Regional Resiliency Efforts in Hampton Roads

JOINT SUBCOMMITTEE ON COASTAL FLOODING

JUNE 20, 2017

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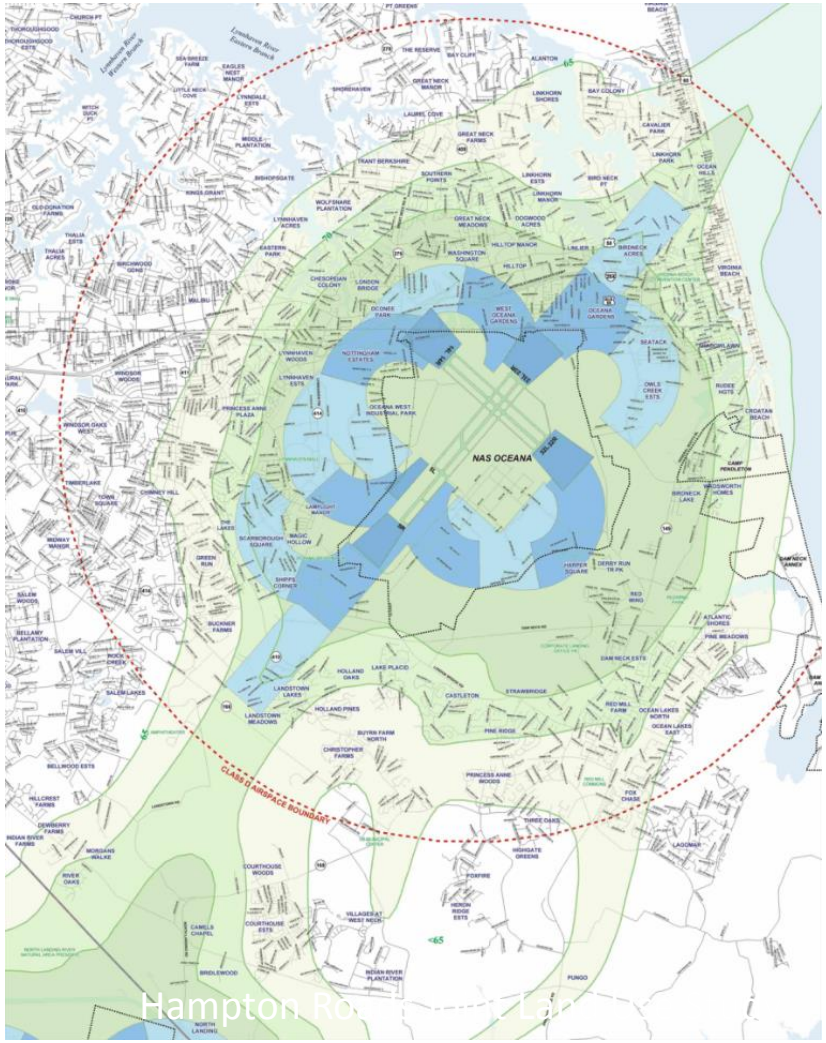
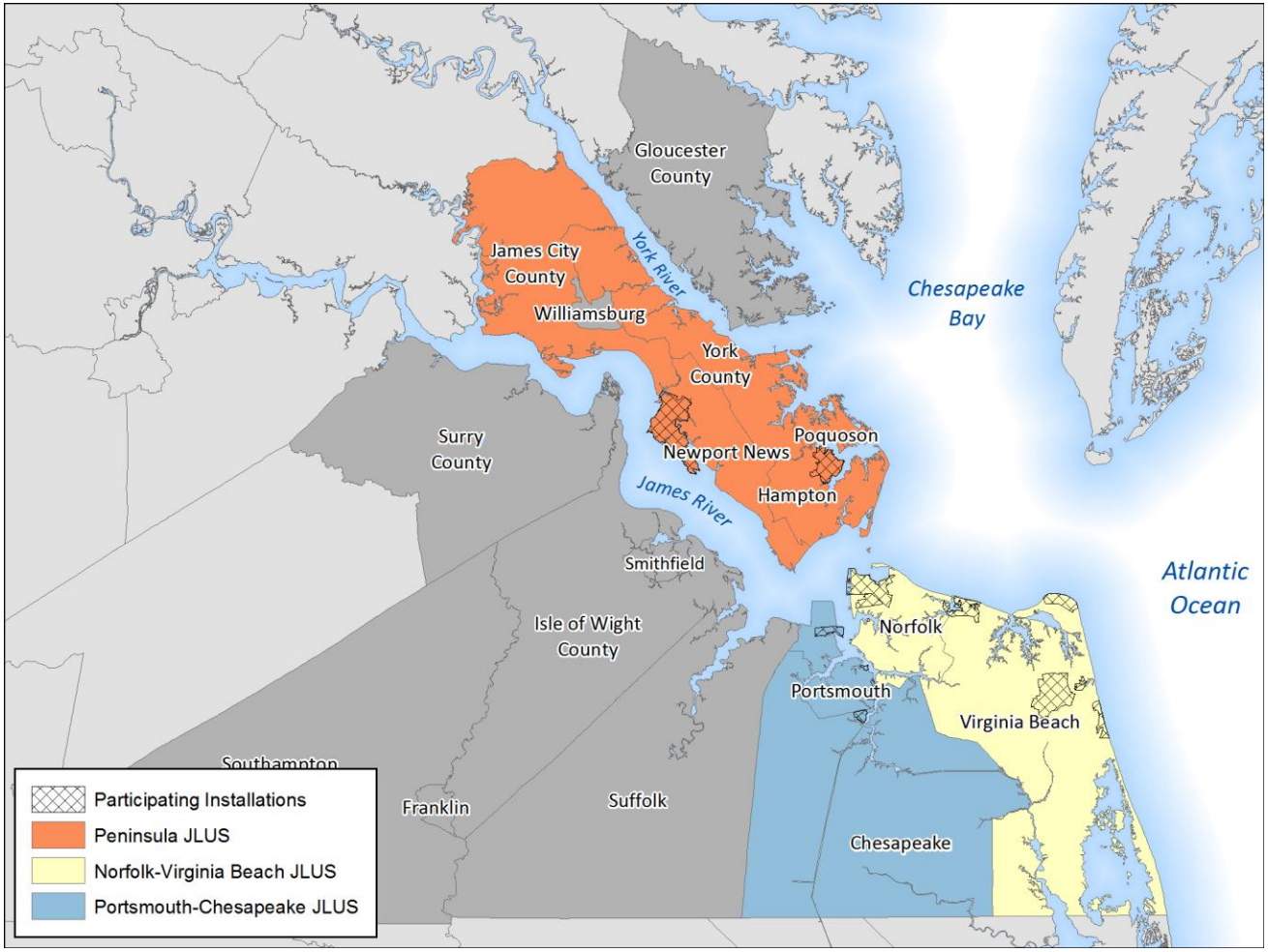
DOD – Joint Land Use Studies



