Southeast Texas Hurricane Evacuation Study

Project Update on Behavioral and Transportation Analyses

December 8, 2025

Project website:

Atlas website:

NATIONAL HURRICANE PROGRAM

Texas A&M Transportation Institute

HAZARD REDUCTION & RECOVERY CENTER

TEXAS DIVISION OF EMERGENCY MANAGEMENT

TDEM

THE TEXAS A&M UNIVERSITY SYSTEM

Team Members:

- US Army Corps of Engineers
  - Kyle Donlevy, Gerald Gaines, Thomas Laczo, and Francis Bui
- FEMA, Region 6
  - Arianne Thomas
- Texas Division of Emergency Management, Regions 3 & 4
  - Blake White & Michael Bradberry
- Texas A&M Hazard Reduction and Recovery Center & Texas A&M Transportation Institute
  - Walt Peacock, David Bierling, Doug Wunneburger, Darrell Borchardt, & Alexander Abuabara

Outline of Presentation

- Introduction and welcome (Kyle)
  - Please sign in via the chat (name, organization, and email)
- Evacuation and Sheltering Behavioral Analysis (David)
- Review of Evacuation Scenarios (Walt)
- Discussion of Transportation Analysis Process (Darrell)
- Summary of Clearance Times (Darrell)
- Evacuation Clearance Animations and Clearance curves (Doug and Walt)
- Questions (Kyle and Walt)

Evacuation and Sheltering Behavior

- Evacuation participation, motivations
- Sheltering demand estimates
- Evacuation response timing
- Evacuation destinations, corridors
- Vehicle use
- Estimates for transportation models

Evacuation participation, motivators

	Hurricane Category				
Risk Area	*1*	*2*	*3*	*4*	*5*
			Residents		
1	46-70%	64%	85-88%	98%	100%
2	36-70%	54%	78-85%	88%	91%
3	31-40%	49%	70-73%	83%	87%
4	28-40%	46%	70%	80%	84%
5	26-40%	44%	68-70%	79%	82%
Non-surge zones	10%		20%		
			Mobile Home Residents		
1	90%		95%		
2	90%		95%		
3	70%		90%		
4	70%		90%		
5	70%		90%		
Non-surge zones	50%		70%		
			Transients		
Any zone	90-100% when advised	90-100% when advised	90-100% when advised	90-100% when advised	90-100% when advised

Source: Lindell et al. (2019).

- Receive official warnings about hurricane evacuations
- Observing peers evacuating
- Mobile home resident
- Hurricane risk area resident
- Observing environmental cues about impacts
- Observing businesses closing
- Expected storm intensity
- Expected disruptions to services
- Expected wind risk
- Expected storm surge risk
- Expected flooding risk
- Expected casualties
- Evacuation recommendations from local officials/authorities
- Expected proximity of landfall

Sheltering demand estimates

Table 10. Estimated Public Shelter Demand (2021) for a Major Surge Evacuation and Higher Shelter Participation Rates.

COUNTY	EVACUATION ZONE					COUNTY TOTAL
	Coastal	A	B	C	Outside	
NEWTON		132			276	408
JASPER					800	800
HARDIN		216	589		937	1,742
ORANGE		3,119	758	428		4,305
JEFFERSON	540	3,329	1,973	4,420		10,262
LIBERTY			677	1,128	1,321	3,126
CHAMBERS	58	1,741	555			2,354
HARRIS		1,327	7,630	27,484	58,988	95,429
GALVESTON	7,207	8,242	1,238			16,687
BRAZORIA	1,055		6,668	8,273		15,996
MATAGORDA	440	63	153	790	81	1,527
JACKSON		89	16	40	227	372
ZONE TOTAL	9,300	18,258	20,257	42,563	62,630	153,008

Evacuation response timing

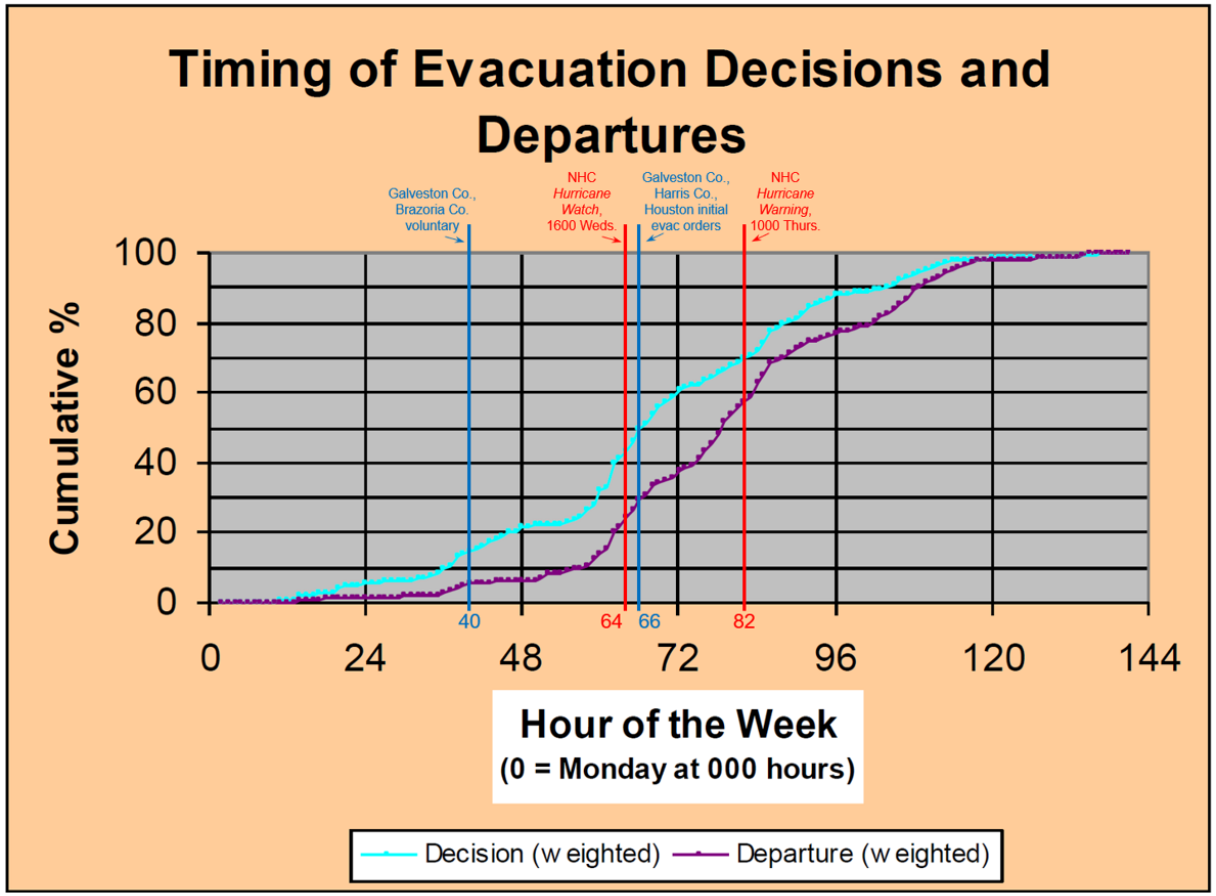


Figure 3. Chart of Hurricane Rita evacuation decisions and departures timing. Adapted from Peacock et al. (2007).

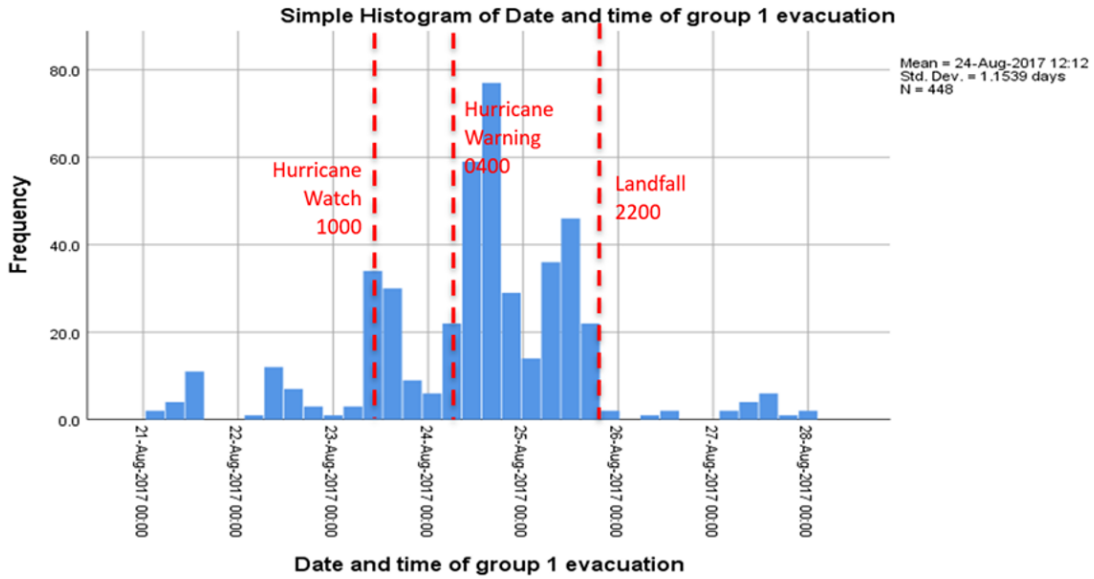
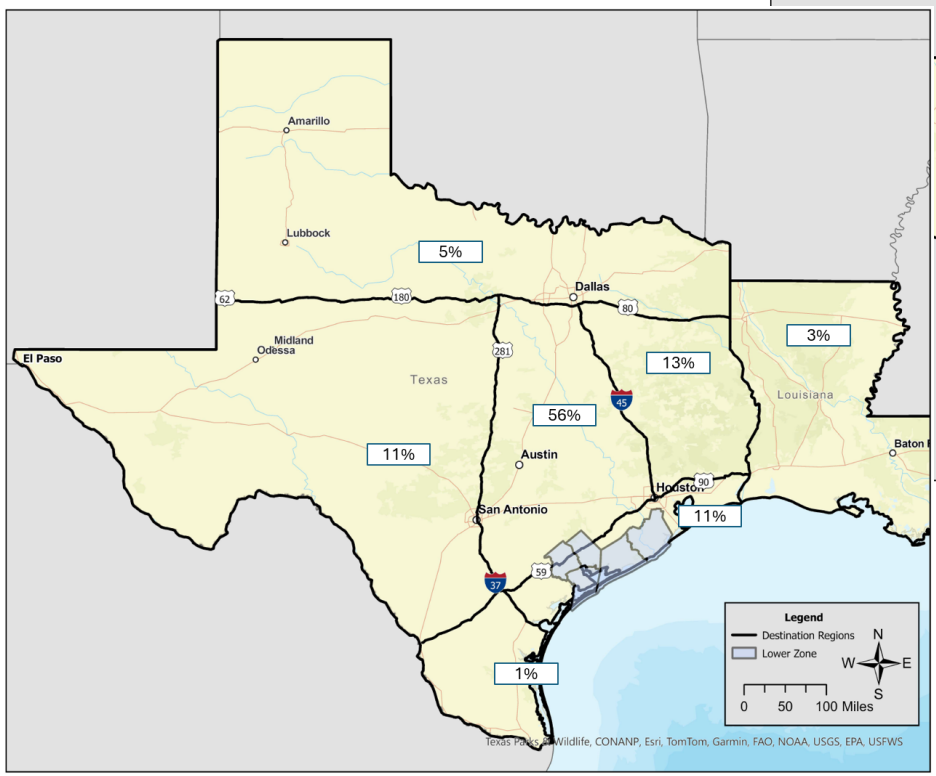
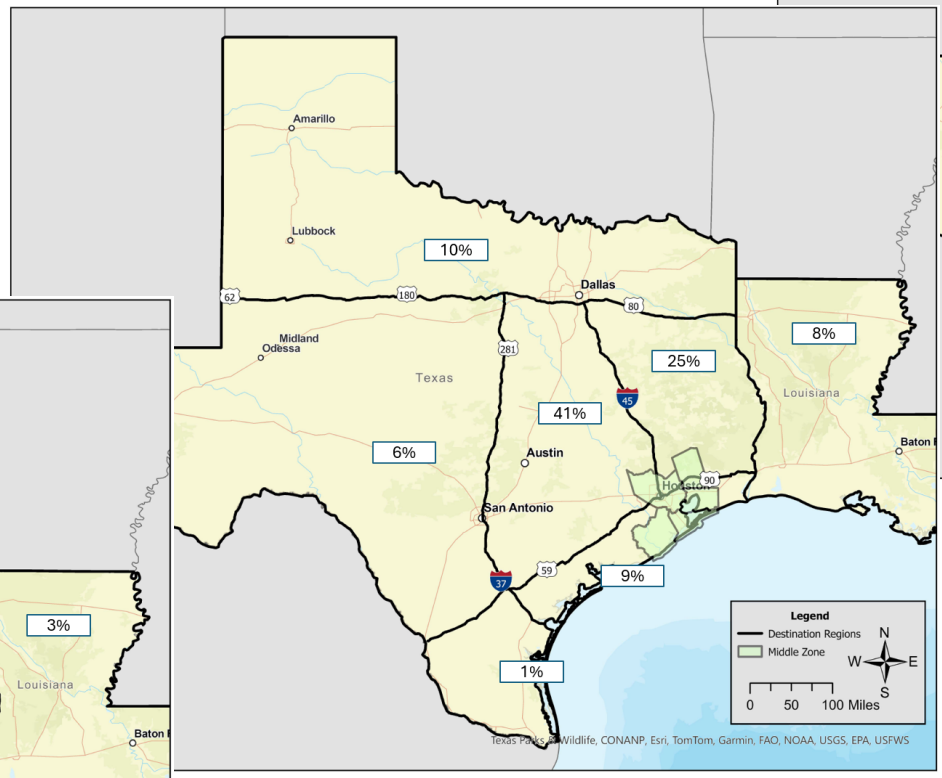
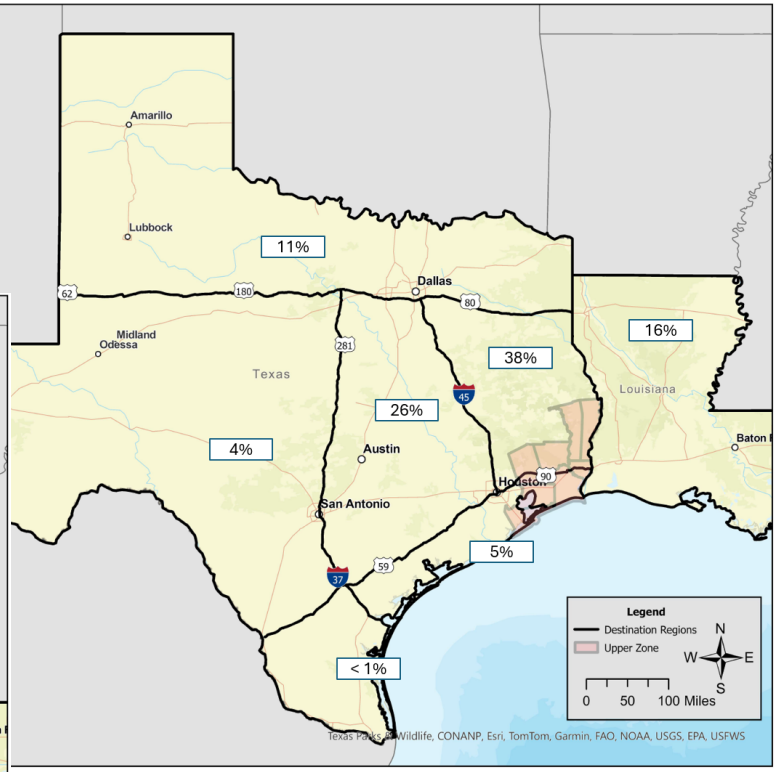


