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June 28, 2010

Local Government Energy Program
Energy Audit Report

Township of Livingston

Sewage Treatment Plant and Animal Shelter
81 Naylon Avenue
Livingston, NJ 07039

Project Number: LGEA50

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INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Township of Livingston. The audit included a review of the following buildings located in the Township of Livingston for which separate energy audit reports are issued:

- Municipal Court
- Main Fire Department
- Northfield Fire Station
- Circle Fire Station
- Township Garage
- Livingston Free Public Library
- Senior & Community Center
- Water Department
- Monmouth Court Community Center
- Well House No. 3, Building 1
- Well House No. 3, Building 2
- Well House No. 4
- Well House No. 9
- Well House No. 11
- Okner Field Concession Building
- Storage Shed
- Northland Pool and Recreation Center
- Sewage Treatment Plant
- Animal Shelter
- Pump House
- Booster Station
- Sewer Station

This report addresses the Sewage Treatment Plant and Animal Shelter located at 81 Naylon Avenue, Livingston NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

The sewage treatment plant is a large complex that houses 12 free standing buildings used for various processes. The various buildings were constructed between 1938 and 1978. Additionally the animal shelter is also located on the same complex as it was established in 1955 through the retrofit of one of the sewage treatment plant's garages. The shelter shares a common electric meter with the plant but has its own independent gas meter. A table summarizing the area and description for all buildings is shown below as well as a map of the entire complex.

Table of Building Descriptions		
#	**Description**	**Gross Area (Sq. Ft.)**
1	Locker room and old control building – single story with basement	1,000
2	Laboratory – single story	760
3	Primary pump building – single story with basement	635
4	Maintenance building – single story with basement	1,150
5	Supernatant pump building – single story with basement	230
6	Chlorine building – single story	280
7	Digester building – single story with basement	3,000
8	Intermediate pump building – single story with basement	2,500
9	Chemical feed building – single story	580
10	Advance treatment building – single story	7,000
11	Effluent pump station – single story	460
12	Three Story Garage – single story	1,200
13	Animal Shelter – single story	1,500
	Total	**20,295**

Site map courtesy of Bing™

The sewage treatment plants occupancy is approximately 8 employees; daily from 7:30 AM to 4:00 PM. Occupancy at the plant is not subject to fluctuations as it is closed to the public. The animal shelter's occupancy is one employee on weekdays from 8:30 AM to 4:30 PM and weekends between 9:00 AM and 11:00 PM. Additionally there is the occasional visitor present at the animal shelter.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Livingston to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

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 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 5 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

Based on the field visit performed by the SWA staff on January 26, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Existing conditions

The Sewage Treatment Plant and Animal Shelter share an electric meter while being metered independently for natural gas. From March 2008 through February 2009, the period of analysis for this audit, the entire facility consumed 3,526,750 kWh or $526,550 worth of electricity at an approximate rate of $0.149/kWh. The Sewage Treatment Plant consumed 12,095 therms or $17,030 worth of natural gas at an approximate rate of $1.408/therm. The Animal Shelter building consumed 999 therms or $1,484 worth of natural gas at an approximate rate of $1.486/therm. The joint energy consumption for the facility, including both electricity and fossil fuel was 13,342 MMBTUs of energy that cost a total of $545,064.

SWA has entered energy information about the Sewage Treatment Plant and Animal Shelter into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The buildings have been combined as one facility since they share a common electric meter. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 654.0 kBtu/sq ft yr compared to the national average of a building consuming 104.0 kBtu/sq ft yr. This intensity is much greater than the national average due to the process equipment present on site and the fact that the average building is just a typical commercial building. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 14.0 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 640.0 kBtu/sq ft yr.

Recommendations

The Sewage Treatment Plant houses buildings over seventy two years old and most HVAC equipment has exceeded their recommended useful life cycles. Additionally, much of the lighting is inefficient. Accordingly, there are numerous recommended improvements. In Appendix C, SWA has included a mechanical inventory list for the plant and shelter. Based on the assessment of the building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: - Capital Improvements (Sewage Treatment Plant)

- Extend natural gas service to Buildings 2, 4, 9 and 11
- Replace Advanced Treatment Building boiler burners
- Replace one (1) domestic water heater in Laboratory Building

- Replace Laboratory Heated Makeup Air Unit
- Replace (1) Mitsubishi Split System in Advanced Treatment Control Room
- Replace electric and hydronic unit heaters
- Replace window air conditioners
- Repair or replace the digester machines

Category II Recommendations: - Operations and Maintenance (Sewage Treat Plant)

- Install premium motors when replacements are required
- Boiler room and other hot water piping insulation
- Water levels in the boiler expansion tanks and the integrity of the tank bladders should be checked to confirm proper operation.
- Tighten belts on exhaust fans
- Use Energy Star labeled appliances
- Maintain and biannually inspect the roof with a focus on the condition of the shingles, drainage, signs of water damage and locations that correspond to locations of known infiltration.
- Conduct biannual maintenance inspections to inspect the windows with a focus on frame damage, degraded caulking, and locating sources of water and air leakage.
- Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seal and signs of water damage and infiltration.

Category I Recommendations: - Capital Improvements (Animal Shelter)

- Replace electric unit heater with gas-fired unit heater
- Replace window air conditioner
- Replace wall exhaust fan with exterior wall fan with premium efficiency motor

Category II Recommendations: - Operations and Maintenance (Animal Shelter)

- Use Energy Star labeled appliances

Category III Recommendations: Energy Conservation Measures – Sewage Treatment Plant

At this time, SWA highly recommends a total of **13** Energy Conservation Measures (ECMs) for the Sewage Treatment Plant as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$4,522**. SWA estimates a first year savings of **$2,615** with a simple payback of **3.2 years**. SWA also recommends **8** ECMs with a 5-10 year payback that have a first year savings of **$5,638** as summarized in Table 2. SWA also recommends **1** End of life cycle ECM that has a first year savings of **$163** as summarized in Table 3, and **2** Renewable ECM that have a first year savings of **$37,192** as summarized in Table 4.

The implementation of all the recommended ECMs would reduce the building electric usage by 75,048 kWh annually, or 2.1% of the building's current electric consumption and 110 therms or 0.9%. SWA estimates that implementing these ECMs will reduce the carbon footprint of the sewage treatment center by **104,107 lbs of CO_2**, which is equivalent to removing approximately 11

cars from the roads each year or avoiding the need of 288 trees to absorb the annual CO_2 produced.

There are various incentives that Township of Livingston could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Livingston apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install could also assist to cover up to 80% of the capital investment.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G

The following three tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance.

Category III Recommendations: Energy Conservation Measures – Animal Shelter

At this time, SWA highly recommends **1** Energy Conservation Measure (ECM) for the animal shelter as summarized in the following Table 5. The total investment cost for these ECMs with incentives is **$108**. SWA estimates a first year savings of **$127** with a simple payback of **0.9 years**. SWA also recommends **31** ECMs with a 5-10 year payback that have a first year savings of **$730** as summarized in Table 6

The implementation of all the recommended ECMs would reduce the building electric usage by 1,889 kWh and natural gas use by 260 Therms. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Animal Shelter by **5,630 lbs of CO_2**, which is equivalent to removing approximately 1 car from the roads each year or avoiding the need of 15 trees to absorb the annual CO_2 produced. SWA also recommends that Township of Livingston contacts third party energy suppliers in order to negotiate a lower electricity rate.

There are various incentives that Township of Livingston could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Livingston apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install could also assist to cover up to 80% of the capital investment.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G

The following three tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance.

Table 1 - Highly Recommended 0-5 Year Payback ECMs (Sewage Treatment Plant)																	
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.2	(92) New CFL fixtures to be installed	4,933	0	4,933	11,950	2.5	0	2.2	156	1,924	5	9,622	2.6	95	19	27	3,829	16,372
1.3	(4) New LED exit sign fixtures to be installed	732	80	652	432	0.1	0	0.1	82	146	15	2,184	4.5	235	16	21	1,061	592
1.5	(7) New occupancy sensors to be installed	1,540	140	1,400	2,186	0.5	0	0.4	0	324	15	4,853	4.3	247	16	22	2,407	2,995
2	Retrofit (1) refrigerated vending machine with VendingMiser device	199	0	199	486	0.1	0	0.1	0	72	12	863	2.8	334	28	35	508	666
4.3	replace (3) 5 Hp microscreen motors with Premium Efficiency	1,512	180	1,332	2,816	0.6	0	0.5	0	321	20	6,420	4.1	382	19	24	3,444	3,858
4.5	replace (1) 5 Hp Muffin Monster pump motor with Premium Eff.	504	60	444	2,816	0.6	0	0.5	0	321	20	6,420	1.4	1346	67	72	4,332	3,858

4.6	replace (3) 1 Hp Collector Drive motors with Premium Efficiency	1,077	150	927	2,829	0.6	0	0.5	0	323	20	6,450	2.9	596	30	35	3,871	3,876
4.8	replace (3) 7.5 Hp Return pump motors with Premium Efficiency	2,076	270	1,806	3,883	0.8	0	0.7	0	443	20	8,853	4.1	390	20	24	4,780	5,320
4.9	replace (1) 10 Hp Digester Gas-Mixer motor with Premium Efficiency	782	100	682	3,311	0.7	0	0.6	0	377	20	7,549	1.8	1007	50	55	4,934	4,536
4.10	replace (2) 10 Hp Sludge Recirculation pump motor with Premium Efficiency	1,564	200	1,364	4,967	1.0	0	0.9	0	566	20	11,325	2.4	730	37	41	7,060	6,805
7.2	incremental cost to replace (25) exhaust fans with premium efficiency units	9,375	1,250	8,125	13,675	0.5	0	0.2	250	1,809	10	15,590	4.5	123	12	14	6,056	18,735
8.1	replace 1-ton Ductless DX split HVAC systems with high efficiency system (SEER 22)	1,950	92	1,858	1,145	0.2	0	0.2	350	481	15	1,958	3.9	288	19	25	3,879	1,569
8.2	incremental cost to replace 1-ton Ductless DX split HVAC systems with high efficiency system (SEER 22 vs SEER 13)	600	92	508	453	0.1	0	0.1	350	402	15	775	1.3	1086	72	79	4,287	621
	TOTALS	**26,844**	**2,614**	**24,230**	**50,949**	**8.3**	**0**	**7.0**	**1,188**	**7,509**	**-**	**82,862**	**3.2**	**-**	**-**	**-**	**50,448**	**69,803**

Assumptions: Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction / month indicates that it is very low / negligible

Table 2 - Recommended 5-10 Year Payback ECMs (Sewage Treatment Plant)																		
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.1	(82) New T8 fixtures to be installed	15,855	2,460	13,395	5,106	1.1	0	0.9	620	1,376	15	20,634	9.7	54	4	6	2,793	6,995
1.4	(37) New pulse start metal halide fixtures to be installed	28,447	925	27,522	11,046	2.3	0	2.0	1,673	3,308	15	49,614	8.3	80	5	8	11,399	15,134
3.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind	99	0	99	95	0.0	0	0.0	0	14	12	169	7.0	70	6	9	39	130
3.2	Replace three (3) refrigerators with an 17 cu ft Energy Star model	1,650	0	1,650	1,275	0.3	0	0.2	0	189	12	2,264	8.7	37	3	5	206	1,747
4.1	replace (1) 30 Hp R.A.S. pump motor with Premium Efficiency	1,958	150	1,808	2,173	0.5	0	0.4	0	248	20	4,954	7.3	174	9	12	1,877	2,977
4.2	replace (3) 3 Hp hot water circulator pump motors with Premium Efficiency	1,500	180	1,320	1,269	0.3	0	0.2	0	145	20	2,893	9.1	119	6	9	832	1,739
4.4	replace (2) 1 Hp Seal motors with Premium Efficiency	718	100	618	943	0.2	0	0.2	0	108	20	2,150	5.7	248	12	17	981	1,292
4.7	replace (5) 2 Hp Return pump motors with Premium Efficiency	2,135	300	1,835	2,192	0.5	0	0.4	0	250	20	4,998	7.3	172	9	12	1,883	3,003
	TOTALS	**52,362**	**4,115**	**48,247**	**24,099**	**5.2**	**0**	**4.3**	**2,293**	**5,638**	**-**	**87,676**	**8.6**	**-**	**-**	**-**	**20,010**	**33,017**

Table 3 - Description of Recommended End of Life Cycle ECMs (Sewage Treatment Plant)																	
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6.1	replace domestic water heater with 95% efficient unit	3,000	400	2,600	0	0.0	110	0.6	0	163	15	2,452	15.9	-6	0	-1	-649	1,287

Table 4 - Description of Renewable ECMs (Sewage Treatment Plant)																	
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5.1	install 5.1 kW PV rooftop system with incentives on old control room building	39,525	5,060	34,465	5,123	5.0	0	17.5	0	3,584	25	14,599	9.6	72.9	2.9	6.9	11,517	7,018
5.2	install 45.0 kW PV rooftop system with incentives on advanced treatment building	348,750	45,080	303,670	47,436	45.0	0	23.1	0	33,608	25	135,193	9.0	83.8	3.4	7.8	127,146	64,988

Table 5 - Highly Recommended 0-5 Year Payback ECMs (Animal Shelter)																		
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
10.2	(2) New CFL fixtures to be installed	108	0	108	727	0.2	N/A	0.2	3	127	5	633	0.9	484	97	114	468	996

Table 6 - Recommended 5-10 Year Payback ECMs (Animal Shelter)																		
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
9	replace domestic water heater with 95% efficient unit	2,700	150	2,550	0	0.0	260	17.3	0	386	15	5,795	6.6	127	8	13	2,062	3,042
10.1	(9) New T8 fixtures to be installed	2,018	270	1,748	737	0.2	N/A	0.2	147	272	15	4,080	6.4	133	9	13	1,452	1,010
11	Replace three (3) refrigerators with an 17 cu ft Energy Star model	550	0	550	425	0.1	N/A	0.1	0	72	12	867	7.6	58%	5%	8	161	582
	TOTALS	5,268	420	4,848	1,162	0.3	260	17.6	147	730	42	10,742	6.6	-	-	-	3,675	4,634

1. HISTORIC ENERGY CONSUMPTION

1.1. Energy usage, load profiles and cost analysis

Sewage Treatment Plant and Animal Shelter

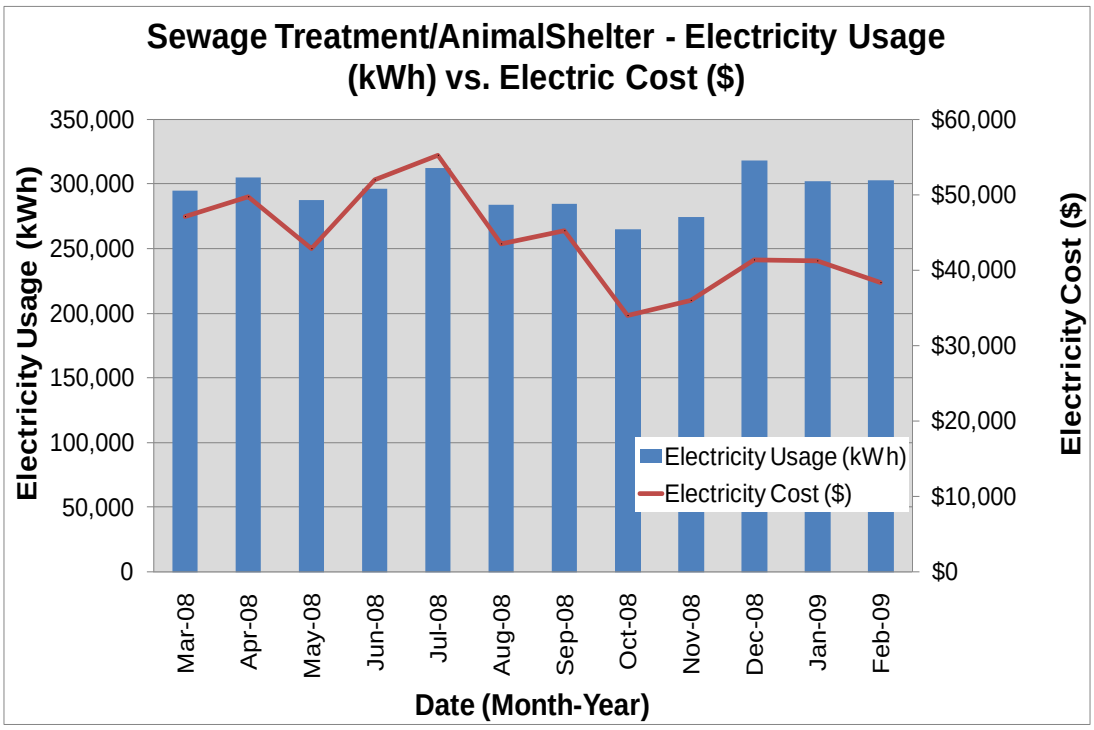
SWA analyzed utility bills for the Sewage Treatment Plant and Animal Shelter for the 24 months between January 2007 and February 2009 with an analysis period of **March 2008 to February 2009**. The Sewage Treatment Plant shares an electric meter with the Animal Shelter; however each building is metered individually for natural gas.

Electricity (combined buildings on one meter) - The Sewage Treatment Plant/Animal Shelter meter purchases electricity from JCP&L at **an average rate of $0.149/kWh** based on 12 months of utility bills from **March 2008 through February 2009**. The building purchased **approximately 3,526,750 kWh or $526,550 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **550.4 kW** and an annual peak demand of **620.3 kW**.

