ENERGY AUDIT – FINAL REPORT

HILLSBOROUGH MUA
BLACKWELL'S MILLS PUMP STATION

15A COLLINS DRIVE
HILLSBOROUGH, NJ 08844

ATTN: MR. GARY NUCERA,
EXECUTIVE DIRECTOR

CEG PROJECT NO. 9C09101

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I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Hillsborough Township Municipal Utilities Authority
220 Triangle Road
Suite #234
Hillsborough, NJ 08844

Authority Contact Person: Gary R. Nucera, Executive Director
Facility Contact Person: Leonard S. Jacakowicz

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$9,892
Natural Gas	$490
Total	$10,382

The potential annual energy cost savings for each energy conservation measure (ECM) are shown below in Table 1. <u>Be aware that the ECM's are not additive because of the interrelation of some of the measures.</u> This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Energy Conservation Measures (ECM's)

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade - General	$340	$18	18.9	-20.6%
ECM #2	Lighting Controls	$483	$6	80.5	-81.4%
ECM #3	Pump and Motor System Upgrade[C]	$30,000	$6,870	4.4	358.0%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.
C. Cost based upon 5 year remaining life.

The estimated demand and energy savings for each ECM is shown below in Table 2. The information in this table corresponds to the ECM's in Table 1.

Table 2
Estimated Energy Savings

ENERGY CONSERVATION MEASURES (ECM's)				
		ANNUAL UTILITY REDUCTION		
ECM NO.	**DESCRIPTION**	**ELECTRIC DEMAND (KW)**	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (THERMS)**
ECM #1	Lighting Upgrade - General	0.7	102	0.0
ECM #2	Lighting Controls	0.0	17	0.0
ECM #3	Pump and Motor System Upgrade	7.7	14,586	0.0

*Elec. Demand Savings are calculated for peak month only. Elec. consumption savings are totaled annually.

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The following Energy Conservation Measures are recommended for the facility:

- **ECM #3:** Pump and Motor System Upgrades

Although ECMs #1 and #2 do not provide a payback less than 7 years, it is recommended to proceed with the installation of both ECMs as a part of a comprehensive pump station upgrade if ECM #3 is expanded to completely upgrade the pump station.

In addition to the ECMs, there are maintenance and operational measures that can provide energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Maintain all weather stripping on entrance doors.
2. Clean all light fixtures to maximize light output.
3. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
4. The new submersible pumps, VFDs and communicator should become a part of a larger pump station upgrade. The additional items are not considered extensive since the structures, generator and chemical feed equipment appear serviceable for many years to come. We recommend the S&L dry well be closed and yard piping reconstructed to accommodate the new pumps.
5. Retro-commissioning – In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating in its designed mechanical efficiency range, hydraulic flow capacity, designed motor efficiency and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

II. INTRODUCTION

This comprehensive energy audit covers the 154 square feet Blackwell's Mills Pumping Station which includes the wet well, dry well, and the generator building.

Electrical and diesel fuel utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, process equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the facility manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting, process equipment and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Specific Process Equipment Energy Method of Analysis:

Dramatic increases in energy prices have made the water and wastewater industry aware of the significance of energy costs. Energy plays an important role in decisions that pertain to equipment replacement and design and operation of water and wastewater treatment plants and pump stations.

An energy audit is an inspection, survey and analysis of energy flows in a process or system with the objective of understanding the energy dynamics of the system and study.

An energy audit is conducted to seek opportunities to reduce the amount of energy input into the system without negatively affecting the output. It is a survey of major areas of energy usage in treatment plants and pump stations followed by a cost effectiveness analysis of methods that can be used to reduce energy usage.

The greatest energy consumers in water and wastewater treatment facilities and pump stations are the motors that drive pumping equipment.

Overall wire-to-water efficiency is calculated by the following equation:

$$e = \frac{H \times Q}{hp \times 3{,}960}$$

Where:

H: differential head across the pump, ft.
Q: flow rate, gpm
hp: horse power (electrical hp into the motor)

The wire-to-water efficiency can also be calculated as follows:

e = pump eff. X drive eff. X motor eff.

To minimize energy consumption each of the efficiency components of the above equation must be examined and maximized.

The overall wire-to-water efficiency formula reveals that the efficiency of the pump can be maximized by operating the pump at design flows and total dynamic head that coincides with the pumps most efficient operation range. In other words, pumps with highest flow per kWh should be operated where there is more than one pump available. It should be noted that pump wear can have a significant effect on pump performance.

