



# 2023 JOINT REGULATORY PLAN REVIEW

Stakeholder Meeting 2



30 September 2020

# KEYS STAKEHOLDER ENGAGEMENT OPPORTUNITIES



Meeting attendance and project awareness



Providing data for technical analyses



Providing feedback on draft material



Participate in targeted outreach efforts

# 1

## Develop Population and Demand Projections

Develop projections of population and water demand over a ten-county area through the year 2100.



# 2

## Conduct Alternative Water Supply Assessment

Review alternative water supplies for the capability of reducing future groundwater demand.



# 3

## Develop the Gulf Coast Land Subsidence and Groundwater Flow Model

Development of the GULF-2023 model for simulating regional groundwater flow and subsidence in the Gulf Coast Aquifer.



# 4

## Evaluate Regulatory Scenarios

Evaluate the performance of the HGSD and FBSD regulatory plans and consider refinements to the regulatory plan framework to accommodate future growth, alternative water supplies, and the most recent aquifer science.



# TODAY'S SPEAKERS



Jason Afinowicz  
• Freese and Nichols



Scott Marr  
• HDR



Wade Oliver  
• INTERA





# PROJECT ELEMENTS

Alternative Water Supply Availability

Projected Water Needs

PRESS Model Assessment

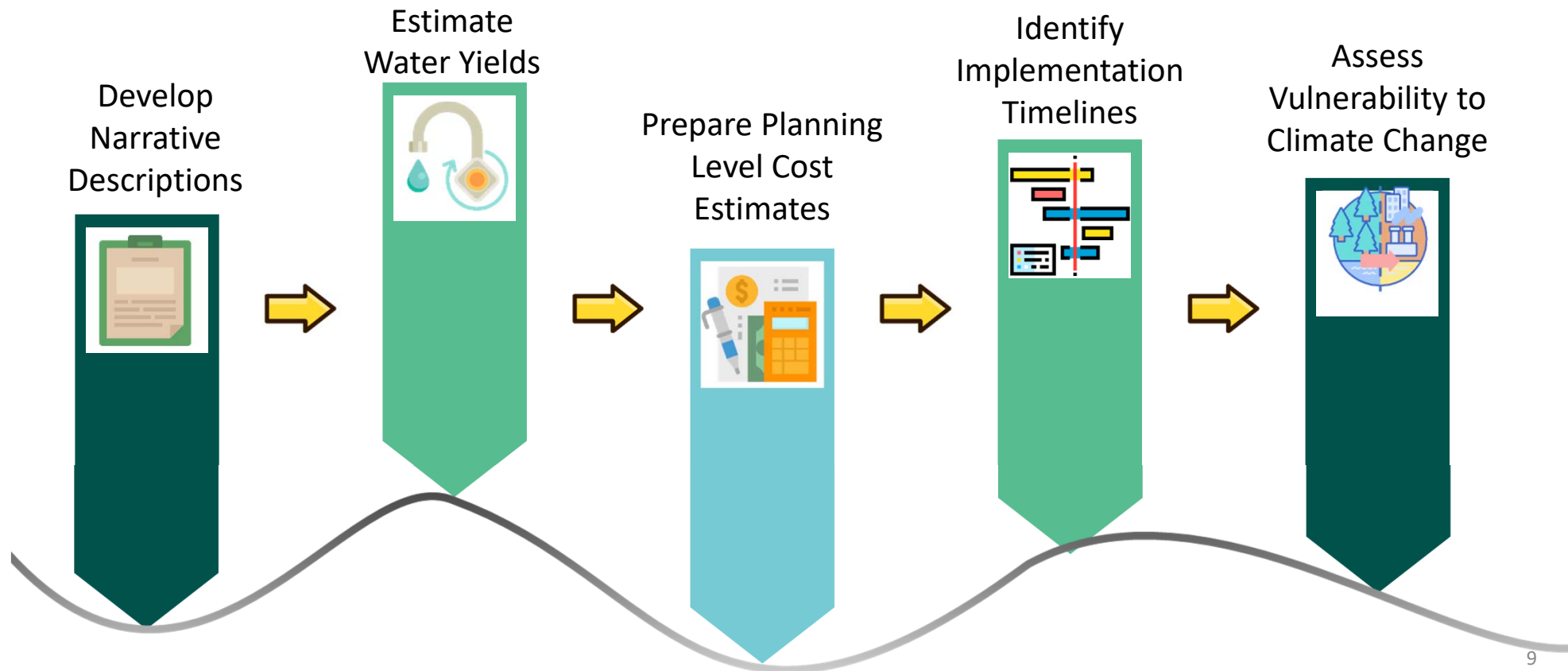
2013 Regulatory Plan Post Audit

# ALTERNATIVE WATER SUPPLY AVAILABILITY



# ALTERNATIVE WATER SUPPLY AVAILABILITY

## Characterization of Shortlisted Options





# PROJECT ELEMENTS

Alternative Water Supply Availability

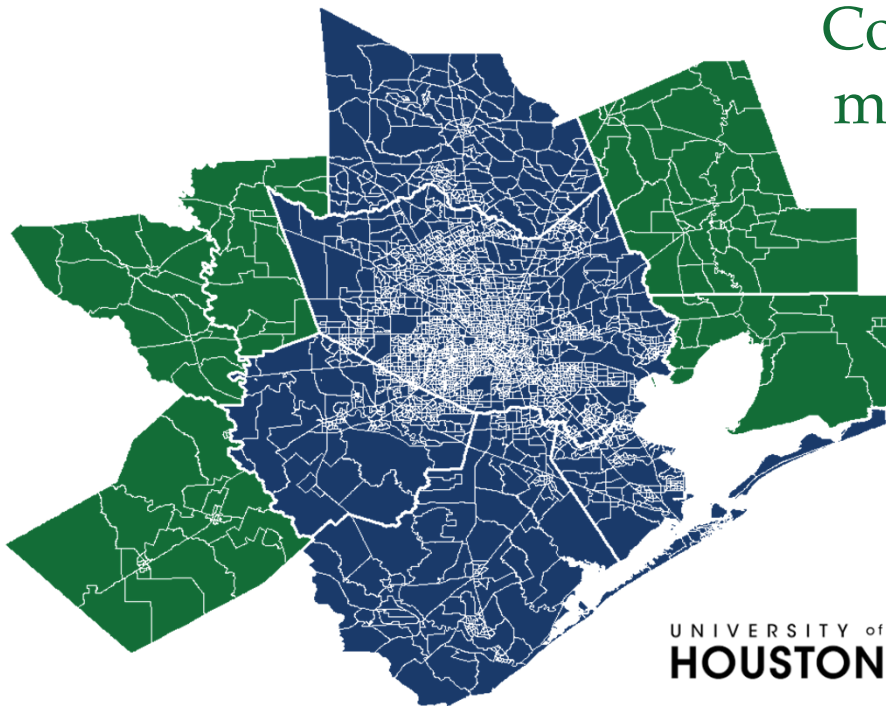
Projected Water Needs

PRESS Model Assessment

2013 Regulatory Plan Post Audit



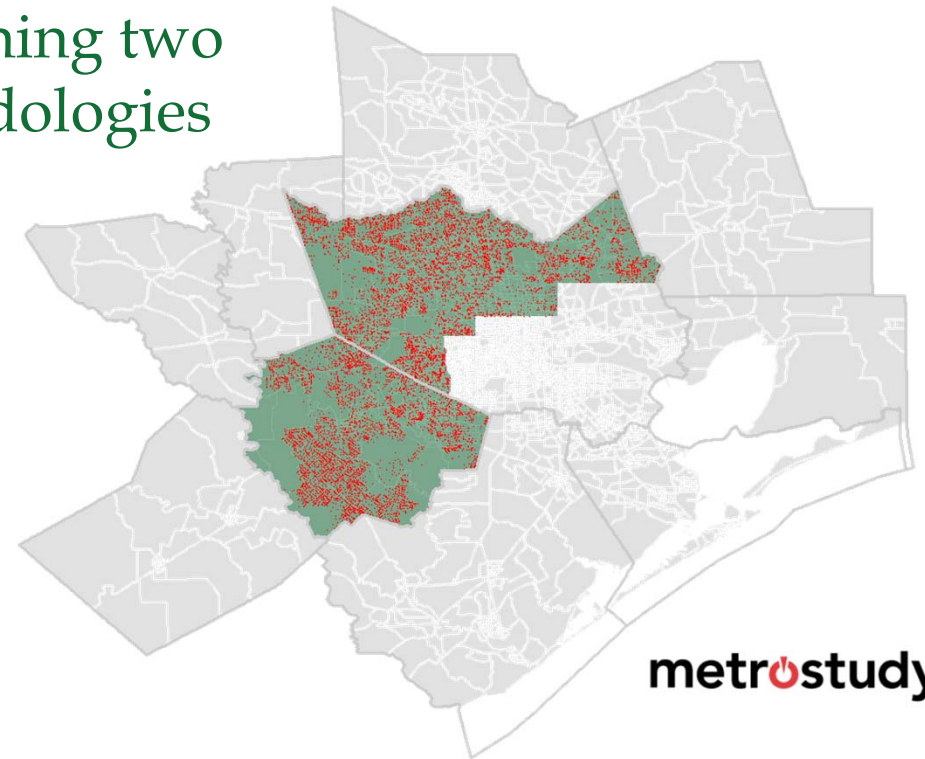
# PROJECTED WATER NEEDS



UNIVERSITY of  
**HOUSTON**

Small Area Model Houston (SAM-Houston)  
Long-range, wide-area projections

Combining two  
methodologies



**metr**ostudy

Projected Development Methodology  
Short-range, detailed projections

# PROJECTED WATER NEEDS

## *SAM-Houston Model Approach*

Predict Total  
Employment

Predict Employment  
by Subcenter

Predict how People  
Sort Around  
Employment  
Subcenters

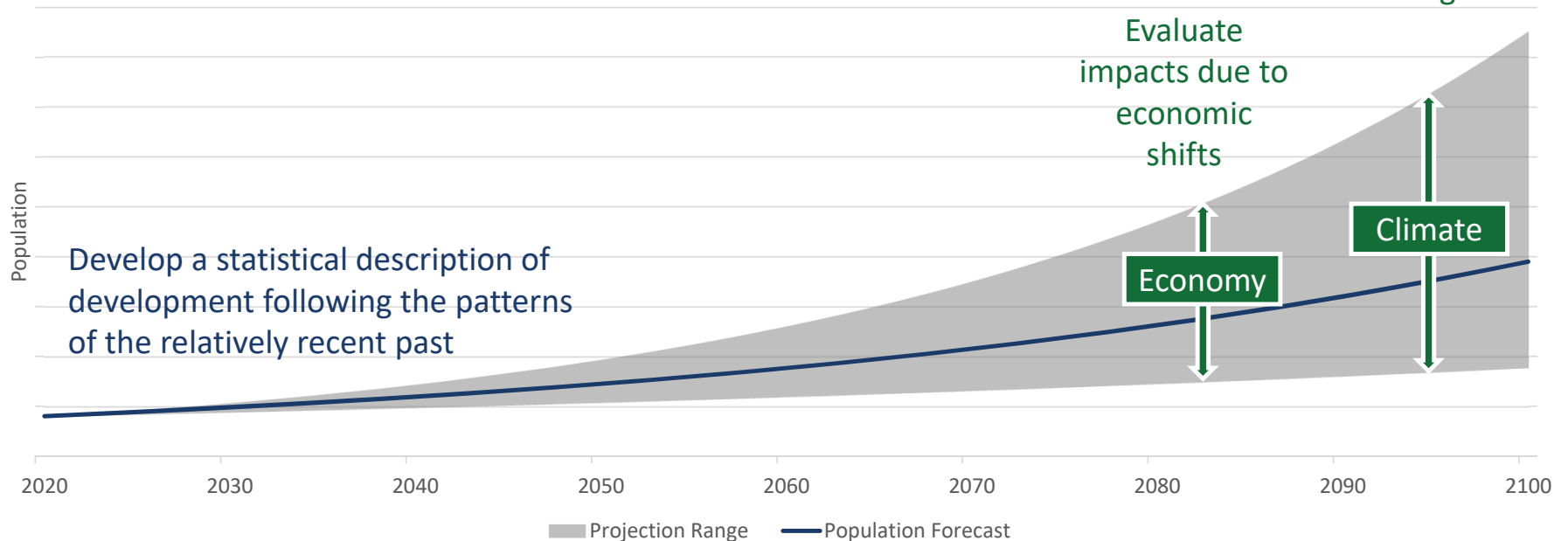
Account for Vacant  
Land (Capacity)



