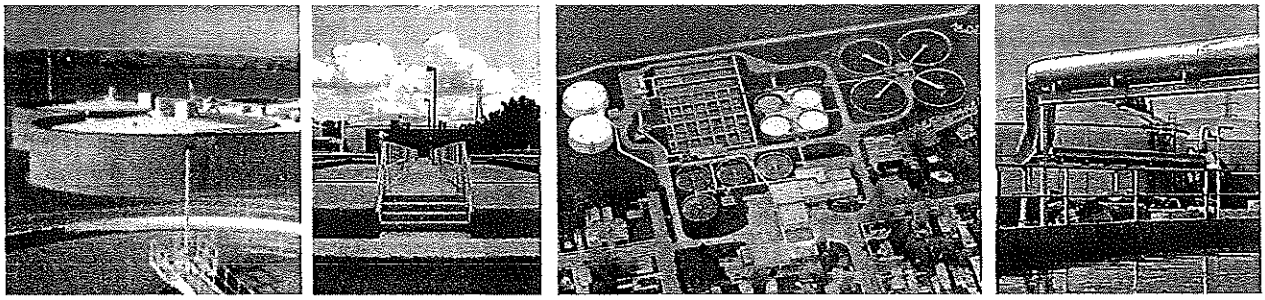
GREEN PROJECT ELEMENTS



CLEAN WATER FUND PROGRAM
Addendum To Financial Assistance Application
(CWF Project No. 4115-03)

WASTEWATER TREATMENT FACILITY EXPANSION & REHABILITATION

Prepared For The

NEENAH-MENASHA SEWERAGE COMMISSION
WINNEBAGO COUNTY, WISCONSIN

NOVEMBER 1, 2012

McM. No. N0008-920500.04

DEG:

McMAHON ENGINEERS \ ARCHITECTS

1445 MCMAHON DRIVE | P.O. BOX 1025, NEENAH, WI 54957-1025
PH. 920.751.4200 | FX. 920.751.4284 | WWW.MCMGRP.COM

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I. INTRODUCTION

A. Variable Frequency Drives

New blowers and pumps throughout the Neenah-Menasha Sewerage Commission (NMSC) Wastewater Treatment Facility are being supplied with new Variable Frequency Drives (VFD's). The VFD's enable the pumps and blowers to operate at adjustable speeds, based on Facility or process demands. As a result, energy is ultimately saved because the pump or blower does not consistently have to operate at maximum design loads, and can be adjusted to meet average loading conditions. The VFD's will save the Facility approximately 35% in energy consumption, as shown in Table #1, located at the end of this Addendum.

The VFD's being provided on this project are shown in Table #2, below:

TABLE #2 - VARIABLE FREQUENCY DRIVES

Description	No.	HP each	Notes
Grit Pumps	2	20	Replaces Existing Grit Pumps
Non-Contact Cooling Water Pumps	3	30	New Units - TPAD Process
Thermophilic Digester Recirculation Pumps	4	40	New Units - TPAD Process
Mesophilic Digester Recirculation Pumps	2	10	New Units - TPAD Process
Thickened Waste Activated Sludge Pumps	4	7.5	New Units - TPAD Process
Centrifuge Feed Pumps	4	15	New Units - Centrifuge Process

TABLE #2 - VARIABLE FREQUENCY DRIVES

Description	No.	HP each	Notes
Non-Potable Water Pumps	2	30	New Units
Inclined Augers	2	3	New Units - Centrifuge Process
Digester Boilers System Pumps	2	20	New Units
Gas Blowers	2	7.5	New Units - Gas Conditioning System
MLSS Channel Aeration Blowers	2	30	New Units
HVAC Roof Exhausters	2	3	New Units
HVAC Hot Water Recirculation Pumps	2	15	New Units - TPAD Process
HVAC Air Conditioning Unit	1	15	New Unit

One example of a process that utilizes the adjustable motor speed is the thermophilic digester recirculation pumps. The pumps are designed to operate at 750 GPM at a maximum Total Dynamic Head (TDH) of 86-feet. A standard engineering safety multiplication factor of 2 was applied to the calculated head loss from friction and fittings to account for the solids content (sludge) in the recirculated water. However, the recirculated sludge is partially digested, and the actual head loss should fall below the calculated design maximum TDH. As a result, the pump would not be required to run at full speed to maintain desired flow. The VFD would allow the pump to operate at lower speeds to account for the lower than calculated TDH.

B. Lighting

All of the exterior pole-mounted, high pressure sodium lights are being replaced with LED Green Cobra Street Lights. The exterior high pressure sodium wall pack fixtures are also being replaced with an LED module. Several interior lighting fixtures are also being replaced with linear fluorescent lights. The existing lights use an estimated 68,000 kWh per year, and the new lights will use 31,000 kWh per year. The new lighting fixtures will save the Facility approximately 55% in annual energy consumption over the existing fixtures, as shown in Table #3, located at the end of this Addendum.

