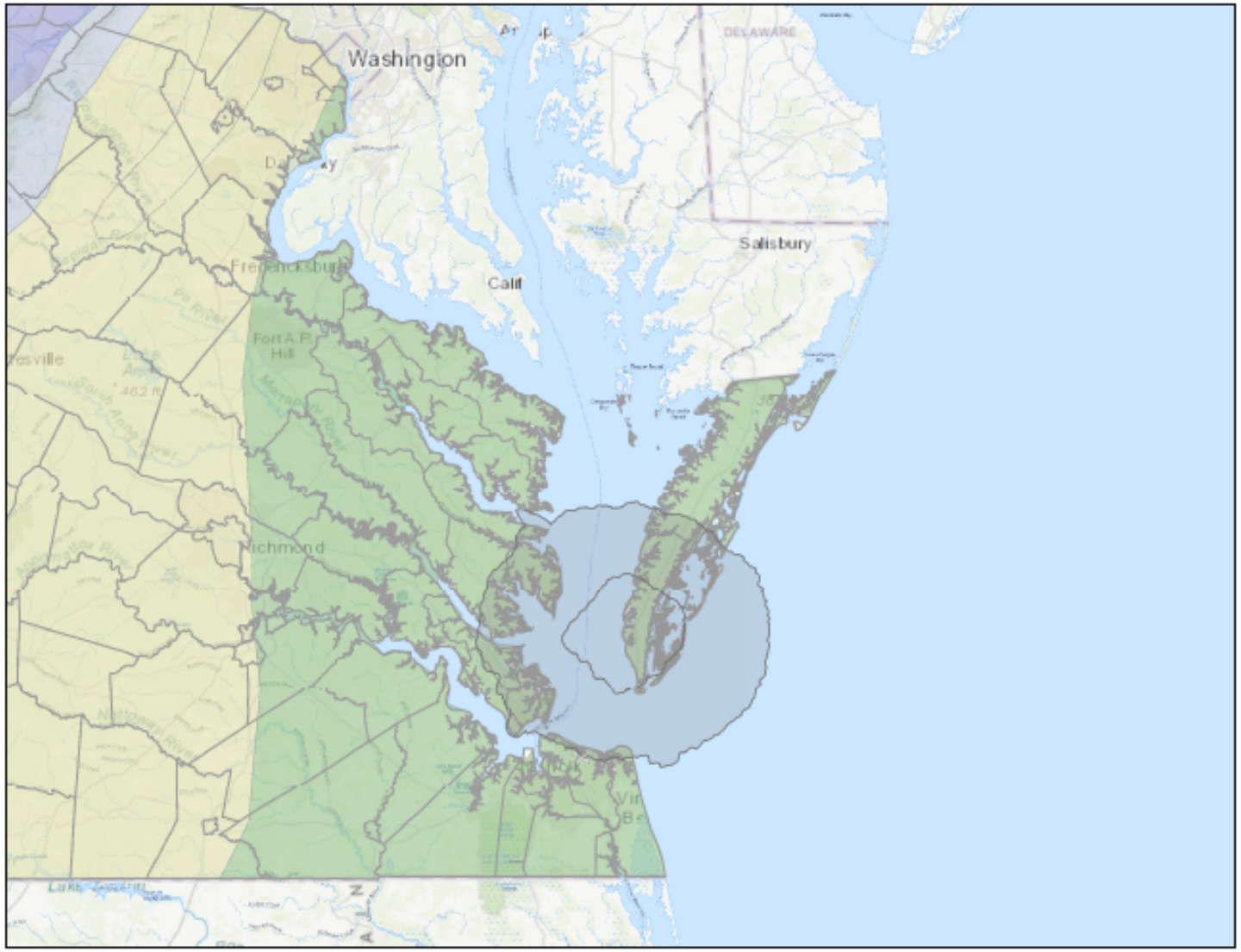

DEQ
VIRGINIA DEPARTMENT OF
ENVIRONMENTAL QUALITY

Groundwater management and regulation in coastal Virginia

Scott Kudlas

Director, Office of Water Supply

Chesapeake Crater outline map



Legend

- c_rim_polygon
- Virginia County Boundaries

Virginia Physiographic Regions

- APPALACHIAN PLATEAUS
- BLUE RIDGE
- COASTAL PLAIN