Natural gas (Sewage Treatment Plant) – The building is currently served by two meters for natural gas. The building currently buys natural gas from PSE&G which acts as the transportation company and energy supplier at **an average aggregated rate of $1.408/therm** and purchased **approximately 12,095 therms or $17,030 worth of natural gas** in the 12 months from March 2008 to February 2009.

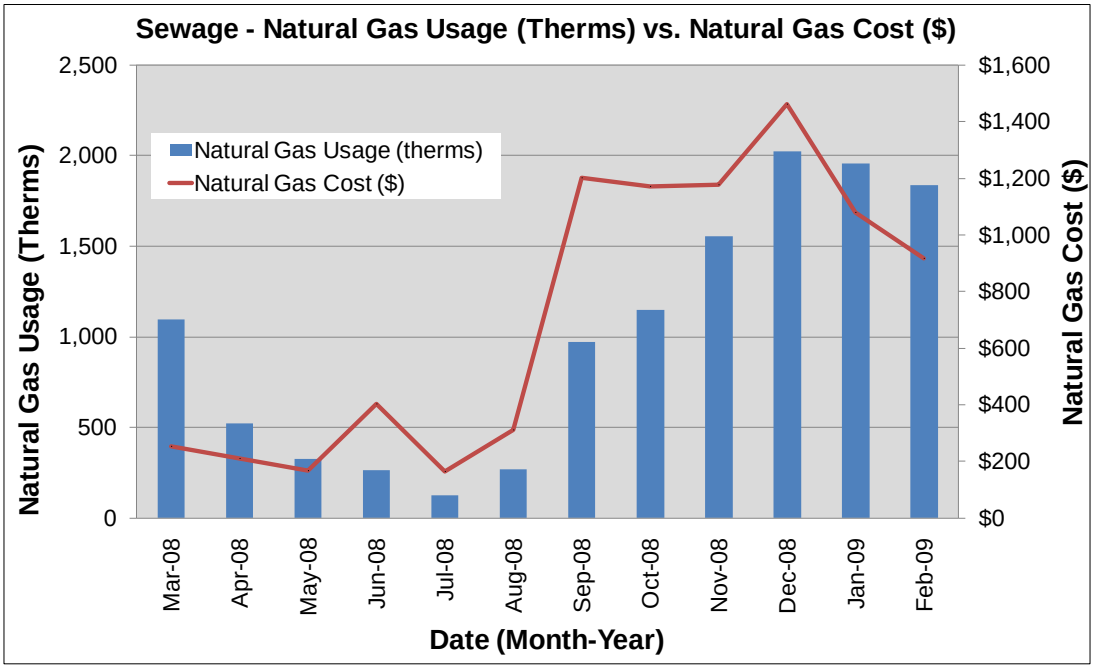
Natural gas (Animal Shelter) – The building is currently served by one meter for natural gas. The building currently buys natural gas from PSE&G which acts as the transportation company and energy supplier at **an average aggregated rate of $1.486/therm** and purchased **approximately 999 therms or $1,484 worth of natural gas** in the 12 months from March 2008 to February 2009.

The following chart shows electricity use versus cost for the plant based on utility bills for the 12 month period of March 2008 to February 2009.



Electricity usage follows a trend that is expected for this building with near constant usage with only a slight rise during the winter due to the electric heating equipment and in the summer due to cooling equipment. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

The following is a chart of the natural gas annual load profile for the Sewage Treatment plant versus natural gas costs, peaking in the coldest months of the year and a chart showing natural gas consumption following the “heating degree days” curve.



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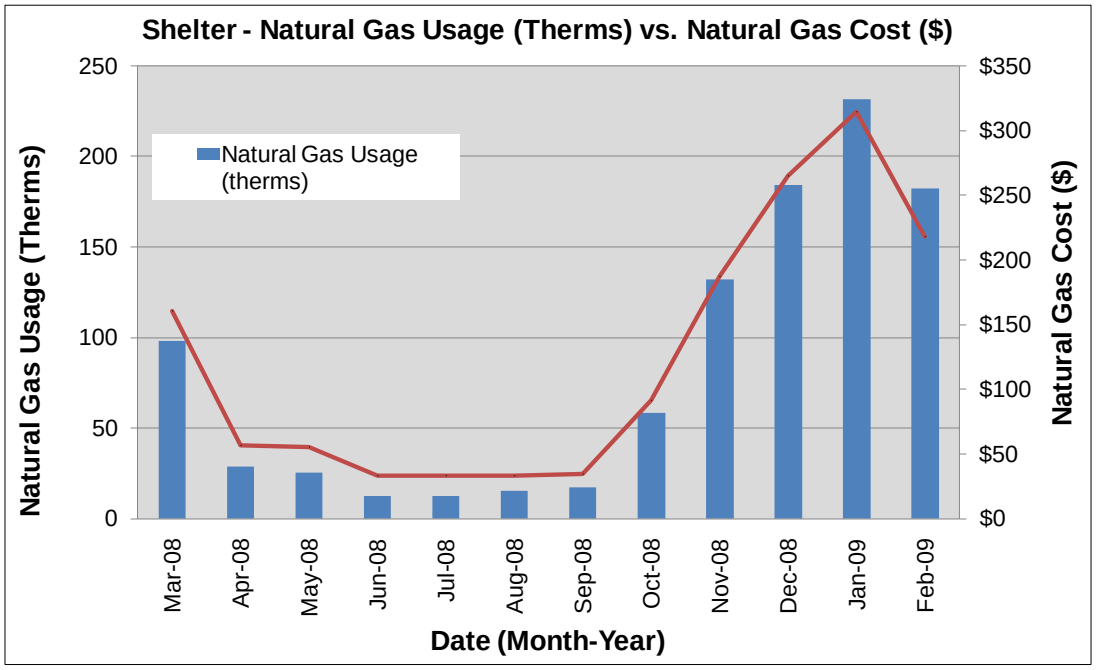
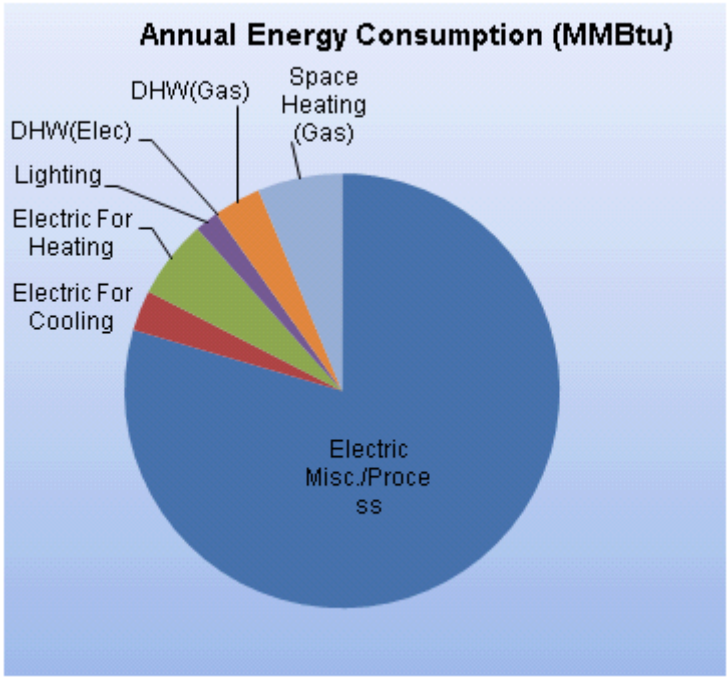
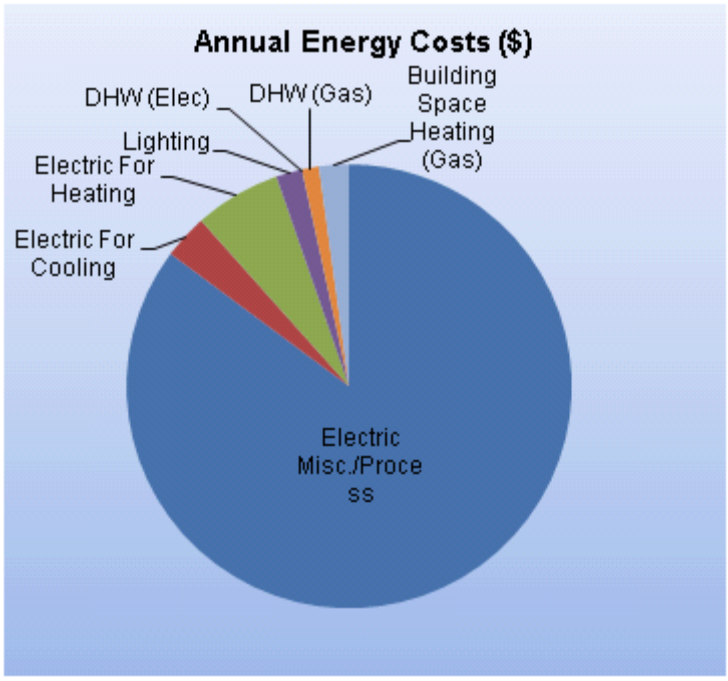


The following table and pie chart show energy use for the entire facility based on utility bills for the 12 month period of March 2008 to February 2009.

March 2008 - February 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc./Process	10,611	80%	$464,325	85%	44
Electric For Cooling	403	3%	$17,654	3%	44
Electric For Heating	782	6%	$34,202	6%	44
Lighting	235	2%	$10,283	2%	44
Domestic Hot Water (Elec)	2	0%	$85	0%	44
Domestic Hot Water (Gas)	471	4%	$6,660	1%	14
Building Space Heating	838	6%	$11,852	2%	14
Totals	13,342	100%	$545,064	100%	
Total Electric Usage	12,033	90%	$526,550	97%	44
Total Gas Usage	1,309	10%	$18,514	3%	14
Totals	13,342	100%	$545,064	100%	



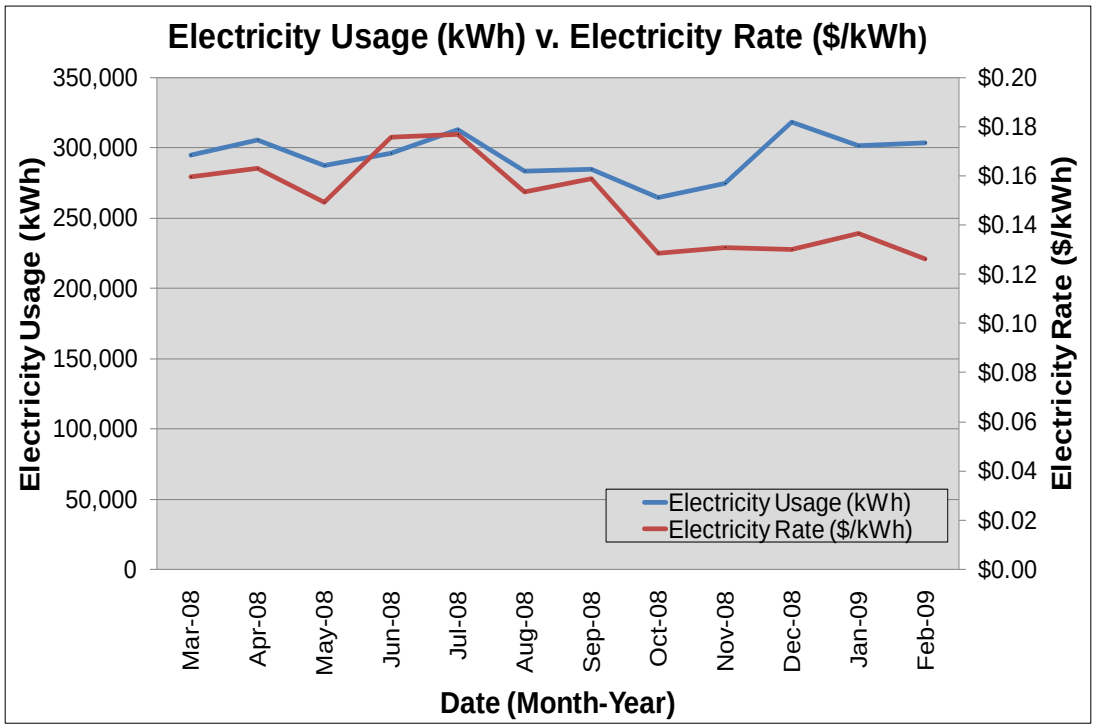


1.2. Utility Rate Analysis

Sewage Treatment Plant/Animal Shelter

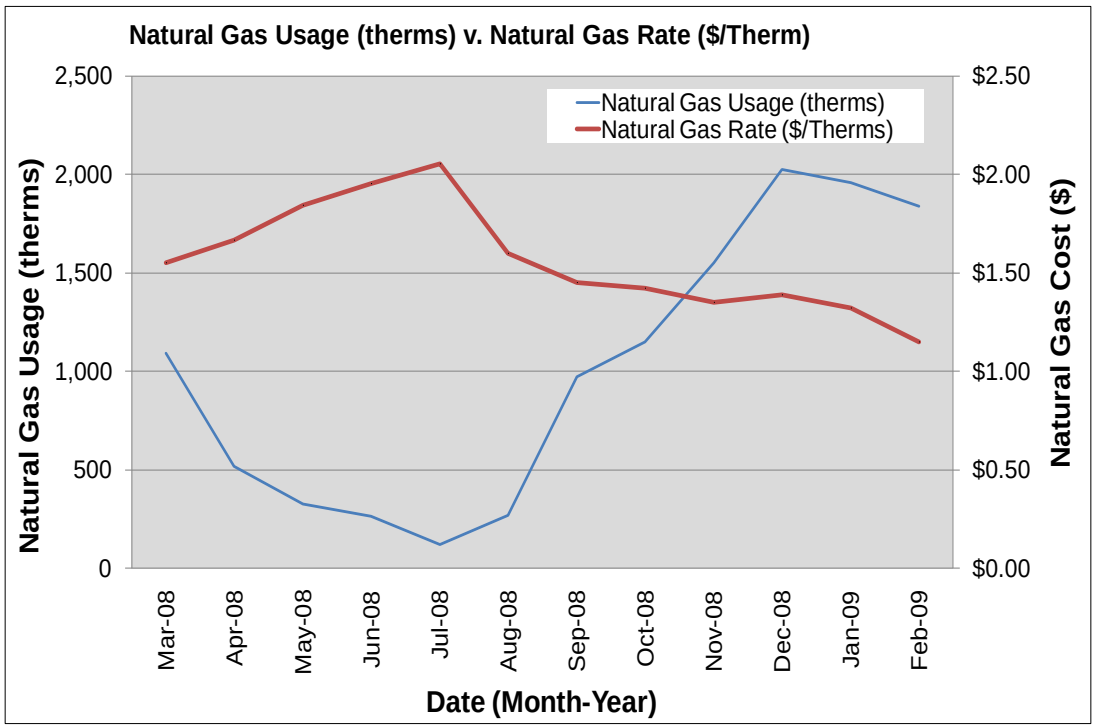
The Sewage Treatment Plant and Animal Shelter currently purchase electricity from JCP&L at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. They currently pay an average rate of approximately $0.149/kWh based on the 12 months of utility bills of March 2008 to February

2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.

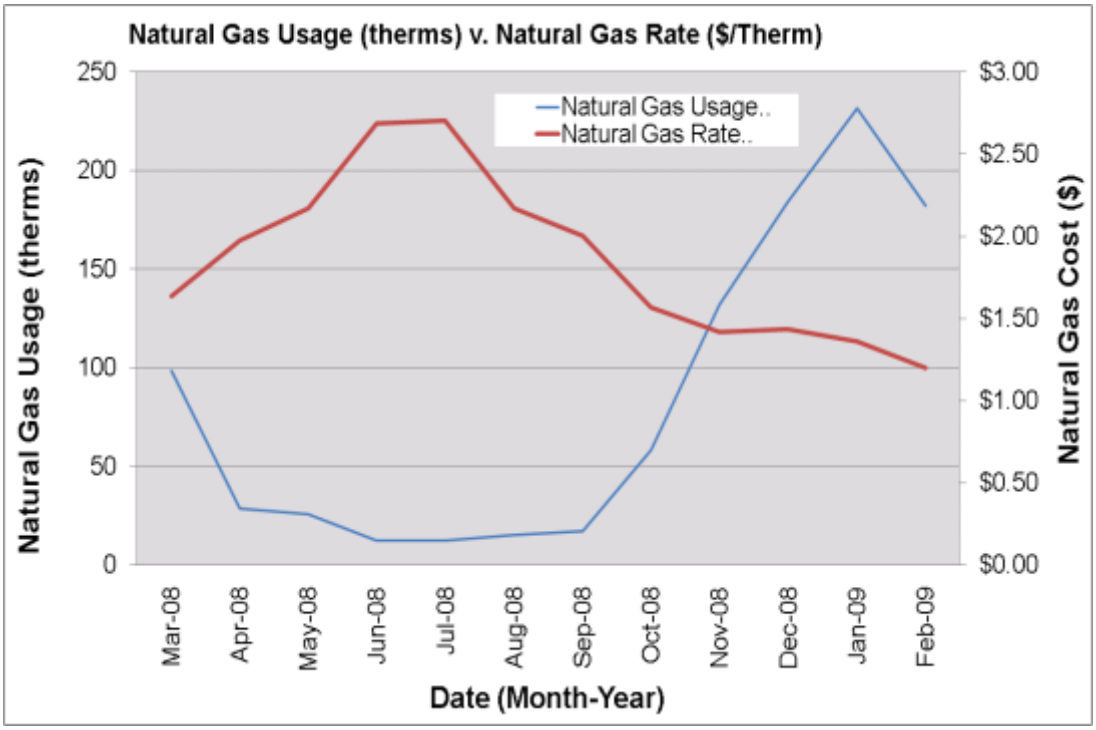


In the above chart, electricity usage is relatively constant throughout the year due to the majority of electric use coming from process equipment that is not weather dependent. Electricity usage spikes only slightly during the summer when air conditioning is usage and slightly during the winter when electric heating is used.

