PRESENTATION OF FINDINGS
FLAMINGO DITCH FEASIBILITY STUDY
CITY OF VENICE

JUNE 30, 2025

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WORKSHOP AGENDA

- Study Progress Review
- Grant Application
- Additional Data Collection
- Model Development
- Model Validation
- Simulated Weather Events
- Alternatives Analysis
- Model Results
- Overall Study Findings
- Next Steps

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FLAMINGO DITCH FEASIBILITY STUDY

Roadways and private property near the Flamingo Ditch outfall experience flooding due to storm surge, rainfall events, and/or a combination of both.

- **Existing Information:**
  - Open drainage ditch surrounded by low lying areas
  - Private ownership with limited drainage easement
  - Repetitive flooding of private properties and nearby roads
  - Subject to storm surge, rainfall, and/or compound events
- **Study Objectives:**
  - Obtain public input for historical context and local observations
  - Review previous studies and existing data for model refinements
  - Conceptualize and compare options to reduce flooding potential

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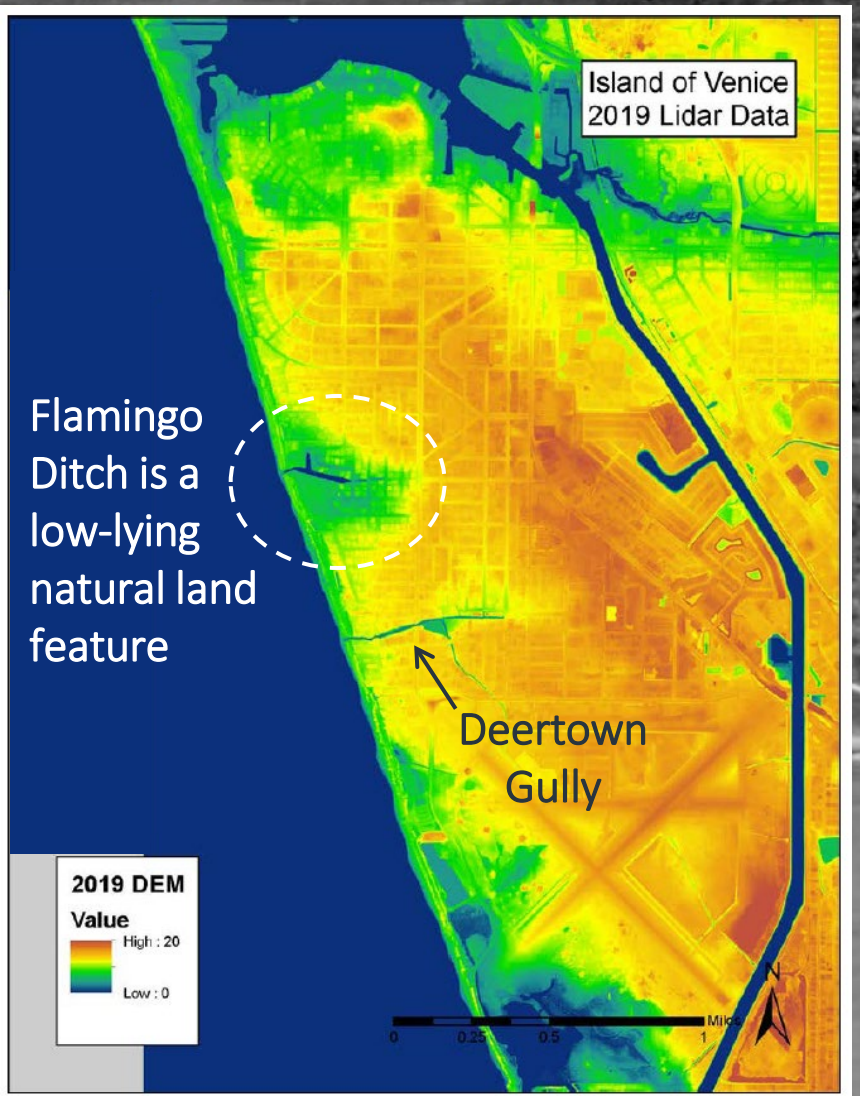
HISTORIC AERIAL IMAGE OF FLAMINGO DITCH (C. 1948)



PRELIMINARY FINDINGS

- **Flooding issues exist on a re-occurring basis supported by public comment, literature review, and preliminary model evaluations.**
  - Minor rain events can result in neighborhood flooding.
  - Hurricanes have caused extensive impacts to homes.
- **Challenge is two-fold:**
  - Stormwater drainage
  - Storm surge inundation
- **Potential concepts to improve the system:**
  - Elevate, Block, Pump, Discharge, Maintain

MARCH 11, 2025 MEETING

- Public comment period
- Background information
- Initial model set-up and review
- Grant application
- Additional data collection
- Finalize model set-up
- Build alternatives in model
- Simulate a range of rain/surge events
- Add/refine alternatives
- Results and reporting

GRANT APPLICATION

National Oceanic and Atmospheric Administration
U.S. Department of Commerce

- NOAA's Transformational Habitat Restoration and Coastal Resilience Grants Under the Bipartisan Infrastructure Law (Round 3)
- Grant application submitted in April 2025:
  - Requested $5.9M in funding for outfall system improvements at Flamingo Ditch
  - Scope includes: Design, Permitting, Plans and Specifications, Construction, Bidding/Administration/Supervision
- Notifications of award anticipated in summer or fall of 2026, after the selection process is complete
- If approved, funding timeline estimated to be 2026-2029

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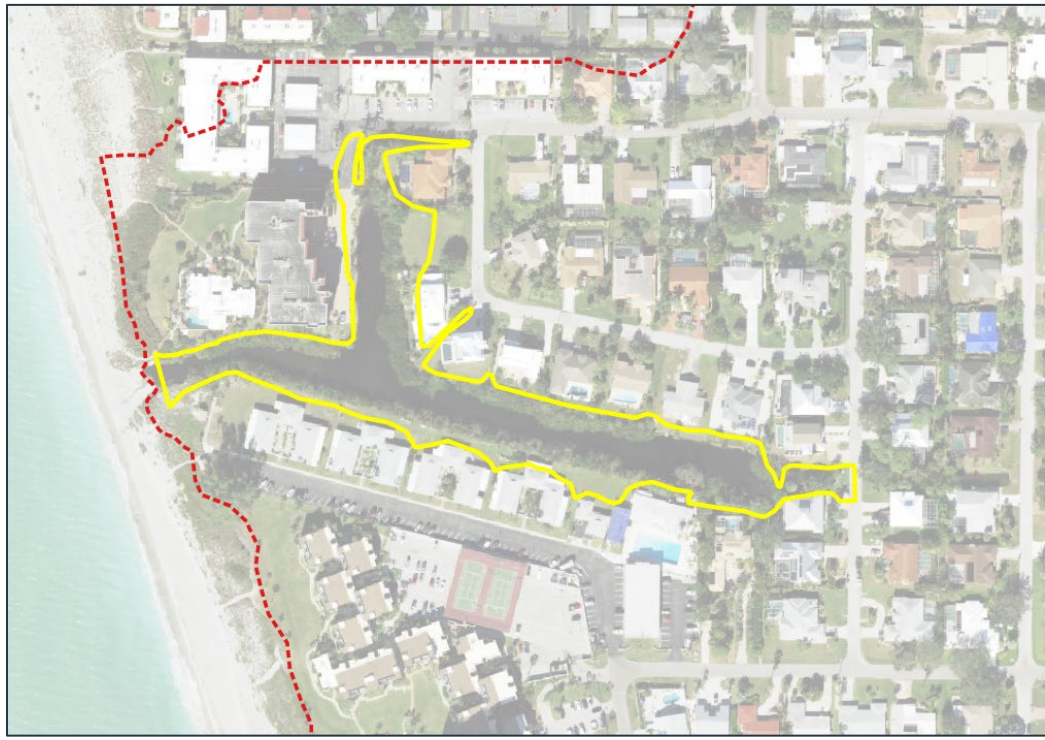
ADDITIONAL DATA COLLECTION

- 2025 updated survey of ditch and pipes
- Recent survey shows average bottom elevation in ditch is around -5’ NAVD88
- Water level measured at time of survey (April/May 2025) matched historic measurements of around +1.4’ NAVD88
- Flamingo Ditch to the +5.5’ contour (yellow line) covers roughly 3.6 acres
- Storage capacity above static water level (+1.4’) is limited to the +5.5’ contour before flooding
- **276,000 cubic feet of storage** (not including the streets and ditches east of Gardenia)



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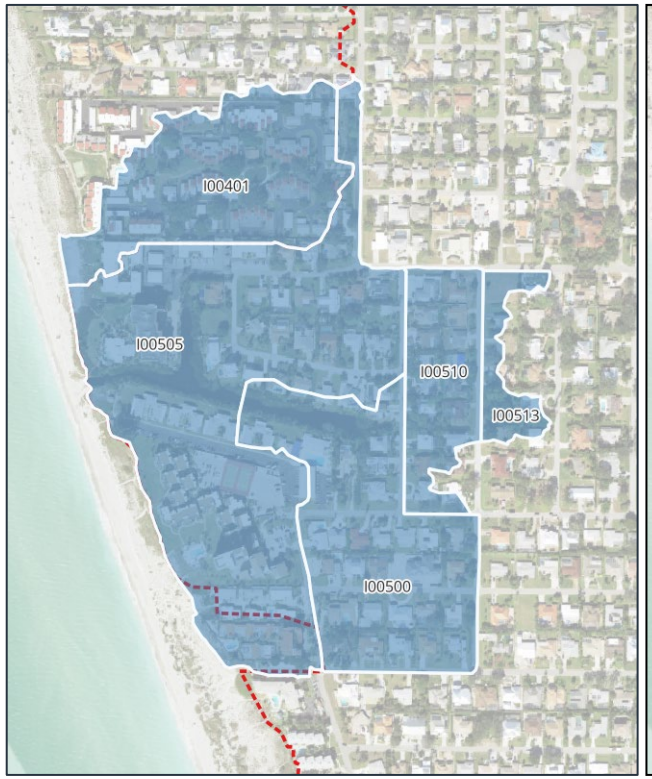
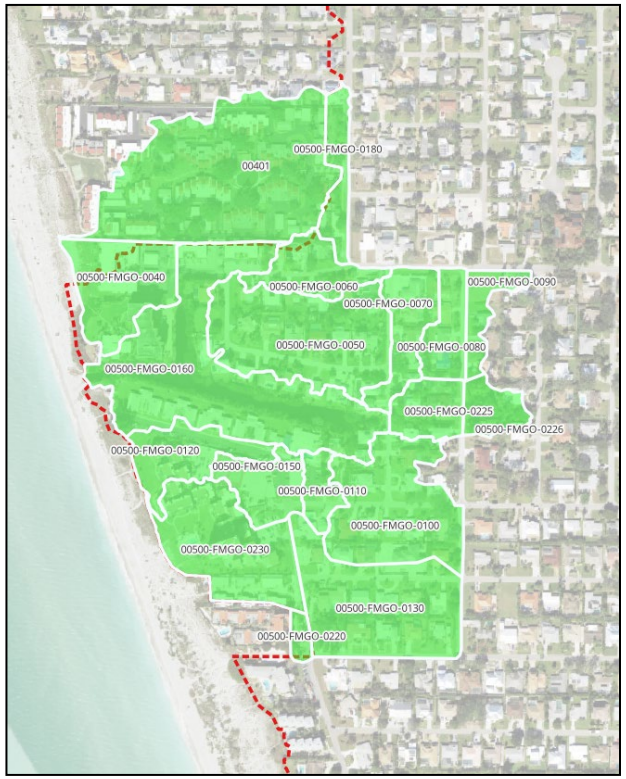
ICPR MODEL DEVELOPMENT

- Interconnected Channel and Pond Routing (ICPR) Program
- Previously developed model
- Correction of routes/features
- Sub-basin refinement
- Data collected: April 2025
  - Stormwater Invert Survey
  - Topographic Survey
- Improvement of model details

