

**VULNERABILITY ASSESSMENT OF OSTDS TO
SEA LEVEL RISE AND STORM SURGE TO DEVELOP
ADAPTATION PLANS IN
ST. AUGUSTINE, FL**

*PRESENTATION TO THE UNIVERSITY OF FLORIDA,
WATER INSTITUTE SYMPOSIUM*

2/23/22

CITY OF ST. AUGUSTINE - JESSICA BEACH, P.E., CHIEF RESILIENCE OFFICER

WILDWOOD CONSULTING, INC. - TRICIA KYZAR, PHD, SPATIAL ANALYST/PROJECT MANAGER

INTRODUCTION

- GRANT FUNDED PROJECT THROUGH FDEP'S FLORIDA RESILIENT COASTLINES PROGRAM (FRCP)
 - ✓ \$75,000 FULLY FUNDED GRANT
- IN PARTNERSHIP WITH THE UNIVERSITY OF FLORIDA
 - ✓ DR. TRICIA KYZAR (FORMERLY PHD CANDIDATE - DEPT. OF URBAN AND REGIONAL PLANNING)
 - ✓ DR. EBAN BEAN, P.E., PRINCIPAL INVESTIGATOR - DEPT. OF AGRICULTURAL AND BIOLOGICAL ENGINEERING
- PROJECT DURATION – OCTOBER 2020 – JUNE 2021

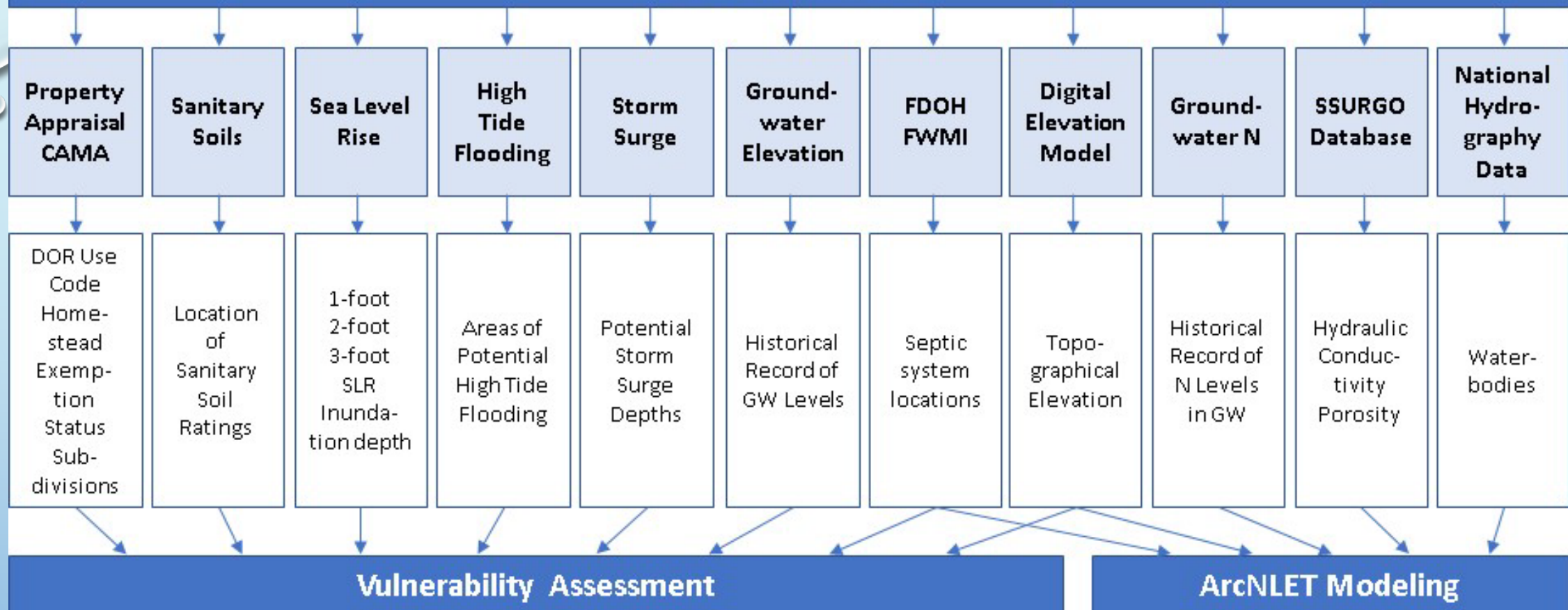


WHAT IS THE PROJECT?

- PROJECT TASKS

- ✓ ASSESS THE VULNERABILITY OF IDENTIFIED ONSITE TREATMENT AND DISPOSAL SYSTEMS (OSTDS) TO MULTIPLE CLIMATE CHANGE RELATED PARAMETERS
- ✓ CALCULATE NITROGEN EXPORTS UNDER CURRENT CONDITIONS USING ARCNLET
- ✓ REPORT ON STATE OF WASTEWATER TREATMENT (WWT) TECHNOLOGIES
 - COSTS AND FUNDING OPPORTUNITIES
- ✓ PRESENT FINDINGS TO THE PUBLIC
 - IDENTIFYING AREAS THAT ARE SUITABLE FOR STRATEGIC PLANNING INITIATIVES BECAUSE THEY ARE AT RISK OF SLR, STORM SURGE, ELEVATED GROUNDWATER TABLES AND/OR SOILS NOT SUITABLE FOR SEPTIC EFFLUENT PROCESSING