The JLUS process helps communities identify and address concerns of military installations

- NAS Oceana and Fentress
- Langley AFB

DOD – Joint Land Use Studies



Localities Participating in JLUS Projects in Hampton Roads

Joint Land Use Studies in HR

Joint Base Langley-Eustis

- Hampton, James City County, Newport News, Poquoson, York
- Comprehensive JLUS for Joint Base Eustis
- Flooding/Sea Level Rise focus for Joint Base Langley

JEB Little Creek-Fort Story, NAS Oceana, NS Norfolk, NSA Hampton Roads

- Norfolk, Virginia Beach
- Focus on Sea Level Rise/Flooding

NSA Hampton Roads-Portsmouth, NSC Craney Island, Norfolk Naval Shipyard (coming soon)

- Comprehensive JLUS – transportation, land use, flooding

Norfolk-Virginia Beach JLUS

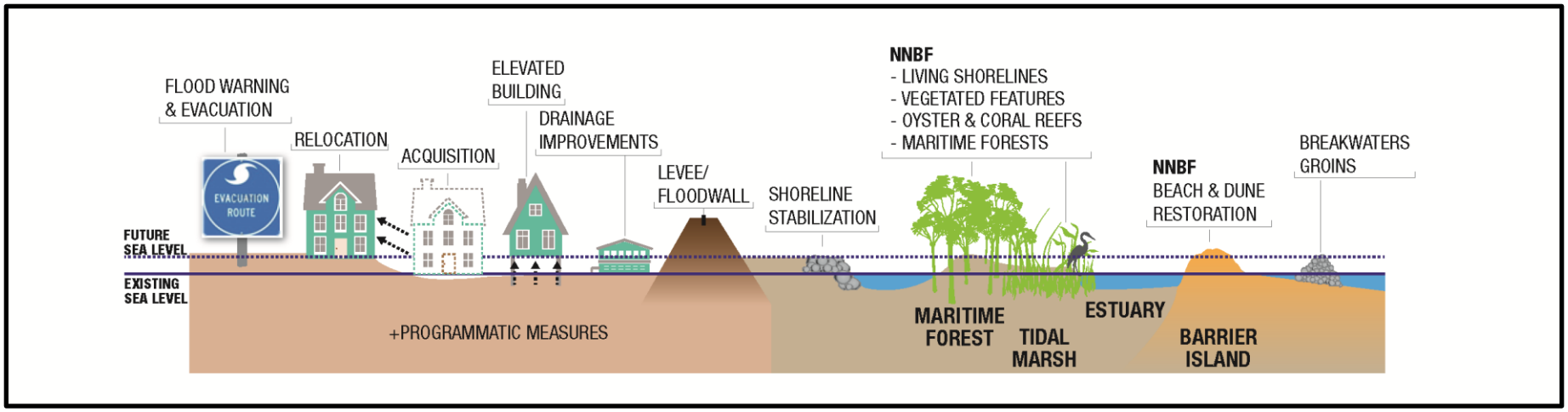
Early takeaways from stakeholder interviews:

- Transportation is a significant issue for all of the Navy installations in the study
  - Access via roads that flood (Shore Dr., Hampton Blvd.)
  - Neighborhood impacts during high traffic periods
  - Emergency access to Sandbridge community in Virginia Beach through Dam Neck Annex
- Coordination on land use proposals remains a focus and a challenge
- Limited institutionalized processes for communicating between cities and installations
- Difficult for cities to and Navy to conduct joint planning (e.g. comprehensive plans, Corps 3x3x3 studies)
- Opportunities for expanding transit access to Naval Station Norfolk and NSA Hampton Roads
- Concern about the impacts of larger ships visiting the port on Navy operations

USACE – 3x3x3 Studies

- **3** Year study duration
- **$3** million maximum cost per study
- **3** Corps command levels

