Steven Winter Associates, Inc.
Building Systems Consultants
www.swinter.com

293 Route 18, Suite 330
East Brunswick, NJ 08816

Telephone (866) 676-1972
Facsimile (203) 852-0741

June 02, 2010

Local Government Energy Program
Energy Audit Final Report

Borough of Freehold

Water Treatment Plant
111 Waterworks Road
Freehold, NJ 07728

Project Number: LGEA55

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Freehold Water Treatment Plant is a single-story building with a total conditioned floor area of 4,600 square feet. The original Water Treatment Plant structure was built in 1890, and there have been numerous major renovations or additions since then. The following chart provides an overview of current energy usage in the building based on the analysis period of January 2009 through December 2009:

Table 1: State of Building—Energy Usage

	Electric Usage, kWh/yr	Gas Usage, Therms/yr	Current Annual Cost of Energy, $	Site Energy Use Intensity, kBtu/sq ft yr	Joint Energy Consumption, MMBtu/yr
Current	608,320	0	103,842	451.3	2,076
Proposed	593,105	0	97,264	440.0	2,024
Savings	15,215	0	6,578	11.3	52
% Savings	3	0	6	3	3

There may be energy procurement opportunities for the Water Treatment Plant to reduce annual utility costs, which are $12,775 higher, when compared to the average estimated NJ commercial utility rates.

SWA has entered energy information about the Water Treatment Plant in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. The Water Treatment Plant is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the plant is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 451.3 $\frac{kBtu}{ft^2-yr}$ compared to the national average of a building consuming 104.0 $\frac{kBtu}{ft^2-yr}$. The Water Treatment Plant shows a large Site Energy Use Intensity since it contains pumps, motors and other process equipment that are not part of the HVAC system. See ECM section for guidance on how to improve the building's rating.

Based on the current state of the building and its energy use, SWA recommends implementing various energy conservation measures from the savings detailed in Table 1. The measures are categorized by payback period in Table 2 below:

Table 2: Energy Conservation Measure Recommendations

ECMs	Savings ($)	Simple Payback Period (years)	Initial Investment, $	CO2 Savings, lbs/yr
0-5 Year	2,258	1.5	3,289	13,704
5-10 Year	4,252	8.7	36,955	12,822
>10 year	68	11.4	780	716
Total	6,578	5.5	35,924	27,242

SWA estimates that implementing the recommended ECMs is equivalent to removing approximately 3 cars from the roads each year or avoiding the need of 83 trees to absorb the annual CO_2 generated.

Other recommendations to increase building efficiency pertaining to operations and maintenance and capital improvements are listed below:

Further Recommendations:

SWA recommends that the Water Treatment Plant further explore the following:

- Capital Improvements
  - VFD feasibility study
  - Replace Seaboard unit heater in the second tank room
  - Install insulation on DHW distribution piping
  - Always install premium efficiency motors
  - Remove and replace all damaged ceiling insulation
  - Improve site drainage

- Operations and Maintenance
  - Maintain roofs
  - Maintain downspouts and cap flashing
  - Maintain exterior walls
  - Maintain doors
  - Maintain windows
  - Provide weather-stripping/air-sealing
  - Repair/seal wall cracks and penetrations
  - Provide water-efficient fixtures and controls
  - Purchase energy efficient appliances including ENERGY STAR®
  - Use smart power electric strips
  - Create an energy educational program for employees

Financial Incentives and Other Program Opportunities

There are various incentive programs that the Borough of Freehold could apply for that could also help lower the cost of installing the ECMs. Please refer to Appendix F for details.

The Borough of Freehold Water Treatment Plant is used primarily as a well house and treatment plant with a small attached office. Due to the use of the building for process equipment, heating loads are minimal and there is a large electric load used by the well pump motors and treatment processes. Based on the use of the building, SWA recommends that measures that reduce the electric load of the building are addressed first. SWA recommends that all lighting recommendations are implemented immediately to reduce the electric use of the building by the Water Department employees. Lighting recommendations will be relatively cheap and cost-effective. SWA also recommends that the Borough of Freehold hire an engineering consultant with experience in Water Treatment Plants to conduct a VFD feasibility study. Any pumps that could be retrofitted with VFDs could have a significant reduction of electrical use. SWA also recommends that programmable thermostats are installed for each electric unit heater to ensure that heating loads are kept at a minimum and the heaters are not run constantly. The office area showed a major concern for a programmable thermostat since this electric heater was observed to be left on at the highest temperature setting 24 hours per day. Rooms that contain chemical process

equipment should have a higher level of preventative maintenance to ensure that equipment, such as electric unit heaters do not corrode to the point of failure. These rooms will typically see mechanical equipment fail before the estimated useful lifetime based on chemical (chlorine) corrosion. Also, in a effort to offset the high electrical baseload, the Borough of Freehold may wish to install a Solar photovoltaic system. SWA has recommended a minimally-sized 5 kW, based on available roof area, to offset a portion of the electric baseload usage and cost.

INTRODUCTION

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize up to 100% of the cost of the audit. The Board of Public Utilities (BPUs) Office of Clean Energy has assigned TRC Solutions to administer the Program.

Steven Winter Associates, Inc. (SWA) is a 37-year-old architectural/engineering research and consulting firm, with specialized expertise in green technologies and procedures that improve the safety, performance, and cost effectiveness of buildings. SWA has a long-standing commitment to creating energy-efficient, cost-saving and resource-conserving buildings. As consultants on the built environment, SWA works closely with architects, developers, builders, and local, state, and federal agencies to develop and apply sustainable, 'whole building' strategies in a wide variety of building types: commercial, residential, educational and institutional.

SWA performed an energy audit and assessment for the Water treatment plant at 28 East Main Street. The process of the audit included facility visits on 02/17/2010, benchmarking and energy bills analysis, assessment of existing conditions, energy modeling, energy conservation measures and other recommendations for improvements. The scope of work includes providing a summary of current building conditions, current operating costs, potential savings, and investment costs to achieve these savings. The facility description includes energy usage, occupancy profiles and current building systems along with a detailed inventory of building energy systems, recommendations for improvement and recommendations for energy purchasing and procurement strategies.

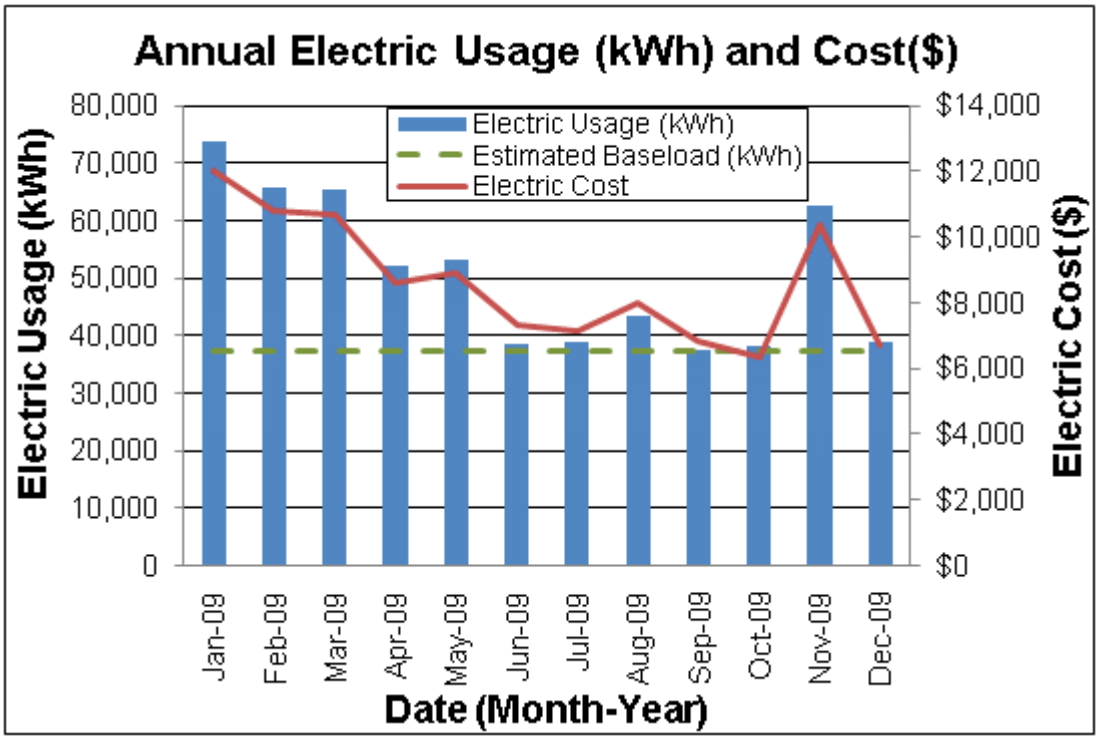
The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Borough of Freehold to make decisions regarding the implementation of the most appropriate and most cost-effective energy conservation measures for the Water treatment plant.