- PIEDMONT
- VALLEY AND RIDGE

Layers

1 inch = 192,597 feet

0 15 30 60 mi

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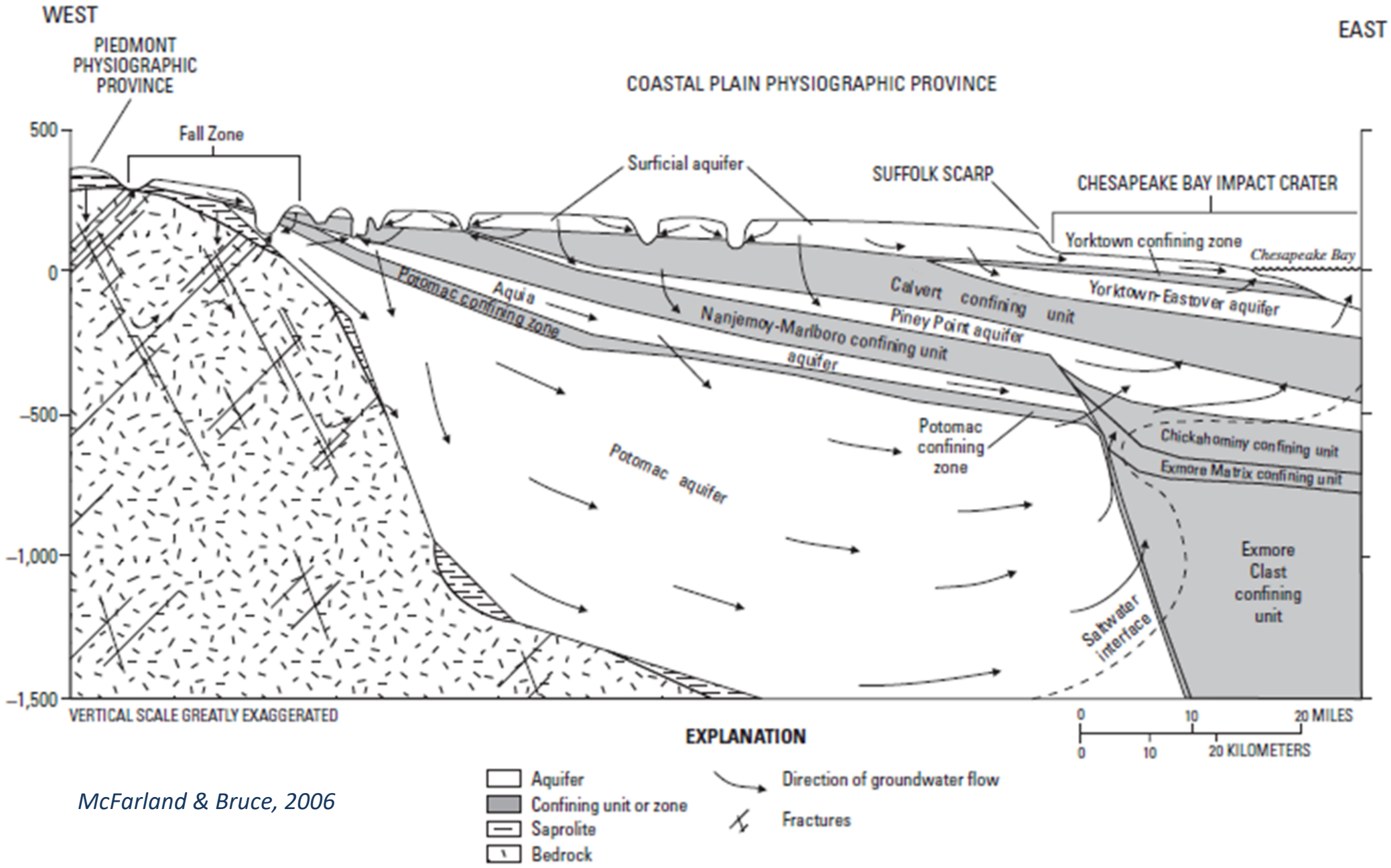

McFarland & Bruce, 2006

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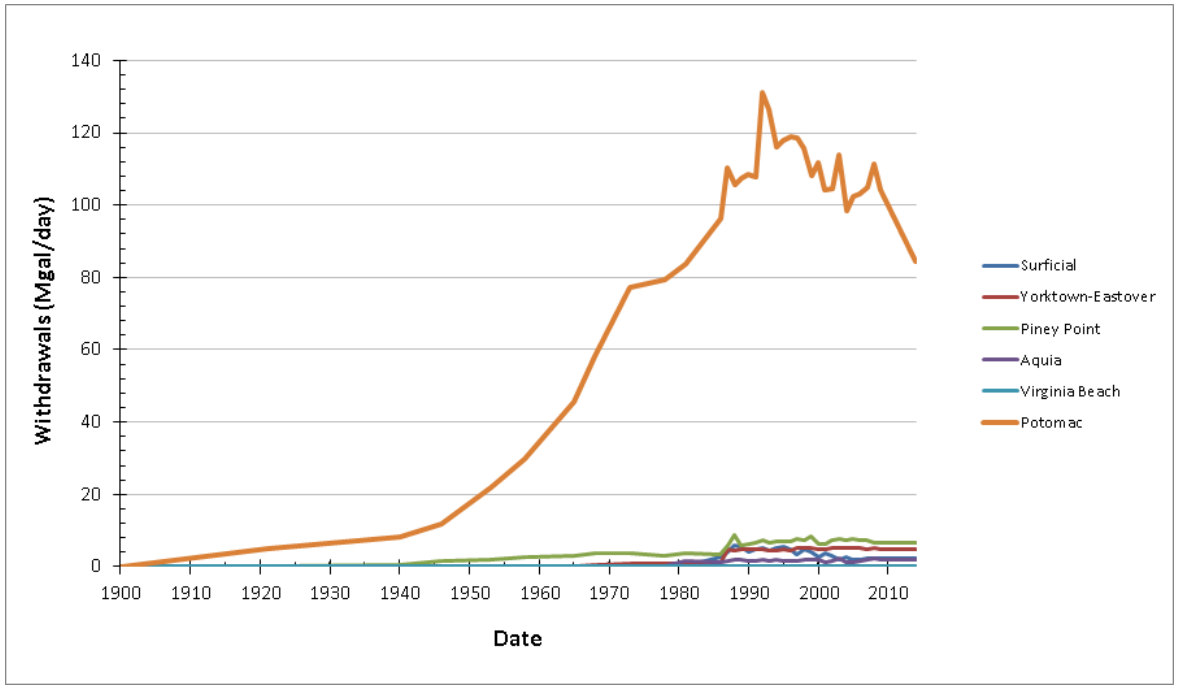
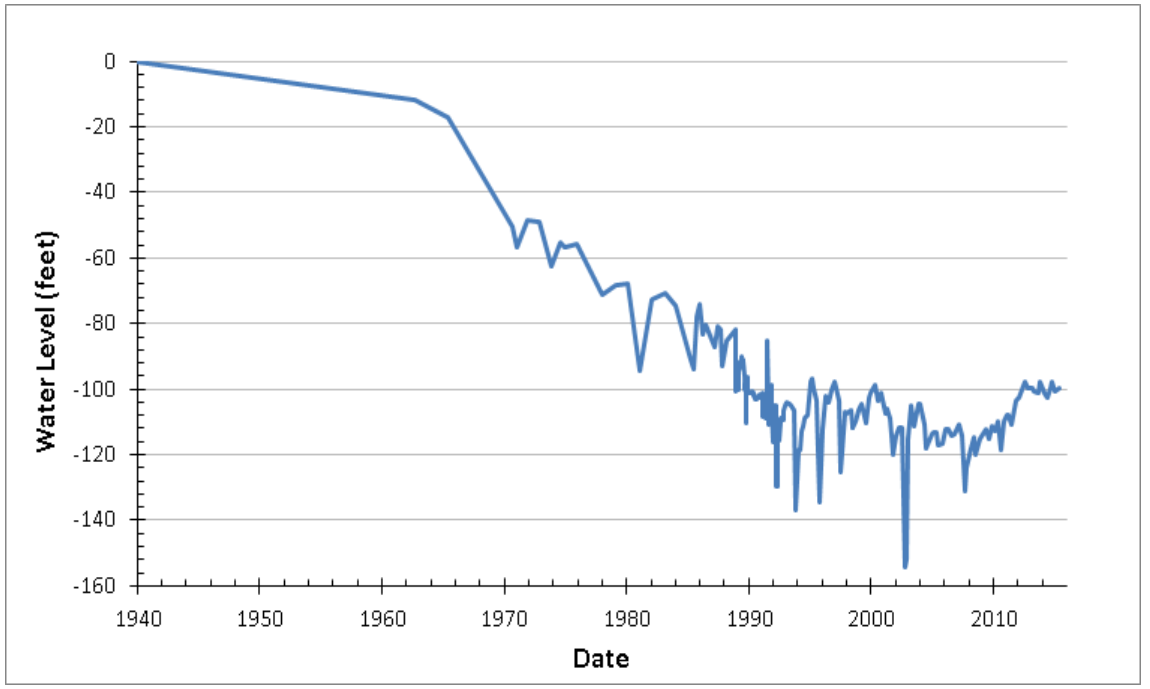
Increases in Withdrawal