# PROJECTED WATER NEEDS

## Three Steps to Consider Variability

Illustrate disruption due to climate change



# PROJECTED WATER NEEDS

- 2020 Census Concerns
  - Schedule
  - Quality
- Exploring Alternatives to Mitigate Risks
- American Community Survey
  - Already being used to populate and calibrate model
  - Could be used for study projections

HOUSTON★CHRONICLE

## Worries about 2020 census' accuracy grow with cut schedule

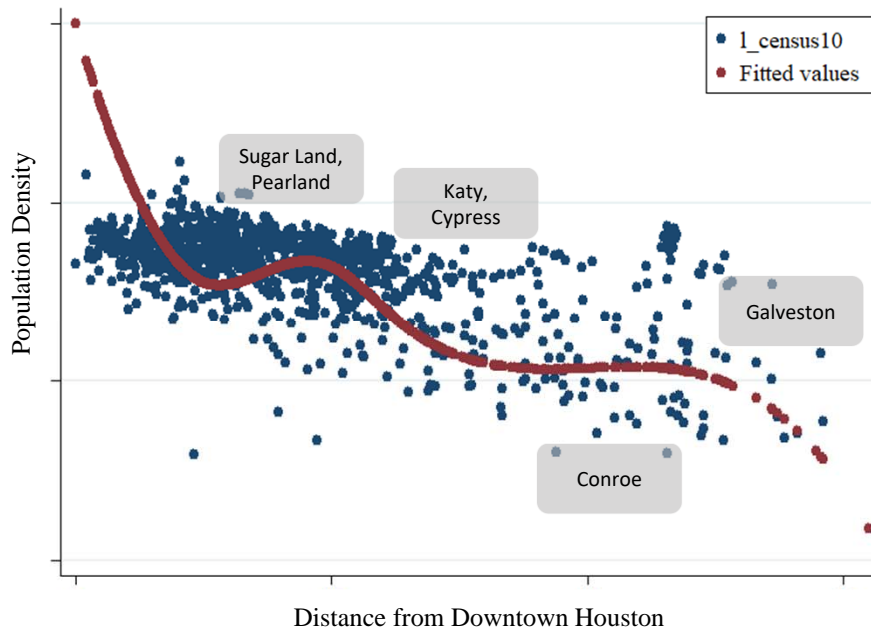
Mike Schneider, Associated Press Updated 12:03 am CDT, Wednesday, August 5, 2020



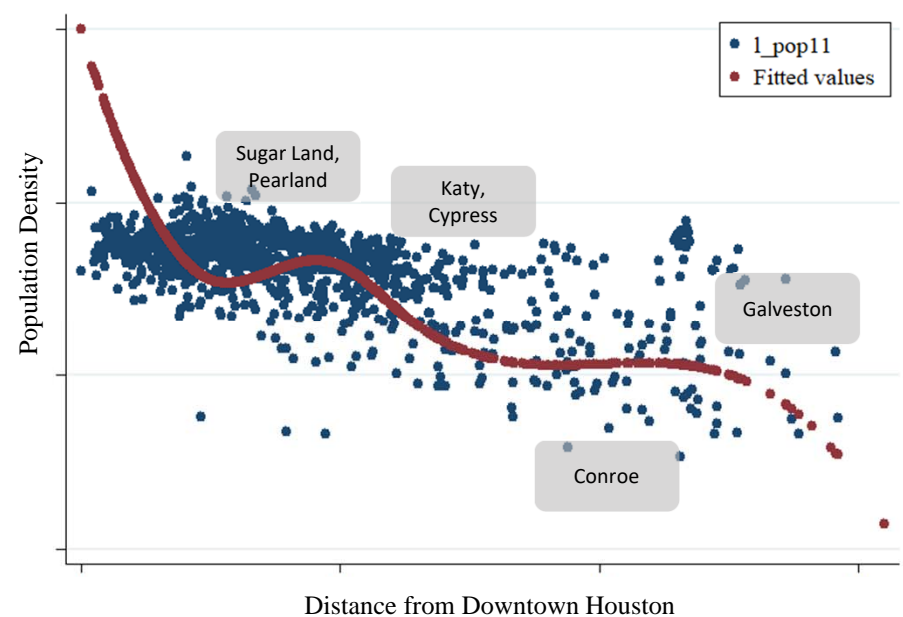
# PROJECTED WATER NEEDS

- ACS and Census data demonstrate similar trends across the region

Census 2010 Basic Density: All Counties



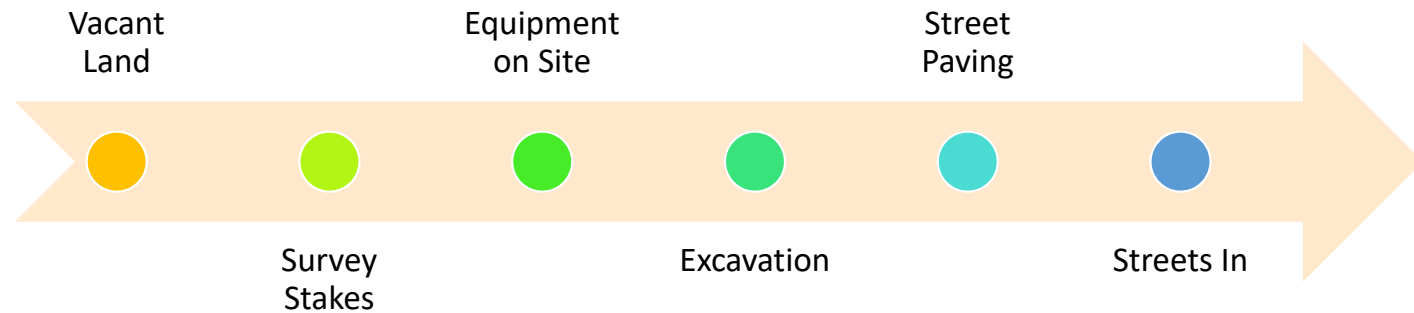
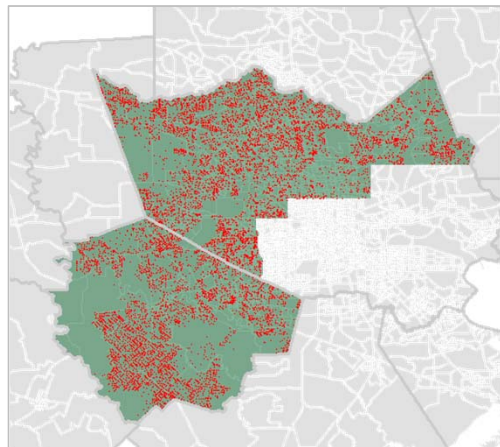
ACS 2011-13 Basic Density: All Counties



