Comprehensive Energy Audit
ASHRAE Level 2 Report

New York Power Authority

in cooperation with

City of Buffalo

NYPA ES-ESN-0657

NYPA's Energy Efficiency Program
Race to the Top

for

City of Buffalo | Dillon Courthouse

Dillon Courthouse
68 Court Street
Buffalo, NY 14202

NEW YORK STATE OF OPPORTUNITY. | BuildSmart NY

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EXECUTIVE SUMMARY

The City of Buffalo is positioning itself to be a leader in energy efficiency as part of the New York Power Authority's (NYPA) Race to the Top competition. As part of the Five Cities Buffalo Energy Plan, the City has targeted an energy usage reduction of 20% by 2020. However, like most cities the availability of capital is scarce and the City of Buffalo would like to maximize the amount of construction that can be done by cost effectively implementing energy efficiency improvements. The City of Buffalo choose to participate in NYPA's Race to the Top competition which provides assistance with the development and implementation of energy efficiency improvements. As such, NYPA and the City of Buffalo have chosen Wendel to determine the most appropriate and feasible energy efficiency measures to reduce energy and operating costs.

This focus of this study is on the Dillon Courthouse, which has not been occupied for several years. The building is being re-commissioned and re-purposed as the Police and Fire Safety Headquarters.

During the course of the ASHRAE audit process, meetings and site visits were conducted to develop a proposed scope of work that could be implemented to decrease energy consumption while improving the general condition of the facility. Details of the analysis for each measure can be found in Appendix D of this report. Based on the energy savings detailed in the study, as well as the capital improvement needs of the Dillon Courthouse, the following Energy Efficiency Measures (EEMs) have been evaluated to be included in the NYPA Race to the Top project:

- EEM 1: LED lighting upgrades
- EEM 2: Steam radiator trap replacements
- EEM 3: Motor replacements
- EEM 4: TDV replacement and VFD upgrade
- EEM 5: Weatherization
- EEM 6: Chiller replacements
- EEM7: Boiler Controls

The following tables summarize the recommended project economics and results of the study. Table 1-1 “Total Project Summary” details the estimated overall project economics for implementing the recommended measures under the NYPA Energy Services Program. The overall total project costs in this table include estimates of all indirect costs and fees. Table 1-2 “EEM Summary” details the direct construction costs, cost and energy savings, and simple payback periods for each measure studied.

Total Project Summary
New York Power Authority - Energy Services Program - Race to the Top
Dillon Courthouse

ES-ESN-0657 August 2, 2017

Project Cost: ASHRAE LEVEL II

	Material	Labor	
Construction Costs:	$149,655.79	$181,412.18	
Asbestos Abatement:	$0.00	$3,310.68	
Payment and Performance Bonds:	$0.00	$5,015.68	
Totals:	**$149,655.79**	**$189,738.54**	
Total Material & Labor & Asbestos:	$339,394.33		
Contingency: 10%	$33,939.43		
Subtotal:	$373,333.76		
Abatement Design & Monitoring:	$791.72		
Hazardous Waste Disposal Cost:	$5,902.43		
Subtotal:	$6,694.15		
Material Handling Cost:	$0.00		
Audit, Design & Construction Mgt:	$57,120.07	(See Note # 1)	
NYPA Project Mgt. & Administrative:	$46,666.72	(See Note # 2)	
Total Fees:	$103,786.79		
Additional Engineering Costs:	$0.00		
Subtotal:	**$483,814.70**		
Interest During Construction (IDC):	$15,661.94	(See Note #4)	
Total Project Cost:	**$499,476.64**		

Estimated Energy Savings

Estimated Electrical:		Estimated Fuel:	Fuel Savings		MMBtu	Cost Savings
kWh Savings:	379,192	Natural Gas:	0	ccf	0.0	$0.00
kWh Cost Savings:	$22,751.50	Oil Savings:	0	gal	0.0	$0.00
Monthly kW Savings:	85.3	Steam:	0	lbs	0.0	$0.00
kW Cost Savings:	$10,269.97	Water:	0	kGal	0.0	$0.00
Total Electrical	$33,021.47				0.0	$0.00
Total EnergySavings:	$33,021.47	Maint. Savings:	$0.00		Est. Total Savings:	**$33,021.47**

Simple Payback

Total Project Cost With IDC:	$499,476.64
Estimated Rebates & Incentives:	$0.00
Net Project Cost	$499,476.64
Total Amount Saved:	$33,021.47
Simple Payback:	15.13

Project Financing

TOTAL AMOUNT FINANCED:	$499,476.64	
Interest Rate:	7.00%	(See Note #3)
Years Financed:	10	
Number of Payments:	120	
Annual Debt Service to NYPA:	**$69,592.17**	
Monthly Debt Service to NYPA:	**$5,799.35**	
Total Project Cost after Financing:	**$695,921.68**	
Total Annual Savings:	$33,021.47	
Payback With Financing:	21.07	
Annual Cash Flow:	**($36,570.70)**	

Notes:

1. Audit, Design & Construction Mgt represents a cost of 15.3% of the direct Construction Costs and Asbestos Abatement and are applied to contingency to provide budget estimates. Final costs will exclude unused contingency and will be calculated at end of project based on final material and labor costs and applicable abatement costs.
2. NYPA Project Mgt. & Administrative represents a fee of 12.5% of the Construction Costs, Asbestos Abatement and associated contingencies.
3. Financing was assumed at 7% interest. Actual rate is variable.
4. IDC Estimated based on 4% interest rate

Table 1-2

Dillon Courthouse
Energy Conservation Measure Summary
8/2/2017
ASHRAE LEVEL II AUDIT

(Y)es / (N)o	ECM #	Measure Description	Total Measure Cost[1]	Annual Electric Savings (kWh)	Annual Demand Savings (kW)	Annual Water Savings (kGal)	Annual Fuel Savings (mmBtu)	Annual O&M Cost Savings	Annual Electrical Cost Savings	Annual Fuel Cost Savings	Total Annual Savings	Simple Payback [2]
Y	1	Lighting Upgrades	$445,918	356,870	972.5	0	0	$0	$31,167	$0	$31,167	14.3
N	2	Steam Trap Replacements	$92,676	0	0.0	0	322	$0	$0	$1,450	$1,450	63.9
Y	3	Motor Replacements	$16,757	5,685	16.7	0	0	$0	$509	$0	$509	32.9
Y	4	TDV to VFD Upgrade	$36,802	16,636	34.7	0	0	$0	$1,346	$0	$1,346	27.3
N	5	Weatherization	$1,669	444	0.2	0	4	$0	$29	$18	$47	35.7
N	6	Chiller Replacement	$520,260	74,100	373.8	0	0	$0	$8,195	$0	$8,195	63.5
N	7	Boiler Controls	$74,498	0	0.0	0	270	$0	$0	$1,214	$1,214	61.4
		TOTALS - Recommended Measures	$499,477	379,192	1,023.9	0	0	$0	$33,021	$0	$33,021	15.1
		TOTALS - All Measures (w/ Options)	$1,188,580	453,736	1,397.9	0	596	$0	$41,245	$2,682	$43,928	27.1

NOTES:

1. TOTAL MEASURE COST includes direct construction costs (subcontractor material and labor), IC and NYPA Fees, Disposal for Hazardous Material, Bonding, Asbestos Design & Air Monitoring and accounts for the Intrest During Construction
2. SIMPLE PAYBACK periods do not include incentives.
3. "TOTALS - All Measures" includes options B and C, which are not included in the CIC scope of work. "TOTALS - Recommended Measures includes only those measures that are in this scope of work.

