



USACE-GALVESTON H&H MODELING EFFORTS IN THE NECHES BASIN

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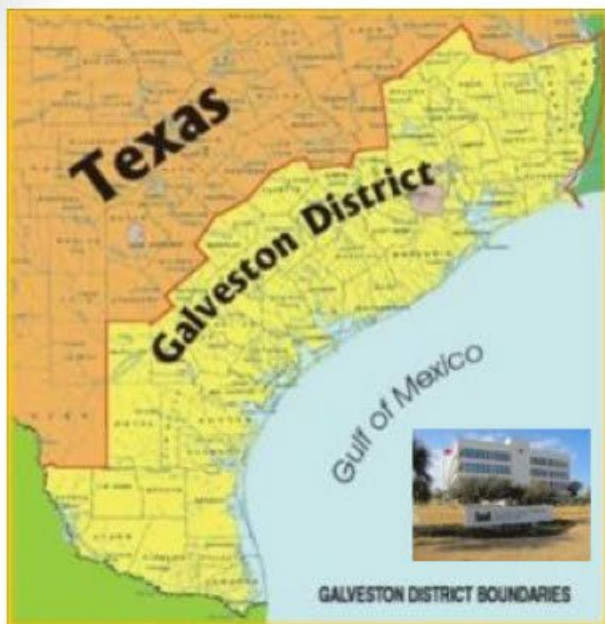
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USACE GALVESTON DISTRICT (SWG): HISTORY AND MISSION



- Navigation (NAV)
- Flood Risk Management (FRM)
- Coastal Storm Risk Management (CSRM)
- Regulatory
- Ecosystem Restoration (ER)
- Emergency Management
- Interagency & International Support

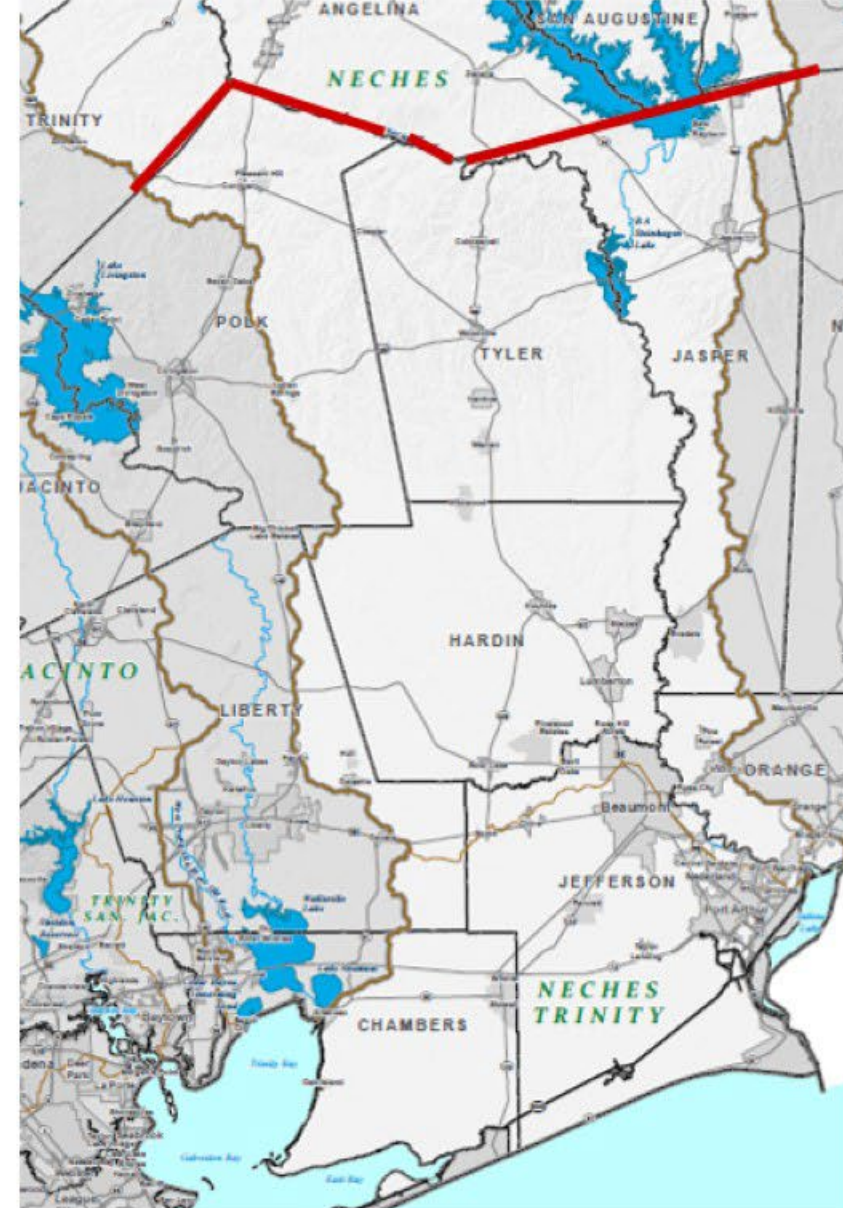
- First engineer district in Texas, established 1880
- 50,000 square mile district boundary, ~100+ miles inland
- 28 ports handling 538+ M tons of commerce annually (FY 16)
- 1,000+ miles of channels
 - 750 miles shallow draft
 - 270 miles of deep draft
- 367 miles of Gulf coastline
- 30-40 M cubic yards/yr material dredged
- 16 Congressional districts
- 48 Texas counties, Louisiana parishes
- 18 Coastal counties - bays / estuaries
- 9 coastal basins



SWG IN THE NECHES RIVER BASIN



- SWG Encompasses Counties of: Trinity, Polk, Tyler, Jasper, Newton, Orange, Jefferson, Chambers, Liberty
- Existing Projects in and around Neches Basin
 - Sabine Pass to Galveston Bay Coastal Storm Risk Management – Port Arthur and Orange
 - Jefferson County Ecosystem Restoration Project
 - West Port Arthur FPMS
 - Town Bluff Dam and Sam Rayburn Reservoir - Ft Worth District



SABINE PASS TO GALVESTON BAY

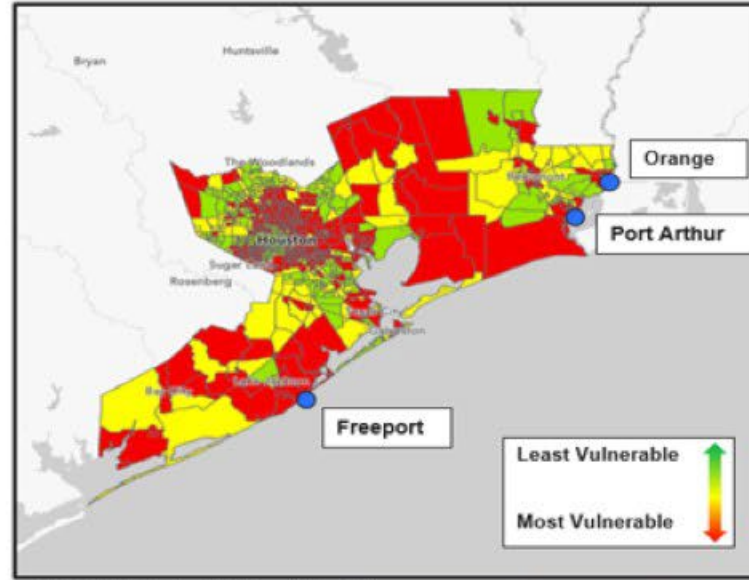


The S2G project encompasses 6 coastal counties with over 5+ million residents.

