WASTE REDUCTION PARTNERS

Town of Pittsboro, NC – Wastewater Plant

ENERGY ASSESSMENT

CONFIDENTIAL REPORT PREPARED BY

Waste Reduction Partners
Triangle J Council of Governments
4307 Emperor Blvd., Suite 110,
Durham, NC 27703

ASSESSMENT TEAM

Conrad Meyer, Waste Reduction Partners
Les Hewlett, Waste Reduction Partners
Mark Valetta, Waste Reduction Partners
Fred Royal, Town of Pittsboro
Randy Heard, Town of Pittsboro

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North Carolina State Energy Office

NC Department of Environment and Natural Resources
Division of Environmental Assistance and Customer Service

DATES

Survey: August 27, 2013

Report: October 8, 2013

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This report was prepared for:
Town of Pittsboro
Fred Royal
41 Fayetteville St. PO Box 759
Pittsboro, NC 27312
Office 919-542-2063l
Froyal@pittsboronc.gov

This report was prepared by:
Waste Reduction Partners
Triangle J Council of Governments
4307 Emperor Blvd., Suite 110,
Durham, NC 27703
www.wastereductionpartners.org

Principal Author:
Conrad Meyer

Contributors: Les Hewlett, Mark Valetta

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Energy Assessment - Executive Summary

Introduction

The Town of Pittsboro requested an energy assessment of their wastewater treatment facility located at 485 Small Street. The plant consists of two small buildings and wastewater treatment process equipment.

Facility Description

The facility was constructed in 1977. A small office is located above a generator room and there is a separate sludge room where sludge is processed. The plant is permitted to run 22 million gallons per month but the average throughput runs about 13 million. It typically runs in a steady-state mode, but rain events can cause daily spikes in flow rates. Solids removed from the waste stream are treated and land applied. Treated liquids are discharged to Roberson Creek. In addition, the facility sells “grey water” to the 3M plant nearby for use at their facility.

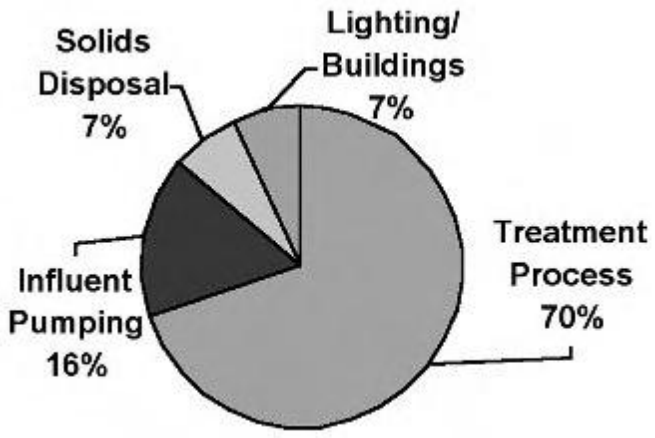
Small office (Second Floor) and Process Equipment

Sludge Room (foreground) and storage tank

Summary of Energy Benchmarks

Typical energy benchmarks for the buildings are relatively meaningless because the vast majority of the energy is used to operate the many motors in the process. Over the past year the plant consumed 718,520 kilowatt hours of electricity (or 2,452 million BTU's) to process 158.4 million gallons of effluent. Total energy cost was $54,034. This yields an overall energy usage rate of 4,536 kWh/MG this compares favorably to an average of 4,620 kWh/MG from a 2008 study in New York. Benchmarking to similar plants becomes quite involved as complex models are used to track energy usage, flow rates, BOD levels, and processes. One such model is available at no cost on the EPA Energy Star website: http://www.energystar.gov/buildings/tools-and-resources/energy-star-score-wastewater-treatment-plants

Summary of Energy Benchmarks	
Total Energy Consumed:	2,452 Million Btu / yr
Total Energy Index:	2,043 kBtu / sq ft / yr
Total Energy Cost:	54,034 $ / yr
Total Energy Cost Index:	45.03 $ / sq ft / yr



Typical Energy Usage in a Wastewater Plant

Overall, there were no major areas of significant savings identified during the site visit. This is a positive testament to the management of the facility by the current employees and WRP commends them. However, there are some areas of investigation that merit further attention to determine if the facility is operating at peak efficiency. Those are listed below and more fully explained in the body of the report.

Summary of Recommendation Measures

Energy Efficiency Recommendations	Cost Savings / yr.	Investment Cost	Payback Period (yr)	mmBtu Saved
Replace existing T12 fluorescent fixtures with T8	$104	$270	2.6	4.7
Investigate additional load shifting from peak to non-peak hours	TBD	TBD		
Setup plant in Portfolio Manager to understand benchmarks and monthly operations	TBD	TBD		
Utilize Motor Master to inventory motors and determine best operating conditions	TBD	TBD		
Further evaluate cogged V belts for Blowers (example info shown)	$570	TBD		25.9
Further evaluate pump operating ranges (3% savings example shown for reference)	$380	TBD		17.2
Totals	$1,054			47.8

Estimated Annual Energy Savings	
Energy Savings $ / year	$1,054
Energy Savings MMBTU / year	47.8
Estimated Annual Emissions Reductions	
Carbon Dioxide (CO_2)e lb/yr	15,807
Nitrogen Oxides (NOX) lb/yr	67
Sulfur Oxides (SOX) lb/yr	18

End of Executive Summary

Background

The Waste Reduction Partners (WRP) program, administered by the Triangle J Council of Governments, provided technical assistance to the Town of Pittsboro Wastewater Treatment facility beginning with a site visit on August 27, 2013. WRP assessors Conrad Meyer, Les Hewlett, and Mark Valetta met with Town representatives Fred Royal and Randy Heard to discuss current energy use at the facility and to take a guided tour.

Facility Description

The facility was constructed in 1977. A small office is located above a generator room and there is a separate sludge room where the sludge is processed. The plant is permitted to run 22 million gallons per month but the average throughput runs about 13 million. It typically runs in a steady-state mode, but rain events can cause daily spikes in flow rates. Solids removed from the waste stream are treated and land-applied. Treated liquids are discharged to Roberson Creek. In addition, the facility sells “grey water” to the 3M plant nearby for use at their facility.

Energy Use Analysis

For the last 12 months the Town of Pittsboro paid $54,034 for 718,520 kilowatt-hours of electricity. The 718,520 kilowatt-hours is equivalent to 2,452 million BTUs.

Load Shifting: Duke Energy – Progress, supplies electricity to the Waste Water Treatment Plant. Monthly electricity bills are calculated based upon the utility’s Small General Service – Time of Use (SGS-TOU) rate schedule. For around-the-clock operations such as municipal water and sewer treatment plants, time-of-use billing provides the client an opportunity to reduce the monthly total electrical kW (kiloWatt) demand charge by employing a load management technique known as load shifting.

The SGS-TOU rate schedule specifies the utility’s summertime (June through September) on-peak kW demand charge is currently $10.23 per kW with an off-peak excess Billing Demand charge of $1.56 per kW. The peak hours during summer months are between 10:00 AM to 10:00 PM Monday through Friday, excluding holidays. In the remainder of the year (October through May), the on-peak demand is billed at $7.58 per kW and the off-peak excess demand is still charged at the rate of $1.56 per kW. On-peak hours during the non-summer months are between 6:00 AM and 1:00 PM plus 4:00 PM through 9:00 PM Monday through Friday, excluding holidays.

