NOTE: We would like to record this meeting and make it available to others that were not able to attend or if you would like to review its content later. Please raise concerns or objections.

Southeast Texas Hurricane Evacuation Study

Evacuation Zone Workshop for Galveston, Harris, Chambers, and Liberty Counties

March 18, 2024

NATIONAL HURRICANE PROGRAM

Texas A&M Transportation Institute

HAZARD REDUCTION & RECOVERY CENTER

TEXAS DIVISION OF EMERGENCY MANAGEMENT

TDEM

THE TEXAS A&M UNIVERSITY SYSTEM

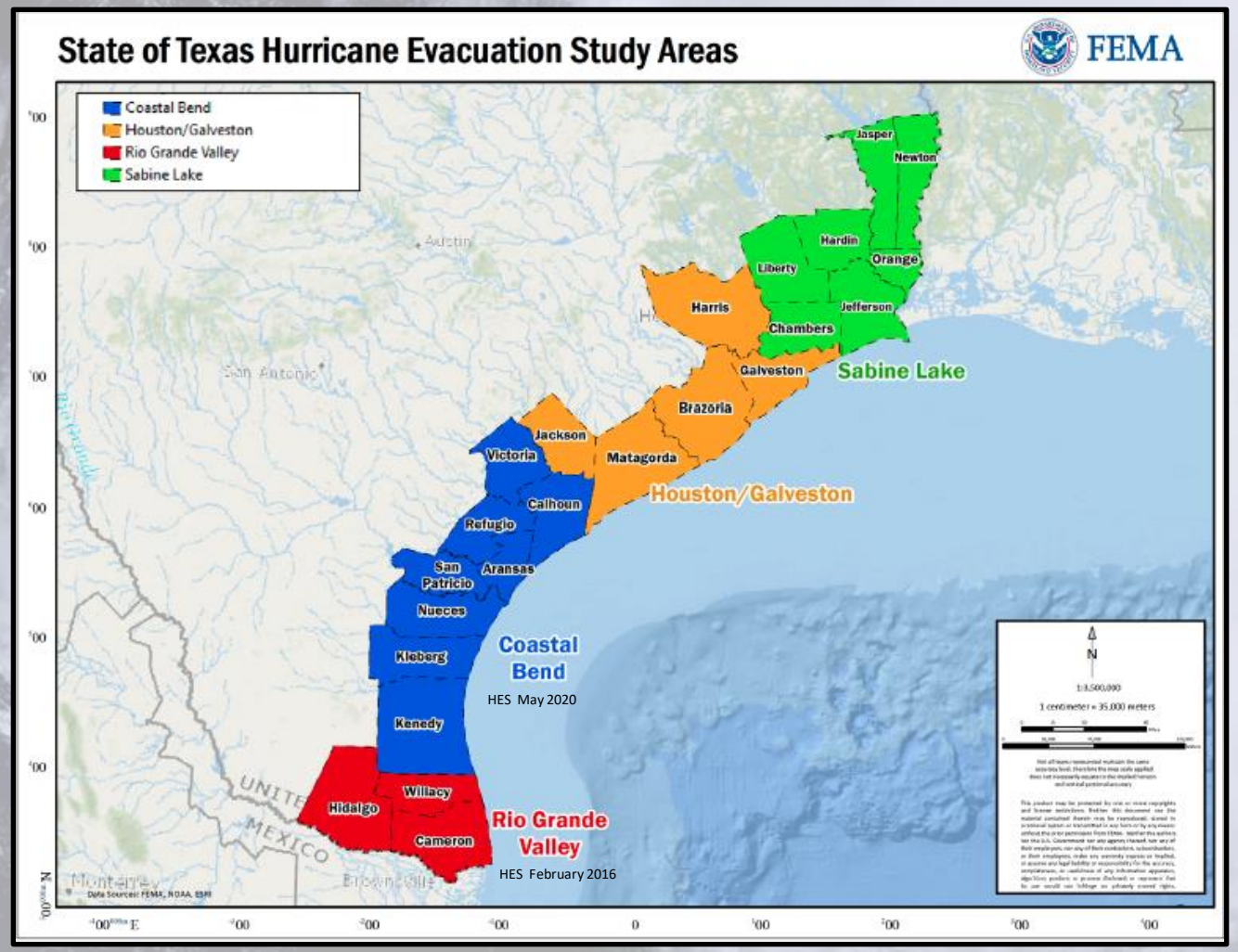
Welcome and Introductions:

- US Army Corps of Engineers: Galveston District
  - Kyle Donlevy
- FEMA, Region 6
  - Arianne Thomas
- Texas Department of Emergency Management
  - Blake White & Carman Apple
- Texas A&M Hazard Reduction and Recovery Center & Texas A&M Transportation Institute
  - Walt Peacock, David Bierling, Doug Wunneburger, Darrell Borchardt, & Alexander Abuabara
- Local government and stakeholder
  - **Please put your name, organization, county, and contact information on the attendance sheet.**

AGENDA: Southeast Texas HES Evacuation Zone Workshop for Harris, Galveston, Chambers and Liberty Counties

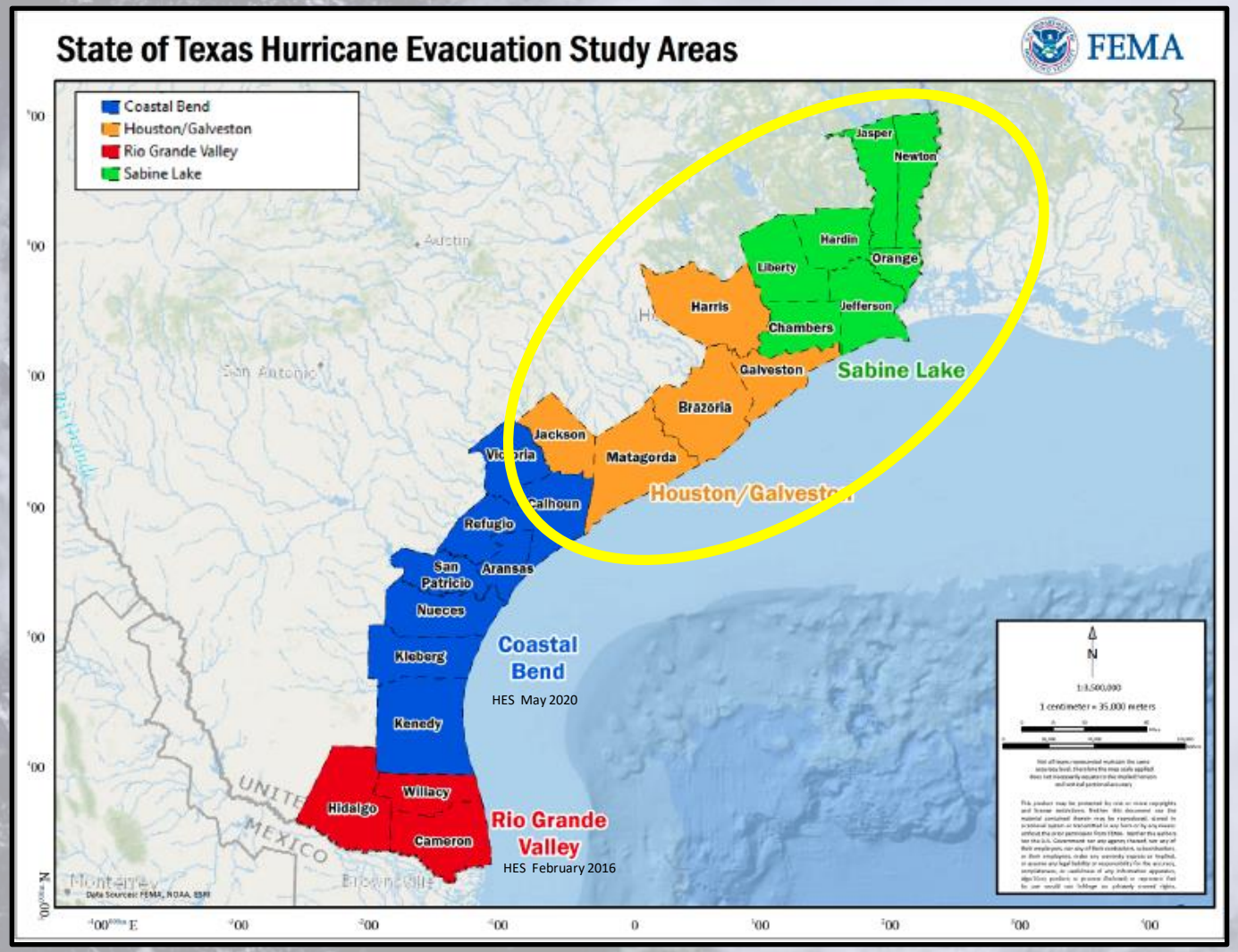
1. Introductions
   - USACE, FEMA, TDEM, TAMU
   - Participants
2. Overview of the Hurricane Evacuation Study (HES) Process
3. Goals for the Day
   - General agreement on guidelines and naming conventions
   - Getting as close as can to a set of evacuation/risk zones
   - Some degree of consistency among county zones.
4. Review workshop Materials
   - HES planning Atlas
   - Maps and County Packets
5. Lunch (~11:30am-1:00pm)
6. Working groups
   - Meet in County working Groups
     - Elect spokesperson/scribe
     - Review data, maps, make recommendations
   - Seek consistency with adjacent counties
7. working group reports
   - Summary of findings and zone changes/modifications or development
   - Issues yet to be resolved
   - Plans for moving foward