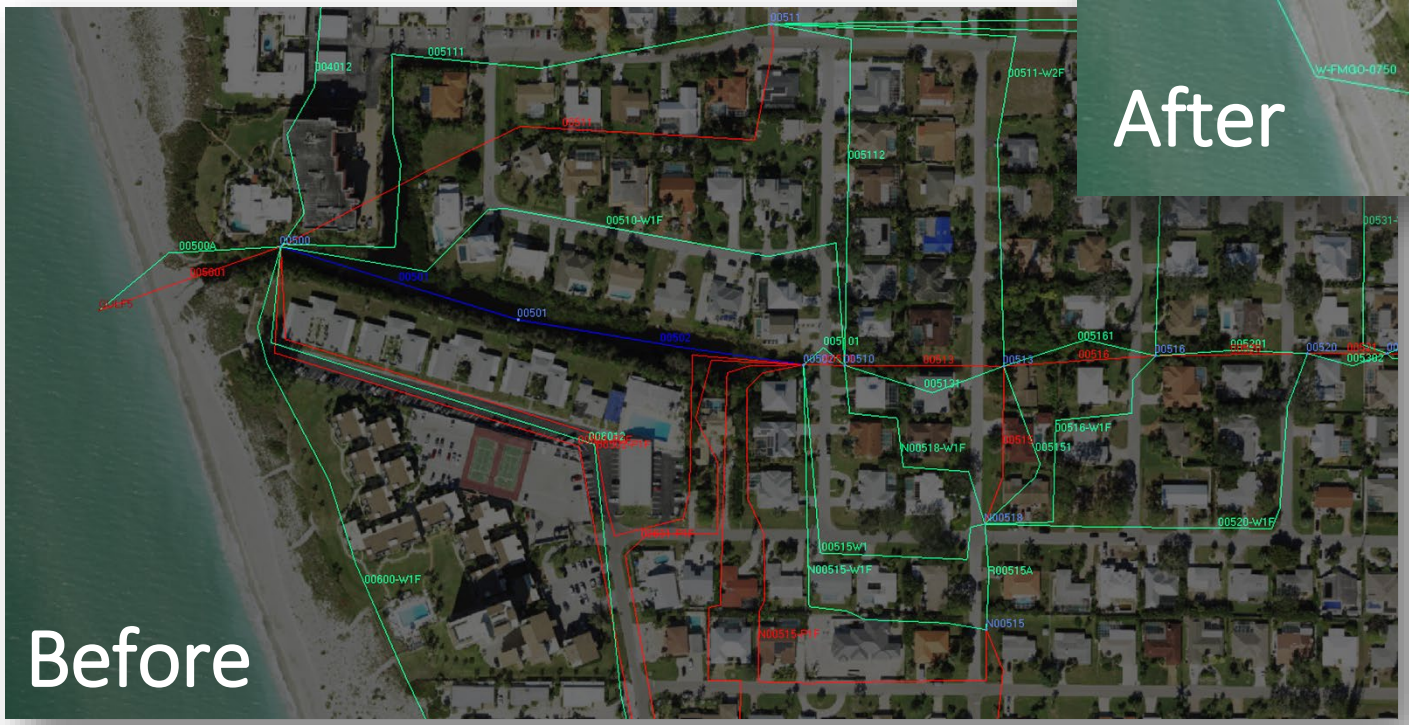
Previous Basins



Refined Basins



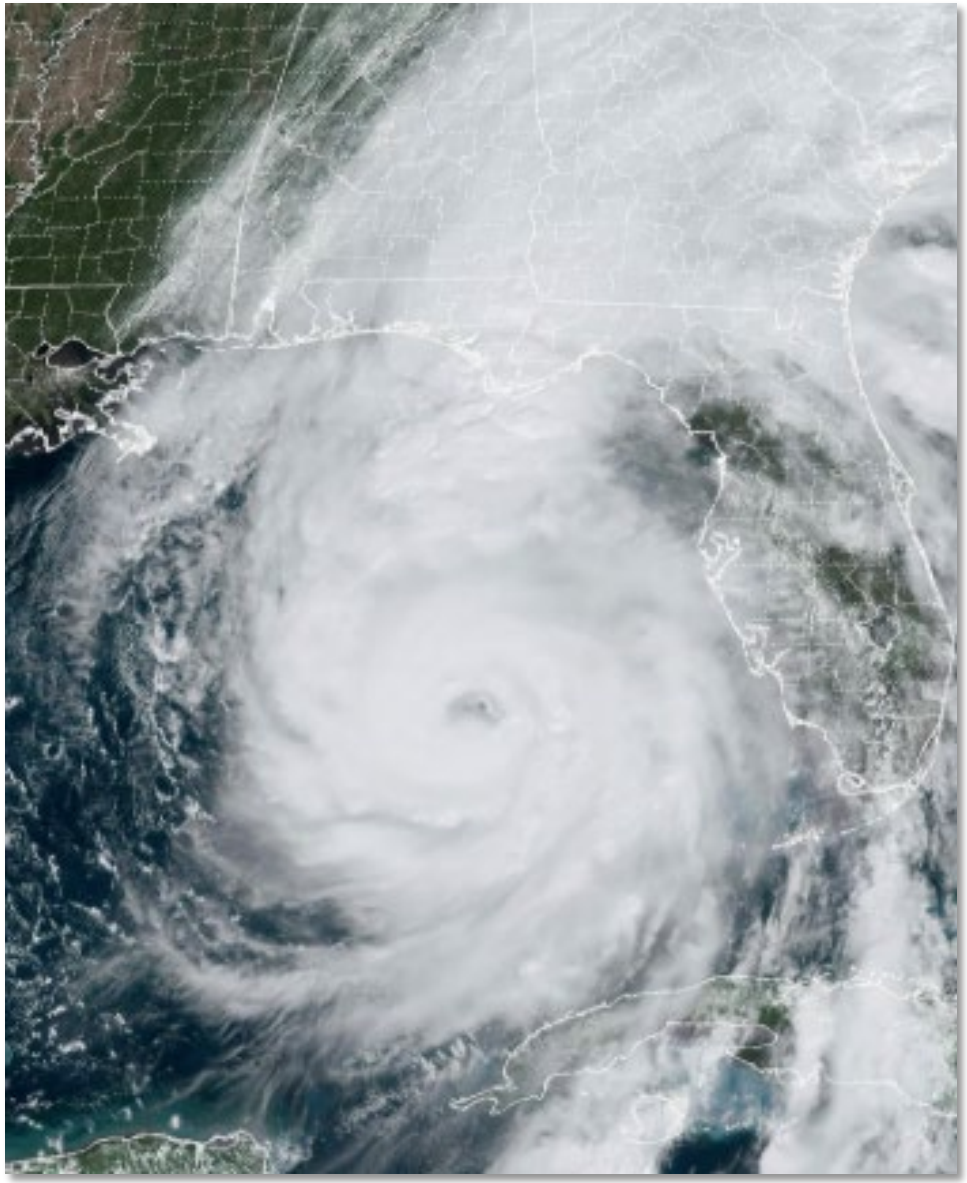
ICPR MODEL UPDATES AND REFINEMENTS



MODEL VALIDATION

- Updated ICPR model with new data and refinements
- Validate model setup with comparison to actual storm events:

- Hurricane Helene
  - 9/26/2024 landfall
  - Between a 50- and 100-year surge event
    - Low frequency, high level surge
  - 1-year/24-hour event (2.45” rain)
    - Very high frequency, low level rainfall



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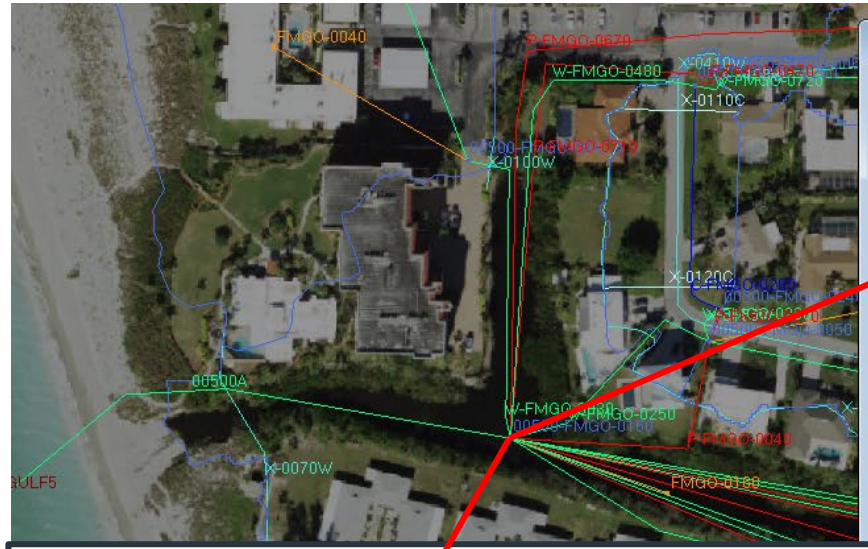
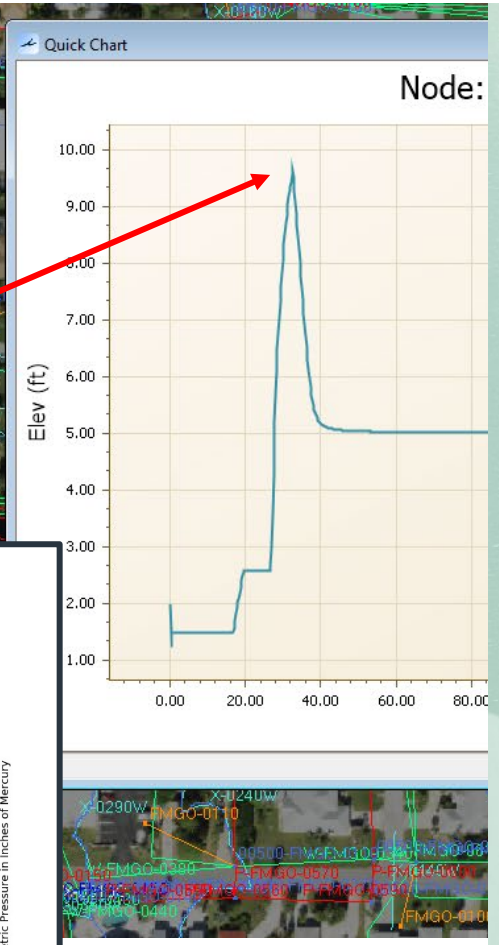
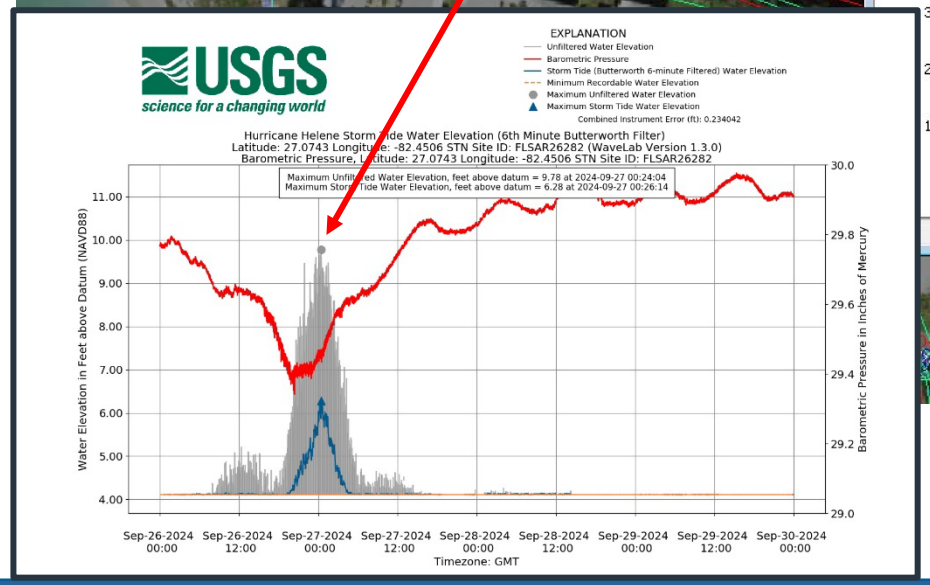
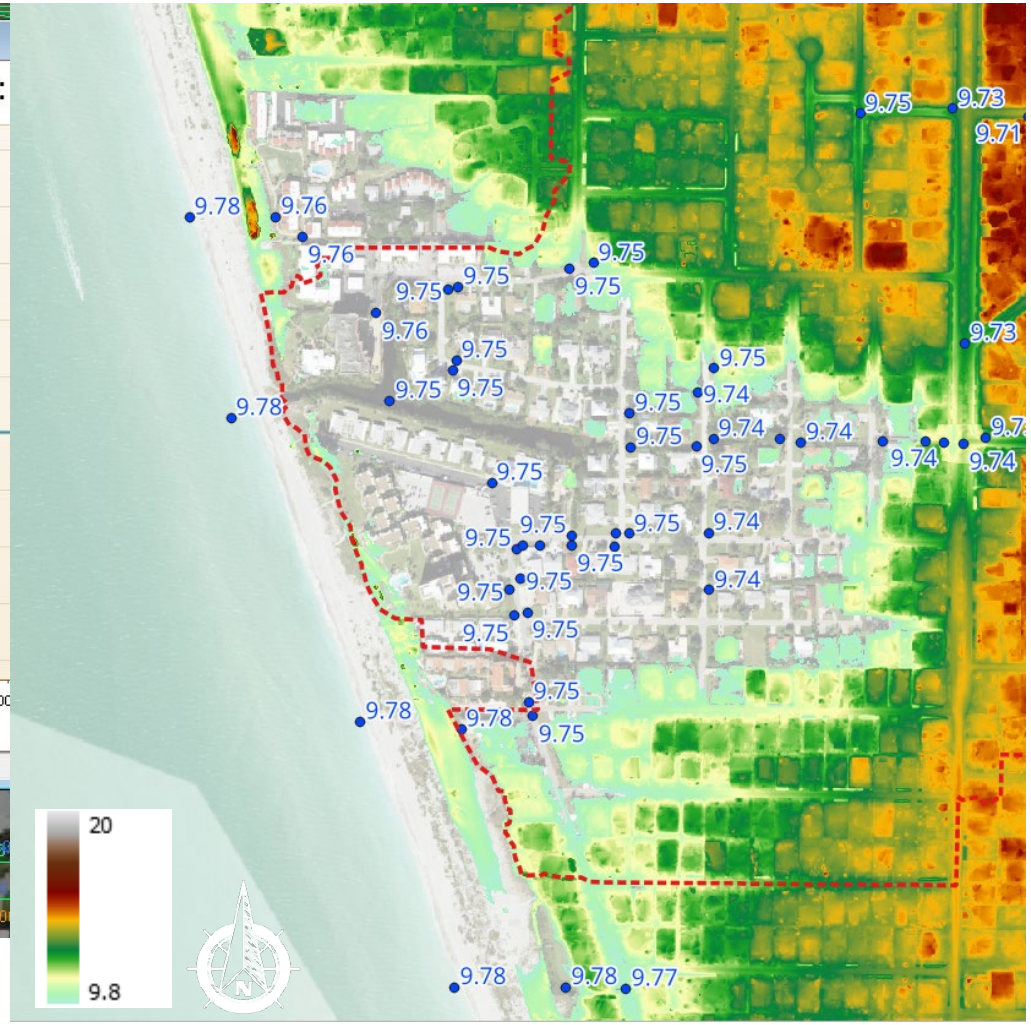
EXISTING CONDITIONS + H. HELENE SIMULATION