To explain how this rate schedule works, let’s assume the August bill shows an on-peak demand of 50kW was measured. Furthermore, the off-peak demand during the same billing period was 55 kW. According to SGS-TOU, the demand portion of the total bill would be determined to be $519.30 as shown below.

On-Peak kW Billing Demand charge: 50 (On-Peak kW) x $10.23/kW = $511.50

Off-Peak Excess kW Billing Demand charge: (55 Off-Peak kW – 50 On-Peak kW) x $1.56/kW = $7.80

Total kW Billing Demand charge = $519.30

Now, assume the plant superintendent determines enough water can be pumped into storage during the off-peak times to totally eliminate the need to operate those pumps on-peak. If those pumps totaled 10 kW when operating, then the same bill could be calculated as shown below assuming the initial off-peak demand already included the 10 kW pumps.

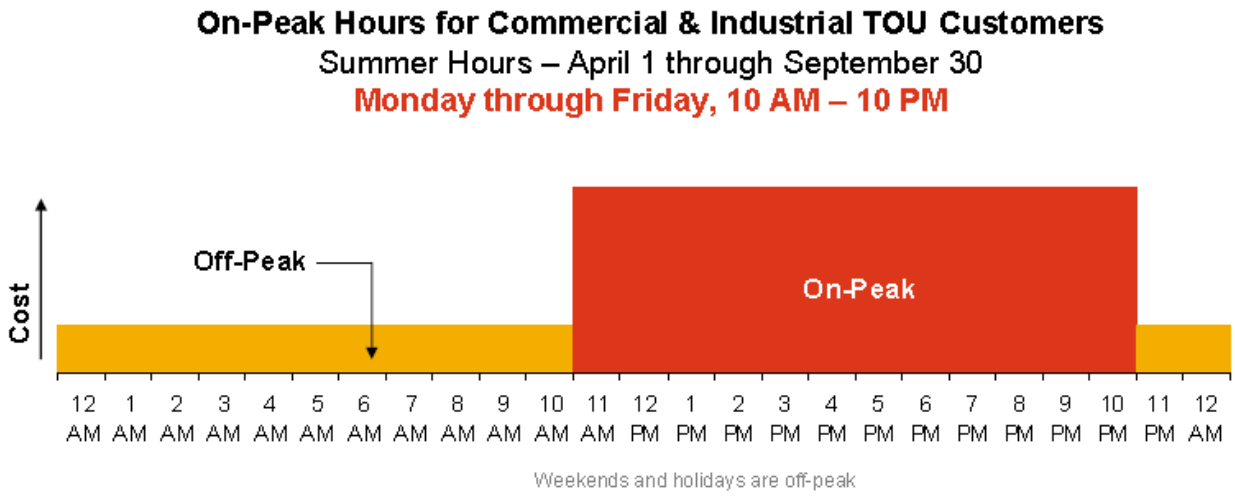
On-Peak kW Billing Demand charge: 40 (On-Peak kW) x $10.23/kW = $409.20

Off-Peak Excess kW Billing Demand charge: (55 Off-Peak kW – 40 On-Peak kW) x $1.56/kW = $23.40

Total kW Billing Demand charge = $432.60

This example provides an $86.70 savings in demand charges alone. The savings would actually be even greater because the kilowatt-hours (kWH) consumed to operate the pumps would be charged at an off-peak rate of $0.04898 per kWH compared to the on-peak rate of $0.06113!

WRP recommends that opportunities to load-shift be investigated for the facility. This could be as simple as pumping the grey water to 3M on off peak hours or on weekends.



Graphic Example of Load Shifting - Summer

Additional Recommendations

Fluorescent Lighting Detail & Recommendations

There are a total of 6 T-12 lighting fixtures in the office and sludge room. WRP recommends replacing them with new T-8 fixtures with electronic ballasts to save energy. Keep in mind that T-12 replacement lamps are no longer manufactured or imported, so when the shelf supply is depleted, a change must be made.

Details of Recommendations - Fluorescent Lighting

	Lamp Change		Ballast Change		Lumens per Fixture		Watts per Fixture			Calculation of Energy Savings		
Locat'n Key	Before	After	Before	After	Before	After	Before	After	Reduction	No. of Units	Hrs. / Year	Saving KWH
2	2 X 4' 34W	2 X 4' 28W	Normal	Low	4058	3945	74	43	31	2	4368	271
1	4 X 4' 34W	4 X 4' 28W	Normal	Low	8117	7891	148	84	64	4	4368	1118
Total										**6**		1389

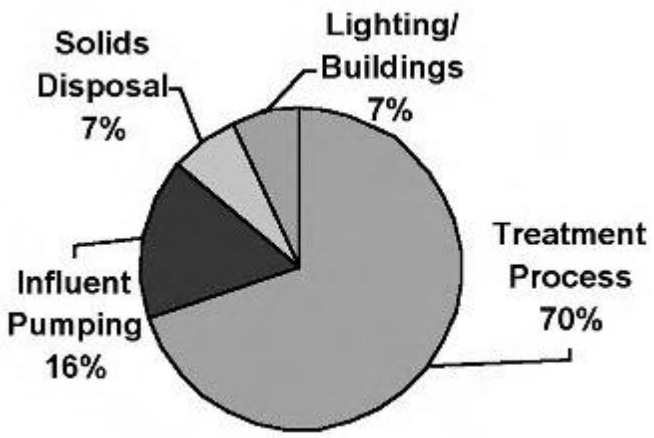
Calculation of Cost and Payback

	Change		Calculation of Utility Cost Savings			Calculation of Cost and Payback				
Locat'n Key	Before	After	Cost per KWH	Savings KWH	Utility Cost Savings	No. of Units	Material Cost per Unit	Labor Cost per Unit	Total Investment Cost	Payback Years
2	2 X 4' 34W	2 X 4' 28W	$0.075	271	$20	2	$21	$20	$82	4.0
1	4 X 4' 34W	4 X 4' 28W	$0.075	1,118	$84	4	$27	$20	$188	2.2
Total					**$104**				**$270**	2.6

1) office area 2) sludge room

Other Building Systems

Normally, WRP performs an extensive review of the buildings to look for energy saving opportunities. Besides the lighting covered above, HVAC and hot water are typically reviewed. An efficient HVAC wall unit is used in the office to condition the small space. WRP has no recommendations for this unit. No other HVAC units were observed. Water heaters were also not observed in the facility. By far the largest energy consumers in the plant are the motors. Some methods to evaluate the motors are shown below.



Typical Energy Usage in a Wastewater Plant

Portfolio Manager

The US EPA has a standardized benchmarking and analysis program called Portfolio Manager which analyzes energy usage at wastewater facilities and compares the results to other facilities. A score from 1 to 100 is calculated, with 50 being the median score. In addition, energy data is captured monthly and plotted to make it more understandable. This web tool has recently been upgraded and WRP recommends that the Town make use of the tool to track performance. Since this tool requires details that only town management can provide (for example: user names and passwords), it is very difficult for WRP to do this work independently. However, as a learning experience, WRP is willing to work directly with Town personnel to get this set up. An alternative would be to use staff time or perhaps an intern to get started. This type of analysis will be helpful when looking for funds to upgrade or expand the facility. As mentioned in the Executive Summary, the plant currently compares favorably with published benchmarking information from the New York State Energy Research and Development Authority.

