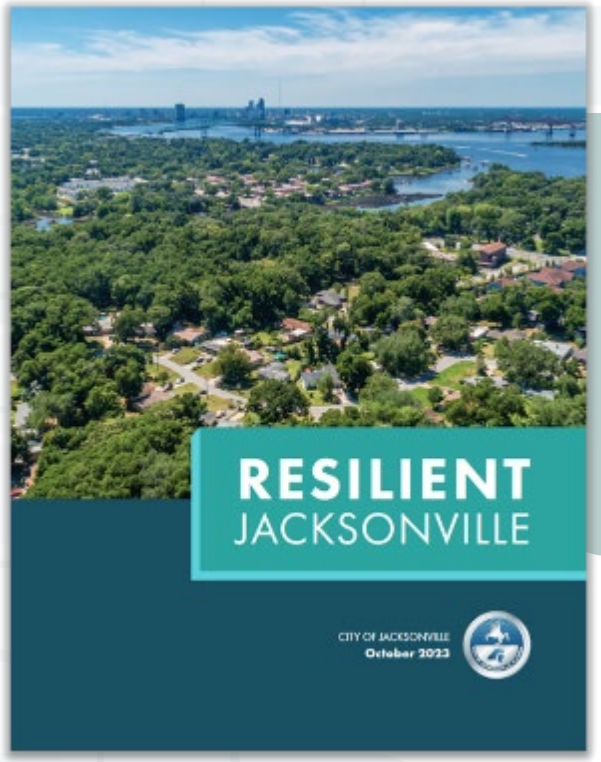
2026 Florida Stormwater Association Summer Conference

Charlotte Harbor, FL

Advanced Flood Modeling in Resilience Planning

Resilient Jacksonville Compound Flood Model

June 18, 2026



PRESENTATION AGENDA

- Resilient Jacksonville
- Compound flood model
- Guide resilient infrastructure implementation

THE WATER INSTITUTE

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CITY RESILIENCE

is the ability of city systems to **adapt** and **thrive** in the face of **acute shocks** *(sudden, extreme events that threaten a community)* and **chronic stresses** *(long-term pressures that weaken the fabric of a community over time)*.

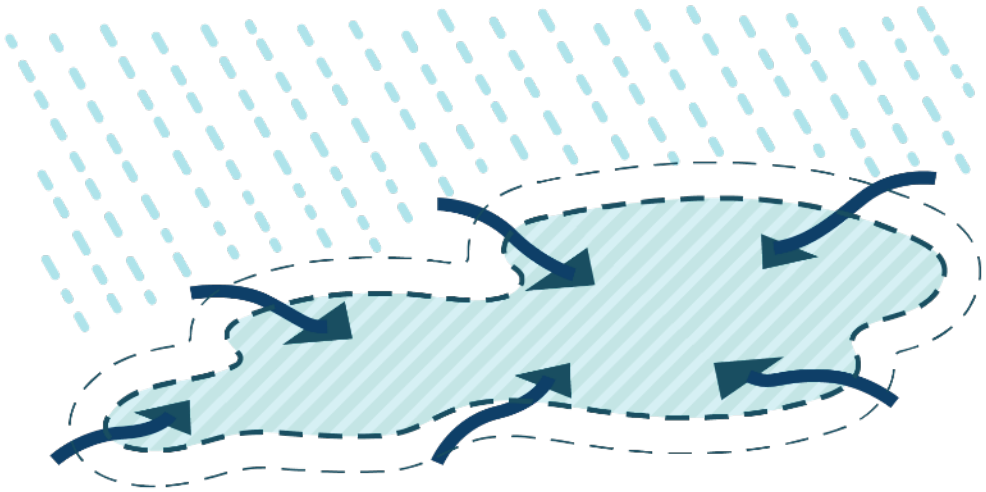
HURRICANE IRMA

Downtown Jacksonville at the height of storm surge flooding [Hurricane Irma]. Image credit: Bob Self / Florida Times Union.

Image credit: City of Jacksonville.

STORMWATER (PLUVIAL) FLOODING

Flooding due to rainwater piling up in areas with poor drainage. This often happens during heavy rainfall events, when drains and pipes can't keep up with the rain.

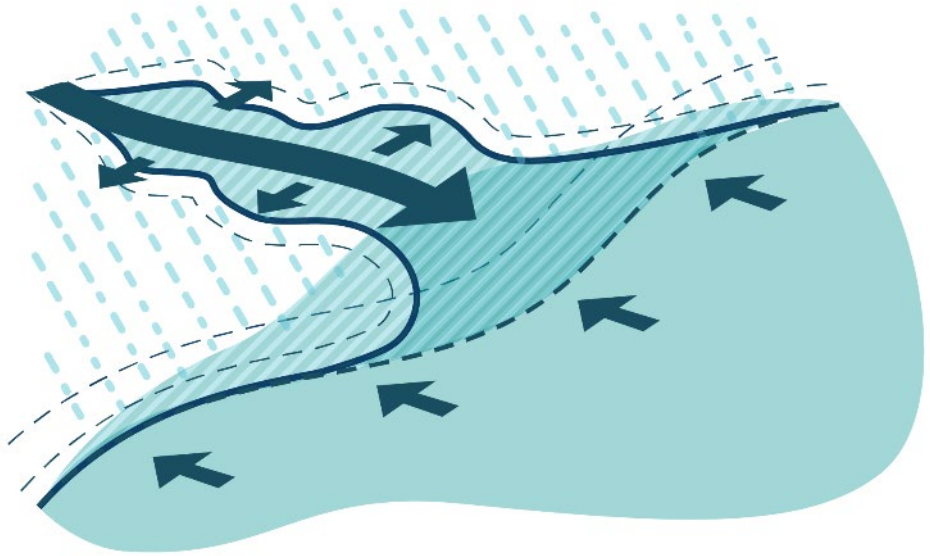


DATA GAP

Existing flood risk data for Jacksonville does not fully account for surface stormwater (pluvial) flooding that might occur away from the river and tributaries.

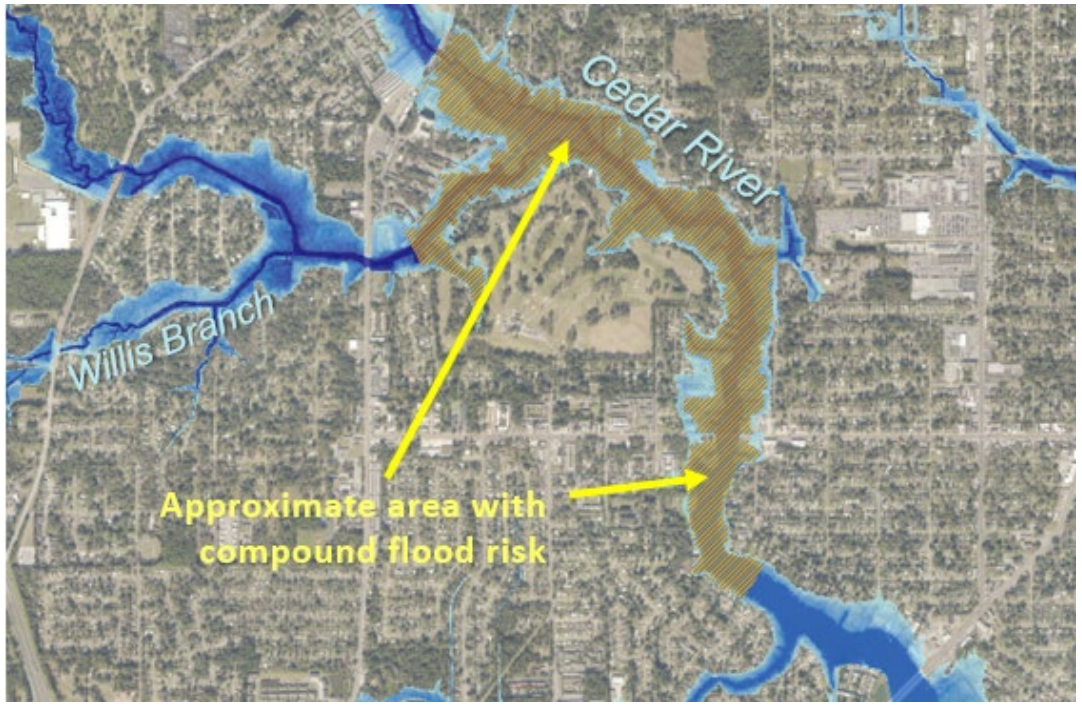
COMPOUND FLOODING

When different types of flooding occur at the same time. An example is when heavy rain falls during a coastal storm. Many places along the St. Johns River and its tributaries are vulnerable to this kind of flooding, but this type of flooding is the most difficult to predict.

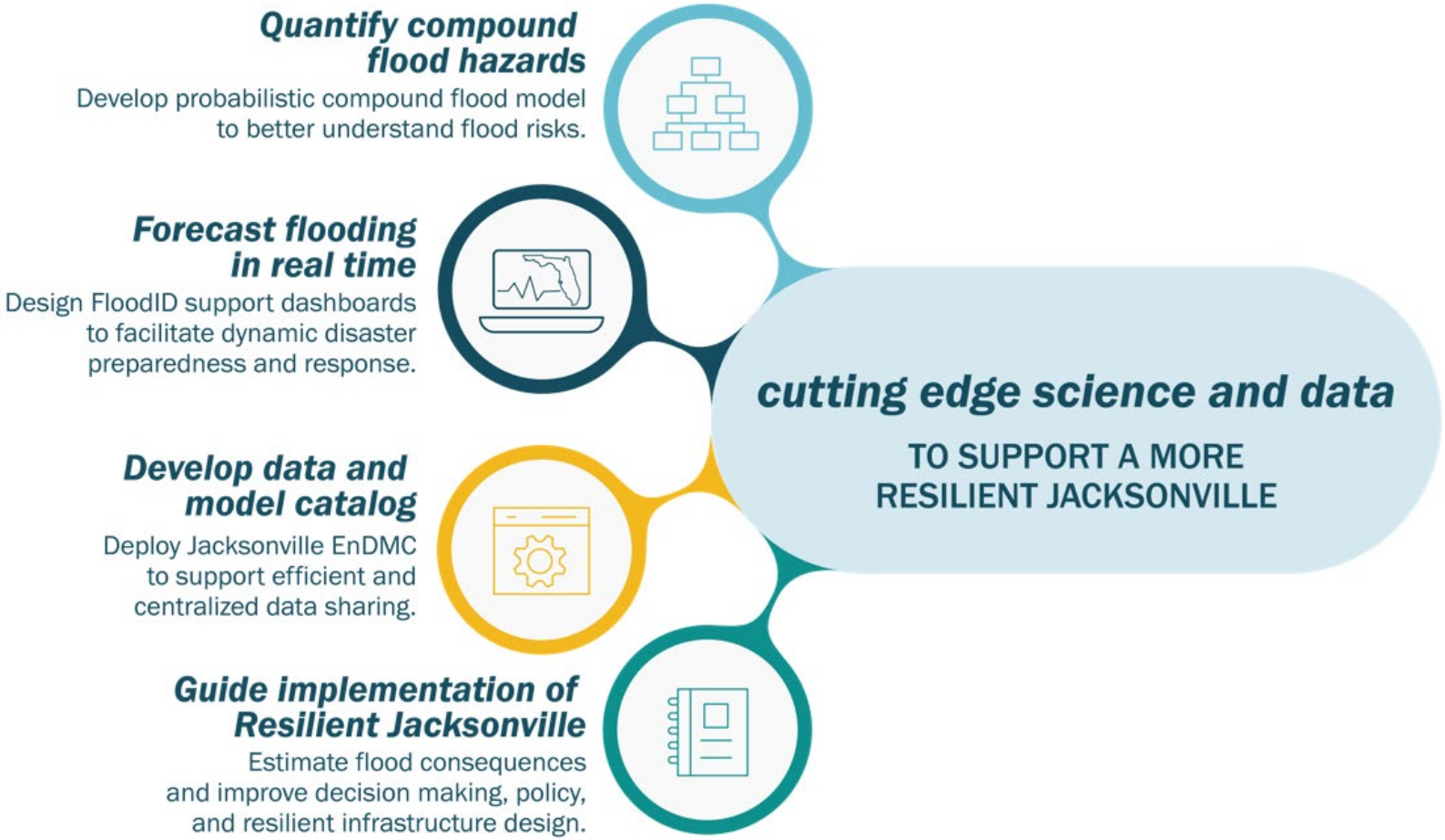


DATA GAP

Compound flooding scenarios are not fully represented in the FEMA National Flood Hazard Layer and/or recent stormwater flood modeling developed for the City of Jacksonville.



