



Decentralized Wastewater Planning in the Town of Nags Head, North Carolina

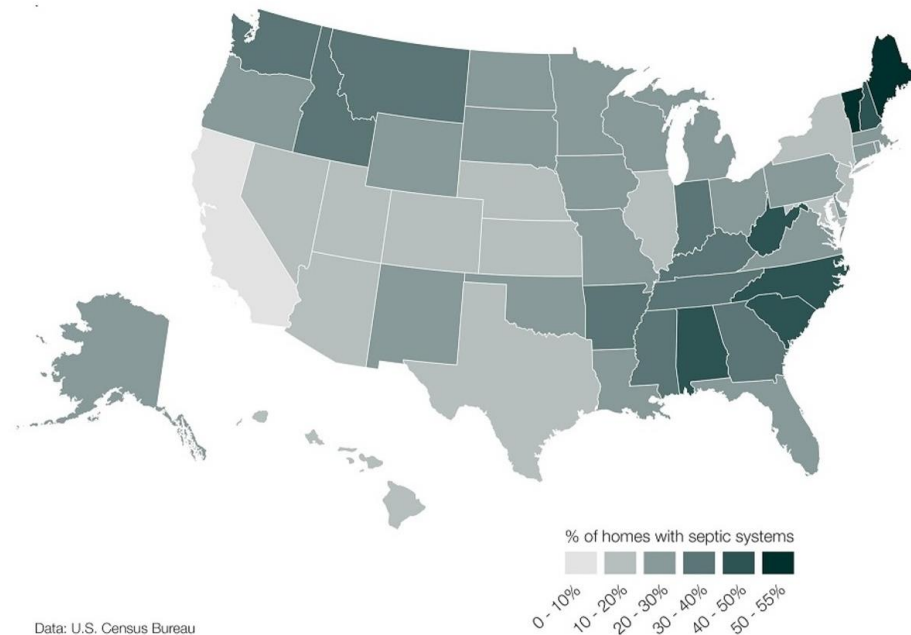
Problem Solving for Coastal Resiliency

Onsite Wastewater Mega-Conference 2023

Hillary Yonce, PH
Tetra Tech

Septic and Floodplain Management

- 21 million septic systems in the U.S.
- 2 million septic systems in rural and coastal communities in N.C.
- Regional Hazard Mitigation Plans often don't include private septic
- Septic systems are rarely maintained well, not often located on a county GIS map, and are aging
- How will future conditions, climate change, nor'easters, SLR, and groundwater affect septic in the Town of Nags Head, other coastal communities, and Eastern North Carolina?



Town of Nags Head

FACT

Over 80% of the Town's wastewater is treated by individual onsite residential septic systems and not central sewer.

When a septic system fails it can cause bacteria and excess pollutants to enter groundwater, stormwater, and surface water. These pollutants are carried to the sound and ocean which can lead to beach closures and affect the quality of life.