Data Acquisition



Vulnerability Assessment

- Vulnerability assessment scores for individual septic systems
- Average of vulnerability assessment scores for subdivisions
- Identification of hotspots and cold spots

ArcNLET Modeling

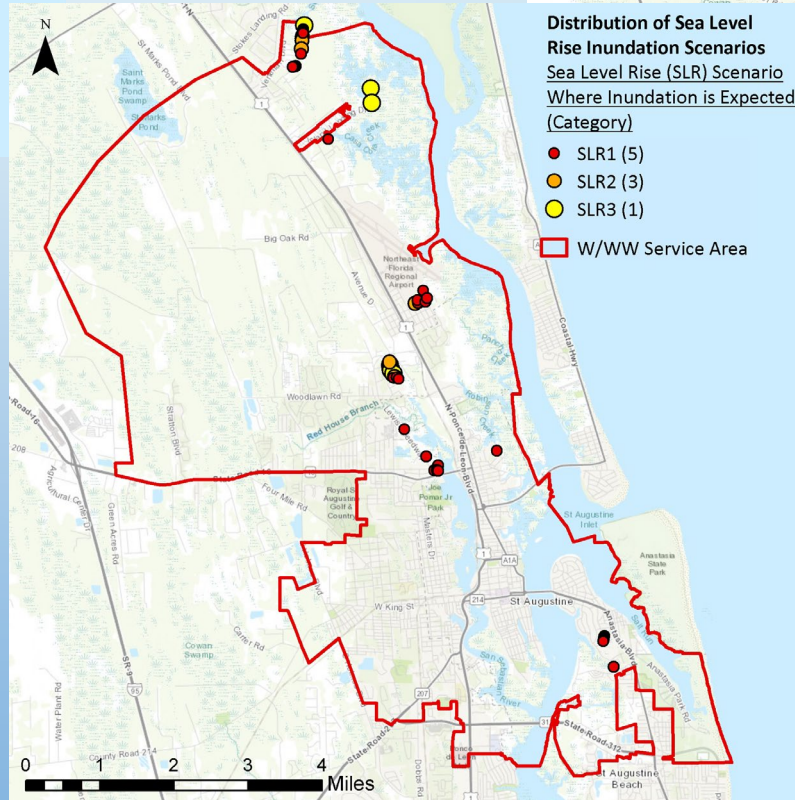
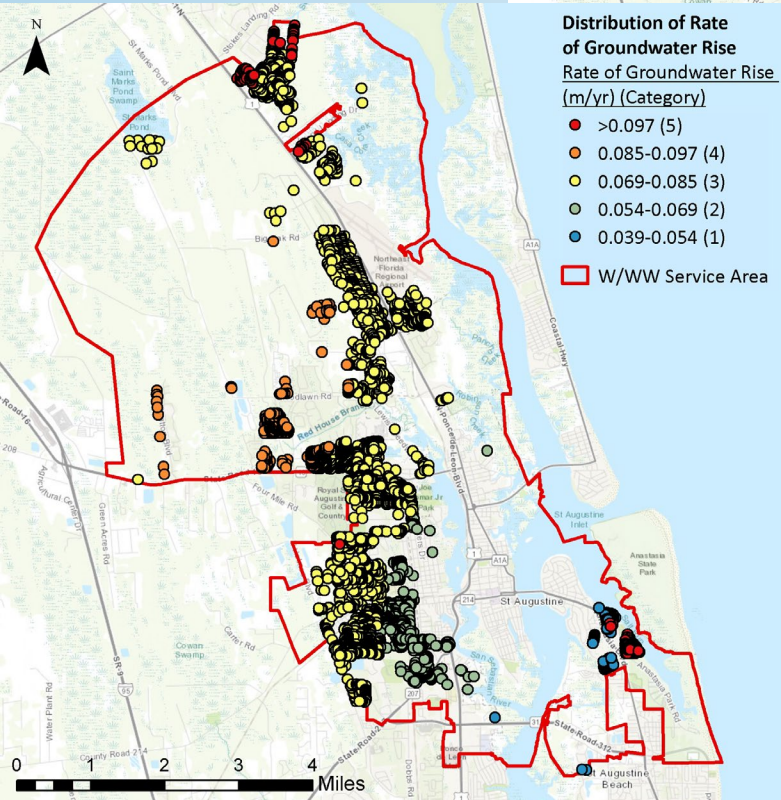
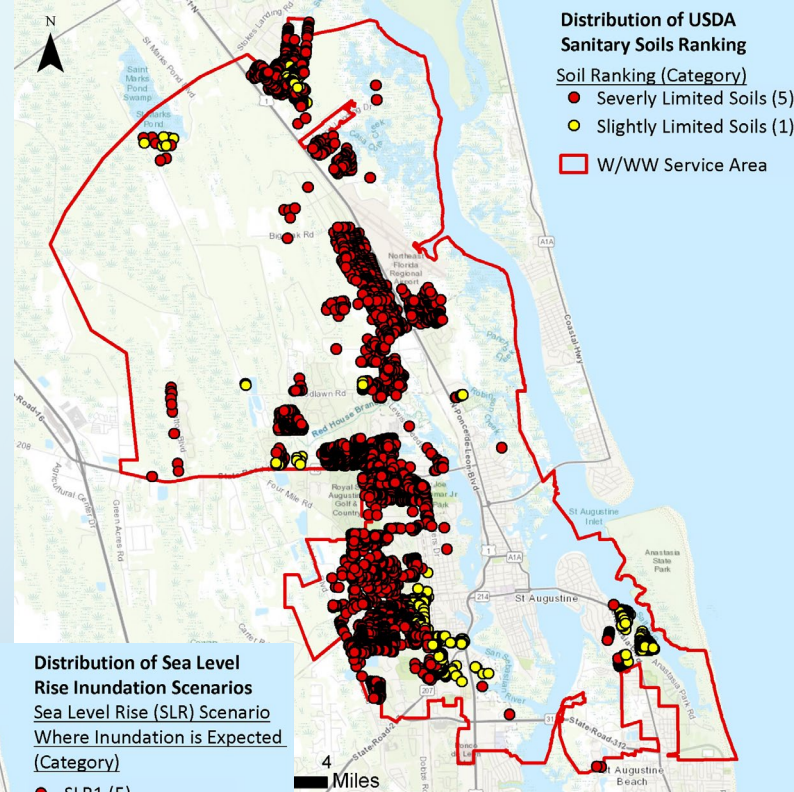
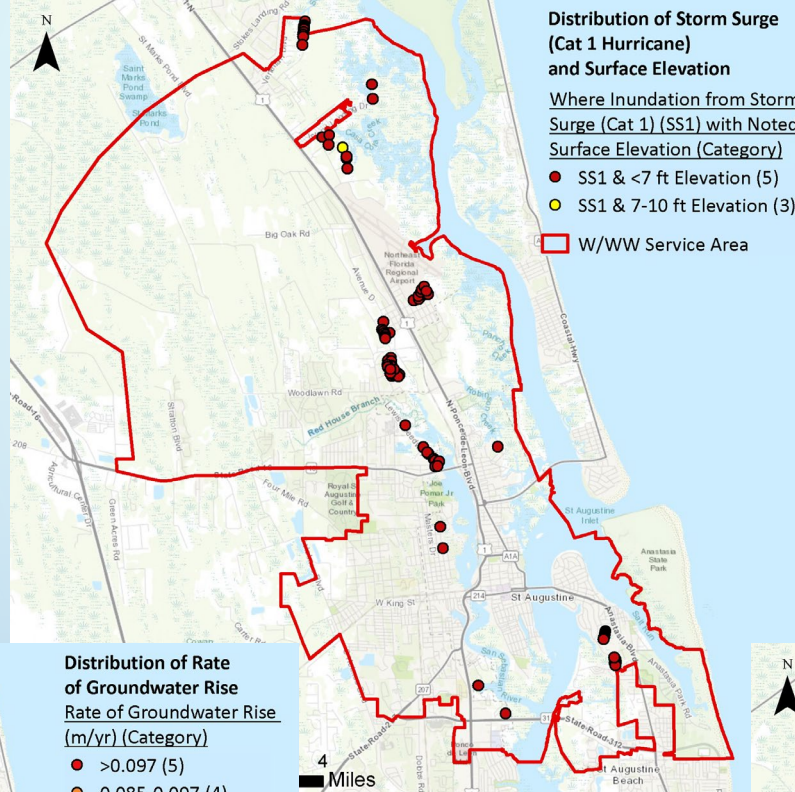
- Estimation of nitrogen loading to waterbodies
- Identification of contributing septic systems

