FORT BEND
SUBSIDENCE DISTRICT

2023 ANNUAL GROUNDWATER REPORT

Determination of Groundwater Withdrawal and Subsidence in Fort Bend County

EXECUTIVE SUMMARY

Fort Bend Subsidence District Report 2024-01

Fort Bend Subsidence District
Richmond, Texas
www.fbsubsidence.org

Determination of Groundwater Withdrawal and Subsidence in Fort Bend County – 2023

by
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2024

2023 Executive Summary

Groundwater was the primary source of water for municipal, agricultural, and industrial users over the last century. The reliance on groundwater and subsequent subsidence that was caused by its regional development resulted in the creation of the Fort Bend Subsidence District (District) in 1989. The District's mission is to regulate the use of groundwater in Fort Bend County, to cease ongoing and prevent future subsidence that can lead to infrastructure damage and contribute to flooding.

This report comprises the 34th Annual Groundwater Report for the District. Pursuant to District Resolution No. 24-477 passed on February 28, 2024, the Board of Directors held a public hearing at 2:00 p.m. on April 25, 2024. This report provides an overview of the information presented during the Public Hearing, including climatic conditions, groundwater use, groundwater levels and measured subsidence within the District through December 31, 2023.

Description of Study Area

Fort Bend County uses groundwater from the Gulf Coast Aquifer System, which includes two primary water-bearing units: the shallow, hydrologically connected system of the Chicot and Evangeline (undifferentiated) aquifers and the deeper Jasper aquifer. The regionally confining Burkeville unit separates the shallow and deeper systems. Only one well is completed in the Jasper aquifer and has only been in use on a limited basis. Therefore, most of the subsidence that has occurred in the District can be sourced to clay compaction in the shallow water-bearing units.

The District's Regulatory Plan was developed to reduce groundwater withdrawal to a level that ceases ongoing subsidence and prevents future subsidence within the District. The District adopted the most recent Regulatory Plan on January 23, 2013 and amended it on June 22, 2022. The District Plan separates Fort Bend County into two regulatory areas (**Figure 1**). Utilizing a novel regulatory approach, the amount of groundwater that may be used by a permittee is dependent upon their total water demand and location within a specific regulatory area. Regulatory Area A permittees can use no more than 40 percent sourced from groundwater for their total water demand unless they are in a certified groundwater reduction plan; whereas, Regulatory Area B permittees have no groundwater reduction requirements.

The District's Regulatory Plan requires permittees to convert to alternative water supplies in order to reduce their reliance on groundwater sources. The primary alternative water supply used in this region is surface water sourced from three river basins: the Brazos River Basin, the San Jacinto River Basin and the Trinity River Basin.

In the 1950s, the City of Houston along with other entities in the region began the development of several water supply reservoirs within the San Jacinto and Trinity River Basins to provide water for the rapidly growing area. Today, water treatment plants served by these surface water sources and the Brazos River Basin are operated by the City of Houston, the City of Sugar Land, the City of Richmond, the Gulf Coast Water Authority, the Brazosport Water Authority, and others.