Figure 5. Timing of evacuation of first or only household evacuee groups for Hurricane Harvey in the Texas Coastal Bend region. Source: Bierling et al. (2020).

Evacuation destinations







Estimates for transportation models

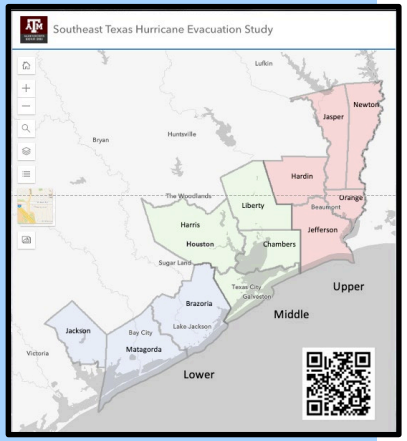
- People per vehicle: 2.0
- Percent of vehicles towing a trailer: 11%
- % of evacuees to internal shelters: 0%
- Percent of population using public transit: 0%
- Percent of population as pedestrians: 0%
- Shorter population response time: 12-hours
- Longer population response time: 2-day, day one (6am – 8pm) 70% & Day two (6am – 12pm) 30%

Southeast Texas Hurricane Evacuation Study: Evacuation Scenarios

General goal in scenario Development

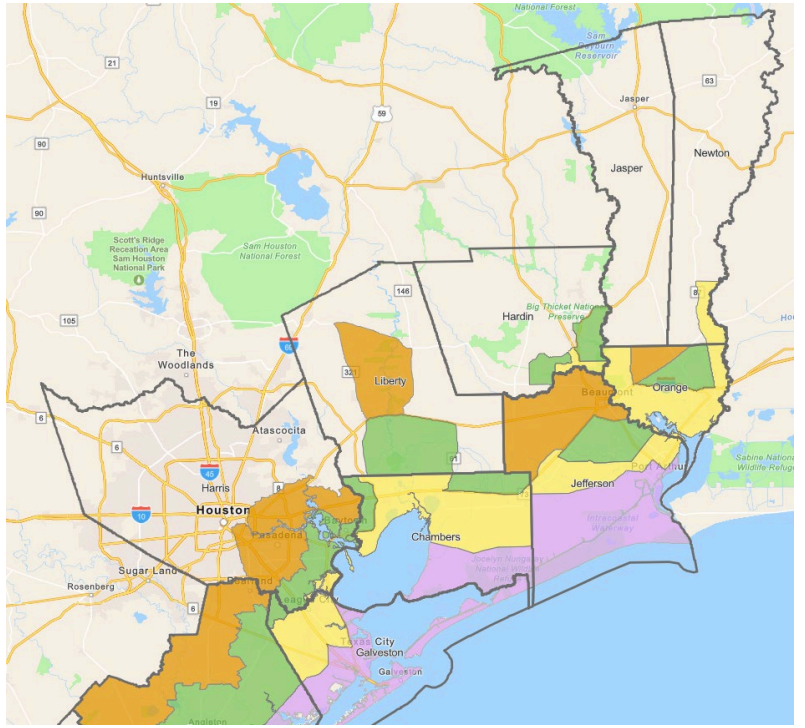
- Capture likely evacuations scenarios for regional clusters of counties in the Southeast Texas Hurricane Evacuation Study Area
  - Including adjacent areas along the Texas and Louisiana coasts
- We have deviated from our three initial planning areas of Upper, Middle, and Lower regions given:
  - likely evacuation calls across the area;
  - how evacuees may flow from and through counties in the study area; and
  - potential evacuee flow from adjacent counties and parishes outside the SE HES study area
  - The final regions are:
    1. **Upper/Middle:** a combined upper & partial middle – Newton, Jasper, Hardin, Liberty, Chambers, and Galveston
    2. **Middle/Lower:** a combined middle & partial lower – Liberty, Chambers, Galveston, Harris, and Brazoria.,
    3. **Lower/Coastal Bend:** a combined lower & partial Coastal Bend – Brazoria, Matagorda, Jackson, Victoria, and Calhoun.

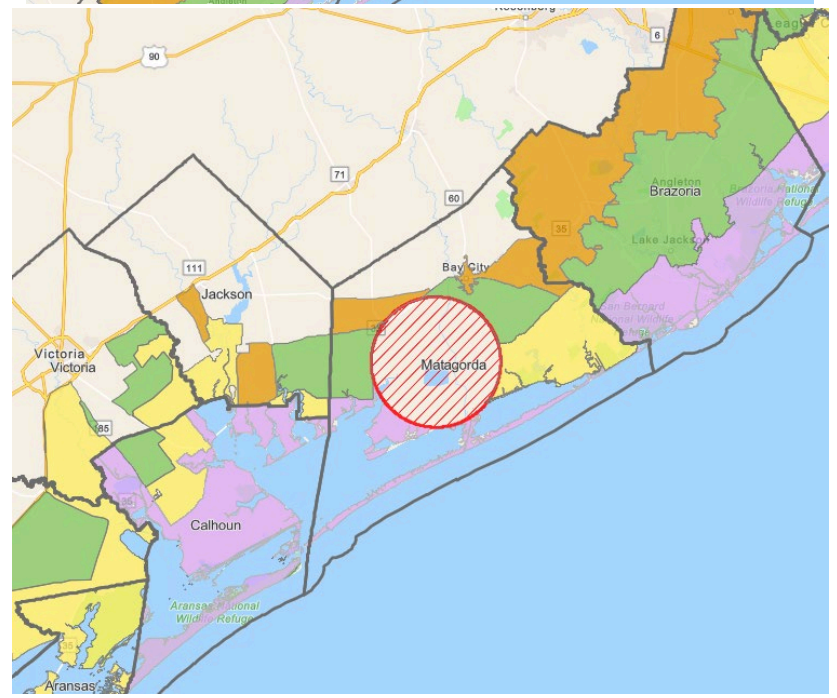
SE HES's Original Planning Areas



Review of Evacuation Scenarios

1) Run a series of **Baseline** and **Special Scenarios** using RtePM that will provide local stakeholders with a range of likely clearance times given potential evacuation events
    - **Baseline:** provide range of evacuation times given different surge events (limited, moderate, significant, & major)
    - **Special:** provide potential evacuation times bases on special situations and additional considerations.
2) Variable assumptions:
    - **Response times**
        - 12-hour
        - 2-day -- *70% day 1 and 30% day 2*
            - Start time: approximately sun-up to sundown
    - **Varying participation rates by zones**
        - Increasing rates for evacuation zones called based on surge risk
        - Increasing rates for shadow evacuation area (zones & outside)
3) Constant assumptions:
    - **Seasonal populations** included as part of residential populations (i.e., without early calls)
    - No adjustments to **background traffic** or **traffic incidents**
    - No early or special calls for **mobile home residents or phasing**
4) Total of 88 final scenario runs.



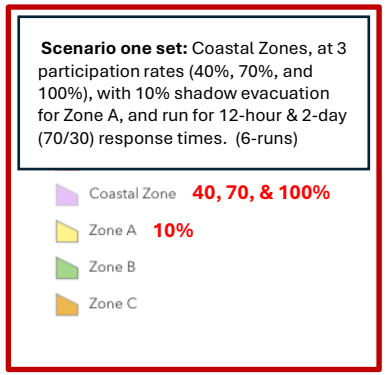


Baseline Scenarios will provide a range of clearance times for ***four*** different surge events with **varying participation rates**, and **varying participation rates.**

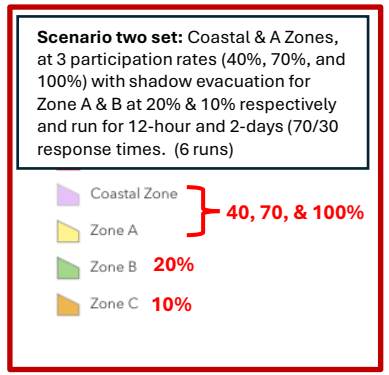
- **Surge Event Baseline Scenario sets (4):**
  - *Limited:* Coastal Zone
  - *Moderate:* Coastal and Zone A
  - *Significant:* Coastal and Zones A & B
  - *Major:* Coastal and Zones A, B, & C
- **Varying participation rates**
  - *Limited* ➔ *Significant*: 40%, 70%, & 100%
  - *Major:* 70% & 100%
  - *Shadow evacuation* rates increase with surge events
    - Including adjacent zones AND areas outside zones
    - Participation rates 10% - 30%
- **Response times:**
  - 12-hour
  - 2-day -- *70% day 1 and 30% day 2*
- **Minimum of 22 baseline scenarios run for three sub-regions**
  - Providing a range of clearance times for each
    - Surge event / evacuation call
    - Given different participation rates
    - Response times
- **Special Scenarios**
  - Upper/middle region with two of Louisiana's parishes (+10 runs)
  - Full Southeastern Regional evacuation call (+5 runs)
  - Middle/lower Region:
    - **Evaculanes** for Scenarios 3 & 4 (2-day response) for middle region (+5 runs)
    - **Evaculanes and Contra-flow** for scenario 4 (2-day), middle region (+2 runs)
- **Total final runs: 66 baseline + 22 special = 88 runs**

4 Baseline Evacuation Scenario sets

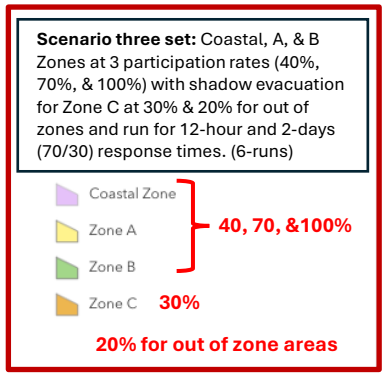
Scenario set one (*limited* surge event)



