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

PRESENTATION TO FLORIDA WATER & CLIMATE ALLIANCE

WEBINAR – SEPTEMBER 20, 2021

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

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

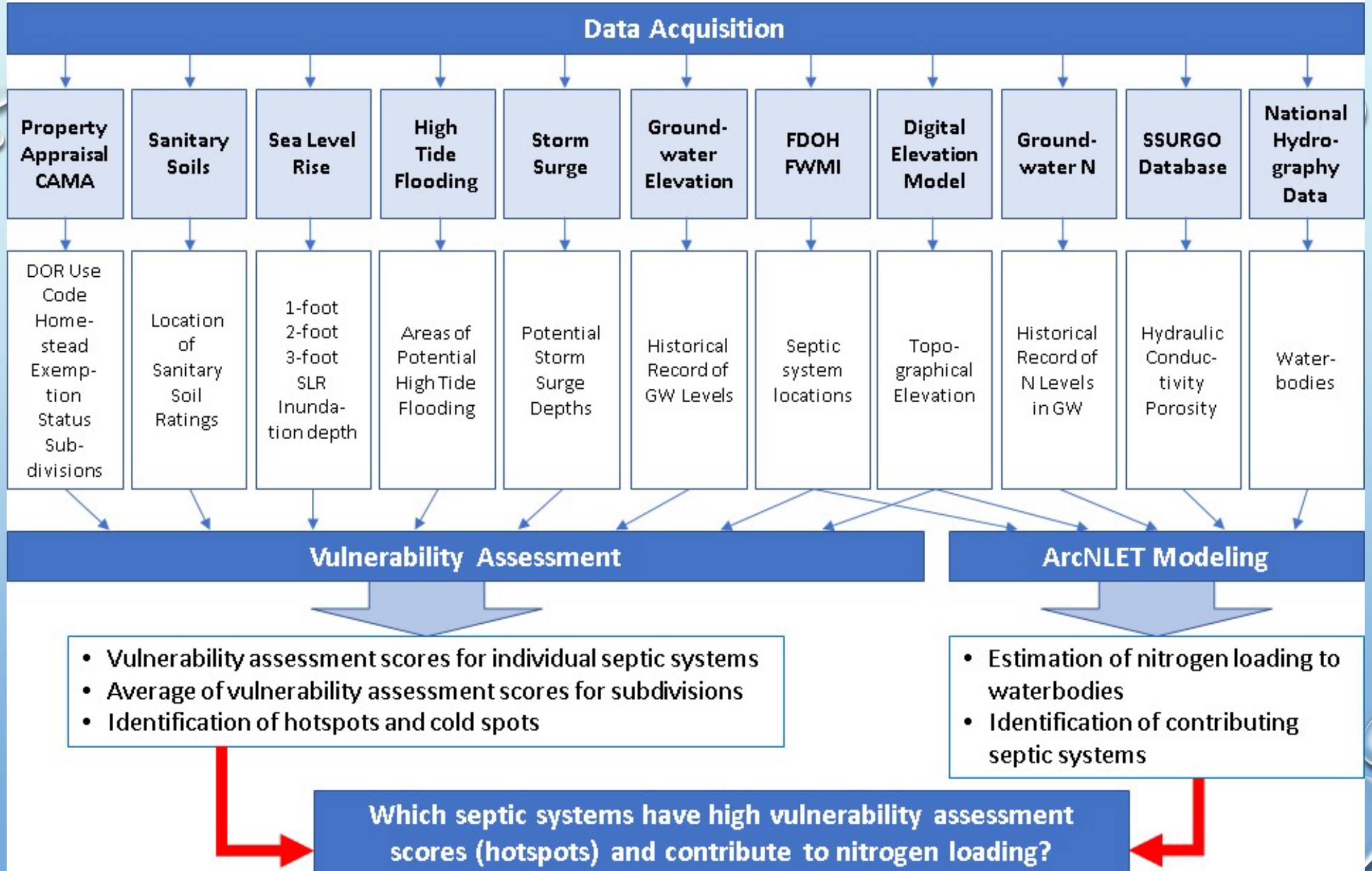
CITY OF ST AUGUSTINE EST. 1565

WILDWOOD CONSULTING INC.