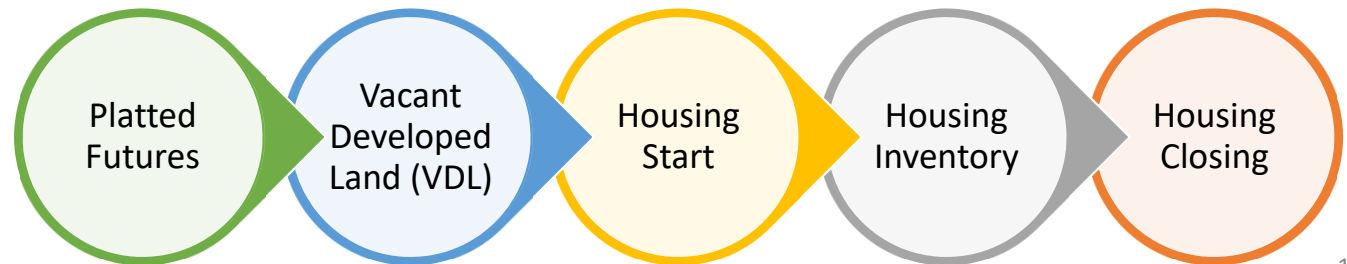
# PROJECTED WATER NEEDS

- Projected Development Methodology

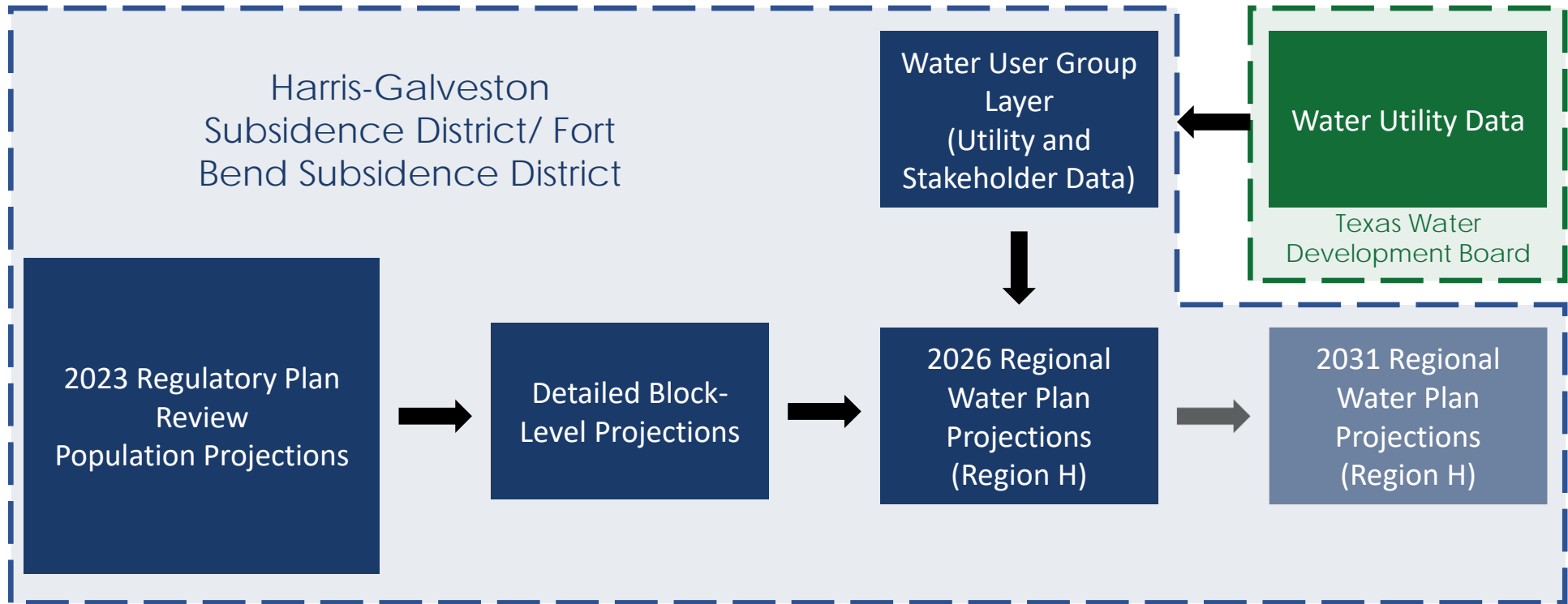
- Land/lot development



- New home development



# PROJECTED WATER NEEDS



# PROJECTED WATER NEEDS

## Ongoing Coordination



Municipalities



Texas Water  
Development Board



Region H Water  
Planning Group







# PROJECT ELEMENTS

Alternative Water Supply Availability

Projected Water Needs

PRESS Model Assessment

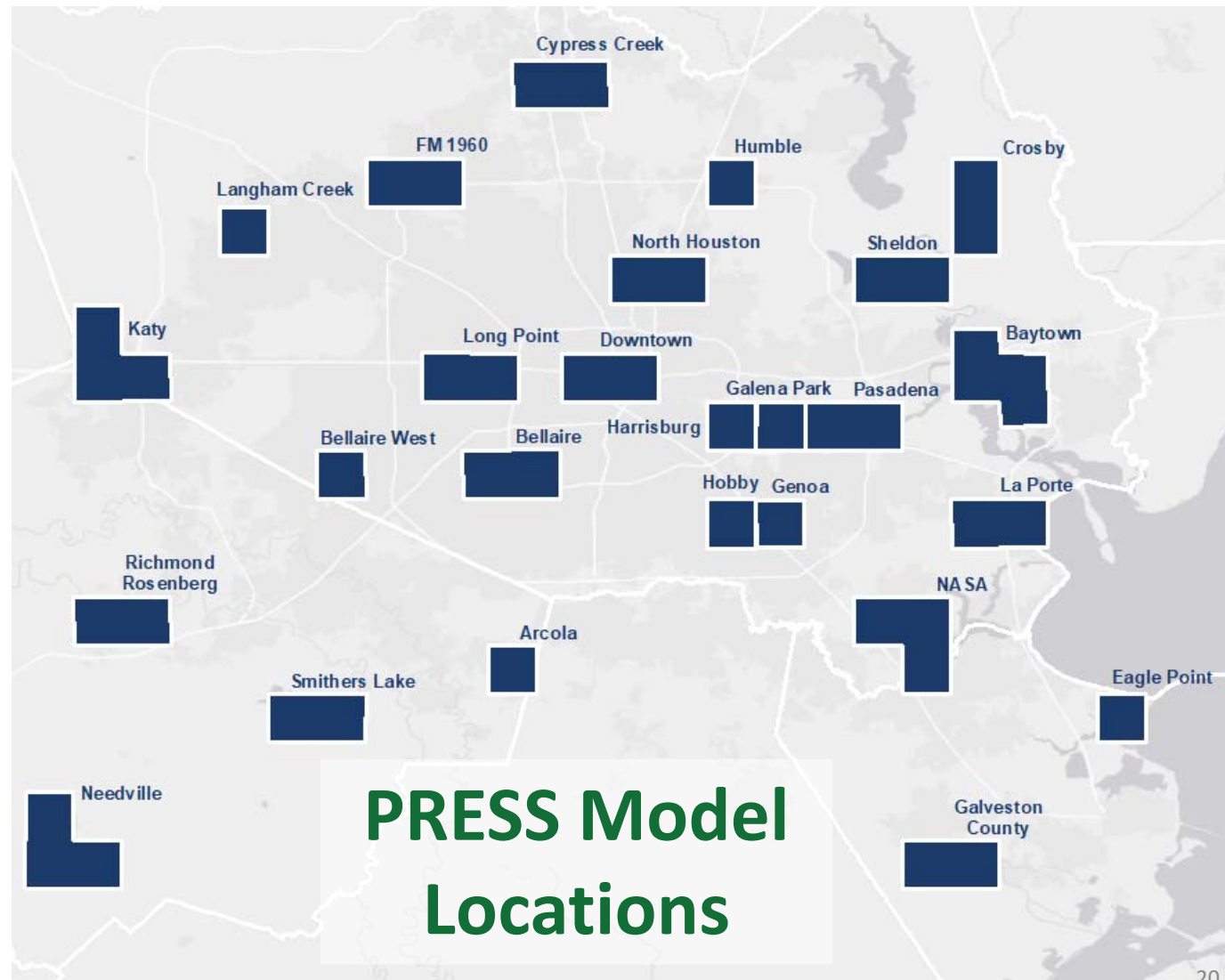
2013 Regulatory Plan Post Audit

# PRESS MODEL ASSESSMENT

What is PRESS?

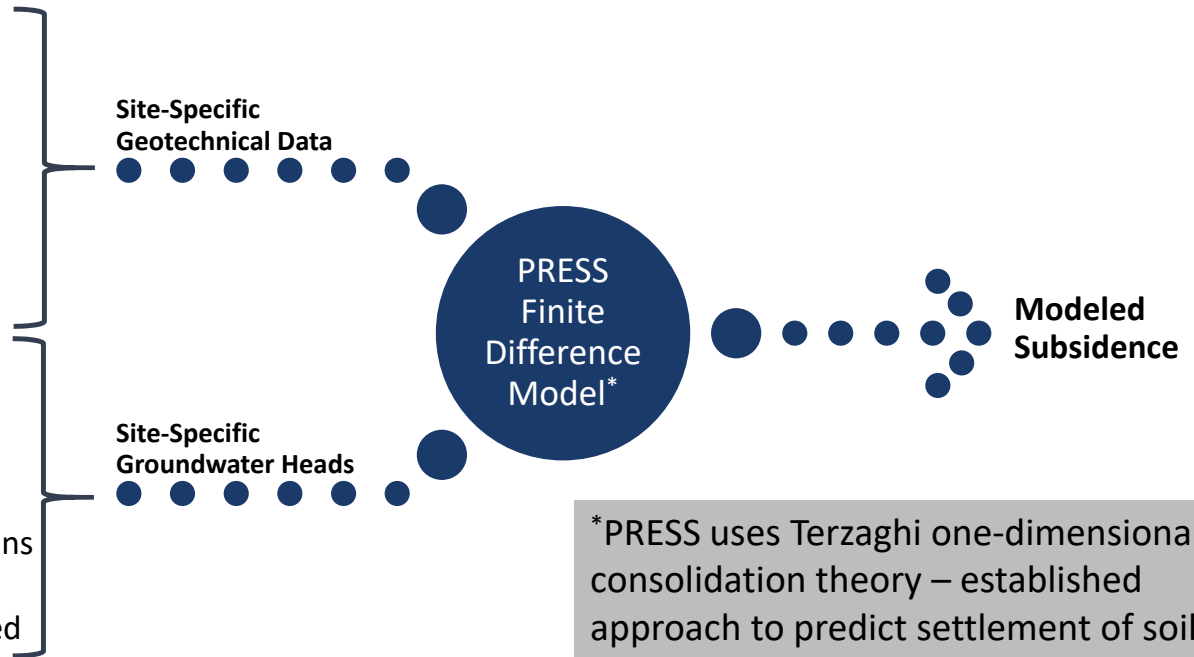
Predictions  
Relating  
Effective  
Stress to  
Subsidence

Site-specific  
models used to  
assess subsidence.



# PRESS MODEL ASSESSMENT

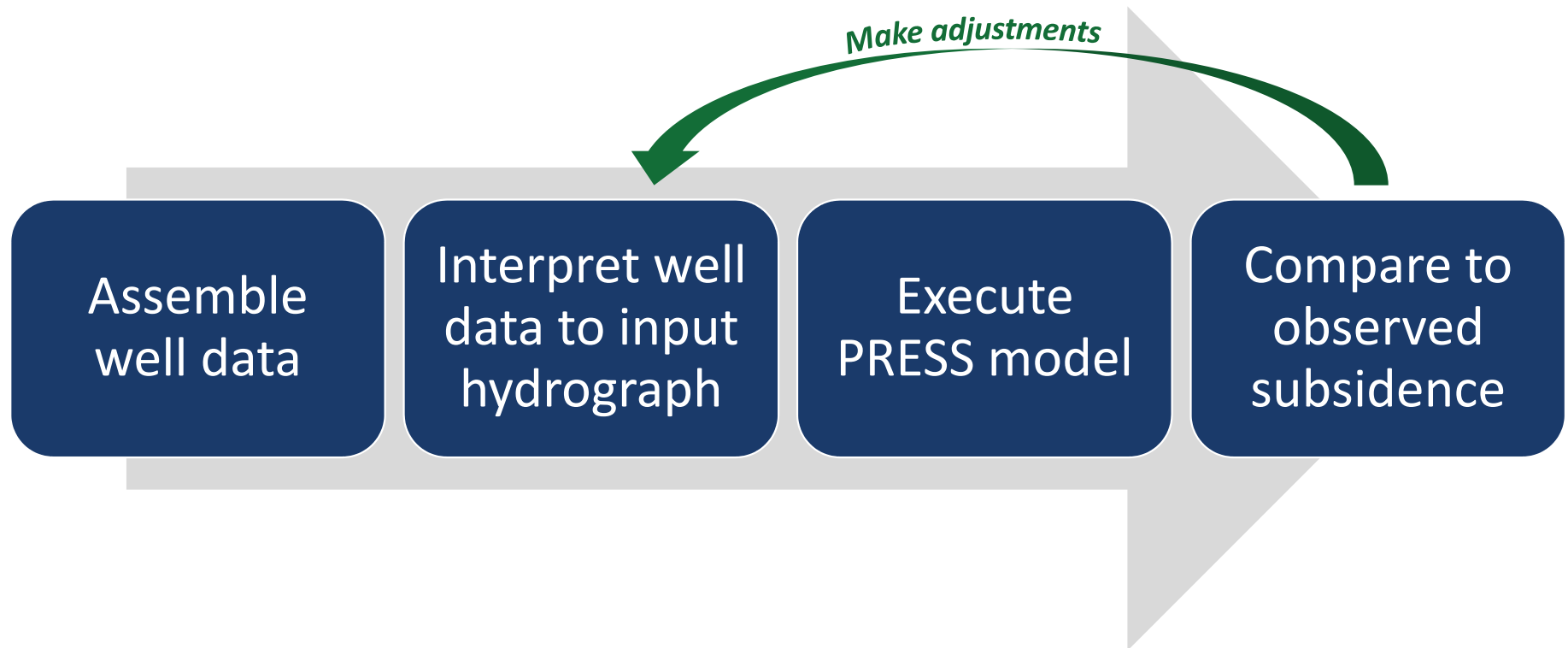
- Permeability
- Rebound/Compression Compressibility
- Virgin Compressibility
- Preconsolidation Stress
- Compacting Intervals
- Thickness of Clay Layers
- Measured water levels for wells within each PRESS Site boundary
- MODFLOW modeled water levels in very limited situations where measured data not available or is severely limited

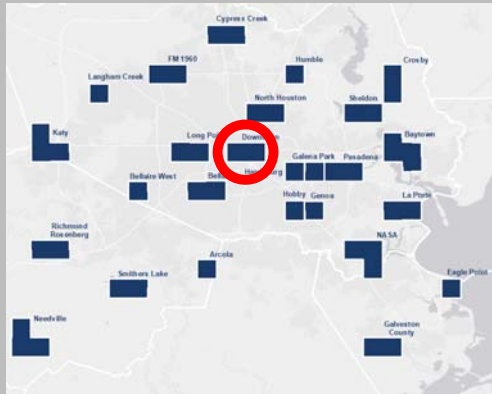


\*PRESS uses Terzaghi one-dimensional consolidation theory – established approach to predict settlement of soils loaded by structures.