The plant currently purchases natural gas from PSE&G which acts as the transportation company and energy supplier at a general service market rate for natural gas (therms). There are two gas meters that provides natural gas service to the facility currently. The average aggregated rate (supply and transport) for the meter is approximately $1.408/therm based on 12 months of utility bills March 2008 to February 2009. The suppliers' general service rate for natural gas charges a market-rate price based on use and the buildings billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the summer months when natural gas is only used by the hot water boilers for domestic hot water. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months. Thus the plant pays for fixed costs such as meter reading charges during the summer months.



The shelter currently purchases natural gas from PSE&G which acts as the transportation company and energy supplier at a general service market rate for natural gas (therms). There is one gas meter that provides natural gas service to the facility currently. The average aggregated rate (supply and transport) for the meter is approximately $1.486/therm based on 12 months of utility bills March 2008 to February 2009. The suppliers' general service rate for natural gas charges a market-rate price based on use and the buildings billing does not breakdown demand costs for all periods. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. Typically, the natural gas prices increase during the summer months when natural gas is only used by the hot water boilers for domestic hot water. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months. Thus the plant pays for fixed costs such as meter reading charges during the summer months.



1.3. Energy benchmarking

Sewage Treatment Plant/Animal Shelter

SWA has entered energy information about the Sewage Treatment Plant and Animal Shelter into the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. The buildings have been combined as one facility since they share a common electric meter. Currently, the facility is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 654.0 kBtu/sq ft yr compared to the national average of a building consuming 104.0 kBtu/sq ft yr. This intensity is much greater than the national average due to the process equipment present on site and the fact that the average building is based on a typical commercial office building. Implementing this report's recommended Energy Conservations Measures (ECMs) will reduce use by approximately 14.0 kBtu/ sq ft yr, which would decrease the building's energy use intensity to 640.0 kBtu/sq ft yr.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

[redacted]

[redacted]

Also, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Sewage Treatment Plant

Building ID: 2025798
For 12-month Period Ending: January 31, 2009[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 12, 2010

Facility	Facility Owner	Primary Contact for this Facility
Township of Livingston - Sewage Treatment Plant 81 Naylon Avenue Livingston, NJ 07039	N/A	N/A

Year Built: 1938
Gross Floor Area (ft²): 20,464

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	12,071,792
Natural Gas (kBtu)[4]	1,302,472
Total Energy (kBtu)	13,374,264

Energy Intensity[5]

Site (kBtu/ft²/yr)	654
Source (kBtu/ft²/yr)	2037

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	1,908

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	856%
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

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

The Sewage Treatment Plant is a large complex of buildings that consists of over a dozen buildings, several sewage treatment tanks and multiple processing facilities. The Animal Shelter is a separate building that is located on the same property. Each building has been described independently in order to clarify the location of existing descriptions.

Building #1 – Old Control Building / Locker Room

The free standing two-story (slab-below-grade) with basement, 1,000 square foot old control building / locker room houses locker rooms, an old control room, office, boiler room and several mechanical rooms.

Partial East Façade

Partial South Facade

Partial North Façade

Partial North Façade

Building #2 – Laboratory

The free standing single-story (slab-on-grade) with basement, 760 square foot laboratory houses a water sample testing laboratory, meeting room, and office.


Partial North Façade


Partial West Facade


Partial South Façade

Building #3 – Primary Pump Building

The free standing single-story (slab-below-grade) with basement, 635 square foot primary pump building houses only pump and mechanical rooms.


North Façade


West Façade


Partial South Façade


Partial East Façade

Building #4 – Maintenance Building

The free standing single-story (slab-below-grade) with basement, 1,150 square foot maintenance building houses only a garage and mechanical rooms.


East Façade


North Façade


Partial West Façade


Partial South Façade

Building #5 – Supernatant Pump Building

The free standing single-story (slab-below-grade) with basement, 230 square foot supernatant building houses only a pump and mechanical room.


East Façade


Partial North Façade


Partial West Façade


Partial South Façade

Building #6 – Chlorine Building

The free standing single-story (slab-on-grade), 280 square feet chlorine building houses mechanical rooms only.


Partial Northeast Façade


Southwest Façade

Partial Northwest Façade

Partial Southeast Façade

Building #7 – Digester Building

The free standing single-story (slab-below-grade) with basement, 3,000 square foot digester building houses mechanical rooms and boiler room.

East Façade

North Façade

Partial South Façade

Partial West Façade

Building #8 – Intermediate Pump Building

The free standing single-story (slab-below-grade) with basement, 2,500 square foot houses pump and mechanical rooms only.

Partial Façade

South Façade

Building #9 – Chemical Feed Building

The free standing single-story (slab-on-grade), 580 square foot chemical feed building was originally constructed in 2002. It houses storage and mechanical rooms only.

Northeast and Southeast Façade
Image courtesy of Bing™

Northwest and Southwest Façade.
Image courtesy of Bing™

Building #10 – Advance Treatment Building

The free standing single-story (slab-on-grade), 7,000 square feet advanced treatment building houses municipal offices, storage rooms, mechanical rooms, electrical rooms and a thickener room.

Partial North Façade

Partial East Façade

Partial West Façade

Partial South Façade

Building #11 – Effluent Pump Station

The free standing single-story (slab-on-grade), 460 square foot effluent pump station houses mechanical rooms only.

Northwest Façade

Southeast Façade

Building #12 – Three Bay Garage

The semi attached single story (slab-on-grade), 1,200 square feet Livingston three bay garage is used for general storage and vehicle storage purposes only.

Southeast Façade

Northeast Façade

Northwest Façade

Animal Shelter

The semi attached single story (slab-on-grade), 1,500 square feet animal shelter houses an animal shelter and storage room and outdoor kennel.

Southwest Façade

Partial Southeast Façade

Partial Southeast Façade

Partial Northwest Façade

2.2. Building Occupancy Profiles

Sewage Treatment Plant

The sewage treatment plants occupancy is approximately 8 employees; daily from 7:30 AM to 4:00 PM. Occupancy at the plant is not subject to fluctuations as it is closed to the public.

Animal Shelter

The animal shelter's occupancy is one employee on weekdays from 8:30 AM to 4:30 PM and weekends between 9:00 AM and 11:00 PM. Additionally there is the occasional visitor present at the animal shelter.

2.3. Building Envelope

Due to unfavorable weather conditions (min. 18 deg. F delta-T in/ outside & no/low wind) no exterior envelope infrared (IR) images were taken during the field audit. Thermal imaging/infrared (IR) technology helps to identify energy compromising problem areas in a non-invasive way.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

Building #1 – Old Control Building / Locker Room

The exterior wall envelope is mostly constructed of exposed and painted brick masonry units with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels *could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.*

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall acceptable, age-appropriate condition with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues mainly on the painted brick facades.

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

Identified areas of shifted brick, water damage and cracked caulking.

In light of the exterior wall conditions mentioned above SWA has the following recommendations;

1. Inspect and maintain gutters, downspouts and downspout deflectors to minimize possible uncontrolled roof water run-off causing exterior wall damage.
2. Insulate original and uninsulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and covering it with gypsum wallboard or other preferred interior finish.
3. Replace broken/ deteriorated bricks and re-point cracked mortar joints.
4. Inspect and replace cracked/ ineffective caulk.
5. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

Building #2 – Laboratory

The exterior wall envelope is mostly constructed of exposed brick masonry units with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

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

Identified areas of efflorescence crack caulking.

In light of the exterior wall conditions mentioned above SWA has the following recommendations;

1. Efflorescence coated brick and masonry materials need to dry out and possible cause of water infiltration into wall cavities should be investigated.
2. Inspect and replace cracked/ ineffective caulk.
3. Insulate original and uninsulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and covering it with gypsum wallboard or other preferred interior finish.
4. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

Building #3 – Primary Pump Building

The exterior wall envelope is mostly constructed of exposed brick masonry units with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

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


Typical primary pump building exterior walls

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

Building #4 – Maintenance Building

The exterior wall envelope is mostly constructed of exposed brick masonry units with 0 inches of detectable insulation. Other areas are constructed of exposed cast-in-place concrete over concrete block with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

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

Maintenance building with cracked and missing caulking, and damaged exterior wall finish

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Inspect and replace cracked/ ineffective caulk.
2. Repair all damaged exterior wall finishes
3. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry, degraded caulking, and locating sources of water and air leakage.

Building #5 – Supernatant Pump Building

The exterior wall envelope is mostly constructed of exposed brick masonry units with 0 inches of detectable insulation. Other areas are constructed of exposed cast-in-place concrete over concrete block with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

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

Cracked/ deteriorated bricks and mortar joints, exposed building penetration, and signs of water damage at perimeter walls due to missing/ ineffective site drainage

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Replace broken/deteriorated bricks and re-point cracked mortar joints.
2. Inspect and replace cracked/ ineffective caulk.
3. Seal and insulate exposed building penetration.
4. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Building #6 – Chlorine Building

The exterior wall envelope is mostly constructed of exposed brick masonry units with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

The following specific exterior walls were identified:

Typical exterior wall surface

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Replace broken/deteriorated bricks and re-point cracked mortar joints.
2. Inspect and replace cracked/ ineffective caulk.
3. Seal and insulate exposed building penetration.
4. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Building #7 – Digester Building

The exterior wall envelope is mostly constructed of exposed brick masonry units over concert block with 0 inches of detectable insulation. The interior is mostly unfinished except for sections of painted gypsum wallboard near office and other non mechanical rooms.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

The following specific exterior walls were identified:


Typical exterior wall surface

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Building #8 – Intermediate Pump Building

The exterior wall envelope is mostly constructed of exposed brick masonry units without detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

The following specific exterior walls were identified:

Typical exterior wall surface

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Building #9 – Chemical Feed Building

The exterior wall envelope is mostly constructed of exposed brick masonry units with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good, age-appropriate condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all facades.

The following specific exterior walls were identified:

Typical exterior wall surface

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

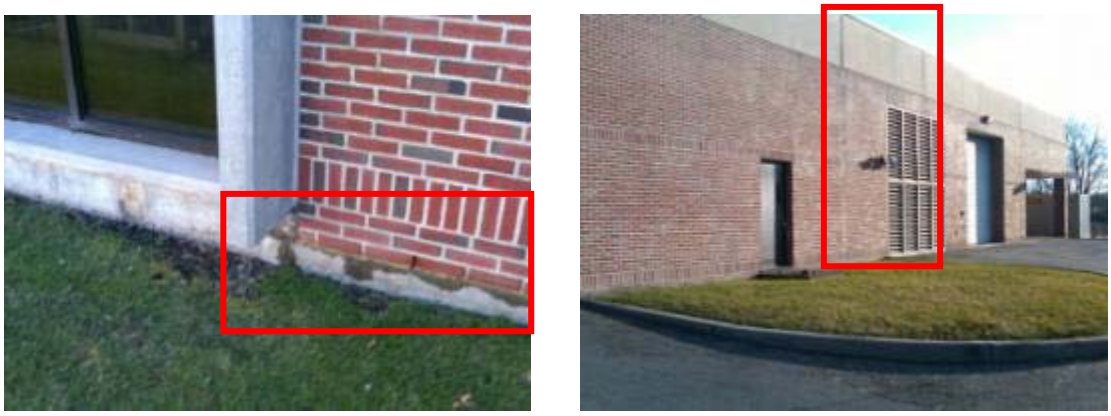
Building #10 – Advance Treatment Building

The exterior wall envelope is mostly constructed of exposed brick masonry units over concert block with 1-1/2 inches of detectable insulation. The interior is mostly unfinished except for sections of painted gypsum wallboard near office and other non mechanical rooms.

Note: Wall insulation levels could not be verified in the field and are based on reports from building management.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues located mostly at the front of the building.

The following specific exterior walls and problem spots were identified:



Signs of water damage at perimeter walls due to missing/ ineffective site drainage and cracked/ aged caulk

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

1. Slope perimeter grade away from building to maximize site drainage
2. Inspect and replace cracked/ ineffective caulk.
3. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Building #11 – Effluent Pump Station

The exterior wall envelope is mostly constructed of exposed brick masonry units over concert block with 0 inches of detectable insulation. The interior is mostly unfinished except for sections of painted gypsum wallboard near office and other non mechanical rooms.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall good condition with only a few signs of uncontrolled moisture, air-leakage or other energy-compromising issues located mostly at the front of the building.

The following specific exterior walls and problem spots were identified:

Typical exterior wall finish and signs of water damage at building grade

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

4. Slope perimeter grade away from building to maximize site drainage
5. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Building #12 – Three Bay Garage

The exterior wall envelope is mostly constructed of stucco accents, over masonry brick units without detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

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

The following specific exterior walls were identified:

Damaged exterior wall finish

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

6. Repair all damaged exterior wall finishes.
7. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

Animal Shelter

The exterior wall envelope is mostly constructed of stucco accents, over masonry brick units with 0 inches of detectable insulation. The interior is mostly unfinished.

Note: Wall insulation levels could not be verified in the field or on construction plans, and are based upon similar wall types and time of construction.

Exterior and interior wall surfaces were inspected during the field audit. They were found to be in overall poor, age-appropriate condition with numerous signs of uncontrolled moisture, air-leakage and other energy-compromising issues detected on all facades.

The following specific exterior walls were identified:

Damaged exterior wall finishes, uncontrolled roof water run-off due to defective/ clogged gutters and downspouts and un-caulked/ un-sealed exterior wall penetrations

In light of the exterior wall conditions mentioned above SWA has the following recommendations:

8. Insulate original and uninsulated exterior wall sections. SWA suggests applying 2" XPS rigid foam boards to the interior and covering it with gypsum wallboard or other preferred interior finish.
9. Apply appropriate air-sealing strategies around all exterior wall penetrations (incl. electrical, plumbing and HVAC).
10. Clean and maintain gutters, downspouts and downspout deflectors to minimize uncontrolled roof water run-off causing exterior wall damage.
11. Conduct biannual maintenance inspections to inspect the exterior walls with a focus on cracks and pointing of the masonry

2.3.2. Roof

Building #1 – Old Control Building / Locker Room

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish. It was recently installed. Two and a half inches of foam board roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:


Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #2 – Laboratory

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish. It was recently installed. Two and a half inches of foam board roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #3 – Primary Pump Building

The building's roof is predominantly a flat and parapet type over steel decking, with a standing-seam metal finish. It is not known when the last roof replacement occurred. Zero inches of assumed roof insulation are present.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #4 – Maintenance Building

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish. It was recently installed. Two and a half inches of foam board roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #5 – Supernatant Pump Building

The building's roof is predominantly a flat, no parapet type over steel decking, with a built-up asphalt finish and gravel ballast. It is not known when the last roof replacement occurred. Zero inches of roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #6 – Chlorine Building

The building's roof is predominantly a flat, no parapet type over steel decking, with a built-up asphalt finish. It is not known when the last roof replacement occurred. Zero inches of roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #7 – Digester Building

The building's roof is predominantly a flat, no parapet type over steel decking, with a dark-colored EPDM single membrane finish. It was recently installed. Two and a half inches of foam board roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #8 – Intermediate Pump Building

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish and gravel ballast. It is not known when the last roof replacement occurred. Zero inches of roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #9 – Chemical Feed Building

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish and gravel ballast. It is not known when the last roof replacement occurred. Zero inches of roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #10 – Advance Treatment Building

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish and gravel ballast. It was recently installed. Two and a half inches of foam board roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #11 – Effluent Pump Station

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish. It was recently installed. Zero inches of roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Building #12 – Three Bay Garage

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish. It was recently installed. Two and a half inches of foam board roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

Animal Shelter

The building's roof is predominantly a flat and parapet type over steel decking, with a built-up asphalt finish and reflective coating. It is not known when the last roof replacement occurred. Zero inches of roof insulation are assumed.

Note: Roof insulation levels could not be verified in the field, and are based on reports from building management.

Roofs, related flashing, gutters and downspouts were inspected during the field audit. They were reported to be in overall good condition, with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues detected on all roof areas.

The following specific roof systems were identified:

Typical roofing systems

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain/ inspect all roof surfaces on a regular basis with a focus on the condition of the flashing, roofing membrane, drainage, signs of water pooling, signs of infiltration and locations that correspond to water damaged ceiling tiles.

2.3.3. Base

Sewage Treatment Plant

The plants buildings bases are typically composed of a mix of slab-on-grade and slab below grade floors with a perimeter footing with poured concrete foundation walls and perimeter insulation. At most locations, the slab is 4", thick concrete or 5" thick concrete with welded wire fabric reinforcement at the garage bays. The concrete slabs and perimeter walls appear to be surrounded by a 2" thick layer of rigid insulation in the newly constructed buildings such as the advanced treatment building.

The building's bases and there perimeters were inspected. Overall, the base was found to be in good condition with no signs of uncontrolled moisture, air-leakage or other energy-compromising issues neither visible on the interior nor exterior.

Animal Shelter

The building's base is composed of a slab-on-grade floor with a perimeter foundation and no detectable slab edge/perimeter insulation.

Slab/perimeter insulation levels could not be verified in the field and are based on reports from building management.

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 good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues detected in some areas inside.

2.3.4. Windows

Building #1 – Old Control Building / Locker Room

The building contains basically two different types of windows.