Decreases in Groundwater Level

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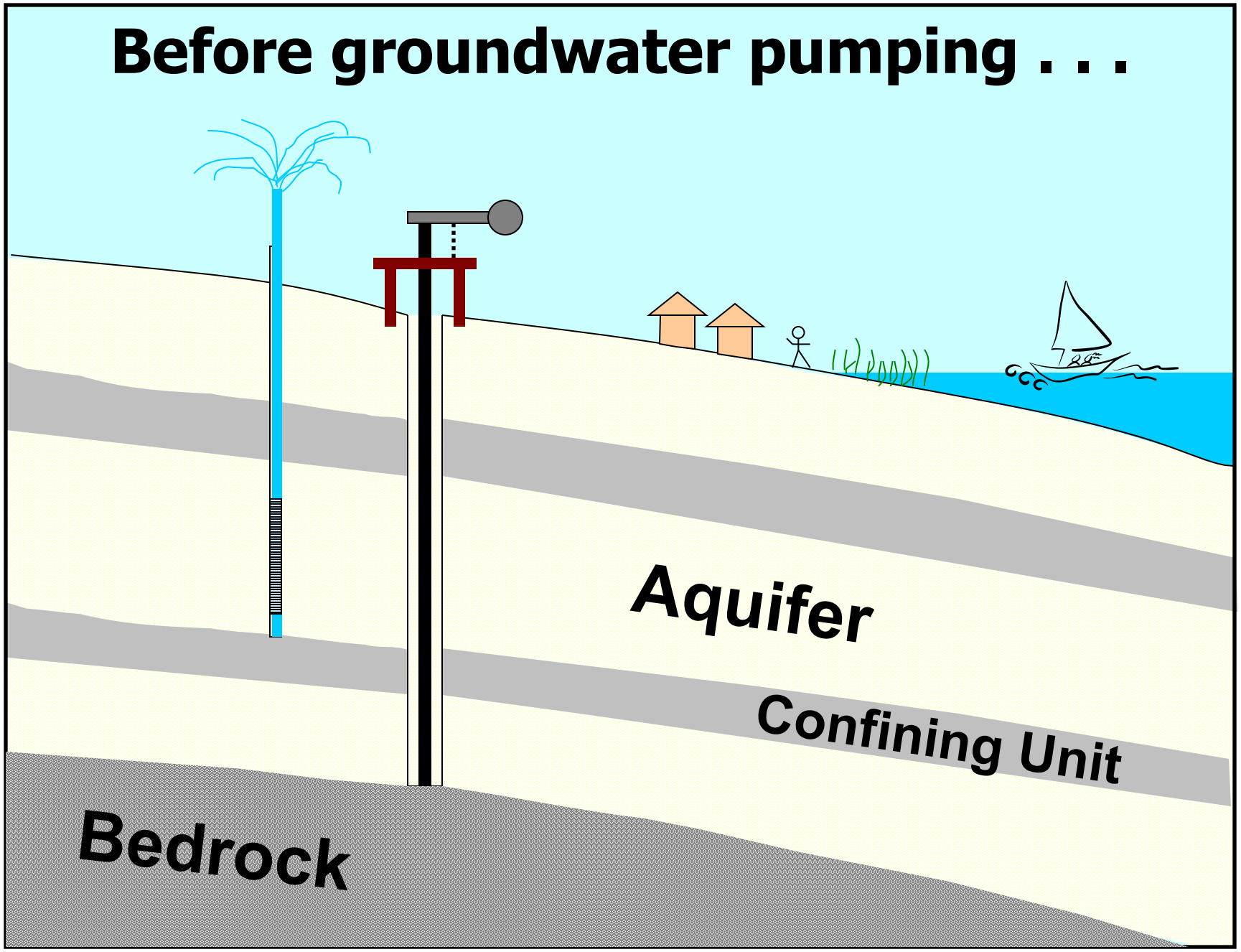