C. High Speed Turbo Blowers

The NMSC Wastewater Treatment Facility currently uses a high percentage of their energy for aeration. The aeration system is being upgraded by installing new fine-bubble diffusers, new HSI high speed turbo blowers, and a new Dissolved Oxygen (DO) control system.

A Present Worth Analysis was performed for new blower options in the 2010 Wastewater Facilities Plan. The options evaluated were conventional positive displacement units versus

new high speed turbines. The high speed turbines were determined to be more cost effective as a result of their higher efficiency and minimal maintenance requirements. The high speed turbo blowers include their own VFD and Programmable Logic Controller (PLC) controls as part of the unit.

At the average air design requirement of 12,010 scfm, four existing rotary lobe blowers would be required to operate with a total load of 685-horsepower. The new blowers will meet the same average design air requirements with only two blowers operating at a total of 560-horsepower. This results in an 18% reduction of energy consumption.

II. DESCRIPTION OF 'ENVIRONMENTALLY INNOVATIVE' ELEMENTS

A. Class A Biosolids - TPAD

A new sludge digestion process has been designed for the Facility in order to have the ability to generate Class A biosolids. The Facility currently operates a Temperature-Phased Anaerobic Digestion (TPAD) process with two anaerobic digesters in series. The first digester is operating at a thermophilic temperature of 131°F, and the second digester is operating at a mesophilic temperature of 98°F.

The new process consists of running two thermophilic digesters and one mesophilic digester. The new process will involve staged feeding and withdrawal from the thermophilic digesters to the mesophilic digester. The process was modeled from an Environmental Protection Agency (EPA) approved Process to Further Reduce Pathogens (PFRP) implemented in Indianapolis, Indiana. The new system is designed to have one withdraw per day per reactor, and allows for feeding a reactor for up to 19-hours per day. The daily sequence of one of the thermophilic digesters is 3-hours of rest with no feed or withdraw, 2-hours of transferring sludge to the mesophilic digester (at year 2030 maximum month conditions) and raw sludge feeding into the digester for the remaining 19-hours.

The staged feeding process to produce Class A biosolids required new rotary lobe transfer pumps, automated valves, instruments and controls. The production of Class A Biosolids is 'Environmentally Innovative' due to the fact pathogens in the biosolids are essentially pasteurized producing a more desirable product with less environmental concerns than typical biosolids.

B. Centrifuges

Two new Alfa Laval centrifuges are being installed at the Facility for sludge dewatering. A Pilot Study was performed in April of 2011 to evaluate the proposed system. The centrifuge was tested with sludge from the TPAD process, which contained a blend of

primary sludge and Waste Activated Sludge (WAS). The Pilot Study concluded the centrifuge system effectively and efficiently dewatered biosolids to an average of 25% dry cake solids, which would be used for land application.

The Facility currently utilizes two belt filter presses that dewater the TPAD sludge and produce approximately 18% dry cake solids. At 18% solids, NMSC would have to haul approximately 19,930 cubic yards of biosolids per year from the Facility at design year loadings. The new centrifuges will produce an average of 25% dry cake solids. At 25% dry cake solids, approximately 14,350 cubic yards of biosolids need to be hauled per year at design year loadings. As a result, the volume of biosolids hauled off site is reduced by approximately 28%.

III. GREEN ELEMENTS SUMMARY OF CAPITAL COSTS

Table #4 summarizes the Green Element Project costs, as show below:

TABLE #4 - GREEN ELEMENTS SUMMARY OF CAPITAL COSTS

Project Number	Item	Energy Efficiency Costs	Environmentally Innovative
Categorical 3.2.-2	VFD's	$285,000	
	Lighting	102,000	
		$445,050	
Subtotal +15% For Engineering, Administrative & Contingencies		$445,050	
Business Case 3.5-1	Blowers & Aeration Diffusers	$869,000	
Subtotal +15% For Engineering, Administrative & Contingencies		$999,350	
Other	Class A Biosolids (TPAD)		$200,000
	Centrifuges		1,022,000
Subtotal +15% For Engineering, Administrative & Contingencies			$1,405,300
TOTAL		$1,444,400	$1,405,300

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Table #1: VFD Estimated Energy Savings

