ANALYSIS OF FAILED, FAILING OR THREATENED SEPTIC SYSTEMS IN THE COASTAL PLAIN

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Collaborating with: Division of Data Management and Process Improvement at VDH

Chesapeake Bay Stakeholder Advisory Group August Meeting
August 19, 2021

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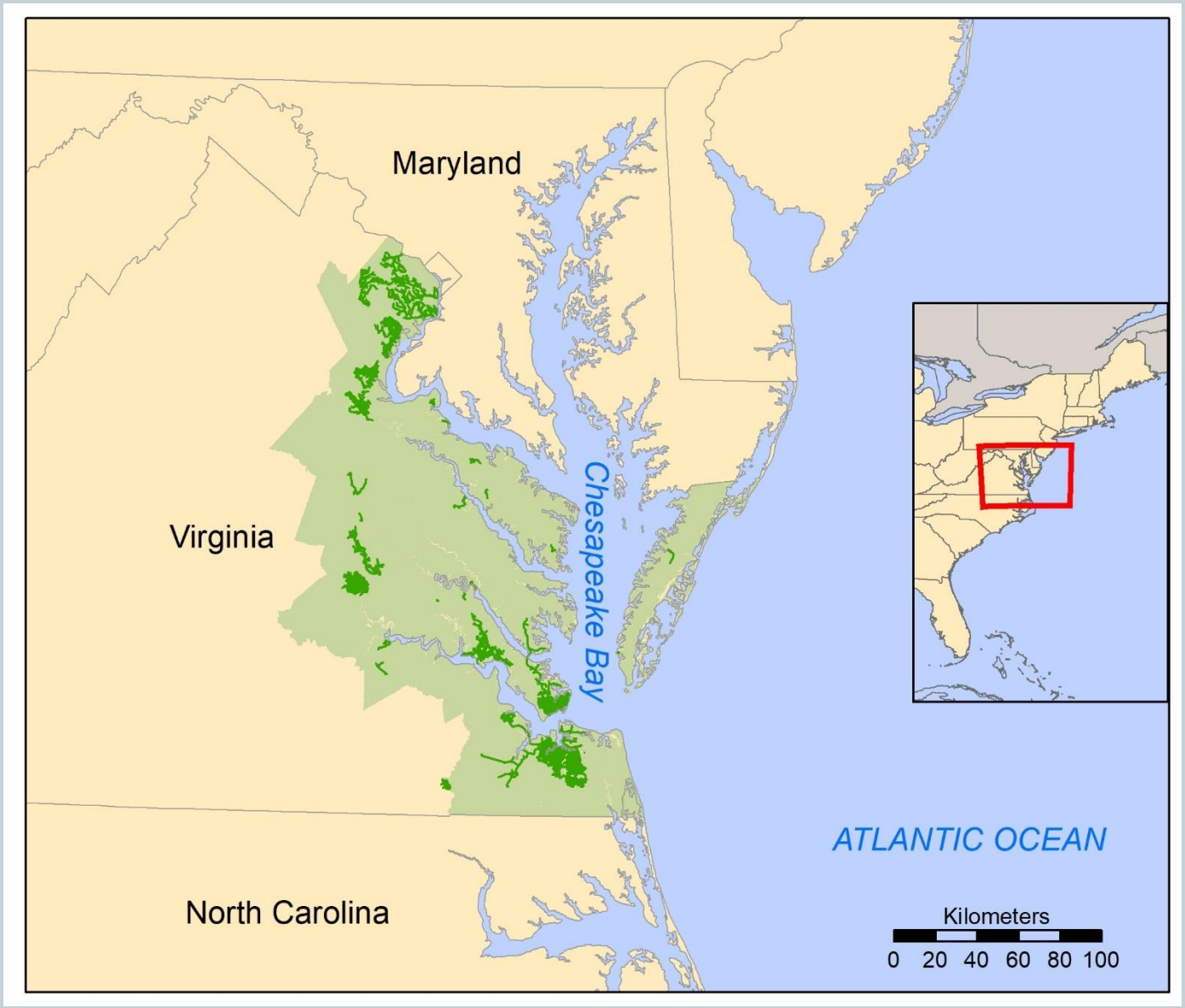
Maryland
Virginia
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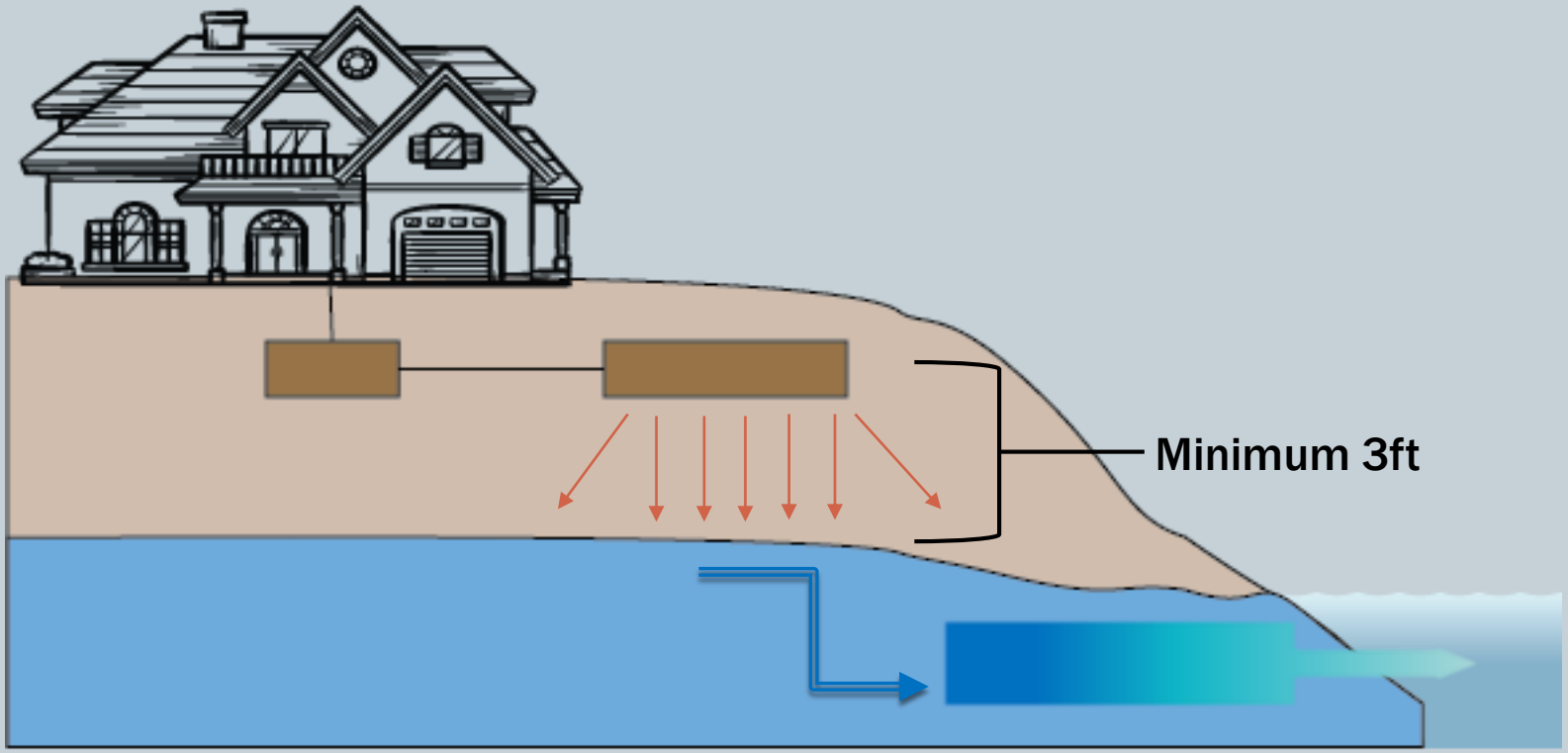
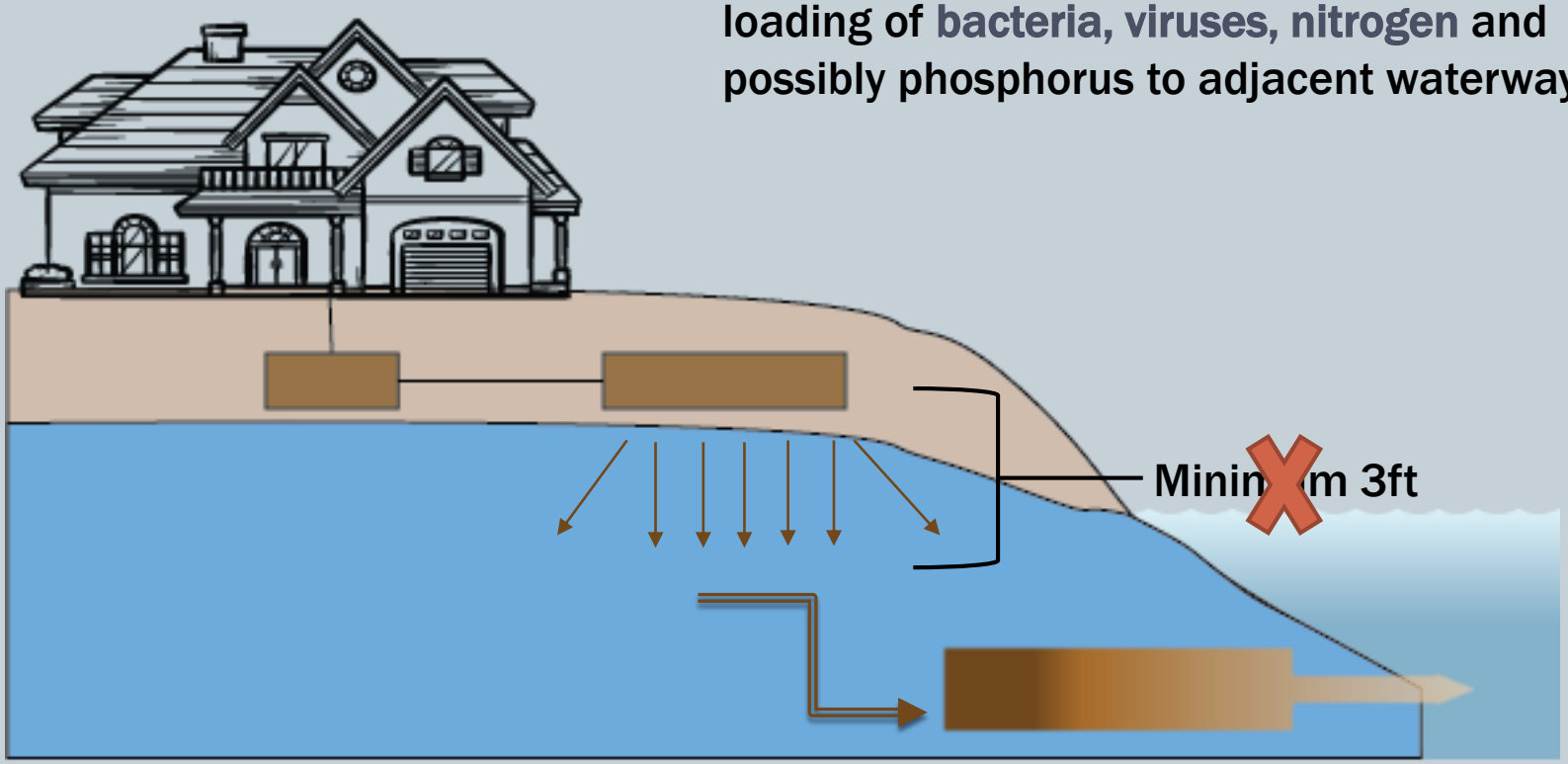
SEA LEVEL RISE AND SEPTIC