27 of 34 census tracts are within socially vulnerable communities

Total Texas Refinery Production produces 4.55 Million b/cd along the coast of Texas

The system has been designed to provide a risk reduction against a 1% ACE probability storm event based on the 50- year intermediate RSLC condition





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PORT ARTHUR, TEXAS AUTHORIZED PROJECT OVERVIEW



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Authorized Plan:

- Improvement of 5.5 miles of Earthen Levee 14.4 to 17.2 ft
- Reconstruction of 5.7 miles of Floodwall elevations 14.4 to 19.4 ft
- A separate 1,830 ft of new earthen levee planned in the Port Neches area



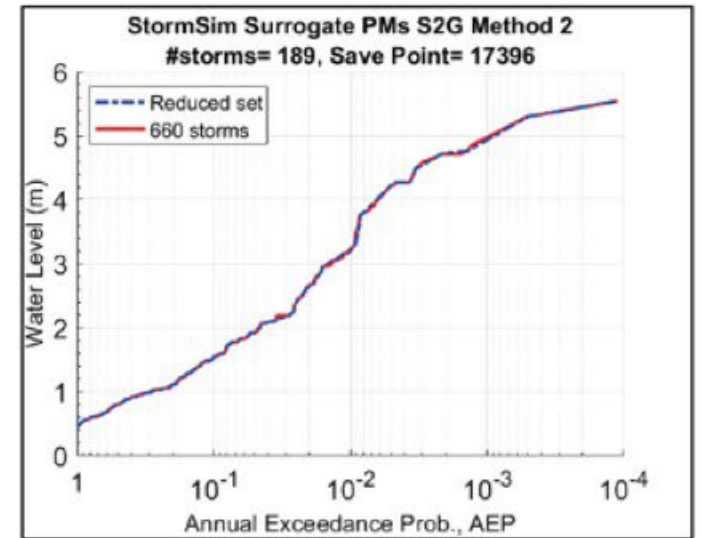
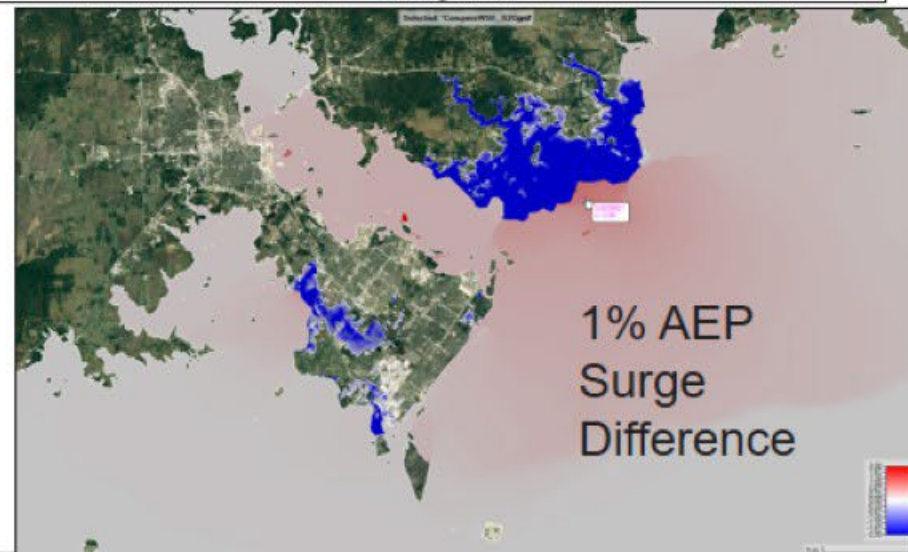
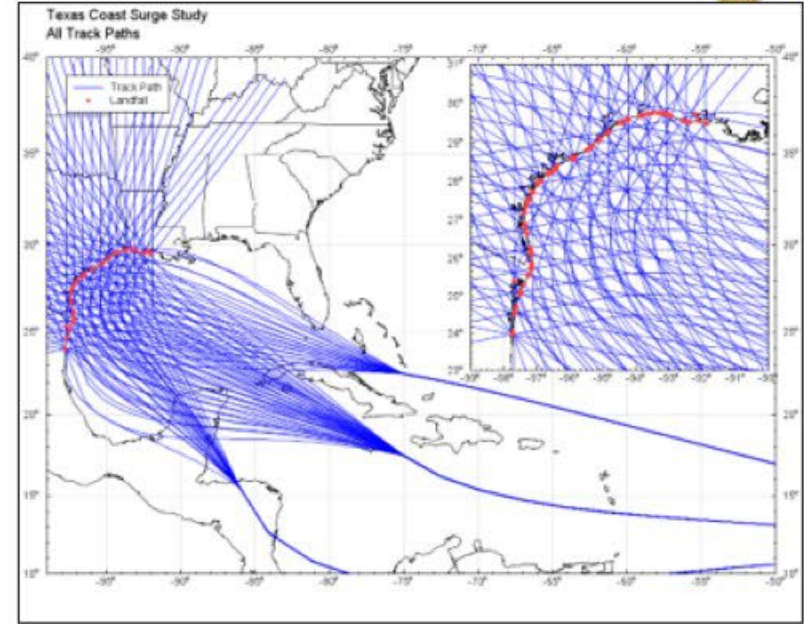
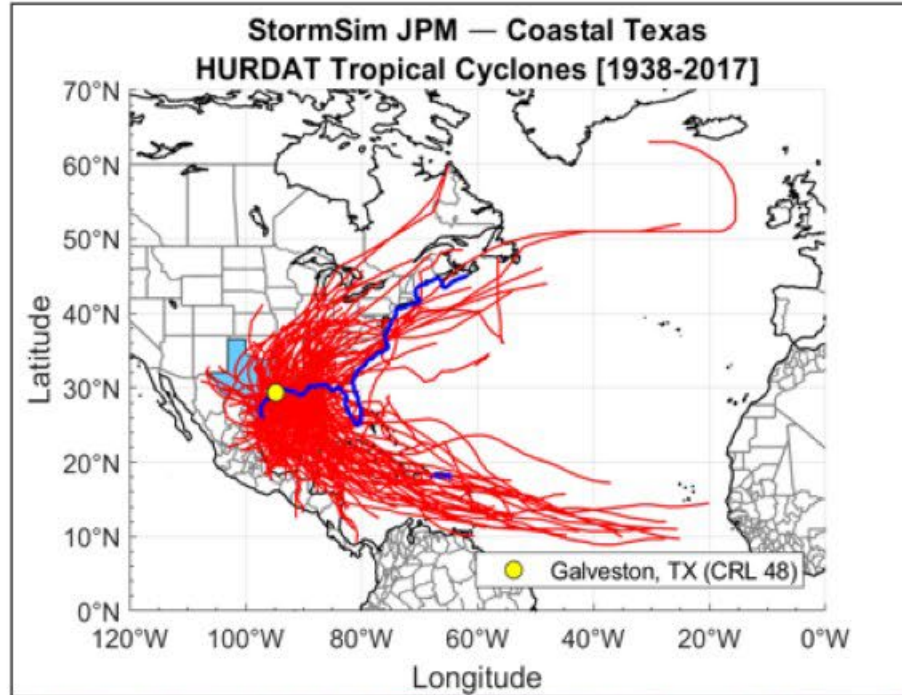
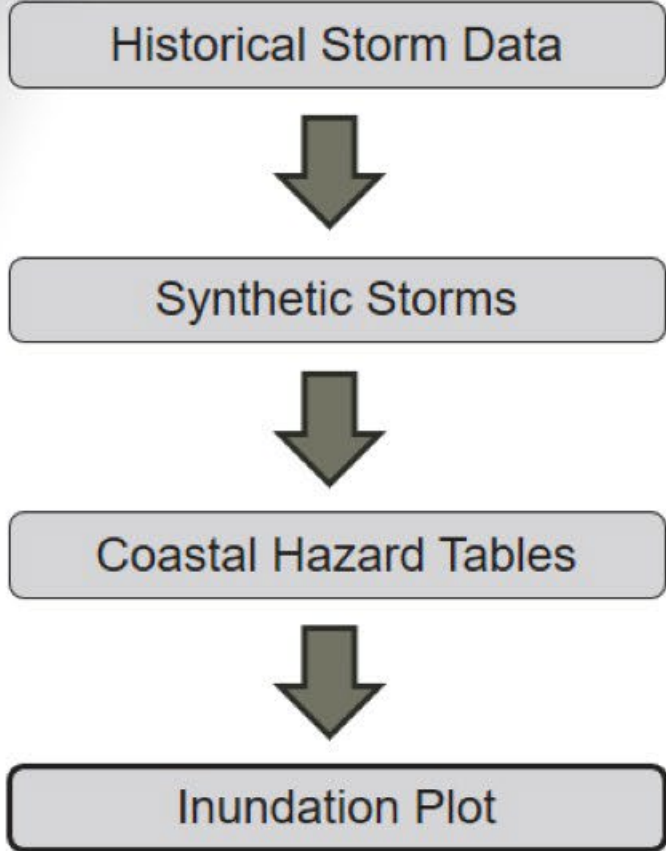
ORANGE COUNTY, TEXAS AUTHORIZED PROJECT OVERVIEW

