

# Clean Water State Revolving Fund Green Project Reserve

– Interim –



## City of Blackfoot WWTP Upgrade Project

SRF Loan #WW1501 (pop. 14,054)

\$2,900,000

### Interim Green Project Reserve Justification

#### Categorical GPR Documentation

1. INSTALL IN THE INTERMEDIATE PUMP STATION NEW CENTRIFUGAL PUMPS WITH PREMIUM ENERGY-EFFICIENT MOTORS AND VFDs (Energy Efficiency). Categorical per GPR 3.2-2: *projects that achieve a 20% reduction in energy consumption; if a project achieves less than a 20% reduction in energy efficiency, then it may be justified using a business case; also, per 3.5-9: VFDs can be justified based upon substantial energy savings (\$135,000).*

#### Business Case GPR Documentation

2. INSTALL SCADA SYSTEM (Energy Efficiency). Business Case GPR per 3.5-8: *SCADA systems can be justified based on substantial energy savings (\$50,000).*
3. PROVIDE NEW SECONDARY CLARIFIER TO MINIMIZE USE OF CHEMICALS (INNOVATIVE). Business case per 4.4-1c: *Conventional technology or approaches that are used in a new application in the State; also, per 4.5-5a: Projects that significantly reduce or eliminate the use of chemicals in wastewater treatment; also, per 4.5-5b: Treatment technologies or approaches that significantly... lower the amount of chemicals in the residuals. (\$1,810,000)*

# 1. NEW PUMPS AND VFDs IN INTERMEDIATE PUMP STATION

## Summary

- As part of the upgrade project, the City will install new centrifugal pumps equipped with premium efficiency motors and VFDs to conserve energy.
- Total Loan amount = \$2,900,000
- Estimated energy efficient (green) portion of loan = 4.6% (\$135,000) (based on engineer's cost opinion at Bid Set)

## Background

- The Blackfoot Wastewater Treatment Plant (WWTP) is a regional facility that provides wastewater treatment for the City of Blackfoot and the Groveland and Moreland Sewer Districts. It is located southwest of the City of Blackfoot on the west side of Interstate 15 and on the bank of the Snake River.
- The existing Intermediate Pump Station uses Archimedes screw pumps to convey primary clarifier effluent and return activated sludge (RAS) to the biological treatment basins. The pump station was originally constructed in 1972 and the last pump upgrades were in 2000. The pumps are evidencing signs of wear and loss of efficiency as clearances on the channels increase.
- During the past 5 years, the average day flows have been 1.42 mgd, with a peak day of 3.42 mgd and an estimated peak hour condition of 5.4 mgd. RAS flows are not currently measured but are estimated to be approximately 67% of the average day influent.

## Energy Efficiency Improvements<sup>1</sup>

- At the intermediate pump station, the three (3) existing screw pumps with constant-speed 20 hp motors will be replaced with three (3) centrifugal pumps with premium energy-efficient 25 hp motors with VFDs. The increased motor size is to accommodate projected future peak conditions as well as current electrical code requirements.
- The existing screw pumps are generally regarded as efficient; however, the existing motor and wear on the structure have likely reduced their efficiency.
- Three pumps will be installed as follows:
  - One “jockey” pump: 1,700 gpm (2.4 mgd)
    - This pump will be installed to accommodate current low flow (nighttime) and average day conditions. The jockey pump will maintain more continuous flow to the biological basin which serves to minimize blower ramp up to higher speeds as slug loads are applied to the basins, increasing efficiency. As flows to the facility increase, it is expected that this pump will be replaced with a larger capacity pump (see next item).
    - The pump efficiency at average day flows is 75%, and the motor efficiency for a premium motor is estimated at 93.4% when operating at 75% of full load. The corresponding brake horsepower at existing flows is 4.9 hp.
  - Two larger capacity pumps: 3,900 gpm (5.6 mgd)
    - These will be installed to accommodate existing peak flow conditions and design flow conditions.
- The Final GPR Justification, prepared at the conclusion of construction, will indicate the specifications of the actual pumps and VFDS installed by the construction contractor.