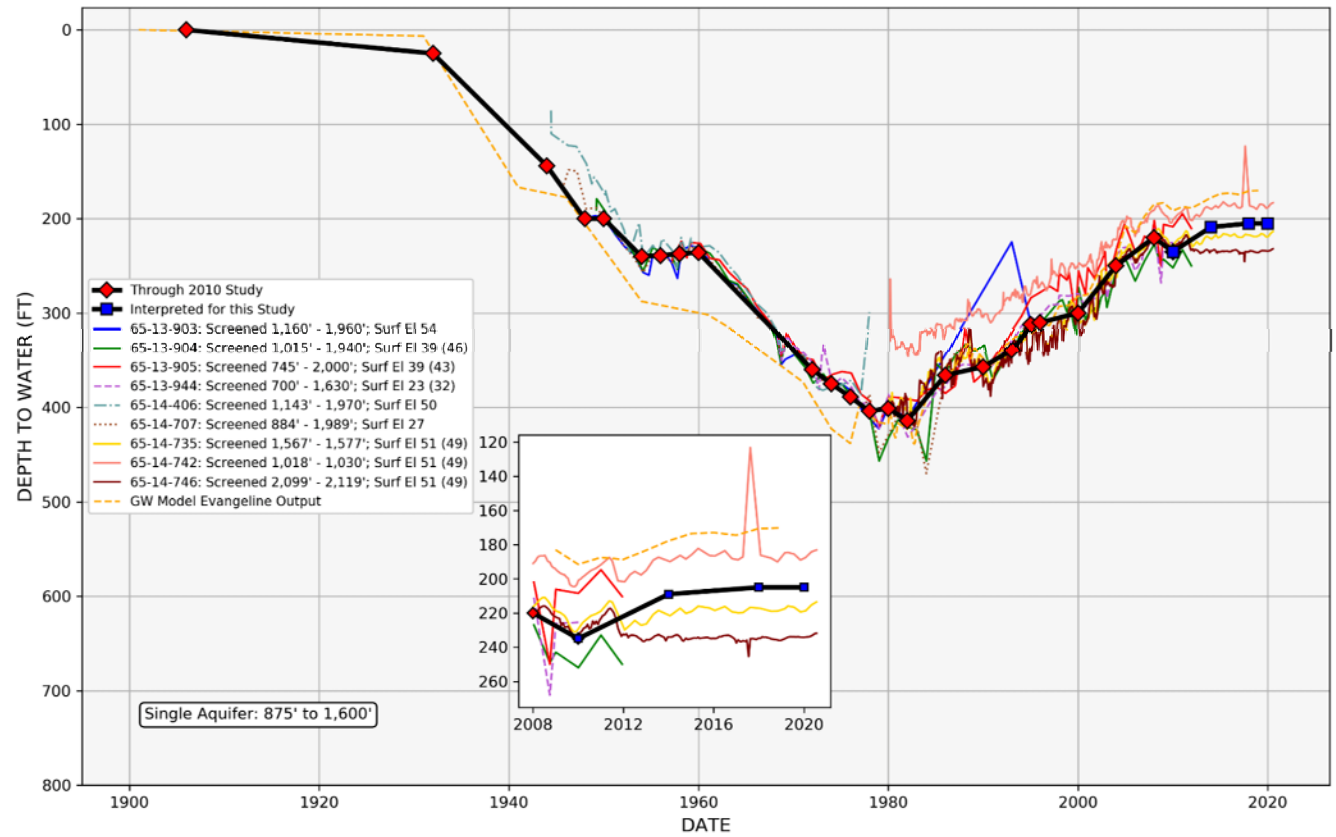
Last calibration in conjunction with 2013 Regional Groundwater Update Project