Authorized Plan:

- 15.6 miles of earthen levee (12.0 - 17.5 ft)
- 10.7 miles of concrete floodwall (13.5 - 16 ft NAVD 88)
- 7 pump stations
- 13,200 CFS pumping capacity
- 176 drainage gravity barrels
- 32 closure gates located at road and railway crossings
- 2 navigable sector gates to be constructed in Adams and Cow Bayous
- Mitigation plan:
 - 453 acres required for estuarine marsh restoration
 - 559.5 acres required for forested wetlands preservation

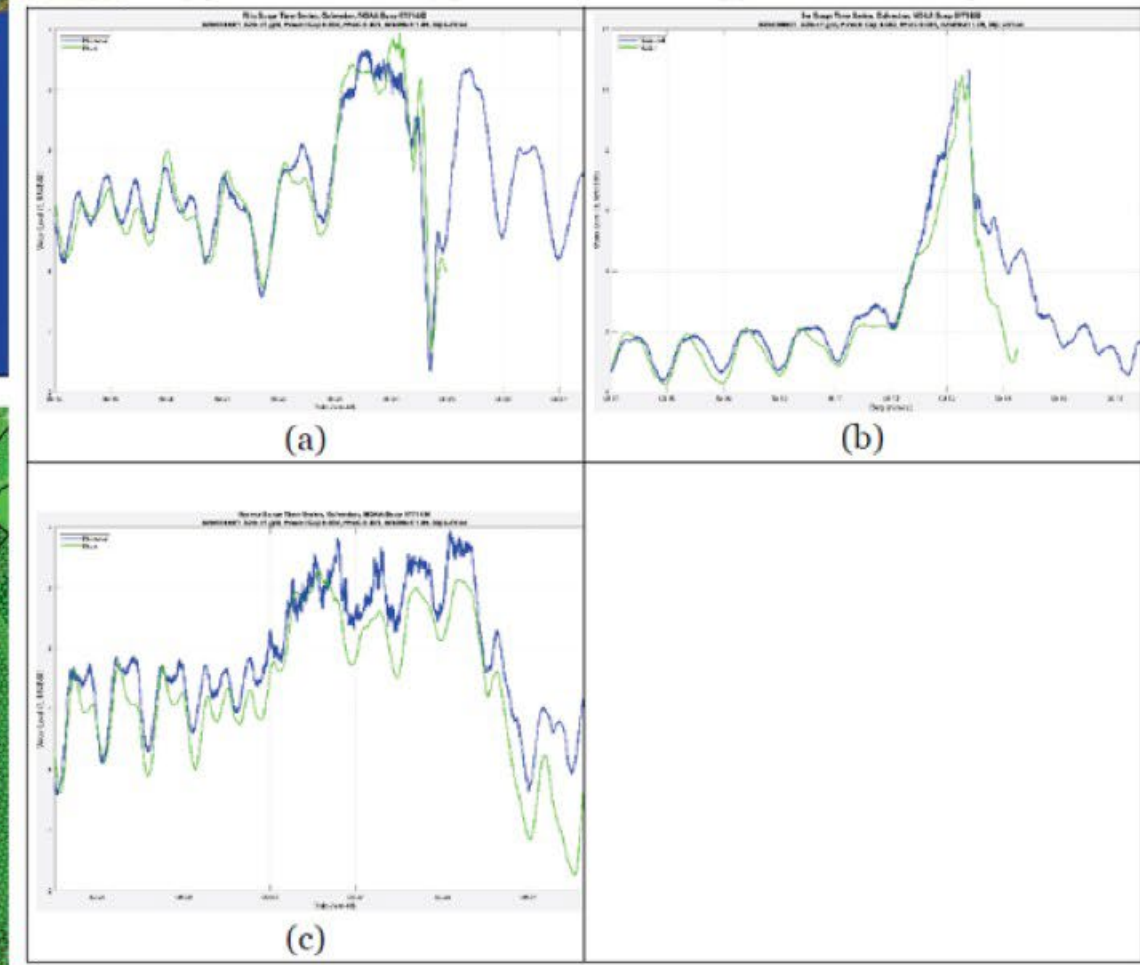
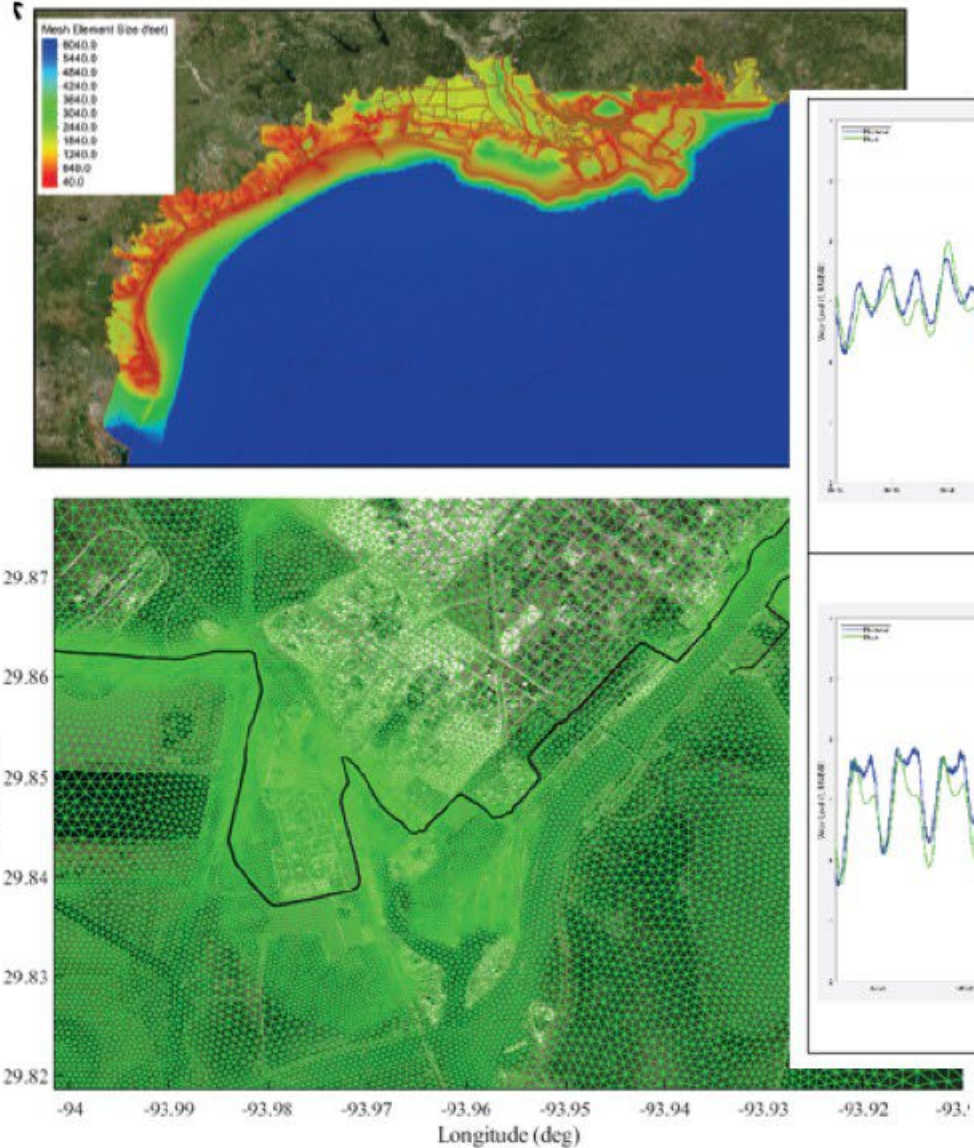


COASTAL HAZARDS



COASTAL MODELS

- ADCIRC Model that compute storm surge are part of the development Hazard Curves