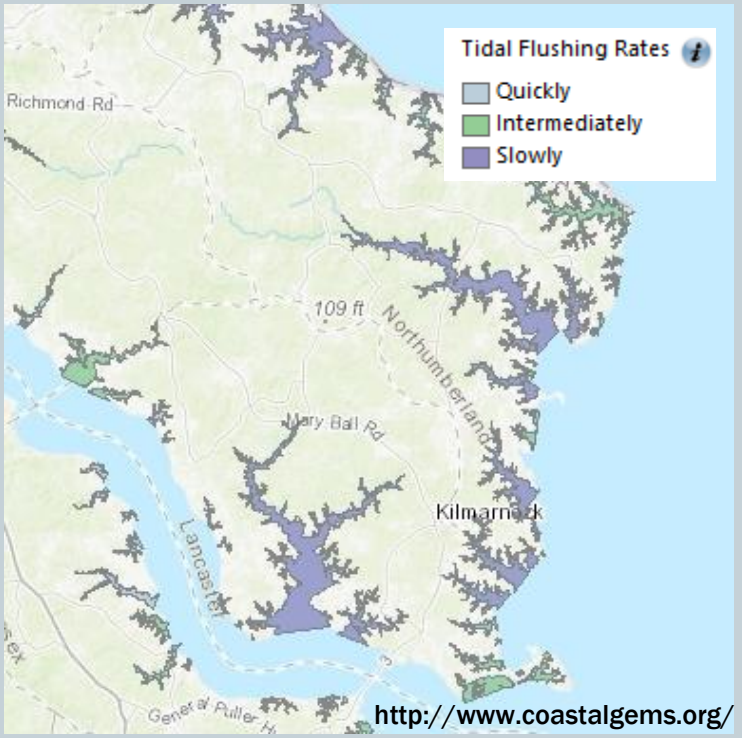
SEA LEVEL RISE AND SEPTIC

Failing septic systems result in an increased loading of **bacteria, viruses, nitrogen** and possibly phosphorus to adjacent waterways