UF IFAS UNIVERSITY of FLORIDA

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
    - o COSTS AND FUNDING OPPORTUNITIES
  - ✓ PRESENT FINDINGS TO THE PUBLIC
    - o 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
Property Appraisal CAMA
Sanitary Soils
Sea Level Rise
High Tide Flooding
Storm Surge
Ground-water Elevation
FDOH FWMI
Digital Elevation Model
Ground-water N
SSURGO Database
National Hydro-graphy Data
DOR Use Code Home-stead Exemp-tion Status Sub-divisions
Location of Sanitary Soil Ratings
1-foot 2-foot 3-foot SLR Inunda-tion depth
Areas of Potential High Tide Flooding
Potential Storm Surge Depths
Historical Record of GW Levels
Septic system locations
Topo-graphical Elevation
Historical Record of N Levels in GW
Hydraulic Conduc-tivity Porosity
Water-bodies
Vulnerability Assessment
ArcNLET Modeling
• Vulnerability assessment scores for individual septic systems
• Average of vulnerability assessment scores for subdivisions
• Identification of hotspots and cold spots
• 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?

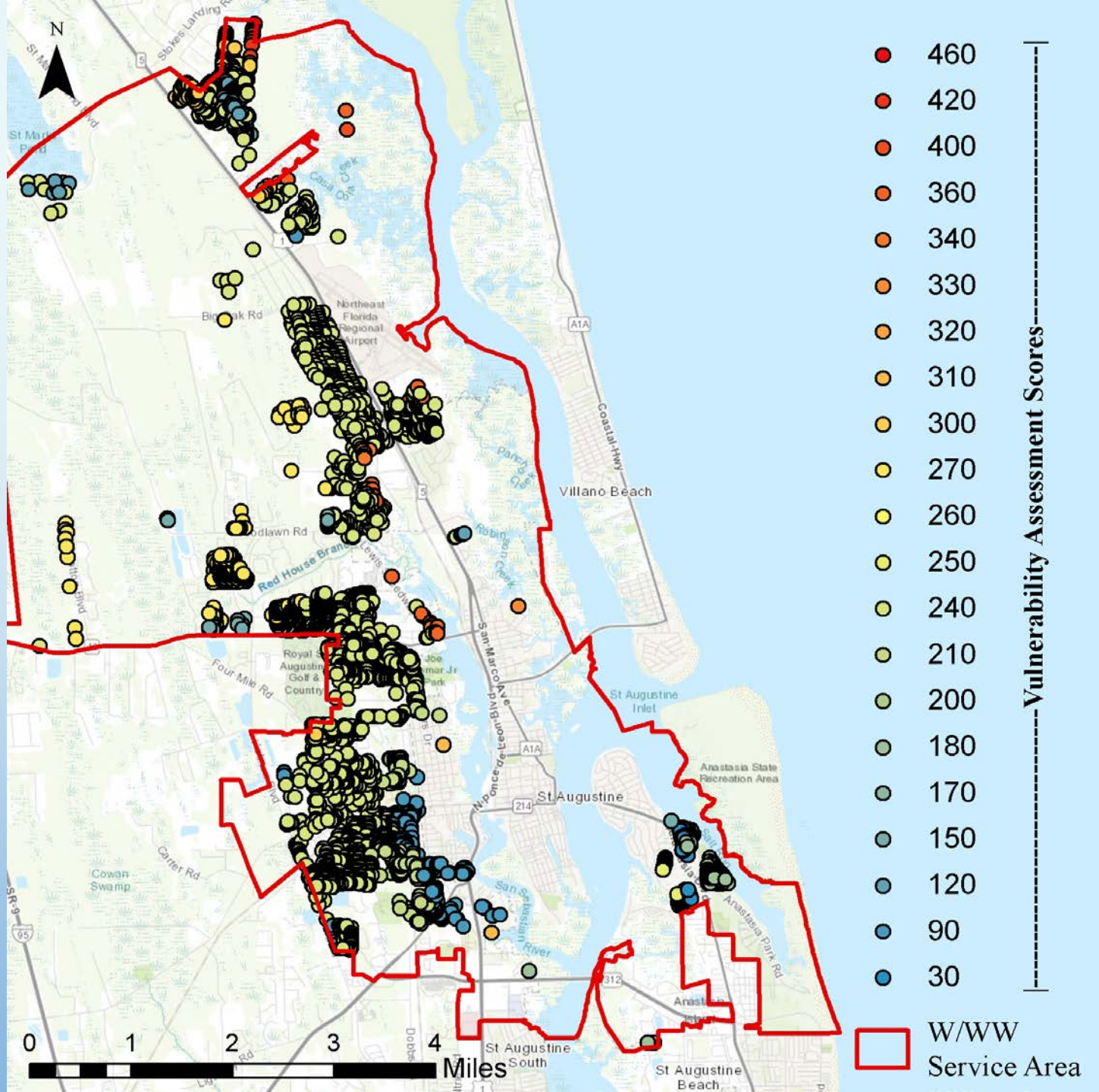