Motor Master

Motor Master is another downloadable tool that has been available for years to manage motor inventories. Normally it is recommended for facilities that have more than 10 motors. Since the plant has over 20 motors in service, this tool could provide valuable information on replacements and operating characteristics. This listing may reveal motors that are oversized which may be energy saving opportunities. A list of the existing motors is shown in Appendix C. Motor Master can be found at the following link:

http://www1.eere.energy.gov/manufacturing/tech_assistance/software_motormaster.html

Using this tool requires significant effort to input all the motor data

Positive Displacement Blowers

Subsequent to the site visit, some high level analysis was done on the blowers. There are a couple of opportunities to save energy. There are currently four positive displacement blowers (two 40hp and two 20hp) that provide low pressure air to the aeration tanks. There are two suggested options for consideration below. The first is to simply change out the V belts to cogged belts which are more energy efficient. The second would be to use VFD's to drive the blowers. Sample results are below.

Cogged V belts - Assuming 95% efficient motors, a 40 hp motor uses .746x40/.95= 31.4 kWh/hour. Annual consumption would be 31.4x24x365 = 275,000 kWh/yr. Annual cost would be 275,000x$0.075=$20,600/year. The 20 hp motors would use half the energy so the total for all four blowers would be $62,000/yr at full capacity. Since the annual energy bill for the entire plant is only $54,000 per year, this suggests that the blowers are not running anywhere near full capacity. Without actual metered data, one could estimate the blower energy usage by assuming the blower energy would be proportional to the total horsepower in the plant. From the listing in Appendix C, the total horsepower of the plant is about 340 hp and the blowers comprise 120 hp of the total or 35%. This means that blower energy usage would be .35 x $54,000 = $19,100/year. This calculation also suggests that the blowers are running at about 19,100/62,000= 30% capacity and that a one horsepower motor uses about $158 in electricity per year.

Savings for cogged V belts is typically about 3% so the potential savings is estimated to be 0.03 x $19,000 = $570/yr. Implementation costs for new sheaves and belts vary by installation and should be quoted to determine implementation cost and payback.

VFD's - For VFD implementation, cost to install runs about $250 per hp or a total of $30,000. Assuming savings of about 10%, this would yield $1900 in annual energy savings, and a 15 year payback. Of course there may be additional costs involved in a control system for the motors that would lengthen payback periods, but additional energy savings may be realized with an engineered control system. If the Town is planning on replacing/refurbishing the plant within the next 15 years, it is probably a better decision not to invest in VFD's at this time. Keep in mind that both of these suggestions can be implemented if funds are available.

Incentives are available from Duke energy – they can be viewed at: http://www.duke-energy.com/pdfs/SS-Comprehensive-Prescriptive-NC.pdf
The incentive is $40 per horsepower, or $1,600 per 40 hp motor and $800 per 20 hp motor. If the incentives were approved, the investment would drop by $4,800 and the payback would drop to 13 years.

Pumps

Now that we have analyzed the positive displacement blowers, it is likely that the same situation exists with centrifugal pumps. Centrifugal pumps operate most efficiently at certain operating conditions as shown on the manufacturers pump curves. The motor list shows at least 8 centrifugal pumps with a horsepower range from 3 to 30 – some with VFD's installed. Motor Master is a tool that can help understand the operating conditions and suggest possible modifications. Another option is to obtain the pump curves for each pump and determine where the pump is operating on the curve. WRP suggests that the process be started by evaluating one of the 30 hp Gorman Rupp T6 influent pumps. A representative pump curve was found here: http://www.hydroinnovations.com.au/Files/Products/Super%20T%20Series/0552200.pdf
The pump at the plant may be different - hopefully a pump curve is on file. The good news is that there is quite a wide area of efficient operation. But if the VFD's operate well outside the "sweet spot" the efficiency could drop by 8% or more. To put that in perspective (using the same assumptions as for the blowers), the energy wasted could be $158x30x.08= $380/yr for one influent pump. Well worth checking.

Appendices

A. Facility Statistics

Square Footage	Year Constructed	Hours Occupied per Week	# of Occupants
1,200	1977	84	2