Authorization by Congress → Selection for Funding → Commitment of Matching Funds



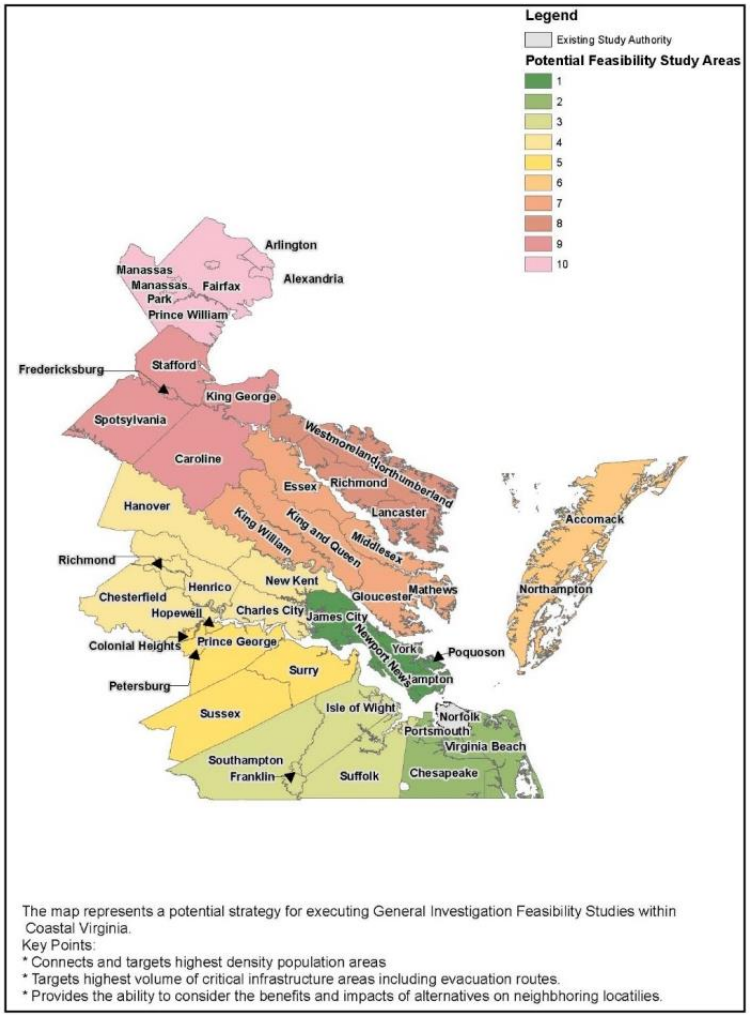
U.S. Army Corps of Engineers

Norfolk Coastal Storm Risk Management Study

Partnership between the City of Norfolk and the USACE

- 3 year effort (currently in year 2)
- $3 million total budget
- Considering many potential measures:
  - Floodwalls
  - Levees
  - Surge barriers
  - Pump stations
  - Elevation or acquisition of real estate
- Next step: Tentatively Selected Plan Milestone (August 2017)
- More information: http://www.nao.usace.army.mil/NCSRM/

USACE – 3x3x3 Studies



