HOW TO FIND A NEEDLE IN A HAYSTACK – FINDING AND FIXING LEAKS AT THE THOMAS E. TAYLOR REGIONAL WATER TREATMENT PLANT

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BACKGROUND

The Upper Trinity Regional Water District (District) is a wholesale provider of water and sewer services in north Texas. The District operates water treatment plants and water reclamation plants and serves customer cities in Denton County, plus limited portions of Collin and Dallas Counties. The District's largest plant is the Thomas E. Taylor Regional Water Treatment Plant (Plant) which was originally constructed in 1997 with a capacity of 20 MGD. In 2001 the plant was expanded to 70 MGD.

In recent years District operations staff began noticing leaks and other issues at the plant including:

- cracking in several walls and floors of the flocculation and filter basins;
- increased settlement of sidewalks around the flocculation and filter basins;
- saturated ground in an unpaved area outside the flocculation basins;
- increased flow in French drains located beneath the basins and clear wells

They also noticed ponding water at a low spot in the yard of the Stonehill Booster Pump Station (Pump Station) located several miles west of the Plant. The pump station is fed by a critical 48-inch transmission main that originates at the Plant. For several years the District's operations and maintenance staff inspected and monitored the leaks at the pump station. In order to locate the leaks and identify the root causes, the District excavated where the water was surfacing at the Pump Station, but was unable to pinpoint the leak.

LOOKING FOR NEEDLES

After noting that the number of cracks and leaks at the Taylor Plant appeared to be increasing over time the District contacted structural engineer Chris Story, PE in JQ Infrastructure's (JQ) Dallas TX office. After an initial visit Mr. Story engaged

Taylor RWTP operations staff began noticing leaks and other issues at the plant, including increased flow in French drains located beneath the basins and clearwell. Superintendent, Tim Brazile, confirmed residual chlorine in the plants French drain sump.

a small team of JQ civil and structural engineers led by Jerry Snead, PE to visit the Plant and Pump Station to help determine the severity of the issues. The District then met with Mr. Snead to develop a scope of work that started with a limited structural and civil investigation in and around the basins that, if needed, would expand to structural and civil repairs and an investigation of selected plant pipelines.

The work began with a structural evaluation of cracks in the plant basins using the following technologies and techniques:

- field observations,
- LIDAR,
- ground penetrating radar
- survey checks at key locations

It also included a civil evaluation of site grading and ground settlement, geotechnical conditions across the facility and installation of piezometers.

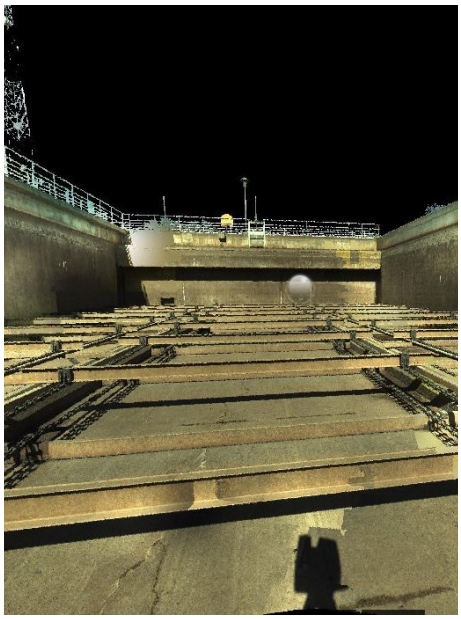
Once the piezometers were installed, District operations staff led by Tim Brazile (Taylor RWTP Superintendent) monitored water levels on a weekly basis, before and after rain events, and when basins were filled and drained. Additionally, operations staff checked the piezometers and French drain sump pit for residual chlorine to provide additional information on whether raw or treated water was leaking.

