

**SOUTH ELIZABETHTON UTILITY DISTRICT  
SYSTEM IMPROVEMENTS PROJECT  
(WATERLINE REPLACEMENTS AND VFD INSTALLATION)  
GREEN PROJECT BUSINESS MODEL SUBMITTAL**

Funding Sources: Tennessee State Revolving Loan Funds

The Utility's project is divided into two parts:

- Water Line Replacement
- VFD Installation at Pump Station and Piping Modifications

Each improvement proposed contains infrastructure components that will increase energy efficiency and incorporate solutions that will result in environmental benefits and system sustainability. The primary sources of expected energy efficiencies are:

- Reduction of water loss
- Reduction of energy used by the system pumping as a result of modifications at pump station
- Reduction of energy used by water pumps due to less friction loss in the larger diameter transmission line to tank

*Technical Aspects:*

Problem with System:

- Water System has a high water loss
- 2015 water loss was 47.5% (including unbilled authorized consumption of 2.146 MG/yr, apparent losses of 5.305 MG/yr, and real losses of 72.646 MG/Yr)
- State reported Average of water loss of other utilities = 25.14% in 2007
- State has set limits on validity score and percent cost of non-revenue as percent of operating costs
- Some of the old distribution lines are inferior material (Asbestos Cement, low pressure rated PVC and Galvanized)
- The system's personnel spend a large amount of their operation costs and manhours finding and repairing leaks
- Some inferior lines are critical to service of entire water district

*Financial Aspects:*

The current main transmission line on Gap Creek Road is a 6" Asbestos Cement line. The Utility is proposing to upgrade the line to a 10" Ductile Iron line from the pump station on Gap Creek Road to the water tank. This line serves the entire district. This would result in less friction loss in the line and therefore will lower the head required by the water pumps. This would reduce the horsepower required at the pumps. Also, the pump station now has a different water source than they originally had when the pumps were installed. The pressure that the source provider can deliver to the station is higher than it was in the past. Currently the inlet piping discharges into a wet well and the station pumps withdraw water from that wetwell. The inlet piping can be directly connected to the suction side of the pumps. By modifying the inlet piping at the station the district can benefit from this increased suction

pressure. This will also reduce the required horsepower (power consumption) of the pumps to pump water to the water tank.

Currently, the pumps transmit water through a 6" line to the water tank. Based on the calculations included in Facilities Plan Appendix, the existing pump has to deliver 450 GPM at 307 feet of head.

When we replace the 6" with a 10" line from pump station to the tank and change the inlet piping (selected alternative), the pumping requirements would be 450 GPM at 124 feet of head. Per the pump curves, the current conditions require approximately 57 HP. With the chosen alternative, the new condition would require approximately 20 HP.

Current usage is 170,326,000 gallons per year (from 2015 audit). This is equal to 466,647 gallons per day. At 450 GPM the pumps run approximately 1037 minutes per day or 17 hours per day.

The savings are calculated as follows:

Current conditions:

$$(57 \text{ HP} \times 0.746 \text{ kW/HP} \times 17 \text{ Hrs}) / 0.9 \text{ motor eff.} = 803 \text{ kWh per day}$$

New conditions:

$$(20 \text{ HP} \times 0.746 \text{ kW/HP} \times 17 \text{ Hrs}) / 0.9 \text{ motor eff.} = 282 \text{ kWh per day}$$

Savings:

$$(803 \text{ kWh per day} - 282 \text{ kWh per day}) \times \$0.10701/\text{kWh} \times 365 \text{ days} = \mathbf{\$20,350/\text{year.}}$$

Per the pump curves, the new operating conditions is about 5% better efficiency than the current operating point. This will result in slightly more savings.

In addition, the more the water loss is reduced the less amount of time these pumps will operate. This will result in more savings and further reduction in power demand.

Finally, the goal of the Utility is to lower their water loss. The current rate at which water is purchased is \$2.46 per 1000 gallons (per the district). This is scheduled to be increased this year and again next year. By July 2017 the rate charged by WRRWA will be \$2.89 per 1000 gallons. The district's "real losses" in 2015 was 72,646 gallons. This project is only replacing a small percentage of their water lines. If the project decreases their overall waterloss by 2% with this project, it will equate to the following savings:

$$2\% \times 72,646,000 \text{ gallons per year} \times \$0.00246 \text{ per gallon} = \mathbf{\$ 3,574 \text{ per year}}$$

This combined to the energy savings calculated above is a total savings of **\$23,9240** per year.

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