Which septic systems have high vulnerability assessment scores (hotspots) and contribute to nitrogen loading?

RISK RATING VALUES AND WEIGHTS

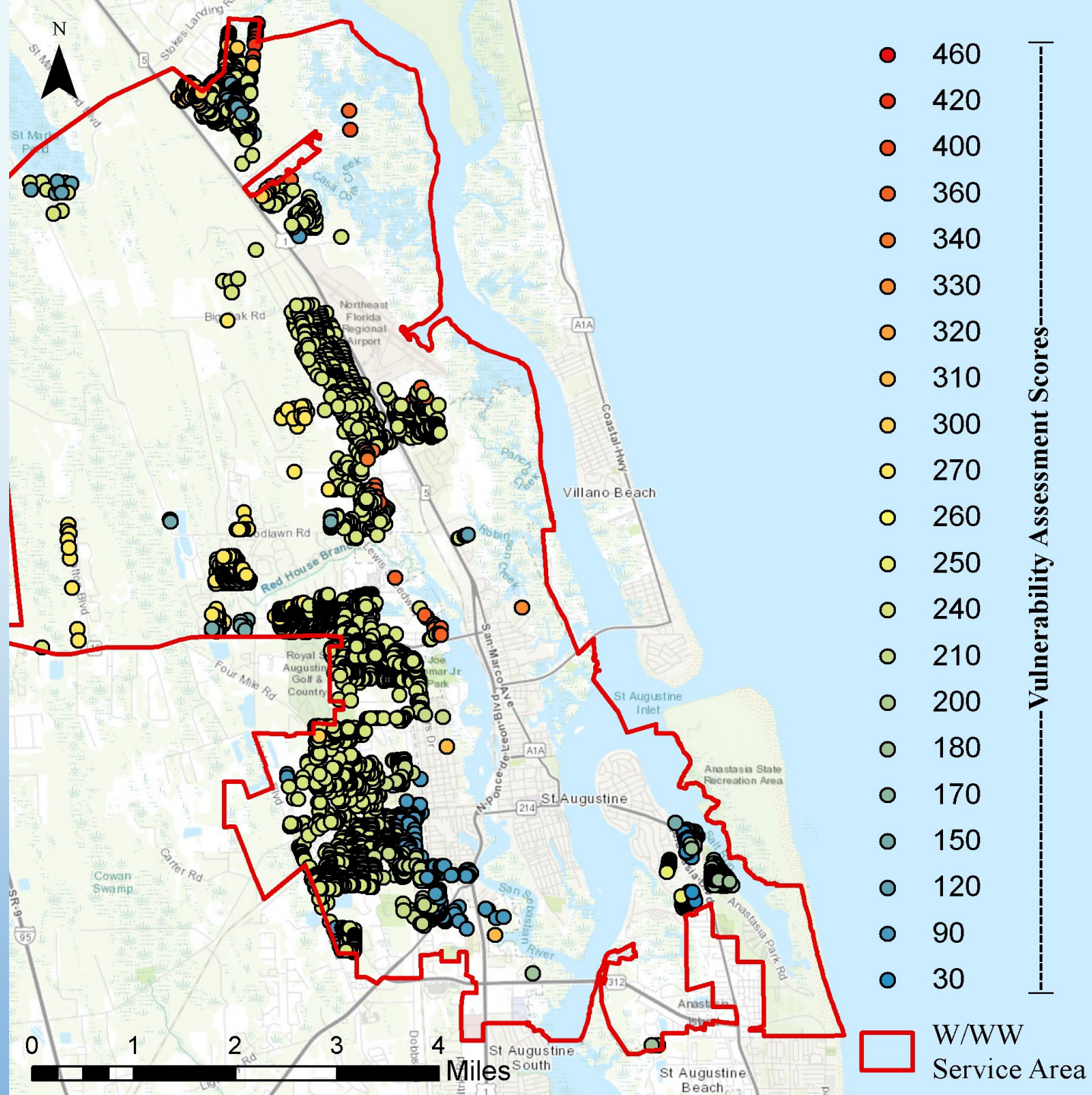
Risk Parameter	Low – 1	2	Medium - 3	4	High - 5	Weight
Storm Surge (Hurricane) & Elevation (ft.)	Cat 1 & > 10 ft.		Cat1 & 7-10 ft.		Cat 1 & < 7 ft.	20%
Soils	Slightly Limited		Moderately Limited		Severely Limited	30%