1. fixed type windows with a non-insulated aluminum frame, tinted single glazing and interior reflective roller shades. The windows are located throughout the building and have never been replaced
2. double-hung type windows with a non-insulated aluminum frame, tinted single glazing and interior reflective roller shades. The windows are located throughout the building and have never been replaced

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in poor/ age appropriate condition with numerous signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Exterior water damage signs on areas around windows, damaged/aged window frame single-glazed window with ineffective frame, exposed window lintel, missing window sill and drip-edge detail and air-leakage at sleeved window/wall air-conditioning units

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Replace/repair and maintain broken/non closing/damaged window units

2. Properly seal and insulate window lintel to eliminate thermal break.
3. Install/repair pan or strip flashing and drip edge detail at window sill.
4. Replace all original/ single glazed windows with a low-E, double glazed type.
5. Openings around window/sleeved air conditioning units need airtight gaskets/ sealants for optimal all year performance. Insulated hoods should be installed during winter months if removing the units is not an option.
6. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #2 – Laboratory

The building contains basically one type of window.

1. Double-hung type windows with an insulated aluminum frame, clear double glazing and interior roller shades. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in poor/ age appropriate condition with numerous signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Damaged/old window frame

exposed window lintel, missing window sill and drip-edge detail

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Replace/repair and maintain broken/ non closing/ damaged window units
2. Properly seal and insulate window lintel to eliminate thermal break.
3. Install/repair pan or strip flashing and drip edge detail at window sill.
4. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #3 – Primary Pump Building

The building contains basically one type of window.

1. double-hung type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Damaged/aged window frame exposed window lintel, missing window sill and drip-edge detail

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #4 – Maintenance Building

The building contains basically one type of window.

1. unit (fixed and hopper) type windows with an insulated aluminum frame, clear double glazing and interior roller shades. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical window with exposed window lintel,

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Properly seal and insulate window lintel to eliminate thermal break.
2. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #5 – Supernatant Pump Building

The building contains basically one type of window.

1. Skylight type windows with a non-insulated aluminum frame, clear single glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical skylight window

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Maintain and inspect all skylight windows with a focus on the condition of the frames, flashing, and signs of water damage.

Building #6 – Chlorine Building

The building contains basically one type of window.

1. fixed type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical window

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #7 – Digester Building

The building contains several different types of windows.

1. hopper type windows with an insulated aluminum frame, tinted double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently
2. fixed type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

3. Slider type windows with an insulated aluminum frame, tinted double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:


Typical window installations

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #8 – Intermediate Pump Building

The building contains basically one type of window.

1. skylight type windows with a non-insulated aluminum frame, clear single glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical skylight window

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Maintain and inspect all skylight windows with a focus on the condition of the frames, flashing, and signs of water damage.

Building #9 – Chemical Feed Building

The building contains basically one type of window.

1. skylight type windows with a non-insulated aluminum frame, clear single glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain and inspect all skylight windows with a focus on the condition of the frames, flashing, and signs of water damage.

Building #10 – Advance Treatment Building

The building contains several different types of windows.

1. Fixed type windows with an insulated aluminum frame, tinted double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising

issues. Overall, the windows were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical window installations

In light of the exterior wall conditions mentioned above SWA has the following recommendation;

1. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #11 – Effluent Pump Station

The building contains several different types of windows.

1. unit (fixed and hopper) type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in acceptable/ age appropriate condition with only a few signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical window installation with exposed lintel

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Properly seal and insulate window lintel to eliminate thermal break.
2. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Building #12 – Three Bay Garage

The building contains basically one type of window.

1. unit (fixed and hopper) type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good/ age appropriate condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical window installation

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

Animal Shelter

The building contains basically one type of window.

1. double-hung type windows with an insulated aluminum frame, clear double glazing and no interior or exterior shading devices. The windows are located throughout the building and were installed recently

Windows, shading devices, sills, related flashing and caulking were inspected as far as accessibility allowed for signs of moisture, air-leakage and other energy compromising issues. Overall, the windows were found to be in good/ age appropriate condition with some signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific window problem spots were identified:

Typical window installation and signs of damaged window frames, infiltration and water damage.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace/ repair and maintain broken/ non closing/damaged window units
2. Replace/ add/ maintain caulk around window frames and sills.
3. Maintain and inspect all exterior windows with a focus on the condition of the frames, water damage from the sills, air tight seal, and proper hardware operation.

2.3.5. Exterior doors

Building #1 – Old Control Building/Locker Room

The building contains three different types of exterior doors..

1. aluminum type exterior doors. They are located throughout the building and were installed recently.
2. aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.
3. aluminum type exterior doors with glass panel and screen door. They are located throughout the building and were installed recently.
4. wood type exterior doors with screen door. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #2 – Laboratory

The building contains only one type of exterior door..

1. Aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #3 – Primary Pump Building

The building contains only one type of exterior door..

1. aluminum type exterior door. They are located in the front of the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #4 – Maintenance Building

The building contains two different types of exterior doors..
1. aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.
2. overhead type exterior doors with glass panels. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #5 – Supernatant Pump Building

The building contains only one type of exterior door..
1. aluminum type exterior doors with glass panels. They are located in the front of the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical exterior door with damaged lower portion of door frame

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Repair damaged lower portion of door frame
3. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #6 – Chlorine Building

The building contains only one type of exterior door.

1. aluminum type exterior door. It is located in the front of the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #7 – Digester Building

The building contains only one type of exterior door..

1. Aluminum type exterior doors. They are located in the front of the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #8 – Intermediate Pump Building

The building contains two different types of exterior doors..

1. Aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.
2. Overhead type exterior doors with glass panels. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #9 – Chemical Feed Building

The building contains two different types of exterior doors..
1. aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.
2. overhead type exterior doors with glass panels. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #10 – Advance Treatment Building

The building contains three different types of exterior doors.
1. aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.
2. aluminum type exterior doors with glass panels. They are located throughout the building and were installed recently.
3. overhead type exterior doors. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:


Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #11 – Effluent Pump Station

The building contains only one type of exterior door.

1. aluminum type exterior door. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:


Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Building #12 – Three Bay Garage

The building contains only one type of exterior door.
1. overhead type exterior doors with glass panels. They are located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:

Typical Exterior Doors

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

Animal Shelter

The building contains three different types of exterior doors.
1. wood type exterior door. It is located throughout the building and were installed recently.
2. overhead type exterior door. It is located throughout the building and were installed recently.

All exterior doors, thresholds, related flashing, caulking and weather-stripping were inspected for signs of moisture, air-leakage and other energy-compromising issues. Overall, the doors were found to be in good condition with no signs of uncontrolled moisture, air-leakage and/ or other energy-compromising issues.

The following specific door problem spots were identified:


Typical exterior doors with damaged frames

In light of the exterior wall conditions mentioned above SWA has the following recommendation:

1. Replace missing or damaged weather-stripping.
2. Repair, seal and insulate and damaged door frames.
3. Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seals and signs of water damage and infiltration.

2.3.6. Building air-tightness

Sewage Treatment Plant

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

Animal Shelter

Overall the field auditors found the building to be reasonably air-tight with only a few areas of suggested improvements, as described in more detail earlier in this chapter.

The air tightness of buildings helps maximize all other implemented energy measures and investments, and minimizes potentially costly long-term maintenance, repair and replacement expenses.

2.4. HVAC Systems

2.4.1. General

Sewage Treatment Plant

The Sewage Treatment Plant is a large complex consisting of over a dozen buildings, several sewage treatment tanks, and multiple processing facilities. A small number of the buildings are nothing more than single rooms used to house some of the plant's pumps or processing equipment. Most buildings make use of electric unit heaters, while a couple of the buildings are conditioned by rooftop units. A small number of the buildings are cooled by through-the-wall air conditioning units; however, the majority of the plant's buildings receive no cooling. The control room in the Advanced Treatment Building is cooled by a split system air conditioner.

Animal Shelter

The Animal Shelter consists of 3 connected small buildings – an active animal shelter/kennel section, a kennel/incinerator section and a garage section. Only the active animal shelter section has heating and cooling. The other 2 sections have heating units, but per the personnel they are connected to a dead/abandoned boiler.

2.4.2. Heating

Sewage Treatment Plant

Building 1: Old Control Building & Locker room – This was originally one of the plant's control buildings, but the controls portion has since been abandoned and the only functioning space of the building is the small locker room at the front. There is a small electric unit heater in the corner of the locker room area which is estimated to be at 50% of its expected useful life. No other heating is provided for the building. The abandoned portion of the building houses a boiler that is no longer in use. This boiler previously provided heat to the several hot water radiators located throughout the small building.

Electric unit heater in locker room

Building 2: Laboratory – This building is heated by an electric heat rooftop unit. Age and condition of the unit were unable to be determined due to lack of roof access during the survey period. It was reported by Sewer department personnel that this equipment was installed in 1994. SWA recommends that the unit be replaced since it is at the end of its useful life of 15 years, according to the 2007 ASHRAE Applications Handbook.

Building 3: Primary Pump Building – This is heated by an electric unit heater mounted from the ceiling. Nameplate information was inaccessible, but the heater appears in fair to good condition and provides adequate heating to the space.

Electric unit heater

Building 4: Maintenance Building – Three electric unit heaters provide heat to this building. These units were installed within the last 5-10 years and are in fair to good condition. The building also has an underground tunnel which houses some of the facility's treatment pump equipment. No heating was observed in the tunnel space.

Electric unit heater in Maintenance Shop; View of adjoining underground tunnel

Building 5: Supernatant Pump Building – A single electric unit heater provides the only heat to this one room building which houses the supernatant pumps. This unit was installed in 2008 and is in very good condition.

Building 6: Chlorine Building – The chlorine building is heated by a portable, electric baseboard heater. This unit is less than a year old and is in very good to excellent condition.

Portable electric baseboard heater

Building 7: Digester Building – This building is built between two large digester tanks, both over two stories tall. The building itself is a two story structure and houses a gas-fired, hot water boiler in the lower level. No nameplate data was available on the boiler, making capacity indeterminable. The boiler serves a single hydronic unit heater in the boiler area and provides hot water for the sewer treatment processes of the building/digester tanks. Despite its appearance, the boiler is said to have been serviced or installed in 2008 and has approximately 90% of its estimated useful life remaining.

Hot water boiler; Hydronic unit heater

Building 8: Intermediate Pump Building – The building receives no actual heating besides the radiant heat generated by the processing equipment.

Building 9: Chemical Feed Building – Two (2) electric unit heaters, mounted at the ceiling, provide heating for this building. These units were installed in 2001 and are in fair to good condition. The building houses the chemical feed pump equipment for the facility.

Electric unit heater

Building 10: Advance Treatment Building – This building is comprised of eight (8) rooms. Two gas-fired hot water boilers provide heating to a pair of hydronic hot water unit heaters in the boiler/electric room of the building. The 1,357,000 btu/h input boilers also provide process hot water to the various pieces of sewage treatment equipment in the building. Although there would be some efficiency to be gained by replacing the boilers, they still have about 10 years of useful life remaining and should be retained and repaired to optimize operation. No other rooms in the building receive heating other than the radiant heat provided by the processing equipment.

Building 11: Effluent Pump Station – A single electric unit heater mounted at the ceiling provides heat for this space. The unit is beyond its expected useful life of thirteen (13) years and SWA recommends that the unit be replaced with a new unit of the same capacity.

Electric unit heater in Effluent Pump Station

Animal Shelter

The Animal Shelter is heated by an electric unit heater (10 KW). All other heaters within these buildings are old hydronic heaters, which are connected to an abandoned boiler and no longer operational.

Electric unit heater

2.4.3. Cooling

Sewage Treatment Plant

Building 1: Old Control Building & Locker room – A small thru-the-wall air conditioner located in the front of the locker room provides cooling. The air conditioner appeared to be in fair condition; however, SWA recommends that the unit be replaced with an Energy Star rated unit to improve efficiency. The abandoned portion of the building receives no cooling.

Thru-wall AC unit

Building 2: Laboratory – This building is cooled by a pair of thru-the-wall air conditioning units. No nameplate data was available, but the units appear to be of adequate condition and functionality.

Building 3: Primary Pump Building – This building receives no cooling.

Building 4: Maintenance Building – This building and the adjoined underground tunnel space receive no cooling.

Building 5: Supernatant Pump Building – This building receives no cooling.

Building 6: Chlorine Building – This building receives no cooling.

Building 7: Digester Building – This building receives no cooling.

Building 8: Intermediate Pump Building – This building receives no cooling.

Building 9: Chemical Feed Building – This building receives no cooling.

Building 10: Advance Treatment Building – The control room of the building is cooled by a split system air conditioner. The air-cooled condensing unit is located on the roof of the building and appears to be in fair to good shape. Exact age of the unit is unknown due to a lack of a serial number on the nameplate of the unit, however, based on the condition, style, and model number of the unit it has been estimated that the unit is roughly twenty (20) years old and is approaching its expected useful life. SWA recommends that the unit be replaced in kind. The remainder of the building does not receive any cooling.

Air-cooled condensing unit on roof for Control Room cooling

Building 11: Effluent Pump Station – This building receives no cooling.

Animal Shelter

The animal shelter has a thru-the-wall air conditioning unit. Nameplate was not visible, age of unit unknown. This is the only cooling in these buildings.

Through the wall A/C unit

2.4.4. Ventilation

Sewage Treatment Plant

Building 1: Old Control Building & Locker room – There is a single exhaust fan located on the roof above the locker room. The fan is believed to serve the toilet room in the locker room, as well as rooms in the abandoned controls portion of the building. It was unable to be determined if the exhaust fan is still operational, but appears to be in good to fair condition.

Roof mounted exhaust fan

Building 2: Laboratory – There is a fume hood serving the actual laboratory, with a rooftop heated makeup air unit to minimize air infiltration due to the negative building pressure caused by the hood while in operation. This unit is beyond its useful life and should be replaced as mentioned in the Heating section above.

Building 3: Primary Pump Building – There is a single exhaust fan providing ventilation to the space located in the rear corner of the roof. Age and condition of the fan were unable to be determined due to lack of roof access during the survey period.

Building 4: Maintenance Building – The maintenance building has five (5) exhaust fans located on the roof of the building. It is reported that some of the fans only operate while welding is taking place in the shop. Age and condition of the fans on maintenance building were unable to be determined due to lack of roof access during the survey period. The underground tunnel connected to the maintenance building is ventilated by a single exhaust fan located in the ceiling space of the tunnel, which is on grade level.


Roof of Maintenance building; Exhaust fan for underground tunnel

Building 5: Supernatant Pump Building – This building has no mechanical ventilation.

Building 6: Chlorine Building – Two exhaust fans located on the roof of the building were observed during the survey. Age and condition of these fans were unable to be determined due to lack of roof access.

Building 7: Digester Building – The building is served by three (3) or more roof mounted exhaust fans. Exact number, age, and conditions of fans were unable to be determined due to lack of roof access during the survey period.

Building 8: Intermediate Pump Building – A large air intake unit on the roof provides process air to the building. A pair of roof mounted exhaust fans provides mechanical ventilation. Exact age and condition of fans was unable to be determined due to lack of roof access during the survey period.

Building 9: Chemical Feed Building – Two (2) sidewall exhaust fans provide mechanical ventilation to this one room building.

Building 10: Advance Treatment Building – Two (2) large intake units, labeled “thickener and filter supply” and “basement supply” provide the building with process ventilation. Seven (7) roof mounted exhaust fans provide mechanical ventilation for the different rooms and processes of the building. No nameplate data was available on the various exhaust fans, but all are in good condition and reported to be functioning in an adequate manner. Due to the reported continual use of these exhaust fans, SWA recommends that if the fans are not currently equipped with high efficiency motors, but are replaced as such when needed as an energy conservation measure for the building.


Various exhaust fans and HV-3 unit; Close-up of F-9 boiler room exhaust fan

Building 11: Effluent Pump Station – There is a single exhaust fan providing ventilation to the space located in the center of the roof. Age and condition of the fan were unable to be determined due to lack of roof access during the survey period.

Animal Shelter

There is a thru the wall exhaust fan in the active animal shelter section. No other ventilation was evident.

Exhaust fan in wall

2.4.5 Domestic Hot Water

Sewage Treatment Plant

Building 2: Laboratory – The lab is served by a single 30 gallon, 2.5KW electric hot water heater located in the kitchen. Domestic hot water is provided to lavatories in two (2) toilet rooms and two other sinks. The heater is well beyond its expected useful life and SWA recommends that it be replaced in kind as part of a capital improvement project. This upgrade will not yield any energy savings.

Building 10: Advanced Treatment – A large 100 gallon gas-fired water heater is located in the electrical/boiler room of this facility. Hot water is provided to sinks and showers in the building. The 199000 btu/h input heater was installed in 1988 and is beyond its

expected useful life of 10-13 years. SWA recommends that the unit be replaced with a new heater of the same capacity.

Domestic water heater

Animal Shelter

The domestic hot water for the building is provided by a gas-fired, 75 gallon, 75 MBH tank-type water heater, located in the inactive kennel section. This heater serves fixtures in the kennel section. This water heater is from 1986 and has exceeded its expected life span.

Domestic water heater

2.4.6 Process Equipment

Sewage Treatment Plant

Throughout the plant, there are numerous pumps, pumping systems, and other sewage treatment process equipment running at various usages. A large number of the pumps are run 24 hours per day and are continually maintained and serviced. It was observed that most of these crucial use pumps and systems employed high efficiency motors making energy conservation measures limited. It should be noted that due to the corrosive nature of the environments in the buildings, many of the nameplates were illegible and some assumptions were made as to the efficiencies of some of the motors. The remaining pumps and systems throughout the plant run anywhere from two (2) to twenty (20) hours per week, also limiting the ability to provide strong energy

conservation measures for this type of equipment due to their limited use. The nature and critical function of the plant requires that the plant employees keep all equipment well-serviced, properly maintained, and efficient on a consistent basis.

