Innovative Solutions: Bryan's Lift Station and CSO Storage System – City of Monticello, Indiana

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The City of Monticello, Indiana owns and operates a combined sewer collection system and a Class II wastewater treatment plant (WWTP) with a design average flow of 1.1 MGD and a peak capacity of 2.4 MGD. The collection system has six combined sewer overflow (CSO) outfalls which discharge to the Tippecanoe River and Lake Freeman, a popular recreational water body.

As a part of the City's long-term control plan (LTCP) to reduce and eliminate CSOs, the City is nearing completion of Phase I of the Bryan's Lift Station Improvements Project. Originally constructed in the 1950s, the lift station is located approximately one mile, as the crow flies, away from the WWTP. During wet weather, the lift station would become overwhelmed and overflow through CSO 002 which discharges directly to the Tippecanoe River, upstream of Lake Freeman. This two-phase project's ultimate goals are to increase the pumping capacity of Bryan's Lift Station to 2.5 MGD and to provide approximately 500,000 gallons of storage capacity during wet weather events.

The City received approximately $1,000,000 in grant money from the Indiana Office of Community and Rural Affairs allowing Phase I of the project to proceed ahead of the LTCP schedule. According to the LTCP, Phase II of the project is expected to be completed in 2014.

Upgrading the Lift Station

The existing pump station consisted of a brick pump house that sat directly over a poured concrete wet well. A new ten-foot diameter wet well was placed 40 feet away from the existing structure to house two 45-horsepower submersible pumps, with room for a third future pump to be installed during Phase II of the project. The system controls were installed in the existing brick pump house. Once the new wet well and pumps were connected to the system, the old pumps and controls were removed from the brick pump house and the abandoned wet well was filled with gravel and sealed off.

The Bryan's Lift Station is located on the banks of the Tippecanoe River, just upstream of Lake Freeman. The lift station conveys a large portion of the City's combined sewer flows, approximately 1.5 miles to the WWTP.

Interior of the existing pump house prior to demolition of the abandoned system.

The pumps were provided with variable frequency drives (VFDs) and the system is controlled by two submersible pressure transducers, located in their individual stilling wells within the wet well. While the new, larger horsepower pumps boosted the pumping capacity of the station significantly (approximately 150% of previous design flows), the ultimate pumping capacity of 2.5 MGD will not be realized until Phase II of the project is complete. Phase II involves replacing the existing 6-inch force main with a 12-inch force main, constructing a new gravity interceptor sewer from the point of the force main discharge to the WWTP, and installing a third pump and VFD for redundancy.

CSO Storage

The location of the project site presented many unique challenges that led to the selection of an innovative new system constructed under an Indiana Department of Environmental Management (IDEM) pilot project using steel reinforced HDPE pipe for a first-of-its-kind CSO storage structure. Limited site space, a high groundwater table, tight hydraulic limitations on the existing sewer systems, and high public visibility of the site quickly eliminated more traditional storage structures.

Open concrete tanks would be difficult and expensive to build on the site. In addition, neighboring property owners directly uphill of the site were highly sensitive of maintaining their prized views of the scenic river.

Glass-lined steel tanks were evaluated but would have required an additional pump station to meet the incoming wet weather flows. Matching the 10-year/one-hour model flow rates would have required two 75-horsepower pumps just to convey the incoming flows to the storage structures.

A large-diameter tunnel simply did not appear practical under the financial constraints of the City and the geographic constraints of the project location.

Ideas taken from stormwater retention led the project team to consider using a grid of buried pipe to store the combined sewage. If void space is created underneath parking lots for stormwater retention, why not create a similar structure underground

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New 10-foot-diameter wet well and 45-horsepower submersible pumps prior to connection to the collection system. The station is controlled by two submersible pressure transducers, each located in its respective stilling well.

As shown above, the project site offered little room for construction. With only a few feet difference between the existing site grade and the water elevation of the Tippecanoe River, high groundwater and erosion control were prime concerns during construction.

for combined sewage? Recent innovations in plastic pipe technologies allow for an economical way to create a watertight structure, constructed out of five-foot to 10-foot-diameter pipes. This system combined the advantages of a buried and out-of-sight tunnel, a low-depth profile that plays well into existing system hydraulics and high water tables, and quick installation times (which also meant less dewatering hassles and expense).

Steel-reinforced polyethylene pipe (SRPE) was selected and installed after consultation with the City and the selected contractor, F&K Construction Inc. of Flora, Indiana. A 96-inch-diameter manifold pipe connects directly to the new lift station wet well above the typical submersible pump operating water depths, so that normal dry weather flows do not back up into the storage structure. Six additional leader pipes connect to the manifold pipe and are sloped down to it with access risers at the higher end of the pipes. The significant slope of the leader pipes helps facilitate flushing of the system after events. During wet weather flows, when the submersible pumps cannot keep up with incoming flows, the wet well backs up into the manifold and leader pipes, capturing the 'first flush' and eliminating CSOs from all but the most extreme conditions. After events, the pump station runs at full speed until the storage structure has drained and the wet well level falls back into normal operating depths.

The SRPE pipe had not been used for sanitary applications prior to this project; in fact, it had never been installed east of the Mississippi River prior to this project. The SRPE pipe was developed for use in rainwater harvesting for agricultural use in the drought-stricken areas of the western US. In places where water really is money, the system was developed to be watertight. The project was given approval by IDEM as a 'pilot project' only. Deflection testing of the pipe system is to be conducted 45 and 180 days after the initial installation and must meet the State's maximum deflection of 5% or less. Under Phase II of the project, the 96-inch manifold pipe is to be extended west approximately 25 feet and two more leader pipes added to provide the full 500,000 gallons of storage volume.

Installation of the storage pipe 'leaders' in progress. The new lift station wet well can be seen in the background, at left.

Installation of the storage pipe 'leaders' in progress.

Final grade over the buried pipe grid. The original brick pump house is shown in the background.

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