Rise in Groundwater (in./yr)	1.5 in./yr	2.1 in./yr	2.7 in./yr	3.3 in./yr	3.8 in./yr	30%
Sea-level rise scenario (ft.)	3 ft.		2 ft.		1 ft.	20%

MULTI-CRITERIA VULNERABILITY ASSESSMENT / INDICATOR BASED
VULNERABILITY ASSESSMENT



VULNERABILITY ASSESSMENT

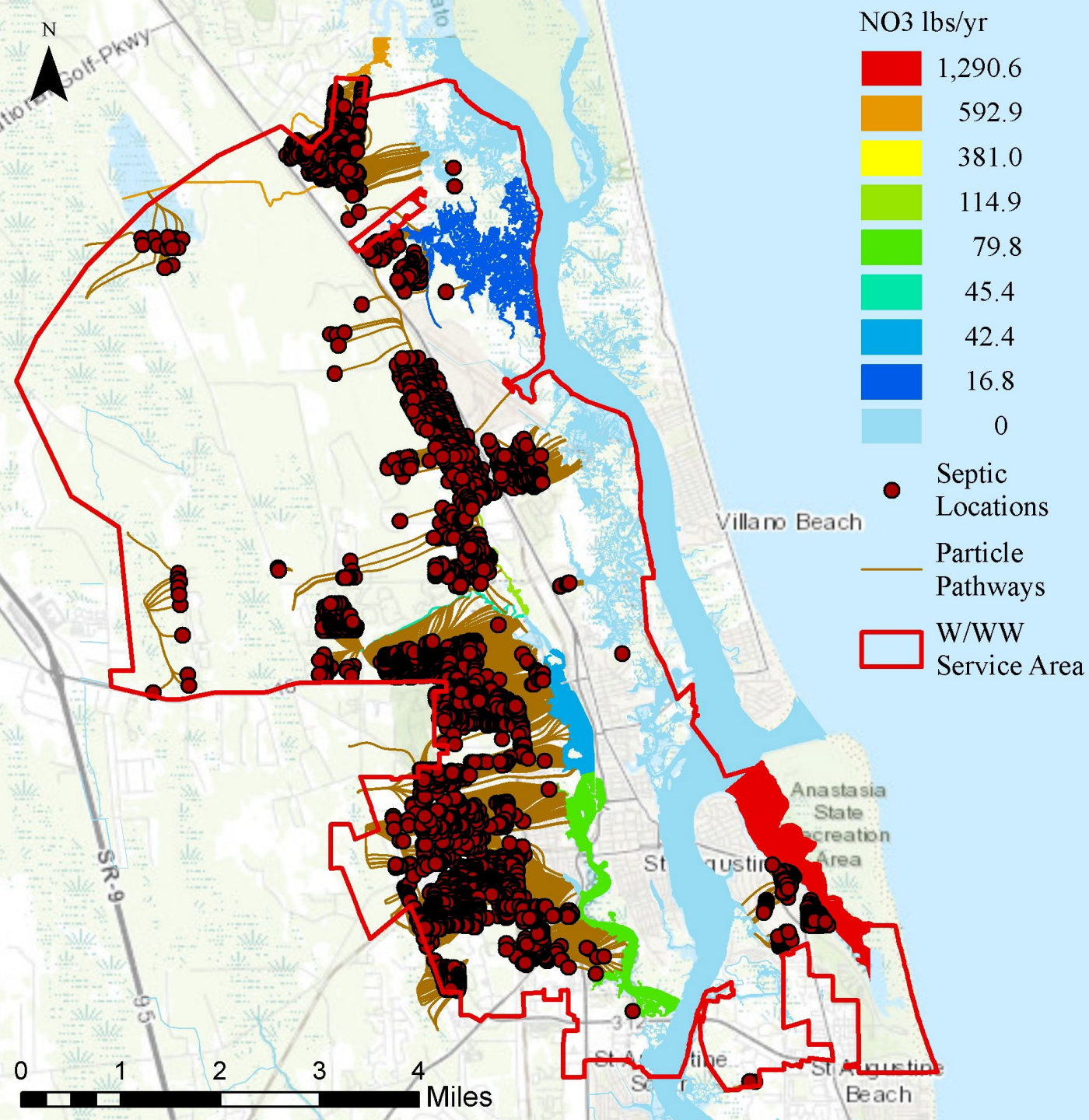
- HIGH SCORES = MORE VULNERABLE
- LOW SCORES = LESS VULNERABLE