The next element in the overall efficiency equation is electric motor. Two approaches are used to improve efficiency in existing systems:

- use of more efficient motors
- operation of motors at or near the nameplate rating

Motors can be loosely categorized as premium efficiency motors and standard motors. Premium efficiency motors generally cost more than comparable standard efficiency motors. These motors offer exceptional value if they are operated more than 50% of the time.

The last major element affecting overall efficiency is the drive. The constant speed drive with simple on-off control is the most efficient overall drive unit when it is operated at or near the most efficient point on the pump curve. However, most pumping applications require more flexibility in pump output. One of the most efficient methods of varying the pump output is using variable speed drives and one of the most efficient variable speed drives is a variable frequency drive.

There are number of other factors that may be considered in an energy audit in addition to equipment selection. They are as follows:

- power factor
- demand
- time of use

The demand and time-of-use factors can be defined for each specific process application.

It is worthwhile to add a few comments regarding the potential of a low power factor at the Authority's facilities and the resultant inefficient operation of the facilities. A review of the Authority's Public Service Electric and Gas Company (PSE&G) electric bills reveals the Authority is billed for kw used and not kva used. This type of billing is typical of power companies in New Jersey. However, if the ratio of kw/kva (power factor) droops below 0.85 PSE&G may impose penalties upon the Authority unless corrective action is taken. PSE&G will give notice before imposing dollar penalties. The energy efficiency improvement methods described above, i.e. premium motors, operating equipment in an efficient range, variable frequency drives, will all serve to raise the ratio closer to 1.0. A quick method to improve the power factor is to add capacitor banks to lower the total reactive kvar.

The New Jersey Board of Public Utilities (BPU) regulates the fee structure of PSE&G and the other New Jersey power companies. BPU allows power factor management by penalties and not by incentives. In the absence of incentives the least cost approach for the Authority is to monitor any change in regulation by the BPU and to install power factor correction devices when utility penalties are imposed.

An effective method to take all of the factors into account is to periodically run equipment performance tests. For motor and pumps new equipment is typically tested during project status to determine compliance with procurement specifications. Subsequent testing can be compared to establish efficiency trends of motor and pump combinations. Small pumps and motors typically receive very little testing whereas larger pieces of equipment receive increased levels of attention.

For situations where test results are available a reasonably reliable increased cost of energy can be calculated for a loss of efficiency.

For situations where test results are not available the energy audit engineer must estimate loss of efficiency, based upon other equipment factors, other data that may be available, maintenance records and personal experience. Confirmation performance testing may be conducted during a subsequent design phase.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost.

Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$Simple\ Payback = \left(\frac{Net\ Cost}{Yearly\ Savings}\right)$$

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime\right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

$$Lifetime\ Maintenance\ Savings = \left(Yearly\ Maintenance\ Savings \times ECM\ Lifetime\right)$$

$$Internal\ Rate\ of\ Return = \sum_{n=0}^{N}\left(\frac{Cash\ Flow\ of\ Period}{(1+IRR)^n}\right)$$

$$Net\ Present\ Value = \sum_{n=0}^{N}\left(\frac{Cash\ Flow\ of\ Period}{(1+DR)^n}\right)$$

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage/Tariffs

The electric usage profile (below) represents the actual electrical usage for the facility. Public Service Electric and Gas (PSE&G) provides electricity to the facility under their Commercial and Industrial Customer Accounts Three-Phase rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as supply service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The facility uses no natural gas. The standby power generator uses diesel fuel.