OWTS Risk

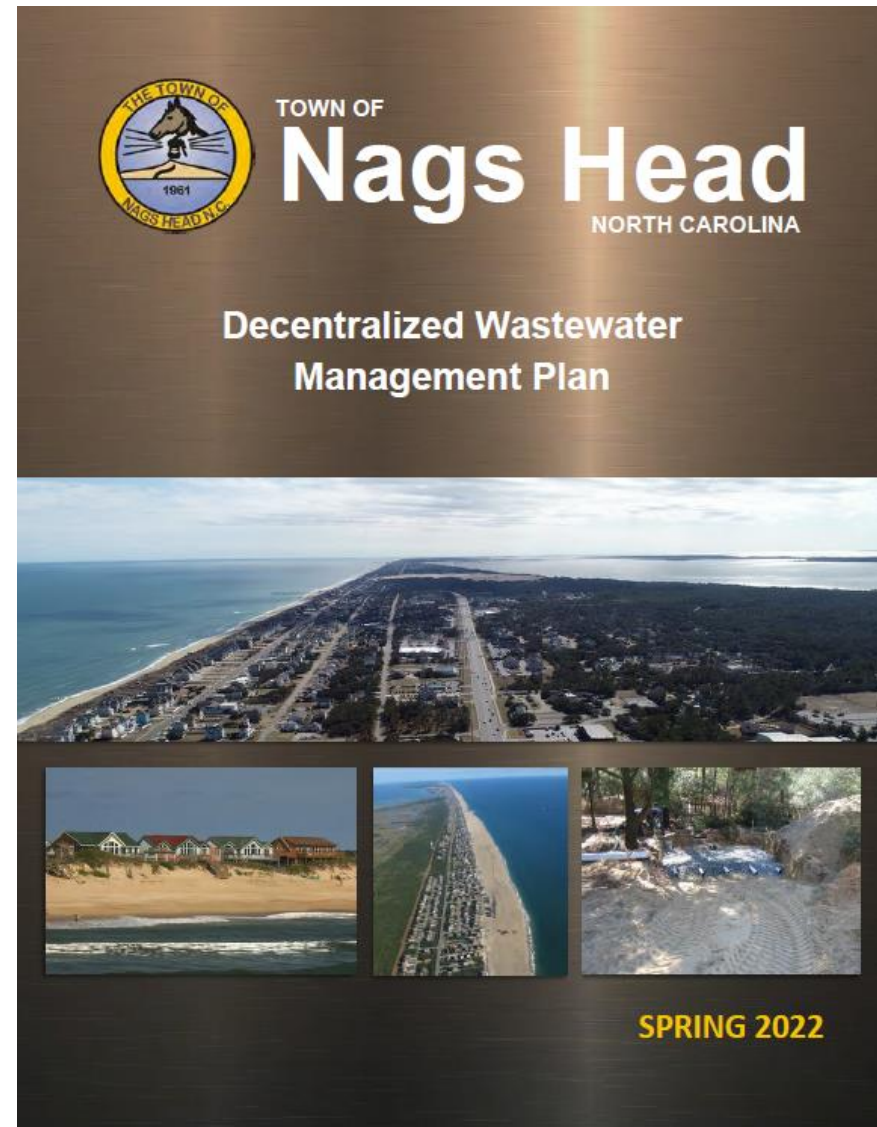


Decentralized Wastewater Management Plan (DWMP) Background

- Septic Health Initiative (SHI) began in 1999 and was renamed to honor Todd D. Krafft in 2019
 - Free septic or onsite wastewater treatment system (OWTS) inspections for single-family homes
 - Septic system pump out rebates
 - Low-interest loans for repairs/replacement
 - Water quality sampling
- DWMP was developed in 2005 to outline a strategy to implement goals to continue to utilize OWTS for wastewater treatment
- Plan update began in March 2021 and will be finalized in May 2022
 - ECU CSI partnered with the Town/Tetra Tech to obtain groundwater table elevations and subsurface water quality at four (4) sites

DWMP Update

- Stakeholder and Community Input
- New Mission, Vision, Goals, and Objectives
- Connection to Other Existing Town Programs and Plans
- SHI Program Review, Additions, and Recommendations
- Groundwater Interface and Interaction with Septic
- Future Conditions and Septic System Risk Management Planning
- Funding Opportunities



Adaptation Planning in
Town of Nags Head:
Vulnerability, Consequences
Scenarios (VCAPS) Report

North Carolina Climate Science Report

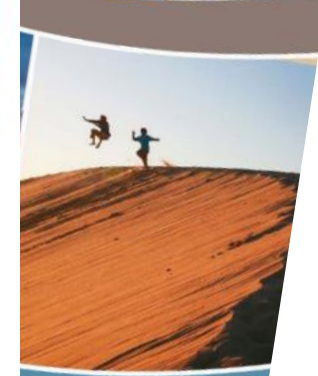
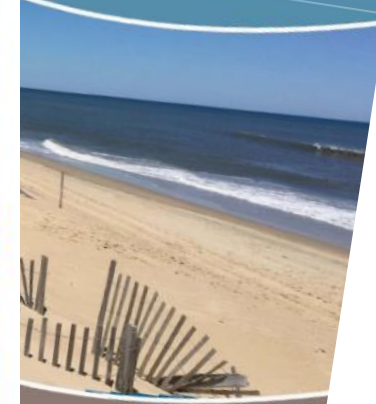