ADVANCED SCIENCE AND DATA MANAGEMENT



Quantify compound flood hazards

IMPROVING OUR UNDERSTANDING OF FLOOD RISK

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BENEFITS

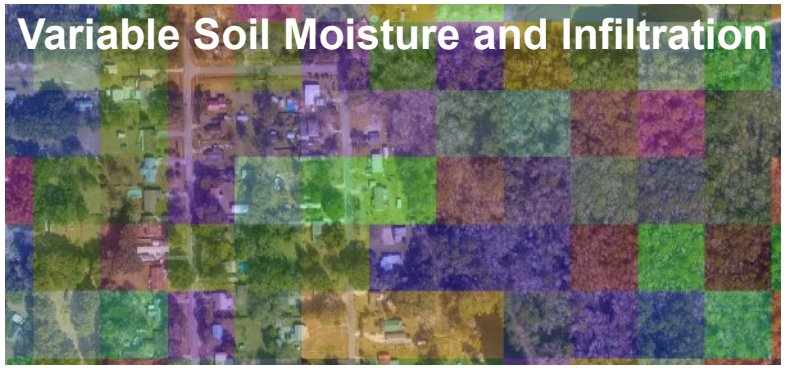
Ability to model response to rain, winds, and storm surge concurrently

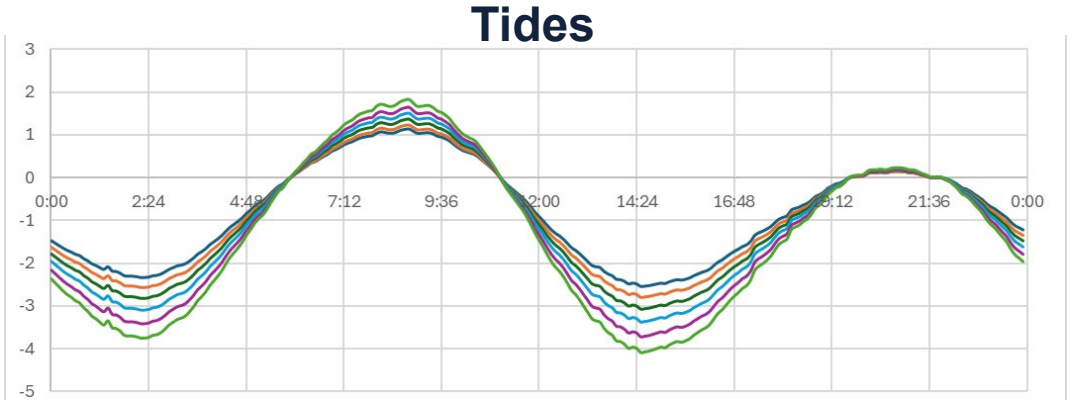
- Coastal Hydrodynamic and Wave models do not represent pluvial/fluvial effects.
- Current stormwater models focus on fluvial effects only, with a static tidal boundary condition

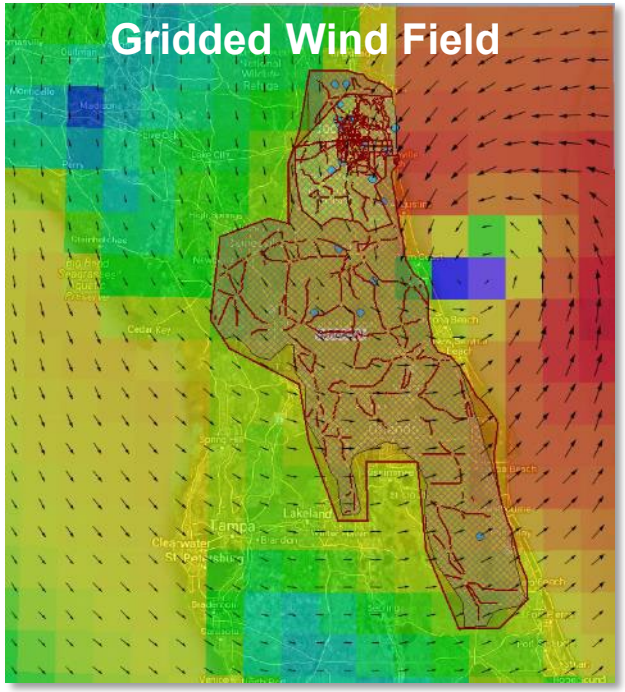
Response based approach to infrastructure design

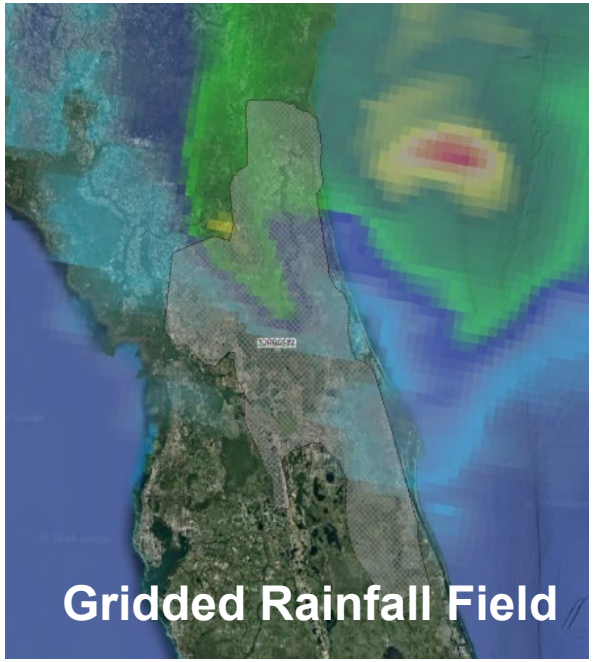
- A 25-year [rainfall/coastal] event at Mayport does not necessarily produce a 25-year flood response at Springfield
- The Annual Exceedance Probability Curves from the HEC-RAS 2D model can be used to identify
  - Flood depths for a desired design period
  - A set of events that can produce the flood depth that can be provided as inputs to other models used for design

MODEL FORCING







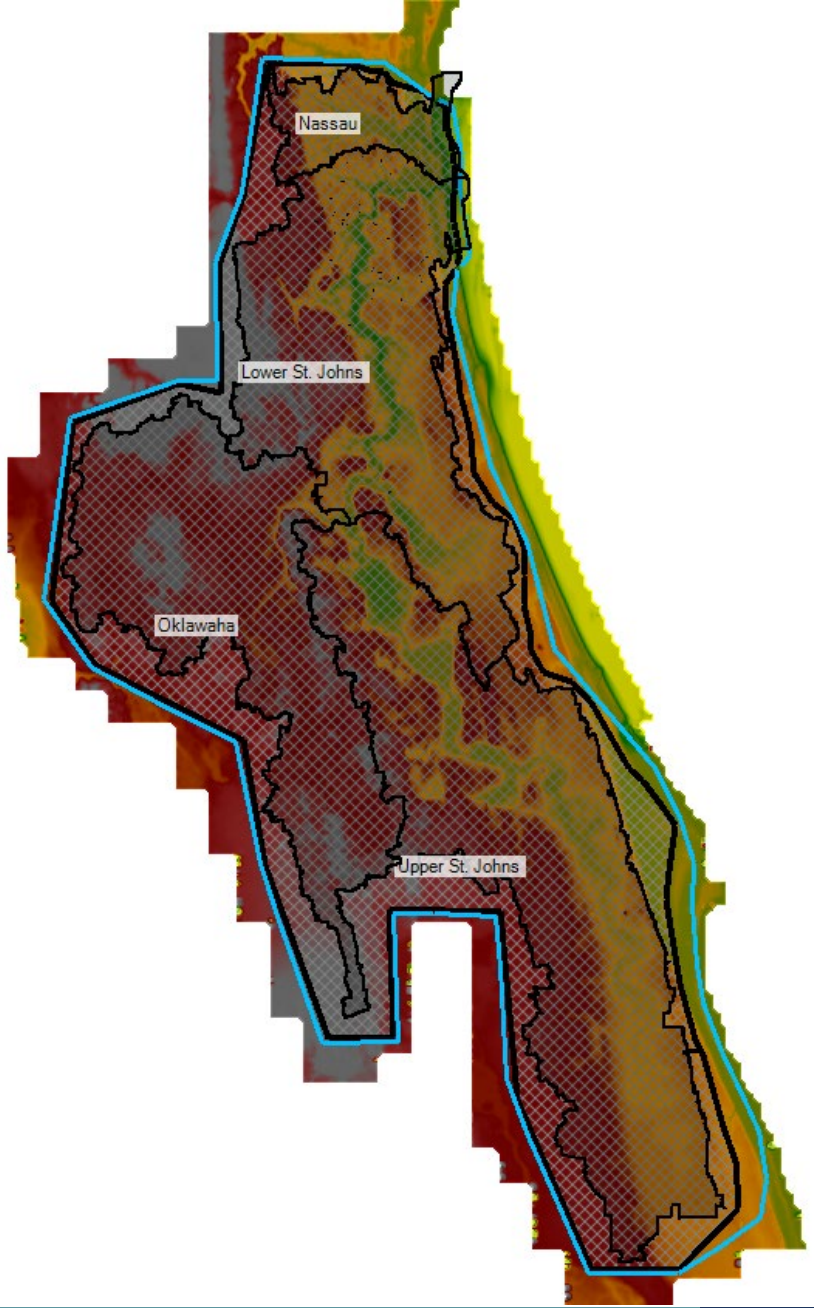


MODEL DOMAIN

Model Domain Covers 4 HUC-8 Basins

- Lower St. Johns River
- Upper St. Johns River
- Ocklawaha River
- Nassau River

Model domain extends beyond the delineated boundary to capture any interbasin flow and allow flow out of the model.