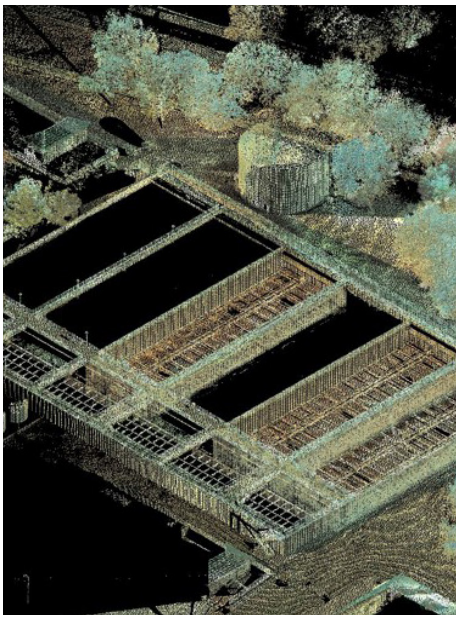
In order to understand the subsurface conditions beneath the facility, JQ reviewed existing geotechnical information from the original plant design to understand the soil stratigraphy and historical perched water or groundwater levels. JQ also installed 4 new borings around the basins to confirm the depth and composition of structural backfill and verify the depth to shale. The bore holes were converted into piezometers after soil sample collection so that District operations staff could monitor water levels around the facility. The piezometers were monitored by District operations staff before and after basins were filled or drained and before and after rain events.

The structural evaluation identified several cracks in the basin walls and a small void beneath a basin floor and recommended replacement of expansion joints and a water stop located at the construction boundary. The civil evaluation identified several eroded locations near the basins and recommended replacement or repair of several sidewalks and paved areas.

The investigation of selected plant pipelines began with a meeting with plant staff to discuss the operation and layout of the plant pipelines and clear wells as well as the Plant's raw water supply pipeline and treated water transmission main that led to the Pump Station. The pipes ranged from 6-inch to 84-inch diameter and included both gravity and pressurized lines. The team discussed previous inspections, access locations, and inspection methods and agreed on the following inspection program:

- French drains around clearwell (6"-12" diameter) – inspect via tethered CCTV crawler
- Clearwell and connector pipeline (84" diameter) –





The leak investigation started by evaluating cracks in the RWTP's basin using a variety of techniques, including field observations and LiDAR scans.

French drains around the clearwell were inspected using a tethered CCTV crawler. Divers used dye and video to inspect the clearwell and its 84-in. connector pipeline.

inspect via divers with dye and video
- Raw water pipeline (60” diameter) – inspect via acoustic smart tools
- Treated water pipeline (48” and 60” diameter) – inspect via acoustic smart tools

The French drains, clearwell and 84” pipeline were accessible through existing entry points and were inspected first.

Inspection of the 48” and 60” raw water and treated water pipelines with in-pipe acoustic leak detection equipment required that insertion and extraction points be located at the upstream and downstream end of the inspection area and monitoring points in between. Unfortunately, the existing pipelines did not have access points at the required locations. JQ worked with District staff and their sub consultant, Pure Technologies, to identify pipe tap and monitoring locations and then mobilized a contractor to install the taps.

The District operations staff helped before the smart tool inspection by exposing the pipeline at key locations so the sub consultant could attach acoustic monitoring sensors. During inspection the operations staff provided access to each location and supported the consultants’ monitoring staff.
The following photos show the team monitoring during inspection of the raw water and treated water pipelines.

FOUND SEVERAL NEEDLES

The inspections found a total of four (4) significant leaks. One (1) was in a basin and three (3) were in pipelines! Two (2) were in the 84-inch pipe located between the clearwell and pump station in the plant yard.

PROJECT STATUS AND CONCLUSION

As of the date of this article, the structural basin repairs are in progress and include replacement of expansion joint material, replacement of some sections of waterstop, limited concrete replacement, and crack injection. The pipe repairs were completed in May 2016 and included installation of two (2) internal gasketed joint seals in the 84” pipe and replacement of a section of 48” pipe.

The Taylor RWTP and Stonehill PS facility are critical components in the Districts’ water delivery program. The successful identification and repair of the leaks at these facilities was only possible due to collaborative efforts between the team members. Special thanks to: Upper Trinity Regional Water District, JQ Infrastructure, Pure Technologies, US Underwater Services, EST-Inc., GPRS, Wilson Contracting, and Felix Construction.

Operations staff exposed raw and treated water pipelines at key locations so the subconsultant could attach accoustic monitoring sensors.