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VIRGINIA DEPARTMENT OF
ENVIRONMENTAL QUALITY

2020 Virginia State Water Resources Plan

Cumulative Impact Analysis Modeling Update

Virginia Department of Environmental Quality

September 2020

Water Supply Planning & The State Water Resources Plan

- Water Supply Planning Program in response to the 2001-2002 drought.
- Section 62.1-44.38:1 in Code of Virginia requires a comprehensive statewide process to:
  - Ensure adequate and safe drinking water is available to all citizens,
  - Encourage, promote, and protect all other beneficial uses,
  - Encourage, promote, and develop incentives for alternative sources.

- Regulation requires localities to develop water supply plans – DEQ evaluates impacts.
- Water Supply Plans on a 5 year cycle: 2013, amended in 2018, and due again in 2023.

- The State Water Resources Plan:
  - Compiles information submitted via Water Supply Plans (existing and projected demands, sources, etc).
  - Cumulative Impact Analysis Modeling by river basin to evaluate future sustainability of water supply and protection of other beneficial uses. Groundwater modeling evaluates sustainability of groundwater resources.
  - First published in 2015. Second one slated for late 2020 (in development).

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State Water Resources Plan - Improvements

	2015 State Water Resources Plan	2020 State Water Resources Plan
Demand Projections	All localities based on 2007-2013 data	13% of localities provided updated projections 33% of locality projections revised to correct errors.
Withdrawal Locations	County Centroid	Demand paired with withdrawal location info collected via Annual Reporting
Stream Flow Simulation	Modeled at HUC8 (48 subwatersheds)	Modeled at HUC10 (405 subwatersheds)
Detailed Analysis Scope Level	9 Major Basins	21 Sub-basins
Groundwater Simulations	Using original WSP projections	Updated WSP Projections and SWIFT
Point Sources (Discharges)	Used historical average from 2006-2010	Based on consumptive use percent for each facility - scales proportionally to demand.
Modeling Scenarios	Current (2020,2030,2040)	•Climate Change (multiple scenarios) •Exempt Users •New Metrics including Unmet Demand & Consumptive Use

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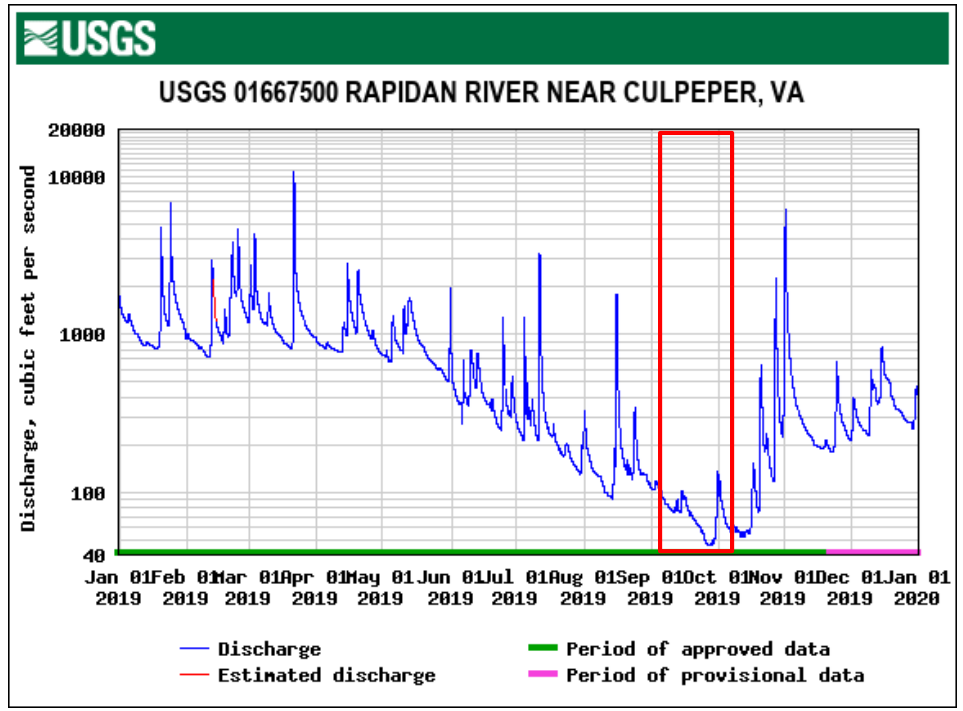
Cumulative Impact Analysis in the State Plan

- VAHydro Surface Water Model: uses withdrawal, discharge, climate/precipitation/evapotranspiration, land use, etc to simulate and predict streamflow.
- Modeling Scenarios include:
  - 2020, 2030, 2040 Demand
  - Climate Change (Dry, Moderate, Wet)
  - Exempt User
- Metrics used to quantify impacts to flow over a range of duration, intensity and frequency.
  - Lowest 30 Day Flow - Acute drought
  - Lowest 90 Day Flow - Extreme, prolonged drought
  - 7Q10 - Recurring short duration drought, 10 year - 7 day low flow.
  - Aquatic Life Specific: Consumptive Use
  - Water System Specific: Unmet Demand



Example of a 30 day low flow in a Hydrograph.

Metrics in Green are new to 2020 State Plan.

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Current & Future Water Demands (MGD)

- In 2020, surface water approximately 82% of demand. Around 80% by 2040.
- Groundwater use - increase at nearly twice the rate of surface water (self-supplied users)
- Demand changes predict several challenges confirmed by modeling:
  - Increased reliance on surface water by public water supplies.
  - Widespread increased groundwater usage both inside and outside the Coastal Plain.

Water Source	Year 2020 (MGD)	Year 2030 (MGD)	Year 2040 (MGD)	20YR Change (%)
Surface Water	1293	1403	1512	17
Groundwater	280	324	368	31
Total	1573	1726	1880	20

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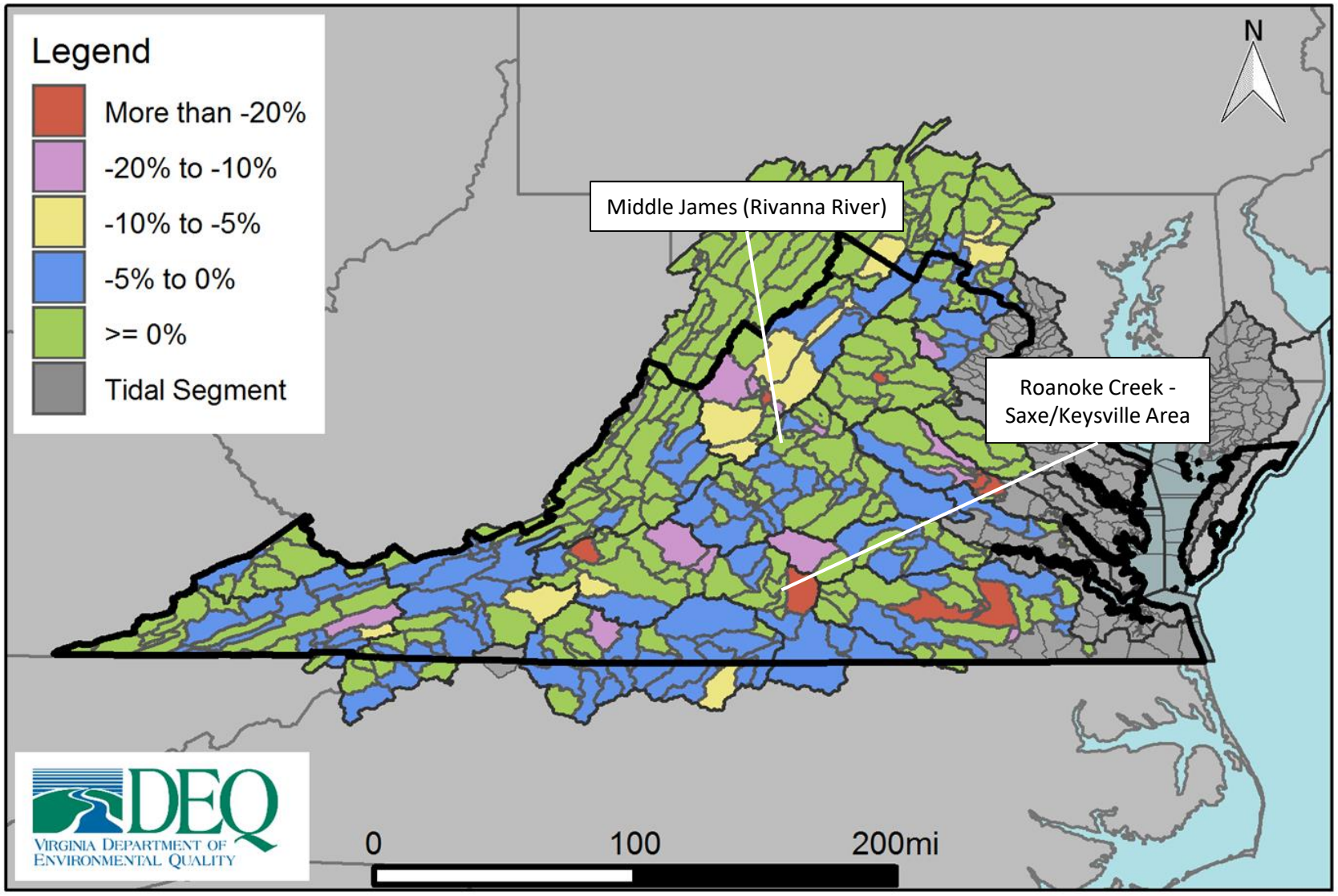
Comparison: 2020 to 2040 Demand (30 Day Low Flow)

- How will increasing demands affect water resources?
- Areas of Concern:
  - Headwaters
  - Significant Demand Increases w/o storage or other alternatives.
- What works? Storage and operational rules including flow-bys.

