Water Treatment Storage and Distribution Improvements

Summary

- This project includes the construction of improvements at the water treatment and within the distribution system.
  - The work at the WTP includes a new finished water ground storage tank with four new high services pumps, installation of a new aerator in an expanded wetwell, installation of four new treatment pumps, installation of a new chemical feed system and piping, construction of a new backwash sedimentation storage basin, and building modifications to allow for future expansion.
  - Improvements within the distribution system include the construction of a new 500,000 gallon elevated storage tank and installation of approximately 5,000 feet of 16" diameter water main in the southwest industrial corridor.
- The GPR portion of the proposed project includes the installation of new high service pumps and new treatment pumps, all with VFDs and connected to the SCADA system. These improvements will result in energy savings.
- Loan Amount: $2,866,000
- **GPR Total: The GPR portion of the loan is $781,808 (27%). This is based on bid costs of $730,730 for the new pumps and SCADA and $51,078 for associated planning and design costs. All GPR costs fall in the Energy Efficiency category.**

Background

- The Princeton water system includes nearly 100 miles of 12", 10", 8", 6", 4", 3", 2", 1.5", 1.25" and 1" cast iron and PVC mains. The treatment plant processes an average of 1.35 million gallons per day (MGD) or 492.3 million gallons per year (MGY).
- As part of the City's April 2008 Preliminary Engineering Report (PER), unaccounted for water was determined to be 43%, or 276.5 million gallons, for the 2006 calendar year.
- The City is currently pursuing funding for a project to replace the meters in their system with autoread-type meters to better account for water usage.
- Although the water treatment plant has sufficient capacity to meet the average daily demand, the high service pumps are at the end of their useful life expectancy and are in need of replacement. Currently, the high service pumps must pump through the pressure filters into the system to fill the waters tanks to their high water level. The pressure required for this process is above 100 psi. It is desirable to change the process so that treatment pumps pump through the filters to a new ground storage tank, from which high service pumps pump to the system and fill the water tanks. Lastly,

Princeton's storage system currently does not store the recommended one day demand. The new 500,000 gallon ground storage tank is proposed to alleviate the discrepancy. Additionally, a new 500,000 gallon elevated storage tank is proposed to provide fire flow to the developing industrial park. Although the current system utilizes a Supervisory Control and Data Acquisition (SCADA) system, the addition of the high service pump station, ground storage tank, and elevated storage tank require that the SCADA system be upgraded and reprogrammed to improve the reliability and efficiency of the system.

Results – High Service Pumps

- The proposed project is the installation of a new high service pumping station, utilizing high service pumps with VFD motors controlled via SCADA system.
- The VFD-driven pumps will operate more efficiently than constant-speed pumps by their ability to operate at various flow rates.

Calculated Energy Efficiency – High Service Pumps

- Assumptions: Demand of 1.35 MGD, pumps designed to provide 1200 gpm at 275' TDH and two (2) pumps will run simultaneously, with third backup pump
- If pumps run at constant speed, then each pump must run 9.4 hrs/day.
- Energy required to run one (1) pump 24 hrs/day, 365 days/year at constant speed is 704,377 kWh (from pump manufacturer's design catalog).
- Energy required to run two (2) pumps at constant speed at the estimated daily run time is 551,762 kWh.
- Annual cost of running two (2) pumps at constant speed is $57,932/year at 10.5 cents/kWh.
- If pumps run at variable speed, each pump would run an estimated 15 hrs/day.
- Energy required to run one (1) pump 24 hrs/day, 365 days/year at assumed variable speeds is 288,478 kWh (from pump manufacturer's design catalog).
- Energy required to run two (2) pumps at the estimated daily run time is 360,598 kWh.
- Annual cost of running two (2) pumps is $37,863/year at 10.5 cents/kWh.
- By utilizing variable frequency drives and SCADA on the high service pumps, the system will reduce energy consumption by approximately 35%, or 191,304 kWh annually.
- At 10.5 cents per kWh, energy reductions from using VFD-driven pumps will save approximately $20,070 annually.

Results – Treatment Pumps

- The proposed project is the installation of new treatment pumps with VFD motors controlled via SCADA system
- The VFD-driven pumps will operate more efficiently than constant-speed pumps by their ability to operate at various flow rates.

Calculated Energy Efficiency – Treatment Pumps

- Assumptions: Demand of 1.35 MGD, pumps designed to provide 700 gpm at 70' TDH and three (3) pumps will run simultaneously, with fourth backup pump
- If pumps run at constant speed, then each pump must run 9.4 hrs/day
- Energy required to run one (1) pump 24 hrs/day, 365 days/year at constant speed is 112,543 kWh (from pump manufacturer's design catalog).
- Energy required to run three (3) pumps at the estimated daily run time is 151,932 kWh.
- Annual cost of running three (3) pumps is $15,943/year at 10.5 cents/kWh.
- If pumps run at variable speed, each of the two pumps would run an estimated 15 hrs/day.
- Energy required to run one (1) pump 24 hrs/day, 365 days/year at assumed variable speeds is 46,883 kWh (from pump manufacturer's design catalog).
- Energy required to run three (3) pumps at the estimated daily run time is 100,800 kWh.
- Annual cost of running three (3) pumps is $10,584/year at 10.5 cents/kWh.
- By utilizing variable frequency drives and SCADA on the treatment pumps, the system will reduce energy consumption by approximately 33.7%, or 51,132 kWh annually.
- At 10.5 cents per kWh, energy reductions from using VFD-driven pumps will save approximately $5,370 annually.

Conclusions

- The proposed improvements will result in an energy savings of approximately 34%.

Referenced Material –

City of Princeton, Indiana Water System Improvement Project Green Project Reserve Business Case, prepared by Hannum Wagle and Cline, November, 2010.