It was reported by Sewer Department personnel that the digesters are not in good operating condition at this time. The mixing systems were installed in 1978 and need to be repaired or replaced. Reportedly, the sludge thickening process is more efficient than the digester process. In addition, the methane discharge from the digesters currently has a high level of water and hydrogen sulfide, such that the Sewer Department must pat for a $1,000.00 per month Air Quality Permit. Upon first inspection, it was SWA's intention to investigate the possibility of recommending an anaerobic digester cogeneration machine at this facility. However, the Sewer Department may wish to first investigate replacement of the digester before pursuing this measure. For more information, see Section 5 Renewable and Distributed Energy Measures.

For a complete list of pumps and equipment solely dedicated to the sewage treatment process, please reference equipment categorized as "sewage treatment" in the inventory list in section 3 of this report.

Animal Shelter

No such equipment present on at the animal shelter

2.5. Electrical systems

Sewage Treatment Plant

2.5.1.1. Lighting

Interior Lighting – The sewage treatment plant contains mostly inefficient lighting. There is primarily inefficient lighting such as the existing T12 fixtures with magnetic ballasts and incandescent fixtures. However, there are some CFL's, mercury vapor and high pressure sodium fixtures. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures, the incandescent and mercury vapors with CFLs and high pressure sodium fixtures with pulse start metal halides. To reduce usage SWA recommends the installation of 7 additional occupancy sensors. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

Exit Lights - Exit signs were found to be LED and fluorescent type and SWA recommends that the LED should remain and that they should be installed in place of the fluorescent exit signs.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be a combination of metal halide, halogen and incandescent. SWA recommends replacing the metal halides with pulse start metal halides and that the halogens and incandescent be replaced with CFL's.

2.5.1.2. Appliances

SWA performed a basic survey of appliances installed at the sewage treatment plant and has determined that it would be cost-effective to replace all of the refrigerators and retrofit the existing vending machine with a CoolingMiser®. Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, and computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. coffee makers, televisions, etc) except refrigerators and ice-makers be plugged in to power strips and turned off each evening just as the lights are turned off. Senior and Community Center computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.1.3. Elevators

There are no elevators located in this plant.

Animal Shelter

2.5.1.4. Lighting

Interior Lighting – The animal shelter contains inefficient lighting. There is primarily inefficient lighting such as the existing T12 fixtures with magnetic ballasts. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures. See attached lighting schedule in Appendix A for a complete lighting inventory throughout the building and estimated power consumption.

Exterior Lighting - The exterior lighting surveyed during the building audit was found to be halogen fixtures. SWA recommends replacing the halogens with CFL's.

2.5.1.5. Appliances

SWA performed a basic survey of appliances installed at the animal shelter and has determined that it would be cost-effective to replace the existing refrigerator as it is almost 30 years old. Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. For example, Energy Star refrigerators use as little as 315 kWh / yr. When compared to the average electrical consumption of older equipment, Energy Star equipment results in a large savings. Building management should select Energy Star label appliances and equipment when replacing: refrigerators, printers, and computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Computers left on in the building consume a lot of energy. A typical desk top computer uses 65 to 250 watts and uses the same amount of energy when the screen saver is left on. Televisions in meeting areas use approximately 3-5 watts of electricity when turned off. SWA recommends all computers and all appliances (i.e. coffee makers, televisions, etc) except refrigerators and ice-makers be plugged in to power strips and turned off each evening just as the lights are turned off. Senior and Community Center computers are generally programmed for the power save mode, to shut down after a period of time that they have not been used.

2.5.1.6. Elevators

There are no elevators located in the building.

3.1 EQUIPMENT LIST – Sewage Treatment Plant Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Sewage Treatment	(3) Polymer Mixers	Advanced Treatment Bldg	Serial #07112 1/2 HP; 220/480V	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2) Thickened Sludge Motors	Advanced Treatment Bldg	Model #M11A 7.5 HP; 10.2A; 460V-3 phase; premium efficiency motor	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) Polymer Pumps	Advanced Treatment Bldg	Serial #P14GG257NQR 1.5 HP; 230/460V – std. eff. motor	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2) Process Drain Pumps	Advanced Treatment Bldg	WF254TTDR40498NW 15 HP motor – 91% eff.	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) W.A.S. Pumps	Advanced Treatment Bldg	5KS286 AD305A 5KS286 AL305B 5KS286 AD305A 20 HP ea., 230/460V 92.4% eff.	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) R.A.S. Pumps	Advanced Treatment Bldg	Model #C6T11FK1A Serial #NEGO46140 30 HP ea.; 230/460V; (1) 91% eff. & (2) 93.6% eff. motors	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) Hot Water Process Pumps	Advanced Treatment Bldg	F029/A899/SO8S156R027F 3 HP ea.; 230/460V Standard Efficiency motors	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) Microscreens	Advanced Treatment Bldg	Serial #1YAB56833A3; - 5 HP ea. Standard Efficiency motors	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) Backwash Pumps	Advanced Treatment Bldg	7 HP; 460 V-3 phase	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2) Seal Water Motor	Advanced Treatment Bldg	1B1E158104161 - 1 HP Standard Efficiency motors	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2)Reaeration Motors	Advanced Treatment Bldg	Balor Motor - Model #EM3661T 5 HP Prem. Eff. Motor	Electric	Treatment Plant	1990	0%

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

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Sewage Treatment	(2) Effluent Water Pumps	Advanced Treatment Bldg	Serial #C125/R09R215R105F 30 HP ea.; 220/460V Premium Efficiency Motors	Electric	Treatment Plant	1990	0%
Sewage Treatment	(3) Intermed. Pump Station Motors	Advanced Treatment Bldg	Serial #W2-90 25 HP ea. (Not In Use)	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2) Flotation Thickener Upper Scrapers	Advanced Treatment Bldg	Serial #P56X1337-R-20 3/4 HP ea.	Electric	Treatment Plant	1990	0%
Heating / Sewage Treatment & Process	(2) Hot Water Boilers w/ Boiler Burners	Boiler Rm: Advanced Treatment Bldg	Weil-McLain (no nameplate) Burners: PowerFlame M# WCR1-G-12 S# 049048974 S# 049048975 - 1357MBH in	Natural Gas	Advanced Treatment Bldg	1990	35% 5%
Domestic Hot Water	Water Heater	Boiler Rm: Advanced Treatment Bldg	A.O. Smith M# BTC-200 840 SN# MH88-0135447-840 199 MBH input - 100 gal.	Natural Gas	Advanced Treatment Building	1988	0% beyond expected useful life
Sewage Treatment	Muffin Monster	Treatment Plant (Outside)	Model #5Ke184KC205C 5 HP	Electric	Treatment Plant	1995	0-25%
Sewage Treatment	Auger Motor	Treatment Plant (Outside)	5 HP	Electric	Treatment Plant	2000	50-60%
Sewage Treatment	(3) Collector Drive Motors	Treatment Plant (Outside)	Serial #3N603 1 HP	Electric	Treatment Plant	1977	0%
Sewage Treatment	(3) Primary Pumps	Primary Pump Building	Serial #R-8355-00-572 10 HP ea.	Electric	Treatment Plant	1998	40-50%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Sewage Treatment	Blower # 1	Control Bldg. Bsm't	Model #214688 Serial #D.S. 8611 - 40 HP	Electric	Treatment Plant	2000	50%
Sewage Treatment	(4) Blowers 2, 3, 4, 5	Control Bldg. Bsm't	Model #5K444AK309 Serial #FM252027 - 100 HP.	Electric	Treatment Plant	2000	50%
Sewage Treatment	(4) Collector Drives	Plant (Outside)	Model #M8H Serial #42A27-5541 3/4 HP	Electric	Treatment Plant	1977	0%
Sewage Treatment	(3) Blowers 6-7-8	Intermediate Pump Building	Model #5KW405AL208 125 HP ea.	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2) Hypo Pumps	Chlorine Building	Model #85M5 – 25 PSI Serial #112008-40337	Electric	Treatment Plant	2008	95%
Sewage Treatment	(2) Alum Pumps	Chemical Feed Building	Baldor Motor Serial #34-452-9551 1/4 HP ea.; 115/230 V	Electric	Treatment Plant	2000	50%
Sewage Treatment	(2) Sub-Pumps	Chemical Feed Building	Model #T1025-1 5 HP ea. 220/460V	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2) Nitrous Tank Pumps	Treatment Plant (Outside)	Model #Unimount 125 Serial #E183-5085158R0118F 75 HP ea.; 230/460V	Electric	Treatment Plant	1990	0%
Sewage Treatment	(2)Supernatant Pumps	Supernatant Pump	Model #5-4 Serial #51-447-490-5316 5HP	Electric	Treatment Plant	1995	25%
Sewage Treatment	Digester	Digester Building	EB21577651026AB F21 10 HP; 230/460V 3-phase	Electric	Treatment Plant	1980	0%
Sewage Treatment	(5) Return Pumps 1-5	Plant (outside)	Model #3614T 2 HP ea.	Electric	Treatment Plant	2004	75%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Sewage Treatment	(3) Return Pumps 6-8	Treatment Plant (Outside)	E498A/T06T114R085F E498A/T10T222R528F E498/T09T052R0415 7.5 HP ea.; 230/460V 3-ph.	Electric	Treatment Plant	2002	60%
Sewage Treatment	(2) Sludge Pumps	Digester Building	Serial #88694; 10 HP	Electric	Treatment Plant	2000	50%
Sewage Treatment	Heat Exchanger	Digester Building	H12800610; 1/2 HP	Electric	Treatment Plant	1977	0%
Sewage Treatment	Reducer Concentration Tank Mixer	Digester Building	Model #C6T11FK1A 1/2 HP	Electric	Treatment Plant	1987	0%
Sewage Treatment	Electric unit Heater	Locker Rm Bldg	(no nameplate)	Electric	Locker Room Bldg	2004	50%
Sewage Treatment	Window A/C Unit	Locker Rm Bldg	(no nameplate)	Electric	Locker Room Bldg	2006	60%
Ventilation	Roof Ex. Fan	Locker Rm	Domex M#CW-95	Electric	Locker Rm	1977	0%
Domestic Hot Water	Hot Water Heater	Lab Kitchen	A.O. Smith M# ECTT-30 S# 850-L-77-50083N 208V 2.5kw 30 gal.	Electric	Lab	Circa 1970's	0% beyond expected useful life
Cooling	(2) Window AC units	Conference room	(no nameplate)	Electric	Conference in Lab	1994	0%
Heating Ventilation	Rooftop Makeup Air	Lab Roof	(nameplate inaccessible)	Electric	Lab	1994	0%
Refriger.	(2) Resident. (2) Small	Kitchen & Lab of Lab Bldg	(no nameplate)	Electric	Kitchen & Lab	2005	50%
Heating	Electric unit Heater	Primary pump Building	(nameplate inaccessible)	Electric	Primary Pump	2010	100%
Ventilation	Roof Ex. Fan	Primary pump	(nameplate inaccessible)	Electric	Prim. Pump	1977	0%

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Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	(3) Electric Unit Heaters	Maintenance Shop	Qmark M# MUH104 - 480V 10kw ea.	Electric	Maintenance Shop	Est. 2000	Est. 25-75%
Ventilation	(6) Exhaust Fans	(5) Maint. Bldg & (1) above tunnel	(no nameplate) / (nameplate inaccessible)	Electric	Maint. Shop & Tunnel	1977	0%
Heating	Electric unit Heater	Supernatant Pump Bldg	Qmark M# MUH104 - 480V 10kw	Electric	Supernatant Bldg	2008	50%
Heating	Portable Elec. Heater	Chlorine Building	(no nameplate)	Electric	Chlorine Bldg	2010	75%
Ventilation	(2) Exhaust Fans	Chlorine Building	(nameplate inaccessible)	Electric	Chlorine Bldg	1977	0%
Sewage Treatment	(2) Chlorine Pumps	Chlorine Building	Stenner M# 85M5	Electric	Chlorine Bldg	2006	75%
Heating / Sewage Treatment	Hot Water Boiler	Digester Building	(no nameplate)	Natural Gas	Digester Building	2008	90%
Heating	Hydronic Unit Heater	Digester Bldg: Boiler area	(nameplate inaccessible)	Electric	Digester Building:	1977	0
Ventilation	(3+) Exhaust Fans	Roof of Digester Bldg	(nameplate inaccessible)	Electric	Digester Building	1977	0%
Process Ventilation	Air Intake HV-1	Intermediate Pump Bldg	(nameplate inaccessible)	N/A	Intermediate Pump Bldg	1990	0%
Ventilation	(2) Exhaust Fans	Intermediate Pump Bldg	(nameplate inaccessible)	Electric	Intermediate Pump Bldg	1990	0%
Heating	(2) Electric Unit Heaters	Chemical Feed Bldg	(nameplate inaccessible)	Electric	Chemical Feed Bldg	2001	25%

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Ventilation	(2) Sidewall Exhaust Fans	Chemical Feed Bldg	(nameplate inaccessible)	Electric	Chemical Feed Bldg	2001	50%
Heating	(2) Hydronic Unit Heaters	Boiler / Elec. Rm: Advanced Treatment	Trane (nameplate inaccessible)	Electric	Boiler / Electrical Room	1990	0%
Process Ventilation	HV-2 (Thickener & Filter Supply) HV-3 (Supply)	High Roof: Advanced Treatment	(no nameplate)	Electric	Advanced Treatment Bldg	1990	0%
Ventilation	(3) Roof (CH-1 Intake) (F-10 Intake) (F-5 Exhaust)	High Roof: Advanced Treatment	(no nameplate)	N/A	Advanced Treatment Bldg	1990	0%
Ventilation	(7) Exhaust Fans	High Roof: Advanced Treatment	(no nameplate)	Electric	Advanced Treatment Bldg	1990	0%
Cooling	Air Cooled Condesner ACC-1 (Control Room)	High Roof: Advanced Treatment	Mitsubishi Electric M# MU-12DN-U1 208V 1ph 11MCA 15MOCP 2lbs 14oz. R-22 refrigerant Indoor unit (not observed) Mitsubishi Electric M# MS-12DN-U1	Electric	Control Room: Advanced Treatment Bldg	Circa 1990	0-15%
Heating	Electric unit Heater	Effluent Pump Station	Trane 480V 3ph 7.5KW	Electric	Effluent Pump Station	1990	0% beyond expected useful life
Ventilation	Exhaust Fan	Effluent Pump Station	(nameplate inaccessible)	Electric	Effluent Pump Station	1990	0%
Lighting	See details - Appendix A	building	-	Electric	Building		

3.2 EQUIPMENT LIST – Animal Shelter

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Electric Unit Heater	Main Bldg. - Kennels	Qmark M# MUH-10-4 S# 09-93-2153 480V 3ph 10KW	Electric	Kennels	1993	0% beyond expected useful life
Cooling	Thru-wall Air Conditioning Unit	Main Bldg. - Kennels	Whirlpool (nameplate inaccessible)	Electric	Kennels	1990s	0-10%
Ventilation	Thru-wall Exhaust Fan	Main Bldg. - Kennels	Dayton M# 3M469B 115V 1/3HP 5.1A	Electric	Kennels	Est. pre-1990	0%
Refrig.	Residential Refrigerator	Main Bldg. - Kennels	Sears: Kenmore M# 564.8631110 S# 40605408 120V 1.8A 4.6oz. R-12 refrigerant	Electric	Kennels	Est. pre-1980	0%
Domestic Hot Water	Hot Water Heater	Second Bldg. - Garage	Rheem M# 29-75-2 S# RN0186402713 75MBH input 75 gal.	Natural Gas	Kennels	1986	0%

4. ENERGY CONSERVATION MEASURES

Sewage Treatment Plant – ECM's Category I and II

Based on the assessment of the Administration Building, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements – Upgrades not directly associated with energy savings
2. Operations and Maintenance – Low Cost/No Cost Measures
3. Energy Conservation Measures – Higher cost upgrades with associated energy savings

Category I Recommendations: - Capital Improvements

- Extend natural gas service to Buildings 2, 4, 9 and 11 – The Sewer Department may wish to consider extending a natural gas service to these buildings and replacing electric unit heaters and makeup air unit with gas-fired equipment. Although this measure would not result in energy savings, the Sewer Department should realize savings in operating costs by seeing reduced utility bills.

- Replace Advanced Treatment Building boiler burners – According to the 2007 ASHRAE Applications Handbook, the boiler burners in the Advanced Treatment Building are nearing the end of their expected service life based on their age. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace one (1) domestic water heater in Laboratory Building– According to the 2007 ASHRAE Applications Handbook, one electric domestic water heater in the Laboratory Building is beyond the end of its expected service life based on its age. Alternatively, the Sewer Department should consider removing the tank-type heater and installing an instantaneous point-of-use heater at each of the 2 sinks and 2 lavatories in this facility. This installation will allow the facility to avoid the tank standby losses associated with tank-type storage tank heaters. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace Laboratory Heated Makeup Air Unit – The Laboratory is heated and ventilated by a rooftop makeup air unit that contains electric heat. According to the 2007 ASHRAE Applications Handbook, this makeup air unit is beyond its expected service life. SWA recommends replacement of this equipment. This is a replacement in kind that will offer negligible energy savings.

- Replace (1) Mitsubishi Split System in Advanced Treatment Control Room -- According to the 2007 ASHRAE Applications Handbook, the split system with 1-ton capacity serving the Advanced Treatment Control Room is beyond its expected service life. SWA recommends replacement of this equipment to see an increase in operating efficiency and to remove environmentally unfriendly refrigerants from service. Based on the small tonnage, this upgrade cannot be justified by energy savings alone. Please See End of Life ECM#7.