U.S. Army Corps of Engineers

Multi-jurisdictional studies have several benefits

- More communities studied
- Less redundancy
- Opportunities for solutions across boundaries

Localities need to work with state to prioritize study areas

USACE – 3x3x3 Studies

In 2016, HRPDC coordinated with other coastal PDCs and the Corps to apply for Coastal Virginia Water Resources Authority

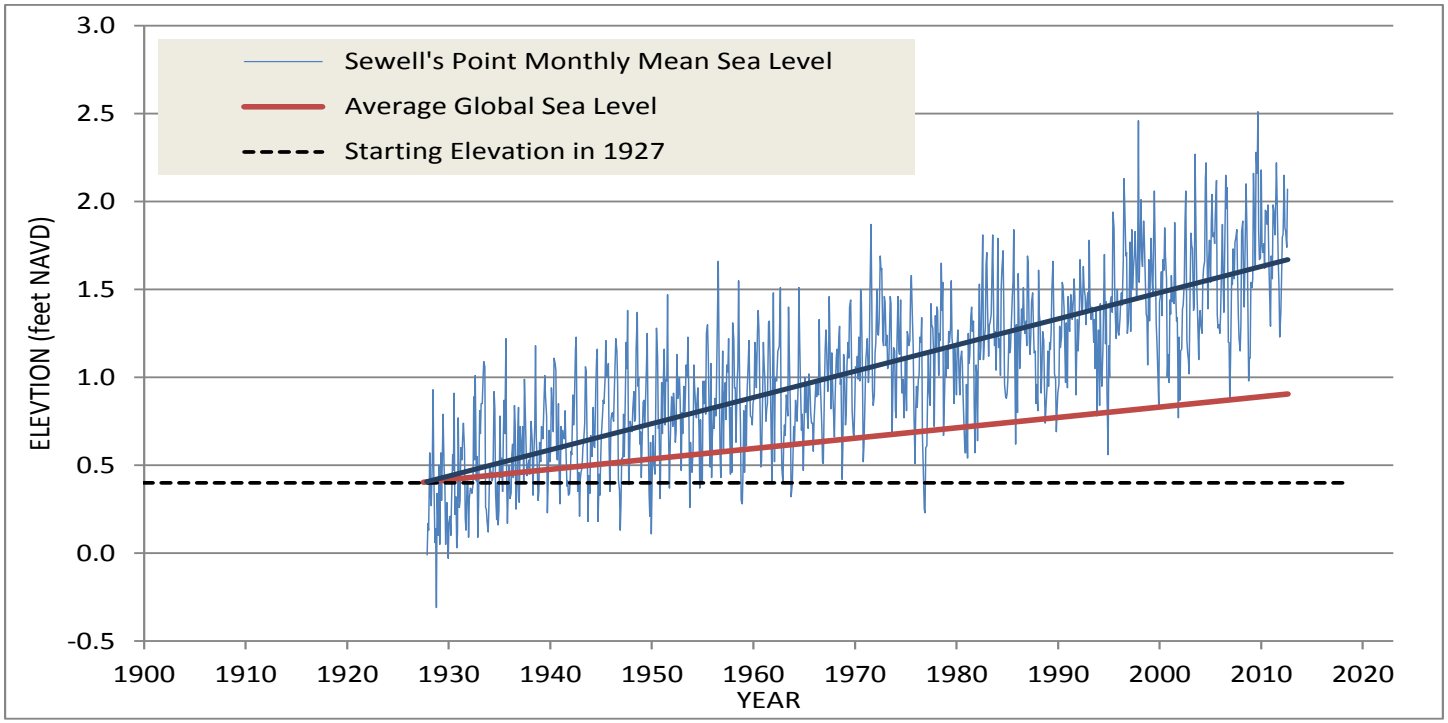
- Would provide authority for studies addressing flooding, erosion, sea level rise, and other water resources issues
- Authority for studies throughout Coastal Virginia