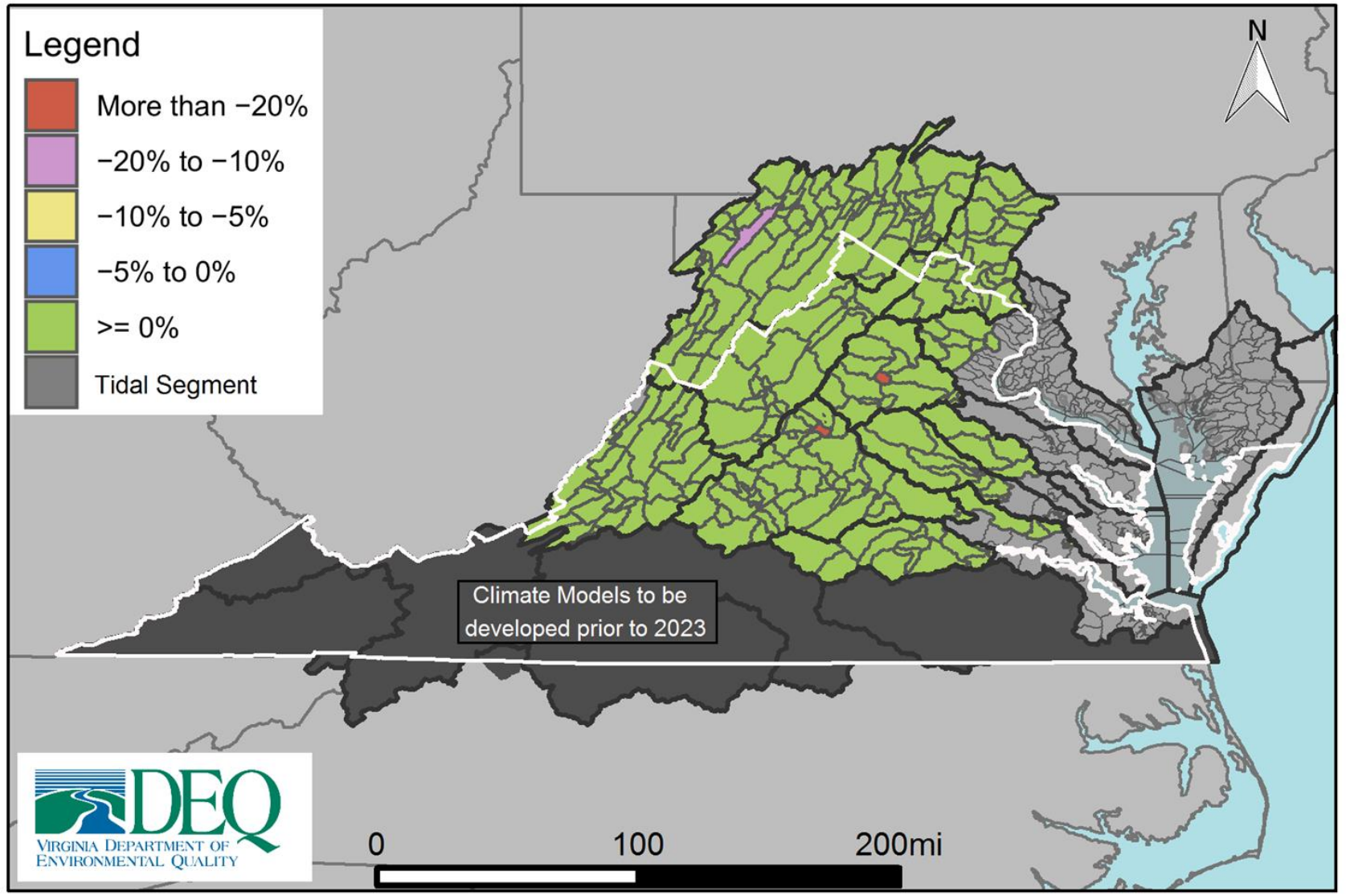
Percent Change in 30 Day Low Flow
(2020 to 2040)



Comparison: 2020 to Wet Climate (30 Day Low Flow)

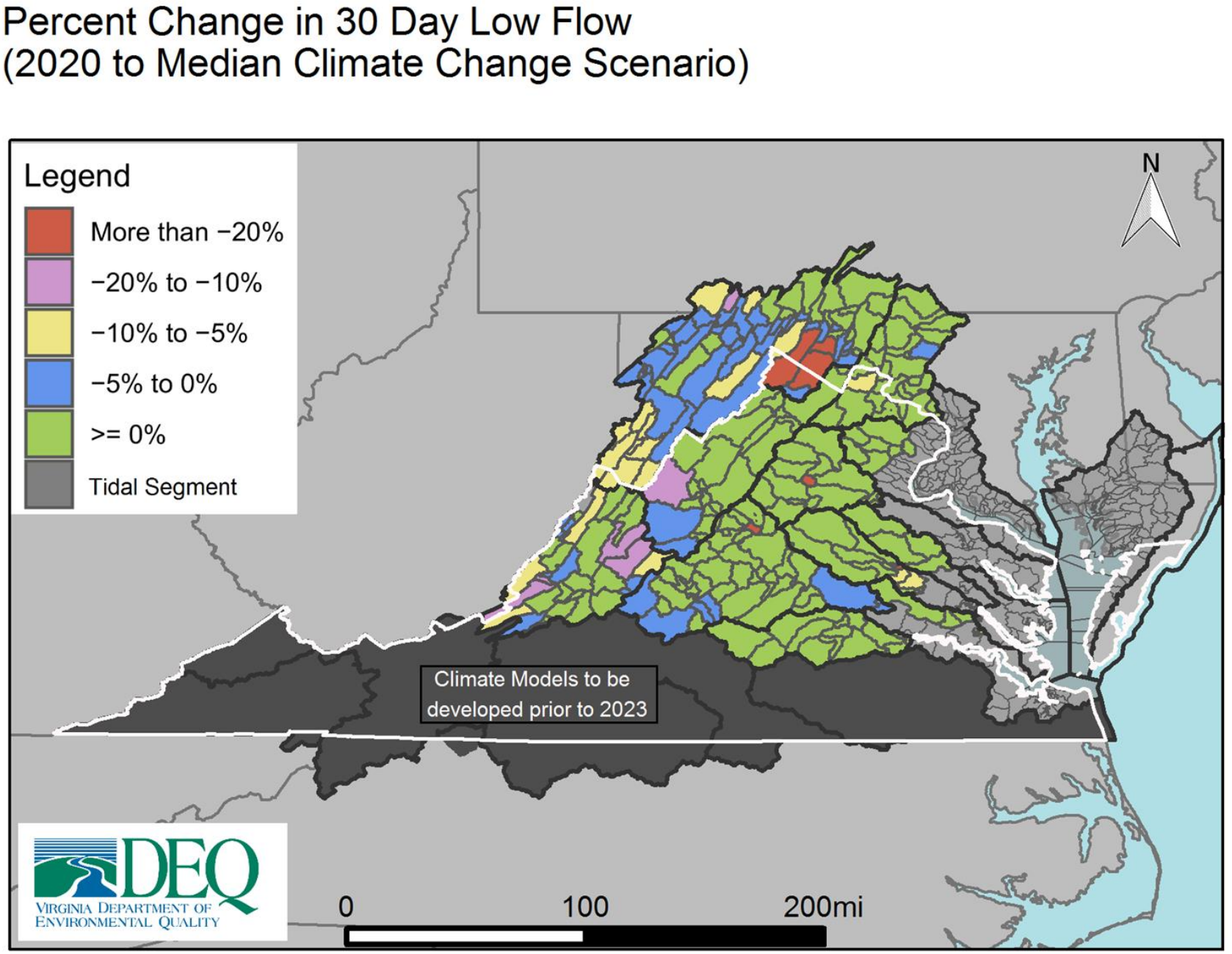
- 2040 Demands + Wet Climate.
- Streamflow increases compared to 2040 demand scenario
- Climate change may increase intensity of rain events - stronger and more frequent high flows/flooding.
- Decreased life cycle for supply reservoirs and increased treatment costs.

Percent Change in 30 Day Low Flow
(2020 to Wet Climate Change Scenario)



Comparison: 2020 to Median Climate (30 Day Low Flow)

