MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: File

FROM: Kurt Swendsen, Project Manager K.C.S.

DATE: November 19, 2014

SUBJECT: State Revolving Fund Project No. 5618-01
City of Pontiac – Wastewater Treatment Plant Improvements
Green Project Reserve (GPR) Funding Cost Calculation

The purpose of this memo is to document the cost calculations for the green project reserve funding for the city of Pontiac Wastewater Treatment Facility Drainage District, SRF Project No. 5618-01.

The waste-activated sludge facilities, tertiary screw pumps, variable frequency drives and building energy reductions are all portions of the Pontiac SRF project that are eligible for GRP principal forgiveness based on a business case and the Department of Environmental Quality's district engineer's approval. Principal forgiveness is set at $1,000,000 for projects that verify between $4,000,000 and $10,000,000 of eligible green costs. Pontiac made a successful business case and therefore are eligible for $1,000,000 of principal forgiveness. Because they exceeded the $4,000,000 threshold based on construction costs, Pontiac did not include engineering costs in its GPR.

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October 23, 2014

HNTB

Mr. Kurt Swendsen
Senior Project Manager, EQA
MDEQ- Revolving Loan Section
P.O. Box 30241
Lansing, MI 48909-7741

Re: 2014 Pontiac WWTP Improvements – Phase 1
Green Project Reserve Business Cases
SRF Project Number 5618-01

Dear Mr. Swendsen:

The 2014 SRF Project Plan presented Green Project Reserve business cases for all proposed improvements at the Pontiac WWTP. This letter is in response to your email dated Monday October 6, 2014 requesting documentation of the Green Project Reserve (GPR) business cases specific to the 2014 Pontiac WWTP Phase 1 Improvements, SRF Project Number 5618-01 scheduled for first quarter, FY 2015 funding.

The 2014 Pontiac WWTP Improvements Phase 1 includes GPR improvements to the Auburn WWTP and East Blvd. WWTP. The Auburn WWTP GPR improvements include the Waste Activate Sludge Thickening Facilities, premium efficiency motors for the screw pumps, variable frequency drive (VFD) for the new screw pumps and building energy reduction improvements at the Chemical Feed Facility. The East Blvd. WWTP GPR improvements include building energy reduction improvements at the Chemical Feed Facility.

The business cases for each of these GPR improvements are attached. We understand that a minimum threshold of approximately $4M project costs is required to be eligible for $1M principal forgiveness. The low bidder for the work was Sorenson Gross. The construction cost for these GPR improvements, as determined from Sorenson Gross's Schedule of values, is as follows:

WAS Thickening Facilities	$3,900,179.00
Premium Eff. Screw Pump Motors	$. 128,767.00
Variable Frequency Drives	$ 61,868.00
Building Energy Reductions	$ 60,380.00
Total	**$4,151,194.00**

We thank you for your assistance in achieving the GPR principal forgiveness for the 2014 Pontiac WWTP Improvements - Phase 1 project. If you have any questions, please do not hesitate to ask.

Best Regards,

Timothy H. Sullivan, P.E.
Section Manager, Water/Wastewater Group

Cc: Mike Walsh, P.E. and Navid Mehram, P.E., WRC
File

Attachments:
Waste Activated Sludge Thickening Facilities - Business Case
Premium Efficiency Motor Replacement - Business Case
Variable Frequency Drive (VFD) Additions - Business Case
Building Energy Reductions – Business Case

WASTE ACTIVATED SLUDGE THICKENING FACITITIES - BUSINESS CASE

General

The new Waste Activated Sludge Thickening (WAS) facilities meet the GPR program under two categories; Energy Efficiency and Environmentally Innovative. Under current operations, WAS is pumped back to the headworks and co-settled in the primary clarifiers with primary sludge. (See Figure 2-7 attached taken from the SRF Project Plan dated July 1, 2014.) Under the proposed improvements WAS is pumped directly to the new WAS facility where it will be thickened prior to digestion. (See Figure 3-3 taken from the SRF Project Plan dated July 1, 2014.) This new project will; eliminate re-introducing the settled sludge back into the liquid stream to settle once again, will improve sludge settling in the primary settling tanks achieving higher primary sludge concentrations, and will increase WAS concentrations to the digesters. Increasing the primary sludge and WAS concentrations significantly reduces the total sludge volume, which in turn reduces heat energy requirements and provides additional solids residence time in the digesters so that additional volatile solids reduction will occur. These attributes both meet the Energy Efficiency category and the Environmentally Innovative categories for volatile solids reduction.

