PROJECT N° 141-13280-11

JEANNE MANCE BUILDING

200 ELGANTINE DRIVEWAY

ENERGY AUDIT REPORT
DRAFT FOR REVIEW

MARCH 2015

JEANNE MANCE BUILDING

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Project N° 141-13280-11

Prepared for:

Public Works and Government Services Canada
Professional and Technical services
NCA Operations
Real Property Branch

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APPENDICES

1 EXECUTIVE SUMMARY

Public Works and Government Services of Canada (PWGSC) retained WSP to conduct an energy and water assessment of Jeanne Mance Building located at 200 Eglantine Driveway, Ottawa, Ontario. This work will be in support of the Federal Government Departments Sustainable Development Strategy to reduce energy consumption and greenhouse gas emissions as part of the Canadian Government's larger commitment to sustainable development.

The aim of this study was to analyze the current energy performance of the property, conduct an onsite energy assessment and produce a list of energy conservation measures (ECM's) complete with relevant implementation costs.

The Jeanne Mance Building is a 21-storey office building constructed in 1970 that is primarily occupied by Health Canada. The building has a total gross floor area of 38,430 m2 (413,507 ft2) and an estimated footprint of 1,560 m2 (16,820 ft.). It has 21 floors above grade, a basement and a mechanical penthouse.

The building operates from 6 a.m. to 6 p.m. on weekdays. On weekends, there are only minimal operations and maintenance staff. Approximately 1,800 employees occupy the building.

A review of the existing energy consumption profile of the facility has been completed and the Building Energy Performance Index (BEPI) was used to compare the performance of this facility against similar buildings. The BEPI for this facility was 253 ekWh/m² (910 MJ/m².yr). The BEPI is 29% lower than the comparable benchmark of 356 ekWh/m².yr (1,282 MJ/m².yr).

The electrical energy intensity is 134 kWh/m².yr (482 MJ/m².yr). This value is 17% lower than the comparable benchmark.

The steam energy intensity is 57 ekWh/m².yr (205 MJ/m².yr). This value is 45% lower than the comparable benchmark

The chilled water energy intensity is 62 ekWh/m².yr (223 MJ/m².yr). This value is 32% lower than the comparable benchmark.

Further discussion on the building energy intensities and comparison to benchmarks is available in Sections 4.1, 4.2 and 4.3.

Table 1-1 below provides a summary of building metrics in addition to the BEPIs listed above.

Table 1-1 Jeanne Mance Metrics

Source Type	ekWh	Cost ($)
Electricity	5,141,635	542,920
Steam	2,187,610	195,363
Chilled Water	2,392,941	231,151
Water & Sewer (m^3)	22,959 (m^3)	73,951
	Total Cost ($)	**$ 1,043,384**

The following table summarizes potential energy and water conservation measures that were identified for the building. It is recommended that PWGSC carefully review the potential to implement these measures.

Table 1-2 ECM Summary

ECM		Savings				Simple Payback (years)
		Electricity (kWh)	Steam (ekWh)	Chilled Water (ekWh)	Potable Water (m^3)	
ECM1	High-Performance Glazing Replacement	**Measures are fully described in section 5.3, calculations to be performed at the final submission.**				
ECM2	Weather Stripping Maintenance					
ECM3	Exhaust Heat Recovery					
ECM4	Demand Controlled Ventilation					
ECM5	VFD for Interior AHUs					
ECM6	Implement Temperature Setback Schedule					
ECM7	Replace Urinal with Low Flow	Not Applicable	Not Applicable	Not Applicable	889	6.3
ECM8	Replace Lavatory Aerators	Not Applicable	Not Applicable	Not Applicable	2316	0.2
ECM9	Ultra Low Flow Water Closets	Not Applicable	Not Applicable	Not Applicable	1,123	17.0
ECM10	Reset Mixing Valve on all Lavatories	**Measure is fully described in section 5.4, calculations not applicable.**				

ECM11	Replace 32 Watt, T8 fluorescent lamps with 25 Watt	279,609	Not Applicable	Not Applicable	Not Applicable	4.5
ECM12	Install day lighting Sensors	86,353	Not Applicable	Not Applicable	Not Applicable	4.8
ECM13	Task Lighting	**Measure is fully described in section 5.5, calculations not applicable.**				

By implementing the measures listed above, a potential savings of [total natural gas savings] m3 of natural gas, [total electricity savings] kWh of electricity, and [total water savings] m3 of water may be anticipated.

Implementation of the measures identified in this assessment will assist PWGSC to reduce risks associated with utility market volatility and unplanned capital maintenance expenditures.

2 INTRODUCTION

2.1 OBJECTIVES AND METHODOLOGY

This report outlines the results of the diagnostic energy audit and findings for Jeanne Mance Building located at the Tunney's Pasture Campus in Ottawa, Ontario in accordance with the PWGSC Terms of Reference defined in the original tender of this work.

The findings of this work can be used to develop an energy reduction work plan and may assist in the implementation of Energy Conservation Measures (ECM's) to reduce the energy use at the facility.

Consistent with the PWGSC Terms of Reference, the energy audit includes the following activities:

- Undertake an analysis of the historical energy use at the facility for the last six years, including development of a typical year and comparison to benchmark data;
- Develop an energy-end use breakdown as the first step in the calculation of the potential energy savings;
- Undertake an audit of mechanical, electrical and domestic water systems that includes data collection and measurements;
- Investigate and verify the current operating practices and control strategies utilized by the Building Automation System (BAS); and,
- Develop a list of potential Energy Conservation Measures (ECMs) and calculate the energy savings and implementation cost for each measure.

3 BUILDING DESCRIPTION

3.1 OVERVIEW

Public Works and Government Services Canada (PWGSC) retained WSP to conduct an energy audit of the Jeanne Mance Building located on 200 Elgantine Driveway, Tunney's Pasture Drive, Ottawa, Ontario. This work will be in support of the Federal Government Departments Sustainable Development Strategy to reduce energy consumption and greenhouse gas emissions as part of the Canadian Government's larger commitment to sustainable development. Table 3-1 below provides a summary of the facility information.

The Jeanne Mance Building is a 21-storey office building constructed in 1970 that is primarily occupied by Health Canada. The building has a total gross floor area of 38,430 m2 (413,507 ft2)). It has 21 floors above grade, a basement and a mechanical penthouse.

Table 3-1 Description of the Facility

Description of the Facility	
Name of Facility Jeanne Mance Building	**Address** Tunney's Pasture, 200 Elgantine Driveway, Ottawa, ON
Owner (if not PWGSC) Government of Canada	**Address** 11 Laurier St., Suite 9A1,Gatineau, QC, K1A 0S5
Building Management PWGSC	**Address** 11 Laurier St., Suite 9A1,Gatineau, QC, K1A 0S5
Building Name: Jeanne Mance Building	**Building #** 19
Address (Street or P.O. Box) Tunney's Pasture, Holland Avenue, Building 7	**City, Province/Territory, Postal Code** Ottawa, Ontario X9X 9X9
Building Manager (administrator responsible for building) Rob Lawson	
Date of Audit February 2005	**Type of Facility** Office ☑ Laboratory ☐ Warehouse ☐ Other: ___________ **Date of construction:** n/a **Population of Facility:** 400
Original Architects (if known) Ronald Ogilvie	**Original Engineers (if known)** Structural engineer was Adjeleian and Associates Mechanical/electrical engineer was Goodkey/Weedmark
Description of the Facility	
Building Modifications or Changes In Use Anticipated in the next 15 years: None	**Remaining Useful life of the building:** 25+ years
Does the Facility have an ongoing energy management program?	☐ Yes ☑ No ☐ Unknown
Previous Energy Audits Completed? (if yes, give dates) ☑ **Yes** ☐ **No** Enerov in 2005 Morris and Hershfield 2012	
Previous Architectural/Engineering Studies Undertaken? (if Yes, Specify) ☑ **Yes** ☐ **No**	
Name of Utility Suppliers Electricity - Hydro Ottawa (Also fed from Tunney's Pasture Central Plant) Heating/Cooling - Tunney's Pasture Central Heating and Cooling Plant Water and Sewage – City of Ottawa	

Current building occupancy is estimated to be 1,800 full time employees. The following table summarizes occupancy by space type.

