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## Water Level Concerns in Texas Require a Stable Solution

Case Study #607

### The City of Commerce, Texas Discovers a Cost-Efficient Approach to a Multi-Tiered Challenge

The Sabine River Authority (SRA) operates the 36,700 surface-acre reservoir of Lake Tawakoni and Iron Bridge Dam on the headwaters of the Sabine River. A number of historic Indian tribes settled in the surrounding land area prior to construction of the reservoir in 1960, giving Lake Tawakoni its name. In order to provide stewardship of the natural resources present, the SRA strives to achieve a balance between recreational demands of the region and preservation of natural resources.

The primary purpose of Lake Tawakoni is to provide a municipal and industrial water supply for the surrounding communities, the city of Dallas and the North Texas Municipal water district. Due to its extensive 200-mile shoreline, Lake Tawakoni also serves as a source of water-oriented recreation for much of central northeast Texas. The Lake is a popular attraction for swimming, fishing and water-skiing alike.



### Water Levels Dangerously Low

City Manager Bill Shipp, Assistant City Manager Mike Dunn, and the City Council for the City of Commerce realized they were facing serious problems when the lake surface rapidly receded. As the level dropped, the upper bowls on the existing vertical turbine pumps were exposed to air and would soon be to a point where water could not be reliably pulled from the lake. Inadequate fire protection and water rationing were grim possibilities. In that Texas typically relies on heavy spring rains to enable man-made reservoirs to remain at full water capacity until the levels are lowered in the summer, concern was validated. Further, due to several years of drought, the area lacked the necessary rain to refill the reservoir. The lake at full capacity would be at 437 feet above sea level, but during the drought, the water level was down – registering at 425 feet.



Prior to being confronted with the high demands of summer, a new system was needed. The City of Commerce staff contacted Hayter Engineering to find a cost-efficient, yet effective solution to the problem. Project Manager Mike Tibbets was assigned to the task. His challenge was to appropriately respond to the falling lake levels, while meeting specific flow and head pressure requirements. His system recommendations would call for unprecedented flexibility. Specifically, the city of Commerce was facing a need to pump 1,000 gallons per minute of flow and 300 feet of head from a receding source of supply.

“There are some rather large customers that reside on the lake and require its resources for day-to-day operations. Specifically the City of Dallas and the North Texas Municipal Water District,” offers Tibbets. “They have huge pipelines and huge pump stations that are able to pull large amounts of water from the lake. The City of Commerce needed to be able to adapt to the lowering water levels, while meeting the consumption needs of the people that relied on the water, as well.”

## Testing the Waters of Lake Tawakoni

Tibbets looked for the best technological solution to deliver upon the city of Commerce's dire needs. Proposals were distributed to qualified firms, and Pierce Pump was selected for their expertise in pumping technologies. Originally, the strategy called for a vertical turbine on a large barge that would be anchored in the middle of the lake with an extending pipeline to the existing pier. After the barge manufacturer explored the plan of action, however, new concerns and challenges began to arise.

"When the barge manufacturer actually investigated and analyzed the situation, they were concerned with anchoring a barge that far out in the lake," shares Tibbets. "Due to the inconvenience and cost associated with even routine maintenance, the application was proving too expensive – both at the onset of the project, and when factoring in a potential total cost of ownership over the life of the project. We had already arrived at a price for the system and informed the city council how much it would cost - so we were constrained to stay within the budget – adding yet another layer of difficulty."



The original strategy called for installation of the barge to be located 300 feet from the end of the existing pier on open lake waters, susceptible to treacherous five and six foot waves that can occur during some Texas storms. Further, this strategy would have required a barge-mounted crane to lift the five thousand pound pump for routine maintenance. The barge also would have required additional hose and piping, a 300 feet power cable, plus a house over the pump, among other things. The expense and maintenance proved to be exorbitant in retrospect.

Upon critical consideration, Pierce Pump proposed an alternative, yet still strategic solution involving the Gorman-Rupp VS6 self-priming, centrifugal pump. Due to the VS6 features, such as the ability to deliver unprecedented head and flow over competitive pump technology, as well as its ability to be installed on-shore with easy maintenance features such as a cartridge-type rotating assembly, the ability to pump solids up to 3" in diameter, removable back cover plate and check valve - the solution was quickly accepted.

