From Pixels to Prediction

3D Mapping for Next Generation Stormwater & Flood Planning

WGI

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Streamline Technologies

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H&H Modeling

Where We've Been and Where We're Going

H&H Modeling

A Bit of a Perspective

Civil Engineering Firms – Mid to Late 1980s

- Drafters
  - Drafting Room
  - Drafting Machines
- Engineers
  - Engineering paper
  - HP 41CV's and TI-55's

First Day on the Job – Nov 4th, 1985

- Columbia 80/86 w/math coprocessor
- 5-1/4" floppy disk – MS DOS
- SBUH & ICPR – 3 Node

H&H Modeling

A Bit of a Perspective

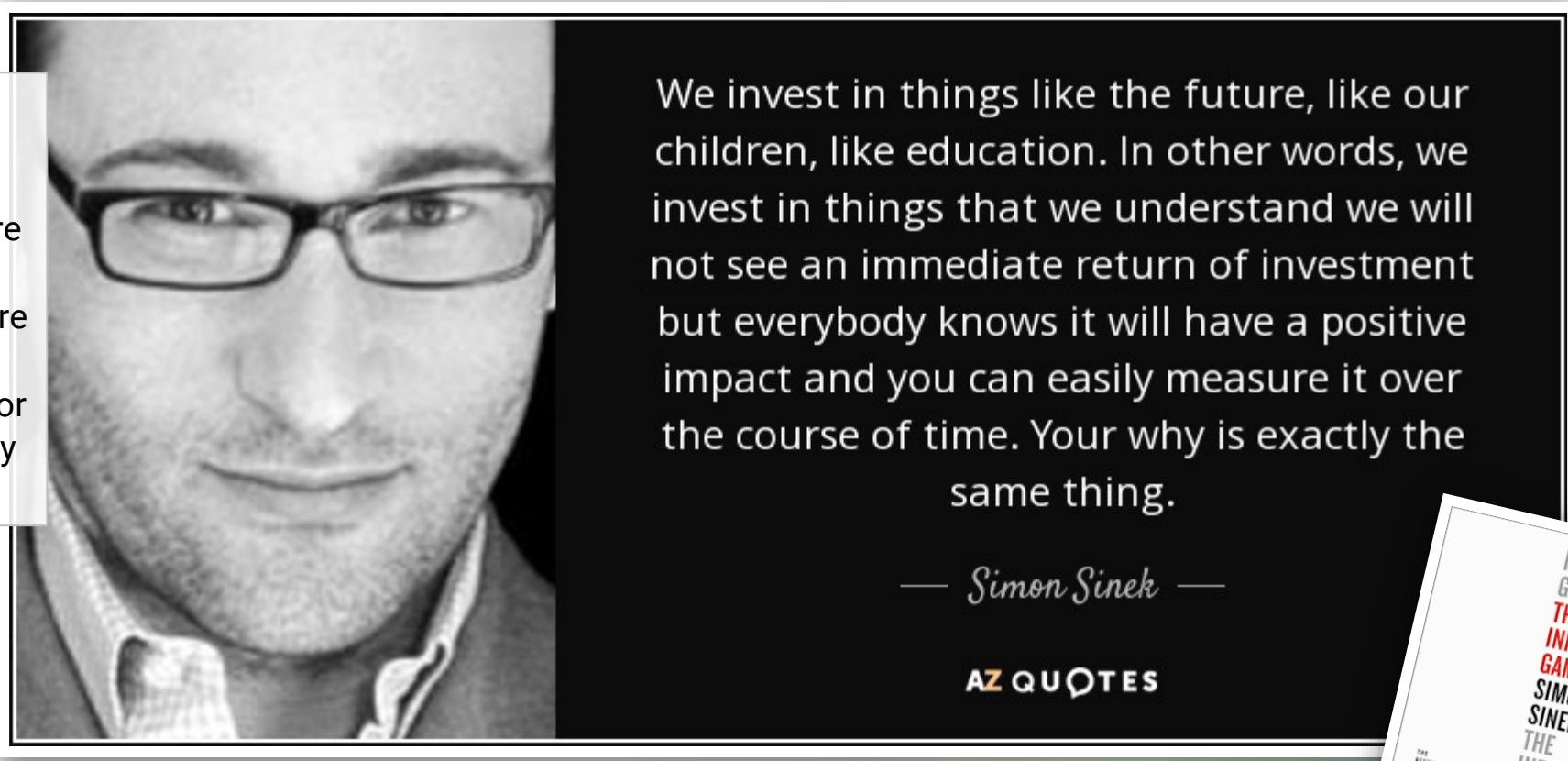
Aerial / Topo Blueprints

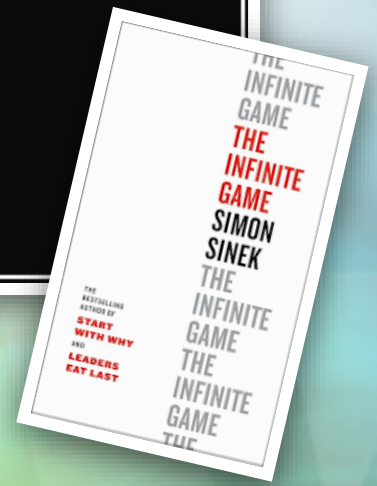
- Delineate Basins
  - Aerial/Topo Maps (SWFWMD)
  - Cover the walls (tape or push pins or tacks)
  - Colored pencils & markers
- Measure Basin Areas
  - Planimeter

H&H Modeling
A Bit of a Perspective

Today's Presentation

- We've come a long way!
- Investments into the future are here
- Returns on investments are coming in the form of predictive modeling and for the benefit of public safety





Geospatial

Data Development

Geospatial Data Development

Basis for Modeling

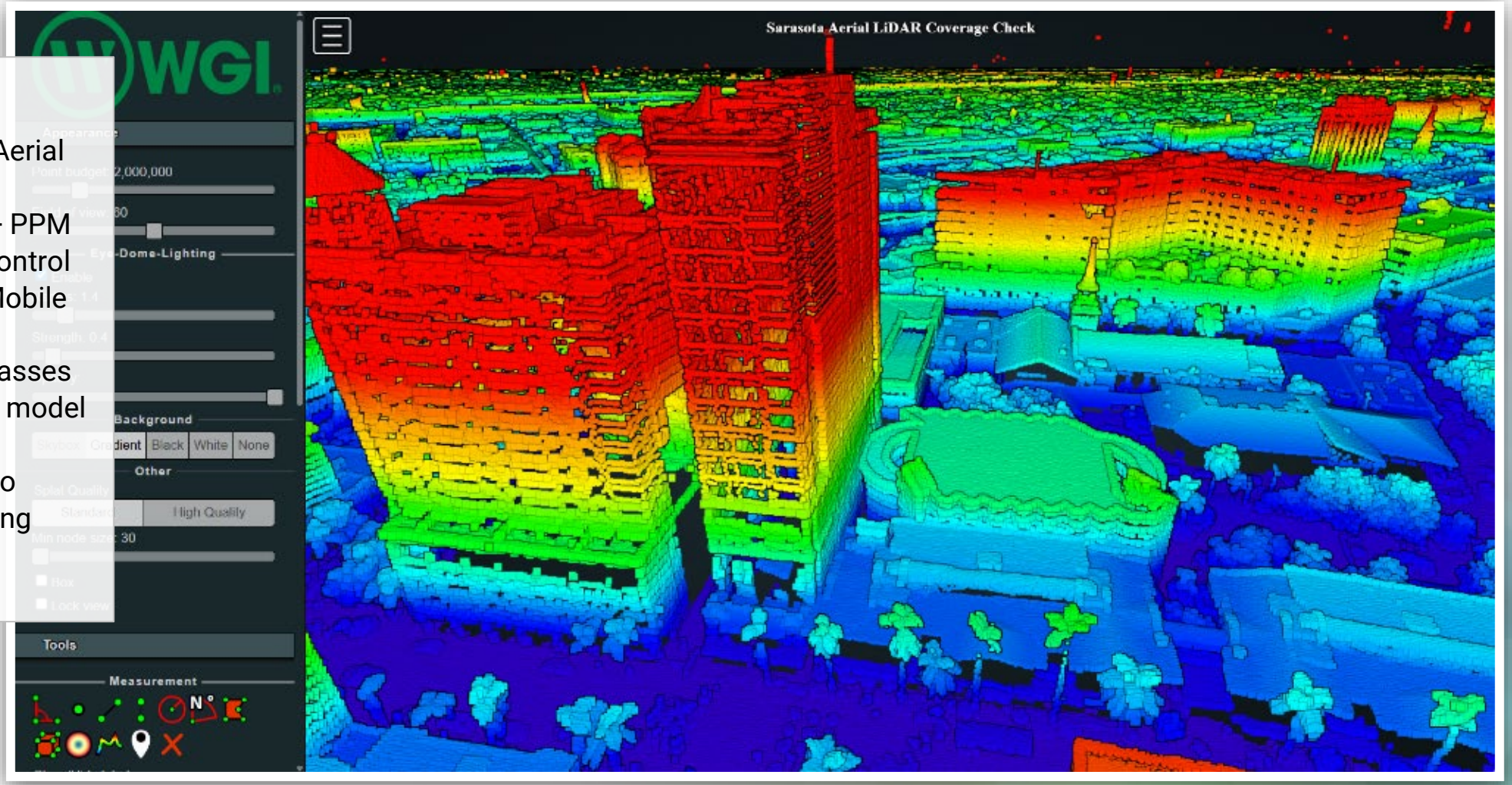
- Current & Accurate Geospatial Data Use for Model Development
- High Resolution Airborne Lidar and Imagery
- Mobile Lidar and Imagery
- Dense Survey Control Network
- Integration and Classification of Lidar Data
- Derivative Products Development
  - *Surface Models*
  - *Building Footprints and First Floor Elevations*
  - *Impervious Surfaces*
  - *Road Planimetrics*
- Stormwater Infrastructure Inventory

