2024 Annual Groundwater Report

Public Hearing
April 29, 2025

FORT BEND
SUBSIDENCE DISTRICT

Fort Bend Subsidence District

The Fort Bend Subsidence District (FBSD) is a special-purpose district created by the Texas Legislature in 1989 to prevent further land subsidence in Fort Bend County.

GROUNDWATER REGULATION

Collaborate with local to state water entities and providers to manage groundwater use through water planning and well permitting.

RESEARCH & MONITORING

Utilize the highest quality data to monitor groundwater usage, aquifer characteristics, and land surface changes.

WATER CONSERVATION

Provide permittees, businesses, and educators with water conservation tools to reduce water use and empower the community to value water.

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Exhibit 1

Location of National Weather Service (NWS) climate stations used for rainfall data for the 2024 calendar year.

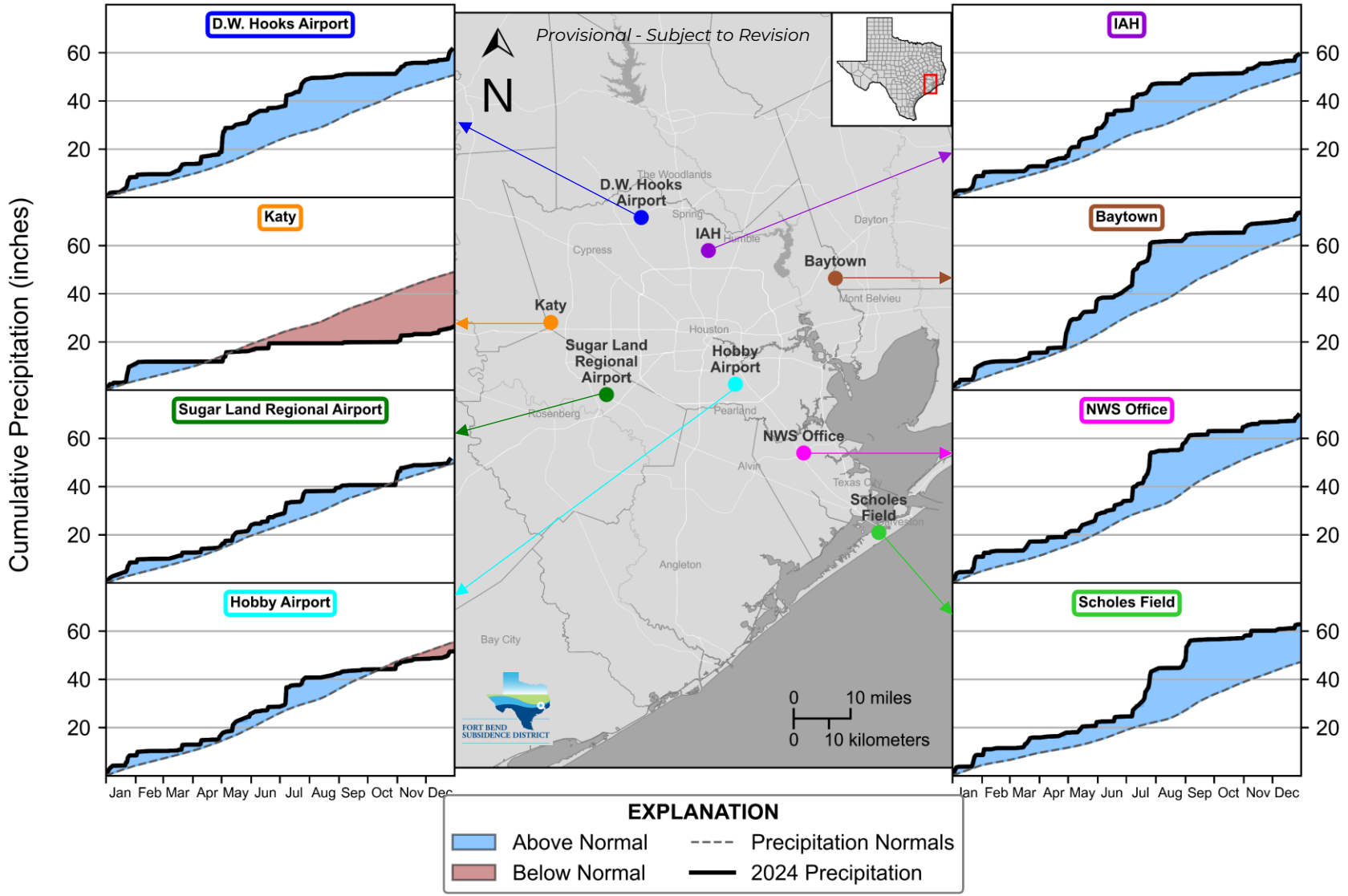
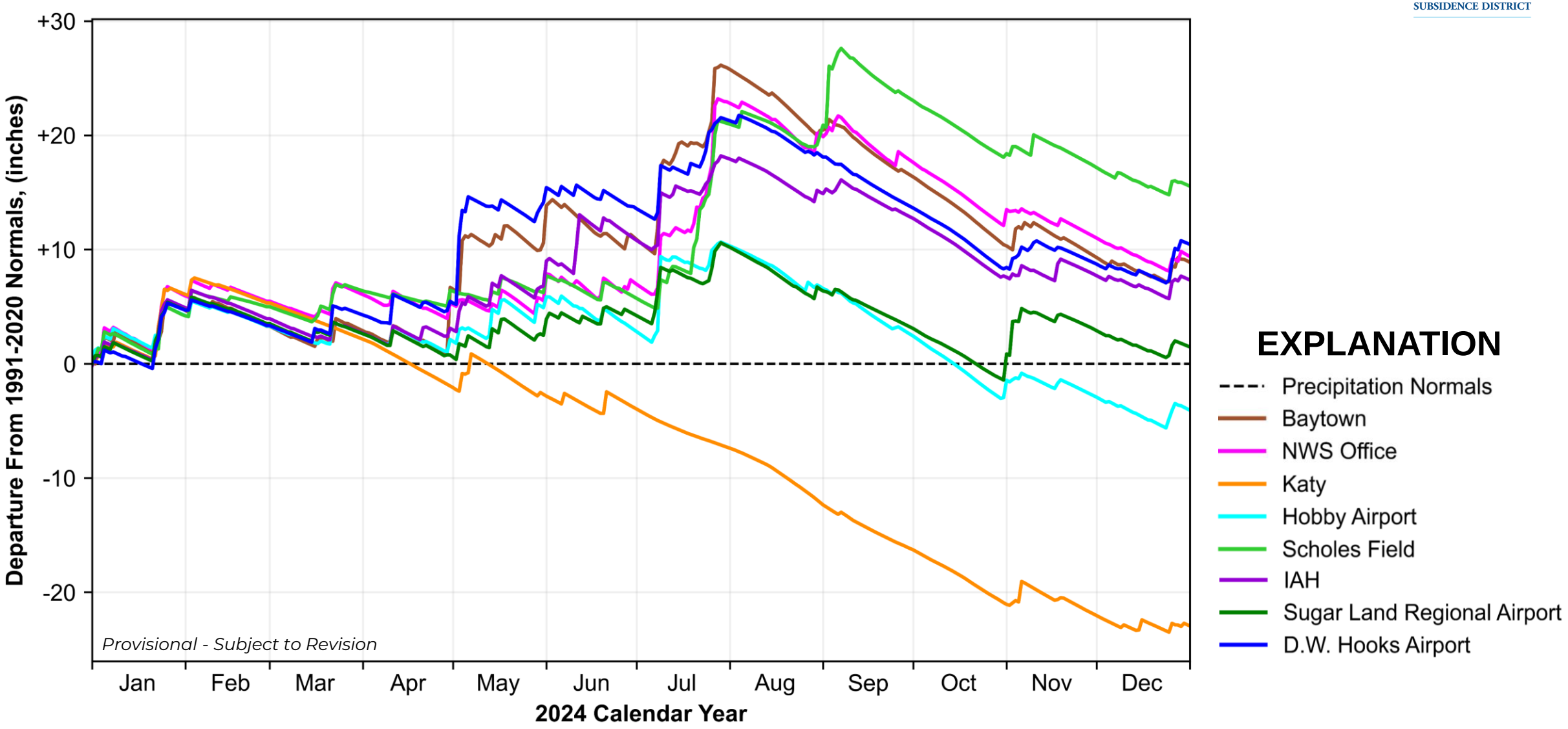


Exhibit 2 2024 Precipitation Data



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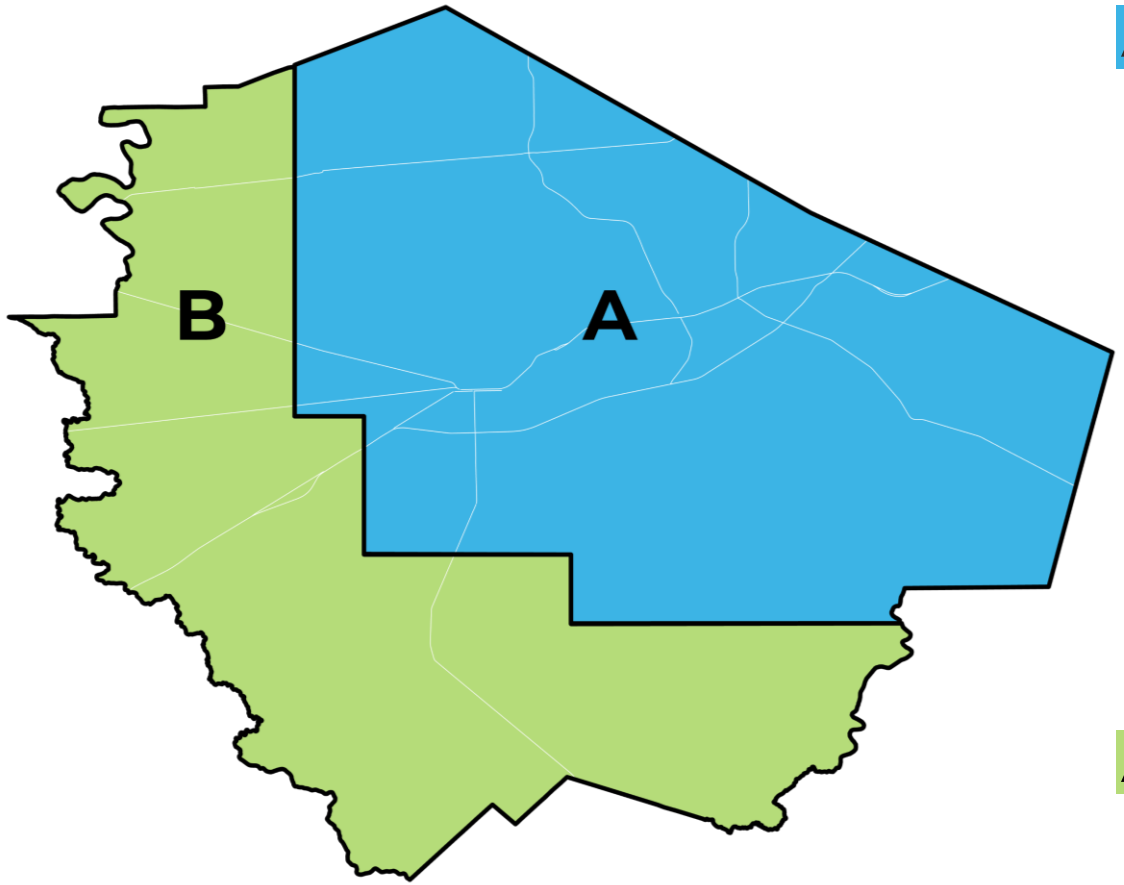
FBSD Regulatory Areas

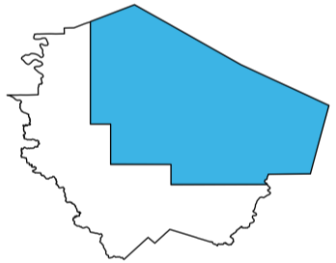


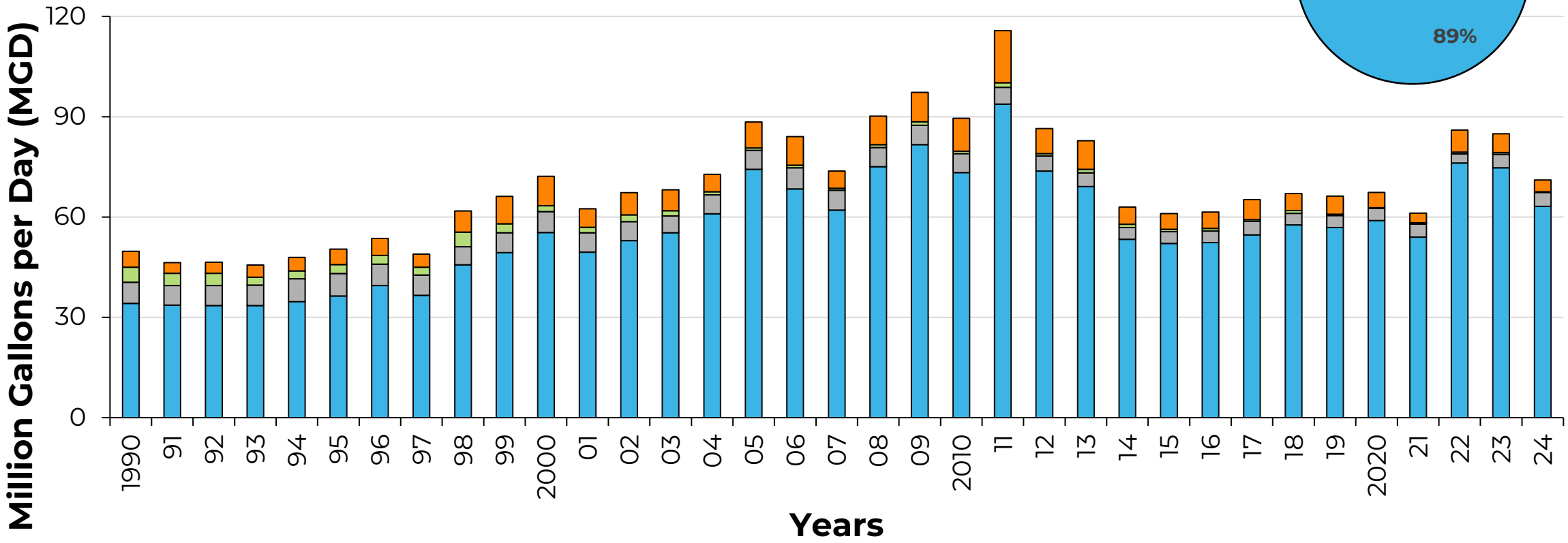
Area A: no more than 40% of Total Water Demand (TWD) may be sourced from groundwater.