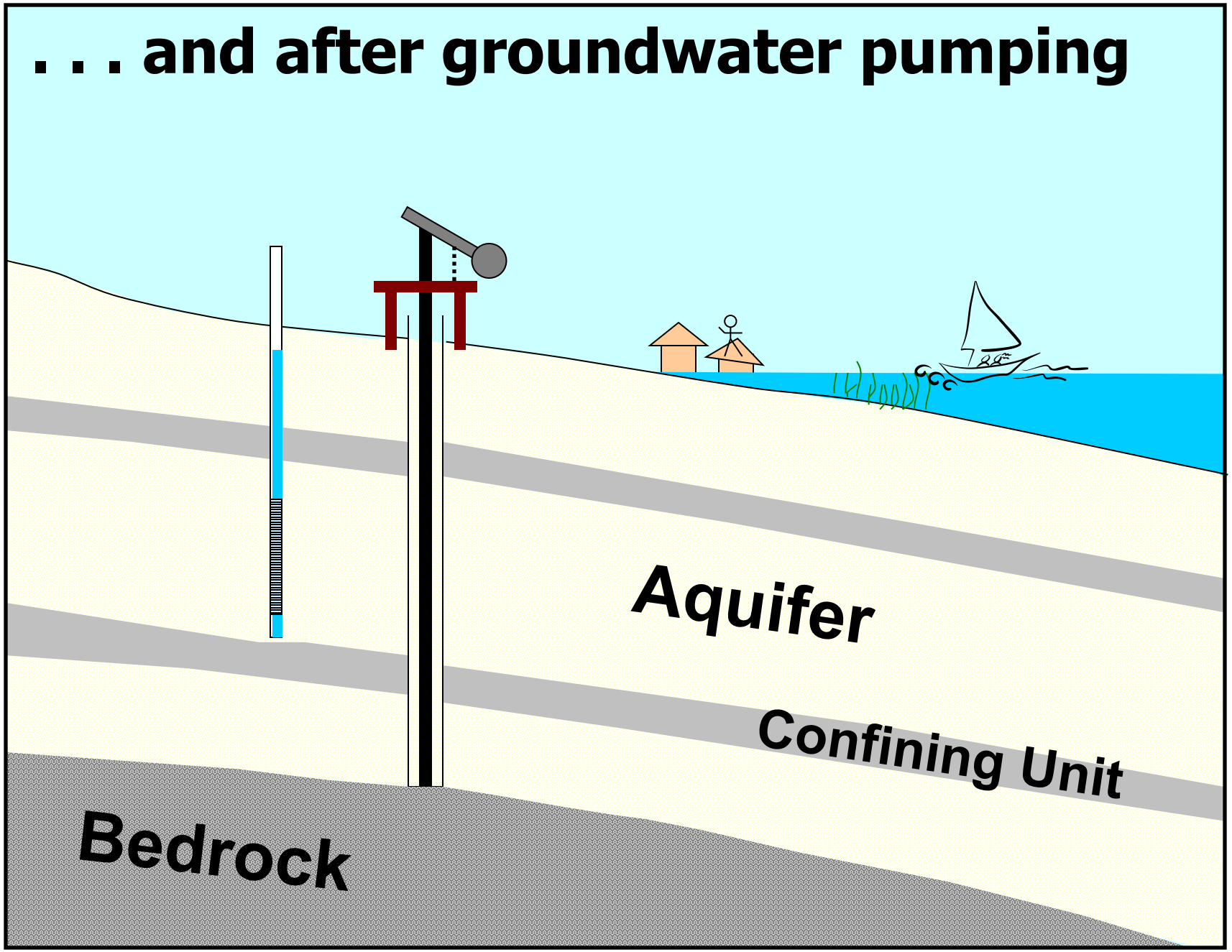
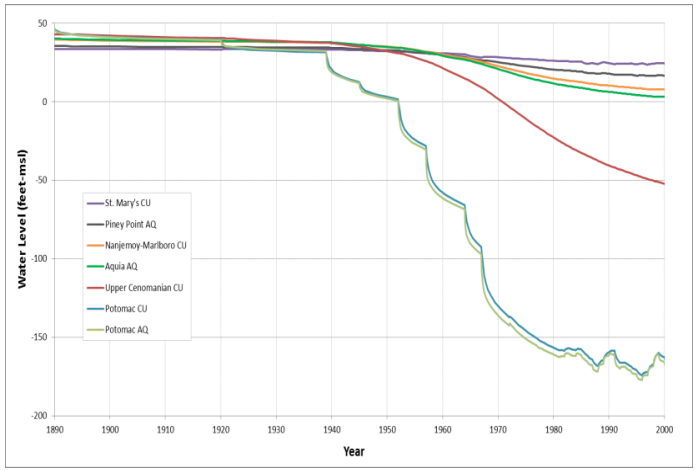
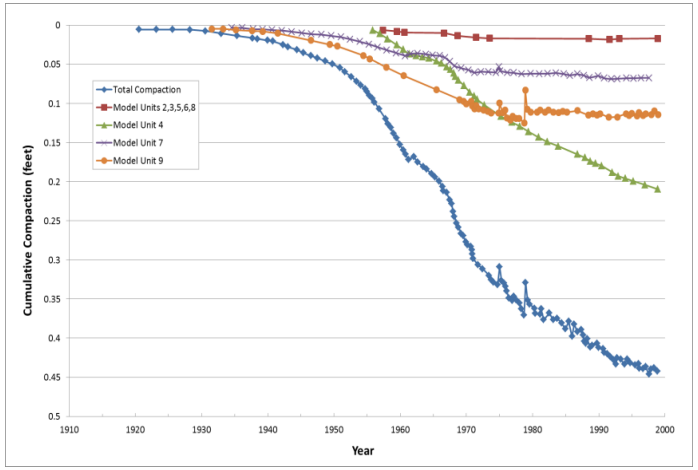

