

VARIABLE FREQUENCY DRIVES AND PUMP MOTOR REPLACEMENTS

Energy Efficiency

Summary

Replacing two well pump motors with new high efficiency motors will reduce energy demand at Well 5 and 8. The addition of variable frequency drives (VFD) on all three of the City's production wells will also reduce energy consumption and use energy in a more efficient way. An increase in overall efficiency of approximately 4% is anticipated by utilizing higher efficiency pump motors and changing the systems flow control scheme from throttling valve control to variable frequency drive control.

- The VFD additions and pump motor replacements are being submitted as a GPR project under the Energy Efficiency category.
- The replacement of two pump motors with NEMA premium efficiency motors is categorically eligible.
- The installation of the VFDs and related controls modifications will eliminate the current practice of pumping against the throttling valve. Operation of the pumps using VFDs may reduce energy use in itself. However it is the energy savings made possible by being able to operate the pumps without the throttling valve that should qualify this component for green project reserve funding.

Total DWRP Project Plan Requested Loan Amount = \$1,650,000

Total Pump Motor Replacements and VFD Additions Component Eligible for GPR = \$138,000

Total Pump Motor Replacements and VFD Additions Green Portion of Loan = 8.4%

Background

- Well pump motor 5 is 100 hp, installed in 1970, with an estimated efficiency of 91.7%. This motor has been re-wound five times.
- Well pump motor 8 is 75 hp, installed in 1992, with a name plate efficiency of 91.7%. This motor has been re-wound two times.
- Well pump motor 7 is 60 hp, installed in 2011, and is a premium efficiency and inverter duty motor.
- Well pump motor 5 is aging. The pump motors for wells 5 and 8 are both less efficient than equipment currently available. The efficiency of the existing pumps is also less than when originally installed due to age, wear, and the fact that they have been rewound (which reduces motor efficiency relative to a new motor).
- Well pump motor 7 was replaced in 2011 with a premium efficiency inverter-duty motor. Only the addition of a VFD is required at this well.
- All three pumps currently operate at constant speed. Flow control into the aeration and detention tank is achieved using a throttling valve on the discharge piping to maintain a specific elevation in the tank.
- The existing method of utilizing throttling valves for flow control is an inefficient mode of operation and will be replaced with VFDs on each pump.

Results

- The proposed new motors will have a rated efficiency of 95.4% for Well 5 and 95.0% for Well 8.
- The VFDs save energy and allow greater flexibility for operation.
- Energy Efficiency fits in with the long term sustainability goal for the City of Grand Blanc.

Eligible Components

Well 7 VFD	\$12,000±
Well 7 Control Modifications	\$10,000±
Well 5 VFD	\$15,000±
Well 5 Pump Motor	\$20,000±
Well 8 VFD	\$15,000±
Well 8 Pump Motor	\$16,000±
Well 5 & 8 Control Modifications	<u>\$10,000±</u>
Estimated Construction Costs	\$98,000±
Undeveloped Details/Contingencies (10%)	\$10,000±
Design/Construction Engineering and Administration (25%)	\$25,000±
Legal/Administration (5%)	\$5,000±
Total Project Cost	\$138,000±

Conclusion

The proposed pump motor and VFD improvements will improve the efficiency of the City's water supply system by utilizing higher efficiency motors and changing the flow control scheme from throttling valve control to variable frequency drive control. The life expectancy of this new equipment is 20 years or more. The energy savings over the life of the equipment will be significant.

FIXED BASED METER READING SYSTEM

Water Efficiency

Summary

The new fixed based meter reading system is an optimization improvement to the existing waterworks system that will enable the City to better manage its water system and provide customers with improved customer service. The operational change in the way that water usage readings are obtained and billed will lead to cost savings and water conservation. The current manual meter reading is highly inefficient and can result in human error in usage calculations. The current reading and billing system costs the City approximately \$52,000 annually in staff time alone. The current inability to quickly identify and isolate water breaks or leaks leads to additional water pumpage and treatment costs.

- Installation of automatic meter reading systems is a categorical GPR component under Water Efficiency as defined by the USEPA guidance documents.
- A Business Case is not required for this categorical component of the project.
- Approximately 250 water meters will be upgraded with new water meters in order to be compatible with the automatic meter reading system. The remaining meters are already compatible with the end point transmitters required for the system. The City of Grand Blanc has made a proactive approach in the purchasing and replacement of meters over the years so they would be compatible with automatic meter reading.

Total DWRP Project Plan Requested Loan Amount = \$1,650,000.

Total Automatic Meter Reading System Component Eligible for GPR = \$571,700.

Automatic Meter Reading System Categorically Green Portion of Loan = 35%.

Background

City Benefits

- Installation of the fixed based meter reading system would eliminate the need for City employees to visit each meter location 6 times annually to log water usage. With approximately 2650 water customers, this reduces the number of miles travelled and carbon emissions. It is estimated that the City currently spends \$28,000 annually for a DPW employee and another \$24,000 annually on administration expenses to read the meters, enter the readings, complete re-reads, cleaning up reading or input errors, and address customer complaints. This staff time spent can be allocated to more productive tasks.
- Current water usage available on real time basis. This is useful when preparing final bills for user changes.
- Leak detection, high/low flow consumption, and no flow/tampering alerts.
- More rapid identification and isolation of breaks and major leaks, reducing water losses.
- Water leakage and inaccuracy increases with water meter age. Replacing the approximately 250 meters that are in excess of 20 years old will result in more accurate metering of water consumption.
- With users realizing their actual water use, they will take corrective measures to prevent leaks and drips, conserving water as a natural resource.

Water User Benefits

- Customers can be notified and a leak fixed in a process up to 60 times faster than before (daily monitoring vs. bi-monthly reads), improving customer service and satisfaction.
- Access to current water usage will simplify final billing for dwelling occupancy changes.
- Access to real time water usage leads to water conservation by sending a stronger price signal to the customer.

Results

Estimated Existing Costs (public works and administration personnel):

Current Annual Meter Reading and Administration Expenses: \$52,000±

Estimated Future Costs:

Annual Regional Network Interface-Hosting Fee: \$18,750±

Annual Backhaul Charges: \$420±

Estimated Costs Savings:

Existing Costs – Future Costs (\$52,000 - \$19,170) \$32,830± (savings)

Annual Budget for Public Water Works (2012-2013): \$1,585,290

Percent of Savings for Public Water Works Operating Costs: 2.1% *

*Based on labor expenses only. Does not include potential for increase revenue from accurate readings and billings, or water supply and treatment savings related to the reduction of water losses.

Eligible Components

Regional Gateway Base Station	\$25,000±
Regional Network Interface Initial Setup Expenses	\$15,000±
End Point Transmitters for Each Meter (approx. 2650)	\$325,000±
Replace existing inadequate meters (approximately 250)	\$37,500±
Use Existing Backhaul Setup	\$200±
Handheld Transmitter Programming Device	<u>\$6,000±</u>
Estimated Construction Costs	\$408,700±
Undeveloped Details/Contingencies (10%)	\$41,000±
Design/Construction Engineering and Administration (25%)	\$102,000±
Legal/Administration (5%)	\$20,000±
Total Project Cost	\$571,700±

Conclusion

The fixed based meter reading system is an optimization improvement to the City's water distribution system that will enable the City to better manage its water system and provide users with improved customer service. The new metering system will allow water customers to identify waste and consider corrective measures which will translate into "smarter" water use. More efficient water use and meter reading abilities will reduce energy consumption and operational expenses.