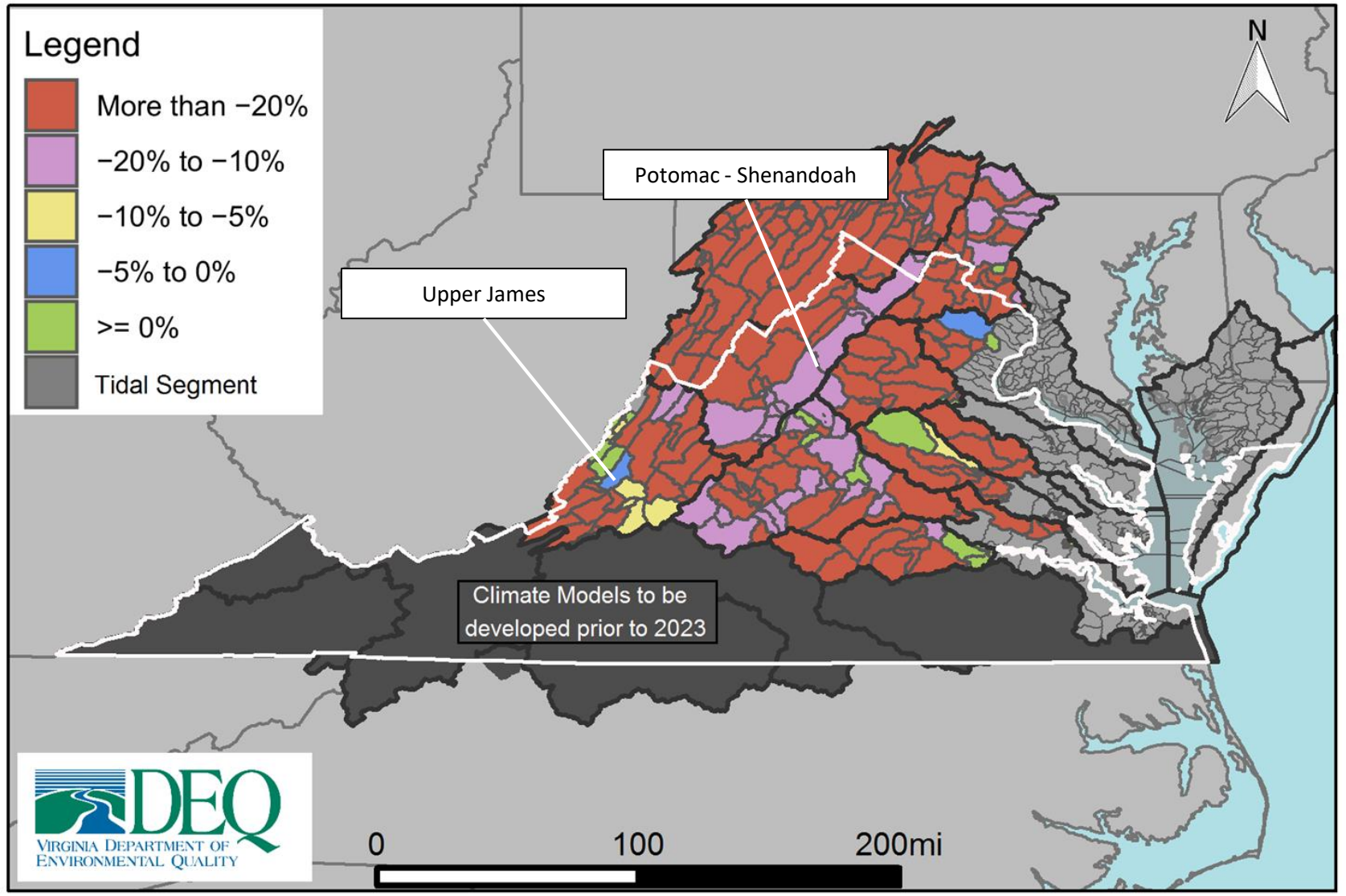
- 2040 Demands + Moderate Climate.
- Increased precipitation outpaces increase in withdrawals.



Comparison: 2020 to Dry Climate (30 Day Low Flow)

- 2040 Demands + Dry Climate.
- Compounds impacts from increasing demands & expands impacts more broadly.
- Potential for significant impacts to all beneficial uses: water supply and aquatic habitat/life in particular.

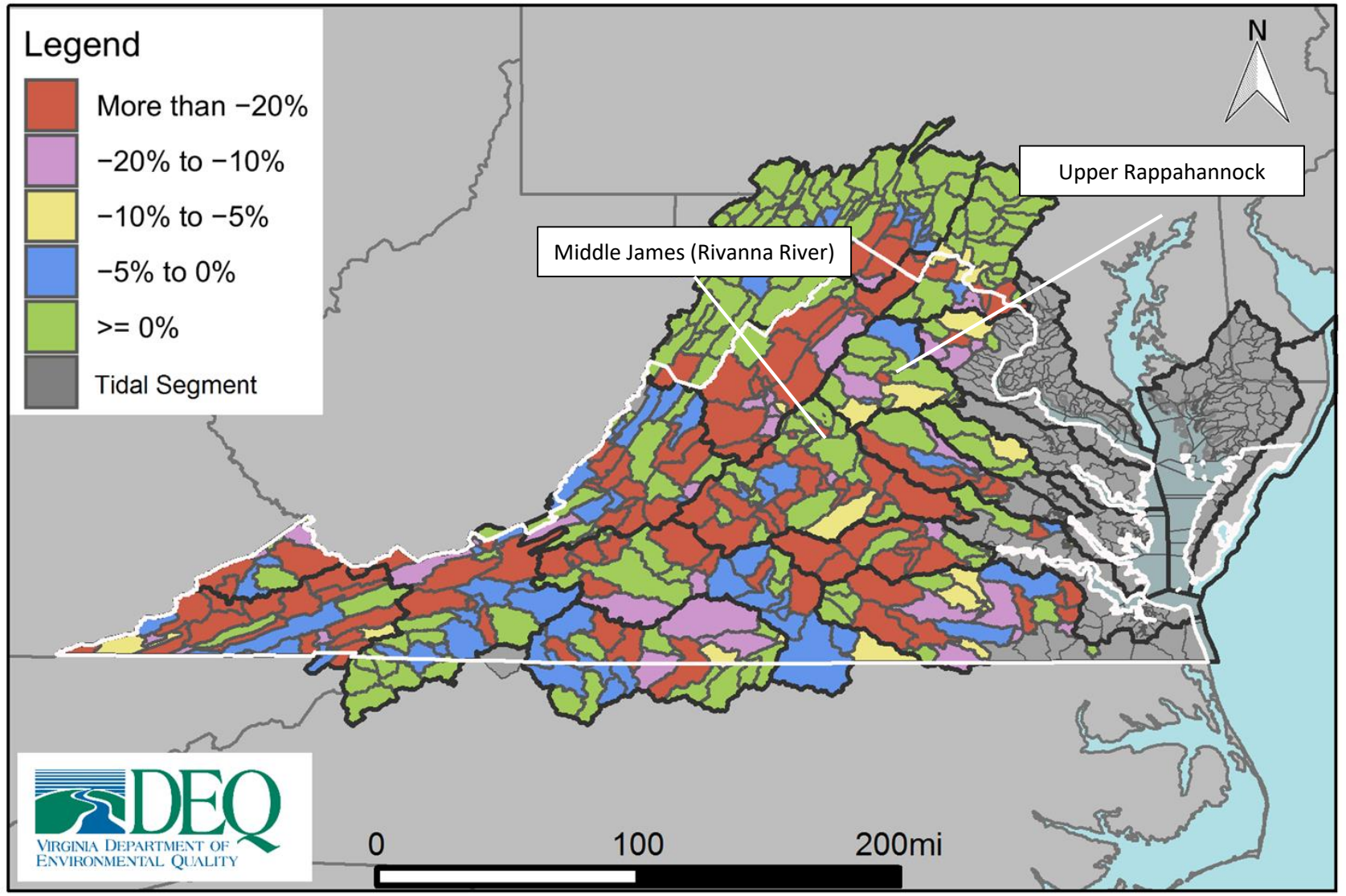
Percent Change in 30 Day Low Flow
(2020 to Dry Climate Change Scenario)



Comparison: 2020 to Exempt Users (30 Day Low Flow)

- Demand estimated using:
  - 401 Cert Limit/VWP Permit Limits (if applicable)
  - DEQ Request for Information – Max Intake Capacity
  - Largest pre-89 reported annual volume
  - VDH Pump Capacity
- Potential impacts to water supply and in-stream beneficial uses

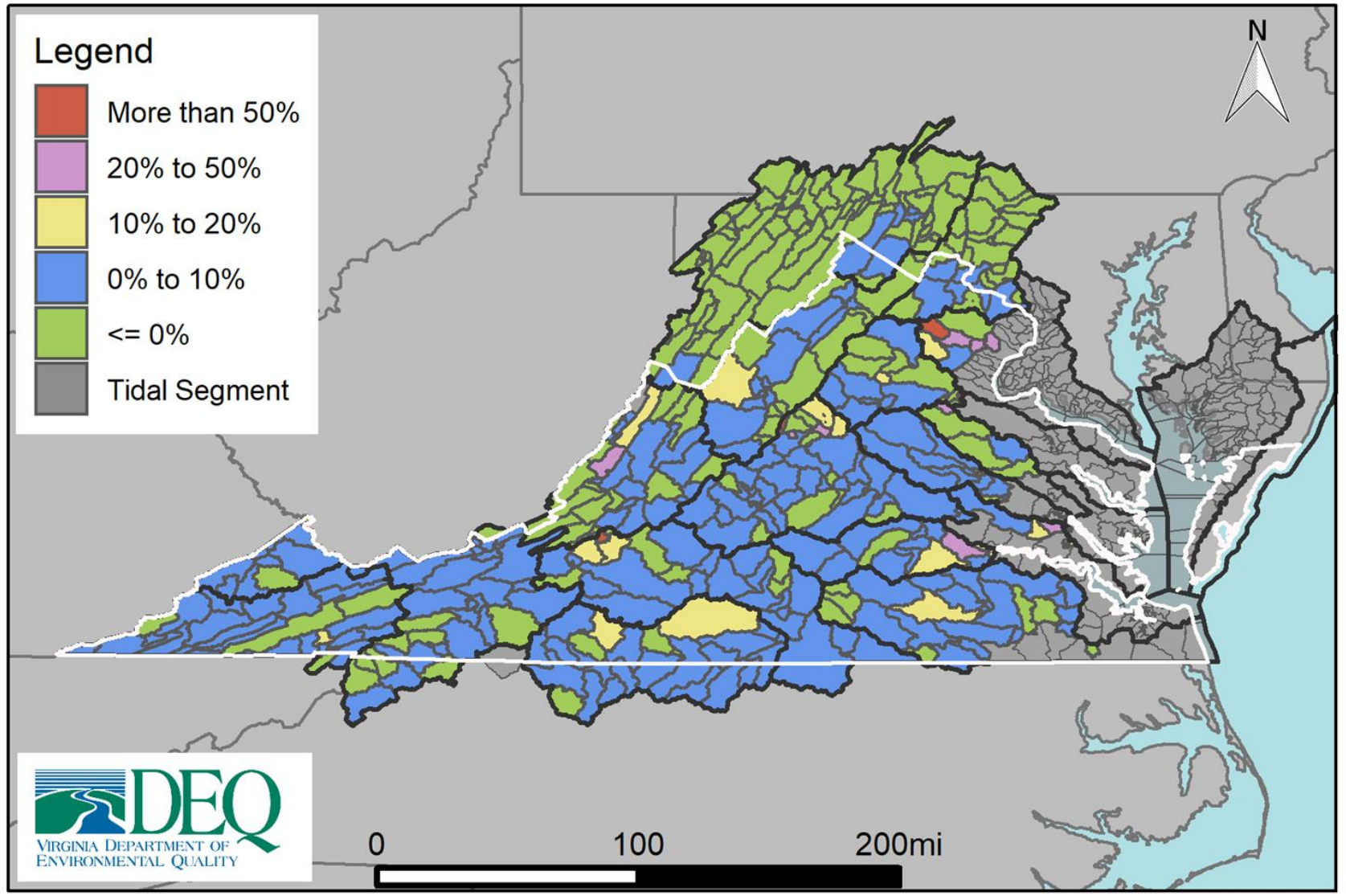
Percent Change in 30 Day Low Flow
(2020 to Exempt Users)