RISK RATING VALUES AND WEIGHTS

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

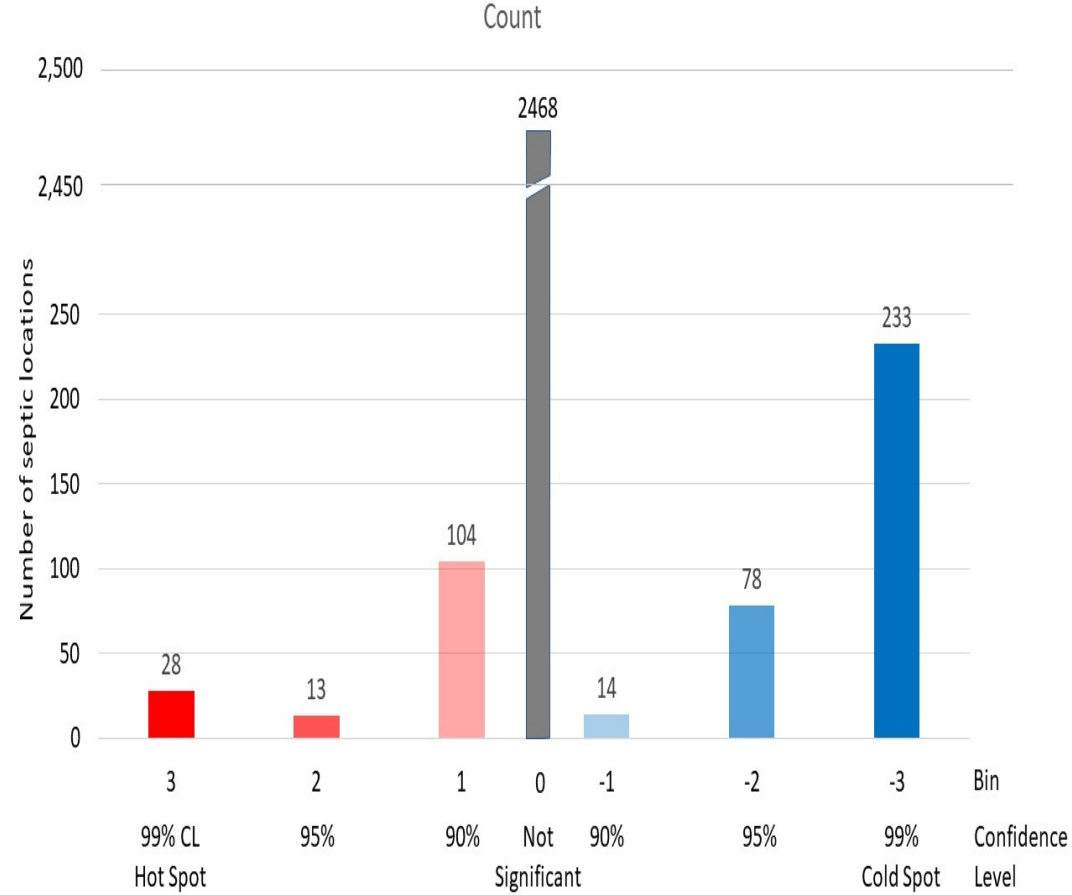


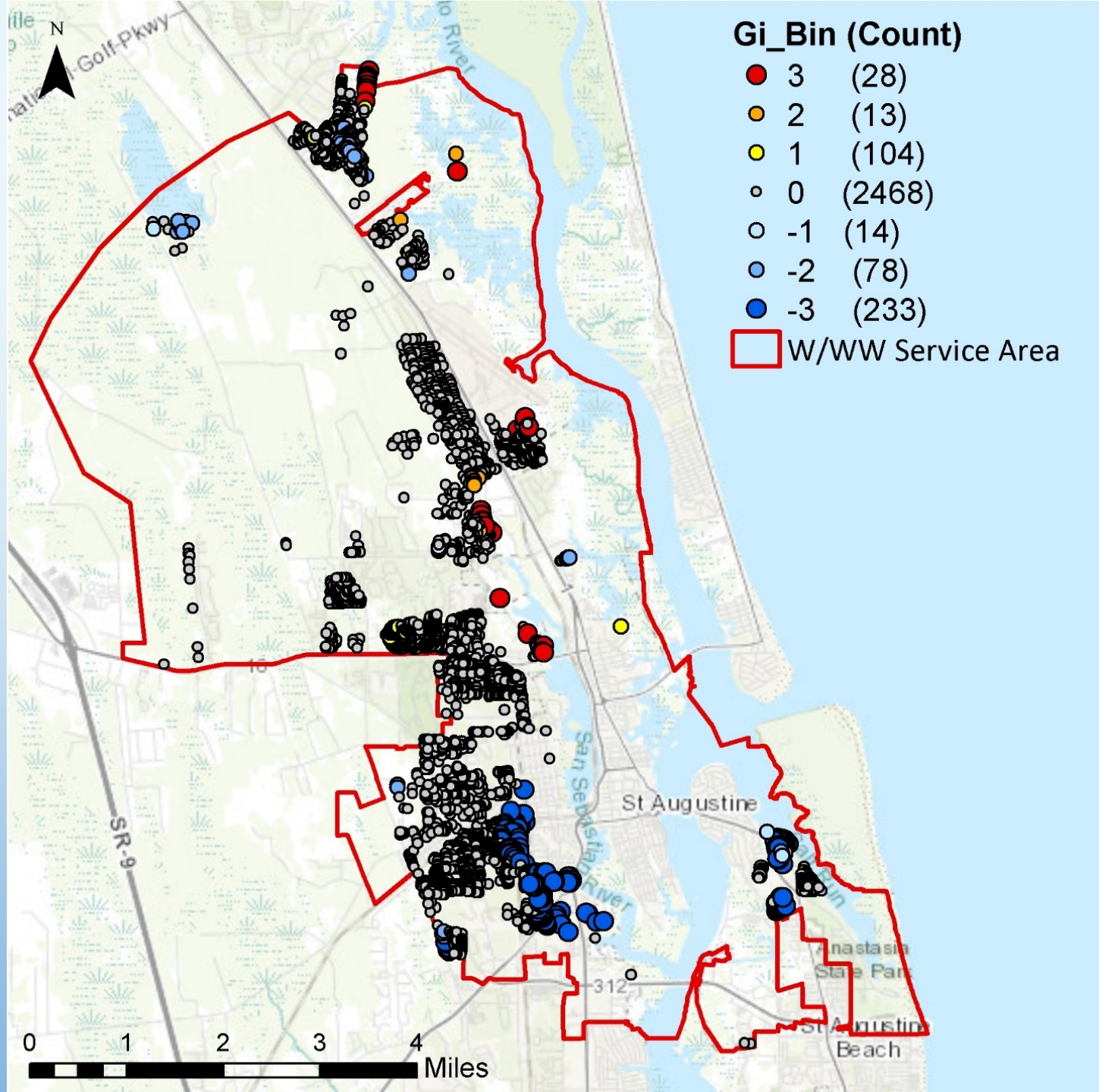
HOTSPOT ANALYSIS

- ESRI'S HOTSPOT ANALYSIS TOOL
  - CALCULATES THE STATISTICAL SIGNIFICANCE OF THE CLUSTERING OF HIGH AND LOW VALUES
  - HIGH VALUES ARE HOT SPOTS
    - HIGH Z-VALUE AND LOW P-VALUE, CLUSTERING IS STATISTICALLY SIGNIFICANT
  - LOW VALUES ARE COLD SPOTS
    - LOW Z-VALUE AND LOW P-VALUE, CLUSTERING IS STATISTICALLY SIGNIFICANT
  - RESULTS ARE 'BIN'D IN CONFIDENCE INTERVALS