HISTORICAL ENERGY CONSUMPTION

1.1 Energy usage, load profile and cost analysis

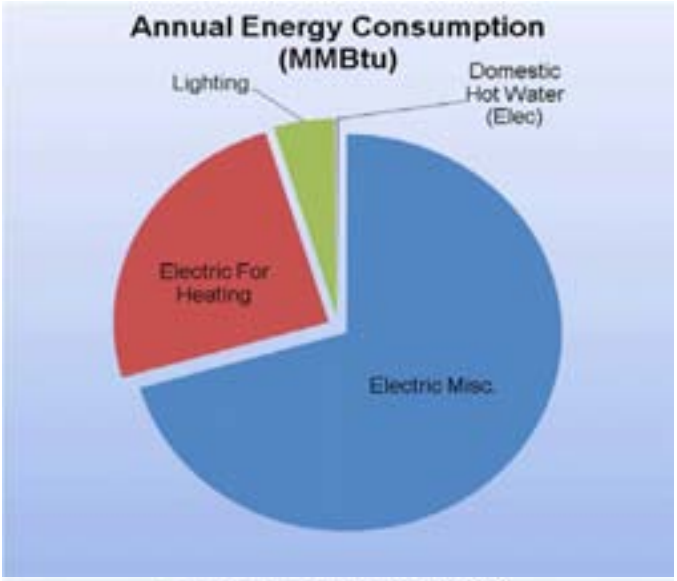
SWA reviewed utility bills from January 2008 through December 2009 that were received from the utility companies supplying the Water Treatment Plant with electricity. A 12 month period of analysis from January 2009 through December 2009 was used for all calculations and for purposes of benchmarking the building.

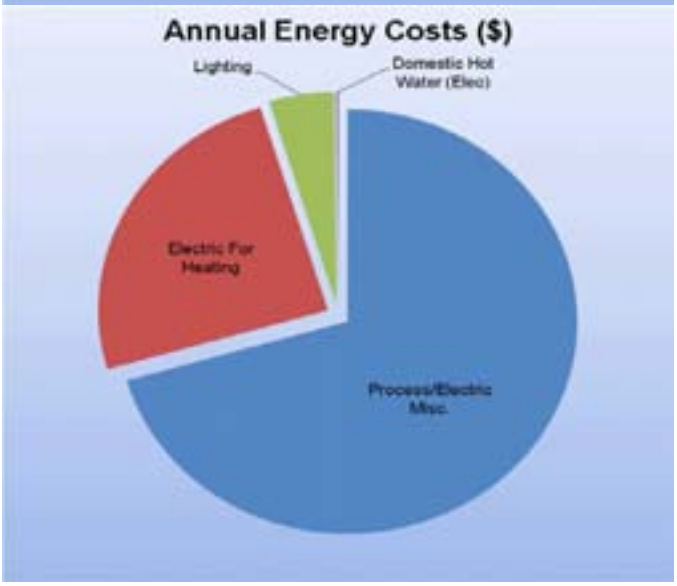
Electricity - The Water Treatment Plant is currently served by one electric meter. The Water Treatment Plant currently buys electricity from JCP&L at **an average aggregated rate of $0.171/kWh**. The plant purchased **approximately 608,320 kWh, or $103,842 worth of electricity,** in the previous year. The average monthly demand was 184.5 kW and the annual peak demand was 245.8 kW.



The following graphs, pie charts, and table show energy use for the water treatment plant based on utility bills for the 12 month period.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	1,464	71%	$73,200	71%	50
Electric For Heating	513	25%	$25,660	25%	50
Lighting	95	5%	$4,766	5%	50
Domestic Hot Water (Elec)	4	0%	$177	0%	50
Totals	2,076	100%	$103,804	100%	
Total Electric Usage	2,076	100%	$103,842	100%	50
Totals	2,076	100%	$103,842	100%	

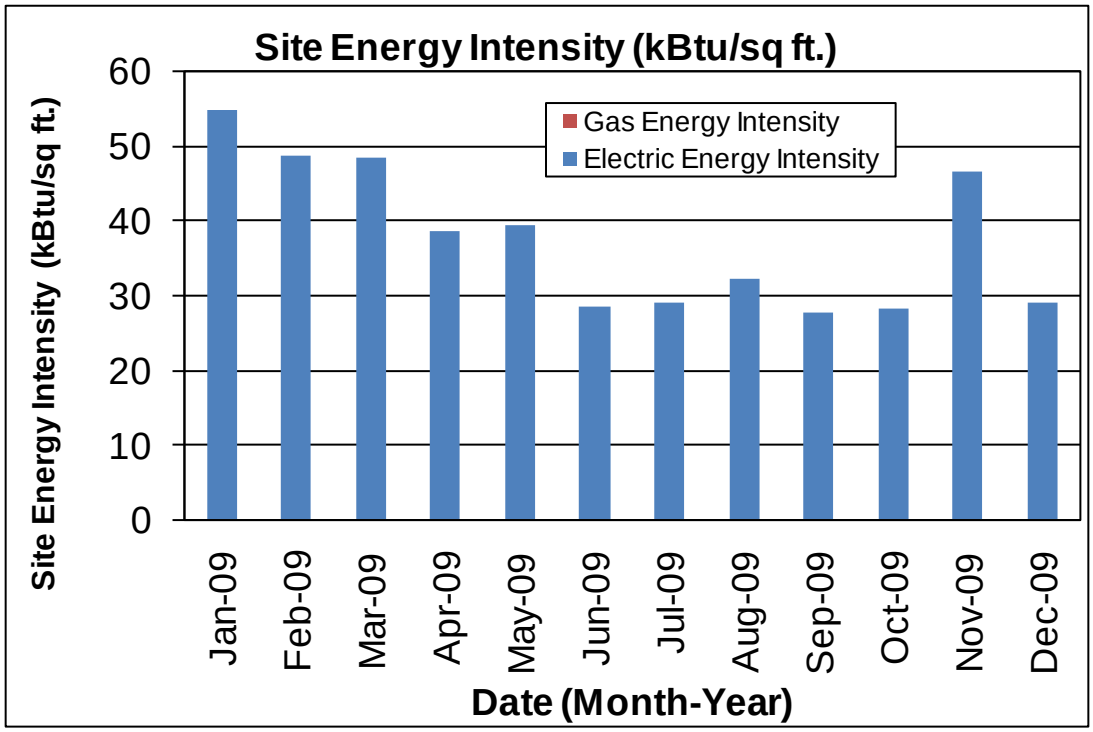




1.2. Energy Benchmarking

SWA has entered energy information about the Water Treatment Plant in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* energy benchmarking system. The water treatment plant is categorized as a non-eligible ("Other") space type. Because it is an "Other" space type, there is no rating available. Consequently, the plant is not eligible to receive a national energy performance rating at this time. The Site Energy Use Intensity is 451.3 $\frac{kBtu}{ft^2-yr}$ compared to the national average of a building consuming 104.0 $\frac{kBtu}{ft^2-yr}$. The national average is based on office buildings that do not contain large process loads. The Site Energy Use Intensity for the Water Treatment Plant is high because it includes large pumps and motors used by a relatively small floor area at the Water Treatment Plant. See ECM section for guidance on how to improve the building's rating.

Due to the nature of its calculation based upon a survey of existing buildings of varying usage, the national average for "Other" space types is very subjective, and is not an absolute bellwether for gauging performance. Additionally, the water treatment plant uses a large amount of electricity for process equipment which is not typically present in the "Other" space type buildings.



Per the LGEA program requirements, SWA has assisted the borough of Freehold to create an *Energy Star Portfolio Manager* account and share the Water treatment plant's information to allow future data to be added and tracked using the benchmarking tool. SWA has shared this Portfolio Manager Account information with the Municipality (user name of "boroughoffreehold" with a password of "*freehold")* and TRC Solutions.