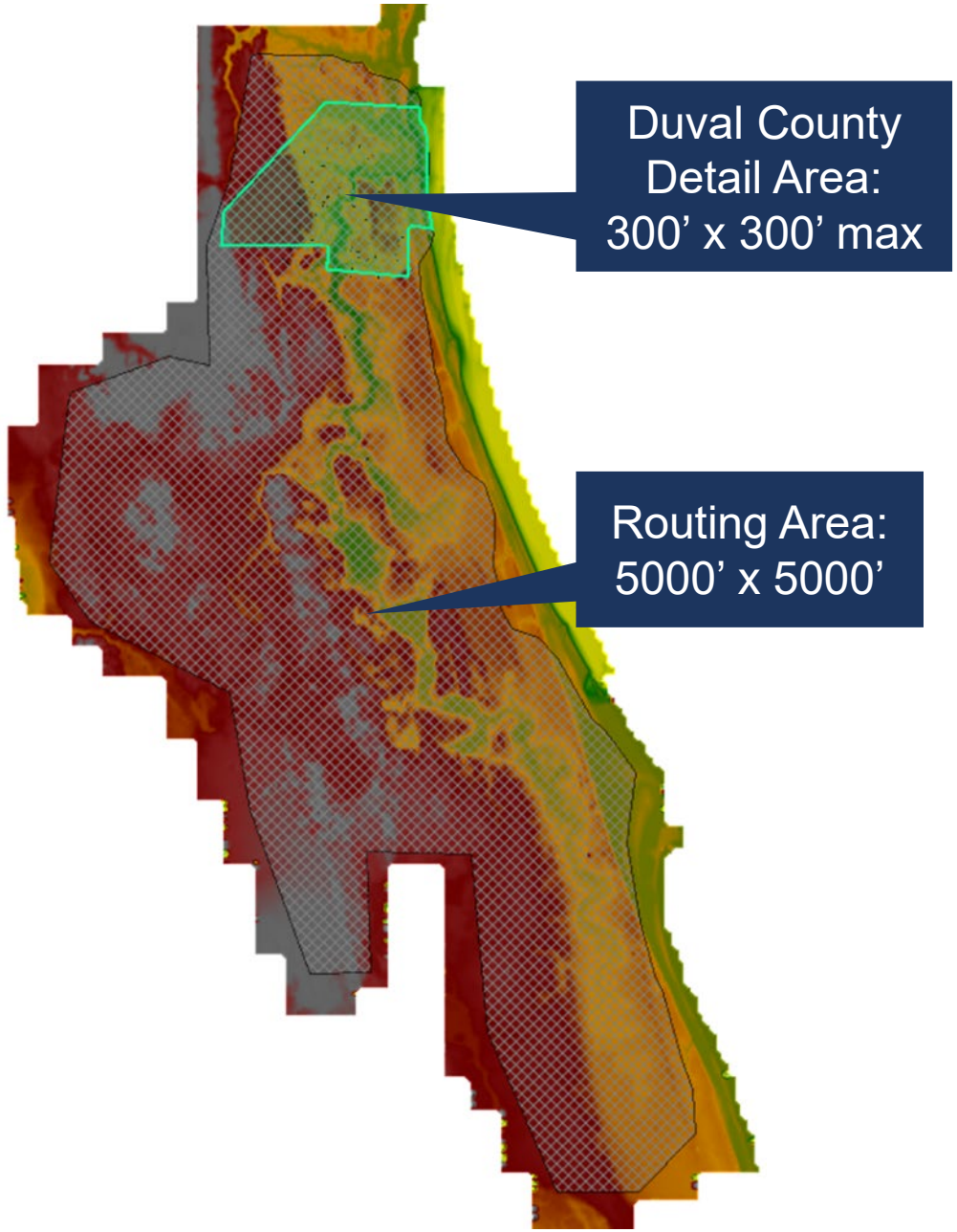
HEC-RAS MODEL SET UP

Routing Area

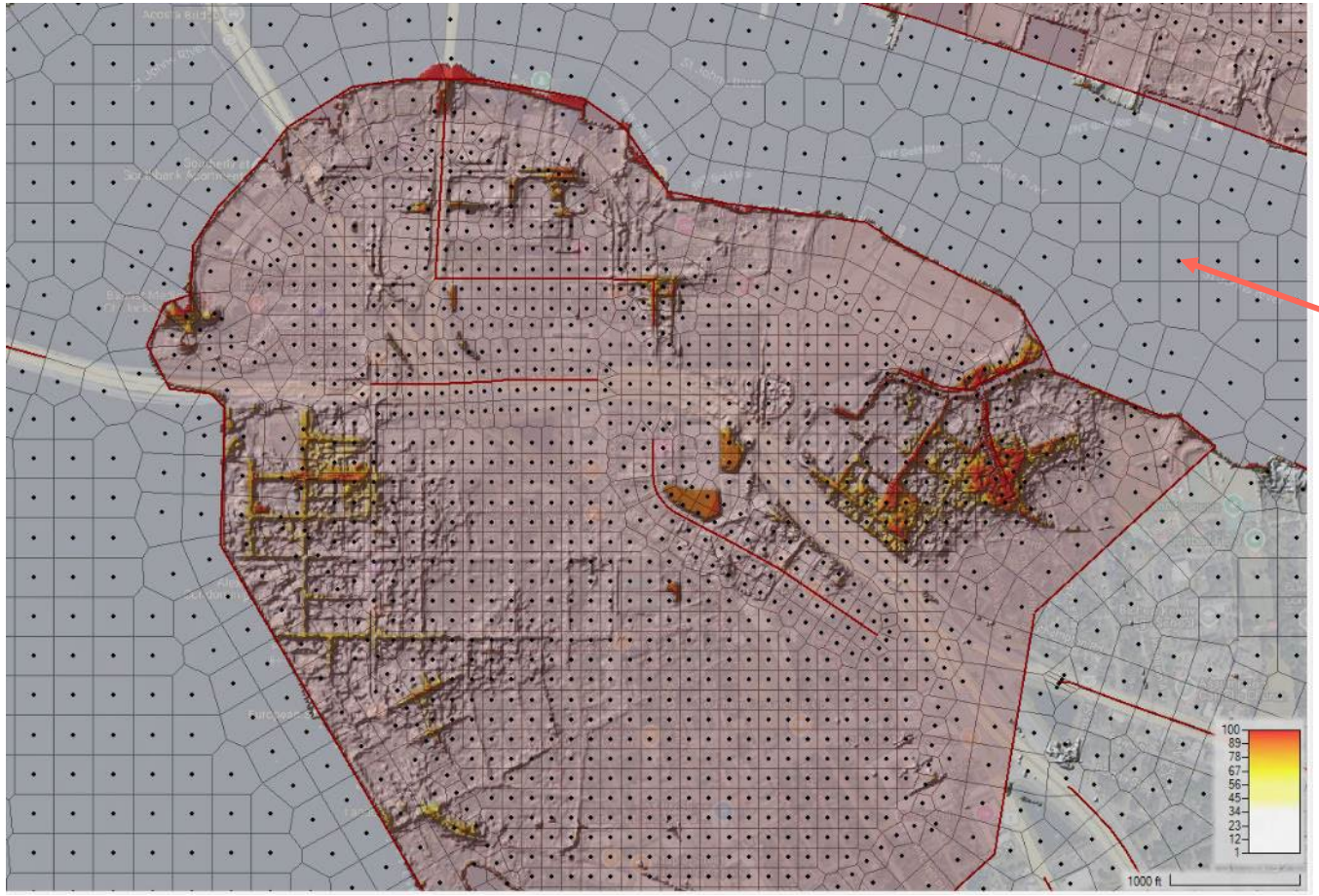
- 5000’ x 5000’ mesh
- Used to route flow to the City of Jacksonville
- Mesh size kept large to optimize model run time

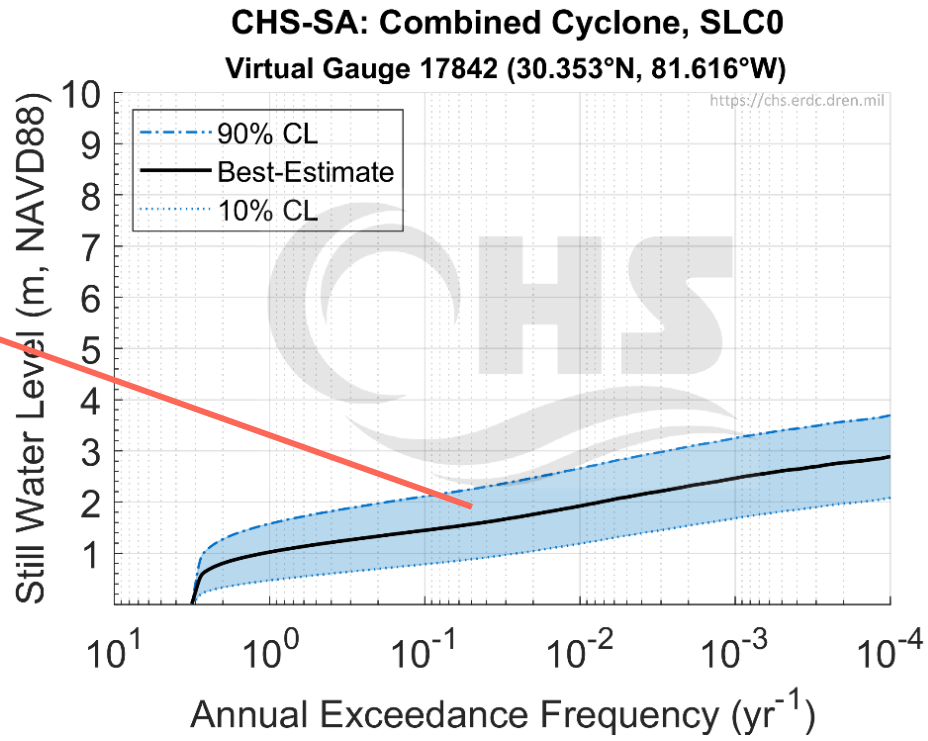
Detail Area

- 300’ x 300’ mesh
- Require higher level of accuracy
- Allows for accurate tidal propagation
- Additional regions of refinement — down to 150’