FACILITY DESCRIPTION

The Dillon Courthouse is located at 68 Court Street and was built in 1936. This is a 7-story building with 1 basement level below grade. The total floor area is approximately 183,000 square feet, and occupies the entire block bounded by Niagara, Court and Frank Streets. There are three (3) elevators that serve from the basement to the 7th level and one (1) freight elevator serving the basement and ground levels.

The building was unoccupied during the site visits and has been unoccupied for the past 5 years. The building is now planned for 24/7 occupancy in the near future. In-office times will vary between the different departments. According to the preliminary occupancy plans, the building will provide office and training space for 286 police and 85 fire personnel.

The floors listed below are occupied by the followings departments and services:

Basement:	Mechanical/Electrical Services, Facilities Maintenance, Armory and Storage
1st:	Public entrance, offices, witness drop off, interview rooms
2nd:	Police offices, witness interview rooms
3rd:	Police offices, internal affairs offices
4th:	Police offices and other use, storage
5th:	Police offices and accounting
6th:	Classroom training space and storage
7th:	Gym, storage, and training simulator

HEATING

Building heat is provided by 3 cast iron sectional steam boilers located in the basement. These boilers provide low pressure steam to the radiant and ventilation equipment throughout the building. Perimeter heating is provided by cast iron, steam radiators equipped with thermostatic control valves (TRVs). Ventilation equipment, located in the basement as well as various upper floors, are equipped with steam coils supplied by the building steam loop.

COOLING

Dillon courthouse is served by several air handling units. The largest of the air handling units are provided chilled water via two (2) water cooled chillers located in the basement mechanical room. The cooling tower for these chillers is located on the rooftop. A second, air cooled chiller is located in a rooftop mechanical room in order to provide chilled water to the air handling unit on the 5th floor. There are two air handling units that serve the larger courtrooms that each have evaporator coils with separate condensing units located on the roof-top. All units utilize older R-22 refrigerant. In addition, a Liebert unit is in place that provided space conditioning to a former computer server area on the 3rd floor, though it appears that this unit will be removed as part of the currently planned renovations.

DOMESTIC HOT WATER

Domestic hot water is supplied to the building by one Lochinvar domestic hot water heater that is relatively new and appears in good condition.

VENTILATION

Air handling units are provided throughout the building. The main air handlers are located in the basement, which includes a 200hp supply fan and 60hp return fan. Most air handling unit motors are controlled by variable frequency drives in order to save energy by providing only the needed ventilation based on instantaneous demand. The larger court rooms have dedicated air handling equipment for ventilation and temperature control. Various office type spaces are served by Variable Air Volume

(VAV) terminal units with reheat coils. This equipment provides tempered ventilation air, from the large air handlers, at the lowest temperature required for the all spaces served and the combination of return air and reheat coils are used to raise the distributed air to the temperature required by the specific space.

BUILDING MANAGEMENT SYSTEM

The Building Management System is built on an Automated Logic platform. Renovations to building spaces throughout the years have resulted in various vintages of control equipment in operation as well as varying levels of user control. The system is currently operational however some of the older equipment is obsolete and can be difficult to source parts. The system controls or monitors the major equipment such as air handlers, chillers and boilers as well as smaller equipment such as most of the exhaust fans and several floors of the VAV equipment. The equipment is currently set for time of day shutdown with equipment running a single shift, however, in the future spaces will vary upon occupancy by its new tenants.

BUILDING ENVELOPE

Dillon Courthouse is a 7-story, steel-framed, Art Moderne building with a granite base and clad with carved sandstone ornamentation. The window units are double-pane, double hung operable windows from the first to the seventh floor. According to available information, the windows were replaced circa 1988 and appear to be in good condition.

LIGHTING

The existing lighting largely consists of T8 and T12 fluorescent fixtures in 2 foot by 4 foot troffer fixtures. The majority of these luminaires are in good condition; however, some T12 industrial fixtures are older and should be considered for replacement. There are various other T8 type lamps in a variety of different length and fixture arrangements.

In the main lobby, there are two (2) different styles of decorative lamps, each appearing to utilize screw-in lamps (assumed to be CFL style).

Occupancy sensors are provided in limited spaces only, including the restrooms on each level. Bi-level switching has been provided in order to give manual control over light levels in some offices.

External illumination is limited to only a two (2) fixtures at each entrance, four (4) total. According to facility personnel, each fixture has a single 135 W HPS lamp. Two (2) wall packs are provided for illumination of the side entrances. A single 150 hps fixture is provided to illuminate the rooftop flag.

UTILITY ANALYSIS

UTILITIES

Energy costs for the City of Buffalo are managed by a third party consultant, Energy Advantage. Energy Advantage manages the City's accounts and negotiates with energy suppliers. For electricity, National Grid provides the distribution services, and ENGIE Energy Resources provides the commodity. For natural gas, National Fuel Gas provides the distribution services and National Fuel Resources provides the commodity.

Since the building has been mostly unoccupied the past several years billing data was annualized from October 2009 to September 2012. The average rates over this period were used to establish typical energy use for this report. This data was not used to calculate utility rates, as electricity and natural gas rates have changed significantly since this time. In addition, the building use is changing and energy use may change significantly due to operating hours of the building and differing tenants. Monthly consumption details and graphs from this time period may be found at the end of this section.

Limited recent billing data was available for use, as the building has been unoccupied for several years. As a result, historical average unit kWh and mmBTU costs were not able to be calculated. In addition, projecting savings based on current tariffs/rates may not provide an accurate representation of payback time periods due to fluctuation in energy costs. Wendel has recently completed an analysis of the City Hall building which uses the same energy suppliers and had several years of recent data available. It was agreed during meetings with the City of Buffalo and NYPA that these rates would be used for the basis of savings for Dillon Courthouse.

