

## CASE STUDY

# SEGMENTAL PVC PIPE SUPPORTS SOLUTION FOR MORE RESILIENT WASTEWATER SYSTEM RECONSTRUCTION AFTER MAJOR HURRICANE

Addressing the Seabrook, Texas, Main Street Wastewater Treatment Plant's (MSWWTP) vulnerability to hurricanes became a critical task after Hurricane Ike devastated the Texas coast in 2008. With the potential for major damage to the wastewater system along with service disruptions, the city faced the challenge of finding a solution that would protect the plant, minimize disruptions, maintain the resiliency of the infrastructure, and ensure continuous service to its residents.

## CHALLENGE

Seabrook, Texas experienced the impact of Hurricane Ike when the storm made landfall on the Texas coast the morning of September 13, 2008. The powerful category 4 hurricane ranked as the third most destructive in U.S. history and the wind's immense power led to storm surge waves as high as 25 feet within Galveston Bay. The city is located approximately 27 miles north of the city of Galveston on the shores of Galveston Bay and at the mouth of Clear Lake.



Photo courtesy of NASA.gov

One of the critical structures affected by Hurricane Ike's storm surge was Seabrook's MSWWTP. The plant was inundated during the hurricane resulting in approximately \$1.5 million in damages. After the storm, thanks to the prompt action of Seabrook's Public Works Department, the sewer service was restored to the MSWWTP and all Lift Stations within just five days. Although the control room and structures of the plant are above ground and elevated above current FEMA flooding and surge elevations, the location today presents a number of challenges: subsidence issues, the proximity to Galveston Bay, and if overtopped, the risk of structural failure of the walls along with the associated overflow leading to the discharge of untreated wastewater into the bay, all which emphasize the need for an improved facility location.

## APPLICATION

In the aftermath of Hurricane Ike, one of the crucial tasks was to address the vulnerability of the MSWWTP to hurricanes of similar magnitude. Along with the low ground elevations, the primary hazard identified at the existing site was the flooding of sensitive components. To provide the plant with longer-lasting protection against flooding and other natural disasters, several alternatives were considered by the city.

The preferred alternative was to construct a new wastewater treatment plant at Pine Gully (PGWWTP). This site is located further inland at a higher elevation. Currently, the top of the MSWWTP tank walls stand only 1 foot above the Base Flood Elevation (BFE), whereas, at PGWWTP, the walls planned are 20 feet above the BFE. Moreover, the new WWTP will be built to current standards and fortified against

**Project Type:**  
Sewer Force Main

**Application:**  
Horizontal Directional Drilling (HDD)

**Owner:**  
City of Seabrook

**Product Used:**  
C900 Certa-Lok® RJIB  
12" DR18  
C900 Certa-Lok® RJ  
14" & 20" DR18

**Contractor:**  
TCH Directional Drilling

**Engineer:**  
Cobb, Fendley &  
Associates, Inc.

hurricanes and other natural disasters. Ideally, this alternative would receive funding assistance from FEMA, enabling construction to be completed within 3 years. The city of Seabrook enlisted the services of Cobb, Fendley & Associates, Inc. (CobbFendley) to assist the city's emergency management planners in the application process for federal assistance; with funding approved, the projects moved forward.

The team first looked at the current process where all the wastewater treated by the MSWWTP flowed into the MSWWTP lift station. One option was to leave the system as-is, allowing the entire volume of wastewater to reach the existing MSWWTP lift station and then pump the wastewater to the new PGWWTP. Reviewing this scenario, CobbFendley proposed an alternative option. They suggested intercepting the wastewater from 6 existing lift stations that are closer to the PGWWTP and rerouting the path directly to the new plant instead of following the current process. By implementing the new approach, approximately 50% of the service area would no longer rely on a single lift station near the MSWWTP, and this option also provided construction flexibility. The alternative approach was approved, resulting in the installation of 21,500 feet of new sewer force main pipe to redirect the sewage flow to the new treatment plant at Pine Gulley.



## SOLUTION

Horizontal Directional Drilling (HDD), a trenchless application, was selected as the installation method. This application offered minimal disruption to surface structures, the ability to cross roads and driveways without closures, and efficient installation in congested, primarily residential, rights-of-way.

Several pipe options were considered for the force main, butt fused HDPE, butt fused PVC, and segmental restrained joint (RJ) PVC. Ultimately, segmental C900 Certa-Lok® RJ PVC pipe from Westlake Pipe & Fittings was chosen as the optimal solution offering the cartridge assembly option; the fused pipe options considered required modifications to the HDD pulls and these solutions were found to be too time consuming and ultimately unable to meet the demands of the project. The green color coding of PVC, whether fused or segmental, was also an advantage for the relatively shallow bury depths as it provided an easy identifier for the wastewater pipe system.

The cartridge style segmental PVC approach involves assembling the pipe string during the pullback operation. Pullback occurs one drill rod at a time and there is a pause every time a drill rod is disconnected and re-racked. The new joint of segmental pipe can be connected to the pipe string during these pauses and the pullback operation can continue at the usual pace. TCH Directional Drilling, the general contractor, was very familiar with the segmental product and expressed no concerns about pipe-string assembly slowing the pullback operation. Moreover, there were specific HDD project sites where this approach was preferred.



"The ability to cartridge feed Certa-Lok during pullback without risking the integrity of the pipe and or gaskets is a major advantage of Certa-Lok over other pipe products when planning and executing HDDs in congested areas as we encountered in Seabrook where space to string out pipe is limited," said Samuel Free, project manager TCH Directional Drilling. "The speed and ease of using Certa-Lok's coupling system to connect joints significantly reduce the amount of time and manpower required to perform drilling operations over other products that require fusion or welding to join."



Certa-Lok segmental PVC pipe is available in 20-foot or 40-foot lengths. TCH Directional Drilling chose the 40-foot option for increased efficiency and to reduce labor. Opting for 40-foot lengths also resulted in a more cost-effective solution. In addition, Westlake Pipe was available on site to provide support during the project.

Throughout the planning phase, resiliency was a top priority. To better facilitate maintenance, shallower profiles for the HDD bores were specified instead of the typical depth. The shallower depths, however, required additional measures to address potential inadvertent return of drilling fluids leading the design firm to require multiple relief pits along the installation path.

Grade control also received significant attention. An air relief valve is required at every high point in a force main and poor grade control could result in unexpected local high points. Using a walkover system to monitor both the depth and direction of a horizontal drill gives operators real-time feedback and enables constant adjustment of the drilling direction. TCH Directional Drilling used a Digital Control Inc. walkover tracker during the HDD process to ensure grade was maintained within tolerance.

As of the end of January 2023, 10,000 LF of 14-inch C900 Certa-Lok DR18, RJ, PVC; 5,300 LF of 12-inch C900 Certa-Lok DR18, RJIB, PVC; and 5,300 LF of 20-inch C900 Certa-Lok DR18, RJ, PVC or 92% of the total 21,540 LF of force main pipe has been installed. Due to outside constraints with the construction of the PGWWTP, the new force mains will not be placed in service until early 2024. All work by TCH Directional Drilling has progressed on schedule and within budget.