Overview of HES Re-Study for Southeast Texas



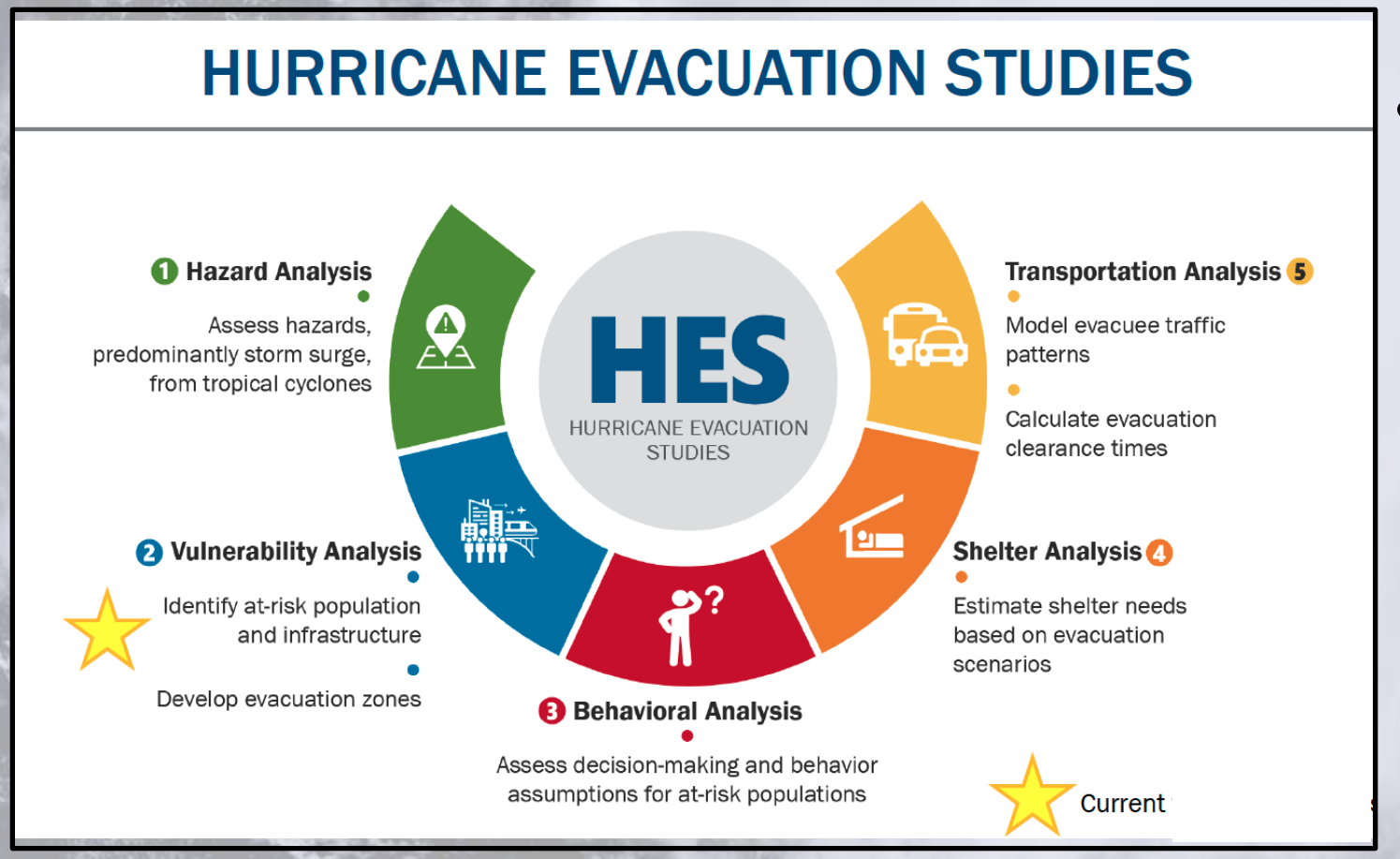
- Texas traditionally had 4 HES areas
  - Sabine Lake, Houston/Galveston, Coastal Bend, and Rio Grande Valley
- Coastal Bend HES 2020
- Rio Grande Valley HES 2016
- Lake Sabine: HES 2011
- Houston/Galveston HES 2004
  - HGAC 2011 Zip-Code based evac zones and transportation analysis

Overview of HES Re-Study for Southeast Texas



- The NHP has combine the Houston/Galveston and Sabine Lake study areas into the **Southeast Texas HES – Re-study area**.
  - 12 highly diverse counties:
    - Population Size: 4.8 million to 12,052
    - Sq. Miles: 1,707 to 334
    - Density: 2,772 to 18.1 per mile
    - Socio-economic, demographic, economic characteristic
    - Extent and nature of hurricane hazard exposure
    - Established Hurricane risk/evacuation zones

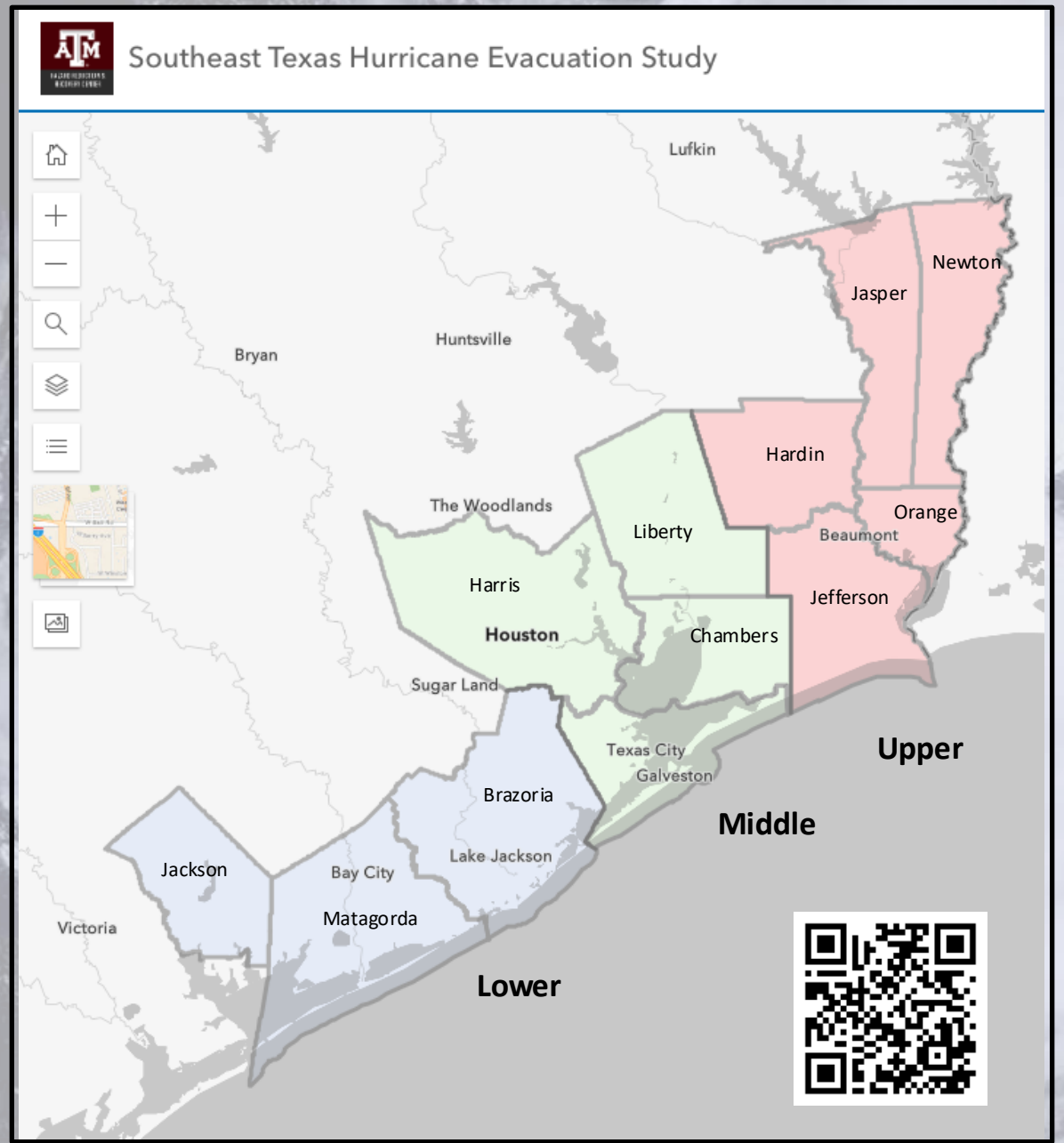
Overview of HES Re-Study for Southeast Texas