The table below summarizes the rates used for this study, which are based on the analysis of the City Hall building.

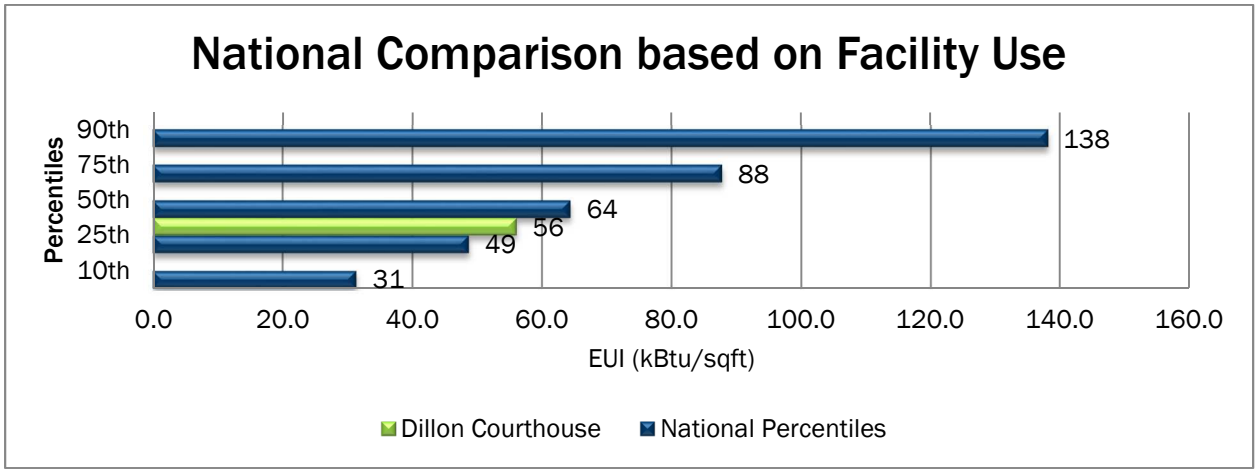
	Unit Cost ($)	*Units*
Electric Usage	$0.06	/kWh
Electric Demand	$10.03	/kW
Natural Gas	$4.50	/mmBtu

BENCHMARKING ANALYSIS

Energy benchmarking is the practice of comparing energy usage data for a select building against data from a national database of buildings in the same usage type and geographic region. Assessing the existing energy performance of your facilities provides multiple benefits. It allows for current energy use to be disaggregated to prioritize opportunities to save energy and utility costs and for the comparison of City of Buffalo facilities to each other and to peers. It also provides the basis for understanding current energy usage and to set clear, attainable and measureable goals.

Typically, a facility's energy usage data is compared to benchmarking data in the 2012 Commercial Building Energy Consumption Survey (CBECS) conducted by the U.S. Department of Energy for buildings across the country. The 2012 CBECS data is the most current data available to date. The CBECS commercial sector survey encompasses data available through the U.S. Energy Information Administration based on a specific U.S. region and division.

Due to the building currently being unoccupied and limited recent data available, this building cannot be benchmarked accurately. However, the following chart depicts how the facility compared to other similar facilities based on the historical data available from 2009-to 2012. This compares the building to other similar courthouse office facilities.



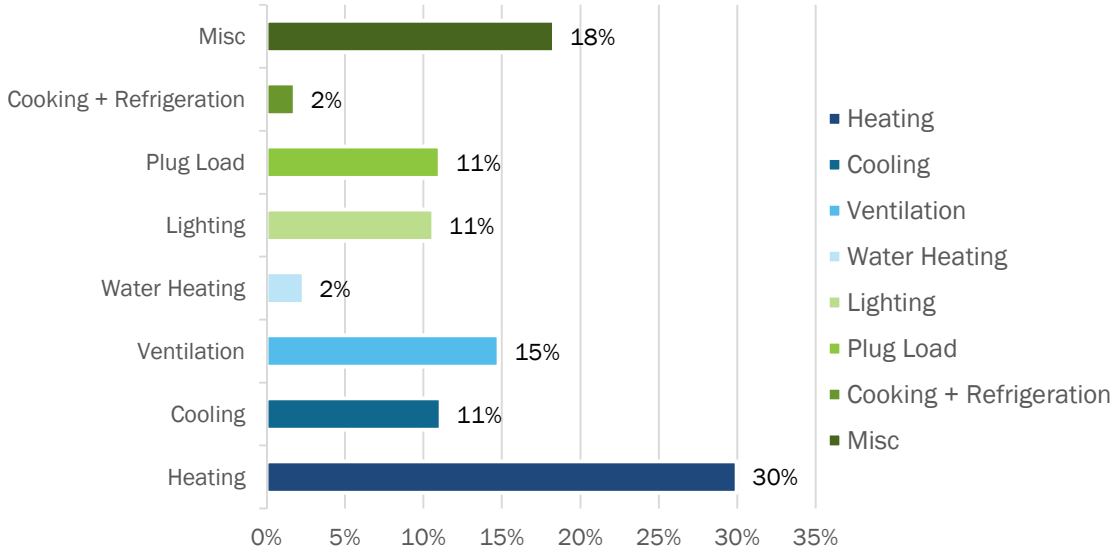
Based on this data, it appears that the Dillon Courthouse performed well compared to other buildings of similar use. According to the General Services Administration (GSA), the Dillon Courthouse has previously earned an Energy Star designation for energy efficiency in 2011, signifying that the building's energy performance rates in the top 25 percent of facilities nationwide. However, an increase in energy consumption is expected when the building is re-occupied due to the transition to a 24/7 facility compared to other buildings on standard weekday only shifts.

ENERGY USAGE BY END USE

As with benchmarking, it is not possible to extrapolate the current energy usage by end use in the building due to the limited data available and current occupancy of the building.