Photo by Matt Lusk

August 2017



TOWN OF
Nags Head
NORTH CAROLINA



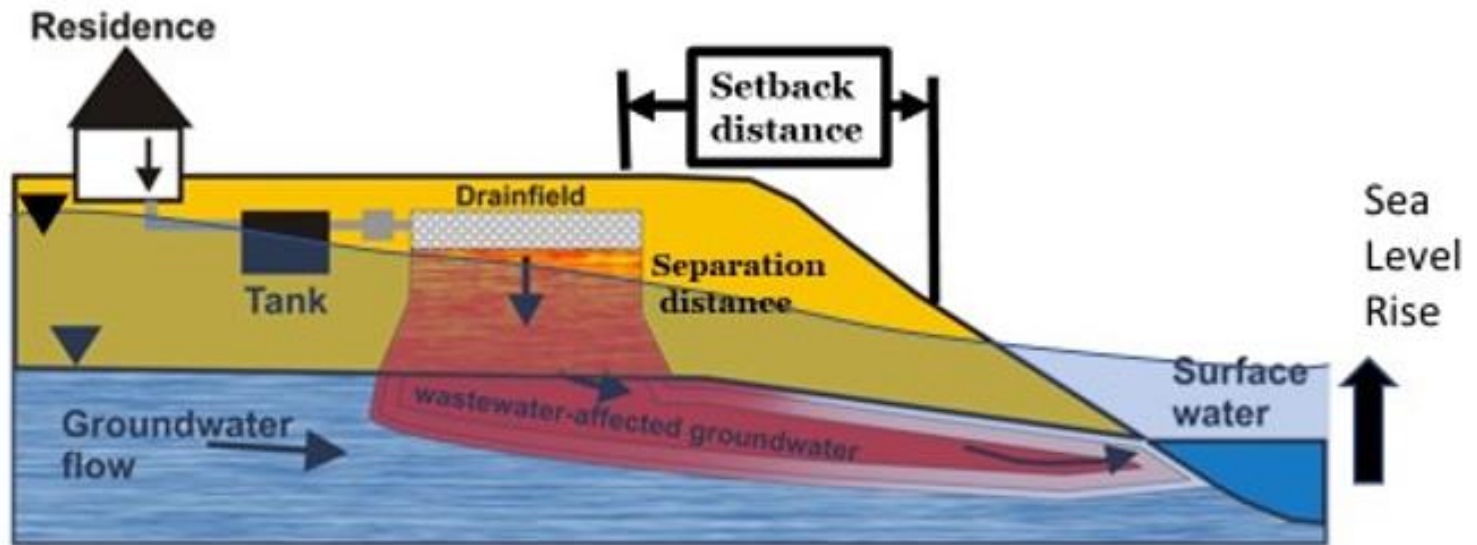
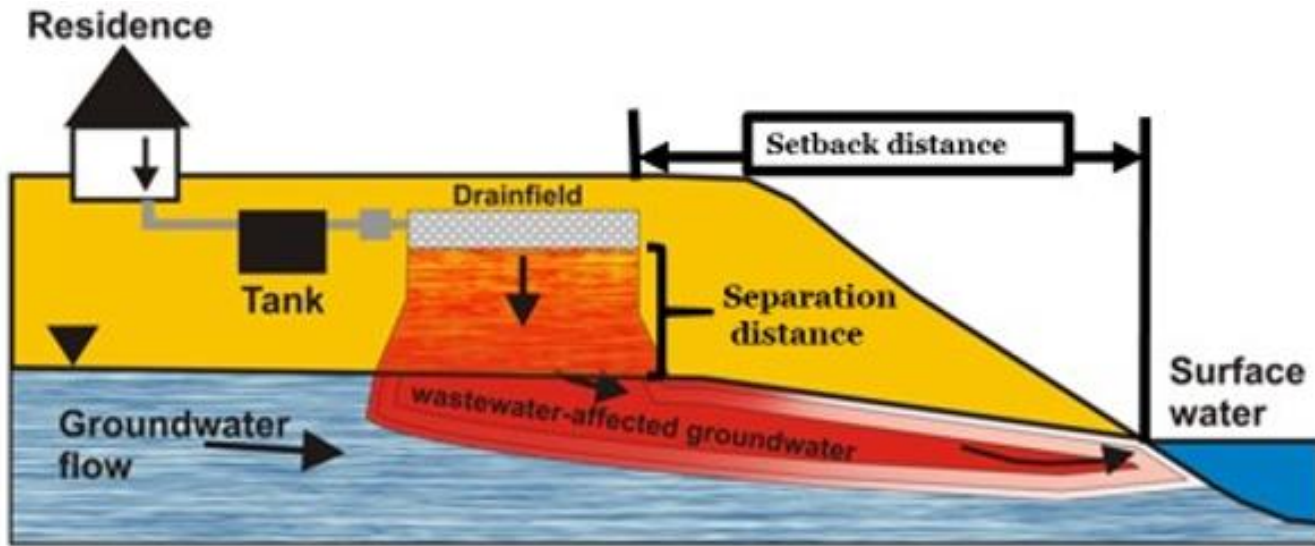
ive Plan
July 5, 2017

Increase in OWTS Threats

- High-Intensity Short Duration Rainfall Events
- King Tides contributing to Ocean Overwash
- Flooding
- Nor'Easters
- Hurricanes