- Replace electric and hydronic unit heaters – Replace electric unit heaters in Building 1 Old Control Room & Locker Room, and in Effluent Pump Station, and replace hydronic unit heaters in Digester Building and Advanced Treatment Building. According to the 2007

ASHRAE Applications Handbook, these heaters are beyond their expected service life. This equipment is in fair condition, but age and wear have reduced the heat transfer capacity. This equipment should be replaced with more modern equipment suited for the intended use. This is a replacement in kind recommendation which offers negligible energy savings.

- Replace window air conditioners – Buildings 1 and 2 contain a total of 3 window air conditioners. These units still have some useful life remaining (on the average 0-5 years left) but replacement should be considered with more modern, energy efficient systems. The window air conditioners should be replaced with split systems to allow for closing up of the existing window penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant. Should the Sewer Department prefer the window air conditioners over the split systems, replace the existing units with Energy Star rated equipment.

- Repair or replace the digester machines - It was reported by Sewer Department personnel that the digesters are not in good operating condition at this time. The mixing systems were installed in 1978 and need to be repaired or replaced. The methane discharge from the digesters currently has a high level of water and hydrogen sulfide, causing the payment of a monthly Air Quality Permit. Also, the digester was reported to be not as efficient as the sludge thickening process. The Sewer Department may wish to consider repairing or replacing the digester with digester equipment or equipment to support another process.

Category II Recommendations: - Operations and Maintenance

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

- Boiler room and other hot water piping insulation - Insulate un-insulated hot water piping in the Digester Building Boiler Room to efficiently deliver heat where required and provide personnel protection.

- Water levels in the boiler expansion tanks and the integrity of the tank bladders should be checked to confirm proper operation.

- Tighten belts on exhaust fans – tightening belts on belt-driven exhaust fans can maximize overall efficiency of the equipment.

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.
- Maintain and biannually inspect the roof with a focus on the condition of the shingles, drainage, signs of water damage and locations that correspond to locations of known infiltration.
- Conduct biannual maintenance inspections to inspect the windows with a focus on frame damage, degraded caulking, and locating sources of water and air leakage.
- Maintain and inspect all doors with a focus on the condition of the weather-stripping, door frame, air tight seal and signs of water damage and infiltration.

Animal Shelter – ECM's Category I and II

Based on the assessment of the Administration Building, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements – Upgrades not directly associated with energy savings
2. Operations and Maintenance – Low Cost/No Cost Measures
3. Energy Conservation Measures – Higher cost upgrades with associated energy savings

Category I Recommendations: - Capital Improvements

- Replace electric unit heater with gas-fired unit heater - The Township could save on operating costs by replacing the electric unit heater with a new high efficiency gas-fired unit heater and serving it by tapping into the nearby natural gas service. The estimated cost for this measure is $2,250.00. Based on a heating degree days analysis and an estimate of the overall R value of the building, it is estimated that the utility cost savings for switching this heater to a gas-fired unit heater would be about $180.00 per year. Therefore this measure would have a simple payback of 12.5 years.

- Replace window air conditioner – The existing window air conditioner is approaching the end of its useful life some useful life remaining (on the average 0-5 years left) but replacement should be considered with a more modern, energy efficient system. The window air conditioners should be replaced with split systems to allow for closing up of the existing window penetrations. These upgrades cannot be justified by energy savings alone but will result in a decrease in energy usage versus the existing equipment. In addition, the existing systems utilize R-22 refrigerant, which is not an ozone-friendly refrigerant. Newer systems should be specified with R-410A refrigerant.

- Replace wall exhaust fan with exterior wall fan with premium efficiency motor – The existing through wall exhaust fan is beyond its expected service life. Replacement with an exterior wall-mounted unit will ensure a tight seal to the wall penetration and minimize infiltration. The fan motor is fractional horsepower, so the energy savings related to the fan motor is negligible. In addition, since the fan utilizes a single phase motor, there is no NJ Clean Energy rebate available for this measure.

Category II Recommendations: - Operations and Maintenance

- Use Energy Star labeled appliances - such as Energy Star refrigerators that should replace older energy inefficient equipment.

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1.2	**(92) New CFL fixtures to be installed**
1.3	**(4) New LED exit sign fixtures to be installed**

1.5	(7) New occupancy sensors to be installed
2	Retrofit (1) refrigerated vending machine with VendingMiser device
4.3	replace (3) 5 Hp microscreen motors with Premium Efficiency
4.5	replace (1) 5 Hp Muffin Monster pump motor with Premium Efficiency
4.6	replace (3) 1 Hp Collector Drive motors with Premium Efficiency
4.8	replace (3) 7.5 Hp Return pump motors with Premium Efficiency
4.9	replace (1) 10 Hp Digester Gas-Mixer motor with Premium Efficiency
4.10	replace (2) 10 Hp Sludge Recirculation pump motor with Premium Efficiency
7.2	incremental cost to replace (25) exhaust fans with premium efficiency units
8.1	replace 1-ton Ductless DX split HVAC system with high eff. system (SEER 22)
8.2	incremental cost to replace 1-ton Ductless DX split HVAC systems with high efficiency system (SEER 22 vs SEER 13)
10.2	(2) New CFL fixtures to be installed
	Description of Recommended 5-10 Year Payback ECMs
1.1	(82) New T8 fixtures to be installed
1.4	(37) New pulse start metal halide fixtures to be installed
3.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind
3.2	Replace three (3) refrigerators with an 17 cu ft Energy Star model
4.1	replace (1) 30 Hp R.A.S. pump motor with Premium Efficiency
4.2	replace (3) 3 Hp hot water circulator pump motors with Premium Efficiency
4.4	replace (2) 1 Hp Seal motors with Premium Efficiency
4.7	replace (5) 2 Hp Return pump motors with Premium Efficiency
9	replace domestic water heater with 95% efficient unit
10.1	(9) New T8 fixtures to be installed
11	Replace three (3) refrigerators with an 17 cu ft Energy Star model
	Description of Recommended End of Life Cycle ECMs
6.1	replace domestic water heater with 95% efficient unit
	Description of Renewable ECMs
5.1	install 5.1 kW PV rooftop system with incentives on old control room building
5.2	install 45.0 kW PV rooftop system with incentives on advanced treatment building

ECM#1: *Building Lighting Upgrades – Sewage Treatment Plant*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Senior and Community Center (see Appendix A). The sewage treatment plant contains mostly inefficient lighting. There is primarily inefficient lighting such as the existing T12 fixtures with magnetic ballasts and incandescent fixtures. However, there are some CFL's, mercury vapor and high pressure sodium fixtures. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures, the incandescent and mercury vapors with CFLs and high pressure sodium fixtures with pulse start metal halides. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. SWA recommends installing 7 occupancy sensors in areas that are occupied only part of the day and payback on savings are justified. Typically, occupancy sensors have an adjustable time delay that shuts down the lights automatically if no motion is detected within a set time period. Advance micro-phonic lighting sensors include sound detection as a mean to control lighting operation. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The exterior lighting surveyed during the building audit was found to be a combination of metal halide, halogen and incandescent. SWA recommends replacing the metal halides with pulse start metal halides and that the halogens and incandescent be replaced with CFL's. Exterior lighting is controlled by an automated timer. Pulse-start metal halide (PSMH) lamps offer the advantages of standard (probe-start) MH lamps, but minimize the disadvantages. They produce higher light output both initially and over time, operate more efficiently, produce whiter light, and turn on and re-strike faster. SWA is not recommending at this time any upgrades to the exterior timers. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources from its facility staff on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $51,507 (Includes $16,897 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.1	(82) New T8 fixtures to be installed	15,855	2,460	13,395	5,106	1.1	N/A	0.9	620	1,376	15	20,634	9.7	54	4	6	2,793	6,995
1.2	(92) New CFL fixtures to be installed	4,933	none at this time	4,933	11,950	2.5	N/A	2.2	156	1,924	5	9,622	2.6	95	19	27	3,829	16,372
1.3	(4) New LED exit sign fixtures to be installed	732	80	652	432	0.1	N/A	0.1	82	146	15	2,184	4.5	235	16	21	1,061	592
1.4	(37) New pulse start metal halide fixtures to be installed	28,447	925	27,522	11,046	2.3	N/A	2.0	1,673	3,308	15	49,614	8.3	80	5	8	11,399	15,134
1.5	(7) New occupancy sensors to be installed	1,540	140	1,400	2,186	0.5	N/A	0.4	0	324	15	4,853	4.3	247	16	22	2,407	2,995
	Totals	**51,507**	**3,605**	**47,902**	**30,721**	**6**	**0**	**5.5**	**2,530**	**7,077**	**-**	**86,907**	6.8	**-**	**-**	**-**	**21,489**	**42,087**

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 10% failure rate in addition to the standard life cycle.

Rebates / Financial Incentives:
NJ Clean Energy - $30 per T8 fixture, $25 per PSMH fixture and $20 per occupancy sensor

Options for Funding ECM:
This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#2: *Retrofit Existing Refrigerator with VendingMiser*

Description:

A simple plug and play device a VendingMiser is Compatible with all refrigerated vending machines. VendingMiser's Passive Infrared Sensor (PIR) help the unit save power. This unit is to be installed on the existing refrigerated vending machines.

Installation Cost:

Estimated installed cost: $199 (Includes $20 of labor)
Source of cost estimate: *Manufacturers info*

Economics (with no incentives):

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2	Retrofit (1) refrigerated vending machine with VendingMiser device	199	0	199	486	0.1	N/A	0.1	0	72	12	863	2.8	334%	28%	35	508	666

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 – None available for this ECM

Options for funding the ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#3: *Replace Four Refrigerators with an Energy Star Models*

Description:

On the day of the site visit, SWA observed that there were four old refrigerators a 2.7 cu. ft. model and three 17 cu. ft. models in the facility which were not Energy Star rated (using approximately 254 and 773 kWh/yr each). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing residential refrigerators with a 17 cu. ft. top freezer refrigerator ENERGY STAR®, or equivalent and the under the coutner refrigerator with a 2.7 cf. ft. ENERGY STAR® model or equivalent. Besides saving energy, the replacement will also keep the kitchen and other areas cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $1,749 (includes $175 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.1	Replace (1) compact refrigerator with an 2.7 cu ft model in kind	99	0	99	95	0.0	N/A	0.0	0	14	12	169	7.0	70%	6%	9	39	130
3.2	Replace three (3) refrigerators with an 17 cu ft Energy Star model	1,650	0	1,650	1,275	0.3	N/A	0.2	0	189	12	2,264	8.7	37%	3%	5	206	1,747
	Totals	**1,749**	**0**	**1,749**	**1,370**	**0**	**0**	**0**	**0**	**203**	**24**	**2,433**	**8.6**	**-**	**-**	**-**	**245**	**1,877**

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#4: Install Premium Efficiency Motors on Sewer Plant Process Pumps & Equipment

Description:
The Sewage Treatment Plant equipment utilizes many pumps of all sizes. The majority of the pumps are high efficiency or premium efficiency at this time. However, there are standard efficiency motors on several pumps that should be replaced with premium efficiency motors. It should be noted that due to the corrosive nature of the environments in the buildings, many of the nameplates were illegible and some assumptions were made as to the efficiencies of some of the motors. The following is a summary of the pumps that SWA has identified that can be replaced, as well as assumptions of operating hours based on information from Sewer Plant personnel:

Advanced Treatment Building

- (1) 30 HP R.A.S. Pump (2 out of 3 are premium efficiency. One pump is 91%, replace with premium eff.) – 2,920 hours/yr
- (3) 3 HP Hot Water Heating Pumps –(1) @ 5,000 hours/year
- (3) 5 HP Microscreens – (1) @8,760 hours per year
- (2) 1 HP Seal Motors – (1) @8,760 hours per year

Treatment Plant (Outside)

- (1) 5 HP Muffin Monster – (1) @8,760 hours per year
- (3) 1 HP Collector Drive Motors – 3 @ 8,760 hours/year
- (5) 2 HP Return Pumps – 2 @ 8,760 hours per year
- (3) 7.5 HP Return Pumps – 2 @ 8,760 hours per year

Digester Building

- (1) 10 HP Digester – Gas Mixer – 1 @ 5,840 hours/year
- (2) 10 HP Sludge Recirculation Pumps – 1 @ 8,760 hours/year

In general, the pumps appear to be in fair condition. The Sewer Treatment Plant will realize energy savings by utilizing premium efficiency motors for the pumps listed above. SWA recommends that all motors selected are TEFC type due to the environment at the facility.

Installation cost:
Estimated installed cost: $13,825 (Includes 3,456 in labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4.1	replace (1) 30 Hp R.A.S. pump motor with Premium Efficiency	1,958	150	1,808	2,173	0.5	0	0.4	0	248	20	4,954	7.3	174	9	12	1,877	2,977
4.2	replace (3) 3 Hp hot water circulator pump motors with Premium Efficiency	1,500	180	1,320	1,269	0.3	0	0.2	0	145	20	2,893	9.1	119	6	9	832	1,739
4.3	replace (3) 5 Hp microscreen motors with Premium Efficiency	1,512	180	1,332	2,816	0.6	0	0.5	0	321	20	6,420	4.1	382	19	24	3,444	3,858

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4.4	replace (2) 1 Hp Seal motors with Premium Efficiency	718	100	618	943	0.2	0	0.2	0	108	20	2,150	5.7	248	12	17	981	1,292
4.5	replace (1) 5 Hp Muffin Monster pump motor with Premium Efficiency	504	60	444	2,816	0.6	0	0.5	0	321	20	6,420	1.4	1346	67	72	4,332	3,858
4.6	replace (3) 1 Hp Collector Drive motors with Premium Efficiency	1,077	150	927	2,829	0.6	0	0.5	0	323	20	6,450	2.9	596	30	35	3,871	3,876
4.7	replace (5) 2 Hp Return pump motors with Premium Efficiency	2,135	300	1,835	2,192	0.5	0	0.4	0	250	20	4,998	7.3	172	9	12	1,883	3,003

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
4.8	replace (3) 7.5 Hp Return pump motors with Premium Efficiency	2,076	270	1,806	3,883	0.8	0	0.7	0	443	20	8,853	4.1	390	20	24	4,780	5,320
4.9	replace (1) 10 Hp Digester Gas-Mixer motor with Premium Efficiency	782	100	682	3,311	0.7	0	0.6	0	377	20	7,549	1.8	1007	50	55	4,934	4,536
4.10	replace (2) 10 Hp Sludge Recirculation pump motor with Premium Efficiency	1,564	200	1,364	4,967	1.0	0	0.9	0	566	20	11,325	2.4	730	37	41	7,060	6,805

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was used with the assumption that one of each set of heating water pumps operates for the heating season. According to weather bin data for Newark and information from Sewer Plant personnel, one of the three hot water heating pumps considered should operate for approximately 5,000 hours per year. For all other pumps and motors listed, operating hours are based on information from Sewer Plant personnel.

Rebates/financial incentives:

NJ Clean Energy – Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $1,690.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#5: Install 5.1 kW & 45.0 kW PV systems

Description:

Currently the Sewage Treatment Plant 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. It is recommended at this time that the Sewage Treatment Plant further review installing a 5.1 KW PV system at the Old Control Room and a 45.0 kW PV System at the Advanced Treatment Building to offset electrical demand and reduce the annual net electric consumption for the building, and review guaranteed incentives from NJ rebates to justify the investment. The Sewage Treatment Plant 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. PSE&G provides the ability to buy SREC's at $600/MWh or best market offer.

Each building has flat roof to accommodate the recommended systems. A commercial crystalline 230 watt panel has 17.5 square feet of surface area (13.1 watts per square foot). A 5.1 kW system needs approximately 22.0 panels which would take up 390 square feet. A 45.0 kW system needs approximately 196.0 panels which would take up 3,430 square feet. The installation of a renewable Solar Photovoltaic power generating system could serve as a good educational tool and exhibit for the community.

Installation cost:

Estimated installed cost: $388,275 (Includes $155,310 in labor)
Source of cost estimate: Similar Projects

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
5.1	install 5.1 kW PV rooftop system with incentives on old control room building	39,525	5,060	34,465	5,123	5	N/A	17.5	0	3,584	25	14,599	9.6	72.9	2.9	6.9	11,517	7,018
5.2	install 45.0 kW PV rooftop system with incentives on advanced treatment building	348,750	45,080	303,670	47,436	45	N/A	23.1	0	33,608	25	135,193	9.0	83.8	3.4	7.8	127,146	64,988
Totals		388,275	50,140	338,135	52,559	50		40.6	0	37,192		149,793					138,663	72,006

Assumptions: 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).

Rebates/financial incentives:
NJ Clean Energy - Renewable Energy Incentive Program, Incentive based on $1.00 / watt Solar PV application for systems 50kW or less. Incentive amount for this application is $50,140 for the proposed option.

http://www.njcleanenergy.com/renewable-energy/programs/renewable-energy-incentive-program

NJ Clean Energy - Solar Renewable Energy Certificate Program. Each time a solar electric system generates 1000kWh (1MWh) of electricity, a SREC is issued which can then be sold or traded separately from the power. The buildings must also become net-

metered in order to earn SRECs as well as sell power back to the electric grid. A total annual SREC credit of $31,200 has been incorporated in the above costs, however it requires proof of performance, application approval and negotiations with the utility.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#6: Replace Domestic Water Heater

Description:

There is one (1) gas-fired domestic water heater that serves the shower areas and sinks at the Advanced Treatment Building that are utilized for the entire year. This unit typically achieves approximately 70% efficiency in natural gas usage considering its current age. This equipment is beyond the end of its expected service life and should be replaced. The Sewer Department can realize energy savings by installing a direct vent high efficiency water heater. This type of heater can achieve up to 95% efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life energy savings opportunity.

