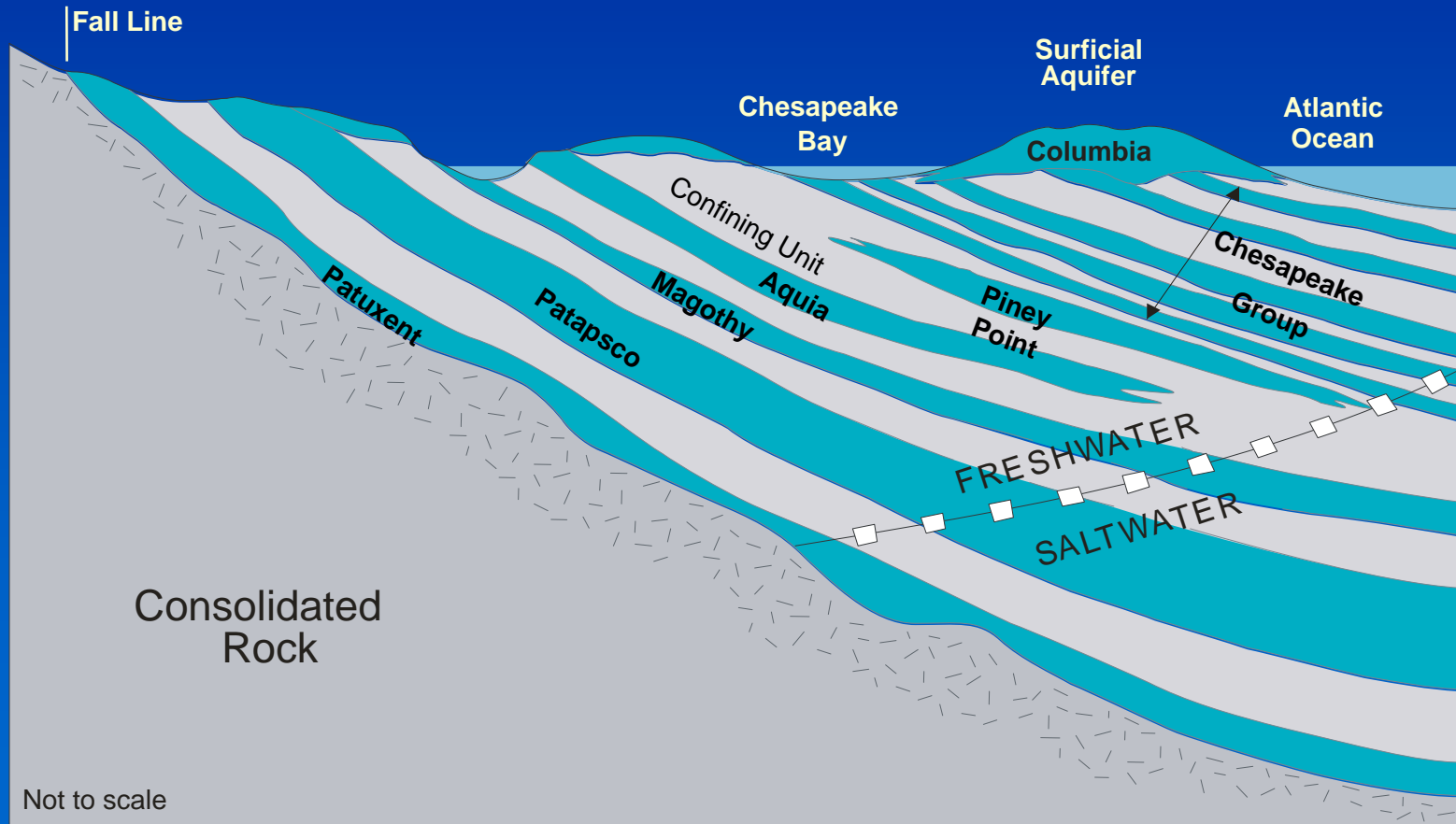


Groundwater level

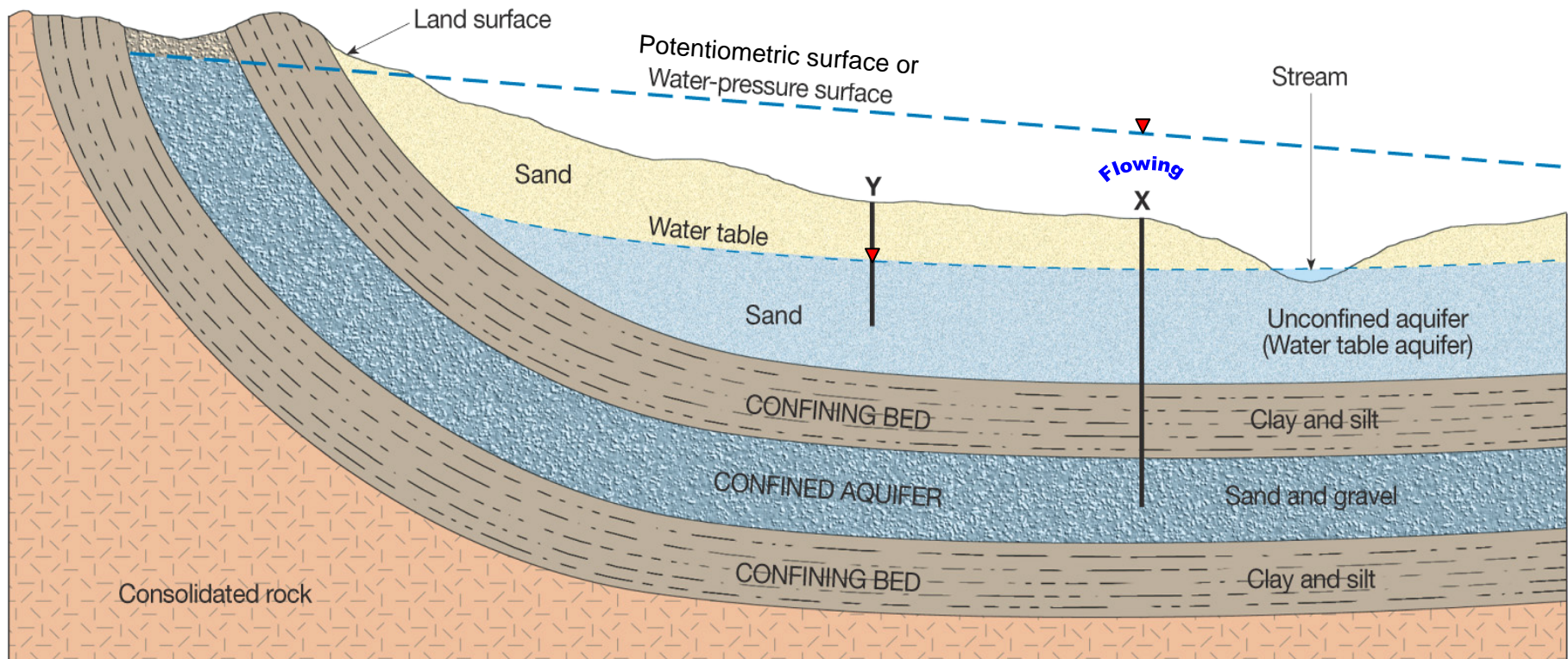


# Coastal Plain Ground Water Characteristics

- Unconsolidated sediments
- Confined aquifers
- Usually high well yields



# Water Table Aquifer vs. Confined Aquifer



# Advisory Committee on the Management and Protection of the State's Water Resources

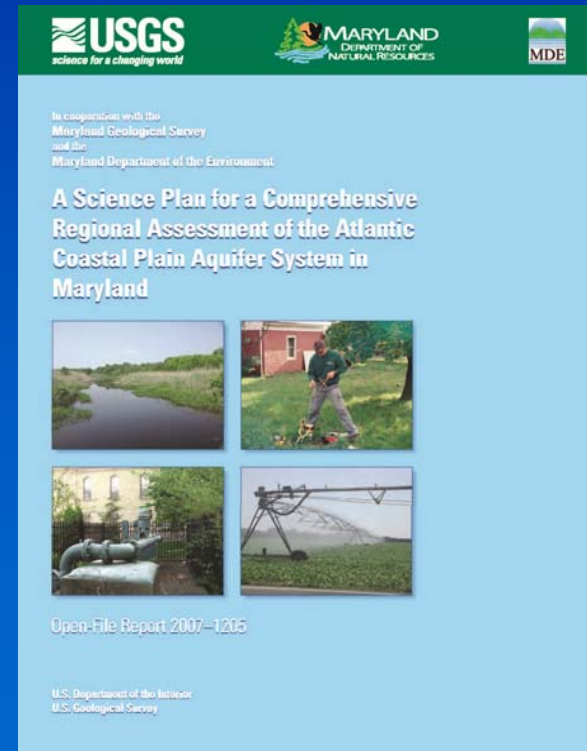
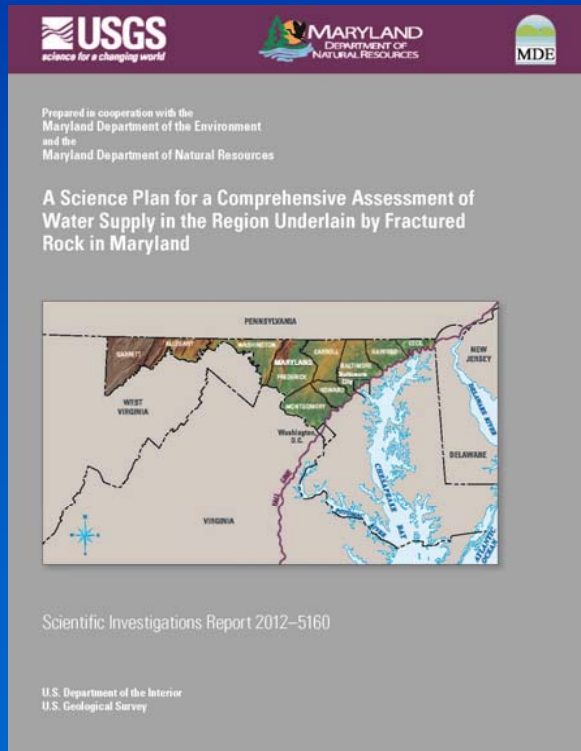
“To provide advice to the State on policies and programs relating to the management, development, conservation, and protection of the State's water resources”



# Assessing Maryland's Groundwater

Science plans developed for comprehensive assessments:

- Coastal Plain Science Plan: published 2007
- Fractured Rock Science Plan: published 2012



## Coastal Plain Science Goals:

- Aquifer characteristics
- Ground-water flow system
- Ground-water quality
- Monitoring networks
- Ground-water management tools

# Science Goal 1: Aquifer characteristics

## What's been done?

- Regional hydrogeologic framework has been developed
- 16 aquifers/aquifer systems; 14 confining units
- 900+ wells used to map aquifers/confining units
- Hydraulic properties from 600+ wells
- Data incorporated into ArcGIS format

## What is needed?

- Information on hydraulic properties of confining units
- Further investigation in some areas
- Funding for keeping system up-to-date