Geospatial Data Development

Aerial Lidar

Aerial Lidar

- High Resolution Aerial Lidar
- Captured at 100+ PPM
- Constrained to Control
- Integrated with Mobile Data
- Classified 10+ Classes
- Basis for surface model
- Extended beyond corporate limits to include intersecting watersheds



Geospatial Data Development

Mobile Lidar

Mobile Lidar and Imagery

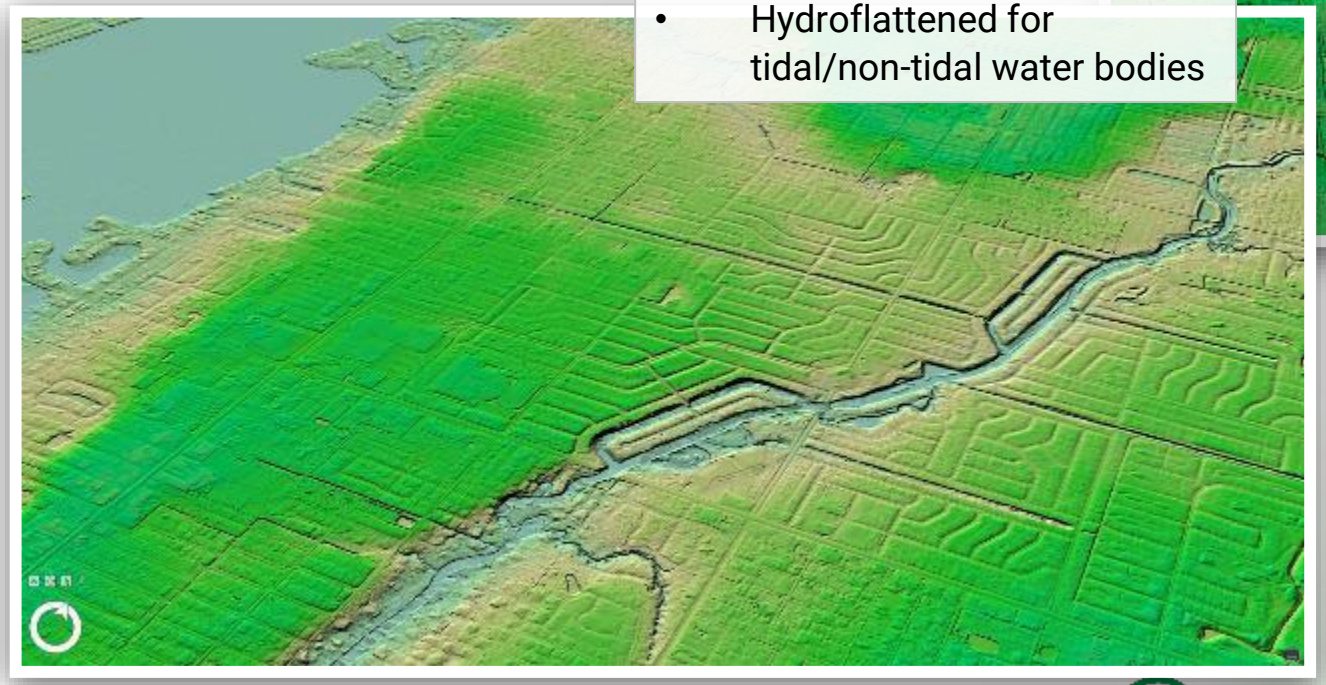
- Street-level Lidar Capture
- Included sidewalk capture using SLAM system
- Tied to 700+ Control Points
- Includes high resolution spherical imagery
- Integrated in Bentley's 3D Mapping Cloud for integration in ArcPro

Geospatial Data Development

Surface Modeling

Surface Modeling

- Derived from Aerial Lidar
- Utilized classified lidar and breaklines
- Hydroflattened for tidal/non-tidal water bodies

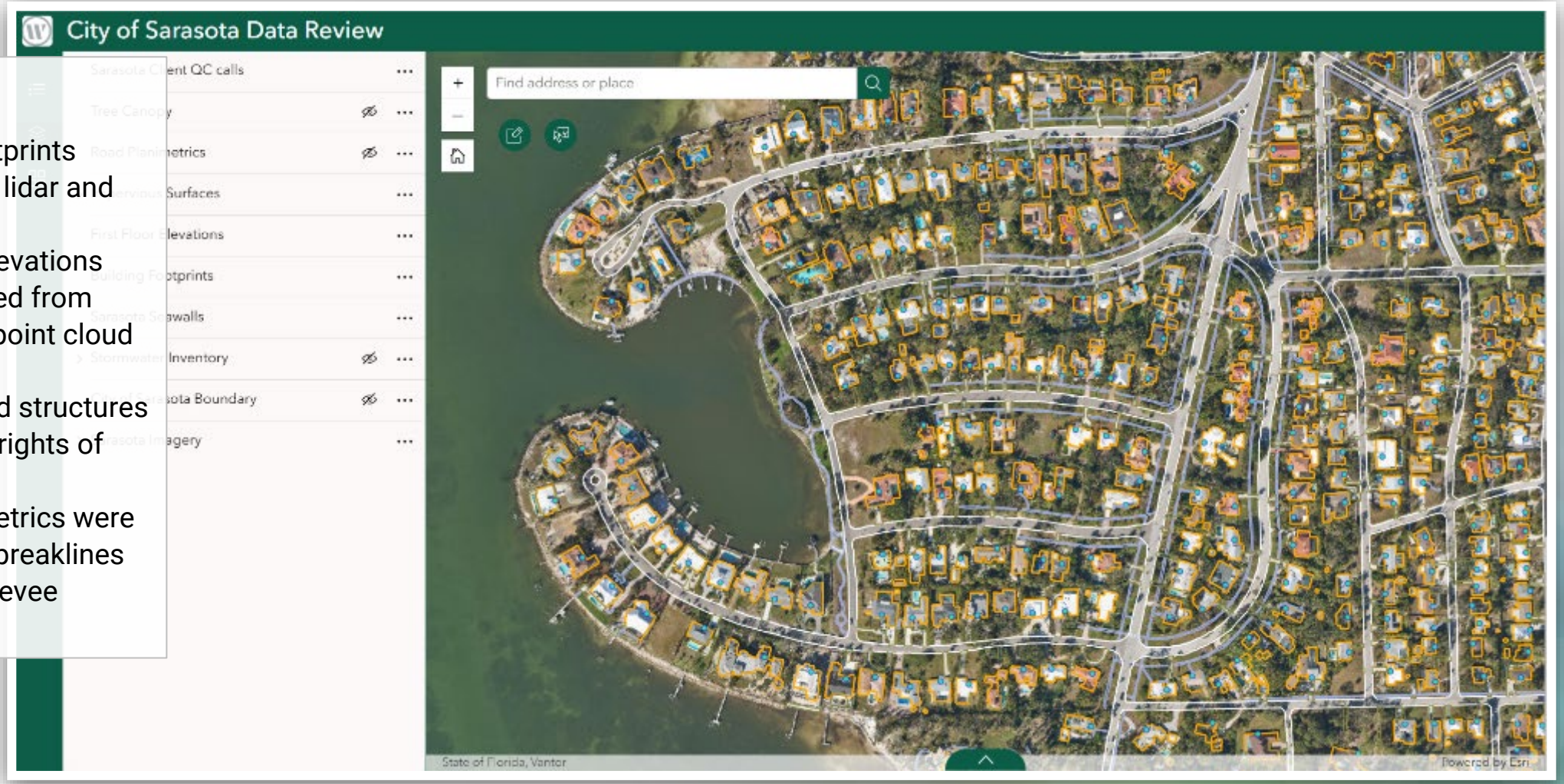


Geospatial Data Development

First Floor Elevations/Building Footprints

Buildings

- Building Footprints derived from lidar and imagery
- First Floor Elevations were extracted from mobile lidar point cloud and imagery
- Only captured structures along public rights of way
- Road planimetrics were included for breaklines and pseudo levee delineation