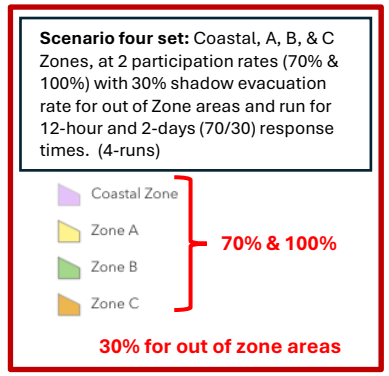
Scenario set two (*moderate* surge event)



Scenario set three (*significant* surge event)



Scenario set four (*major* surge event)



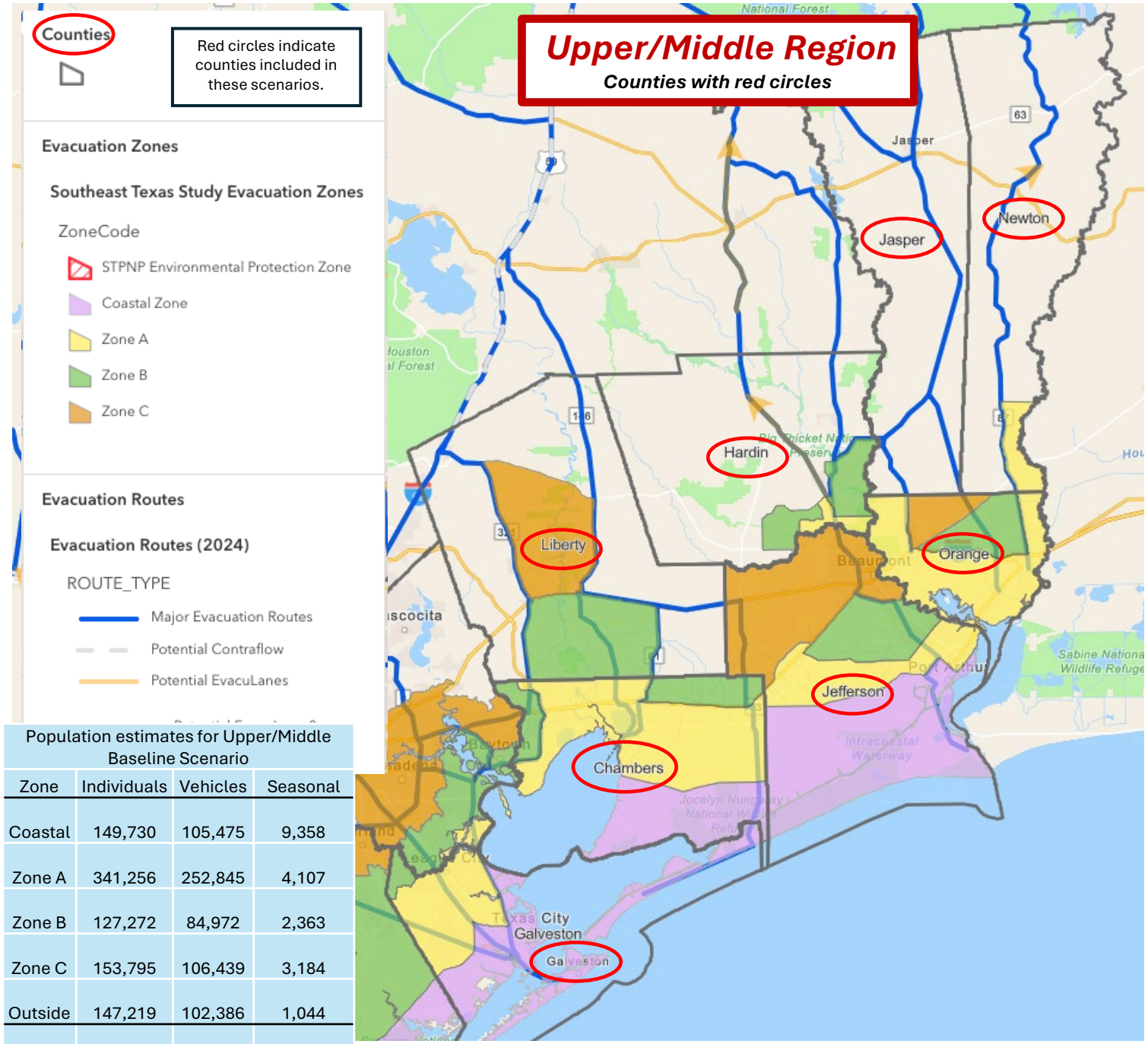
Each **scenario set** will be run at two response times

- - 12-hour response time
- - 2-day response time (70% day 1 & 30% day 2)

All Scenarios will assume

- - Seasonal population included at full occupancy for each zone
- - No special calls for mobile home residents or phasing.
- - Background traffic and traffic incidents not adjusted

Upper/Middle Region
Baseline Evacuation Scenarios



Population estimates for Upper/Middle Baseline Scenario			
Zone	Individuals	Vehicles	Seasonal
Coastal	149,730	105,475	9,358
Zone A	341,256	252,845	4,107
Zone B	127,272	84,972	2,363
Zone C	153,795	106,439	3,184
Outside	147,219	102,386	1,044
Totals	919,272	652,117	20,056

Scenario one (*limited* surge event)

Scenario one set: Coastal Zones, at 3 participation rates (40%, 70%, and 100%), with 10% shadow evacuation for Zone A, and run for 12-hour & 2-day (70/30) response times. (6-runs)

- Coastal Zone **40, 70, & 100%**
- Zone A **10%**
- Zone B
- Zone C

Scenario two (*moderate* surge event)

Scenario two set: Coastal & A Zones, at 3 participation rates (40%, 70%, and 100%) with shadow evacuation for Zone A & B at 20% & 10% respectively and run for 12-hour and 2-days (70/30 response times. (6 runs)

- Coastal Zone, Zone A **40, 70, & 100%**
- Zone B **20%**
- Zone C **10%**

Scenario three (*significant* surge event)

Scenario three set: Coastal, A, & B Zones at 3 participation rates (40%, 70%, & 100%) with shadow evacuation for Zone C at 30% & 20% for out of zones and run for 12-hour and 2-days (70/30) response times. (6-runs)

- Coastal Zone, Zone A, Zone B **40, 70, &100%**
- Zone C **30%**

20% for out of zone areas

Scenario four (*major* surge event)

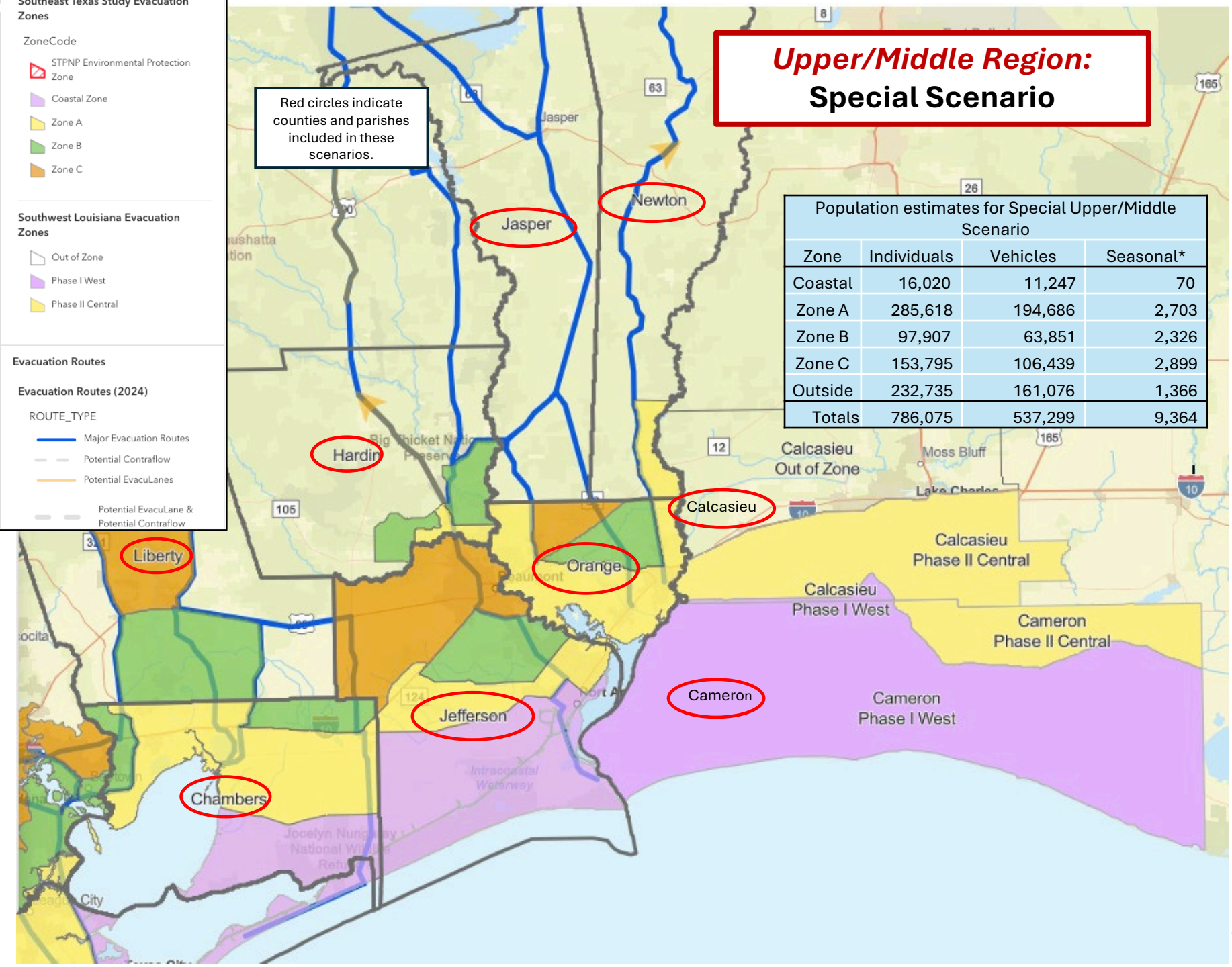
Scenario four set: Coastal, A, B, & C Zones, at 2 participation rates (70% & 100%) with 30% shadow evacuation rate for out of Zone areas and run for 12-hour and 2-days (70/30) response times. (4-runs)

- Coastal Zone, Zone A, Zone B, Zone C **70% & 100%**

30% for out of zone areas

1. Each scenario set will be run for two response times
   - - 12-hour response time
   - - 2-day response time (70% day 1 & 30% day 2)
2. All Scenarios will assume
   - - Seasonal population included at full occupancy for each zone
   - - Background traffic and traffic incidents not adjusted
3. A total of **22** baseline scenarios for the Upper/middle Region

Upper/Middle Region: Special Scenario



Population estimates for Special Upper/Middle Scenario

Zone	Individuals	Vehicles	Seasonal*
Coastal	16,020	11,247	70
Zone A	285,618	194,686	2,703
Zone B	97,907	63,851	2,326
Zone C	153,795	106,439	2,899
Outside	232,735	161,076	1,366
Totals	786,075	537,299	9,364

1. Significant surge event

Significant Surge sett: Coastal, A, & B Zones (40%, 70%, & 100%);shadow evac. for Zone C at 30% & 20% for outside zones; & 12-hour and 2-days (70/30) response times. (6-runs)