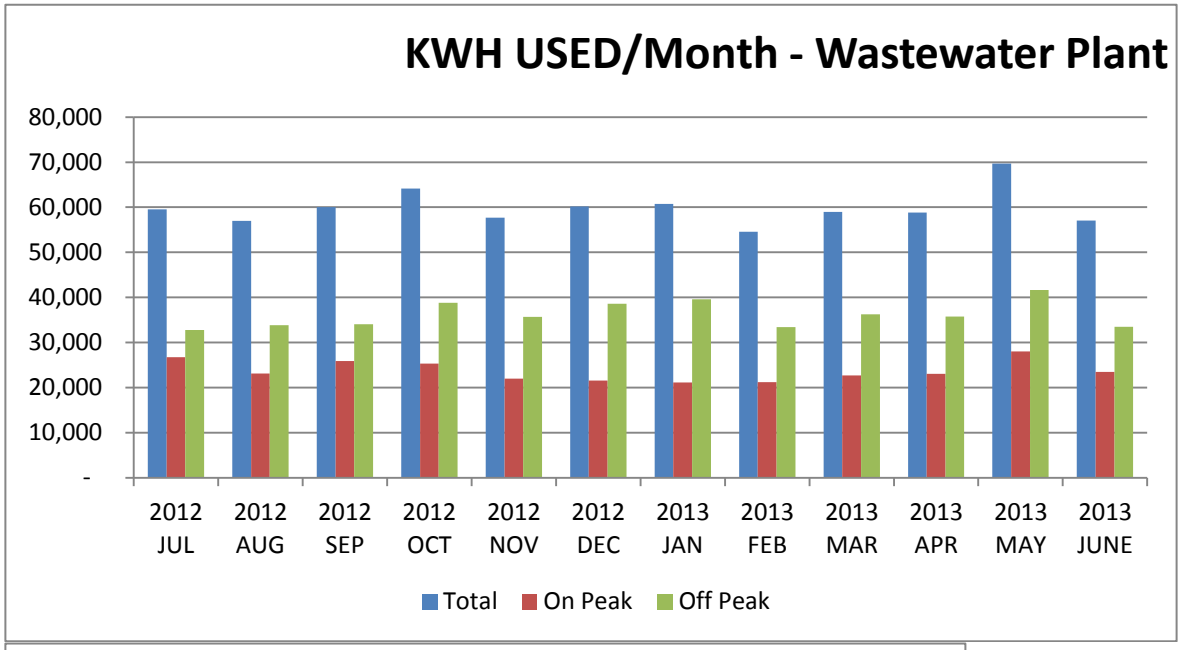
B. Utility History

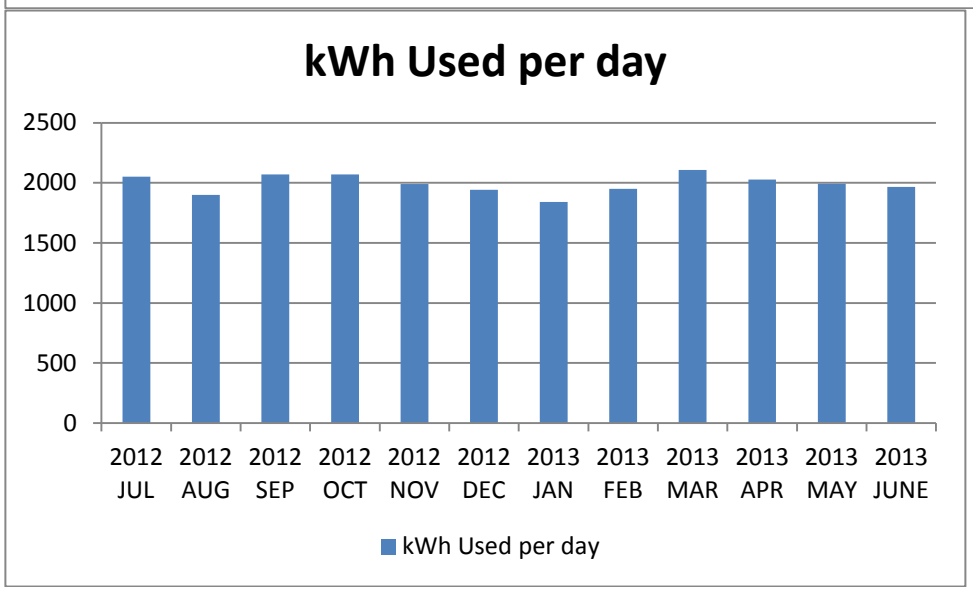
Mo / Yr	Elect-All Usage KWH	Electric Cost	Nat Gas Usage Therms	Nat Gas Cost	Oil Usage Gallons	Oil Cost	Propane Usage Gallons	Propane Cost	Water Usage Gallons	Water / Sewage Cost
2012 JUL	59,520	$4,733	$0	$0	0	$0	0	$0	0	$0
2012 AUG	57,000	$4,544	$0	$0	0	$0	0	$0	0	$0
2012 SEP	60,000	$5,008	$0	$0	0	$0	0	$0	0	$0
2012 OCT	64,160	$4,970	$0	$0	0	$0	0	$0	0	$0
2012 NOV	57,720	$4,236	$0	$0	0	$0	0	$0	0	$0
2012 DEC	60,200	$4,190	$0	$0	0	$0	0	$0	0	$0
2013 JAN	60,760	$4,295	$0	$0	0	$0	0	$0	0	$0
2013 FEB	54,600	$4,390	$0	$0	0	$0	0	$0	0	$0
2013 MAR	59,000	$4,324	$0	$0	0	$0	0	$0	0	$0
2013 APR	58,800	$4,252	$0	$0	0	$0	0	$0	0	$0
2013 MAY	69,720	$4,811	$0	$0	0	$0	0	$0	0	$0
2013 JUN	57,040	$4,281	$0	$0	0	$0	0	$0	0	$0
Total	**718,520**	**$54,034**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**

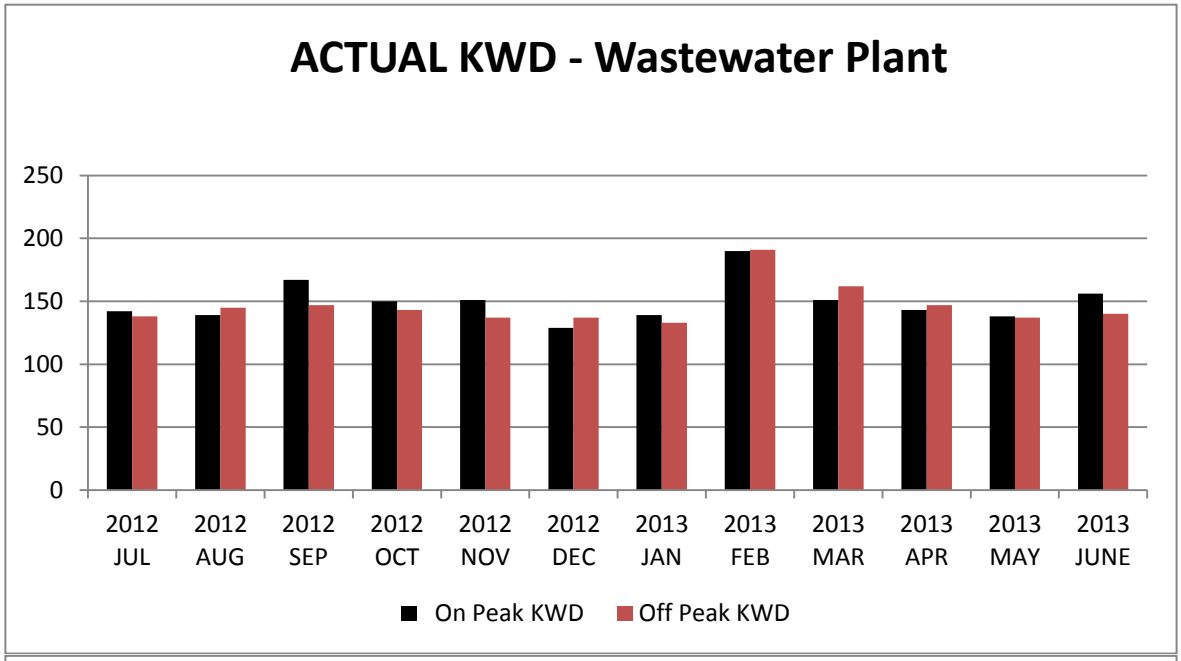
	Utility Totals		Conversion to BTU Equivalents			Total Units
Electricity	718,520	**X**	3,413	Btu/kWh	=	2452 Million Btu's

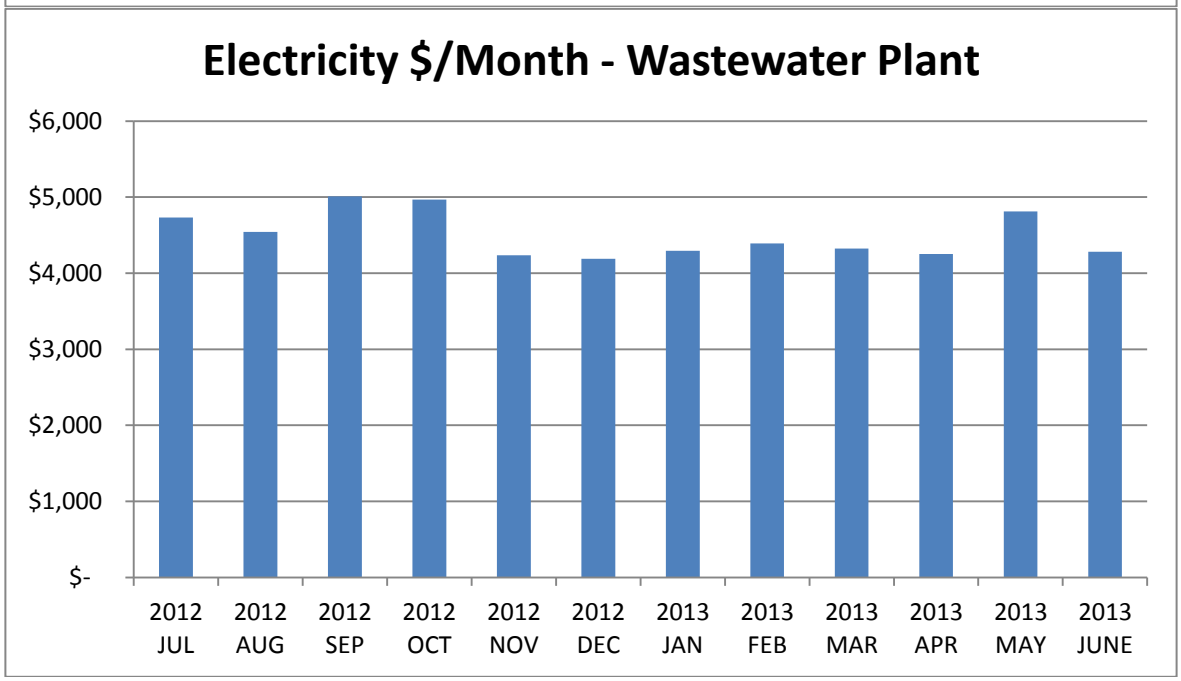
Total Energy Use	=	2452.309 MMBtu's
Total Sq. Ft.	=	1200.000 FT^2
Total Energy Index	=	2043.591 kBtu's /sq ft
TOTAL COST INDEX	=	**45.028 $ / SQ FT**