1.2.1. Tariff analysis

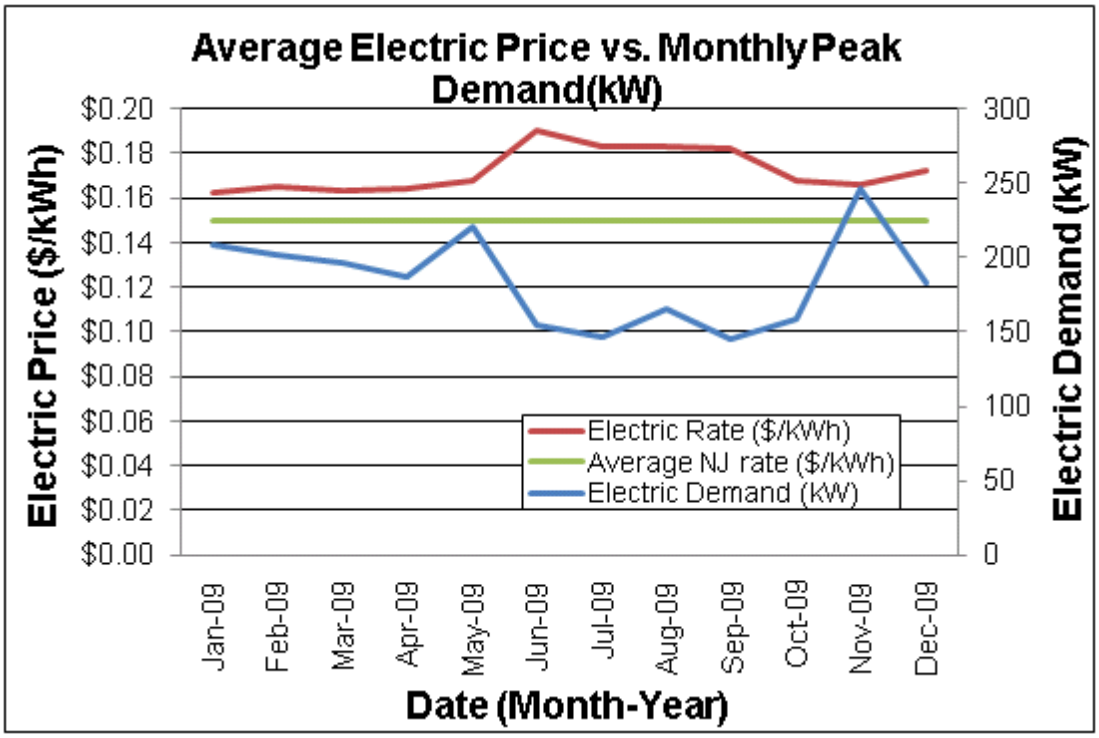
As part of the utility bill analysis, SWA evaluated the current utility rates and tariffs. Tariffs are typically assigned to buildings based on size and building type.

Tariff analysis is performed to determine if the rate that a municipality is contracted to pay with each utility provider is the best rate possible resulting in the lowest costs for electric provision. Typically, electricity prices increase during the cooling months when electricity is used by the air conditioning units.

The building is direct metered and currently purchases electricity at a general service rate for usage with an additional charge for electrical demand factored into each monthly bill. The general service rate for electric charges is market-rate based on use. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric supplier charges a market-rate price based on use, and the billing does not break down demand costs for all periods because usage and demand are included in the rate. Currently, the Borough of Freehold is paying a general service rate for natural gas. Demand is not broken out in the bill. Thus the building pays for fixed costs such as meter reading charges during the summer months.

1.2.2. Energy Procurement strategies

The average estimated NJ commercial utility rates for electric are $0.150/kWh, while the Water Treatment Plant pays a rate of $0.171/kWh. The Water treatment Plant's annual electric utility costs are $12,775 higher, when compared to the average estimated NJ commercial utility rates. Electric bill analysis shows fluctuations up to 14% over the most recent 12 month period.



SWA recommends that the Water Treatment Plant further explore opportunities of purchasing

electricity from third-party suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the Water treatment plant. Appendix C contains a complete list of third-party energy suppliers for the borough of Freehold service area.

EXISTING FACILITY AND SYSTEMS DESCRIPTION

This section gives an overview of the current state of the facility and systems. Please refer to the Proposed Further Recommendations section for recommendations for improvement.

Based on visits from SWA on dates, the following data was collected and analyzed.

2.1. Building Characteristics

- Free-standing, single-story, slab on grade building
- Constructed in 1890 with major additions and architectural alterations in 1977 and 1995 and capital improvement inspection scheduled for next year.
- Approximately 4,600 square feet of conditioned space
- The building houses offices, a control room, garage, workshop, loading bay and numerous mechanical rooms, tank storage rooms and pump rooms.

2.2. Building occupancy profiles

- Typical occupancy of 140 hours per week.
- The building is always open and in use 24 hours a day seven days a week.
- The Water Treatment Plant is occupied by 2 full time employees during each shift.

2.3. Building envelope

This is an overview of the current state of the building. SWA has included recommendations to improve the efficiency and sustainability of the building. Implementing the suggestions will reduce the energy demand.

2.3.1. Exterior Walls

The exterior wall envelope is mostly constructed of painted brick masonry units, over concrete block with no observable insulation. Other areas are constructed of only painted brick masonry units or concrete block with no observable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could visually be verified in the field by non-destructive methods.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall acceptable, age-appropriate condition with some signs of uncontrolled moisture, air-leakage and other energy-compromising issues located mostly at the side(s) of the building.

The following specific exterior wall problem spots and areas were identified:

Example of sections with signs of water damage, cracked caulking, damaged bricks and shifted blocks.

SWA recommends fixing all damaged brick masonry units and concrete block units as well as repairing any damaged caulking. SWA also recommends inspecting the exterior wall with a focus on the condition of the siding, flashing, and water damage from roof runoff and the existing gutters and downspouts. Water and moisture penetrations in walls have the potential to cause major energy losses and structural damage.

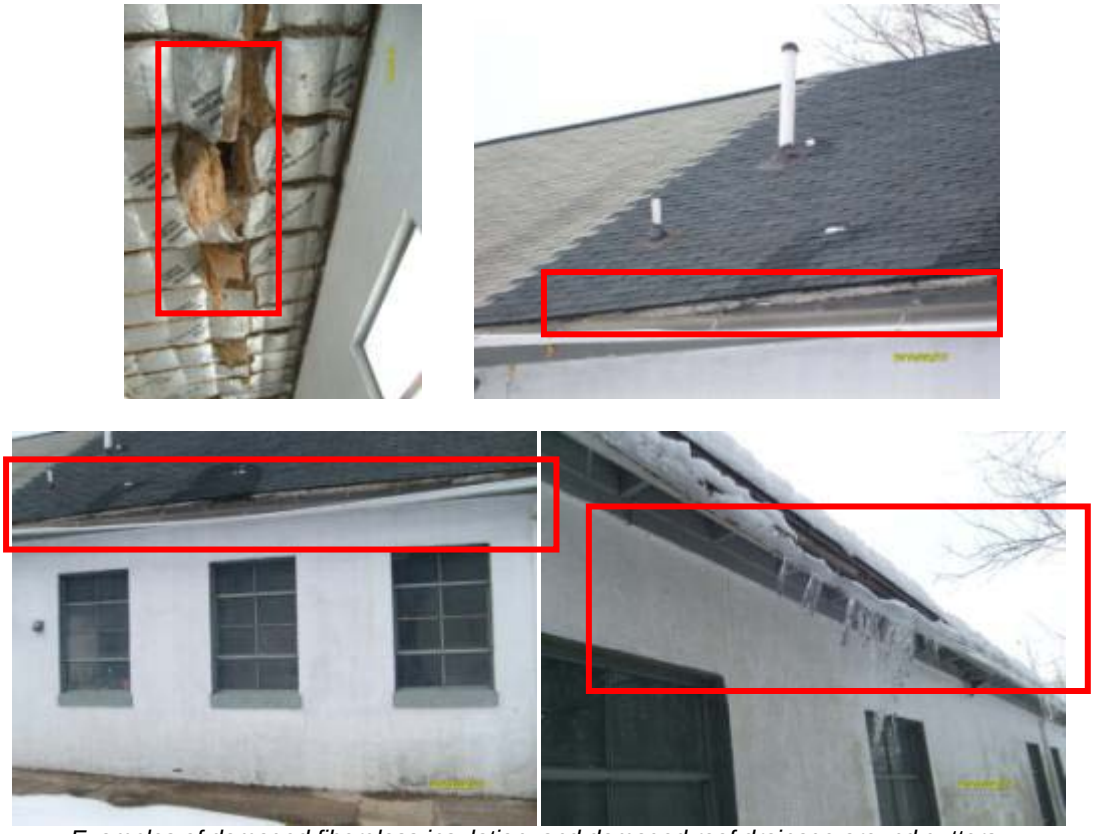
2.3.2. Roof

The building's roof is predominantly a medium-pitch hipped type over a wood structure, with an asphalt shingle finish. Despite their similar construction there is one section that was installed in 1977 and the other in 1995. Four to six inches of fiberglass batt ceiling insulation was observed throughout the different roofs. At many locations this insulation showed signs of water damage or other damage such as rips and tears.