25% for assumed participation rates for LA zones, moving west into Texas

Coastal Zone
Zone A
Zone B
40, 70, & 100%
Zone C **30%**

20% for out of zone areas

2. Major surge event

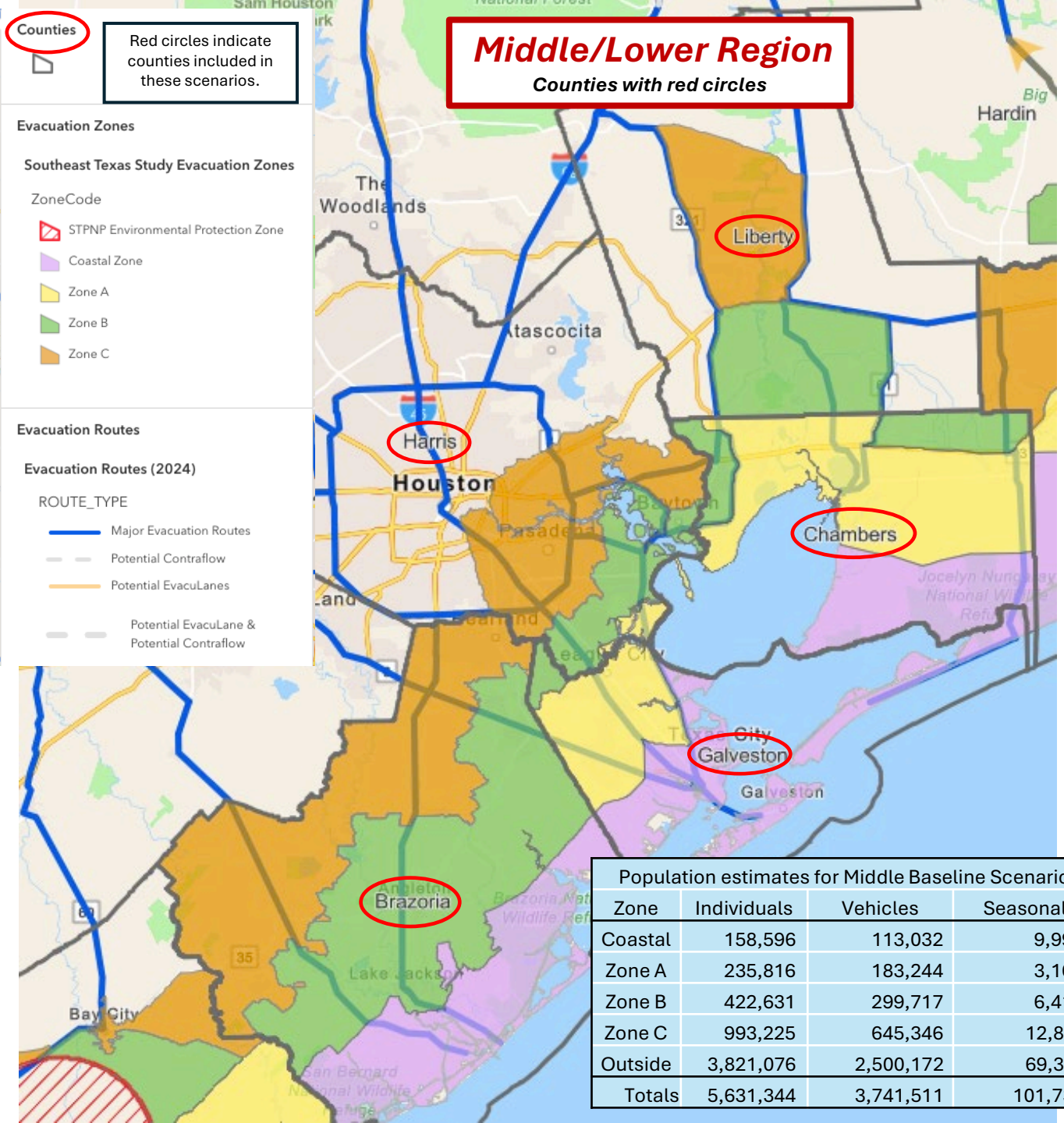
Major Surge Scenario: Coastal, A, B, & C Zones at 70% & 100% with 30% shadow evacuation rate outside zones; 12-hour and 2-days (70/30) response times. (4-runs)

25% of assumed participation rates LA zones, all moving west into Texas

Coastal Zone
Zone A
Zone B
Zone C
70% & 100%

30% for out of zone areas

1. Each scenario set will be run for two response times
   - - 12-hour response time
   - - 2-day response time (70% day 1 & 30% day 2)
2. All Scenarios will assume
   - - Seasonal population included at full occupancy for each zone
   - - Background traffic and traffic incidents not adjusted
3. *Evacuation from Louisianna will be constrained to 25% of assumed participation rates moving west from the two zones and shadow.*
4. *Total of **10** runs*



Population estimates for Middle Baseline Scenario			
Zone	Individuals	Vehicles	Seasonal
Coastal	158,596	113,032	9,995
Zone A	235,816	183,244	3,167
Zone B	422,631	299,717	6,410
Zone C	993,225	645,346	12,825
Outside	3,821,076	2,500,172	69,342
Totals	5,631,344	3,741,511	101,739

Middle/Lower Region
Baseline Evacuation Scenarios

Scenario one (*limited* surge event)

Scenario one set: Coastal Zones, at 3 participation rates (40%, 70%, and 100%), with 10% shadow evacuation for Zone A, and run for 12-hour & 2-day (70/30) response times. (6-runs)

- Coastal Zone — 40, 70, & 100%
- Zone A — 10%
- Zone B
- Zone C

Scenario two (*moderate* surge event)

Scenario two set: Coastal & A Zones, at 3 participation rates (40%, 70%, and 100%) with shadow evacuation for Zone A & B at 20% & 10% respectively and run for 12-hour and 2-days (70/30 response times. (6 runs)

- Coastal Zone, Zone A — 40, 70,& 100%
- Zone B — 20%
- Zone C — 10%

Third scenario (*significant* surge event)

Scenario three set: Coastal, A, & B Zones at 3 participation rates (40%, 70%, & 100%) with shadow evacuation for Zone C at 30% & 20% for out of zones and run for 12-hour and 2-days (70/30) response times. (6-runs)

- Coastal Zone, Zone A, Zone B — 40, 70, & 100%
- Zone C — 30%

20% for out of zone areas

Fourth scenario (*major* surge event)

Scenario four set: Coastal, A, B, & C Zones, at 2 participation rates (70% & 100%) with 30% shadow evacuation rate for out of Zone areas and run for 12-hour and 2-days (70/30) response times. (4-runs)

- Coastal Zone, Zone A, Zone B, Zone C — 70% & 100%

30% for out of zone areas

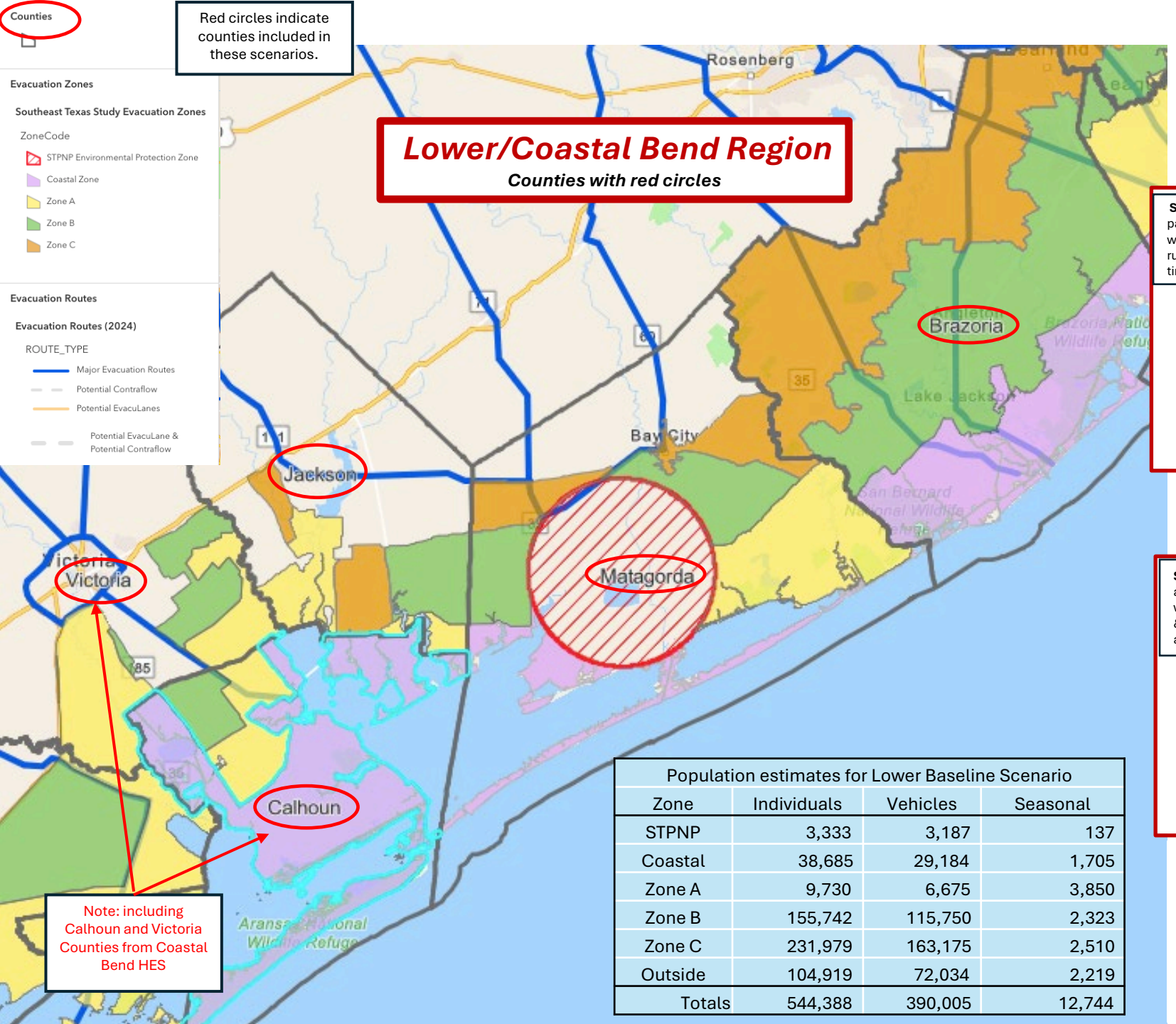
1. Each scenario will be run for two response times (22 runs)
   - 12-hour response time
   - 2-day response time (70% day 1 & 30% day 2)
2. Scenarios 3 & 4 will be run with/without evaculanes for 2-day response (+5 runs)
3. Scenario 4 will be run with/without evaculanes & contra flow for 2-day resp. (+2 runs)

All Scenarios will assume

- Seasonal population at full occupancy for each zone
- Background traffic and traffic incidents not adjusted

4. A total of **29 runs** for the Upper/middle Region

Lower/Coastal Bend Region
Baseline Evacuation Scenarios



Population estimates for Lower Baseline Scenario			
Zone	Individuals	Vehicles	Seasonal
STPNP	3,333	3,187	137
Coastal	38,685	29,184	1,705
Zone A	9,730	6,675	3,850
Zone B	155,742	115,750	2,323
Zone C	231,979	163,175	2,510
Outside	104,919	72,034	2,219
Totals	544,388	390,005	12,744

Scenario one (*limited* surge event)

Scenario one set: Coastal Zones, at 3 participation rates (40%, 70%, and 100%), with 10% shadow evacuation for Zone A, and run for 12-hour & 2-day (70/30) response times. (6-runs)

- STPNP Environmental Protection Zone 100%
- Coastal Zone 40, 70, & 100%
- Zone A 10%
- Zone B
- Zone C

Scenario two (*moderate* surge event)

Scenario two set: Coastal & A Zones, at 3 participation rates (40%, 70%, and 100%) with shadow evacuation for Zone A & B at 20% & 10% respectively and run for 12-hour and 2-days (70/30 response times. (6 runs)

- STPNP Environmental Protection Zone 100%
- Coastal Zone, Zone A 40, 70, & 100%
- Zone B 20%
- Zone C 10%

Scenario three (*significant* surge event)

Scenario three set: Coastal, A, & B Zones at 40%, 70%, & 100% participation rates with shadow evacuation for Zone C at 30% & 20% for out of zones and run for 12-hour and 2-days (70/30) response times. (6-runs)

- STPNP Environmental Protection Zone 100%
- Coastal Zone, Zone A, Zone B 40, 70, & 100%
- Zone C 30%

20% for out of zone areas

Scenario four (*major* surge event)