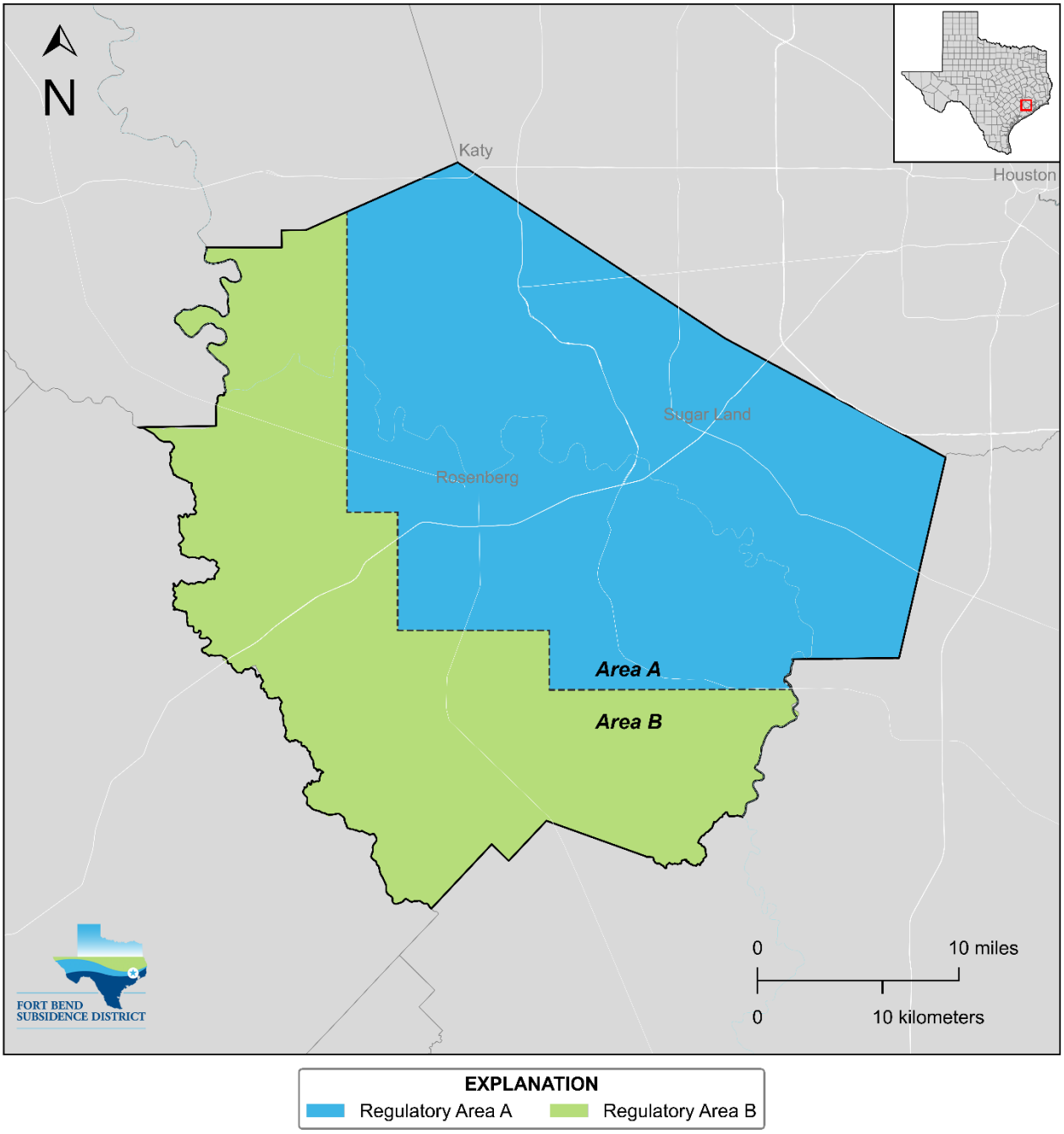

Figure 1. Location of the Fort Bend Subsidence District Regulatory Areas.

Climate

Annual variations in precipitation can significantly impact the total water demand in the District. Groundwater use patterns fluctuate during periods of climatic variation, which results in changes in aquifer water levels and potentially in subsidence rates. During periods of excessive rainfall, total water demand can decline; conversely, during periods of drought, water use can increase resulting in declining water levels in the aquifer and increased rates of subsidence. The 2023 calendar year began with below normal rainfall for half of the National Weather Service (NWS) climate stations analyzed for the region (**Figure 2**). The year progressed with five out of the eight stations recording below the 1991-2020 average normal precipitation and worsened in the summer months. From August through December, an extreme drought was classified for the region and all climate stations ended 2023 with rainfall accumulations below normal. This was similar to the drought experienced in 2022 as the majority of analyzed climate stations measured below normal rainfall from summer through end of year.