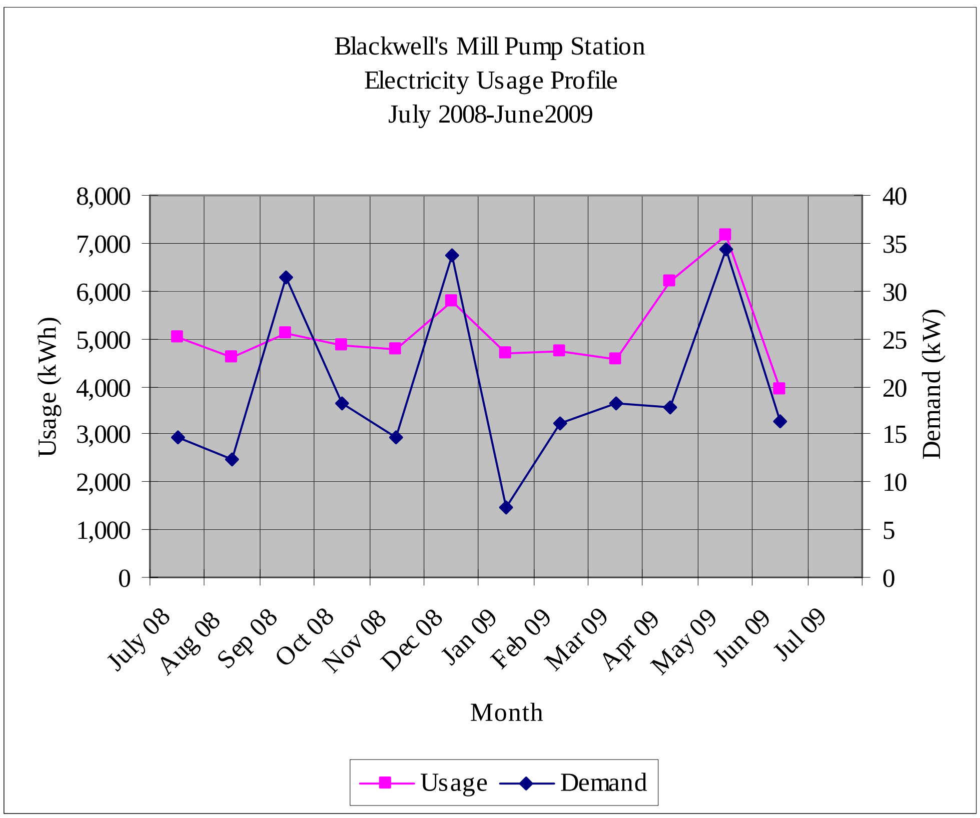
The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provide, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	16.1¢ / kWh
Diesel Fuel	$490/yr

Table 3
Electricity Billing Data

Utility Provider: PSE&G 3 Phase Rate Structure (Meter # 286004664)			
MONTH OF USE	**CONSUMPTION KWH**	**DEMAND**	**TOTAL BILL**
July-08	5,040	14.6	$941.06
Aug-08	4,626	12.4	$886.93
Sep-08	5,130	31.5	$1,140.79
Oct-08	4,842	18.2	$683.17
Nov-08	4,770	14.6	$649.34
Dec-08	5,778	33.8	$830.47
Jan-09	4,680	7.4	$633.92
Feb-09	4,716	16.2	$700.10
Mar-09	4,554	18.2	$682.39
Apr-09	6,210	17.8	$865.67
May-09	7,146	34.4	$1,032.29
Jun-09	3,924	16.4	$846.33
	AVERAGE DEMAND	**19.6 KW average**	
	AVERAGE RATE	**$16.11/kWh**	

Figure 1
Electricity Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Diesel\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + DieselFuel\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 4
Blackwell's Mills Pumping Station Building EUI Calculations

ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	61,416			205,191	3.340	685,337
FUEL OIL			196.00	27,068	1.010	27,338
TOTAL				232,258		712,676
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	154			SQUARE FEET		
BUILDING SITE EUI	*1508.17*			kBtu/SF/YR		
BUILDING SOURCE EUI	*4627.76*			kBtu/SF/YR		

C. EPA Energy Benchmarking System

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

At the present time Portfolio Manager has benchmarking tools for water and wastewater treatment plants but does not have benchmarking tools for water treatment plants and water and wastewater pumping stations.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitor the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

User Name: Hillsborough TMUA
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: hillsborough

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 5
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Blackwell's Mills Pumping Station	N/A	N/A

Statement of Energy Performance Appendix for the detailed energy summary is not applicable.

V. FACILITY DESCRIPTION

The Blackwell's Pumping Station consists of four energy consuming structures inside a fenced enclosure measuring 55 feet x 32 feet. Three structures are below ground and one structure is an above ground building. One below ground structure is a wet well with lighting, mechanical ventilation and small chemical feed pumps. A second is a washdown water collection well with a submersible pump. The third which the most significant energy consumer a dry well housing two pumps, lights and ventilation equipment. The above ground building measures 180 square feet and houses a standby generator, motor control center, automatic transfer switch, pump controller, lights and a unit heater. The station is visited on average 1 hour per day by Authority personnel and/or regulators and Authority contractors as needed. Public access is denied. The building is a one story masonry block structure with a wood frame roof and fiberglass singles. The building has doors and ventilation louvers, but no windows. The roof is insulated with 6 inches of fiberglass insulation. The flour structures were built in 1988.

