



**Cave Bay Community Services FY13 Wastewater
System Project (pop. 500)
SRF Loan #WW 1308
\$1,263,000**

Final Green Project Reserve Justification

Categorical GPR Documentation

1. INSTALL NEW FINE BUBBLE DIFFUSED AERATION SYSTEM TO REPLACE SURFACE AERATORS (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” (\$52,415).*

Business Case GPR Documentation

2. INSTALLS INSTALL NEW ENERGY-EFFICIENT VFDS (Energy Efficiency). Business Case per GPR 3.2-2: *if a project achieves less than a 20% reduction in energy efficiency, then it may be justified using a business case (\$7,420).*
3. PROVIDE FLOW METERS AND PUMP TIME RUN METERS to generate data to assist with minimizing or eliminating I/I in existing septic tanks (Energy Efficiency). Business Case per GPR 3.5-4: *I/I correction projects that save energy from pumping and reduced treatment costs (\$13,300).*

1. TREATMENT PROCESS – FINE BUBBLE AERATION

Summary

- Cave Bay Community Services, Inc. (CBCS) is constructing improvements to their wastewater facilities including expansion of one of their wastewater lagoons, lining of both lagoons, a new fine-bubble aeration system for both lagoons, a new wastewater irrigation pump station, approximately 4.6 acres of new wastewater land application area, and improvements to flow monitoring in their collection system.
- Estimated Loan Amount = \$1,263,000 (SRF Loan Agreement #WW1308)
- Estimated GPR portion of loan (fine bubble aeration) = 4.2% (\$52,415)
- Annual Energy savings = 52%

Background¹

- The CBCS wastewater collection and treatment system was constructed in 1977 and has been serving the Cave Bay Community since that time.
- The system consists of individual septic tanks, which pump effluent through a septic tank effluent pump (STEP) collection system to four (4) centralized lift stations, which then discharge to a pair of un-lined lagoons. The lagoons were designed and have historically operated to dispose of wastewater through evaporation and seepage.
- Currently, Lagoon #1 is aerated with blowers purchased used out of surplus, which have been in operation at Cave Bay for about 5 years. These blowers feed perforated tubing floating on the lagoon surface. Lagoon #2 is partially aerated with three floating decorative fountain aerators on one end of the lagoon. The proposed facility expansion and upgrade includes installation of fine bubble diffused aeration in both lagoons.
- The new aeration system is sized for complete mixing of both lagoons. The existing system does not provide complete mixing and aeration.

Results

- The existing aeration system, which currently operates with 2 ea. 3 HP blowers and 3 ea. ¾ HP fountains (8.25 HP total), will be replaced with a high efficiency fine bubble aeration system.
- This system will be supplied from one air blower that will draw an estimated 2.7 Brake HP during normal operation².
- The energy consumed by the existing system averaged 14,000 kW-hr/yr³.
- The estimated energy consumed by the proposed system will be 7,290 kW-hr/yr⁴.

Energy Efficiency Improvements

- The resulting reduction in energy requirements with the new system = $1 - (7,290 \div 14,000) = .521 = 52.1\%$
- The total system oxygenation efficiency of the existing system is unknown.
- The total system oxygenation efficiency of the proposed system is 2.695 lbs. O₂/HP-hr.

Conclusion

- By replacing the current system with a fine bubble diffusion aeration system, CBCS will provide complete mixing and aeration of the lagoons while reducing energy requirements by 52%.
- **GPR Costs:** \$52,415.
- **GPR Justification:** Categorically GPR-eligible (Energy Efficiency) per Section 3.2-2⁵: *projects that achieve a 20% reduction in energy consumption.*

¹ 2012 Wastewater Facilities Plan, Cave Bay Community Services

² Air Diffusion Systems (ADS) literature.

³ Kootenai Electric Cooperative billing records.

⁴ Air Diffusion Systems (ADS) calculation.

⁵ Attachment 2. April 2010 EPA Guidance for Determining Project Eligibility.

2. ENERGY EFFICIENT VFDs⁶

Summary

- Cave Bay Community Services, Inc. (CBCS) is constructing improvements to their wastewater facilities including expansion of one of their wastewater lagoons, lining of both lagoons, a new fine-bubble aeration system for both lagoons, a new wastewater irrigation pump station, approximately 4.6 acres of new wastewater land application area, and improvements to flow monitoring in their collection system.
- It is proposed to install high-head, submersible irrigation pumps with variable frequency drives (VFDs) to transfer the treated lagoon effluent to the land application site.
- Estimated loan amount = \$1,263,000
- Estimated GPR portion of loan (pump & VFD) = 0.6% (\$7,420)

Background

- The effluent irrigation system will include variable frequency drive (VFD) pumps to maximize pumping efficiency.