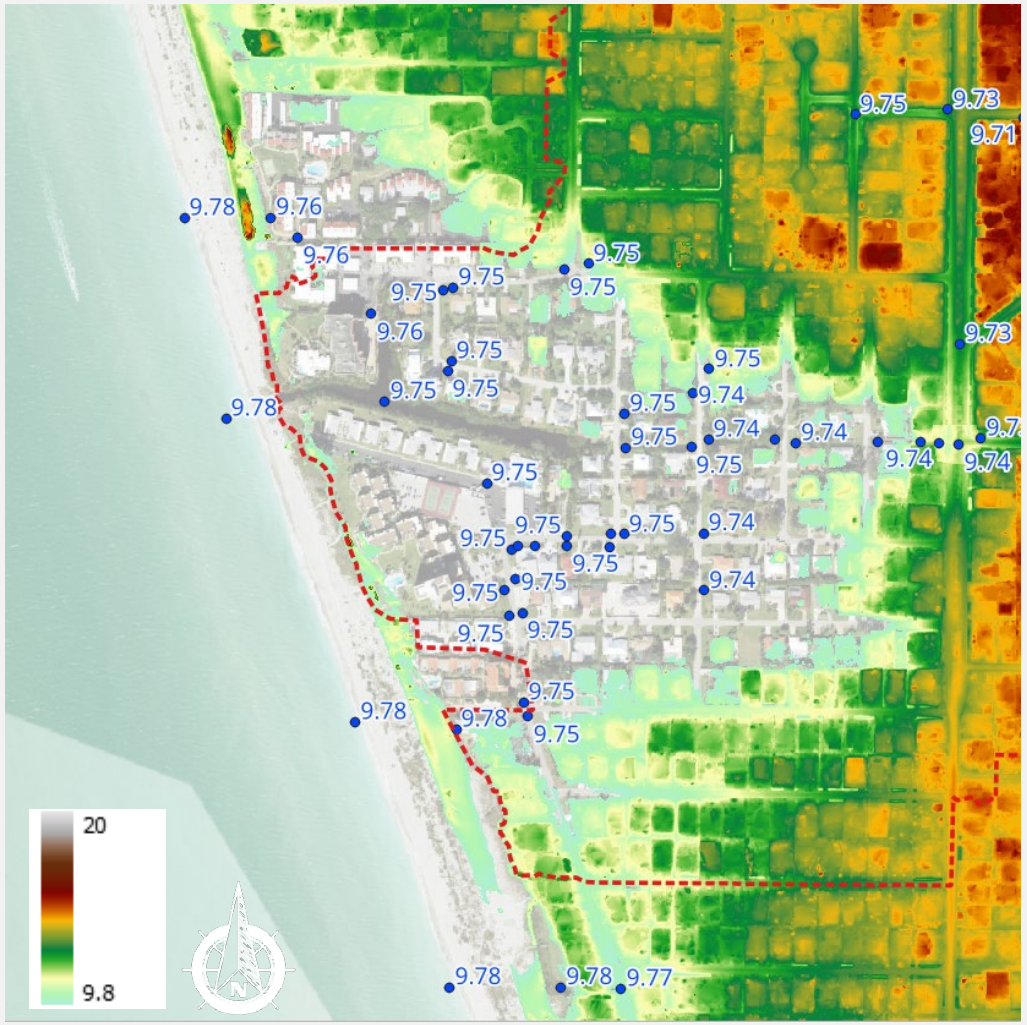


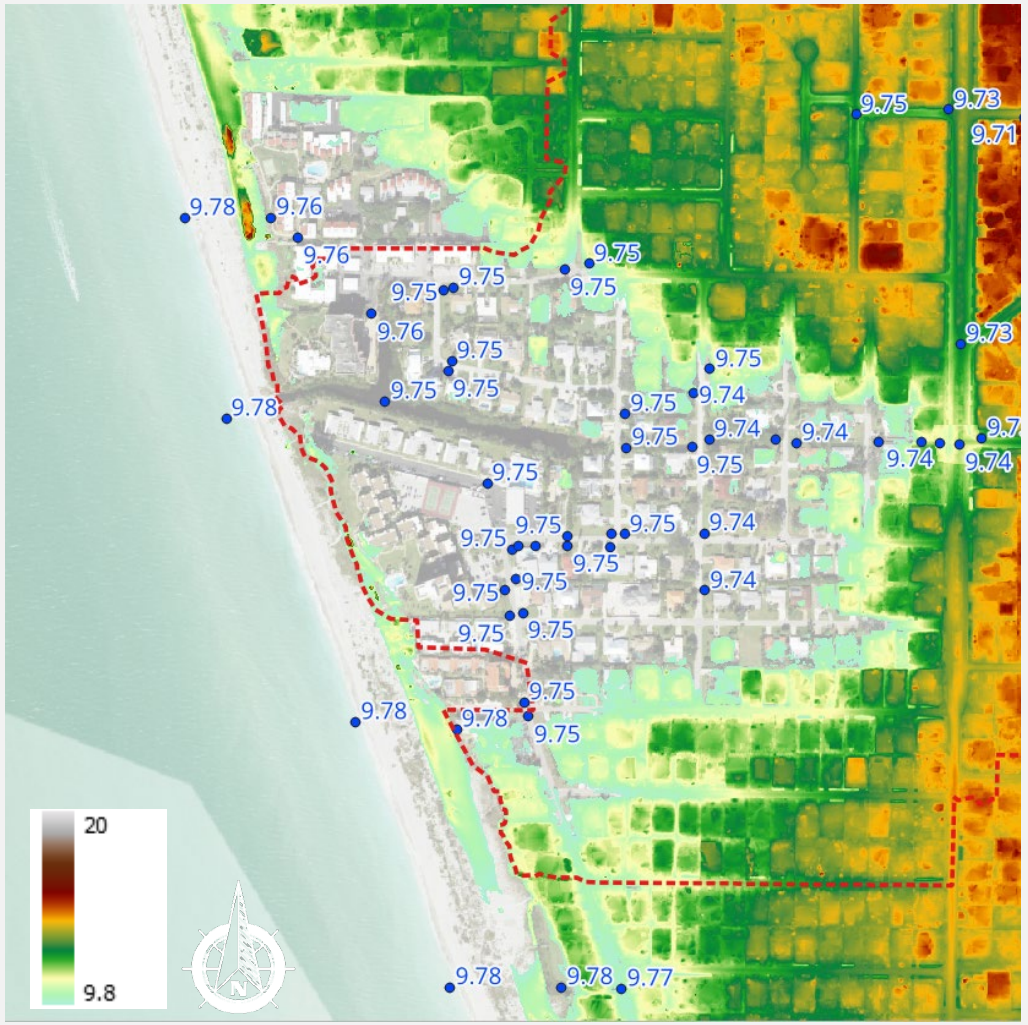
MODEL SIMULATION

- H. Helene flooding

Photo courtesy of City of Venice, photo date of 10/1/2024, view to northwest

H. HELENE SIMULATION: OUTFALL OPEN VS. CLOSED





SELECTED RAIN AND SURGE EVENTS FOR MODEL

- Rainfall Events
  - 1” – 1 Hour (High frequency event)
  - 2” – 1 Hour (High frequency event)
  - 25-Year (8.2” – 24 Hours) (City of Venice design criteria)
  - 100-Year (10” – 24 Hours) (Extreme event)

- Coastal Surge Events
  - 25-Year (7.2’)
  - 50-Year (9.1’)
  - 100-Year (11.7’)

- Rain + Surge = Compound Events
  - 10-Year Rain (6.59”) + 50-Year Coastal Surge

ALTERNATIVES ANALYSIS

- Initial Alternatives - One scenario for each category:
  - Drain – pipe/pump
  - Elevate – raise banks/landforms
  - Storage – retain (some) water to gain time
  - Upstream Improvements – reconfigure/re-route
  - Block – keep the surge out

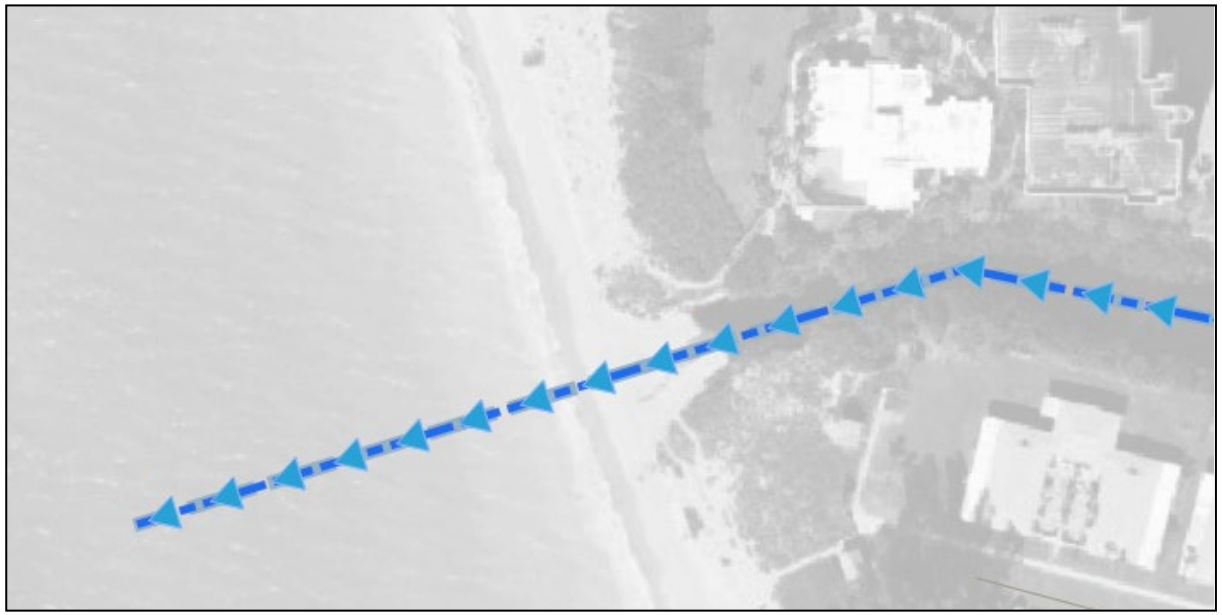
- Presentation of model results
  - Each alternative compared to existing conditions for rainfall and surge

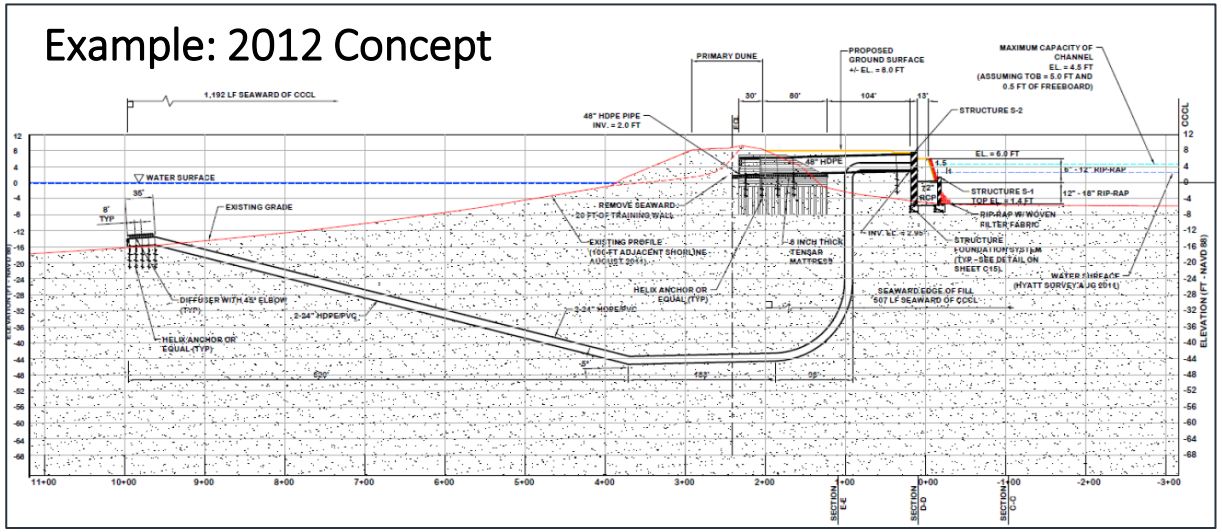
- Combined Alternatives
  - Developed based on results of initial model runs

ALTERNATIVES ANALYSIS

- Alternative 1
  - Drain: Pipe and pump system for systemized drainage to the Gulf
    - 1 pump @ 35 CFS
    - 2 pumps @ 70 CFS
    - Massive pump @500 CFS
  - Elevate: none
  - Storage: none
  - Upstream Improvements: none
  - Block: none

- Results:
  - Reduces some flooding in rainfall events, no effect on surge
  - Include for further analysis