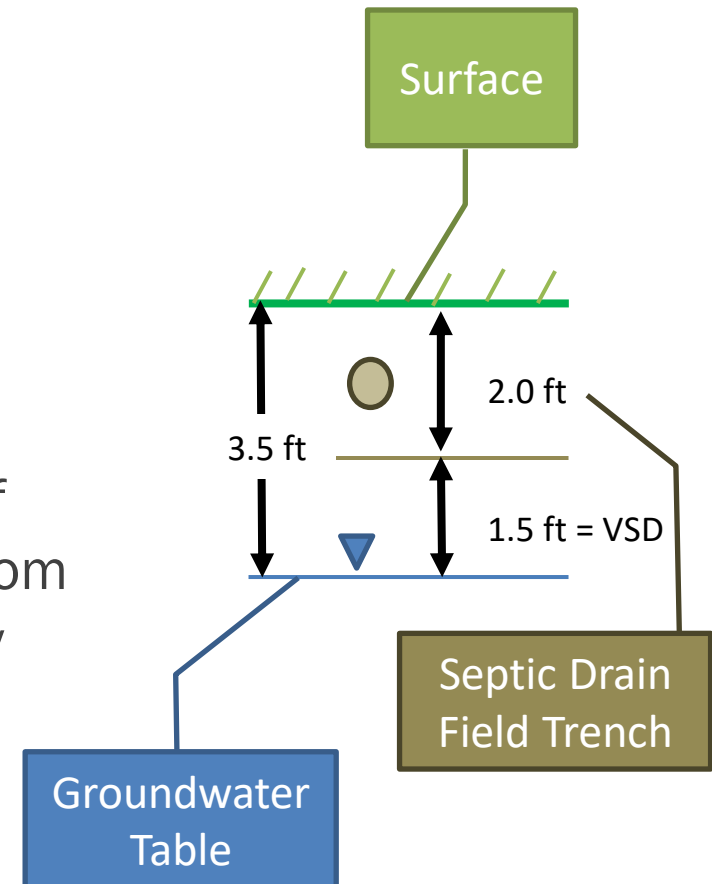
Septic and Groundwater Interaction



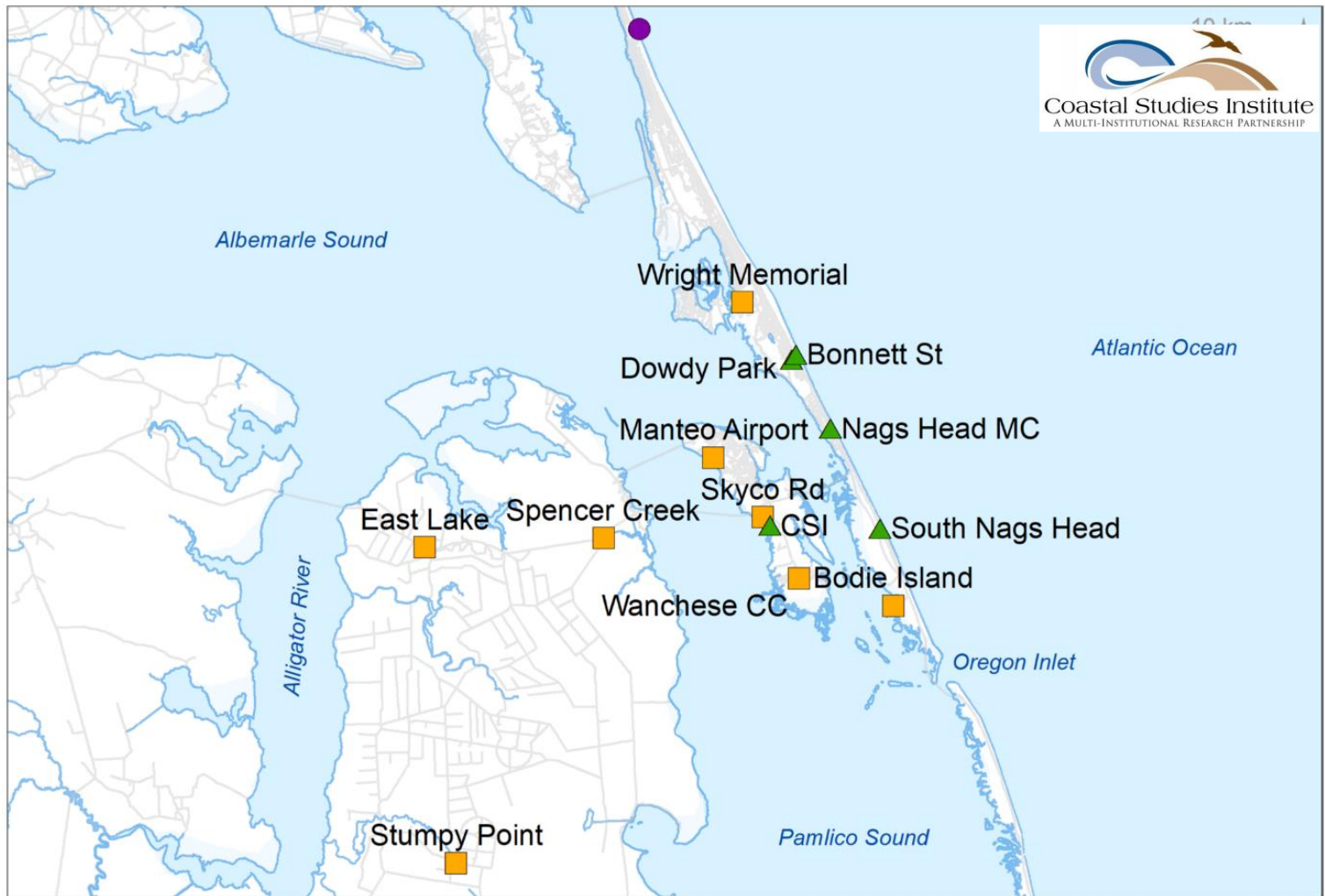
Groundwater Analysis

- ECU CSI sampled groundwater elevations at six (6) locations in Nags Head over twelve (12) months
- Used to determine the average vertical separation distance from the bottom of the drain field to groundwater (1.5 feet required)

2.0 feet drain field depth + 1.5 feet of separation = 3.5 feet total required from surface to groundwater table in sandy soils