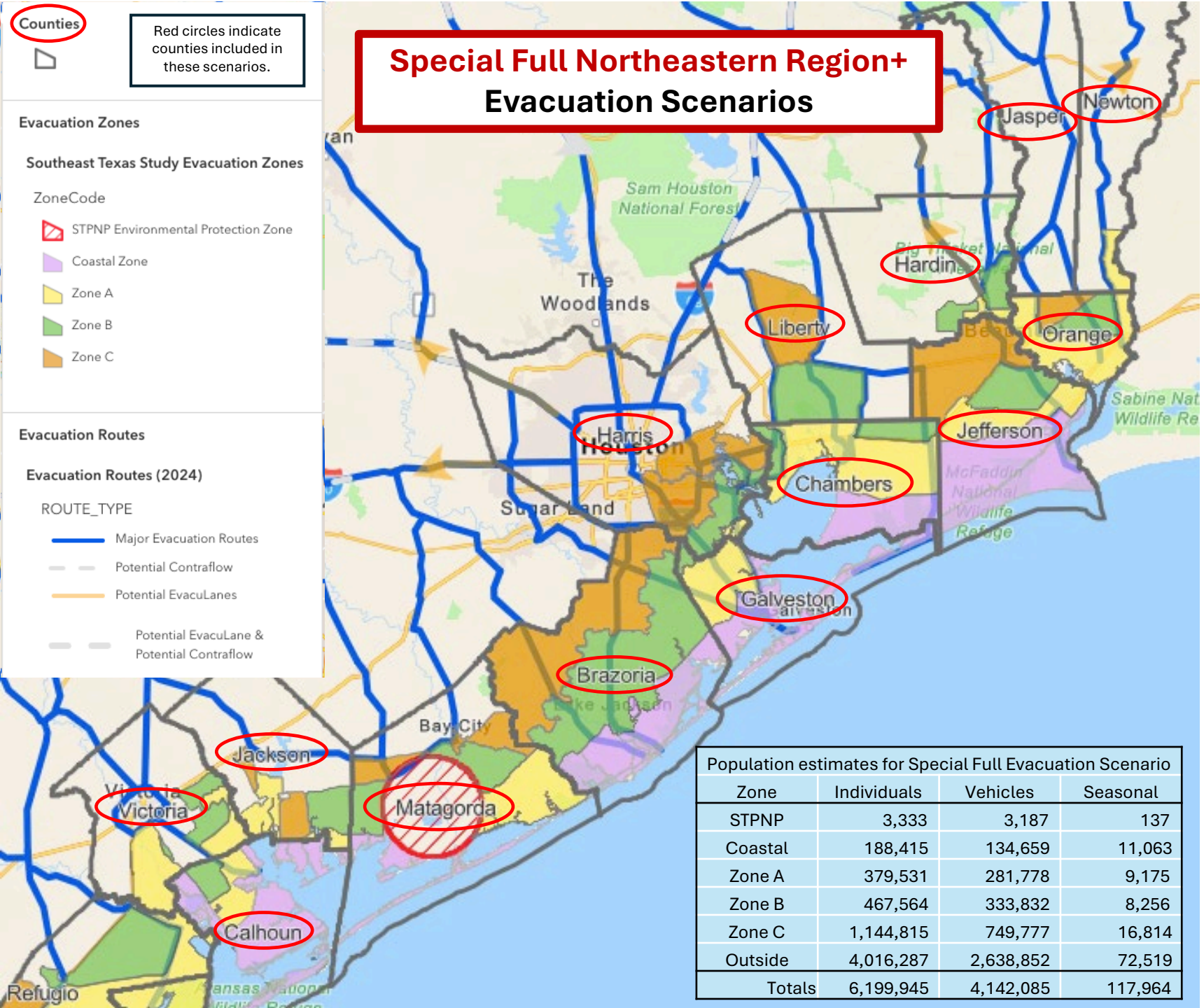
Scenario four set: Coastal, A, B, & C Zones, at 2 participation rates (70% & 100%) with 30% shadow evacuation rate for out of Zone areas and run for 12-hour and 2-days (70/30) response times. (4-runs)

- STPNP Environmental Protection Zone 100%
- Coastal Zone, Zone A, Zone B, Zone C 70% & 100%

30% for out of zone areas

1. Each scenario will be run for two response times
   - 12-hour response time
   - 2-day response time (70% day 1 & 30% day 2)
2. All Scenarios will assume
   - 100% participation for STPNP
   - Background traffic and traffic incidents not adjusted
3. A total of 22 baseline scenarios for the Lower Regional

Special Full Northeastern Region+ Evacuation Scenarios



Population estimates for Special Full Evacuation Scenario			
Zone	Individuals	Vehicles	Seasonal
STPNP	3,333	3,187	137
Coastal	188,415	134,659	11,063
Zone A	379,531	281,778	9,175
Zone B	467,564	333,832	8,256
Zone C	1,144,815	749,777	16,814
Outside	4,016,287	2,638,852	72,519
Totals	6,199,945	4,142,085	117,964

Significant Surge Scenario

Evacuation Zones

Significant Surge Scenario set: Coastal, A, & B Zones at 40%, 70%, & 100% participation rates with shadow evacuation for Zone C at 30% & 20% for out of zones and run for 12-hour and 2-days (70/30) response times. (3runs)

- STPNP Environmental Protection Zone **100%**
- Coastal Zone
- Zone A
- Zone B

40, 70, & 100%

- Zone C **30%**

20% for out of zone areas

Major surge Scenario

Evacuation Zones

Major Surge Scenario set: Coastal, A, B, & C Zones, at 2 participation rates (70% & 100%) with 30% shadow evacuation rate for out of Zone areas and run for 12-hour and 2-days (70/30) response times. (2-runs)

- STPNP Environmental Protection Zone **100%**
- Coastal Zone
- Zone A
- Zone B
- Zone C

70% & 100%

30% for out of zone areas

1. Scenario will be run assuming 2-day response time
   - (70% day 1 & 30% day 2)
2. All Scenarios will assume
   - - 100% participation for STPNP
   - - Seasonal population at full occupancy for each
   - - Background traffic and traffic incidents not adjusted
   - - Evaculane and contra flow active
3. A total of 5 full regional scenarios will be run.

Southeast Texas Hurricane Evacuation Study Transportation Analysis

Why is the transportation analysis needed?

To provide estimated clearance times for the regions based upon a variety of scenarios that can be used by emergency managers for evacuation planning.

RtePM → Real time evacuation Planning Model

- **“Cloud-based” software**

- **Model includes the street network**
  - **** Allows for modifications, closures, shoulder lanes, contraflow**

- **Population totals from latest census data**
  - **Daytime & Nighttime**
  - **Seasonal populations can be added**

- **Behavioral analysis can be used to better define evacuating traffic**

- **Evacuation Zones imported as shapefiles – customize each zone**
  - **Population adjusted as needed**
  - **Percentage of population evacuating**
  - **Response time [12-hours and over 2-days]**

- **RtePM clearance time = estimated time for the last car to reach EndPoint**

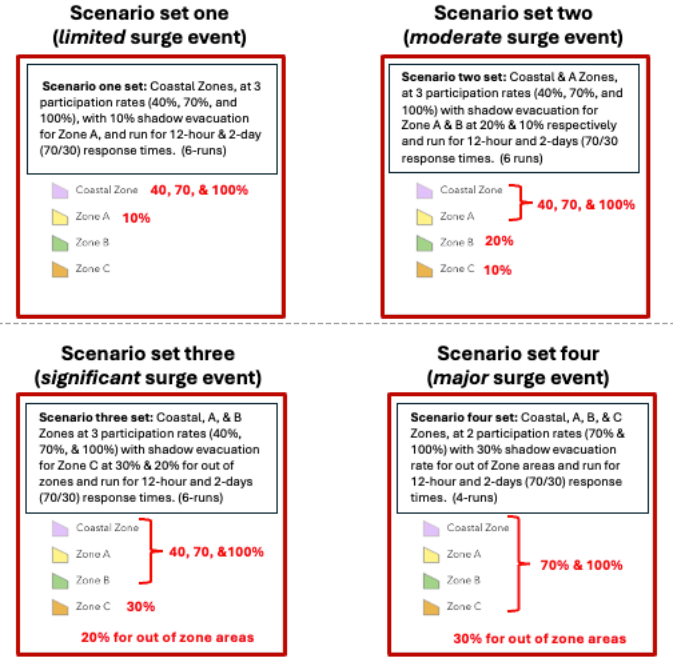
- **Results can also be exported in GIS formats to do additional analysis**

RtePM → Steps, Procedures, Issues

1. Import Zone Shapefiles
2. Adjust zone populations to match Atlas values + include seasonal
3. Input specific settings to be used for each zone
4. “Build” road network including location of EndPoints
5. “Vett” the network to assure that all population blocks are connected to the road network – multiple runs of RtePM for each region necessary to complete this effort
6. RtePM down time
7. Initially did not “weight” the EndPoints – results did not look reasonable → completed weighting process to better match evacuation destinations as seen in behavioral analysis

Preliminary Results – Lower Region

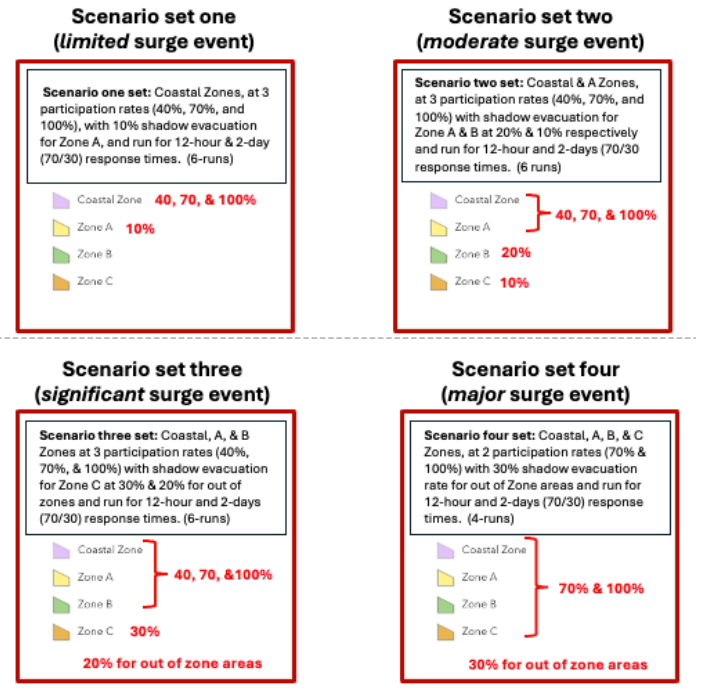
Brazoria, Matagorda, Jackson, Calhoun, Victoria**



Surge Level	Estimated Population Moved	Estimated Clearance Time in Hours [RtePM]	
		12-Hour Response Time	Response Time over 2-days
Limited Surge	9,831 -- 33,383	12.9	30.8
Moderate Surge	22,389 -- 40,425	12.8 to 12.9	30.8
Significant Surge	66,145 -- 252,088	12.9 to 16.1	30.8
Major Surge	241,688 -- 478,275	12.8 to 18.0	30.8 to 31.0

Preliminary Results – Upper-Middle Region

Newton, Jasper, Hardin, Orange, Jefferson, Liberty, Chambers, Galveston



Surge Level	Estimated Population Moved	Estimated Clearance Time in Hours [RtePM]	
		12-Hour Response Time	Response Time over 2-days
Limited Surge	32,223 -- 183,222	13.6 to 13.8	31.5 to 31.8
Moderate Surge	90,995 -- 533,056	13.6 to 21.4	31.5 to 32.7
Significant Surge	125,375 -- 676,766	13.6 to 21.8	31.5 to 32.8
Major Surge *[Evaculane]*	349,552 -- 684,316	13.8 to 21.8	31.6 to 32.8

Preliminary Results – Middle-Lower Region

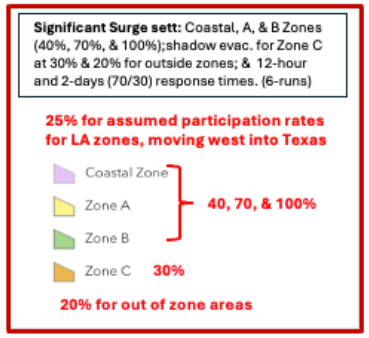
Liberty, Chambers, Galveston, Harris, Brazoria

Surge Level	Estimated Population Moved	Estimated Clearance Time in Hours [RtePM]	
		12-Hour Response Time	Response Time over 2-days
Limited Surge	33,107 -- 194,196	13.1 to 15.2	31.1 to 31.2
Moderate Surge	96,572 -- 462,061	13.1 to 26.1	31.1 to 33.2
Significant Surge	387,957 -- 1,098,640	13.8 to 38.8	36.1 to 37.8
Major Surge *[Evaculane/Contraflow]*	*pending*	*pending*	*pending*

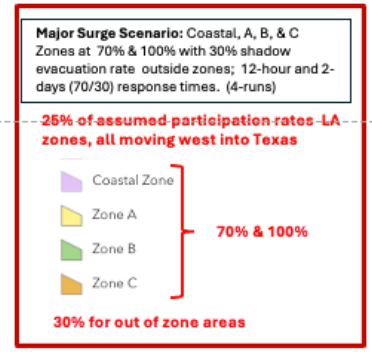
Preliminary Results – Upper-Middle Region Special

Newton, Jasper, Hardin, Orange, Jefferson, Liberty, Chambers, Cameron Parish, Calcasieu Parish

1. *Significant* surge event



2. *Major* surge event



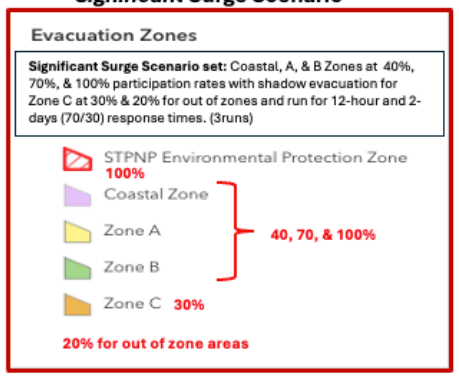
Surge Level	Estimated Population Moved	Estimated Clearance Time in Hours [RtePM]	
		12-Hour Response Time	Response Time over 2-days
Significant Surge	*pending*	*pending*	*pending*
Major Surge *[Evaculane]*	*pending*	*pending*	*pending*