Note: Roof insulation levels could visually be verified in the field by non-destructive methods.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall poor, age-appropriate condition, with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues detected on all roof areas.

The following typical problem spots were identified:



Examples of damaged fiberglass insulation, and damaged roof drainage around gutters.

SWA recommends inspecting the entire roof insulation for missing, or damaged metal finish and any sections that show signs of water damage or infiltration.

2.3.3. Base

The building's base is a 6" concrete slab-on grade with a perimeter footing. The building's base and its perimeter were inspected for signs of uncontrolled moisture or water presence and other energy-compromising issues. Overall the base was reported to be in acceptable/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected in some areas inside.

The following specific base problem spots were identified:

Example of poor site drainage and cracks at exterior surfaces due to water damage

2.3.4. Windows

The building contains several different types of windows.

1. Fixed type windows with a non-insulated aluminum frame, single tempered glazing and no interior or exterior shading devices.
2. Double-hung type windows with a vinyl clad frame, clear double glazing and interior mini blinds.

Typical Window Installations with some signs cracked window sills and water damage along frames.

SWA recommends inspecting the windows with a focus on the condition of the frames, glazing and signs of water damage and infiltration.

2.3.5. Exterior doors

The overhead aluminum exterior doors with glass panels were inspected and observed to be in overall good condition, as were the solid metal entrance doors.

Typical exterior doors that are in good age appropriate condition

SWA recommends checking the weather-stripping of each door on a regular basis and replacing any broken seals. Tight seals around doors will help ensure the building is kept continuously insulated. SWA also recommends the inspection of the door frames, and any sings of water damage and infiltration.

2.3.6. Building air tightness

In addition to the above mentioned recommendations, SWA suggests air-sealing, caulking and/or insulating around all plumbing, electrical, HVAC and structural envelope penetrations. This should include bottom and top plates, recessed light fixtures, electrical boxes and windows.

The air tightness of buildings helps to maximize other implemented energy measures and investments, and minimizes long-term maintenance and repair cost.

2.4. Mechanical Systems

Based on staff interviews, there were no major comfort concerns with the heating system. The building does not contain a cooling system and uses unit heaters of heating. Heat is

generated as a by-product from process equipment which in supplements the heating equipment.

Equipment

The Freehold Water Treatment Plant is heated by a combination of six electric powered space heaters. There is no cooling equipment installed at the plant. A comprehensive Equipment List can be found in Appendix A.

The heating of the building spaces is provided by six convective electric powered space heaters. All of the heaters serve their own separate spaces except for tank room # 4 which is served by two units, a Trane manufactured unit and unidentifiable unit. They were all installed approximately thirty years ago and have approximately twenty percent of their remaining useful lifecycle remaining except for the unit manufactured by Seaboard that services the second tank area. This unit has exceeded its useful remaining lifecycle; it is currently not operational as it is being repaired for chlorine corrosion.

Examples of typical unit heater installations

The entire facility is naturally ventilated except for instances of toilet and emergency exhaust.

Distribution Systems

The entire facility is serviced by unitary convective heaters therefore no ducted distribution system is present. Domestic hot water is distributed by uninsulated copper piping.

Controls

All of the existing unitary heaters including the non functioning Seaboard unit are controlled by non-programmable thermostats that are hard wired directly to their respective units. All of the units were observed to be set to the maximum temperature setting during the time of the audit.

Typical non-programmable thermostat control

2.4.1. Domestic Hot Water

The domestic hot water (DHW) for the Water Treatment Plant is provided by an electric heated Bradford-White manufactured unit with 30 gal storage and 1 electric coil heating element with a capacity of 1,500 Watts. According to the ENERGY GUIDE™ label the unit uses 4,721 kWh annually.

This heater was installed in 2000, has 30% estimated useful operating life remaining and appears in good condition.

2.4.2. Process Equipment

Due to its use as a Water Treatment Plant the building is home to numerous pieces of process equipment especially those used for water well pumping. All of the pumps were observed to be circa 1977 and have approximately 20% of their useful product life cycle remaining. The pumps were observed to have NEMA nominal efficiency motors installed with efficiencies of 93% and one of the units was installed with a variable frequency drive (VFD). However, the unit is currently used without the VFD. Some of the pumps were not installed in the treatment building although, they are located on the grounds of the facility and the characteristics of this equipment were relayed through the building personnel. A comprehensive equipment list can be found in Appendix A.

2.5. Electrical systems

2.5.1. Lighting

See attached lighting schedule in Appendix B for a complete inventory of lighting throughout the building including estimated power consumption and proposed lighting recommendations.

Interior Lighting - The Water Treatment Plant currently contains mostly recessed and ceiling suspended T12 magnetically ballasted fixtures, a couple of incandescent fixtures and a T8 electronically ballasted fixture. SWA recommends replacing the T12 fixtures with electronically ballasted T8 fixtures and incandescent fixtures with compact fluorescent light bulbs (CFL's). Based on measurements of lighting levels for each space, there are no vastly over-illuminated areas.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to wall pack Metal Halide fixtures. Exterior lighting is controlled by timers.

2.5.2. Appliances and process

SWA has conducted a general survey of larger, installed equipment. Appliances and other miscellaneous equipment account for a significant portion of electrical usage within the building. Typically, appliances are referred to as "plug-load" equipment, since they are not inherent to the building's systems, but rather plug into an electrical outlet. Equipment such as process motors, computers, computer servers, radio and dispatch equipment, refrigerators, vending machines, printers, etc. all create an electrical load on the building that is hard to separate out from the rest of the building's energy usage based on utility analysis.

2.5.3. Elevators

The Water Treatment Plant does not have an installed elevator.

2.5.4. Other electrical systems

The Water Department Plant currently houses 6 separate wells that each contains one well pump. The property includes other out-buildings that house additional well pumps; however these outbuildings are not part of the scope of work and are fed from separate electric meters. Well pumps #3,4,6,7,8 and 9 are all contained within the Water Department building.

Well #3 – This well has a 100 HP US Motors hollow shaft motor with NEMA premium efficiency of 93.0%. The well is approximately 700 feet deep and sees an average of 850 GPM.

Well #4 – This well has a 100 HP US Motors hollow shaft motor with NEMA premium efficiency of 93.0%. The well is approximately 700 feet deep and sees an average of 850 GPM.

Well #6 – This well has a 150 HP US Motors hollow shaft motor with NEMA premium efficiency of 93.0%. Prior to 1991, a VFD was installed at this motor but never properly connected. The well is approximately 1,000 feet deep and sees an average of 1,100 GPM.

Well #7 – This well has a 150 HP US Motors hollow shaft motor with NEMA premium efficiency of 93.0%. The well is approximately 1,000 feet deep and sees an average of 1,100 GPM.

Well #8 – This well has a 75 HP US Motors hollow shaft motor with NEMA premium efficiency of 93.0%. The well is approximately 350 feet deep and sees an average of 500 GPM.

Well #9 – This well has a 75 HP US Motors hollow shaft motor with NEMA premium efficiency of 93.0%. The well is approximately 270 feet deep and sees an average of 500 GPM.