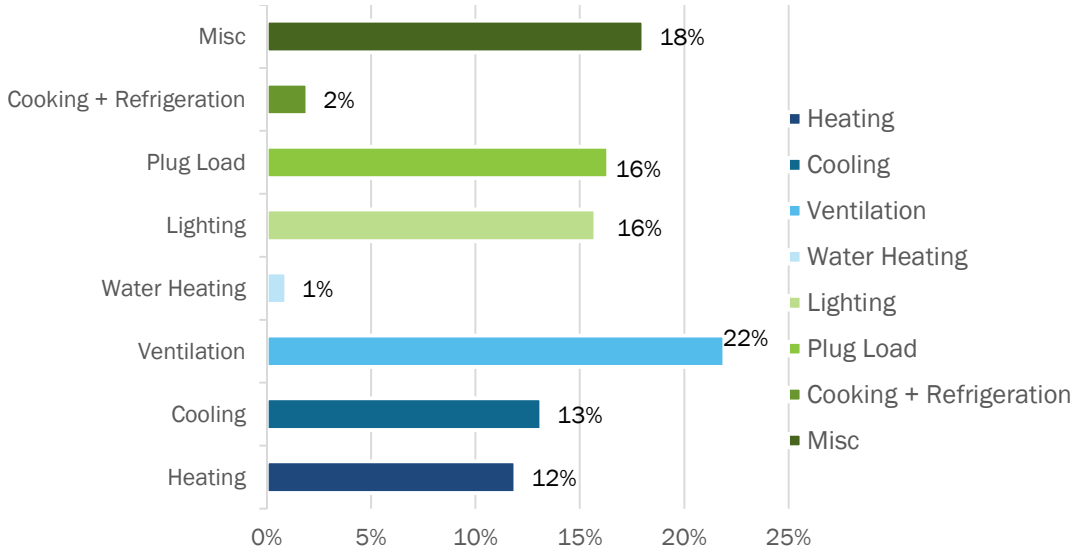
However, based on the available CBECS data, expected energy use was separated into lighting, heating, ventilation, cooling, fan and pump motors, domestic hot water, plug loads and miscellaneous energy use.

The charts below depict the *anticipated* Dillon Courthouse energy consumption areas by type and where energy costs are going. This data is based on a typical government office building.



Energy Usage by End Use – Government Office Building

As shown above, while the heating system makes up a significant portion of the building energy usage, it only comprises just over a tenth of the building's annual energy costs. Conversely, lighting loads are a relatively small proportion of the energy usage, but much larger portion by cost. This is due to the relatively low cost of natural gas for usage such as heating, versus the high costs of electricity for lighting or cooling.



Energy Costs by End Use – Based on Current Utility Rates

WEATHER NORMALIZATION

Some calculations in this report use 30 year weather data for Buffalo, NY to predict the energy savings likely to result in a given measure. The normal number of heating degree-days (HDD) for these areas were used to find the typical heating load of a given building for certain calculations.

Some calculations in this report required the use of BIN weather data. BIN weather data provides the average number of hours a location will observe temperatures in a certain range during a typical year. The temperatures are based on 30 year averages and grouped into temperature ranges of 5°F. For these calculations the weather information was used from the closest available location. Weather information was obtained from the National Weather Service website.

ENERGY EFFICIENCY MEASURES & PROJECT ECONOMICS

This section provides an overview of the Energy Efficiency Measures for Dillon Courthouse. Each subsection is separated by Energy Efficiency Measure (EEM). In each of these section we provide:

1. Investigation – overview of the process used to identify and evaluate an EEM
2. Existing System Description – this details the existing system and its operation. The focus of this section is to outline the conditions that are present now that present an opportunity for savings.
3. Proposed System Description – this details the changes that will be made to reduce energy consumption and costs. In some cases a listing of options may be considered.
4. Recommendations – this section outlines Wendel's opinion regarding how the proposed solution will address the owner's return on investment requirements, capital improvement needs, differed maintenance costs, or other considerations.

An opinion of probable cost is presented with each opportunity. The costs shown in the document were carefully developed using, recent similar project prices / unit costs, vendor provided pricing, contractor pricing or RS Means.

EEM1 | LED LIGHTING UPGRADES

INVESTIGATION

Wendel visited Dillon Courthouse to investigate lighting systems and determine opportunities to save energy. A room-by-room survey of all interior lighting was performed to identify the type of lighting fixtures, lamps, and lighting controls used on each floor. Areas of the Dillon Courthouse have been renovated at different times, resulting in the building having varying lighting designs and fixture types in use for general lighting in office areas.

Run hours for the lighting are based on the planned building hours, occupancy and space type. Typical offices expected to be occupied on average 8 hours per day, 7 days a week, while hallway lights and other higher usage areas will be left on 24/7. Storage areas will have lower run times, as they are accessed less often.

Wendel was able to evaluate the current level of energy efficiency and identify upgrades. These upgrades will result in direct energy savings by decreasing the overall energy usage necessary to provide general lighting. Since some areas will receive new lighting fixtures, LED lamps and ballasts, maintenance savings will result from the decreased cost of the replacements. The proposed upgrades will follow industry standard guidelines to ensure that proper lighting levels are maintained for the various illuminated areas, while maximizing the energy efficiency of the lighting system. These lighting levels have been selected based on criteria established by the Illuminating Engineering Society (IES). This measure also examined the use of occupancy sensors in beneficial areas of the buildings to control the lighting. Cost estimates were developed using pricing from previous projects. Refer to the following calculations and cost estimates for details.

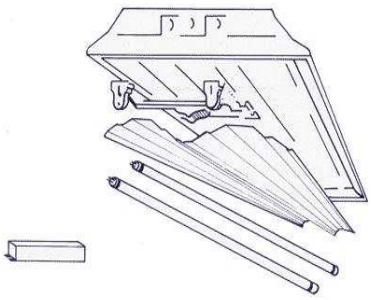
Investigation of Luminaires

The proposed lighting upgrade focuses on optimizing the current lighting system by re-lamping, retrofitting, or replacing the existing luminaire. Normally a re-lamp or retrofit is recommended in a situation where either:

a) removing the luminaire may cause disturbance of hazardous material
b) energy savings would not warrant the cost of the luminaire replacement

c) the luminaire is relatively new or in good condition and therefore replacing the entire luminaire does not make economic sense

The opportunity to re-lamp the existing luminaire occurs when the condition and power supply are suitable for a one-for-one replacement of the lamps. This straightforward approach to upgrading existing fluorescent technology to LED will yield significant energy savings while minimizing implementation costs.



Under a retrofit condition, the existing fixture body is left in place and the internal components are replaced with energy efficient LED tubes, external drivers, and new socket bars as needed. With the use of a reflector or lens kit, a retrofit can be further enhanced by accommodating the ability to de-lamp the existing fixture where the opportunity presents itself. Reflectors increase the efficiency of the fixture, greatly improving overall fixture photometric. With a retrofit, significant energy savings can be realized at a much lower cost than a complete fixture replacement. Although the costs will be greater than in the re-lamping option, the benefits to providing dedicated drivers with lamps include:

a) avoiding future maintenance costs when existing ballasts reach the end of their useful life
b) improved fixture efficacy measured in lumens/watt
c) maximize energy and maintenance savings and improve system reliability

The opportunity for luminaire replacement is highest when the existing technology is High Intensity Discharge (HID) and/or the fixture has high run hours such as corridors, exit signs, mechanical room fixtures, etc. New luminaires are inherently clean, and are designed to have excellent performance and rated life due to the nature of the current LED industry. New luminaires will only be considered for certain spaces where LED retrofit kits are not available, such as the circulene fixtures found in some closets, or fluorescent “D” lamp fixtures found in the mechanical and storage spaces. The presence of asbestos materials will limit the deployment of new luminaires.