Includes 25% of evacuating traffic from Cameron and Calcasieu Parishes -- NO evacuation to the East

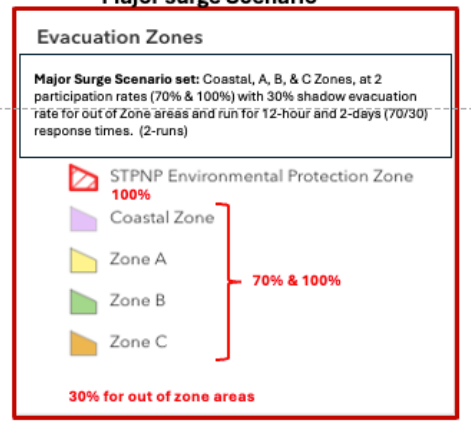
Preliminary Results – Special Full Regional

Newton, Jasper, Hardin, Orange, Jefferson, Liberty, Chambers, Galveston, Harris, Brazoria, Matagorda, Jackson, Calhoun, Victoria**

Significant Surge Scenario



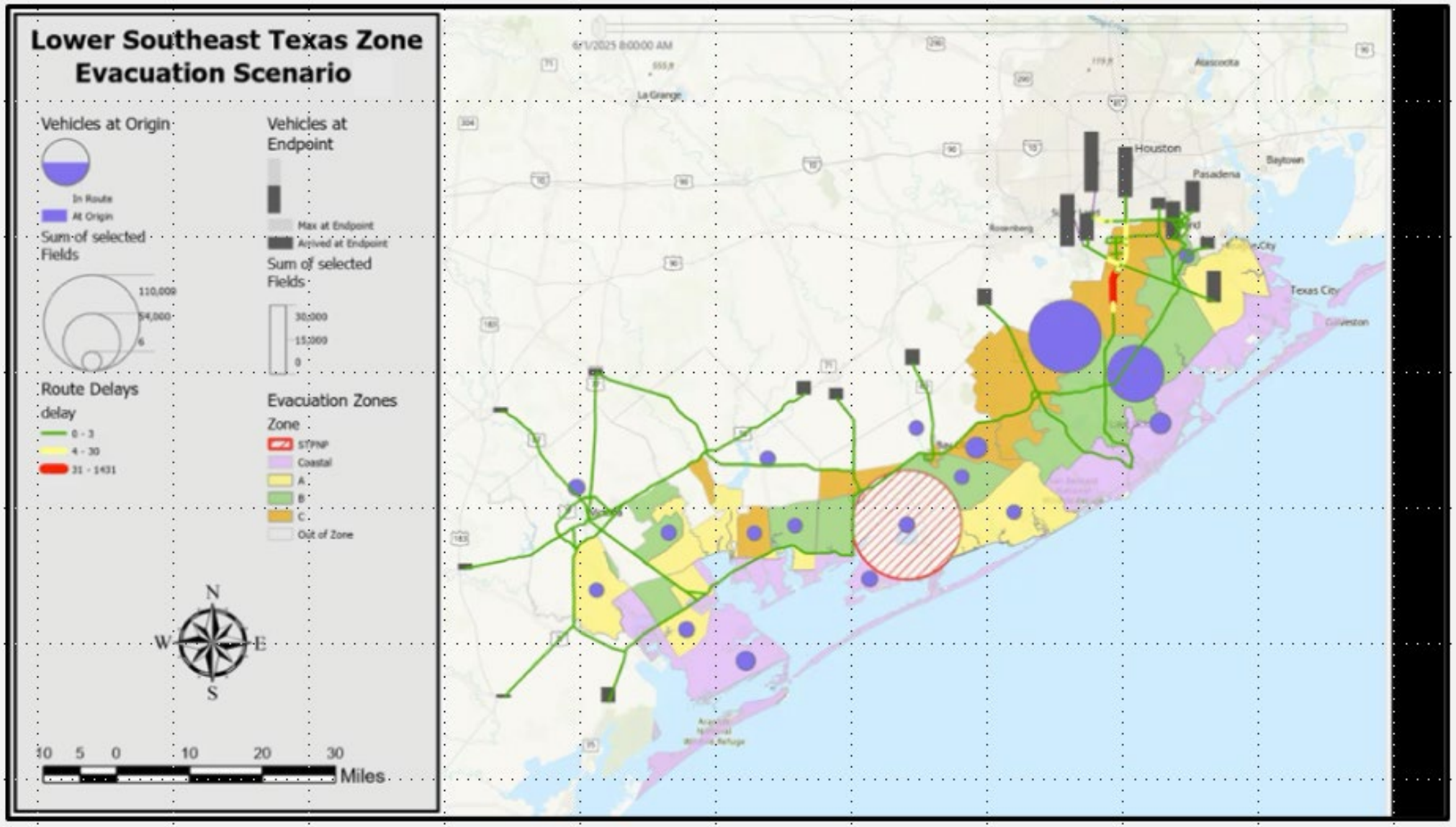
Major surge Scenario



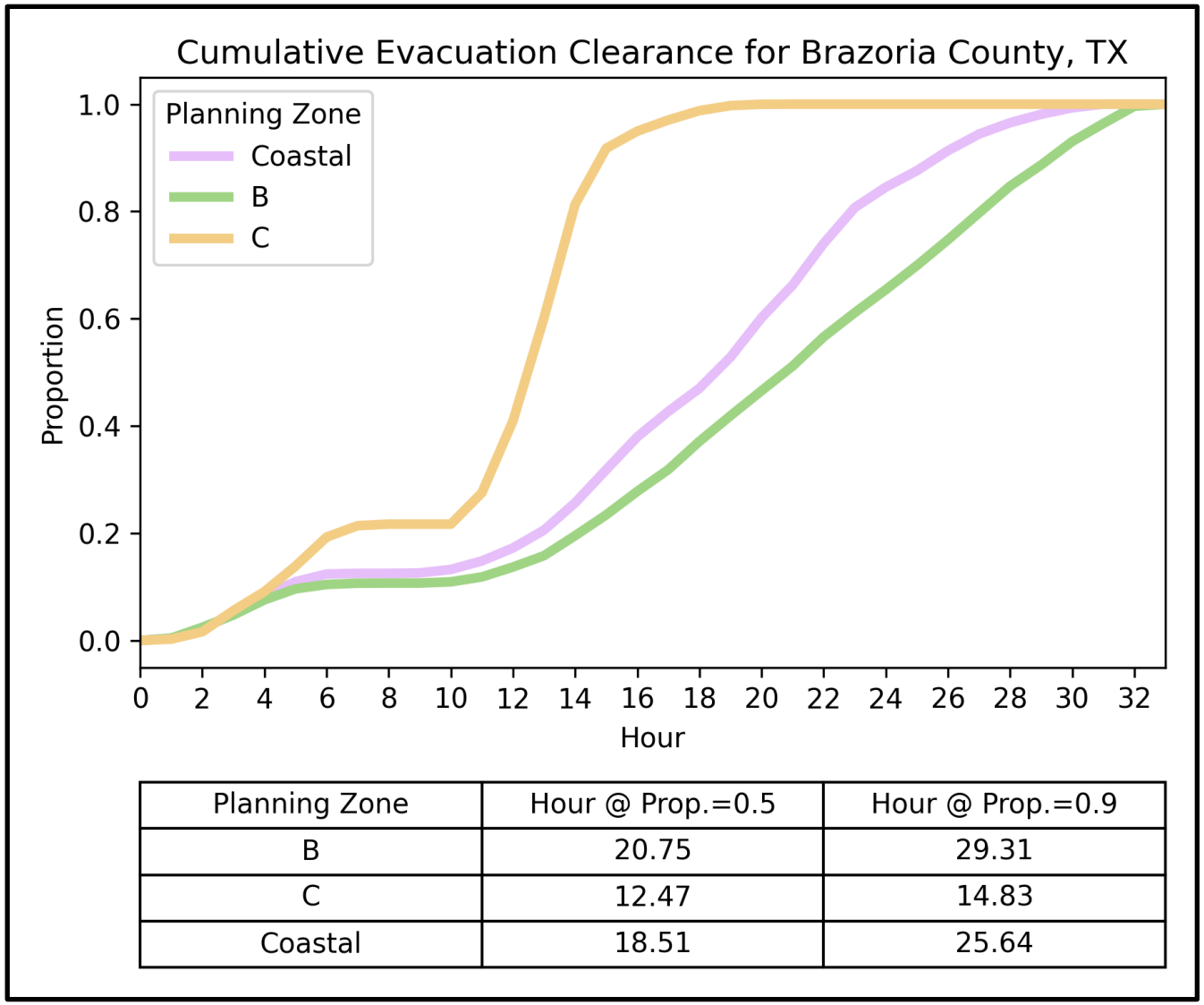
Surge Level	Estimated Population Moved	Estimated Clearance Time in Hours [RtePM] Response Time over 2-days
Significant Surge	*pending*	*pending*
Major Surge *[Evaculane]*	*pending*	*pending*

Example of Evacuation Scenario

Scenario: Lower region, significant surge event,
12-hour response,
100% participation rates for Coastal, Zone A, & Zone B,
30% for Zone C and 20% out of Zones.

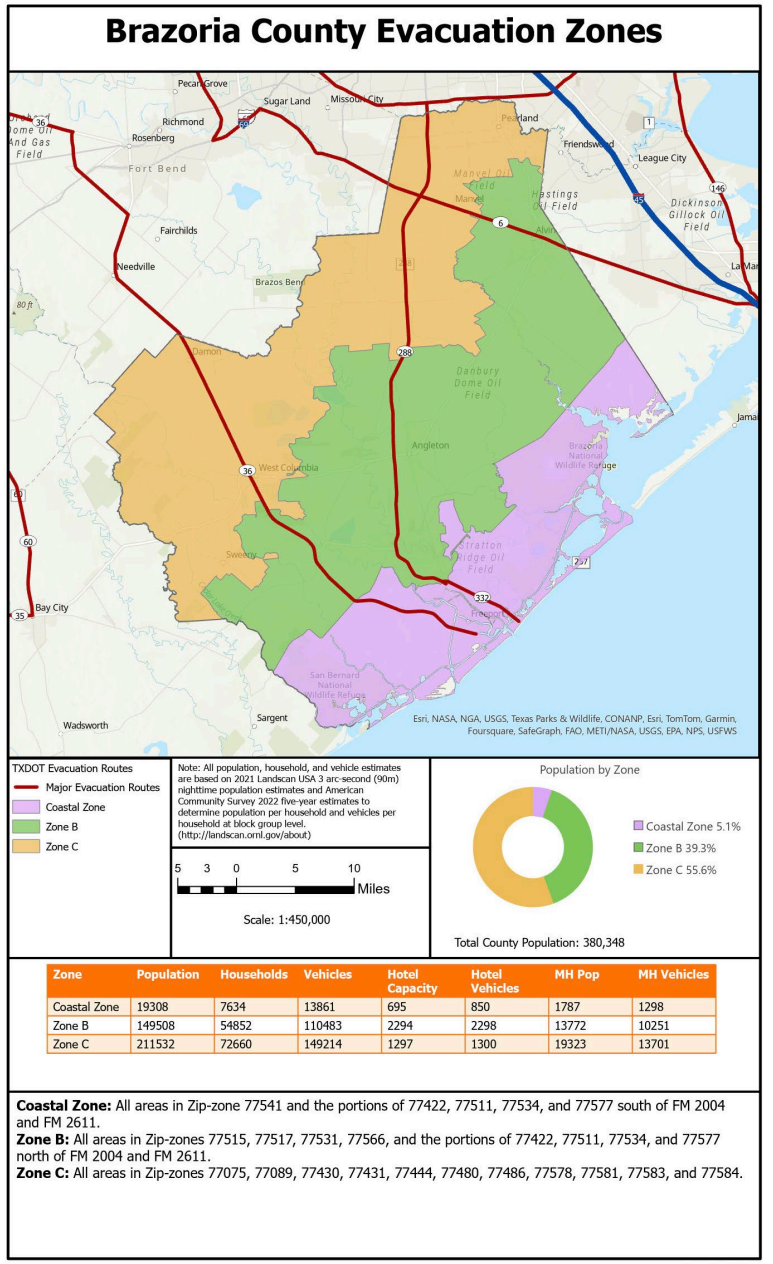


Example of Zone Clearance Times by County



Planning Zone	Hour @ Prop.=0.5	Hour @ Prop.=0.9
B	20.75	29.31
C	12.47	14.83
Coastal	18.51	25.64

