

That Sinking Feeling Subsidence

If you're looking for a culprit to blame for **subsidence**, some natural settling or shifting of sediments laid down millions of years ago may indeed cause this geological phenomenon, but not to the extent of that caused by the withdrawal of oil and gas, subsurface coal mining, and the pumpage of groundwater.

As people have been saying for ages, "*Nature abhors a vacuum.*" When copious amounts of groundwater are drawn out of the aquifers below, the clay layers collapse under the weight of everything above them, effectively decreasing the storage capacity of the aquifer...never to return to previous levels.

Most of the groundwater wells that supply drinking water to the Houston-Galveston area have been constructed in the upper 1,000 to 2,000 feet of the *Chicot and Evangeline aquifers*. As subsidence increased inland – north and west of Houston – water levels have declined more than 100 feet in the Evangeline aquifer between 1977 and 1997. The area's steadily increasing population and decades of aggressive water usage resulted in a corresponding decline of the aquifers and in subsidence.

According to the United States Geological Service (USGS), the greater Houston area has been more adversely impacted by subsidence than any other metropolitan area in the U.S. Extensive subsidence – caused primarily by groundwater pumping and to

a lesser extent, by oil and gas extraction -- has caused damage to the area's industrial and transportation infrastructure. One conservative estimate placed the average annual direct and indirect cost of subsidence to property owners at more than \$90 billion in 1998 dollars.

Look at it this way. If the elevation of your house is only 10 feet above sea level and you lose 10 feet of elevation because of subsidence...your house would be under water. This happened to Brownwood, a subdivision in the City of Baytown that subsequently had to be abandoned – an extreme example of the effects of subsidence. While regional land subsidence can be subtle and difficult to detect, there are locations in and near Houston where the effects are quite evident.

As much as 10 feet of subsidence has shifted the coastline and changed the distribution of important wetlands. One of the most obvious impacts of subsidence has occurred at the *San Jacinto Battleground State Historical Park*, where Texas won its independence, which is now partly submerged with 100 acres of the park under water.

There are plenty of reasons to care about subsidence...not the least of which are preserving our land for future generations and, "cha-ching", saving money. We all know it's important to conserve our natural resources, but are we really doing anything to make it happen? And how does that apply to subsidence? The truth is, it can be



difficult to change our habits when we aren't sure how our actions make a difference. To truly get motivated, we must first understand the fundamental issues and why change is necessary.

Utility districts have supplied our neighborhoods with drinking water by traditionally drawing groundwater from aquifers beneath the earth's surface. But our area's steadily increasing population and decades of aggressive water usage have resulted in a decline of the aquifers and cause subsidence (the actual "dropping" or "sinking" of land). In fact, some areas within the Authority's boundaries have dropped more than 2cm per year from 2016-2020. If we did nothing, the subsidence rate could exceed 1-foot every 15 years.

The Harris-Galveston Subsidence District (HGSD) has been measuring subsidence since the mid-1970s, and they are the first U.S. regulatory agency of their kind with the assignment to "end subsidence". Their current measurement methods combine the latest technology (which collects data from orbiting satellites), with knowledge gained from more traditional methods, resulting in highly accurate measurements of change in

land elevation due to subsidence. Armed with the authority to restrict groundwater withdrawals by the Texas Legislature, the HGSD has positively impacted critical situations in the coastal and Galveston Bay areas...and are now focusing much of their efforts in our area.

The HGSD has been using Global Positioning Satellite (GPS) technology since 1987, providing reference frames to measure subsidence at specific locations throughout the area. In the mid-1990s, the District and the National Geodetic Survey also utilize portable units, or PAMS (GPS Port-A-Measure) to provide subsidence measurements and operates four permanent CORS (Continuously Operating Reference Stations) which continuously output data, providing a basis from which change comparisons may be made and analyzed.

It is through this continued monitoring of subsidence and a commitment to water conservation that we will enable nature to replenish our aquifers.

For additional information on this important topic, please visit whcrwa.com/subsidence. 💧