Table 3-2 Space Type Occupancy

Space Type Occupancy			
Space Category	**Floor**	**Total Area (m^2)**	**% of Space**
Office Spaces(includes: meeting rooms, washrooms, breakouts, kitchenettes)	B-21	31,036	81%
Mechanical Rooms	B, PH	3,600	9%
Electrical Rooms	B	211	1%
Storage	B-22	2080	5%
Cafeteria	1	1503	4%
Total		**38,430**	**100%**

3.2 BUILDING ENVELOPE

3.2.1 OVERVIEW

The majority of the basement perimeter walls are poured concrete. The majority of the building envelope above grade consists of precast concrete panels and punched windows. A curtain wall exists at ground level at the south, east and west elevations.

The building envelope appears to employ the basic principles of a rainscreen system in its design. The cementitious rendering over the concrete block located on the warm side of the insulation is intended to act as an air barrier. A caulking joint provides continuity in the air barrier tying the cementitious rendering to the aluminum window frame.

The roof on the building is a protected membrane system, where the waterproofing membrane is located below, and protected by, the insulation and ballast.

3.2.2 EXTERIOR WALLS

The building is clad primarily with precast concrete panels. The precast panel sections consist of three vertical bands joined by two fluted spandrels. Vertical joints between the precast panels are caulked with sealant; horizontal joints are open in a rainscreen design. The joints between the precast panels and fluted spandrels are also sealed with caulking.

The ground floor is recessed by 1.5 m and the precast extends through to the roof of the mechanical penthouse. The precast is attached to the structure with steel brackets. According to the architectural drawings the exterior wall construction consists of precast panels, an air space, 25 mm insulation, cementitious parging and 150 mm concrete block. However a report completed by Halsall in December 2008 found the following construction when completing a test opening: precast panel, air space, 50 mm expanded polystyrene insulation with sealed joints, 25 mm thick cementitious parging, 100 mm concrete block and interior painted gypsum board.

3.2.3 WINDOWS

There are approximately 2080 punched office windows. According to the drawings, the windows are set in wood blocking in the concrete block back-up walls. The windows have sealed, insulated glazing units, in thermally broken and drained aluminum frames. Aluminum extrusions are present at the sills, directing water onto the precast concrete panels. The joints between the window frames and precast panels has been sealed with caulking.

There are double glazed curtain wall systems at grade level on the majority of the east, and west elevations as well as the entire south elevation. This ground floor curtain wall system, with sealed, insulated glazing (I.G.) units and aluminum framing is original to construction. The IG units are constructed with standard clear glass and have aluminum spacers.

3.2.4 DOORS

Located on the south elevation is the main entrance, which consists of two sets of glazed double doors and a single fire exit door with metal frames. A set of metal framed double doors with IGU's exists on the east and west elevations in each of the cafeteria seating areas.

There is excessive salt build up on the lower mullions of the main entrance system (located on the south elevation). Corrosion was also noted at the base of these doors and adjacent glazing. This deterioration appears to be due to the exposure to snow, water and ice melting salts. The sealant located between the glazing and the aluminum framing is in poor condition and/or missing.

Staining and salt build up at the lower mullions was noted at the base of the cafeteria exit doors on the east and west elevations. Sealant failure between the glazing and aluminum frames was typical. Infiltration around both doors was observed. Staining was noted on the carpet adjacent to the west exit door, as well as at the head of the door.

There are two exterior steel doors located at the loading dock on the north elevation, one is an exit door only for the basement floor level and the other is an exit/entrance at the loading dock. There is also a steel access door to the generator room and two steel doors to the penthouse machine room and roof area.

There are two electrically operated steel overhead doors, 3.0 m wide x 2.4 m high, in the loading/receiving area on the basement level on the north elevation of the building. The west door has two, small glazed panels, and the east door only has one

3.2.5 ROOFING

The roof on the building is a protected membrane system, where the waterproofing membrane is located below, and protected by the insulation and ballast. The membrane on the elevator machine room consists of a rubberized membrane with 50 mm of insulation and gravel ballast. The main roof level and the four air wells have a 4-ply membrane with 50 mm of insulation and gravel ballast (main roof) or concrete paver ballast in the outdoor air wells.

3.2.6 AIR TIGHTNESS

Generally the weather stripping is in fair condition, some maintenance is required to repair damaged and corroded weather stripping components on the cafeteria doors and main doors which have issues with infiltration. The lock mechanism on the main doors has a permanent gap allowing constant infiltration.

3.3 MECHANICAL SYSTEMS OVERVIEW

The building uses steam and chilled water from Tunney's Pasture Central Heating Plant (CHP). Direct steam is used in air handling units serving the induction units, while the interior, basement and main floor air handling units use glycol hot water. Steam converters, located in the basement and penthouse, generate hot water for space heating as well as domestic hot water.

There are no chillers or cooling equipment for base building functions. The purchased chilled water is used directly in air handling unit cooling coils without an intermediary heat exchanger.

3.3.1 HEATING SYSTEMS

The heating system consists of both direct steam heating coils as well as hydronic heating coils which are served by numerous heat exchangers located in both the penthouse and basement mechanical rooms that convert steam from the Tunney's Pasture CHP to heating water. The heating coils in the three perimeter AHU's located in the penthouse are original direct steam coils. The four interior units each have glycol heating coils and are also located in the penthouse. The AHU located in the basement are provided with glycol heating coils.

Heating water and glycol is distributed to the induction units, perimeter radiation and unit heaters by a series of dedicated pumps. These pumps are located in the both the penthouse and basement mechanical rooms.

There were electric reheat coils of the major interior duct branches serving each floor, however these oils have been decommissioned.

3.3.1.1 HOT WATER HEAT EXCHANGERS AND SECONARY PUMPS

There is a single shell and tube steam to hot water heat exchanges located in in the mechanical penthouse. The heat exchanger use low pressure steam in the shell of each unit to heat the water. The hot water is delivered to the perimeter induction units by two 30 HP pumps operated in a lead lag configuration.

3.3.1.2 GLYCOL HEAT EXCHANGERS AND CIRCULATING PUMPS

There are several shell and tube steam to glycol heat exchanges located in various mechanical rooms. The heat exchanger use low pressure steam in the shell of each unit to heat the glycol. There are a total of 8 glycol circulation pumps.

3.3.1.3 GLYCOL UNIT HEATERS

Glycol unit heaters are provided for the loading dock and at the bottom of the main return air shaft.

3.3.1.4 PERIMETER HEATING

The majority of the perimeter heating comes from perimeter induction units which are located beneath windows serving the perimeter spaces on floors 2 to 21. They utilise high-pressure primary air from the induction air-handling units to induce secondary airflow to provide conditioning air in the spaces adjacent to the exterior wall. The induction units are two pipe variety, providing heating during winter or cooling during summer, but not both at the same time.

The induction units are separated into three zones served by separate AHUs. The North East Perimeter AHU located in the mechanical penthouse serve the induction units on a portion of the north side of each floor and the east side of each floor, while the North West Perimeter AHU serves the induction units on the remaining portion of the north side of each floor, as well as the west side of each floor. The south perimeter induction units on each floor are served by the South Perimeter AHU.

Perimeter radiation is provided at the base of the windows on the ground floor through hydronic baseboard heaters.

3.3.1.5 ELECTRIC HEATING

There are four electric force-flow heaters in the exit corridors at basement end of ground level. Wattage is not marked but estimated at 4,000 W. Units have integral control.

3.3.1.6 CONDENSATE RETURN AND STEAM TRAPS

The condensate return pumps are located in the basement mechanical room. The steam traps throughout the mechanical rooms all look to be well maintained.

3.3.2 COOLING SYSTEM

Chilled water is provided by the Tunney's Pasture Central plant and used directly in the AHUs. The perimeter induction units are switched over to cooling in the spring.

3.3.2.1 COMPUTER ROOM COOLING UNITS

The 12th floor computer room is served by "Ecosaire" chilled water air conditioning system

3.3.2.2 KITCHEN REFRIGERATION EQUIPMENT

There is one walk-in cooler and on walk-in freezer used by the cafeteria kitchen.

3.3.2.3 OTHER COOLING EQUIPMENT

Blanchard Ness chilled water recirculating air handling unit that supplies cooling to the basement mechanical room.

Trane model TCH121 packaged rooftop unit that supplies air conditioning to the high rise elevator machine room that is accessed off the penthouse mechanical room. This unit is located on roof beside the elevator machine room.

Trane MCCB012 chilled water modular air handling unit serving the low rise elevator machine rooms on the 14th and 15th floors. Consideration is being given to revising the chilled water connections for this unit so that it comes off before the main isolation valves for the penthouse. This will permit the unit to continue operating while the chilled water valve replacement is being carried out.