- Model have been recently coupled with HEC RAS models to reflect storm surge to provide information on coastal compound flooding condition.
- Model calibrated and validated to larger Tropical Storms



INTERIOR DRAINAGE PORT ARTHUR

Identify Residual flood risk behind the line of protection

Reduced through pump stations and gravity drains.

Hydrology models developed in HMS with flood routing and hydraulic design in HEC RAS





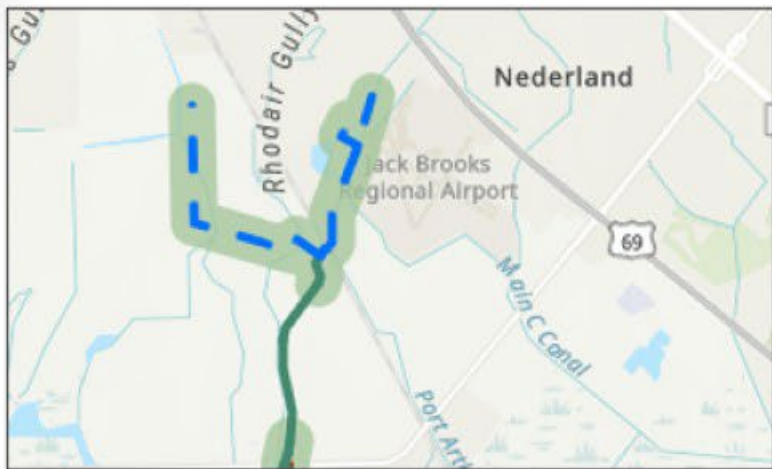
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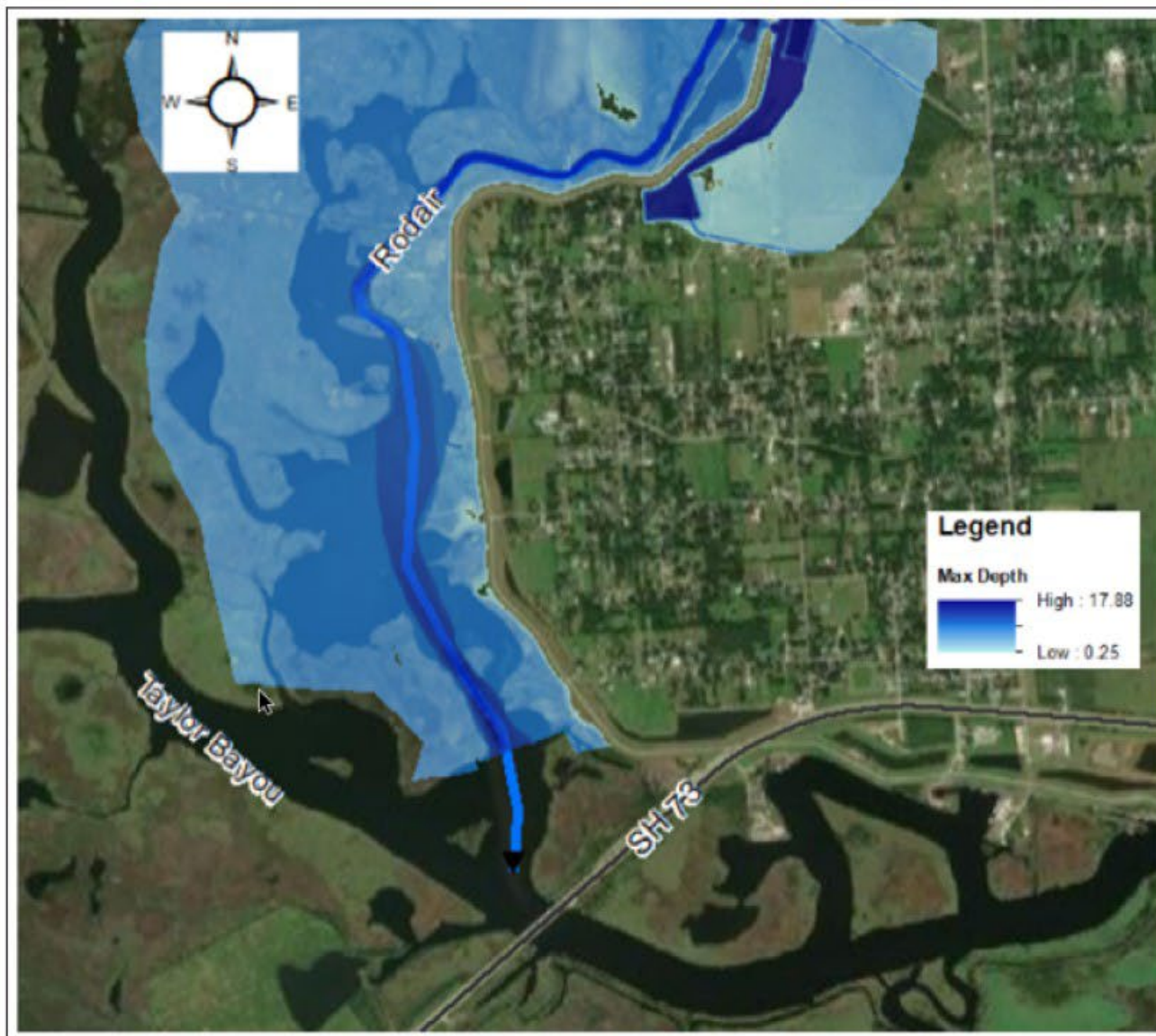
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INTERNAL DRAINAGE – PORT ARTHUR

