TOWN OF DOVER

WATERWORKS PARK

100 PRINCETON AVENUE
DOVER, NJ 07801

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

Electric Utility Provider:	Jersey Central Power & Light
Electric Utility Rate Structure:	General Service Primary
Third Party Supplier:	Hudson Energy
Natural Gas Utility Provider:	New Jersey Natural Gas
Utility Rate Structure:	GSL
Third Party Supplier:	N/A

The electric usage profile represents the actual electrical usage for the facility. 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 generation 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 gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

A review of the utility bills for this facility reveals a small winter spike in electrical costs probably due to the electric unit heaters in the various well pump houses. It is apparent that the heat dissipated by the water pump motors and electrical gear is supporting the heating load and keeping this cost to a small increase versus the summer month electrical costs. Also, the temperatures in the well pump houses are not maintained for human comfort, only for freeze and condensation prevention.

The main service building has new (only 3 years old) heating and cooling equipment that is relatively efficient. The main booster pump house has a very old (37 years) boiler that is in very poor condition and extremely inefficient.

The following table is a breakdown of the estimated annual energy consumption for the pump house and the main service building.

ENERGY USE BREAKDOWN		
Description	**Electric (kWh)**	**Natural Gas (therm)**
Main Service Building	102,800	9,584
Pump House	2,274,890	0

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Jersey Central Power & Light
Rate: General Service Primary
Meter No: G51954768
Account No: 100 001 663 440
Third Party Utility Provider: Hudson Energy
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND KW	TOTAL BILL
Jul-14	196,865	434.9	$22,123
Aug-14	183,524	436.8	$20,188
Sep-14	181,071	434.9	$19,918
Oct-14	188,281	434.9	$20,711
Nov-14	175,101	448.3	$19,261
Dec-14	183,727	451.2	$20,210
Jan-15	213,509	459.8	$23,486
Feb-15	217,097	463.7	$23,881
Mar-15	233,885	464.6	$25,727
Apr-15	209,955	456.0	$23,095
May-15	203,712	456.0	$22,408
Jun-15	190,963	434.9	$21,006
Totals	**2,377,690**	**464.6 Max**	**$262,013**

AVERAGE DEMAND **448.0 KW average**
AVERAGE RATE **$0.110** **$/kWh**

Figure 1
Electricity Usage Profile

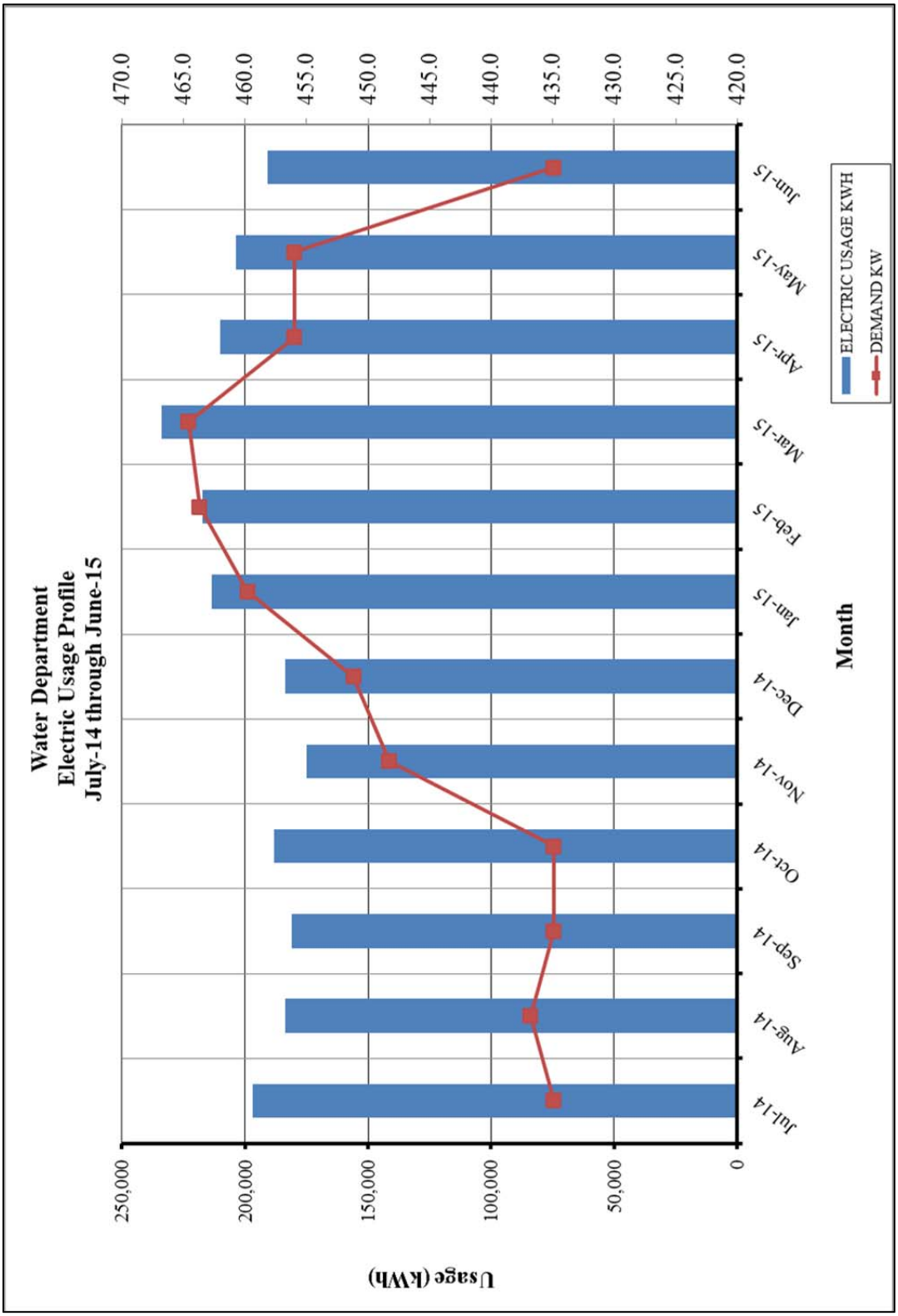
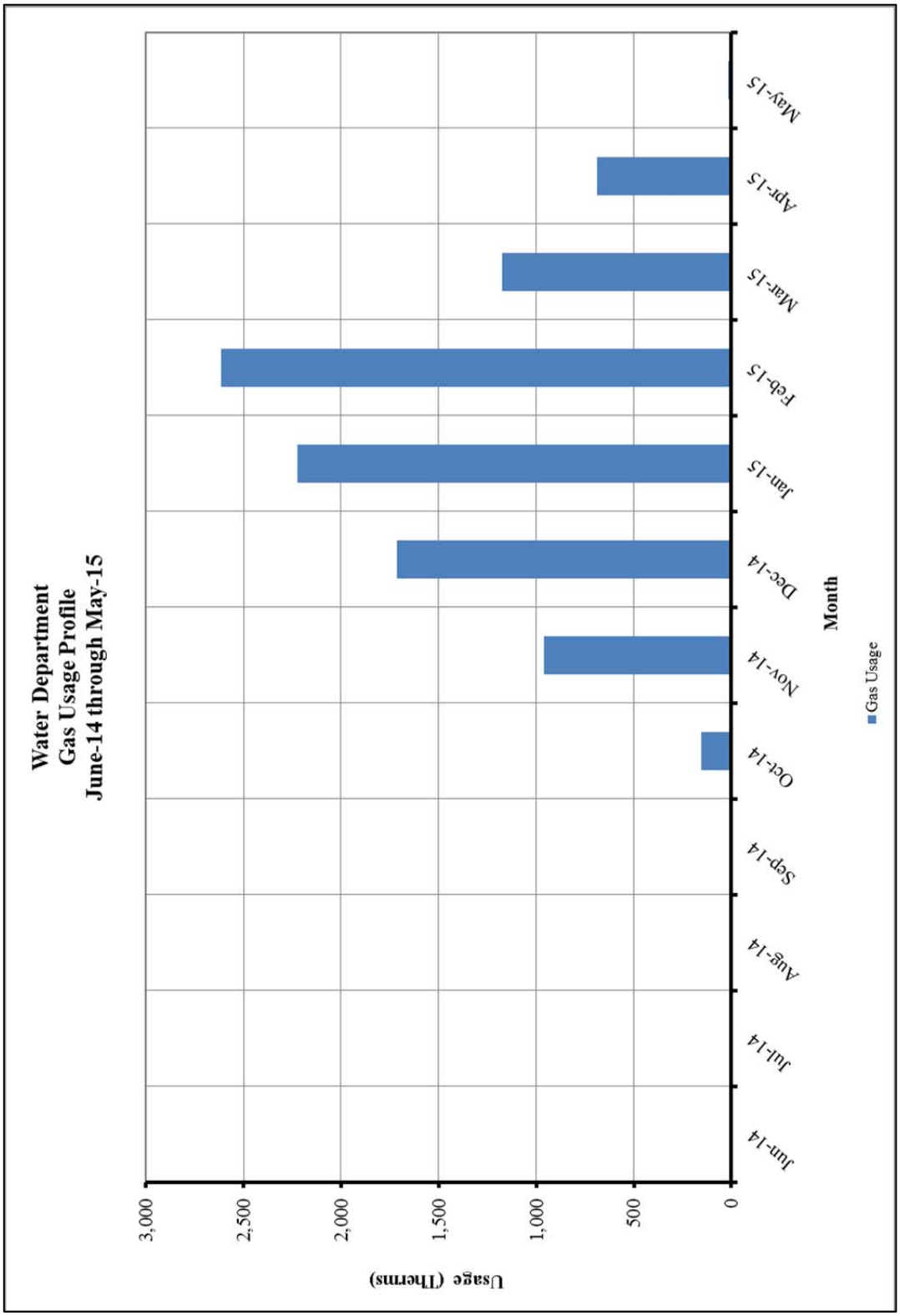


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: New Jersey Natural Gas		
Rate: GSL		
Meter No: 00267465		
Account No: 07-1132-5905-1Y		
Third Party Utility Provider: -		
TPS Meter No: -		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jun-14	12.00	$205.00
Jul-14	9.00	$203.00
Aug-14	9.00	$203.00
Sep-14	8.00	$202.00
Oct-14	152.00	$268.00
Nov-14	962.00	$600.00
Dec-14	1,716.00	$961.00
Jan-15	2,223.00	$1,245.00
Feb-15	2,616.00	$1,465.00
Mar-15	1,175.00	$940.00
Apr-15	687.00	$618.00
May-15	15.00	$261.00
TOTALS	**9,584.00**	**$7,171.00**
AVERAGE RATE:	**$0.75**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY 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. Building Benchmarking data is collected and analyzed within the Commercial Building Energy Consumption Survey (CBECS), performed by the Energy and Information Administration (EIA). Building data is grouped by function types and tabulated, from which a median site and source energy intensity is determined. The national median or PEER Group Comparable in this instance is the middle value of the national population meaning half the buildings use more energy, and half use less. The PEER Group EUI allows us to compare the relative efficiency of the audited building to that of an average building with the same or similar primary function (i.e. group type).