- Permittees operating within an approved Groundwater Reduction Plan have the following requirements:
  - 2013 – no more than 70% of TWD from groundwater
  - 2027 – no more than 40% of TWD from groundwater

Area B: not subject to groundwater reduction requirements.

Exhibit 3 Regulatory Area A





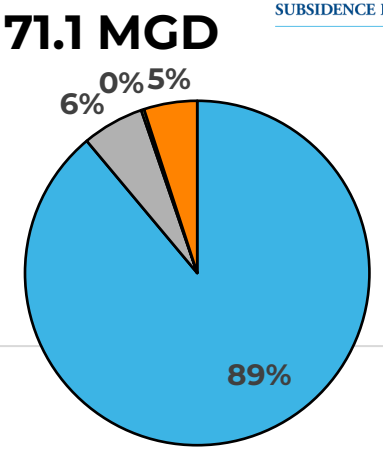
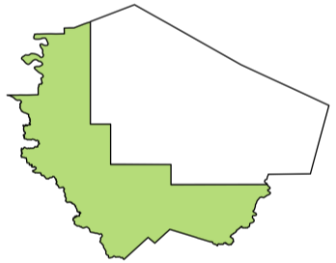
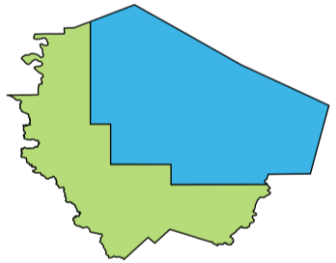


Exhibit 4 Regulatory Area B

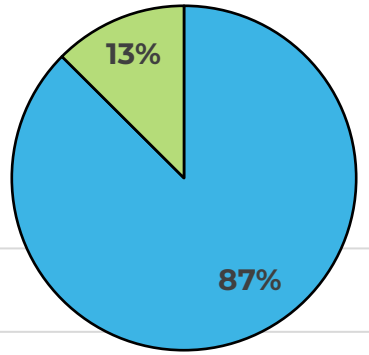


2024: 10.2 MGD

Exhibit 5 Entire District by Regulatory Area



2024: 81.3 MGD



Groundwater Withdrawals Grouped by Area

Area A Area B

Million Gallons per Day (MGD)

140
120
100
80
60
40
20
0

1990 91 92 93 94 95 96 97 98 99 2000 01 02 03 04 05 06 07 08 09 2010 11 12 13 14 15 16 17 18 19 2020 21 22 23 24

Years

Exhibit 6 Entire District by Use Type

FORT BEND SUBSIDENCE DISTRICT

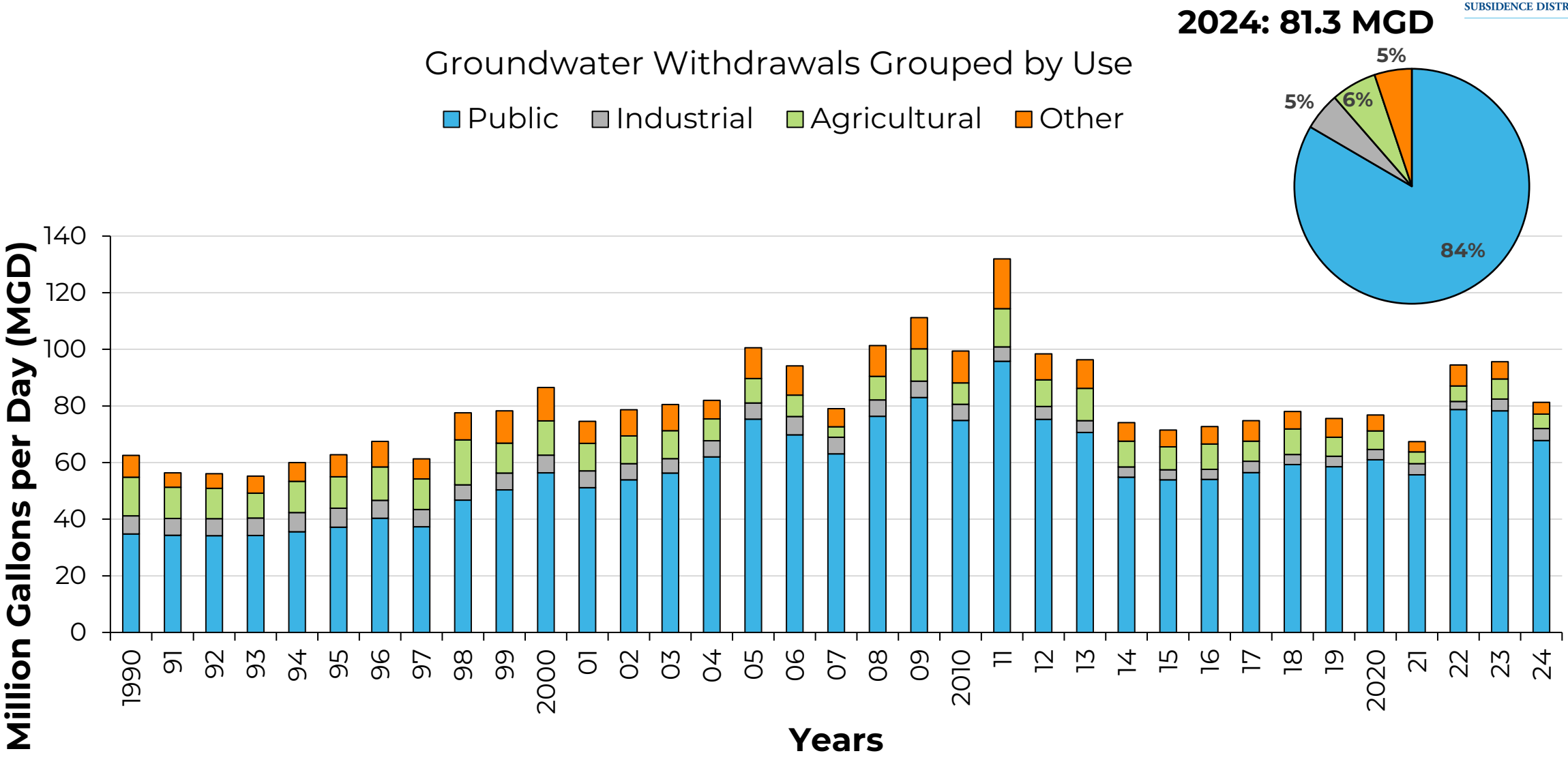


Exhibit 7 Alternative Water Use

FORT BEND SUBSIDENCE DISTRICT

2024: 100.1 MGD

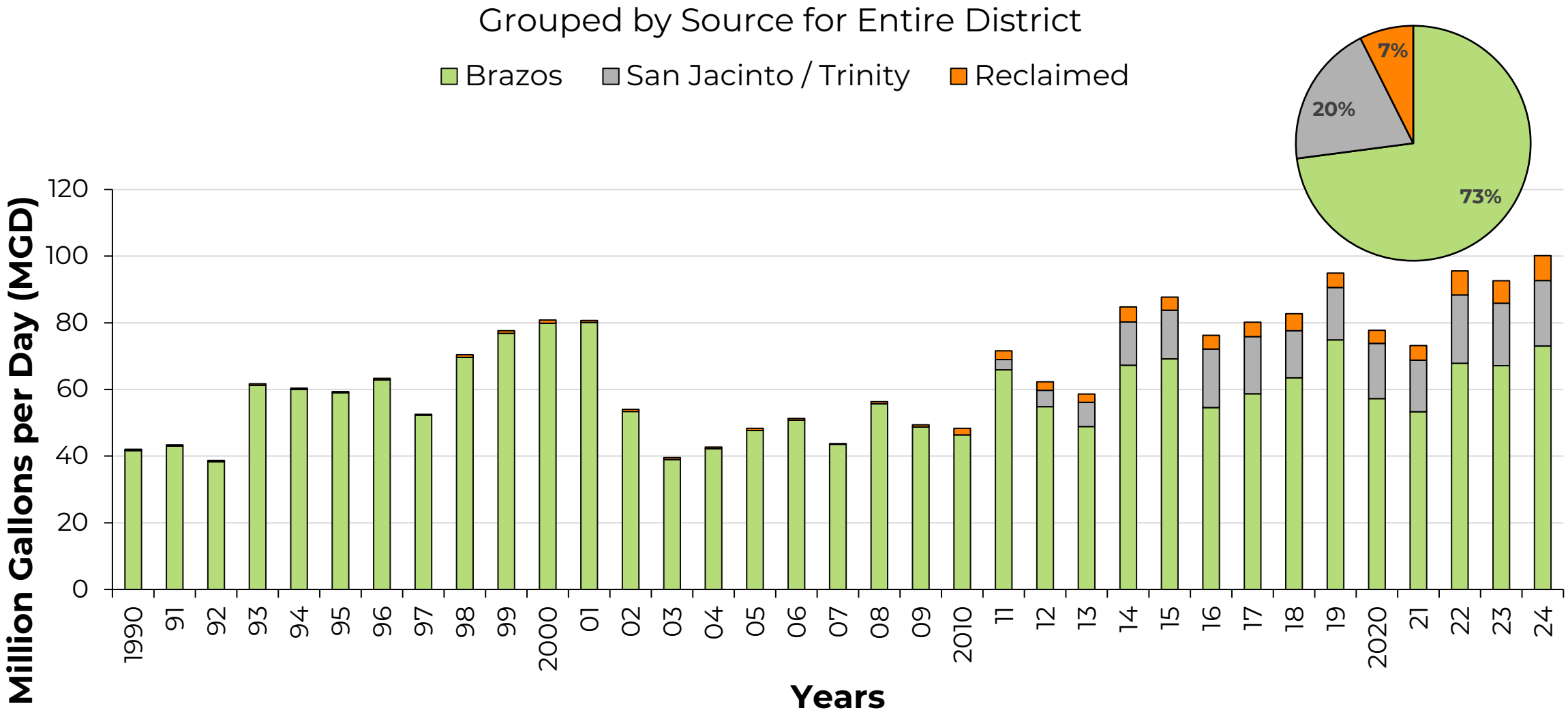
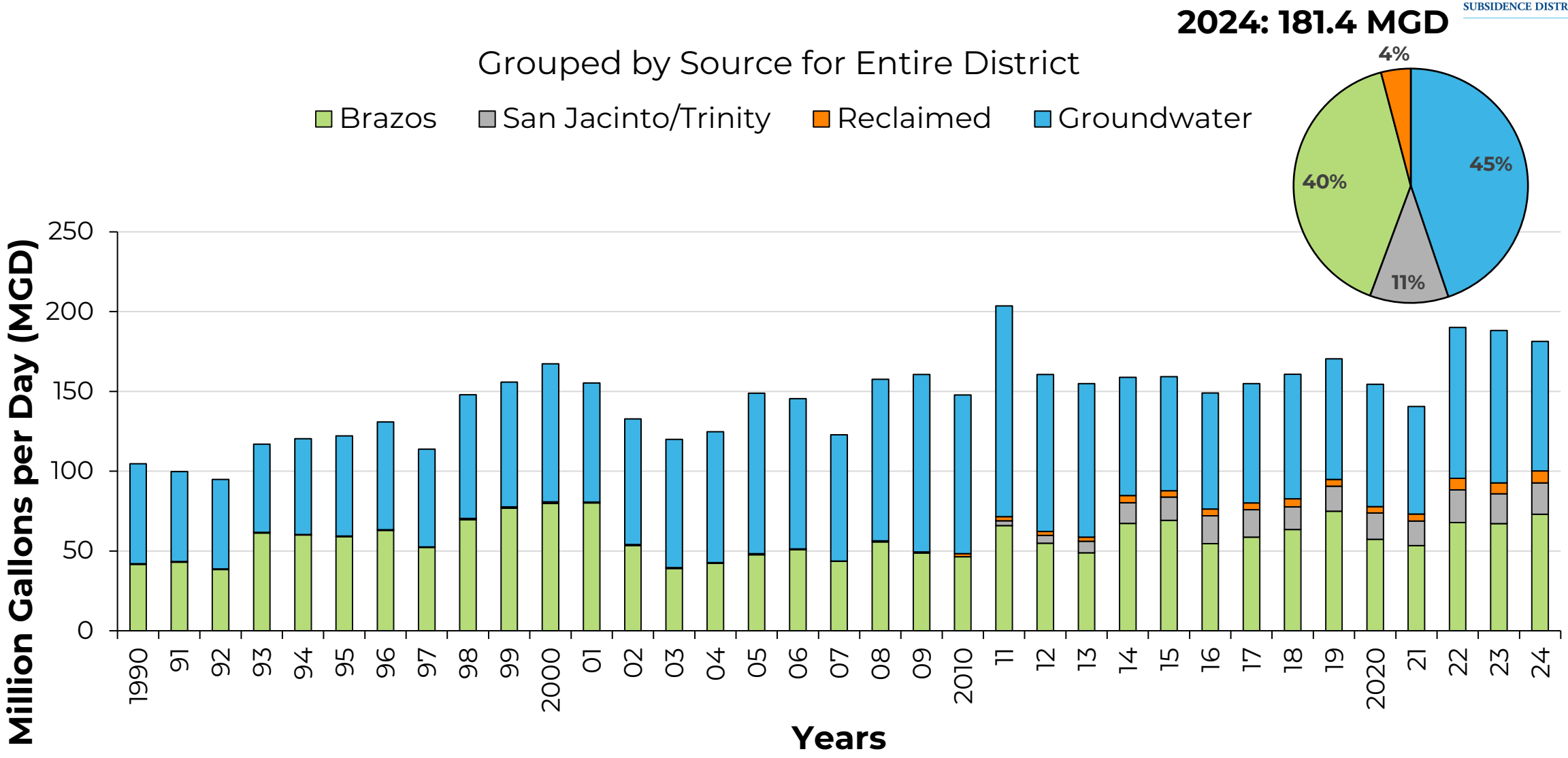