Proposal was considered along with 52 other proposals nationwide for the 2017 Report to Congress and was **one of 13** to meet all the criteria for inclusion

Next step: Congress

Relative Sea Level Rise in Hampton Roads

Relative sea level rise in region is 3.9 mm/year compared to global average of 1.8 mm/year.



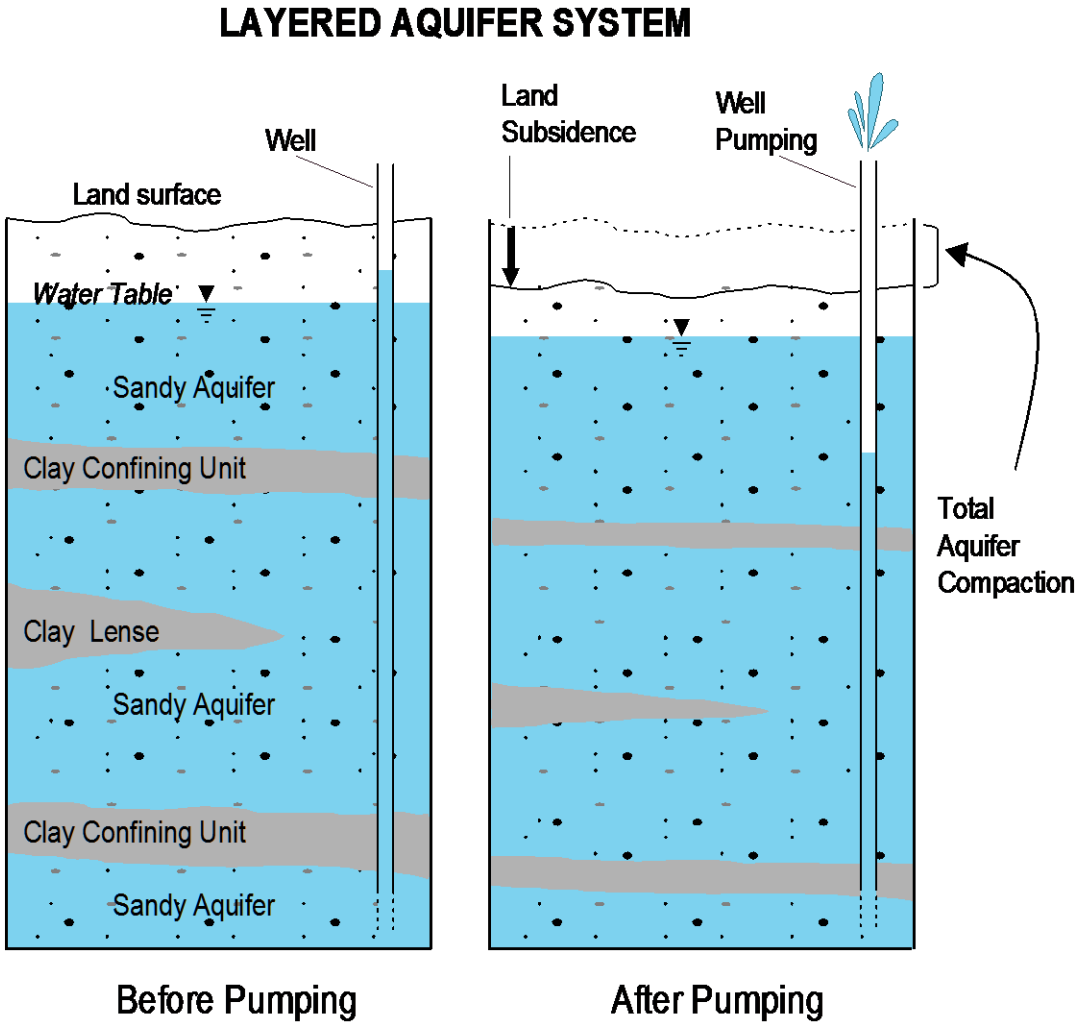
Tidal stations measurements of sea levels do not distinguish between water that is rising and land that is sinking.