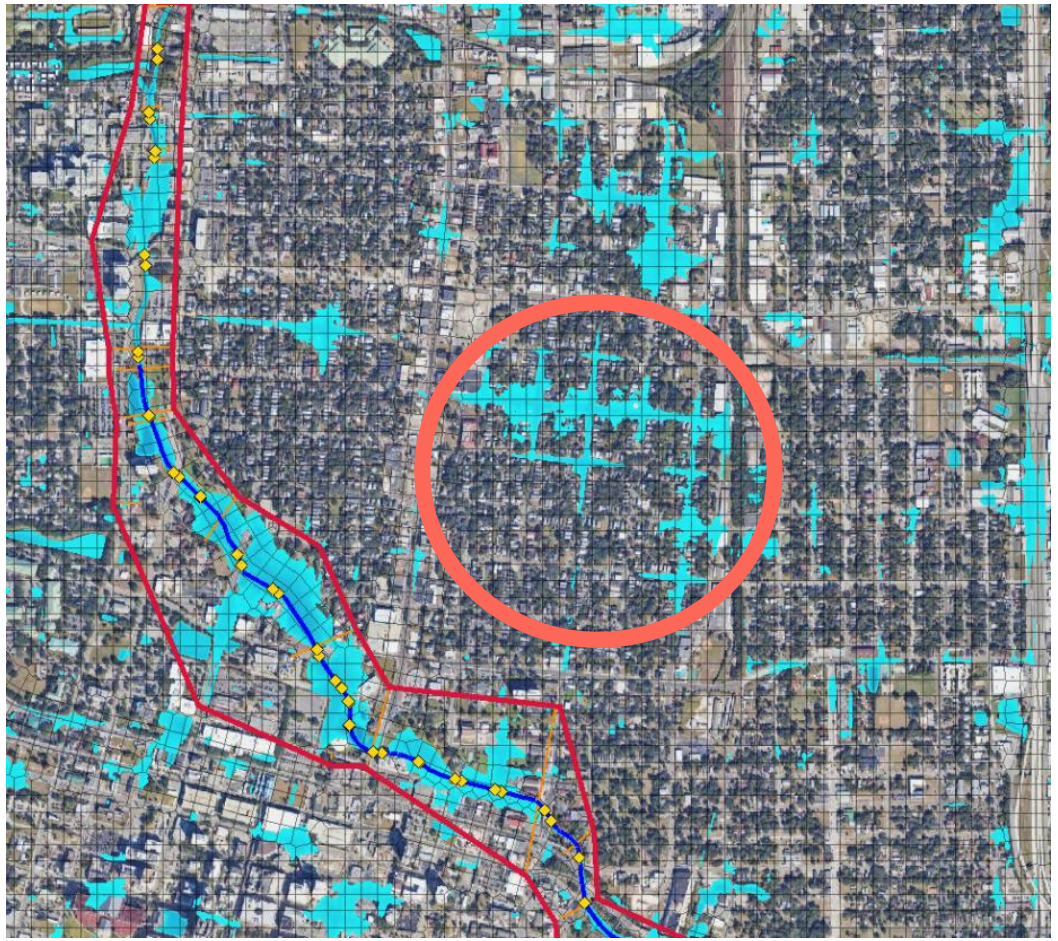
MODEL MESH & COMPOUND FLOOD FREQUENCY





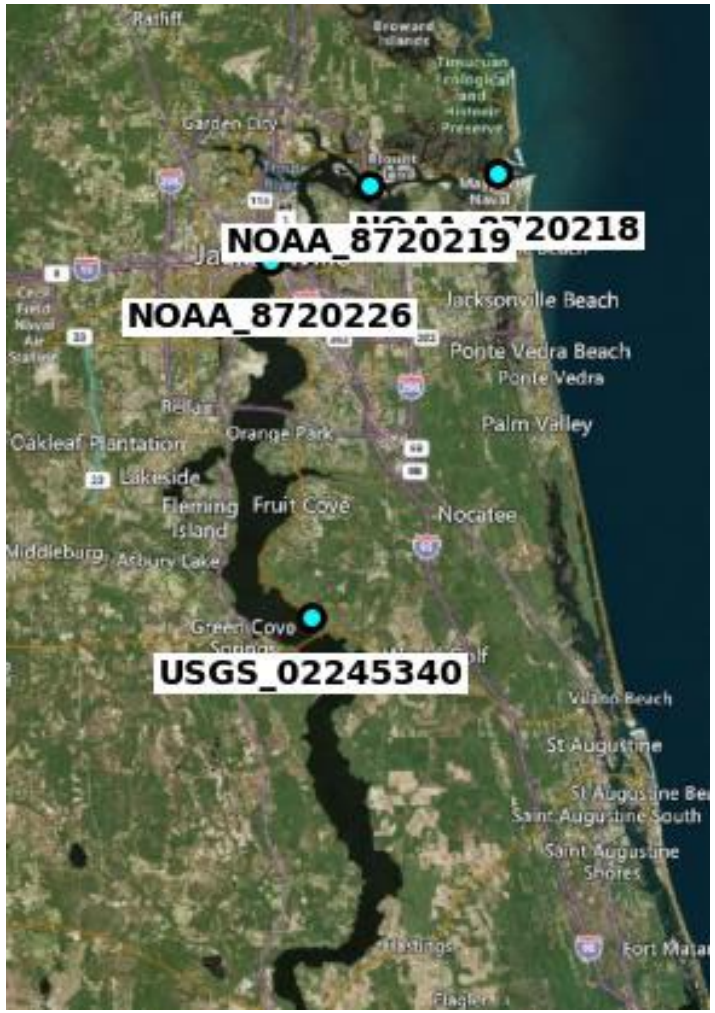
PLUVIAL FLOODING

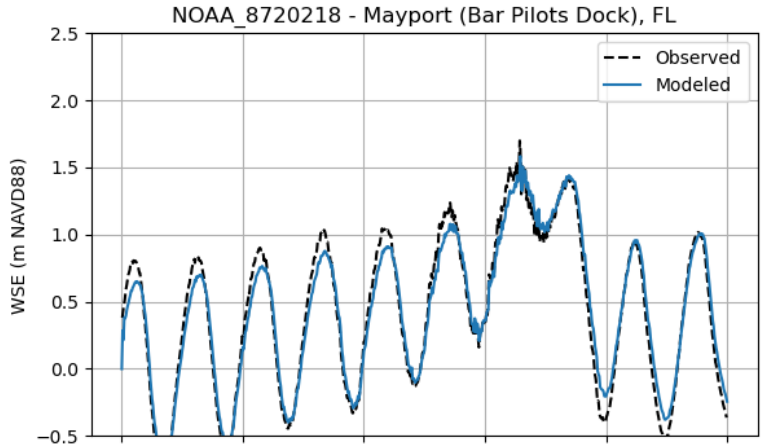
The compound flood model captures localized (pluvial) flooding not currently quantified

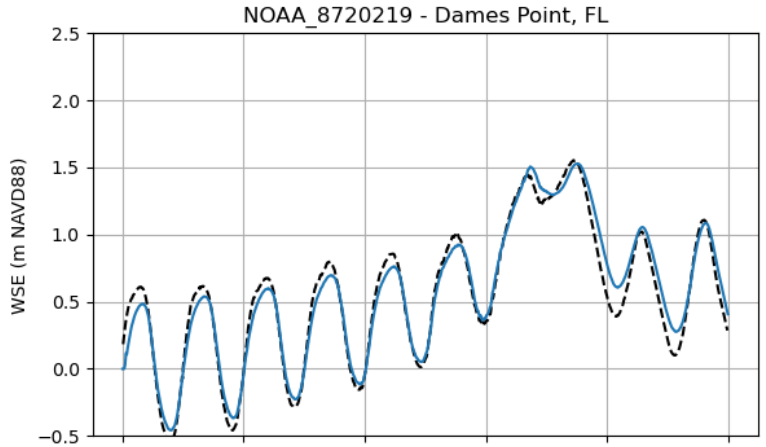


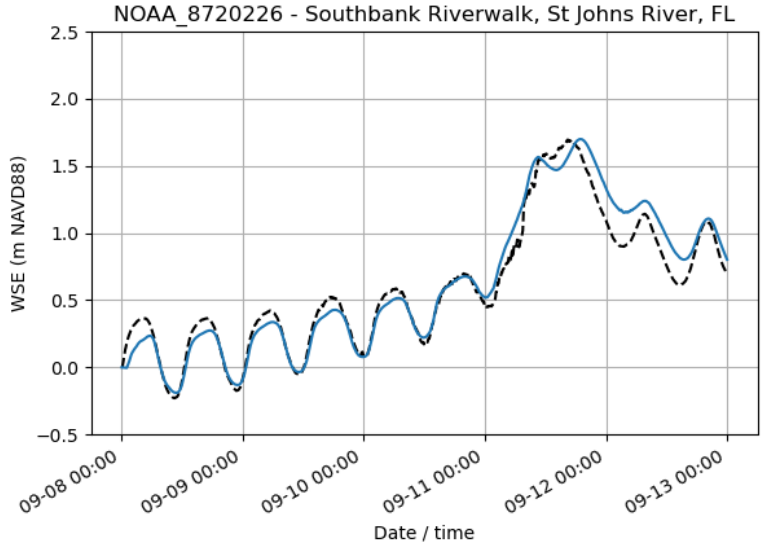
HURRICANE IRMA

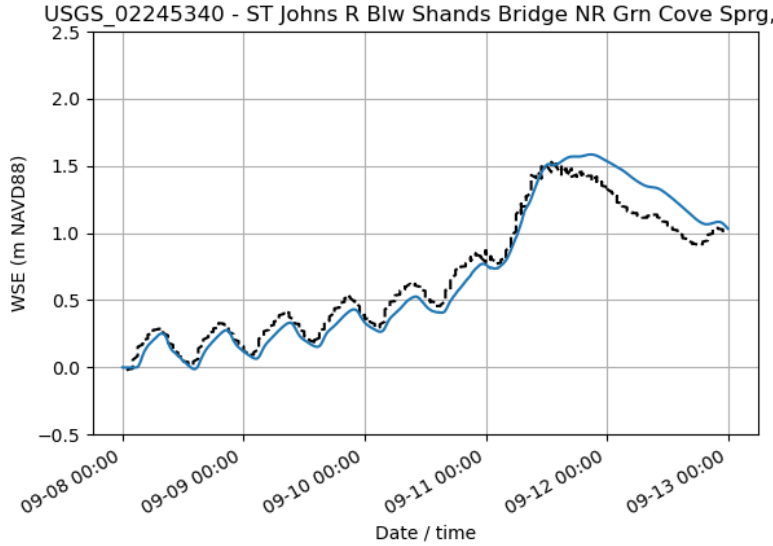
MODEL PERFORMANCE











PROBABILISTIC RISK

Winds

Rain

Soil moisture

Tides

SLC

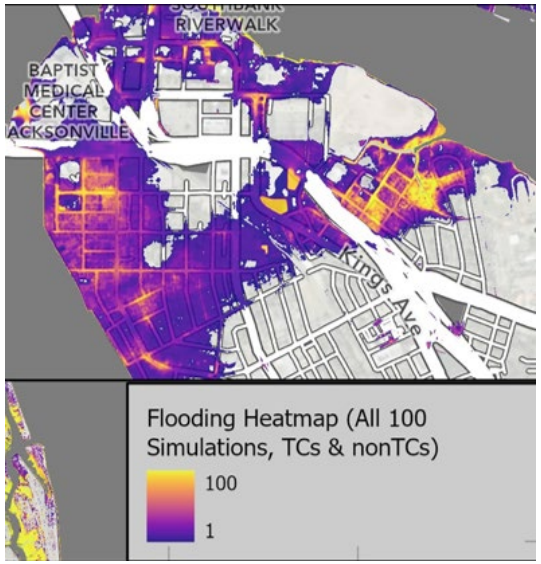
MODEL INPUTS

Hydraulic Model

~50,000 Combinations of Model Inputs Simulated

Statistical Analysis

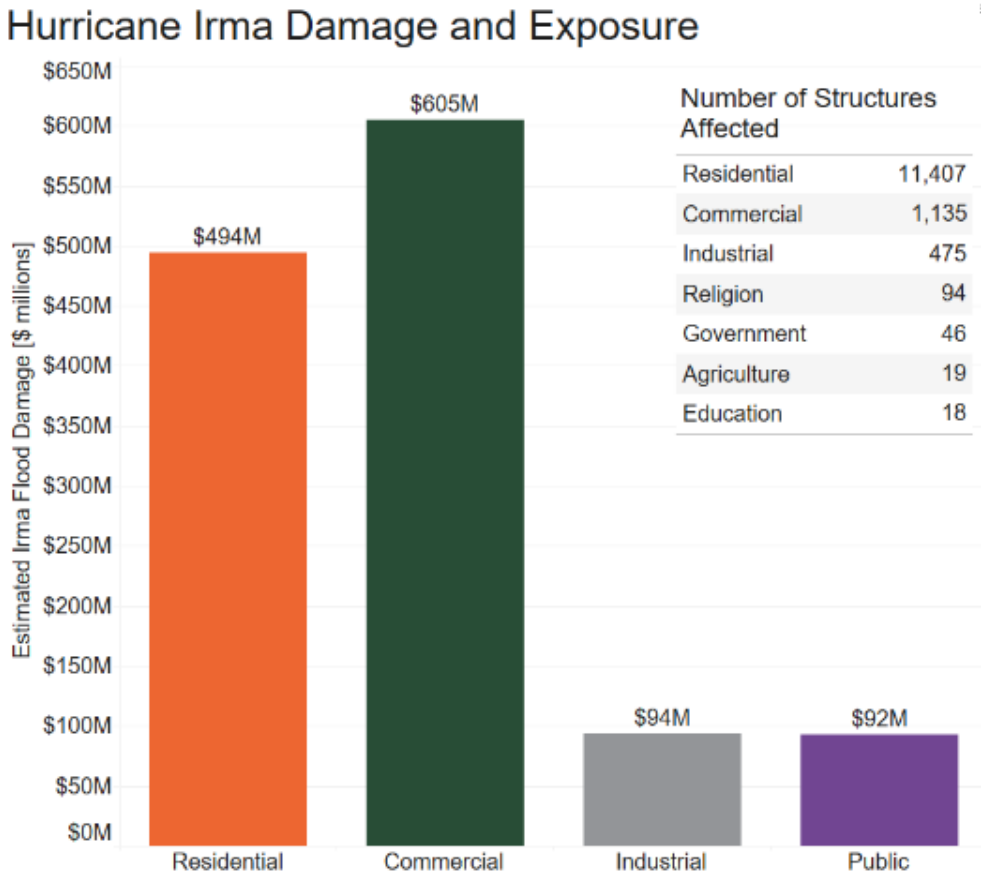
Results of all model simulations are compared at every cell in the model