FAILING SEPTIC SYSTEMS…

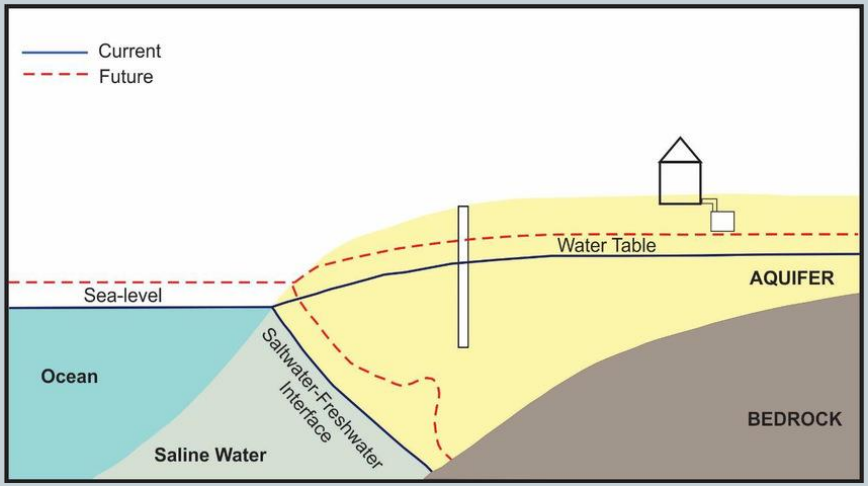
- Contribute as much as 6% of the total nitrogen load from the Chesapeake watershed (Bay Watershed Model 2009 Scenario, Chesapeake Bay TMDL)
- In small waterbodies, the local impact can be much higher.
  - For example, in MA, 74% of the nitrogen was attributed to septic systems (Horsley Witten Hegeman. Inc. 1991)
- Contaminated waterbodies result in the closure of shellfish harvest areas → economic impacts
- Can also cause bacterial contamination of groundwater (e.g., Stewart & Reneau, 1981, Arnade 1999)

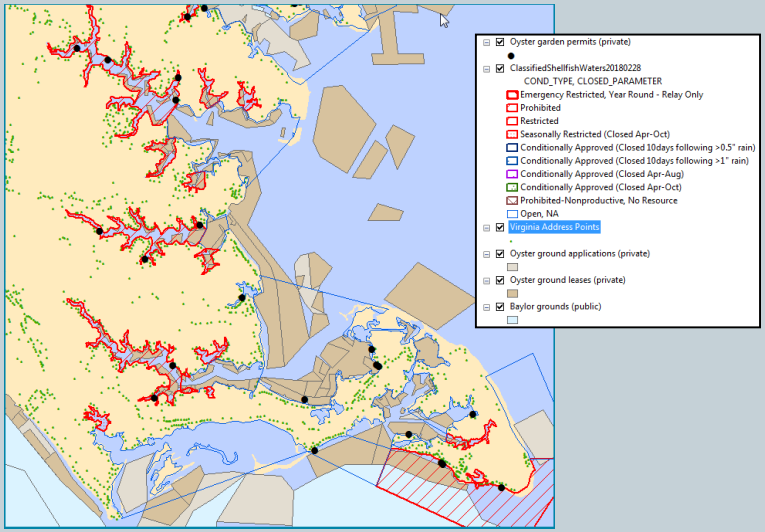


- Miami has estimated the cost of solving their failing septic issues at over $3 billion! (Miami-Dade County Report Dec 2020)

PROJECT GOAL

- Assess areas of high septic failure
- Consider changes in septic failure rates with changing climate conditions (e.g., sea level rise, increased precipitation)