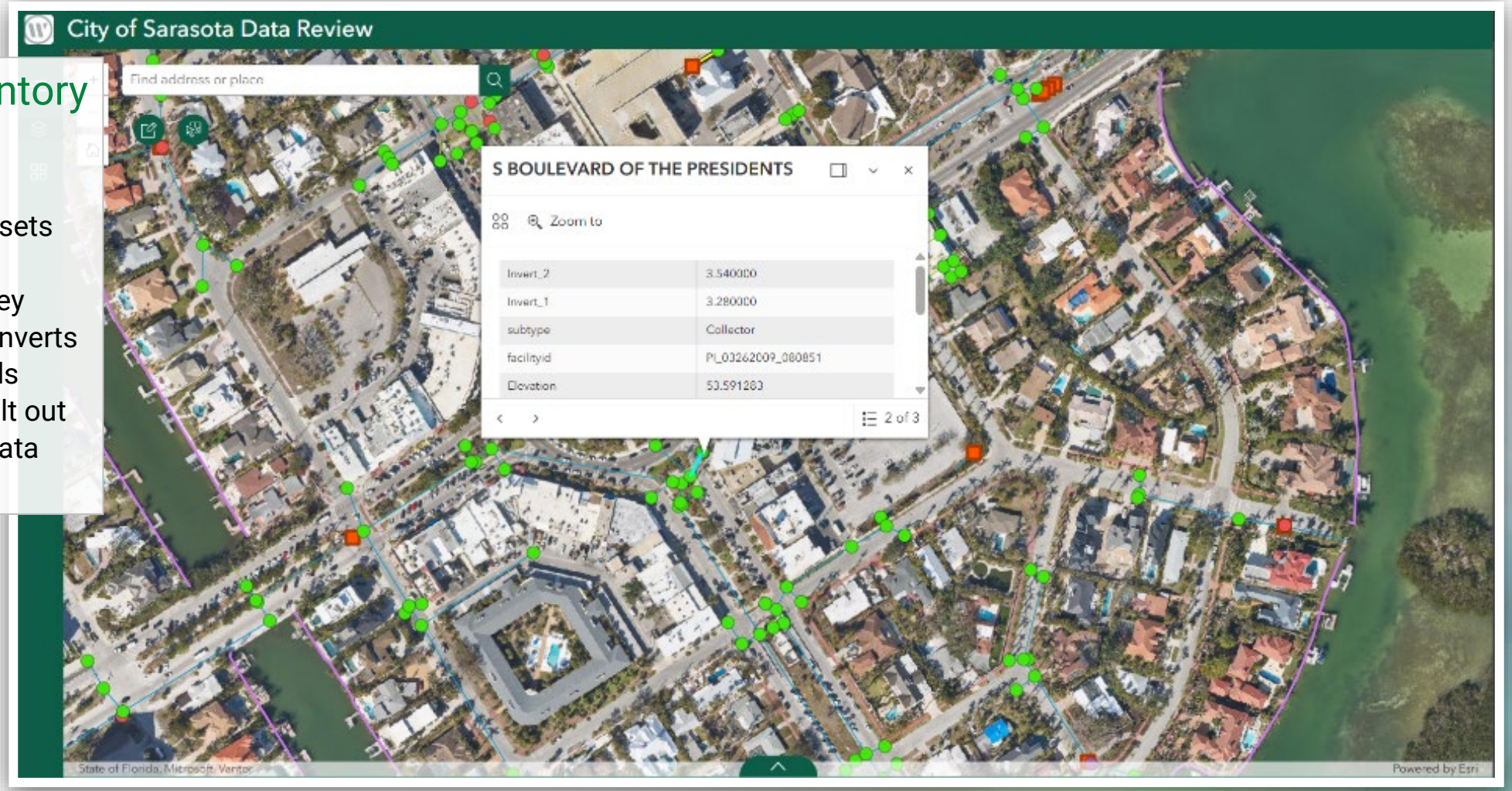


Geospatial Data Development

Stormwater Infrastructure

Stormwater Inventory

- Identified through mobile lidar and available GIS datasets
- Field verified with conventional survey crews to capture inverts and other materials
- 3D GIS feature built out using measured data and lidar



Watershed

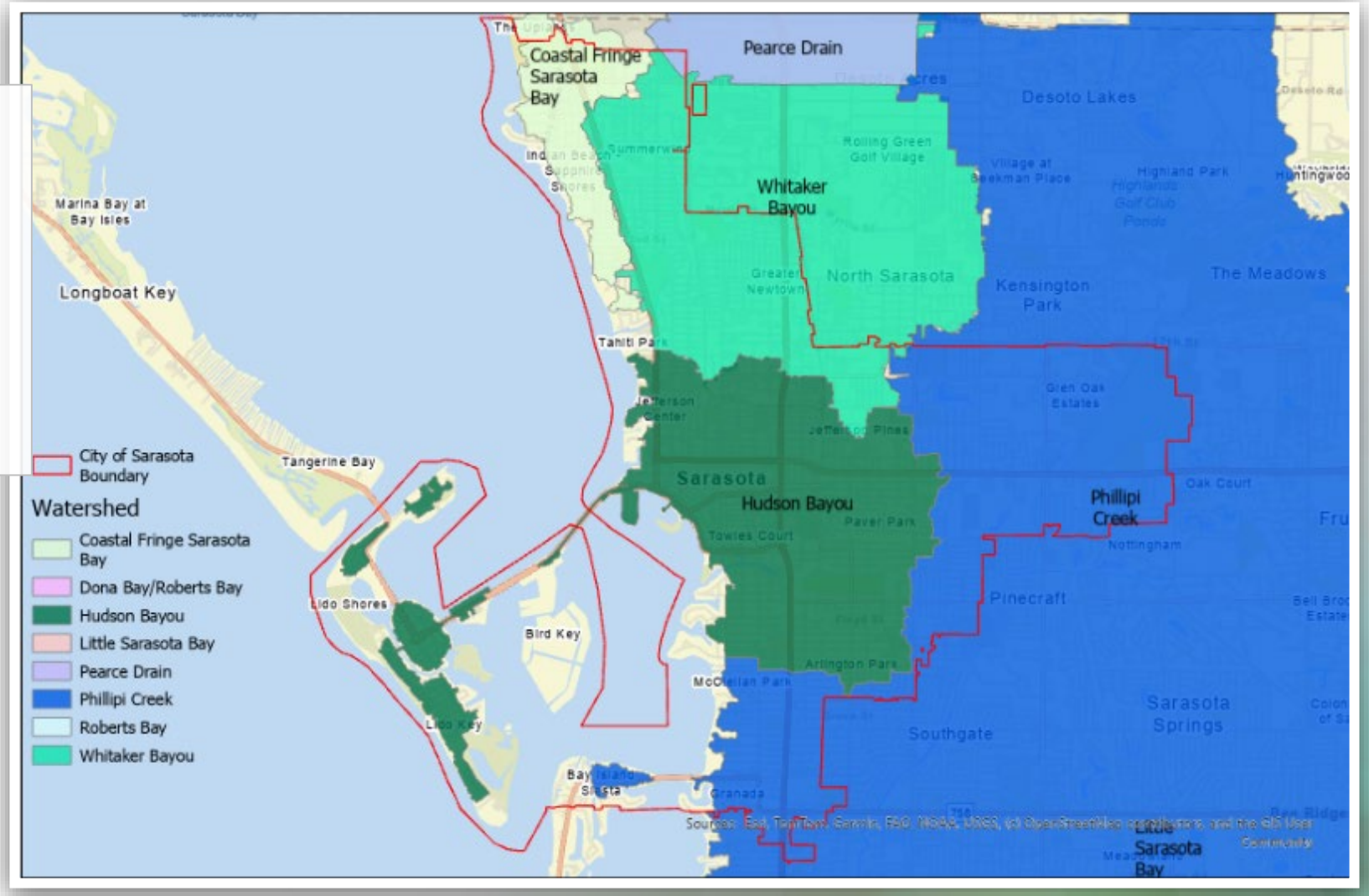
Model Development

Watershed Model

Setup

Existing Focus Watersheds

- Hudson Bayou (2020)
- Phillipi Creek (2017)
- Whitaker Bayou (2024)
- Coastal Fringe Sarasota Bay (2024)
- Pearce Drain (current)