Consumptive Use 2040 Scenario

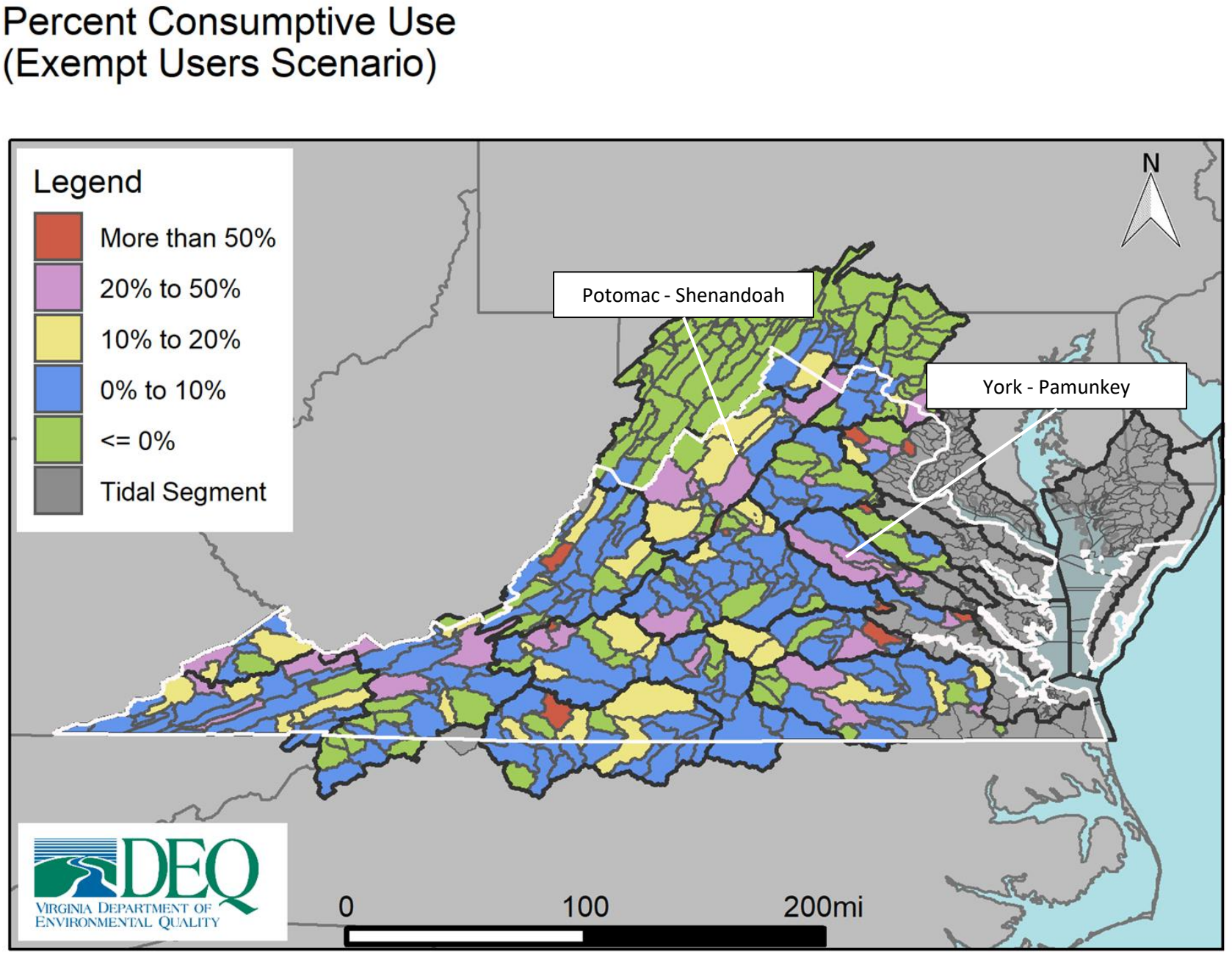
- Map shows % of a stream that is consumed (not returned via discharge).
- Mean Annual Flow relationship with biodiversity.
- > 10% consumed = 0.5 species lost (elevated risk).
- > 20% consumed = 1 species lost.

Percent Consumptive Use
(2040 Scenario)



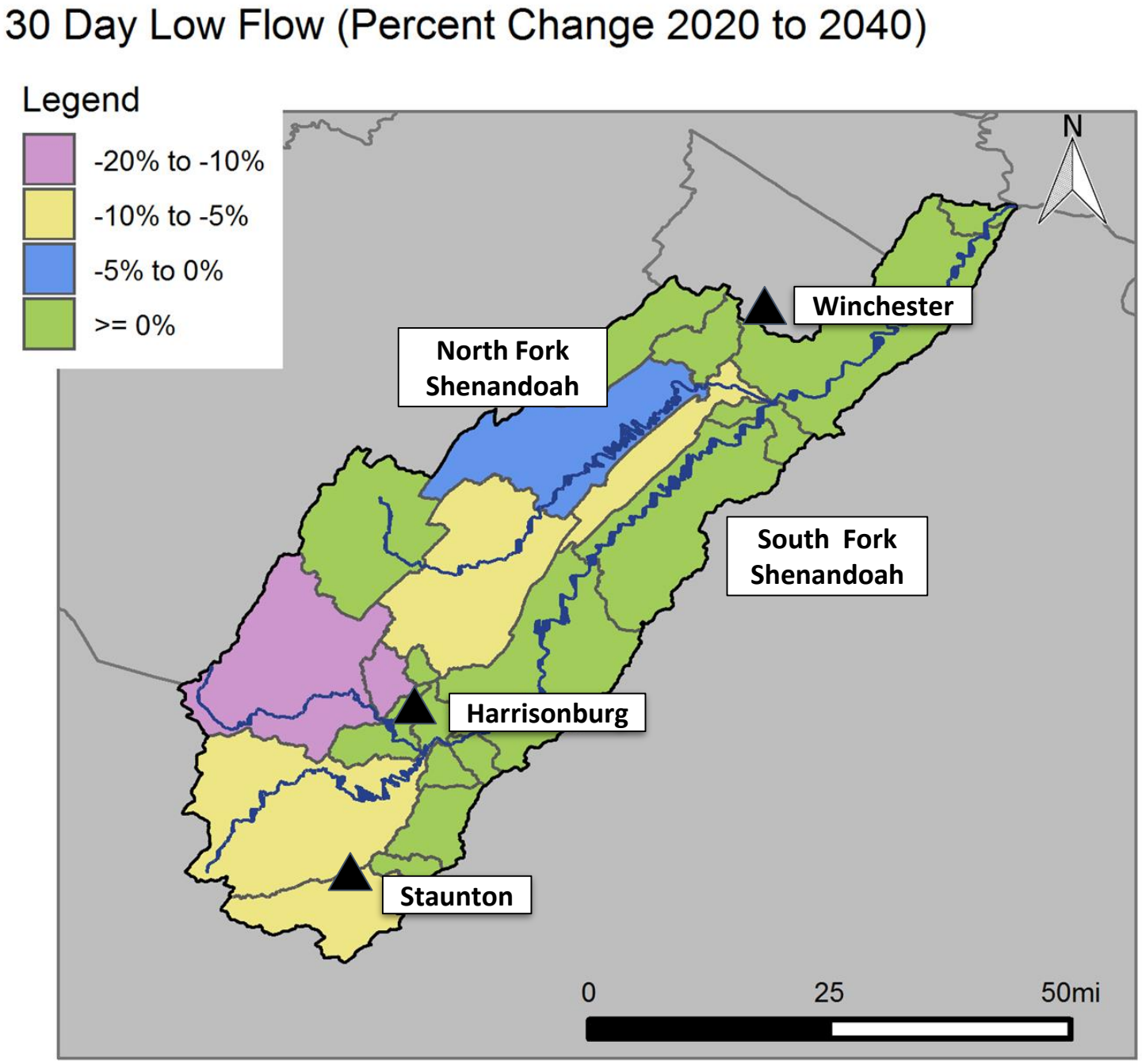
Consumptive Use Exempt User Scenario

- Exempt Users Scenario - more significant, widespread impacts than 2040 Demands.
- Identifies areas with increased risk related to exempt withdrawals.



Basin Scale Analysis

- Higher resolution Cumulative Impact Analysis.
- Will provide a locally meaningful level of analysis for future planning efforts.
- State Plan will include maps and tables specific to each sub-basin at this scale.



Water Supply Plan Groundwater Modeling

- Water supply plan projections used to estimate water use trends for residential use and permitted facilities.
- 2020 & 2040 demand scenarios completed for each management area.
- SWIFT (Sustainable Water Initiative for Tomorrow) project scenario for Eastern Virginia GWMA.