Installation cost:

Estimated installed cost: $3,000 (Includes $1,200 in labor)
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
6.1	replace domestic water heater with 95% efficient unit	3,000	400	2,600	0	0.0	110	0.6	0	163	15	2,452	15.9	-6	0	-1	-649	1,287
6.2	incremental cost to replace domestic water heater with 95% efficient unit	1,000	400	600	0	0.0	110	0.6	0	163	15	2,452	3.7	309	21	26	1,351	1,287

Assumptions: SWA calculated the savings for this measure using nameplate data taken the days of the field visits, equipment efficiencies listed above and using the billing analysis.

Rebates/financial incentives:

NJ Clean Energy – Gas-fired water heaters >50 gallons and <300 MBH ($2.00 per MBH but not less than $50 per heater) Maximum incentive amount is $400.

Options for funding the ECM: This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#7: Replace Exhaust Fans with High Efficiency Units

Description:

Several of the building rooftop exhaust fans are in fair condition and should be considered for replacement.. SWA recommends replacement of approximately twenty-five (25) exhaust fans on the roofs of various buildings and tunnels that are operating beyond their useful lives. These buildings include the Old Control Room & Locker Rooms, Primary Pump Building, Maintenance Building & Tunnel, Chlorine Building, Digester Building, Intermediate Pump Building, Advanced Treatment Building and the Effluent Pump Station. The motors are generally small, in the 1-2 horsepower range, and replacement units will have small energy savings over the existing.

Installation cost:

Estimated installed cost: $75,000 (Includes $15,000 in labor)
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
7.1	replace (25) exhaust fans with premium efficiency units	75,000	1,250	73,750	13,675	2.8	N/A	2.5	0	2,024	10	20,239	36.4	-73	-7	NA	-56,661	18,735

7.2	incremental cost to replace (25) exhaust fans with premium efficiency units	9,375	1,250	8,125	13,675	0.5	0	0.2	250	1,809	10	15,590	4.5	123	12	14	6,056	18,735

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. SWA assumed an average annual run time of 4,500 hours based on the continuous use of some of the facilities.

Rebates/financial incentives:

NJ Clean Energy - Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $1,250.

Options for funding the ECM: This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#8: Replace Ductless Cooling Only DX Cooling Split System Serving Control Room

Description:

The Advanced Treatment Building contains a 1-ton ductless split system DX cooling that serves the Control Room. This equipment was installed in 1990 and is beyond its expected service life of 15 years. SWA recommends replacement of this equipment to gain increase in operating efficiency. This project has a simple payback period of less than 10 years. Replacement is recommended as an End of Life ECM.

Due to age the equipment, it is assumed that it is operating with an SEER of approximately 8.0. The new equipment should have a minimum 13.0 EER rating, but premium units list SEER of 22.0. The higher EER will involve increased cost for the equipment over units with lower EER. The equipment shall be Energy Star certified and ASHRAE 90.1 compliant. The equipment shall utilize R-410A refrigerant.

Installation Cost:

Estimated installed cost: $1,950 (Includes $650 in labor)
Source of cost estimate: Similar projects

Economics (with no incentives):

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
8.1	replace 1-ton Ductless DX split HVAC systems with high efficiency system (SEER 22)	1,950	92	1,858	1,145	0.2	0	0.2	350	481	15	1,958	3.9	288	19	25	3,879	1,569
8.2	incremental cost to replace 1-ton Ductless DX split HVAC systems with high efficiency system (SEER 22 vs SEER 13)	600	92	508	453	0.1	0	0.1	350	402	15	775	1.3	1086	72	79	4,287	621

Assumptions: SWA calculated the savings for this measure using measurements taken the days of the field visits and using the billing analysis. Based on bin hour weather data for Newark, it is assumed that this unit runs for approximately 1,200 hours per year.

Rebates/financial incentives:
NJ Clean Energy – Electric Unitary HVAC/Split Systems min. 14.0 SEER (< 5.4 tons, $92 per ton)
Maximum incentive amount is $92.

Options for funding the ECM: This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.
http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#9: Replace Domestic Water Heater

Description:

There is one (1) gas-fired 75 gallon domestic water heater that serves the plumbing fixtures in the kennel area that are utilized for the entire year. This unit typically achieves approximately 70% efficiency in natural gas usage considering its current age. This equipment is approaching the end of its expected service life and should be replaced. The Animal Shelter can realize energy savings by installing a direct vent high efficiency water heater. This type of heater can achieve up to 95% efficiency. This measure cannot be justified by energy savings alone, but should be considered as an end-of-life energy savings opportunity.

Installation cost:

Estimated installed cost: $2,700 (Includes $1,200 in labor)
Source of cost estimate: Similar projects

Economics (with incentives):

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
9	replace domestic water heater with 95% efficient unit	2,700	150	2,550	0	0.0	260	17.3	0	386	15	5,795	6.6	127	8	13	2,062	3,042

Assumptions: SWA calculated the savings for this measure using nameplate data taken the days of the field visits, equipment efficiencies listed above and using the billing analysis.

Rebates/financial incentives:

NJ Clean Energy – Gas-fired water heaters >50 gallons ($2.00 per MBH but no less than $50 per heater)
Maximum incentive amount is $150.

Options for funding the ECM: *This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.*

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#10: *Building Lighting Upgrades – Animal Shelter*

Description:

On the days of the site visits, SWA completed a lighting inventory of the Senior and Community Center (see Appendix A). The sewage treatment plant contains mostly inefficient lighting. There is primarily inefficient lighting such as the existing T12 fixtures with magnetic ballasts. SWA recommends replacing the T12 lights with T8 electronic ballast fixtures.. Based on measurements of lighting levels for each space, there are not any vastly over-illuminated areas. See attached lighting schedule in Appendix A for a complete inventory of lighting throughout the building and estimated power consumption. The exterior lighting surveyed during the building audit was found to be halogen. SWA recommends replacing the halogens with CFL's. Exterior lighting is controlled by an automated timer. SWA is not recommending at this time any upgrades to the exterior timers. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources from its facility staff on a scheduled, longer timeline than otherwise performed by a contractor.

Installation cost:

Estimated installed cost: $51,507 (Includes $16,897 in labor cost)
Source of cost estimate: RS *Means; Published and established costs*

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
10.1	(9) New T8 fixtures to be installed	2,018	270	1,748	737	0.2	N/A	0.2	147	272	15	4,080	6.4	133	9	13	1,452	1,010
10.2	(2) New CFL fixtures to be installed	108	0	108	727	0.2	N/A	0.2	3	127	5	633	0.9	484	97	114	468	996
	Totals	**2,126**	**270**	**1,856**	**1,464**	**0**	**0**	0.5	**150**	399	**-**	**4,713**	4.7	**-**	**-**	**127**	**1,921**	**2,006**

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 10% failure rate in addition to the standard life cycle.

Rebates / Financial Incentives:
NJ Clean Energy - $30 per T8 fixture

Options for Funding ECM:
This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

ECM#11: *Replace Refrigerator with an Energy Star Model – Animal Shelter*

Description:

On the day of the site visit, SWA observed that there was one old refrigerators, a 17 cu. ft. model in the shelter which was not Energy Star rated (using approximately 773 kWh/yr each). Appliances, such as refrigerators, that are over 10 years of age should be replaced with newer efficient models with the Energy Star label. SWA recommends the replacement of the existing residential refrigerator with a 17 cu. ft. top freezer refrigerator ENERGY STAR®, or equivalent. Besides saving energy, the replacement will also keep the kitchen and other areas cooler. When compared to the average electrical consumption of older equipment, Energy Star equipment results in large savings. Look for the Energy Star label when replacing appliances and equipment, including: window air conditioners, refrigerators, printers, computers, copy machines, etc. More information can be found in the "Products" section of the Energy Star website at: http://www.energystar.gov.

Installation cost:

Estimated installed cost: $550 (includes $50 of labor)
Source of cost estimate: *Manufacturer and Store established costs*

Economics:

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
11	Replace three (3) refrigerators with an 17 cu ft Energy Star model	550	0	550	425	0.1	N/A	0.1	0	72	12	867	7.6	58%	5%	8	161	582

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

Rebates/financial incentives: *NJ Clean Energy - There aren't any incentives at this time offered by the state of NJ for this energy conservation measure.*

Options for Funding ECM:

This project may benefit from applying for a grant from the State of New Jersey - American Recovery and Reinvestment Act Energy Efficiency and Conservation Block Grant (EECBG) Program to offset a portion of the cost of implementation.
http://www.state.nj.us/recovery/infrastructure/eecbg_program_criteria.html

5. ENEWABLE AND DISTRIBUTED ENERGY SYSTEMS

Existing Systems

There aren't currently any existing renewable energy systems.

Wind

A Wind system is not applicable for this building because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

Solar Photovoltaic

Please see the above recommended ECM#4.

Solar Thermal Collectors

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

Combined Heat and Power

Upon first inspection, it was SWA's intention to investigate the possibility of recommending an anaerobic digester cogeneration machine at this facility. This machine would utilize the waste methane to fire a boiler. The boiler would turn a turbine to generate electricity, and the waste heat from the boiler would be used to support the current hot water boiler in serving the digester process. However, it was reported by Sewer Department personnel that the digesters are not in good operating condition at this time, and that the methane quality may not be suitable for this measure. SWA recommends that the Sewer Department consider repairing or replacing the existing digesters prior to investigating an anaerobic digester cogeneration machine at this facility.

Geothermal

Geothermal was not considered for this building since the existing RTUs have a significant number of remaining years of operating life and the usage may be significantly reduced depending on the design.

6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

Sewage Treatment Plant

The plant receives electricity purchased via one incoming meter directly from JCP&L without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis

shows fluctuations of 28% over the 12 month period between March 2008 and February 2009. Natural gas is also purchased via two incoming meter directly from PSE&G as well. Natural gas bill analysis shows fluctuations of up to 44% over the 12 month period between March 2008 and February 2009. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity and $1.55/therm for natural gas. The electricity rate for the pool is $0.149kWh, which means there is no potential cost savings as they pay below market rate. The natural gas rate is $1.408 which means that they are already paying below market rate Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.

Animal Shelter

The animal shelter receives natural gas purchased via one incoming meter directly from PSE&G without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. Natural gas is purchased via one incoming meter directly from PSE&G. Natural gas bill analysis shows fluctuations of up to 56% over the 12 month period between March 2008 and February 2009. The high gas price per therm fluctuations in the summer may be due to low use caps for the non-heating months. Thus the building pays for fixed costs such as meter reading charges during the summer months.

Currently, New Jersey commercial buildings of similar type pay $1.55/therm for natural gas. The natural gas rate is $1.486 which means that they are already paying below market rate. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.

6.2. Energy Procurement strategies

Also neither the Sewage Treatment Plant or Animal Shelter would not be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option.

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	Established / standard industry assumptions, DOE e-Quest
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

7.2. 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 BUILDING 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 BUILDING(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.

Appendix A:
Lighting Study of the Sewage 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	1	Men's Locker Room (Building # 1)	Parabolic	M	4'T12	2	4	40	S	9	365	24	368	1,209	T8	Parabolic	4'T8	E	S	2	4	32	9	365	13	282	926	283	0	283
1	1	Bathroom (Building # 1)	Circline	M	2'T12	1	1	24	S	2	365	8	32	23	T8	Circline	2'T8	E	S	1	1	20	2	365	4	24	18	6	0	6
1	1	Ctl rm (Building # 1)	Parabolic	M	4'T12	2	2	40	S	9	365	15	190	624	T8	Parabolic	4'T8	E	S	2	2	32	9	365	6	140	460	164	0	164
1	1	Hallway (Building # 1)	Screw-in	N	Inc	1	1	60	N	9	365	0	60	197	CFL	Screw-in	CFL	N	N	1	1	20	9	365	0	20	66	131	0	131
1	1	Office (Building # 1)	Parabolic	M	4'T12	5	2	40	S	9	365	15	475	1,560	T8	Parabolic	4'T8	E	S	5	2	32	9	365	6	350	1150	411	0	411
1	B	Boiler Rm (Building # 1)	Screw-in	N	Inc	4	1	40	S	2	365	0	160	117	CFL	Screw-in	CFL	N	S	4	1	15	2	365	0	60	44	73	0	73
1	B	Mechanical Rm (Building # 1)	Screw-in	N	Inc	5	1	40	S	2	365	0	200	146	CFL	Screw-in	CFL	N	S	5	1	15	2	365	0	75	55	91	0	91
1	GF	Mechanical Rm (Building # 1)	Screw-in	N	Inc	4	1	100	S	2	365	0	400	292	CFL	Screw-in	CFL	N	S	4	1	35	2	365	0	140	102	190	0	190
1	GF	Mechanical Rm (Building # 1)	Parabolic	N	4'T12	1	4	40	S	2	365	24	184	134	T8	Parabolic	4'T8	E	S	1	4	32	2	365	13	141	103	31	0	31
1	GF	Boiler Rm (Building # 1)	Screw-in	N	CFL	1	1	28	S	2	365	0	28	19	N/A	Screw-in	CFL	N	S	1	1	28	2	365	0	28	19	0	0	0
1	Ext	Exterior (Building # 1)	Exterior	N	Hal	2	2	90	T	12	365	48	452	1,980	CFL	Exterior	CFL	N	T	2	2	50	12	365	0	120	526	1454	0	1454
1	GF	Mechanical Rm (Building # 3)	Screw-in	N	CFL	4	1	28	S	2	365	0	104	76	N/A	Screw-in	CFL	N	S	4	1	28	2	365	0	104	76	0	0	0
1	B	Mechanical Rm (Building # 3)	Screw-in	N	Inc	8	1	100	S	2	365	0	800	584	CFL	Screw-in	CFL	N	S	8	1	35	2	365	0	280	204	380	0	380
1	Ext	Exterior (Building # 3)	Screw-in	N	Inc	1	1	100	T	12	365	0	100	438	CFL	Screw-in	CFL	N	T	1	1	35	12	365	0	35	153	285	0	285
1	GF	Staircase (Building # 4)	Screw-in	N	CFL	2	1	26	S	9	365	0	52	171	N/A	Screw-in	CFL	N	S	2	1	26	9	365	0	52	171	0	0	0
1	B	Mechanical Rm (Building # 4)	Screw-in	N	CFL	10	1	26	S	2	365	0	260	190	N/A	Screw-in	CFL	N	S	10	1	26	2	365	0	260	190	0	0	0
1	GF	Office (Building # 4)	Screw-in	N	CFL	2	1	26	S	9	365	0	52	171	N/A	Screw-in	CFL	N	S	2	1	26	9	365	0	52	171	0	0	0
1	GF	Garage (Building # 4)	Parabolic	M	4'T12	2	4	40	S	9	365	24	368	1,209	T8	Parabolic	4'T8	E	S	2	4	32	9	365	13	282	926	283	0	283
1	GF	Garage (Building # 4)	Screw-in	N	CFL	7	1	26	S	9	365	0	182	598	N/A	Screw-in	CFL	N	S	7	1	26	9	365	0	182	598	0	0	0
1	Ext	Exterior (Building # 4)	Exterior	N	Inc	4	1	100	T	12	365	0	400	1,752	CFL	Exterior	CFL	N	T	4	1	35	12	365	0	140	613	1139	0	1139
1	GF	Mechanical Rm (Building # 5)	Screw-in	N	CFL	4	1	26	S	2	365	0	104	76	N/A	Screw-in	CFL	N	S	4	1	26	2	365	0	104	76	0	0	0
1	B	Mechanical Rm (Building # 5)	Screw-in	N	CFL	2	1	26	S	2	365	0	52	38	N/A	Screw-in	CFL	N	S	2	1	26	2	365	0	52	38	0	0	0
1	GF	Mechanical Rm (Building # 6)	Screw-in	N	Inc	4	1	100	S	2	365	0	400	292	CFL	Screw-in	CFL	N	S	4	1	35	2	365	0	140	102	190	0	190
1	Ext	Exterior (Building # 6)	Exterior	N	Inc	2	1	100	S	12	365	0	200	876	CFL	Exterior	CFL	N	S	2	1	35	12	365	0	70	307	569	0	569
1	GF	Mechanical Rm (Building # 6)	Screw-in	N	Inc	4	1	100	S	2	365	0	400	292	CFL	Screw-in	CFL	N	S	4	1	35	2	365	0	140	102	190	0	190
1	B	Mechanical Rm (Building # 7)	Screw-in	N	Inc	16	1	100	S	2	365	0	1,600	1,168	CFL	Screw-in	CFL	N	S	16	1	35	2	365	0	560	409	759	0	759
1	B	Staircase (Building # 7)	Screw-in	N	Inc	2	1	100	S	9	365	0	200	657	CFL	Screw-in	CFL	N	S	2	1	35	9	365	0	70	230	427	0	427
1	GF	Staircase (Building # 7)	Screw-in	N	CFL	1	1	28	S	9	365	0	28	85	N/A	Screw-in	CFL	N	S	1	1	28	9	365	0	28	85	0	0	0
1	B	Boiler Rm (Building # 7)	Screw-in	N	Inc	6	1	100	S	2	365	0	600	438	CFL	Screw-in	CFL	N	S	6	1	35	2	365	0	210	153	285	0	285
1	B	Staircase (Building # 7)	Screw-in	N	Inc	1	1	100	S	9	365	0	100	329	CFL	Screw-in	CFL	N	S	1	1	35	9	365	0	35	115	214	0	214
1	Ext	Exterior (Building # 7)	Exterior	N	MH	2	1	250	T	12	365	63	626	2,742	PSMH	Exterior	PSMH	N	T	2	1	175	12	365	38	426	1866	876	0	876
1	GF	Vestibule (Building # 10)	2'U-shape	M	4'T12	1	1	40	S	9	365	12	52	171	T8	2'U-Shape	4'T8	E	S	1	1	32	9	365	3	35	115	56	0	56
1	GF	Vestibule (Building # 10)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
1	GF	Office (Building # 10)	Recessed	M	4'T12	3	2	40	S	9	365	15	285	936	T8	Recessed	4'T8	E	S	3	2	32	9	365	6	210	690	246	0	246
1	GF	Hallway (Building # 10)	Recessed	M	4'T12	3	2	40	S	9	365	15	285	936	T8	Recessed	4'T8	E	S	3	2	32	9	365	6	210	690	246	0	246
1	GF	Hallway (Building # 10)	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
1	GF	Bathroom (Building # 10)	Recessed	M	4'T12	2	2	40	S	2	365	15	190	139	T8	Recessed	4'T8	E	S	2	2	32	2	365	6	140	102	37	0	37
1	GF	Janitor's Closet (Building # 10)	Parabolic	M	4'T12	1	2	40	S	2	365	15	95	69	T8	Parabolic	4'T8	E	S	1	2	32	2	365	6	70	51	18	0	18
1	GF	Men's Locker Room (Building # 10	Parabolic	M	4'T12	2	2	40	S	9	365	15	190	624	T8	Parabolic	4'T8	E	S	2	2	32	9	365	6	140	460	164	0	164
1	GF	Men's Locker Room (Building # 10	2'U-shape	M	4'T12	1	1	40	S	9	365	12	52	171	T8	2'U-Shape	4'T8	E	S	1	1	32	9	365	3	35	115	56	0	56
1	GF	Storage Rm (Building # 10)	2'U-shape	M	4'T12	2	1	40	S	2	365	12	104	76	T8	2'U-Shape	4'T8	E	S	2	1	32	2	365	3	70	51	25	0	25
1	GF	Storage Rm (Building # 10)	Parabolic	M	4'T12	1	2	40	S	2	365	15	95	69	T8	Parabolic	4'T8	E	S	1	2	32	2	365	6	70	51	18	0	18
1	GF	Mechanical Rm (Building # 10)	Recessed	M	4'T12	3	4	40	S	2	365	24	552	403	T8	Recessed	4'T8	E	S	3	4	32	2	365	13	423	309	94	0	94