- Steps in HES process:
  1. Hazard Analysis: Hazard data for surge and wind has been generated, report forthcoming
  2. Vulnerability Analysis: The focus of this phase
  3. Behavioral Analysis
  4. Shelter Analysis
  5. Transportation Analysis

TBA: Awaiting final funding. Hopefully will begin in late summer early fall.

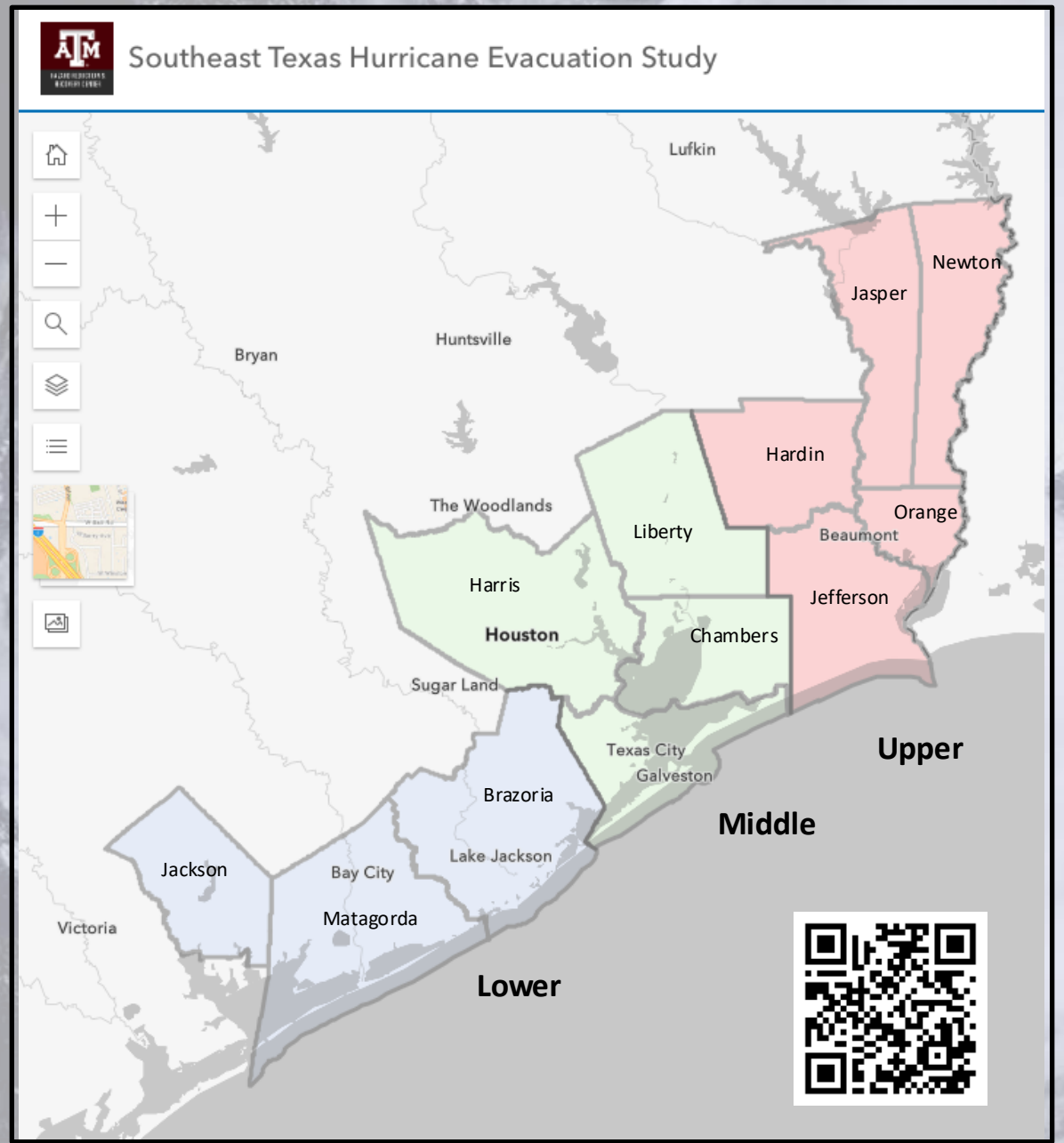
Overview of Vulnerability Analysis Phase



Two key components:

1. Evacuation zone assessment, modification, and development
   - Driven by new hazard analysis, updated population and other data, and existing evacuation zones.
   - To facilitate this process and enhance meeting participation we will identify three planning zones
     - "Working" Website: https://texasatlas.arch.tamu.edu/hes
     - Project front page: https://texasatlas.arch.tamu.edu/
2. Vulnerability Analysis
   - Predicated on modified evacuation zones and hazard data.