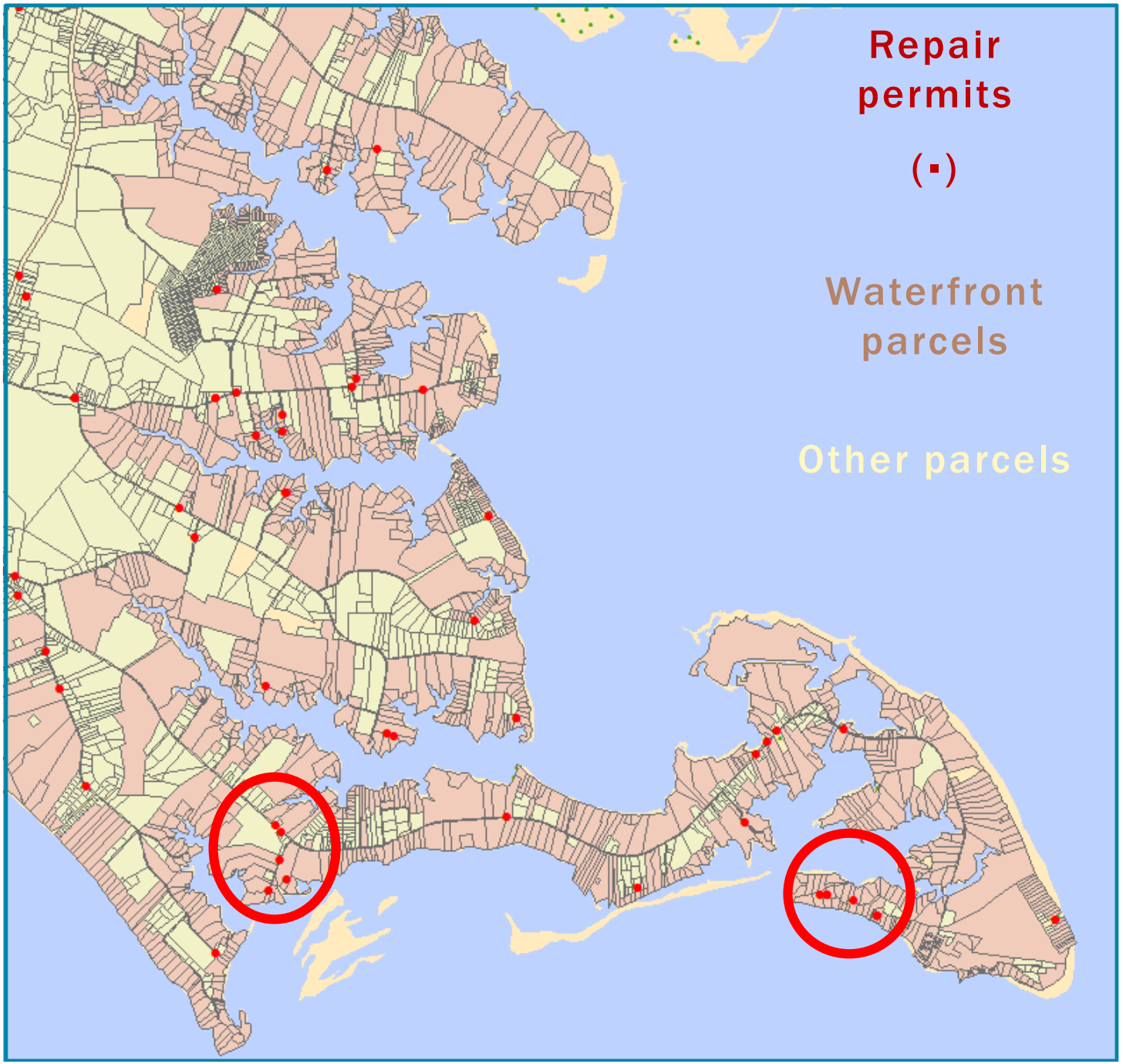


- Assess impacts of increased septic failures on water quality (under current conditions)

REASONS FOR FAILURES

ONLY DATASET AVAILABLE—PERMITS FOR REPAIRS

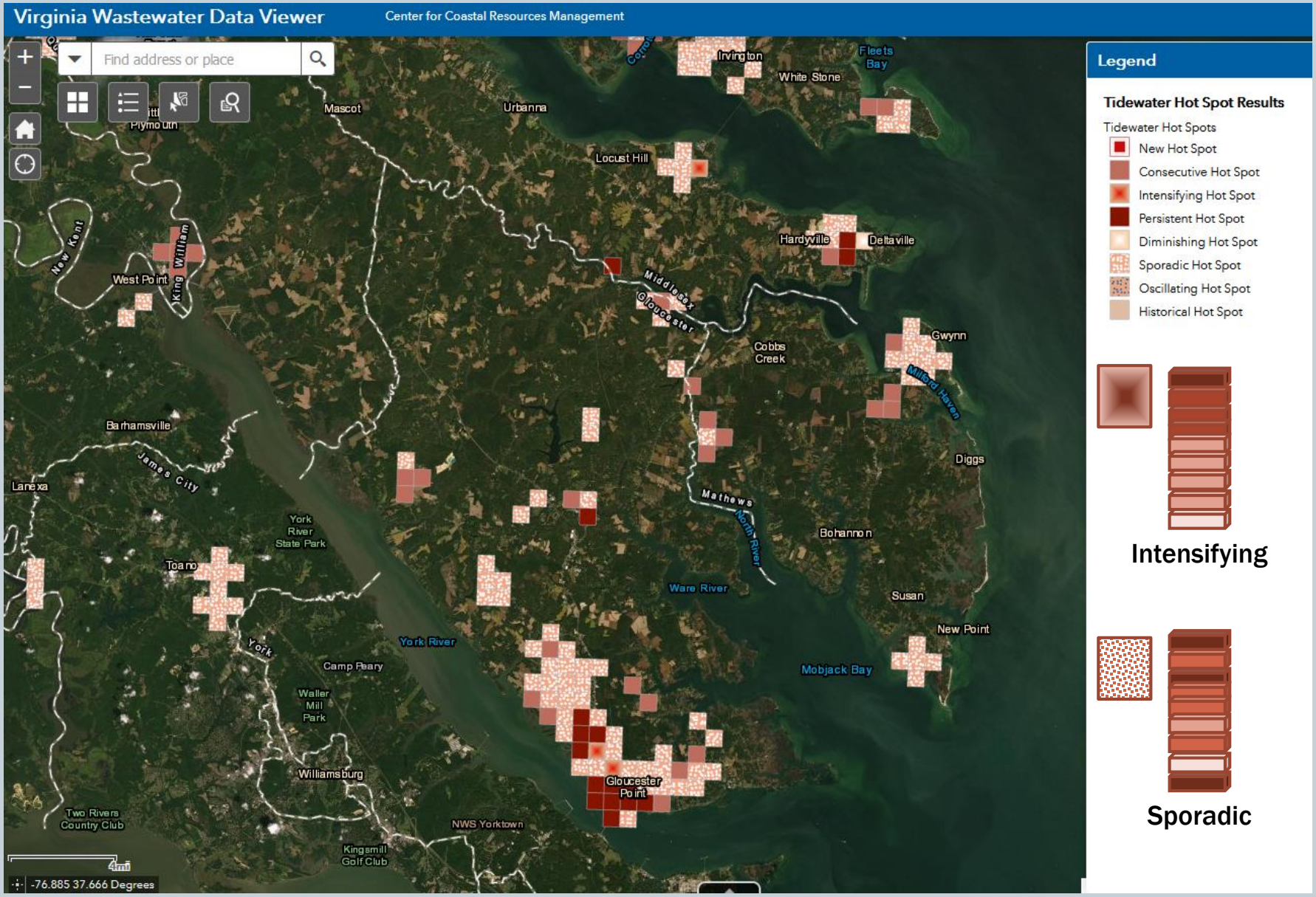
■ Human ▪ Poor maintenance ▪ Parking on septic field	■ No known proxies—but humans predictability is low (i.e. no pattern)
■ Structural ▪ Age of system (20-40 year lifespan) ▪ Type of system	■ Some proxies, but hard to actually know
■ Geologic ▪ High water table (seasonal or permanent) ▪ Low soil permeability	■ Potential proxies for evaluation & responsive to changing conditions



UNDERLYING DATA

9 YEARS OF DATA

Statistically analyze the temporal & geospatial distribution of permit repairs to find underlying patterns that could help inform decision-making.