# PRESS MODEL ASSESSMENT





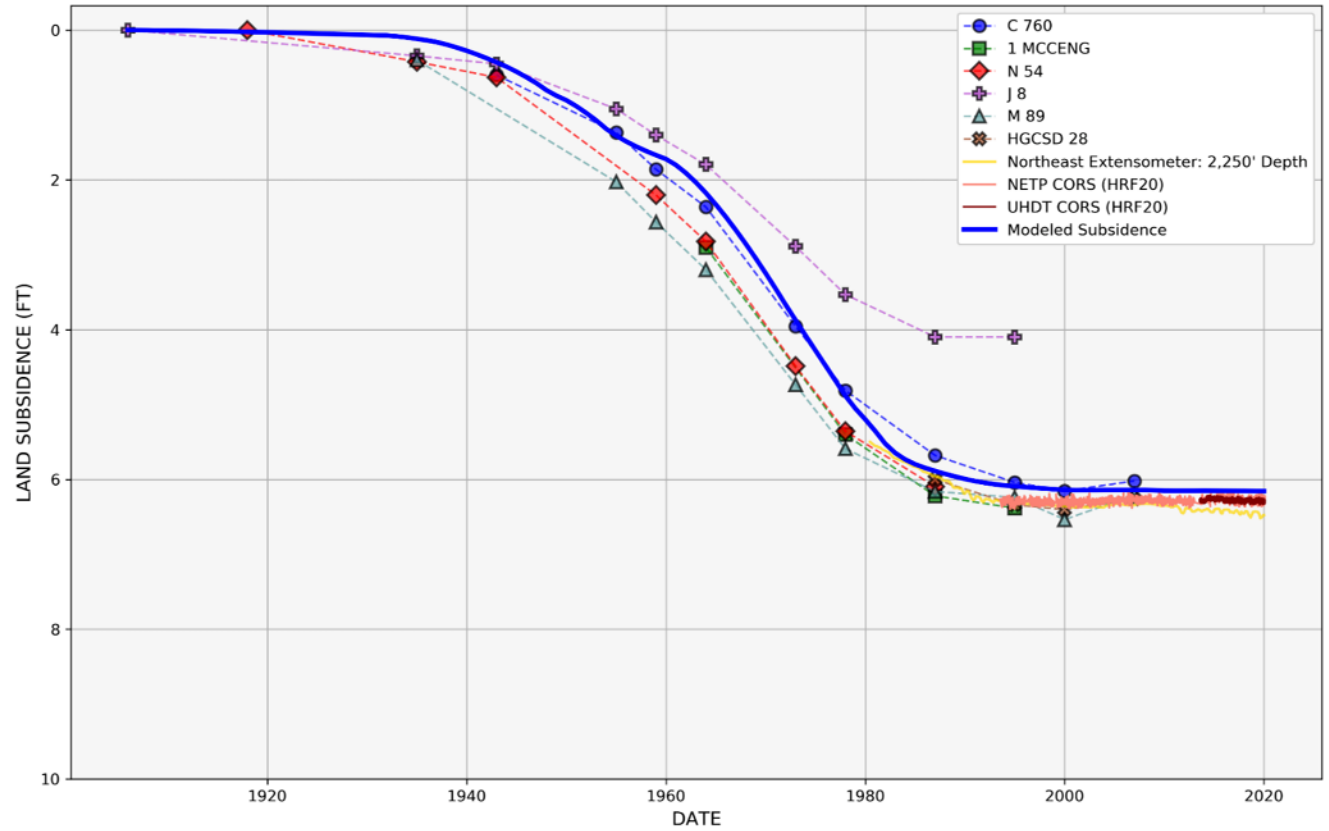
# DOWNTOWN PRESS SITE



**HYDROGRAPHS FOR DOWNTOWN SINGLE MODEL AQUIFER**



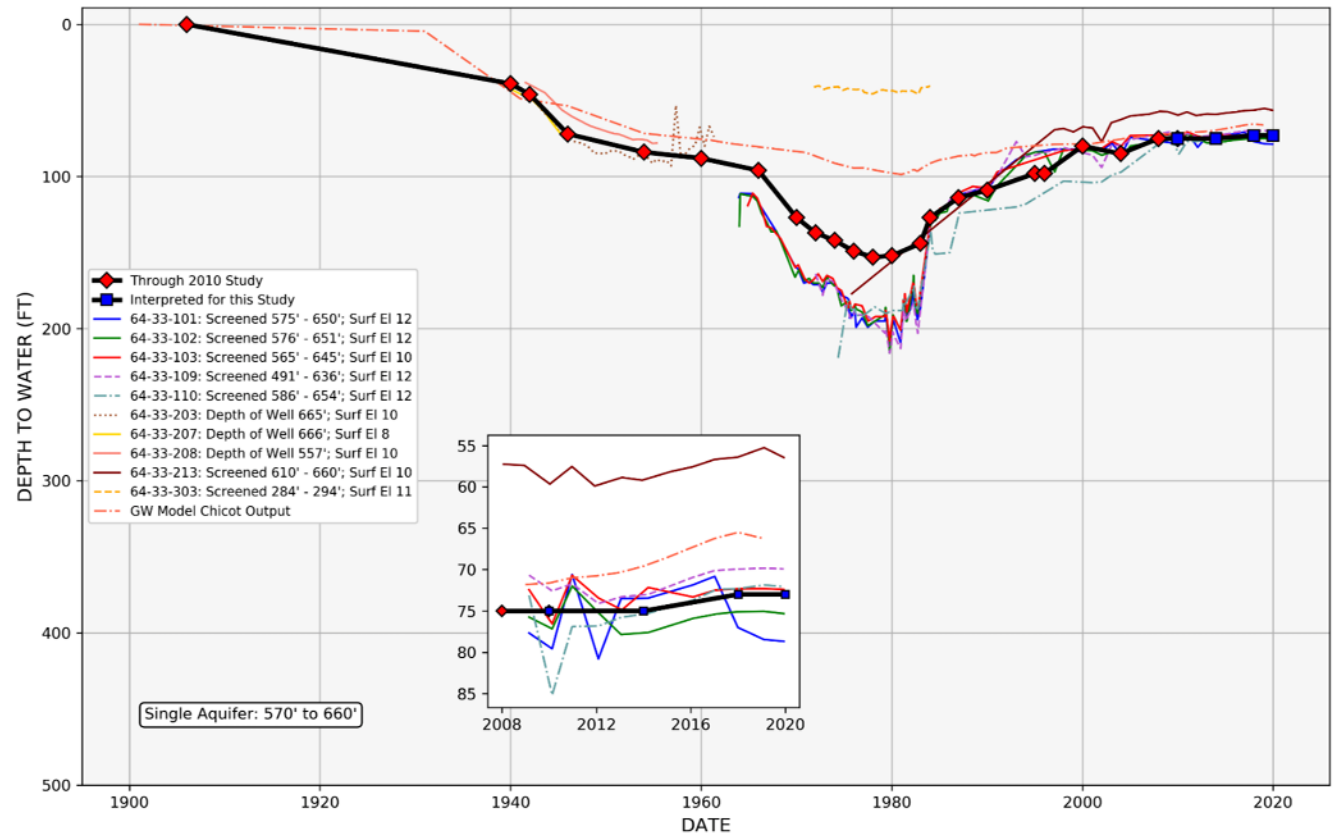
# DOWNTOWN PRESS SITE



**COMPUTED AND MEASURED SUBSIDENCE DOWNTOWN SITE**



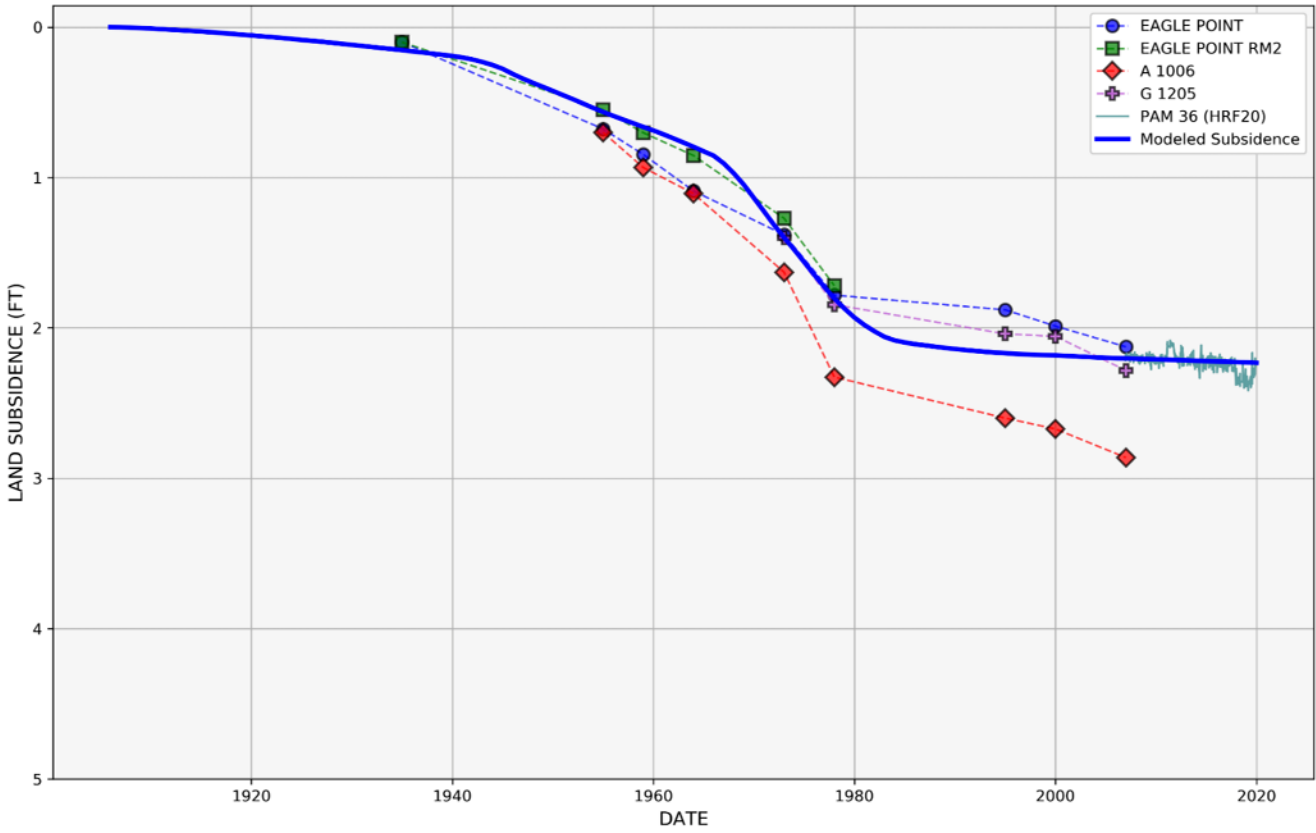
# EAGLE POINT PRESS SITE



**HYDROGRAPHS FOR EAGLE POINT SINGLE MODEL AQUIFER**



# EAGLE POINT PRESS SITE

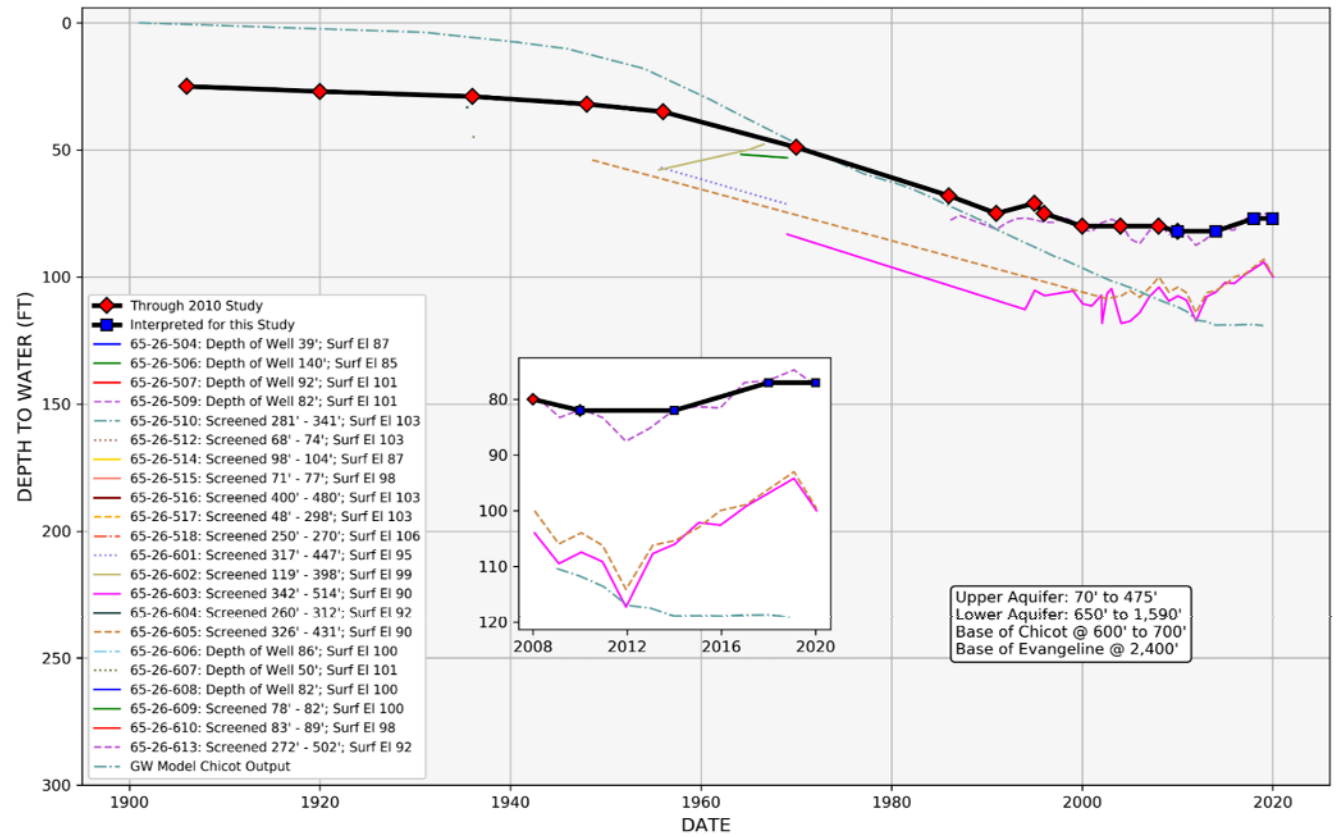


**COMPUTED AND MEASURED SUBSIDENCE  
EAGLE POINT SITE**





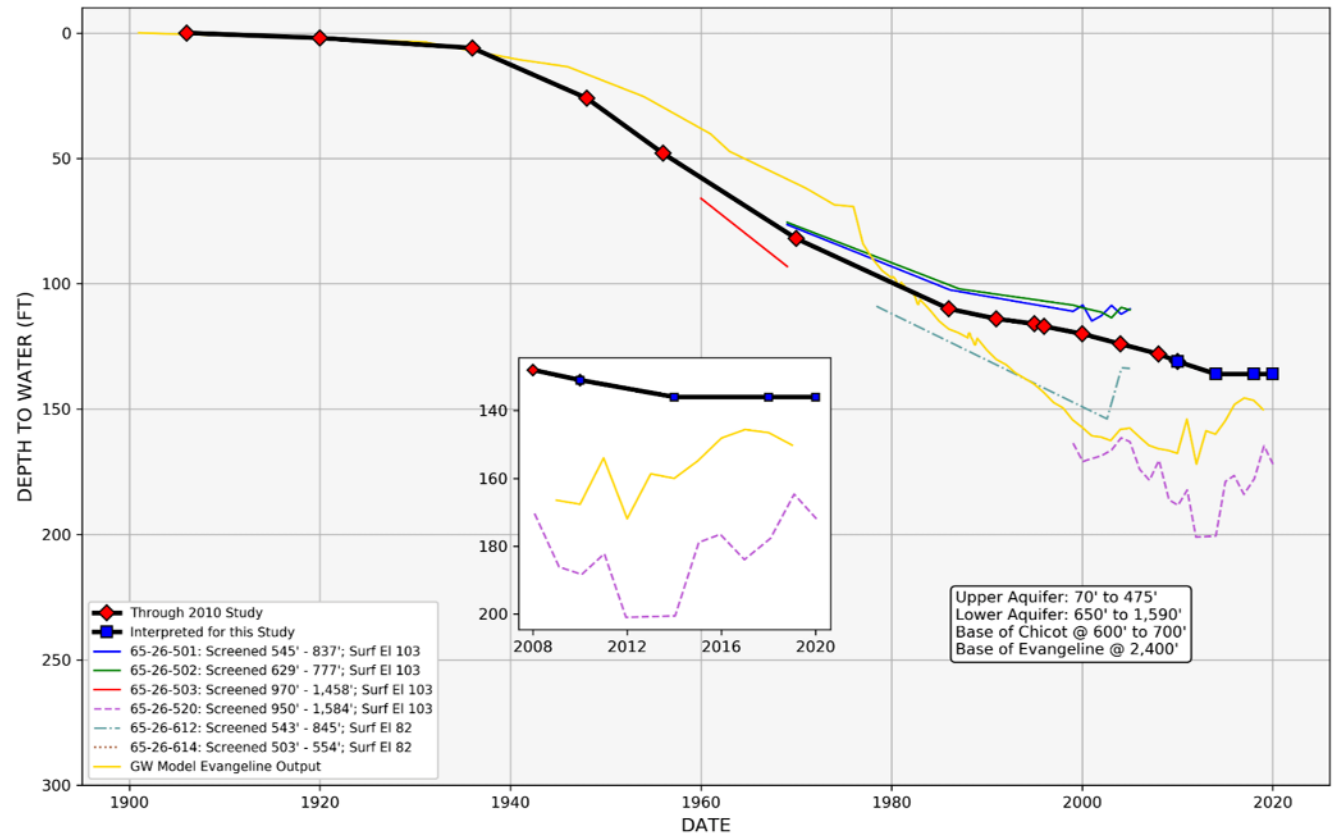
# RICHMOND-ROSENBERG PRESS SITE



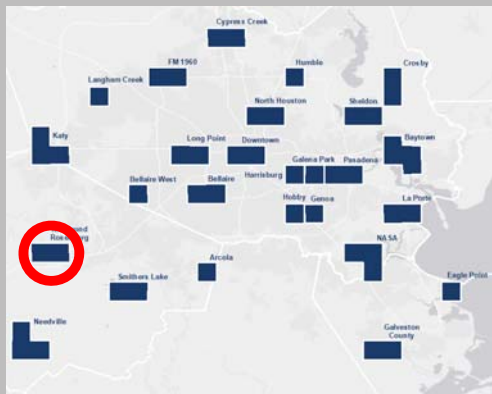
**HYDROGRAPHS FOR RICHMOND-ROSENBERG MODEL UPPER AQUIFER**



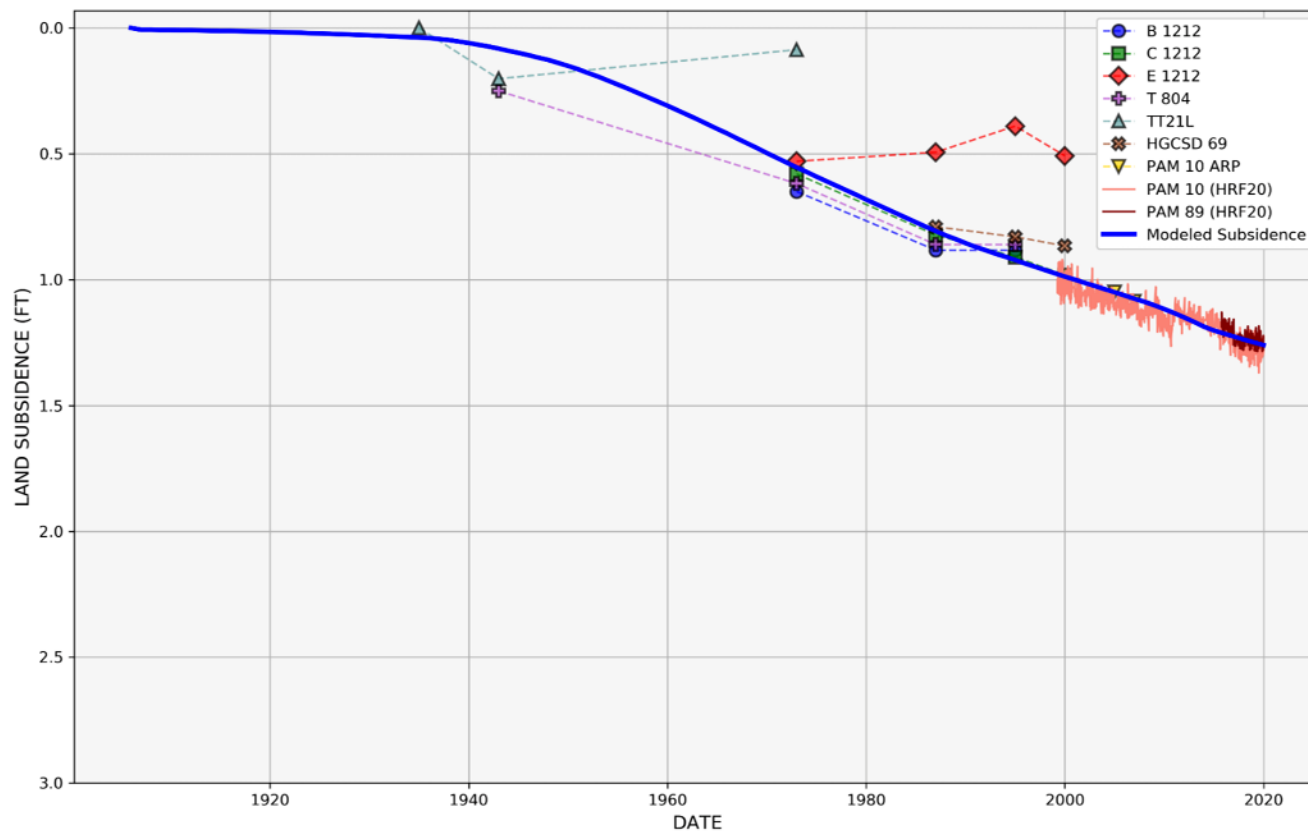
# RICHMOND-ROSENBERG PRESS SITE



**HYDROGRAPHS FOR RICHMOND-ROSENBERG MODEL LOWER AQUIFER**



# RICHMOND-ROSENBERG PRESS SITE



**COMPUTED AND MEASURED SUBSIDENCE  
RICHMOND-ROSENBERG SITE**