3.3.3 VENTILATION SYSTEM

The ventilation at Jeanne Mance is primarily delivered through the AHUs which take in outdoor air and mix it with return air then temperate it to meet a supply air temperature. There are seven AHUs that serve the tower from floors 2 – 21, there is a Basement VAV AHU that serve the basement level, and there are two units that serve the ground floor one unit serves the kitchen area while a multi-zone AHU serves the lobby, security and cafeteria seating areas.

Return air for the all the main air handling systems located in the penthouse is provided by two centrifugal fans manufactured by "Trane", one for the west side and one for the east. Return air for the ground floor is provided by two airfoil return air fans manufactured by "Trane" and located at the bottom of the east and west return air shafts - accessed from the basement. Currently only one fan is in use due to problems with the building pressure. The fan in the west shaft is equipped with a VSD. The return air unit for the basement air handling system is also located at the bottom of the east return air shaft and is manufactured by "Engineered Air" with a "Chicago Blower" fan.

3.3.3.1 AIR HANDLING UNITS

The building's main air handling systems located in the penthouse mechanical room are manufactured by "Trane" with the two air handling systems located in the basement mechanical room manufactured by "Engineered Air".

An original AHU manufactured by "Blanchard Ness" also located in the basement, serves the basement mechanical room. This original equipment has had numerous components replaced over the years and will continue to serve as a reliable source of ventilation for this building and its occupants until such time a complete rebuild or replacement of this equipment can be carried out.

Three high-pressure constant volume air handling units serve the perimeter induction units from the second lo 21st floors. The units are zoned to serve the North East, North West and South facades of the building. Each unit is equipped with a bag prefilter section, cartridge final filter, chilled water cooling coil, direct steam heating coil and supply fan. Originally, the units were equipped with direct steam pre-heat coils, which have been subsequently removed. In addition, the perimeter units original outdoor air intakes have been blanked off and relocated further away, above the intakes of the adjacent interior air handling units.

The interior zone ventilation is constant volume on the typical office floors with no floor by floor control of the supply air temperatures. The four electric reheat coils that were installed in the interior zone ductwork for each floor has been decommissioned.

Four constant volume, air handling units with electric reheat serve the building interior. Two units supply air to floors two to 11 and the other units supply the remaining upper floors. The units in turn serve either the east interior or west interior of each floor.

The AHUs are equipped with bag and cartridge filter sections, glycol hot water heating coil, humidification section, cooling coil and mixed air section. Each unit is served by a dedicated low-pressure steam converter, which produces glycol hot water used in the heating section. Humidification is provided by a DRISTEAM steam.

Fan coils are provided for the boardrooms on the 7th floor, storage rooms and server rooms on the 13th floor. floors.

North East Perimeter AHU is a constant volume high pressure system that serves the perimeter induction units on a portion of the north and the east side of floors 2-21. The unit supplies a total of 11,260 cfm through a belt driven Trane centrifugal fan with a 50 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The perimeter AHUs each have a direct steam heating coil, original to the unit. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney’s Pasture Central Plant.

North West Perimeter AHU is a constant volume high pressure system that serves the perimeter induction units on a portion of the north and the west side of floors 2-21. The unit supplies a total of 10,690 cfm through a belt driven Trane centrifugal fan with a 50 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The perimeter AHUs each have a direct steam heating coil, original to the unit. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney’s Pasture Central Plant.

South Perimeter AHU is a constant volume high pressure system that serves the perimeter induction units on the south side of floors 2-21. The unit supplies a total of 8,900 cfm through a belt driven Trane centrifugal fan with a 50 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The perimeter AHUs each have a direct steam heating coil, original to the unit. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney's Pasture Central Plant.

West Interior Lower AHU is a constant volume system that serves the interior spaces of floors 2-11 on the west side of the building. The unit supplies a total of 18,580 cfm through a belt driven Trane centrifugal fan with a 60 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The interior AHUs had the original direct steam heating coils replaced with glycol coils in 2002. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney's Pasture Central Plant.

West Interior Upper AHU is a constant volume system that serves the interior spaces of floors 12-21 on the west side of the building. The unit supplies a total of 15,210 cfm through a belt driven Trane centrifugal fan with a 60 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The interior AHUs had the original direct steam heating coils replaced with glycol coils in 2002. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney's Pasture Central Plant.

East Interior Lower AHU is a constant volume system that serves the interior spaces of floors 2-11 on the east side of the building. The unit supplies a total of 18,535 cfm through a belt driven Trane centrifugal fan with a 60 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The interior AHUs had the original direct steam heating coils replaced with glycol coils in 2002. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney's Pasture Central Plant.

East Interior Upper AHU is a constant volume system that serves the interior spaces of floors 12-21 on the east side of the building. The unit supplies a total of 17,264 cfm through a belt driven Trane centrifugal fan with a 60 HP high efficiency motor.

The tower has two general return fans that serve the east and west sides of floors 2-21, this general return is shared by all seven AHUs that serve floors 2-21.

The interior AHUs had the original direct steam heating coils replaced with glycol coils in 2002. The cooling coils in the both the interior and perimeter air handling equipment are original to each unit a supplied with chilled water from the Tunney's Pasture Central Plant.

Basement VAV AHU is an Engineered Air variable air volume air handling unit that serves the basement offices, and storage rooms. The unit provides a total of 7,680 cfm and is equipped with a 10 HP supply fan and a 3 HP return fan.

Ground Floor Multi-zone AHU is an Engineered Air multi-zone AHU that serves the 4 zones on ground floor - Lobby, Servery, and East and West cafeteria seating. The unit supplies a total of 20,200 cfm, and is equipped with a 25 HP supply fan and a 5 HP return fan.

Kitchen AHU The kitchen is ventilated with a Garland/KDH, Model FRU-16 Ecology unit containing multiple filter banks, the unit is equiped with glycol heating and chilled water cooling.

Table 3-3 provides a summary of each AHU characteristics, including motor capacity and operating hours. It should be noted that during the site visit it was mentioned that the current winter (2015) has been a particularly cold winter, and as such the schedules for the normal operation of the building have been changed to maintain temperature throughout the building. These changes include the operation of almost all AHU after building hours and over weekends.

Table 3-3 Characteristics of Air Handling Units

Characteristics of Air Handling Units								
ID	Area Served	Type	Supply Fan Motor (HP)	Return Fan Motor (HP)	Heating Coil (Y/N)	Cooling Coil (Y/N)	Hours of Operation	
							Week	Weekends
Basement VAV AHU	Basement	VAV	10	3	Y	Y	7AM-12AM	6AM-11:59PM
Ground Floor Multizone AHU	Ground Floor	CAVMZ	25	5	Y	Y	7AM-12AM	6AM-11:59PM
Kitchen AHU	Kitchen	CAV	10	NA	Y	Y	6AM-11:59PM	Off
Elevator	Elevator Room	CAV	3	NA	N	Y	24 Hours	24 Hours
	Low Rise Elevator	CAV	3	NA	N	Y	24 Hours	24 Hours
East	Return Fan	CAV	NA	50	N	N	6AM-11:59PM	6AM-11:59PM
West	Return Fan	VAV	NA	50	N	N	6AM-11:59PM	6AM-11:59PM
East Interior Upper AHU	East Interior Upper	CAV	60	NA	Y	Y	6AM-11:59PM	6AM-11:59PM
East Interior Lower AHU	East Interior Lower	CAV	60	NA	Y	Y	6AM-11:59PM	6AM-11:59PM
West Interior Upper AHU	West Interior Upper	CAV	60	NA	Y	Y	6AM-11:59PM	6AM-11:59PM
West Interior Lower AHU	West Interior Lower	CAV	60	NA	Y	Y	6AM-11:59PM	6AM-11:59PM
North/East Perimeter AHU	North/East Perimeter	CAV	50	NA	Y	Y	6:35-11:59PM	6AM-11:59PM
North/West Perimeter AHU	North/West Perimeter	CAV	50	NA	Y	Y	6:15-11:59PM	6AM-11:59PM
South Perimeter AHU	South Perimeter	CAV	50	NA	Y	Y	6:15-11:59PM	6AM-11:59PM

3.3.3.2 EXHAUST FANS

The majority of the exhaust air fans serving this building are located in the mechanical penthouse. Exhaust systems are provided for the east and west washrooms - manufacturer "Trane", photocopy room exhaust - manufacturer "Trane", electrical closets exhaust - manufacturer "Delhi" and smoke exhaust – manufacturer "Northern Blower". The transformer room axial exhaust fan is located at the bottom of the east return air shaft off the basement. The east and west general exhaust fans are located in the basement; the east general exhaust fan is decommissioned.
There are numerous exhaust fans throughout the building, below is a table summarizing the fan characteristics.