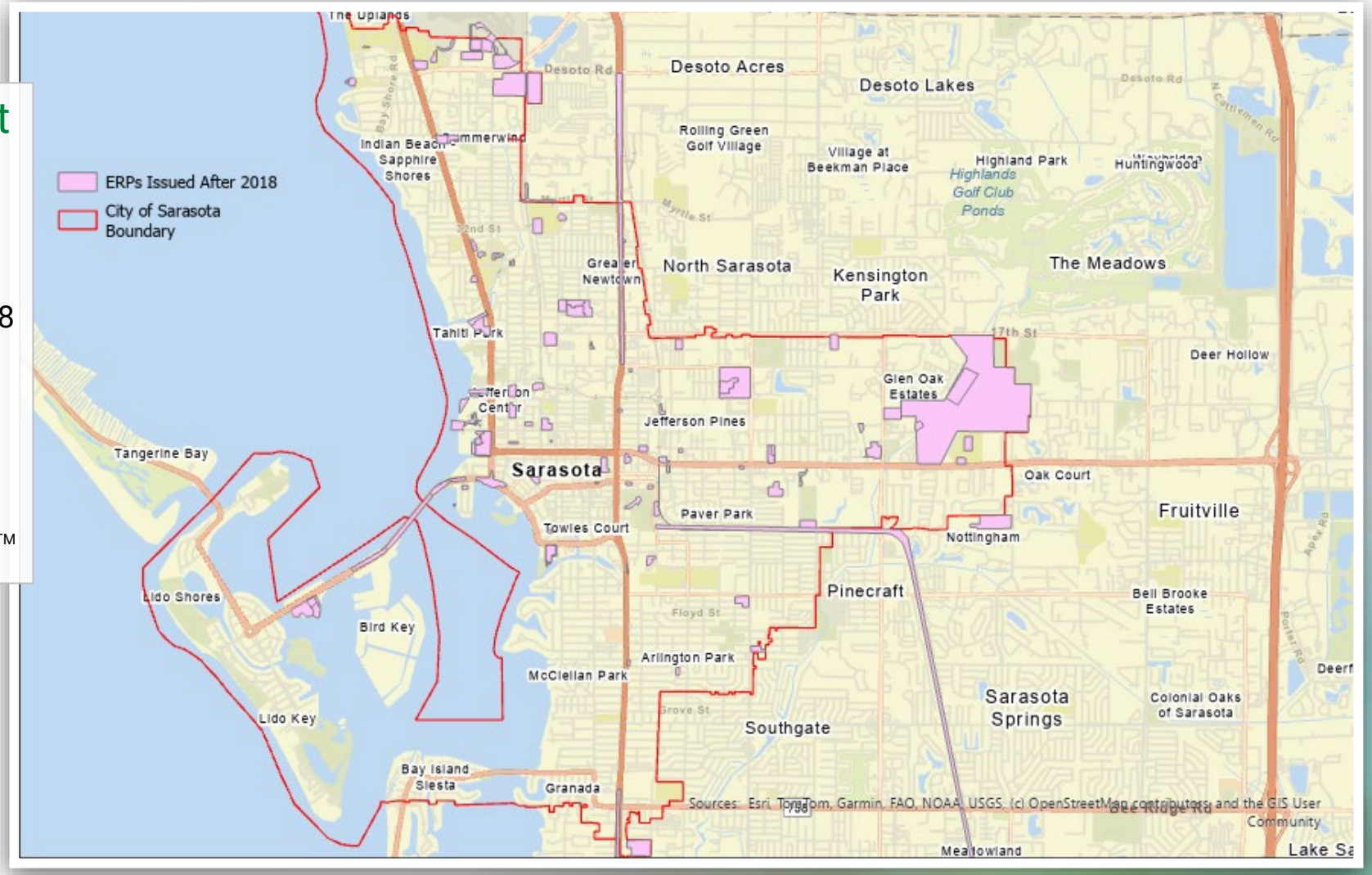


Watershed Model

Setup

Update Models to Reflect Current Conditions

- Utilize City geospatial data – GIS direct inputs
- Statewide LiDAR flown in 2018
- Environmental Resource Permits issued after 2018 – digitize within GIS & spatially reference
- Export GIS datasets
- Bring models into StormWise™

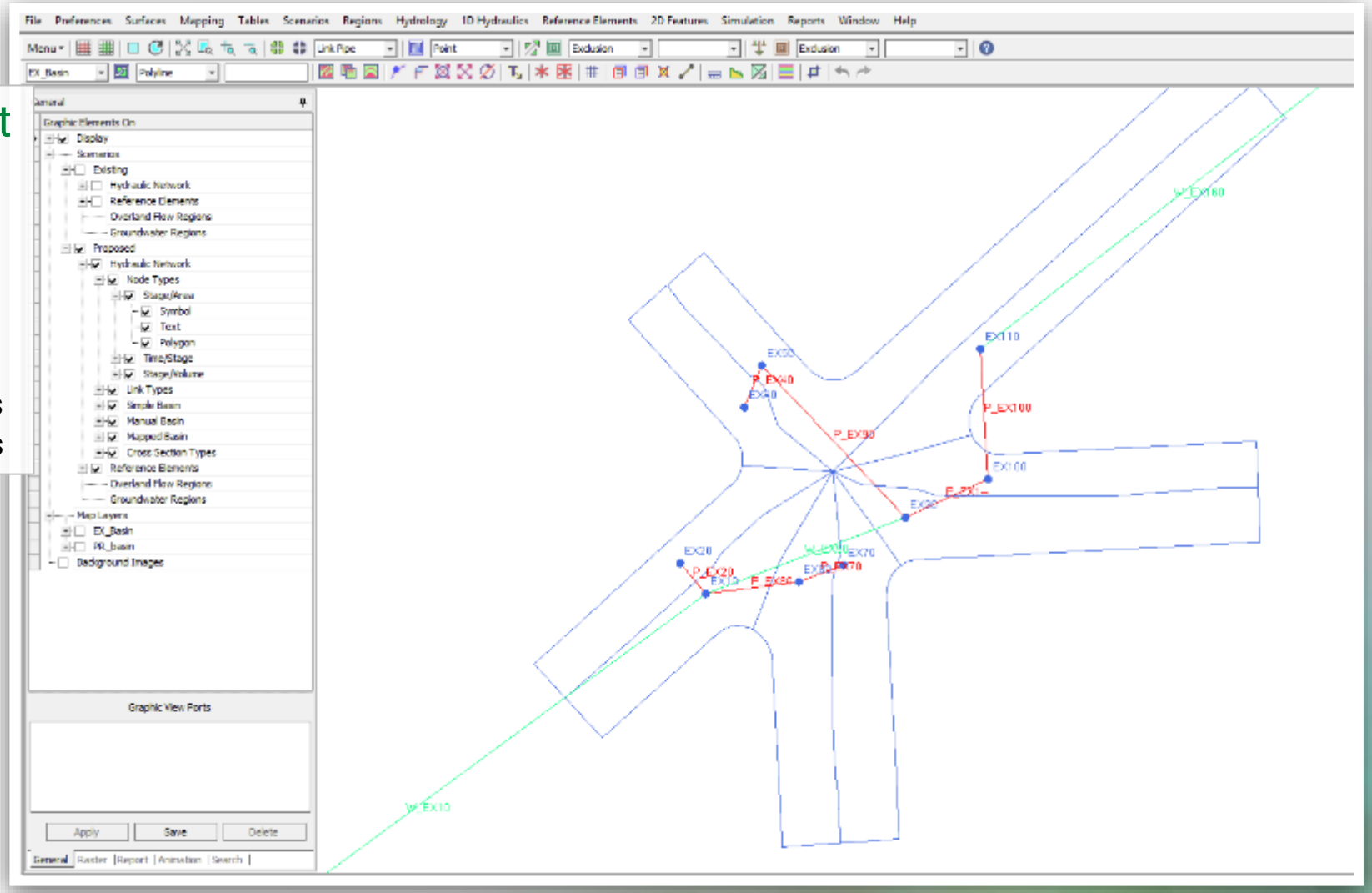


Watershed Model

Setup

Verify Models to Reflect Current Conditions

- Pipe networks and connectivity
- Basin and watershed boundaries
- Stage/storage relationships
- Hydraulic control structures