1 year	52.1775	weeks
1 horsepower	745.7	watts
1 kW-hr	0.08	$

Description	No.	HP @ Maximum Load (Each)	Maximum RPM	Average RPM	% Speed	Estimated HP Saved @ Average Load	Estimated HP Required @ Average Load	Estimated Energy (kW) Saved	Estimated Run Time Each (Hrs/Day)	Estimated Run Time (Days/Week)	Hours/Year	Estimated Energy Saved (Dollars)
Grit Pumps	2	6.5	750	700	93%	1.2	5.3	0.91	6	7	2191	$318
Non-Contact Cooling Water Pumps	3	22.6	1,750		85%	8.7	13.9	6.50	16	7	5844	$9,121
Thermophilic Digester Recirculation Pumps	4	22.46	1,355	1235	91%	5.5	17.0	4.07	12	7	4383	$5,705
Mesophilic Digester Recirculation Pumps	2	3.46	1,020	960	94%	0.6	2.9	0.43	12	7	4383	$301
Thickened Waste Activated Sludge Pumps	4	4	360	240	ump Curve Use	1.6	2.4	1.19	3.5	7	1278	$488
Centrifuge Feed Pumps	4	7	270	240	ump Curve Use	3.0	4.0	2.24	5	4	1044	$747
Non-Potable Water Pumps	2	26	3,600		70%	17.1	8.9	12.74	9	7	3287	$6,700
MLSS Blowers	2	25.3	3,017	Assumed 5% HP Reduction		1.3	24.0	0.94	12	7	4383	$662
Gas Blowers (GCS)	2	7.5		Assumed 5% HP Reduction		0.4	7.1	0.28	12	7	4383	$196
HVAC Digester Boilers System Pumps	2	20	1,750		75%	11.6	8.4	8.62	12	7	4383	$6,046
HVAC Roof Exhausters	2	3			75%	1.7	1.3	1.29	12	7	4383	$907
HVAC Hot Water Recirculation Pumps	2	15	1,750		75%	8.7	6.3	6.47	12	7	4383	$4,535
HVAC Air Conditioning Unit	1	15		Assumed 5% HP Reduction		0.8	14.3	0.56	12	7	4383	$65
TOTAL												**$35,800**

Centrifugal Pumps (Fan's Law used for HP Calculations: "Horsepower required changes in proportion to the change of the speed cubed")

Positive Displacement Pumps/Blowers

* 85% speed assumes equipment is operating at 15% below maximum ouput, based on past experiences

Total Max HP:	178
Total HP on VFD @ Average Loads:	116
Power Saved, %:	**35%**

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Table #3: Energy Savings From Installation Of New Light Fixtures

Lighting Type	Description	Energy of New Lights (Watts)	Energy of Existing Lights (Watts)	Wattage Reduction (%)	Quantity	Est. Duration of Lighting (Hrs/Day)	New Energy Consumption	Existing Energy Consumption	Energy Savings	Cost per Fixture	Total Capital Cost
P1	LED - Pole Mounted	70	170	59%	55	12	$1,349	$3,276	$1,927	$570	$31,350
W2	LED-Wall Pack	20	80	75%	2	12	$14	$56	$42	$337	$674
W4	LED-Wall Pack	40	80	50%	3	12	$42	$84	$42	$507	$1,521
H4	Linear Fluorescent	128	170	25%	20	5	$374	$496	$123	$833	$16,660
W4	LED-Wall Pack	40	80	50%	2	12	$28	$56	$28	$507	$1,014
W4	LED-Wall Pack	40	80	50%	2	12	$28	$56	$28	$507	$1,014
W2	LED-Wall Pack	20	80	75%	1	12	$7	$28	$21	$337	$337
W2	LED-Wall Pack	20	80	75%	2	12	$14	$56	$42	$337	$674
W3	LED-Wall Pack	30	80	63%	1	12	$11	$28	$18	$419	$419
W3	LED-Wall Pack	30	80	63%	1	12	$11	$28	$18	$419	$419
W4	LED-Wall Pack	40	80	50%	6	12	$84	$168	$84	$507	$3,042
W6	LED-Wall Pack	60	170	65%	6	12	$126	$357	$231	$594	$3,564
F	Linear Fluorescent	128	170	25%	13	5	$243	$323	$80	$261	$3,393
D2	Linear Fluorescent	60	170	65%	7	5	$61	$174	$112	$128	$896
W2	LED-Wall Pack	20	80	75%	5	12	$35	$140	$105	$337	$1,685
W2	LED-Wall Pack	20	80	75%	3	12	$21	$84	$63	$337	$1,011
Subtotal									**$2,964**	**Subtotal**	**$67,673**
Additional Contractor & Installation Fee (50%):											**$33,837**
TOTAL											**$101,510**

Menasha Utilities Charge: **0.08 kW*hr**

SUMMARY TABLE:	
Existing Energy Consumed (kW*hr):	67,642
New Energy Consumed (kW*hr):	30,594
Percent Energy Saved:	**55%**