
# City of Weiser WWTP Upgrade Project

## SRF Loan #WW1304 (pop. 6,304)

## $6,000,000

## Final Green Project Reserve Justification

### Categorical GPR Documentation

1. INSTALL NEW FINE BUBBLE DIFFUSED AERATION SYSTEM WITH HIGH SPEED SCREW COMPRESSORS (Energy Efficiency). Categorical GPR per Section 3.2-2: *projects that achieve a 20% reduction in energy consumption; retrofits to compare existing system to that proposed…New POTW projects or capacity expansion projects should be designed to maximize energy efficiency and should select high efficiency premium motors and equipment where cost effective."* ($970,000).
2. INSTALL NEW ENERGY-EFFICIENT PREMIUM MOTORS ON WATER REUSE PUMPS (Energy Efficiency). Categorical per GPR 3.2-2: *projects that achieve a 20% reduction in energy consumption* ($117,900).

### Business Case GPR Documentation

3. INSTALL SCADA SYSTEM (Energy Efficiency). Business Case GPR per 3.5-8: *SCADA systems can be justified based on substantial energy savings.* ($150,000).

Categorical

# 1. Treatment Process – Aeration System

## Summary

- Large-scale wastewater plant improvement project includes upgrades to the aeration system.
- Total Loan amount = $6,000,000
- Estimated Categorical energy efficient (green) portion of loan = 16.2% ($970,000) (installed cost)[1].
- Annual Energy savings = 48.5%

## Background[2]

- The City of Weiser's Wastewater Treatment Plant currently services approximately 5,500 people and includes 1,775 residential and 186 commercial connections as of fiscal year 2013.
- The City faces changing effluent discharge conditions in the Snake River and new regulatory requirements driven by water quality impairment in the Snake.
- Current treatment processes include activated sludge process tanks, and aerobic digestion tanks. Aeration is currently provided by five (5) positive displacement air compressor blowers.
- The estimated energy consumed by the aerobic treatment system required to meet new regulatory requirements without implementing energy-efficient improvements is 1,175,260 kW-hr per year.

## Upgrades

- Two of the five existing positive displacement air compressors were replaced with two energy-efficient screw compressor blowers: Aerzen D98S Hybrid Package, equipped with Eaton SVX 9000 VFDs. Another of the existing positive displacement air compressor blowers was equipped with an Eaton SVX 9000 VFD.
- The blowers are also equipped with dissolved oxygen probes, air flow control valves, and air flow meters that adjust blower speed based on continuous oxygen concentration readings from dissolved oxygen sensors that were also installed.


**Aerzen D98S Hybrid Package**

- The existing coarse bubble diffusers were replaced with fine bubble membrane diffusers that greatly enhance the oxygen transfer and efficiency of the aeration process.
- The 4th aeration tank was equipped with an oxygen probe and mechanical mixer (Landia POP-19 HP 360 rpm) that is activated when oxygen demand drops below a certain threshold so the aeration to this tank can be shut off completely. This prevents the blowers from running continuously to keep the 4th aeration tank mixed.
- In the Digester, additional diffusers were added and existing diffusers reorganized to improve aeration efficiency. Oxygen probes were also added to improve oxygen control.

**Landia Mixer**

- The estimated energy consumed by the proposed system will be 570,000 kW-hr per year

## Energy-Efficiency Improvements

- Fine bubble diffusers provide for a decreased actual oxygen requirement (AOR) to standard oxygen requirement (SOR) ratio of 0.33 compared to 0.50 for coarse bubble diffusers. [3]
- Fine bubble diffusers provide an oxygen transfer efficiency (OTE) of 2 percent per foot of submergence compared to 0.75 percent for coarse bubble diffusers. [2]

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[1] December 2015 email J. Walker P.E. (Keller Associates) to K. McNeill P.E. (IDEQ)
[2] July 2013 City of Weiser Wastewater Treatment Improvements Project Preliminary Engineering Report
[3] Sanitaire Diffused Aeration Design Guide.