Watershed Model

Calibrate / Validate

Phillipi Creek (Tropical Storm Debby)

King Tide

Real-Time Flood Forecasting

Implementation

Implementation

- ✓ Existing H&H Model
  - ✓ StormWise™
- ✓ Simplify/Optimize Model
- ✓ GIS Data
  - ✓ Geospatial Model Computational Network
  - ✓ Digital Elevation Model
  - ✓ Building Footprints
  - ✓ Roadway Alignments
  - ✓ Critical Infrastructure
  - ✓ Utilities
- ✓ Make Forecastable
  - ✓ Reference ET
  - ✓ Rainfall
  - ✓ Boundary Conditions
- ✓ Calibration/Validation
- ✓ FloodWise™ Testing
- ✓ FloodWise™ Operational

Implementation
Model Setup

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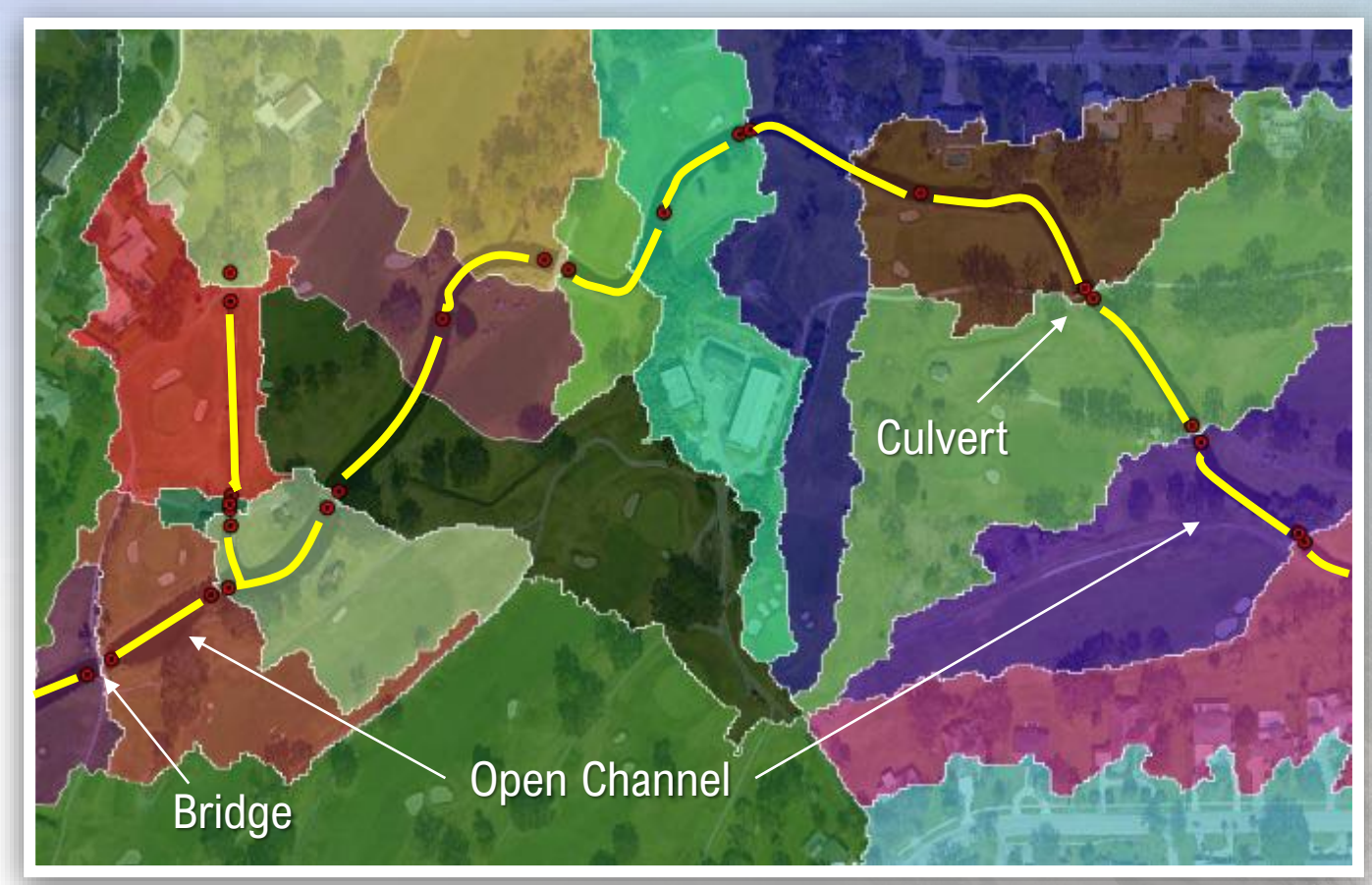
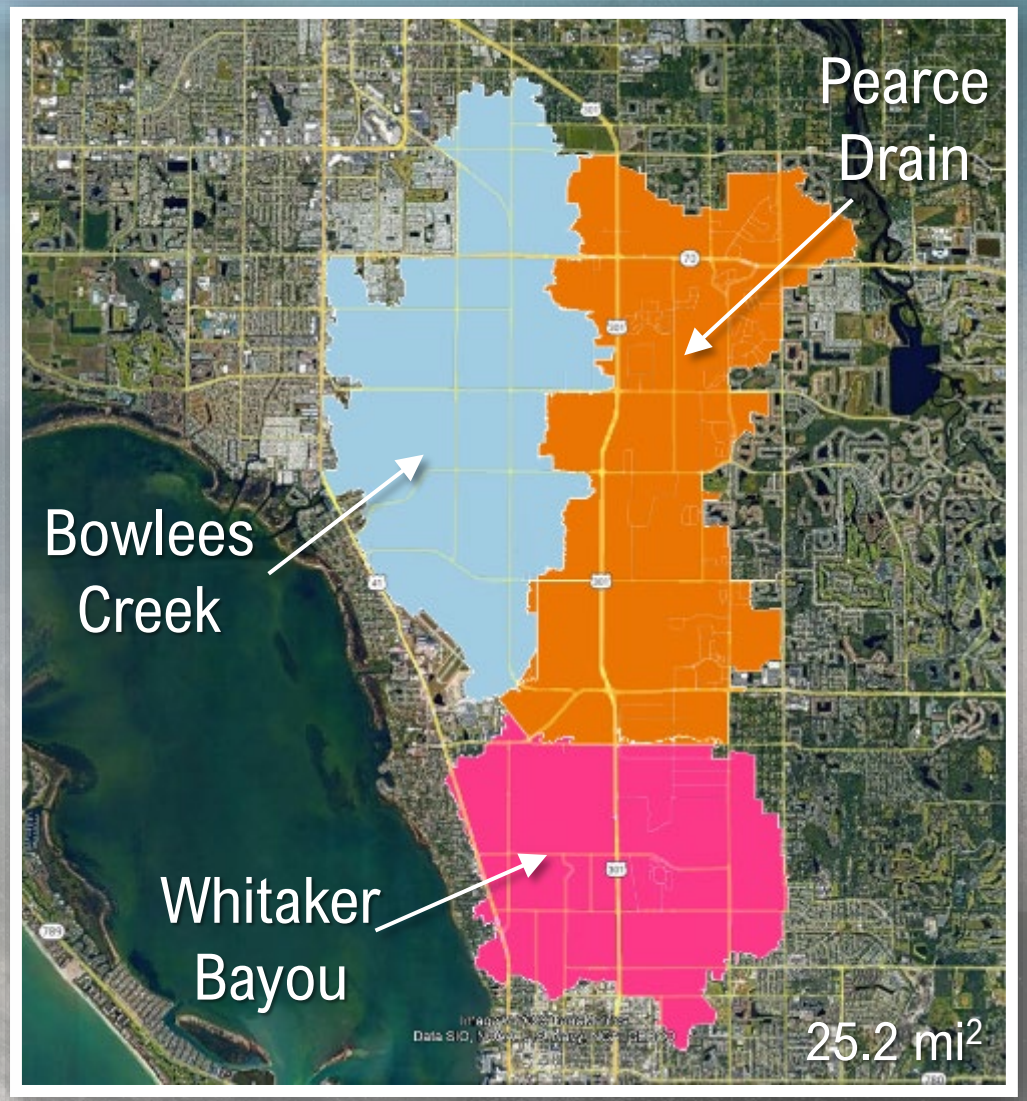
Model Setup