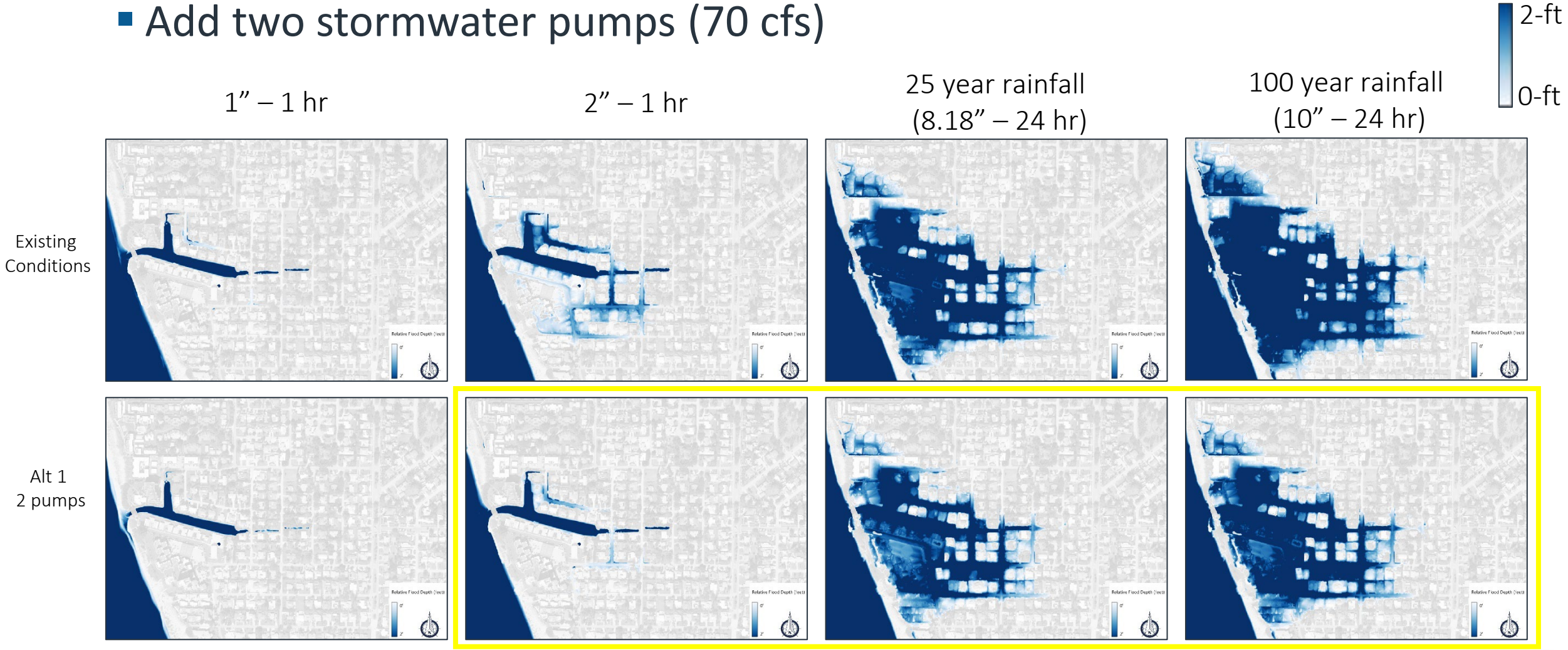




ALTERNATIVE 1: PIPE & PUMP SYSTEM

RAINFALL

- Add two stormwater pumps (70 cfs)



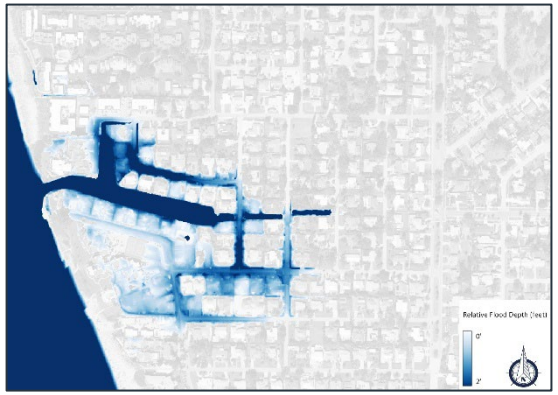
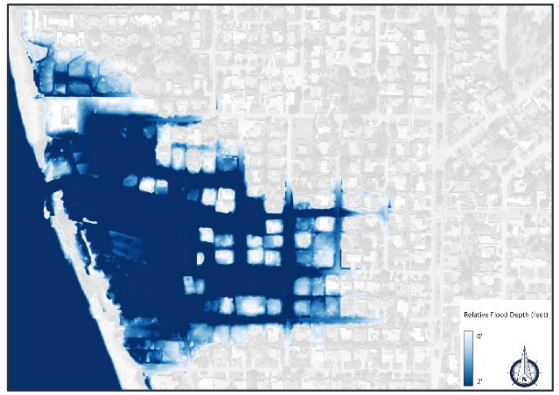
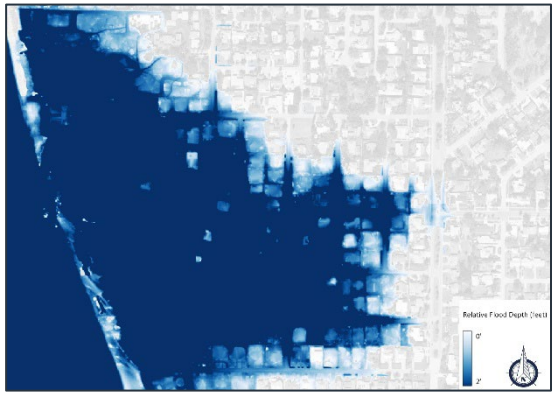
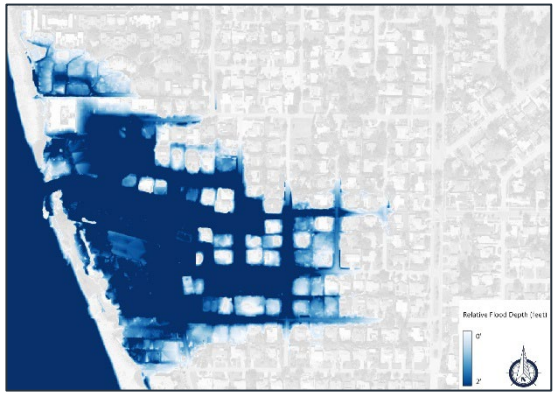
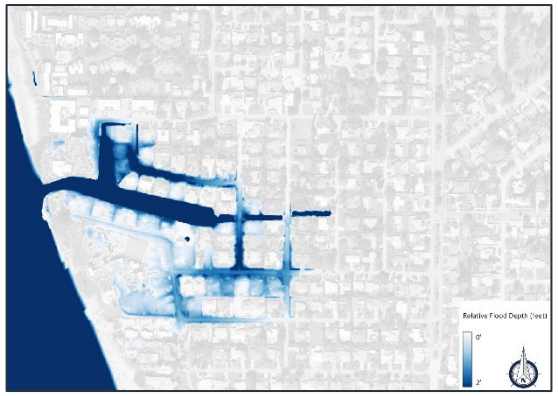
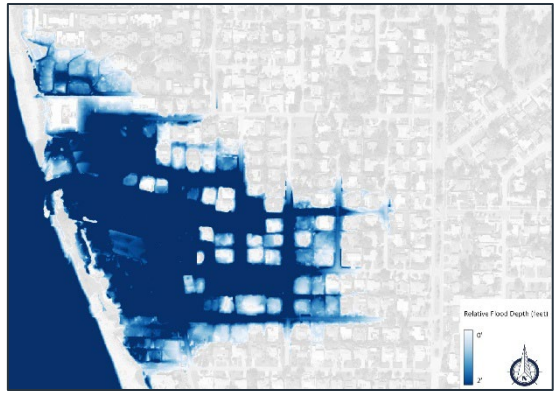
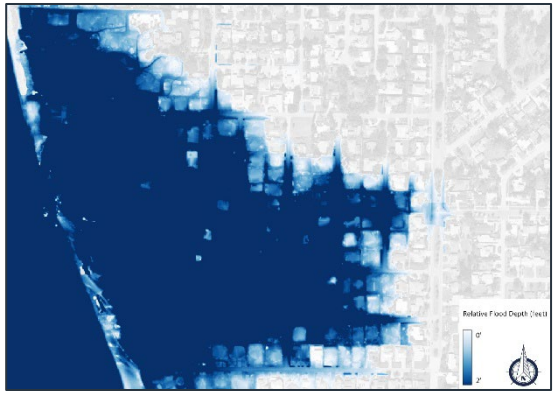
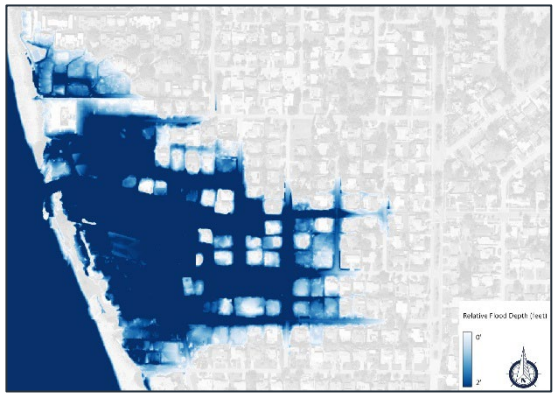
ALTERNATIVE 1: PIPE & PUMP SYSTEM

SURGE

- Add two stormwater pumps (70 cfs)

2-ft

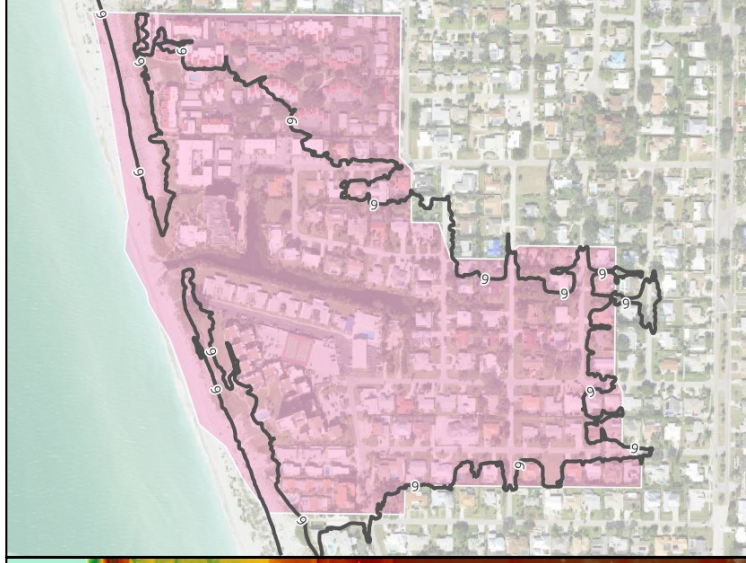
0-ft

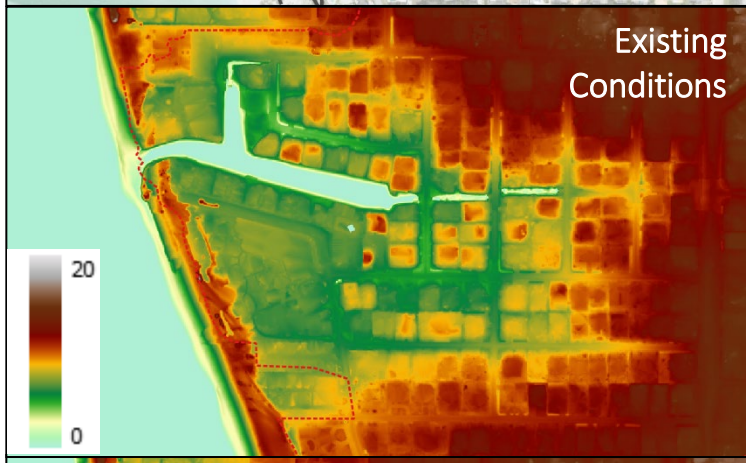
	25 YR	50 YR	100 YR	50 YR + 10 YR Rain (6.59” – 1 hr)
Existing Conditions				
Alt 1 2 pumps				

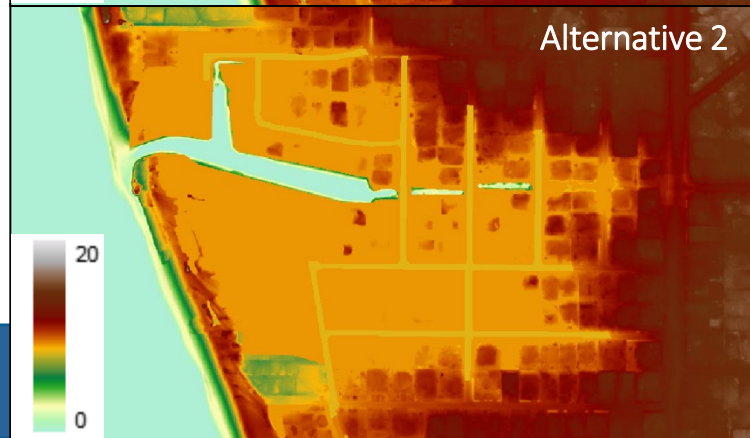
ALTERNATIVES ANALYSIS

- Alternative 2
  - Drain: none
  - Elevate: Raise neighborhood elevation to > 9-ft NAVD
    - FEMA flood 8’ with City requirement +1’ above FEMA
  - Storage: none
  - Upstream Improvements: none
  - Block: none

- Results:
  - Reduces flooding in rainfall and surge events.
  - Include for further analysis.