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- Existing System
- Proposed Pump to Rhodair Gully
 - To decrease inundation at the gully
 - To maintain “existing conditions”





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INTERIOR DRAINAGE-ORANGE

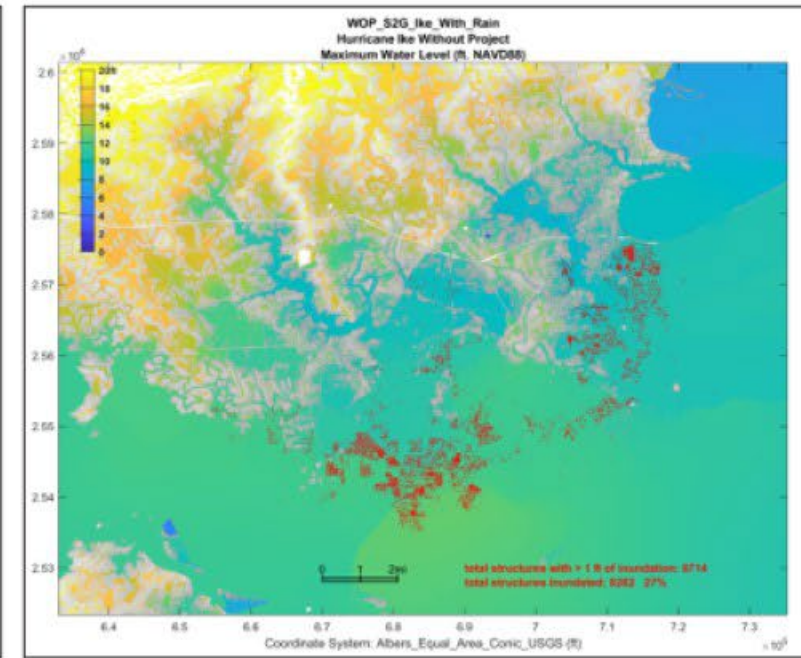
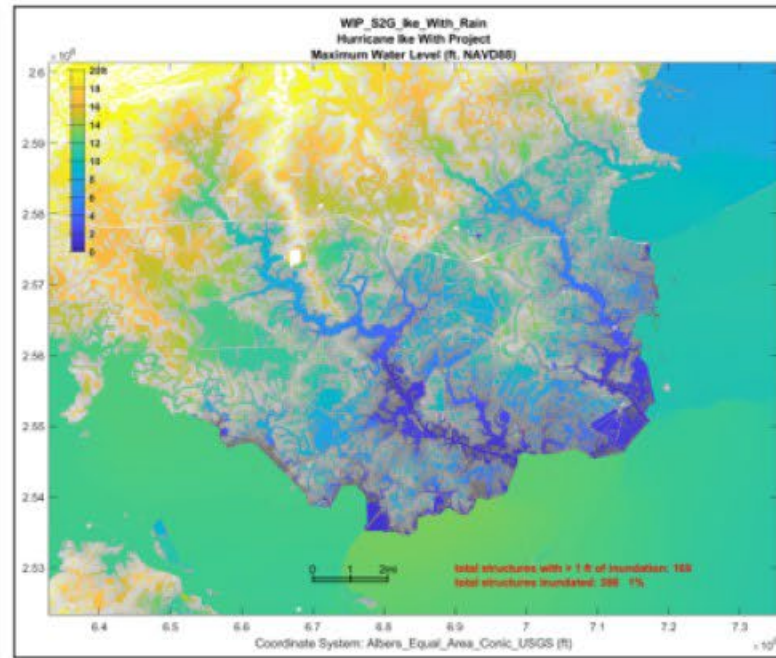
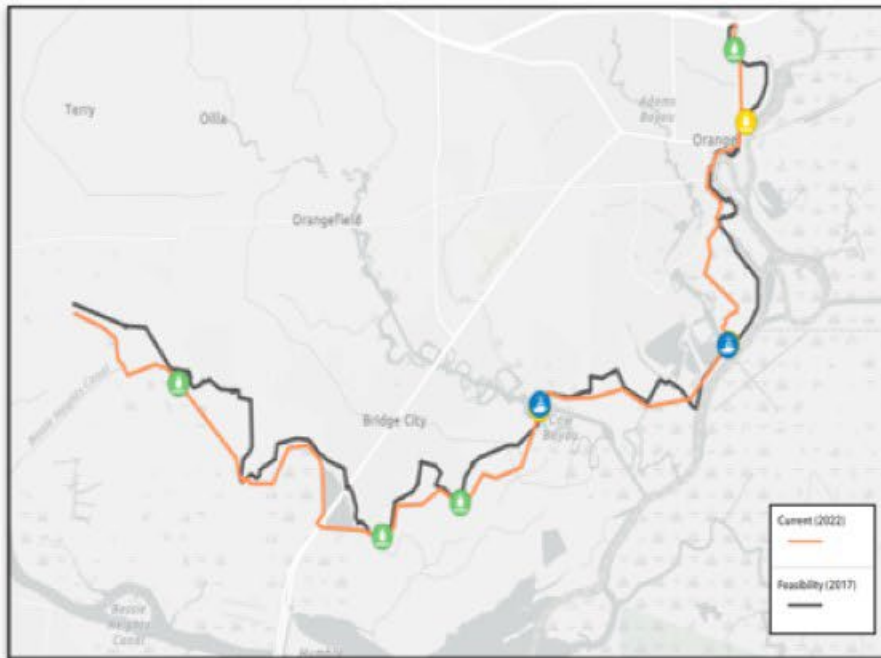