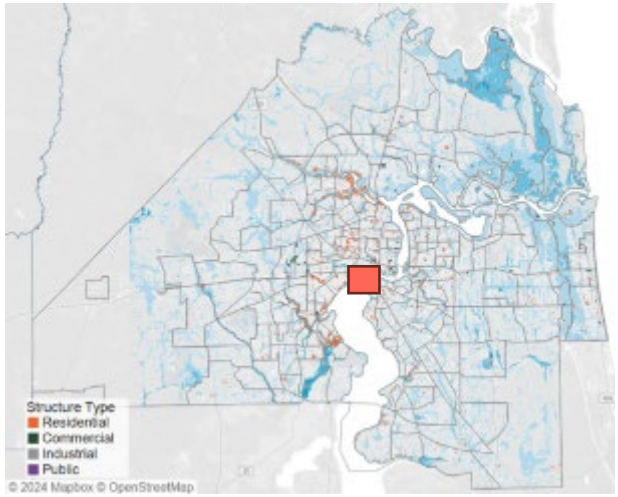
Probabilistic Flood Risk Mapping

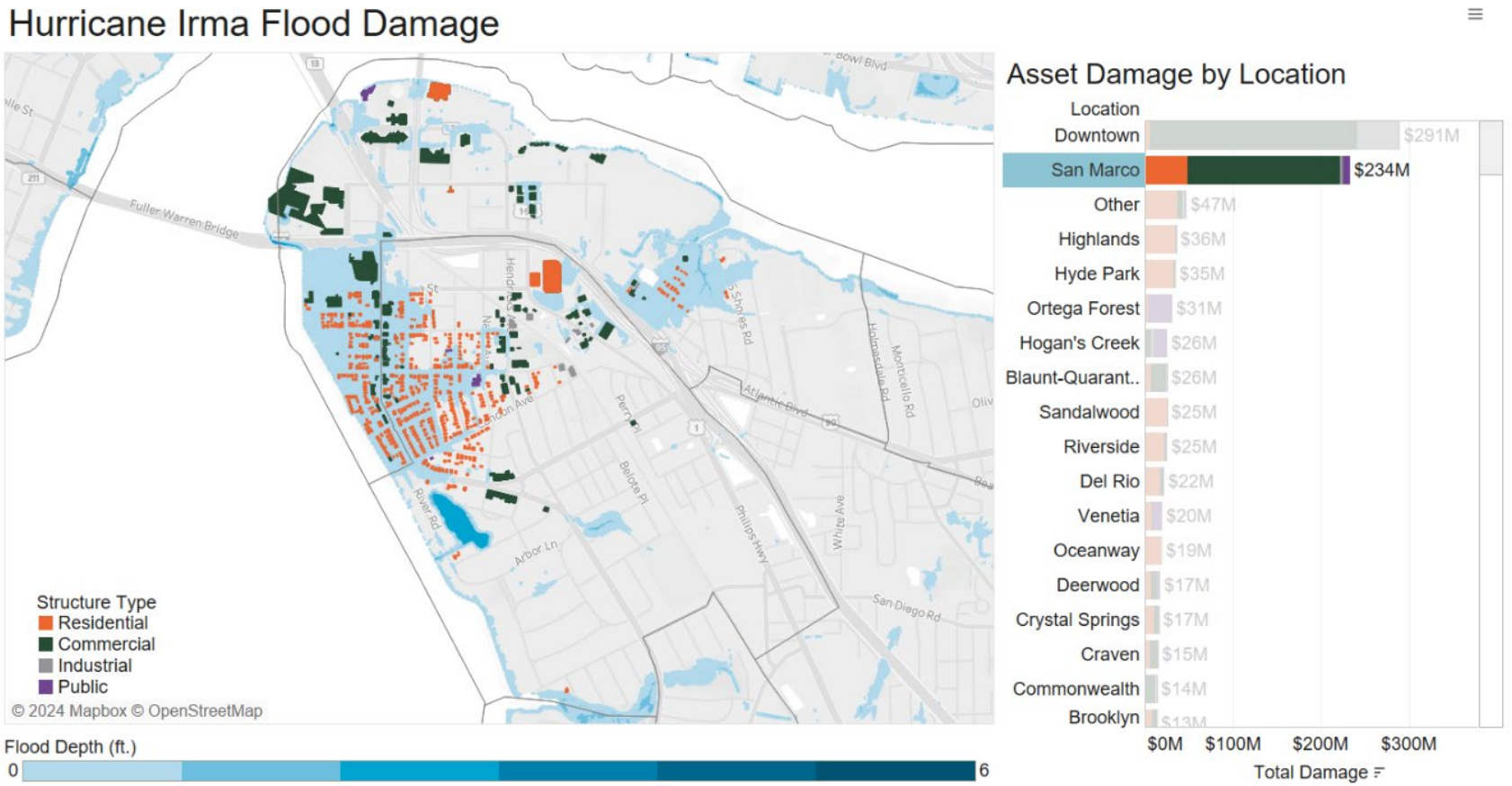
EXPOSURE

The city's compound flood model estimates consequences to support resilient infrastructure decision making

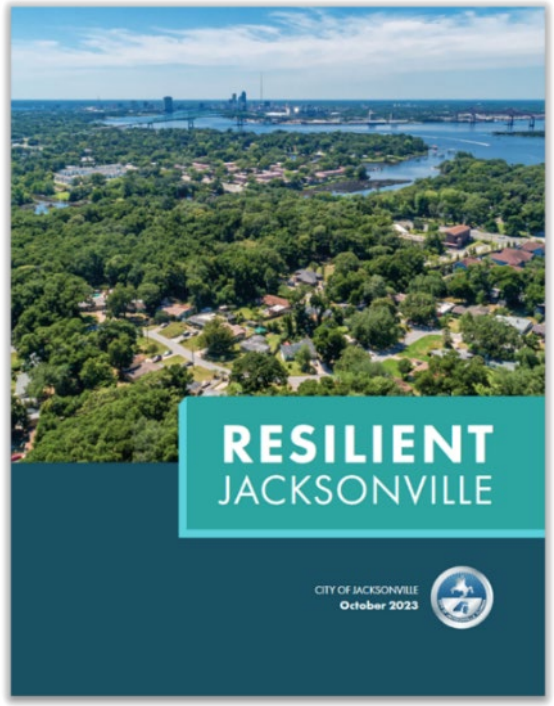


LOCATION-SPECIFIC DAMAGE ESTIMATES





GUIDE IMPLEMENTATION



Land Development Regulations Update

Rather than implementing mandates, the committee focused on creating a framework to guide development outcomes.

Incentive Based Approach

- Encourages desired outcomes
- Provides clearer expectations for developers and neighborhoods
- Ties flexibility directly to public benefit

Identified Target Growth Area

- Better suited to accommodate growth
- Lower flood risk and better infrastructure access
- Enables housing opportunities connected to transit
- Protects existing single-family neighborhoods

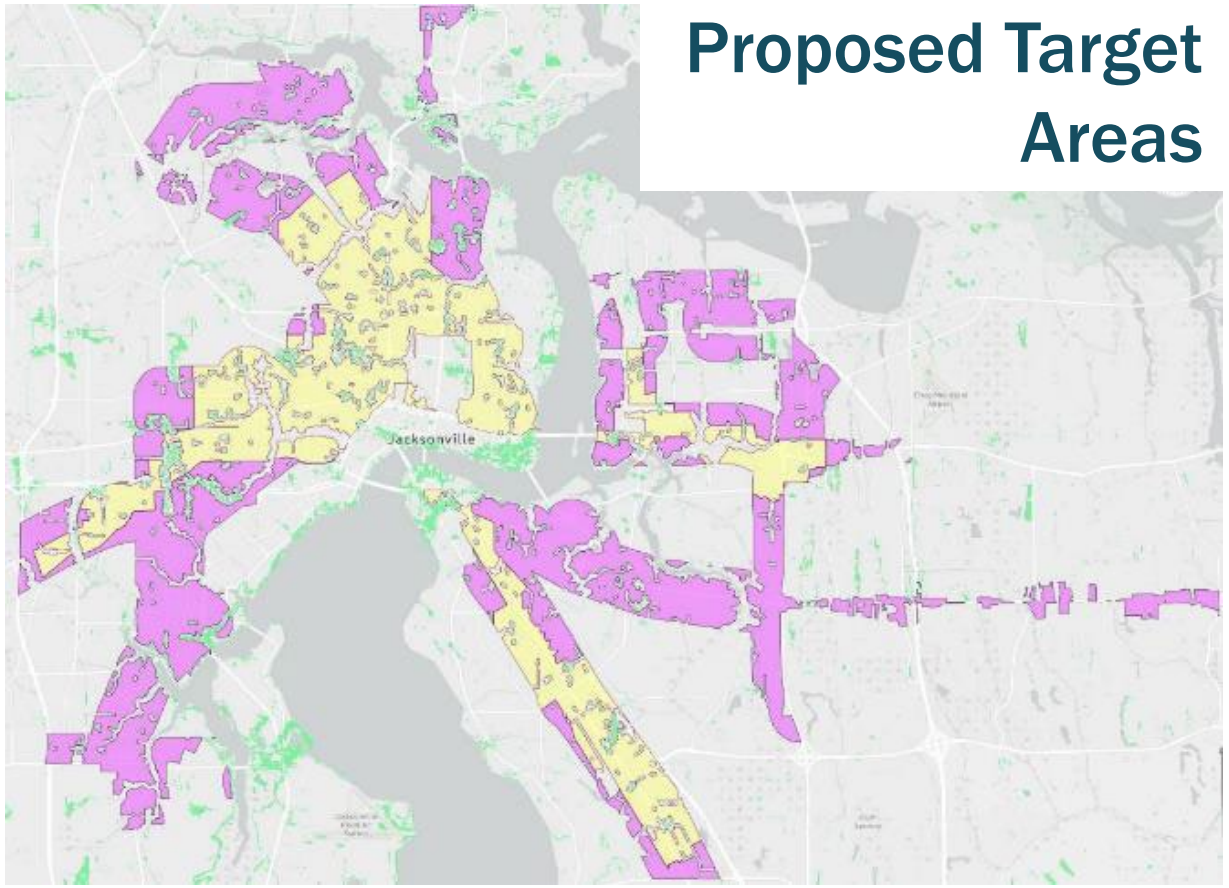
Development incentives apply only in the Target Growth Area — not citywide.

GUIDE IMPLEMENTATION

Proposed Lower Risk Areas are areas that…

- Did not fall in the Higher Risk Areas (Compound Flood Model)
- Did not fall in the FEMA Higher Risk Insurance Areas
- Have a 100 ft set back from Higher Risk Areas
- Exclude accidental potential zone
- Include existing zoning overlays that did not conflict with the proposed incentive structure

Proposed Target Areas



Compound flood model results can be used to prioritize investments and tailor infrastructure solutions.