Virginia Wastewater Data Viewer
Center for Coastal Resources Management
Find address or place
Legend
Tidewater Hot Spot Results
Tidewater Hot Spots
New Hot Spot
Consecutive Hot Spot
Intensifying Hot Spot
Persistent Hot Spot
Diminishing Hot Spot
Sporadic Hot Spot
Oscillating Hot Spot
Historical Hot Spot
Intensifying
Sporadic
Irvington
White Stone
Fleets Bay
Mascot
Urbanna
Locust Hill
Hardyville
Deltaville
West Point
King William
New Kent
Middlesex
Gloucester
Gwynn
Cobbs Creek
Milford Haven
Barhamsville
James City
Lanexa
Diggs
Mathews
North River
Bohannon
York River State Park
Toano
Ware River
Susan
New Point
York River
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Camp Peary
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Williamsburg
Gloucester Point
Two Rivers Country Club
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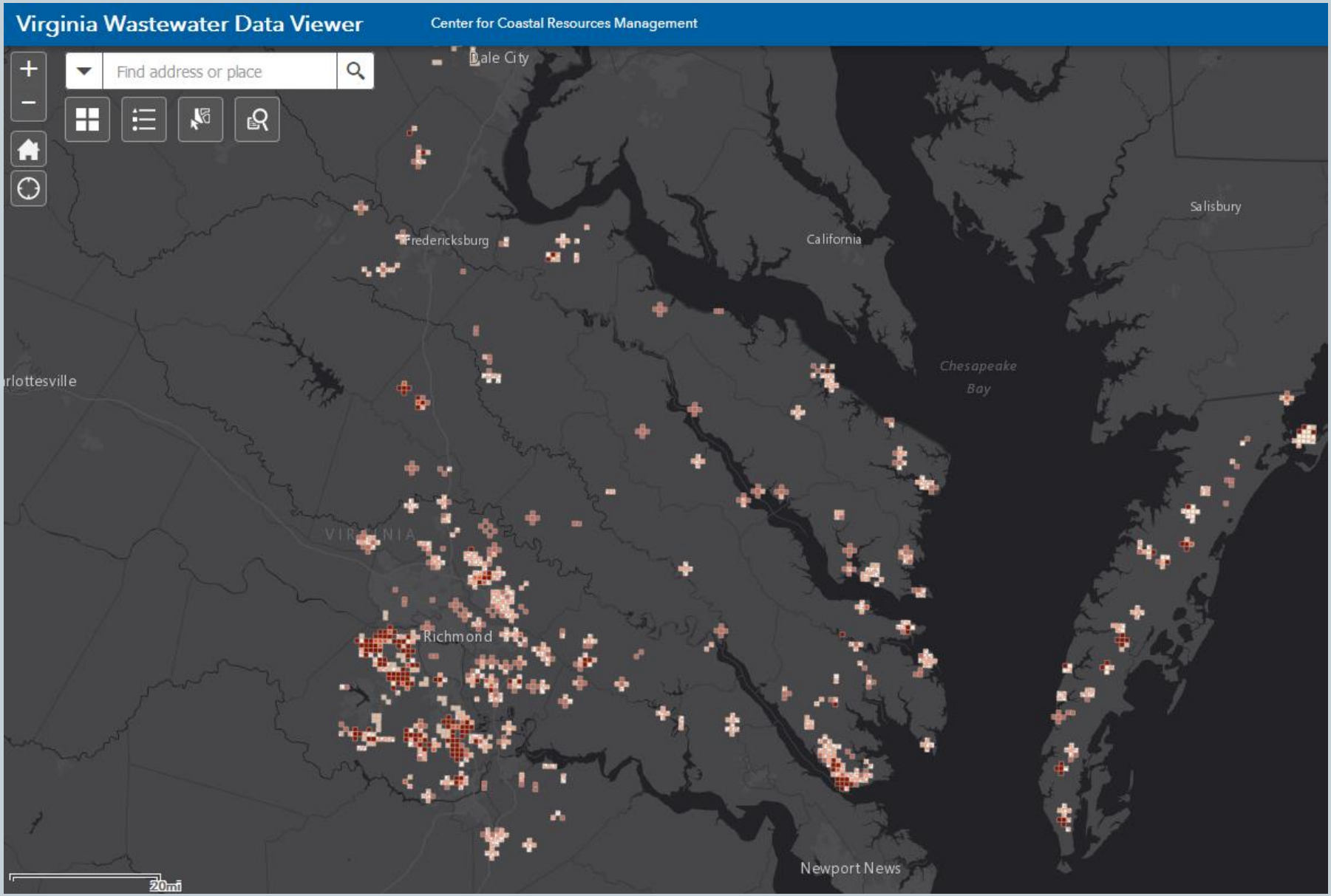
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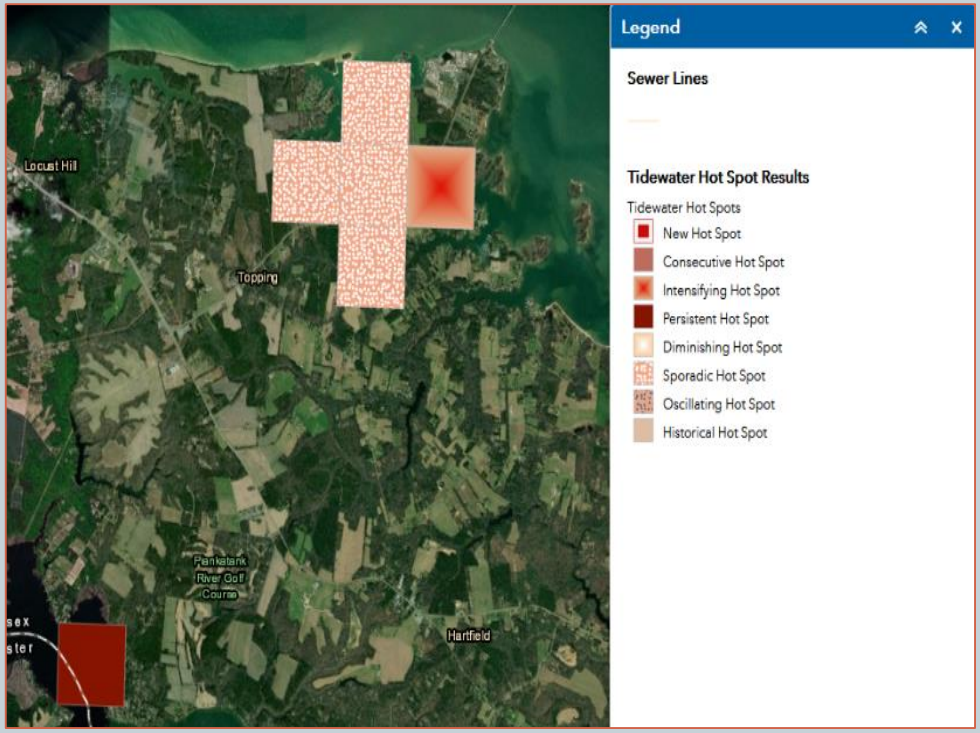
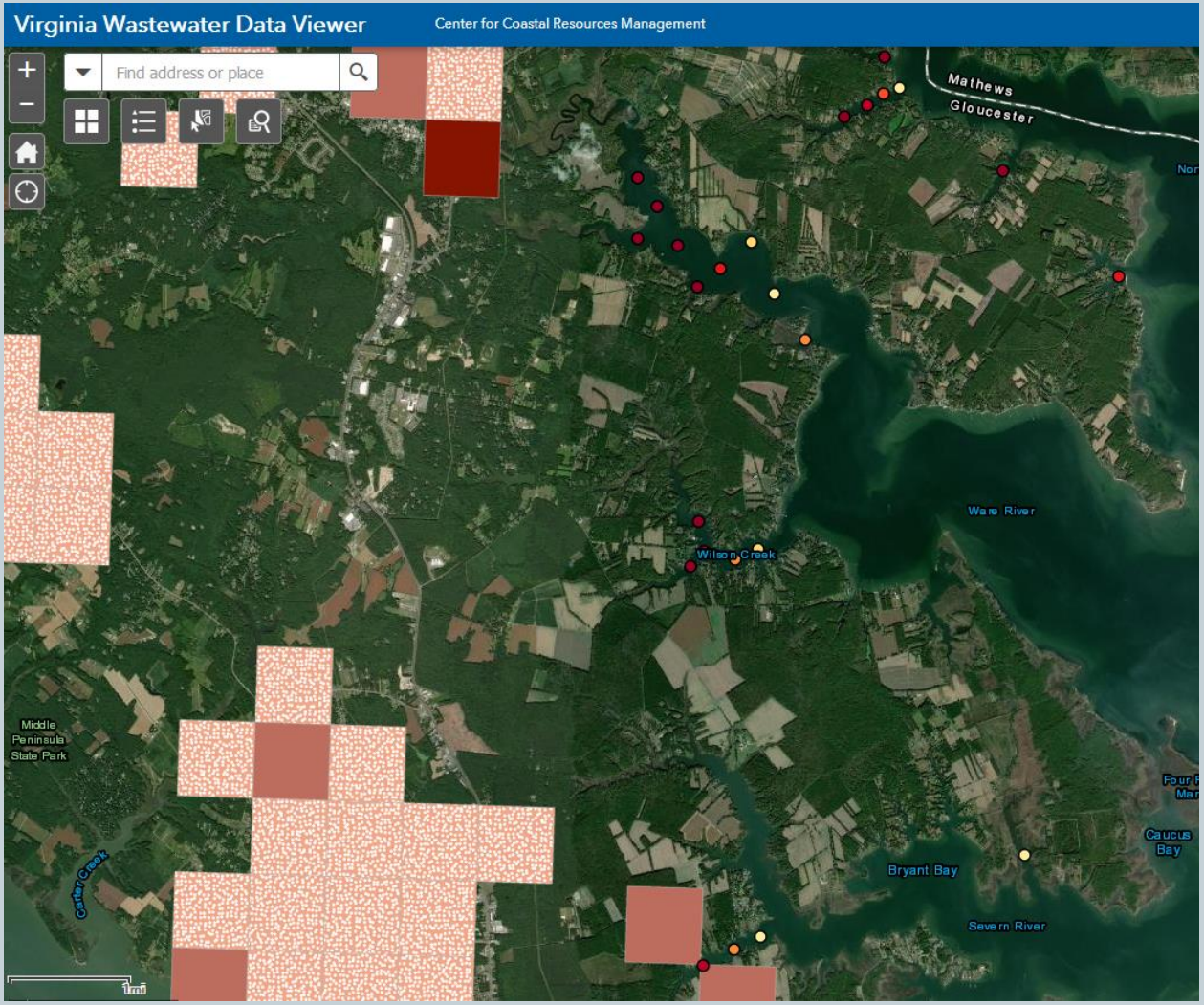
CONSIDERING GEOSPATIAL/TEMPORAL PATTERNS