Investigation of Lamps & Ballasts

Improvements in lighting technology have resulted in more energy efficient lamp and ballast combinations. An emerging technology has been the introduction of LED (light emitting diode) linear lamps and drivers. The performance, cost and applicability varies by manufacturer. Philips Instantfit products were investigated for their potential energy savings and project costs.

LED lamps have a great life expectancy typically from 50,000 to 70,000 hours. The end of life for an LED is defined as the point when an LED reaches 70% of its initial light output. Conversely, LED lamps will typically produce 1,600 to 2,000 lumens, where as a T8 lamp will produce 2,800 lumens. However, these lamps are more directional than standard fluorescent tubes. As a result, a higher percentage of the lumens produced will reach the desired work surface.

Investigation of incentives

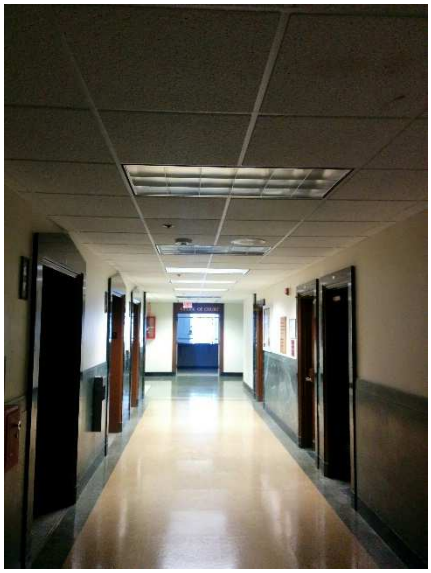
To maximize potential incentives as a result of implementing lighting improvements, where available, the proposed material include Energy Star labeled LED lamps and Design Lights Consortium tested and verified LED luminaires.

The City of Buffalo has had great success in the past on other projects implementing lighting programs offered by the utility (National Grid). The direct install program was for buildings that consumed under 100 KW of total load and offered an incentive that equated to a lower simple payback time period making lighting improvement projects more viable. Dillon Courthouse consumes at least 132 kW when unoccupied and therefore will not be eligible for these type of incentive programs.

Subject to utility approval and continuation of existing programs, Wendel estimates that up to $35,000 in rebates should be able to be secured through National Grids incentives for replacement of inefficient lighting with LEDs. This is subject to review with National Grid and provided the project qualifies for incentives.

EXISTING SYSTEM

The existing lighting consists primarily of three styles of luminaires:



1. 4 foot x 2 foot recessed troffer fixtures with three (3) or four (4) linear T8/T12 lamps. Most fixtures are provided with parabolic lenses, though some have acrylic prismatic lenses for light diffusion.
2. 4 foot x 1 foot surface mounted wrap fixtures with two (2) linear T8 lamps. Fixtures are generally provided with acrylic prismatic lenses.
3. 2 foot x 2 foot recessed troffer fixtures with two (2) u-bend T8 lamps. Fixtures are provided with parabolic lenses for light diffusion.
4. Decorative fixtures in the courtroom areas with multiple CFL or incandescent screw-in lamps. Some fixtures also include high intensity discharge (HID) down lighting.

The majority of these luminaires are in good condition, though some are older fixtures that should be considered for replacement. All lighting is of various ages and efficiencies.

Switching is done manually, however, most restrooms have occupancy sensors that were observed during the audit. Some of the perimeter office fixtures are provided with bi-level switching for manual dimming of light levels.

PROPOSED SYSTEM

The focus of the proposed system is as follows:

1. Retrofit existing T-8 and T12 lamps, in a variety of different lengths and types, with high efficiency LED lamp and provide new electronic ballasts.
2. Replace any incandescent lamps with LED lamps.
3. Replace any compact fluorescent lamps with LED lamps.

This option produces an acceptable simple payback. A review of some existing fixtures with City of Buffalo personnel is recommended to determine whether fixtures should or can be replaced. Some older fixtures appear to have some damage, but may have some heritage value.