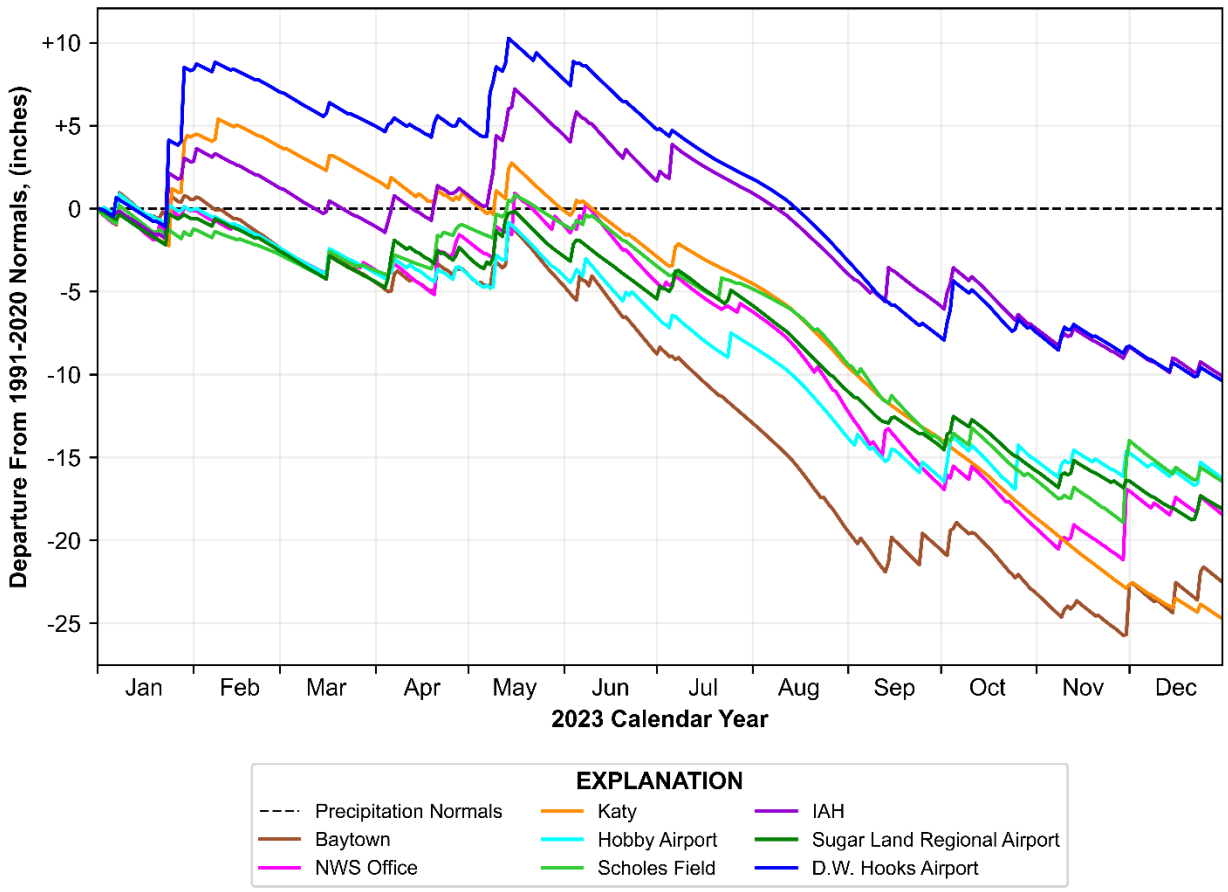

Figure 2. Cumulative precipitation, in inches, departure from 1991-2020 normal precipitation at selected NOAA-NWS Climate Stations within and around the District. Source: https://www.ncei.noaa.gov/access.

Water Use

The four primary water uses in the District are public supply, industrial, agricultural, and other. The total amount of groundwater withdrawal for 2023 is 95.5 million gallons per day (MGD). Public supply groundwater use remains the largest single-use category at 74.6 MGD and accounts for 82 percent of groundwater used in the District (**Figure 3**).