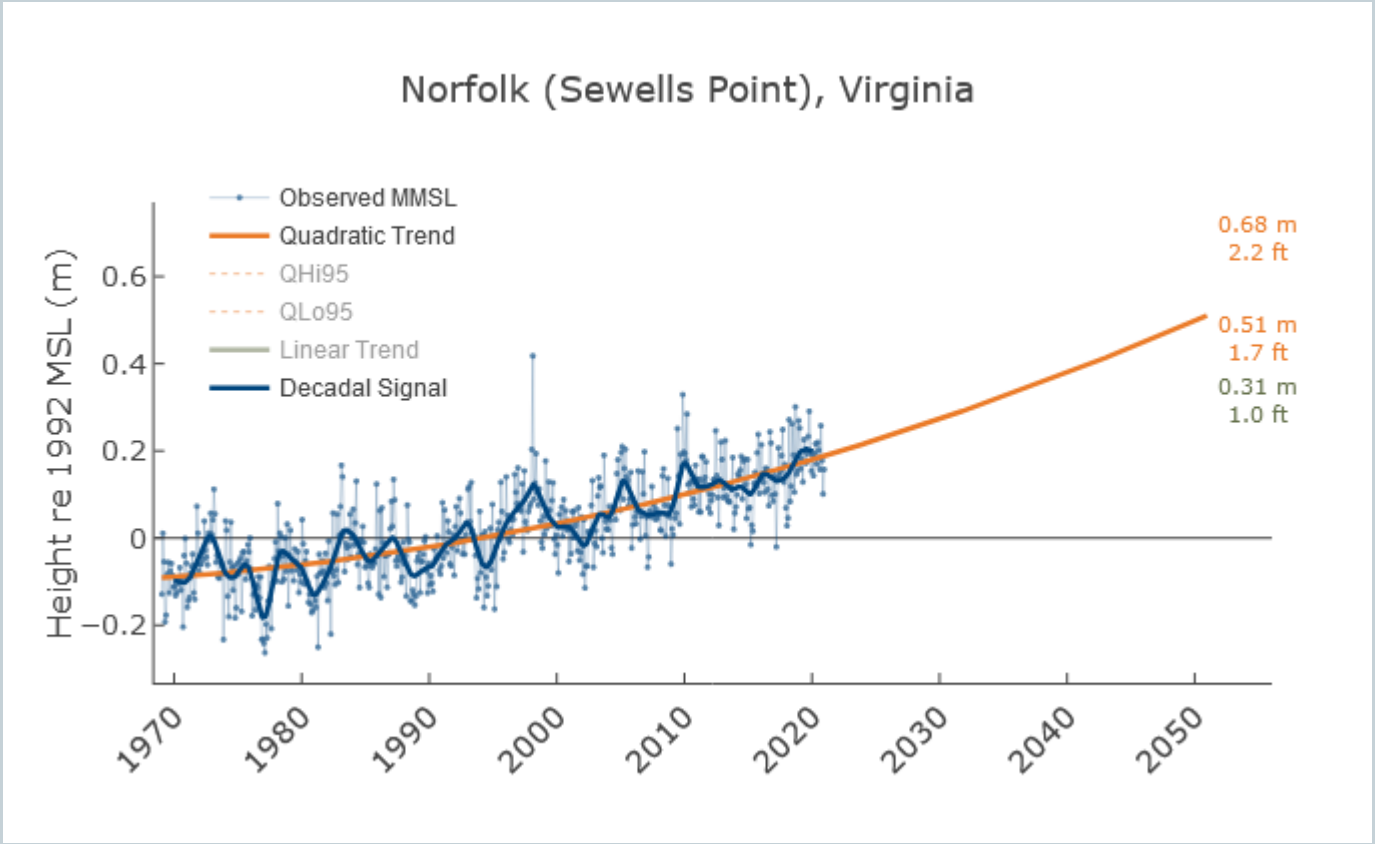
- **Consecutive/Persistent hotspots 38%** (current issues)
  - Target for sewer systems?
  - Active and continuous monitoring of adjacent waterbodies
- **Intensifying hotspots 3%** (emerging issues)
  - High risk of failures under increased sea level
- **Sporadic hotspots 47%**
  - These are likely due to years of high water table
  - They are at high risk of failures under increased precipitation