RENEWABLE AND DISTRIBUTED ENERGY MEASURES

Renewable energy is defined as any power source generated from sources which are naturally replenished, such as sunlight, wind and geothermal. Technology for renewable energy is improving, and the cost of installation is decreasing, due to both demand and the availability of state and federal government-sponsored funding. Renewable energy reduces the need for using either electricity or fossil fuel, therefore lowering costs by reducing the amount of energy purchased from the utility company. Technology such as photovoltaic panels or wind turbines, use natural resources to generate electricity on the site. Geothermal systems offset the thermal loads in a building by using water stored in the ground as either a heat sink or heat source. Solar thermal collectors heat a specified volume of water, reducing the amount of energy required to heat water using building equipment. Cogeneration or CHP allows you to generate electricity locally, while also taking advantage of heat wasted during the generation process.

Existing systems

Currently there are no renewable energy systems installed in either building.

Evaluated Systems

SWA evaluated the following renewable and distributed energy measure possibilities: wind, solar photovoltaic, solar thermal collectors, combined heat and power, and geothermal.

Solar Photovoltaic

Based on utility analysis and a study of roof conditions, the Water Department building would be good candidate for a Solar Panel installation. There is sufficient roof space for panels to reasonably supplement the power consumption of the building.

Solar Thermal Collectors

Solar thermal collectors are not cost-effective for these buildings and would not be recommended due to the insufficient and intermittent use of domestic hot water throughout the building to justify the expenditure.

Geothermal

The Water Department building is not a good candidate for a geothermal installation since it would require replacement of the entire existing HVAC system, and would not be cost effective.

Combined Heat and Power

The Water Department building is not good a candidate for CHP installation and would not be cost-effective due to the size and operations of the building. Typically, CHP is best suited for buildings with a high electrical baseload to accommodate the electricity generated, as well as a means for using waste heat generated. The Water Department building has a high electric baseload but would not have a significant way to use the additional waste heat generated. Typical applications include buildings with an absorption chiller, where waste heat would be used efficiently.

PROPOSED ENERGY CONSERVATION MEASURES

Energy Conservation Measures (ECMs) are recommendations determined for the building based on improvements over current building conditions. ECMs have been determined for the building based on installed cost, as well as energy and cost-savings opportunities.

Recommendations: Energy Conservation Measures

ECM#	Description of ECMs with 0-5 Year Payback
1	Install (2) new CFL fixtures
2	Install (22) new T8 fluorescent fixtures
3	Install (3) new Occupancy Sensors
	Description of ECMs with 5-10 Year Payback
4	Install 5 kW Photovoltaic system
5	Install (4) new Pulse Start Metal Halides
	Description of ECMs with >10 Year Payback
6	Install (6) Programmable Thermostats

ECM#1: Install (2) new CFL fixtures

On the day of the site visit, SWA completed a lighting inventory of the Borough of Freehold Water Department building (see Appendix B). The existing lighting inventory contained 2 inefficient incandescent lamps. SWA recommends that each incandescent lamp is replaced with a more efficient, Compact Fluorescent Lamp (CFL). CFLs are capable of providing equivalent or better light output while using less power.

Installation cost:

Estimated installed cost: $30 (includes $20 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1	30	701	0.1	0	0.5	204	324	5	1,619	0.1	53	11	11	1,445	1,255

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 5 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs.

ECM#2: *Install (22) new T8 Fluorescent Fixtures*

On the day of the site visit, SWA completed a lighting inventory of the Borough of Freehold Water Department Building (see Appendix B). The existing lighting inventory contained mostly inefficient T12 fluorescent fixtures with magnetic ballasts. SWA recommends replacing each existing fixture with more efficient, T8 fluorescent fixtures with electronic ballasts. T8 fixtures with electronic ballasts provide equivalent or better light output while reducing energy consumption by 30% when compared to a T12 fixture with magnetic ballast.

Installation cost:

Estimated installed cost: $2,659 (includes $660 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
2	2,659	6,114	1.3	0	4.5	745	1,790	15	26,857	1.5	9	1	1	18,410	10,947

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 5 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – T8 fixtures with electronic ballasts ($15 per fixture)*

Please see Appendix F for more information on Incentive Programs.

ECM#3: *Install (3) new Occupancy Sensors*

On the day of the site visit, SWA observed that the Water Department Building did not contain any lighting that was operated via occupancy sensors. SWA identified 3 areas within the Water Department Building that could benefit from the installation of occupancy sensors. Please see Appendix B for a detailed lighting inventory.

Installation cost:

Estimated installed cost: $600 (includes $90 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program, ENERGY STAR®*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
3	600	839	0.2	0	0.6	0	143	15	2,152	4.2	3	0	0	1,088	1,502

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Wall-mounted occupancy sensors ($20 per sensor).*

Please see Appendix F for more information on Incentive Programs.

ECM#4: *Install a 5 kW Solar Photovoltaic system*

Description:

Currently, the Water Department Building does not use any renewable energy systems. Renewable energy systems such as photovoltaic panels, can be mounted on the building roofs, and can offset a portion of the purchased electricity for the building. Power stations generally have two separate electrical charges: usage and demand. Usage is the amount of electricity in kilowatt-hours that a building uses from month to month. Demand is the amount of electrical power that a building uses at any given instance in a month period. During the summer periods, when electric demand at a power station is high due to the amount of air conditioners, lights, equipment, etc. being used within the region, demand charges go up to offset the utility's cost to provide enough electricity at that given time. Photovoltaic systems not only offset the amount of electricity use by a building, but also reduce the building's electrical demand, resulting in a higher cost savings as well. The Water Department Building is not eligible for a 30% federal tax credit, available only to residential buildings. Instead, the Borough of Freehold may consider applying for a grant and / or engage a PV generator / leaser who would install the PV system and then sell the power at a reduced rate. JCP&L provides the ability to buy SRECs at $600 / MWh or best market offer. There are several possible locations for a 5 kW PV installation on the building roofs and away from shade.

Installation cost:

Estimated installed cost: $30,000 (Includes $12,000 in labor cost)
Source of cost estimate: *Similar Projects*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
4	30,000	5,900	5.0	0	4.4	0	4,009	25	100,223	7.5	2	0	0	22,484	10,564

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the field visit and using the billing analysis aggregate utility rate. SWA estimated the cost and savings of the system based on past PV projects. SWA projected physical dimensions based on a typical Polycrystalline Solar Panel (230 Watts, model #ND-U230C1). PV systems are sized based on Watts and physical dimensions for an array will differ with the efficiency of a given solar panel (W/sq ft). A commercial multi-crystalline 230 Watts panel (37.0 volts, 8.24 amps) has 17.5 square feet of surface area (13. 1 Watts per square foot). A 5 kW system needs approximately 22 panels, which would take up 385 square feet. The installation of a renewable Solar Photovoltaic power generating system could also serve as a good educational tool and exhibit for the community.

Rebates/financial incentives:

- *NJ Clean Energy – Renewable Energy Incentive Program (REIP) (based on $1 per Watt installed for systems under 50kW)*
- *NJ Clean Energy – Solar Renewable Energy Certificate (SREC) program. Each time a system generates 1,000 kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The building must also become net-metered in order to earn SREC's as well as sell power back to the electric grid. A total of $3,000/year has been incorporated into the above costs for a period of 15 years; however it requires proof of performance, application approval and negotiations with the utility.*

Please see Appendix F for more information on Incentive Programs.

ECM#5: *Install (4) new Pulse Start Metal Halide fixtures*

On the day of the site visit, SWA completed a lighting inventory of the Borough of Freehold Water Department Building (see Appendix B). The existing lighting inventory contained 4 inefficient Probe Start Metal Halide fixtures located on the exterior of the building. SWA recommends replacing each existing fixture with more efficient, pulse start metal halide. Pulse start metal halides can be installed at lower wattages than probe start technology since the quality of light does not degrade over time, which is anticipated when sizing a probe start metal halide fixture.

Installation cost:

Estimated installed cost: $1,855 (includes $240 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
5	1,855	1,261	0.3	0	0.9	27	243	15	3,639	7.6	1	0	0	1,000	2,258

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA also assumed an aggregated 5 hrs/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:

- *NJ Clean Energy – SmartStart – Metal Halide with Pulse Start ($25 per fixture)*

Please see Appendix F for more information on Incentive Programs.

ECM#6: *Install (6) Programmable Thermostats*

On the day of the site visit, SWA observed 6 electric unit heaters within the Water Department building that were controlled by non-programmable thermostats. One of the six thermostats, which is located in the office are is always set to the highest temperature setting. The building currently has much of the heating load met by waste heat from process equipment and therefore the electric unit heaters are only needed for the coldest periods of weather. SWA recommends installing programmable thermostats for each electric unit heater. These thermostats should be set to reduce the temperature when the building is not occupied. In addition, these programmable thermostats should be set to a relatively low minimum temperature, so that they are only operated when waste heat is not capable of meeting the heating load of the building and also to prevent freezing at night time.