Before groundwater pumping . . .
Aquifer
Confining Unit
Bedrock


. . . and after groundwater pumping
Aquifer
Confining Unit
Bedrock

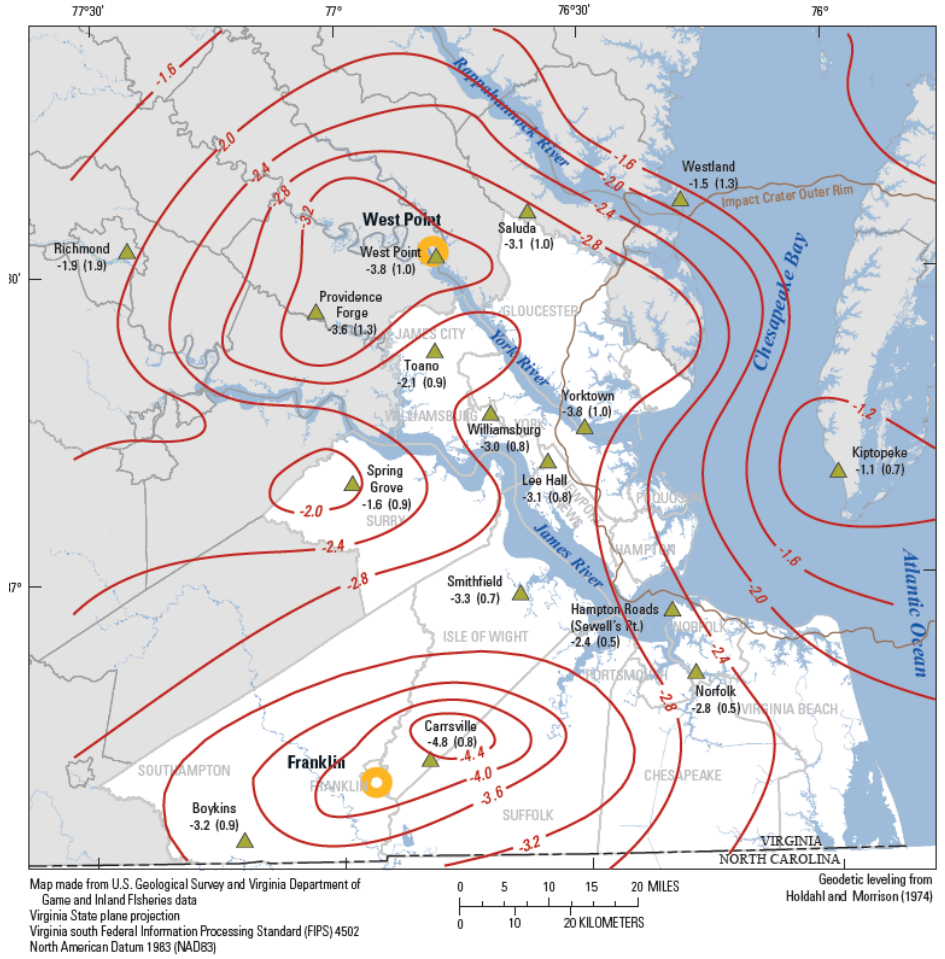
Subsidence Reflects Groundwater Level



VAHydro-GW simulated water levels at the Franklin

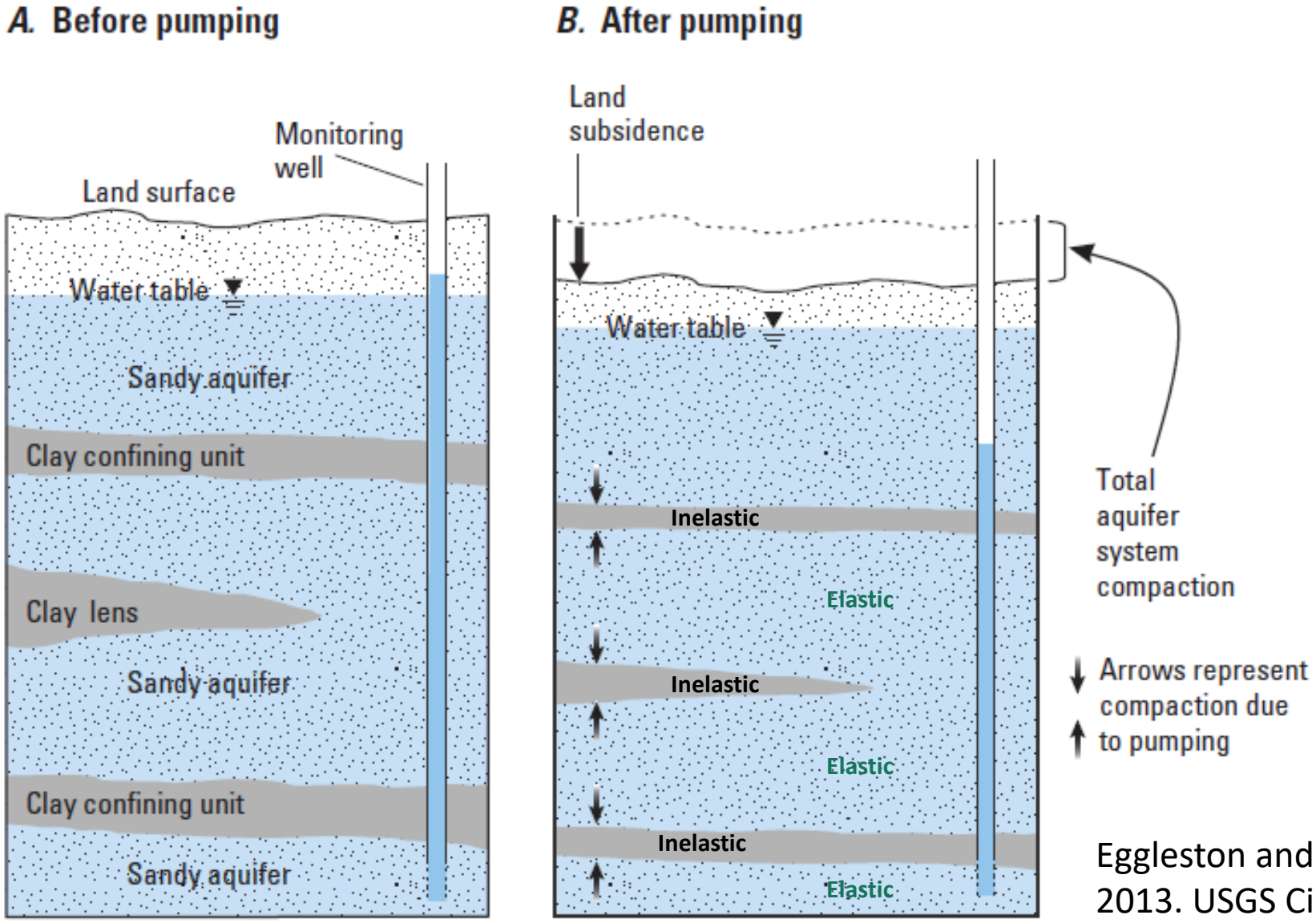