# Why do we need to investigate the aquifers if they have a layer cake geometry?



Because in many areas,  
the aquifer system  
layering is complex



...more like marble cake



# Science Goal #1 (continued)

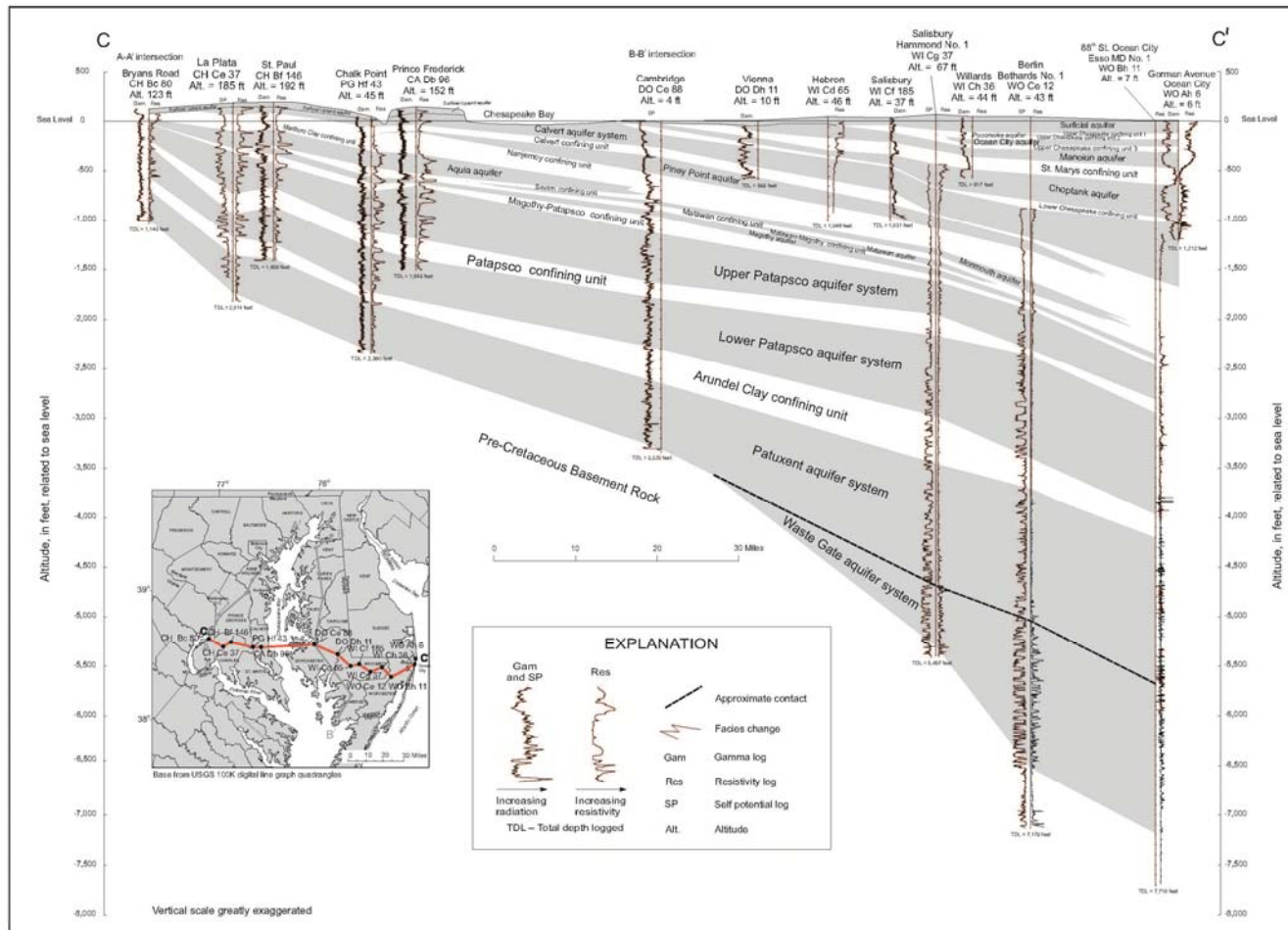


Figure 4. Hydrogeologic cross section C-C' from Bryans Road, Charles County to Ocean City, Worcester County, Maryland.

## Science Goal #2: Ground-water flow system

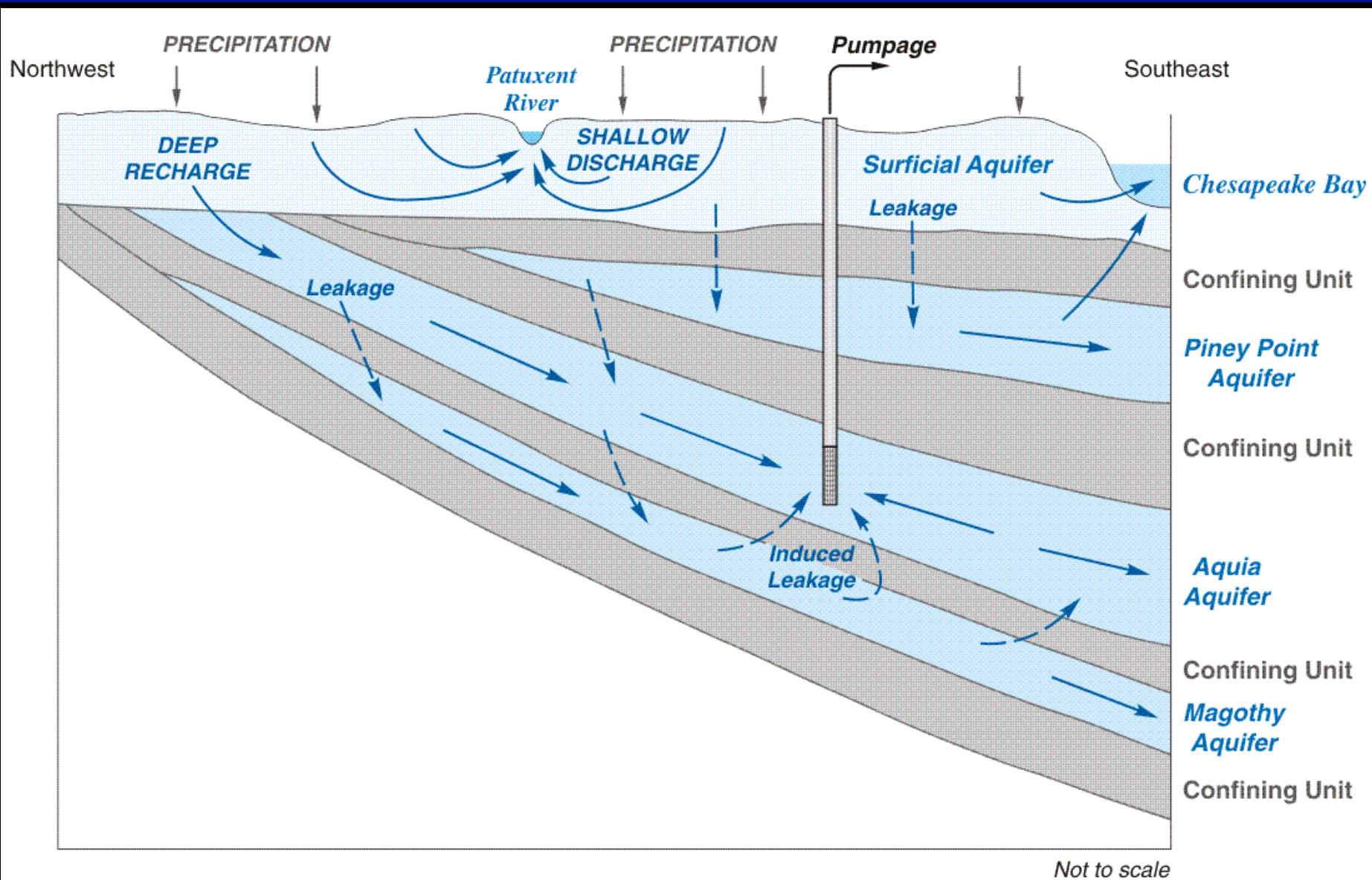
### What's been done?