Installation cost:

Estimated installed cost: $780 (includes $180 of labor)
Source of cost estimate: RS *Means; Published and established costs, NJ Clean Energy Program, ENERGY STAR®*

Economics:

ECM #	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
6	780	400	0.1	0	0.3	0	68	15	1,026	11.4	0	0	0	25	716

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumed that temperatures would be setback based on the operation schedule of the building.

Rebates/financial incentives:

- *None*

Please see Appendix F for more information on Incentive Programs.

PROPOSED FURTHER RECOMMENDATIONS

Capital Improvements

Capital Improvements are recommendations for the building that may not be cost-effective at the current time, but that could yield a significant long-term payback. These recommendations should typically be considered as part of a long-term capital improvement plan. Capital improvements should be considered if additional funds are made available, or if the installed costs can be shared with other improvements, such as major building renovations. SWA recommends the following capital improvements for the water treatment plant:

- VFD feasibility study – Well #6 contains a US Motors hollow shaft motor that is currently not operated by a VFD. Prior to 1991, a VFD was installed by a Water Department employee but was never properly connected. SWA recommends that a feasibility study is performed in order to determine the feasibility of a VFD on Well #6 as well as all other wells at the building. The feasibility study should also address whether the VFD that is currently installed but not operated is appropriate for the pump on Well #6.

- Replace Seaboard unit heater located in second tank room – SWA observed that the Seaboard unit heater located in the second tank room is no longer functional due to chlorine corrosion. SWA recommends that this electric unit heater is replaced immediately in order to satisfy heating loads of the building and prevent freezing in the second tank room when waste heat from process equipment is not significant to heat the room. Due to chemical processes in this room, extra maintenance should be provided to all equipment due to possibility of chlorine corrosion.

- Install insulation on the DHW distribution piping – Currently, the electric DHW heater contains piping that is not insulated. SWA recommends installing insulation on this copper piping in order to prevent thermal losses through the DHW pipe; especially since the source of domestic hot water is electric which is can be expensive to maintain temperatures.

- Always install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

- Remove and replace all damaged ceiling insulation

- Improve site drainage trough the installation of pumps, drywells or sloping surfaces away from the building.

Operations and Maintenance

Operations and Maintenance measures consist of low/no cost measures that are within the capability of the current building staff to handle. These measures typically require little investment, and they yield a short payback period. These measures may address equipment settings or staff operations that, when addressed will reduce energy consumption or costs.

- Maintain roofs - SWA recommends regular maintenance to confirm the condition of the roof shingles and flashing and to verify water is draining correctly.

- Maintain downspouts and cap flashing - Repair/install missing downspouts and cap flashing as needed to prevent water/moisture infiltration and insulation damage. SWA recommends round downspout elbows to minimize clogging.

- Maintain exterior walls – Inspect and regularly maintain exterior walls with a focus on the condition of the caulking, brick face, and signs of water damage and infiltration.

- Maintain doors – Inspect and regularly maintain doors with a focus on the condition of the frames, ability of the door to close with an airtight seal, and signs of water damage and infiltration.

- Maintain windows – Inspect and regularly maintain windows with a focus on the condition of the glazing, frames, proper hardware operation, airtight seat, window sill run-off, and signs of water damage and infiltration.

- Provide weather-stripping/air-sealing - SWA observed that exterior door weather-stripping was beginning to deteriorate in places. Doors and vestibules should be observed annually for deficient weather-stripping and replaced as needed. The perimeter of all window frames should also be regularly inspected, and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should also be sealed with caulk or spray foam.

- Repair/seal wall cracks and penetrations - SWA recommends as part of the maintenance program installing weep holes, installing proper flashing and correct masonry efflorescence, and sealing wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

- Provide water-efficient fixtures and controls - Adding controlled on/off timers on all lavatory faucets is a cost-effective way to reduce domestic hot water demand and save water. Building staff can also easily install faucet aerators and/or low-flow fixtures to reduce water consumption. There are many retrofit options, which can be installed now or incorporated as equipment is replaced. Routine maintenance practices that identify and quickly address water leaks are a low-cost way to save water and energy. Retrofitting with more efficient water-consumption fixtures/appliances will reduce energy consumption for water heating, while also decreasing water/sewer bills.

- SWA recommends that the building considers purchasing the most energy-efficient equipment, including Energy Star labeled appliances, when equipment is installed or replaced. More information can be found in the “Products” section of the Energy Star website at: http://www.energystar.gov.

- Use smart power electric strips - in conjunction with occupancy sensors to power down computer equipment when left unattended for extended periods of time.

- Create an energy educational program for employees - that teaches how to minimize energy use. The U.S. Department of Energy offers free information for hosting energy efficiency educational programs and plans. For more information please visit: http://www1.eere.energy.gov/education/.

APPENDIX A: EQUIPMENT LIST

Inventory

Building System	Description	Location	Make/ Model	Fuel	Space Served	Date Installed	Estimated Remaining Useful Life %
Heating	Qmark electric unit heater, convective heater, no nameplate, connected to non-programmable thermostat always set to max. temperature	Entrance Office (original section of building), hung from ceiling in corner	Qmark, Model #NA, Serial #NA	Electricity	Entrance Office Area	1980	20%
Heating	Seaboard electric unit heater, convective heater, no nameplate info, controlled by a non-programmable thermostat	First Tank room	Seaboard, Model #NA, Serial #NA	Electricity	First Tank room	1980	20%
Heating	Seaboard unit heater, convective heater, no nameplate info, controlled by a non-programmable thermostat, unit is currently not working due to chlorine corrosion	Second Tank room	Seaboard, Model #NA, Serial #NA	Electricity	Second Tank room	1980	0%
Heating	llg unit heater, convective heater, no nameplate info, controlled by a non-programmable thermostat	Third Tank room	llg, Model #NA, Serial #NA	Electricity	Third Tank room	1980	20%
Heating	Trane electric unit heater, convective heater, no nameplate info, controlled by a non-programmable thermostat	Fourth Tank room (back wash/well room)	Trane, Model #NA, Serial #NA	Electricity	Fourth Tank room (back wash/well room)	1980	20%
Heating	Electric unit heater, convective heater, no make or nameplate info	Fourth Tank room (back wash/well room)	No nameplate info	Electricity	Fourth Tank room (back wash/well room)	1980	20%
Wells/ Pumps	Well #3; US Motors, hollow shaft motor, 100 HP, 93.0% NEMA nominal efficiency, pump motor used to extract water from well, well is ~700 feet deep, pump sees 850 gpm, information given by facility maintenance personnel	Separate location from buidling	US Motors, Type RU, Model #NA, Serial #NA	Electricity	Well #3, separate location from building	1980	20%
Wells/ Pumps	Well #4; US Motors, hollow shaft motor, 100 HP, 93.0% NEMA nominal efficiency, pump motor used to extract water from well, well is ~700 feet deep, pump sees 850 gpm, information given by facility maintenance personnel and collected directly from motor	Fourth Tank room (back wash/well room)	US Motors, Type RU, Model #NA, Serial #NA	Electricity	Well #4, located in Fourth Tank room	1980	20%
Wells/ Pumps	Well #6; US Motors, hollow shaft motor,VFD was installed prior to 1991 but never used, 150 HP, 93.0% NEMA nominal efficiency, pump motor used to extract water from well, well is ~1000 feet deep, pump sees 1100 gpm, information given by facility maintenance personnel	Separate location from buidling	US Motors, Type RU, Model #NA, Serial #NA	Electricity	Well #6, separate location from building	1980	20%

Wells/ Pumps	Well #7; US Motors, hollow shaft motor,150 HP, 93.0% NEMA nominal efficiency, pump motor used to extract water from well, well is ~1000 feet deep, pump sees 1100 gpm, information given by facility maintenance personnel	Separate location from buidling	US Motors, Type RU, Model #NA, Serial #NA	Electricity	Well #7, separate location from building	1980	20%
Wells/ Pumps	Well #8; US Motors, hollow shaft motor, 75 HP, 93.0% NEMA nominal efficiency, pump motor used to extract water from well, well is ~350 feet deep, pump sees 500 gpm, information given by facility maintenance personnel	Separate location from buidling	US Motors, Type RU, Model #NA, Serial #NA	Electricity	Well #8, separate location from building	1980	20%
Wells/ Pumps	Well #9; US Motors, hollow shaft motor, 75 HP, 93.0% NEMA nominal efficiency, pump motor used to extract water from well, well is ~270 feet deep, pump sees 500 gpm, information given by facility maintenance personnel	Separate location from buidling	US Motors, Type RU, Model #NA, Serial #NA	Electricity	Well #9, separate location from building	1980	20%
Domestic Hot Water	Bradford-White electric heater, 30 gallons storage capacity, Lower element 1500W, Total element 1500W, According to Energy Star label uses 4,721 kWh/year	Third Tank room	Bradford-White, Model #M23OU655-1NAL, Serial #DG9385624	Electricity	Bathroom only	2000	30%
Lighting	See Appendix A	-	-	-	-	-	-

Note: The remaining useful life of a system (in %) is an estimate based on the system built date and existing conditions derived from visual inspection.