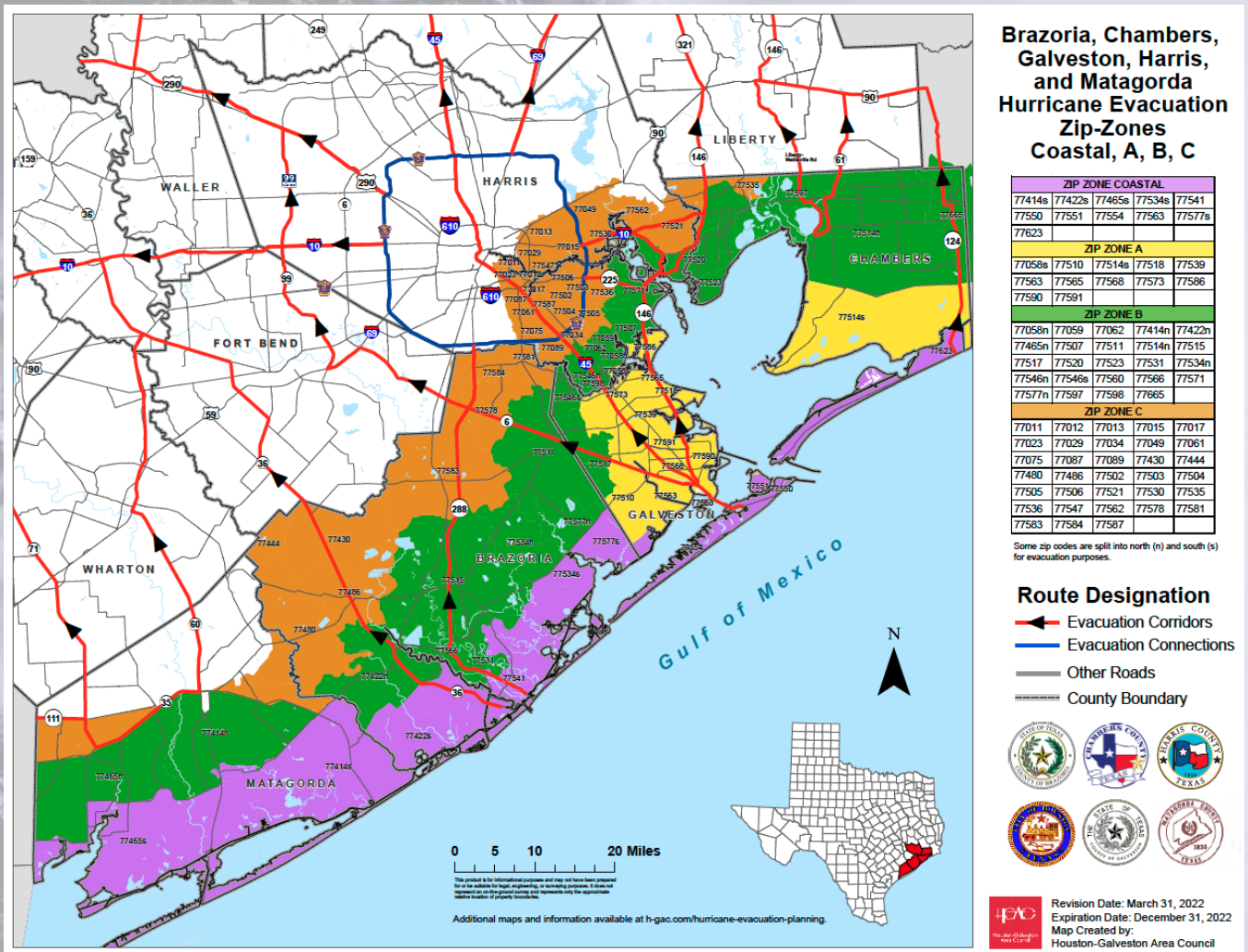
The Purpose of this workshop…



… is to assess, modify, or develop hurricane evacuation/risk zones for 2025

1. Our focus is on the four counties in the middle planning area:
   - 4 highly diverse counties:
     - Population Size (est. July 1, 2022)
       - Harris: 4.8 million, Galveston: 357K, Liberty: 109K, and Chambers: 51.3K
     - Density (per sq. mile)
       - Harris: 2,272; Galveston: 924.6; Liberty: 79.1; and Chambers: 78.
     - Variations in the extent and nature of hurricane hazard exposure
     - Variations in evacuation flow if households leave their county
     - Established Hurricane risk/evacuation zones

Current Situation



Brazoria, Chambers, Galveston, Harris, and Matagorda Hurricane Evacuation Zip-Zones Coastal, A, B, C

ZIP ZONE COASTAL				
77414s	77422s	77465s	77534s	77541
77550	77551	77554	77563	77577s
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Some zip codes are split into north (n) and south (s) for evacuation purposes.

Route Designation

- Evacuation Corridors
- Evacuation Connections
- Other Roads
- County Boundary

Revision Date: March 31, 2022
Expiration Date: December 31, 2022
Map Created by:
Houston-Galveston Area Council

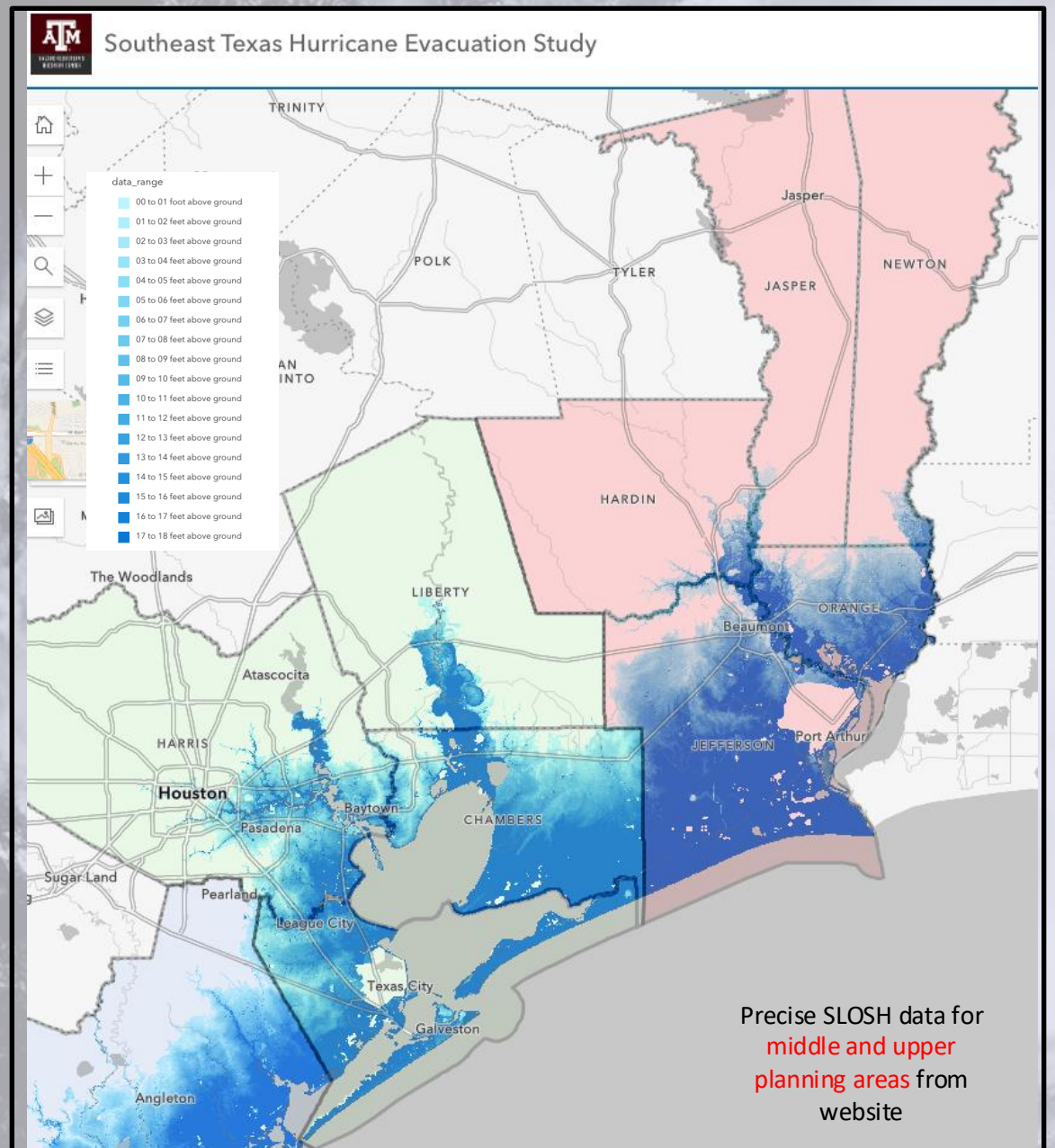
Galveston, Harris, and Chambers Counties have existing Hurricane Evacuation Zones:

- Based on 2011 HGAC Study
- Employs zip-code zones but at times modified with zones cut into sections employing roads and other landmarks
- Appears that it has been "updated" as some zip-codes boundaries changed or new zips added.
- Evacuation zone naming convention: Coastal, Zone A, Zone B, and Zone C
  - In general, each successive zone from Coastal to C has declining risk
    - But this pattern does not hold in some areas where phased evacuation is an important issue.

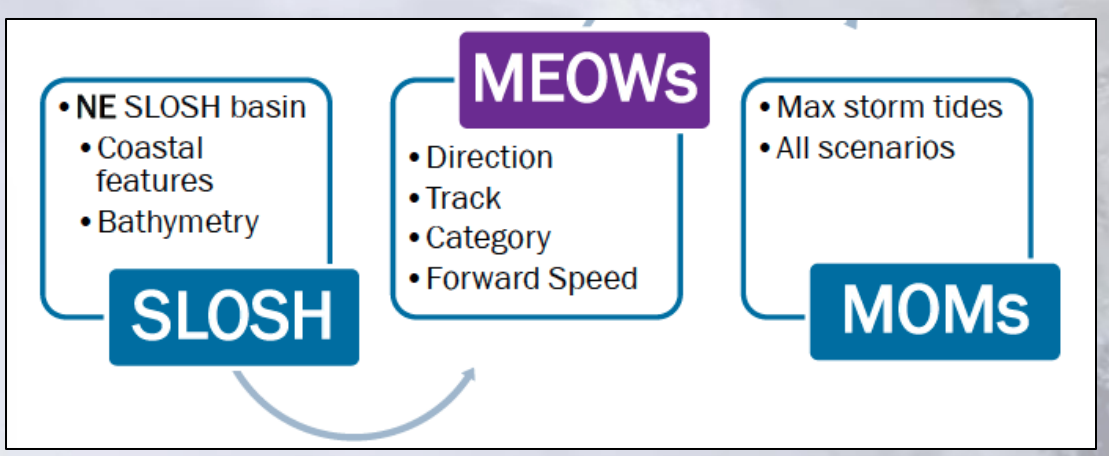
Liberty County does not have defined evacuation/risk zones.