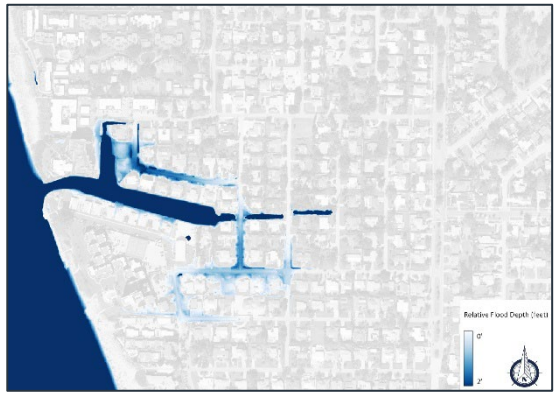
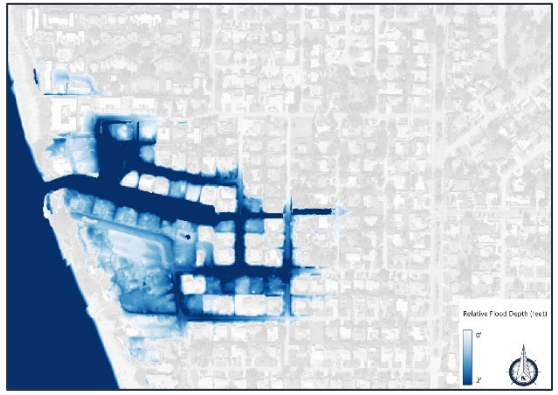
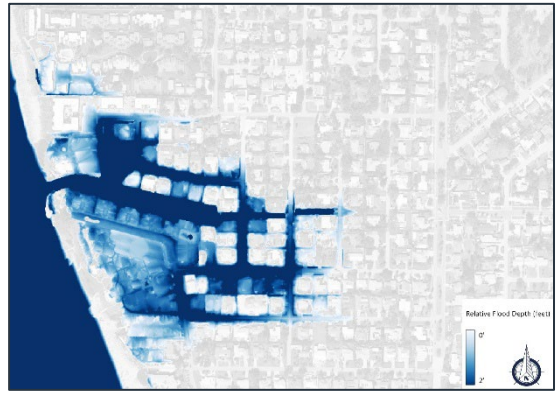
ALTERNATIVE 2: ELEVATE

RAINFALL

- Raise neighborhood elevation to > 9-ft NAVD

2-ft

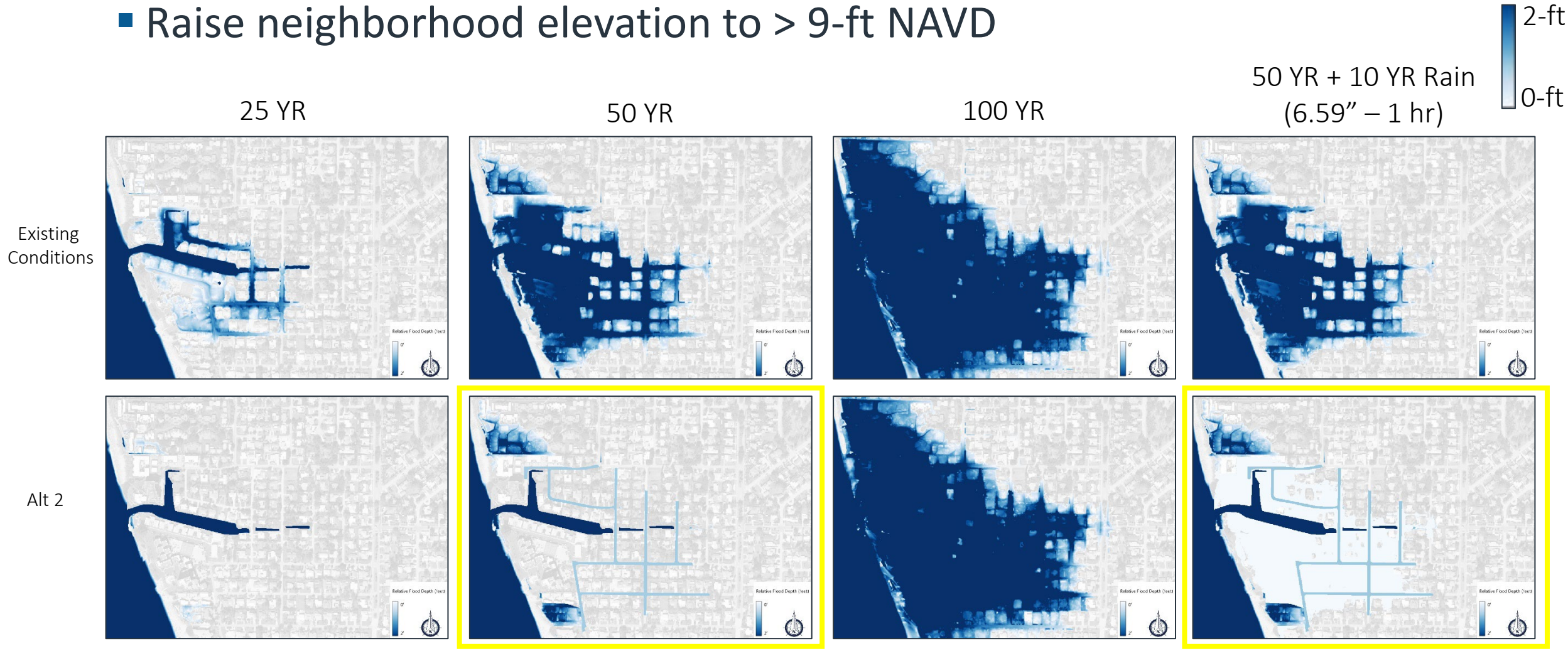
0-ft

	1” – 1 hr	2” – 1 hr	25 year rainfall (8.18” – 24 hr)	100 year rainfall (10” – 24 hr)
Existing Conditions				
Alt 2				

ALTERNATIVE 2: ELEVATE

SURGE

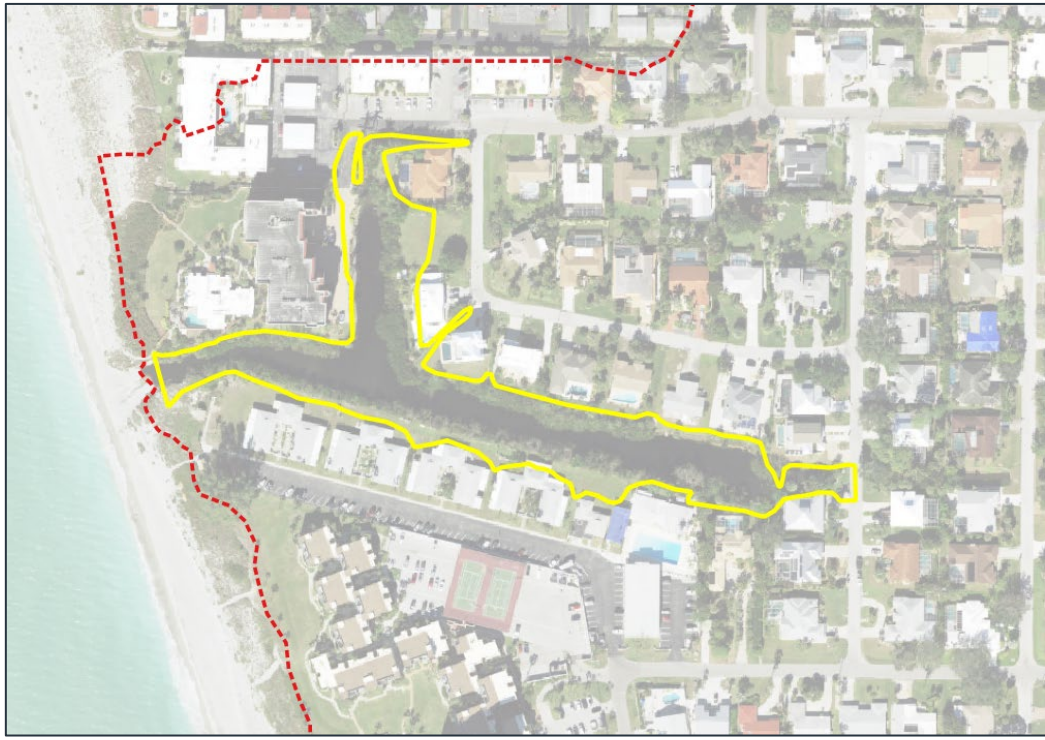
- Raise neighborhood elevation to > 9-ft NAVD



ALTERNATIVES ANALYSIS

- Alternative 3
  - Drain: none
  - Elevate: none
  - Storage: Increase storage capacity
    - 0.25 acre, 0.5 acre, 1 acre, 1.5 acre and 2.0 acre
  - Upstream Improvements: none
  - Block: none

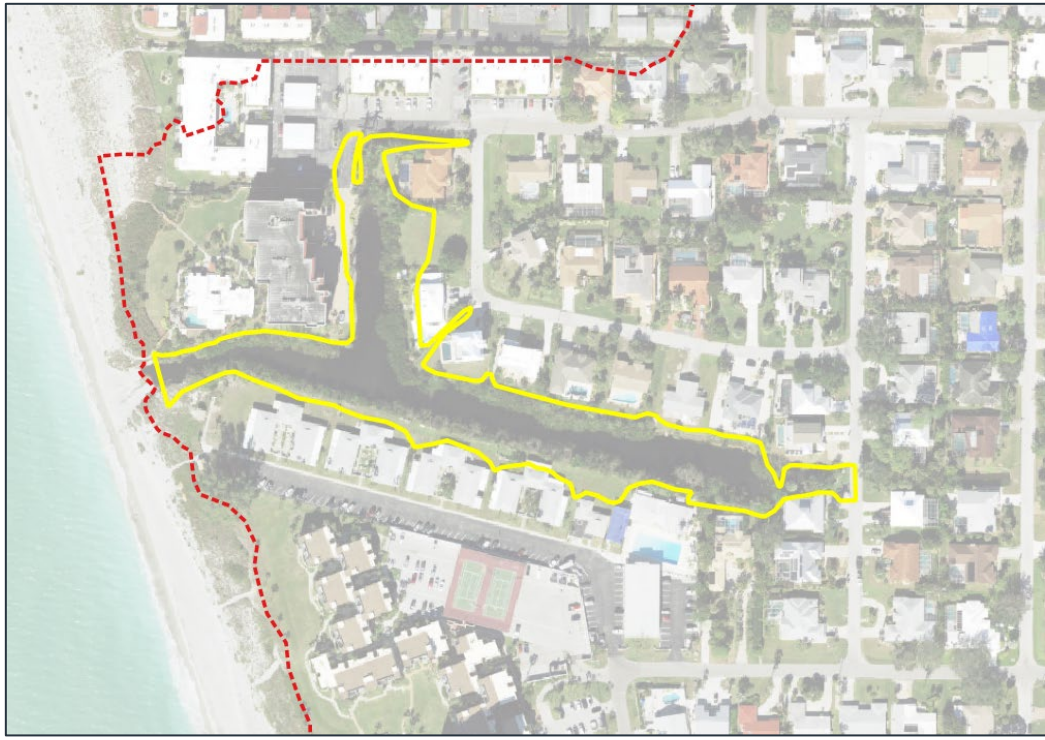
- Results:
  - Little improvement upon existing conditions
  - Include for further analysis in combination with other alternatives



Note: +5.5 ft contour shown in yellow.

ALTERNATIVE 3: STORAGE

- **Flamingo Ditch Storage Capacity ~276,000 cubic feet**
  - Static water level (+1.4’) to the +5.5’ contour.
  - Not including the streets and ditches east of Gardenia
- **1” Rainfall Event - Net Inflow Volume ~346,000 cubic feet**
  - Peak stage at +4.6’ NAVD88 with outfall closed
  - Adding 2 acres decreases water levels by ~1 ft for a 1” rain event
- **2” Rainfall Event - Net Inflow Volume ~660,000 cubic feet**
  - Peak stage at +6.5’ NAVD88 with outfall closed
  - Adding 2 acres decreases water levels by ~0.5 ft for a 2” rain event



Note: +5.5 ft contour shown in yellow.

- Ditch storage capacity is exceeded for minor rain events with closed outfall
- Excess storage capacity currently comes from the streets and open channels (flooding)

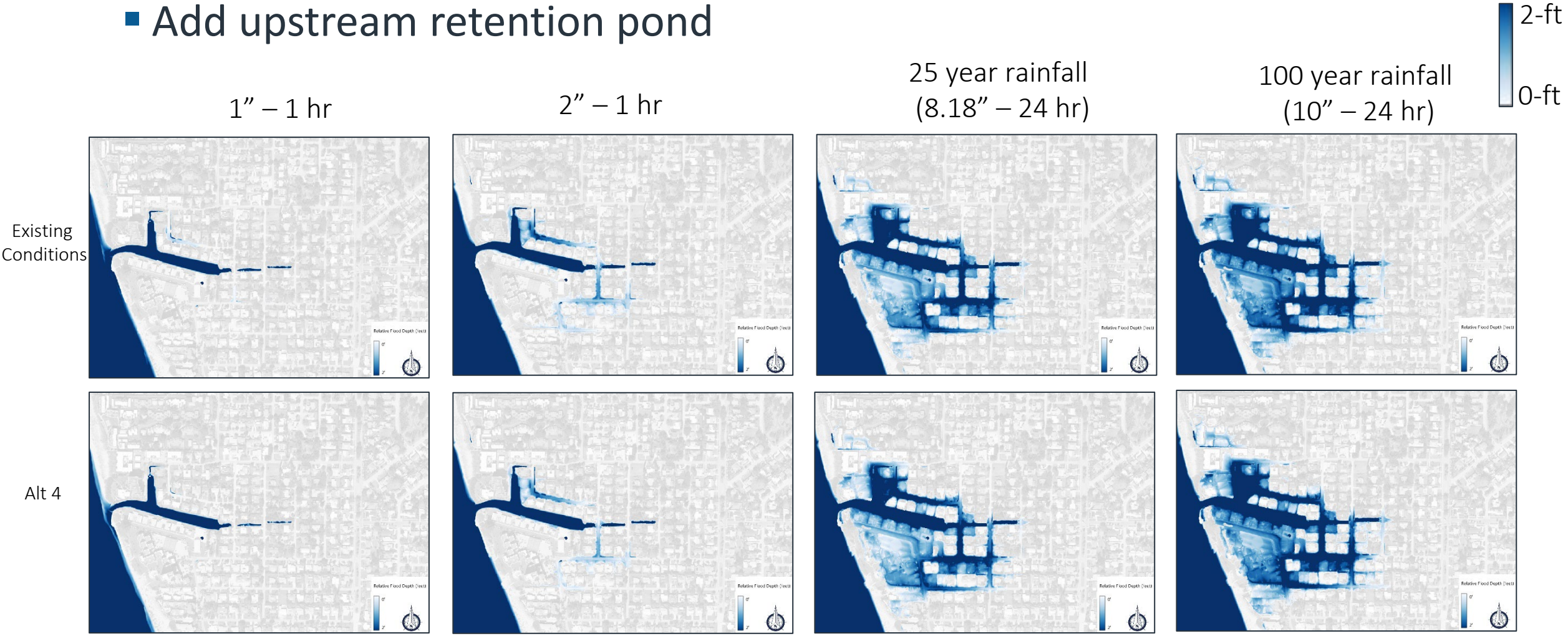
ALTERNATIVES ANALYSIS

- Alternative 4
  - Drain: none
  - Elevate: none
  - Storage: none
  - Upstream Improvements: Retention pond
    - Existing pipe junction
  - Block: none

- Results:
  - Little improvement upon existing conditions
  - Not included for further analysis