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:

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

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

Table 3

Energy Use Index Summary

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	102,800			350,959	3.14	1,102,012
NATURAL GAS		9,584		958,400	1.05	1,006,320
TOTAL				1,309,359		2,108,332

*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document.

	AUDITED BUILDING		**PEER COMPARISON**	
BUILDING TYPE	Offices/Garage		Other	
BUILDING AREA	11,000	SQUARE FEET		
BUILDING SITE EUI	*119.03*	kBtu/SF/YR	78.8	kBtu/SF/YR
BUILDING SOURCE EUI	*191.67*	kBtu/SF/YR	123.1	kBtu/SF/YR

56%	Less Efficient than PEER Comparison

The electric usage above only includes the main service building consumption. The booster and well water pumps would skew the building specific benchmark; therefore they have been removed from the total electric consumption shown in the table above.

III. FACILITY DESCRIPTION

The Town of Dover Municipal Water Treatment Plant is located at 100 Princeton Avenue in Dover, New Jersey. The primary function of this facility is the treatment of water pumped from three (3) water wells on this property and one (1) water well at the Crane Hill Pumping Station. The main service facility is comprised of the superintendent's office, lunch/locker rooms, meter repair room, water commission board room, lab, central offices, mechanical room, storage rooms and repair garage.

There are three (3) 50-HP well pumps at the facility that are used on a demand basis and pull water from a deep aquifer. There is little benefit for a variable speed drive on a constant flow pump or a pump with a high static head such as these well pumps that have to lift water from a deep aquifer.

The main booster plant has three (3) 200-HP pumps which have premium efficient motors but no variable speed controllers. Variable frequency (speed) drives are ideal for varying flow or head in these pumps which have relatively low static head.

The following table summarizes the characteristics of the water pumps:

Well No.	No. of Pumps	Motor HP	Premium Eff. Motor	Drive	Hours of Operation
1	1	50	Yes	Constant Speed	3,200 hrs./year
3	1	50	Yes	Constant Speed	3,200 hrs./year
5	1	50	Yes	Constant Speed	3,200 hrs./year
Crane Hill Pumping Station	1	50	Yes	Constant Speed	--
Booster Pumps	3	200	Yes	Constant Speed	Each Pump = Average of 3,820 hrs./year

Concord Engineering recommends that the Town of Dover evaluate the total pumping system, and not just the pump, in order to maximize energy savings. There is normally much more potential in the proper application of a pump and the total system design, then in the pump efficiency alone. This evaluation should include the following:

1. *The pumps that consume the greatest annual kilowatt hours (the greatest energy savings potential) should be studied first.*

2. *Collect key detailed information on these pumps and systems, including:*

    a. *What are the required flow rates both minimum and maximum?*

    b. *Perform field tests to determine the actual system head vs. the pump flow curves.*

    c. *Determine the actual pressure drops across the various system valves and other major components at the average flow rates. Measure pressure drops at the control valve when it is 100% open and at the average system flow.*

    d. *Field testing should be performed to determine what the current pump head and capacity curve and the power versus capacity curve is for each pump system.*

    e. *Pump field tests should include both pump suction and discharge pressure measurements, the heights of the suction and discharge gauges and the total head developed by the pump.*

    f. *Determine the motor efficiencies for the 200 HP motors (typical performance curves should be developed over the normal pump load range).*

    g. *Determine the efficiency versus power curve for the variable speed driver being considered.*

3. *Based on this collected data, the current annual energy cost can be calculated at the average flow rate for each pumping system.*

Occupancy Profile

The main service facility was built in 1974, operates 24 hours per day and does not shut down.

Building Envelope

The building exterior walls consist of corrugated metal siding, steel framing, and interior insulation. The roof and exterior walls have 1½ inches of insulation. The office section has insulated walls and drywall interior. The facility has minimal windows that are single pane un-insulated glass with metal frames that are in very poor condition. The metal frames are badly deteriorated from rust caused by water leakage, failed window seals, rusted spacers, and no weep holes in the window frame. Also, there is a failure of the caulking around the frames and corrosion of the metal frames.

Concord strongly recommends the replacement of the single pane windows and deteriorated metal frames/window seals to high-efficiency, double pane low-E glass with thermal break spacers, insulated glass and aluminum window frames.

The roofing is composed of a formed steel roof deck with 1½ inches of insulation.

HVAC Systems

Heating for the main service facility is provided by three (3) Burnham Model 810HE modular boilers each rated at 406 MBH of heating for a total of 1,218 MBH with a thermal efficiency of 80.5%. The heating hot water is pumped to various hot water coils throughout the facility via two (2) hot water pumps with 2 HP motors and a smaller pump with a ¾ HP motor.

The offices in the main building are heated & cooled by two (2) split air handlers with hot water heating coils and DX cooling coils. One of the units is a Carrier Model 40RUAA14 packaged air handler which is rated at 362 MBH of heating capacity and a nominal 10 tons of cooling. The other unit is a Carrier Model 40RUAA07 packaged air handler which is rated at 156 MBH of heating capacity and a nominal 5.2 tons of cooling.

The two (2) split condensing units that feed the two (2) air handling units are located outside on concrete pads. One unit is a Carrier Model 38AUZA14 air-cooled condenser rated at 12.5 tons of cooling with an efficiency of 11.0 EER. The other unit is a Carrier 38AUZA07 air-cooled condenser rated at 5.2 tons of cooling with an efficiency of 11.5 EER.

There are two (2) air stripping towers with two (2) blower fans at each tower. Each fan is an American Fan Company Model BSC-300 with a 15 HP fan motor and an efficiency of 89.5%.

The well pump buildings contain electrical unit heaters while the main booster plant has a Utica Model 275 AGB cast-iron sectional, gas-fired hot water boiler in the basement that is rated at 275 MBH input with a thermal efficiency of 67% in its present condition and age. This heating hot water boiler shows signs of flooding and has serious corrosion up to the fan section.

Concord Engineering strongly recommends that this boiler be replaced with a high-efficiency condensing boiler based on the boiler's corroded condition, age, and low thermal efficiency.

Exhaust System

The various areas of the garage, restrooms, locker rooms, mechanical room, storage room and offices are served by rooftop exhaust fans that are rated from 240 to 1,028 CFM. Fresh air is provided by a large in-line fan rated at 1,617 CFM that feeds both of the split air handling units.

HVAC System Controls

The boilers for the main building are controlled by a tekmar model 274 boiler controller that sequences each of the three (3) modular boilers based on heating demand and resets the hot water supply temperature based on outside air temperature. The new split air handling units have standalone controllers with individual thermostats in the areas that they serve. The individual

make-up air units, hot water unit heaters, electric unit heaters, wall/ceiling unit heaters, reheat coils, etc. have local/internal thermostats that control the space heating. The

Domestic Hot Water

Domestic hot water for the restrooms in the facility is provided by a Bradford White Model MI403S6 gas-fired water heater with a storage capacity of 40 gallons, input rating of 40 MBH, a thermal efficiency of 79% and a recovery of 42 Gallons/Hour at a temperature rise of 100°F

Plumbing System

The plumbing fixtures in the restrooms are not low-flow units. The sink faucets are rated at 1.0 gallon per minute. The water closets and urinals located in the restroom and locker room areas have a rating of 2.6 and 2.0 gallons per flush, respectively.

Lighting

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed list of the lighting throughout the facility and estimated operating hours per space.

IV. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of 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 manufactures 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 Appendix.

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

V. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 1
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Interior Lighting Upgrade	$23,315	$1,475	15.8	-5.1%
ECM #2	Interior Lighting Controls	$2,480	$50	49.6	-69.8%
ECM #3	Exterior Lighting Upgrade	$19,945	$1,996	10.0	50.1%
ECM #4	Boiler Replacement	$15,580	$387	40.3	-50.3%
ECM #5	NEMA Premium Efficiency Motors	$7,232	$338	21.4	-6.5%
ECM #6	Infrared Tube Unit Heaters	$17,200	$211	81.5	-81.6%
ECM #7	Variable Flow Booster Pump	$29,500	$2,685	11.0	82.0%
ECM #8	Water Conservation	$2,970	$208	14.3	-29.9%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

Table 2
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Interior Lighting Upgrade	10.0	13,407	0
ECM #2	Interior Lighting Controls	0.0	456	0
ECM #3	Exterior Lighting Upgrade	7.7	18,150	0
ECM #4	Boiler Replacement	0.0	0	515
ECM #5	NEMA Premium Efficiency Motors	1.0	3,072	0
ECM #6	Infrared Tube Unit Heaters	0.0	0	282
ECM #7	Variable Flow Booster Pump	0.0	24,411	0
ECM #8	Water Conservation	0.0	0	94

Table 3
ECM Emissions Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**GREENHOUSE GAS EMISSIONS REDUCTION**		
		CO_2 EMISSIONS (LBS)	**NO_X EMISSIONS (LBS)**	**SO_2 EMISSIONS (LBS)**
ECM #1	Interior Lighting Upgrade	20,379	38	87
ECM #2	Interior Lighting Controls	693	1	3
ECM #3	Exterior Lighting Upgrade	27,588	51	118
ECM #4	Boiler Replacement	6,026	5	0
ECM #5	NEMA Premium Efficiency Motors	4,669	9	20
ECM #6	Infrared Tube Unit Heaters	3,299	3	0
ECM #7	Variable Flow Booster Pump	37,105	68	159
ECM #8	Water Conservation	1,100	1	0
	Total Emissions Savings	**100,859**	**175**	**387**

Notes: A. Emissions Reduction based on NJCEP published factors for electric & gas.