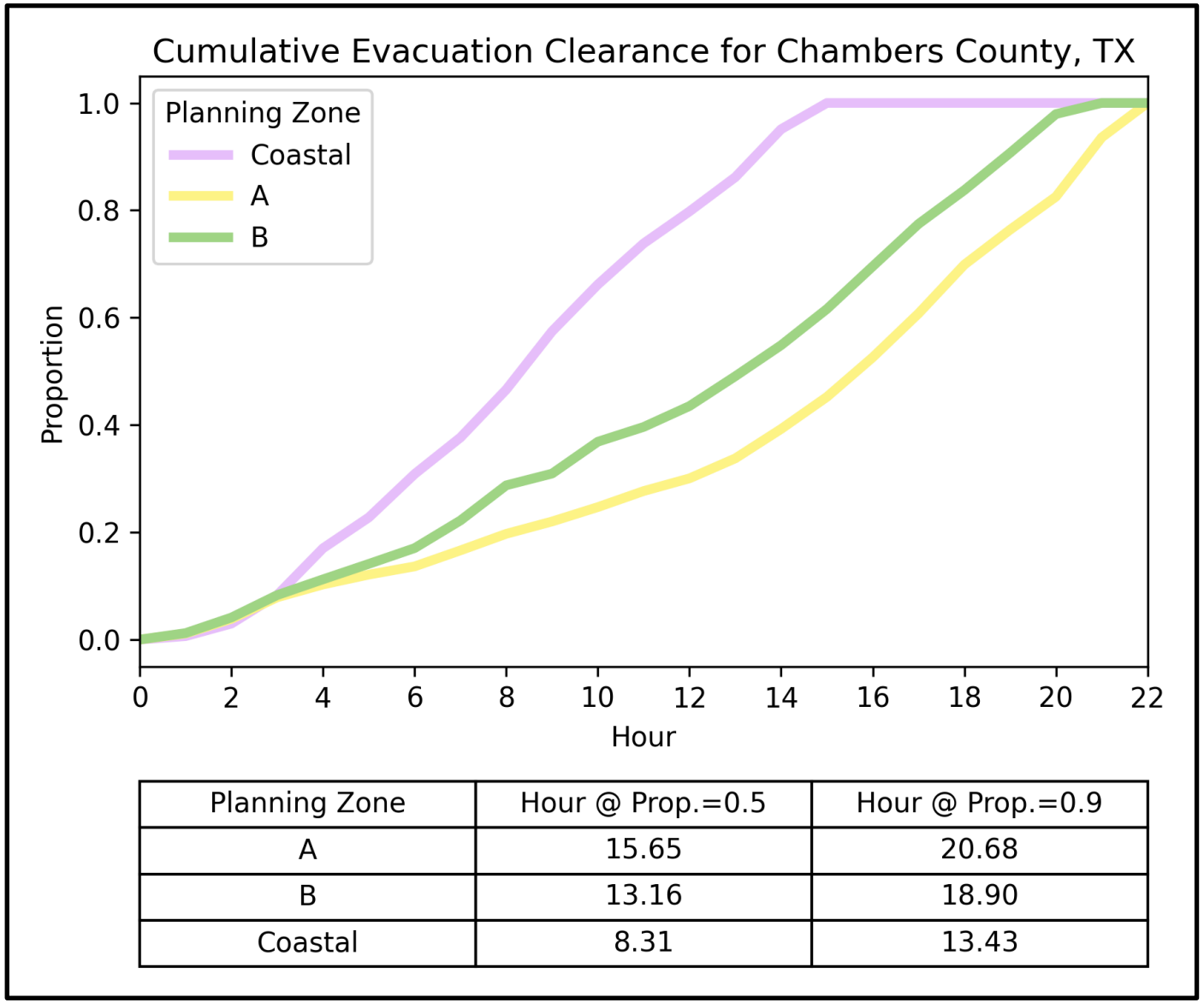
Scenario: Middle/Lower Region, Significant Surge Event, 12-hour response, 100% participation rates for Coastal, Zone A, & Zone B, with 30% for Zone C and 20% out of Zones if applicable.



Zone	Population	Households	Vehicles	Hotel Capacity	Hotel Vehicles	MH Pop	MH Vehicles
Coastal Zone	19308	7634	13861	695	850	1787	1298
Zone B	149508	54852	110483	2294	2298	13772	10251
Zone C	211532	72660	149214	1297	1300	19323	13701

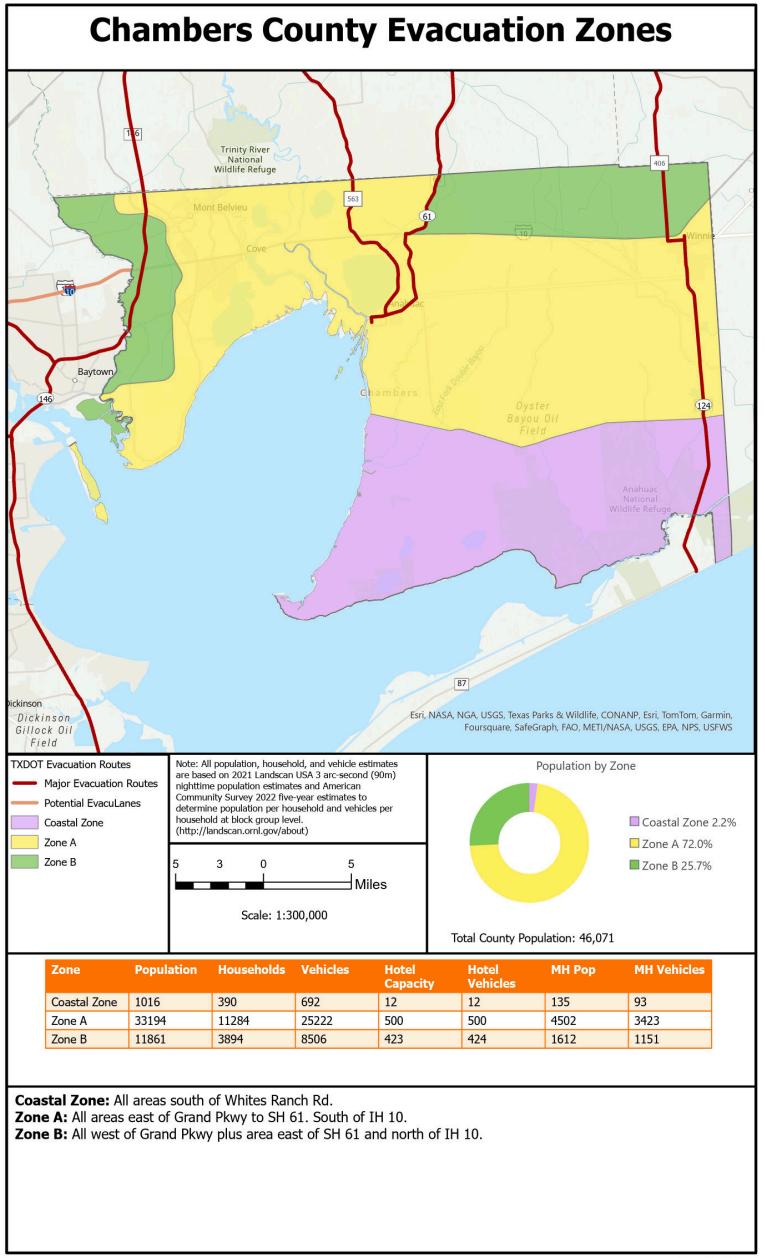
Coastal Zone: All areas in Zip-zone 77541 and the portions of 77422, 77511, 77534, and 77577 south of FM 2004 and FM 2611.
Zone B: All areas in Zip-zones 77515, 77517, 77531, 77566, and the portions of 77422, 77511, 77534, and 77577 north of FM 2004 and FM 2611.
Zone C: All areas in Zip-zones 77075, 77089, 77430, 77431, 77444, 77480, 77486, 77578, 77581, 77583, and 77584.

Example of Zone Clearance Times by County



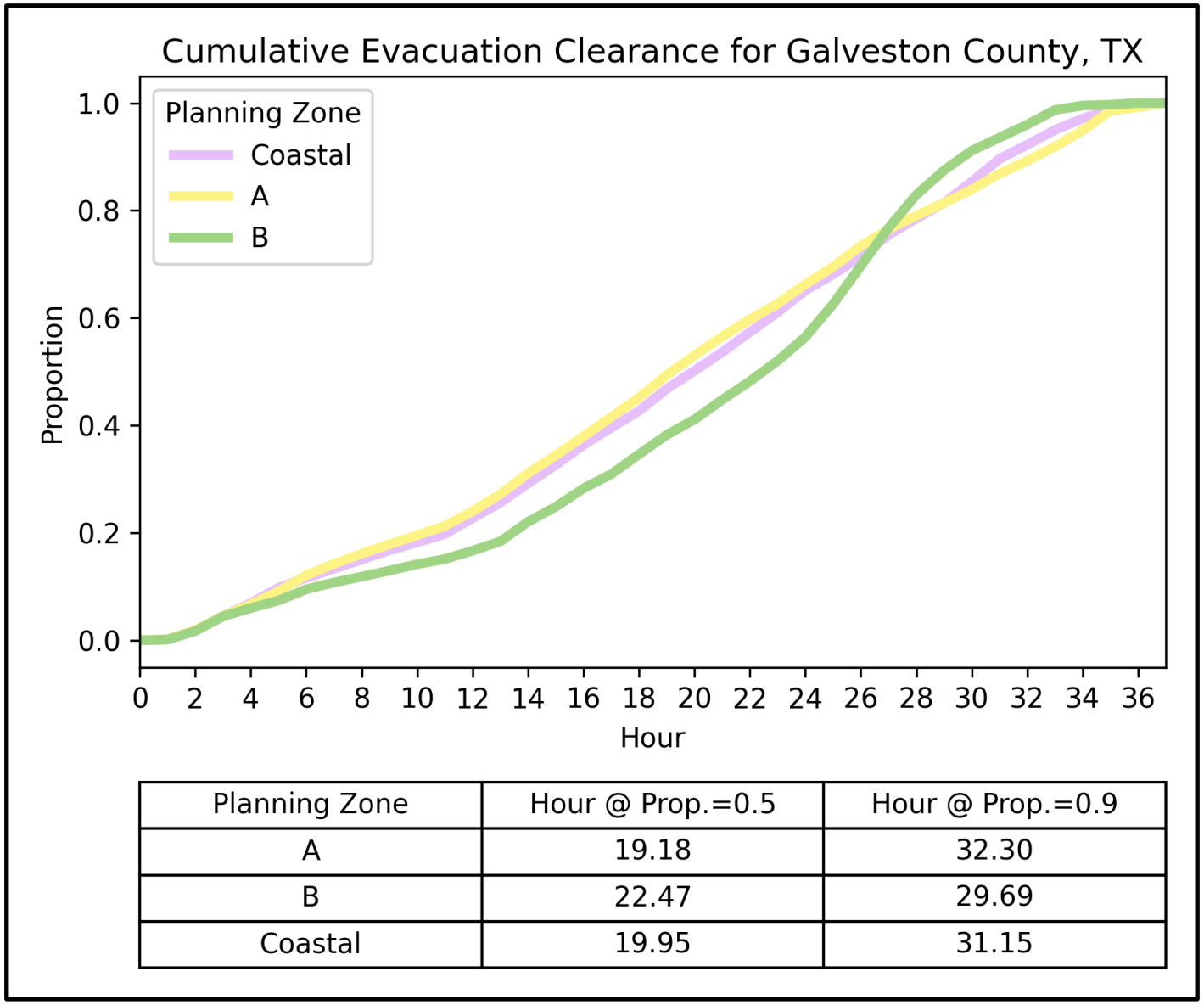
Planning Zone	Hour @ Prop.=0.5	Hour @ Prop.=0.9
A	15.65	20.68
B	13.16	18.90
Coastal	8.31	13.43

Scenario: Middle/Lower Region, Significant Surge Event, 12-hour response, 100% participation rates for Coastal, Zone A, & Zone B, with 30% for Zone C and 20% out of Zones if applicable.