Measurements of land subsidence in Hampton Roads

What was measured	Monitoring technique	Number of stations	Period	Average Rate (mm/year)
Aquifer compaction	Extensometer	2	1979-1995	-2.6
Land subsidence	Geodetic survey	17	1940-1971	-2.8
Land subsidence	Fixed GPS	3	2006-2011	-3.1

- Relative sea level rise has been 3.5 to 4.5 mm/yr.
- Land subsidence, measured to be 1.1 to 4.8 mm/yr, causes more than half the relative sea level rise.
- Aquifer compaction estimated to be 1.5 to 3.7 mm/yr can explain the majority of observed land subsidence.

Why do groundwater withdrawals cause subsidence?

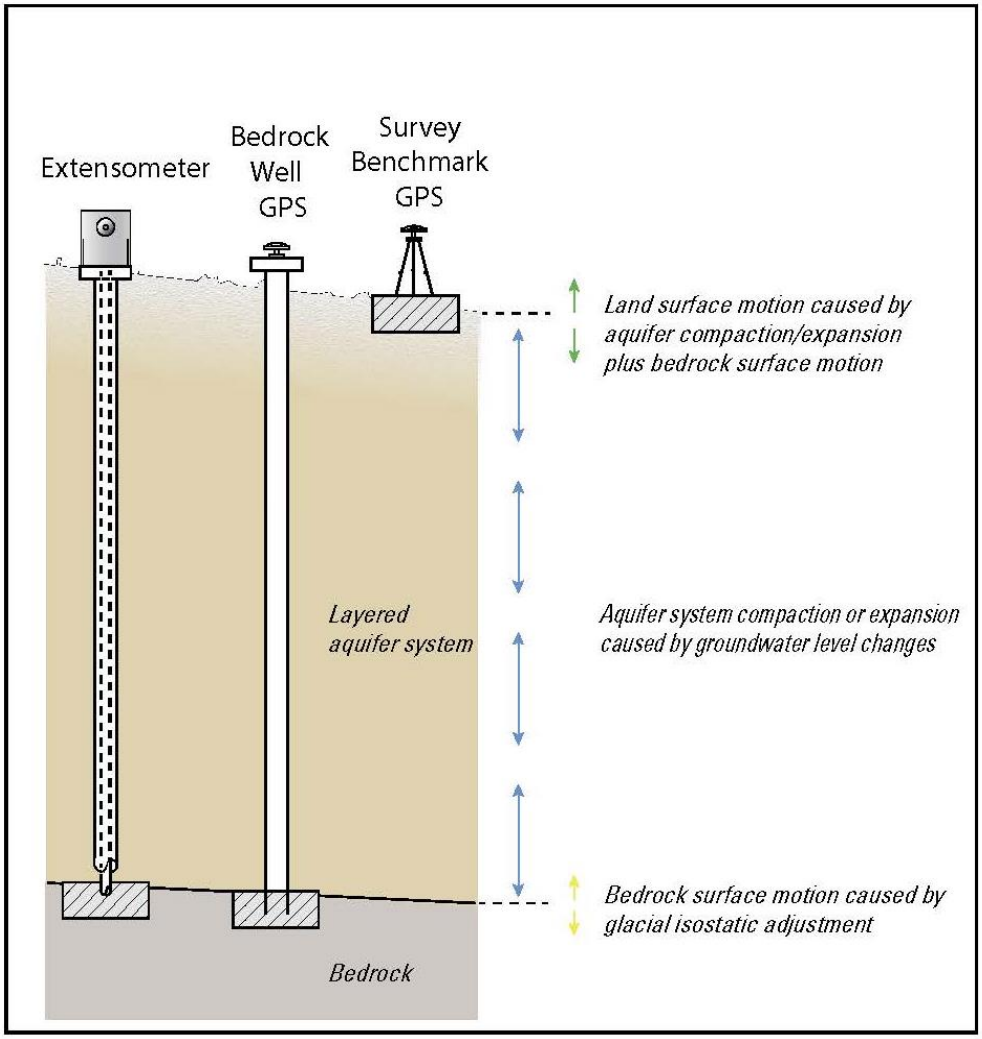


In Hampton Roads, aquifer system is a stack of sand and clay layers.

Pumping from aquifers reduces water pressure in the clay layers and allow them to compress.

Types of Subsidence Measurements

1. **Extensometer** measures aquifer system compaction or expansion
2. **Bedrock well GPS** measures bedrock surface motion
3. **Survey benchmark GPS** measures land surface motion
4. **InSAR** measures land surface motion



Measuring Subsidence

Type	Spatial coverage	Temporal detail	Accuracy	Cost
Extensometer	Low	High	High	Very High
Bedrock GPS	Low	High	Moderate- High	High
Survey Benchmark GPS	Low–Moderate	Low-High	Moderate-High	Low-Moderate
InSAR	High	Moderate	Low-Moderate?	Low-Moderate

Details on Accuracy

Subsidence in Hampton Roads approximately 1-5 mm/year

Extensometers provide sub-millimeter data (0.01 mm).

Survey Benchmark achieve centimeter scale accuracy for absolute vertical position and millimeter scale accuracy for differential vertical position.

InSAR typical error is 5-10 mm. Maybe worse in Hampton Roads.

Research Collaboration

Extensometers

USGS refurbished old extensometers in Franklin and Suffolk in 2015 and may add GPS antennas to measure bedrock motion .