Table 4
Facility Project Summary

FACILITY PROJECT SUMMARY TABLE					
ENERGY CONSERVATION MEASURES	**ANNUAL ENERGY SAVINGS ($)**	**PROJECT COST ($)**	**SMART START INCENTIVES**	**CUSTOMER COST**	**SIMPLE PAYBACK**
Interior Lighting Upgrade	$1,475	$26,825	$3,510	$23,315	15.8
Interior Lighting Controls	$50	$2,550	$70	$2,480	49.6
Exterior Lighting Upgrade	$1,996	$26,445	$6,500	$19,945	10.0
Boiler Replacement	$387	$16,580	$1,000	$15,580	40.3
NEMA Premium Efficiency Motors	$338	$7,232	$0	$7,232	21.4
Infrared Tube Unit Heaters	$211	$18,400	$1,200	$17,200	81.5
Variable Flow Booster Pump	$2,685	$29,500	$0	$29,500	11.0
Water Conservation	$208	$2,970	$0	$2,970	14.3
Total Project	**$7,350**	**$130,502**	**$12,280**	**$118,222**	**16.1**

Note that the measure totals in this table do not take into account interactive effects of measures; see Method of Analysis Section III in Executive Report for further explanation.

This project does not qualify for additional incentives through the Pay for Performance Program; please see the Installation Funding Options section for additional program options.

ECM #1: Interior Lighting Upgrade

Description:

The majority of the interior lighting throughout the Water Department campus is provided with fluorescent fixtures with older generation, 700 series and 741/ECO 32W T8 lamps and electronic ballasts. Although these T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with Light Emitting Diode (LED) direct replacement T8 ballast compatible lamps without compromising light output.

All of the 2'x4' T8 recessed ceiling lighting fixtures and 1'x4' surface wrap lighting fixtures located in the main service building are in good condition and would be retrofitted with the appropriate direct replacement LED bulbs. All exit signs throughout the building are currently high efficiency LED exit signs.

Any older T12 fixtures with magnetic ballasts (booster pump building, emergency generator room, well #5 building, etc.) would be replaced with the appropriate new LED lighting fixtures. The 2'x2' T8 U-lamps would be retrofitted with equivalent LED lamps.

This ECM also includes replacement of any incandescent or compact fluorescent lamps with Phillips Endura LED lamps which can be retrofit into existing incandescent/compact fluorescent lamp fixtures. LED lamps provide equivalent lumens and much longer burn hours at reduced wattages.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in each building.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	10.0
Electric Usage Savings (kWh)	13,407
Electric Cost Savings ($)	$1,475

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$26,825
NJ Smart Start Equipment Incentive ($):	$3,510
Net Installation Cost ($):	$23,315
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,475
Total Yearly Savings ($/Yr):	$1,475
Estimated ECM Lifetime (Yr):	15
Simple Payback	15.8
Simple Lifetime ROI	-5.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$22,125
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($5,706.55)

ECM #2: Interior Lighting Controls Upgrade – Occupancy Sensors

Description:

Some of the lights in the Main Service Building and Booster Pump Building are 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 room is first occupied. This is common in 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 expected to be 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 of a current wall switch, or on the ceiling to cover large areas.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the "Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways," document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors (The majority of the savings is expected to be after hours when rooms are left with lights on)

This ECM includes installation of ceiling or switch mount sensors for offices, large storage rooms, conference rooms, pump rooms, and restrooms. The larger rooms/spaces will have multiple sensors that will automatically turn off lights when the spaces are unoccupied. These new sensors will contain the latest dual-sensor technology (passive infrared and ultrasonic activated).

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 the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = (\%\ \text{Savings} \times \text{Controlled Light Energy (kWh/Yr)})$$

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

LIGHTING CONTROLS SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	0.0
Electric Usage Savings (kWh)	456
Electric Cost Savings ($)	$50

Rebates and Incentives:

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive:

Smart Start Incentive
= (# Wall mount sensors × $20 per sensor)
+ (# Ceiling mount sensors × $35 per sensor)

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,550
NJ Smart Start Equipment Incentive ($):	$70
Net Installation Cost ($):	$2,480
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$50
Total Yearly Savings ($/Yr):	$50
Estimated ECM Lifetime (Yr):	15
Simple Payback	49.6
Simple Lifetime ROI	-69.8%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$750
Internal Rate of Return (IRR)	-12%
Net Present Value (NPV)	($1,883.10)

ECM #3: Exterior Lighting Upgrades

Description:

Exterior lighting throughout the campus is provided by various types, sizes and wattages of metal halide wall-mounted fixtures. This ECM includes the replacement of existing fixtures with new higher efficiency LED lighting fixtures that require a lower energy use for the same light output. LED bulbs and diodes have an outstanding operational life time expectancy of 100,000 hours which equates to 22 years at 55% operation. This results in substantial savings in bulb replacement.

Exterior lighting fixtures are controlled via time clocks and photocells which typically operate from dusk to dawn.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

LIGHTING UPGRADE SAVINGS SUMMARY	
DESCRIPTION	**SAVINGS**
Electric Demand Savings (kW)	7.7
Electric Usage Savings (kWh)	18,150
Electric Cost Savings ($)	$1,996

Maintenance Savings and Project Costs:

Maintenance savings is negligible for this ECM and has not been included in the energy savings summary.

Project Costs were obtained from lighting vendor quotes and a local lighting contractor.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$26,445
NJ Smart Start Equipment Incentive ($):	$6,500
Net Installation Cost ($):	$19,945
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,996
Total Yearly Savings ($/Yr):	$1,996
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.0
Simple Lifetime ROI	50.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$29,940
Internal Rate of Return (IRR)	6%
Net Present Value (NPV)	$3,883.12

ECM #4: Replace Cast-Iron Sectional Boiler with High-Efficiency Condensing Boiler

Description:

There is a Utica Model 275 AGB gas-fired, cast-iron, sectional hot water boiler in the basement which supplies hot water for heating the Main Booster Pump Building. This boiler is 37 years old, shows signs of flooding damage and some of the sections are seriously corroded. The boiler has a rated output of 275 MBH and a thermal efficiency of 67% in its present age and condition. The existing boiler plant is long past its life expectancy of a typical gas-fired, hydronic, boiler heating system (25 years).

A new, high-efficiency, condensing, modular boiler could substantially improve the operating efficiency of the heating system of the booster pump building. Condensing boiler's peak efficiency tops out at 96% depending on return water temperature. Due to the operating conditions of the building (24/7), the annual average operating efficiency of the proposed condensing boiler is expected to be 96%. This is a 29% increase in efficiency over the existing boiler plant which is estimated to operate at 67% efficiency due to its age and poor condition. This ECM is based on variable supply water temperature adjusted based on outdoor temperature (outside air temperature reset).

This ECM includes installation of one (1) condensing, gas-fired, modular boiler to replace the existing modular boiler. The basis for this ECM is a Weil McLain Ultra 230 gas-fired, condensing boiler with a rated input of 194 MBH and an average thermal efficiency of 96%. The boiler installation is based on a one-for-one replacement based on capacity of the existing boiler plant.

Energy Savings Calculations:

<u>Existing Boiler – Utica 275 MBH Cast-Iron Section:</u>

Total Input	= 275 MBH (Input)
Rated Capacity	= 184 MBH (Output)
Estimated Average Combustion Efficiency	= 77% (New Condition)
Less Age/Condition & Radiation Losses	= 10%
Existing Thermal Efficiency	= 67%

<u>New Plant -- One (1) Weil McLain Ultra 230 Modular, Condensing Boiler</u>

Total Input	= 194 MBH (Input)
Rated Capacity	= 183 MBH (Output)
Estimated Average Thermal Efficiency	= 96%
Cost of Gas	= $0.75 / Therm

Existing Annual Heating Energy Production
$$= \text{Fuel Consumption} \times \text{Existing Plant Efficiency}$$

$$\text{New Annual Gas Fuel Consumption} = \frac{\text{Annual Heating Energy Production}}{\text{Fuel HHV per Unit} \times \text{New Plant Efficiency}}$$

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Boiler	New Condensing Boilers	
Existing Therms Used for Heating	1,706		
Boiler Efficiency (%)	67%	96%	29%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	114	114	
Gas Cost ($/Therm)	$ 0.75	$ 0.75	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	1,706	1,191	515
Energy Cost ($)	$1,280	$893	$387
COMMENTS:	Boiler Efficiency Based on Age of Boiler and IBR Rating		

Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure.

Project Costs are based off of RS Means Unit Cost data, vendor quotes, and local Mechanical Contractor estimates.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$16,580
NJ Smart Start Equipment Incentive ($):	$1,000
Net Installation Cost ($):	$15,580
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$387
Total Yearly Savings ($/Yr):	$387
Estimated ECM Lifetime (Yr):	20
Simple Payback	40.3
Simple Lifetime ROI	-50.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$7,740
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	($9,822.42)

ECM #5: Install NEMA Premium® Efficiency Motors

Description:

The improved efficiency of the NEMA Premium® efficient motors is primarily due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95% of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings. The electric motors driving the stripping tower blower fans (15-HP each) are candidates for replacing with premium efficiency motors. These standard efficiency motors run approximately 3,200 hours per year.

This energy conservation measure replaces these inefficient electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

There are currently no NJ OCE incentives for premium efficiency motors.