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	Mechanical Rm (Building # 10)	Parabolic	M	4'T12	2	2	40	S	2	365	15	180	139	T8	Parabolic	4'T8	E	S	2	2	32	2	365	6	140	102	37	0	37
1	GF	Thickener rm (Building # 10)	HID	N	MV	8	1	100	S	9	365	25	750	2,484	CFL	Screw-in	CFL	N	S	6	1	35	9	365	0	210	690	1774	0	1774
1	GF	Thickener rm (Building # 10)	Exit Sign	N	LED	6	1	5	N	24	365	1	36	315	N/A	Exit Sign	LED	N	N	6	1	5	24	365	1	36	315	0	0	0
1	GF	Mechanical Rm (Building # 10)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
1	GF	Mechanical Rm (Building # 10)	Parabolic	M	4'T12	1	2	40	S	2	365	15	95	69	T8	Parabolic	4'T8	E	S	1	2	32	2	365	6	70	51	18	0	18
1	GF	Electrical Rm (Building # 10)	Parabolic	M	4'T12	3	2	40	S	2	365	15	285	208	T8	Parabolic	4'T8	E	S	3	2	32	2	365	6	210	153	55	0	55
1	GF	Electrical Rm (Building # 10)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
1	GF	Electrical Rm (Building # 10)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
1	GF	Mechanical Rm (Building # 10)	Exit Sign	N	LED	2	1	5	N	24	365	1	12	105	N/A	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	0	0	0
1	GF	Mechanical Rm (Building # 10)	HID	N	MV	7	1	75	S	2	365	19	658	480	CFL	Screw-in	CFL	N	S	7	1	25	2	365	0	175	128	353	0	353
1	GF	Staircase (Building # 10)	Parabolic	M	4'T12	1	2	40	S	9	365	15	95	312	T8	Parabolic	4'T8	E	S	1	2	32	9	365	6	70	250	62	0	62
1	GF	Staircase (Building # 10)	2'U-shape	M	4'T12	2	1	40	S	9	365	12	104	342	T8	2'U-Shape	4'T8	E	S	2	1	32	9	365	3	70	230	112	0	112
1	GF	Staircase (Building # 10)	Exit Sign	N	LED	1	1	5	N	24	365	1	6	53	N/A	Exit Sign	LED	N	N	1	1	5	24	365	1	6	53	0	0	0
1	GF	Staircase (Building # 10)	HID	N	HPS	14	1	150	N	9	365	38	2,632	8,646	PSMH	HID	PSMH	N	N	14	1	100	9	365	22	1708	5611	3035	0	3035
1	Ext	Exterior (Building # 10)	Exterior	N	MH	7	1	150	N	12	365	38	1,316	5,764	PSMH	Exterior	PSMH	N	N	7	1	100	12	365	22	954	3741	2024	0	2024
1	GF	Mechanical Rm (Building # 11)	Parabolic	M	4'T12	3	2	40	T	2	365	15	285	208	T8	Parabolic	4'T8	E	T	3	2	32	2	365	6	210	153	55	0	55
1	GF	Mechanical Rm (Building # 11)	Exit Sign	N	LED	1	1	5	N	2	365	1	6	4	N/A	Exit Sign	LED	N	N	1	1	5	2	365	1	6	4	0	0	0
1	GF	Exterior (Building # 11)	Screw-in	N	Inc	2	1	100	T	12	365	0	200	876	CFL	Screw-in	CFL	N	T	2	1	35	12	365	0	70	307	569	0	569
1	B	Mechanical Rm (Building # 8)	Exit Sign	N	FI.	1	1	15	N	2	365	2	17	12	LEDex	Exit Sign	LED	N	N	1	1	5	2	365	1	6	4	8	0	8
1	B	Mechanical Rm (Building # 8)	HID	N	HPS	5	1	150	S	2	365	38	940	686	PSMH	HID	PSMH	N	S	5	1	100	2	365	22	610	445	241	0	241
1	B	Staircase (Building # 8)	Parabolic	M	4'T12	3	2	40	S	9	365	15	285	936	T8	Parabolic	4'T8	E	S	3	2	32	9	365	6	210	690	246	0	246
1	GF	Mechanical Rm (Building # 8)	HID	M	HPS	4	1	150	S	2	365	38	752	549	PSMH	HID	PSMH	M	S	4	1	100	2	365	22	488	356	193	0	193
1	GF	Mechanical Rm (Building # 8)	Exit Sign	N	FI.	2	1	15	N	24	365	2	34	298	LEDex	Exit Sign	LED	N	N	2	1	5	24	365	1	12	105	193	0	193
1	Ext	Exterior (Building # 8)	Exterior	N	MH	3	1	150	T	24	365	38	564	4,941	PSMH	Exterior	PSMH	N	T	3	1	100	24	365	22	366	3206	1734	0	1734
1	GF	Mechanical Rm (Building # 9)	Parabolic	M	4'T12	4	2	40	S	2	365	15	380	277	T8	Parabolic	4'T8	E	S	4	2	32	2	365	6	280	204	73	0	73
1	GF	Mechanical Rm (Building # 9)	Parabolic	M	4'T12	4	2	40	S	2	365	15	380	277	T8	Parabolic	4'T8	E	S	4	2	32	2	365	6	280	204	73	0	73
1	Ext	Exterior (Building # 9)	Exterior	N	Inc	3	1	100	T	12	365	0	300	1,314	CFL	Exterior	CFL	N	T	3	1	35	12	365	0	105	460	854	0	854
1	GF	Laboratory (Building # 2)	Parabolic	M	4'T12	10	2	40	S	9	365	15	950	3,121	T8	Parabolic	4'T8	E	S	10	2	32	9	365	6	700	2300	821	0	821
1	GF	Office (Building # 2)	Parabolic	M	4'T12	4	2	40	S	9	365	15	380	1,248	T8	Parabolic	4'T8	E	S	4	2	32	9	365	6	280	920	329	0	329
1	GF	Meeting Rm (Building # 2)	Parabolic	M	4'T12	8	2	40	S	9	365	15	760	2,497	T8	Parabolic	4'T8	E	S	8	2	32	9	365	6	560	1840	657	0	657
1	GF	Bathroom Men (Building # 2)	Screw-in	N	Inc	1	1	100	S	2	365	0	100	73	CFL	Screw-in	CFL	N	S	1	1	35	2	365	0	35	26	47	0	47
1	GF	Bathroom Women (Building # 2)	Screw-in	N	Inc	1	1	100	S	2	365	0	100	73	CFL	Screw-in	CFL	N	S	1	1	35	2	365	0	35	26	47	0	47
1	GF	Laboratory (Building # 2)	Recessed	M	4'T12	4	2	40	S	9	365	15	380	1,248	T8	Recessed	4'T8	E	S	4	2	32	9	365	6	280	920	329	0	329
1	GF	Vestibule (Building # 2)	Recessed	N	4'T12	1	2	40	S	9	365	15	95	312	T8	Recessed	4'T8	E	S	1	2	32	9	365	6	70	230	82	0	82
1	GF	Vestibule (Building # 2)	Exit Sign	N	FI.	1	1	15	S	24	365	2	17	149	LEDex	Exit Sign	LED	N	S	1	1	5	24	365	1	6	53	96	0	96
1	Ext	Exterior (Building # 2)	Exterior	N	Hal	1	1	90	T	12	365	23	113	495	CFL	Exterior	CFL	N	T	1	1	30	12	365	0	30	131	364	0	364
1	Ext	Exterior (Building # 2)	Exterior	N	MH	2	1	150	T	12	365	38	376	1,647	PSMH	Exterior	PSMH	N	T	2	1	100	12	365	22	244	1069	578	0	578
1	GF	Garage (Building # 12)	Screw-in	N	Inc	6	1	100	S	9	365	0	600	1,971	CFL	Screw-in	CFL	N	S	6	1	35	9	365	0	210	690	1281	0	1281
1	Ext	Exterior (Building # 12)	Exterior	N	Inc	1	1	100	T	12	365	0	100	438	CFL	Exterior	CFL	N	T	1	1	35	12	365	0	35	153	285	0	285
Totals:						264	116	4,853				886	25,402	84,941						264	116	2,782			376	14,726	38,906	26,034	0	26,034
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

Lighting Study of the Animal Shelter

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	1	Shelter	Parabolic	M	4'T12	4	4	40	S	8	261	24	736	1,537	T8	Parabolic	4'T8	E	S	4	4	32	8	261	13	564	1178	359	0	359
2	1	Shelter	Parabolic	M	4'T12	3	2	40	S	8	261	15	285	595	T8	Parabolic	4'T8	E	S	3	2	32	8	261	6	210	438	157	0	157
3	1	Shelter Storage	Parabolic	M	8'T12	2	2	80	S	8	261	24	368	768	T8	Parabolic	8'T8	E	S	2	2	59	8	261	13	262	547	221	0	221
4	1	Exterior	Exterior	N	Hal	1	2	90	S	12	365	46	226	990	CFL	Exterior	CFL	N	S	1	2	30	12	365	0	60	263	727	0	727
Totals:						10	10	250				109	1,615	3,890						10	10	153			32	1,096	2,426	1,464	0	1,464
Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space																														

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 (Install new T8)
Pin	1T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2T5	T (Timer)		CFL (Install new CFL)
Recessed	3T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4T5	D (Dimming)		LED (Install new LED)
Circline	2T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3T8	M (Microphonic Sensor)		C (Controls Only)
	4T8			PSMH (Install new Pulse-Start Metal Halide)
	6T8			
	8T8			
	2T12			
	3T12			
	4T12			
	6T12			
	8T12			
	CFL (Compact Fluorescent Lightbulb)			
	Hal (Halogen)			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	FL (Fluorescent)			

Appendix B: VendingMiser Savings

EnergyMisers

VendingMiser® CoolerMiser™ SnackMiser™ PlugMiser™ VM2iQ® CM2iQ®

Savings Calculator

Please replace the default values in the table below with your location's unique information and then click on the "calculate savings" button.
Note: To calculate for CoolerMiser, use the equivalent VendingMiser results. To calculate for PlugMiser, use the equivalent SnackMiser results.

Energy Costs ($0.000 per kWh)	.148
Facility Occupied Hours per Week	56
Number of Cold Drink Vending Machines	1
Number of Non-refrigerated Snack Machines	0
Power Requirements of Cold Drink Machine (Watts; 400 typical)	100
Power Requirements of Snack Machine (Watts; 80 typical)	0
VendingMiser® Sale Price (for cold drink machines)	199
SnackMiser™ Sale Price (for snack machines)	0

Calculate Savings!

Results of your location's projected savings with VendingMiser® installed:

COLD DRINK MACHINES	Current	Projected	Total Savings	% Savings
kWh	874	388	485	56%
Cost of Operation	$129.29	$57.46	$71.83	56%

SNACK MACHINES	Current	Projected	Total Savings	% Savings
kWh	0	0	0	NaN%
Cost of Operation	$0	$0	$0	NaN%

Location's Total Annual Savings

	Current	Projected	Total Savings	% Savings
kWh	874	388	486	56%
Cost of Operation	$129.29	$57.46	$71.83	56%

Total Project Cost	Break Even (Months)
$199	33.25

Estimated Five Year Savings on ALL Machines = $359.15

Appending C: Third Party Energy Suppliers (ESCOs)
http://www.state.nj.us/bpu/commercial/shopping.html

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 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 300 Madison Avenue Morristown, NJ 07926	(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
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 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 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) 756-3749 www.southjerseyenergy.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 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Gas Suppliers for PSEG Service Territory	Telephone & Web Site
Cooperative Industries 412-420 Washington Avenue Belleville, NJ 07109	(800) 628-9427 www.cooperativenet.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
Dominion Retail, Inc. 395 Highway 170, Suite 125 Lakewood, NJ 08701	(866) 275-4240 www.retail.dom.com
Gateway Energy Services Corp. 44 Whispering Pines Lane Lakewood, NJ 08701	(800) 805-8586 www.gesc.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com
Great Eastern Energy 116 Village Riva, Suite 200 Princeton, NJ 08540	(888) 651-4121 www.greateastern.com
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
Hudson Energy Services, LLC 545 Route 17 South Ridgewood, NJ 07450	(877) 483-7669 www.hudsonenergyservices.com
Intelligent Energy 2050 Center Avenue, Suite 500 Fort Lee, NJ 07024	(800) 724-1880 www.intelligentenergy.org
Keil & Sons 1 Bergen Blvd. Fairview, NJ 07002	(877) 797-8786 www.systrumenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
MxEnergy, Inc. 510 Thornall Street, Suite 270 Edison, NJ 08837	(800) 375-1277 www.mxenergy.com
NATGASCO (Mitchell Supreme) 532 Freeman Street Orange, NJ 07050	(800) 840-4427 www.natgasco.com

Pepco Energy Services, Inc. 112 Main Street Lebanon, NJ 08833	(800) 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 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) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Stuyvesant Energy LLC 10 West Ivy Lane, Suite 4 Englewood, NJ 07631	(800) 646-6457 www.stuyfuel.com
Woodruff Energy 73 Water Street Bridgeton, NJ 08302	(800) 557-1121 www.woodruffenergy.com

Appendix D: Glossary and Method of Calculations

Glossary of ECM Terms

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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

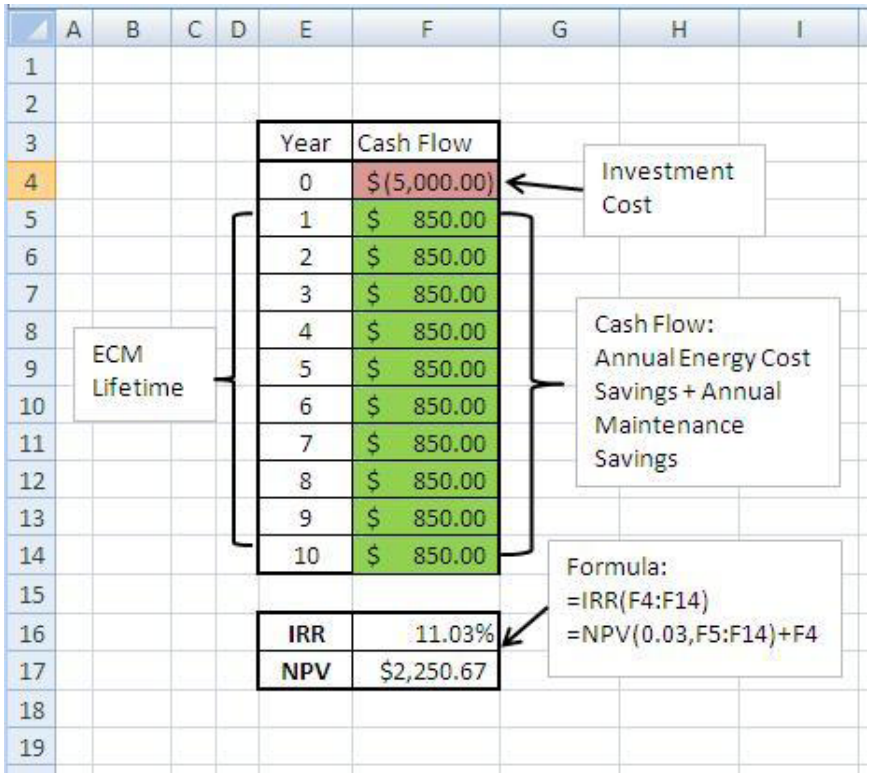
Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding 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