Volumetric Reduction due to WAS and Primary Sludge Concentrations

The Additional Volatile Solids reduction is based on the following conditions:

(Future Average Daily Sludge Flow Without WAS Thickening)
Co-settled Primary Sludge (with WAS) production ..... 25,281 lbs./day
Co-settled Primary Sludge (with WAS) concentration 3.6%
Co-settled Primary Sludge (with WAS) flow to digester ..... 83,765 gpd

(Future Average Daily Sludge Flow With WAS Thickening)
WAS production ..... 10,600 lbs./day
WAS concentration 0.51%
WAS flow to new thickeners ..... 244,670 gpd
Thickened WAS concentration 5%
Thickened WAS Sludge flow to digester ..... 23,766 gpd

Future Primary Sludge production ..... 14,751 lbs./day
Future Primary Sludge concentration 4%
Future Primary Sludge flow to digester ..... 43,859 gpd

Total Future Average Daily Sludge Flow to Digester
23,766 gpd + 43,859 gpd = ... 67,625 gpd

Reduction of Total Sludge flow to Digester
(83,765 gpd – 67,625) = ... 16,140 gpd
..... 134,600 lbs. /day
Delta T ..... 40 Deg. F.
System Efficiency (Boiler, heat exchanger and digester heat loss) 50%
Energy Reduction – Digester Heating ..... 464,780 Btu/hr.
Cost ..... $1.90 per therm
Annual Digester Heating Cost Reduction ..... $77,560/yr.

Conclusion

The reduction of energy consumption and volatile solids are significant, and is therefore WAS thickening is deemed eligible for GPR funding.

Cost

The construction cost for the WAS sludge thickening facility is as follows:

Division 02 Site work	$ 39,550.00
Division 11 - Equipment	$1,842,351.00
Division 15 - Mechanical	$ 857,546.00
Division 16 Electrical	$ 780,961.00
Subtotal:	$3,520,408.00
General Conditions	$ 379,770.00
Total	**$3,900,179.00**

PREMIUM EFFICIENCY MOTOR REPLACEMENT - BUSINESS CASE

General

The existing tertiary screw pumps will be equipped with premium efficiency motors meeting Energy Policy Act of 1992, and therefore meets the GPR Energy Efficiency category.

Energy Savings - Screw Pump Motor Replacement

The average yearly flow will be 19.7 MGD, and generally one screw pump will operate at a time, for 24 hours a day 365 days/year. This calculation presents the energy savings for one pump using a high efficiency motor being ran in a 24 hour period.

Nameplate Hp	125 Hp
Total Average Screw Pump Rate	19.7 MGD
Estimated Total Dynamic Head	19.15 ft.
Pump Efficiency	65%
Brake Horsepower	101.78 Hp
Existing Motor Efficiency	85%
Existing Motor Input Horsepower	119.7 HP
New Motor Efficiency	95%
New Motor Input Horsepower	107.1 HP
Reduction in Motor Input Horsepower	12.6 HP
Reduction in Motor Input KW @ 0.7457 KW/HP	9.40 KW
Electrical Costs	$0.065/ KW-hr
Reduction in Energy Costs	**$5,352/year**

Conclusion

The reduction of energy consumption is significant, and therefore new premium efficiency motors for the screw pumps are deemed eligible for GPR funding.

Cost

The construction cost for the Premium efficiency motor replacement is as follows:

Screw Pump Motors	$ 35,058.00
Electrical	$ 81,171.00
General Conditions	$ 12,538.00
Total	**$128,767.00**

VARIABLE FREQUENCY DRIVE (VFD) ADDITIONS - BUSINESS CASE

General

New VFDs are being added to the screw pumps. The VFDs contribute to energy efficiency as they allow the pumps to match driver speed to load demands, operate at a higher efficiency duty point, operate at reduced horsepower or drive frequency, requiring less energy than a standard drive which operates at a set frequency independent of flow requirements. Therefore VFD additions to the screw pumps meets the GPR Energy Efficiency category based on substantial energy savings as illustrated in the following example.