ALTERNATIVE 4: UPSTREAM IMPROVEMENTS RAINFALL

- Add upstream retention pond

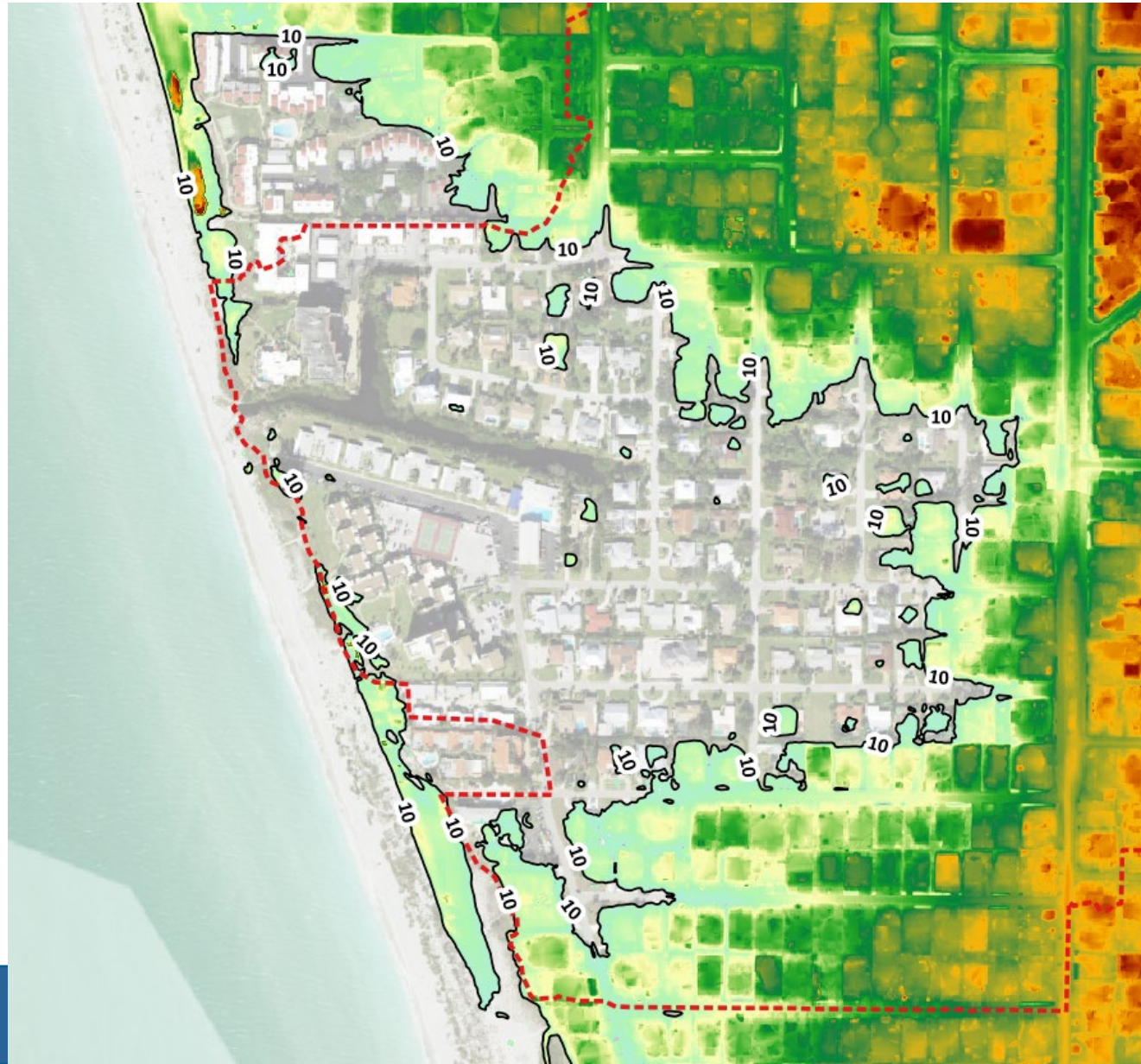


Note: No difference in surge results between existing conditions and Alt 4.

ALTERNATIVES ANALYSIS

- Alternative 5
  - Drain: triple pipes (gravity, one-way)
    - Two 36” pipes and one 48” pipe
  - Elevate: none
  - Storage: none
  - Upstream Improvements: none
  - Block: Dunes/Seawall
    - Existing dune elevation (+10-ft)

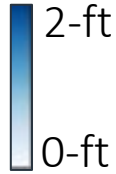
- Results:
  - Some improvement in reducing storm surge impacts
  - Increases flooding from rainfall due to adverse trapping effect
  - Include for further analysis only if used in combination with other alternatives



ALTERNATIVE 5: DUNE/SEAWALL

RAINFALL

- Block at existing dune elevation, approximately +10 ft, with 3 pipes



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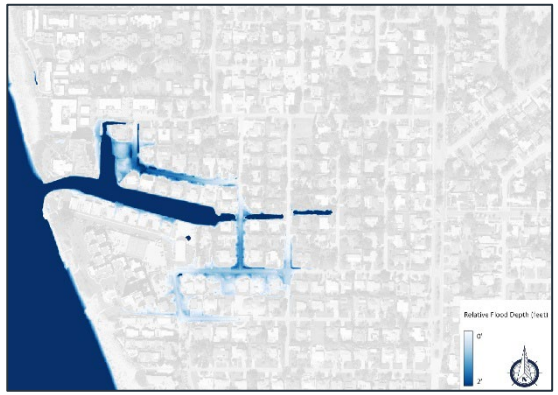
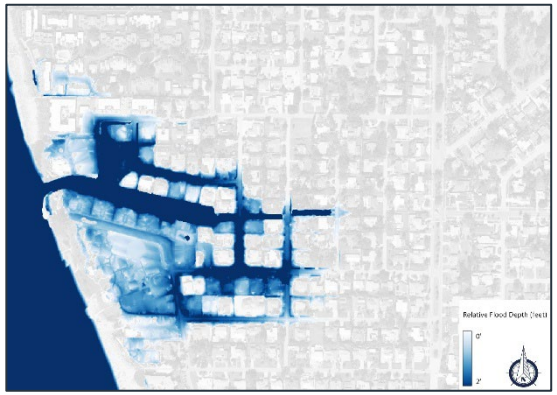
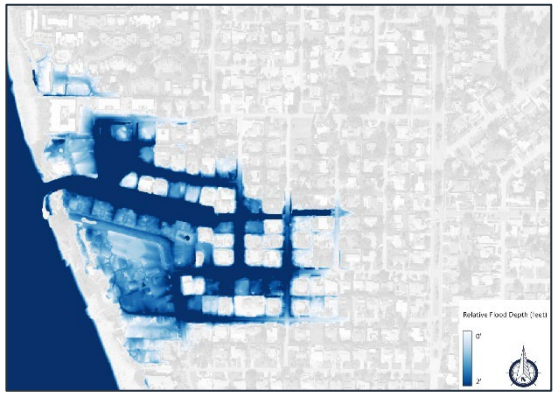
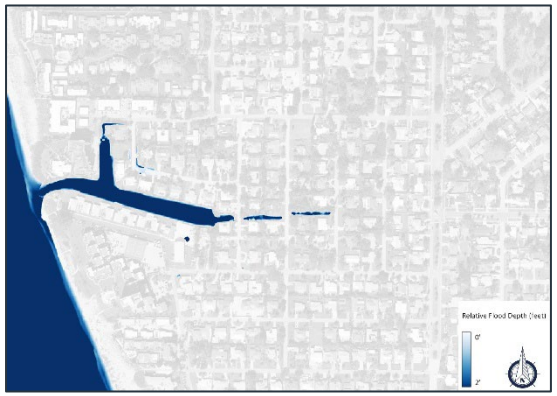
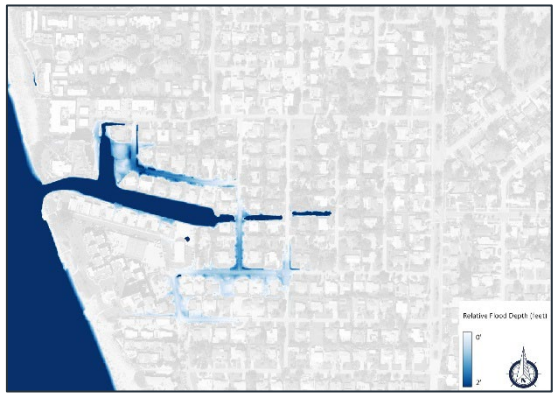
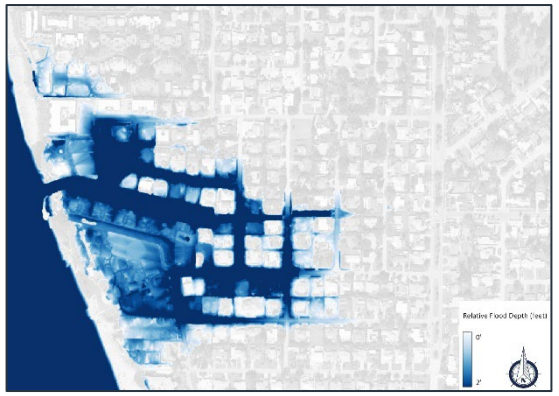
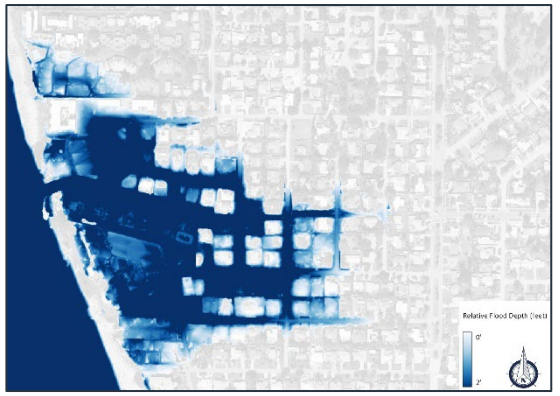
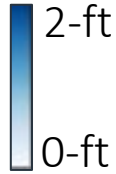
Existing Conditions				
Alt 5				

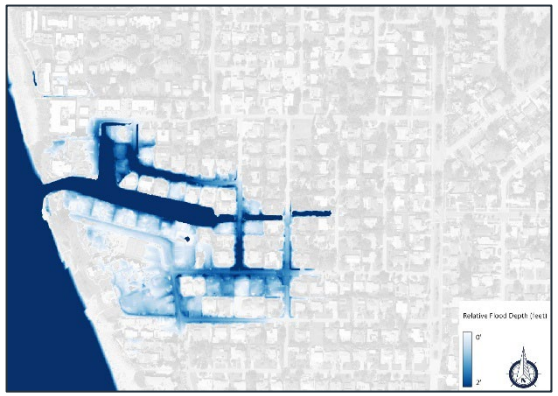
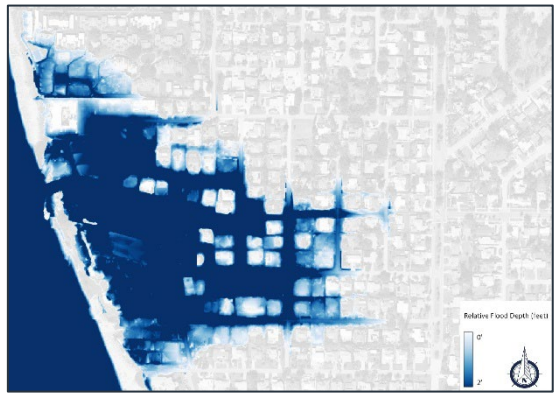
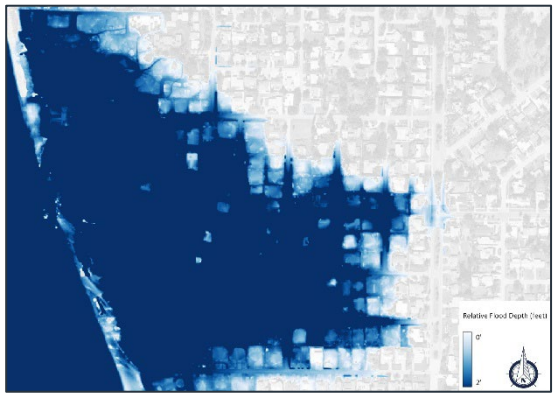
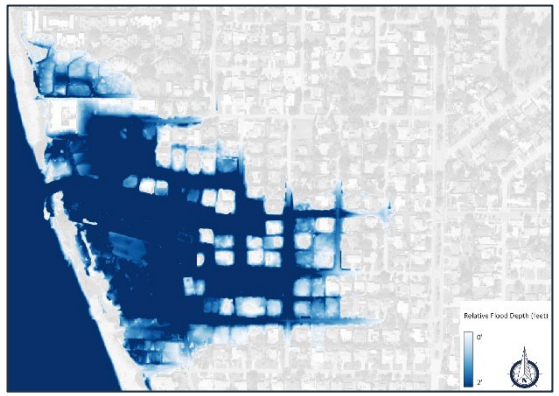
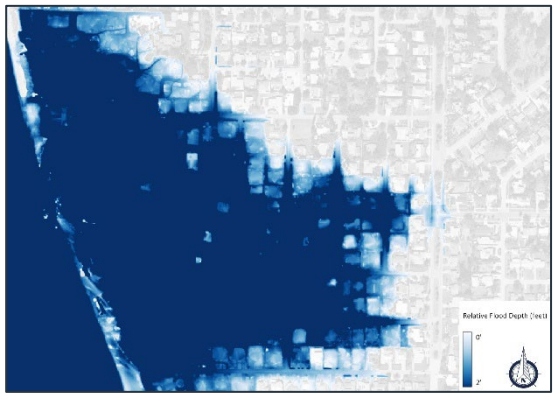
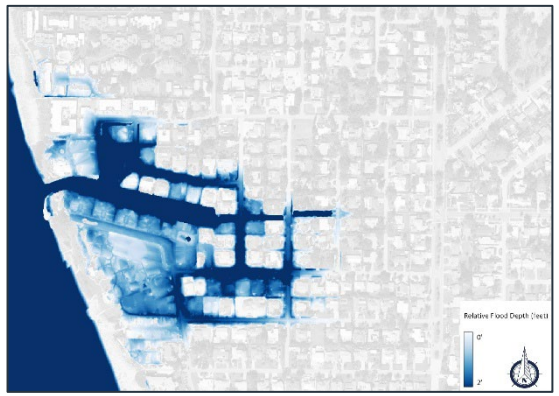
ALTERNATIVE 5: DUNE/SEAWALL

SURGE

- Block at existing dune elevation, approximately +10 ft, with 3 pipes



50 YR + 10 YR Rain
(6.59” – 1 hr)

	25 YR	50 YR	100 YR	
Existing Conditions				
Alt 5				

EVALUATION MATRIX: INITIAL ALTERNATIVES

Alternative	Technical Effectiveness	Relative Cost	Ownership Challenges	Operations & Maintenance	Liability & Risk	Permitting Feasibility
1 – Pump to Gulf						
2 – Elevate						
3 – Storage Capacity						
4 – Upstream Improvements						
5 – Dune/Seawall						

Note: All ranking and costs are provided for discussion and comparison purposes only.