DECISION SUPPORT

ENGINEERING & DESIGN APPLICATION

Supporting resilient infrastructure design

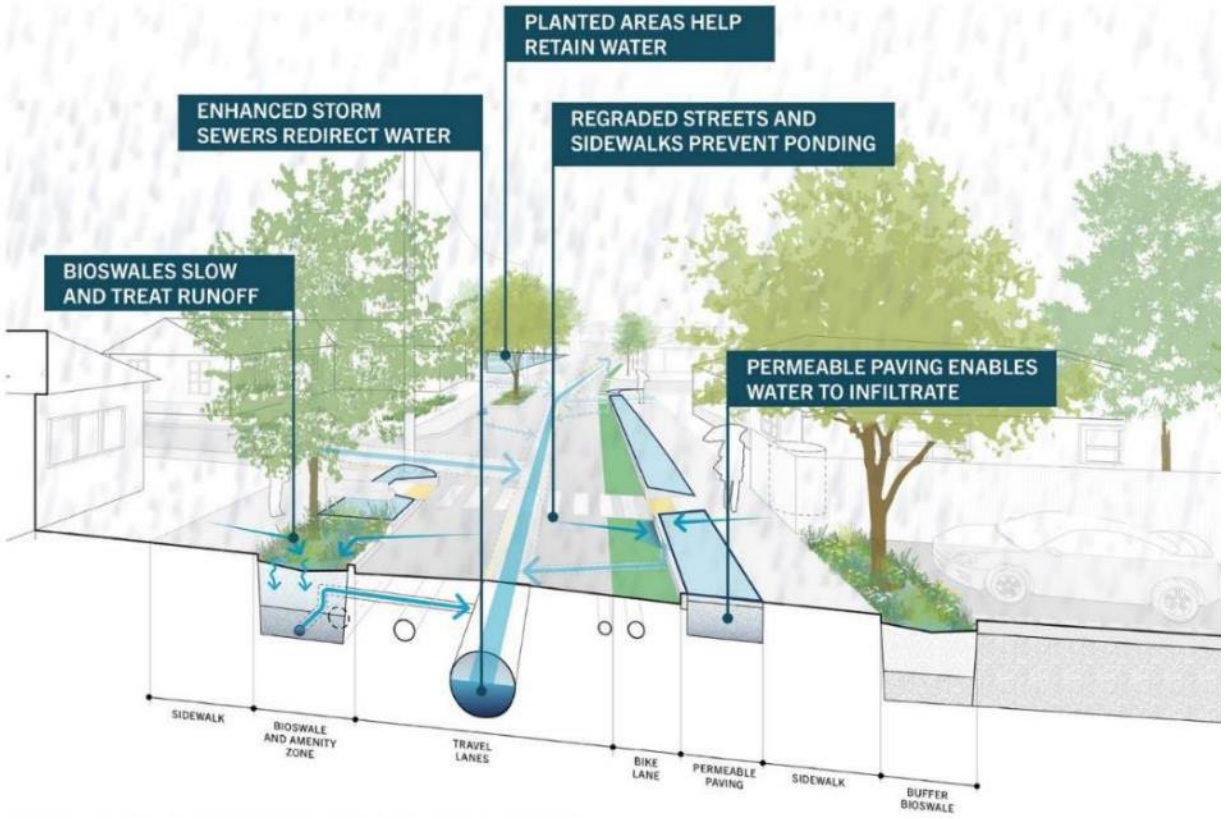
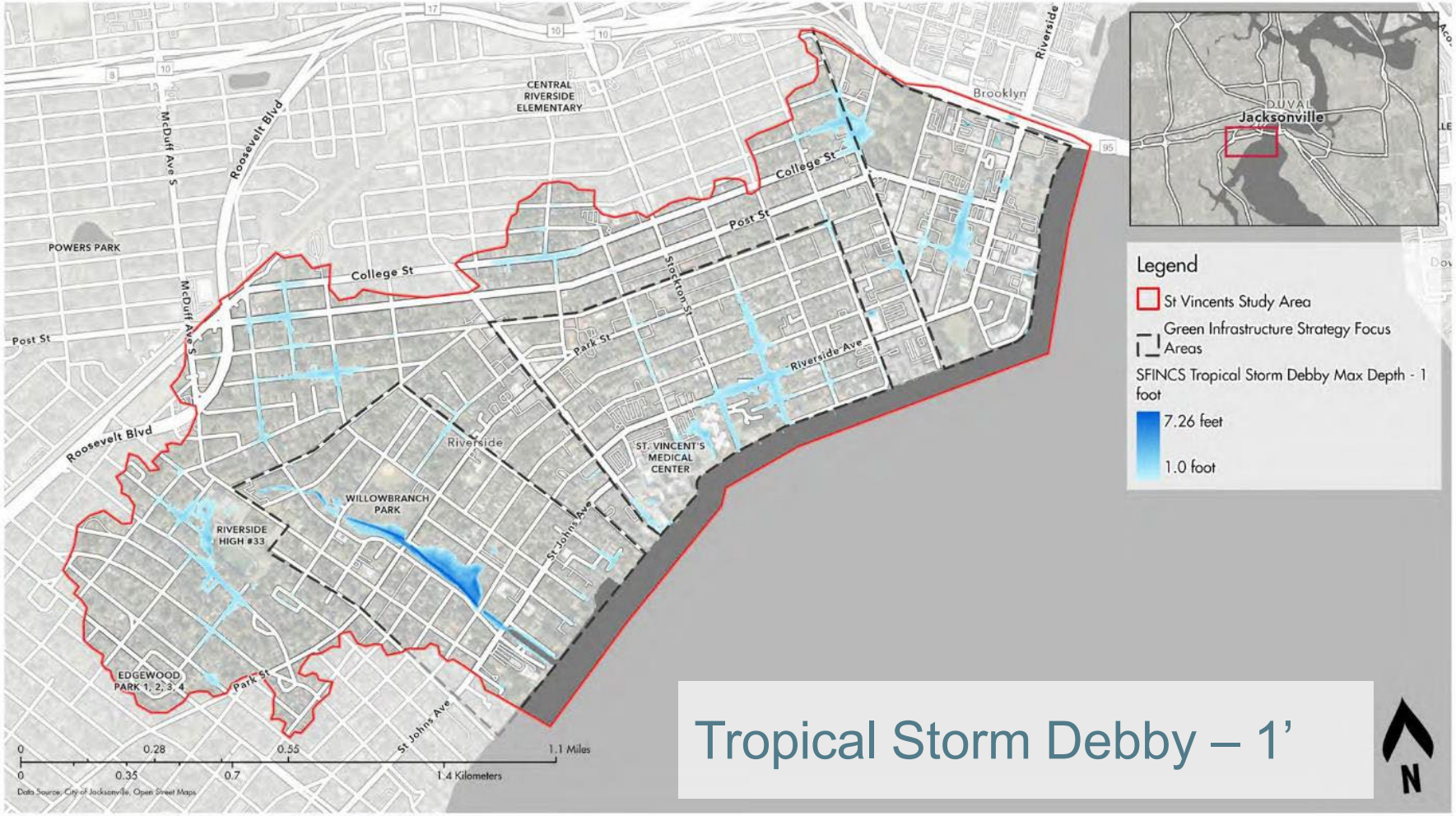
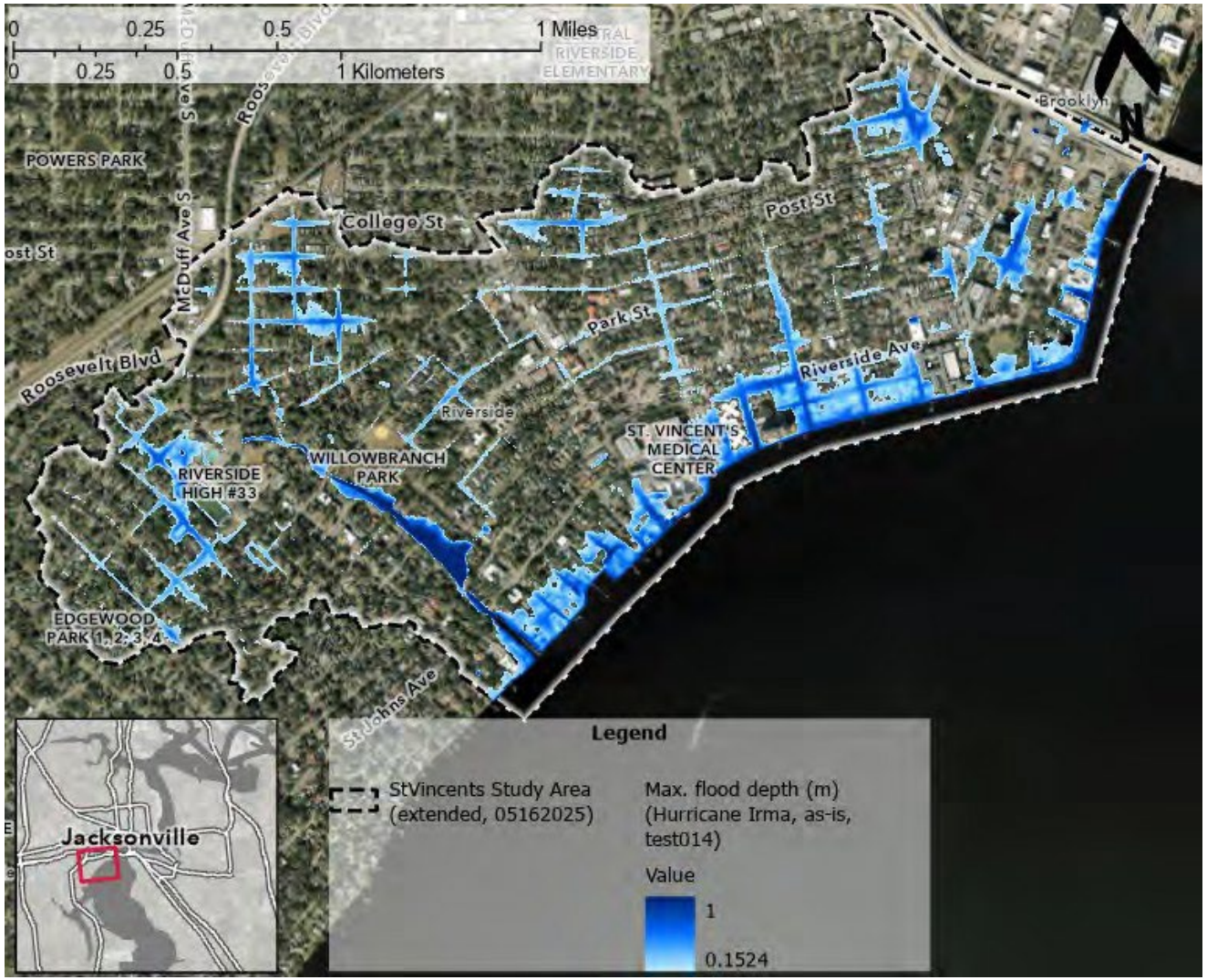