IMPLEMENTATION SUMMARY					
Location	**FUNCTION**	**MOTOR HP**	**HOURS OF OPERATION**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**
Stripping Tower #1	Blower Fan Motor	15	3,200	89.5%	91.7%
Stripping Tower #1	Blower Fan Motor	15	3,200	89.5%	91.7%
Stripping Tower #2	Blower Fan Motor	15	3,200	89.5%	91.7%
Stripping Tower #2	Blower Fan Motor	15	3,200	89.5%	91.7%

Energy Savings Calculations:

$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor Motor Efficiency = Motor Nameplate Efficiency

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric cost savings} = \text{Electric Usage Savings} \times \text{Electric Rate} \left(\frac{\$}{\text{kWh}}\right)$$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
Location	**MOTOR HP**	**LOAD FACTOR**	**EXISTING EFFICIENCY**	**NEMA PREMIUM EFFICIENCY**	**POWER SAVINGS kW**	**ENERGY SAVINGS kWH**	**COST SAVINGS**
Stripping Tower #1	15	80%	89.5%	91.7%	0.25	768	$84
Stripping Tower #1	15	80%	89.5%	91.7%	0.25	768	$84
Stripping Tower #2	15	80%	89.5%	91.7%	0.25	768	$84
Stripping Tower #2	15	80%	89.5%	91.7%	0.25	768	$84
TOTAL					**1.00**	**3,072**	**$338**

Equipment Cost:

The following table outlines the summary of motor replacement costs which were obtained from Baldor Motors and a local Electrical Contractor:

MOTOR REPLACEMENT SUMMARY					
Location	**MOTOR POWER HP**	**INSTALLED COST**	**NET COST**	**TOTAL SAVINGS**	**SIMPLE PAYBACK**
Stripping Tower #1	15	$1,808	$1,808	$84	21.40
Stripping Tower #1	15	$1,808	$1,808	$84	21.40
Stripping Tower #2	15	$1,808	$1,808	$84	21.40
Stripping Tower #2	15	$1,808	$1,808	$84	21.40
TOTAL	**Totals:**	**$7,232**	**$7,232**	**$338**	**21.40**

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$7,232
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$7,232
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$338
Total Yearly Savings ($/Yr):	$338
Estimated ECM Lifetime (Yr):	20
Simple Payback	21.4
Simple Lifetime ROI	-6.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$6,760
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($2,203.41)

ECM #6: Infra-Red Radiant Unit Heaters in Service Garage

Description:

The Main Service Building garage has four (4) hot water unit heaters mounted from the ceiling steel structure. These hot water unit heaters are beyond the ASHRAE service life of 20 years and are rated at approximately 60,000 Btuh output each. These units along with two (2) make-up air units are used to keep the garage at 65°F in the wintertime.

This ECM would upgrade the water department garage by replacing these four (4) hot water unit heaters with more efficient gas-fired, infrared tube heaters rated at 90% thermal efficiency. When compared to convective heating systems, infrared heaters provide more efficient heating in large areas and garages because they only heat people and objects (not air). The demand from the garage for heating hot water from the boilers will be reduced. The installation will require new gas lines run to the garage and flues for exhaust venting. The units would be mounted across the overhead doors and at a perimeter wall. The basis of design for replacement of the existing hot water unit heaters with infrared tube heating is the Reznor VPS Series of infrared heaters or equivalent.

Energy Savings Calculations:

Gas Savings (Therms)

$$= \frac{OF \times \left(\left(CAPY_{Bi} \times EFF_{Q} \right) - \left(CAPY_{Qi} \times EFF_{B} \times ICF \right) \right) \times HDD_{mod} \times 24}{\Delta T \times HC_{fuel} \times EFF_{B} \times ICF \times EFF_{Q}}$$

Where:

OF = Oversize Factor, usually OF = 0.8 for standard boiler
$CAPY_{Bi}$ = Total input capacity of the baseline unit heater in btu/hour
$CAPY_{Qi}$ = Total input capacity of the qualifying infra-red radiant unit heater in btu/hour
HDD_{mod} = HDD by zone and building type HDD_{mod} = 4,604
24 = 24 hours/day
ΔT = design temperature difference (ΔT = 14 for Newark)
HC_{fuel} = 100,000 btu/therm of natural gas
EFF_Q = Efficiency of qualifying heater. For Infrared EFF_Q=90%
EFF_B = Efficiency of baseline heater. For hot water unit heaters EFF_B=70% (Boiler Eff.)
ICF = Infrared Compensation Factor (ICF = 0.8 for IR Heaters, 1.0 for hot water unit heaters)

INFRARED HEATING CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing HW Unit Heaters	New Gas Fired Infrared Heating	
Existing Nat Gas (Therms)	2,670	0	
Overall Efficiency (%)	80.5%	90%	9.5%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	215	215	
Gas Cost ($/Therm)	0.75	0.75	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	2,670	2,388	282
Energy Cost ($)	$2,003	$1,791	$211
COMMENTS:			

Cost of four (4) Reznor VPT-60-30 infrared tube heaters installed plus new gas line, exhaust gas flue, and wall thermostat is 4 x $4,600 = $18,400.

Project costs obtained from Reznor and local Mechanical Contractor.

NJ Smart Start® Program Incentive for low intensity infrared heating is $300 per unit.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$18,400
NJ Smart Start Equipment Incentive ($):	$1,200
Net Installation Cost ($):	$17,200
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$211
Total Yearly Savings ($/Yr):	$211
Estimated ECM Lifetime (Yr):	15
Simple Payback	81.5
Simple Lifetime ROI	-81.6%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$3,165
Internal Rate of Return (IRR)	-16%
Net Present Value (NPV)	($14,681.10)

ECM #7: Install VFD on 200-HP Booster Pump Motor

Description:

The booster pump system uses constant volume pumps to supply water to the various boroughs. These pumps operate continuously to maintain pressure in the system. The pump system consists of three (3) 200 horsepower motors with each pump rated at a maximum flow of 3,500 gallons per minute at 160 feet of head pressure. During normal domestic cold water demand, one pump runs continuously while during high demand periods (6-9 AM and 5-8 PM) a second pump comes on line. The third pump is used for high peak flows and as a stand-by should of one of the other two pumps fail to come on or one of the pumps is off-line for maintenance.

This ECM would install one (1) variable frequency drive controlled by a differential pressure transducer on the 200-HP booster pump that has the most kilo-watt hours of usage. Since this motor is already premium efficiency and invertor duty rated, the project would only need a variable speed controller, differential pressure transducer and controls to convert this pump to variable flow. To determine the actual system head versus flow curve, field measurements will need to be taken at various flow rates.

Energy Savings Calculations:

$$\text{Pump Power HP} = \frac{\text{Flow}_{\text{GPM}} \times \text{Head}_{\text{ft-hd.}}}{3960 \times \eta_{\text{Pump}} \times \eta_{\text{motor}}}$$

$$\text{Energy Consumption (kWh)} = \text{Motor HP} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{Hours of operation (Hr)} \times \frac{1}{\eta_{\text{motor}}}$$

$$\text{Energy Cost (\$)} = \text{Total Comsumption(kWh)} \times \text{Average Cost of Electric} \left(\frac{\$}{\text{kWh}}\right)$$

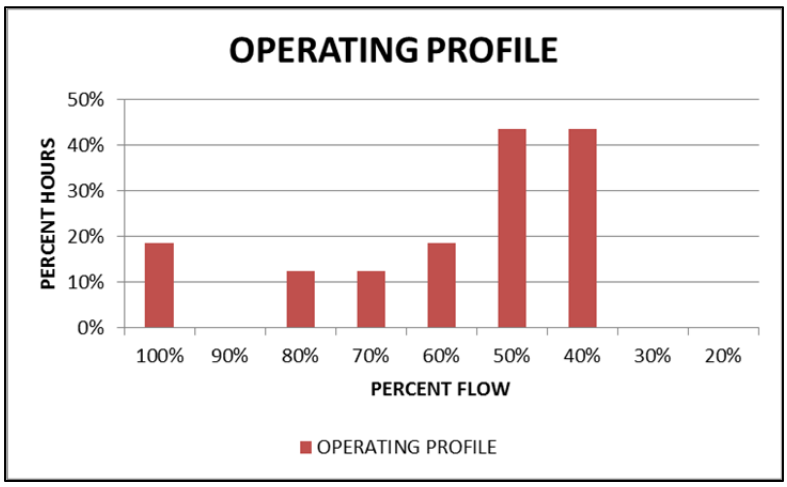
Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

Q = Flow, n = RPM, p = total pressure

$$\frac{Q_2}{Q_1} = \frac{n_2}{n_1} \qquad \frac{p_2}{p_1} = \left(\frac{n_2}{n_1}\right)^2 \qquad \frac{HP_2}{HP_1} = \left(\frac{n_2}{n_1}\right)^3$$

200-HP BOOSTER PUMP VFD CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CV Pump	VFD Pump	
Flow Control	Throttle	VFD	-
Motor Nameplate HP	200.0	200.0	
Average Flow (GPM)	3500	2800	-
Head (Ft)	130	100	-
Pump Efficiency (%)	65.0%	65.0%	-
Motor Efficiency (%)	89.5%	89.5%	0.0%
Operating Hrs	4400	4400	-
Estimated Power (HP)	197.5	121.5	75.96
Elec Cost ($/kWh)	0.110	0.110	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Demand (kW)	111.7	111.7	0.0
Electric Energy (kWh)	430,930	406,518	24,411
Electric Energy Cost ($)	$47,402	$44,717	$2,685

Estimated Operating Profile with Variable Speed Drive:



Maintenance Savings and Project Costs:

No maintenance cost savings were estimated for this measure. The estimated cost for a 200-HP variable speed drive, differential pressure transducer, controls, etc. is $29,500.

Project Costs are based off of RS Means Unit Cost data, vendor quotes, and local Mechanical Contractor estimates.

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$29,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$29,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$2,685
Total Yearly Savings ($/Yr):	$2,685
Estimated ECM Lifetime (Yr):	20
Simple Payback	11.0
Simple Lifetime ROI	82.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$53,700
Internal Rate of Return (IRR)	7%
Net Present Value (NPV)	$10,446.02

REM #1:

Description:

The Waterworks Building is not a suitable application for the installation of solar. The roof availability is limited and is sloped in a northerly direction. The roof structure also appears insufficient to support the additional weight due to panels. The ground area around the building is also heavily shaded from trees. Based on these factors solar is not recommended at the facility.