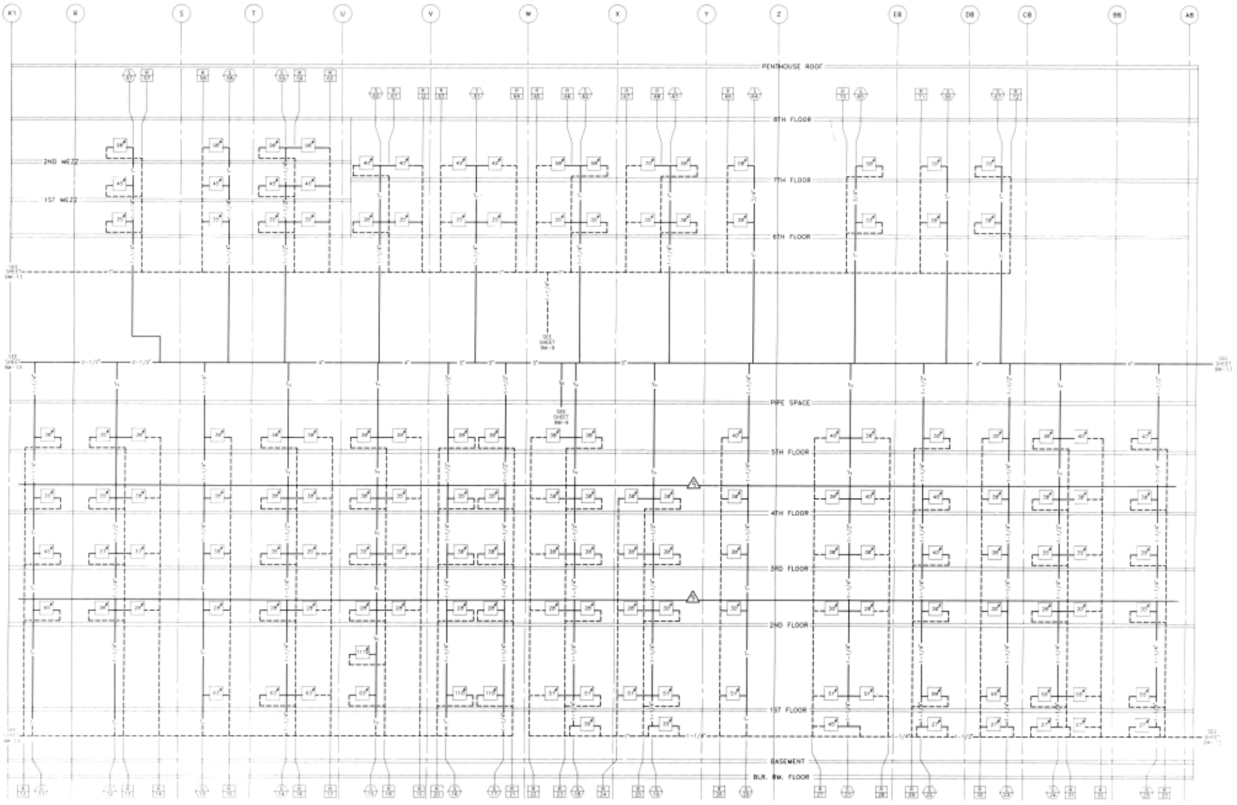
RECOMMENDATIONS

Wendel recommends the implementation of the lighting upgrades for all spaces in the building. The general approach will be to replace lamps with LED equivalents and new electronic ballasts where required. No additional controls are considered at this time, though integral sensors could be provided for luminaires that targeted for replacement.

EEM2 | STEAM RADIATOR TRAP REPLACEMENTS

INVESTIGATION

The perimeter heating for Dillon Courthouse is provided by steam radiators, and air handling units are provided with steam heat exchanges. Wendel reviewed the building plans and interviewed facility personnel who are familiar with the building and these systems. Our team discovered that the radiators are piped vertically rather than horizontally by floor. This limits the opportunities for improvement since the system cannot be zoned for more precise control of floor areas.



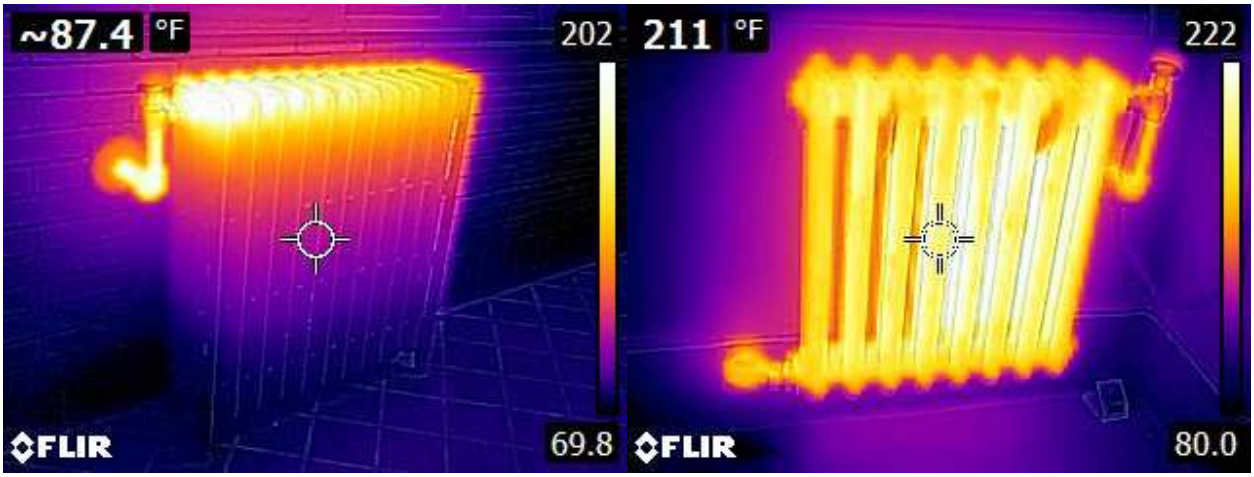
Dillon Courthouse – Existing steam distribution piping drawings

EXISTING

Steam from the main boilers is produced in the basement mechanical room. Steam radiators are located throughout the building perimeter and utilize thermostatic control valves (TRVs). Site visits were performed in June/July 2017 and the steam system was not in operation. The building is not occupied at this time and therefore there are no reports of whether spaces are adequately heated or overheated during the winter and shoulder months.

According to site personnel, the vast majority of steam traps have not been replaced in the past 7 years. Limited, if any, maintenance has been done on this system in the recent past. It is likely that

many of the existing steam traps have failed resulting in a higher condensate return temperature at the unit that would otherwise be anticipated if the trap was working properly. In areas where there is insufficient heating the radiator traps are likely clogged resulting in flooded radiators. When a radiator is flooded its capacity to reject heat into the room is reduced.



Examples of flooded radiator left; blown through radiator right - images not taken from Dillon Courthouse

The condensate return is under a vacuum system powered by two (2) 5hp motors that run continuously during the winter months, according to facility personnel.

PROPOSED

To improve the operation of the steam system and reduce energy consumption the following steps can be taken.

1. Replacement of radiator thermostatic steam traps
2. Targeted replacement of Float and Thermostatic (F&T) traps.

By addressing these deferred maintenance items, issues such as flooded radiators and uncontrolled heating will be addressed. This will create a better controlled steam system. The resulting energy savings will be seen as follows:

1. Reduction in over heating resulting in open windows and uncomfortable environment
2. Reduction in cold zones resulting in the need for personal electric resistance heaters

RECOMMENDATION

The proposed improvement will have a positive impact on the building's operation and help address maintenance and comfort issues in addition to saving energy. Due to the number of radiators, the relative overall cost is high resulting in a longer return on investment.

Wendel is not recommending this EEM at this time, as the funds are not available as part of this project. Regular steam trap maintenance during building operation is recommended in order to save energy, and improve space control and comfort.

EEM3 | MOTOR REPLACEMENTS

INVESTIGATION

Energy efficiency standards for motors have gradually increased as demand for high efficiency motors and the technology to achieve those efficiencies have developed. Motors in HVAC systems such as fan motors can often have high run hours and account for substantial electrical energy usage. Typically motors that are 5 horsepower and greater can be viable candidates to upgrade. Wendel identified the size, existing efficiency, and average annual run hours of fan motors throughout the facility.

Air Handling Unit Motors

Motor	Location	Motor Control	Efficiency	Horsepower	Recommended for Replacement
Supply Fan	Basement	VFD	95%	200	No
Return Fan	Basement	VFD	93.6%	60	No

Pump Motors

Motor	Location	Motor Control	Efficiency	Horsepower	Recommended for Replacement
Condensate Suction Pump 1	Basement	Starter	84% (est.)	5	Yes
Condensate Suction Pump 1	Basement	Starter	84% (est.)	5	Yes
Chilled Water Pump 1	Basement	None	87.5%	30	Yes
Chilled Water Pump 2	Basement	None	87.5%	30	Yes
Condenser Water Pump 1	Basement	None	91%	40	Yes
Condenser Water Pump 2	Basement	None	91%	40	Yes

A list of specific motor energy savings are shown in Appendix B of this report.