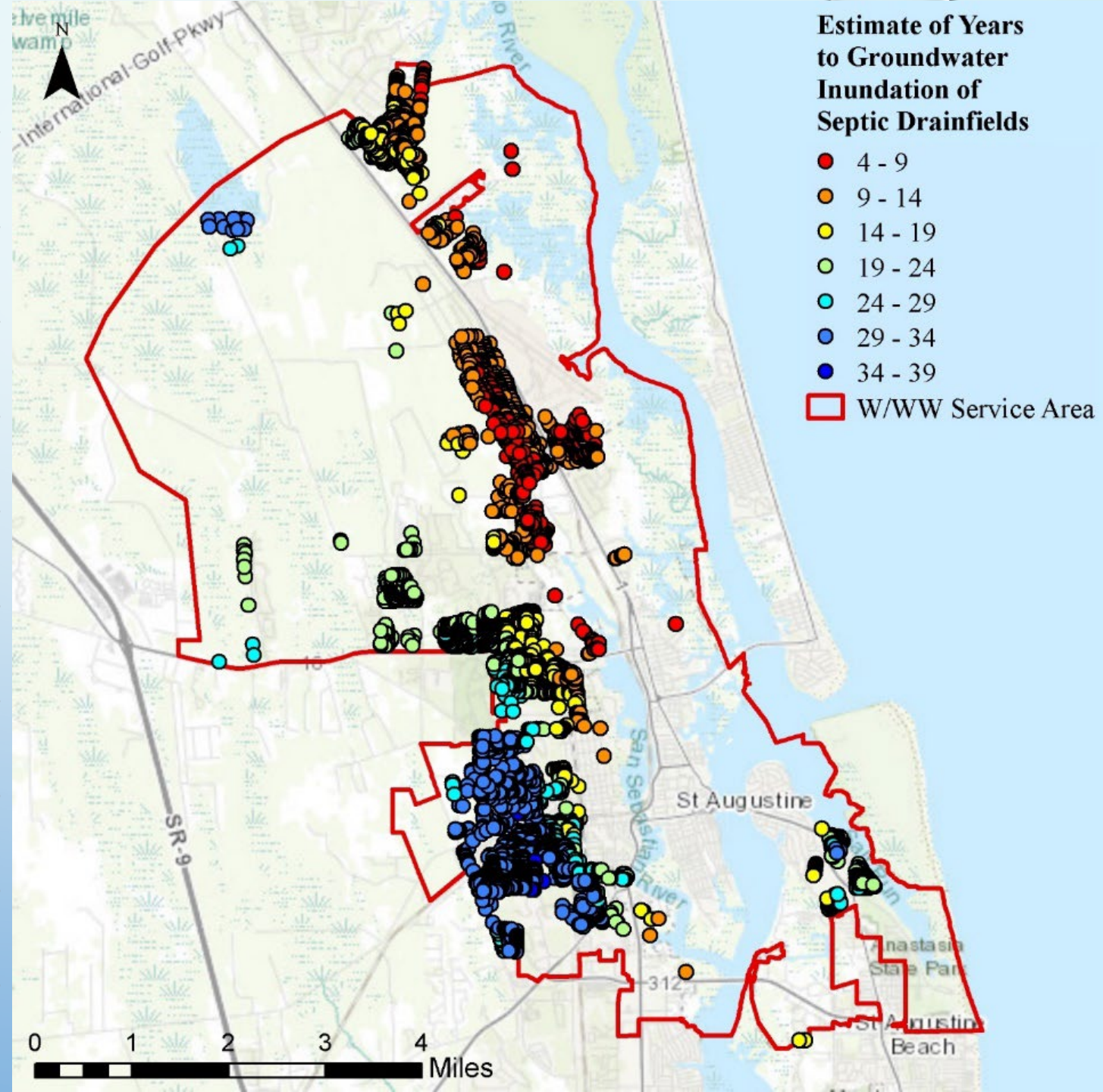
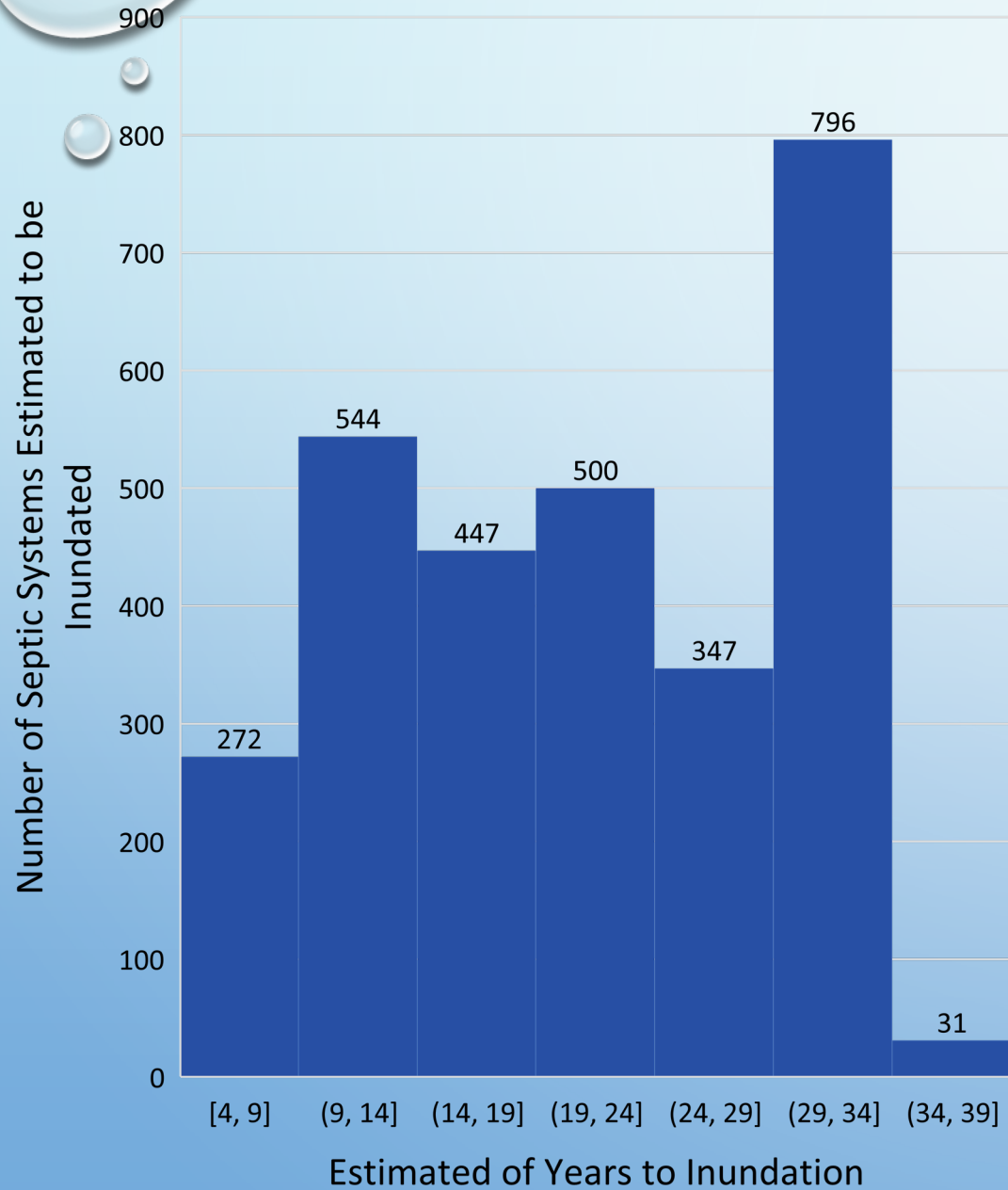
ARCNLET MODELING