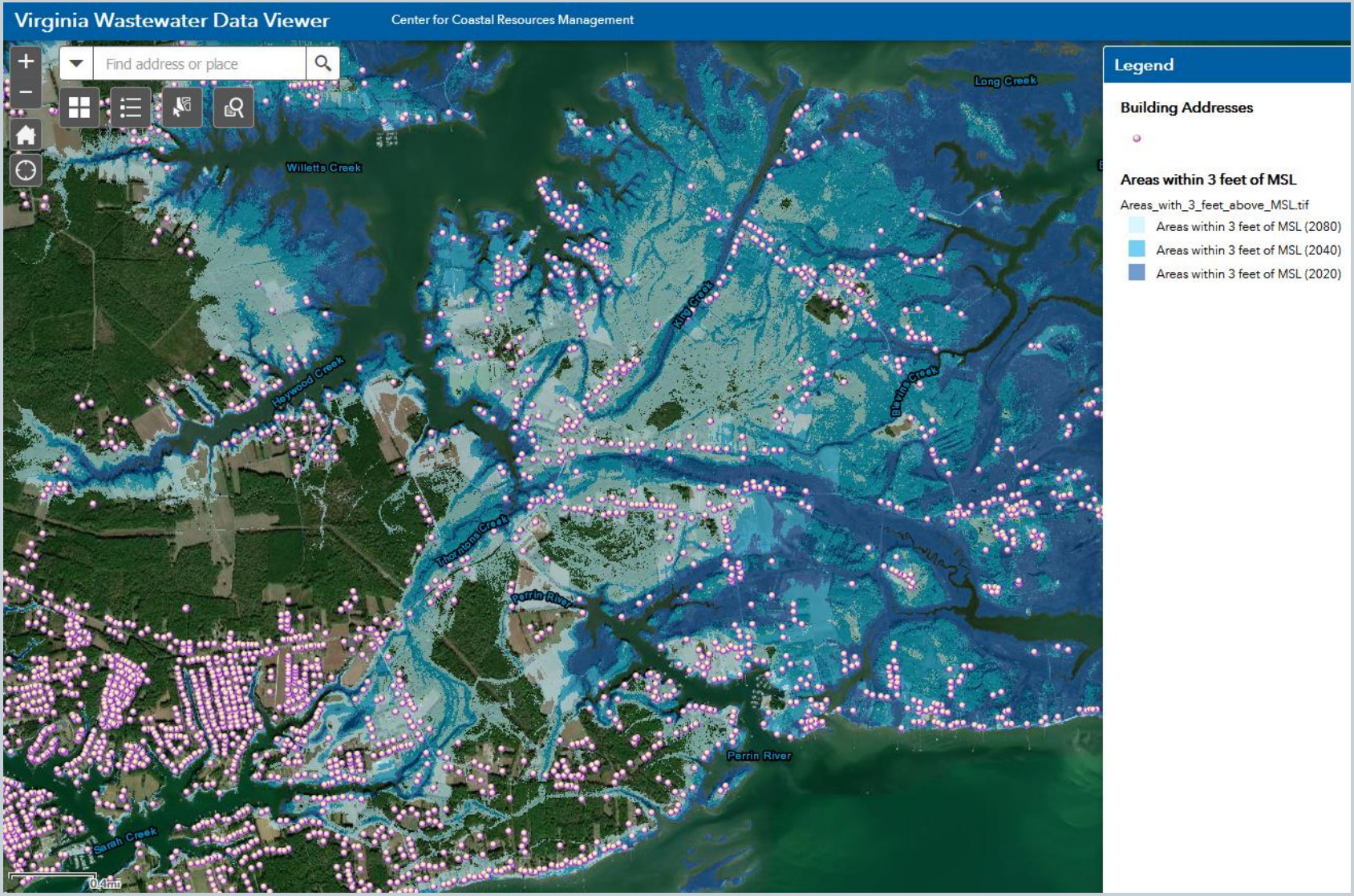
WATER QUALITY IMPACTS



SEA LEVEL RISE IN VIRGINIA



2020 rate of rise: 5.385 mm/yr **2020 rate of acceleration: 0.131 mm/yr^2**


Virginia Wastewater Data Viewer
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Willetts Creek
Long Creek
King Creek
Haywood Creek
Thornton Creek
Perrin River
Perrin River
Sarah Creek
0.4mi
Legend
Building Addresses
Areas within 3 feet of MSL
Areas_with_3_feet_above_MSL.tif
Areas within 3 feet of MSL (2080)
Areas within 3 feet of MSL (2040)
Areas within 3 feet of MSL (2020)

IMPORTANT POINTS

- All of this data is collected for regulatory/permitting processes, not statistical analysis
- BUT geospatial examination of patterns can allow targeting of monitoring and adaptive actions

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NEXT STEPS

- Expand hot spot analysis to the rest of the state
- Use participatory mapping to improve our understanding of potential issues/target areas for mitigation
- Identify potential areas for mitigative issues