Energy & Effluent Flow Charts






ACTUAL KWD - Wastewater Plant
250
200
150
100
50
0
2012 JUL
2012 AUG
2012 SEP
2012 OCT
2012 NOV
2012 DEC
2013 JAN
2013 FEB
2013 MAR
2013 APR
2013 MAY
2013 JUNE
On Peak KWD
Off Peak KWD


Electricity $/Month - Wastewater Plant
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$-
2012 JUL
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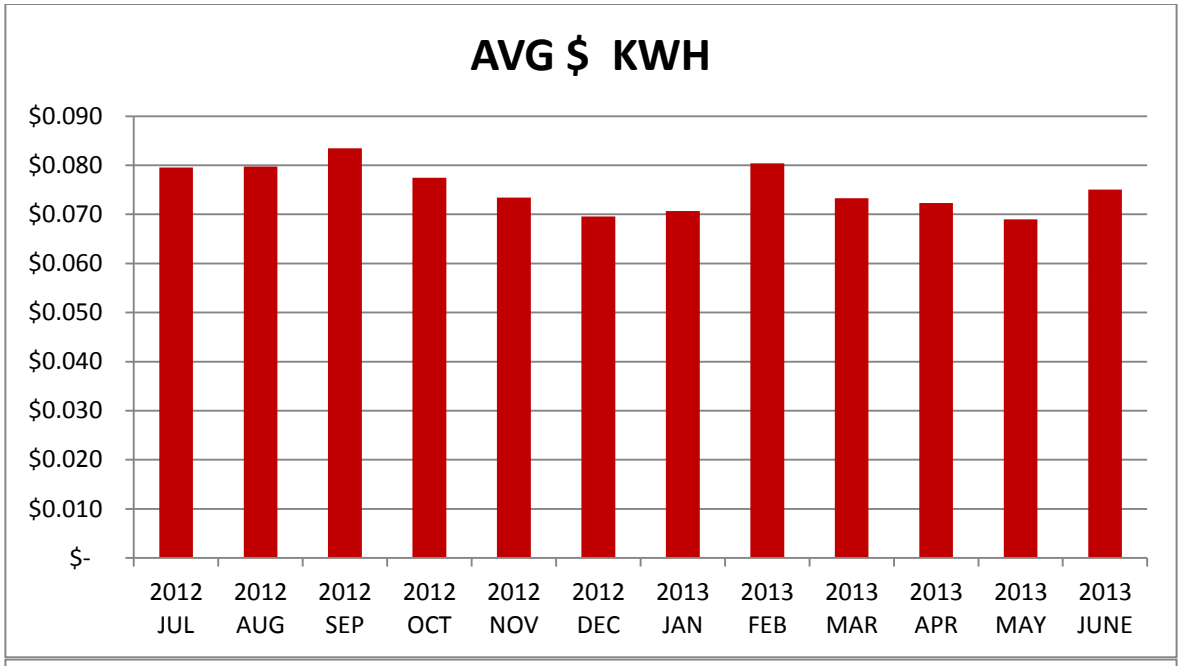
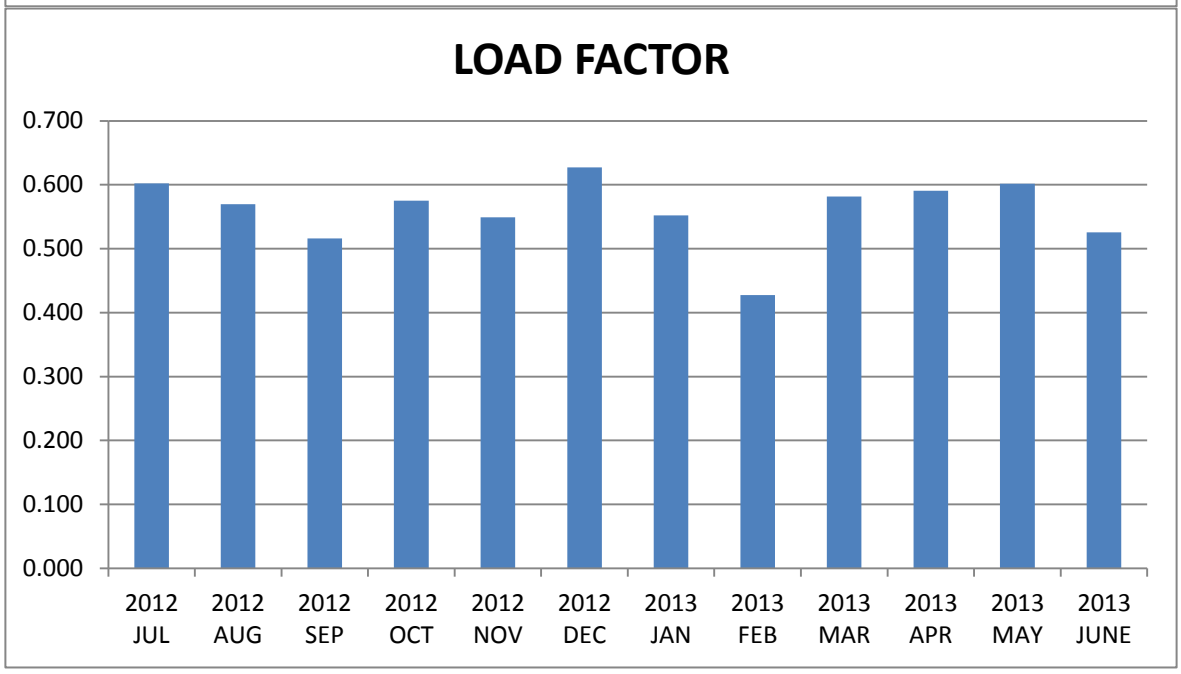
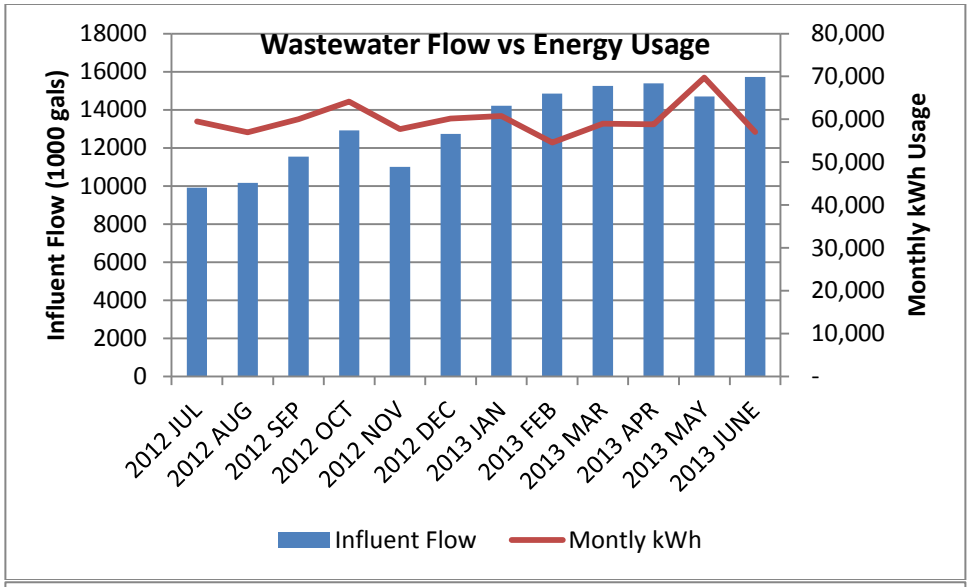
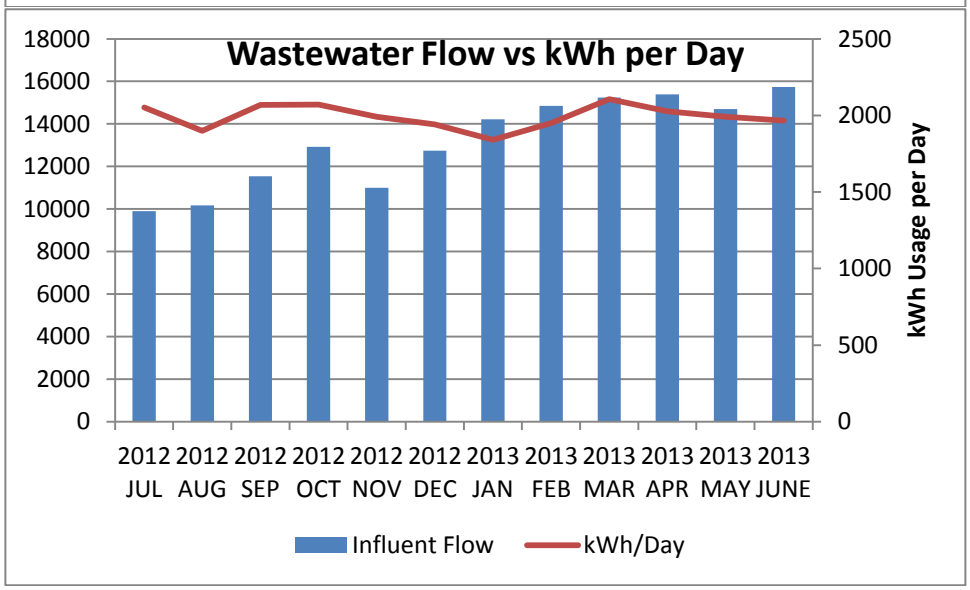
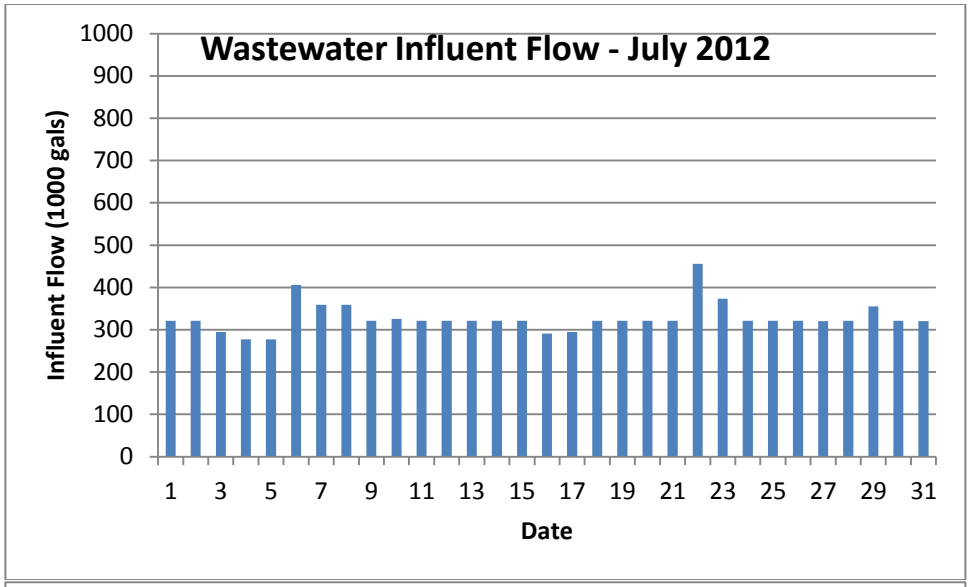
2012 SEP
2012 OCT
2012 NOV
2012 DEC
2013 JAN
2013 FEB
2013 MAR
2013 APR
2013 MAY
2013 JUNE