- Orange County Modeling split up Interior Drainage into Pumpsheds
- HEC RAS models took HMS rainfall Excess and routed via 2d Grids.
- Potential Flood Areas were mitigated using gravity drains and pump stations



INTERNAL DRAINAGE - ORANGE

- Systems continues to be modified to mitigate flood risk
- Optional methods of H&H analysis include Rain on Grid 2D HEC Model with entire interior Drainage area as one domain with applied coastal forcing.





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HURRICANE IKE IN HEC RAS

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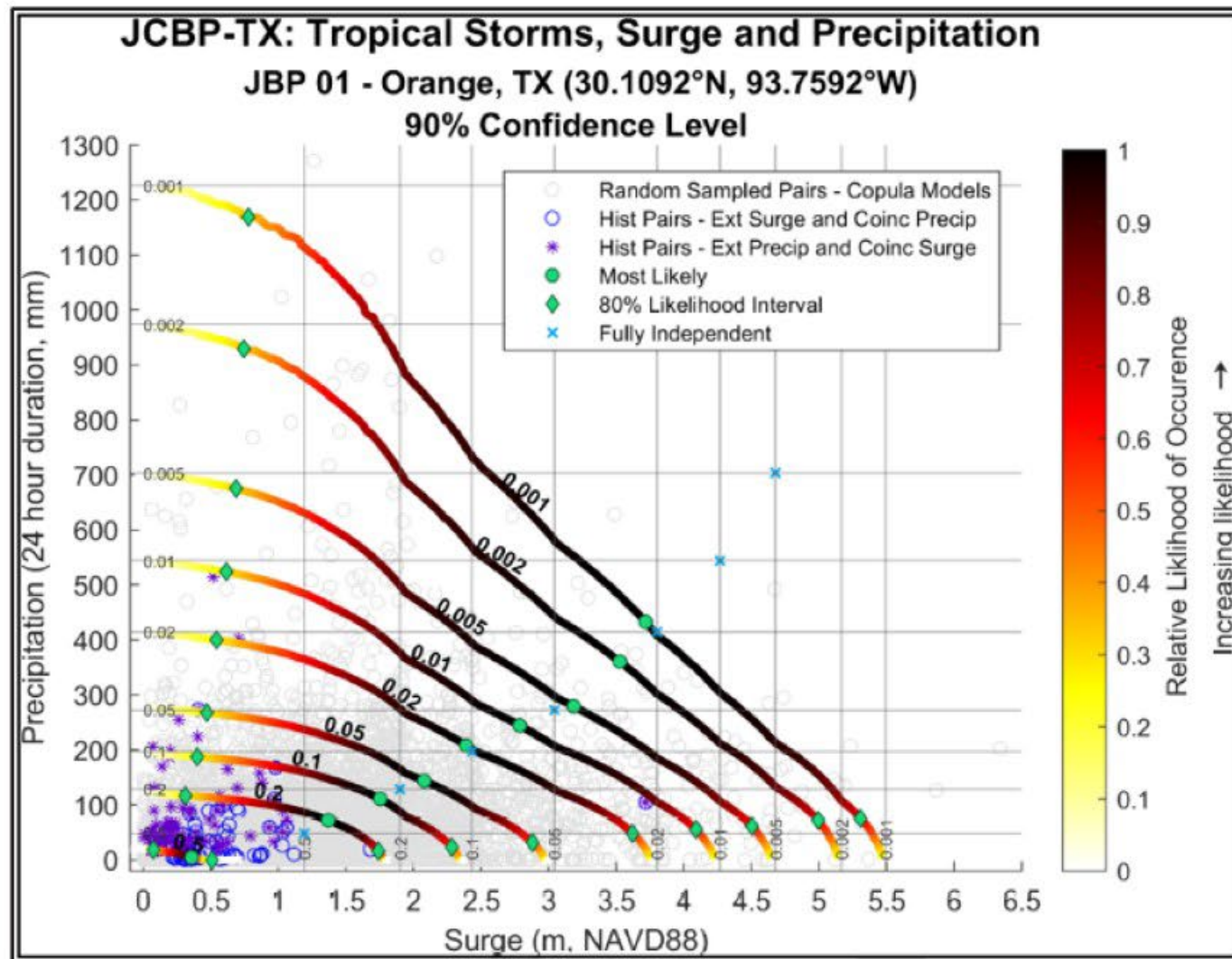


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JOINT PROBABILITY METHODS



- Determines the return interval of a select surge event and rain event occurring congruently in a synthetic storm
- Use to validate the necessary return intervals for pump station design