VI. 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. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

E. Turn off computers when not in use. Ensure computers are not running in screen saver mode.

F. Replace any old CRT Monitors with LED/LCD Type Monitors, which can draw as much as a quarter the power of an equivalent CRT monitor.

G. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING

Town of Dover - Waterworks Park

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	Interior Lighting Upgrade	$15,140	$11,685	$3,510	$23,315	$1,475	$0	$1,475	15	$22,125	$0	-5.1%	15.8	-0.65%	($5,706.55)
ECM #2	Interior Lighting Controls	$1,800	$750	$70	$2,480	$50	$0	$50	15	$750	$0	-69.8%	49.6	-12.22%	($1,883.10)
ECM #3	Exterior Lighting Upgrade	$17,230	$9,215	$6,500	$19,945	$1,996	$0	$1,996	15	$29,940	$0	50.1%	10.0	5.57%	$3,883.12
ECM #4	Boiler Replacement	$8,980	$7,600	$1,000	$15,580	$387	$0	$387	20	$7,740	$0	-50.3%	40.3	-5.90%	($9,822.42)
ECM #5	NEMA Premium Efficiency Motors	$4,672	$2,560	$0	$7,232	$338	$0	$338	20	$6,760	$0	-6.5%	21.4	-0.63%	($2,203.41)
ECM #6	Infrared Tube Unit Heaters	$9,200	$9,200	$1,200	$17,200	$211	$0	$211	15	$3,165	$0	-81.6%	81.5	-16.22%	($14,681.10)
ECM #7	Variable Flow Booster Pump	$20,000	$9,500	$0	$29,500	$2,685	$0	$2,685	20	$53,700	$0	82.0%	11.0	6.54%	$10,446.02
ECM #8	Water Conservation	$1,350	$1,620	$0	$2,970	$208	$0	$208	10	$2,082	$0	-29.9%	14.3	-5.99%	($1,194.01)

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* .

APPENDIX B

Concord Engineering Group, Inc.

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VOORHEES, NEW JERSEY 08043
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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 from July 1, 2015 to June 30, 2016, further details including how to apply, forms, and calculated incentive values can be found the Clean Energy Website. (www.njcleanenergy.com)

Electric Chillers

Water-Cooled Chillers	Constant Speed: Base: $8 - $30 per ton Performance Add: $2 - $2.25 per ton Variable Speed: Base: $12 - $44 per ton Performance Add: $2 - $4.00 per ton
Air-Cooled Chillers	Constant Speed: Base: $20 per ton Performance Add: $3.50 per ton Variable Speed: Base: $90 - $92 per ton Performance Add: $4.00 per ton

Energy Efficiency must comply with ASHRAE 90.1-2013

Gas Cooling

Gas Absorption Chillers (Indirect & Direct-Fired)	$185 - $450 per ton

Desiccant Systems

$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	$73 - $92 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
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	$75 per thermostat
A/C Economizing Controls	≤ 5 tons $85/unit; >5 tons $170/unit

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Hot Water Gas Fired Boilers < 300 MBH	Non-Condensing: $0.95 per MBH, Minimum $400 per unit Condensing: $2.00 per MBH, Minimum $1000 per unit
Hot Water Gas Fired Boilers ≥ 300 - 1500 MBH	Non-Condensing: $1.75 per MBH Condensing: $2.20 per MBH Minimum $1000 per unit
Hot Water Gas Fired Boilers >1500 - ≤ 2500 MBH	Non-Condensing: $1.50 per MBH Condensing: $2.20 per MBH
Hot Water Gas Fired Boilers >2500 - ≤ 4000 MBH	Non-Condensing: $1.30 per MBH Condensing: $2.00 per MBH
Steam, Except Natural Draft, Gas fired Boilers < 300 MBH	$1.40 per MBH, Minimum $400 per unit
Steam, Except Natural Draft, Gas fired Boilers ≥ 300 – 1500 MBH	$1.20 per MBH
Steam, Except Natural Draft, Gas fired Boilers > 1500 – 2500 MBH	$1.20 per MBH
Steam, Except Natural Draft, Gas fired Boilers > 2500 – 4000 MBH	$1.00 per MBH
Steam, Natural Draft < 300 MBH	$1.40 per MBH, Minimum $300 per unit
Steam, Natural Draft ≥ 300 - 1500 MBH	$1.00 per MBH
Steam, Natural Draft >1500 - ≤ 2500 MBH	$0.90 per MBH
Steam, Natural Draft >2500 - ≤ 4000 MBH	$0.70 per MBH
All Types Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$400 per unit, AFUE ≥ 95%
Boiler Economizing Controls	$1,200 - $2,700
Low Intensity Infrared Heating	$300 - $500 per unit

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons, 0.67 energy factor or better	$50 per unit
Gas-Fired Water Heaters > 50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH
Gas Fired Tankless Water Heaters	$300 per unit

Ground Source Heat Pumps

Closed Loop	$450 per ton, EER ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps ≥ 20 hp	$60 per VFD rated hp
Rotary Screw Air Compressors ≥ 25 hp	$5,250 to $12,500 per drive
Centrifugal Fan Applications on Constant Volume HVAC Systems	$80 per VFD rated hp, maximum $6,000 per drive
Cooling Towers ≥ 10 hp	$60 per VFD rated hp
Boiler Fans ≥ 5 HP	$65 to $155 per hp
Boiler Feed Water Pumps ≥ 5 HP	$60 to $155 per hp
Commercial Kitchen Hood up to 50 HP	Retrofit $55 – $300 per hp New Hood $55 - $250 per hp

Prescriptive Lighting

T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	$10 per fixture
For retrofit of T-8 fixtures by permanent de-lamping & new reflectors (Electronic ballast replacement required)	$5 per fixture
T-5 and T-8 High Bay Fixtures	$25 - $150 per fixture
HID ≥ 100w Replace with new induction fixture. (must be 30% less watts/fixture than HID system)	$70 per fixture
HID ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture

Prescriptive Lighting - LED

LED Architectural Floor and Spot Luminaires	$50 per fixture
LED Bollard Fixtures	$50 per fixture
LED Display Case Lighting	$30 per display case
LED Fuel Pump Canopy	$100 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	$150 per fixture
LED High-Bay-Aisle Lighting	$150 per fixture
LED Linear Ambient Luminaires (Indirect, Indirect/Direct, Direct/Indirect, Direct)	2’ Fixtures - $20/fixture 3’ Fixtures - $30/fixture 4’ Fixtures - $45/fixture 6’ Fixtures - $60/fixture 8’ Fixtures - $75/fixture
LED Linear Replacement Lamps (2’ & 4’ only)	$5 per lamp
Luminaires for Ambient Lighting of Interior Commercial Spaces (1x4, 2x2, 2x4 New Fixtures and Retrofit Kits)	1x4 LED - $15 per fixture 2x2 LED - $15 per fixture 2x4 LED - $25 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	$100 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	$50 per fixture
LED Outdoor Wall-Mounted Area Luminaries	$100 per fixture
LED Parking Garage Luminaries	$100 per fixture
LED Retrofit Kits for Large Outdoor Pole / Arm-Mounted Area and Roadway Luminaires	$150 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	$30 per 4 foot $42 per 5 foot $65 per 6 foot
LED Shelf-Mtd. Display & Task Lights	$15 per linear foot

LED Stairwell and Passageway Luminaires	$40 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	$30 per fixture
LED Wall-Wash Lights	$30 per fixture
EnergyStar Commercial Lighting Fixtures	$5 to $10 per fixture
EnergyStar Screw and Pine-Based Bulbs	$5 to $10 per lamp

Lighting Controls – Occupancy Sensors

Wall Mounted (Existing Facilities Only)	$20 per control
Remote Mounted (Existing Facilities Only)	$35 per control
Daylight Dimming Controls	$45 per fixture controlled
Occupancy Based hi-low Dimming Control	$35 per fixture controlled
Occupancy Sensor Remote Mounted High-Bay (Existing Facilities Only)	$35 per control

Refrigeration Doors/Covers

Energy-Efficient Doors/Covers for Installation on Open Refrigerated Cases	$100 per door
Aluminum Night Curtains for Installation on Open Refrigerated Cases	$3.50 per linear foot

Refrigeration Controls

Door Heater Controls	$50 per control
Electric Defrost Controls	$50 per control
Evaporator Fan Controls	$75 per control
Novelty Cooler Shutoff	$50 per control

Refrigerator / Freezer Case Premium Efficiency Motors

Fraction ECM Motor < 1 HP	$40 per ECM for replacement of existing shaded-pole motor

Food Service Equipment

Combination Oven/Steamer (Electric)	$1,000/oven
Combination Oven/Steamer (Natural Gas)	$750/oven
Convection Oven (Electric)	$350/oven
Convection Oven (Natural Gas)	$500/oven
Rack Oven (Natural Gas)	$1,000/single oven, $2,000/double oven
Conveyor Oven (Natural Gas)	$500/small deck $750/large deck
Fryer (Electric)	$200/vat
Fryer (Natural Gas)	$749/vat
Large Vat Fryer (Electric)	$200/vat
Large Vat Fryer (Natural Gas)	$500/vat
Griddle (Electric)	$300/griddle
Griddle (Natural Gas)	$125/griddle
Steam Cooker (Electric)	$1,250/steamer
Steam Cooker (Natural Gas)	$2,000/steamer
Insulated Holding Cabinets	$200 to $300/unit
Glass Door Refrigerators	$75 to $150/unit
Solid Door Refrigerators	$50 to $200/unit
Glass Door Freezers	$200 to $1,000/unit
Solid Door Freezers	$100 to $600/unit
Ice Machines	$50 to $500/unit
Dishwashers	$400 to $1,500/unit

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	$0.16 KWh and $1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and an IRR of at least 10%.

APPENDIX C

ENERGY STAR® Statement of Energy Performance

N/A

ENERGY STAR® Score[1]

Waterworks Park

Primary Property Type: Drinking Water Treatment & Distribution
Gross Floor Area (ft²): 11,000
Built: 1974

For Year Ending: May 31, 2015
Date Generated: February 24, 2016

1. The ENERGY STAR score is a 1-100 assessment of a building's energy efficiency as compared with similar buildings nationwide, adjusting for climate and business activity.