COMPAC simulated aquifer-system compaction at Franklin



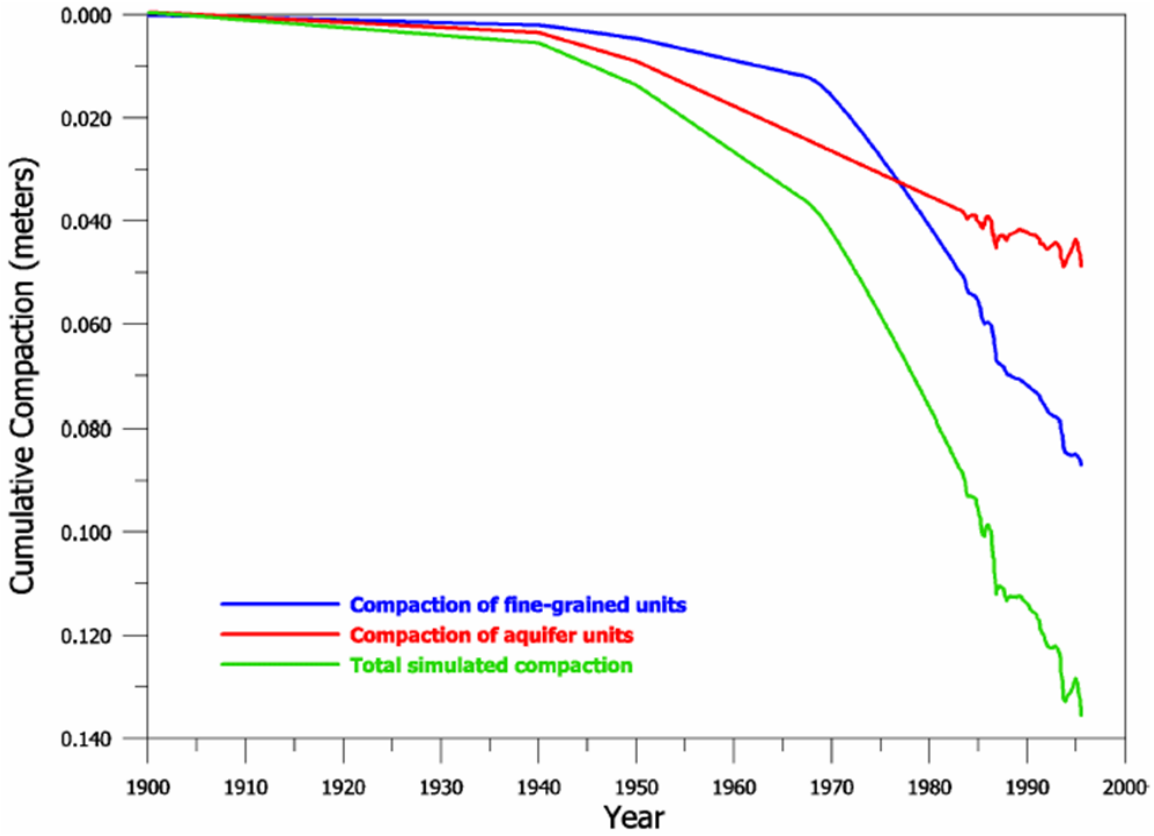
Land elevation change rates from 1940 - 1971 (mm/year)
Negative elevation rates indicate subsidence

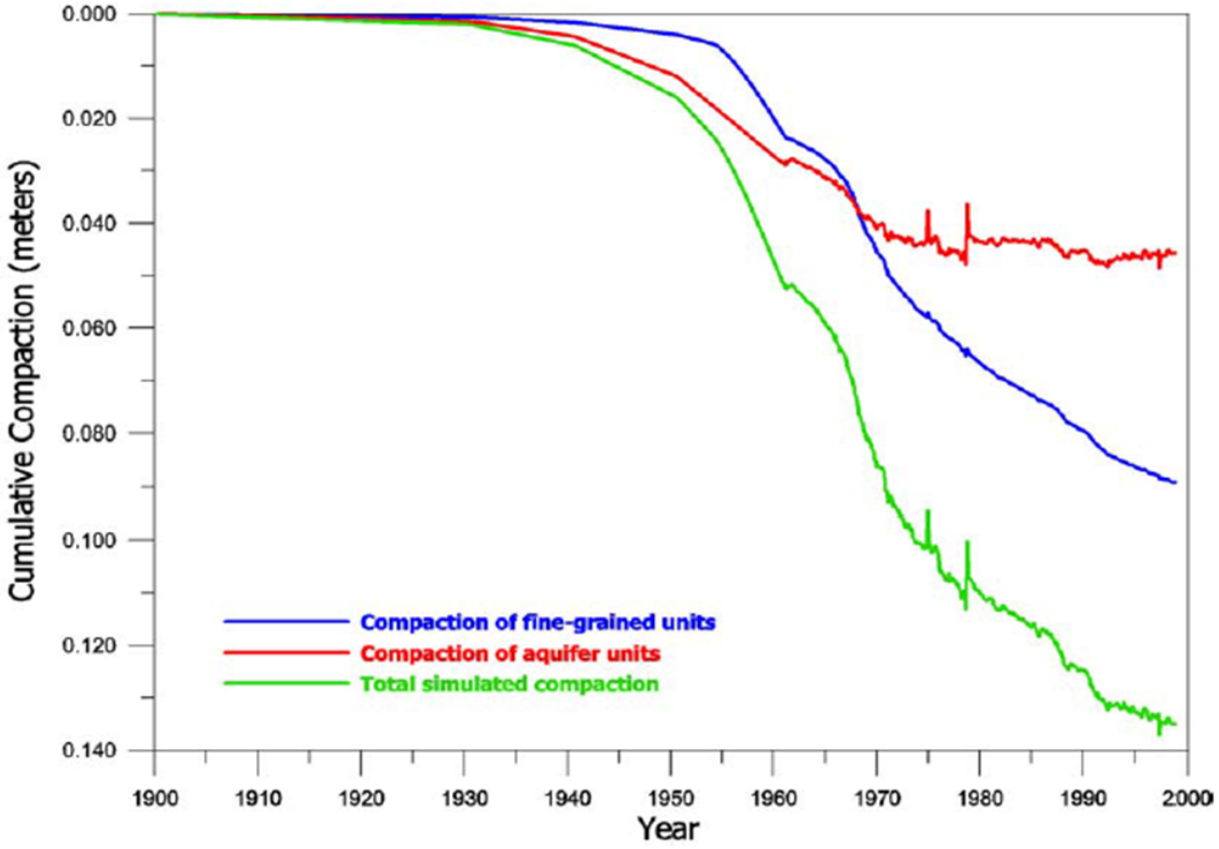
Groundwater Level Declines – Potomac Aquifer