Table 4. Total Pumping for Each VAHydroGW-VCPM Scenario

Scenario	MNW File Withdrawal (MGD)	Domestic Well File Withdrawal (MGD)	Injection (MGD)	Total Pumping (MGD)
2019 Total Permitted	94.6	25.2		**119.8**
2018 Reported Use	66.7	25.2		**91.9**
2020 Water Supply Demand	62	35.4		**97.4**
2040 Water Supply Demand	88.1	46.7		**134.8**
2040 WSP with SWIFT Injection	88.1	46.7	81.45	**53.4**

Pumping Rates for Eastern Virginia GWMA Scenarios

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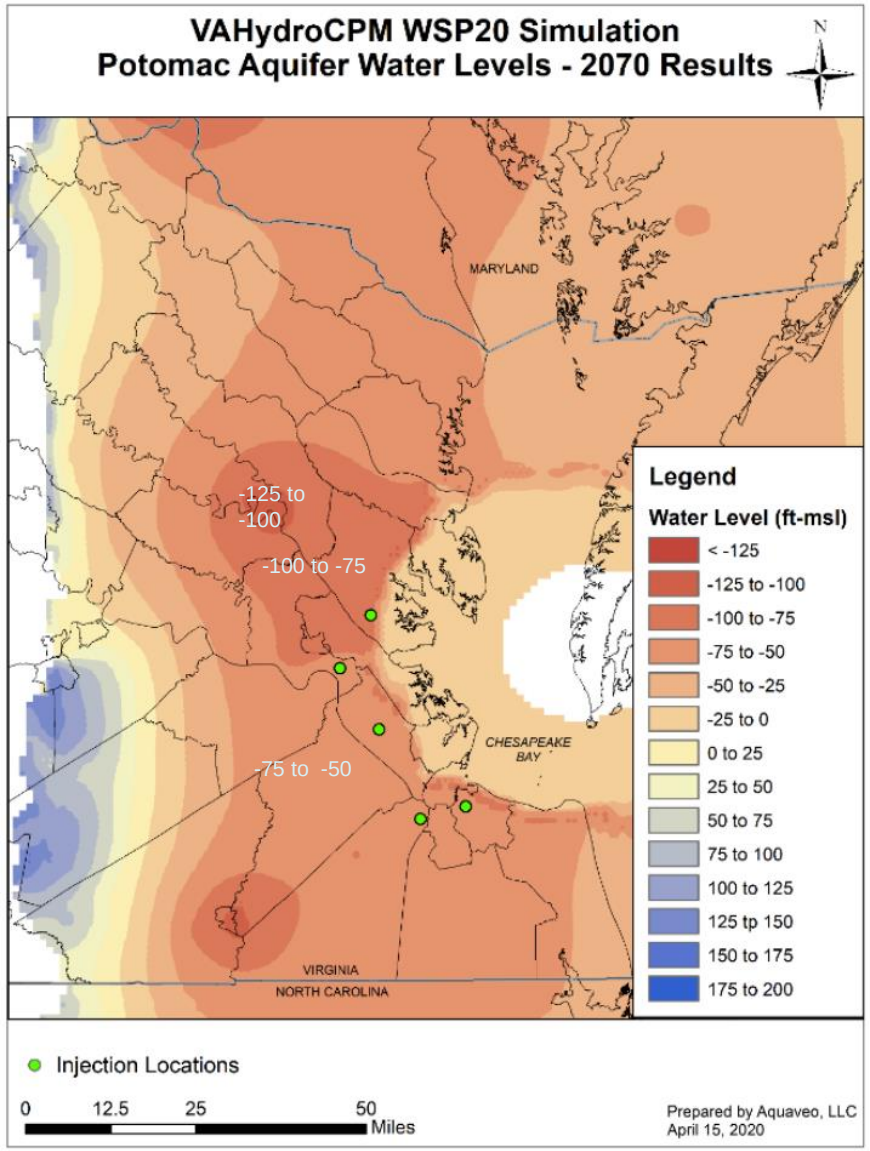
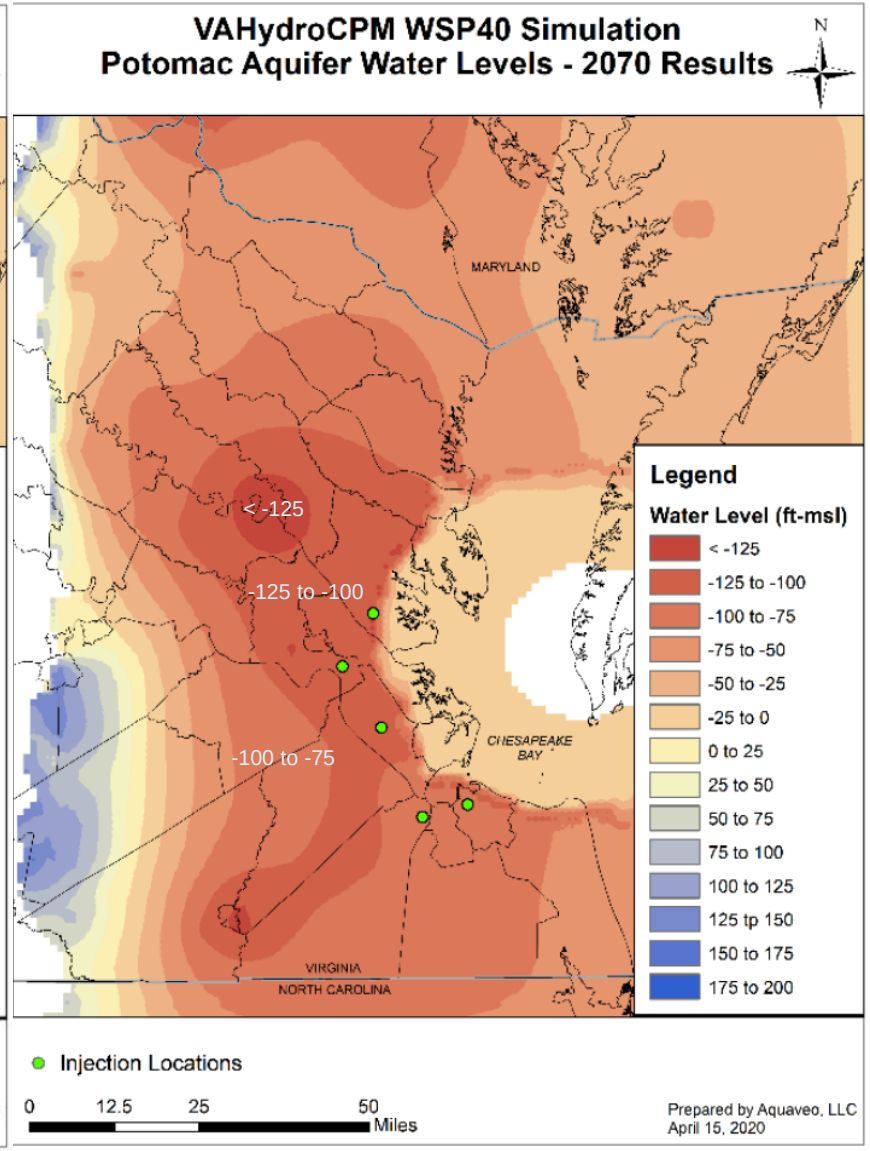
Eastern Virginia Groundwater Management Area

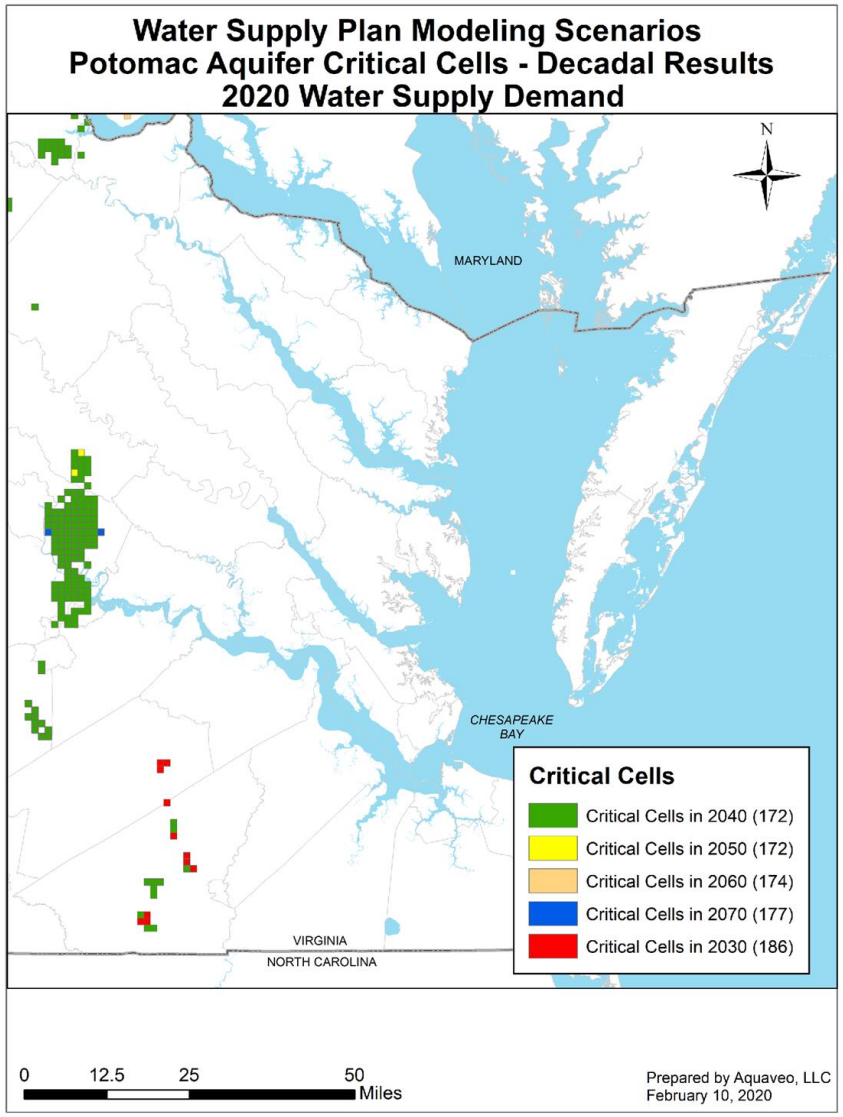
- Simulated water levels for 2020 and 2040 scenarios.
- Water levels in major existing cones of depression (Franklin & West Point) continue to decline and expand.
- Declines are driven both by large users as well as increasing domestic use of groundwater.
- 2020 State Plan will include similar figures for all confined aquifers.