- A TOOL USED IN ARCGIS DESKTOP SOFTWARE
- ESTIMATES NITROGEN OUTPUTS TO WATERBODIES FROM SOURCE LOCATIONS (OSTDS)
- INPUT DATA: DEM, HYDRAULIC CONDUCTIVITY, POROSITY, WATERBODIES, SOURCE LOCATIONS
- DEVELOPS A GROUNDWATER FLOW MODEL TO ESTIMATE NITRATE PLUMES AND LOAD ESTIMATES
 - PROJECT USED A SMOOTHING FACTOR OF 50, ALL OTHER DEFAULT SETTINGS
 - NO₃ ONLY

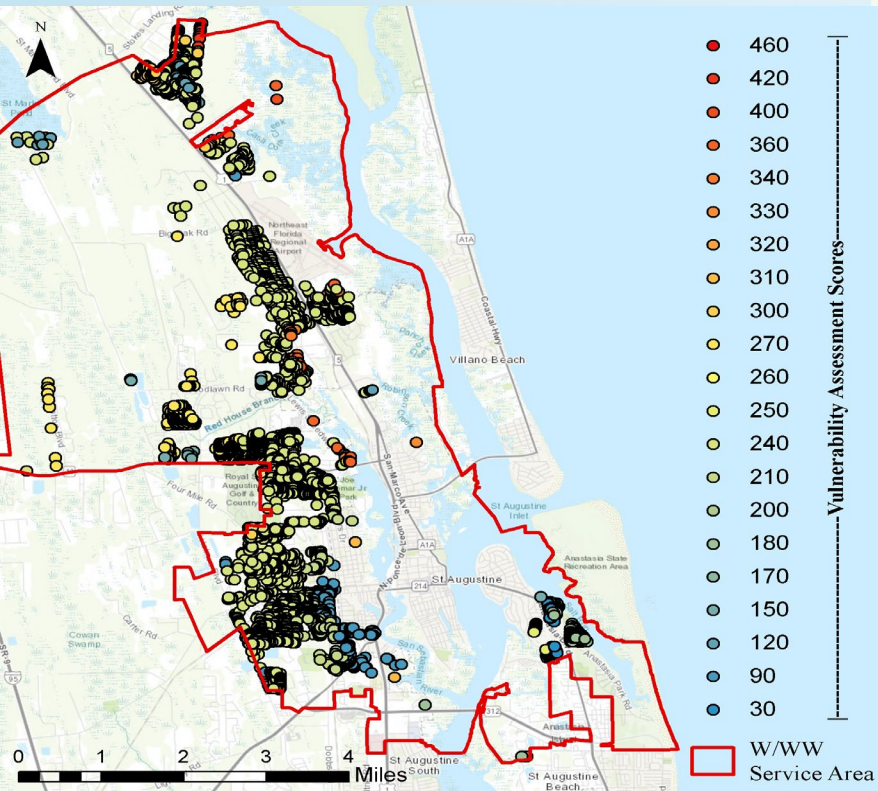
Water Body ID	Waterbody Name	OSTDS Plumes to Reach Waterbody	Mass Output Load (lbs/yr)
10	Salt Run	46	1,290.60
12	Stokes Creek	51	592.88
2	Oyster Creek (within Evergreen Cemetery)	29	380.97
5	San Sebastian River north of Red House Branch	4	114.86
8	San Sebastian River from ~Bernard St to Matanzas River	11	79.80
4	Red House Branch	5	45.44
7	San Sebastian River from ~Bella Vista Blvd to ~Bernard St	2	42.38
13	Wetland/Marsh areas off Casa Cola Creek	2	16.78



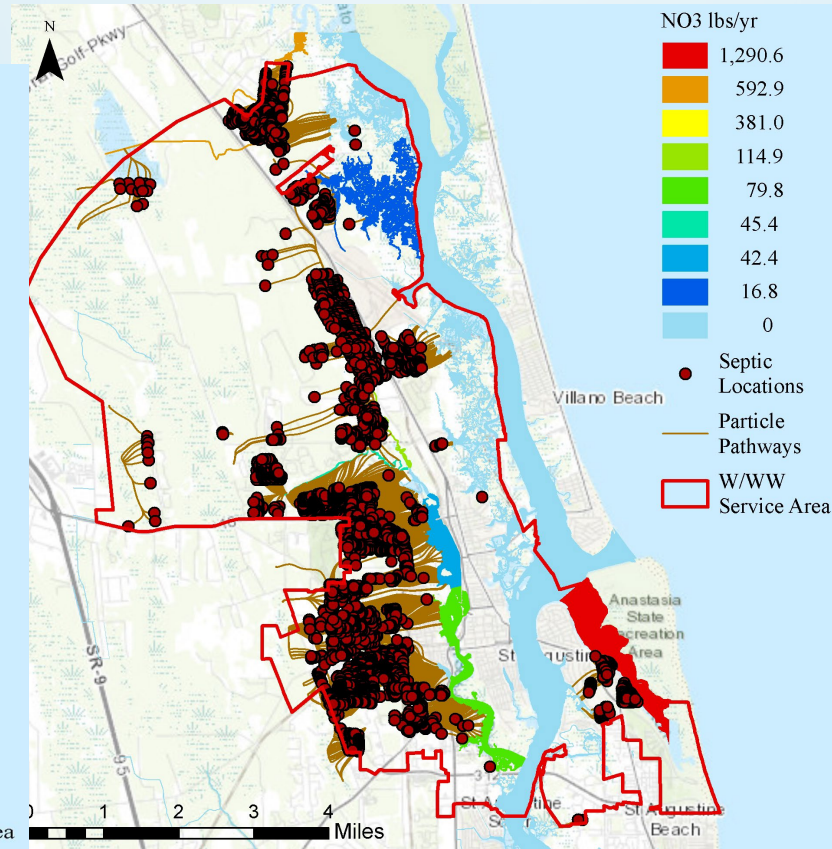
Estimate of Years to Inundation of Septic Drainfields by Rising Groundwater Elevations