Exhibit 8 Total Water Demand



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USGS
science for a changing world

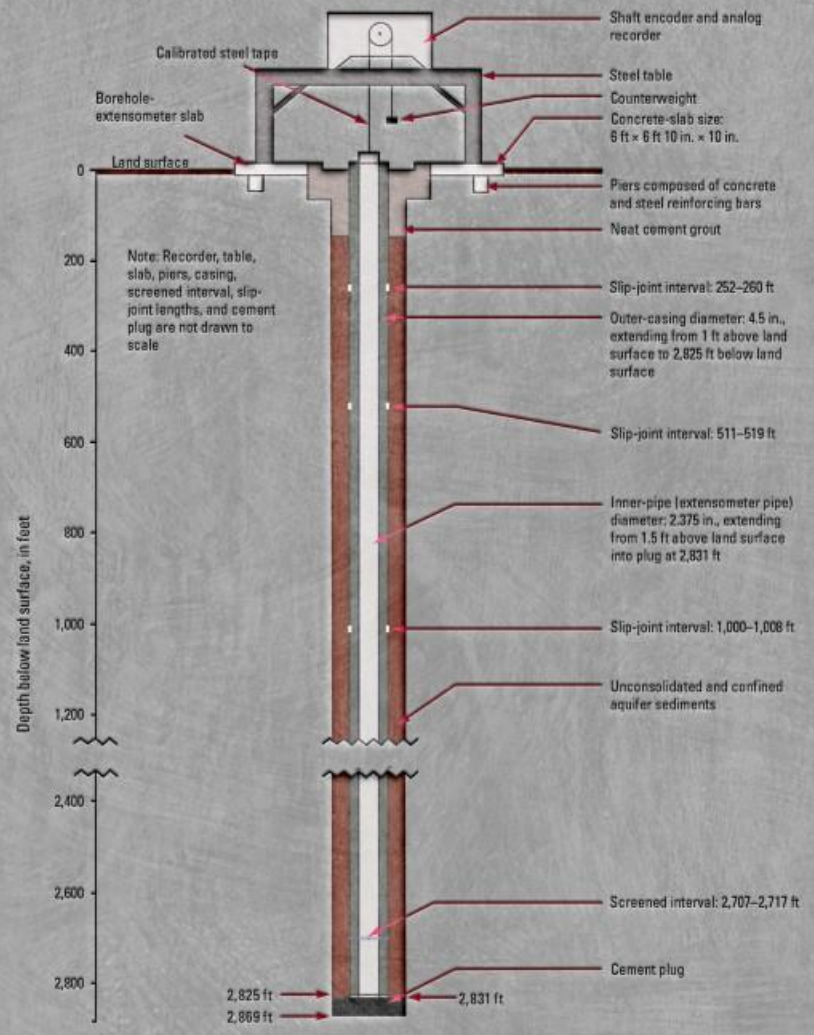


DIAGRAM OF A BOREHOLE EXTENSOMETER

Groundwater-level Altitudes, Long-Term Change & Compaction

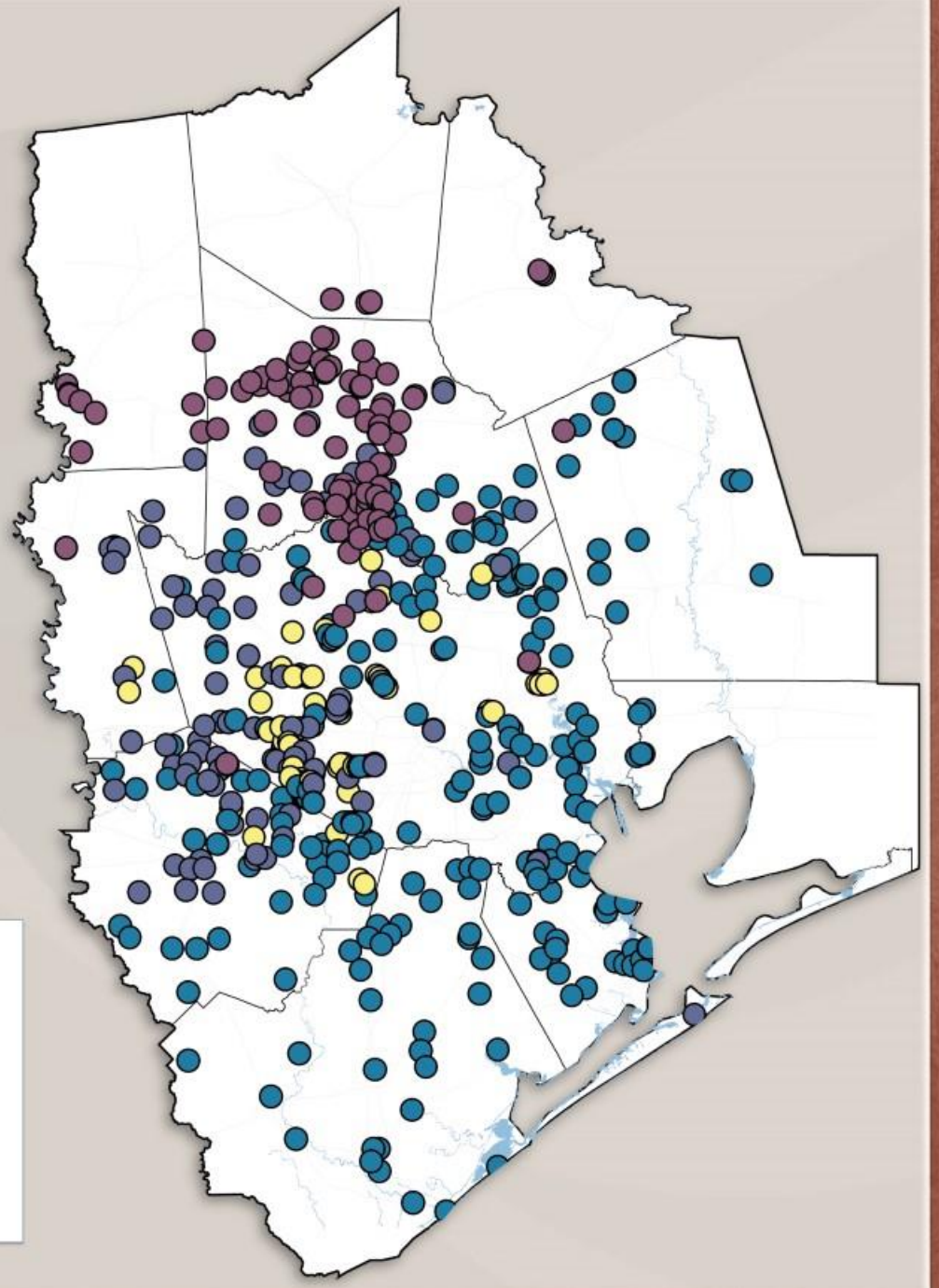
CHICOT/EVANGELINE AND JASPER AQUIFERS

RESEARCH IN COOPERATION WITH THE HARRIS–GALVESTON & FORT BEND SUBSIDENCE DISTRICTS BRAZORIA GROUNDWATER CONSERVATION DISTRICT, THE CITY OF HOUSTON AND LONE STAR GROUNDWATER CONSERVATION DISTRICT

2025 Water-Level Map Series

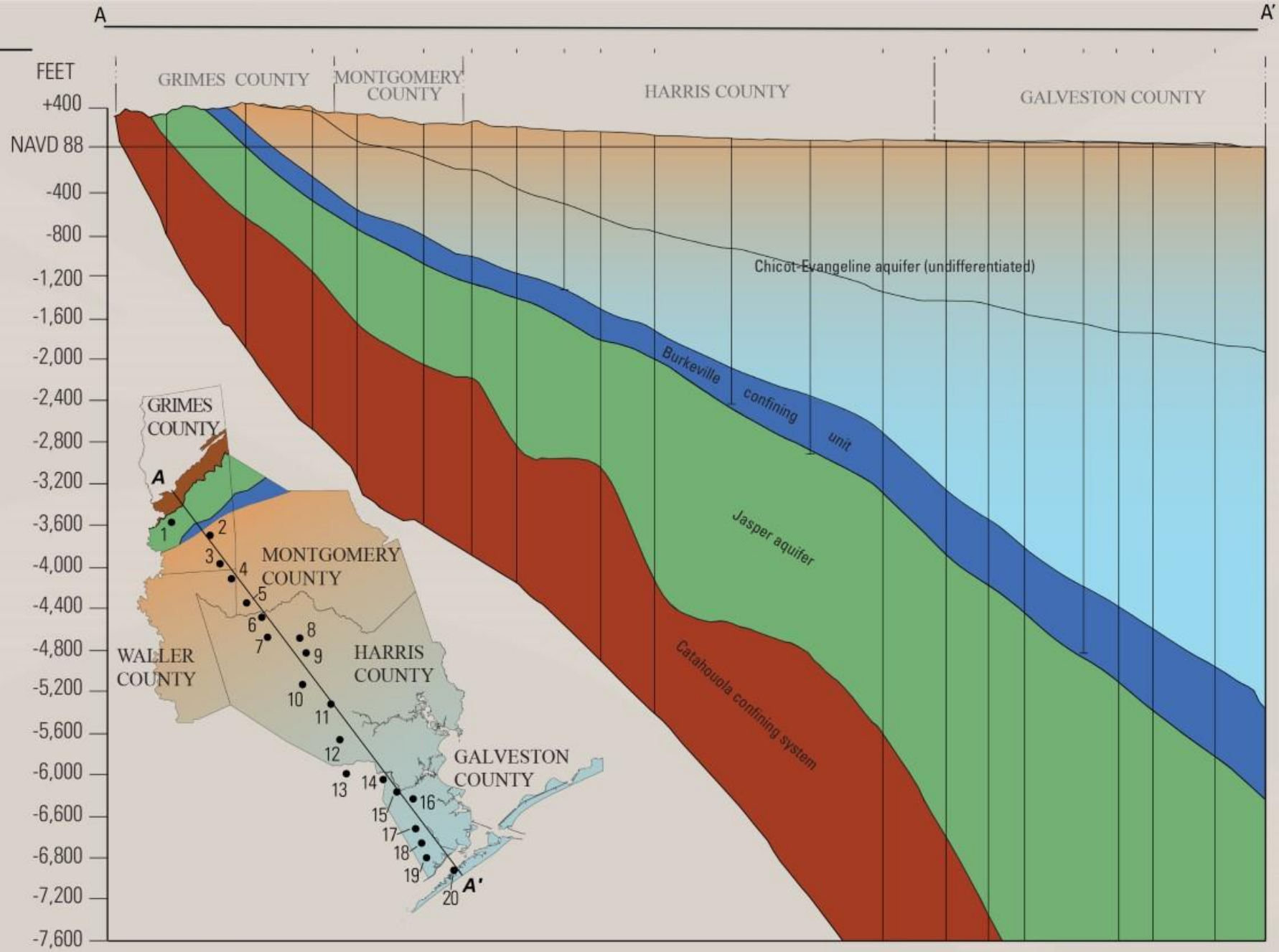
- Chicot and Evangeline Aquifers (undifferentiated)
  - 2025 Water-Level Altitude
  - 2024 to 2025 Water-Level Change
  - 2020 to 2025 Water-Level Change
  - 1990 to 2025 Water-Level Change