<u>HVAC Systems</u>

The generator building has a 5 kw unit heater. The heater is rarely used and typically only when long duration maintenance or repairs are required during cold weather.

<u>Exhaust Systems</u>

The wet well has a fresh air ventilator as required by the New Jersey Department of Environmental Protection (NJDEP).

The dry well has a fresh air ventilator in compliance with confined space entry requirements and NJDEP rules and regulations.

The generator has an exhaust through the roof and a ducted air outlet louver for the radiator.

A motor operated air inlet louver is interconnected to the generator control system.

<u>Lighting</u>

Typical lighting in the generator building, wet well and dry well is fluorescent tube drop fixtures with T-12 lamps and magnetic ballasts. Access tubes and the wet well are lit with incandescent lamps. The exterior of the generator building is lit with incandescent flood lights.

VI. MAJOR EQUIPMENT LIST

The equipment describes the major energy consuming equipment, which through energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufacturers date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the **Major Equipment List Appendix**.

National studies show that by far the largest consumption of energy at water and wastewater facilities occurs from the transfer of fluids by pumping equipment. The handbook of Public Water Systems by Robert William and Gordon Culp, Van Nostrand Reinhold, 1986 presents data that justifies that pumping consumes about 80% of the electric consumption at water treatment facilities. The energy consumption by electric motor driven pumps at pumping stations is probably closer to 95% of all electric power consumed motor at the pumping station.

Refer to the **Major Equipment List Appendix** for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade – General

Description:

The lighting in the pumping station building and dry well is primarily made up of fluorescent fixtures with T-12 lamps and magnetic ballasts. The wet well and exterior areas have incandescent lighting fixtures.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

This ECM also includes replacement of all incandescent fixtures to compact fluorescent fixtures. The energy usage of an incandescent compared to a compact fluorescent is approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = \$10 per fixture; T-5 or T-8 (3-4 lamp) = \$20 per fixture.

$$\text{Smart Start® } Incentive = (\#\, of\ 1-2\ lamp\ \ fixtures \times\ \$10) + (\#\, of\ 3-4\ lamp\ \ fixtures \times\ \$20)$$

$$\text{Smart Start® } Incentive = (3 \times\ \$10) + (0 \times\ \$20) = \underline{\$30}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (replacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$

$$Savings = (0.3\, lamps\ per\ year) \times (\$2.00 + \$5.00) = \underline{\$2}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$370
NJ Smart Start Equipment Incentive ($):	$30
Net Installation Cost ($):	$340
Maintenance Savings ($/Yr):	$2
Energy Savings ($/Yr):	$16
Total Yearly Savings ($/Yr):	$18
Estimated ECM Lifetime (Yr):	15
Simple Payback	18.9
Simple Lifetime ROI	-20.6%
Simple Lifetime Maintenance Savings	$30
Simple Lifetime Savings	$270
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	($125.12)

ECM #2: Lighting Controls

Description:

Authority policy requires all lights to be off when the building is unoccupied; however, in some areas the lighting may be left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a pump station is first occupied. This is possibly in lower floor rooms. That are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place or a current wall switch, or on the ceiling to cover large areas. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

ASHRAE Standard 90.1-2004, **Appendix** G is a reference standard for modeling building efficiency. The standard estimates that lighting controls provide a 10% reduction in lighting power usage for daytime occupancies in buildings over 5,000 SF, and 15% reduction in buildings under 5,000 SF. This ECM includes occupancy sensors in the pump room, generator building, and wet well as well as a dual technology motion and photocell daylight sensor controlling the exterior lighting.

The ECM includes replacement of standard wall switches with sensor wall switches for individual areas and photocell sensors for the exterior lighting. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the **"Investment Grade Lighting Audit" Appendix** for details.

The **"Investment Grade Lighting Audit" Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by 15% for all areas that include occupancy sensor lighting controls and 20% for areas that include photocell daylight sensors.

Light Energy = 112 kWh/Yr. occupancy sensor controlled lighting
and
= 60 kWh/Yr. daylight sensor controlled lighting

Energy Savings Calculations:

Energy Savings = 15% x Occupancy Sensored Light Energy (kWh/Yr) +

20% x Daylight Sensored Light Energy (kWh/Yr)

Energy Savings = 15% x 112 (kWh) + 20% x 60 (kWh) = 16.8 (kWh)

Savings = Energy Savings (kWh) x Ave Elec Cost $\left(\frac{\$}{\text{kWh}}\right)$

Savings = 16.8 (kWh) x 0.161 $\left(\frac{\$}{\text{kWh}}\right)$ = $6

Installation cost per occupancy sensor (Basis: Sensorswitch or equivalent) is $110/unit including material and labor. Installation cost per daylight sensor with dual motion sensor technology is $238/unit

Installation Cost =$110 x 3 motion sensors + $238 x 1 Daylight Sensors = $568

From the **NJ Smart Start Appendix**, the installation of a lighting control device warrants the following incentive: occupancy = $20 per fixture, daylight = $25 per fixture.