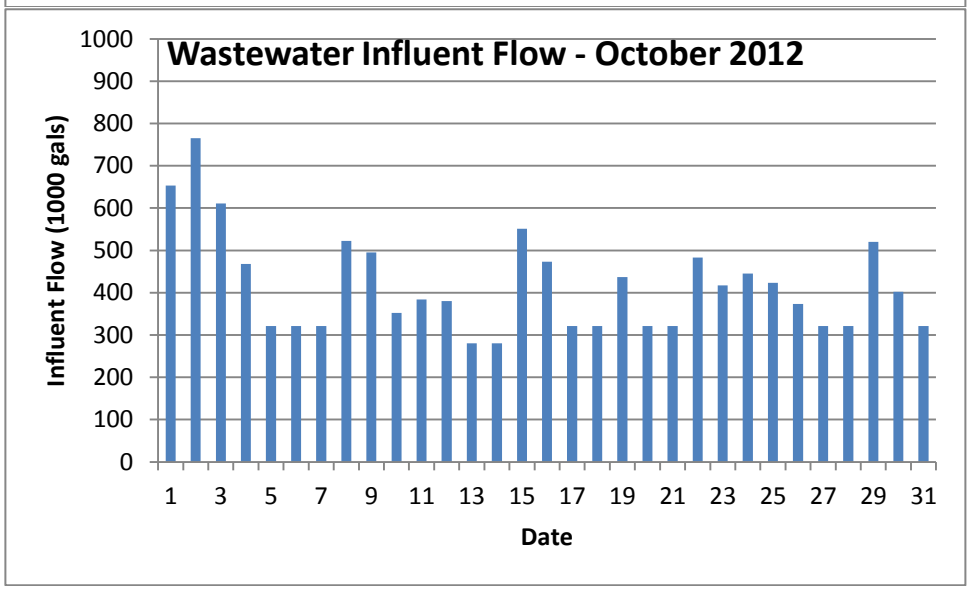

AVG $ KWH
$0.090
$0.080
$0.070
$0.060
$0.050
$0.040
$0.030
$0.020
$0.010
$-
2012 JUL
2012 AUG
2012 SEP
2012 OCT
2012 NOV
2012 DEC
2013 JAN
2013 FEB
2013 MAR
2013 APR
2013 MAY
2013 JUNE