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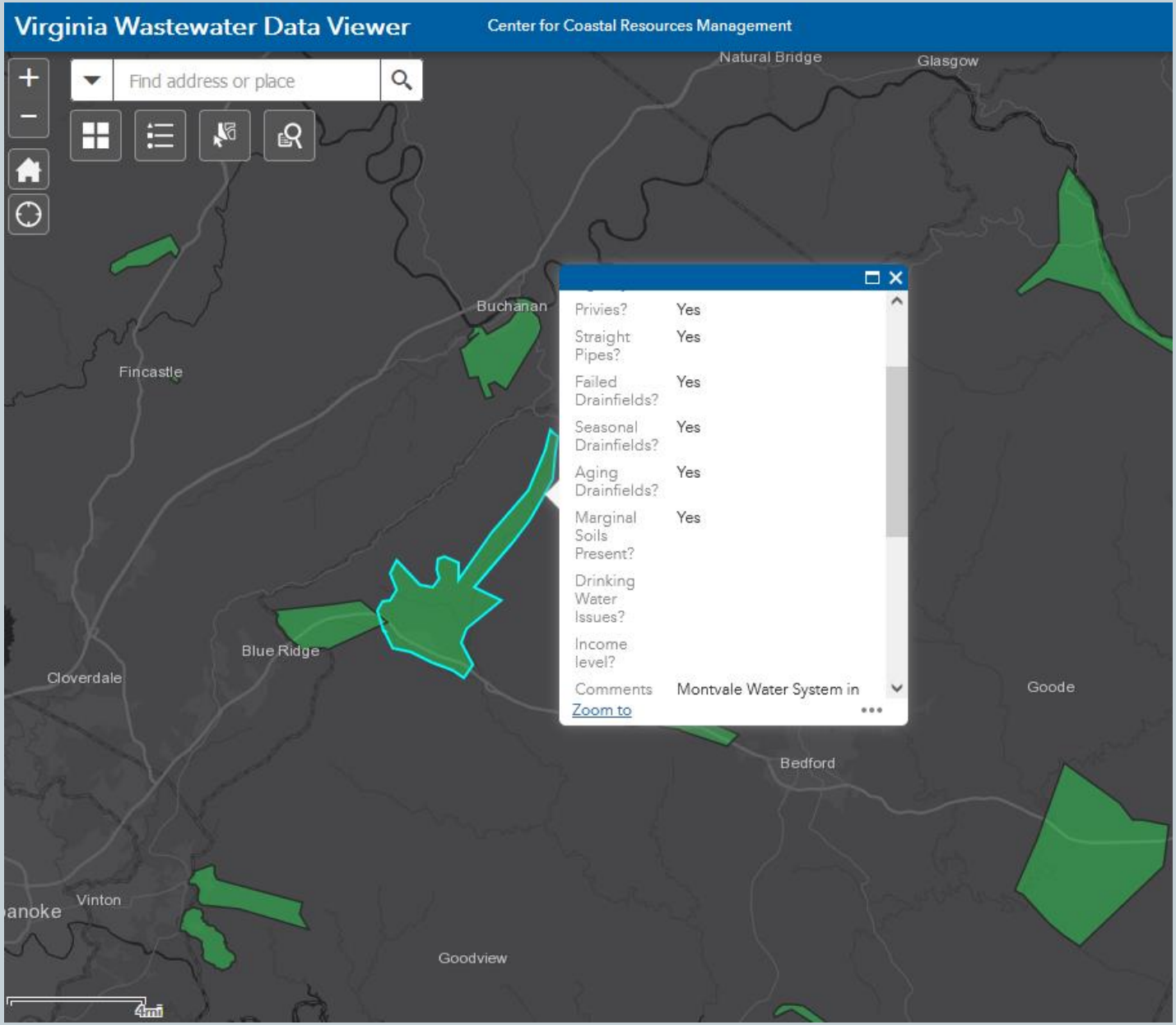
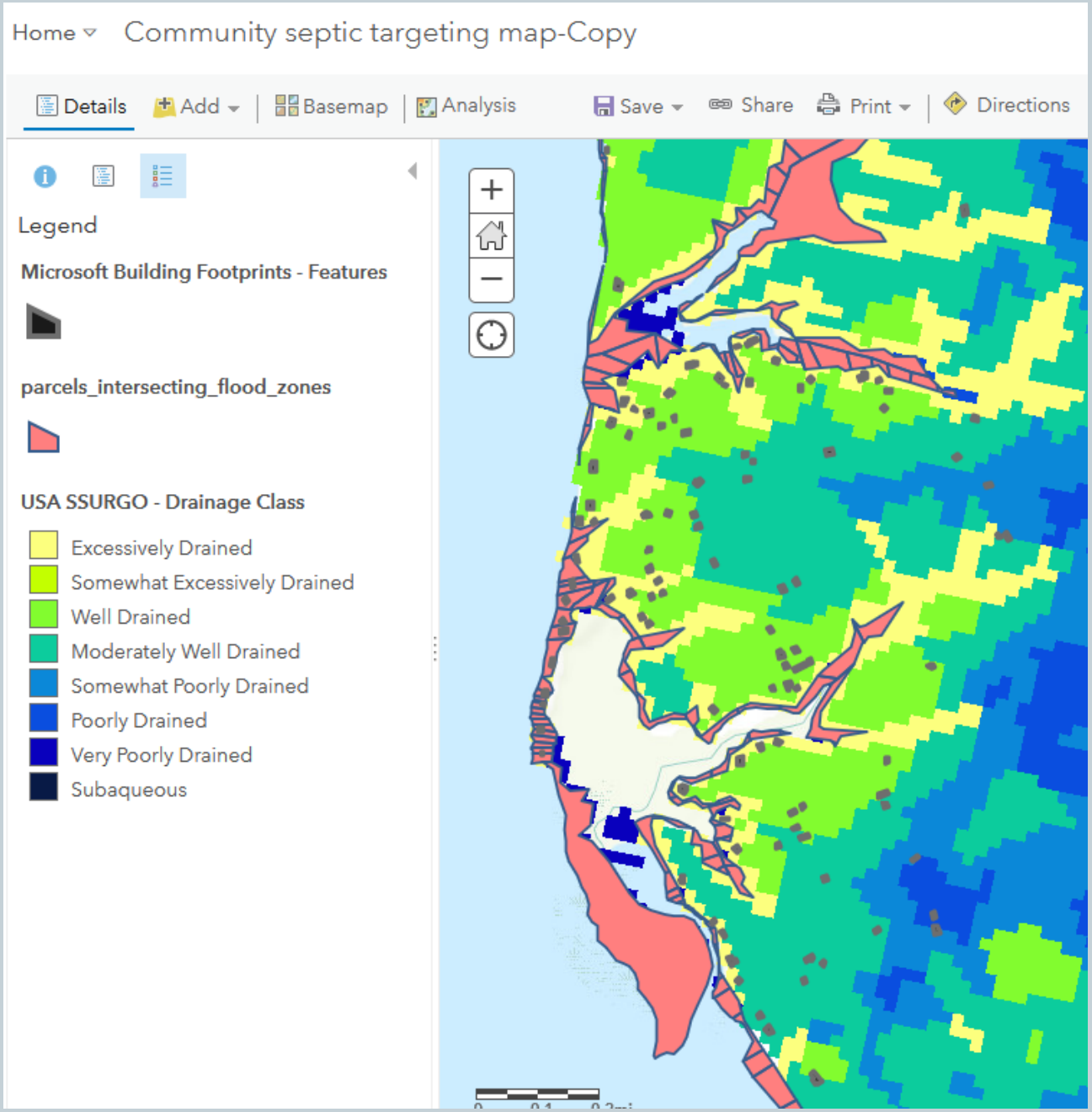
Participatory Mapping

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Directions
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Microsoft Building Footprints - Features
parcels_intersecting_flood_zones
USA SSURGO - Drainage Class
Excessively Drained
Somewhat Excessively Drained
Well Drained
Moderately Well Drained
Somewhat Poorly Drained
Poorly Drained
Very Poorly Drained
Subaqueous

QUESTIONS?

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