Smart Start® *Incentive = (# of wall mount devices* x $20) = (3 x $20) = $60

Smart Start® *Incentive = (# of day light devices* x $25) = (1 x $25) = $25

Smart Start® *Incentive* = $85 *Total*

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$568
NJ Smart Start Equipment Incentive ($):	$85
Net Installation Cost ($):	$483
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$6
Total Yearly Savings ($/Yr):	$6
Estimated ECM Lifetime (Yr):	15
Simple Payback	80.5
Simple Lifetime ROI	-81.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$90
Internal Rate of Return (IRR)	-16%
Net Present Value (NPV)	($411.37)

*** ECM#2 Calculations <u>DO NOT</u> include lighting changes implemented in ECM#1. If ECM #1 and #2 are implemented together the savings will be relatively lower than shown above.**

ECM #3: Pump and Motor System Upgrade

Description:

The pump station was designed and built in 1988 using a Smith and Loveless Company, pre-engineered underground pump station. A separate 10 feet in diameter wet well was constructed with a trash basket and no grinding equipment. As a consequence considerable effort is devoted to cleaning the trash basket and unclogging pump impellers. The pumps start across the line without benefit of a soft starter to reduce the electric demand charge.

This ECM #3 includes decommissioning of the Smith and Loveless dry well and all associated dry well equipment. The wet well is prepared to be outfitted with 30 hp flight brand high efficiency motor submersible pumps installed directly in the wet well on a quick disconnect rail system. The trash basket is to be replaced with a JWC brand "Muffin Monster" 3 hp grinder. The grinder is proposed to be mounted on the incoming pipe wall and fitted with a bypass. The controls are to be replaced by variable frequency drives on each pump, with a bypass, and a flow matching controller to vary the speed. The existing generator building, automatic transfer switch and generator are to be retained in the ECM. The piping between the existing wet well, the dry well and the bypass chamber is to be replaced. A magnetic flow meter is to be added to the bypass chamber or alternatively a new bypass chamber will be constructed to house a magnetic flow meter. The ECM does not provide a complete pumping system upgrade, which is addressed in Section XI Additional Recommendations.

Energy Savings Calculations:

The **Major Equipment List Audit Appendix** outlines the proposed retrofits, costs, and savings.

NJ Smart® program incentives are calculated as follows:

From the **Smart Start® Incentive Appendix**, the use of variable frequency drives for the new pumps greater than 200 hp or premium motors over 25 hp warrants an incentive of $0.16 per kWh saved provided at least 25,000 kWh are saved each year.

Smart Start® Incentive = kWh savings x $0.16/kWh
= 14,586 x $0.16
= $2,334

From the **Smart Start® Incentive Appendix** the replacement of standard motors with premium motors, fails to qualify since the kWh savings currently fall below 25,000. If the incentive threshold is lowered in the future, an ECM #3 energy savings summary is provided for future consideration.

Operations and maintenance savings are calculated as follows:

Savings cleaning = weekly cleaning of bar rack in wet well, 2 manhours each week x 52 weeks/year x $31.50 ave. labor rate for HMUA = $3,276 per year.

Savings clogging = 6 times per year (reduction to 1 time per year = net of 5) at 8 mahours per event x $31.50 ave. Labor rate for HMUA = $1,260

Total O&M savings = $4,536

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$30,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$30,000
Maintenance Savings ($/Yr):	$4,536
Energy Savings ($/Yr):	$2,334
Total Yearly Savings ($/Yr):	$6,870
Estimated ECM Lifetime (Yr):	20
Simple Payback	4.4
Simple Lifetime ROI	358.0%
Simple Lifetime Maintenance Savings	$90,720
Simple Lifetime Savings	$137,400
Internal Rate of Return (IRR)	23%
Net Present Value (NPV)	$72,208.25

*** ECM#3 Calculations are based upon a pumping system replacement with implementation of premium motor submersible pumps, VFDs, and grinder equipment together as one project. The $50 per year energy savings to remove dry well motor driven equipment and the energy savings to eliminate lights are not factor into the energy savings calculations.**

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey crated the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operation expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy technologies for Hillsborough NJ, and concluded that there is potential for solar energy generation.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the Blackwell's Mills Pump Station available area and has concluded that there is not an application for solar energy at this facility. In addition to the solar PV screening, CEG has also reviewed the applicability of wind energy. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile, refer to The Electric and Diesel Fuel Usage Profiles included within this report to reference the respective electricity and diesel fuel usage load profiles.