- Compaction 1973 to 2024
  - Compaction Data from 14 Extensometers



Geology and Hydrology

In 2021 and Moving Forward		
Geologic units[1]		Hydrogeologic units[1]
Alluvial, terrace, and dune deposits		Chicot - Evangeline aquifer (undifferentiated)
Beaumont Formation		
Lissie Formation	Montgomery Formation	
	Bentley Formation	
Willis Sand		
Goliad Sand (upper part)		
Goliad Sand (lower part)		
Lagarto Clay (upper part)		
Lagarto Clay (middle part)		Burkeville confining unit
Lagarto Clay (lower part)		Jasper aquifer
Oakville Sandstone		
Catahoula Formation	Upper Catahoula Formation	Catahoula Confining System
	Frio Formation	

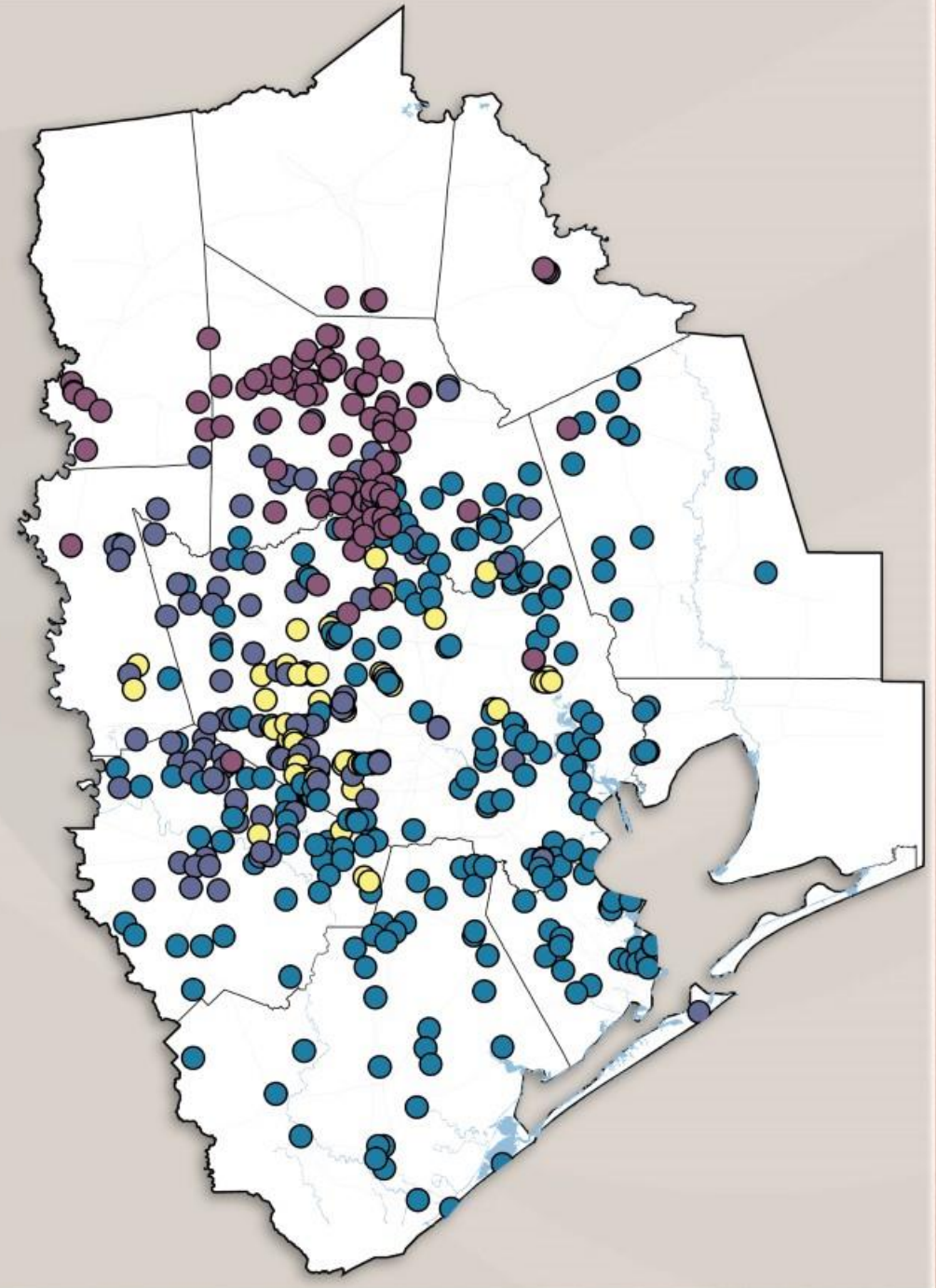


[1]Young, S.C., Kelley, V.A., Deeds, N., Hudson, C., Piemonti, D., Ewing, T.E., Banerji, D., Seifert, J., and Lyman, P., 2017

[1]Modified from Young and Draper, 2020 and Young and others (2012, 2014)

Network

- Data collected across 11 counties
- Data collection from 12-03-2024 to 3-13-2025
- Well Types:
  - Public Supply, Irrigation, Industrial, Observation
- Chicot and Evangeline (undifferentiated) water-levels: **562**
- Jasper water-levels: **112**
- Number of wells used to create the 2025 altitude maps
  - Chicot and Evangeline (undifferentiated): *525*
    - *Data from 39 wells were estimated*
  - Jasper: *108*
    - *Data from 15 wells were estimated*



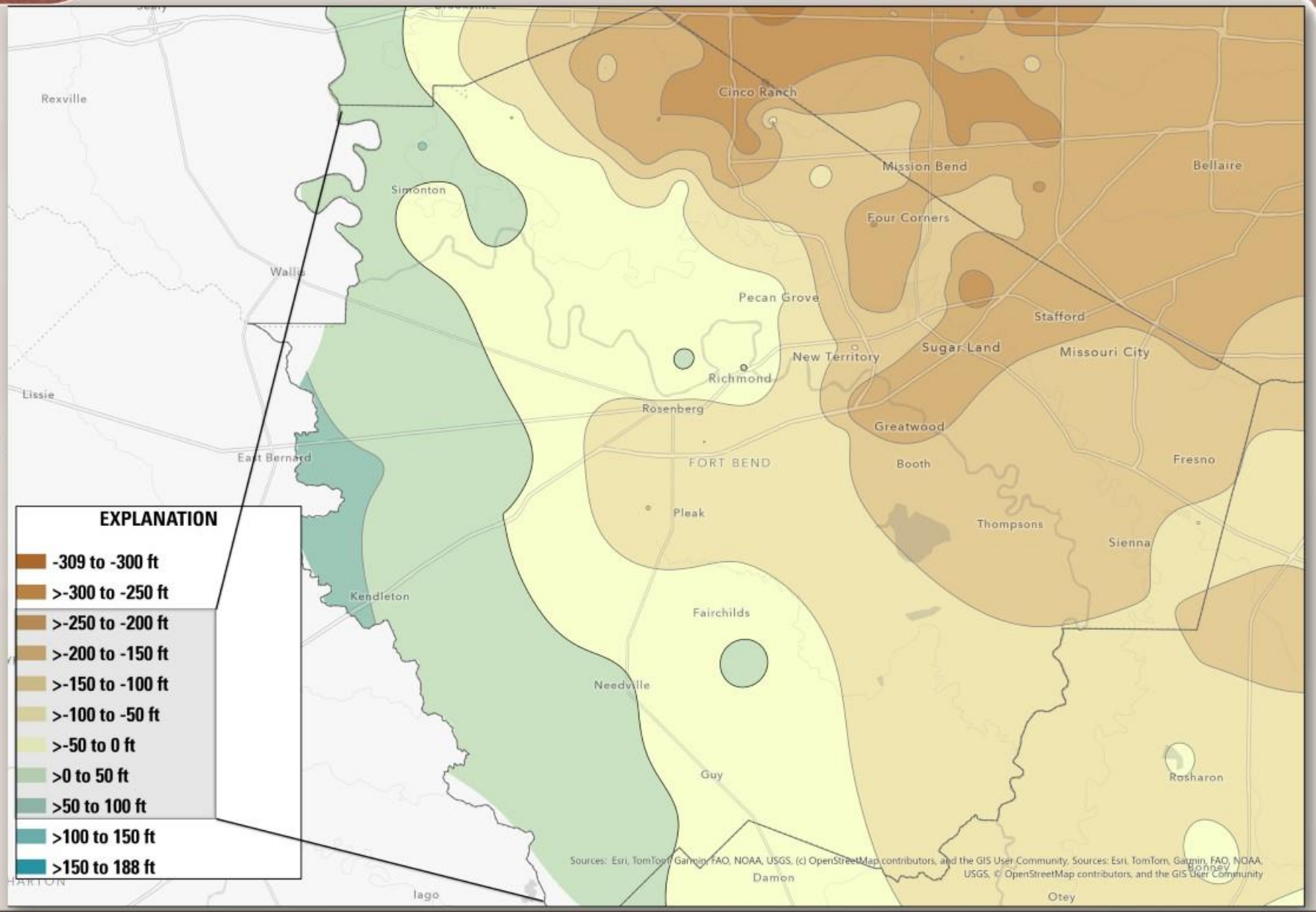
Water-Level Altitude

Chicot and Evangeline (undifferentiated)

Altitudes are referenced from NAVD 88

Lowest altitudes in south-central portion of Montgomery County and west and west-central Harris County

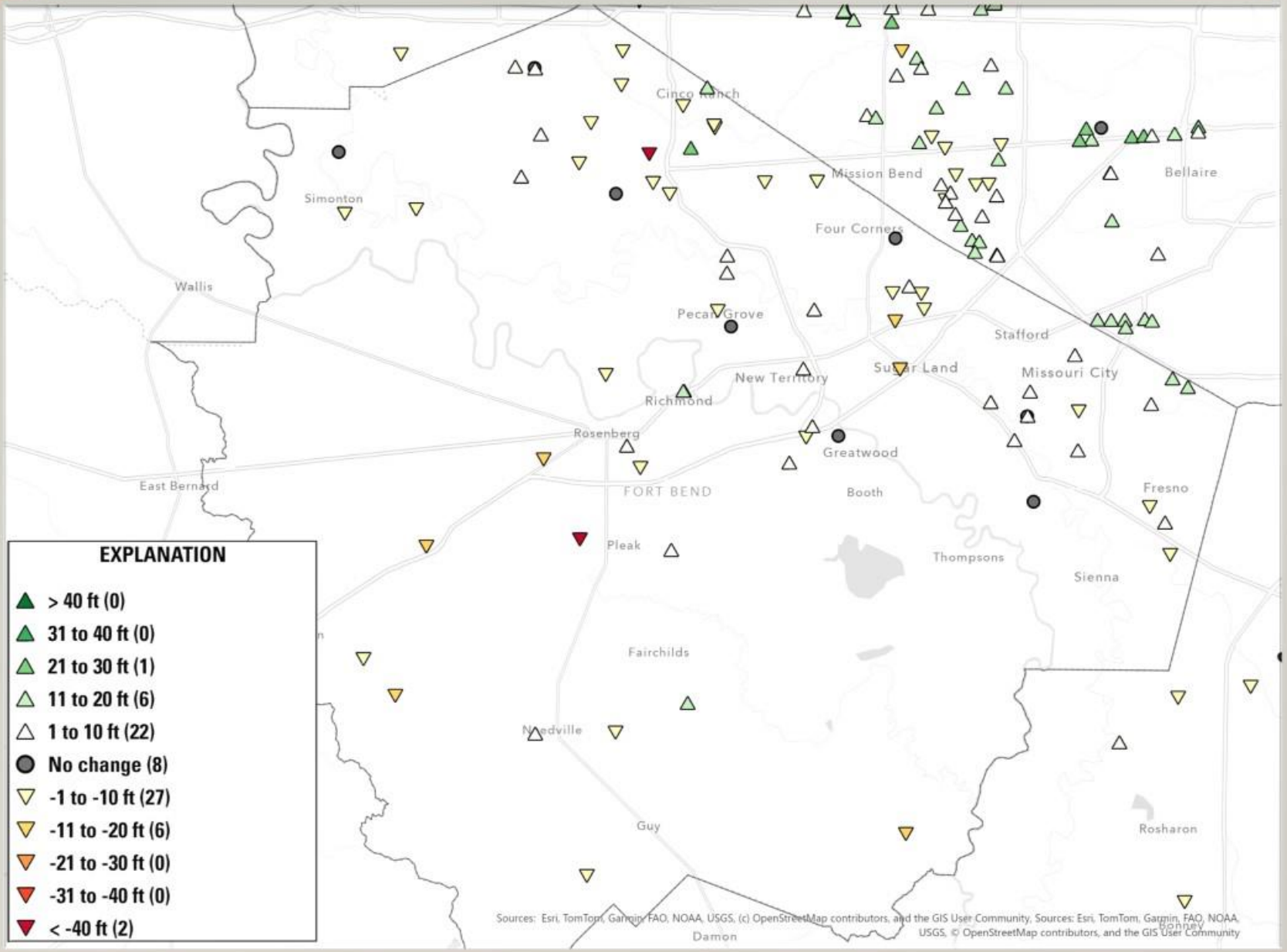
Highest altitudes in portions of south-eastern Grimes County, and northern Montgomery County



2024 to 2025 Water-Level Change

Chicot and Evangeline (undifferentiated)