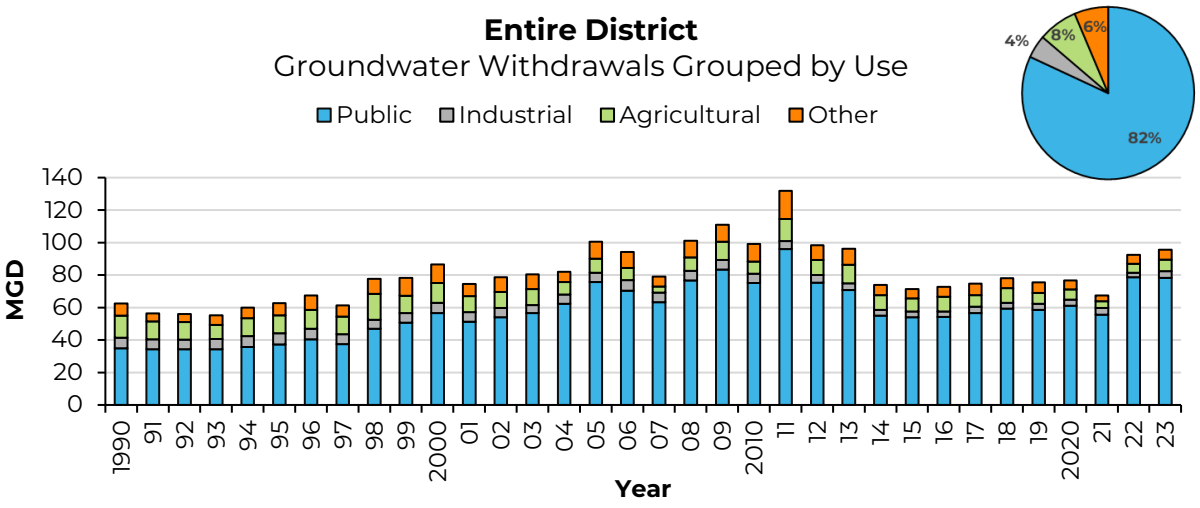

Figure 3. Groundwater withdrawals, in million gallons per day, by water use category from 1990 to 2023. The total groundwater used in the District was 95.5 MGD in 2023, with 82 percent of the use being public supply.

The District's Regulatory Plan requires permittees to convert to alternative water supplies to reduce their reliance on groundwater sources. The primary alternative water supply used in our region is surface water sourced from three river basins: the Brazos River Basin, the San Jacinto River Basin and the Trinity River Basin.

Total alternative water usage for 2023 was 92.6 MGD, with the Brazos River remaining the single largest source of alternative water, providing a total of 67.1 MGD in surface water supply (**Figure 4**). Groundwater remains the largest source of water supply within the District as a whole. The total water use for the District was determined to be 188.1 MGD in 2023.

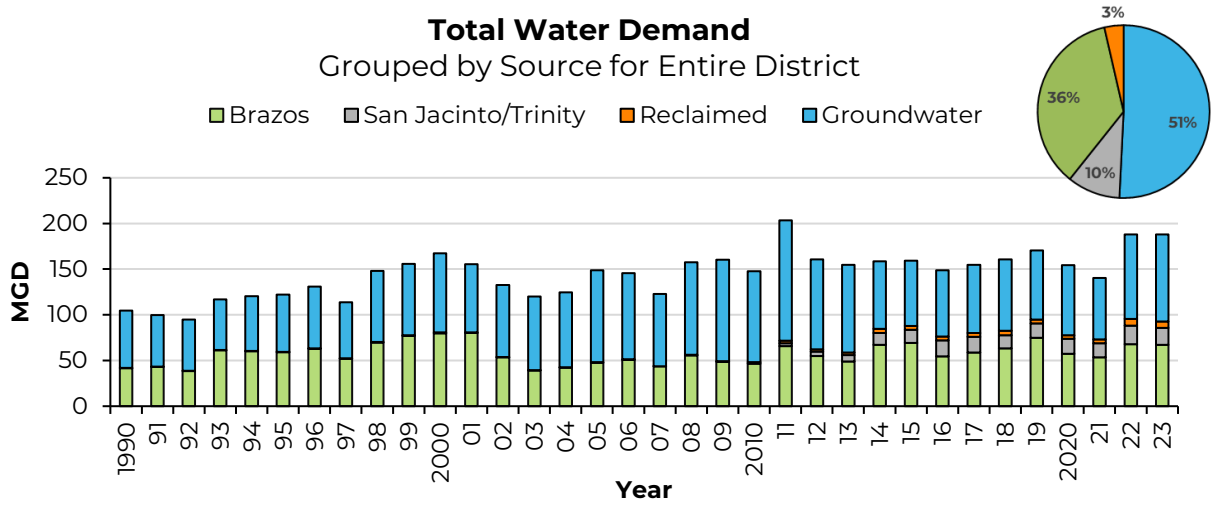

Figure 4. Total water use for the District, in million gallons per day, by source from 1990 to 2023. The total water use for the District in 2023 was 188.1 MGD. The 2023 total water demand ranks second in historical use with the 2011 drought being the first at 203.5 MGD.

Groundwater Levels

Annually, since 1990, the United States Geological Survey (USGS) has measured the water level in hundreds of wells throughout the region in cooperation with the District through a joint funding agreement along with additional cities, subsidence districts and groundwater conservation districts to monitor and provide reports on groundwater level altitude data for the Chicot/Evangeline and Jasper aquifers. Since aquifer water level is the best measure of the pressure in the aquifer, this information is also of vital importance to understanding the impact of changes in water use on subsidence.