Hazard Data: Storm Surge Modeling

Produced by NOAA and USACE



Precise SLOSH data for middle and upper planning areas from website

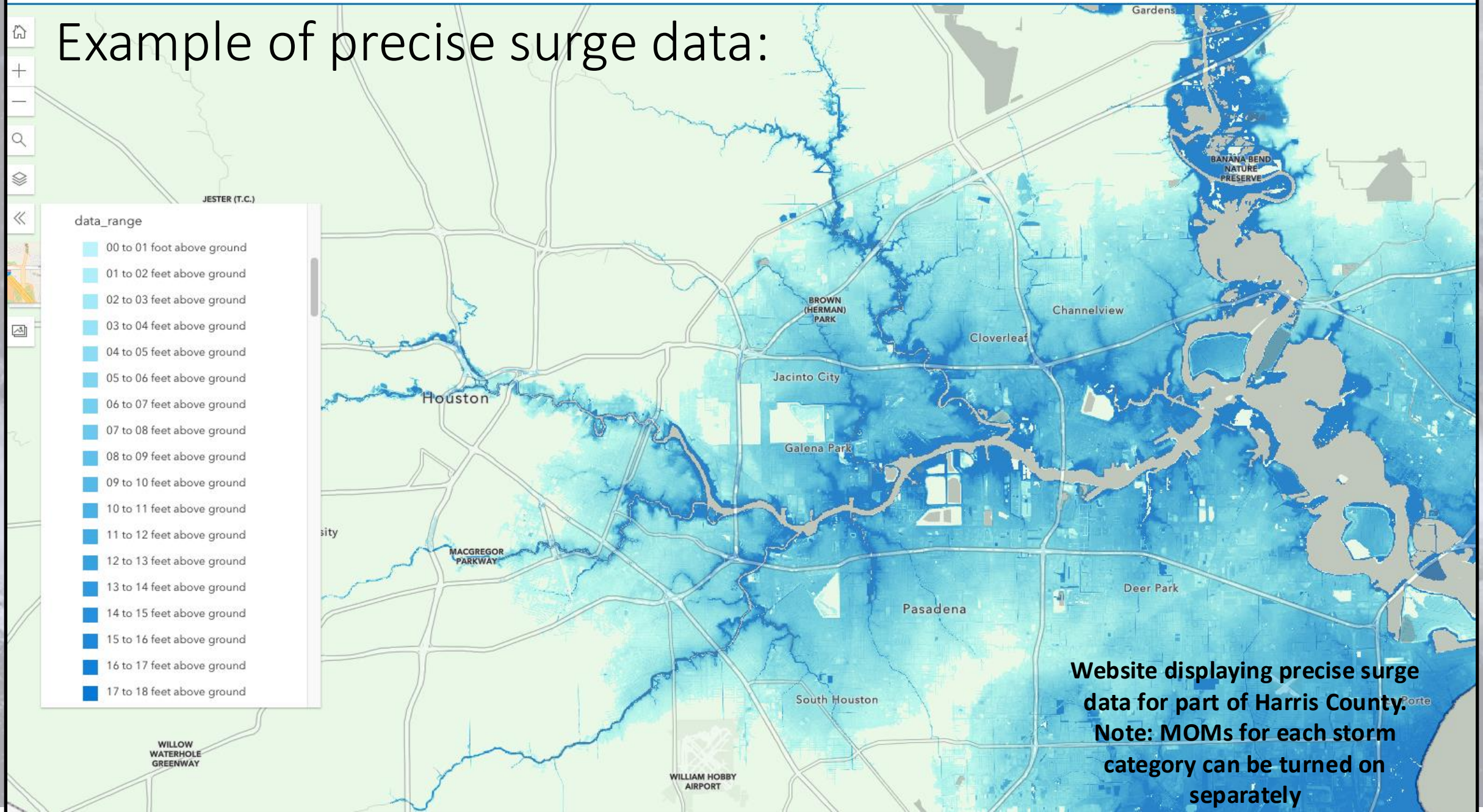


SLOSH = Sea, Lake, and Overland Surges from Hurricanes
MEOW = Maximum Envelope of Water
MOM = Maximum of Maximums

Data are generated from multiple SLOSH model runs

- Total of 216 MEOWs
  - 9 directions WNW, 6 intensities & 4 forward speeds
  - Assuming High-tide
- Total of 6 MOMs generated
  - Category 1 – Category 5 storms on website
  - Note MEOWs are are classified according to predominant storm categories generating similar surge levels, not necessarily specific wind speeds.

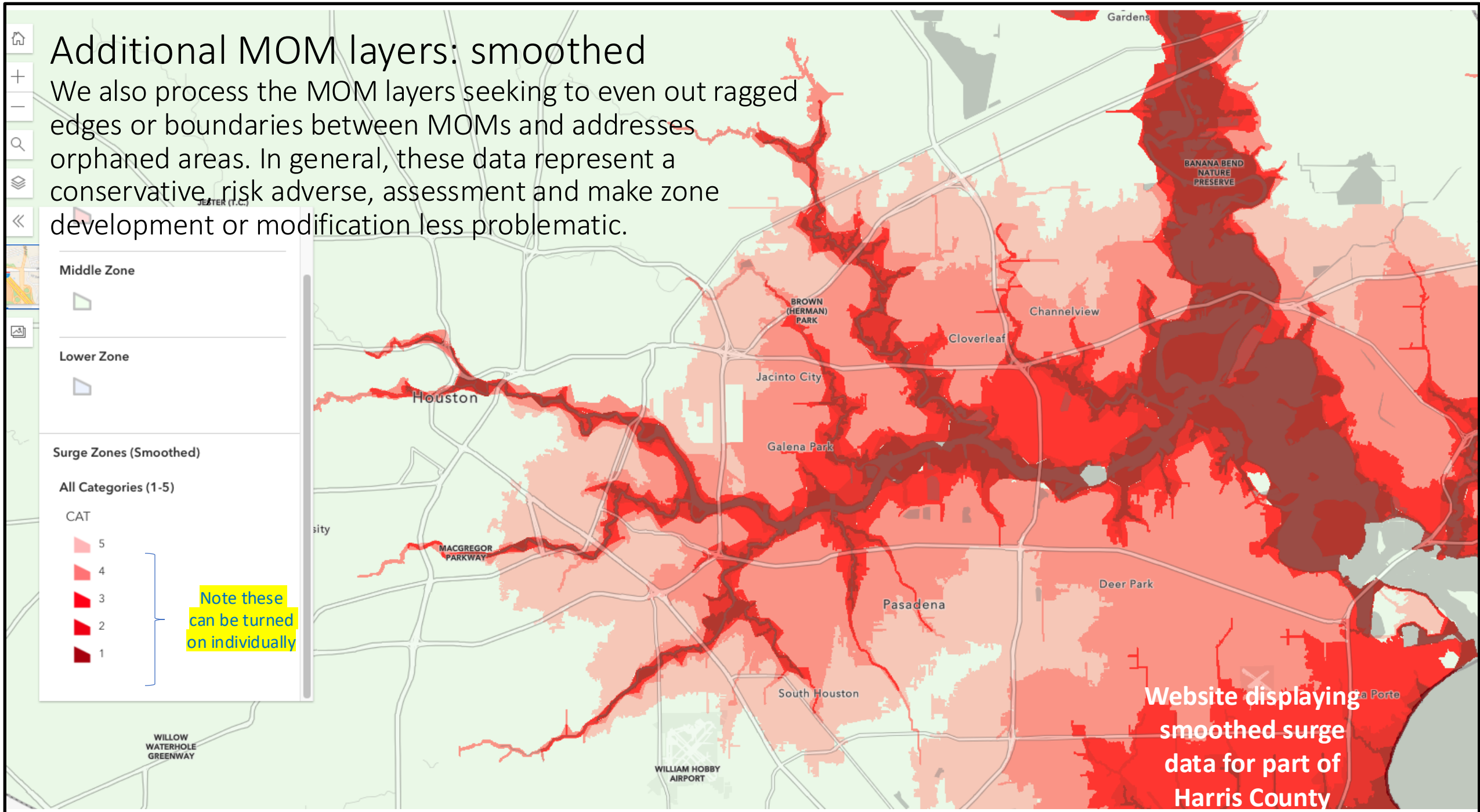
Example of precise surge data:



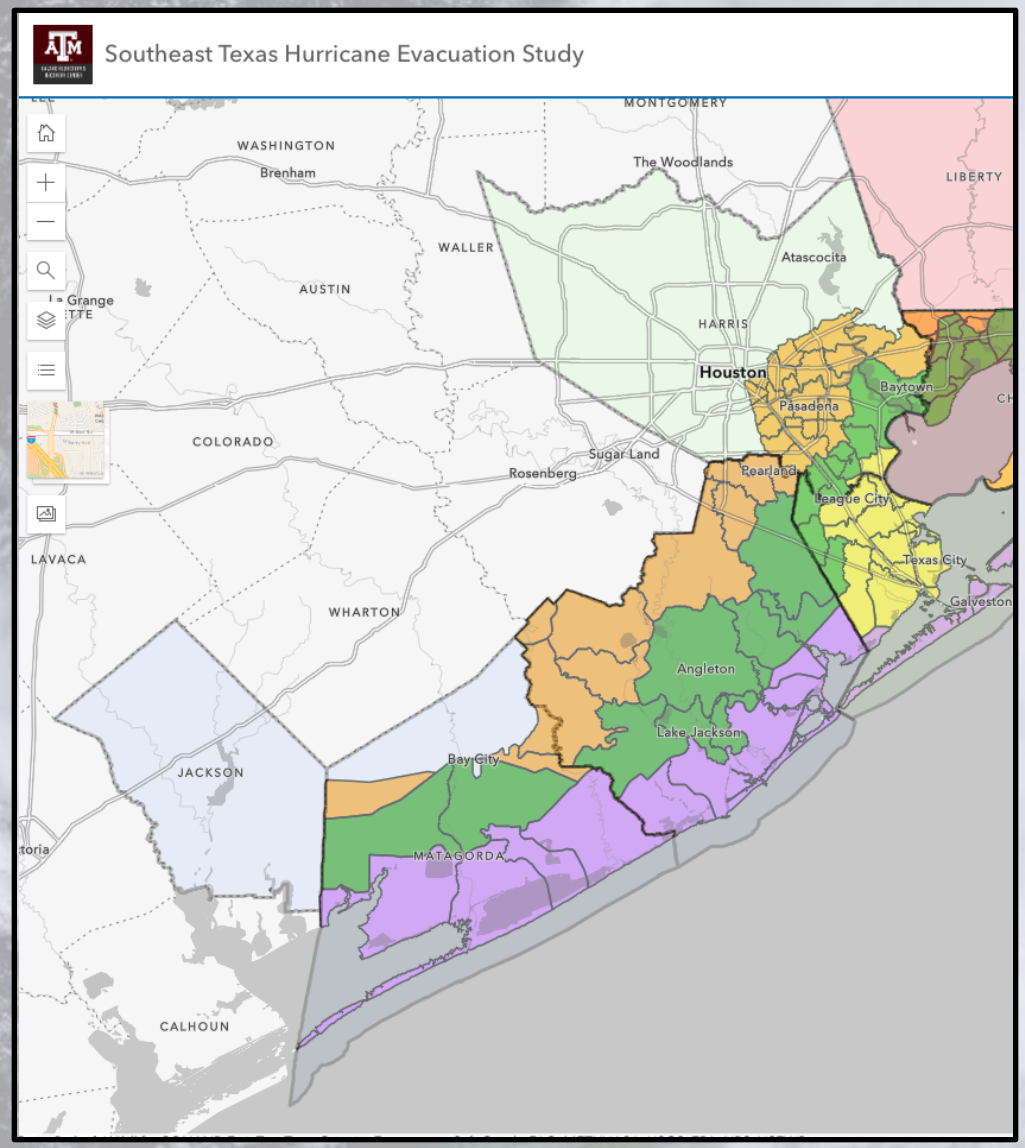
Website displaying precise surge data for part of Harris County. Note: MOMs for each storm category can be turned on separately

Additional MOM layers: smoothed

We also process the MOM layers seeking to even out ragged edges or boundaries between MOMs and addresses orphaned areas. In general, these data represent a conservative, risk adverse, assessment and make zone development or modification less problematic.

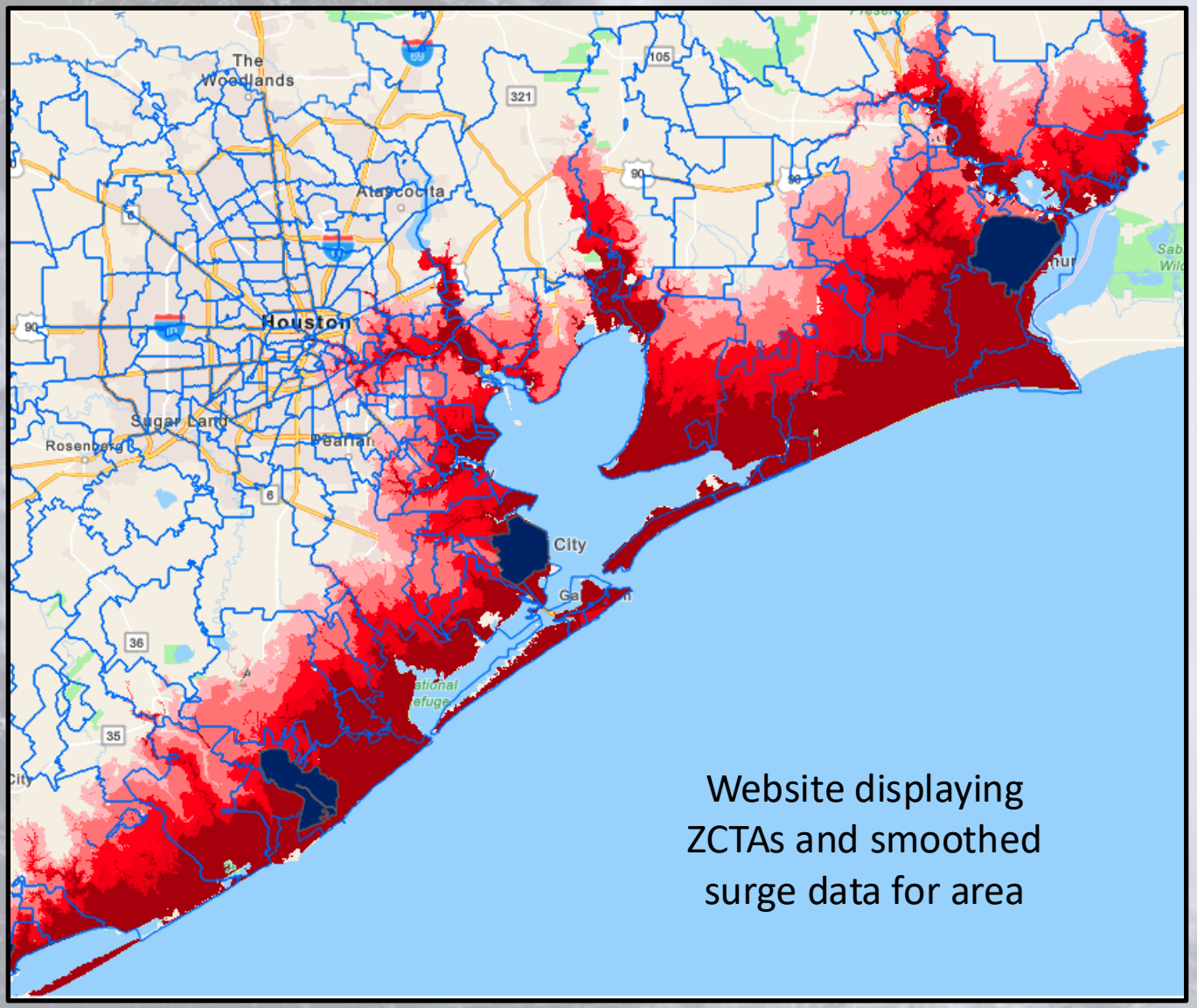


Additional data:



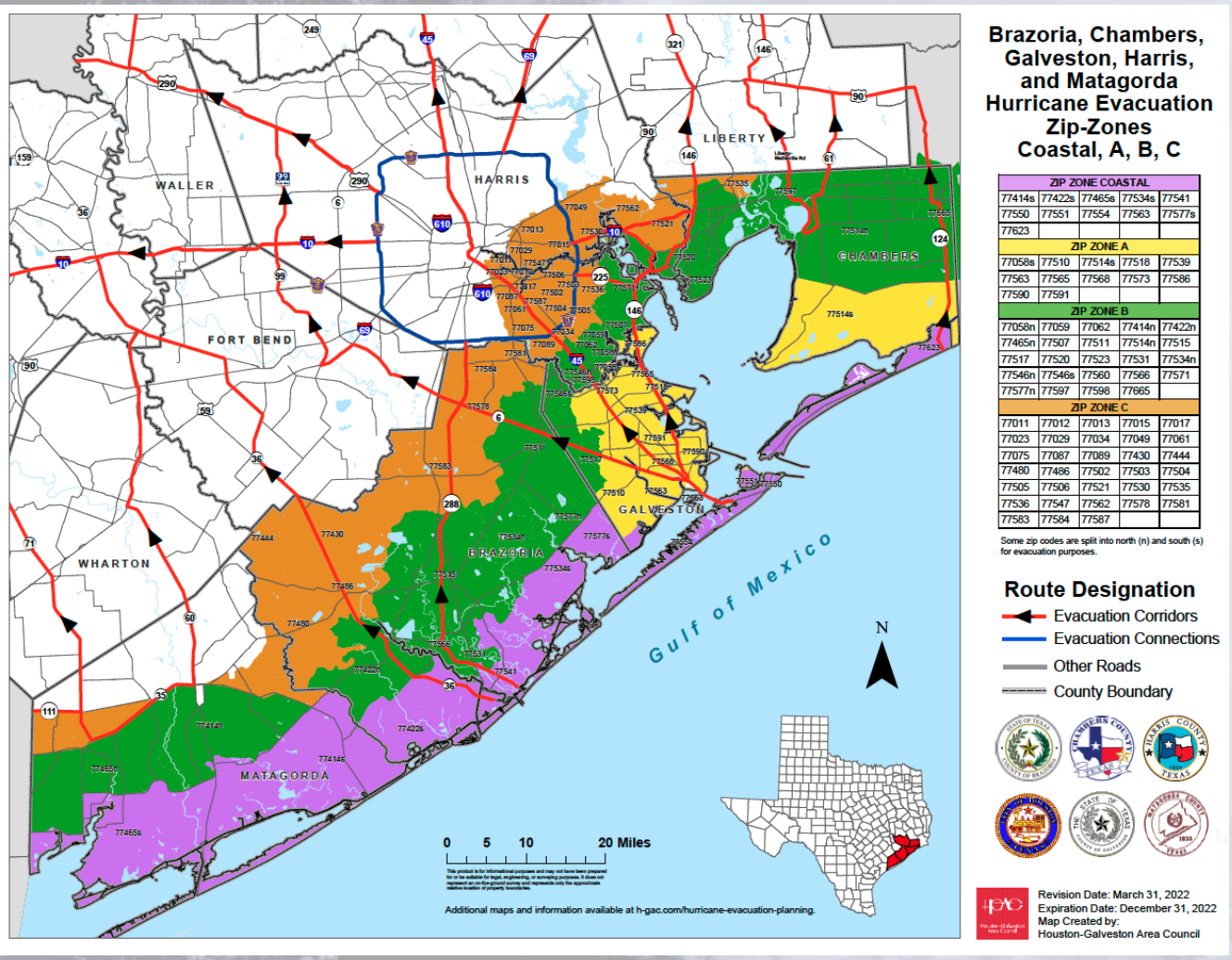
- Additional Hazard Data:
  - FEMA Flood Zones
  - Levy areas
- Current Evac zones and zip-code areas employed
  - Boundaries
  - Color coded areas
- Latest Zip-Code Tabulation Areas
  - Both old and new can be compared in terms of individuals, households, and vehicles

Additional data:



- Population and infrastructure data
  - Population:
    - Landscan 90-meter (2021)
    - Census's LEHD Origin-Destination Employment Statistical (LODES) data on job and residential locations by Census Blocks (2022)
  - Building foot-print data
  - Transportation road network data
  - Zip code tabulation areas (ZCTAs)
  - Other data:
    - Critical facilities
      - Mass shelters and/or evacuation centers
      - vulnerable populations
  - We will review these and other data shortly.

Evacuation Zone assessment and modification



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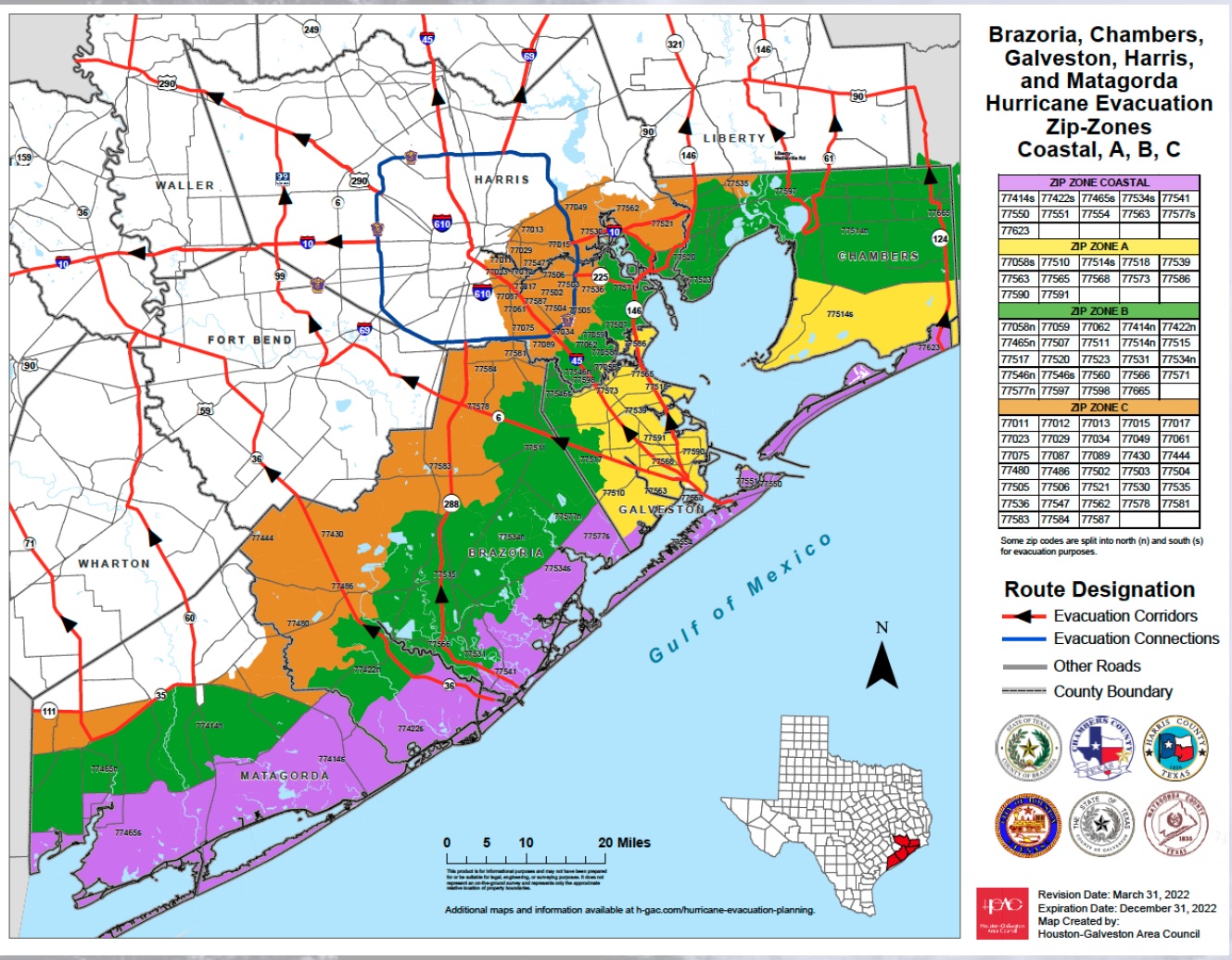
Guiding principles in zone development and/or modification:

1. **Life safety –** getting the public out of potential harms way
2. **Storm Surge hazard** is the key hazard driving evacuation/risk zone development & modifications
3. **Facilitating risk/warning communication** – zones should be easily identifiable, communicable, and interpretable by public
4. **Facilitating emergency management decision making** – getting people out of harms way but in manner facilitating transportation flow
5. **Avoiding zone identification based on storm categories** – variations in storms and conditions can demand modifications in evacuation calls
6. **Regional Consistency:** naming and, where possible, adjacency in zones.