# CONT. : TREATMENT PROCESS –AERATION SYSTEM

- Screw compressor blowers operate with an increased wire to air efficiency of approximately 90 percent compared to positive displacement blowers which operate with a wire to air efficiency of approximately 70 percent.[4]
- The dissolved oxygen control system allows for precise control of the air flow to match the diurnal dissolved oxygen demand which substantially decreases the power demand of the new system.
- The mixer and oxygen probe in the 4th tank prevents continuous aeration to keep mixed liquor in suspension.

## Conclusion

- By using a fine bubble diffused aeration system, screw compressor blowers with oxygen probes, VFDs, flow metering, a dissolved oxygen control system, and a mechanical mixer in the 4th tank with oxygen probe, the City reduces the required air demand of the aeration system by approximately 38.5 percent.

Eaton SVX 9000 VFD

- **GPR Costs:**

| Equipment Name | Cost |
|---|---|
| Fine Bubble Diffusers | $350,000 |
| Screw Compressor Blowers | $430,000 |
| Dissolved Oxygen Control System | $115,000 |
| Mixer and Probe in 4th Tank | $75,000 |
| **Total** | **$970,000** |

- **GPR Justification:** Categorically GPR-eligible (Energy Efficiency) per Section 3.2-2[5]: *projects that achieve a 20% reduction in energy consumption*.

[4] Blower curves and data from existing blowers and new Aerzan Blowers.
[5] Attachment 2. April 2011 EPA Guidance for Determining Project Eligibility.

# 2. New Pumps and Motors

## Summary

- The new W3 pumps are lower horse power and are equipped with premium efficiency motors to conserve energy and enhance the operability of the water reuse system.
- Total Loan amount = $6,000,000
- Estimated Categorical energy efficient (green) portion of loan = 2% ($117,900) (installed costs)[6].
- Annual Energy savings = 20%

## Background

- Before the upgrade, the plant formerly had two (2) 30HP W3 pumps that provided grey water and irrigation water throughout the site.

## Results

- The former 30HP W3 pumps were replaced with two (2) 20HP premium efficiency pumps (Goulds 7CLC 11 stage Vertical Turbine) with VFDs.
- Premium efficiency motors save on average 3-7% over standard efficiency motors.
- The use of premium energy-efficiency motors and VFDs results in a power savings of 60,000 kW-hr per year and an annual cost savings of $3,600.

## Energy Efficiency Improvements

- Before the new system was installed, one 30HP W3 pump was on all the time, providing up to 300gpm (at flows less than 300gpm, water was recycled back to the wet well).
- The standard efficiency motors were 90% efficient as compared to the newly installed premium efficient motors which are 93% efficient.
- The annual power savings was derived by calculating power use for both the old standard efficiency 30HP motors and for the upgraded premium efficiency 20HP motors. The results are depicted in Table 1.

**Goulds Vertical Turbine pump**

Table 1. Annual Power Savings

| 2016 | GPD | Avg. HP | Efficiency | connected Power, kWh | | GPD | Avg. HP | Efficiency | connected Power, kWh |
|---|---|---|---|---|---|---|---|---|---|
| Jan | 216,000 | 30 | 90% | 18,493 | | 180,000 | 20 | 93% | 11,916 |
| Feb | 216,000 | 30 | 90% | 16,704 | | 180,000 | 20 | 93% | 10,763 |
| Mar | 288,000 | 30 | 90% | 18,493 | | 252,000 | 21.1 | 93% | 12,556 |
| Apr | 216,000 | 30 | 90% | 17,897 | | 180,000 | 20 | 93% | 11,531 |
| May | 216,000 | 30 | 90% | 18,493 | | 180,000 | 20 | 93% | 11,916 |
| Jun | 288,000 | 30 | 90% | 17,897 | | 252,000 | 21.1 | 93% | 12,172 |
| Jul | 216,000 | 30 | 90% | 18,493 | | 180,000 | 20 | 93% | 11,916 |
| Aug | 216,000 | 30 | 90% | 18,493 | | 180,000 | 20 | 93% | 11,916 |
| Sep | 288,000 | 30 | 90% | 17,897 | | 252,000 | 21.1 | 93% | 12,172 |
| Oct | 216,000 | 30 | 90% | 18,493 | | 180,000 | 20 | 93% | 11,916 |
| Nov | 216,000 | 30 | 90% | 17,897 | | 180,000 | 20 | 93% | 11,531 |
| Dec | 288,000 | 30 | 90% | 18,493 | | 252,000 | 21.1 | 93% | 12,556 |
| | | | | 217,744 | | | | | 142,862 |
| Average | 1.405 | | | | | | | | |