VFD addition to new screw pumps at Auburn WWTP:

Total Average Flow	19.7 MGD
Estimated Total Dynamic Head	19.15 ft.
Pump Efficiency without VFD control	65%
Pump Efficiency with VFD control	80%
VFD Efficiency	95%
Combined Pump and VFD Efficiency	76%
BHp without VFD Control (for All Screw Pumps)	101.4 Hp
BHp with VFD Control (for All Screw Pumps)	87.0 Hp
Reduction in Motor Input Horsepower with VFD	14.3 Hp
Annual Energy Savings Via VFDs	93,555 kW-hrs.
Electrical Costs	$0.065/ kW-hr.
Reduction in Energy Costs VFDs	$6,081 / year

Conclusion

The reduction of energy consumption through VFD additions improves energy efficiency, and new VFDs are deemed GPR eligible.

Cost

The construction cost for the VFDs is as follows:

Screw Pump VFDs	$55,844.00
General Conditions	$ 6,024.00
Total	**$61,868.00**

BUILDING ENERGY REDUCTIONS – BUSINESS CASE

General

The existing buildings envelope (doors, windows and roofs) are inefficient due to aged technology, materials, and conditions. These antiquated products require significantly more heating and cooling energy to overcome heat loss during cold months and heat transfer into the buildings in the warmer months. The interior and exterior lighting systems are currently an additional source of high energy consumption from inefficient lamping and lighting controls. Improvements to the doors, window, roofing and lighting for the buildings at the Pontiac WWTP will reduce energy consumption, and therefore meet the GRP Energy Efficiency category (non-categorical).

The dated metal frame single pane glass windows will be replaced with Low E, Argon filled double pane glass windows. This will provide more insulation and save heating and cooling cost.

The aged doors will be replaced with insulated fire rated doors which provide a R factor of 11, and are constructed with polyurethane cores with weather-stripping. Such door replacement will improve insulation.

Replacement of windows, doors and roof at Auburn WWTP Chemical Building
(2 windows, 1single door, 1 overhead door, and roof)

2 windows

Existing Window R-value	0.76
New Window R-Value	2.94
Existing Window Efficiency	25%
New Window Efficiency	98%
Existing Window Heat loss factor (HLF)	80
New Window Heat loss factor (HLF)	45.5
Existing Window BTUs used per hour (Window Area x HLF) at 0°	2560 BTU's-hr.
New Window BTUs used per hour (Window Area x HLF) at 0°	1456 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan	0.70
Existing Window BTUs used per hour (Window Area x HLF) at 20°	1792 BTU's-hr.
New Window BTUs used per hour (Window Area x HLF) at 20°	1019 BTU's-hr.
Annual Energy Savings (1 BTU/hr. = .00029307 kw/hr.)	0.34 kw-hr
Electrical Costs	$0.065 / KW
Reduction in Energy Costs	**$128.99/ year**

1single door

Existing Door R-value	0.83
New Door R-Value	11
Existing Door Efficiency	5%
New Door Efficiency	73%
Existing Door Heat loss factor (HLF) at 0°	80
New Door Heat loss factor (HLF) at 0°	45.5
Existing Door BTUs used per hour (Window Area x HLF) at 0°	1680 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 0°	956 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan	0.70
Existing Door BTUs used per hour (Window Area x HLF) at 20°	1176 BTU's-hr.

New Door BTUs used per hour (Window Area x HLF) at 20°	669 BTU's-hr.
Annual Energy Savings (1 BTU/hr. = .00029307 kw/hr.)	0.15 kw-hr
Electrical Costs	$0.065 / KW
Reduction in Energy Costs	**$84.61 / year**

Overhead door

Existing Door R-value	0.22
New Door R-Value	0.60
Existing Door Efficiency	5%
New Door Efficiency	73%
Existing Door Heat loss factor (HLF) at 0°	80
New Door Heat loss factor (HLF) at 0°	45.5
Existing Door BTUs used per hour (Window Area x HLF) at 0°	3360 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 0°	1911 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan	0.70
Existing Door BTUs used per hour (Window Area x HLF) at 20°	2352 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 20°	1338 BTU's-hr.
Annual Energy Savings (1 BTU/hr. = .00029307 kw/hr.)	0.30 kw-hr
Electrical Costs	$0.065 / KW
Reduction in Energy Costs	**$169.21 /year**