EXISTING

Dillon Courthouse has a multitude of motors serving exhaust and supply air fans along with different pump systems. Motors were found to be of various sizes and efficiencies, with air handling units being controlled by Variable Frequency Drives (VFD's) to reduce motor speed during times of lowered demand. The chilled water and condenser water pumps are not currently controlled by VFD's, but these units have shorter run times than the air handling units.

PROPOSED

The pump motors will be replaced as they are lower efficiency and do not already utilize VFD control. These motors will be replaced in-kind with NEMA premium efficiency motors. The new motors will match the existing motors, horsepower, voltage, and frame size. The existing starters will be replaced with variable speed drives to reduce motor speeds when there exists less demand on the fan systems.

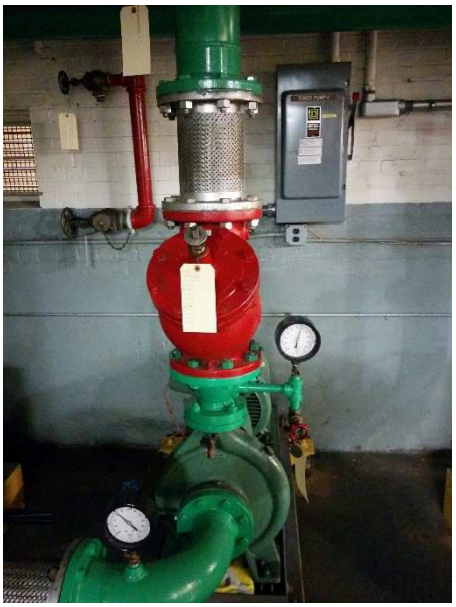
RECOMMENDATIONS

Wendel recommends replacement of standard efficiency motors with NEMA efficiency motors where economical. New induction rated (class F & H) motors are required for applications with variables speed drives.

Replacement of the larger supply and return fans is not recommended at this time, as these are connected to variable frequency drives and are close to current NEMA premium efficiency levels. However, these motors are older and could be considered for replacement to avoid future system downtime.

EEM4 | OPEN TDV AND VFD UPGRADE

INVESTIGATION



The condenser water loop for the chiller plant is served by two (2) 40 HP pumps. These pumps are rated for 525 GPM at 160 feet of head according to the pump nameplate.

EXISTING

Currently, the pump operates consistently at full speed and uses a triple duty valve (TDV) that is used to balance the system is in the 50% open position, which adds approximately 4.25 feet of head loss across the pump. The minimum head loss across this particular TDV when fully open at a flow rate of 525 GPM is 1.6 feet of head loss.

The extra head loss across the pump equates to additional work that the pumps need to overcome to operate in comparison with the ideal condition.

PROPOSED

This measure will consist of the following:

- Install new VFD drives for motor control
- Open the TDVs to the 100% open position
- Re-balance the pump to achieve the desired GPM using the VFD

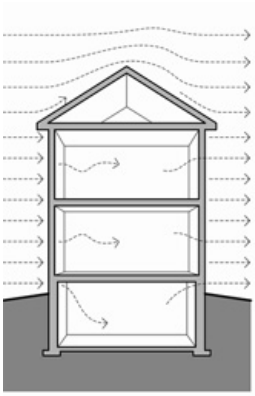
Changing the TDV position will allow the pump to achieve the same amount of flow while reducing the work required by the pump. This will have a direct effect on the electrical energy required to operate the pump. The completion of this measure will reduce operating costs by achieving a minimum head loss across the TDV of 1.6 feet of head.

RECOMMENDATIONS

Wendel recommends implementation of this EEM as the energy savings associated with the measure justifies the expenditure.

EEM5 | WEATHERIZATION

The building envelope is a critical part of a facility's energy efficiency. Thermal energy is transferred through the building's exterior by various modes of heat transfer. The largest single component is conductive heat transfer through stationary masses such as the walls, windows, roofs and other external surfaces. This energy loss is most notably mitigated by insulation installed during construction. Energy is also transferred through radiation, also known as solar heat gain, where heat is absorbed by the building through the transparent glazing of windows. The final component is convective heat transfer (airflow), also known as infiltration or exfiltration.



Wind Effect

The building envelope was investigated and assessed. Air infiltration was identified as cracks in the building envelope. These breaks throughout the facilities' exterior develop over time and result in outside air penetrating into the conditioned space, which increases the load on the cooling and heating equipment. Energy losses were identified in locations where gaps were present at exterior doors. For air flow to occur there must be both a pressure difference between two points and a continuous flow path or opening connecting the points. There are three main forces that create a pressure difference: wind forces, the stack effect, and mechanical air handling equipment. Based on the geographic location temperature and wind data, existing heating and cooling system temperature set points, equipment efficiencies and the occupancy schedule, energy losses due to wind contributing infiltration and exfiltration were calculated.

INVESTIGATION

The intent of this measure is to reduce leakage of conditioned air by replacing or implementing door sweeps where needed. Door sweeps ensure a tight fit between the door and the ground thereby reducing infiltration of outside air and exfiltration of conditioned air. Infiltration and exfiltration cause the HVAC system to have to condition more air than would be required with a properly sealed building. Often times, existing door sweeps deteriorate due to exposure to the elements and normal wear and tear. By implementing this measure, heating and cooling savings will be realized by reducing the load on the HVAC system caused by unwanted airflow.

EXISTING

Dillon Courthouse has two main entrances. Most of the doors were found to be in good condition, including having properly functioning door sweeps. Only a few sweeps were found to be in need of replacement. The doors in need of new sweeps include the main visitor entrance, staff entrance and two doors located on the east side of the building.

It should be noted that the main entrances (both visitor and staff) door frames appear to be in poor condition and have some gaps that would benefit from being sealed. However, due to the vintage of the building, it may be difficult to make modifications without requiring complete replacements. Replacement of these doors is expected to be very expensive due to the architectural detailing and would not provide an acceptable payback.

There are several loading bay doors that have sealing found to be in acceptable condition.

PROPOSED

The proposed system includes new bottom sweeps for the main doors.

RECOMMENDATIONS

Wendel does not recommend replacement of bottom door sweeps on exterior man doors with degraded bottom sweeps. Maintenance on the existing doors is recommended due to the existing conditions.

EEM6 | CHILLER REPLACEMENTS

INVESTIGATION

The Dillon Courthouse has two (2) identical chillers located in the basement. The chillers currently installed are aging and of inefficient technology utilizing R-22 refrigerant that is not environmentally friendly.