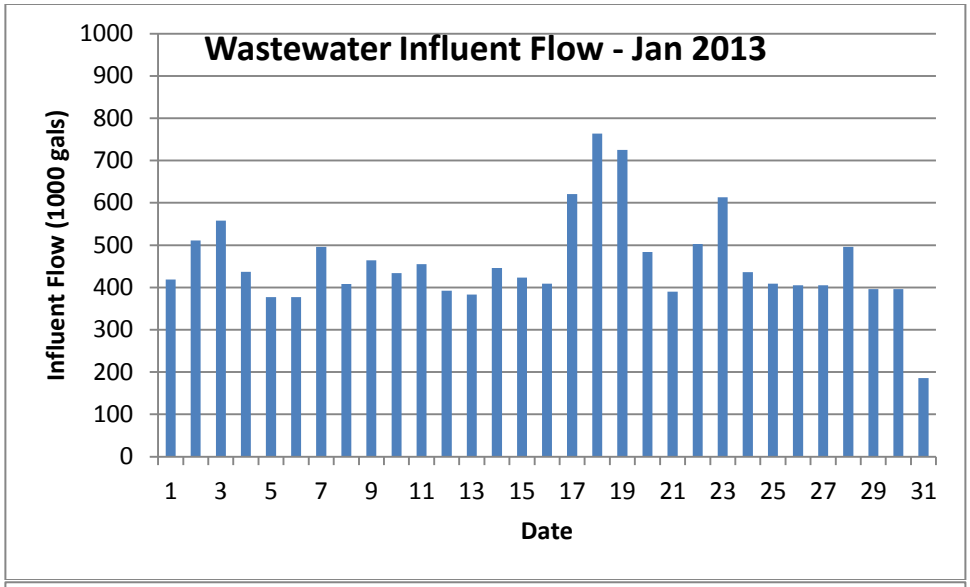

LOAD FACTOR
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
2012 JUL
2012 AUG
2012 SEP
2012 OCT
2012 NOV
2012 DEC
2013 JAN
2013 FEB
2013 MAR
2013 APR
2013 MAY
2013 JUNE

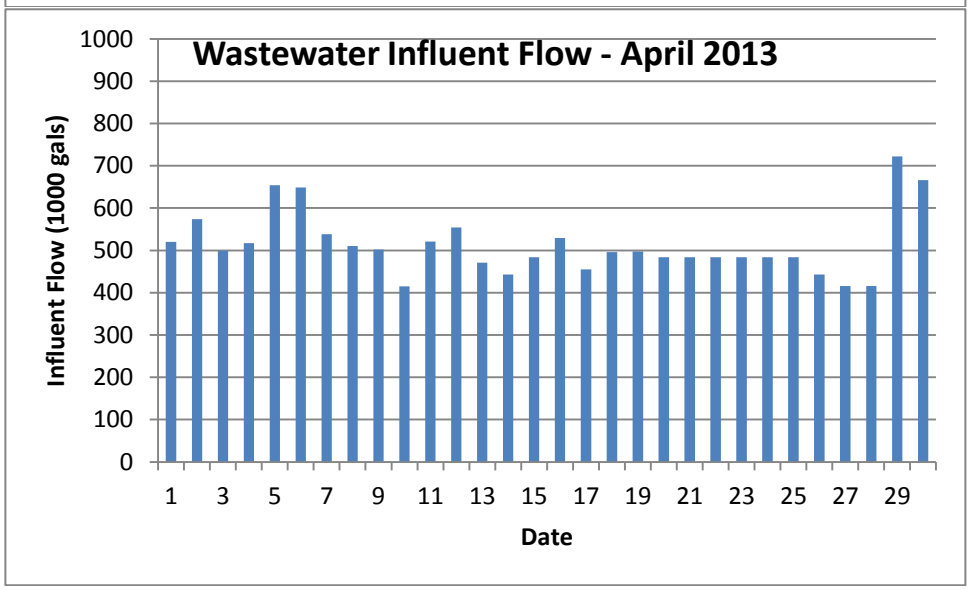

Wastewater Flow vs Energy Usage
Influent Flow (1000 gals)
Monthly kWh Usage
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
2012 JUL
2012 AUG
2012 SEP
2012 OCT
2012 NOV
2012 DEC
2013 JAN
2013 FEB
2013 MAR
2013 APR
2013 MAY
2013 JUNE
Influent Flow
Montly kWh

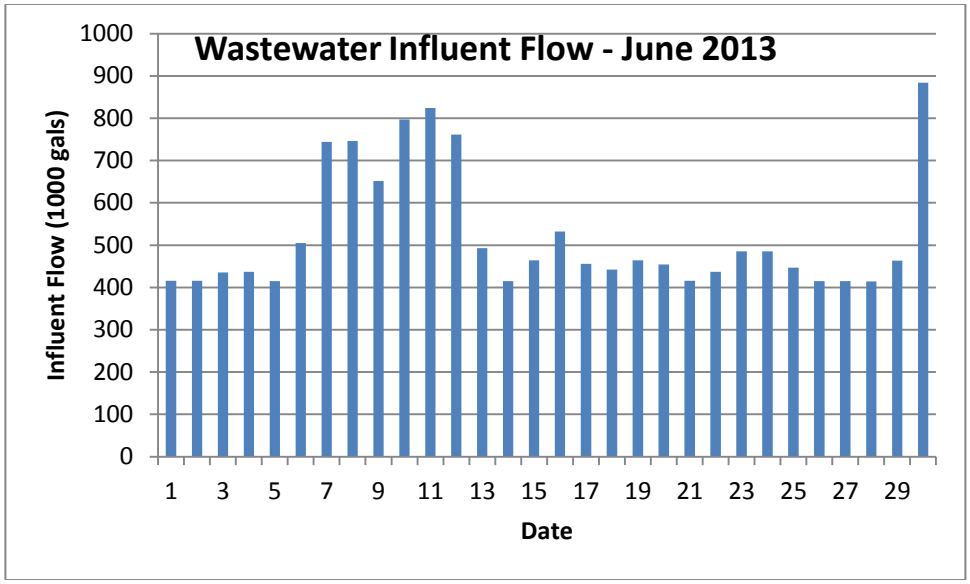

Wastewater Flow vs kWh per Day
kWh Usage per Day
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
2500
2000
1500
1000
500
0
2012 JUL
2012 AUG
2012 SEP
2012 OCT
2012 NOV
2012 DEC
2013 JAN
2013 FEB
2013 MAR
2013 APR
2013 MAY
2013 JUNE
Influent Flow
kWh/Day


Wastewater Influent Flow - July 2012
Influent Flow (1000 gals)
1000
900
800
700
600
500
400
300
200
100
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Date


Wastewater Influent Flow - October 2012
Influent Flow (1000 gals)
1000
900
800
700
600
500
400
300
200
100
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Date


Wastewater Influent Flow - Jan 2013
Influent Flow (1000 gals)
1000
900
800
700
600
500
400
300
200
100
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31
Date


Wastewater Influent Flow - April 2013
Influent Flow (1000 gals)
1000
900
800
700
600
500
400
300
200
100
0
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29
Date


Wastewater Influent Flow - June 2013
Influent Flow (1000 gals)
1000
900
800
700
600
500
400
300
200
100
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
Date