<u>Electricity</u>

The Electric Usage Profile demonstrates a fairly typical seasonal load profile for a pumping station that may be experiencing extraneous flow issues. There is a fairly steady yearlong electric load except for the months of May and June indicating the pump electric motors are the dominant electricity consumers at this pumping station. It appears the electric heater is only nominally used during the winter with no discernable impact on electric consumption. Peak month electric consumption is 20% above average and minimum month consumption is 10% below average. The high and low consumptions are reasonable and it appears that system extraneous flows may not be excessive. A flat load profile will allow for more competitive energy prices when shopping for alternative suppliers.

<u>Natural Gas</u>

Not Applicable.

<u>Diesel Fuel</u>

Used in standby generators only.

Tariff Analysis:

<u>Electricity:</u>

This facility receives electrical service through Public Service Electric and Gas (PSE&G) on a commercial and industrial account rate schedule. This facility's rate is based in part on a three phase service at secondary voltages. For electric supply (generation), the customer will use the utilities Basic Generation Service (BGS) or a Third Party Supplier (TPS). This facility uses Basic Generation service from the utility. Therefore, they will pay according to the BGS default service for BGS generator capacity, BGS transmission capacity, BGS energy on-peak and BGS energy off-peak. The PSE&G delivery service includes the following changes: service change, annual demand, summer demand, kWh on-peak, kWh off-peak, societal benefits, and securitization transmission.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the HTMUA service area. The primary area for potential improvement is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical average price is 16.1¢/kWh (this is the average "price to compare" if the client intends to shop for energy). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The HTMUA could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before they increase. Based on annual historical consumption (July 2008 through June 2009) and current electric rates, the HTMUA could see an improvement in its electric costs of up to 20% annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire HTMUA electric load to gain the most optimal energy costs. CEG recommends advisement for alternative sourcing and supply of energy on a "managed approach".

CEG also recommends that the municipality schedule a meeting with the current utility providers to review their utility charges and current tariff structures for electricity. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local distribution Company (LDC), the HTMUA can learn more about the competitive supply process. HTMUA can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/pbu. HTMUA should consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The Township should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier.

X. INSTALLATION FUNIDNG OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *New Jersey Environmental Infrastructure Trust* – The New Jersey Environmental Infrastructure Trust (NJEIT) works in conjunction with the New Jersey Department of Environmental Protection (NJDEP) to identify "clean water" projects and to establish an annual "priority list" for the disbursement of low interest and no interest 20 year loans. The NJEIT also administers the American Recovery and Reinvestment Act of 2009 (ARRA or "Stimulus Program"). Projects funded in FY 2009 are eligible for a 25% market rate loan (currently 4.0-4.5%) and a 75% 0% interest rate loan. Projects receiving a high priority are also eligible for a 50% loan forgiveness up to $5 million. Competition for the 50% forgiveness is severe; however, a 75/25 loan is a very attractive means for financing a project with an effective interest rate of only slightly more than 1%. Also renewable energy projects are given favorable consideration and often receive funding set asides.

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

A. The new submersible pumps, VFDs and communicator should become a part of a larger pump station upgrade. The additional items are not considered extensive since the structures, generator and chemical feed equipment appear serviceable for many years to come. We recommend the S&L dry well be closed and yard piping reconstructed to accommodate the new pumps.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide frequent air filter changes to decrease overall system power usage and maintain better indoor air quality and to protect electronic controls.

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating in its designed mechanical efficiency range, hydraulic flow capacity, designed motor efficiency and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Hillsborough MUA - Blackwell's Mills Pump Station

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY																
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Lighting Upgrade - General	$220	$150	$30	$340	$16	$2	$18	15	$270	$30	-20.6%	18.9	-2.75%	($125.12)
ECM #2	Lighting Controls	$229	$339	$85	$483	$6	$0	$6	15	$90	$0	-81.4%	80.5	-16.13%	($411.37)
ECM #3	Pump and Motor System Upgrade	$18,000	$12,000	$0	$30,000	$2,334	$4,536	$6,870	20	$137,400	$90,720	358.0%	4.4	22.50%	$72,208.25

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period*.