Image credit: SCAPE

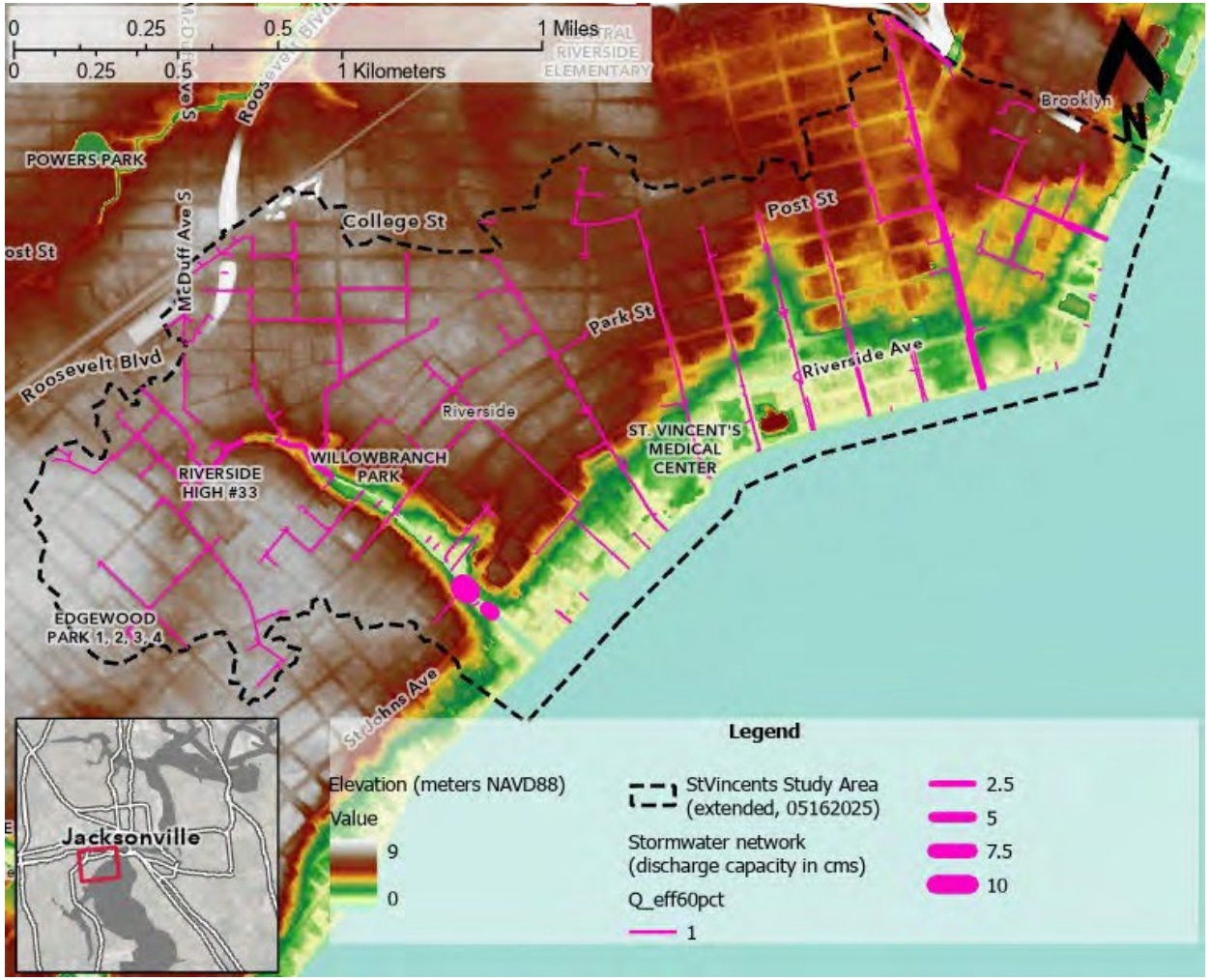
TROPICAL STORM DEBBY



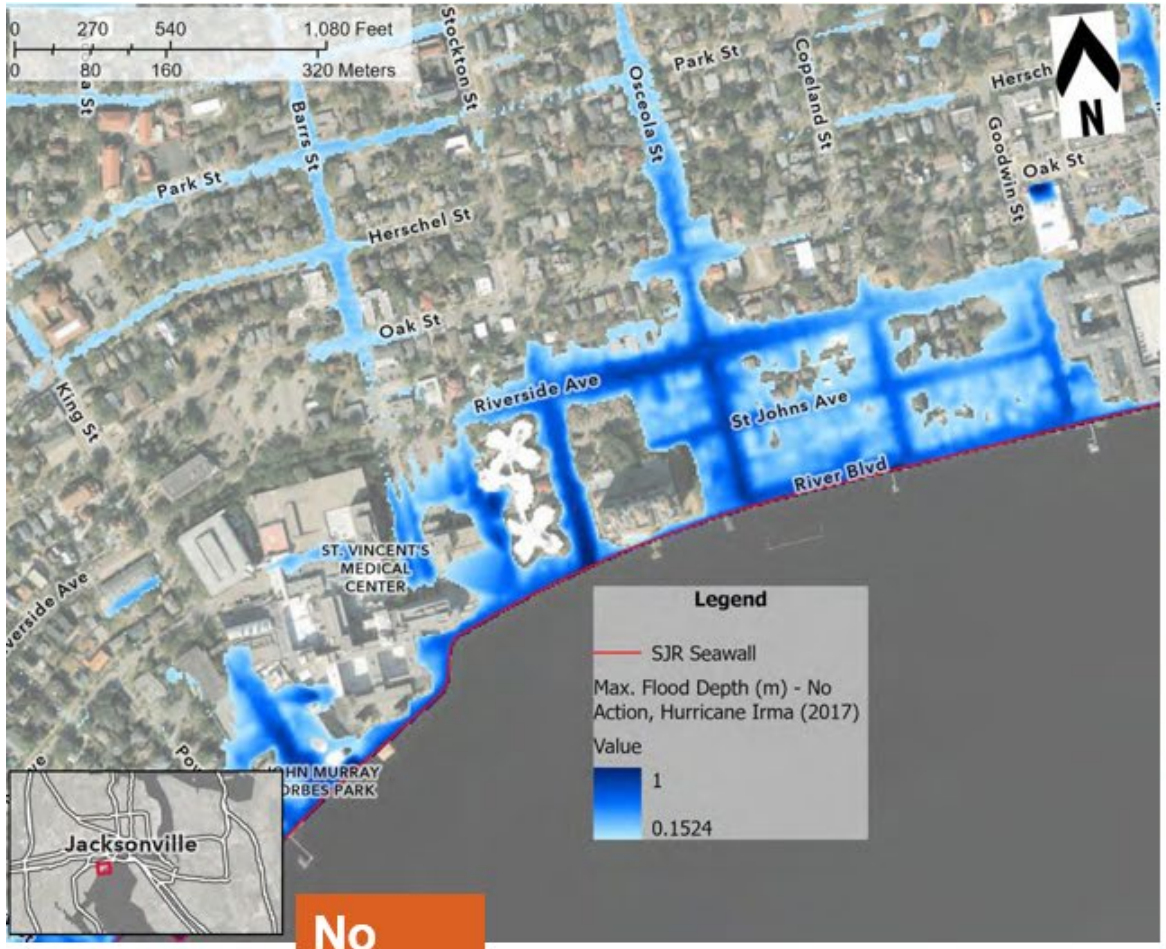
HURRICANE IRMA

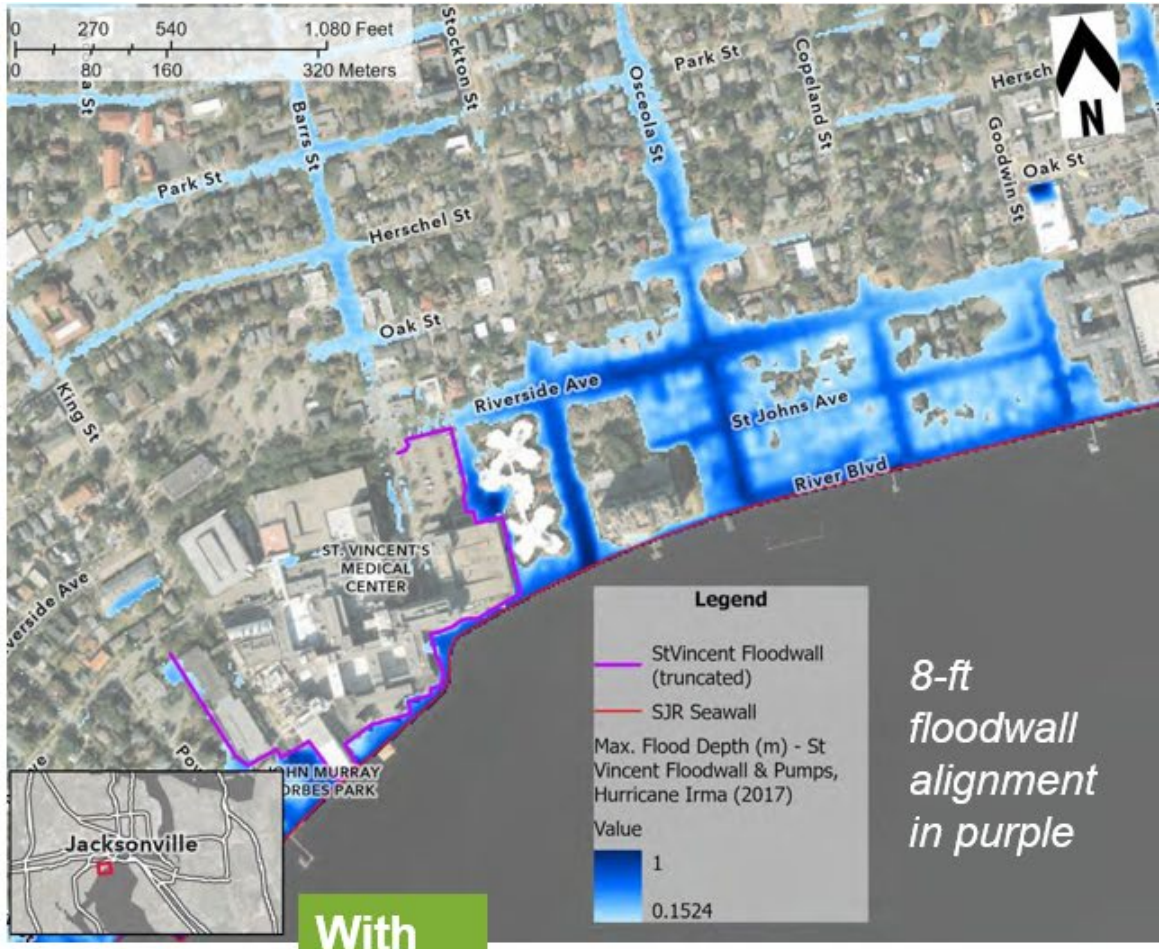


MODEL EXTENT



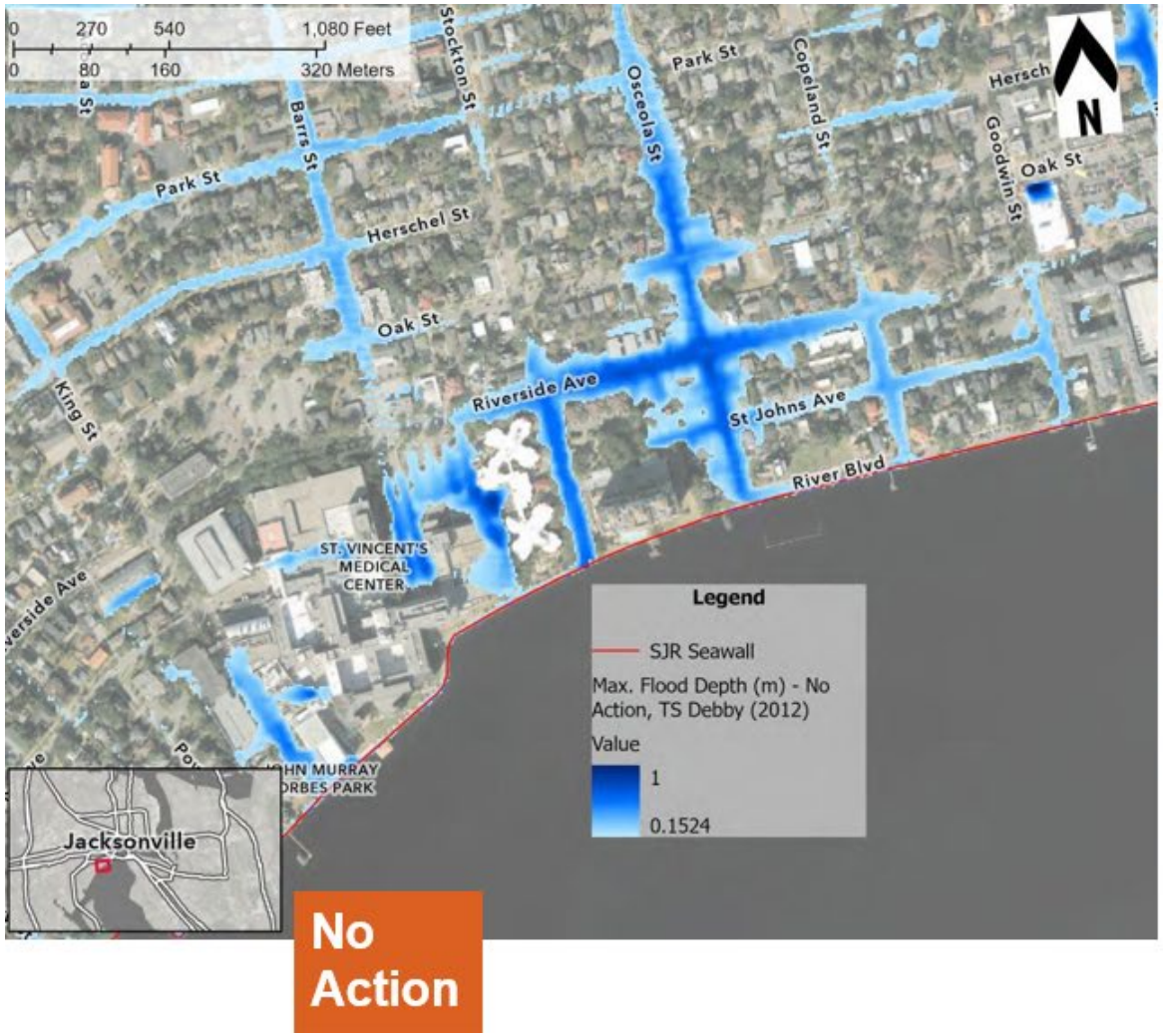
HURRICANE IRMA WITH HOSPITAL FLOODWALL





1-YEAR EVENT WITH PUMP STATION

TROPICAL STORM DEBBY WITH PUMP STATION



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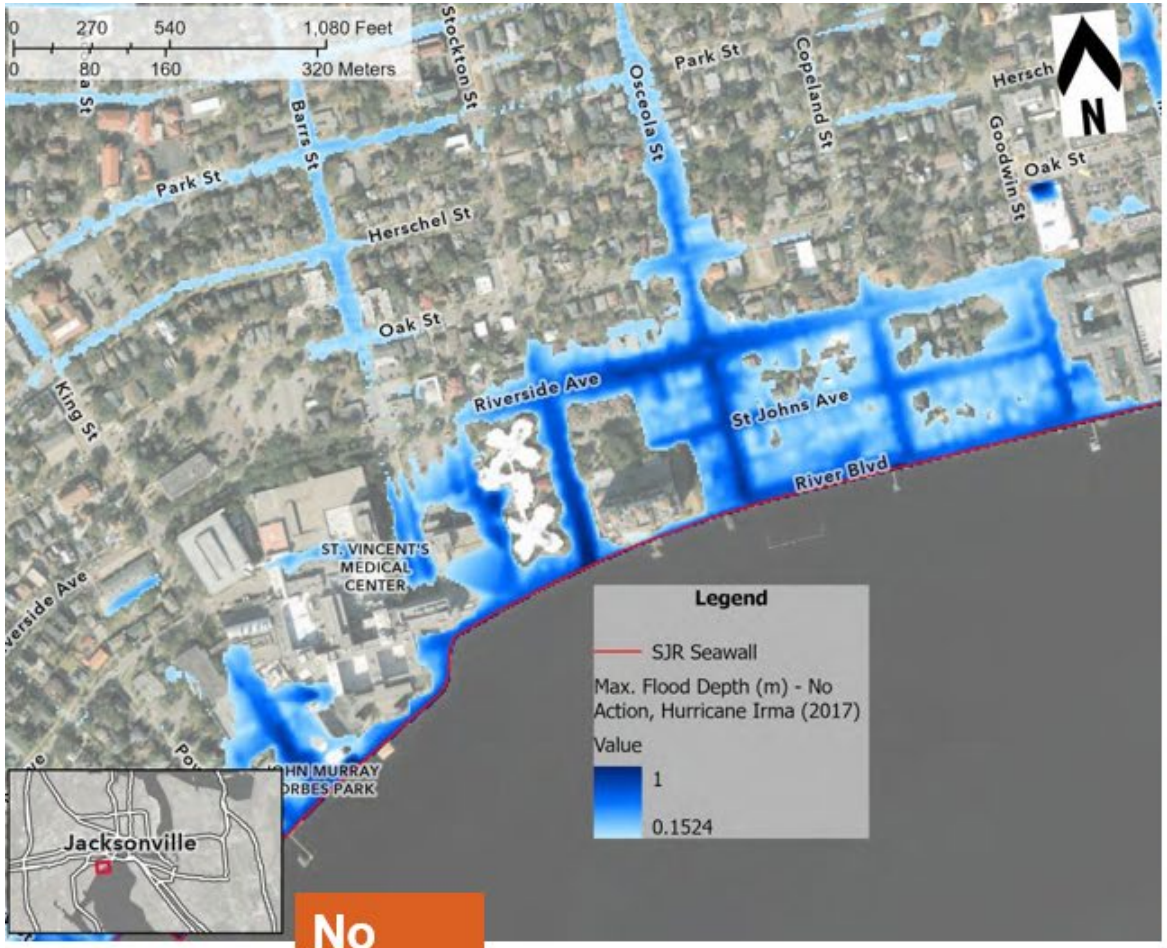
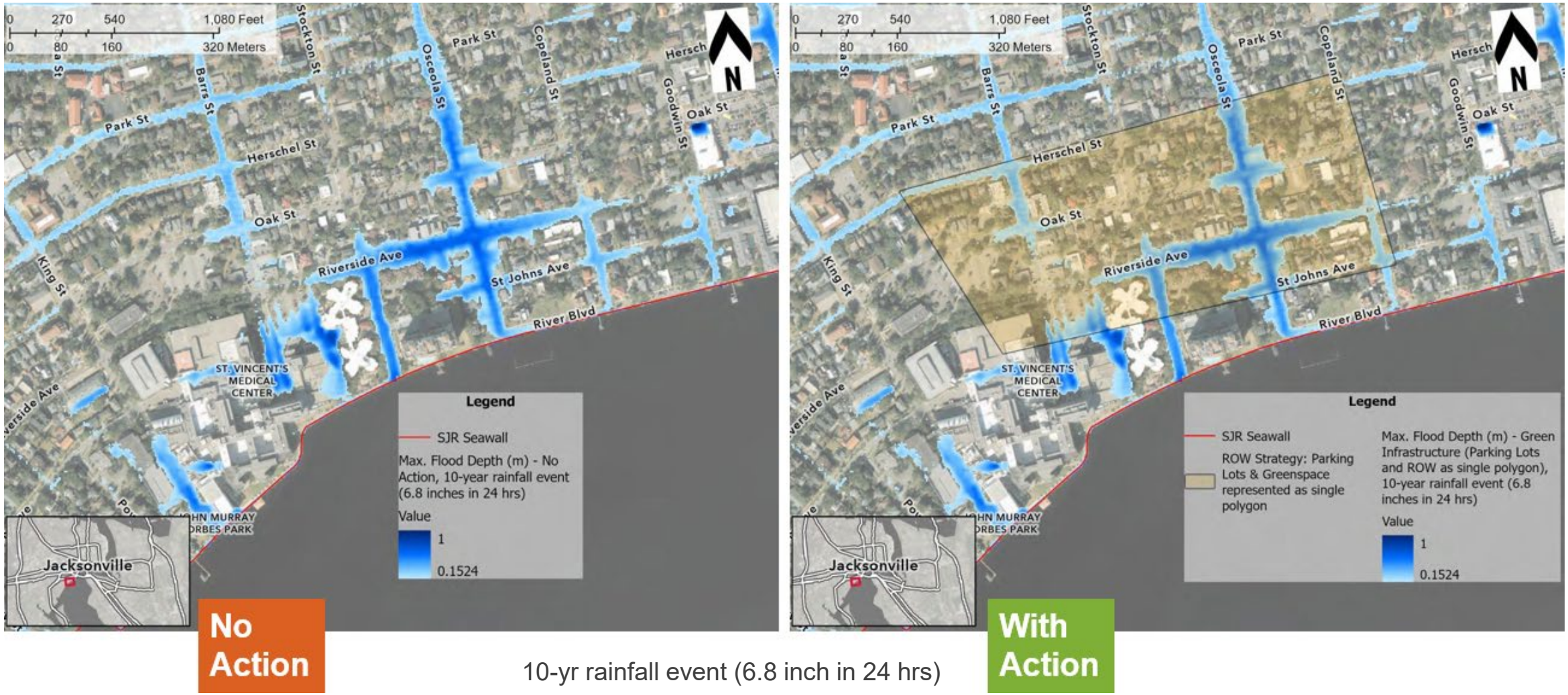