C. Motor Listing

Town Of Pittsboro
Wastewater Treatment Plant

	Motor HP	FLA	Plant Use	Description	VFD/Cross Line	Notes
1	40	95.2	Blower #4	Pos. Displacement		
2	40	95.2	Blower #2	Pos. Displacement		New 2010
3	40	91.0	Reclaimed Pump	Peerless Vertical Turbine	Reduced Voltage Starter	New 2010
4	30		Influent Pump A	Gorman Rupp T6 series Centrifugal	VFD	
5	30		Influent Pump B	Gorman Rupp T6 series Centrifugal	VFD	New 2011
6	20	50	Blower #1	Pos. Displacement		
7	20	50	Blower #3	Pos. Displacement		
8	20	50	EQ Pump 1	Gorman Rupp V Series Centrifugal		New 2010
9	20	50	EQ Pump 2	Gorman Rupp V Series Centrifugal		New 2010
10	20	91.0	Digester Blower 1	4 Stage Centrifugal		Not in Operation
11	20	91.0	Digester Blower 2	4 Stage Centrifugal		Not in Operation
12	7.5	20	Air Compressor 1	Ingersoll Rand Type-30 Reciprocating		
13	7.5	20	Air Compressor 2	Ingersoll Rand Type-30 Reciprocating		
14	7.5	20	Surface Aerator 1	Aqua-Jet Model FSS Endura Series.		New 2010
15	7.5	20	Surface Aerator 2	Aqua-Jet Model FSS Endura Series.		New 2010
16	3	8.4	WAS #1	Gorman Rupp T4 Centrifugal	VFD	New 2012
17	3	8.4	WAS #2	Gorman Rupp T4 Centrifugal	VFD	New 2012
18	3		RAS	Heyward Gordon Recessed Impeller	VFD	New 2010
19	1	3.8	Bar Screen	Parkson Aqua Guard, Winsmith Gear drive		New 2011
20	1	3.8	Clarifier 1	Eimco Process Unit		New 2013
21	1	3.8	Clarifier2	Eimco Process Unit		New 2013
22	1	1.8	UV Hydraulic Pump	Trojan UV 3000+, Wiper system pump.		New 2010
23	N/A	13.4	UV Banks(2)	Trojan UV 3000+, Wiper system pump.		New 2010

* Plant is 230 V Delta

D. Resources and Fact Sheets

Waste Reduction Partners has created a number of technical publications to help you pursue your utility cost-saving and environmental goals. Click on the link below to open the document.

Self-Assessment Guide for Energy Saving Opportunities

Benchmarks - Ranking Building Energy Intensity

Caulk and Weather Stripping

CFL Retrofits in Commercial Lighting

Chillers

Drinking Fountains and Water Coolers

Exhaust Fans

Exit Signs

Fluorescent Light and Ballast Recycling

High Bay Lighting

Insulation Guidelines

Monitor Power System

Occupancy Sensors

Setback Temperature Control

T-12 to T-8 Conversion

Task Lighting

Tracking Energy Savings

Vending Machines

Ventilation and Indoor Air Quality

Commercial Kitchens

Commercial Washing Machines

Commercial Dishwashers

WRP Fact Sheet Compilation (includes all fact sheets listed above)

E. Follow-up Evaluation

Waste Reduction Partners provides energy, solid waste, water, and pollution prevention assessments to institutional and business entities throughout North Carolina. These assessments are confidential, non-regulatory, and provided at no or reduced cost to the client. A follow-up contact will be made with clients 6-12 months after this assessment report has been delivered to discuss the value of the assessment. The purpose of the follow-up is to evaluate the effectiveness of our reports and consultation and to determine if report recommendations were found to be worthy of implementation. You are encouraged to take the few minutes required to complete the follow-up in order to help Waste Reduction Partners continually improve its services.

F. Utility Financial Incentives

Duke Energy Business Incentives

Duke Energy's Super Saver Program offers incentives for many energy efficiency upgrades, including lighting upgrades. These incentives will reduce investment cost and shorten payback periods for the upgrades. For more information, please visit

http://www.duke-energy.com/north-carolina-business/smart-saver/smart-saver-incentive-program-customer.asp

G. Fluorescent Lamp Disposal

NC Division of Environmental Assistance and Outreach ***strongly encourages all generators to recycle all lamps containing mercury, regardless of their regulatory status. For more information, please see*** http://www.p2pays.org/Fluorescent/index.asp.

Recycling Options for Businesses

- The North Carolina Recycling Markets Directory lists dozens of companies offering collection and recycling services for fluorescent lamps – about half of these companies are outside of North Carolina but include NC in their service area.
- Search the NC Recycling Markets Directory under "Fluorescent Lights" at http://www.p2pays.org/DMRM/
- If you have an existing hazardous waste collection vendor, inquire about their ability to recycle your fluorescent lamps and ballasts.
- Lamp Upgrade Vendors: Contact the vendor or manufacturer of your fluorescent lamps to ask about take-back programs they may provide.
- Many of these collection companies offer on-site pick-up of materials (suitable mostly for large generators) and many also offer pre-paid mailing kits, which are especially practical for small generators.

New Rules for Demolition Projects in NC

State law, G.S. 130A 309.06(c), requires building owners and demolition contractors in NC to remove all fluorescent lamps and thermostats that contain mercury from the building or structure prior to demolition.

Average Costs for Recycling Fluorescent Lamps

The NC Division of Environmental Assistance and Outreach conducted web-based and phone research of fluorescent lamp recyclers on the costs charged to manage the materials through use of kits, which depend on a number of variables, including the amount and kind of fluorescent lamps being generated. The following table shows a summary of this research. LCM= Lights containing mercury

Price of Recycling LCMs Using Vendor-Provided Kits Type of Lamp	Median Cost/Lamp	Average Cost/Lamp	Lowest Cost	Highest Cost
4 ft. tube	$1.77	$1.62	$.55	$3.27
8 ft. tube	$3.13	$3.03	$1.10	$5.93
CFLs	$1.13	$1.49	$.75	$2.80
State Contract prices for recycling services	Current Pricing			
Straight Tubes	$0.04/ft			
CFLs	$0.24/each			

Fluorescent Lamp Regulatory Status

For all practical purposes, commercial and industrial entities should assume used fluorescent lamps are hazardous and manage them in accordance with the Universal Waste Rules, which requires special handling, storage, and recycling. See http://www.p2pays.org/ref/45/44990.pdf for more information.

The consolidation of hazardous waste lamps via the process of crushing is considered treatment. Generators may crush lamps on-site in closed containers. However, the crushed lamps are then considered to be a fully-regulated hazardous waste.

Generators should contact the N.C. Division of Waste Management at (919) 508-8546 with all questions related to the regulatory status of fluorescent lamps.

Ways to Reduce Lamp Mercury Hazard

- **Properly store and recycle fluorescent lamps:** Safe storage and recycling/disposal of lamps will help mitigate the potential mercury hazard.
    - Don't crush or break the lamps. See the following EPA Web site for recommendations on what to do if a fluorescent lamp breaks: http://www.epa.gov/cfl/cflcleanup.html
    - Store lamps in a manner that will prevent breakage. Ideally, unbroken used lamps should be packed in boxes.
    - Don't tape lamps together. Lamps stored in this manner can break by implosion.
    - Recycle used lamps.
- **Use lamps that contain less mercury:** Fluorescent lamps contain various amounts of mercury depending on the size and type of the bulb, and the manufacturer. Using the more efficient T5 or T8 lamps, rather than the T12 lamps, reduces mercury content. Look for Energy Star qualified bulbs or green-tipped bulbs.
- **Use Light-Emitting Diodes:** LEDs are often used as small indicator lights on electronic devices and increasingly in higher power applications such as flashlights and area lighting. LEDs cost three times as much as a fluorescent tube, but last twice as long, contain no mercury and use 25 percent less energy.
- **Reduce use of lighting:** Turn out your lights wherever and whenever possible. Using daylight and minimizing your use of lighting will extend the useful life of lamps, save energy, reduce power plant emissions of mercury and other pollutants and save money.