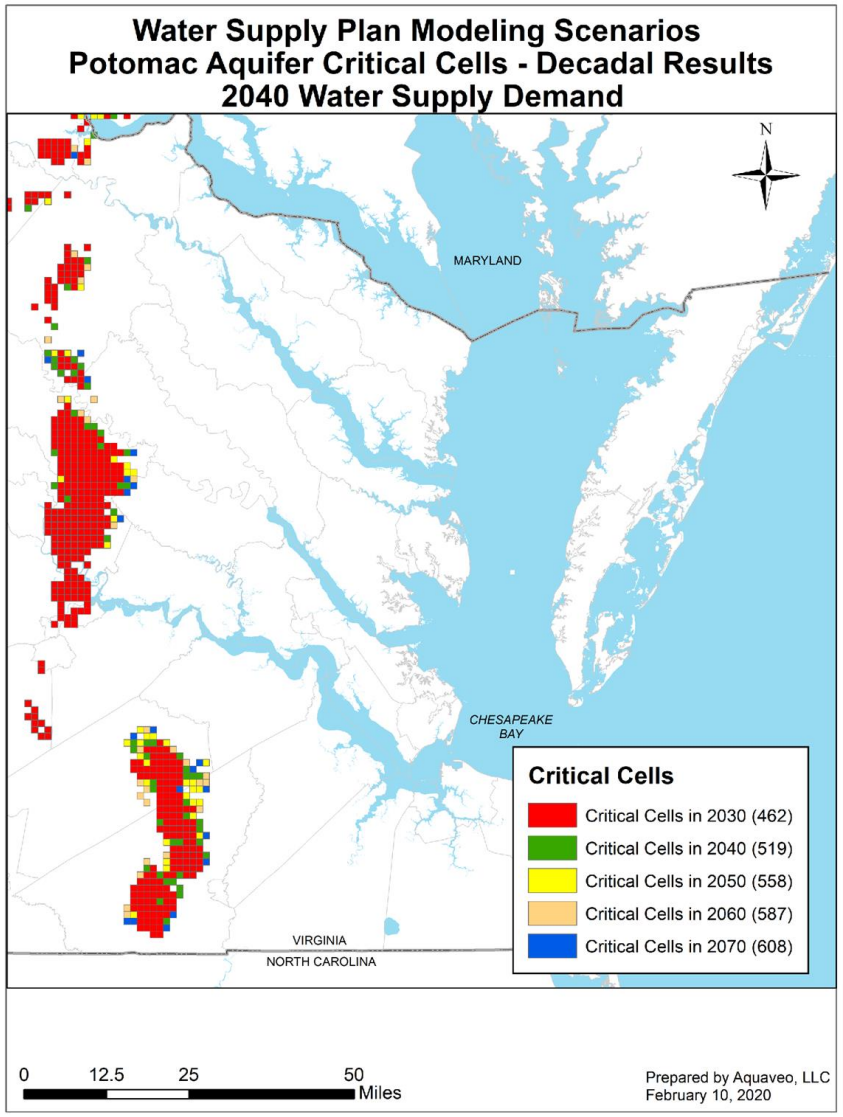




Simulation of Critical Cells

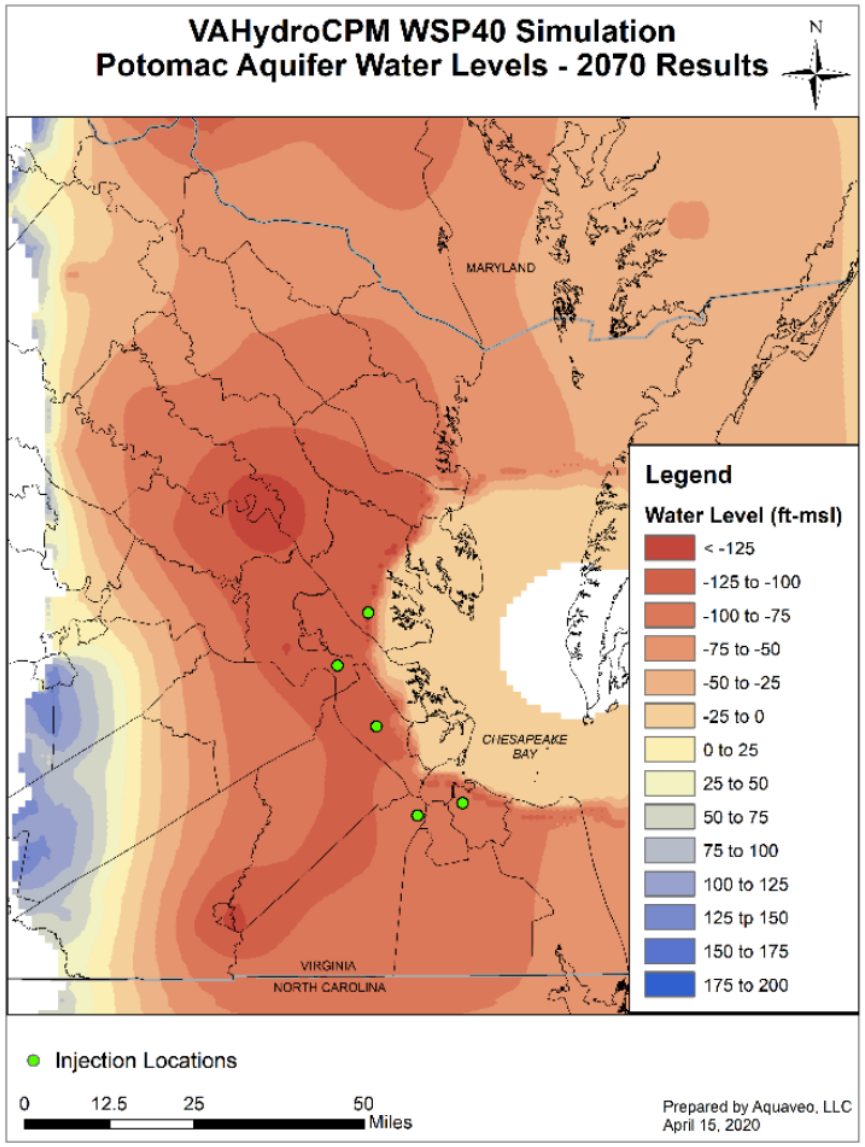
- Critical Cells: regulatory criteria for groundwater withdrawal permit issuance
- 2020 Demand Scenario - fewer cells through 2040, then marginal increases 2040-2070.
- 2040 Demand - consistent increases in critical cells – particularly along the fall line and within Sussex and Southampton.
- Meeting criteria for permit issuance in these areas not guaranteed.

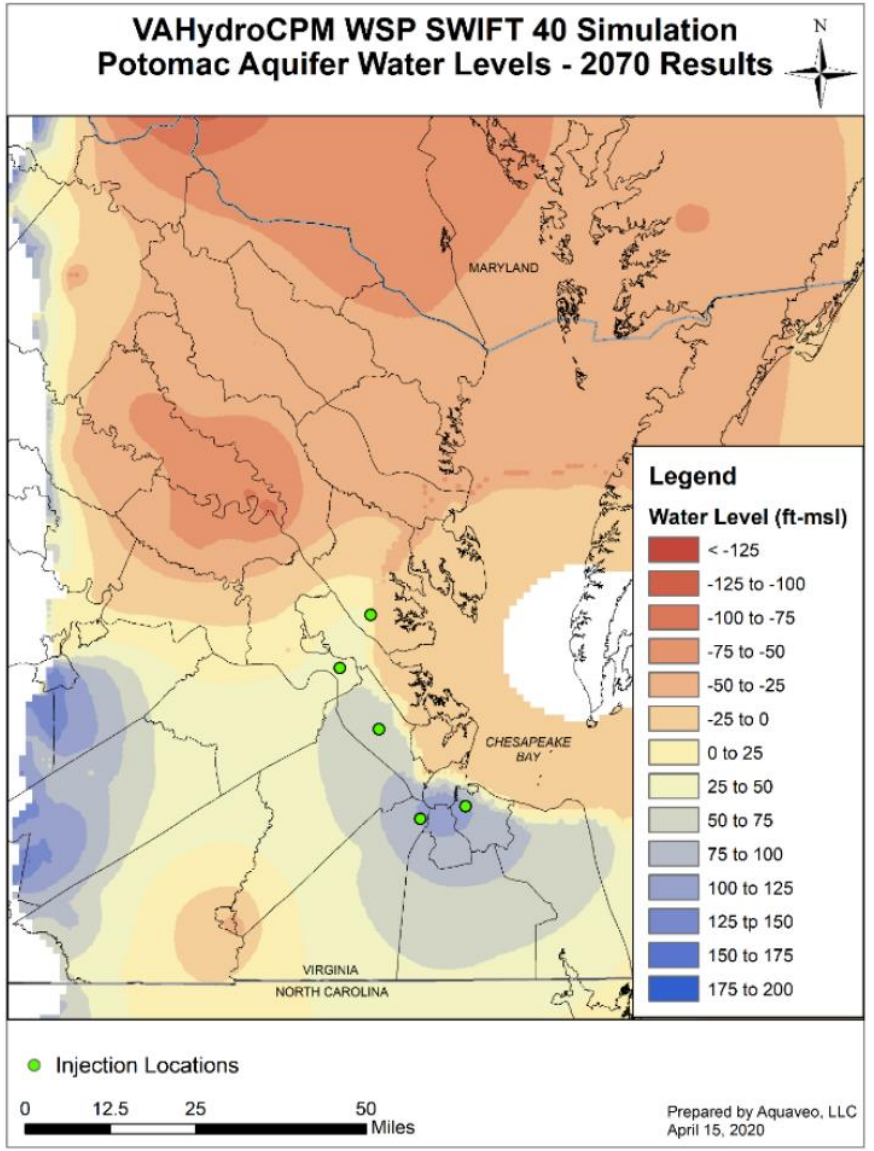




Modeling Sustainable Water For Tomorrow Initiative (SWIFT) Project

- SWIFT simulation shows significant improvement.
- Ongoing pilot at Nansemond to better understand recharge rates.
- Pilot indicates modeled head improvements is likely higher than seen in the field.
- As SWIFT expands, new data will help evaluate its long-term impact.





