

# ***Houston Public Works Makes Improvements to Critical Groundwater Facility***

By Melissa Mack, P.E., and Tina Yao, P.E.

## **Project Overview**

Over the past decades, Houston Public Works has been making improvements at 80 of the city's existing groundwater facilities and six re-pump stations. Originally, some of these groundwater facilities, constructed decades ago, were operated by Municipal Utility Districts. Later, ownership and operations of these facilities were

transferred to the City of Houston. The improvements to these facilities, which produce more than 200 million gallons of water a day (MGD), have helped the City meet its customers' water demands and provide redundancy for its surface water supplies.

Currently, there are more than 20 on-going Capital Improvement Projects (CIP) for groundwater facilities

and re-pump stations city-wide. One of the projects in the ongoing CIP is the District 71 groundwater facility improvements in west Houston. This facility, which supplies 5.8 MGD of groundwater, pumps into a neighborhood that also receives treated surface water. District 71 currently uses free chlorine from chlorine gas injection to disinfect the water and provide the re-



quired chlorine residual in the distribution system. The water produced from District 71 mixes with chloraminated water in the distribution system.

To avoid water quality issues in the distribution system, Houston Public Works decided to convert the facility's chlorine disinfection process to a chloramine disinfection process. This required the installation of an ammonia solution feed facility consisting of a new building, bulk storage tank, day tanks, liquid ammonia sulfate (LAS) vacuum feed system, piping, and mon-

itoring and control equipment. Other improvements to the District 71 facility included rehabilitation of existing booster pumps, discharge header modifications (addition of isolation butterfly valves and flow meters), addition of flow meters on well discharge piping, and SCADA modifications to meet current City standards.

"District 71 is the largest groundwater facility in the western part of the city," said Sandeep Aggarwal, P.E., managing engineer at Houston Water – Drinking Water Operations Branch.

"So, this is a critical project for us."

In 2015, Houston Public Works hired Lockwood, Andrews & Newnam, Inc. (LAN), a national planning, engineering and program management firm, to design these improvements. In November 2018, LEM Construction Co, Inc. began construction on this project.

### Project Challenges

Once the project got underway, LAN and LEM Construction faced numerous challenges. Chief among them was designing the chlorine and liquid



ammonia sulfate feed systems with the flexibility to provide consistent water quality from the District 71 facility for blending with surface water in the distribution system. At the District 71 facility, three wells provide raw groundwater (two offsite wells and one onsite well), resulting in three potentially different raw water qualities to treat and then blend in the ground storage tank. The ground storage tank is fed by two inlet lines, one from the onsite well and a single line for both offsite wells, each of which are tapped for both chlorine and LAS injection. To form chloramines for essentially two water supply sources (onsite and offsite wells), the project team decided to provide two separate chlorine and LAS feed systems for each ground storage tank inlet line, with redundant chemical feed systems that could serve either

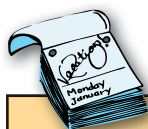
system. During the design phase, the team spent considerable time evaluating various factors for the design of the chemical feed systems, including raw groundwater quality data, appropriate chlorine and ammonia mass feed ratios, injection points and contact time, as well as target combined chlorine residual concentrations entering the distribution system. New chlorine and LAS storage and feed facilities are housed in a new dedicated chemical feed building.

“It was a delicate balancing act,” says Jeremy Nakashima, P.E., LAN’s senior associate and water/wastewater practice leader. “We had to take raw groundwater from three different water wells with different flow rates and blend them with two different chemicals in the right concentrations in accordance with the Texas Commission on Environmental Quality regulations. At the same time, we had to provide enough flexibility so operators could meet fluctuating system demands.”

Preventing accidental leakage of chlorine was also a concern. Previously, District 71 used a chlorine gas wet scrubber system to collect and treat chlorine gas from an accidental release in the storage building. But these wet scrubbers required significant maintenance. Consequently, Houston Public Works and the project team installed



high-pressure, secondary containment vessels called ChlorTainers<sup>®</sup> for the chlorine ton cylinders. In the event of a leak, all chlorine is contained within the ChlorTainer<sup>®</sup> where it can be recovered and used in the disinfection process. Using ChlorTainers<sup>®</sup> allowed Houston Public Works



## 2021 CALENDAR OF EVENTS

### Young Professionals Virtual Happy Hour

4:30 pm

(3rd Wednesday of each month)

[http://texas.apwa.net/  
PageDetails/12642](http://texas.apwa.net/PageDetails/12642)

### Public Works Emergency Response Council

12:30 to 1:15pm

(Last Friday of each month)

[http://texas.apwa.net/  
PageDetails/21105](http://texas.apwa.net/PageDetails/21105)

### 2021 Annual Conference & Public Workshop

**May 25th-27th 2021**

in Galveston

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EventDetails/18880](http://texas.apwa.net/EventDetails/18880)



to decommission the existing wet scrubber system and associated appurtenances, resulting in significant savings in maintenance and insurance costs. Additionally, LAN designed a customized system to load the heavy chlorine cylinders into the ChlorTainers<sup>®</sup>, further easing operations.

“These are difficult to move, chlorine ton cylinders,” says Nakashima. “The operator has to take them off the truck, move them into the building, and then load them into the ChlorTainer<sup>®</sup>. Once inside the building, the standard loading mechanism that was available from the manufacturer would not have worked efficiently at this installation. So, working with operations staff, we designed a customized loading system that better suited the project requirements and the needs of the operators.”

The conversion to chloramine disinfection also required permitting from Harris County Flood Control District and the City of Houston Floodplain Administrator due to the increased impermeable surfaces from the new building and paved areas. Originally, the project team considered detention ponds to manage the stormwater runoff. But the operations staff wanted a solution that didn’t require maintenance, so the project team added deeper swales instead.

In addition to District 71, Houston Public Works was implementing improvements to three other groundwater facilities in the area. To ensure that Houston Public Works could continue serving customers when District 71 was out of service, the project team coordinated with the drinking water operations staff to determine the construction sequencing. The construction sequencing took into account winter periods, lag time to avoid shutdowns during summer months when demand is typically high, as well as potential setbacks such as delays in equipment, procurement, inspections, SCADA troubleshooting and training.

## Conclusion

Despite these challenges, Houston Public Works and the project team completed the approximately \$2 million improvements in June 2020.

“These improvements will enable us to continue providing high-quality groundwater to our customers for the next few decades,” said Aggarwal.

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