Groundwater Sample Locations



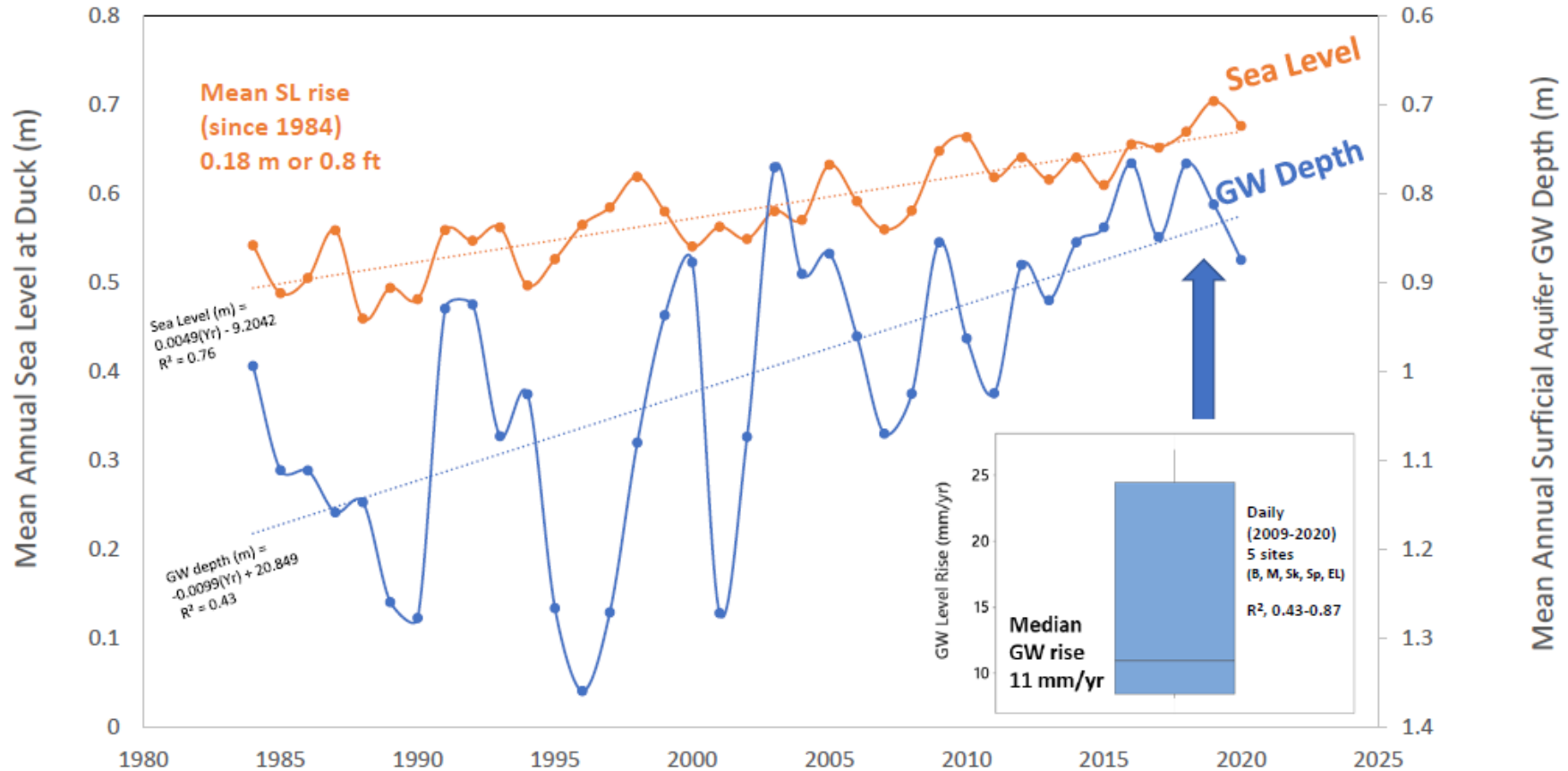
- ▲ Project Sampling Wells
- Groundwater Well
- Duck Sea Level Station
- Road
- Water Feature