The change in water-levels from 2013 to 2024 include areas of rise within Regulatory Area A such as Sugar Land and Missouri City with over 20 feet in the Chicot/Evangeline (undifferentiated) aquifer as these areas began utilizing alternative water in compliance with the District's Regulatory Plan (**Figure 5**). In northeastern Fort Bend County, the change in water-levels during this time period had a decline of over 30 feet. These areas are growing rapidly and the conversion to alternative sources of water will not be completed in the District until 2027.

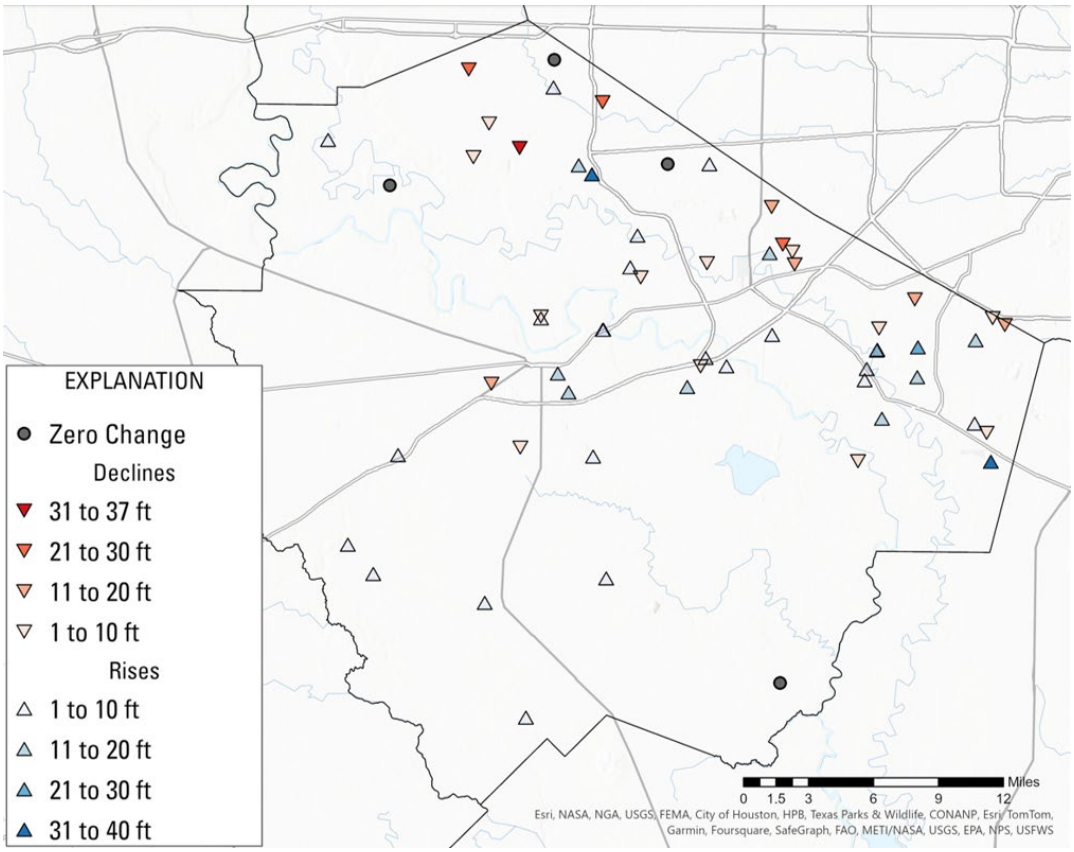

Figure 5. Water-level change at wells screened in the Chicot/Evangeline (undifferentiated) aquifer, Fort Bend County, Texas, from 2013 to 2024 (Source: USGS provisional data – preliminary and subject to change).

Subsidence

Since the mid-1990s, the District has utilized global positioning system (GPS) technology to monitor the land surface deformation in the area. Working collaboratively with University of Houston researchers, the subsidence monitoring network has grown to 230 GPS stations throughout the region. These stations are operated by the District, the Harris-Galveston Subsidence District (HGSD), the University of Houston (UH), Texas Department of Transportation (TxDOT), and other local entities.