INSTALLATION COST AND REBATES

CONCORD ENIGNEERING GROUP

Blackwell's Mill Pumping Station

ECM 1: LIGHTING UPGRADE

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Fixture Replacement	LS	$370			$370
Utility Incentive – NJ Smart Start					($30)
Total Cost Less Incentive					$340

ECM 2: LIGHTING CONTROLS

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual – Technology Sensor	3	$110	$110	$220	$330
Daylight Sensor	1	$238	$119	$119	$238
Utility Incentive – NJ Smart Start					($85)
Total Cost Less Incentive					$483

ECM 3: PUMP AND MOTOR SYSTEM UPGRADE

	Qty	Unit Cost $	Material $	Labor $	Total $
2 pumps, 2 VFDs, communicator, misc.	1	$30,000	$18,000	$12,000	$30,000
Utility Incentive – NJ Smart Start					$0*
Total Cost Less Incentive					$30,000

*kWh savings below current threshold of 25,000 kWh per year

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508

SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of January, 2009:

Electric Chillers

Water-Cooled Chillers	\$12 - \$170 per ton
Air-Cooled Chillers	\$8 - \$52 per ton

Gas Cooling

Gas Absorption Chillers	\$185 - \$400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

\$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	\$73 - \$93 per ton
Air-to-Air Heat Pumps	\$73 - \$92 per ton
Water-Source Heat Pumps	\$81 per ton
Packaged Terminal AC & HP	\$65 per ton
Central DX AC Systems	\$40- \$72 per ton
Dual Enthalpy Economizer Controls	\$250

Ground Source Heat Pumps

Closed Loop & Open Loop	\$370 per ton

Gas Heating

Gas Fired Boilers < 300 MBH	\$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	\$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	\$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	\$300 - \$400 per unit

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

Lighting Controls – Occupancy Sensors

Wall Mounted	$20 per control
Remote Mounted	$35 per control
Daylight Dimmers	$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	$75 per fixture controlled
Daylight Dimming	$75 per fixture controlled

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

<u>Portfolio Manager "Statement of Energy Performance"</u>

Not applicable at this time. A Portfolio Manager for wastewater pumping stations has not been developed at the time of this audit's preparation.

MAJOR EQUIPMENT LIST
Concord Energy Group
"Blackwell's Mill Pumping Station"

Large Motors >25HP												Proposed Equipment					Savings	
Service	Location	Manufacturer	Type	Model / Number	Serial Number	Rated Horsepower hp	Speed RPM	Annual Power consumption kWh/year	Approx. Age	Remain. Life	Annual Operation hours	Retro-Unit Description	Horsepower	Unit Cost Installed	Remaining Life/ Service Life	Unit Cost for ECM Analysis	kW Savings	Yearly $ Savings
Sewage Pumps	Dry well	S&L Fairbanks Morse	30	Fairbanks Morse	08-8121-V	30	1760	29172.5	20	5	1314	Flygt Premium motor 30hp dry pit submersible pump	30	25000	0.2	5000	7293.1	$1,422.16
Sewage Pumps	Dry Well	S&L Fairbanks Morse	30	Fairbanks Morse	08-8121-V	30	1760	29172.5	20	5	1314	Flygt Premium motor 30hp dry pit submersible pump	30	25000	0.2	5000	7293.1	$1,422.16
Comminutor	Not Presently Installed											Wall mounted JWC Muffin Monster comminutor 3 hp	3	20000	0.2	4000	0	(-$510)
Magnetic Nema-3 across the line starters												Danfoss 30 hp 50-100 percent variable	30	15000	0.2	3000	Considered in Pump	
Magnetic Nema-3 across the line starters												Danfoss 30 hp 50-100 percent variable	30	15000	0.2	3000	Considered in Pump	
Miscellaneous Pump, comminutor and VFD components	Not Presently Installed											Miscellaneous Pump, comminutor and VFD components	NA	50000	0.2	10000	Considered in Pump	