HRSD / USGS installation of new extensometer at Nansemond Wastewater Treatment Plant. Construction began in 2016.

HRPDC staff inquired if Navy could fund installation of extensometer at Sewell's Point. Not clear what DoD program can fund this type of research.

DEQ does not currently have funding for extensometers.

Benchmark Survey data would be used by ODU and DEQ for calibration

ODU professor, Ben Hamlington, learning to process InSAR data. Working with NASA and analyzing InSAR data over Hampton Roads collected from 2008-2011. Not enough GPS or extensometer data from 2008-2011 to verify the accuracy of InSAR.

In 2017, new U.S. satellite will collect InSAR over Hampton Roads.

DEQ has funded AquaVeo to incorporate subsidence into the Coastal Plain groundwater model but calibration based on data from one extensometer.

Local Governments and the CCRFR

Proposal for Benchmark Network:

- HRPDC = $35K/yr for annual monitoring and report
- USGS contributing $60K to purchase 3 GPS units

Locality suggested that HRPDC should request that CCRFR provide funding for Benchmark Network.

- Unclear whether CCRFR set up to provide funds to other entities
- Raised questions about role of CCRFR to fill data gaps and provide maintenance on equipment needed for data collection

Resolution:

- CCRFR provided letter of support
- HRPDC will manage contract and collect local contributions to fund monitoring

Local Governments and the CCRFR – Key Questions

- What is the CCRFR's annual capacity to take on new initiatives?
- Is CCRFR only offering staff time of existing university staff? Funding for equipment? Consultants?
- Who are the available staff? What are their areas of expertise?
- How will CCRFR prioritize projects when requests exceed capacity?