Appendix B: Lighting Study – Water Treatment Plant

Location			Existing Fixture Information												Retrofit Information												Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	GF	Control Room	Recessed	M	4T12 U-Shaped	4	2	40	Sw	24	365	12	368	3,224	T8	Recessed	4T8 U-Shaped	E	Sw	4	2	32	24	365	5	278	2418	806	0	806
2	GF	Tank Room # 1	Ceiling Suspended	M	8T12	2	2	60	Sw	24	365	20	360	3,154	T8	Ceiling Suspended	8T8	E	Sw	2	2	59	24	365	7	250	2190	964	0	964
3	GF	Tank Room # 2	Ceiling Suspended	M	4T12	2	2	40	Sw	24	365	12	184	1,612	T8	Ceiling Suspended	4T8	E	Sw	2	2	32	24	365	5	138	1209	403	0	403
4	GF	Tank Room # 3	Ceiling Suspended	M	4T12	3	2	40	Sw	24	365	12	276	2,418	T8	Ceiling Suspended	4T8	E	Sw	3	2	32	24	365	5	207	1813	604	0	604
5	GF	Chemical Room	Ceiling Mounted	M	4T12	1	2	40	Sw	24	365	12	92	806	T8	Ceiling Mounted	4T8	E	Sw	1	2	32	24	365	5	69	604	201	0	201
6	GF	Loading Dock / Bay	Ceiling Suspended	M	8T12	2	2	60	Sw	24	365	20	360	3,154	T8	Ceiling Suspended	8T8	E	Sw	2	2	59	24	365	7	250	2190	964	0	964
7	GF	Showers	Ceiling Mounted	S	Inc	1	1	60	Sw	24	365	0	60	526	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	24	365	0	20	175	350	0	350
8	GF	Bathroom	Ceiling Mounted	S	Inc	1	1	60	Sw	24	365	0	60	526	CFL	Ceiling Mounted	CFL	S	Sw	1	1	20	24	365	0	20	175	350	0	350
9	GF	Pump Room	Ceiling Suspended	M	4T12	6	2	40	Sw	24	365	12	552	4,836	T8	Ceiling Suspended	4T8	E	Sw	6	2	32	24	365	5	414	3627	1209	0	1209
10	GF	Garage	Ceiling Suspended	M	8T12	1	2	80	Sw	24	365	20	180	1,577	T8	Ceiling Suspended	8T8	E	OS	1	2	59	18	365	7	125	821	482	274	756
11	GF	Workshop	Ceiling Suspended	M	8T12	1	2	80	Sw	24	365	20	180	1,577	T8	Ceiling Suspended	8T8	E	OS	1	2	59	18	365	7	125	821	482	274	756
12	GF	Office	Parabolic Ceiling Mounted	M	4T8	1	4	32	Sw	24	365	5	133	1,165	C	Parabolic Ceiling Mounted	4T8	M	OS	1	4	32	18	365	5	133	874	0	291	291
13	Ext	Exterior	Wallpack	E	MH	4	1	150	T	12	365	42	768	3,364	PSMH	Wallpack	PSMH	E	T	4	1	100	12	365	20	480	2102	1261	0	1261
Totals:						29	25	822				187	3,573	27,936						29	25	568			78	2,507	19,020	8,077	839	8,915
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																													

Proposed Lighting Summary Table			
Total Gross Floor Area (SF)	4,600		
Average Power Cost ($/kWh)	0.1710		
Total Interior Lighting	**Existing**	**Proposed**	**Savings**
Annual Consumption (kWh)	11,136	7,752	**3,384**
Lighting Power (watts)	5,560	3,809	**1,752**
Lighting Power Density (watts/SF)	1.39	0.95	**0.44**
Estimated Cost of Fixture Replacement ($)	4,766		
Estimated Cost of Controls Improvements ($)	0		
Total Consumption Cost Savings ($)	**1,112**		

Legend:

Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Installl new T8)
Pin	1'T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2'T5	T (Timer)		CFL (Install new CFL)
Recessed	3'T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4'T5	D (Dimming)		LED (Install new LED)
Circiline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
HID (High Intensity Discharge)	4'T8			
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	MR16			
	Halogen			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	LPS (Low Pressure Sodium)			

APPENDIX C: THIRD PARTY ENERGY SUPPLIERS

http://www.state.nj.us/bpu/commercial/shopping.html

JCP&L ELECTRICAL SERVICE TERRITORY Last Updated: 06/15/09		
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095 (800) 437-7872 www.hess.com	**BOC Energy Services, Inc.** 1135 Mountain Avenue Murray Hill, NJ 011374 (800) 247-2644 www.boc.com	**Commerce Energy, Inc.** 4400 Route 9 South, Suite 100 Freehold, NJ 07728 (800) 556-84113 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446 (888) 635-0827 www.newenergy.com	**Direct Energy Services, LLC** 120 Wood Avenue Suite 611 Iselin, NJ 08830 (866) 547-2722 www.directenergy.com	**FirstEnergy Solutions Corp.** 300 Madison Avenue Morristown, NJ 0113113 (800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640 (877) 569-2841 www.glacialenergy.com	**Integrys Energy Services, Inc.** 99 Wood Ave, South, Suite 802 Iselin, NJ 08830 (877) 763-9977 www.integrysenergy.com	**Strategic Energy, LLC** 55 Madison Avenue, Suite 400 Morristown, NJ 011360 (888) 925-9115, www.sel.com
Liberty Power Holdings, LLC Park 80 West, Plaza II, Suite 200 Saddle Brook, NJ 07663 (866) 769-31139 www.libertypowercorp.com	**Pepco Energy Services, Inc.** 112 Main St. Lebanon, NJ 08833 (800) ENERGY-9 (363-7499) www.pepco-services.com	**PPL EnergyPlus, LLC** 811 Church Road Cherry Hill, NJ 08002 (800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions The Mac-Cali Building 581 Main Street, 8th Floor Woodbridge, NJ 07095 (877) 273-6772 www.semprasolutions.com	**South Jersey Energy Company** One South Jersey Plaza Route 54 Folsom, NJ 08037 (800) 800-756-3749 www.south jerseyenergy.com	**Suez Energy Resources NA, Inc.** 333 Thornall Street 6th Floor Edison, NJ 08837 (888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 080113 (856) 273-9995 www.ugienergyservices.com	**American Powernet Management, LP** 437 North Grove St. Berlin, NJ 08009 (800) 437-7872 www.hess.com	**ConEdison Solutions** Cherry Tree, Corporate Center 1135 State Highway 38 Cherry Hill, NJ 08002 (888) 665-0955 www.conedsolutions.com

APPENDIX D: GLOSSARY AND METHOD OF CALCULATIONS

Glossary of ECM Terms

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and/or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement/repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings

LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

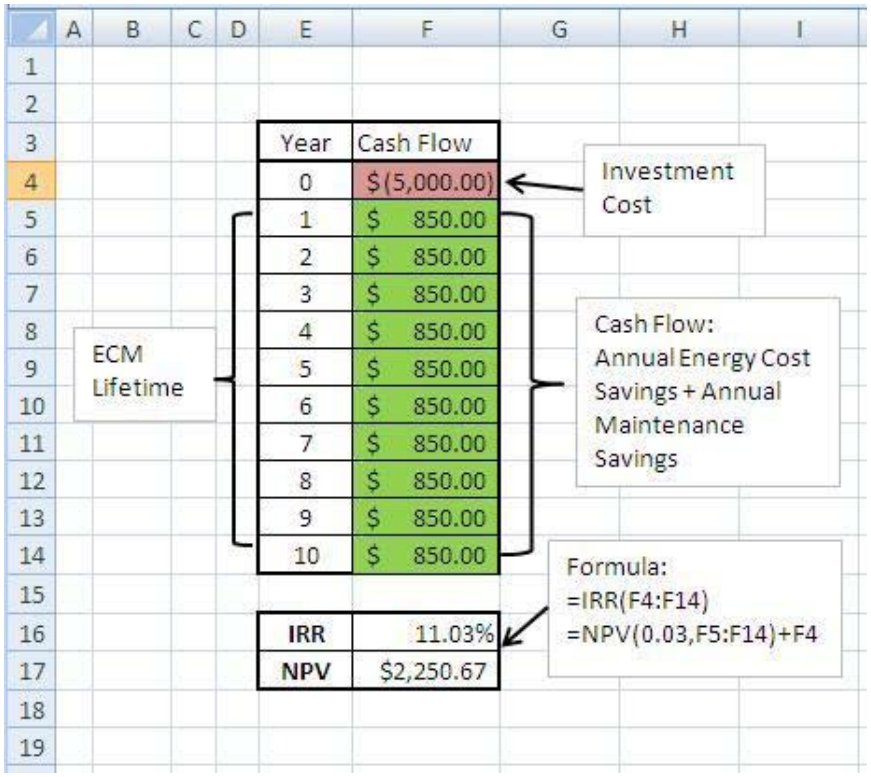
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

Excel NPV and IRR Calculation

In Excel, function =IRR(values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours/annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

NJCEP C & I Lifetimes

Measure	Measure Life
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8

APPENDIX E: STATEMENT OF ENERGY PERFORMANCE FROM ENERGY STAR

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Borough of Freehold - Water Treatment Plant

Building ID: 2211695
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: April 15, 2010

Facility	**Facility Owner**	**Primary Contact for this Facility**
Borough of Freehold - Water Treatment Plant 144 Waterworks Road Freehold, NJ 07728	Borough of Freehold 51 West Main Street Freehold, NJ 07728	Joseph Bellina 51 West Main Street Freehold, NJ 07728

Year Built: 1890
Gross Floor Area (ft²): 4,600

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	2,075,588
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	2,075,588

Energy Intensity[5]	
Site (kBtu/ft²/yr)	451
Source (kBtu/ft²/yr)	1507

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	316

Electric Distribution Utility
FirstEnergy - Jersey Central Power & Lt Co

National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	608%
Building Type	Other

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Certifying Professional
N/A

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

APPENDIX F: INCENTIVE PROGRAMS

New Jersey Clean Energy Pay for Performance

The NJ Clean Energy Pay for Performance (P4P) Program relies on a network of Partners who provide technical services to clients. LGEA participating clients who are not receiving Direct Energy Efficiency and Conservation Block Grants are eligible for P4P. SWA is an eligible Partner and can develop an Energy Reduction Plan for each project with a whole-building traditional energy audit, a financial plan for funding the energy measures and an installation construction schedule.

The Energy Reduction Plan must define a comprehensive package of measures capable of reducing a building's energy consumption by 15+%. P4P incentives are awarded upon the satisfactory completion of three program milestones: submittal of an Energy Reduction Plan prepared by an approved Program Partner, installation of the recommended measures and completion of a Post-Construction Benchmarking Report. The incentives for electricity and natural gas savings will be paid based on actual savings, provided that the minimum 15%performance threshold savings has been achieved.

For further information, please see: http://www.njcleanenergy.com/commercial-industrial/programs/pay-performance/existing-buildings .

Direct Install 2010 Program

Direct Install is a division of the New Jersey Clean Energy Program's Smart Start Buildings. It is a turn-key program for small to mid-sized facilities to aid in upgrading equipment to more efficient types. It is designed to cut overall energy costs by upgrading lighting, HVAC and other equipment with energy efficient alternatives. The program pays **up to 80%** of the retrofit costs, including equipment cost and installation costs.

Eligibility:

- Existing small and mid-sized commercial and industrial facilities with peak electrical demand **below 200 kW** within 12 months of applying
- Must be located in New Jersey
- Must be served by one of the state's public, regulated or natural gas companies
    - Electric: Atlantic City Electric, Jersey Central Power & Light, Orange Rockland Electric, PSE&G
    - Natural Gas: Elizabethtown Gas, New Jersey Natural Gas, PSE&G, South Jersey Gas

For the most up to date information on contractors in New Jersey who participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/direct-install

Smart Start

New Jersey's SmartStart Building Program is administered by New Jersey's Office of Clean Energy. The program also offers design support for larger projects and technical assistance for smaller projects. If your project specifications do not fit into anything defined by the program, there are even incentives available for custom projects.

There are a number of improvement options for commercial, industrial, institutional, government, and agricultural projects throughout New Jersey. Alternatives are designed to enhance quality while building in energy efficiency to save money. Project categories included in this program are New

Construction and Additions, Renovations, Remodeling and Equipment Replacement.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings.

Renewable Energy Incentive Program

The *Renewable Energy Incentive Program (REIP)* provides incentives that reduce the upfront cost of installing renewable energy systems, including solar, wind, and sustainable biomass. Incentives vary depending upon technology, system size, and building type. Current incentive levels, participation information, and application forms can be found here.

Solar Renewable Energy Credits (SRECs) represent all the clean energy benefits of electricity generated from a solar energy system. SRECs can be sold or traded separately from the power, providing owners a source of revenue to help offset the cost of installation. All solar project owners in New Jersey with electric distribution grid-connected systems are eligible to generate SRECs. Each time a system generates 1,000 kWh of electricity an SREC is earned and placed in the customer's account on the web-based SREC tracking system.

For the most up to date information on how to participate in this program, go to: http://www.njcleanenergy.com/renewable-energy/home/home.

Utility Sponsored Programs

Check with your local utility companies for further opportunities that may be available.

Federal and State Sponsored Programs

Other federal and state sponsored funding opportunities may be available, including BLOCK and R&D grant funding. For more information, please check http://www.dsireusa.org/.

APPENDIX G: ENERGY CONSERVATION MEASURES

Energy Conservation Measures																			
ECM #	ECM description	Cost Source	Est. installed cost, $	Est. incentives, $	Net est. cost with incentives, $	kWh, 1st year savings	kW, demand reduction	therms, 1st year savings	kBtu/sq ft, 1st year savings	Est. operating cost, 1st year savings, $	Total 1st year savings, $	Life of measure, years	Est. lifetime energy cost savings, $	Simple payback, years	Lifetime return-on-investment, %	Annual return-on-investment, %	Internal rate of return, %	Net present value, $	CO_2 reduced, lbs/year
1	Install (2) new CFL Fixtures	RS Means	30	0	30	701	0.1	0	0.5	204	324	5	1,619	0.1	53	11	11	1,445	1,255
2	Install (22) new T8 Fluorescent Fixtures	RS Means	2,989	330	2,659	6,114	1.3	0	4.5	745	1,790	15	26,857	1.5	9	1	1	18,410	10,947
3	Install (3) new Occupancy Sensors	RS Means	660	60	600	839	0.2	0	0.6	0	143	15	2,152	4.2	3	0	0	1,088	1,502
4	Install 5 kW Photovoltaic System	Similar Projects	35,000	5,000	30,000	5,900	5.0	0	4.4	0	4,009	25	100,223	7.5	2	0	0	22,484	10,564
5	Install (4) new Pulse Start Metal Halide fixtures	RS Means	1,955	100	1,855	1,261	0.3	0	0.9	27	243	15	3,639	7.6	1	0	0	1,000	2,258
6	Install (6) Programmable Thermostats	RS Means	780	0	780	400	0.1	0	0.3	0	68	15	1,026	11.4	0	0	0	25	716
	TOTALS		**41,414**	**5,490**	**35,924**	**15,215**	**7.0**	**0**	**11.3**	**976**	**6,578**	**-**	**135,517**	**5.5**	**-**	**-**	**-**	**44,452**	**27,242**

APPENDIX H: METHOD OF ANALYSIS

Assumptions and tools

Energy modeling tool:	Established/standard industry assumptions, eQUEST
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF The Water treatment plant SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF The Water treatment plant(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.