# PRESS MODEL ASSESSMENT

## Observations

- PRESS models demonstrate a good fit to observed subsidence for sites across the region
- Existing models can be utilized for evaluation of regulatory scenarios in future phases of study

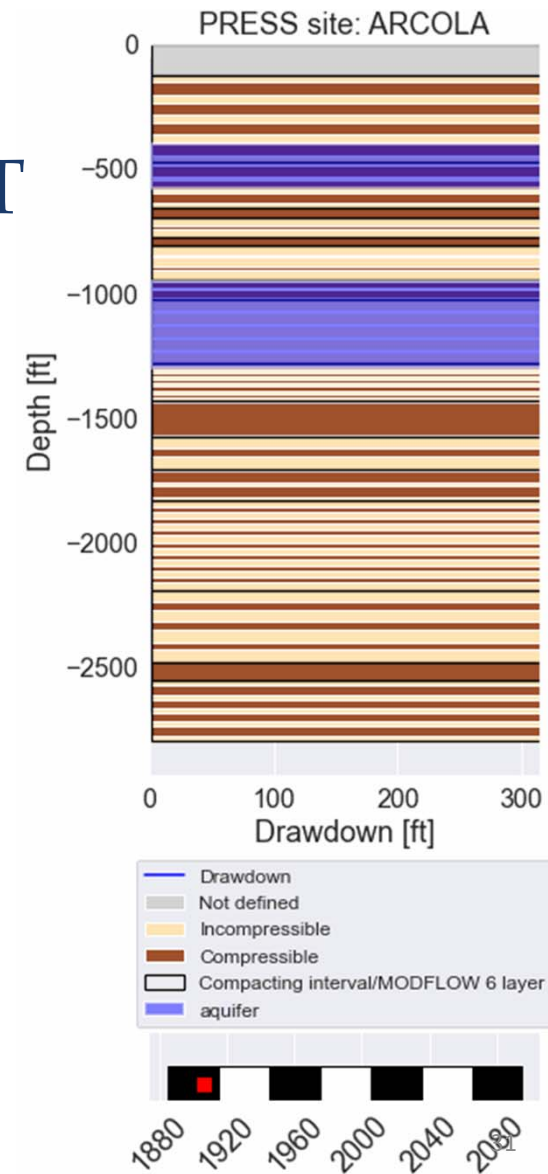


# PRESS/MODFLOW ASSESSMENT

Districts have used multiple models to assess impacts at the local- (PRESS) and regional-scales (MODFLOW with subsidence package)

The newest version of MODFLOW combined with an updated subsidence package may suitably serve both roles. Potential benefits include:

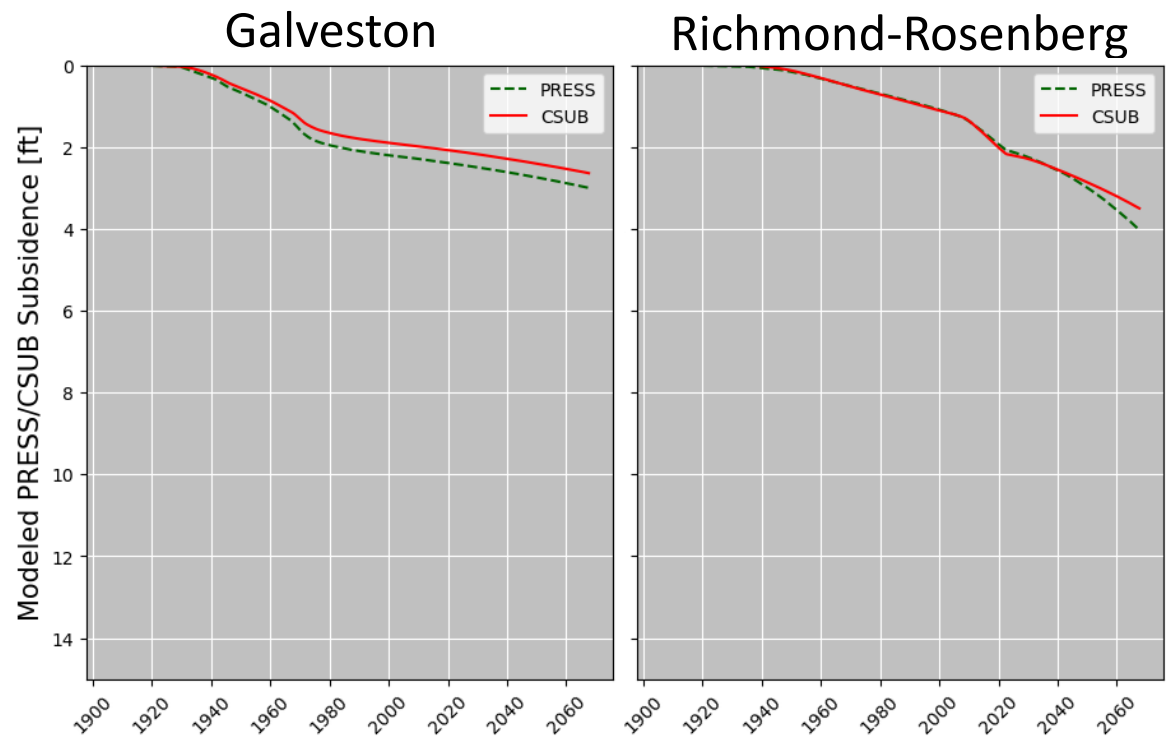
- Direct link between local and regional-scale models
- More robust representation of the physics of compaction



# PRESS/MODFLOW ASSESSMENT

## Observations

- Initial findings indicate local-scale MODFLOW models replicate the functionality of PRESS models
- Small differences between modeled and observed appear due to differences in model physics
- This assessment is ongoing