74,883 Annual KwH Savings

- The calculated annual power savings is 74,883KwH; to be conservative 60,000KwH is the value used.

[6] December 2015 email J. Walker P.E. (Keller Associates) to K. McNeill P.E. (IDEQ)

# Cont.: New Pumps and Motors

- The 20% reduction in energy consumption is calculated by dividing 60,000KwH by the former power consumption of 220,000KwH (rounded down to 20% to be slightly conservative).
- The annual cost savings is calculated by multiplying the 60,000KwH by $0.06 per KwH = $3,600/yr.

## Conclusion

- By using premium efficiency motors and VFDs, the City reduces their power needs by approximately 60,000 kW-hr per year and annual power costs by approximately $3,600 each year – a 20% overall savings in energy and costs.

- **GPR Costs**:

| Equipment Name | Cost |
|---|---|
| Premium Efficiency Motors | $117,900 |

- **GPR Justification:** Categorically GPR-eligible (Energy Efficiency) per Section 3.2-2[7]: *"projects that achieve a 20% reduction in energy consumption."*

[7] Attachment 2. April 2011 EPA Guidance for Determining Project Eligibility.

# 3. SCADA CONTROL TECHNOLOGY

## Summary

- Energy efficiency results from the remote electronic sensing and control of the treatment plant.
- Estimated loan amount = $6,000,000
- Estimated energy efficiency (green) portion of loan ≅ 2.5% ($150,000) (installed costs)[8]
- Estimated annual energy savings $11,800 per year.

## Background/ Results[9]

- The SCADA system is part of the project.
- TREATMENT PLANT: The aeration system is now tied to dissolved oxygen levels in the aeration tanks and aeration header through PLC's; these control the mixer and aeration blower speed through VFDs. Thus, SCADA optimizes and controls tank oxygen levels.
- DISINFECTION: The SCADA system controls the disinfection system through flow PLC monitoring. Chlorine and dechlorination pump rates are controlled by SCADA system based on information from floats.
- PLANT: Through a computer based Graphical User Interface (GUI) program the plant's processes are now monitored and observed remotely. The SCADA GUI also saves energy through reduced travel to and from the plant.

## Energy Efficiency Improvements

- TREATMENT PLANT OPERATIONS: Total plant operations result in about $5,000 of savings per year.
- OPERATORS: Remote SCADA control saves labor and travel costs = 1 person thirty minutes each day of the year = $6,400 per year in labor costs; travel cost @ $0.51 per mile @ 2 miles = $400 per year = total saving of $6,800/yr.

## Conclusion

- Total SCADA savings are around $11,800 per year in energy, labor, and travel costs = payback of 13 years. therefore SCADA system costs are GPR-eligible by 3.5-8.
- **GPR Costs:** SCADA = $150,000
- **GPR Justification:** SCADA system costs are GPR-eligible by a Business Case per 3.5-8[10]: *SCADA systems can be justified based on substantial energy savings.*

[8] December 2015 email J. Walker P.E. (Keller Associates) to K. McNeill P.E. (IDEQ)
[9] July 2013 City of Weiser Wastewater Treatment Improvements Project Preliminary Engineering Report
[10] Attachment 2. April 21, 2011 EPA Guidance for Determining Project Eligibility.