Property & Contact Information

Property Address	Property Owner	Primary Contact
Waterworks Park 100 Princeton Avenue Dover, New Jersey 07801	Town of Dover 37 N. Sussex Street Dover, NJ 07801 (____)____-_____	Donald Travisano 37 N. Sussex Street Dover, NJ 07801 973-366-2200 dtravisano@dover.nj.us

Property ID: 4778408

Energy Consumption and Energy Use Intensity (EUI)

Site EUI
785.7 kBtu/ft²

Source EUI
2,285.2 kBtu/ft²

Annual Energy by Fuel

Electric - Grid (kBtu)	7,685,089 (89%)
Natural Gas (kBtu)	958,035 (11%)

National Median Comparison

National Median Site EUI ()	N/A
National Median Source EUI ()	N/A
% Diff from National Median Source EUI	N/A%

Annual Emissions

Greenhouse Gas Emissions (Metric Tons CO2e/year)	1,080

Signature & Stamp of Verifying Professional

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____Date: _____

Licensed Professional

Donald Travisano
37 N. Sussex Street
Dover, NJ 07801
973-366-2200
dtravisano@dover.nj.us

Professional Engineer Stamp (if applicable)

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering

Air Handler Units

Tag	AHU-1	AHU-2
Unit Type	Split Air Handler	Split Air Handler
Qty	1	1
Location	Garage (Ceiling-Mounted)	Lunch Room (Ceiling-Mounted)
Area Served	Front Sections	Front Sections
Manufacturer	Carrier	Carrier
Model No.	40RUAA14A2A6-0A0A0	40RUAA07A2A6-0A0A0
Serial No.	-	-
Cooling Type	Split System DX	Split System DX
Cooling Capacity (Tons)	Nominal 10-Ton	Nominal 5.2-Ton
Heating Type	Hot Water	Hot Water
Heating Input	362MBH	156 MBH
Supply Fan (HP)	2.9 HP	2.4 HP
Supply Fan VFD	☐ Yes ☑ No ☐ N/A	☐ Yes ☑ No ☐ N/A
Return Fan (HP)	N/A	N/A
Return Fan VFD	☐ Yes ☐ No ☑ N/A	☐ Yes ☐ No ☑ N/A
Approx Age	3	3
ASHRAE Service Life	20	20
Remaining Life	17	17
Comments	6,250 CFM	3,000 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Tag	UH-1 to UH-4	UH-5
Unit Type	Unit Heater	Unit Heater
Qty	4	1
Location	Garage	Mechanical Rm.
Area Served	Garage	Mechanical Rm.
Manufacturer	Wing	Wing
Model No.	2OU	W1-1/2 U
Serial No.	-	-
Cooling Type	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A
Cooling Efficiency	N/A	N/A
Heating Type	Hot Water	Hot Water
Heating Input (BTUH)	10.8 GPM	0.77 GPM
Heating Efficiency	80.5% Eff. (Boilers)	80.5% Eff. (Boilers)
Approx Age	30	30
ASHRAE Service Life	20	20
Remaining Life	0	0
Comments	2,550 CFM	256 CFM

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Tag	MUA-1, 2	EUH
Unit Type	Ceiling-Mounted MUA	Electric Unit Heater
Qty	2	5
Location	Garage	Various Pump Houses
Area Served	Garage	Various Pump Houses
Manufacturer	Wing	TPI
Model No.	FAS-HC-24	-
Serial No.	-	-
Cooling Type	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A
Cooling Efficiency	N/A	N/A
Heating Type	Hot Water	Electric
Heating Input (BTUH)	23.5 GPM	5kW to 10 kW
Heating Efficiency	80.5% Eff. (Boilers)	97%
Approx Age	30	5
ASHRAE Service Life	20	20
Remaining Life	0	15
Comments	3,000 CFM	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Terminal Units

Tag	RC-1, 2	EH	UH
Unit Type	Reheat Coils	Wall & Ceiling Unit Heater	Unit Heater
Qty	2	2	1
Location	AC-1 and AC-2 Ductwork	Entrance Vestibule and Showers	Clorine Room
Area Served	Front Sections	Shower Room & Entrance Vestibule	Clorine Room
Manufacturer	-	-	-
Model No.	-	-	-
Serial No.	-	-	-
Cooling Type	No Cooling	No Cooling	No Cooling
Cooling Capacity (Tons)	N/A	N/A	N/A
Cooling Efficiency	N/A	N/A	N/A
Heating Type	Electric	Electric	Hot Water
Heating Input (BTUH)	5 kW	5 kW	25,000 BTUH
Heating Efficiency	97%	97%	80.5% Eff. (Boilers)
Approx Age	30	20	20
ASHRAE Service Life	20	20	20
Remaining Life	0	0	0
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Boilers

Tag	B-1, 2 & 3	B-4
Unit Type	Cast-Iron Sectional (Water)	Cast-Iron Sectional (Water)
Qty	3	1
Location	Main Building Boiler Room	Main Pump Building (Basement)
Manufacturer	Burnham	Utica
Model No.	P810HENEI-L2	275 AGB
Serial No.	11367557	1-78
Input Capacity	505 MBH	275 MBH
Output Capacity	406 MBH	184 MBH
Approx. Efficiency % (Present Condition)	80.5%	67.0%
Fuel Type	Natural Gas	Natural Gas
Approx Age	3	37
ASHRAE Service Life	25	25
Remaining Life	22	0
Comments	Total of 1,515 MBH Input and 1,218 MBH Output	Signs of flooding along the base of the unit. Several sections severely corroded.

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Domestic Water Heaters

Tag	DHW-1
Unit Type	Atmospheric Vent Gas Water Heater
Qty	1
Location	Boiler Room
Area Served	Entire Facility
Manufacturer	Bradford White
Model #	MI403S6EN12
Serial #	ZB2804461
Storage Size (Gal)	40
Input Capacity	40,000 BTUH
Recovery (Gal/Hr)	42 GPH
Efficiency %	79%
Fuel	Natural Gas
Approx Age	12
ASHRAE Service Life	15
Remaining Life	3
Comments	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag	P-3	P-4
Unit Type	Pipe-mounted	Pipe-mounted
Qty	1	1
Location	Mechanical Room	Mechanical Room
System Served	UH-1 thru UH-5	MAU-1, 2
Manufacturer	-	-
Model #	-	-
Serial #	-	-
Horse Power	2.0	2.0
Flow Rate (GPM)	No tag on pump	No tag on pump
Head Pressure (FTHD)	No tag on pump	No tag on pump
Motor Manufacturer	Baldor	Baldor
Motor Frame	56CZ	56CZ
Electrical Power (V/P/HZ)	208/3/60	208/3/60
Motor RPM	3,450	3,450
Motor Efficiency %	85.5%	85.5%
Pump VFD	☐ Yes ☑ No ☐ N/A	☐ Yes ☑ No ☐ N/A
Approx Age	3	3
ASHRAE Service Life	18	18
Remaining Life	15	15
Comments		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag	P-5	
Unit Type	Pipe-mounted	Base-mounted
Qty	1	1
Location	Mechanical Room	Crane Hill Pumping Station
System Served	HC-1, 2	Crane Hill Pumping Station
Manufacturer	Grundfus	No tag on pump
Model #	UPS 40-160 F	No tag on pump
Serial #	-	No tag on pump
Horse Power	3/4	50
Flow Rate (GPM)	13-110 GPM	No tag on pump
Head Pressure (FTHD)	1 to 45 Feet Max	No tag on pump
Motor Manufacturer	Grundfus	Baldor
Motor Frame	-	326TS
Electrical Power (V/P/HZ)	208/1/60	230/460 Volts
Motor RPM	3,450	1760
Motor Efficiency %	-	93.0%
Pump VFD	☐ Yes ☑ No ☐ N/A	☐ Yes ☑ No
Approx Age	3	
ASHRAE Service Life	18	18
Remaining Life	15	18
Comments	Two-Speed Pump	Premium Efficiency/High Trust

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag		
Unit Type	Base-Mounted	Base-mounted
Qty	1	1
Location	Well No. 1	Well No. 3 Building
System Served	Well No. 1	Well No. 3 Building
Manufacturer	No tag on pump	No tag on pump
Model #	No tag on pump	No tag on pump
Serial #	No tag on pump	No tag on pump
Horse Power	50	50
Flow Rate (GPM)	No tag on pump	No tag on pump
Head Pressure (FTHD)	No tag on pump	No tag on pump
Motor Manufacturer	U. S. Electrical Motors	U. S. Electrical Motors
Motor Frame	326TP	326TP TE
Electrical Power (V/P/HZ)	230/460 Volts	230/460 Volts
Motor RPM	1760	1765
Motor Efficiency %	93.0%	91.7%
Pump VFD	☐ N/A	☐ Yes ☐ No ☐ N/A
Approx Age		
ASHRAE Service Life		18
Remaining Life		18
Comments		Premium Efficiency/High Trust

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag		
Unit Type	Base-mounted	Base-mounted
Qty	1	1
Location	Well No. 5 Building	Main Pumping Station
System Served	Well No. 5 Building	Main Pumping Station
Manufacturer	No tag on pump	No tag on pump
Model #	No tag on pump	No tag on pump
Serial #	No tag on pump	No tag on pump
Horse Power	50	200
Flow Rate (GPM)	No tag on pump	No tag on pump
Head Pressure (FTHD)	No tag on pump	No tag on pump
Motor Manufacturer	Emerson Motor Company	U. S. Electrical Motors
Motor Frame	326TP	445TP WP1
Electrical Power (V/P/HZ)	230/460 Volts	230/460 Volts
Motor RPM	1780	1780
Motor Efficiency %	94.5%	95.4%
Pump VFD	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A
Approx Age		
ASHRAE Service Life	18	18
Remaining Life	18	18
Comments	Premium Efficiency/High Trust	Premium Efficiency/High Trust