Eastern Shore Groundwater Management Area

- Simulation includes both a permitted use component & domestic/residential use based on Water Supply Plan projections.
- Reduction in Domestic Well Withdrawal from 2020 to 2040 – small self supplied users (domestic) projected to decrease in Accomack and Northampton.
- Total permitted scenario includes the highest pumping rate.

Scenario	MNW File Withdrawal (MGD)	Domestic Well File Withdrawal (MGD)	Total Pumping (MGD)
2019 Total Permitted	10.38	2.65	**13.03**
2018 Reported Use	5.72	2.65	**8.37**
2020 Water Supply Demand	5.61	4.13	**9.74**
2040 Water Supply Demand	6.95	3.73	**10.68**

Pumping Rates for Eastern Shore GWMA Scenarios

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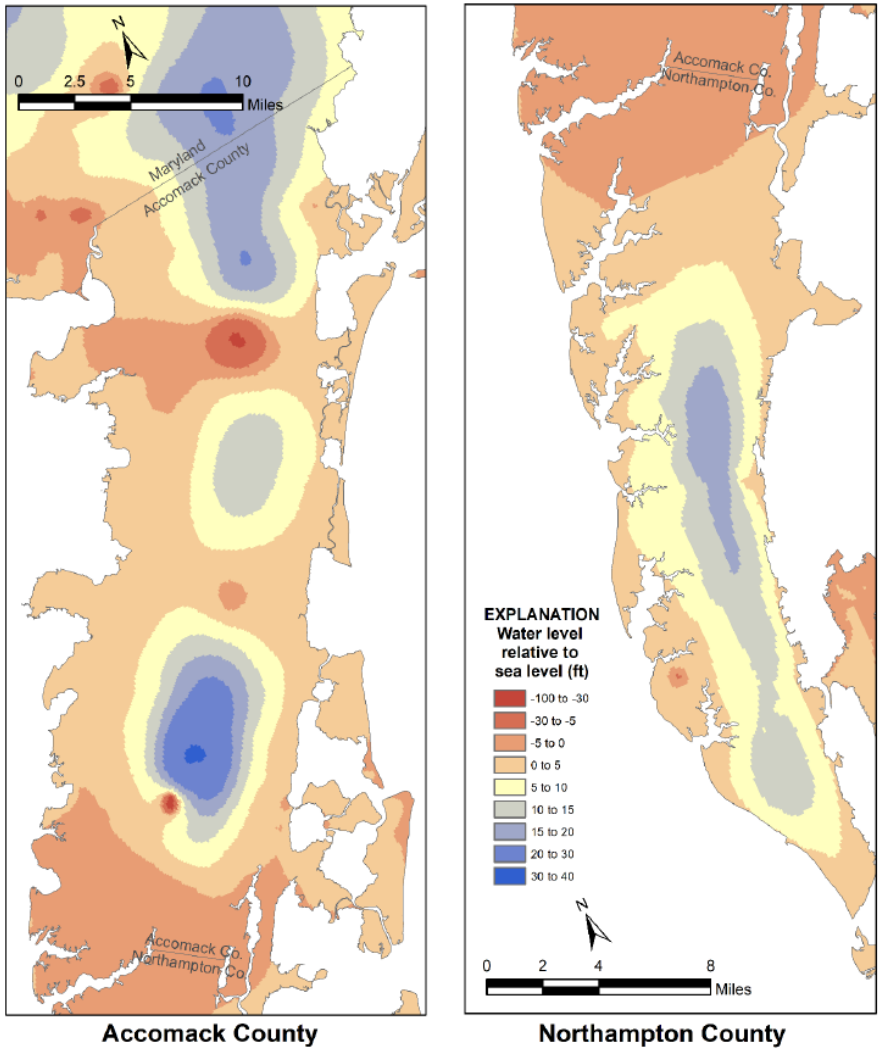
Upper Yorktown Eastover – 2020 and 2040 WSP Scenarios

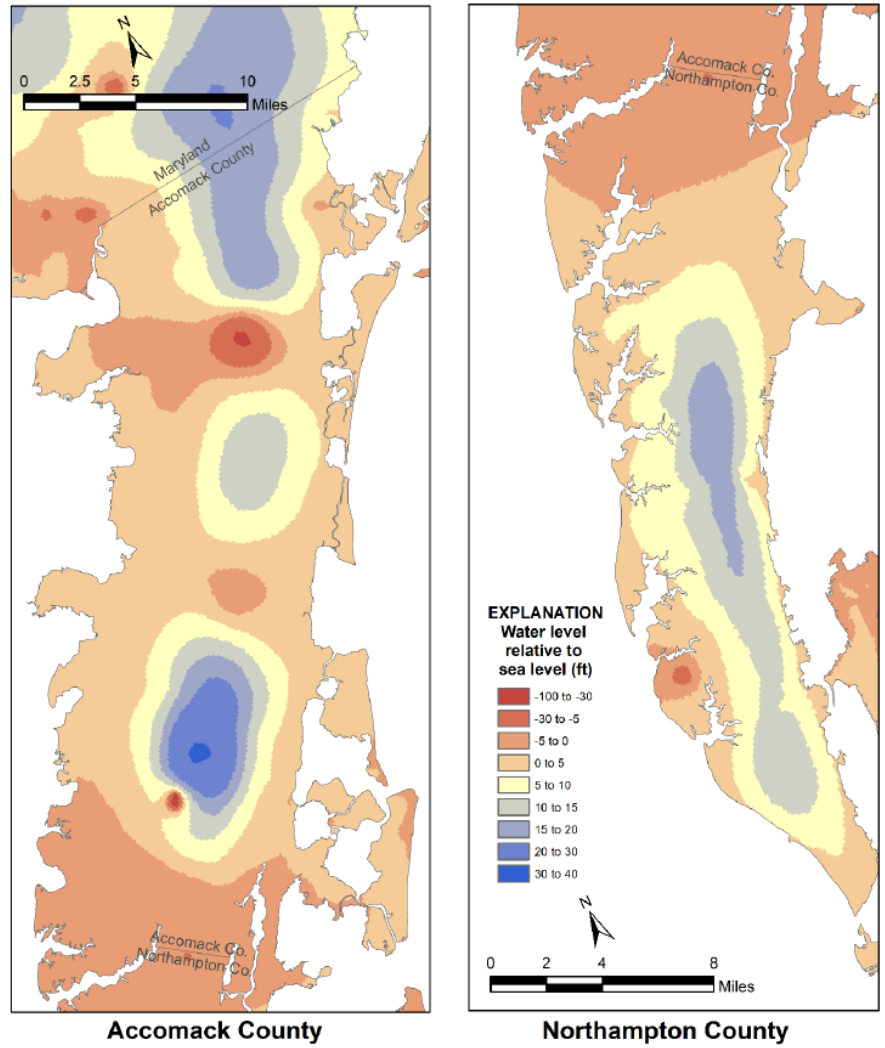
- Some changes in Upper Yorktown Eastover water levels.
- In general, simulated water levels are higher when compared to the 2019 Total Permitted simulations for all three aquifers.
- No critical cells simulated in 2020 or 2040 demand scenarios.

VAHydro-ES 2019 WSP20 Simulation
Upper Yorktown-Eastover Water Levels (2070)



Accomack County | Northampton County

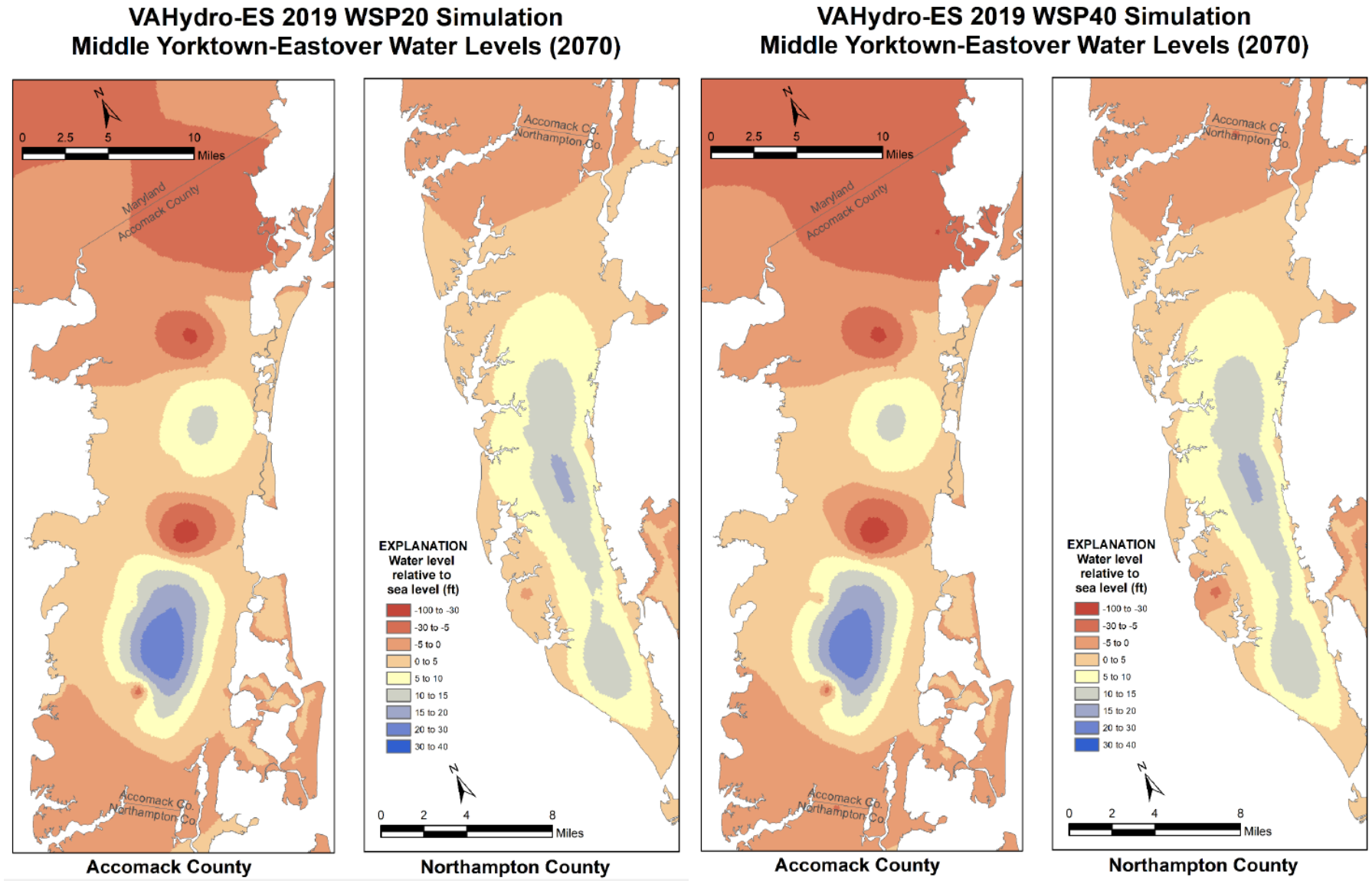
VAHydro-ES 2019 WSP40 Simulation
Upper Yorktown-Eastover Water Levels (2070)