Table 3-4 Characteristics of Major Exhaust Fans

	Characteristics of Major Exhaust Fans						
ID	Area Served	Type	Design Volume (cfm)	Total kilowatt (kW)	Fan Motor Size (HP)	Hours of Operation	
						Week	Week End
1	East Washrooms	CAV	3,655	3.7	5	6AM-11:59PM	12AM-11:59PM
2	West Washrooms	CAV	4 970	3.7	5	6AM-11:59PM	12AM-11:59PM
3	Copy Rooms	CAV	6 940	5.6	7.5	6AM-11:59PM	12AM-11:59PM
4	Electrical Closets	CAV	1,100	1.5	2	6AM-11:59PM	12AM-11:59PM
5	East General Exhaust (decommissioned)	NA	NA	NA	NA	NA	NA
6	West General Exhaust	CAV	17,750	22.4	30	7AM-12AM	6AM-12AM
7	Dishwasher Exhaust	CAV	NA	NA	NA	NA	NA
8	Transformer Vault	CAV	NA	NA	3	12AM-11:59PM	12AM-11:59PM

3.3.4 HUMIDIFICATION

Humidification is provided for the four interior air handling systems located in the penthouse by dedicated steam to steam units manufactured by "Dristeem", installed in 1996. In addition, a humidification system manufactured by "Chemline" located in the basement mechanical room is provided to serve the ground floor air handling system. This system is not currently in use as it creates condensation, frosting on the glazing of that floor. All humidification systems are provided with a domestic water connection equipped with water softening equipment.

3.3.5 DOMESTIC HOT WATER SYSTEM AND PLUMBING

The domestic hot water heating system that serves this facility consists of two instantaneous steam to hot water heaters manufactured by "Flo-Rite Temp. These heaters were installed in 2001 and are in good condition. The domestic hot water recirculation pumps were replaced in 2007. Domestic cold water is supplied to the building via a triplex "Armstrong" booster pump system installed in 2001. The motors for these pumps were rebuilt in 2008.

Majority of the plumbing fixtures were installed as part of the original construction in 1970 with new barrier-free lavatories and waterclosets added for each washroom on all floors as part of the 1998 fit-up. Flush valves serving the waterclosets and urinals have been replaced at some point with electronic valves provided at the urinals.

The two "Gorman-Rupp" sump pumps located at the bottom of the west return air shaft off the basement were replaced in 1990, 2002 and are in fair to good condition. An elevator sump pump is also located in the west shaft.

3.3.5.1 PLUMBING FIXTURES

The building domestic hot water (DHW) needs are met via a steam converter that provides instantaneous hot water. DHW is distributed throughout the building by two circulating pumps. One pump serves the upper floors while the other serves lower floors. There are a total of 330 bathroom fixtures in the building including 125 water closets, l65 lavatories, and 40 urinals.

Lavatories, urinals, water closets, kitchen sinks and janitor sinks are provided in this facility. The water closets in the building are low flow 6 litres per flush (lpf) and the urinals are low flow at 3.8 lpf. The urinals and lavatories are equipped with electronic sensors to minimize run times and to ensure proper flushing. The water closets are equipped with a mixture of standard lever handles, and Infrared sensors on the flush valves.

Table 3-5 Summary of Plumbing Fixtures

Summary of Plumbing Fixtures					
Fixture				Observations	Flow Rate
Type	Mounting (wall, floor)	Supply (tank, valve, faucet, infrared)	Quantity		
Toilet	Wall	IR/Valve	125	Conventional Flow	6 Lpf
Urinal	Wall	Infrared	40	Conventional Flow	3.8 Lpf
Lavatory	Countertop	IR/Faucet	165	High flow Flow	8.5 Lpm
Drinking Fountain	Wall	NA	42	NA	NA
Janitor Slop Sinks	Floor	Faucet	21	NA	NA
Kitchen Sink	Countertop	Faucet	27	NA	NA
Shower	Wall	Faucet	6	Conventional Flow	9.5 Lpm

3.3.6 MAJOR CIRCULATION PUMPS

The following table summarizes the Characteristics of Major Circulating Pumps

Table 3-6 Characteristics of Major Circulating Pumps

Characteristics of Major Circulating Pumps				
	Qty	**Area Served**	**Total Kiowatts (kW)**	**Motor Size (HP)**
Secondary Water Pumps (Induction Units)	2	Induction Units	22.38	30
Heating Circulating Pumps	2	Ground Floor Radiators	0.746	1
	2	Basement/Multi-zone AHUs	3.73	5
	2	Kitchen MAU	2.238	3
	2	Loading Dock Unit Heaters	0.746	1
Domestic Hot Water	1	B - 12	22.38	30
	1	13 - 21	22.38	30
Condensate Pumps	2	Building	7.46	10
Sump Pump	1	Elevator Pit	NA	NA
	1	Building	5.595	7.5

3.4 ELECTRICAL SYSTEM

3.4.1 POWER DISTRIBUTION

Power is provided by the Tunney's Pasture substation via a 13.4 kV service to the main switchgear located in the basement. The single line diagram shows two separate incoming services. One service feeds a 347V 1,000 kVA transformer which then provides 600V/347V power (line-line and line to neutral) to HVAC equipment in the basement and penthouse and 347V power to lighting panels on the floors. The other service feeds a 12OV 500 kVA transformer that provides 12W2A8V power throughout the building. Each service has a separate digital demand meter.

The Jeanne Mance main secondary switchgear consists of a 600V switchboard and a 208V switchboard in the main electrical room, each supplied by the transformers in the adjacent vault through 4000A, 3-phase, 4-wire, FPE low impedance bus duct.

The 600V two-cell switchboard is free-standing, totally enclosed, manufactured by FPE and rated for 4000A. The switchboard contains one insulated case circuit breaker, and four drawout air circuit breakers, including the main circuit breaker, as well as three feeders with current-limiting fuses.

The main 208V switchboard is in the basement electrical room, immediately adjacent to the main 600V switchboard. It is totally enclosed, free-standing 4000A, 208(120)V, 3 phase, 4 wire switchboard, manufactured by

FPE. The switchboard contains two cells, the first containing a metering compartment, the main air circuit breaker, and a feeder air circuit breaker, and the second containing a distribution panel with 9 fused disconnect switches.

3.4.2 LIGHTING SYSTEM

The majority of lighting throughout the facilities is 347V fluorescent lighting supplemented with compact fluorescent lamps (CFLs). The PL13 recessed CFLs used in the elevator lobbies are reportedly 347V, Exceptions to the above include the lighting on the first floor entrance and the two cafeterias, which consists of 175 W Metal Halide lamps, the 120V fluorescent lighting in the basement and approximately nineteen (19) 2-lamp, and several T12 strip luminaires in a mechanical room and 15th floor elevator machine rooms.

The lighting riser for the building is FPE 2000A, 600(347)V, 3 phase, 4 wire low impedance bus duct, originating from the basement electrical room, terminating in the electrical room on the 21st floor. There is a Federal Pacific type CDP 600(347)V, 100A or 400A, 3 phase 4 wire panelboard supplied by a 100A fused disconnect switch, tapped off the lighting riser in each electrical room on floors 2 through 21, to supply the lighting at 347V on the individual floors. There are two additional lighting panels, one designated "BL-1" located in the basement records room, tapped off the lighting riser at the ground floor, and the second "1EM", an emergency lighting panel located in the 2nd floor electrical room, supplied by distribution panel "DP-X2", located in the basement electrical room. The 13th floor has an additional 600(347)V panelboard, designated "13F" (room C1375), fed from panel "13L".

During the audit lighting levels were measured to determine if appropriate

Table 3-7 - Summary of Illuminance

Lighting Summary	
Area	**LUX Level**
Interior Meeting Room	250 -400
East Perimeter Offices	320-440
South Perimeter Offices	400-450
North Perimeter Offices	300-750
West Perimeter Offices	550-1350
Interior Hallway	270

3.4.2.1 INTERIOR LIGHTING

The fluorescent lighting on the second to the 21 st floor consists of 1 x 4 recessed fixtures with one F32TB lamp per fixture powered by an electronic ballast. The ballasts were installed between 1996 and 1997 and reported to be Ultrasave ballasts with an input current of 0.19 Amps and a stamped power factor of 0.98. Each ballast serves two fixtures and displays an input power of 64 Watts.

Each men's/women's washroom has strips in cove 2 x 1200 mm, 2 x T8 lamps; 600 x 1200 mm recessed 2 x T8 lamps, controlled by occupancy sensor; and one 300 x 1200 mm, 1 x T8 lamps recessed in vestibule.