# PROJECT ELEMENTS

Alternative Water Supply Availability

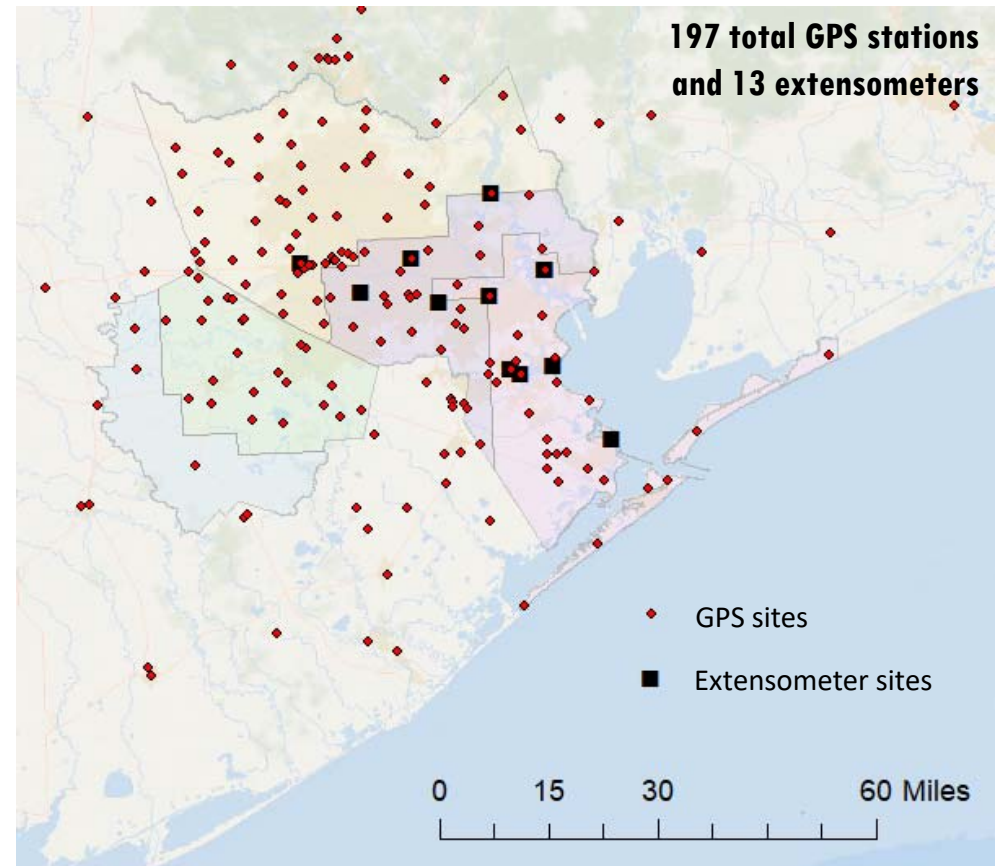
Projected Water Needs

PRESS Model Assessment

2013 Regulatory Plan Post Audit

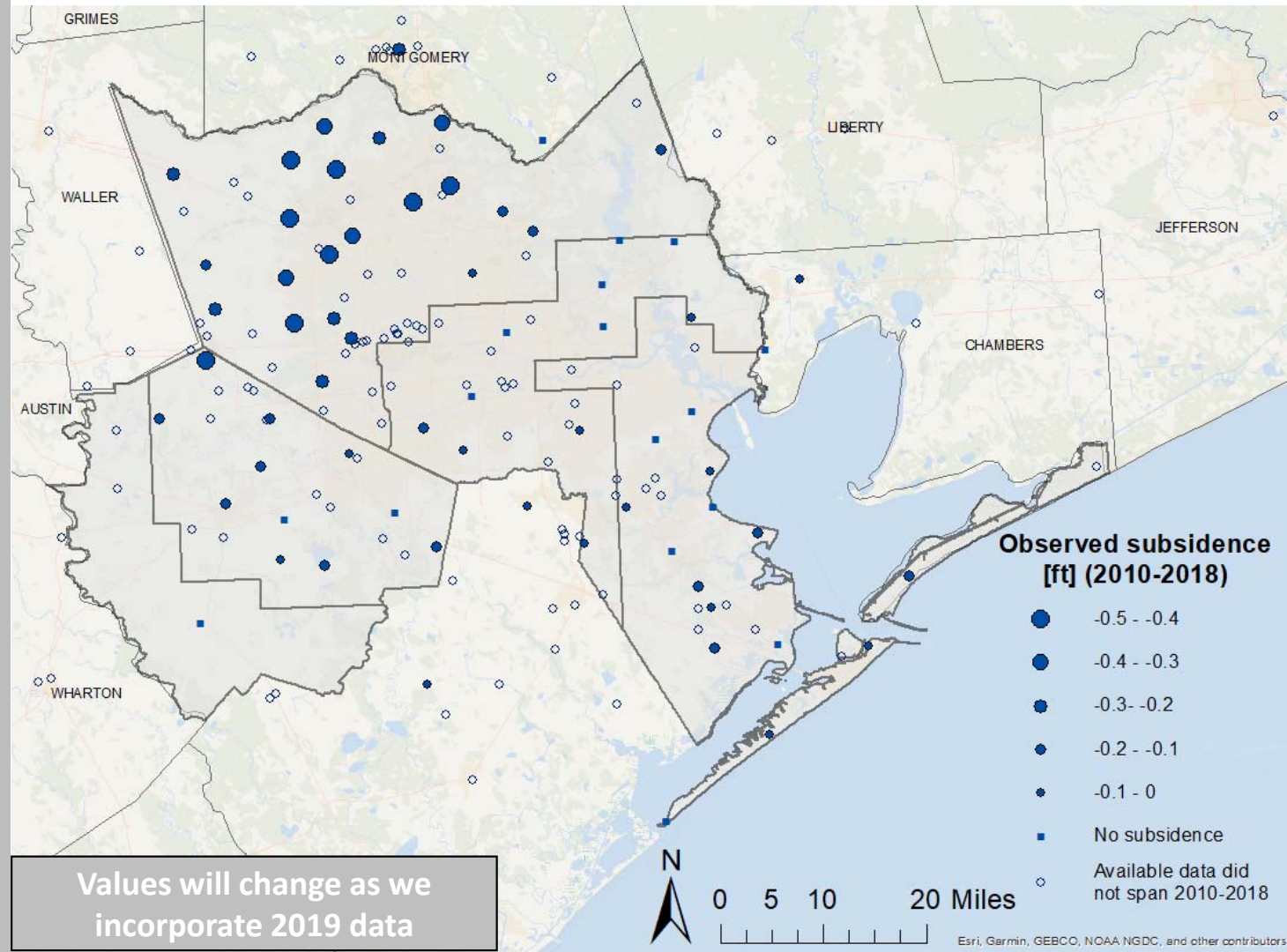
# 2013 REGULATORY PLAN POST AUDIT

- Evaluate the performance of the model using subsidence and compaction data collected since the last regulatory plan
- Apply lessons-learned to the development and use of the model for this Regulatory Plan Review
- Evaluation focused on 2010-2018

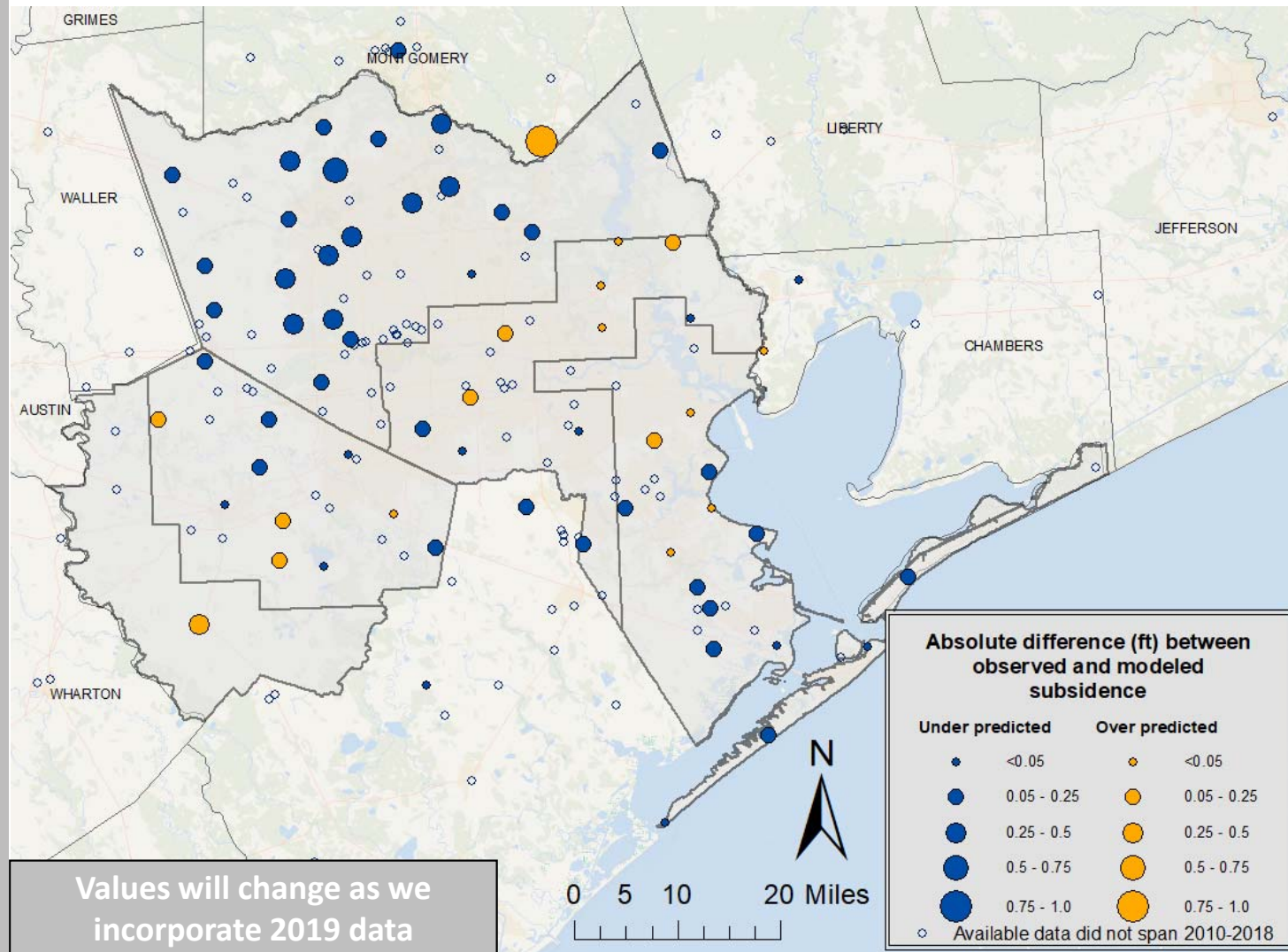




# OBSERVED SUBSIDENCE 2010-2018



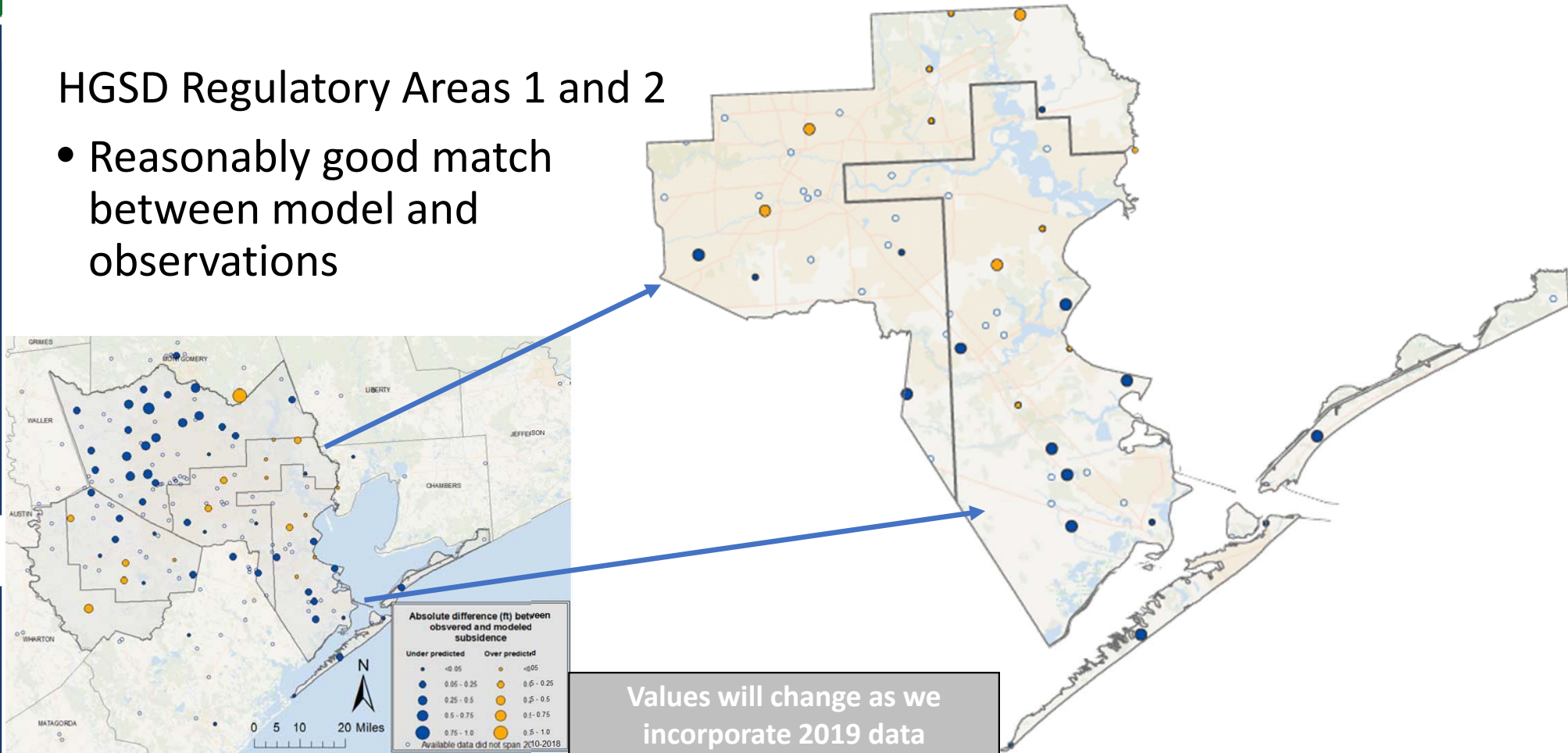
# MODELED VS. OBSERVED SUBSIDENCE 2010-2018