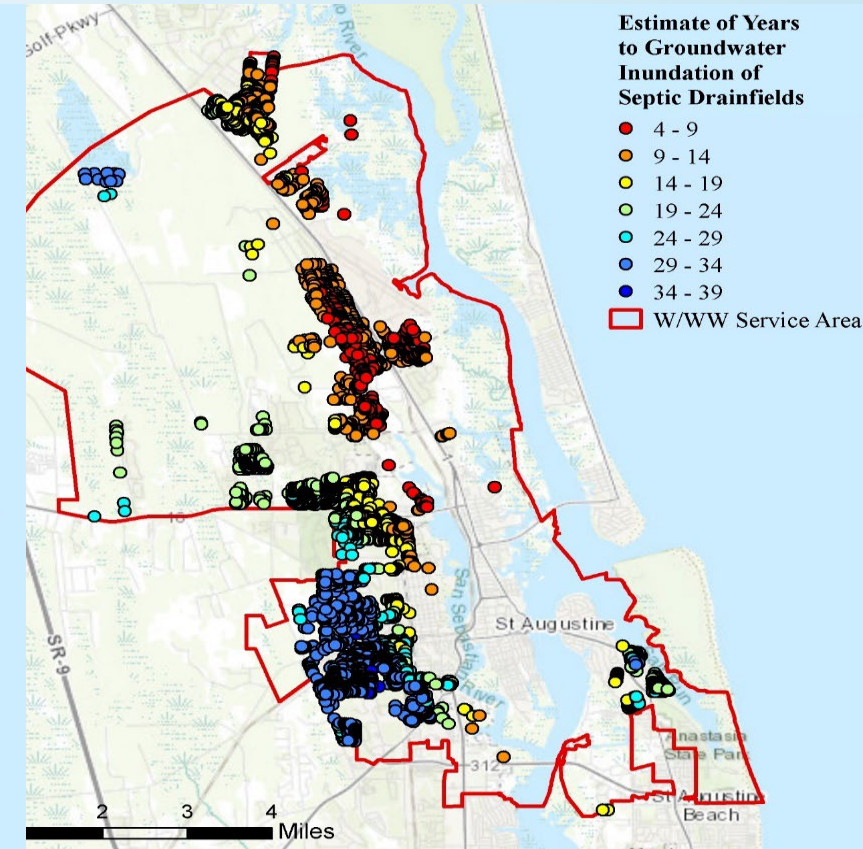
Vulnerability Assessment Scores



Nitrogen Export Estimates



Groundwater Inundation Estimates



KEY TAKEAWAYS

- VULNERABILITY ASSESSMENT PROVIDED CRITICAL NEW INFORMATION THAT REVEALED THREATS TO SOME LOCATIONS FROM STORM SURGE, HIGH TIDE FLOODING AND SEA LEVEL RISE
- ARCNLET MODELING PROVIDED CRITICAL NEW INFORMATION THAT REVEALED ESTIMATED NITROGEN EXPORTS BASED ON CURRENT CONDITIONS
- RISING GROUNDWATER IS THE CURRENT GREATEST THREAT IN THIS STUDY AREA
 - THE VALUES USED TO ESTIMATE GROUNDWATER RISE NEED TO BE VALIDATED WITH MORE MONITORING LOCATIONS (THERE IS A PROPOSAL OUT TO SUPPORT THIS)

IN SUMMARY

- PLANNING LEVEL TOOL TO HELP IDENTIFY AREAS TO TARGET UPGRADES TO EXISTING SEPTIC SYSTEMS
- COORDINATION WITH ST JOHNS COUNTY
- TARGET VARIOUS FUNDING OPTIONS IDENTIFIED TO ASSIST WITH THE UPGRADES
- MAKE THIS INFORMATION PUBLICLY AVAILABLE

✓ STORYMAP:

[HTTPS://STORYMAPS.ARCGIS.COM/STORIES/B44A8EFFD9D943228125C48F2C0151DA](https://storymaps.arcgis.com/stories/b44a8effd9d943228125c48f2c0151da)

✓ SUBMIT PUBLIC COMMENTS AND INPUT TO STORMWATER@CITYSTAUG.COM

DIRECTION APPLICATIONS

- NUTRIENT LOADING RESULTS IDENTIFIED IN THE STUDY FOR SALT RUN GOT THE ATTENTION OF THE CITY COMMISSION AND CITY MANAGER
 - ✓ HELPED TO RE-PRIORITIZE FUTURE SANITARY SEWER EXPANSION
 - ✓ THE CITY HAS INITIATED CONCEPTUAL DESIGN FOR THE LIGHTHOUSE PARK AREA
- THE IDENTIFIED NEAR-TERM PROJECTED CHANGES IN THE GROUNDWATER LEVELS AND ASSOCIATED DATA GAP IDENTIFIED IN THE GROUNDWATER MONITORING NETWORK WAS IMPORTANT TO UNDERSTAND
 - ✓ ENABLED THE CITY TO APPLY FOR & RECEIVE FUNDING TO ESTABLISH A MORE ROBUST GROUNDWATER MONITORING NETWORK
 - ✓ DATA CAN BE USED TO BETTER REFINE THE PROJECTIONS AND HELP WITH PRIORITIZING PROJECTS
- NORTHEAST FLORIDA REGIONAL COUNCIL INTERESTED IN REGIONAL APPLICATIONS

QUESTIONS AND DISCUSSION



Jessica Beach, P.E.
Chief Resilience Officer
City of St. Augustine
jbeach@citystaug.com



Tricia Kyzar, Ph.D.
Spatial Analyst/Project
Manager
Wildwood Consulting, Inc.
tkyzar@wildwoodconsulting.net



Dr. Eban Bean
Assistant Professor
Agricultural and
Biological Engineering
University of Florida
ezbean@ufl.edu



Thank you to the Florida Department of
Environmental Protection – Florida
Resilient Coastlines Program, Office of
Resilience & Coastal Protection for
making this project possible
<https://floridadep.gov/rcp/florida-resilient-coastlines-program>