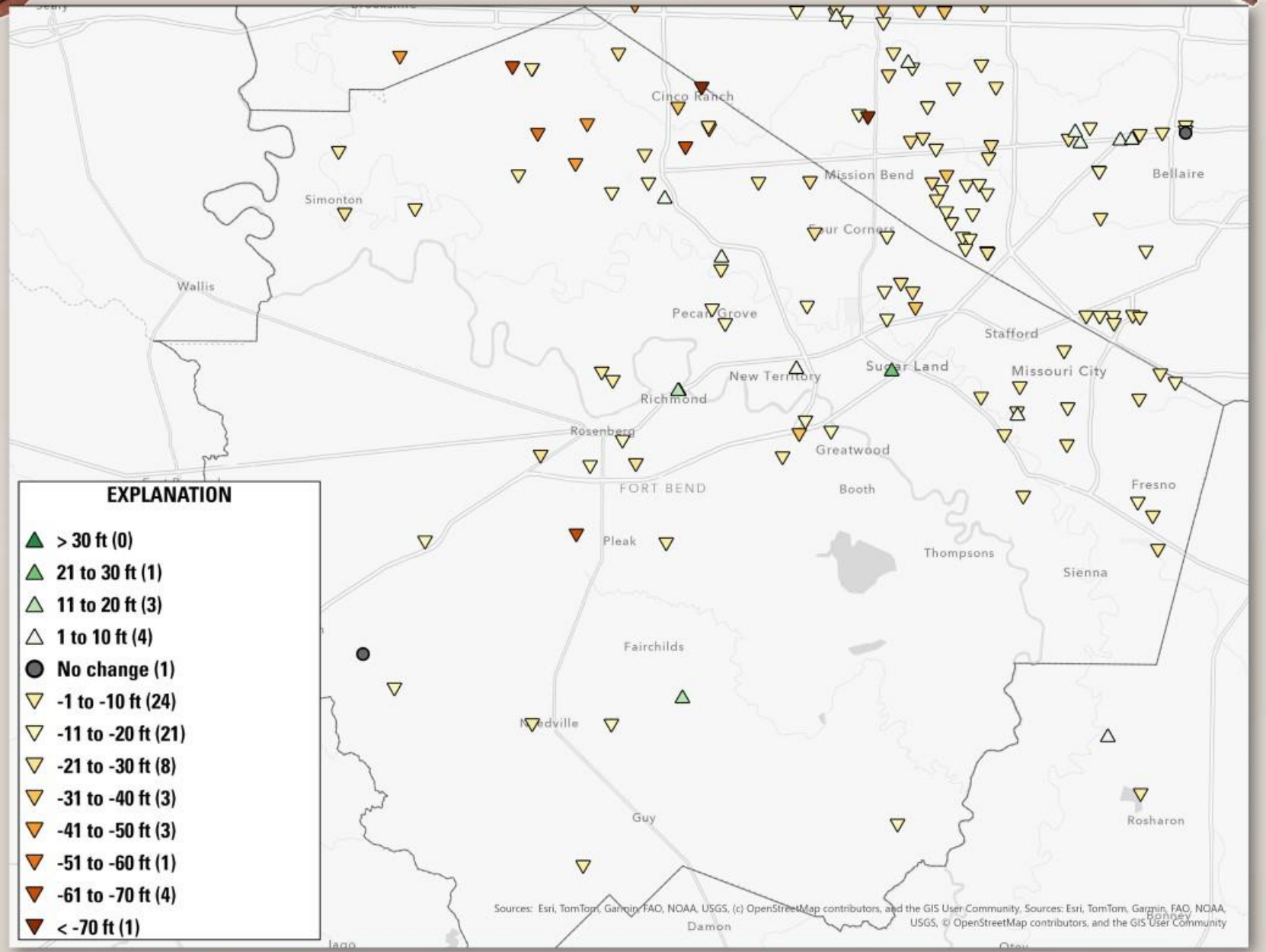
- 72 water-level pairs
  - About 48.6% were declines
    - Mostly in the 1 to 10 ft range
    - Largest declines (>40 ft):
      - Northern and central Fort Bend County (2)
  - About 40.2% were rises
    - Mostly in the 1 to 10 ft range
    - Largest rise (>20ft):
      - Northern Fort Bend County



2020 to 2025 Water-Level Change

Chicot and Evangeline (undifferentiated)

- 74 water-level pairs
  - Mostly declines (~87.8%)
    - Most are declines of less than 20 ft.
    - Largest decline (>70 ft):
      - (1) central Fort Bend County
  - About 10.8% were rises
    - Largest rise (> 20 ft):
      - (1) near Sugar Land area

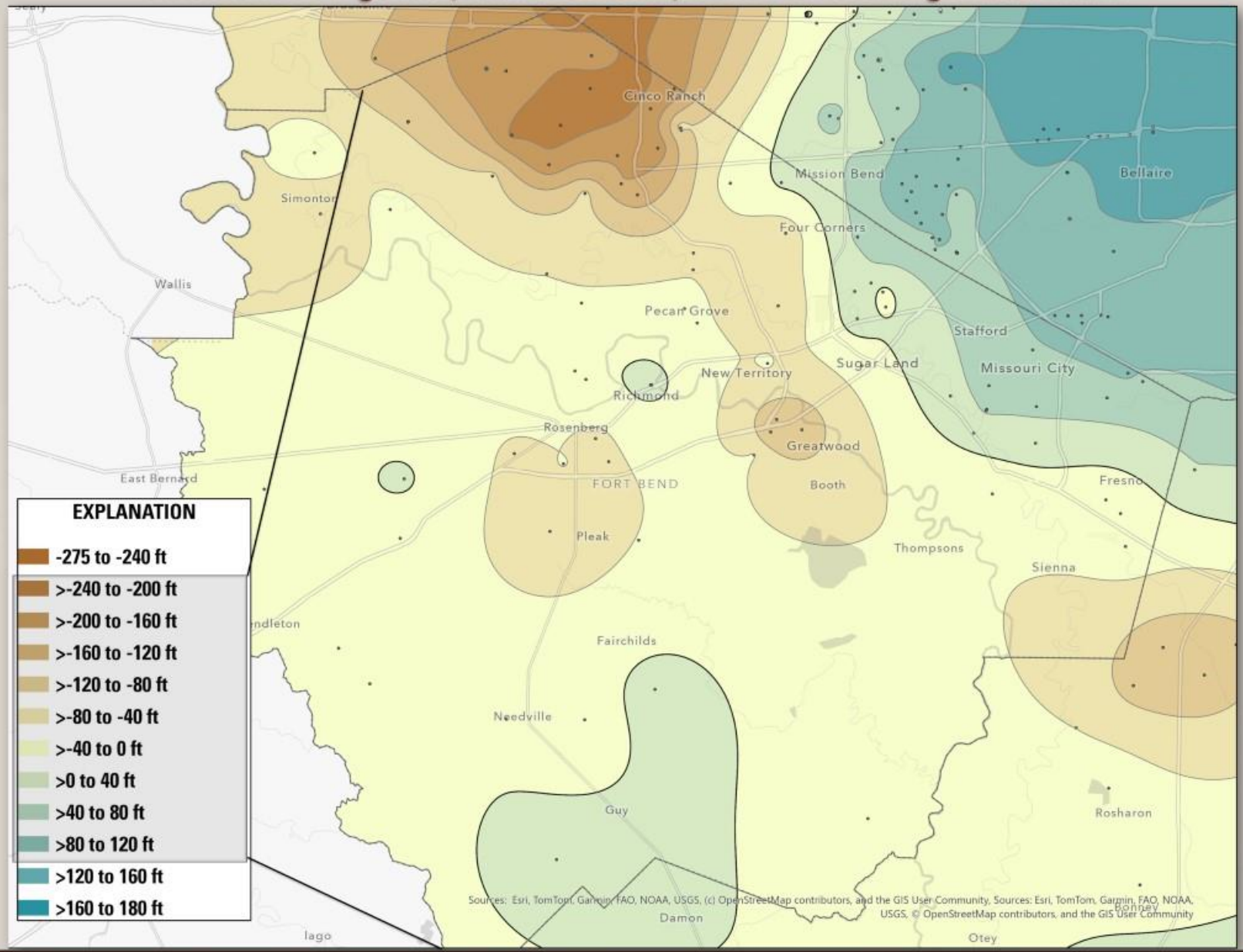


Long term change

Water level rises along the north-eastern border with Harris County and the eastern border of Brazoria County

Water-level declines across much of the county with larger declines in the northern portion of the county

Chicot and Evangeline (undifferentiated) Water-Level Change 1990 to 2025



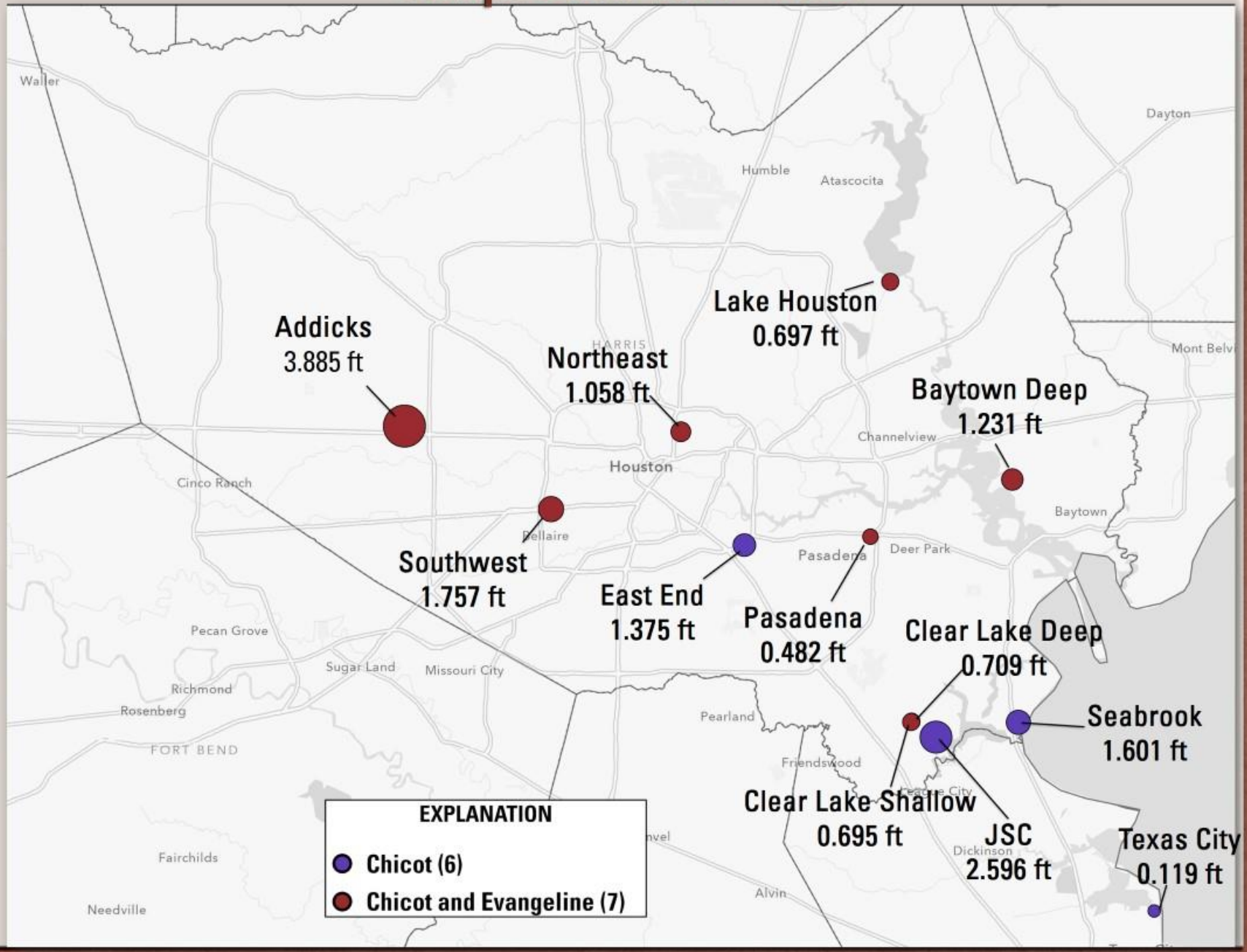
Compaction 1973 - 2024

Compaction Interval:
Chicot

1. 1973 | Baytown Shallow 1.032 ft.
2. 1973 | East End 1.375 ft.
3. 1962 | Johnson Space Center 2.596 ft.
4. 1973 | Seabrook 1.601 ft.
5. 1973 | Texas City 0.119 ft.
6. 1976 | Clear Lake Shallow 0.695 ft.