Thank You

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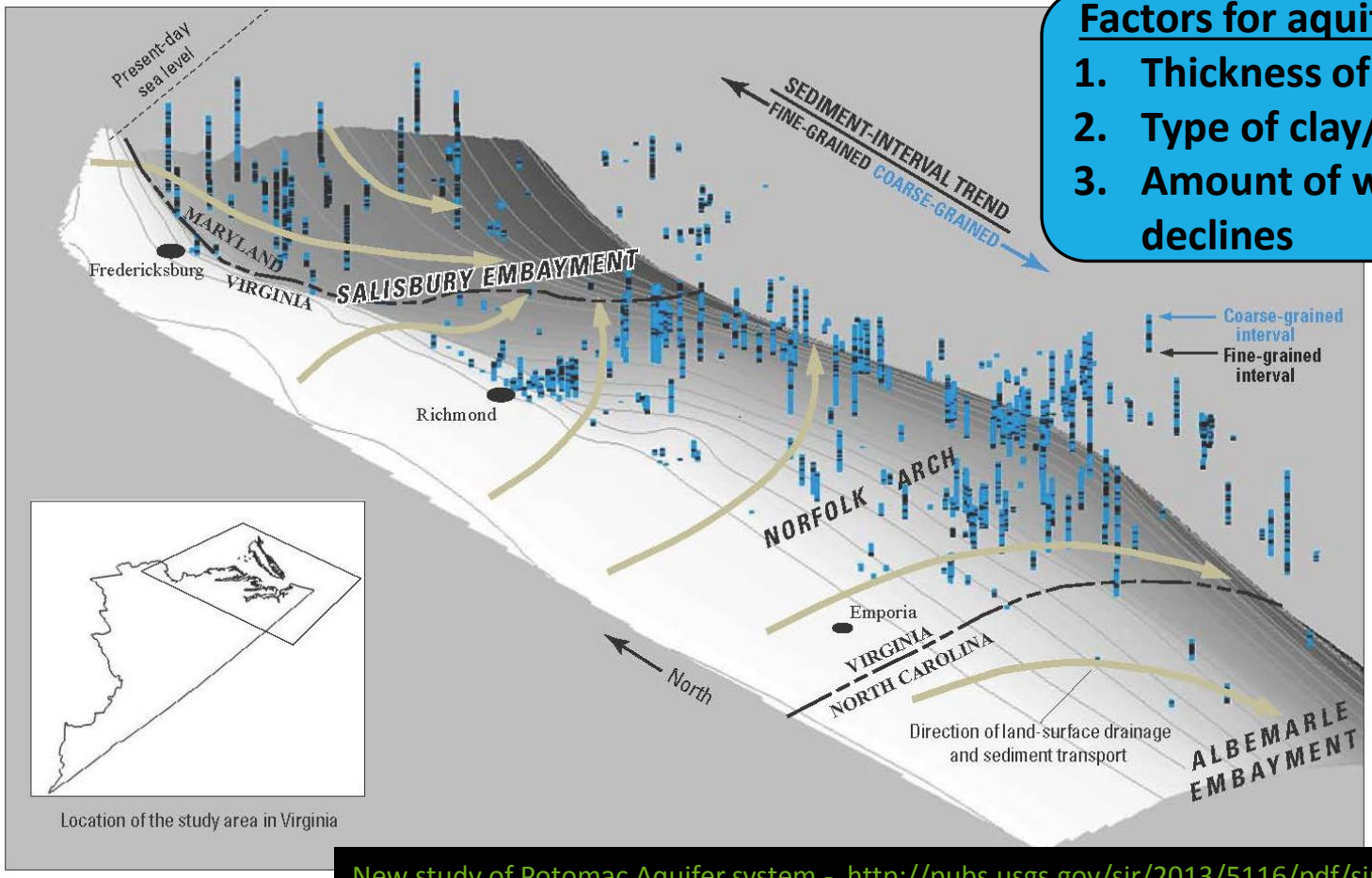
Additional Slides

Why should we identify the causes of land subsidence?

- Future rate of land subsidence may not be constant.
- Aquifer compaction will not occur at the same rate across the region.

Factors for aquifer compaction

1. **Thickness of clay**
2. **Type of clay/soils**
3. **Amount of water level declines**



New study of Potomac Aquifer system - http://pubs.usgs.gov/sir/2013/5116/pdf/sir2013-5116.pdf