- Ranking:
  - Red – Not likely to meet objectives
  - Yellow – May meet some objectives
  - Green – Most likely to meet objectives
- Relative Cost Ranges:
  - Red – Greater than $5M
  - Yellow – Between $1M and $5M
  - Green – Less than $1M

EVALUATION MATRIX: POTENTIAL COMPONENTS

Alternative	Technical Effectiveness	Relative Cost	Ownership Challenges	Operations & Maintenance	Liability & Risk	Permitting Feasibility
1 – One-way Pipes						
2 – Elevate Roads						
3 – Storage Capacity						
4 – Upstream Improvements						
5 – Dune						

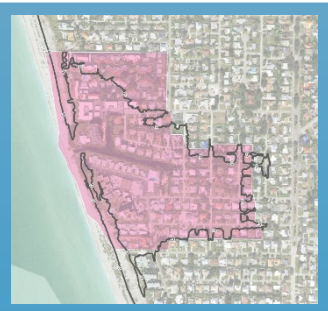
Note: All ranking and costs are provided for discussion and comparison purposes only.

- **Results suggest further consideration of the following components:**
  - Alt 1 – Piping with one-way valves
  - Alt 2 – Elevate roads adjacent to ditch
  - Alt 3 – Add storage in available location(s)
  - Alt 4 – Upstream improvements (deferred)
  - Alt 5 – Build dune (only in combination with drainage)

COMBINE SELECTED COMPONENTS

Drain

One-way pipes



Elevate

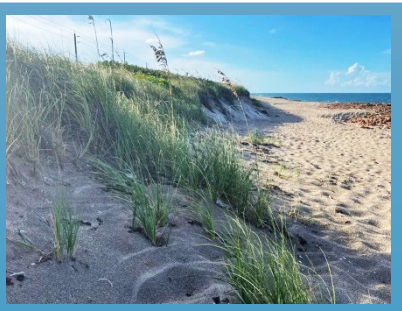
Raise road elevation

Storage

Increase capacity at ditch

Upstream Improvements

Defer



Block

Dune

Combined Alternatives 6a, 6b, 7a, 7b

COMBINED ALTERNATIVES ANALYSIS

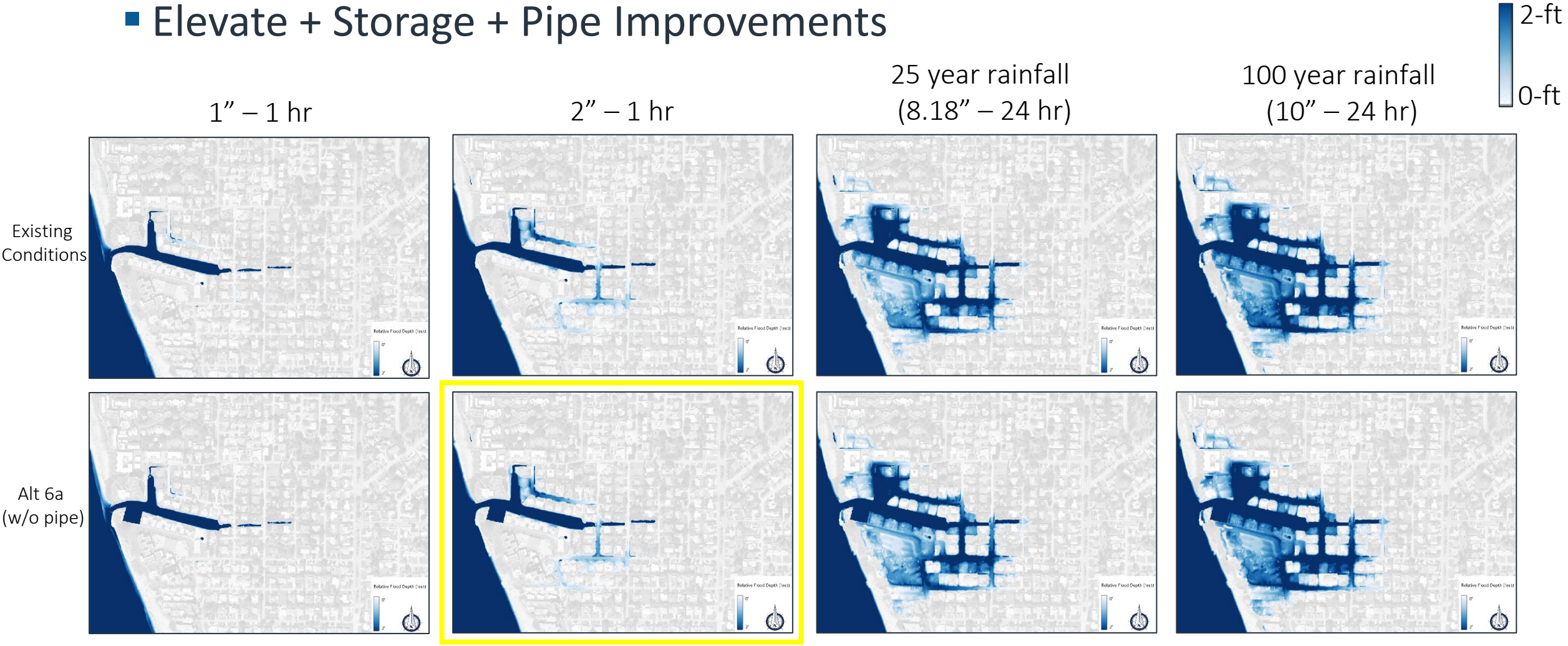
- Alternative 6a and 6b
  - **Drain**: without outfall pipe (Alt 6a) and with 555’ long 36” outfall pipe with drop structure (Alt 6b)
  - **Elevate**: Raise road sections on Flamingo Drive and Villas/Gardenia to +5’
  - **Storage**: 0.5 acre added
  - Upstream Improvements: none
  - **Existing Pipe Improvements**:
    - Flamingo Drive Pipe: made one way
    - Villas Drive Pipe: made one way
  - Block: none

- Results:
  - Alt 6a (no pipe): No significant effect on rainfall or surge
  - Alt 6b (with pipe): No significant benefit for large rain events
  - Storm surge not evaluated with this alternative (no dune component)

ALTERNATIVE 6A: COMBINATION

RAINFALL

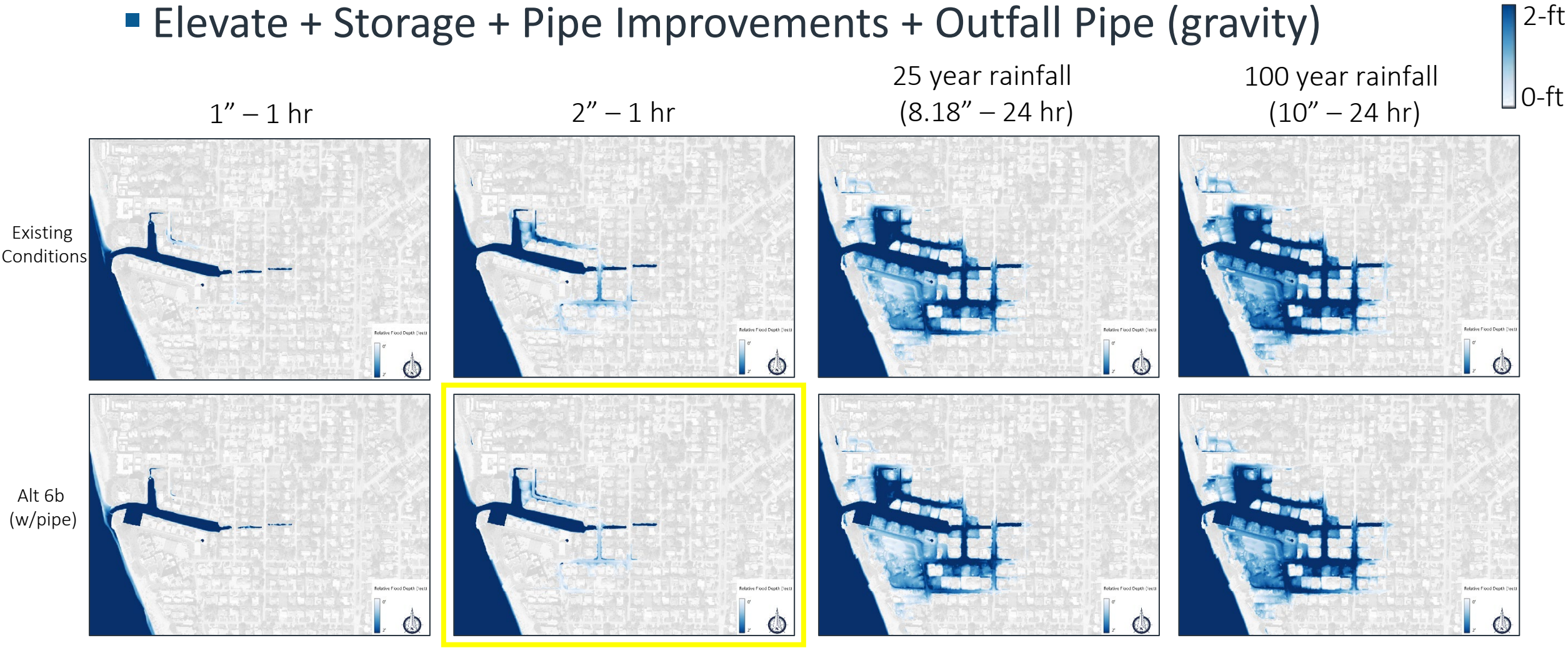
- Elevate + Storage + Pipe Improvements



ALTERNATIVE 6B: COMBINATION

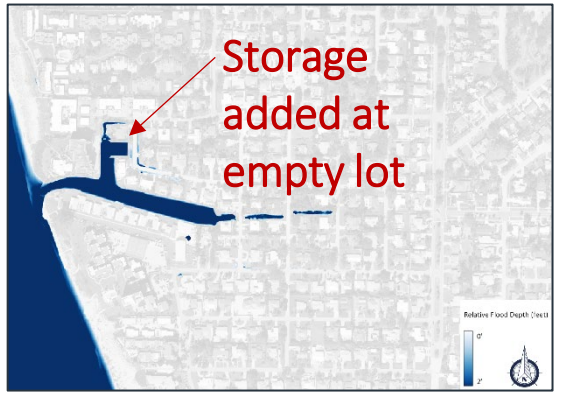
RAINFALL

- Elevate + Storage + Pipe Improvements + Outfall Pipe (gravity)



COMBINED ALTERNATIVES ANALYSIS

- Alternative 7a and 7b
  - Drain: none
  - **Elevate**: Road sections on Flamingo Drive and Villas/Gardenia raised to +5’
  - **Storage**:
    - Converted Lot 2 BLK 11 of Golden Beach Development (~0.24 acres)
    - 10' wide berm at +5.5, side slopes of 1:2 to -5
  - Upstream Improvements: none
  - **Existing Pipe Improvements**:
    - Flamingo Drive Pipe: made one way, pipe increased from 15" to 18" size
    - Villas Drive Pipe: made one way, pipe size stays the same
  - **Block**: Existing berm +5 ft (Alt 7a) and large dune +15 ft (Alt 7b)



- Results:
  - Alt 7a (no dune): Minor benefit to rainfall flooding and no effect on surge
  - Alt 7b (dune): Dune blocks surge but also blocks drainage of rainwater. Obstructs view for first story structures and does not address other pathways.
  - An opening to drain stormwater is needed in combination with a dune