Evacuation Zone assessment and modification



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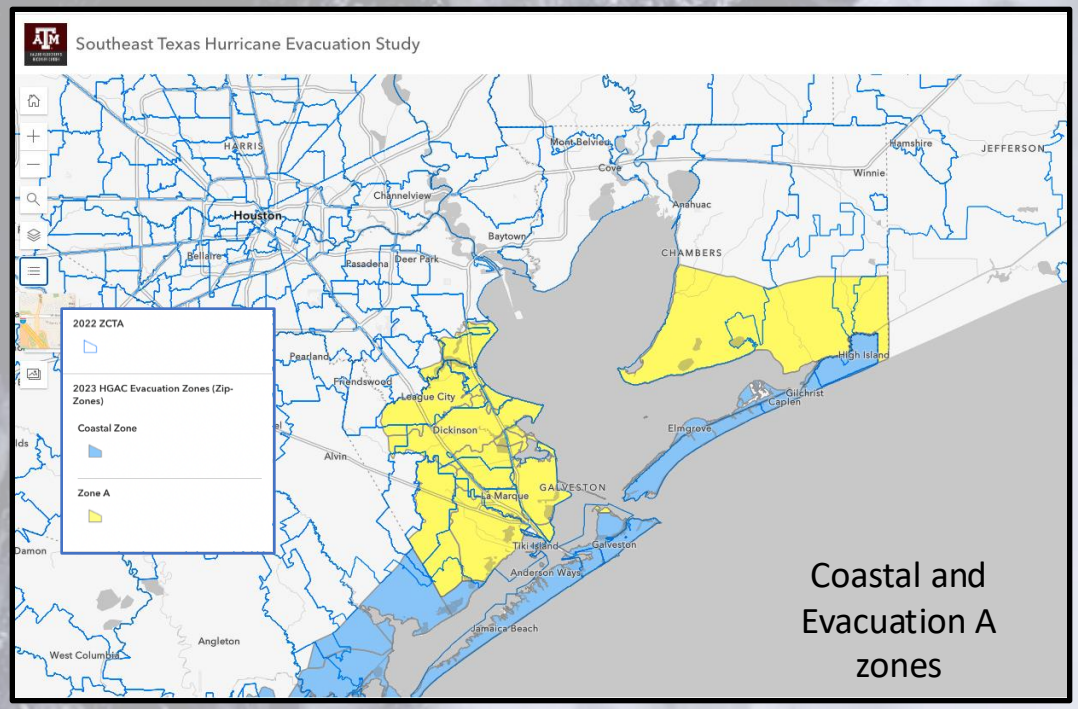
Evacuation Zone Naming Convention:

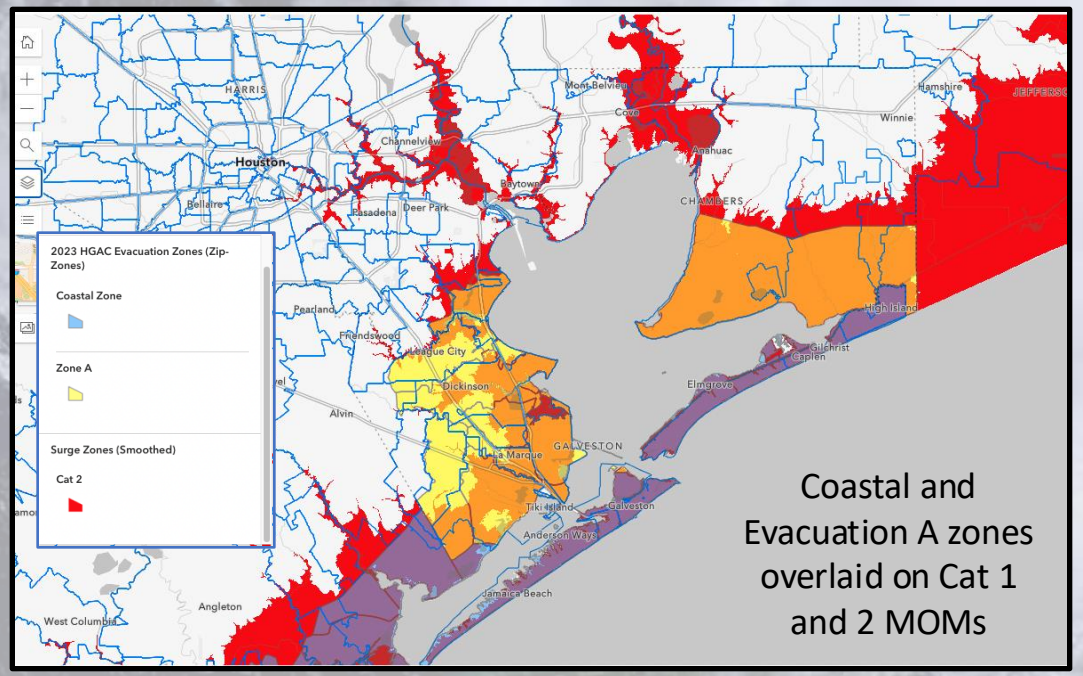
Current:

- Coastal and Zones A-C
- Generally, successive zones reflect declining surge risk probability
- But evacuation timing/phasing may be important to consider
- Not all counties must have each zone

Review of Workshop Materials



Coastal and Evacuation A zones



Coastal and Evacuation A zones overlaid on Cat 1 and 2 MOMs

Example of Working Group Activities:

1. Elect spokesperson/reporter
2. Review map packets, problems/issues highlighted, and proposed changes
3. Work with maps and Atlas data to develop a better understanding of the issues
4. Propose, consider, and reconsider problem areas, other issues, and produce solutions.
5. Develop consensus where possible
   - Strive for consensus within work groups
   - Write up/record changes, modifications, solutions
   - Identify problems and issues that will need additional data or unique solutions
   - Meet with adjacent county groups to assess consistency problems or issues – seek solutions.
6. Develop a county report to entire group
   - make sure that HES team member has clear understanding (preferably written and recorded on printed maps) of changes, modifications, problems to be addressed, and steps forward.

Contacts

- USACE Galveston District
  - **Kyle Donlevy:** kyle.a.donlevy@usace.army.mil
    - Overall, HES Re-Study Manager and coordination
- FEMA Region 6
  - **Arianne Thomas:** arianne.deruise@fema.dhs.gov
    - HES input and technical support
- Texas Department of Emergency Management
  - **Blake White:** blake.white@tdem.texas.gov
  - **Carman Apple:** carman.apple@tdem.texas.gov
    - HES oversight, input and technical support, coordination with county, local, & regional government, agencies, and stakeholders.

- Texas A&M HRRC and TTI
  - Conducting vulnerability, behavioral, shelter, and transportation analysis and providing technical assistance.
    - **Walt Peacock:** peacock@tamu.edu
      - Overall team management, coordination, and data analysis
    - **David Bierling:** d-bierling@tti.tamu.edu
      - Overall team management, coordination, and data analysis
    - **Doug Wunneberger:** dwunneburger@arch.tamu.edu
      - GIS and data development and analysis, website development
    - **Darrell Borchardt:** d-borchardt@tti.tamu.edu
      - Transportation scenario development and analysis
    - **Alexander Abuabara:** aabuabara@arch.tamu.edu
      - GIS & data development and analysis and website development and maintenance