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Pumps

Tag		
Unit Type	Base-mounted	Base-mounted
Qty	1	1
Location	Main Pumping Station	Main Pumping Station
System Served	Main Pumping Station	Main Pumping Station
Manufacturer	No tag on pump	No tag on pump
Model #	No tag on pump	No tag on pump
Serial #	No tag on pump	No tag on pump
Horse Power	200	200
Flow Rate (GPM)	No tag on pump	No tag on pump
Head Pressure (FTHD)	No tag on pump	No tag on pump
Motor Manufacturer	U. S. Electrical Motors	Emerson Motor Company
Motor Frame	445TP WP1	H445TPA
Electrical Power (V/P/HZ)	230/460 Volts	230/460 Volts
Motor RPM	1780	1785
Motor Efficiency %	95.4%	95.8%
Pump VFD	☐ Yes ☐ No ☐ N/A	☐ Yes ☐ No ☐ N/A
Approx Age		
ASHRAE Service Life	18	18
Remaining Life	18	18
Comments	Premium Efficiency/High Trust	Premium Efficiency/High Trust

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Condensing Units

Tag	CU-1	CU-2
Unit Type	Standard Air-Cooled	Standard Air-Cooled
Qty	1	1
Location	Outside on Pad	Outside on Pad
Area/Unit Served	AHU-1	AHU-2
Manufacturer	Carrier	Carrier
Model No.	38AUZA14A0…	38AUZA07A0…
Serial No.	2112C93847	1612C93073
Refrigerant Type	R-410a	R-410a
Cooling Capacity	12.5 Nominal Tons	6 Nominal Tons
Cooling Efficiency	11.0 EER	11.5 EER
Volts / Phase / Hz	208/3/60	208/3/60
Approx Age	3	3
ASHRAE Service Life	20	20
Remaining Life	17	17
Comments		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Fans

Tag	EF-1 thru EF-6	EF-7	EF-8
Unit Type	Up Blast	Up Blast	Up Blast
Qty	6	1	1
Location	Roof	Roof	Roof
Area Served	Garage	Garage	Front Office Restrooms
Manufacturer	Loren Cook	Engwald	Loren Cook
Model #	15UC2B	EBS	7UC15D
Motor (HP)	1/6	3/4	0.05
Fan RPM	N/A	N/A	N/A
Motor Efficiency	N/A	N/A	N/A
Electrical (V/H/P)	120/60/1	120/60/1	120/60/1
Approx Age	20	20	20
ASHRAE Service Life	20	20	20
Remaining Life	0	0	0
Comments	1,028 CFM	700 CFM	240 CFM

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Fans

Tag	EF-9	EF-10	EF-11
Unit Type	Up Blast	Up Blast	In-line
Qty	1	1	1
Location	Roof	Roof	Toilet Room
Area Served	Water Commission Board Room	Lunch/Locker Room	Toilet Room Intake
Manufacturer	Loren Cook	Loren Cook	Loren Cook
Model #	12UCO12B	12UCO12B	12CV17D
Motor (HP)	1/6	1/6	1/3
Fan RPM	N/A	N/A	N/A
Motor Efficiency	N/A	N/A	N/A
Electrical (V/H/P)	120/60/1	120/60/1	120/60/1
Approx Age	20	20	20
ASHRAE Service Life	20	20	20
Remaining Life	0	0	0
Comments	883 CFM	883 CFM	1,617 CFM

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering

Fans

Tag	Stripping Tower Blower Fans
Unit Type	Industrial Fan
Qty	4
Location	Stripping Tower
Area Served	Stripping Tower
Manufacturer	American Fan Company
Model #	RCS-300
Motor (HP)	15
Fan RPM	1081
Motor Efficiency	89.50%
Electrical (V/H/P)	460/60/3
Approx Age	22
ASHRAE Service Life	20
Remaining Life	0
Comments	13,600 CFM Each Runs 2,190 Hrs. per Year

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

APPENDIX E

CEG Project #: IC15676
Facility Name: Waterworks Park
Address: 100 Princeton Avenue
City, State, Zip Dover, NJ 07801

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST				
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
1	Lobby	3000	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	1	0.06	186	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	72	0.04	114	$13	0	No New Controls	0	0.0%	0	$0	$44.00	$47.50	$91.50	$10.00	6.50	$0.00	$0.00	$0.00	FALSE	-
2	Lobby	3000	2-Lamp 13 Watt CFL Recessed High-Hat	2	26	2	0.05	156	Existing to Remain	No Change	2	26	0	0.05	156	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
3	Men's Restroom	2600	2-Lamp 13 Watt CFL Ceiling Globe	2	26	1	0.03	68	Existing to Remain	No Change	2	26	0	0.03	68	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	$1.49	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	67.24
3	Women's Restroom	2600	2-Lamp 13 Watt CFL Ceiling Globe	2	26	1	0.03	68	Existing to Remain	No Change	2	26	0	0.03	68	0.00	0	$0	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	14	$1.49	$0.00	$0.00	$0.00	$0.00	-	$50.00	$50.00	$100.00	FALSE	67.24
1	Janitor's Closet	400	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	2	0.12	50	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	19	0.08	30	$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	$0.42	$88.00	$95.00	$183.00	$20.00	48.74	$50.00	$50.00	$100.00	FALSE	236.74
1	Central Office	3000	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	16	0.99	2,976	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	16	0.38	1,152	0.61	1,824	$201	0	No New Controls	0	0.0%	0	$0	$704.00	$760.00	$1,464.00	$160.00	6.50	$0.00	$0.00	$0.00	FALSE	-
1	Office	3000	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	6	0.37	1,116	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	432	0.23	684	$75	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	86	$9.50	$264.00	$285.00	$549.00	$60.00	6.50	$200.00	$50.00	$250.00	FALSE	26.30
1	Office	3000	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	7	0.43	1,302	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	7	0.17	504	0.27	798	$88	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	101	$11.09	$308.00	$332.50	$640.50	$70.00	6.50	$200.00	$50.00	$250.00	$35.00	19.39
1	Sup't Office	3000	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	7	0.43	1,302	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	7	0.17	504	0.27	798	$88	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	101	$11.09	$308.00	$332.50	$640.50	$70.00	6.50	$200.00	$50.00	$250.00	FALSE	22.55
1	Board Room	1200	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	12	0.74	893	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	12	0.29	346	0.46	547	$60	0	No New Controls	0	0.0%	0	$0	$528.00	$570.00	$1,098.00	$120.00	16.25	$0.00	$0.00	$0.00	FALSE	-
2	Board Room	1200	2-Lamp 13 Watt CFL Recessed High-Hat	2	26	4	0.10	125	Existing to Remain	No Change	2	26	0	0.10	125	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
1	Lunch & Locker Room	1200	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	6	0.37	446	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	173	0.23	274	$30	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	35	$3.80	$264.00	$285.00	$549.00	$60.00	16.25	$200.00	$50.00	$250.00	$35.00	56.56
8	Lunch & Locker Room	1200	3-Lamp 2x4 F32T8 Recessed, Prismatic	3	93	3	0.28	335	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	3	36	3	0.11	130	0.17	205	$23	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	26	$2.85	$198.00	$285.00	$483.00	$45.00	19.40	$200.00	$50.00	$250.00	FALSE	87.68
5	Men's Toilet	2600	2-Lamp 2x2 F32T8 U Lamps Recessed Prismatic	2	62	1	0.06	161	Re-Lamp / Reflector	Philips LED T8 InstaFit U-Lamp (16.5W) with semi Specular Reflector Kit	2	33	1	0.03	86	0.03	75	$8	0	No New Controls	0	0.0%	0	$0	$60.00	$47.50	$107.50	$10.00	11.76	$0.00	$0.00	$0.00	FALSE	-
9	Shower	400	1-Lamp 6"x4' F32T8Ceiling Vaportite	1	32	1	0.03	13	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	1	12	1	0.01	5	0.02	8	$1	0	No New Controls	0	0.0%	0	$0	$22.00	$47.50	$69.50	$5.00	73.30	$0.00	$0.00	$0.00	FALSE	-
4	Record Storage Room	400	2-Lamp 1x4 F32T8 Surface Wrap	2	62	2	0.12	50	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	19	0.08	30	$3	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	4	$0.42	$88.00	$95.00	$183.00	$20.00	48.74	$50.00	$50.00	$100.00	FALSE	236.74
1	Kitchenette	800	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	2	0.12	99	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	2	0.05	38	0.08	61	$7	0	No New Controls	0	0.0%	0	$0	$88.00	$95.00	$183.00	$20.00	24.37	$0.00	$0.00	$0.00	FALSE	-
5	Rest Room	2600	2-Lamp 2x2 F32T8 U Lamps Recessed Prismatic	2	62	1	0.06	161	Re-Lamp / Reflector	Philips LED T8 InstaFit U-Lamp (16.5W) with semi Specular Reflector Kit	2	33	1	0.03	86	0.03	75	$8	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	17	$1.89	$60.00	$47.50	$107.50	$10.00	11.76	$50.00	$50.00	$100.00	FALSE	52.98
5	Restroom	2600	2-Lamp 2x2 F32T8 U Lamps Recessed Prismatic	2	62	1	0.06	161	Re-Lamp / Reflector	Philips LED T8 InstaFit U-Lamp (16.5W) with semi Specular Reflector Kit	2	33	1	0.03	86	0.03	75	$8	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	17	$1.89	$60.00	$47.50	$107.50	$10.00	11.76	$50.00	$50.00	$100.00	FALSE	52.98
4	Janitor's Closet	400	2-Lamp 1x4 F32T8 Surface Wrap	2	62	1	0.06	25	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	10	0.04	15	$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	$0.21	$44.00	$47.50	$91.50	$10.00	48.74	$50.00	$50.00	$100.00	FALSE	473.48
1	Meter Repair Room	1200	2-Lamp 2x4 F32T8 Recessed, Prismatic	2	62	4	0.25	298	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	115	0.15	182	$20	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	23	$2.53	$176.00	$190.00	$366.00	$40.00	16.25	$200.00	$50.00	$250.00	FALSE	98.64
4	Closet	400	2-Lamp 1x4 F32T8 Surface Wrap	2	62	1	0.06	25	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	1	0.02	10	0.04	15	$2	6	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	2	$0.21	$44.00	$47.50	$91.50	$10.00	48.74	$50.00	$50.00	$100.00	FALSE	473.48
7	Mechanical Room	400	2-Lamp 1x4 F32T8 Ceiling, Industrial Open	2	26	11	0.29	114	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	11	0.26	106	0.02	9	$1	0	No New Controls	0	0.0%	0	$0	$484.00	$522.50	$1,006.50	$110.00	926.14	$0.00	$0.00	$0.00	FALSE	-
7	Store Room	400	2-Lamp 1x4 F32T8 Ceiling, Industrial Open	2	62	6	0.37	149	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	58	0.23	91	$10	5	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	12	$1.27	$264.00	$285.00	$549.00	$60.00	48.74	$200.00	$50.00	$250.00	FALSE	197.29
4	Main Corridor	3000	2-Lamp 1x4 F32T8 Surface Wrap	2	62	8	0.50	1,488	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	8	0.19	576	0.30	912	$100	0	No New Controls	0	0.0%	0	$0	$352.00	$380.00	$732.00	$80.00	6.50	$0.00	$0.00	$0.00	FALSE	-
7	Garage	3000	2-Lamp 1x4 F32T8 Ceiling, Industrial Open	2	62	89	5.52	16,554	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	89	2.14	6,408	3.38	10,146	$1,116	0	No New Controls	0	0.0%	0	$0	$3,916.00	$4,227.50	$8,143.50	$890.00	6.50	$0.00	$0.00	$0.00	FALSE	-
6	Main Service Building	3000	LED Exit Signs 2 Watts	1	2	18	0.04	108	Existing to Remain	No Change	1	2	0	0.04	108	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
10	Main Service Building	4000	150 Watt MH Wall-Mount	1	185	10	1.85	7,400	Replace	RAB LED 26W Slim Wall Pack	1	26	10	0.26	1,040	1.59	6,360	$700	0	No New Controls	0	0.0%	0	$0	$2,700.00	$950.00	$3,650.00	$1,000.00	3.79	$0.00	$0.00	$0.00	FALSE	-
11	Main Service Building	4000	70 Watt MH Wall-Mount	1	93	8	0.74	2,976	Replace	RAB 18W LED Wall Pack	1	18	8	0.14	576	0.60	2,400	$264	0	No New Controls	0	0.0%	0	$0	$2,080.00	$1,520.00	$3,600.00	$800.00	10.61	$0.00	$0.00	$0.00	FALSE	-