# 2013 REGULATORY PLAN POST AUDIT

## HGSD Regulatory Areas 1 and 2

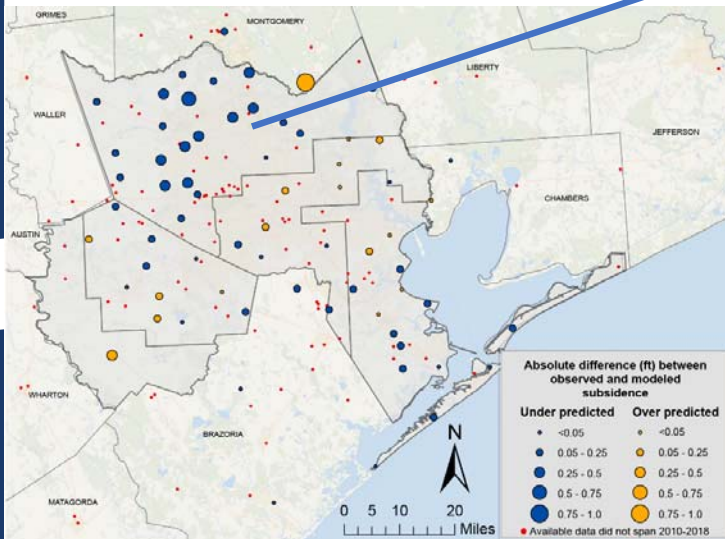
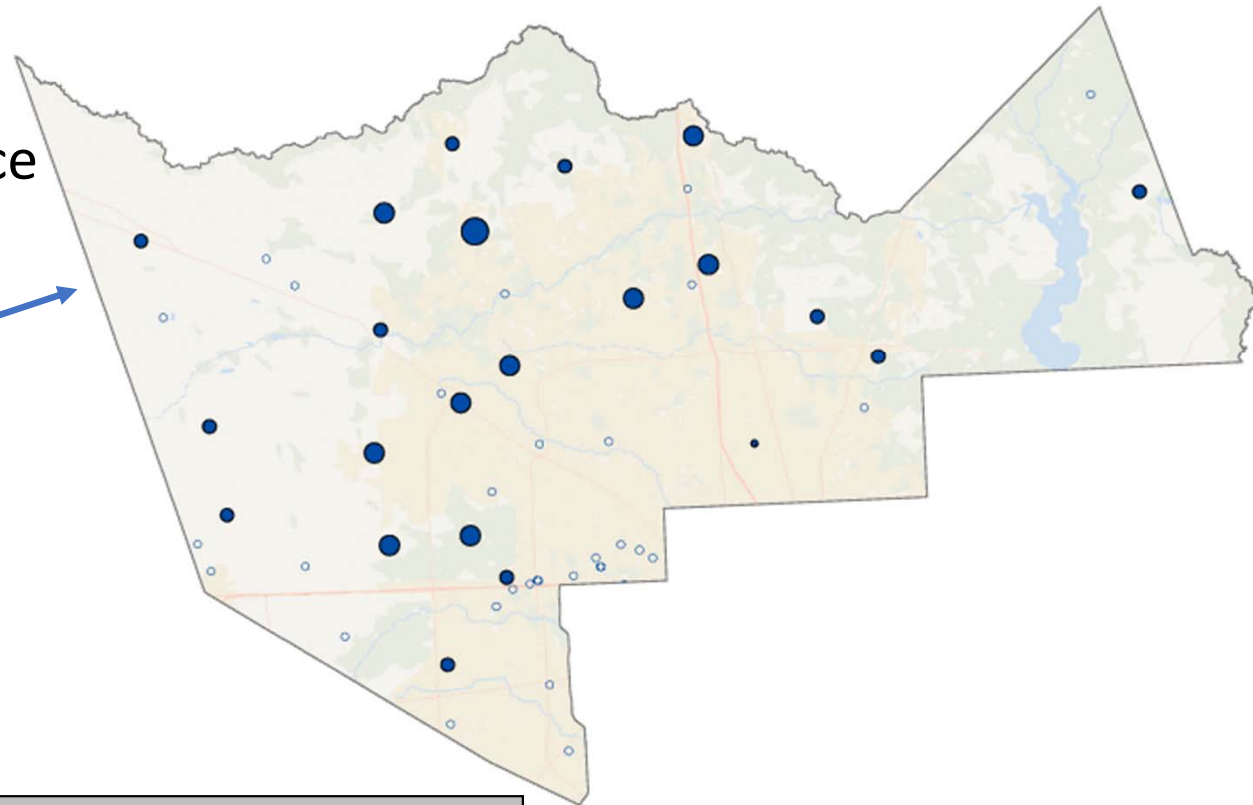
- Reasonably good match between model and observations



# 2013 REGULATORY PLAN POST AUDIT

## HGSD Regulatory Area 3

- Model generally underpredicted subsidence
- Important to address in model update

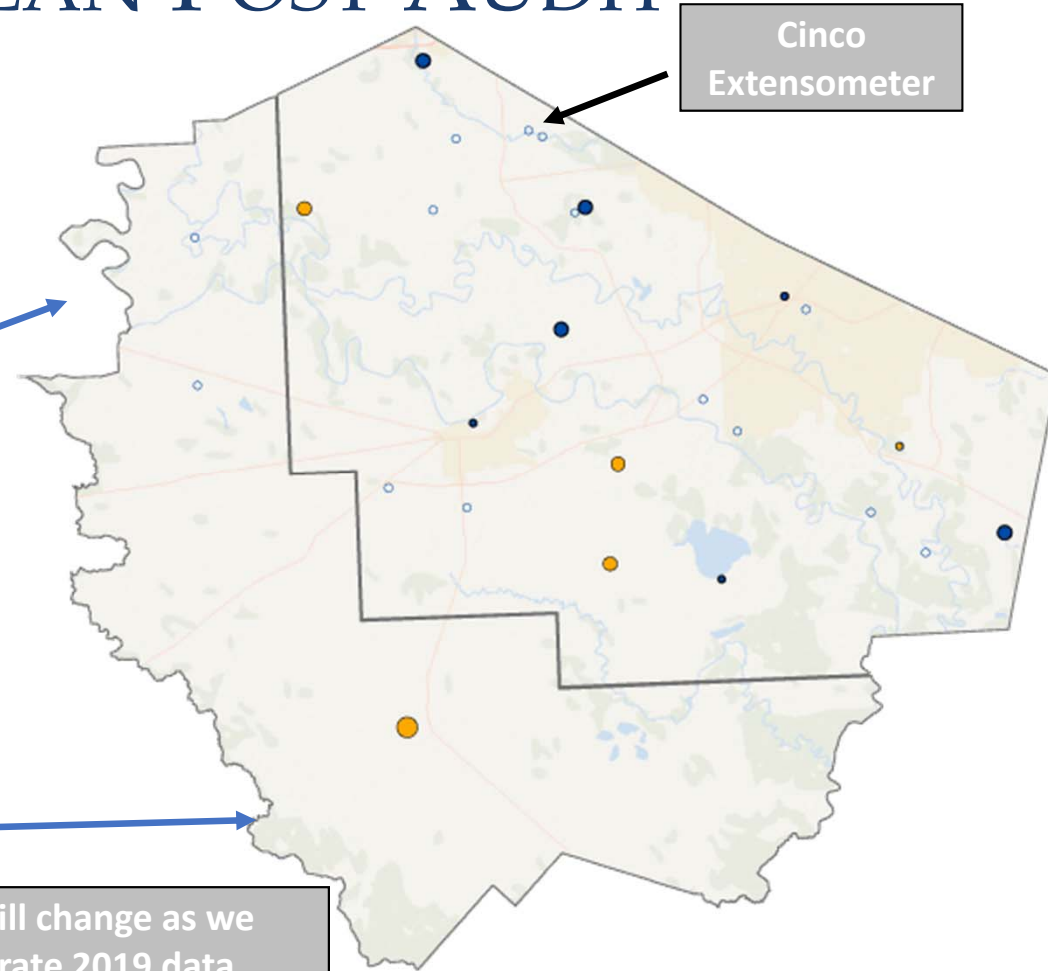
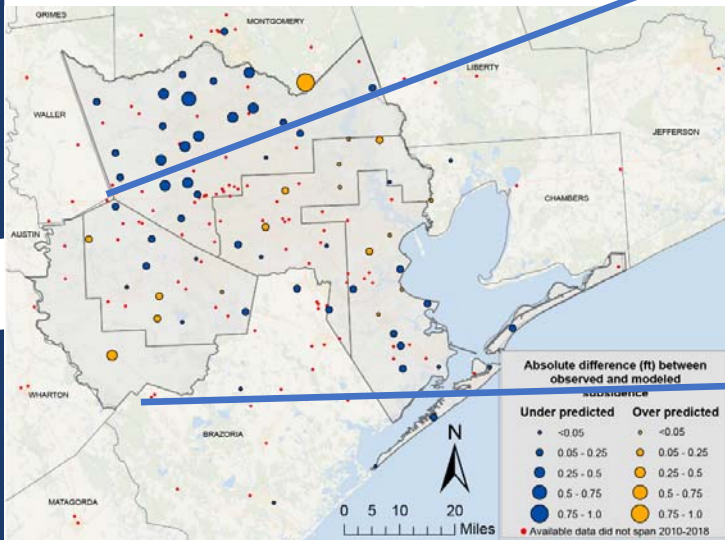


Values will change as we incorporate 2019 data

# 2013 REGULATORY PLAN POST AUDIT

## FBSD Regulatory Areas A and B

- Reasonable agreement
- Expected mix of over/under predictions



Values will change as we incorporate 2019 data

# 2013 REGULATORY PLAN POST AUDIT

## Takeaways

- At most GPS sites modeled subsidence is very close (just above or below) observed subsidence
- Will spend additional effort on characterization of Regulatory Area 3 in the GULF 2023 model
- Working with USGS to incorporate new calibration targets such as subsidence and drawdown rates
- Incorporating 2019 data into results



# SCHEDULE AND NEXT STEPS



### GULF 2023 Model

### Projected Water Needs

### Alternative Water Supplies

### PRESS Assessment

### Water Use Scenarios

|      |                         |   |  |                        |                                   |
|------|-------------------------|---|--|------------------------|-----------------------------------|
| 2020 | Model Conceptual Report | Methodology, Model Updates                    | Overview of Alternatives                 | PRESS Model Validation |                                   |
| 2021 | Complete Model Update   | Population and Demand Projections             | Technical Characterization, Final Report |                        |                                   |
| 2022 |                         | Direct Stakeholder Process, Final Projections |  |                        | Scenario Development              |
| 2023 |                         |   |  | Scenario Testing       | Scenario Testing, Recommendations |

STATUS





# UPCOMING MILESTONES

## December 2020

- GULF 2023 Conceptual Model Briefing
- Alternative Water Supply Assessment Update



# QUESTIONS AND ANSWERS





# Thank you for attending the Joint Regulatory Plan Review Stakeholder Meeting



**We appreciate your interest and  
engagement in this meeting.**

If you have time, please take a moment to complete the survey at the end of this webinar. We will also include a link to the survey in a follow-up email if you cannot complete the survey now.