- Conceptual model of regional ground-water flow
- Model prototypes (small-scale models to test-drive new components)
- Begun regional GW flow model development
- Data collection for model calibration
- Updated ground-water withdrawal data

### What is needed?

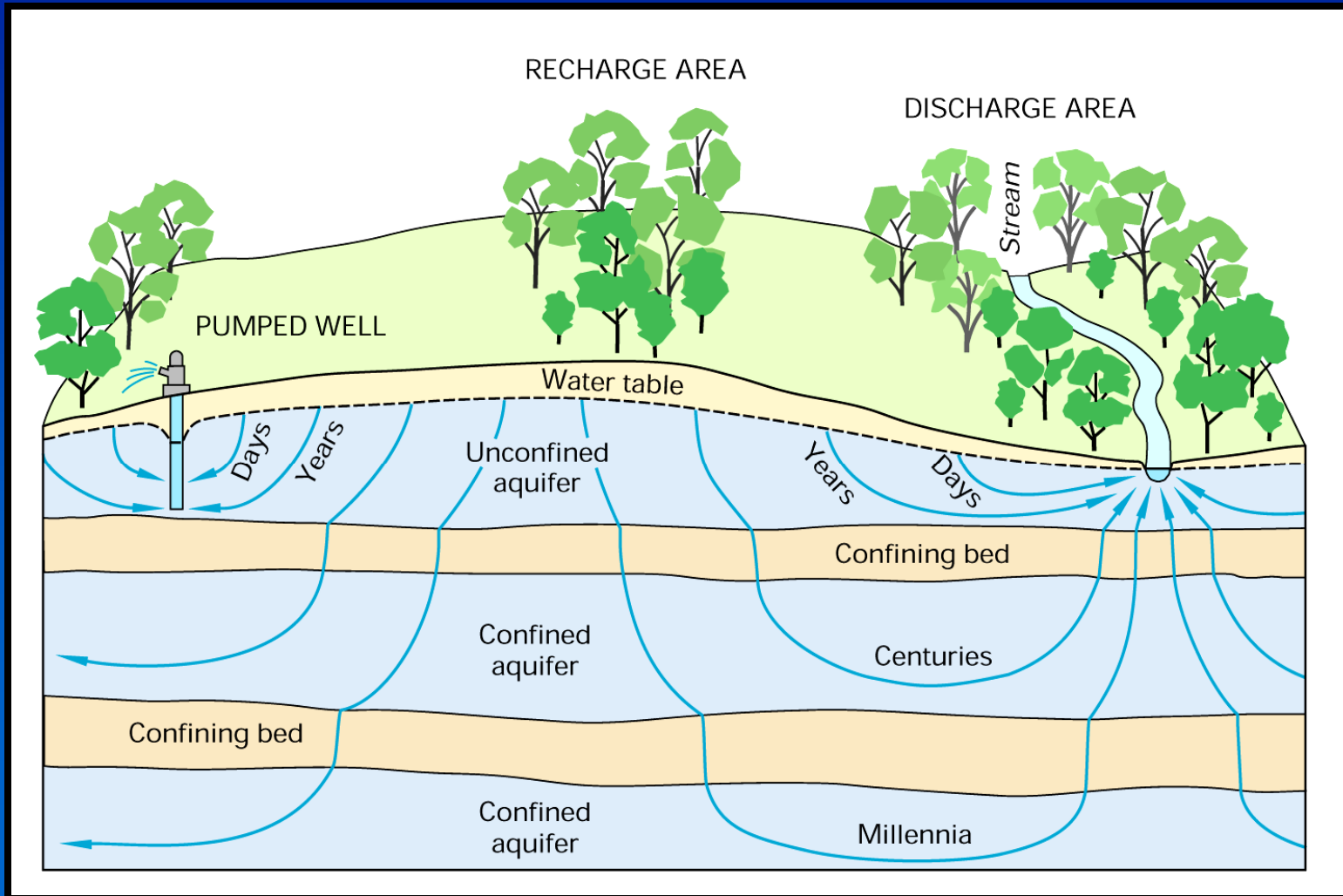
- Full development of ground-water flow model
- Ongoing water-use data gathering

## Science Goal #2: Ground-water flow system (continued)



Diagrammatic cross section showing water sources and losses.

## Age of Ground Water



## Science Goal #3: Ground-water Quality

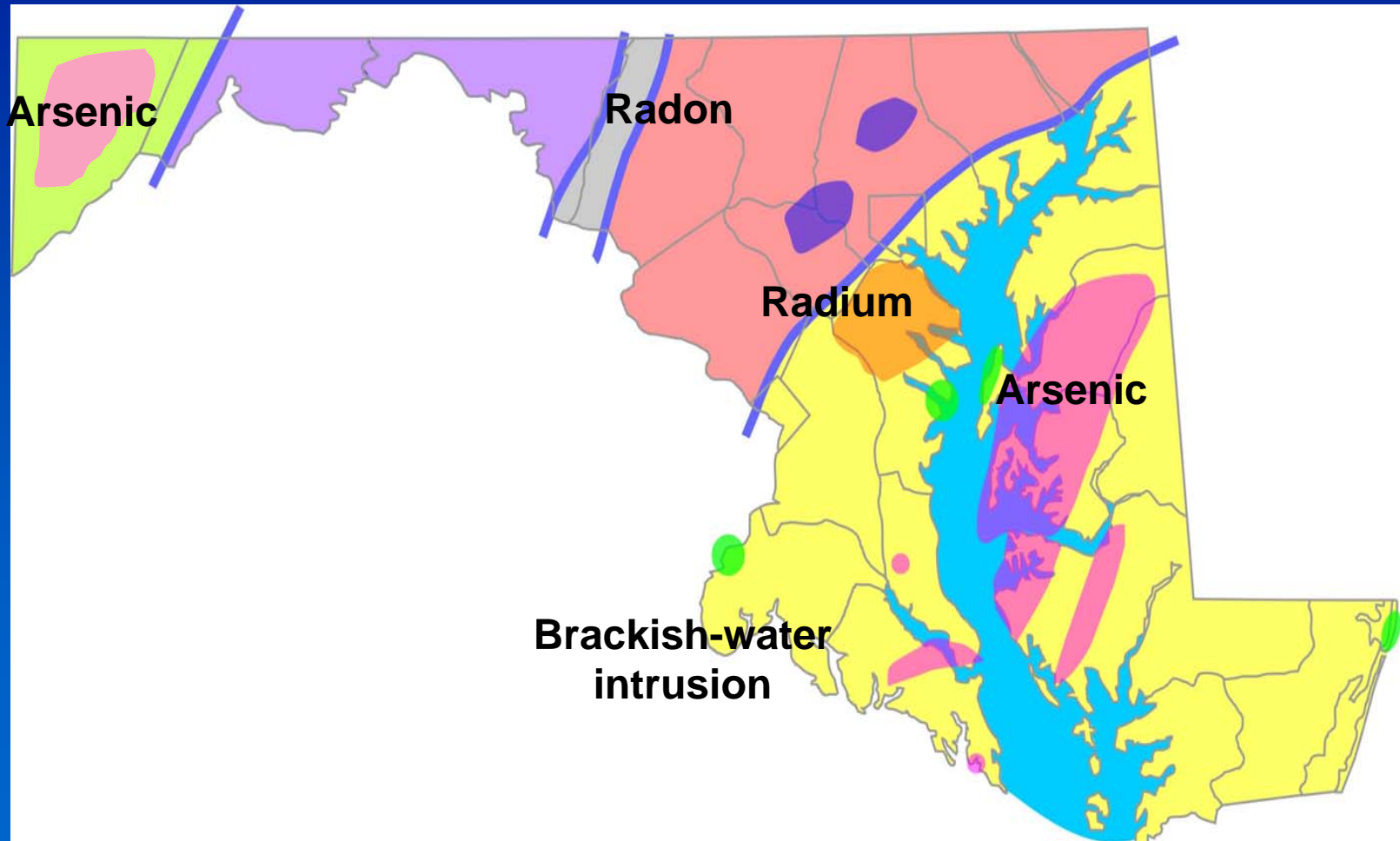
### What's been done:

- Most “problem” constituents have been mapped
- Prototype developed (arsenic) for displaying information

### What is needed:

- Private water wells: not tested for all health-related constituents)
- Fresh water/brackish-water boundary not known

# Regional Ground-Water Quality Issues





## Frequently Asked Questions

## Hydrogeology and Hydrology Program

## Current Projects

## Recently Completed Projects

## Legend

## above 20 ug/L arsenic



## 15-20 ug/L arsenic



## 10-15 ug/L arsenic



## 5-10 ug/L arsenic



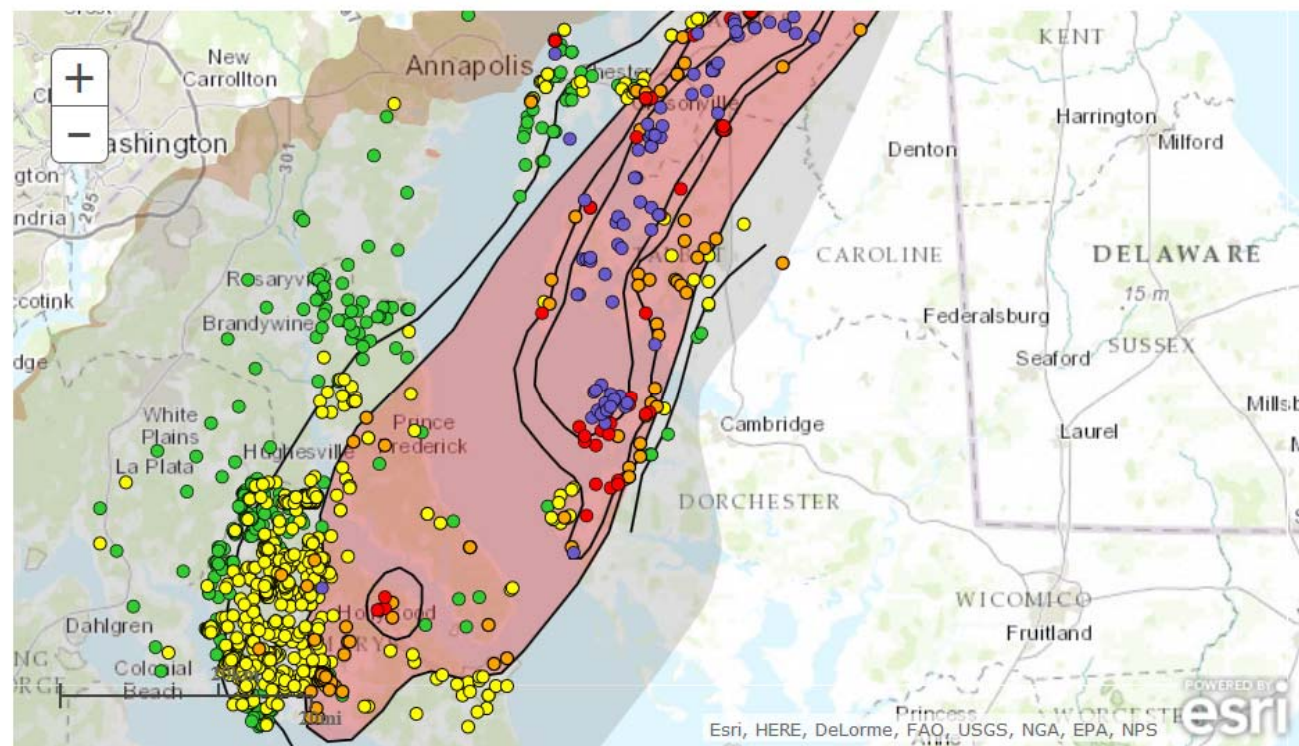
## 0-5 ug/L arsenic



## arsenic concentration con

determine which coastal plain aquifers have elevated arsenic concentrations, the extent and range of arsenic in these aquifers, and to identify possible hydrochemical controls on arsenic distribution. Data on the following interactive maps is taken from MGS Report of Investigations 78.

The interactive map below provides information on the occurrence of arsenic in the Aquia aquifer. The red shaded area is where arsenic commonly exceeds the 10 ug/L drinking water standard.



[View Larger Map](#)

The interactive map below provides information on the occurrence of arsenic in the Piney Point aquifer. The red shaded area is where arsenic commonly exceeds the 10 ug/L drinking water standard.