			EXISTING FIXTURES						PROPOSED FIXTURE RETROFIT							RETROFIT ENERGY SAVINGS			PROPOSED LIGHTING CONTROLS						LIGHTING RETROFIT COSTS					LIGHTING CONTROLS COST					
Fixture Reference #	Location	Average Burn Hours	Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, $	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $	Material	Total Labor	Total All	Rebate Estimate	Simple Payback	Total Materials	Total Labor	Total All	Smart Start Incentive	Simple Payback
10	Front of Service Bldg.	4000	150 Watt MH Wall-Mount	1	185	3	0.56	2,220	Replace	RAB LED 26W Slim Wall Pack	1	26	3	0.08	312	0.48	1,908	$210	0	No New Controls	0	0.0%	0	$0	$810.00	$285.00	$1,095.00	$300.00	3.79	$0.00	$0.00	$0.00	FALSE	-
12	Booster Pump Bldg.	400	250 Watt HPS HID Chain-Mouted Ceiling	1	295	8	2.36	944	Replace	125 Watt LED Hi-Bay Fixture	1	125	8	1.00	400	1.36	544	$60	0	No New Controls	0	0.0%	0	$0	$5,120.00	$760.00	$5,880.00	$1,200.00	78.21	$0.00	$0.00	$0.00	FALSE	-
13	Booster Pump Bldg.	400	2-Lamp 6"x 4' F34T12 Open, Strip	2	68	4	0.27	109	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	38	0.18	70	$8	0	No New Controls	0	0.0%	0	$0	$176.00	$190.00	$366.00	$40.00	42.10	$0.00	$0.00	$0.00	FALSE	-
15	Booster Pump Bldg. - Chlorine Rm.	400	2-Lamp 6"x 4' F34T12 Strip, Vaportite	2	68	4	0.27	109	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	38	0.18	70	$8	0	No New Controls	0	0.0%	0	$0	$176.00	$190.00	$366.00	$40.00	42.10	$0.00	$0.00	$0.00	FALSE	-
14	Booster Pump Bldg.- Chlorine Room	400	13 Watt CFL Open Socket	1	13	3	0.04	16	Existing to Remain	No Change	1	13	0	0.04	16	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
16	Booster Pump Basement	400	60 Watt Incandescent Socket	1	60	6	0.36	144	Replace	TCP 13W LED A21 LED	1	13	6	0.08	31	0.28	113	$12	0	No New Controls	0	0.0%	0	$0	$72.00	$142.50	$214.50	$60.00	12.45	$0.00	$0.00	$0.00	FALSE	-
15	Booster Pump Basement	400	2-Lamp 6"x 4' F34T12 Strip, Vaportite	2	68	12	0.82	326	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	12	0.29	115	0.53	211	$23	0	No New Controls	0	0.0%	0	$0	$528.00	$570.00	$1,098.00	$120.00	42.10	$0.00	$0.00	$0.00	FALSE	-
14	Booster Pump Basement	400	13 Watt CFL Open Socket	1	13	4	0.05	21	Existing to Remain	No Change	1	13	0	0.05	21	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
10	Booster Pump Building	800	150 Watt MH Wall-Mount	1	185	6	1.11	888	Replace	RAB LED 26W Slim Wall Pack	1	26	6	0.16	125	0.95	763	$84	0	No New Controls	0	0.0%	0	$0	$1,620.00	$570.00	$2,190.00	$600.00	18.94	$0.00	$0.00	$0.00	FALSE	-
17	Booster Pump Building	800	150 MH Box Fixture	1	185	4	0.74	592	Replace	RAB LED 26W Slim Wall Pack	1	26	4	0.10	83	0.64	509	$56	0	No New Controls	0	0.0%	0	$0	$1,080.00	$380.00	$1,460.00	$400.00	18.94	$0.00	$0.00	$0.00	FALSE	-
18	Well #3 Building	400	23 Watt CFL	1	23	4	0.09	37	Existing to Remain	No Change	1	23	0	0.09	37	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
18	Well #3 Basement	400	23 Watt CFL	1	23	6	0.14	55	Existing to Remain	No Change	1	23	0	0.14	55	0.00	0	$0	0	No New Controls	0	0.0%	0	$0	$0.00	$0.00	$0.00	$0.00	-	$0.00	$0.00	$0.00	FALSE	-
11	Well #3 Bldg.	400	70 Watt MH Wall-Mount	1	93	4	0.37	149	Replace	RAB 18W LED Wall Pack	1	18	4	0.07	29	0.30	120	$13	0	No New Controls	0	0.0%	0	$0	$1,040.00	$760.00	$1,800.00	$400.00	106.06	$0.00	$0.00	$0.00	FALSE	-
11	Stripping Tower #1	400	70 Watt MH Wall-Mount	1	93	8	0.74	298	Replace	RAB 18W LED Wall Pack	1	18	8	0.14	58	0.60	240	$26	0	No New Controls	0	0.0%	0	$0	$2,080.00	$1,520.00	$3,600.00	$800.00	106.06	$0.00	$0.00	$0.00	FALSE	-
10	Stripping Tower #1	400	150 Watt MH Wall-Mount	1	185	5	0.93	370	Replace	RAB LED 26W Slim Wall Pack	1	26	5	0.13	52	0.80	318	$35	0	No New Controls	0	0.0%	0	$0	$1,350.00	$475.00	$1,825.00	$500.00	37.88	$0.00	$0.00	$0.00	FALSE	-
15	Emergency Generator Bldg.	400	2-Lamp 6"x 4' F34T12 Strip, Vaportite	2	68	6	0.41	163	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	58	0.26	106	$12	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$60.00	42.10	$0.00	$0.00	$0.00	FALSE	-
11	Stripping Tower #2	400	70 Watt MH Wall-Mount	1	93	8	0.74	298	Replace	RAB 18W LED Wall Pack	1	18	8	0.14	58	0.60	240	$26	0	No New Controls	0	0.0%	0	$0	$2,080.00	$1,520.00	$3,600.00	$800.00	106.06	$0.00	$0.00	$0.00	FALSE	-
10	Stripping Tower #2	400	150 Watt MH Wall-Mount	1	185	5	0.93	370	Replace	RAB LED 26W Slim Wall Pack	1	26	5	0.13	52	0.80	318	$35	0	No New Controls	0	0.0%	0	$0	$1,350.00	$475.00	$1,825.00	$500.00	37.88	$0.00	$0.00	$0.00	FALSE	-
13	Well #5 Bldg.	400	2-Lamp 6"x 4' F34T12 Open, Strip	2	68	6	0.41	163	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	6	0.14	58	0.26	106	$12	0	No New Controls	0	0.0%	0	$0	$264.00	$285.00	$549.00	$60.00	42.10	$0.00	$0.00	$0.00	FALSE	-
15	Well #5 Bldg.	400	2-Lamp 6"x 4' F34T12 Strip, Vaportite	2	68	4	0.27	109	Re-Lamp	Philips LED T8 InstaFit Lamp (12W)	2	24	4	0.10	38	0.18	70	$8	0	No New Controls	0	0.0%	0	$0	$176.00	$190.00	$366.00	$40.00	42.10	$0.00	$0.00	$0.00	FALSE	-
11	Well #5 Bldg.	400	70 Watt MH Wall-Mount	1	93	4	0.37	149	Replace	RAB 18W LED Wall Pack	1	18	4	0.07	29	0.30	120	$13	0	No New Controls	0	0.0%	0	$0	$1,040.00	$760.00	$1,800.00	$400.00	106.06	$0.00	$0.00	$0.00	FALSE	-
	TOTAL					**346**	**26.1**	**46,332**					**303**	**8.5**	**14,775**	**17.6**	**31,557**	**$3,471**			**15**		**456**	**$50**	**$32,370**	**$20,900**	**$53,270**	**$10,010**	**12.46**	**$1,800**	**$750**	**$2,550**	**$70.00**	**49.45**