Calculated Energy Efficiency Improvements

VFDs:

- The Baseline Standard Practice for comparison is a standard Epact motor that is not controlled by a VFD⁷.
- VFD efficiency data were calculated using the Franklin Control Systems Savings Calculator⁸ (for pump applications).
- The combined annual energy savings for utilizing VFDs is estimated to be 3,760 kWh/year per motor/VFD system - corresponding to a cost savings of \$338/year (at an energy cost of 0.09\$/kwh) when compared to the Baseline Standard Practice.
- With an estimated incremental cost increase of \$3,710 the simple payback is 11 years per VFD.

Conclusion

- The project would result in a more energy efficient operation = 62% of the energy requirement of the Baseline Standard Practice.
- **GPR Costs:**

| | |
|------------------------|----------------|
| New VFDs = | \$5,920 |
| Application Software = | <u>\$1,500</u> |
| Total = | \$7,420 |
- **GPR Justification:** The installation of energy efficient pumps with VFDs is GPR-eligible per Section 3.2-2⁹: *Use of VFD pumps in a new project where they are cost effective...if a project achieves less than a 20% reduction in energy efficiency, then it may be justified using a business case.*

⁶ 11/9/15 Final GPR Justification, Scott McNee, P.E., T-O Engineers.

⁷ NYS Energy Research and Development Authority, Energy Evaluation Memorandum, Village of Greenport WWTP Upgrade 8-2009

⁸ <http://www.cerusing.com/VFDEstSavingsCalc.asp>

⁹ Attachment 2. EPA Guidance for Determining GPR Eligibility for FY12 SRF Projects

3. INFLOW/INFILTRATION REDUCTION

Summary

- Cave Bay Community Services, Inc. (CBCS) is constructing improvements to their wastewater facilities including expansion of one of their wastewater lagoons, lining of both lagoons, a new fine-bubble aeration system for both lagoons, a new wastewater irrigation pump station, approximately 4.6 acres of new wastewater land application area, and improvements to flow monitoring in their collection system.
- Estimated loan amount = \$1,263,000
- Estimated GPR portion of loan (flow monitoring) = 1.1% (\$13,300)

Background¹⁰

- The CBCS wastewater collection and treatment system consists of individual septic tanks, which pump effluent through a septic tank effluent pump (STEP) collection system to four (4) centralized lift stations, which then discharge to a pair of un-lined lagoons.
- Flow meters will be placed on the three (3) main sewer lift stations, which are currently un-metered, to help track flows, and better identify areas of the system where infiltration and inflow (I/I) may be occurring.
- Pump run time meters will be placed on individual septic tank pumping systems to identify and eliminate sources of I/I or excessive water usage, such as seasonal use homeowners leaving their water running during the winter.

Calculated Energy Efficiency Improvements

- During the spring, lake level and groundwater levels increase in portions of the service area. High groundwater typically extends for approximately 4 months, from March through June.
- Cave Bay operators have noted significant increases in flows when lake and groundwater levels are high. Operators have also noted high flows from some residences leaving water running during the winter months when vacation homes are un-occupied.
- Only the uppermost main lift station currently has a flow meter. Installation of meters at the other three (3) main lift stations will allow CBCS to track and evaluate flows in more isolated portions of the system.
- Ten (10) portable individual septic tank lift station run time meters will allow CBCS to install these meters in individual homeowner pump stations to evaluate flows where I/I or excessive winter water usage suspected. This will allow for identification of needed septic tank/service line repairs where high I/I is identified.

Conclusion

- It is estimated that collection system I/I from individual septic tanks could amount to 15% of the total annual wastewater flow.
- The use of metering throughout the collection system will help CBCS identify and repair sources of I/I and identify and curtail water usage when homes are unoccupied. This will result in lower energy consumption throughout the wastewater collection system through less pumping at individual septic tank and main lift stations.

- **GPR Costs:**

| | |
|---------------------------------|----------|
| Main Lift Station Flow Meters = | \$8,100 |
| New VFD = | \$5,200 |
| Total = | \$13,300 |

- **GPR Justification:** The installation of main lift station flow meters and individual run time meters and septic tank pump stations is GPR-eligible by a Business Case per Section 3.5-3¹¹ *Projects that cost effectively eliminate pumps or pumping stations*; and per Section 3.5-4 (Energy Efficient): *I/I correction projects that save energy from pumping ...and are cost effective.*

¹⁰ 11/9/15 Final GPR Justification, Scott McNee, P.E., T-O Engineers

¹¹ Attachment 2. April 21, 2010 EPA Guidance for Determining GPR Eligibility for FY11 SRF Projects, P.10