The stairs have 1200 mm surface-mounted fluorescent wall units with one - T8 347-V lamp, one per landing.

The main lobby lighting is ceiling surface mounted square (approx. 400 mm) fixtures with prismatic lens and use 400 W high-intensity discharge lamps (metal halide).

The main floor elevator lobby has fluorescent T8 strips in a valance/cove around the entire perimeter. There is one recessed incandescent fixture at each elevator door.

Typical elevator lobby has wall-mounted direct/indirect fluorescent 347 V - 1 x T8 lamps and recessed fluorescent downlights with 347-V PL lamps.

Basement elevator lobby has 300 x 1200 mm, recessed fluorescent, 2 x T8 lamps.

Ground floor cafeteria seating area has suspended hemispherical (450 mm) with remote-ballasted metal halide lamps.

Servery has recessed fluorescent fixtures with two 32 W T8 lamps.

Basement records area has surface-mounted 300 x 1200 mm fluorescent fixtures complete with hinged frame acrylic lens, 1 x T8 fluorescent lamp, 347 Volts.

Basement washroom/showers have fluorescent vapour-proof 300 x 1200 mm, 2 x T8, 120 Volt; 1200 mm strip fixtures in cove, 1 x T8 lamps, 120 Volts; recessed shower light 120 V; recessed 2' x 4' fluorescent, 2 x T8 lamps, 120 V.

Basement corridors have 300 x 1200 mm recessed fluorescent fixtures, 2 x T8 lamps.

Basement storage and utility areas have recessed 600 x 1200 mm fluorescent fixtures.

Penthouse and basement equipment areas have suspended two lamp, 1200 mm industrial fixtures and re-used commercial surface units with lens removed. Lamps remain as 2 x T8 per fixture.

Occupancy sensors were added in 2007 to the washrooms from the second floor up, to control the lighting.

3.4.2.2 EXTERIOR LIGHTING

Exterior lighting consists of square-shaped surface-mounted high-intensity discharge type fixtures with glass lens mounted on the underside of the soffit at the front expanse (south side). In addition, there are wall-mounted matching units in the columns. There are seven (7) wall packs located at the loading dock - north side.

There are also recessed downlights in the soffit over the east and west side exit from the ground floor cafeteria.

The exterior pole-mounted fixtures surrounding the building serve as general exterior lighting for the Tunney's Pasture and do not belong to the Jeanne Mance facility, with the exception of two pole-mounted fixtures in the parking area behind the building.

3.4.2.3 EXIT SIGN LIGHTING

The exit signs throughout the building are the green running man type with no illumination.

The following Table provides a summary of the lighting system:

Table 3-8 Lighting Summary

Lighting Summary					
Area	Lighting Fixture	Lamp (W)	Fixture Count	Existing System (Hours/Day)	
				Mon-Fri	Sat-Sun
Basement	4′ F32T8	32	340	12	12
	2* CFL	17	14	12	12
	4' F40T12	40	10	12	12
Ground Floor	4′ F32T8	32	135	12	5
	CFL	18	8	12	-
	Metal Halide	175	37	12	5
	Metal Halide	400	24	12	5
2nd Floor	4′ F32T8	32	529	12	12
	CFL	17	14	12	12
3rd Floor	4′ F32T8	32	529	12	-
	CFL	17	14	12	-
4th Floor	4′ F32T8	32	529	12	11
	CFL	17	14	12	11
5th Floor	4′ F32T8	32	529	18	8
	CFL	17	14	18	8
6th Floor	4′ F32T8	32	529	12	-
	CFL	17	14	12	-
7th Floor	4′ F32T8	32	529	12	-
	CFL	17	14	12	-
8th Floor	4′ F32T8	32	529	12	-
	CFL	17	14	12	-
9th Floor	4′ F32T8	32	529	12	-
	CFL	17	14	12	-
10th Floor	4′ F32T8	32	529	12	8
	CFL	17	14	12	8
11th Floor	4′ F32T8	32	529	12	-
	CFL	17	14	12	7
12th Floor	4′ F32T8	32	529	12	-

	CFL	17	14	12	-
13th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
14th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
15th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
16th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
17th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
18th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
19th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
20th Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
21st Floor	4' F32T8	32	529	12	-
	CFL	17	14	12	-
Penthouse	4' F32T8	32	102	1	-
Exterior	400 W MH	400	12	12	12

3.5 BUILDING AUTOMATION SYSTEM

The control system in this facility includes a full building automation system, the interface is was developed by Andover. An operator workstation in the Penthouse and in the Building Operations office in the basement allow monitoring, control and scheduling of almost all devices on all floors. The software is up to date and a service contract is in place on this system with Airtron (formerly Direct Energy).

Control air for the pneumatic controls system is provided by two DeVilbiss air compressors, 7.5 HP complete with a receiver and two refrigerated dryers.

The pneumatic control points include thermostats and valves on induction units, VAV boxes, damper operators at the air handling units, and secondary water temperature control valves.

Some control point have been upgraded to DDC electric valves which include, steam to glycol heat exchangers for heating coils in 4 interior zone air handling units, steam to steam heat exchanger humidifiers for the four interior zone air handling units, chilled water valves on the air handling units, valves and dampers on the two air handling units serving the basement and the ground floor, steam to glycol heat exchanger for glycol heating system serving the unit heaters in loading docks.

Four DDC temperature sensors on each typical office floor monitor the space temperatures.

4 ENERGY USE ANALYSIS

The following sections detail the energy and water analysis that was performed for the facility, and includes a utility analysis, a comparison to a benchmark, and a breakdown of energy consumed by fuel type and major end-use.

4.1 UTILITY USAGE ANALYSIS

This section presents an analysis of all utilities in use at the facility, covering the period from 2009 to 2014. Data provided by PWGSC including electricity consumption (kWh), steam (GJ) and domestic water use (m³), together with their respective costs were used to derive six years of historical energy. Tables containing the six years of data and the calculated electrical and natural gas energy and water intensities are presented in **Appendix A**.

Based on the provided data, an average year was generated as a representative year of the overall energy/water consumption at the facility. A summary of the utility usage is presented in Table 4-32.

The electricity consumption is billed under the Large Consumer (LU) rate for customers whose minimum billing demand is 5,000 kW and over. Under this rate, as of January 2015, demand is charged at $8.64/kW. Energy (kWh) is charged at the wholesale market rate which is 8.8¢/kWh for the first 1,000 kWh and 10.3¢/kWh above 1,000 kWh. Hydro Ottawa also adds on Regulatory and Debt Retirement charges totaling 1.26¢/kWh. The rate also imposes a fixed charge of $15,231.32/month. The rate structure is summarized in Table 4-1 below

Table 4-1 Summary of Charges for Rate LU

Summary of Charges for Rate LU			
Service	**Description**		**Charge**
Rate LU Large Consumer	Demand	Transmission Network	$3.3462/kW
		Transmission Connection	$1.9535/kW
		Delivery	$3.3129/kW
		Low Voltage Services	$0.02833/kW
	Energy	First 1,000 kWh	8.8¢/kWh
		Above 1,000 kWh	10.3¢/kWh
		Regulatory	$0.0057/kWh
		Debt Retirement	$0.00694/kWh
		Fixed Charge	$15,231.32/month
Information from Hydro Ottawa website, January 27 2015			

4.2 TYPICAL YEAR ENERGY USE AND COMPARISON TO BENCHMARK DATA

A typical year energy use for the facility was derived using data from 2009 to 2014. Table 4-2 provides a tabular summary of the typical year energy use. Annual energy consumption and cost for each fuel type for a typical year is as follows.

Table 4-2 Typical Year Energy Consumption by Source

Source Type	ekWh	Cost ($)
Electricity	5,141,635	542,920
Steam	2,187,610	195,363
Chilled Water	2,392,941	231,151
Water & Sewer (m^3)	22,959 (m^3)	73,951
	Total Cost ($)	**$ 1,043,384**

From energy consumption by fuel type, electricity used for HVAC equipment (fans and pumps), lighting, and office equipment accounts for approximately 53% of the total consumption. Steam for space heating and domestic hot water accounts for 22% and chilled water for cooling accounts for the remaining 25%.

As shown at the bottom of 4-3, the Building Energy Performance Index (BEPI) is 253 ekWh/m².yr (910 MJ/m².yr) based on a total building gross floor area of 38,430 m² (413,657ft²).1 The BEPI is 29% lower than the comparable benchmark of 356 ekWh/m².yr (1,282 MJ/m².yr).2

The electrical energy intensity is 134 kWh/m².yr (482 MJ/m².yr). This value is 17% lower than the comparable benchmark. This may be due to the various energy conscious upgrades over the years including improved BAS controls and scheduling as well as the replacement of T12 to T8 lamps in the mechanical rooms.