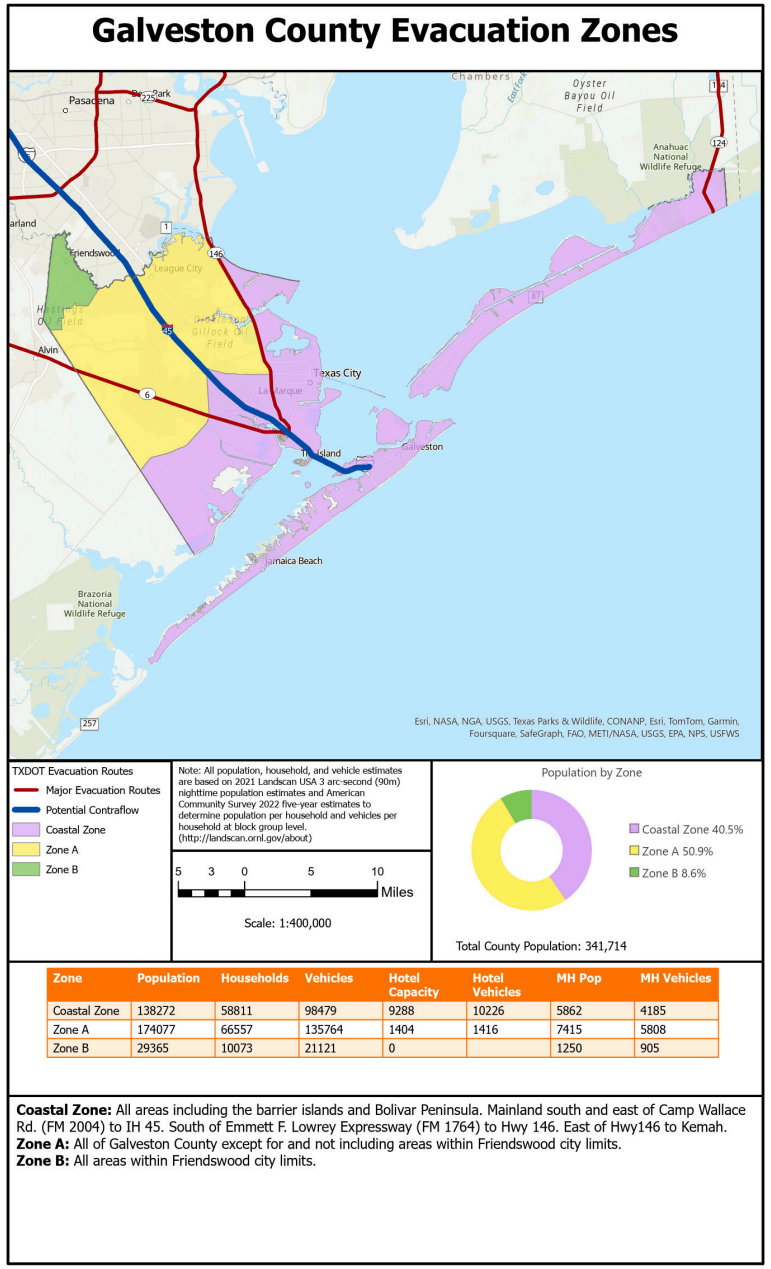
Zone	Population	Households	Vehicles	Hotel Capacity	Hotel Vehicles	MH Pop	MH Vehicles
Coastal Zone	1016	390	692	12	12	135	93
Zone A	33194	11284	25222	500	500	4502	3423
Zone B	11861	3894	8506	423	424	1612	1151

Example of Zone Clearance Times by County



Planning Zone	Hour @ Prop.=0.5	Hour @ Prop.=0.9
A	19.18	32.30
B	22.47	29.69
Coastal	19.95	31.15

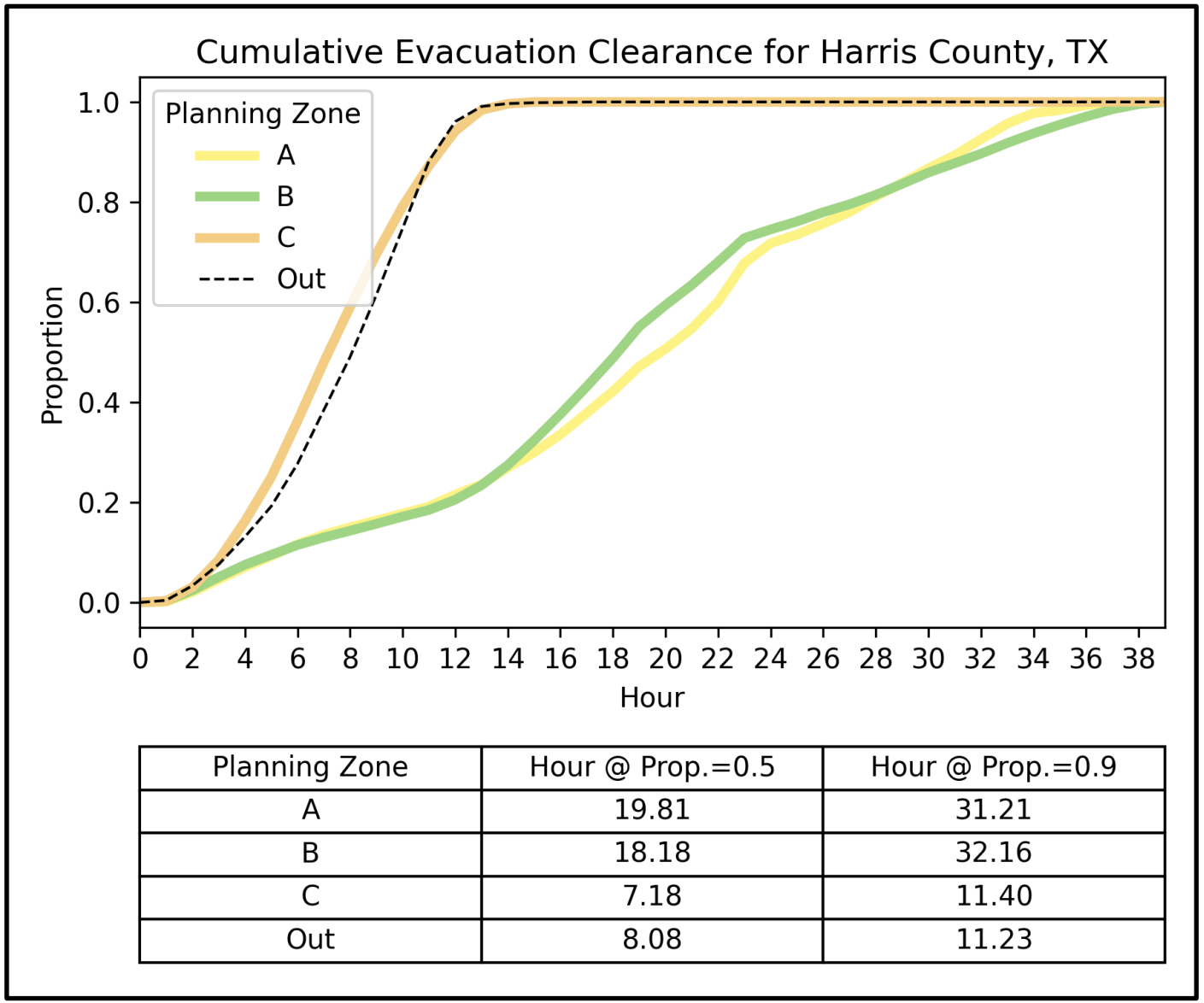
Scenario: Middle/Lower Region, Significant Surge Event, 12-hour response, 100% participation rates for Coastal, Zone A, & Zone B, with 30% for Zone C and 20% out of Zones if applicable.



Zone	Population	Households	Vehicles	Hotel Capacity	Hotel Vehicles	MH Pop	MH Vehicles
Coastal Zone	138272	58811	98479	9288	10226	5862	4185
Zone A	174077	66557	135764	1404	1416	7415	5808
Zone B	29365	10073	21121	0		1250	905

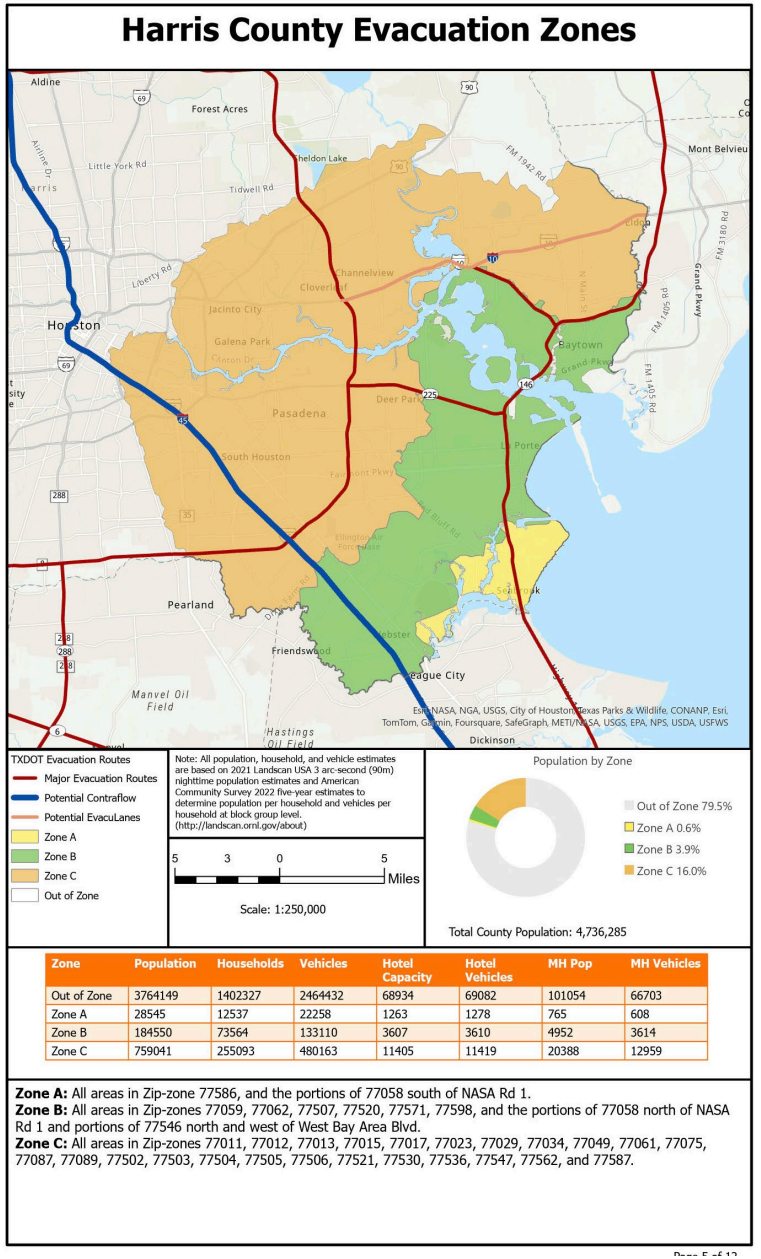
Coastal Zone: All areas including the barrier islands and Bolivar Peninsula. Mainland south and east of Camp Wallace Rd. (FM 2004) to IH 45. South of Emmett F. Lowrey Expressway (FM 1764) to Hwy 146. East of Hwy146 to Kemah.
Zone A: All of Galveston County except for and not including areas within Friendswood city limits.
Zone B: All areas within Friendswood city limits.

Example of Zone Clearance Times by County



Planning Zone	Hour @ Prop.=0.5	Hour @ Prop.=0.9
A	19.81	31.21
B	18.18	32.16
C	7.18	11.40
Out	8.08	11.23

Scenario: Middle/Lower Region, Significant Surge Event, 12-hour response, 100% participation rates for Coastal, Zone A, & Zone B, with 30% for Zone C and 20% out of Zones if applicable.



Zone	Population	Households	Vehicles	Hotel Capacity	Hotel Vehicles	MH Pop	MH Vehicles
Out of Zone	3764149	1402327	2464432	68934	69082	101054	66703
Zone A	28545	12537	22258	1263	1278	765	608
Zone B	184550	73564	133110	3607	3610	4952	3614
Zone C	759041	255093	480163	11405	11419	20388	12959

Zone A: All areas in Zip-zone 77586, and the portions of 77058 south of NASA Rd 1.
Zone B: All areas in Zip-zones 77059, 77062, 77507, 77520, 77571, 77598, and the portions of 77058 north of NASA Rd 1 and portions of 77546 north and west of West Bay Area Blvd.
Zone C: All areas in Zip-zones 77011, 77012, 77013, 77015, 77017, 77023, 77029, 77034, 77049, 77061, 77075, 77087, 77089, 77502, 77503, 77504, 77505, 77506, 77521, 77530, 77536, 77547, 77562, and 77587.

Questions?

Project website:

Atlas website:

Project website:

Atlas website:

Contacts

- USACE Galveston District
  - **Kyle Donlevy:** kyle.a.donlevy@usace.army.mil
  - **Gerald Gains:** gerald.d.gaines@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 Division of Emergency Management, Regions 3 & 4
  - **Blake White:** blake.white@tdem.texas.g
  - **Michael Bradberry:** michael.bradberry@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 Wunneburger:** 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@tamu.edu
      - GIS & data development and analysis and website development and maintenance