Groundwater Relative to SLR

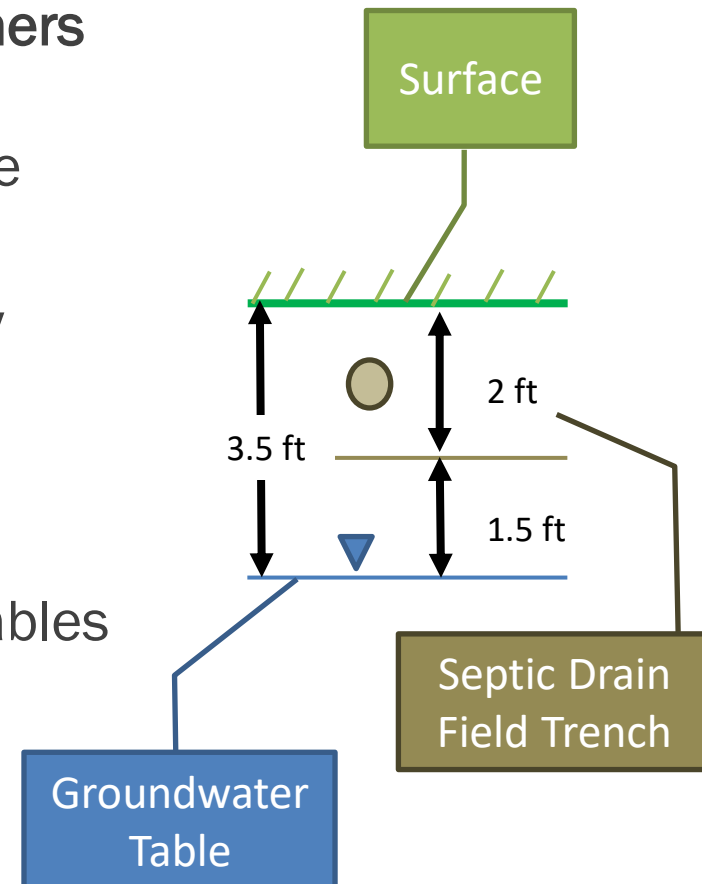


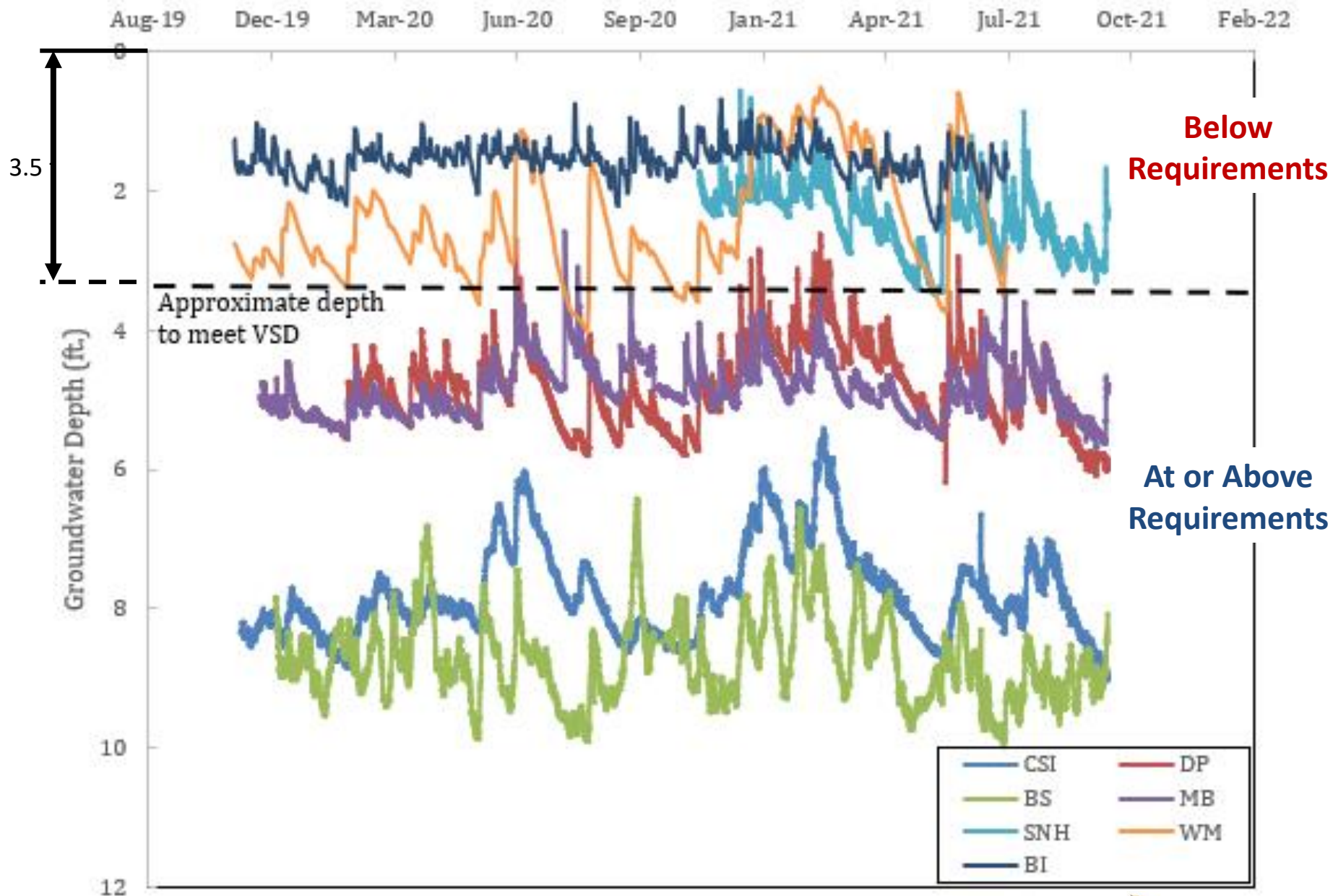
GW is Rising with Sea Level at the Coast (Mean Annual Data, Dare Co., NC)



Groundwater Data Analysis Summary

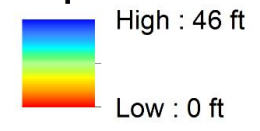
- **Below Requirements:** South Nags Head (SNH), Bodie Island (BI), and Wright Brothers Memorial (WM) had shallow groundwater tables, less than 3.5 feet from the surface
- **At or Above Requirements:** Town of Nags Head Municipal Building (MB) and Dowdy Park (DP) had groundwater table depths greater than 3.5 feet from the surface
- **Above Requirements:** Bonnett Street (BS) Beach Access had deeper groundwater tables