Eggleston and Pope, 2013. USGS Circular 1392

Simulated Compaction at Suffolk





Simulated Compaction at Franklin

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Regional Land Subsidence in Southern Chesapeake Bay Region: Likely Causes

Likely Possible Cause	Rate (mm/yr)	Possible to Reduce or Prevent
Aquifer Compaction / Groundwater Pumping	**1.6 – 3.7**	**Yes**
Glacial Isostatic Adjustment	**1 ?**	**No**

Unlikely Possible Causes:

- **Impact crater settling**
- **Bedrock dissolution**
- **Volcanic or tectonic movement**
- **Organic soil drainage/degradation**

Eggleston and Pope, 2013. USGS Circular 1392

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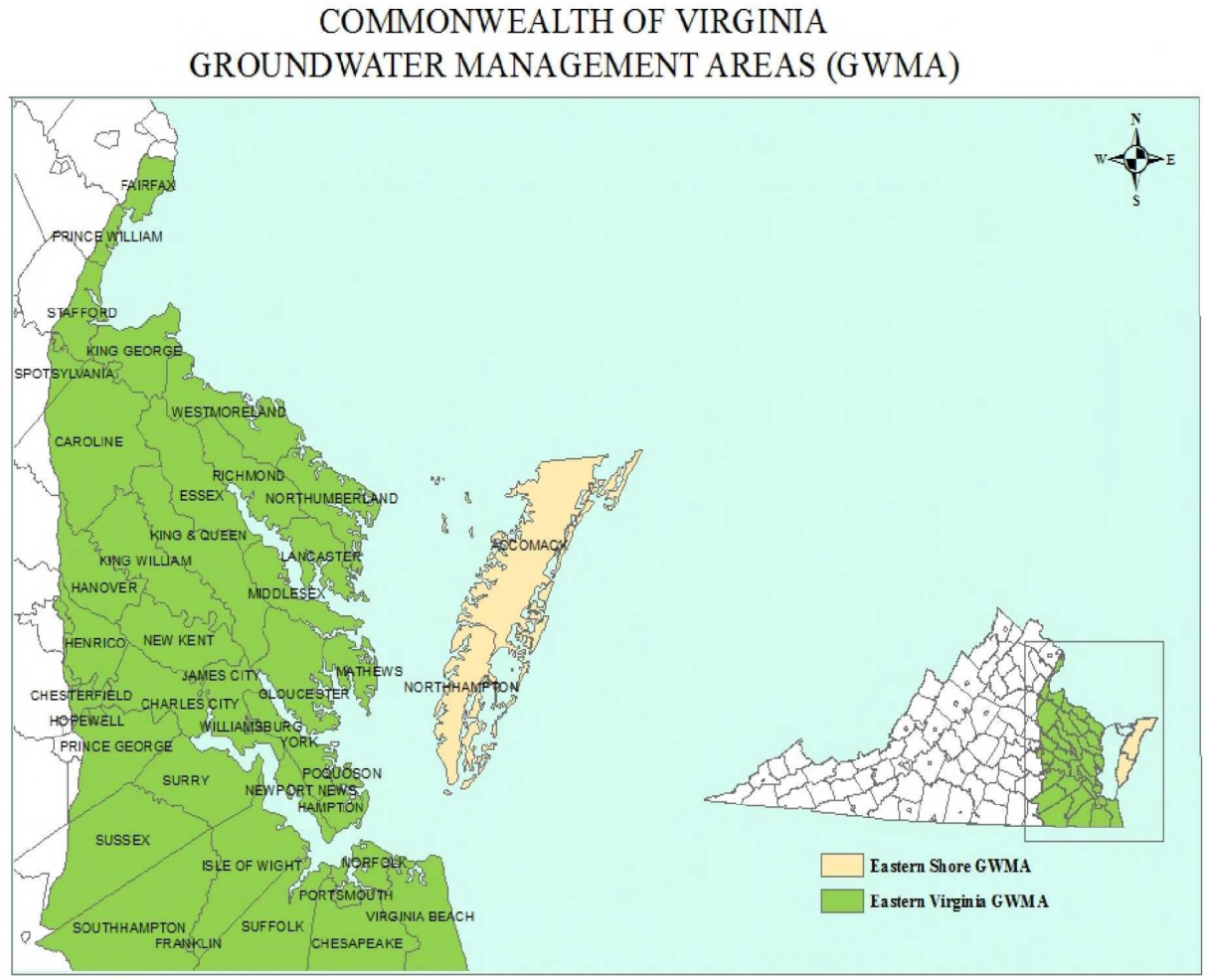
Groundwater Management Issues

- Declining water levels
- Reversal of the hydraulic gradient (groundwater flow) leads to salt water intrusion
- Subsidence and loss of storage



Effective: January 1, 2014
Prepared By: Virginia Department of Environmental Quality
Groundwater Withdrawal Permitting Program