The steam energy intensity is 57 ekWh/m².yr (205 MJ/m².yr). This value is 45% lower than the comparable benchmark accounting for the plant efficiency. As per the utility data, the nil consumption of steam during the summer months suggests electric domestic water heating during summer. However, it was confirmed during the site visit that steam is used for domestic hot water all year which suggests that the steam meter require calibration for the lower limits of steam consumption.

The chilled water energy intensity is 62 ekWh/m².yr (223 MJ/m².yr). This value is 32% lower than the comparable benchmark. The cooling intensity of Jean Mance if served by a centrifugal chiller with a COP of 4.5 would be equal to 14 kWh/m².yr (62/4.5), whereas a typical office building would have a cooling intensity in the range of ~20 kWh/m².yr, which is calculated as shown below.

$$\left[\frac{0.75kW}{ton}\right]\left[\frac{ton}{400ft^2}\right]1000FLH = 1.9\,\frac{\mathrm{kWh}}{\mathrm{ft}^2}.\mathrm{yr} = 20\mathrm{kWh/m^2}.\mathrm{yr}$$

The lower chilled water energy intensity can be attributed to the operation of the induction units and the HVAC controls system,

Finally, domestic water use is also shown in Table 4-2. The water consumption index of 0.60 m³/m².yr is lower than the typical BOMA office building value and the Public Works and Government Services (PWGSC) office standard.

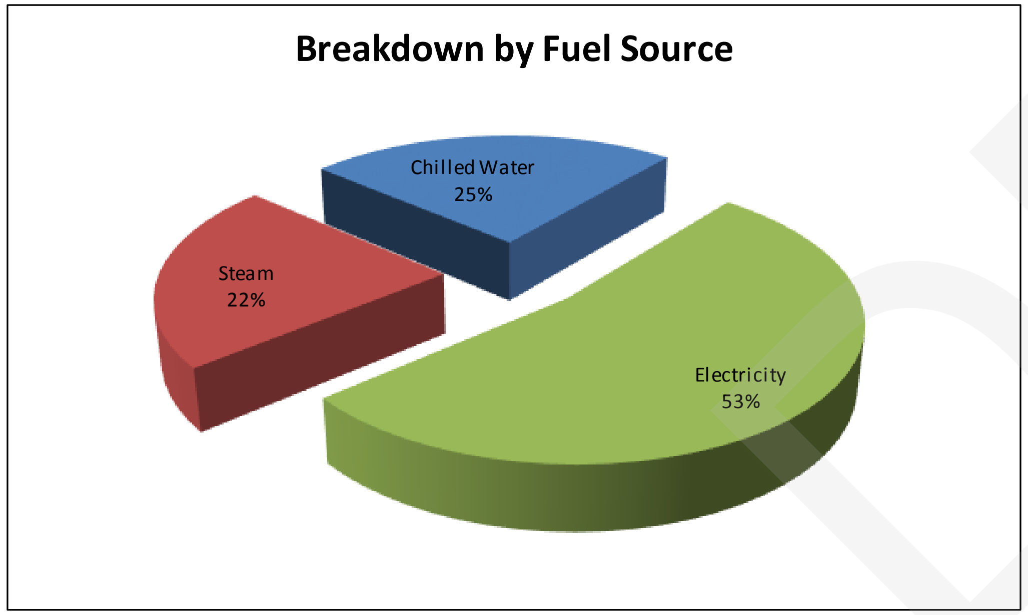
[1] Gross floor area as reported in Jeanne Mance Functionality & Serviceability Assessment 2015 (WSP).
[2] BEPI benchmarks extracted from the Commercial Building Energy Consumption Survey (CBECS) as well as the Building Owners and Managers Association (BOMA) Ottawa summary.

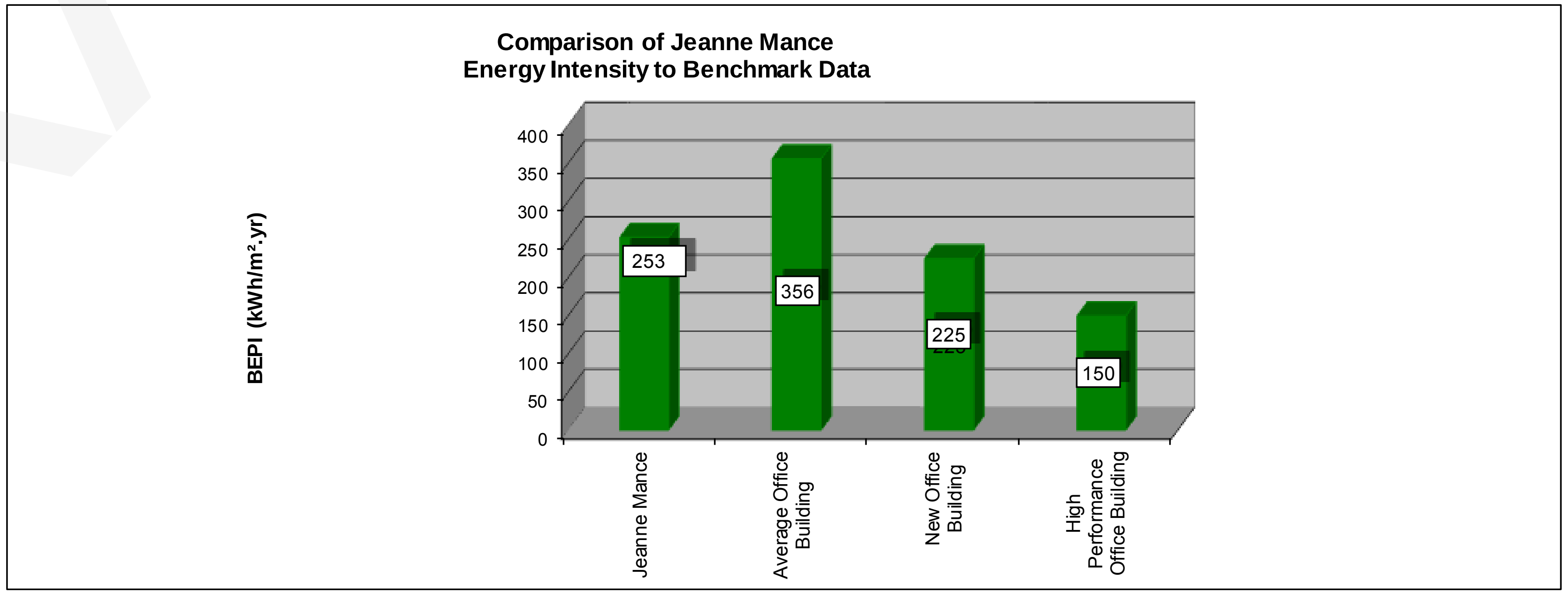
Table 4-3 Typical Energy Use

Typical Year Energy Use and Energy Intensities

Typical Year	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m^3)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr	382,317			40,159	9.9	1.04	186	51,725	4,928	1.3	0.13	426	118,194	11,507	3.1	0.30	1,946	6,406	552,236	14	$62,999	336	4.4
May	433,147			45,833	11.3	1.19	1,015	281,919	27,352	7.3	0.71	57	15,852	1,461	0.4	0.04	2,291	7,525	730,919	19	$82,171	141.6	36
Jun	411,815			43,300	10.7	1.13	1,525	423,710	40,713	11.0	1.06	4	1,157	101	0.0	0.00	2,142	7,073	836,683	22	$91,188	55.8	66.4
Jul	437,776			46,593	11.4	1.21	1,956	543,359	52,535	14.1	1.37	0	0	0	0.0	0.00	2,185	7,276	981,135	26	$106,404	18.6	133.2
Aug	440,273			46,627	11.5	1.21	1,817	504,794	48,508	13.1	1.26	0	0	0	0.0	0.00	1,657	5,436	945,067	25	$100,571	28.2	93.8
Sep	425,591			45,046	11.1	1.17	1,114	309,392	29,715	8.1	0.77	0	0	0	0.0	0.00	1,927	6,456	734,983	19	$81,217	114.4	31
Oct	416,760			44,162	10.8	1.15	469	130,253	12,716	3.4	0.33	109	30,322	2,828	0.8	0.07	1,741	5,830	577,336	15	$65,536	292.2	3.2
Nov	410,060			43,588	10.7	1.13	207	57,404	5,520	1.5	0.14	791	219,771	20,931	5.7	0.54	1,807	5,995	687,235	18	$76,033	474.2	0
Dec	453,973			48,233	11.8	1.26	110	30,607	3,028	0.8	0.08	1,642	456,245	43,285	11.9	1.13	1,448	4,735	940,826	24	$99,282	737	0
Jan	449,086			47,581	11.7	1.24	78	21,784	2,230	0.6	0.06	2,029	563,613	53,484	14.7	1.39	1,653	4,453	1,034,482	27	$107,748	843	0
Feb	432,059			45,072	11.2	1.17	50	13,893	1,463	0.4	0.04	1,638	455,110	35,914	11.8	0.93	1,439	4,603	901,062	23	$87,052	702.8	0
Mar	448,779			46,723	11.7	1.22	87	24,099	2,444	0.6	0.06	1,178	327,345	25,853	8.5	0.67	2,725	8,165	800,224	21	$83,185	582.6	1.6
Total	**5,141,635**			**$542,920**	**133.8**	**14.13**	**8,615**	**2,392,941**	**$231,151**	**62.3**	**$6.01**	**7,875**	**2,187,610**	**$195,363**	**56.9**	**$5.08**	**22,959**	**$73,950.75**	**9,722,187**	**253**	**$1,043,384**	4,326	369.6