Compaction Interval:
Chicot and Evangeline

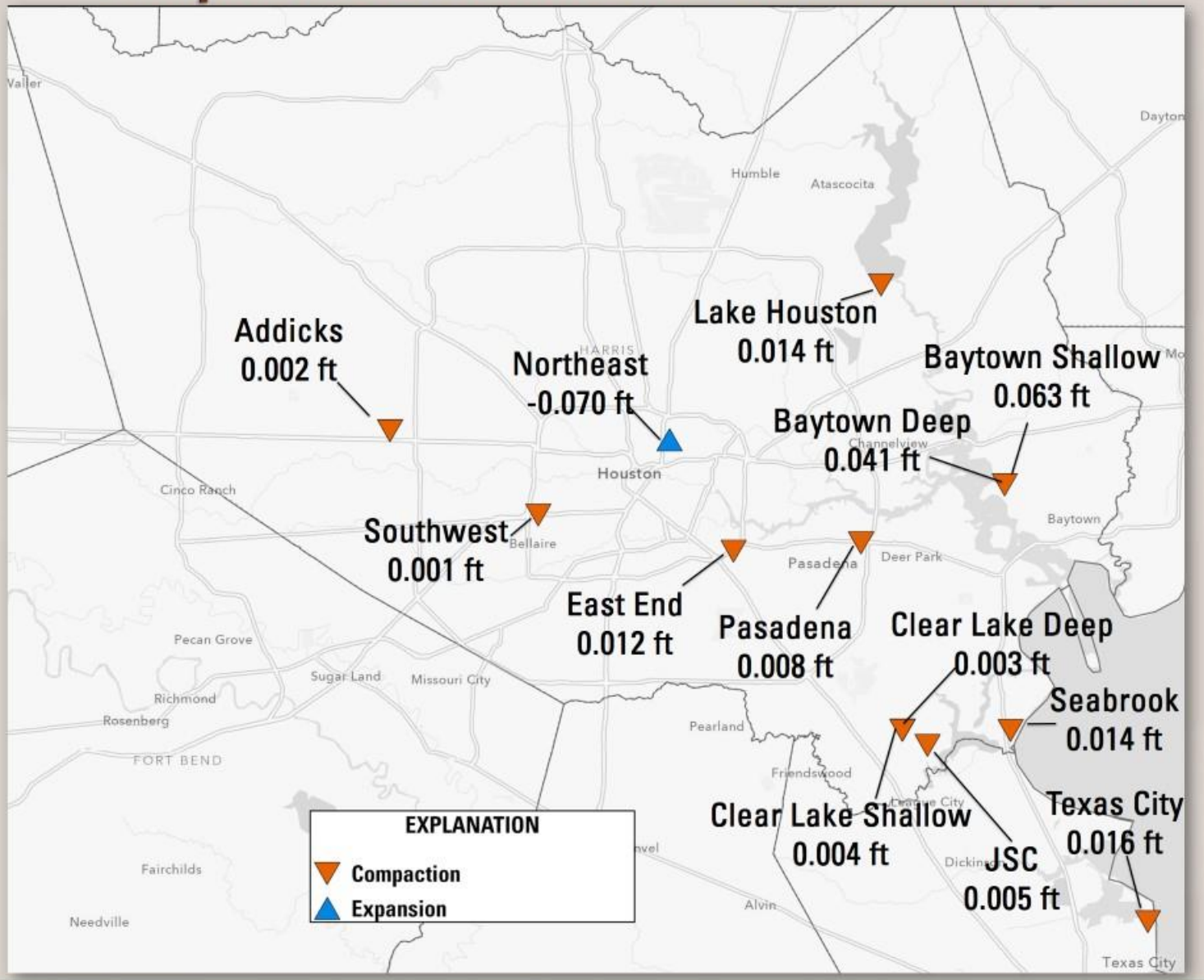
7. 1973 | Baytown Deep 1.231 ft.
8. 1974 | Addicks 3.885 ft.
9. 1974 | Pasadena 0.482 ft.
10. 1976 | Clear Lake Deep 0.709 ft.
11. 1980 | Lake Houston 0.697 ft.
12. 1980 | Northeast 1.058 ft.
13. 1980 | Southwest 1.757 ft.
14. 2017 | Cinco MUD --- ft.



2024 Compaction Summary

- Northeast recorded expansion for the period
- All other sites recorded compaction
- Compaction ranged from -0.070 ft (expansion) to 0.063 ft (compaction)

Compaction December 2023 to December 2024



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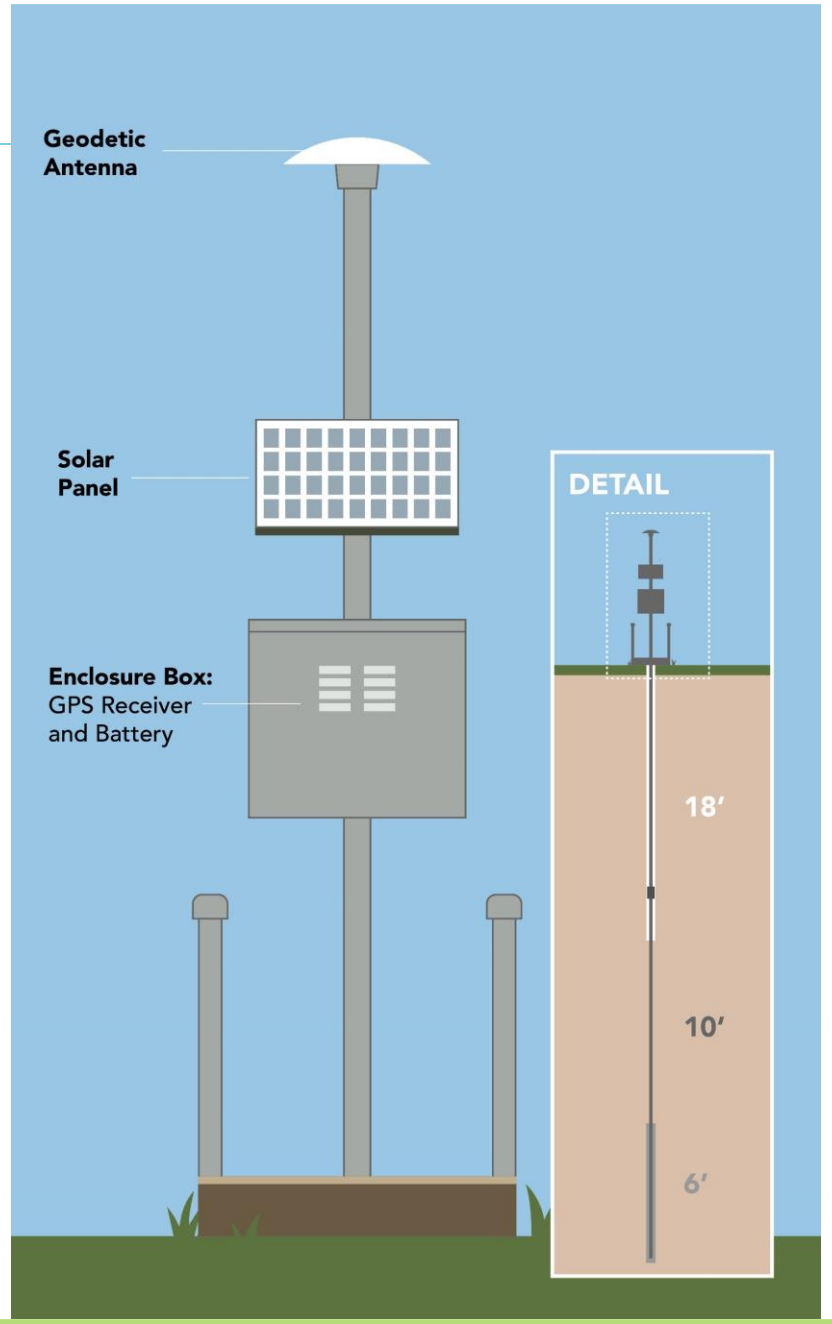
Subsidence Monitoring

All FBSD operated global positioning system (GPS) stations are constructed in a custom design.

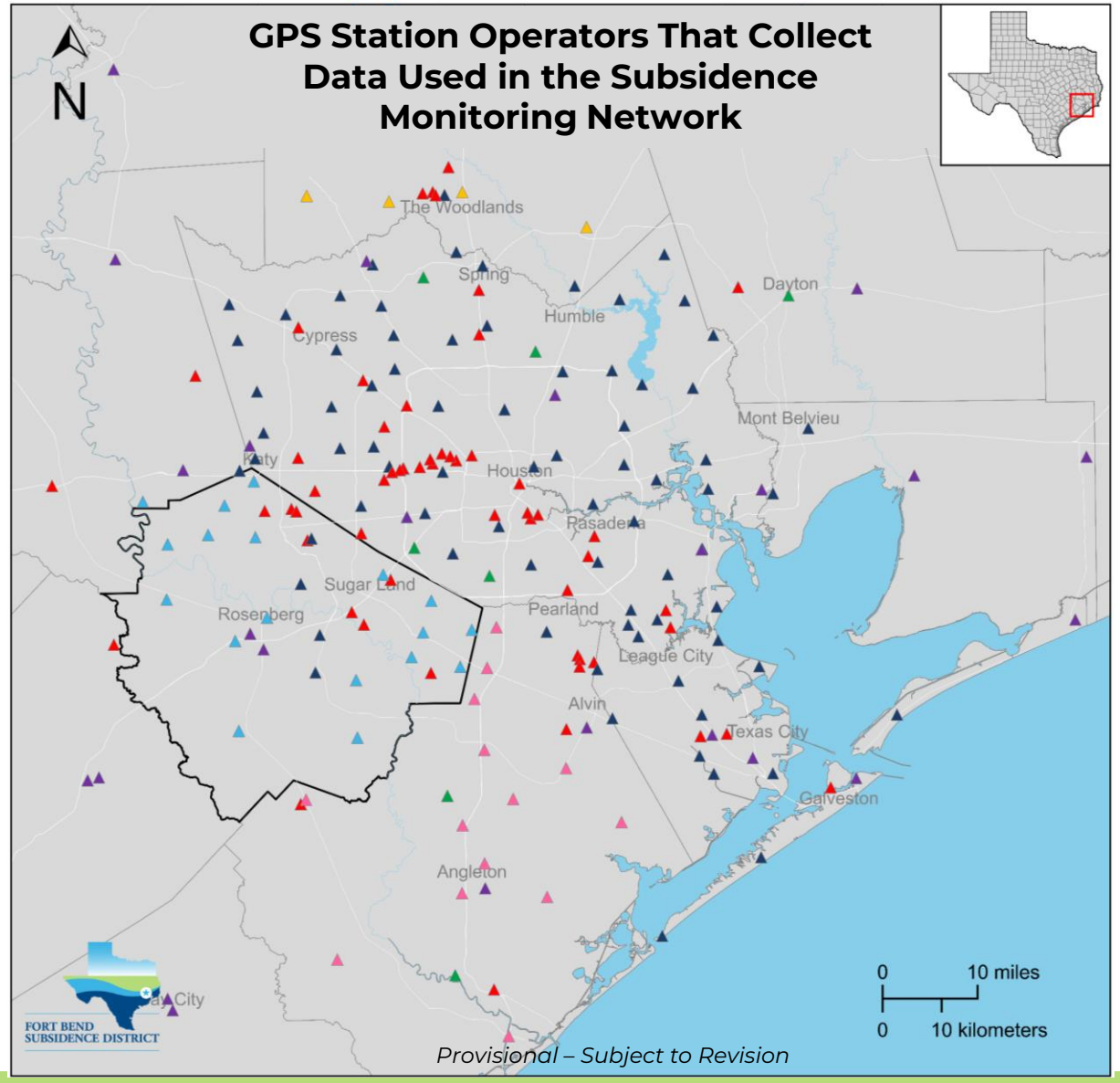
GPS data are collected for one week every two months. A conversion to continuous monitoring (data collection every day of the year) began in 2023 and will continue through 2027.



FORT BEND SUBSIDENCE DISTRICT

Exhibit 9 Subsidence Monitoring Network

Location and operator of GPS stations that monitor land surface deformation periodically or continuously within southeast Texas in 2024.



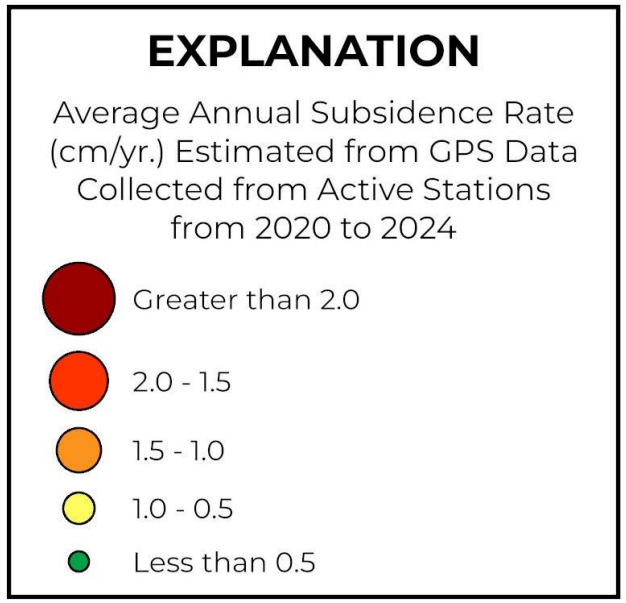
EXPLANATION

- FBSD Jurisdiction
- Harris-Galveston Subsidence District
- Fort Bend Subsidence District
- University of Houston
- Texas Department of Transportation
- Brazoria County Groundwater Conservation District
- Lone Star Groundwater Conservation District
- Other Operators

Exhibit 10 Subsidence Rates in Fort Bend

FORT BEND SUBSIDENCE DISTRICT

Annual subsidence rate, in centimeters per year (cm/yr.), estimated from GPS data collected at active stations with three or more years of data averaged from 2020 to 2024.