DEMINIMIS EQUIPMENT LIST																		
Ventilation Blower	Wet Well	Penn Ventilator		XQ-60		1/6	1750		20									
Ventilation Blower	S&L dry well	Smith and Loveless				3/4			20			Remove					50	9.75
Sump Pump	S&L dry well	Smith and Loveless				1/2			20			Remove					50	9.75
Submersible Well Pump (wash down water)	Washdown water collection well	Crane Deming	submersible	Figure 6721		3			20									
2 each - Air Compressors	S&L dry well	Smith and Loveless				1/12			20			Relocate					50	9.75
2 each - Pump cooling blowers	S&L dry well	Smith and Loveless							20			Remove					50	9.75
Generator Engine Block Heater	Generator Building	Kohler				1.34			20									
Wet Well Mixer	Wet Well					1.9			20									
Dehumidifier	S&L dry well	Smith and Loveless				0.8			20			Remove					50	9.75
2 each - Bioxide Pumps	Wet Well	Local manufacturer																
Standby Generator	Generator Building	Kohler	Diesel			80			20									
Unit Heater	Generator Building	Chromalox	Electric			6.7			20									

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

"Blackwell's Mill Pump Station"

CEG Job #: PHB00500.01
Project: Hillsborough Energy Audit
Address: Blackwell's Mill P.S.
City: Hillsborough Twp.
Building SF: 180

DATE: 11/23/2009
KWH COST: $0.161

ECM # 1: Lighting Upgrade

EXISTING LIGHTING											PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. Fixts	No. Lamps	Fixture Type	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Exterior of Generator Superstructure	4	1	1- Lamp Incancdescent Recessed Par Fixture	100	150	0.60	60	$9.66	4	1-Lamp 23 W CFL Recessed PAR 38 MaxLite M/NSKR3823FL	26	0.10	10.4	1.6744	$11.67	$46.68	0.50	49.6	7.9856	5.85
2		Dry Well	1	2	1'x4' 2-Lamp T-12 Industrial Strip Magnetic Ballast	300	80	0.08	24	$3.86	1	1'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.06	16.5	$2.66	$100.00	$100.00	0.03	7.5	1.2075	82.82
3		Generator building	2	2	1'x4' 2-Lamp T-12 Industrial Strip Magnetic Ballast	300	80	0.16	48	$7.73	2	1'x4' 2-Lamp 32W T-8 Prism Lens/Elect Ballast; Metalux M/N GC	55	0.11	33	$5.31	$100.00	$200.00	0.05	15	2.415	82.82
4		Wet Well	2	1	1-Lamp EV type Incandescent enclosed fixture	200	100	0.20	40	$6.44	2	1-Lamp 23 W CFL Recessed PAR 38 MaxLite M/NSKR3823FL	26	0.05	10.4	$1.67	$11.67	$23.34	0.15	29.6	4.7656	4.90
		Totals	9					1.04	172	$27.69	9			0.32	70.3	$11.32		$370.02	0.72	101.7	$16.37	22.60

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CME Job #: PBM00500.01
Project: Hillsborough Energy Audit
Address: Blackwell's Mills P.S
City: Hillsborough Twp.
Building SF: 180

"Blackwell's Mills Pump Station"

DATE: 11/23/2009
KWH COST: $0.161

ECM # 2: Lighting Controls

EXISTING LIGHTING											PROPOSED LIGHTING										SAVINGS			
Line No.		Fixture Location	No. Fixts	No. Lamps	Fixture Type	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Lighting Control Description	Watts Used	Total kW	Reduction %	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Exterior of Generator Building	4	1	1- Lamp Incancdescent Recessed Par Fixture	100	150	0.60	60	$9.66	4	1	Dual technology occupancy sensor plus timer	120	0.48	20%	48	$7.73	$313.00	$313.00	0.12	12	1.932	162.01
2		Dry Well	1	2	1'x4' 2-Lamp T-12 Industrial Strip Magnetic Ballast	300	80	0.08	24	$3.86	1	2	Dual technology on/off switch plus timer	68	0.07	15%	20.4	$3.28	$110.00	$110.00	0.01	3.6	0.5796	189.79
3		Generator builidng	2	2	1'x4' 2-Lamp T-12 Industrial Strip Magnetic Ballast	300	80	0.16	48	$7.73	2	2	Dual technology on/off switch plus timer	68	0.14	15%	40.8	$6.57	$110.00	$220.00	0.02	7.2	1.1592	189.79
4		Wet Well	2	1	1-Lamp EV type Incandescent enclosed fixture	200	100	0.20	40	$6.44	2	1	Dual technology on/off switch plus timer	85	0.17	15%	34	$5.47	$110.00	$220.00	0.03	6	0.966	227.74
		Totals	9					1.04	172	$27.69	9				0.85		143.2	$23.06		$863.00	0.19	28.8	$4.64	186.12