## Science Goal #4: Monitoring networks

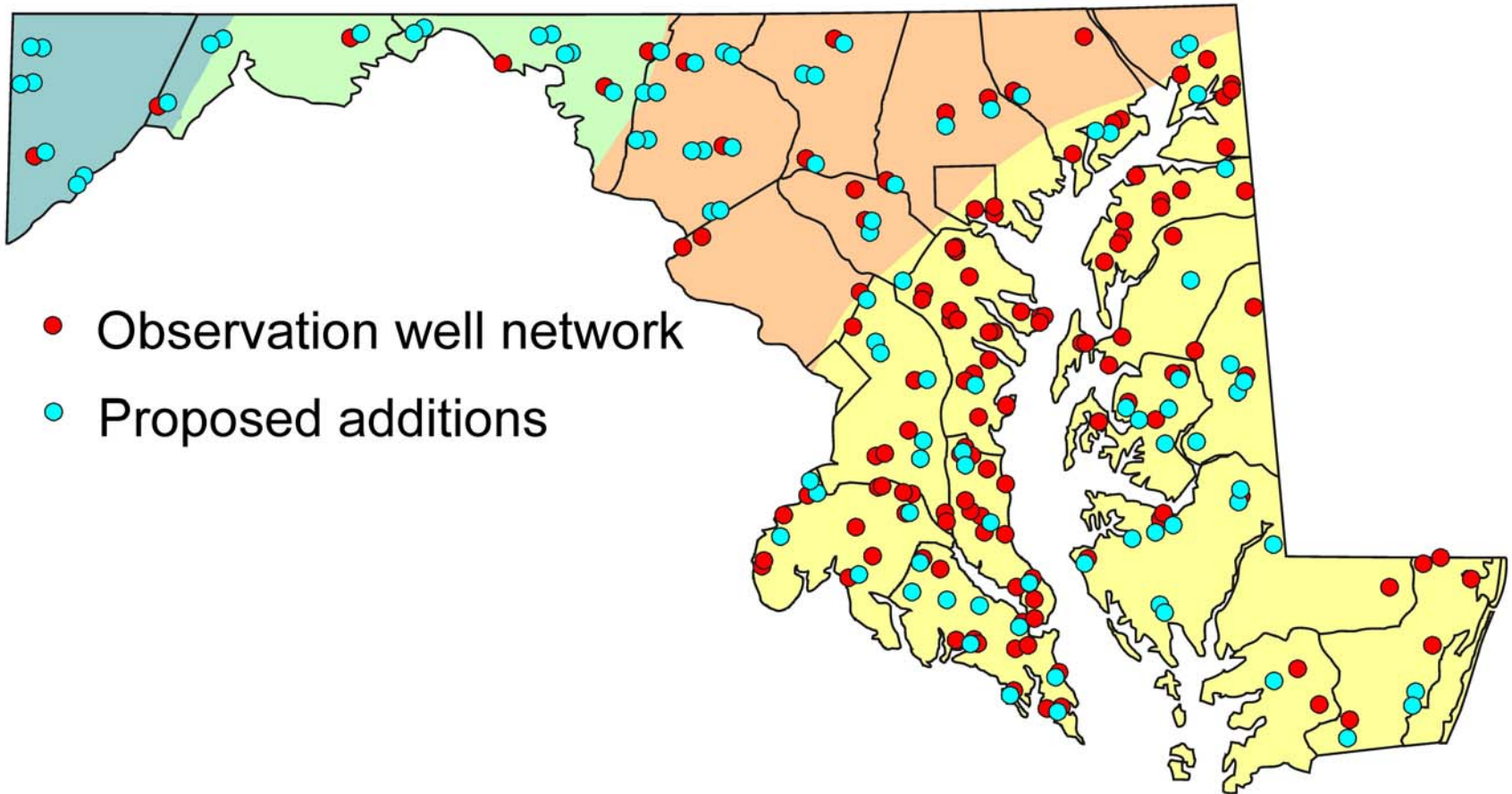
### What's been done:

- Water levels in more than 400 wells statewide are measured on regular basis (USGS database)
- Water-level maps are published every other year; show changes in water levels over the years

### What is needed:

- “Dedicated” observation wells in selected locations
- Support for well maintenance, database management