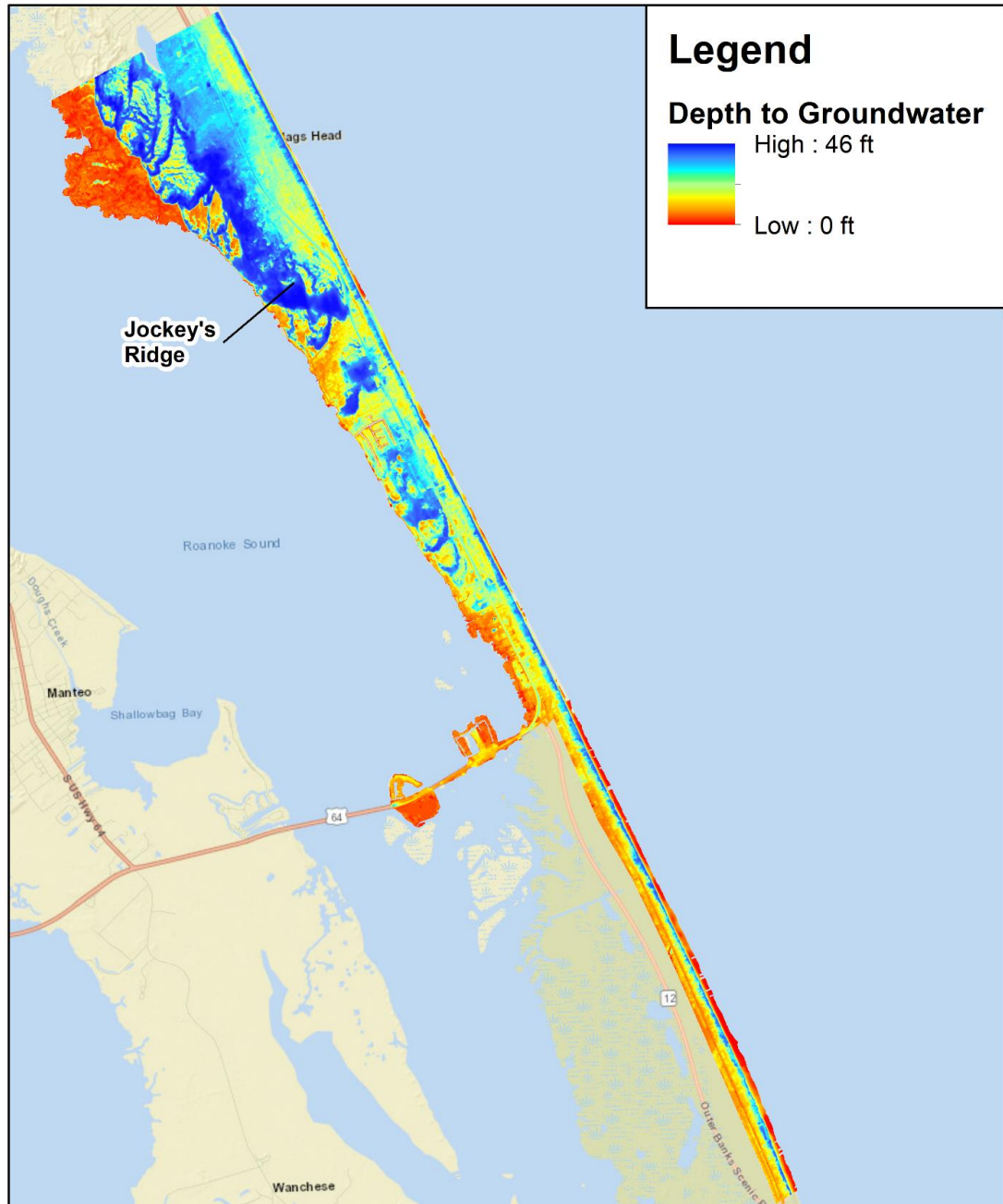
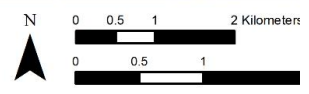
Legend

Depth to Groundwater



Land Surface Elevation
Nags Head, NC

Map produced by H. Yonce, 10-06-2021
NAD_1983_StatePlane_North_Carolina_FIPS_3200_Feet