	Cold Spot						Hot Spot
CI	99%	95%	90%	0	90%	95%	99%
Bin	-3	-2	-1	0	1	2	3

HOT SPOT ANALYSIS

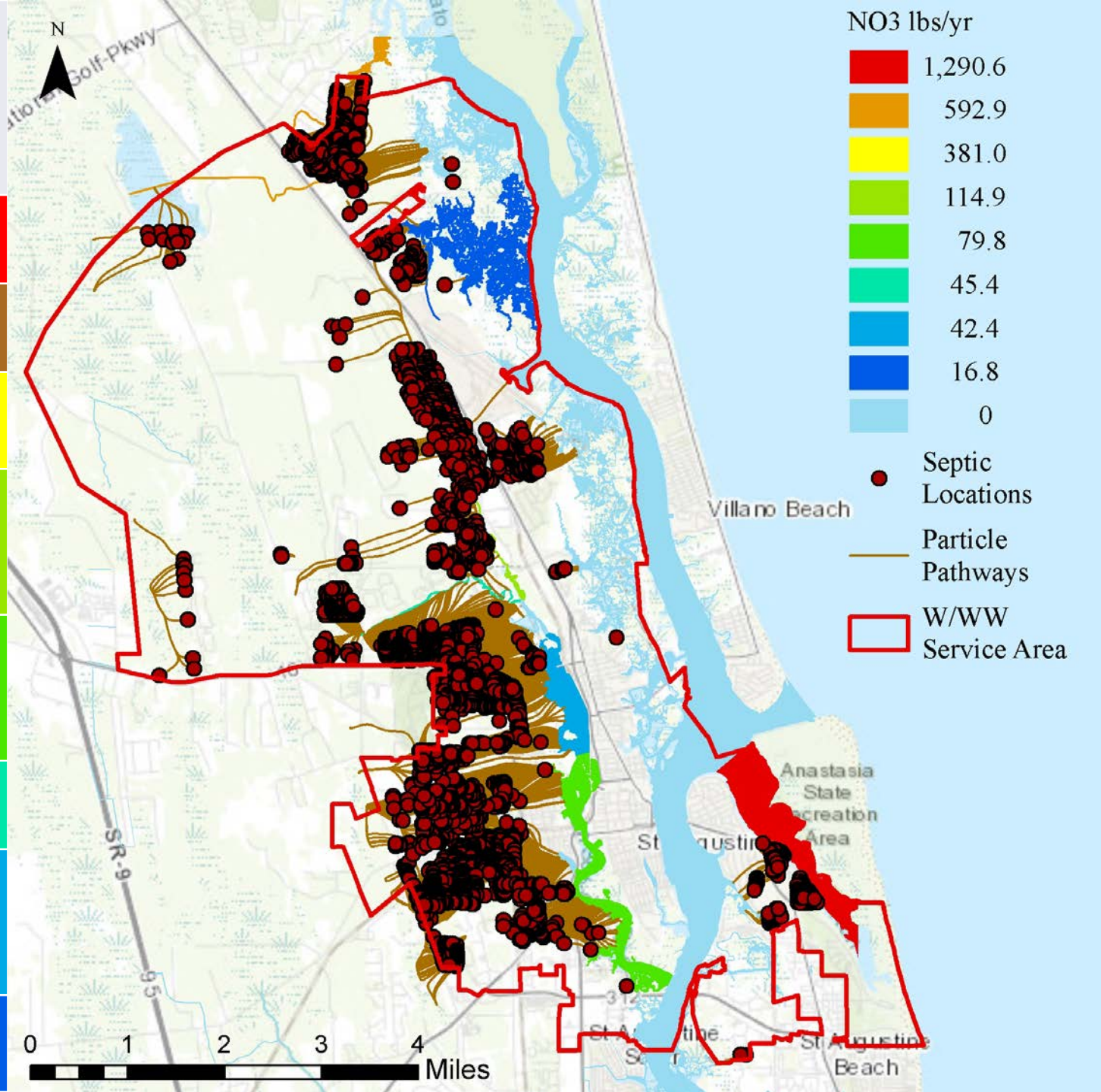




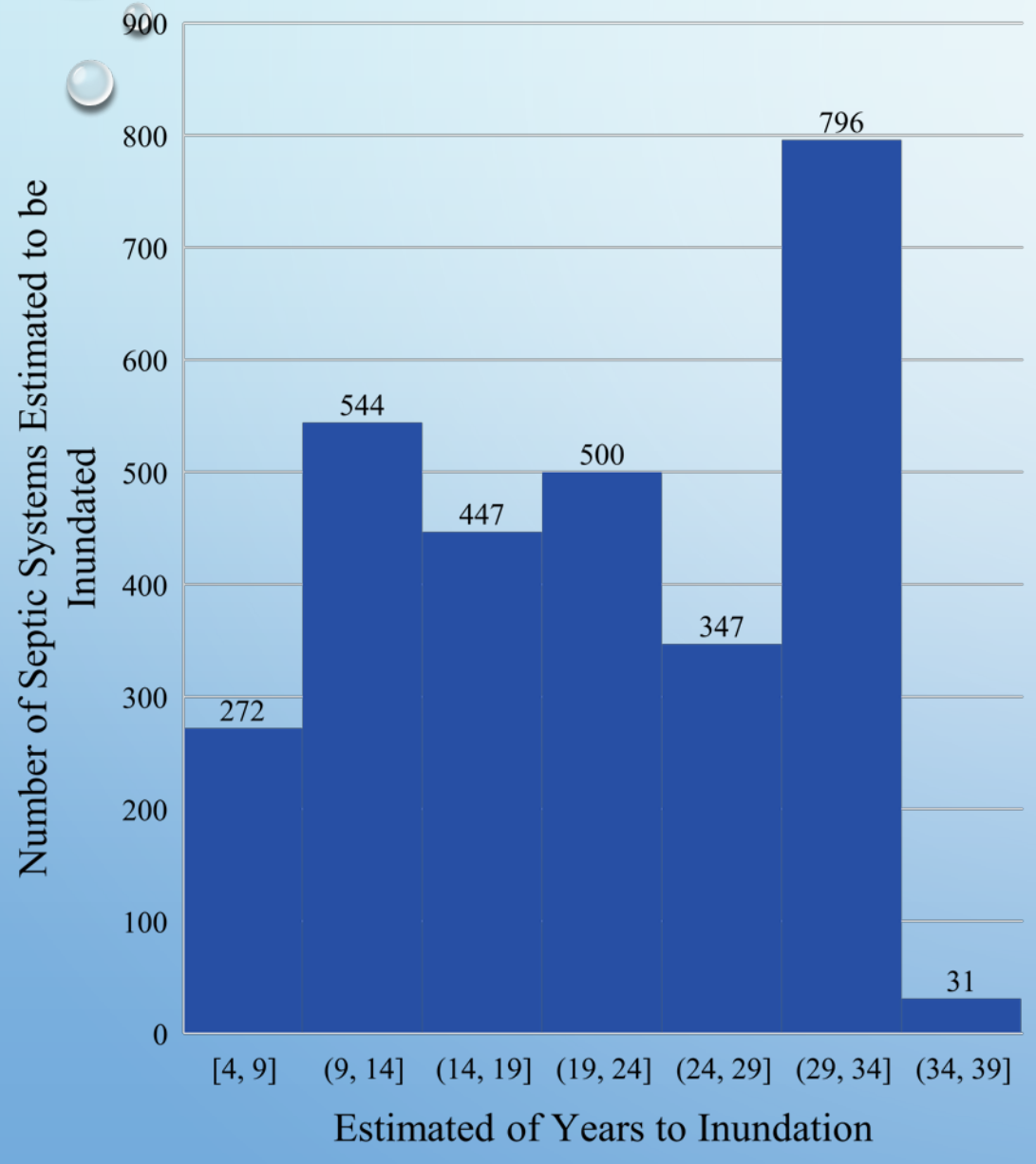
ARCNLET MODELING

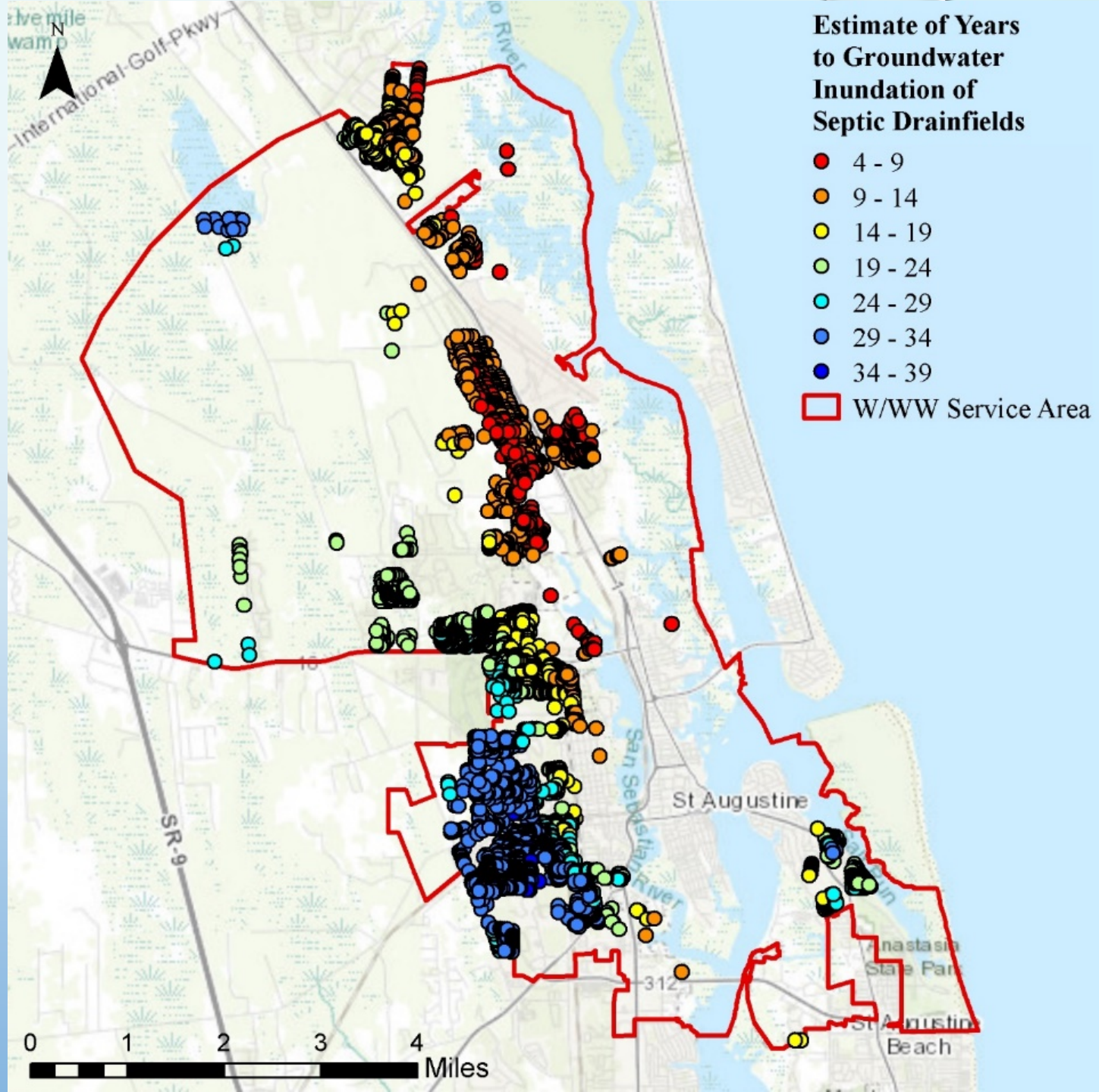
- A TOOL USED IN ARCGIS DESKTOP SOFTWARE
- ESTIMATES NITROGEN OUTPUTS TO WATERBODIES FROM SOURCE LOCATIONS (OSTDS)
- INPUT DATA: DEM, HYDRAULIC CONDUCTIVITY, POROSITY, WATERBODIES, SOURCE LOCATIONS
- DEVELOPS A GROUNDWATER FLOW MODEL TO ESTIMATE NITRATE PLUMES AND LOAD ESTIMATES
  - PROJECT USED A SMOOTHING FACTOR OF 50, ALL OTHER DEFAULT SETTINGS
  - NO_3 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





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 IDENTIFIY 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 PUBLICALY AVAILABLE
  - ✓STORYMAP: HTTPS://STORYMAPS.ARCGIS.COM/STORIES/B44A8EFFD9D943228125C48F2C0151DA
  - ✓SUBMIT PUBLIC COMMENTS AND INPUT TO STORMWATER@CITYSTAUG.COM

QUESTIONS AND DISCUSSION

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https://floridadep.gov/rcp/florida-resilient-coastlines-program