<sup>1</sup> Design specs were used to calculate energy efficiencies; installed pump/VFD data will be used to calculate final efficiencies.

## GPR Justification

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### **Motors/VFDs:**

The Baseline Standard Practice for comparison is a standard Epact motor that is not controlled by a VFD<sup>2</sup>. Published operating curves by the pump manufacturer provided VFD efficiency data:

- **Proposed Pumps - no VFD, standard efficiency motor**  
Type submersible, centrifugal  
Efficiency 70%; Flow 3,000 gpm; 4.3 mgd; Head 17 ft  
Motor rating = 25 hp; Motor type = standard efficiency (89.3% assumed at 75% of full load<sup>3</sup>)  
BHP, existing avg flow = 20.6 hp  
% operation = 34% (average day flow/pump output)  
Energy usage = 45,239 kW-hr
- **Proposed Pumps - no VFD, with premium efficiency motor**  
(93.4% assumed at 75% of full load)  
BHP, existing avg flow = 19.7 hp  
% operation = 34% (average day flow/pump output)  
Energy usage = 43,254 kW-hr
- **Proposed Pumps - VFD operation with premium efficiency motor**  
Type submersible, centrifugal  
Efficiency 70%; Head 12.5 ft;  
Motor rating = 25 hp; Motor type = standard efficiency (93.4% assumed at 75% of full load)  
BHP, existing avg flow = 4.9 hp  
% operation = 100% (VFD control to match flow)  
Energy usage 31,804 kW-hr
- **Energy Reduction - comparing with VFD to without VFD**  
Energy usage, w/o VFD 43,254 kW-hr  
Energy usage, w/ VFD 31,804 kW-hr  
  
∴ There is a 26% energy reduction compared to non-VFD, standard efficiency motors
- Additionally, the VFDs will permit nearly continuous loading to the biological basins. Without VFDs, the nighttime flows could be intermittent and cause unnecessary ramping of the blowers for slug loads, followed by blower turndown to lower efficiency ranges.

## Conclusion

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- The combined annual energy savings for utilizing VFDs is estimated to be 11,449 kWh/year per motor/VFD system - corresponding to an energy reduction of 26% when compared to the Baseline Standard Practice.
- The premium energy-efficient pumps/VFDs are categorically GPR eligible as they achieve greater than 20% reduction in energy consumption.
- **GRP Costs Identified:**  
VFDs (3 @ \$20,000 ea. = \$60,000) + Pumps (3 @ \$25,000 = \$75,000) = **Total = \$135,000**
- **GPR Justification:**
  - The Pump/VFD system is Categorically GPR eligible (Energy Efficiency) per Section 3.2-2 page 9<sup>4</sup>:  
*Projects that achieve a 20% reduction in energy consumption are categorically eligible for GPR; also, per 3.5-9: VFDs can be justified based upon substantial energy savings.*

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<sup>2</sup> NYS Energy Research and Development Authority, Energy Evaluation Memorandum, Village of Greenport WWTP Upgrade 8-2009.

<sup>3</sup> [http://www.copper.org/environment/sustainable-energy/electric-motors/education/motor\\_text.html](http://www.copper.org/environment/sustainable-energy/electric-motors/education/motor_text.html)

<sup>4</sup> Attachment 2. April 21, 2010 EPA Guidance for Determining Project Eligibility

## 2. SCADA CONTROL TECHNOLOGY<sup>5</sup>

### Summary

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- Energy efficiency results from the remote electronic sensing and control of the intermediate pump station.
- Estimated loan amount = \$2,900,000
- Estimated energy efficiency (green) portion of loan  $\cong$  1.7% (\$50,000) (conceptual costs, based on preliminary engineering estimate)
- Estimated annual energy and labor savings of \$7,800 per year.