Roof

Roof Area	600 sf
Existing Roof R-value	7
New Roof R-Value	20
Existing Roof Efficiency	18%
New Roof Efficiency	50%
Existing Roof Heat loss factor (HLF) at 0°	7.7
New Roof Heat loss factor (HLF) at 0°	4.9
Existing Roof BTUs used per hour (Window Area x HLF) at 0°	4620 BTU's-hr.
New Roof BTUs used per hour (Window Area x HLF) at 0°	2940 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan	0.70
Existing Roof BTUs used per hour (Window Area x HLF) at 20°	3234 BTU's-hr.
New Roof BTUs used per hour (Window Area x HLF) at 20°	2058 BTU's-hr.
Annual Energy Savings (/hr. = .00029307 kw/hr.)	0.35 kw-hr
Electrical Costs	$0.065 / KW
Reduction in Energy Costs	**$199.19 /year**

Total Reduction in Energy Costs at Auburn WWTP Chemical Building ..... **$581.96 /year**

Replacement of windows, doors and roof at **East Blvd. WWTP Chemical Building**
(1single door, 1 double door, and roof)

1single door

Existing Door R-value 0.83
New Door R-Value 11
Existing Door Efficiency 5%
New Door Efficiency 73%
Existing Door Heat loss factor (HLF) at 0° 80
New Door Heat loss factor (HLF) at 0° 45.5
Existing Door BTUs used per hour (Window Area x HLF) at 0° ..... 1680 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 0° ..... 956 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan 0.70
Existing Door BTUs used per hour (Window Area x HLF) at 20° ..... 1176 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 20° ..... 669 BTU's-hr.
Annual Energy Savings (/hr. = .00029307 kw/hr.) ..... 0.15 kw-hr
Electrical Costs ..... $0.065 / KW
Reduction in Energy Costs ..... $84.61 / year

1Double door

Existing Door R-value 0.83
New Door R-Value 11
Existing Door Efficiency 5%
New Door Efficiency 73%
Existing Door Heat loss factor (HLF) at 0° 80
New Door Heat loss factor (HLF) at 0° 45.5
Existing Door BTUs used per hour (Window Area x HLF) at 0° ..... 3360 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 0° ..... 1911 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan 0.70
Existing Door BTUs used per hour (Window Area x HLF) at 20° ..... 2352 BTU's-hr.
New Door BTUs used per hour (Window Area x HLF) at 20° ..... 1338 BTU's-hr.
Annual Energy Savings (/hr. = .00029307 kw/hr.) ..... 0.30 kw-hr
Electrical Costs ..... $0.065 / KW
Reduction in Energy Costs ..... $169.21 /year

Roof

Roof Area ..... 1056 sf
Existing Roof R-value 7
New Roof R-Value 20
Existing Roof Efficiency 18%
New Roof Efficiency 50%
Existing Roof Heat loss factor (HLF) at 0° 7.7
New Roof Heat loss factor (HLF) at 0° 4.9
Existing Roof BTUs used per hour (Window Area x HLF) at 0° ..... 8131 BTU's-hr.
New Roof BTUs used per hour (Window Area x HLF) at 0° ..... 5174 BTU's-hr.
Conversion Number for Outside Design Temp in Pontiac, Michigan 0.70

Existing Roof BTUs used per hour (Window Area x HLF) at 20°	5692 BTU's-hr.
New Roof BTUs used per hour (Window Area x HLF) at 20°	3622 BTU's-hr.
Annual Energy Savings (/hr. = .00029307 kw/hr.)	0.87 kw-hr
Electrical Costs	$0.065 / KW
Reduction in Energy Costs	**$493.45 /year**
Total Reduction in Energy Costs at East Blvd WWTP Chemical Building	**$747.27 /year**
Total Reduction in Energy Costs	**$1,329.23**

Conclusion

Reduction of energy consumption occurs through building improvements, and is therefore GPR-eligible (Energy Efficiency) per this Business Case.

Cost

The construction cost for the doors windows and roofs are as follows:

Doors and windows	$28,627.00
Roof	$25,874.00
Subtotal:	$54,501.00
General Conditions	$ 5,879.00
Total	**$60,380.00**