Don Drake, a representative from the Pierce Pump Company, further proposed that a welded steel platform be added to the end of the existing concrete pier used by the City of Commerce. The pier extended approximately 300 yards into the lake and already housed the three existing vertical turbine pumps. The Gorman-Rupp VS6 pump would be installed on the platform in conjunction with a long suction line extended to a deep spot in the lake.

"The VS6, a high-volume, high-pressure solids-handling pump, is capable of passing three-inch solids, such as fish, turtles and other unforeseen additive to the water - and has self-priming capabilities," offers Drake. "The total solution brought the necessary pressure to move the water through the twenty-six mile pipeline from Lake Tawakoni to the Commerce plant, lifting the water eight or ten feet from the surface, while still incorporating key safety features, too. By keeping the pump above the liquid, but still be able to provide the high volume and pressure, we ended up with both a smart and viable solution."

In reality, the VS-series technology provides a staged solution – whereby one self-priming pump feeds a duplicate centrifugal pump that is close coupled to its discharge. In Lake Tawakoni's case, 75 horsepower motors power both pumping units. One motor runs the lower unit, while another is enlisted to power the upper unit. "We bring the water up, out of the lake, then we take it to maybe 65 psi on the lower stage and then the next stage kicks it up to 130," adds Drake. "The pump is delivering more than we ask for. It's giving us 325 feet of head total and flowing 1100 gallons per minute."



## No Such Thing As Smooth Sailing

Soon after the initial installation, just when the team was beginning to feel good about the overall solution, new challenges popped-up. Severe vibrations occurred during pump operation. After careful investigations, Pierce determined that the problem was caused by leaks in the existing force main. A faulty 30-year old check valve on one of the existing vertical turbine pumps allowed the force main to partially drain back into the lake when the new pump was not in operation. Furthermore, whenever a leak developed on the force main, city crews had to partially drain the force main to repair the leak. Both conditions resulted in a force main that was not completely full when the new pump came back on. This condition caused the total dynamic head (TDH) to be less than anticipated, which caused the new VS6 pump to operate “off the curve”.

In effect, when city maintenance personnel needed to drain the pipeline to repair a leak, or after the water drained away after the pump was shut down, the pump had to refill the force main. Consequently, far more liquid was being pumped than designed for, due to inadequate backpressure resistance.

While all this sounds pretty insignificant, the physical effects can be devastating to any pump. The Gorman-Rupp Company and its engineering team’s expertise were integral to identifying and correcting this problem. The leaking valve was replaced, which kept the line from draining back into the lake when the pump was not running. This resulted in a much smoother operating pump since it was running at its design point, which helped to ensure satisfaction with the new pump system.



## Hindsight is Twenty-Twenty, Indeed

“In retrospect, I’m glad we didn’t end up with the vertical turbine on a barge. Now, the operators can just drive to the end of the concrete pier and do maintenance or check the pump as needed,” said Tibbets. “We got in on budget thanks to Pierce Pump and Gorman-Rupp and have a much better situation now than we would have.” In the end, the total cost of ownership of the solution at the end of its life cycle will be lower than the original plan. In the end, the VS6 helped solve the raw water pumping dilemma for the city of Commerce with the performance, reliability and safety by providing the high head, high flow and solids-handling capabilities required.

## About The Gorman-Rupp Company

Gorman-Rupp is a leading manufacturer of pumps and pumping systems for the municipal, water, wastewater, sewage, industrial, construction, petroleum, fire and OEM markets. Pumps include self-priming centrifugal, centrifugal, submersible, trash, priming assist, rotary gear and air-driven diaphragm pumps. In addition, Gorman-Rupp manufactures a complete line of packaged lift stations and booster stations, which include pumps, motors, controls, piping, accessories and enclosures. The company prides itself on manufacturing and delivering the right pump for the job.

## About Hayter Engineering

Hayter Engineering is a civil and environmental engineering firm located in Paris, Texas. Hayter has been serving the engineering needs of northeast Texas and southeastern Oklahoma for over 50 years. For more information on this article, Mike Tibbets can be contacted at [mtibbets@hayterengineering.com](mailto:mtibbets@hayterengineering.com).