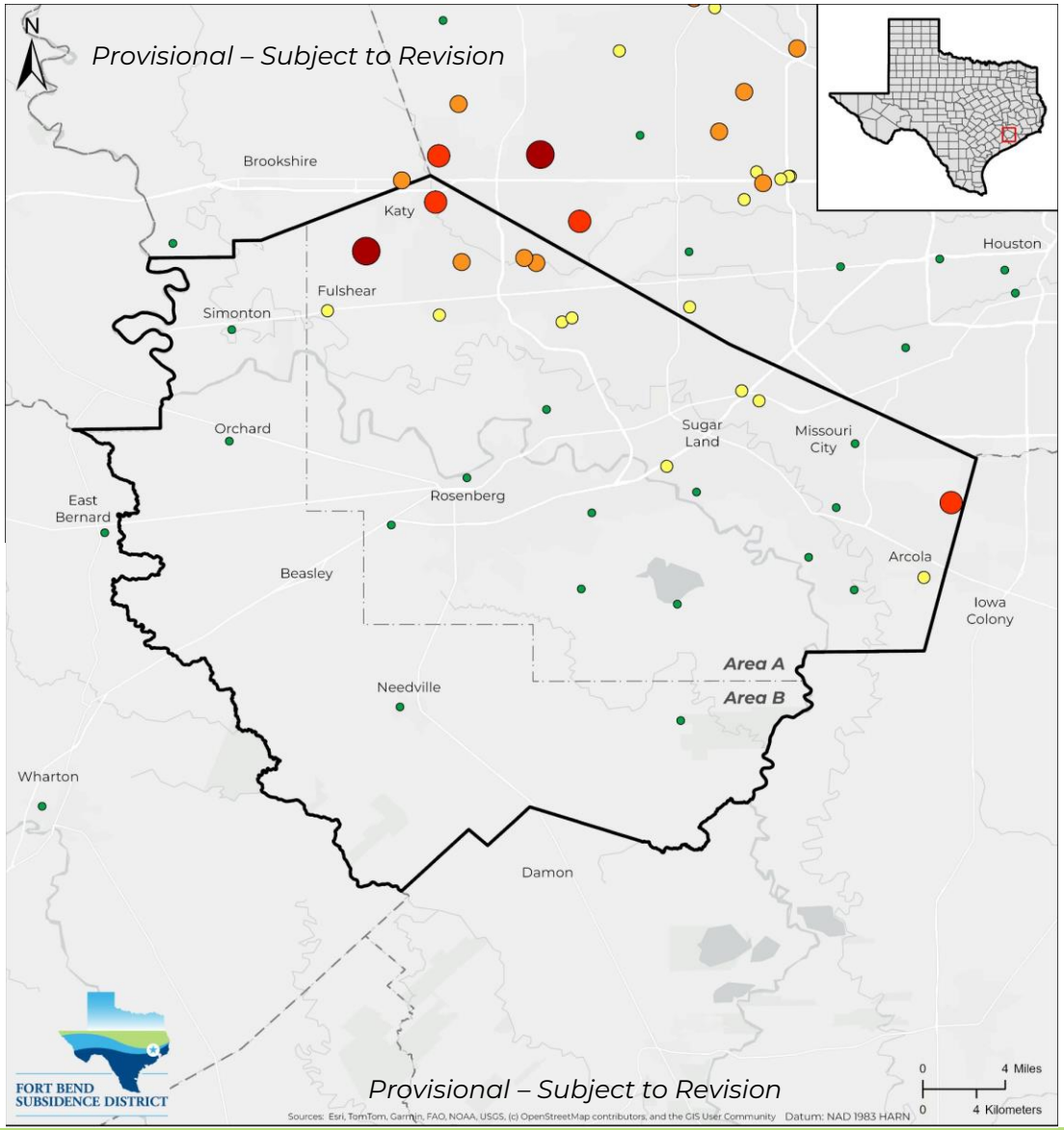
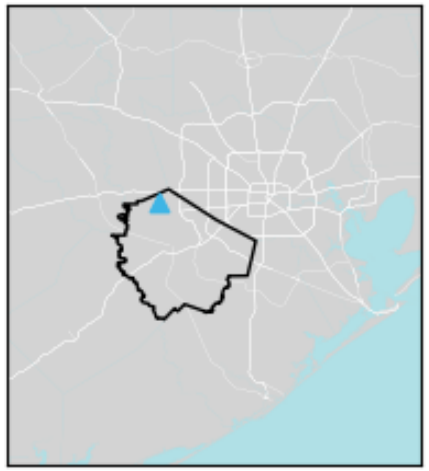
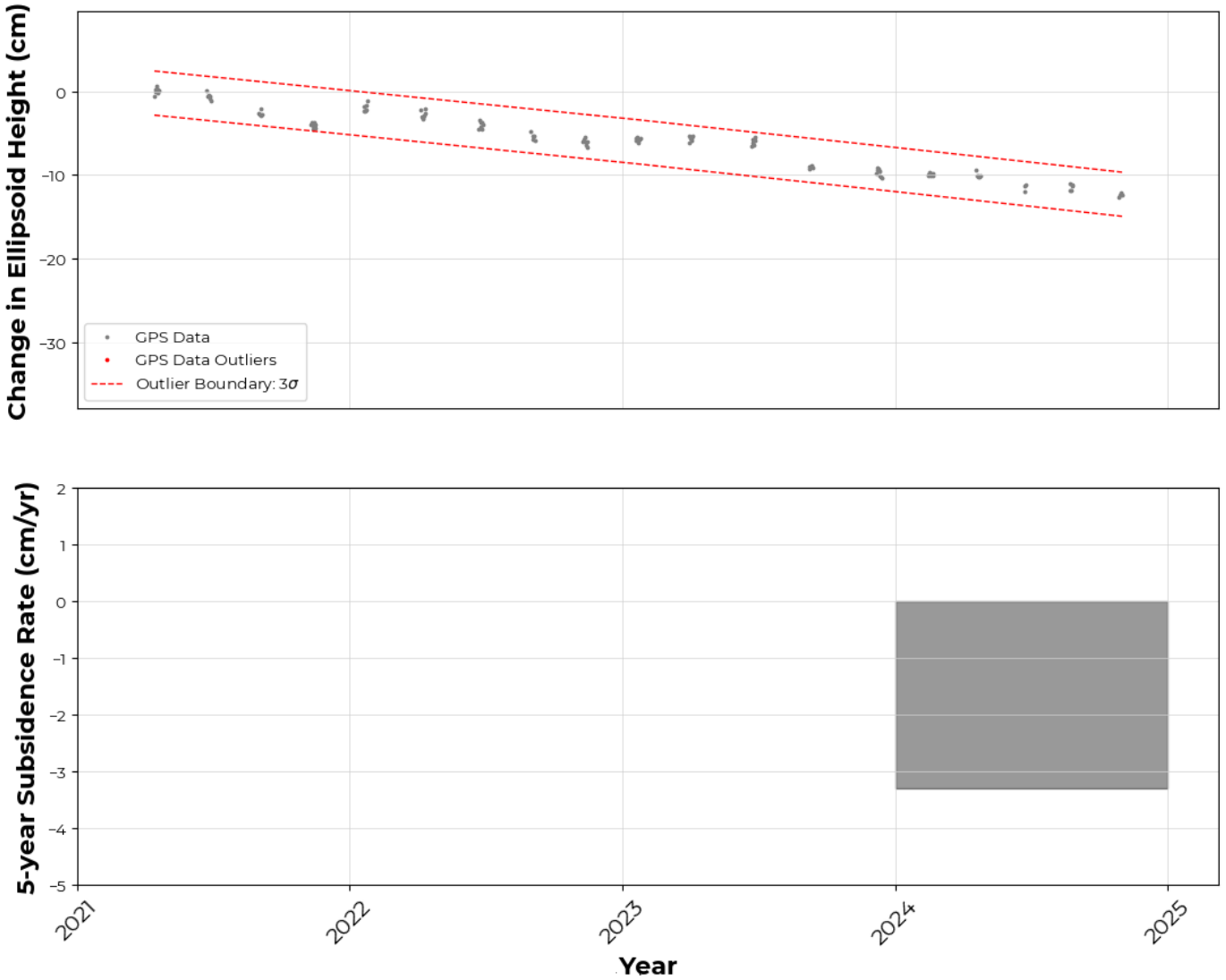


Exhibit 11 Subsidence Data in Katy/Fulshear

- GPS station P111, located in Katy, has measured a total of approximately 10.7 cm of subsidence since 2021.
- 2020-2024 average annual subsidence rate is 3.31 cm/yr.



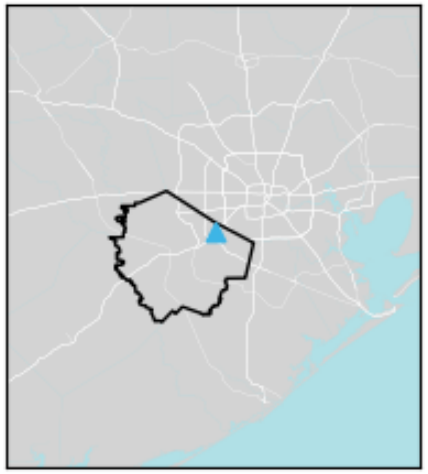


Processed GPS data (source: UH) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed lines) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by the District when calculating subsidence rates and are shown for informational purposes only.

Exhibit 12 Subsidence Data in Sugar Land

FORT BEND SUBSIDENCE DISTRICT

- GPS station P004, located in Sugar Land, has measured a total of approximately 30.9 cm of subsidence since 1994.
- 2020-2024 average annual subsidence rate is 0.61 cm/yr.



Processed GPS data (source: UH) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed lines) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by the District when calculating subsidence rates and are shown for informational purposes only.

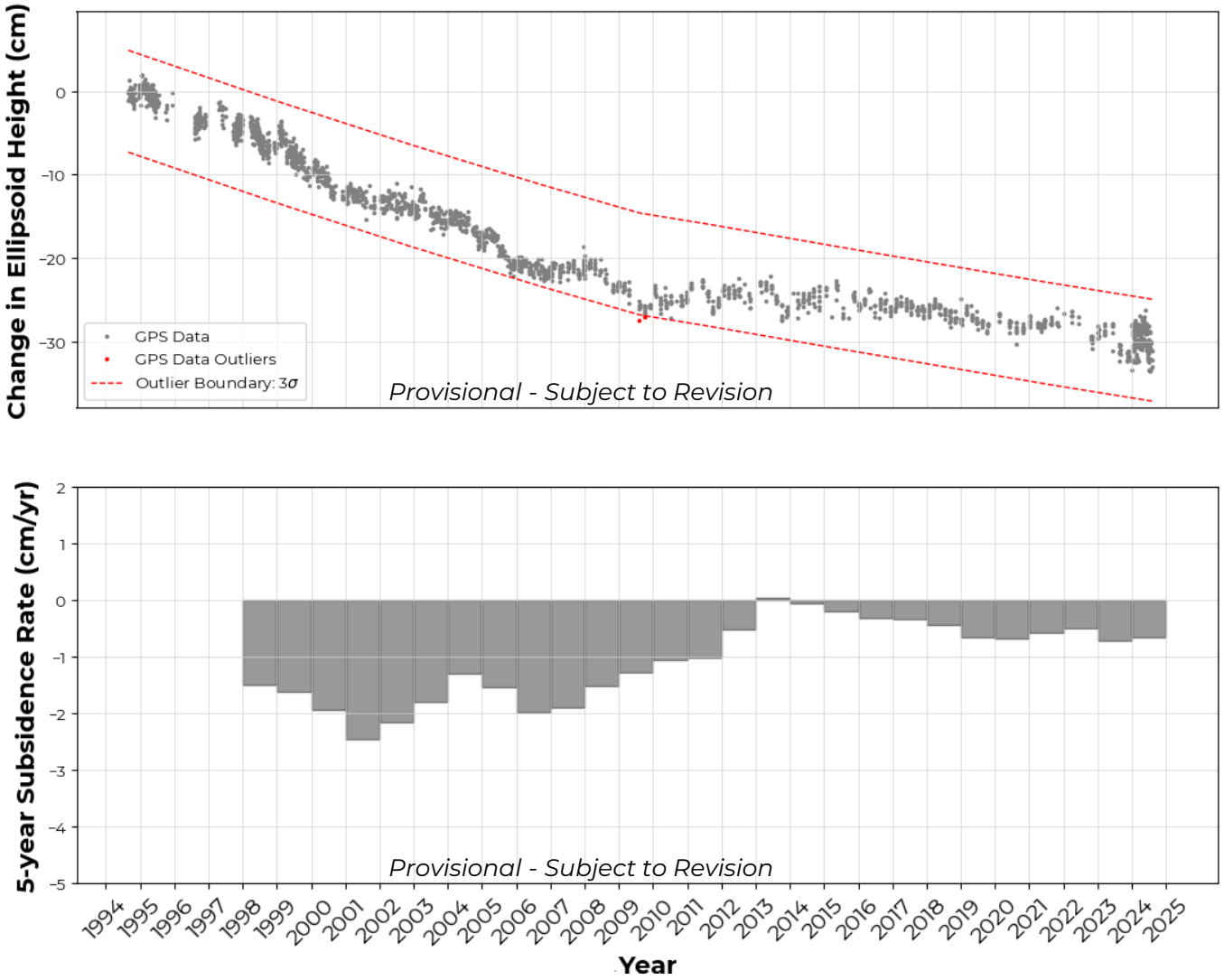
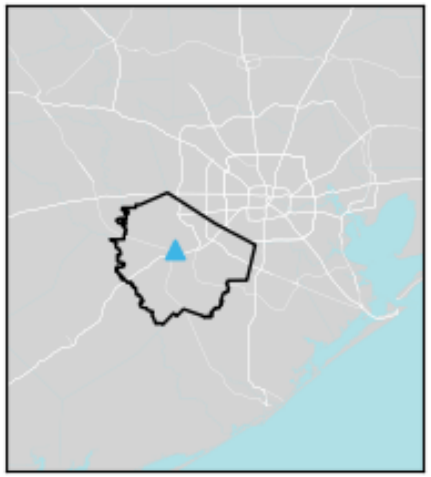