The Montreal Protocol is an international treaty that was created to protect the ozone layer by phasing out the production of ozone depleting substances. As a result of the treaty, Congressional Amendments to the U.S. Clean Air Act in 1990 and 1998 required that the Environmental Protection Agency (EPA) develop regulations for responsible management of ozone depleting substances in the United States. One of the requirements of these regulations is that the production of hydrochlorofluorocarbons (HCFC), which includes refrigerant R-22, be phased out by January 1, 2020.

EXISTING

The two (2) chillers were manufactured by York and installed circa 1993. The chillers have a cooling capacity of 175 Tons each and have a full load efficiency of 0.657 kW/ton. The single speed rotary screw compressor does not have speed control resulting in poor part-load efficiencies. The chillers are approximately 24 years old and nearing the end of their useful life. During the site visit one unit was out of service due to outstanding maintenance issues.

The new chillers will utilize R-134a refrigerant and will be sized to replace the existing chillers, as discussed with the facility. The proposed system will make use of the existing building piping where possible to minimize overall construction costs.

PROPOSED

The two (2) existing chillers will be replaced with two (2) new chillers of identical capacities. The new chillers will utilize modern compressor technology with variable speed drives for increased efficiency. The primary pumps for these chillers will be retained, as they were observed to be in fair condition. The facility has not reported any issues with existing pumping or cooling capacities.

The proposed measure for this building includes the following scope of work:

- Pressure and flow testing of pumps and ventilation prior to removal of equipment
- Recovery of existing R22 refrigerant in accordance to regulations
- Installation of new chillers and circulation pumps
- Tie into existing hydronic piping system
- Pipe Insulation

- Valve Tags and Pipe Labeling
- Electrical/Controls Installation and re-connection to BMS
- New refrigerant monitoring and alarm system
- Testing and Commissioning including balancing of system
- Asbestos Abatement

RECOMMENDATIONS

Replacing the chillers is not recommended as the replacement costs exceed the budget available for this project and the energy savings payback is small compared to the cost of replacement. However, due to the age of the equipment and the phase out of R-22 refrigerant, plans should be made to replace these in the near future.

EEM7 | BOILER BURNER CONTROLS UPGRADES

INVESTIGATION

Wendel investigated upgrades for the heating system at the Dillon Courthouse. The existing system is comprised of 3 cast iron sectional boilers of the identical sizes. Each of the boilers is equipped with a burner with an operating range from 750 to 3103 MBH input. Two boilers are older and were installed in a project during the late eighties. One is a newer version of the same boiler installed in a more recent project. At the time of investigation one of the two older boilers was removed from the operating sequence as it had developed leaks at the section gaskets. During the heating season the boilers provide low pressure steam to the perimeter radiation and air handling units. For the purposes of this evaluation, the savings calculation was normalized to an average of the data provided from late 2009 through most of 2012 when the building was occupied.

EXISTING

The burners on the boilers appear to be original to their installation. The burner controls currently utilized by the boilers consist of mechanical linkages and cams to modulate air and fuel flow for the combustion process. This type of control is prone to fall out of calibration, require frequent maintenance, and become less efficient over time.

PROPOSED

Cast iron sectional boilers are a robust design and in many applications have long life expectancy. This measure proposes the installation of new combustion control equipment to supplement the operation of the existing burners. This would involve removing the existing linkages to the air and fuel valves, and installing direct-connect servomotors. These motors will then be controlled via the burner control system to maintain superior combustion efficiency. The new burner controls will adjust the firing rate and damper position to optimize the combustion process. This measure will improve boiler efficiency by exactly matching fuel and air ratios to the actual boiler load demand. For the purposes of this evaluation it was proposed to replace the controls on the 2 active boilers, the third boiler once repaired would be brought online as a backup as needed in case of emergency.

RECOMMENDATIONS

Upgrading the boiler burner controls is not recommended as energy savings dollar value low relative to the cost of upgrade.

NR | WATER CONSERVATION

Since the City does not pay for water, water conservation improvements would not yield a simple payback.

The City should consider the following when upgrading facilities.

- Sink aerators should be replaced with a 0.5 and 1.5 GPM aerators depending on faucet use.
- Flush valves and tank toilets are to be upgraded to more modern "low flow" options. The water closets of today use 1.6 GPF and are as effective as the previous versions at removing waste.
- Urinal flush valves are also proposed to be replaced with more modern 0.5, 1.0, or 1.6 GPF valves depending on urinal size.
- Additionally for Hand wash medical and food service sinks hands free pedal faucet controllers will be installed, these not only reduce water usage but also eliminate the need to touch the faucet controls eliminating hand contamination at the faucets.

NR | OTHER IMPROVEMENTS CONSIDERED

Wendel, working with City's staff, reviewed the building's operation, interviewed building staff, and conducted several facility tours. From these initial visits, Wendel identified several potential opportunities. Some facility improvements have been ruled out due to the available budget or low return on investment.

LIGHTING

Advanced Lighting Controls

The architecture of building (heavy construction) and the presence of asbestos containing materials (ACM) would make an advance lighting control system (wireless or wired) cost prohibitive. These types of systems include technologies for daylight harvesting, occupancy sensing, and integrated demand response. Select spaces for "on-fixture" sensors may be used, but should be evaluated after occupancy due to unknown usage patterns.

BUILDING ENVELOPE

Window Replacements | Caulking | Window Film

Windows are relatively new and appear to be in good condition with caulking intact. Replacement of windows or any further sealing or window film applications would not provide an acceptable return on investment and does not fit within the allocated budget.

HEATING & COOLING SYSTEM

Commissioning

It is assumed in this report that heating and cooling set points will be commissioned to suit the new tenant requirements as part of the current work. According to the drawings, existing VAV boxes are being rebalanced to suit the spaces, new VAV boxes are being provided, main supply cooling coils are being replaced, along with other upgrades and associated control work. Therefore, savings for these measures cannot be included in this project.

Condenser unit replacements

Several smaller areas in the building are cooled with condenser units located on the roof top. These units utilize older R-22 style refrigerant, similar to the chiller units. Though slight increases in efficiency would be possible by upgrading to R-134a units, the work to replace piping and coil units would be cost prohibitive relative to the energy savings. As with the chiller units, these should be considered

for replacement in the near future due to the phase out of R-22. When units are approaching the end of their useful anticipated life they should be replaced with the most efficient units available.

Building Management System

The building management system is currently capable of providing adequate control and monitoring of the buildings varying vintage of connected equipment. Though energy savings opportunities may be possible with newer, more advanced control systems, the investment relative to the potential energy savings would be small. Costs would also exceed the budget available, due to the priority of lighting retrofits for this particular project.