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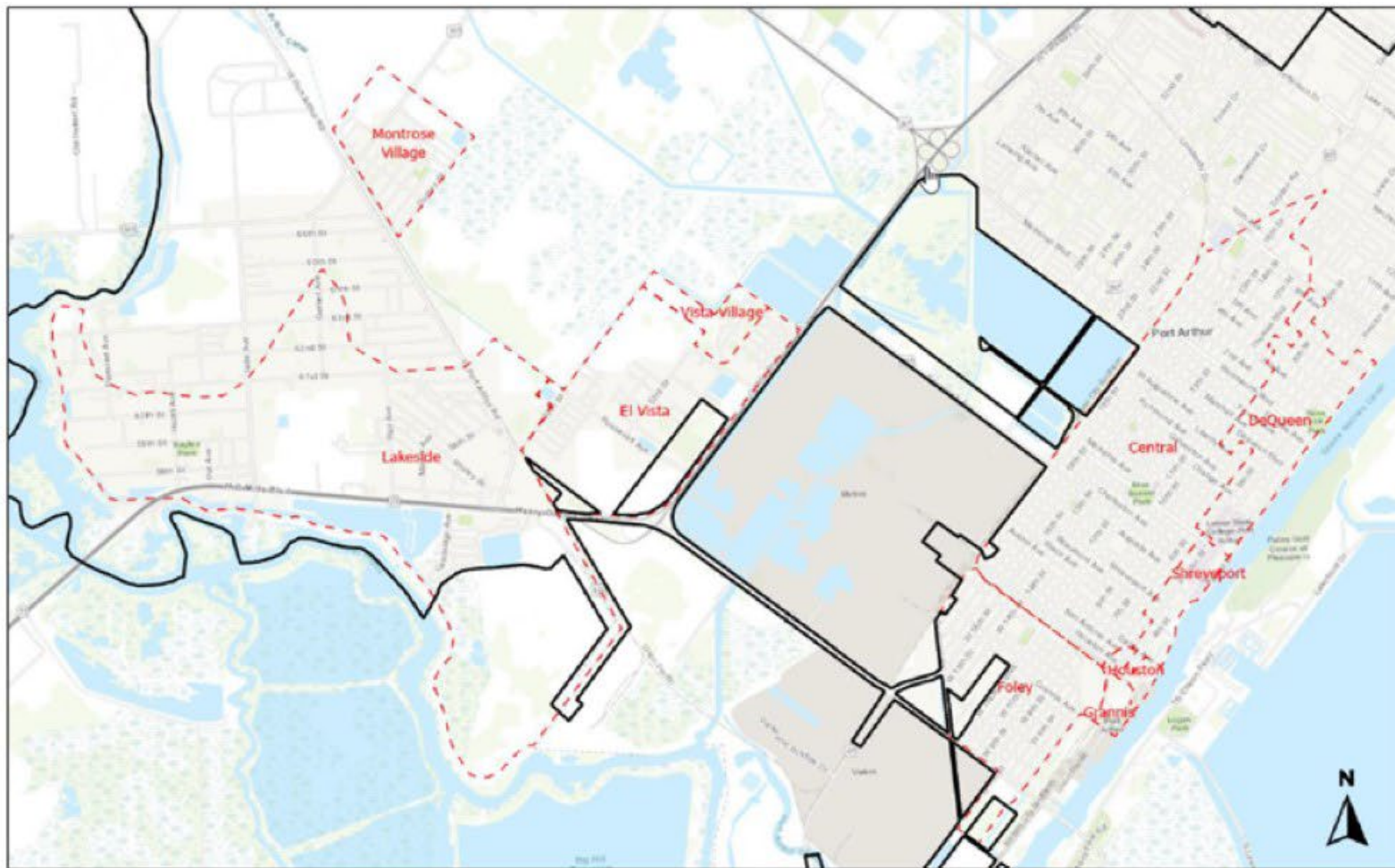
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WEST PORT ARTHUR FPMS

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- Focus to create a flood risk management plan based on available flood risk data.
- A Floodplain Management Plan includes important historical details, considerations, and an action plan to help manage flood risks.
- The analysis of at-risk homes focuses on eight neighborhoods within Port Arthur: Montrose; Vista Village, DeQueen, Lakeside, Central, Shreveport, El Vista, Foley, Houston, Grannis





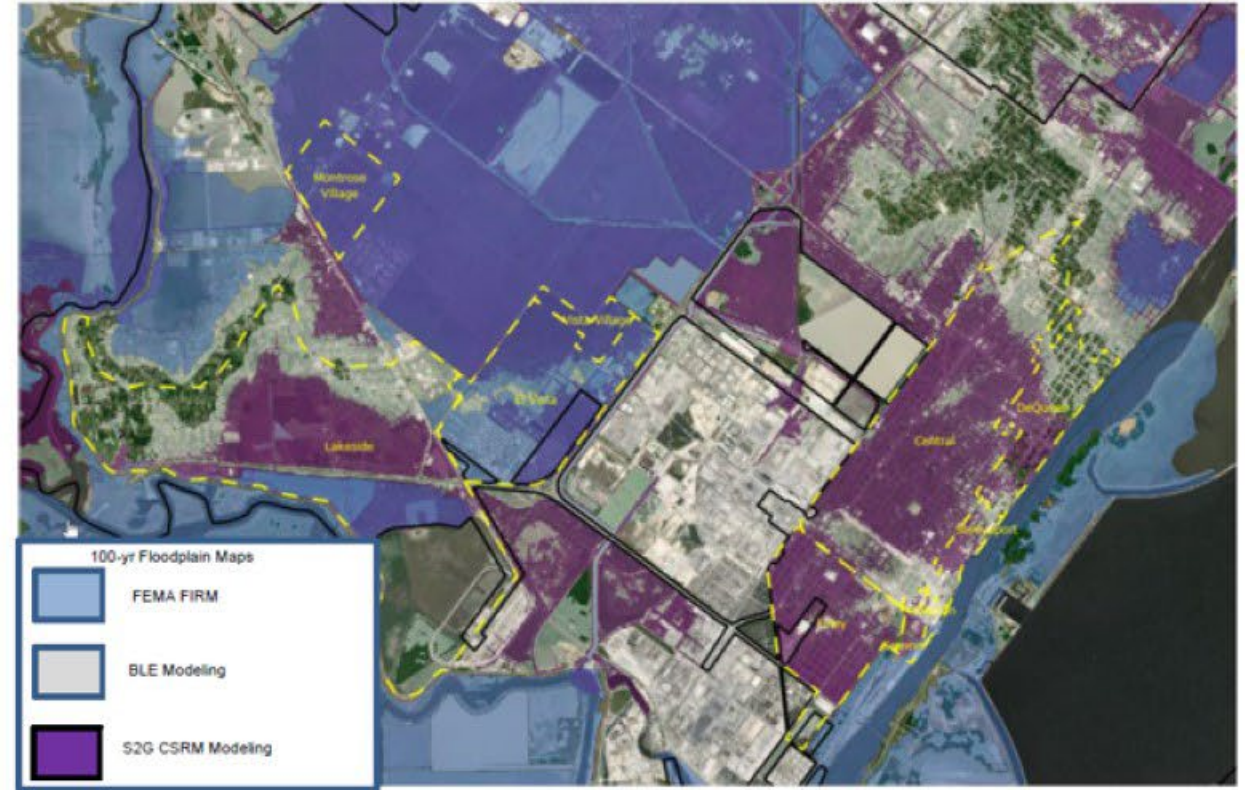
COMPARISON OF MODEL

Comparisons made for the BLE, Effective FEMA Models S2G Interior Drainage model for Port Arthur.