Implementation
Coastal Integration

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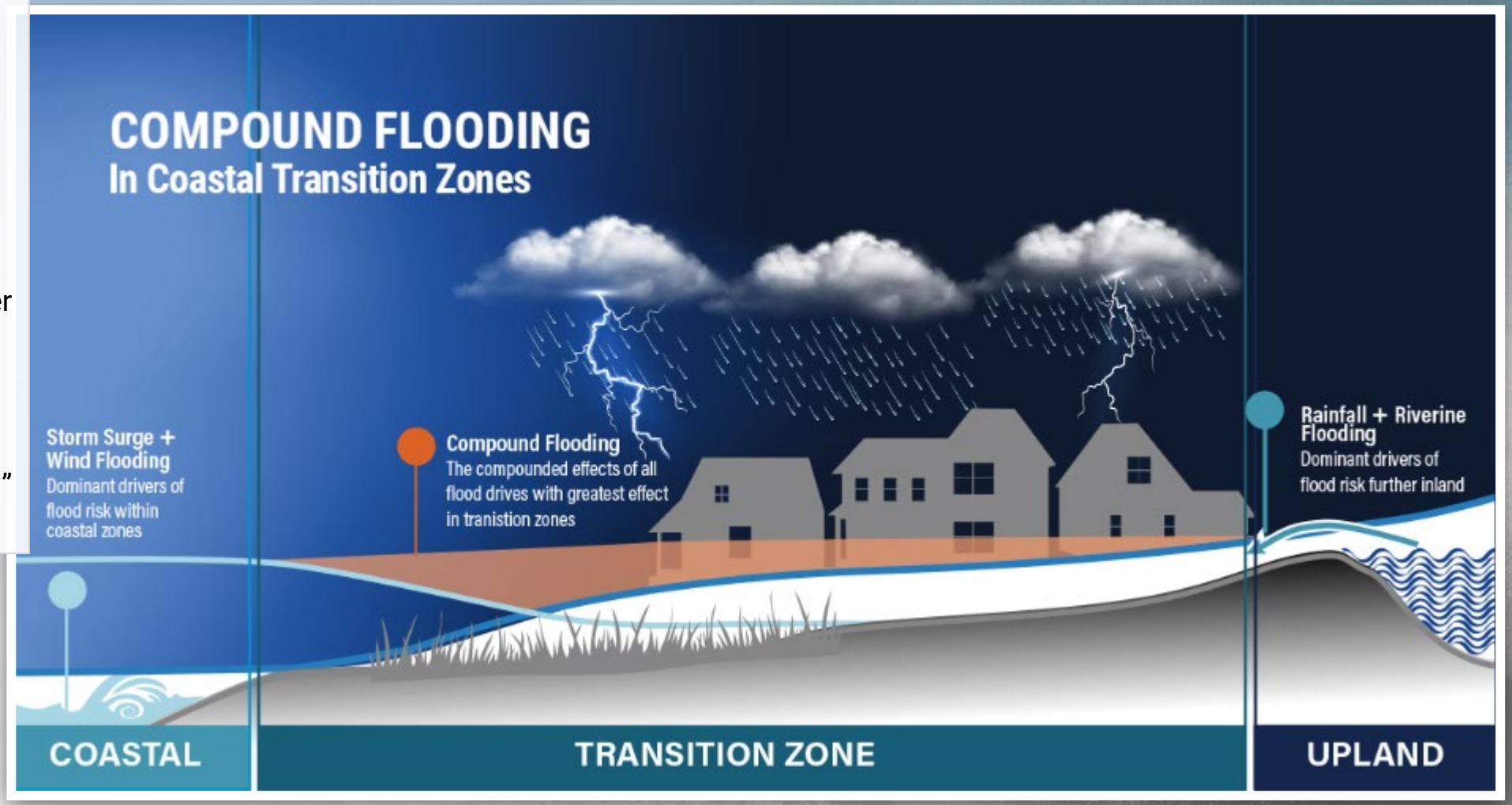
Characteristics

- Multi-Source: Overwash, Surge, Precipitation, Astronomical Tide
- Consecutive or Coincident: Recovery Time Sensitive
- The Aggregate of Smaller Events
- Rainfall & Groundwater Seepage
- Results in "**Compounded**" Flooding Impact



Implementation

Coastal Integration

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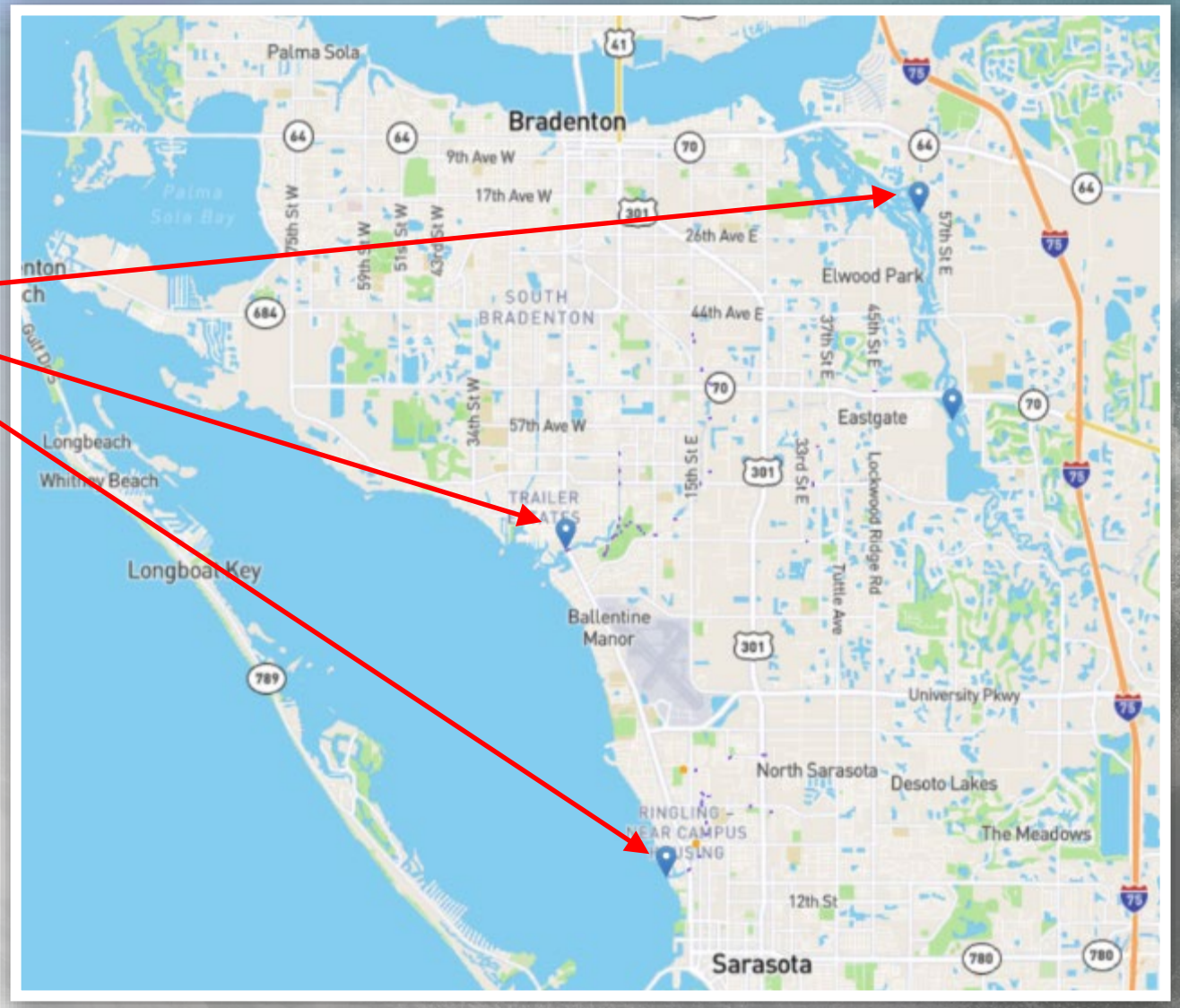
Coastal Nesting Points