RIGHT OF WAY RETENTION STRATEGY - REFINED

1-YR EVENT WITH GREEN INFRASTRUCTURE

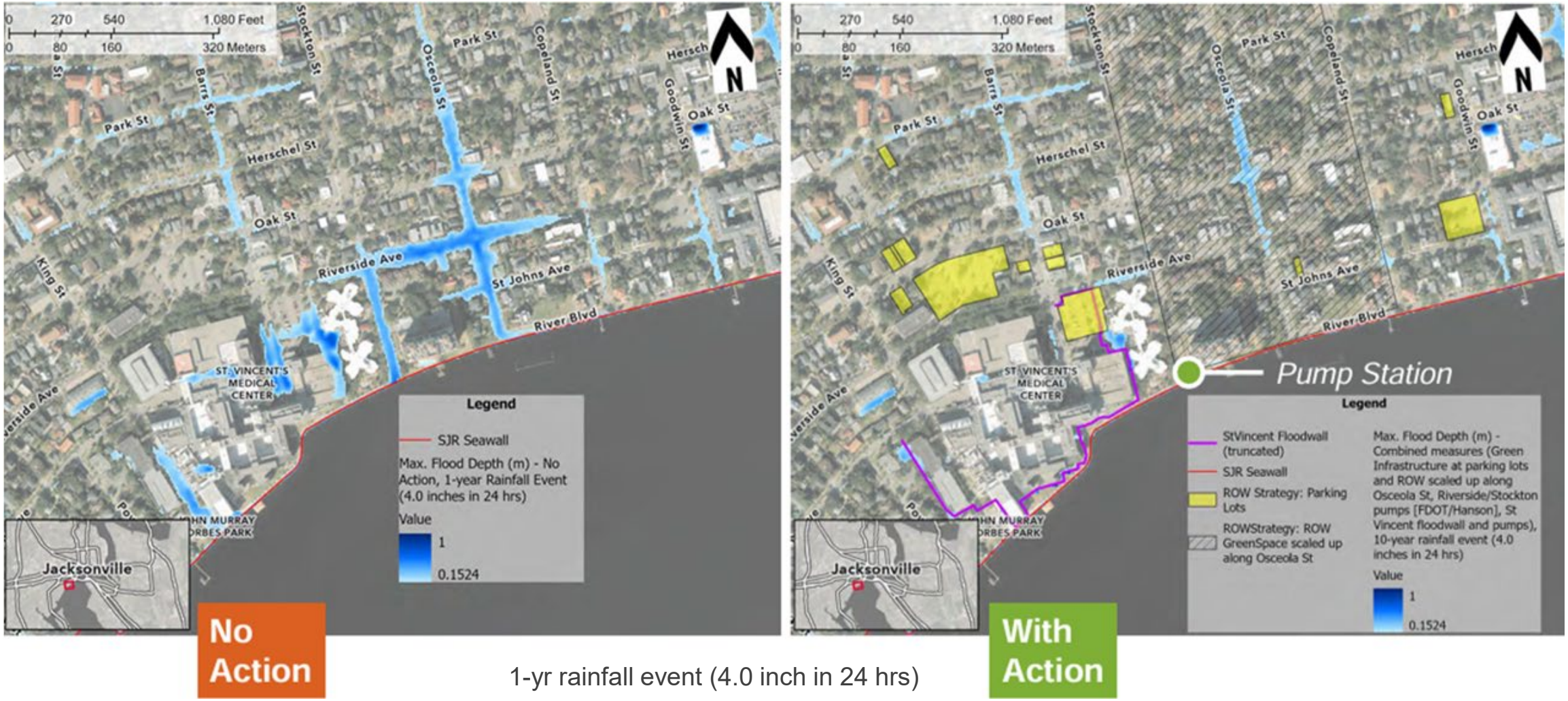
1-yr rainfall event (4.0 inch in 24 hrs)

10-YEAR EVENT WITH GREEN INFRASTRUCTURE



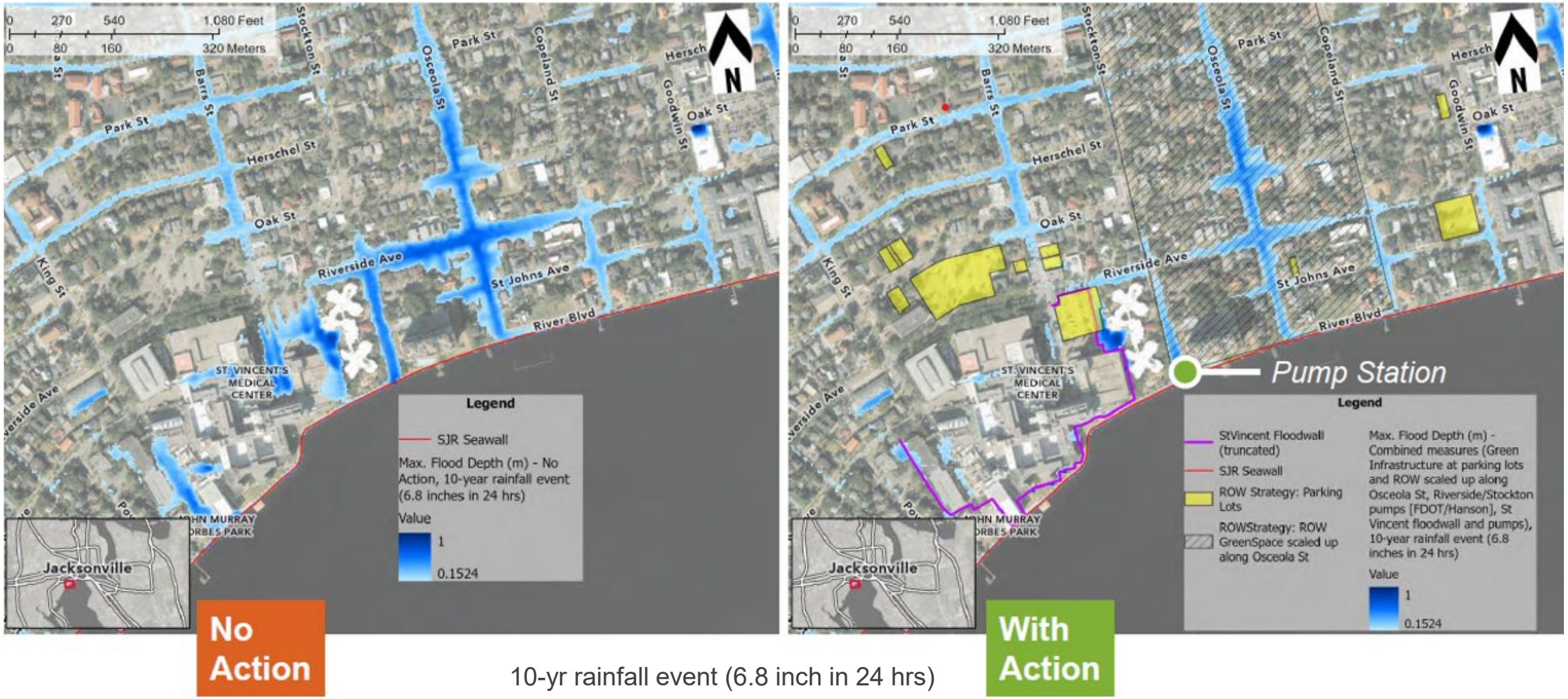
10-yr rainfall event (6.8 inch in 24 hrs)

1-YEAR EVENT WITH COMBINED SOLUTIONS



1-yr rainfall event (4.0 inch in 24 hrs)

10-YEAR EVENT WITH COMBINED SOLUTIONS



10-yr rainfall event (6.8 inch in 24 hrs)

THANK YOU

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