	Jeanne-Mance Building	Benchmark Data
Electrical Energy Intensity (kWh/m².yr)	134	161
Chilled Water Energy Intensity (kWh/m².yr)	62	92
Steam Energy Intensity (kWh/m².yr)	57	103
BEPI (kWh/m².yr)	253	356
Peak Demand Intensity (W/m²)	0	50 to 55
Water Consumption Index (m³/m².yr)	0.60	1.1 to 1.75





4.3 HISTORICAL ENERGY USE ANALYSIS

Table 4-4 provides a historical energy use of the facility based on five most recent years of available data. Electrical consumption averaged 5.1 million kWh for the period of 2009-2014. However, the overall trend shows a decrease in electricity consumption from a high of 6.4 million kWh in 2009/2010 to 4.7 million kWh in 2014/2015. This is likely due to the improve control strategies and lighting upgrades.

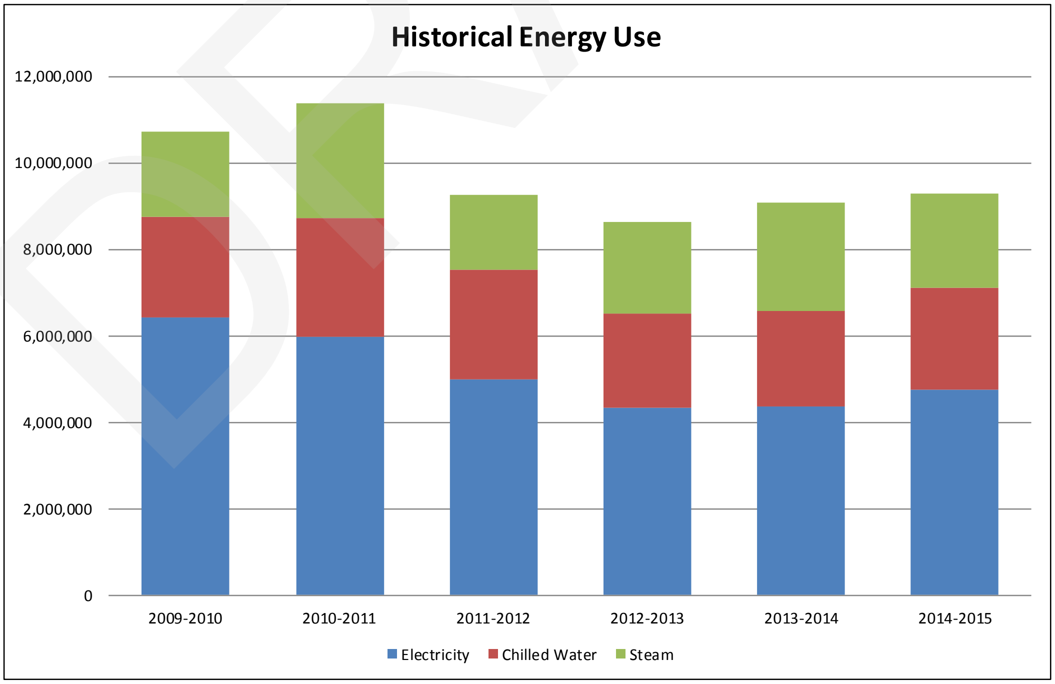
Steam consumption averaged 7,800 GJ (2.1 million ekWh/year) and has remained constant over the analysis period. It is also important to point out that the summer consumption appears as zero even though steam is used for domestic hot water. This is believed to be due to the steam meter limited flow range which cannot provide reliable readings at the low end.

Chilled water averaged 8,615 GJ (2.3 million eKWh) between 2009 – 2014. It is worth noting that the building uses chilled water year round in air handling units that do not have free cooling capability. The units requiring cooling capacity include units serving the data centres on the 12th and 13th floors and other units serving elevators on the 14th and 15th floors.

Table 4-4 Historical Energy Usage

DND Historical Energy Use (ekWh/year)

	Electricity Consumption (kWh)	Chilled Water Consumption (ekWh)	Steam Consumption (ekWh)	Total (ekWh)
2009-2010	6,436,756	2,324,873	1,955,026	10,716,655
2010-2011	5,970,178	2,757,564	2,635,940	11,363,681
2011-2012	5,004,508	2,535,819	1,728,339	9,268,666
2012-2013	4,326,969	2,178,316	2,119,214	8,624,500
2013-2014	4,361,480	2,203,852	2,518,911	9,084,243
2014-2015	4,749,921	2,357,221	2,168,233	9,275,376



4.4 ENERGY END USE ANALYSIS

The total annual energy consumption of the facility was analyzed and broken down into major end-use categories. These categories included in this analysis include:

- **Space Cooling** – This includes all energy consumed by the cooling equipment. Chilled water is provided to the cooling equipment from a central cooling plant.
- **Space Heating** – This includes all energy consumed by the heating equipment. Steam is generated at the central heating plant.
- **Domestic Hot Water** – All domestic hot water used in building.
- **Fans** – All supply, return and exhaust fans serving the facility.
- **Pumps** – All heating, cooling and domestic water pumps.
- **Plug Load** – This includes all energy consumed by all plugged in equipment such as computers and telephones as well as any miscellaneous process equipment that may be installed.
- **Lighting** – All interior and exterior lighting.

The following table summarizes that annual energy breakdown by major end-use in absolute energy consumption, as a percentage of the total energy consumed, and as an absolute cost.

Table 4-5 Annual Energy Consumption by Major End-Use

Energy Type	Total (KWh)	Total (%)	Total ($)
Space Cooling (Chilled water)	2,392,941	25%	$231,151
Space Heating (Steam)	2,187,610	23%	$195,363
Domestic Hot Water (Steam)			
Fans	1,701,315	17%	$179,647
Pumps	336,845	3%	$35,568
Lighting	1,572,949	16%	$166,092
Plug Load	1,090,613	11%	$115,161
Electric Unit Heaters	48,000	0%	$5,068
Miscellaneous	391,913	4%	$41,383
TOTAL	**9,722,187**	**100%**	**$969,434**

4.4.1 ELECTRICAL ENERGY CONSUMPTION BY MAJOR END USE

An estimation of the electricity consumption by major end-use has been made based on the listing of identified equipment on site, the estimated run hours, and any diversity in that use that can be foreseen. The following table summarizes that annual electricity consumption by major end-use in total consumption, as a percentage of the total energy consumed, and as an absolute cost.

Table 4-6 Annual Electricity Consumption Breakdown by Major End-Use

Energy Type	Total (kWh)	Total (%)	Total ($)
Fans	1,701,315	33%	$179,647
Pumps	336,845	7%	$35,568
Lighting	1,572,949	31%	$166,092
Plug Load	1,090,613	21%	$115,161
Electric Unit Heaters	48,000	1%	$5,068
Miscellaneous	391,913	8%	$41,383
TOTAL	**5,141,635**	**100%**	**$542,920**

5 RECOMMENDATIONS FOR ENERGY MANAGEMENT

This section provides an overview of the energy conservation measures (ECMs) analyzed in this report. A series of ECMs were reviewed. For each measure, estimates of the annual savings in each of the following were determined:

- Steam,
- Chilled Water; and,
- Electricity.

For all measures, estimate calculations were used to determine the amount of savings. The maintenance cost premiums are estimates with operator feedback.