# Maryland Observation Well Network



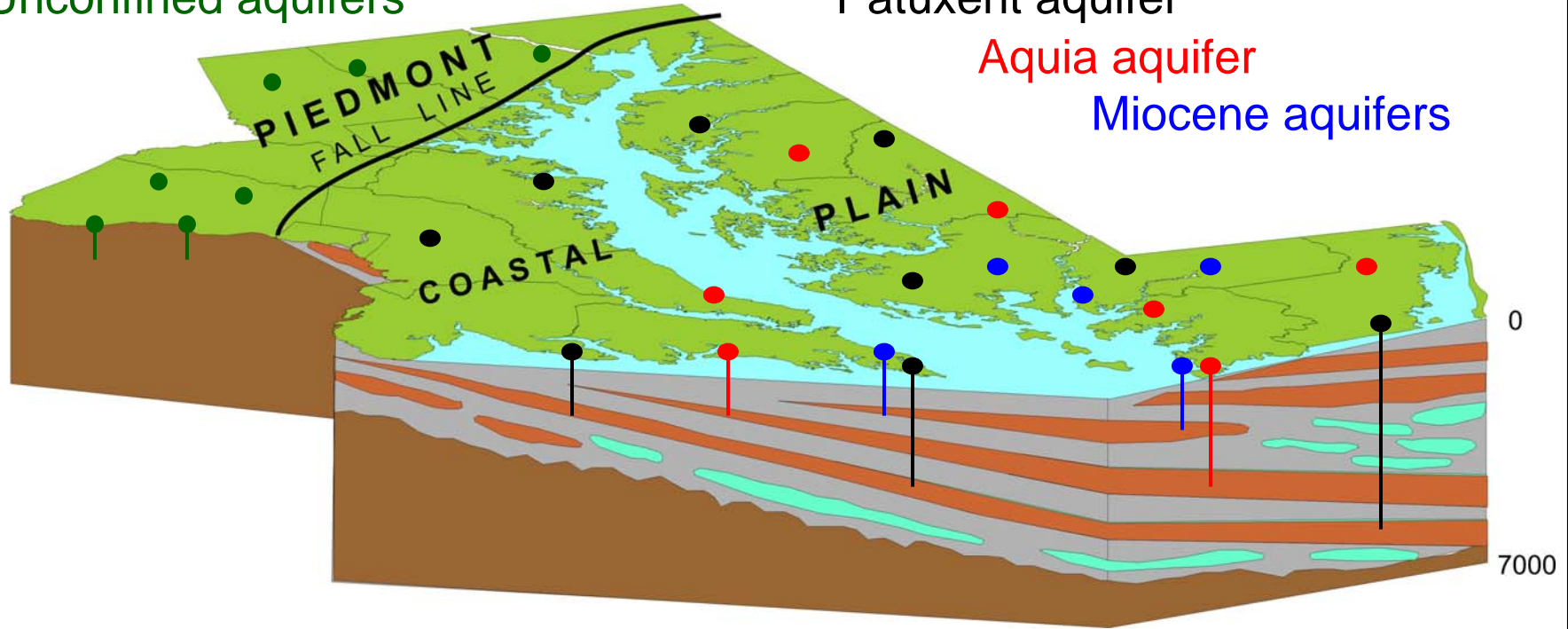
# Ground-Water Level Monitoring Network

Unconfined aquifers

Patuxent aquifer

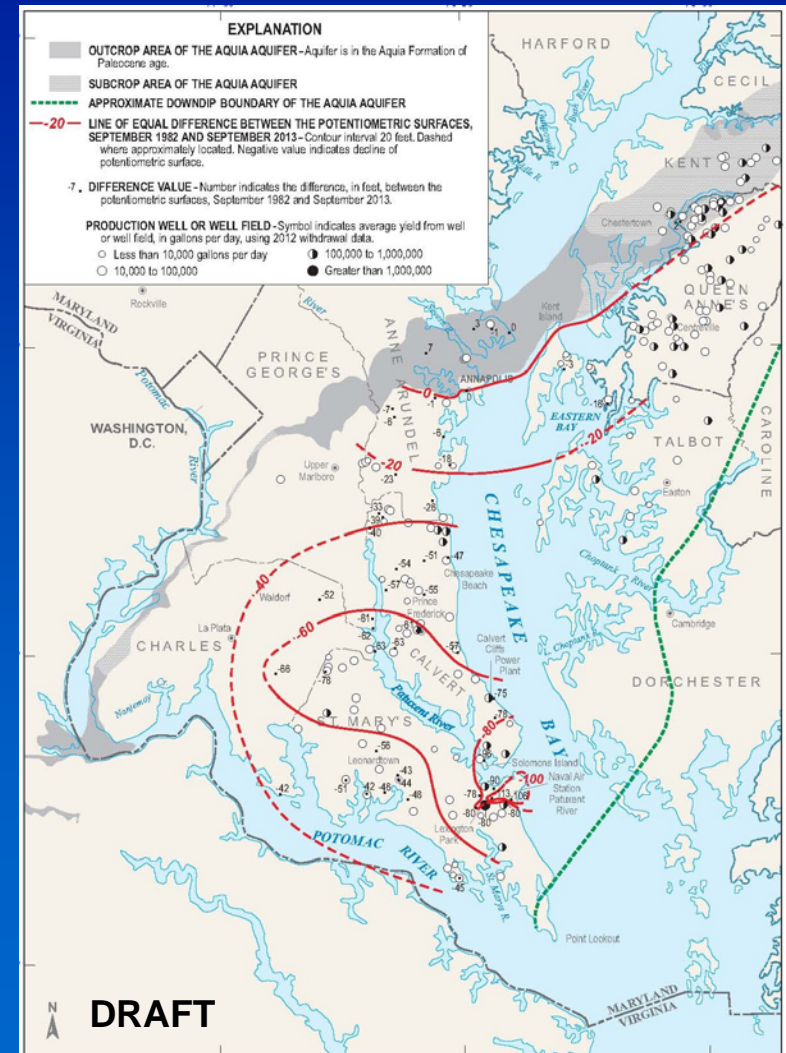
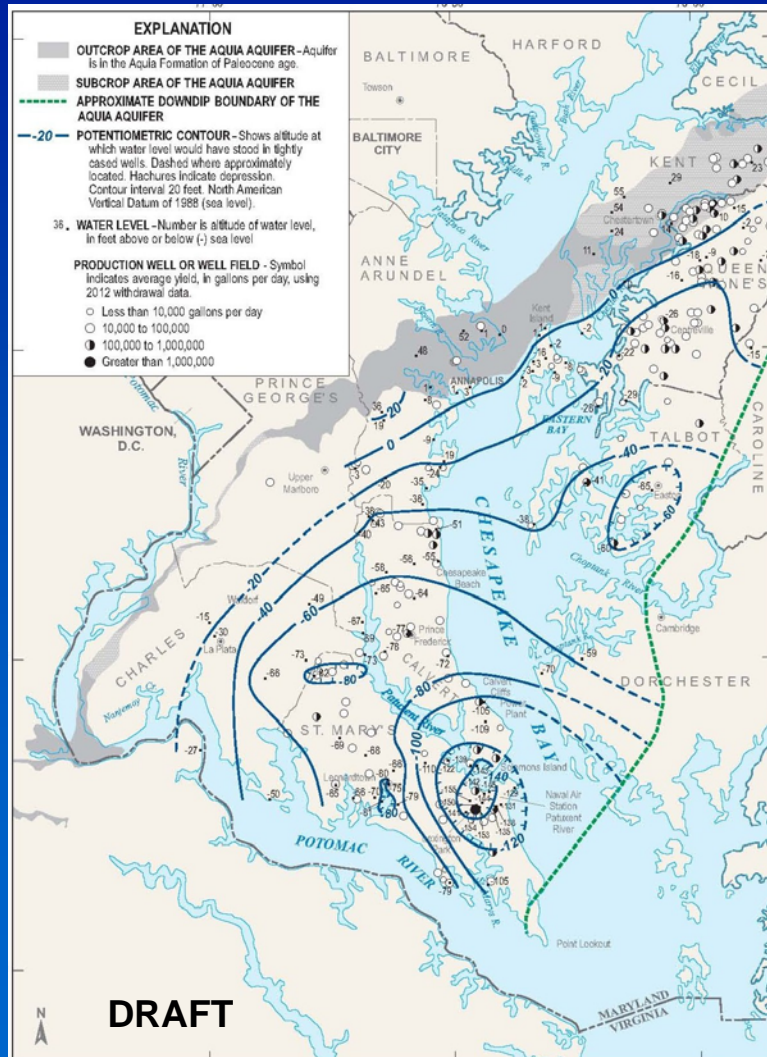
Aquia aquifer

Miocene aquifers



## Science Goal #4 (continued)

# Water levels in Southern Maryland 2013





# Science Goal #5: Ground-water Management Tools

## What's been done:

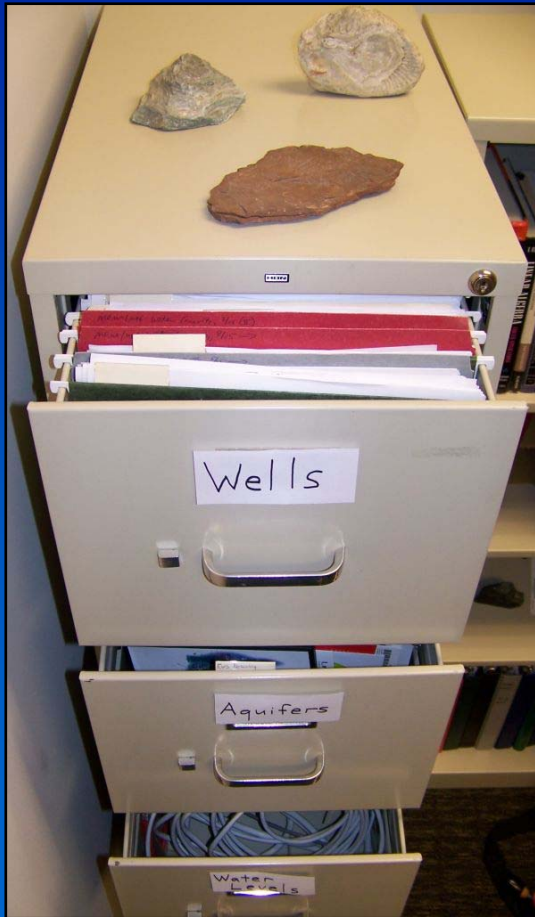
- Development of Maryland Coastal Plain Aquifer Information System (MCPAIS)