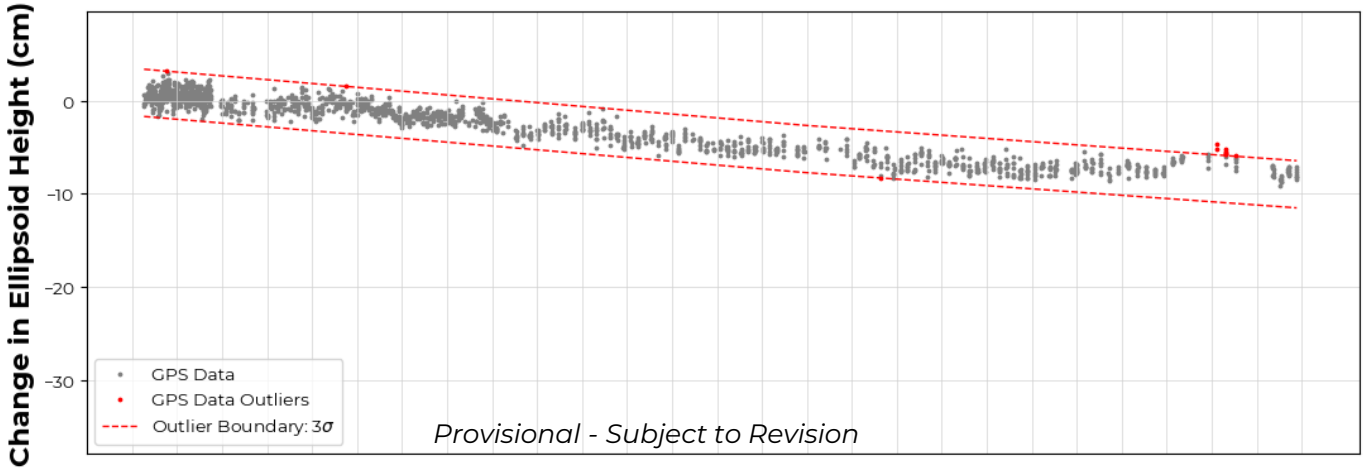
Exhibit 13 Subsidence Data in Rosenberg

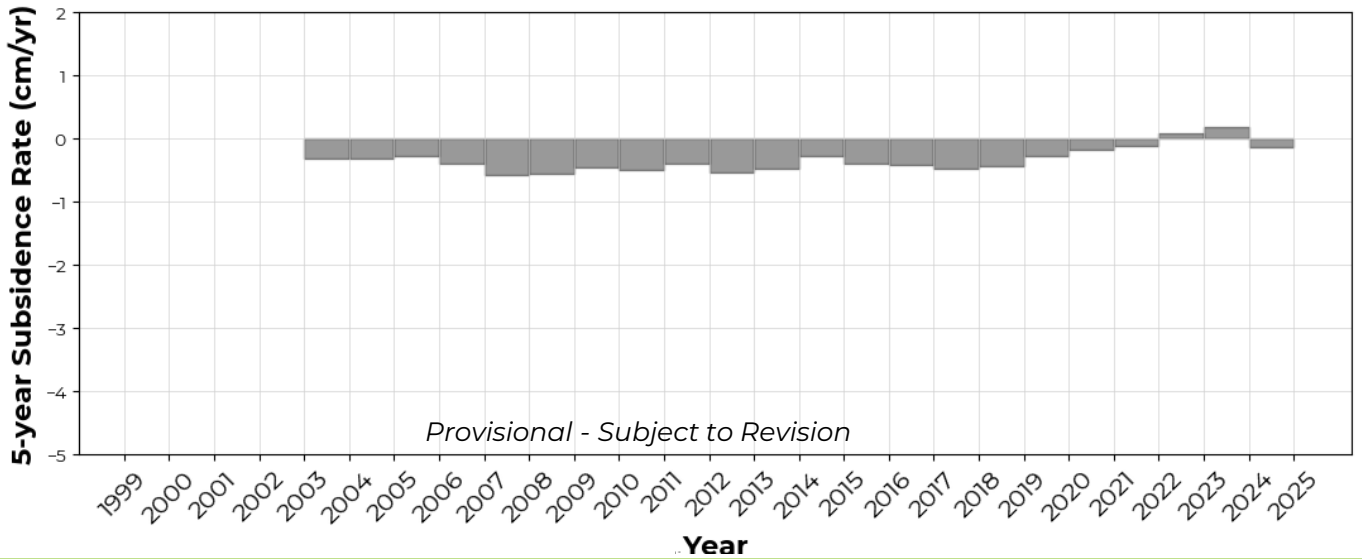
FORT BEND SUBSIDENCE DISTRICT

- GPS station P010, located in Rosenberg, has measured a total of approximately 8.1 cm of subsidence since 1999.
- 2020-2024 average annual subsidence rate is 0.09 cm/yr.



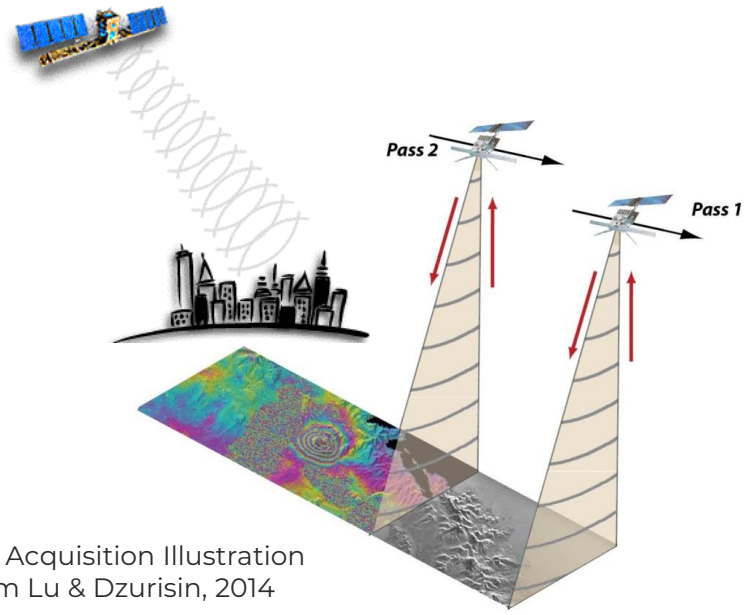
Processed GPS data (source: UH) over period of record. Processed GPS data (gray circles) located inside the outlier boundary (red dashed lines) are used when calculating subsidence rates. Processed GPS data identified as outliers (red circles) are not considered by the District when calculating subsidence rates and are shown for informational purposes only.





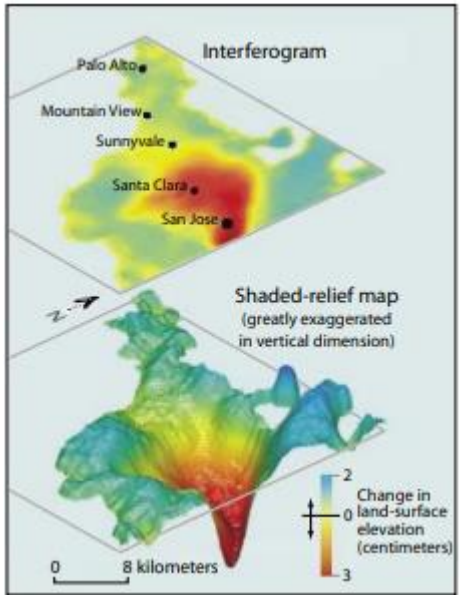
Interferometric Synthetic Aperture Radar (InSAR)

- Synthetic aperture radar (SAR) data are generated by transmitting radio waves from the sensor to the ground and back to the sensor.
- InSAR compares two SAR images of the same area at different times to detect small changes in distances between them. This processed pair of SAR images is the interferogram.
- Processing techniques can be used to achieve an accuracy of millimeters.



InSAR Acquisition Illustration
from Lu & Dzurisin, 2014

Processing

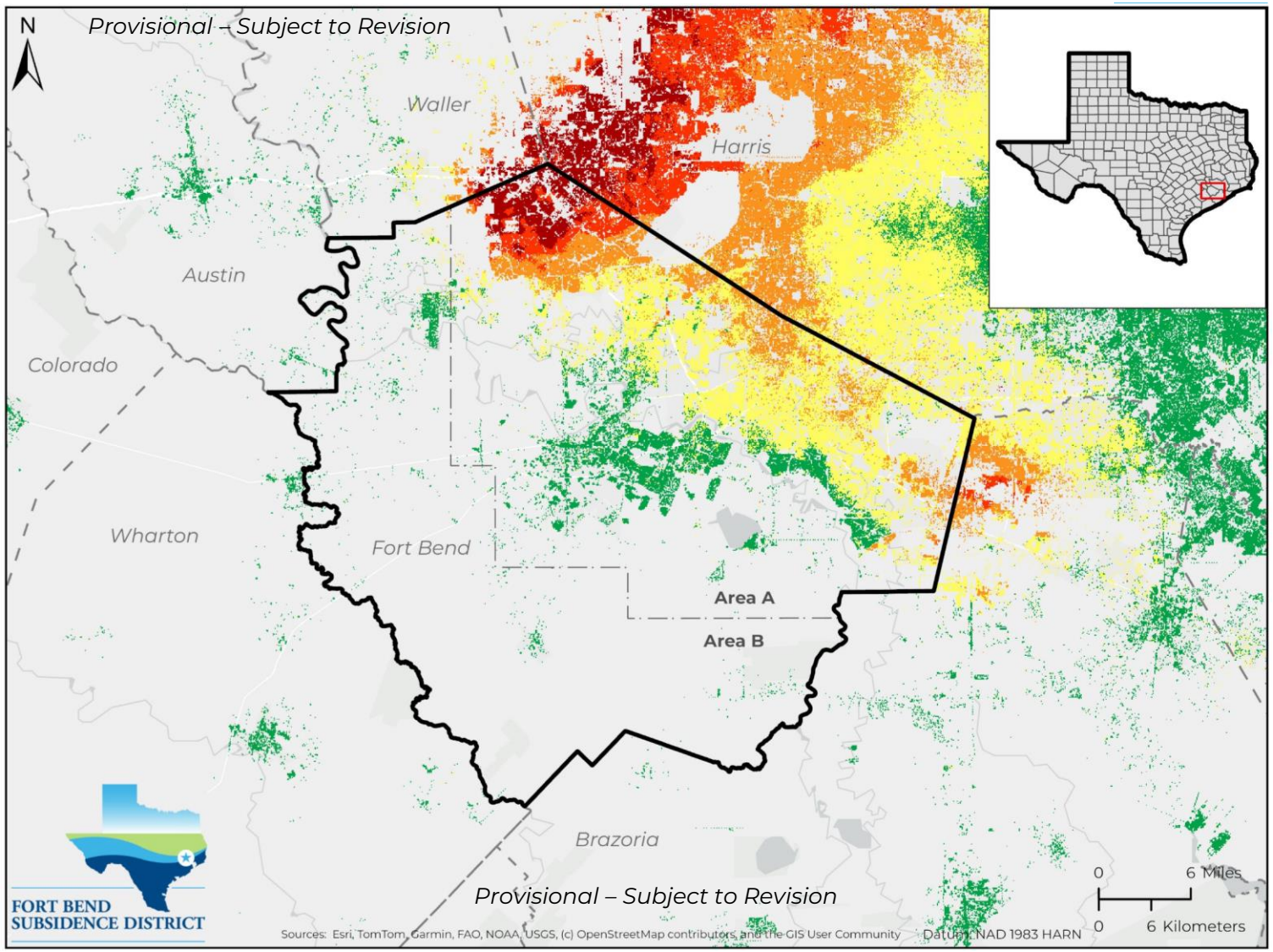


Interferogram (top) and
3-D topography (bottom)
from USGS Fact Sheet 2005-3025

Exhibit 14 Subsidence Rates from InSAR

FORT BEND SUBSIDENCE DISTRICT

Annual subsidence rate, in centimeters per year (cm/yr.), estimated from Sentinel 1A derived time-series interferograms averaged from 2020 to 2024.



EXPLANATION

Sentinel-1 Derived Average Annual Subsidence Rate (cm/yr.) Processed from 2020 to 2024

- Greater than 2.0
- 2.0 - 1.5
- 1.5 - 1.0
- 1.0 - 0.5
- Less than 0.5

Gray areas show no data as the accuracy of InSAR decreases in rural areas due to tropospheric errors and seasonal vegetative growth.

Testimony and Public Comment

FORT BEND SUBSIDENCE DISTRICT

Any person who wishes to present testimony, evidence, exhibits or other information may do so in person, by counsel, via email to **fbinfo@subsidence.org**, or any combination of these options.

Thank You for Attending the 2024 Annual Groundwater Report Public Hearing

- The record will be open until **May 7, 2025**. You may provide comments by sending an email to **fbinfo@subsidence.org**
- The 2024 Annual Groundwater Report will be presented for approval to the Fort Bend Subsidence District Board of Directors at their next meeting on **May 28, 2025.**
- Upon Board approval, the 2024 Annual Groundwater Report will be posted on our website, **fbsubsidence.org**, located within the Science & Research section.

Scan the QR code to visit the Annual Groundwater Reports page on our website. →

Contact Information

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www.fbsubsidence.org

FORT BEND
SUBSIDENCE DISTRICT