Implementation
Coastal Integration

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Name	BC_A00000_N
Scenario	Scenario 1
Type	Stage/Area
Base Flow	0
Initial Stage	0
Warning Stage	0
Alert Stage	0
Comment	~~vars~~ live_gage_type=stofs live_gage_id=3182969 live_gage_offset=0.58 live_gage_force=1 ~~end~~

Implementation

Surge & Tide Forecast

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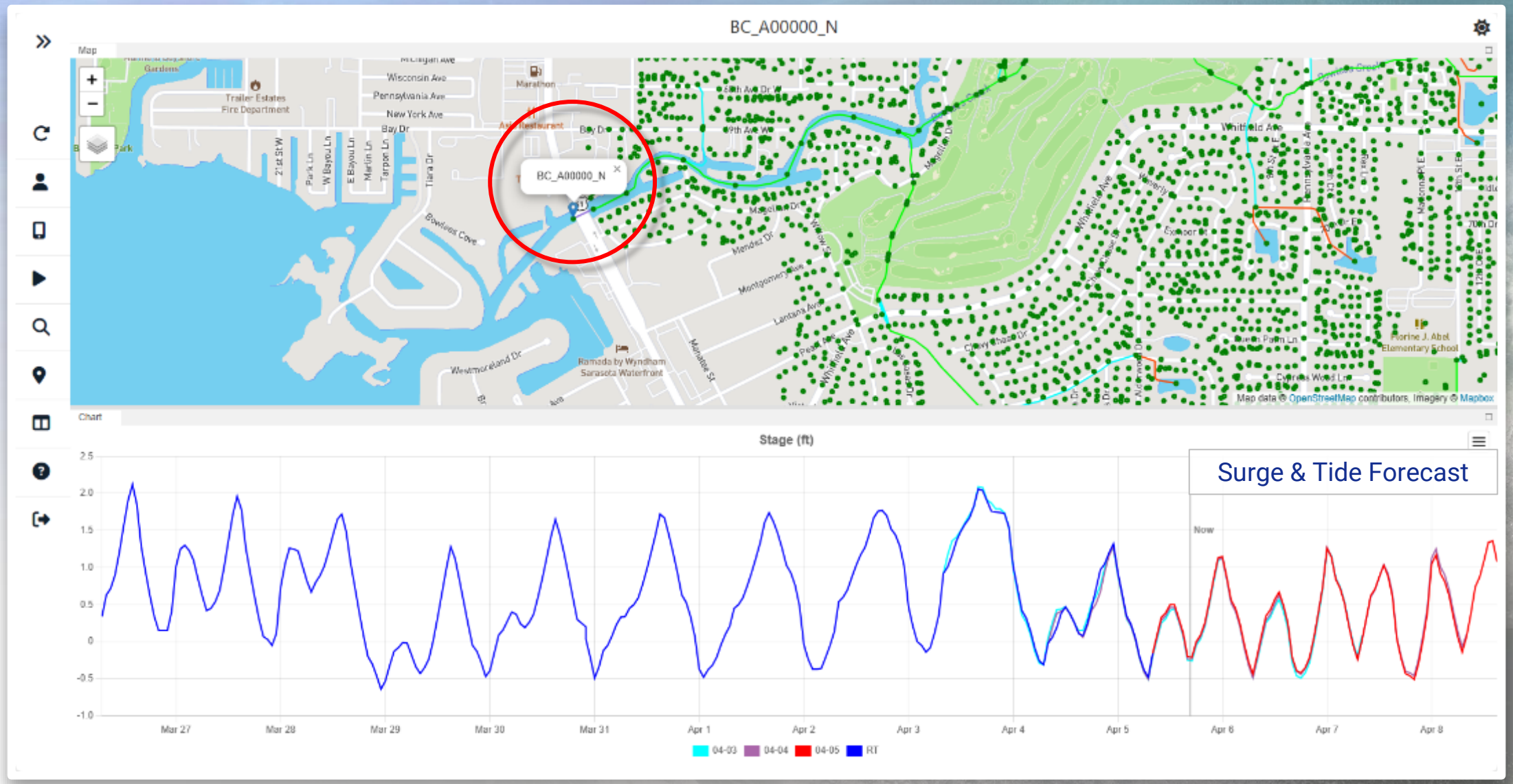

Real-Time Flood Forecasting

Operational

Real-Time Flood Forecasting

Data Flow

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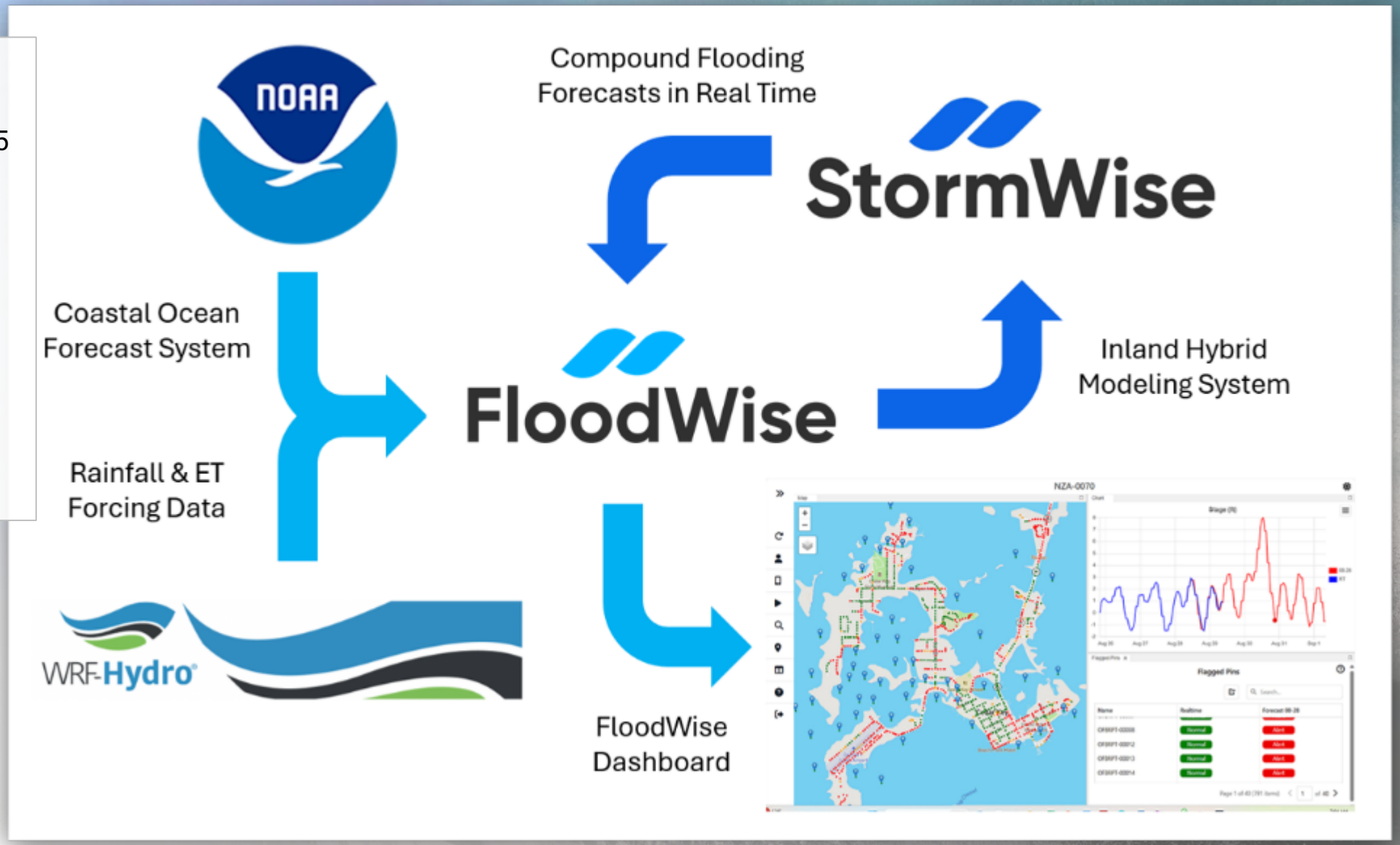
- **Real-Time**:
  Hydrologic & hydraulic model running 24/7/365
- **Flood Forecasting**:
  Quantifies flood risks several days into the future
- **Street Level**:
  Flood depths and durations at streets, homes, buildings, and critical infrastructure