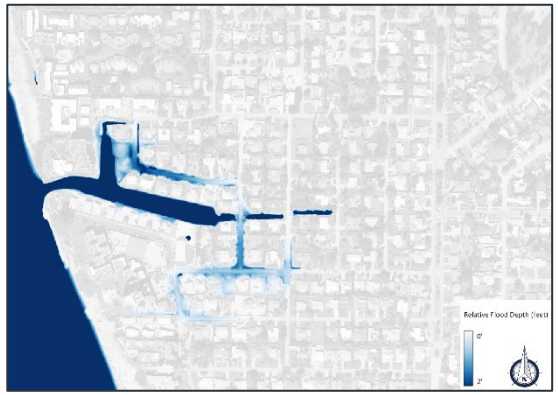
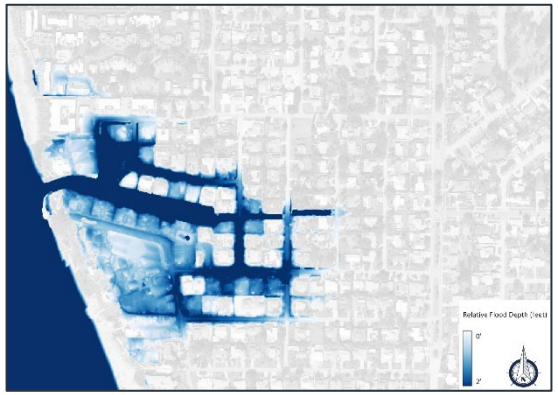
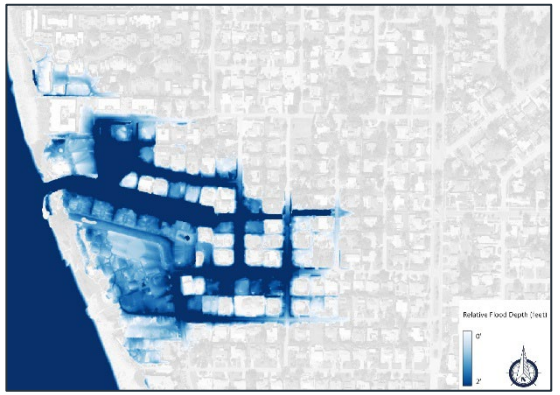
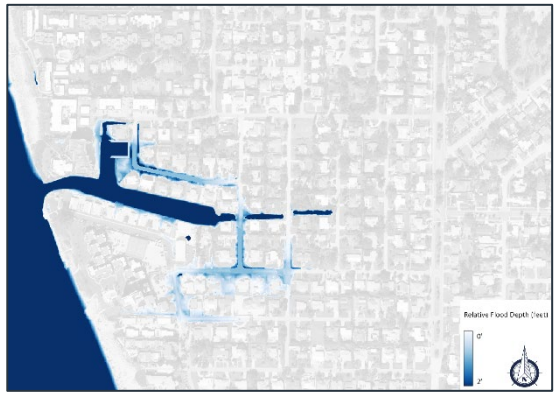
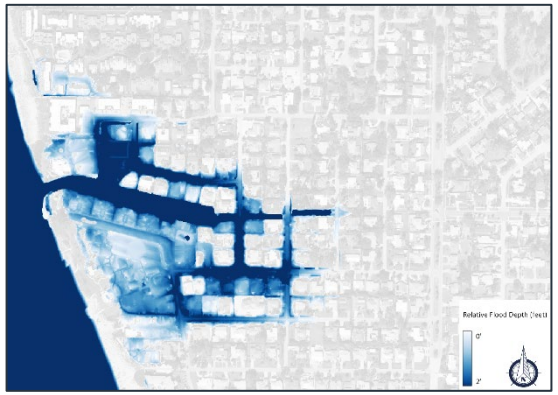
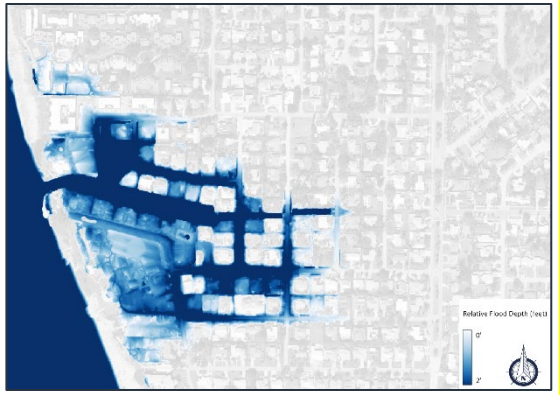
ALTERNATIVE 7A: COMBINATION

RAINFALL

- Elevate + Storage + Pipe Improvements

2-ft

0-ft

	1” – 1 hr	2” – 1 hr	25 year rainfall (8.18” – 24 hr)	100 year rainfall (10” – 24 hr)
Existing Conditions				
Alt 7a (w/o dune)				

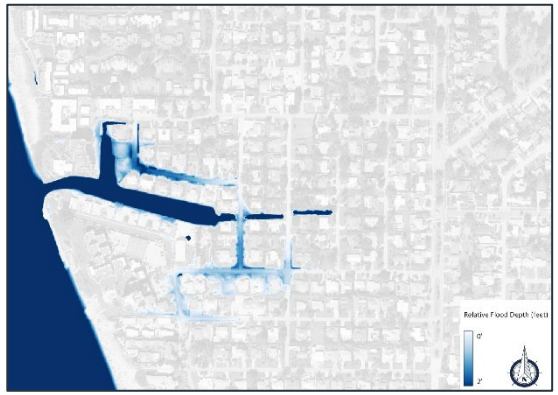
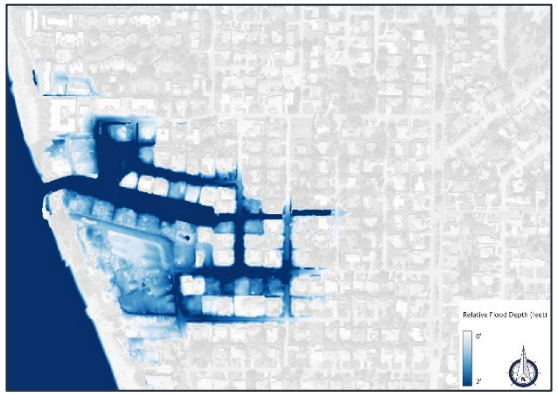
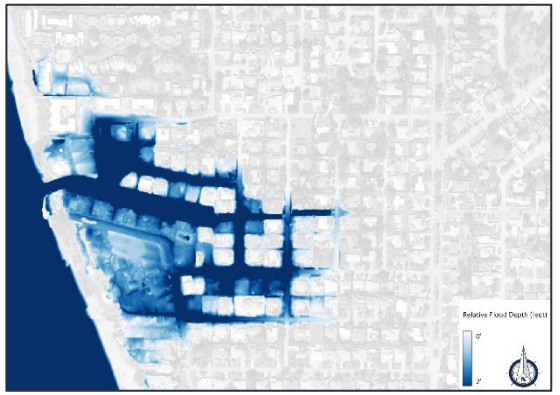
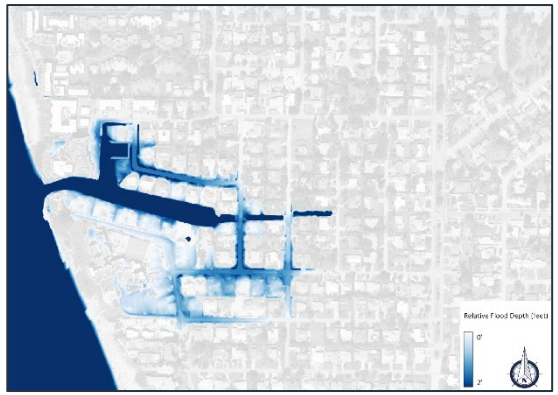
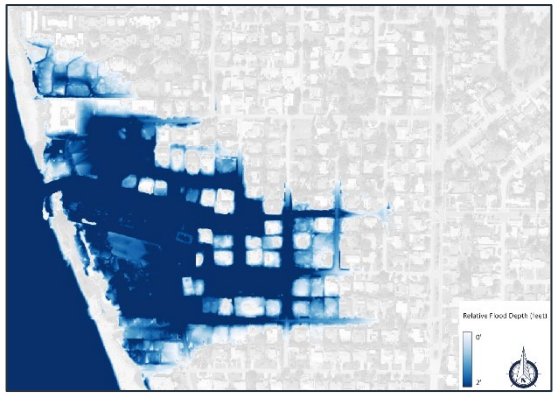
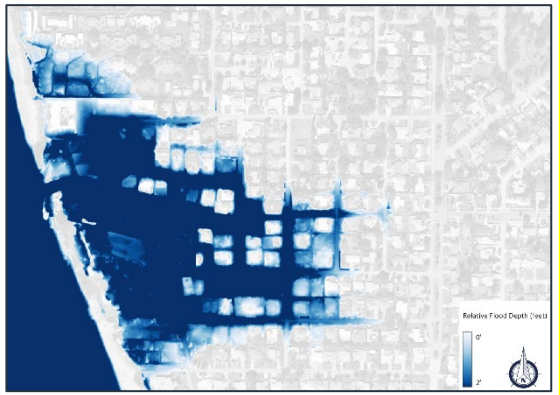
ALTERNATIVE 7B: COMBINATION

RAINFALL

- Elevate + Storage + Improvements + Block (+15 ft Dune)

2-ft

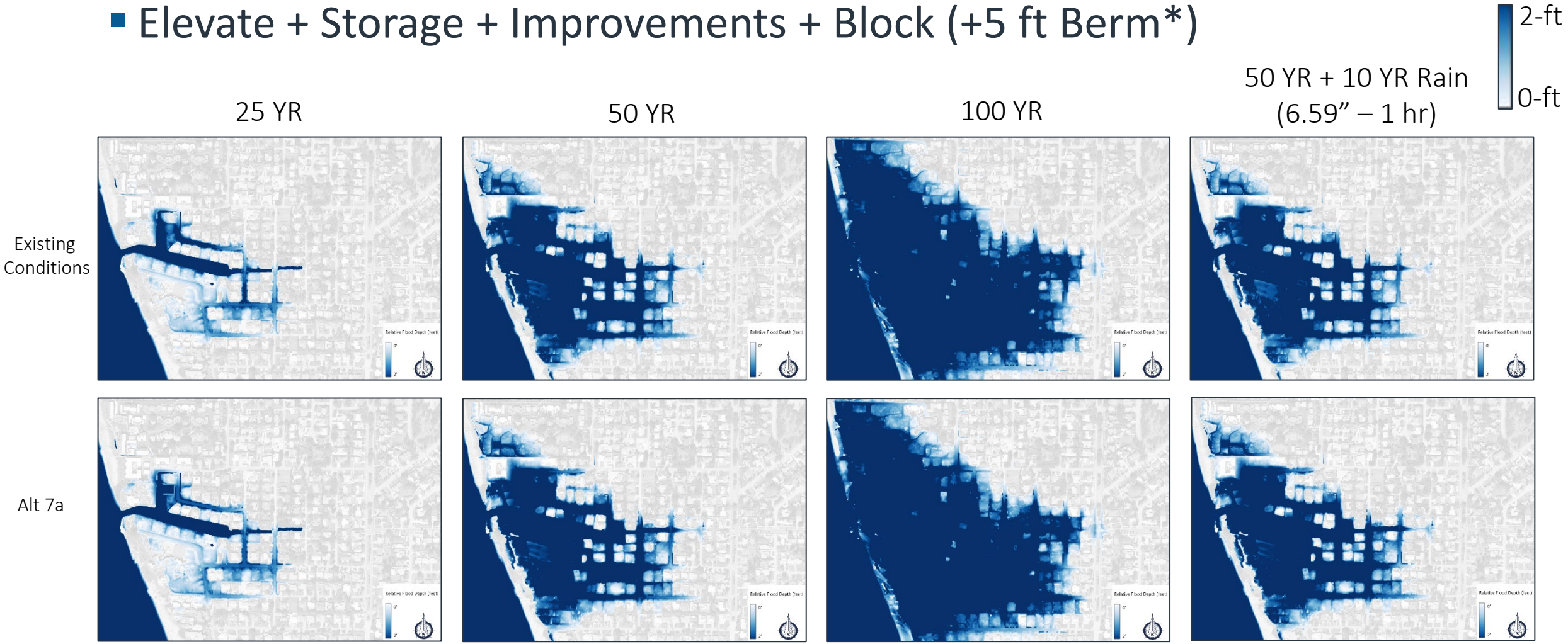
0-ft

	1” – 1 hr	2” – 1 hr	25 year rainfall (8.18” – 24 hr)	100 year rainfall (10” – 24 hr)
Existing Conditions				
Alt 7b (w/ dune)				

ALTERNATIVE 7A: COMBINATION

SURGE

- Elevate + Storage + Improvements + Block (+5 ft Berm*)



*Alt 7b with 15 ft dune blocks surge events but traps water from rainfall and other flood pathways.

GENERAL FINDINGS

- Flamingo Ditch is a regional geographic depression and natural wetland that is prone to flooding from minor rain events and modest storm surge.
- The margins for flooding are very thin and small amounts of water introduced to the system can exceed the ditch capacity.
- The surrounding properties are privately owned with a mix of single family and multi-family homes constructed on low lying land.
- The City's easement is limited to general maintenance along a 20-ft wide area down the centerline of the ditch.
- Relocating homes and returning the area back to a natural system is not feasible due to the level of development and private lands.
- A dune or seawall creates a barrier for surge protection but is likely to worsen flooding from rainfall.

TECHNICAL FINDINGS

- Model results suggest the following:
  - Elevating the entire area to above +9 ft NAVD can reduce flooding up to a 100 yr rain event and 50 yr storm surge event.
  - Reasonably sized pumps (35-70 cfs) will not keep up with rainfall or surge and massive pumps (500 cfs) are not feasible.
  - Additional water storage areas would increase ditch capacity to better accommodate rainfall events but space to create new ponds is limited.
  - Storm surge with water levels up to a 50 yr event can be blocked from entering the ditch with a dune but the elevated dune traps water from discharging back to the Gulf.
- A phased approach may allow for improvements to address high frequency events while developing long term adaptations as part of other system-wide upgrades.
- All components are conceptual and require additional design, siting, engineering, permitting, and cost considerations for further development.

OVERALL STUDY FINDINGS

- The following concepts are provided for further discussion and development:
  - Raise City-owned roads to improve ingress/egress during nuisance flooding events and identify properties that may require modifications to meet new elevations (driveways, landscaping, etc.).
  - Install local stormwater system improvements to accommodate road modifications (replace pipes/grates, install one-way valves, swales, etc.) and seek easements for related actions.
  - Consider acquiring additional property along the ditch (i.e., empty parcel on Lot 2) to offset loss of road storage and increase overall basin capacity.
  - Approach the U.S. Army Corps of Engineers to discuss surge barrier options (beach berm, drainage, dune, wall) as it pertains to the federally-authorized Venice Beach Shore Protection Project.
  - Install publicly accessible (web-based) data collection system for real-time monitoring and early warning of rising water levels.
  - Consider other major improvements as potential components to the City's Stormwater Master Plan for rerouting/pumping water away from the ditch as part of system-wide upgrades.
  - Continue to pursue grant funding for short term improvements and major system upgrades.

DISCUSSION AND NEXT STEPS

- Public comment period
- Background information
- Initial model set-up and review
- Grant application
- Additional data collection
- Finalize model set-up
- Build alternatives in model
- Simulate a range of rain/surge events
- Add/refine alternatives
- Results and reporting

THANK YOU