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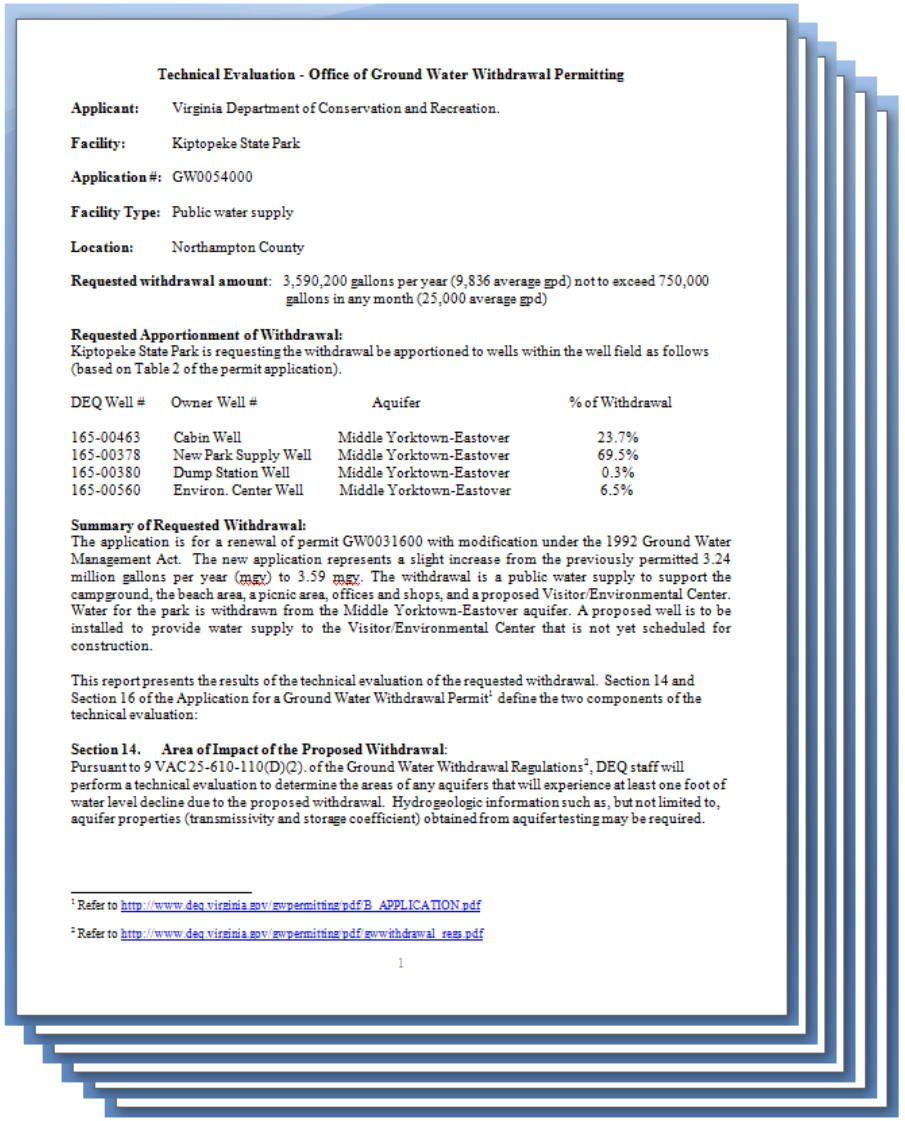
Permit Program Evaluation

- ANY user in a GROUND WATER MANAGEMENT AREA whose ground water withdrawals exceed 300,000 gallons in a month
- Approval is based on geo-technical analysis and modeling:
  - Compare hydrogeologic framework
  - Compare water levels
  - Analyze aquifer pump tests
  - Run appropriate regional model
  - Determine Area of Impact (AOI)
  - Evaluate 80% drawdown criteria
  - Assess adverse water quality changes



Technical Evaluation - Office of Ground Water Withdrawal Permitting

Applicant: Virginia Department of Conservation and Recreation.

Facility: Kiptopeke State Park

Application #: GW0054000

Facility Type: Public water supply

Location: Northampton County

Requested withdrawal amount: 3,590,200 gallons per year (9,836 average gpd) not to exceed 750,000 gallons in any month (25,000 average gpd)

Requested Apportionment of Withdrawal:
Kiptopeke State Park is requesting the withdrawal be apportioned to wells within the well field as follows (based on Table 2 of the permit application).

DEQ Well #	Owner Well #	Aquifer	% of Withdrawal
165-00463	Cabin Well	Middle Yorktown-Eastover	23.7%
165-00378	New Park Supply Well	Middle Yorktown-Eastover	69.5%
165-00380	Dump Station Well	Middle Yorktown-Eastover	0.3%
165-00560	Environ. Center Well	Middle Yorktown-Eastover	6.5%

Summary of Requested Withdrawal:
The application is for a renewal of permit GW0031600 with modification under the 1992 Ground Water Management Act. The new application represents a slight increase from the previously permitted 3.24 million gallons per year (mgy) to 3.59 mgy. The withdrawal is a public water supply to support the campground, the beach area, a picnic area, offices and shops, and a proposed Visitor/Environmental Center. Water for the park is withdrawn from the Middle Yorktown-Eastover aquifer. A proposed well is to be installed to provide water supply to the Visitor/Environmental Center that is not yet scheduled for construction.

This report presents the results of the technical evaluation of the requested withdrawal. Section 14 and Section 16 of the Application for a Ground Water Withdrawal Permit[1] define the two components of the technical evaluation:

Section 14. Area of Impact of the Proposed Withdrawal:
Pursuant to 9 VAC 25-610-110(D)(2). of the Ground Water Withdrawal Regulations[2], DEQ staff will perform a technical evaluation to determine the areas of any aquifers that will experience at least one foot of water level decline due to the proposed withdrawal. Hydrogeologic information such as, but not limited to, aquifer properties (transmissivity and storage coefficient) obtained from aquifer testing may be required.

[1] Refer to http://www.deq.virginia.gov/gwpermitting/pdf/B_APPLICATION.pdf

[2] Refer to http://www.deq.virginia.gov/gwpermitting/pdf/gwwithdrawal_regs.pdf

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Manage Groundwater Levels = Manage subsidence

- Assume by managing groundwater levels we can restore some elastic storage and minimize future loss of inelastic storage
  - Permit by permit changes are barely measurable
  - Permit time step is 15 years; subsidence happens over much longer time steps
- SWIFT has the potential to recover more elastic storage faster than through individual permits
- Need to look at this as a long-term management issue

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Questions??

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https://www.deq.virginia.gov/Programs/Water/WaterSupplyWaterQuantity.aspx

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