### Background/ Results<sup>6</sup>

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- The existing WWTP does not have a complete SCADA system, but the City is upgrading to include SCADA as the budget allows. The proposed project would include a partial SCADA upgrade to incorporate components for the intermediate pump station improvements, and subsequently interface with a plant-wide system once it is completed (as a separate project).
- The Intermediate Pump Station is one of the most critical components of the Blackfoot facility. It conveys primary clarifier effluent and RAS to the biological basins. If it ceases operation, uncontrolled overflows could occur at the facility. Secondary clarification is also critical at the facility as it captures biomass prior to disinfection and discharge to the Snake River.
- By developing a SCADA system as part of this upgrade, the operations staff will be able to receive notices during off hours in the event the processes experience an alarm condition, as well as the severity of the alarms. Operations staff are then be able to address the alarm remotely, thereby saving a trip to the facility, or respond on-site if necessary.

### Energy Efficiency Improvements

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Intermediate pump station/secondary clarifier/Treatment Plant operations:

- Remote SCADA control saves labor costs (1 person an average of 1.5 call-outs per week at 2 hours/ call-out = \$7,800/yr in labor costs) and travel cost (5 miles per call out @ \$0.51 per mile = \$200/yr).
- Additionally, the SCADA system will enable more efficient use of the control functions of the lift station (reference the prior section), thereby reducing energy consumption by approximately \$572/yr.
- The total estimated savings is \$8,572/yr.

### Conclusion

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- Total SCADA savings would be around \$8,572 per year in energy, labor, and travel costs = payback of less than 6 years. Therefore, since the payback period is within the life of the installed equipment, the SCADA system costs are GPR-eligible.
- **GPR Costs:** SCADA = \$50,000 (costs estimated at Bid Set)
- **GPR Justification:** SCADA system costs are GPR-eligible by a Business Case per 3.5-8<sup>7</sup>: *SCADA systems can be justified based on substantial energy savings.*

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<sup>5</sup>Analysis is preliminary and will be updated with actual cost schedule values when project has been awarded.

<sup>6</sup>City of Blackfoot Wastewater Treatment Facility Plan. April 2014. J-U-B Engineers, Inc.

<sup>7</sup>Attachment 2. April 21, 2011 EPA Guidance for Determining Project Eligibility.

## 3. NEW SECONDARY CLARIFIER

### Summary

- As part of the upgrade project, the City will construct a new secondary clarifier to provide additional secondary settling capacity in order to minimize chemical enhancement of wastewater clarification and avoid generation of chemical residuals.
- Total Loan amount = \$2,900,000
- Estimated green portion of loan = 62% (\$1,810,000) (based on cost opinion at Bid Set)

### Background<sup>8</sup>

- The secondary clarifiers are operating near full capacity. If one is taken offline or unexpectedly fails (as occurred from December 2012 through March 2013), the remaining clarifier cannot process existing flows while satisfying NPDES permit requirements.
- With one clarifier offline, polymer and/or coagulants are required to enhance flocculation and settling in an effort to satisfy BOD and TSS discharge permit limits.
- Historically, the City added chemicals daily during a clarifier outage at approximately 5 gallons/day (46 pounds/day). During the extended outage in 2012 and 2013 (4 months), approximately 600 gallons of chemical were used (5,520 pounds).
- The additional chemical usage also results in more solids generation from the biological process, which impacts solids processing and disposal (quantity not estimated).



### Treatment Description

- Construction of a third 60-ft secondary clarifier is included in the project to avoid having to add chemicals to achieve permit limits, and to avoid creating chemical residuals for treatment and disposal.
- With three secondary clarifiers available, the City can take one offline without having to add chemicals to achieve satisfactory solids settling and removal.

### Innovative Process Justification

- Providing an additional secondary clarifier will achieve removal of secondary solids and meet TSS permit limits without the need for the addition of chemical settling aids.

### Conclusion

- Constructing an additional clarifier is GPR eligible as it significantly reduces or eliminates the need for chemical addition, and minimizes the amount of chemical sludge to be disposed.
- **GPR Costs:** Secondary clarifier = \$1,810,000 (Opinion of probable cost at Bid Set)
- **GPR Justification:** The process is GPR-eligible per Section 4.5-5a: *Projects that significantly reduce or eliminate the use of chemicals in wastewater treatment*; 4.5-5b: *...significantly reduce the volume of residuals, or lower the amount of chemicals in the residuals.*

<sup>8</sup> City of Blackfoot Wastewater Treatment Facility Plan. April 2014. J-U-B Engineers, Inc.