Real-Time Flood Forecasting

Real-Time Benefits

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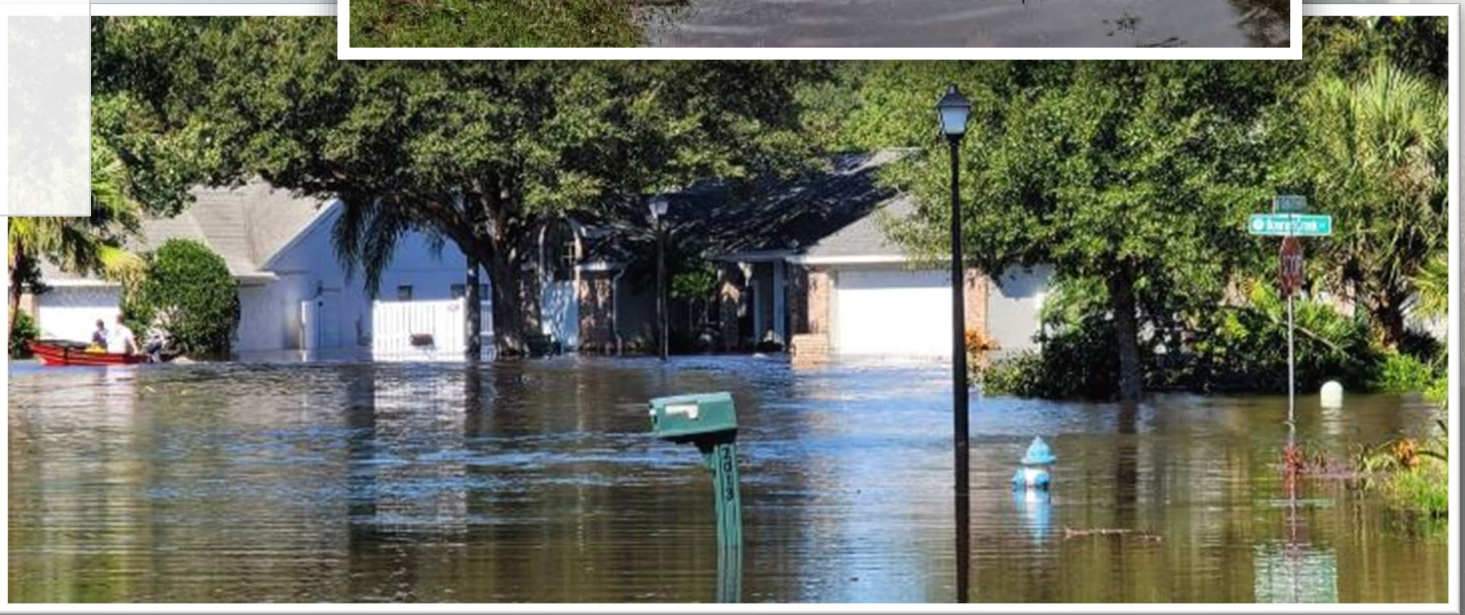
What if we could know 1 to 3 days in advance precisely where flooding will occur and how long it will last?

Real-Time Benefit

- ✓ Anticipate road closures
- ✓ Pinpoint evacuations
- ✓ Move vehicles/resources out of harm's way
- ✓ Smart sandbag & flood wall deployment
- ✓ Reduce or eliminate wastewater overflows
- ✓ Optimize water control structure operations/maximize storage
- ✓ Plan recovery efforts sooner and preposition response assets
- ✓ Making communities more resilient



Real-Time Flood Forecasting

Flood Risk Points™ & FRP Notifications

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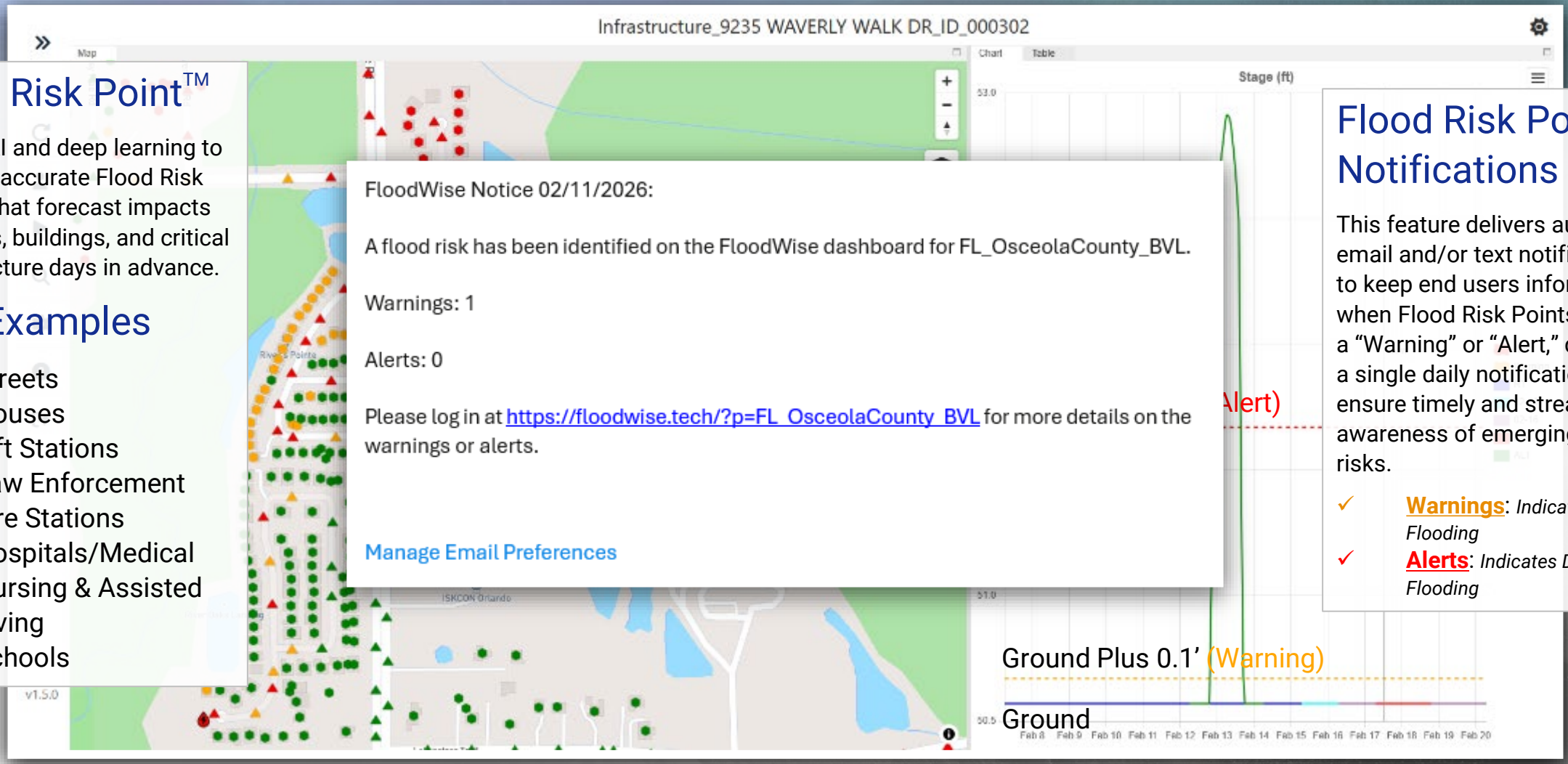
Flood Risk Point™

We use AI and deep learning to generate accurate Flood Risk Points™ that forecast impacts to streets, buildings, and critical infrastructure days in advance.

FRP Examples

- ✓ Streets
- ✓ Houses
- ✓ Lift Stations
- ✓ Law Enforcement
- ✓ Fire Stations
- ✓ Hospitals/Medical
- ✓ Nursing & Assisted Living
- ✓ Schools



Flood Risk Point™ Notifications

This feature delivers automated email and/or text notifications to keep end users informed when Flood Risk Points™ trigger a "Warning" or "Alert," delivering a single daily notification to ensure timely and streamlined awareness of emerging flood risks.

- ✓ **Warnings**: *Indicates Shallow Flooding*
- ✓ **Alerts**: *Indicates Deep Flooding*

Green: No Flooding **Orange: Shallow Flooding** **Red: Deep Flooding**

Thank You!

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