## What is needed:

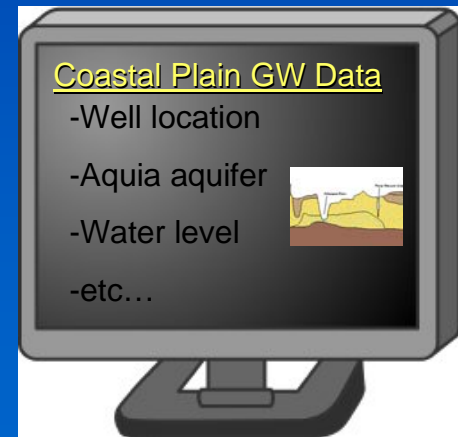
- Ongoing support for MCPAIS:
  - Update with new information
  - Develop web-based system, available to all?
- Development of optimization techniques

# MCPAIS: A Digital Aquifer Information System

MCPAIS allows a user to access, display, manipulate, and eventually port to models, hydrogeologic and water use data for the Atlantic Coastal Plain of Maryland. Output will include maps and various views (including 3 dimensional) of hydrogeologic data, including logs, cross sections, aquifer configurations, head distributions, and areal distribution of wells in the various aquifers.



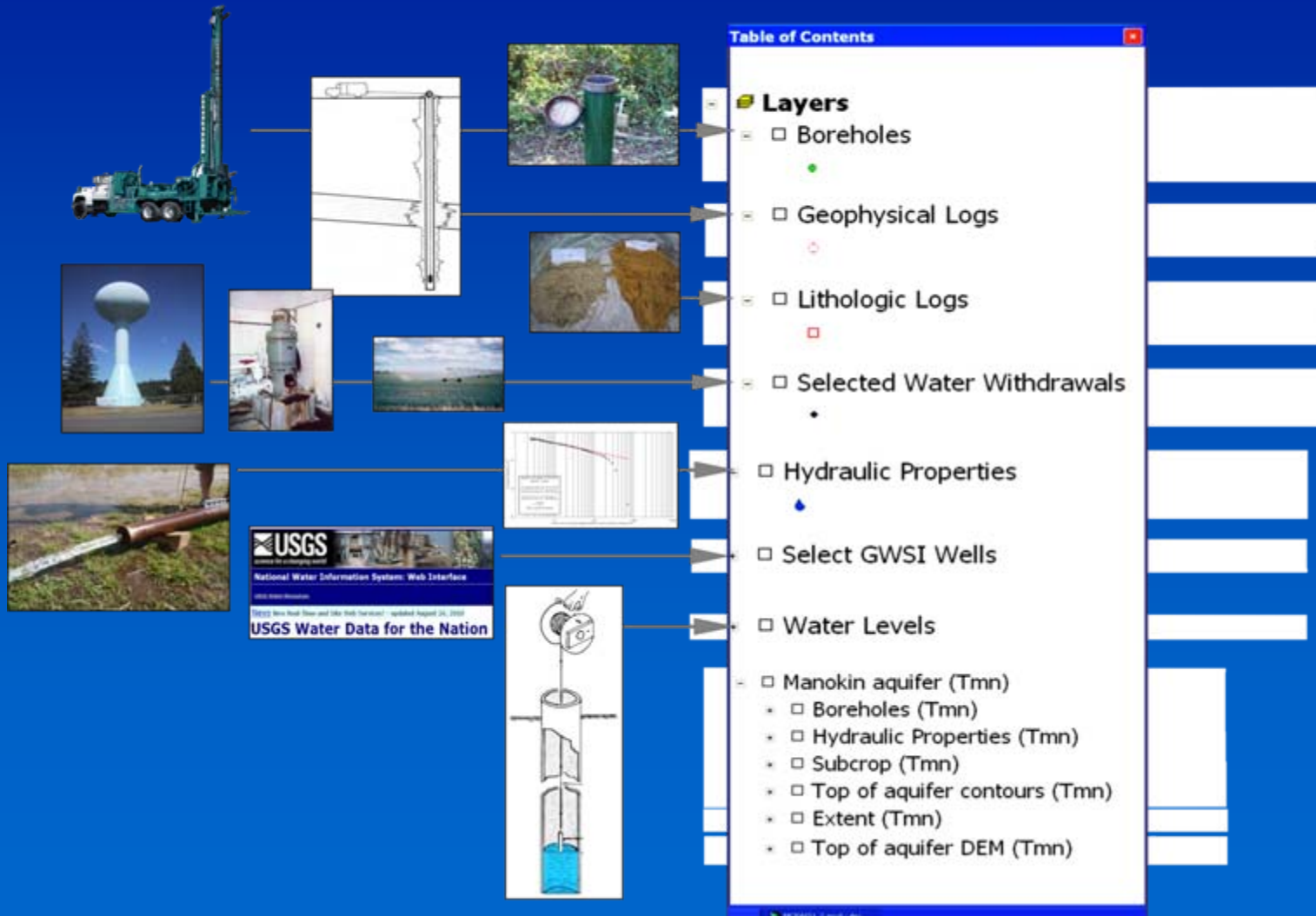
*Changing from a  
paper to digital  
paradigm*



# Maryland Coastal Plain Aquifer Information System

Data Source

MCPAIS Layers





# So...are we running out of water?

## ➤ Do we have a sustainable, safe supply of ground water?

Comprehensive management of aquifers needed, including:

- Development of regional flow model
- Upgrading of the Aquifer Information System
- Optimization techniques
- Water use
- Conservation/infrastructure repair/recycling



# THANK YOU

## Contact information:

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<http://www.mgs.md.gov/>

U.S. Geological Survey MD-DE-DC Water Science Center

<http://md.water.usgs.gov/>