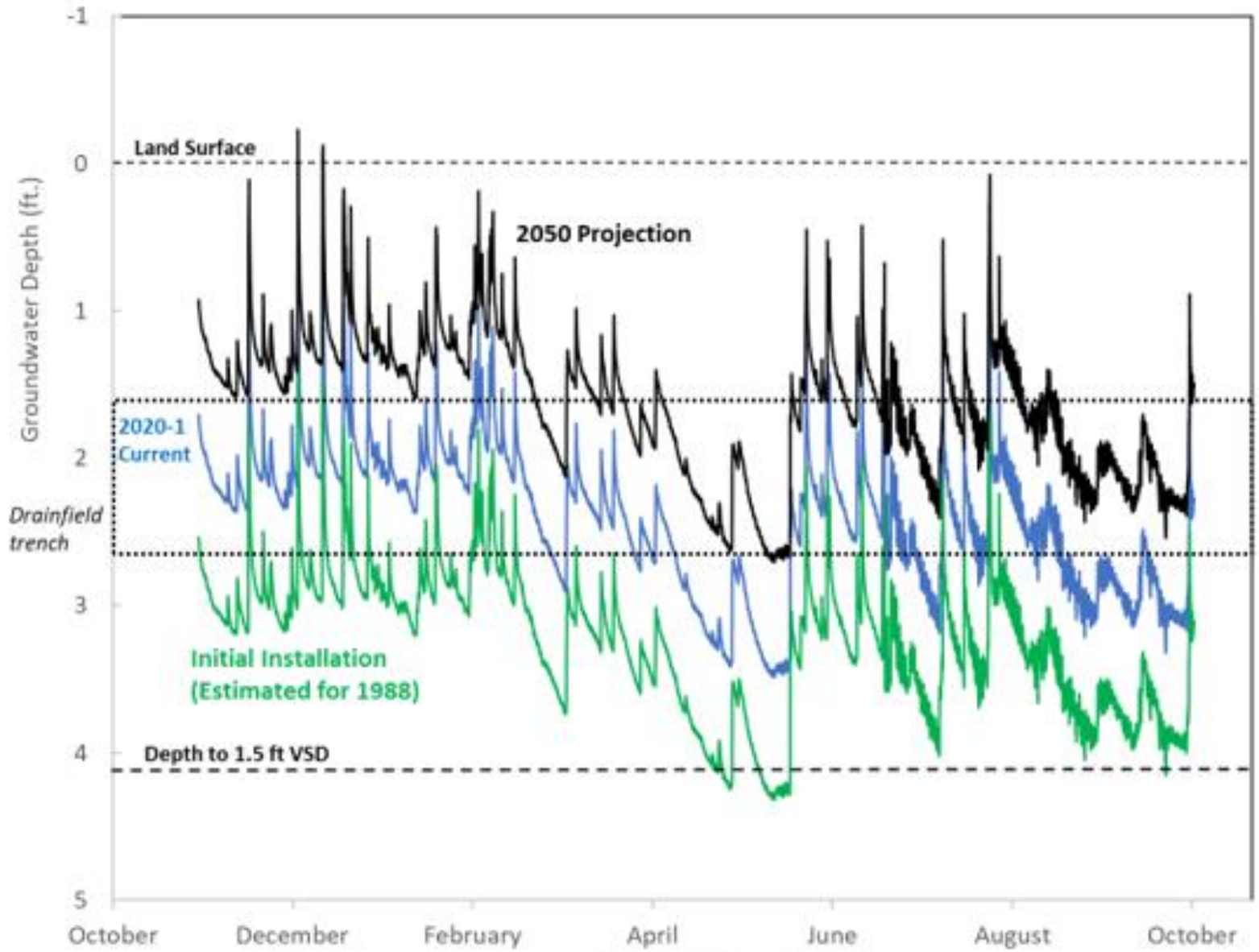


Approximate Groundwater Elevation
Nags Head, NC

Map produced by H. Yonce, 11-03-2021
NAD_1983_StatePlane_North_Carolina_FIPS_3200_Feet



S. Nags Head (SNH) Residential Site



Relative Risk Assessment Categories

- 1. Low Risk:** Site conditions support effective treatment of septic effluent, there is minimal risk of system failure.
- 2. Medium Risk:** Site conditions generally support treatment of septic effluent, but environmental factors may require use of advanced septic systems for successful long-term performance.
- 3. High Risk:** Site conditions are not currently favorable to support treatment of septic effluent via conventional septic systems. Alternative treatment such as advanced or a decentralized cluster treatment systems that convey wastewater effluent to more suitable sites are likely needed within the near future.

Risk Assessment Analysis Metrics

Evaluation metrics were selected based on data availability and the likelihood of potential environmental and human health risk factors associated with a potential OWTS failure:

1. Land surface elevation
2. Depth to groundwater
3. Proximity to stormwater infrastructure
4. Proximity to surface water including all waterbodies
5. Proximity to environmentally sensitive areas
6. Observed poor surface water quality

Site Evaluation Criteria	Weight	Scoring Threshold Value	Relative Risk
Land Surface Elevation (feet)	High	> 7	Low
		3 - 7	Medium
		< 3	High
Depth to Groundwater (inches)	High	> 36	Low
		24 - 36	Medium
		< 24	High
Proximity to Stormwater Infrastructure (count of proximity flags as < 300 feet away, by infrastructure type)	Medium	0 - 1	Low
		2 - 3	Medium
		4 - 5	High
Proximity to Waterbodies (feet)	Medium	Distance < 25 th percentile	Low
		Distance 25 th - 75 th percentile	Medium
		Distance > 75 th percentile	High
Proximity to Environmentally Sensitive Areas (feet)	Low	Distance < 25 th percentile	Low
		Distance 25 th - 75 th percentile	Medium
		Distance > 75 th percentile	High
Proximity to Poor Surface Water Quality (feet)	Low	Distance < 25 th percentile	Low
		Distance 25 th - 75 th percentile	Medium
		Distance > 75 th percentile	High

Risk Assessment Analysis Metrics

Low Risk (green) = 42%
(1,512 parcels)

Medium Risk (orange) = 48%
(1,787 parcels)

High Risk (purple) = 10%
(428 parcels)



Legend

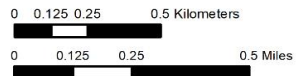
Relative Risk Assessment

- Low Risk
- Medium Risk
- High Risk



Risk Assessment: Results (South) Nags Head, NC

Map produced by H. Yonce, 1-17-2022
NAD_1983_StatePlane_North_Carolina_FIPS_3200_Feet



For Medium Risk (orange) and High Risk (purple) Areas:

- Targeted outreach and engagement for parcels under the SHI program
- Possible advanced levels of septic system treatment due to current or projected future onsite conditions
- State or Federal grants or loans for neighborhood-scale septic system replacement or implementation of community decentralized septic systems with offsite cluster treatment options
- Identification of areas for future open space preservation, land acquisition, or consideration of FEMA buyouts for properties with repetitive losses due to flooding greater than 50% of the property value
- Conduct additional groundwater elevation monitoring data using continual remote loggers to determine actual conditions in hot spots and develop seasonal averages

DWMP Next Steps

1. Increase septic system inspections annually to 500 by FY2027
2. Increase septic system pump out credits annually to 250 people by FY2027
3. Increase septic system pump out credit from \$45 to \$150 (half the cost)
4. Increase septic system repair/replacement maximum loan amount from \$7,500 to \$12,000
5. Increase education through a variety of materials, media sources, and giveaways
6. Add 10 GW and 6 WQ stations
7. Apply for grants





Thank you.

Any Questions?

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