Accomack County | Northampton County

Middle Yorktown Eastover – 2020 and 2040 WSP Scenarios

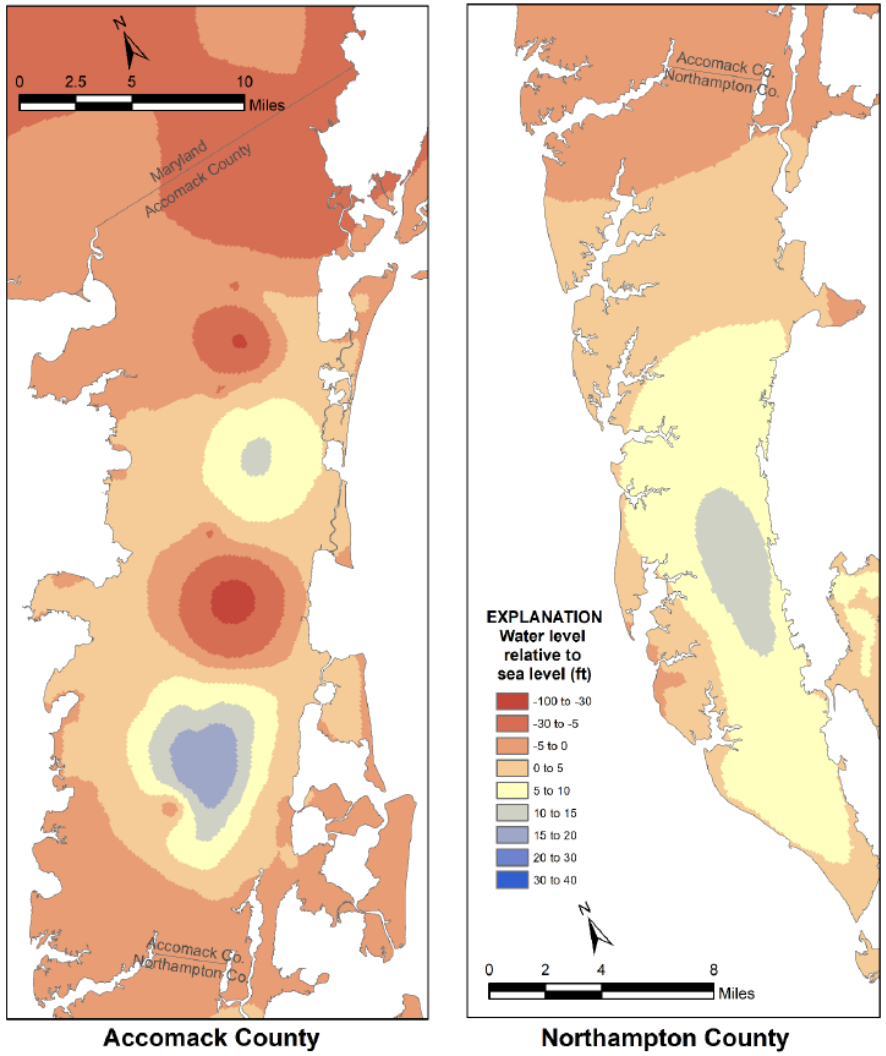
- Increasing drawdown in Northern Accomack, Virginia/Maryland Line.
- Additional drawdown in the Cape Charles (Northampton).
- Some increases in extent of existing cones of depression.



Lower Yorktown Eastover – 2020 and 2040 WSP Scenarios

- Similar increase in extent of drawdown on Virginia/Maryland border.
- Some changes in extent of existing drawdowns.
- State Plan will also include chloride concentration simulations.

VAHydro-ES 2019 WSP20 Simulation
Lower Yorktown-Eastover Water Levels (2070)



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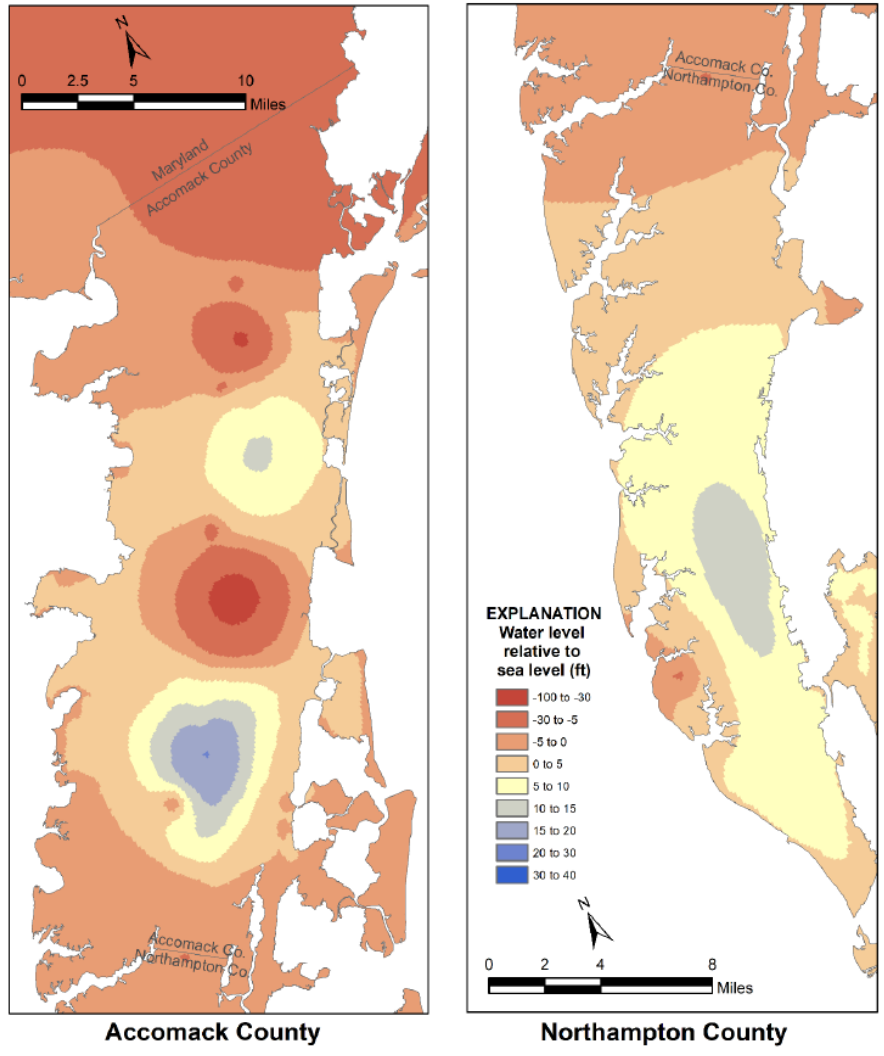
VAHydro-ES 2019 WSP40 Simulation
Lower Yorktown-Eastover Water Levels (2070)



Accomack County | Northampton County

Statewide Summary

- Even under current climate conditions, increasing demands will result in future water supply challenges for some localities/users, e.g. those with limited storage, and those located in headwaters.
- Climate Change Scenarios show a range of potentials for the Commonwealth. In reality, Virginia will experience years similar to each scenario. Should prepare for longer and drier droughts and heavier wet periods. Storage and planning that emphasizes interconnectivity and redundancy are key.
- Exempt User scenarios indicate the Commonwealth's surface water resources, though plentiful in areas, are insufficient to meet the combined demands that could be claimed by exempt users.
- Decreasing stream flows not only risks future water supply, but jeopardize habitat and species richness. Already vulnerable species most at risk. Looking at metrics such as "Consumptive Use" can be useful to quantify that risk.
- Cumulative impact analysis modeling continue to indicate areas of the state where excluded surface water withdrawals may be having an impact on protected beneficial uses. Shenandoah & Pamunkey were identified in the 2015 Plan as potential basins Surface Water Management Areas. 2020 results generally consistent.
- Groundwater Modeling indicates that with 2040 demands, groundwater levels may continue to decline, primarily in the Eastern Virginia Groundwater Management Area. Must continue to focus on active management of the aquifer systems in both EVGWMA and ESGWMA.

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Next Steps

- Drafting of the Plan expected to continue through the fall of 2020.
- Formal Public Comment Period will follow.

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Questions or Comments

We hope this preview gives you a sense of the analysis that will be included in the State Plan.

“Are there additional kinds of analysis that you think should be in the State Plan? Other methods of presentation or focuses?”

Use the chat function in Gotowebinar to provide feedback, ask questions, or comment. You may also follow up with an email at any point after the webinar.

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