By benefit of

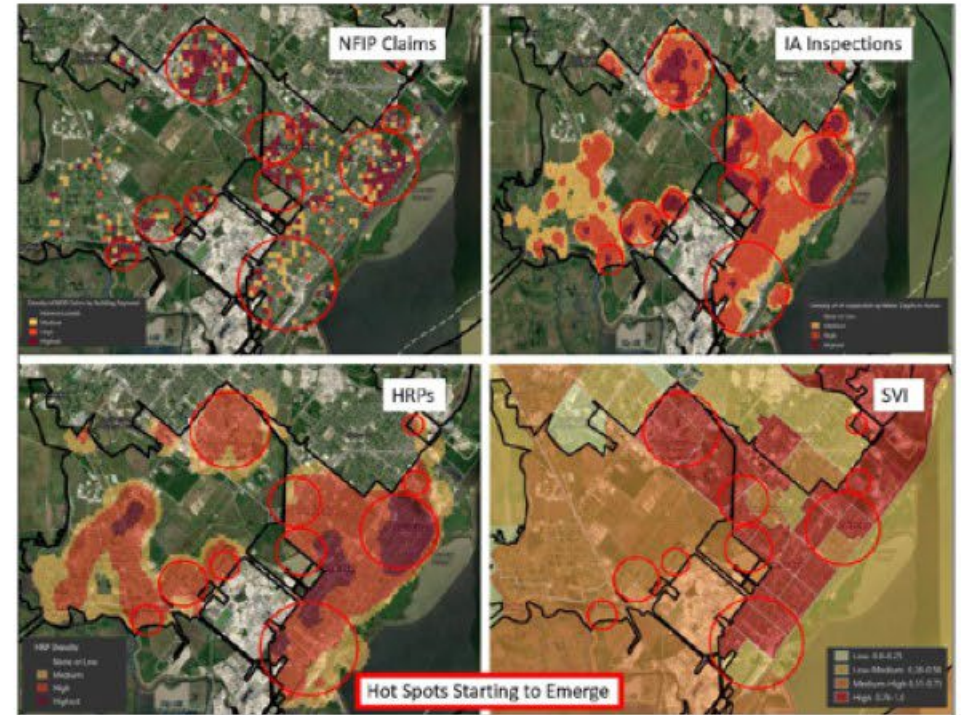
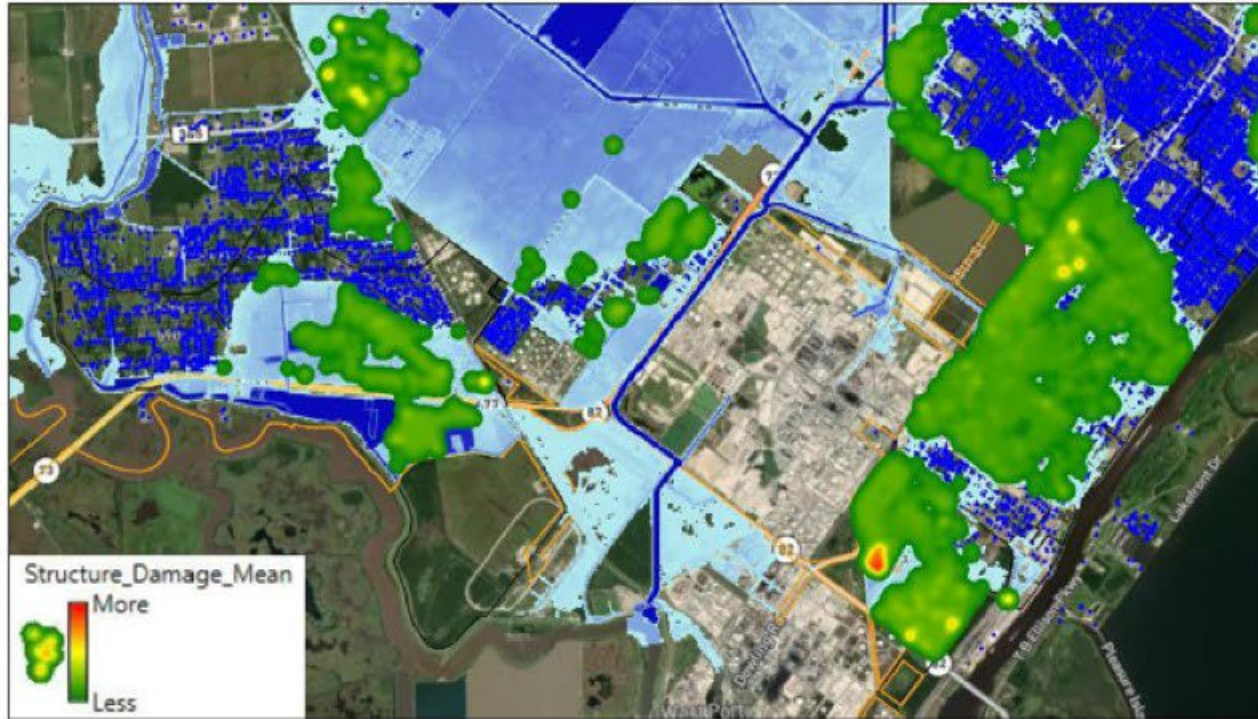
- Updated Terrain,
- Land Use,
- Precip,
- Survey,
- Bathymetric Data
- Pump Operation

S2G CSRMM modeling and mapping products best represent the current flood risks for the West Port Arthur communities.



EVALUATION

The source of the structure inventory used is the National Structure Inventory (NSI); the source of the depth grids used is S2G CSRM.



RECOMMENDED RISK MITIGATION MEASURES

Assessing:

Strategy 1: Modifying Human Susceptibility to Flood Hazards

Strategy 2: Modifying the Impact of Flooding on individuals and the community

Strategy 3: Preserving and Restoring the Environmental Quality of Floodplains

Strategy 4: Modifying floodwaters

Tools	Advisable	Further Evaluation Needed	Not Advisable
<u>Development Policies and Land Use Regulation</u> Limit the types of development that can occur in high flood risk areas	X		
<u>FEMA Flood Insurance Rate Maps (FIRMs)</u> Work with FEMA to have local FIRMs updated to ensure flood zones and special flood hazard areas are accurately captured	X		
<u>Flood Warning Systems</u> Measures used to communicate the anticipated timing and extend of a flood event so people can take steps to protect themselves and their property	X		
<u>Flood Forecasting Inundation Map</u> Shows inundation extents for a given river stage		X	
<u>Warning Dissemination: Flood Warning Lights and Sirens</u> Audible and visual warnings during a flood	X		
<u>Warning Dissemination: Multi-Media</u> Warnings that are communicated via methods such as social media, texting services, etc.	X		
<u>Emergency Operations Plans</u> Define the steps the community will take to prepare for, respond to, and mitigate against flood risk		X	
<u>Elevation of Buildings</u> Raising a structure to reduce the chance of flood damage to the structure			X
<u>Relocation of Buildings</u> Moving a building to higher ground so it is less likely to flood			X
<u>Wet Floodproofing</u> Measures that allow floodwaters to enter the structure without significantly damaging the structure or its contents			X
<u>Dry Floodproofing</u> Sealing the walls of a structure with water-proofing compounds, impermeable sheeting, or other materials and using closures for covering and sealing openings from floodwaters		X	
<u>Berms and Floodwalls for Buildings</u> Construction of compacted soil berms and/or installation of constructed walls to prevent flood waters from reaching structures			X
<u>Fill or Conversion of a Basement for Buildings</u> Filling in the existing basement or converting the basement space to an uninhabitable crawl space			X
<u>Acquisition of Buildings</u> Buying the property and removing the structure either by demolition or relocation		X	



TO PARTNER WITH THE CORPS



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