The average annual rate of movement is a useful measure to show the current activity at a GPS station. Subsidence rates greater than 2 centimeters (cm) per year were measured in northern Fort Bend County, near Katy and Fulshear (**Figure 6**). Some southern portions of Regulatory A near the Richmond and Rosenberg area and all of Regulatory Area B show very little subsidence at under half a centimeter per year based on the subsidence rate averaged from 2019 to 2023.

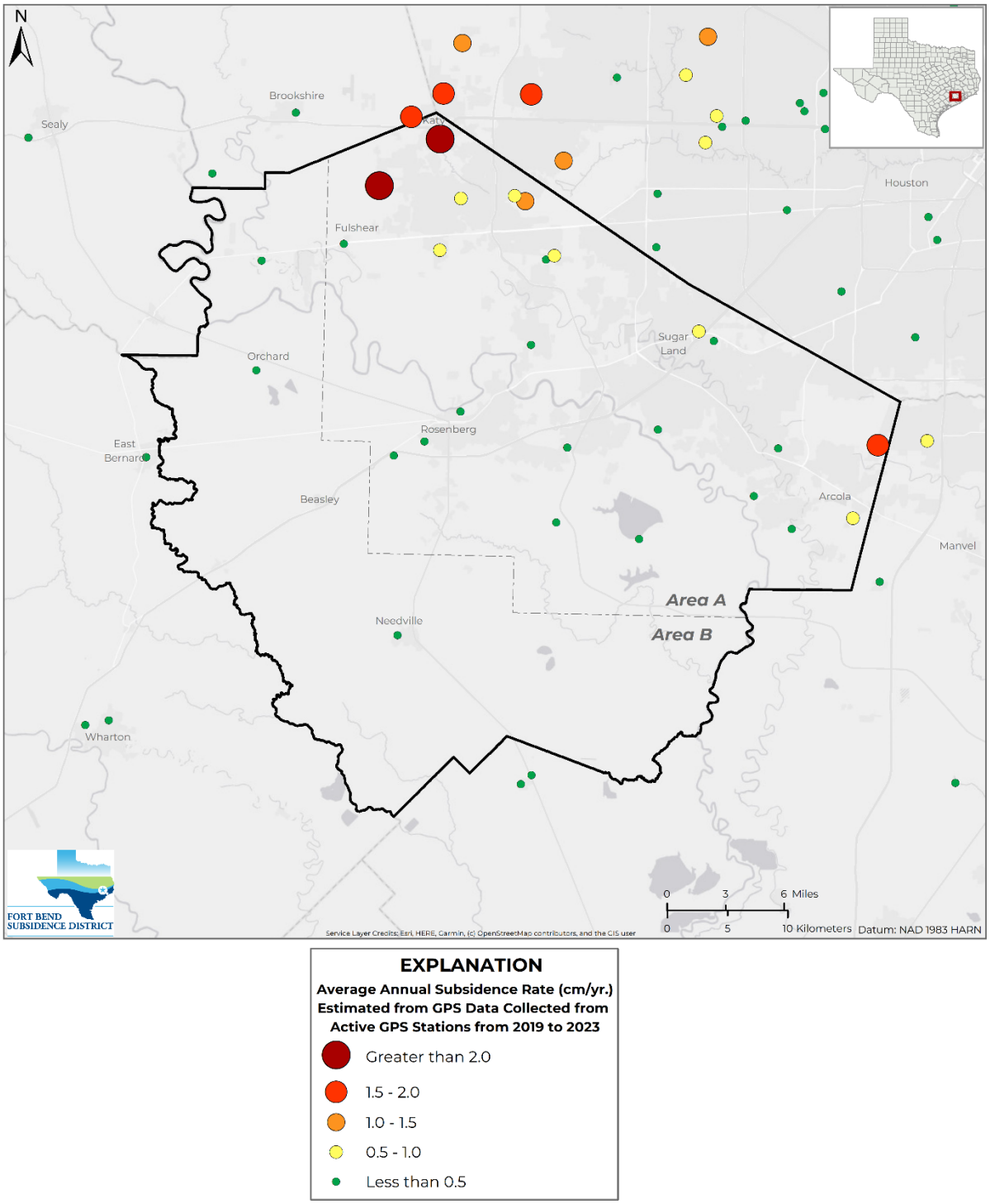

Figure 6. Annual subsidence rate, measured in centimeters per year, from 2018 to 2022, referenced to Houston20 and estimated from three or more years of GPS data collected from GPS stations in Fort Bend and surrounding counties, Texas.

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