5.1 ENERGY SAVINGS STRATEGIES/CONSERVATION MEASURES

In order to achieve energy consumption reduction in the facility a holistic approach for the implementation of the ECMs must be adopted. The implementation strategy should ensure that the measures are carefully prioritized to enable short payback measures to subsidize the longer payback measures. The ECMs in this report can be categorized into the following categories:

- **Behavioral & Communication** which includes increasing awareness, education and training of the building operators, staff, and visitors.
- **Technological Changes** which involves the implementation of measures related to the building systems such as envelope, lighting, heating, ventilation and domestic hot water.

5.2 BEHAVIORAL & COMMUNICATION ECMS

5.2.1 STAFF TRAINING AND OCCUPANT AWARENESS

Equipment operation practices and policies can have a significant impact upon energy consumption. There is generally ample opportunity for energy savings from office equipment as equipment is frequently left ON when not in use. For example, studies in office environments indicate that the average computer is used only 4.5 hrs over the course of a workday and 57 percent of computer workstations are left running 24 hrs daily. An energy efficiency awareness program should be put in place to encourage staff to turn OFF computers, printers, copiers, televisions, and other equipment when not in use during the day, at the end of the day, and for the weekend.

5.2.2 PROCUREMENT POLICY

Purchasing efficient products reduces energy costs without compromising quality. It is strongly recommended that a procurement policy be implemented as a key element for the overall energy management strategy. An effective policy would direct procurement decisions to select EnergyStar® qualified equipment, in contracts or purchase orders. For products not covered under EnergyStar®, the labeling should be reviewed to select products with upper level performance in their category. Improved energy performance will involve the investment in energy efficient equipment coupled with a user education and awareness program.

5.3 TECHNOLOGICAL CHANGES (ENVELOPE ECMS)

5.3.1 HIGH PERFORMANCE GLAZING REPLACEMENT

The windows on Jeane Mance are past there serviceable life and should be replaced with high performance insulated glass units with higher U-value and an optimised Solar heat gain coefficient. There a total of 2,080 punched windows serving floors two to 21. The age of these units and the general condition suggest a thermal performance of RSI 0.3.

This ECM is a large capital measure which will compare the replacement of the old window with new minimum efficiency window units, to the replacement of the old window with high performance glazing units. Being a capital measure, only the incremental cost associated with the high performance window system over the minimum efficiency system will be considered, and not the total cost of replacing all of the windows.

Measure	Steam Savings (ekWh)	Chilled water Savings (ekWh)	Cost Savings ($)	Incremental Cost ($)	Payback (years)
High Performance Glazing Replacement					

5.3.2 WEATHER STRIPPING MAINTAINANCE

As noted in the building description the main doors and the cafeteria emergency exit doors have issues with infiltration due to poor weather stripping and seals. Infiltration and exfiltration burden the HVAC system with additional heating and cooling loads in the winter and summer respectively. Regular replacement of damage weather stripping and door seals will save energy hand has little to no payback.

5.4 TECHNOLOGICAL CHANGES (HVAC SYSTEM ECMS)

The HVAC ECMs are fully described in this section. Calculations concerning energy savings, capital cost, and payback time will be completed and included in the final submission.

5.4.1 EXHAUST AIR HEAT RECOVERY

There is potential for exhaust air heat recovery for the general exhaust fans and air handling units. Installation of a glycol runaround loop to reclaim energy from the general exhaust air streams and use it to preheat incoming outdoor air at the main AHUs. Typically, run around loops can recuperate 30 -40% of the normally exhausted energy.

Measure	Steam Savings (ekWh)	Chilled water Savings (ekWh)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Heat Recovery on General Exhaust					

5.4.2 DEMAND CONTROL VENTILATION

Both the interior and perimeter AHUs use a constant volume of outdoor air. The amount of outdoor air was determined during the design and set to provide adequate outdoor air to the building occupants. A demand control ventilation strategy would vary the amount of outdoor air to the AHU depending on the measured CO2 levels on each floor.

This measure would require the installation of CO2 sensors on every floors. These sensors would be used to control the OA damper in each air hadling unit. The current Andover control BAS would require some new programming by the Airtron (Controls Vendor) to map each sensor and control the OA dampers.

Further investigation is required to determine actual system capacities for the two make-up air units, all associated exhaust fans, confirm sequences of operation, and occupancy levels in each zone of the building.

Measure	Steam Savings (ekWh)	Chilled water Savings (ekWh)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Demand Control Ventilation					

5.4.3 VARIABLE FLOW DRIVE FOR INTERIOR AIR HANDLING UNITS

Install a variable speed drive on each interior air handling units. Presently, the four interior AHUs start at 6:00 a.m. at 100% flow rate and remain at full capacity until shutdown at 11:59 p.m. The VSD shall enable the Make-up Air units to operate at a lower capacity during times when the building is not fully occupied or when the interior spaces have met the room temperature setpoint.

This measure would require the installation of interior zone VAV boxes to help maintain comfort in the interior office spaces. Further controls could then be implemented to run the interior VAV system using static pressure reset to optimise the VAV energy savings

Measure	Steam Savings (ekWh)	Chilled water Savings (ekWh)	Cost Savings ($)	Capital Cost ($)	Payback (years)
VFD for Interior Air Handling Units					

5.4.4 IMPLEMENT A TEMPERATURE SETBACK SCHEDULE

During the heating season the room temperature setpoints are set to 22°C with no setback temperature during unoccupied hours. This measure proposes implementing a temperature setback strategy in the building so that the temperature drops to 18°C during unoccupied hours and raises back up to 22°C for the beginning of occupancy.

Temperature setback can save energy. By changing the set-point of a building there are reductions in the building envelope losses and in the ventilation load during unoccupied periods. Typical heating savings are in the range of 0.3% for every 1°F the space temperature is reduced. By reducing the temperature during the unoccupied times by 4°C (7°F) can lead to a 2.1% savings of steam.

Measure	Steam Savings (ekWh)	Chilled water Savings (ekWh)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Implement Temperature Setback Schedule					

5.5 TECHNOLOGICAL CHANGES (PLUMBING SYSTEM ECMS)

5.5.1 REPLACE URINAL AUTOMATIC FLUSHOMETERS WITH LOW FLOW

There are currently 40 urinals in the building, only some are equipped with automatic flush valves, but both the manual flush and the automatic flush urinal have a flow rate of 3.8 l/flush. Consider replacing the flush valves on all urinals with 1.9 l/flush. Water savings will be realized due to the lower volume of water used for each flush. This measure can be easily implemented by replacing the existing flush valves with new low flow automatic flush valves. The existing fixtures would remain unchanged.

The water savings were calculated assuming 900 male occupants each flushing urinals twice per day for a total of 1,800 flushes per day.

$$Water\ Savings = \left[\frac{1{,}800\ flush}{day}\right]\left[\frac{(3.8-1.9)\,litre}{flush}\right]\left[\frac{5\,day}{week}\right]\left[\frac{52\,week}{year}\right]\left[\frac{m^3}{1{,}000\,litre}\right]$$
$$= 889 m^3 / year$$

The cost savings based on a domestic water cost of $3.27/m³ are $2,907/year.

Implementation cost is $50 for removal of old flush valves and $450 for new valves per urinal for a total of $18,200.

Measure	Water Savings (m^3/year)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Replace Urinal with Low Flow	889	2,907	18,200	6.3

5.5.2 REPLACE THE EXISTING LAVATORY AERATORS WITH NEW WATER SAVING ONES

There are currently 165 lavatories in the building, each h a flow rate of 8.5 L/min. Consider installing a low flow aerator allowing 1.9 L/min. This measure can be easily implemented by replacing the existing aerators with new ultra low flow aerators.

The water savings were calculated with 1,800 occupants each using a lavatory faucet for 15 seconds per use, three times per day.

$$Water\ Savings = \left[\frac{1{,}800\,occupant}{}\right]\left[\frac{15\sec}{occupant}\right]\left[\frac{3}{day}\right]\left[\frac{5\,day}{week}\right]\left[\frac{52\,week}{year}\right]\left[\frac{\min}{60\sec}\right]\left[\frac{(8.5-1.9)\,litres}{\min}\right]\left[\frac{m^3}{1{,}000\,litre}\right]$$

$$= 2316 m^3 / year$$

The cost savings based on a water cost of $3.27/m³ are $7,574 /year.

Implementation cost to remove old aerator and supply and install new is approximately $10 per faucet for a total of $1650.

Measure	Water Savings (m^3/year)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Replace Lavatory Aerators	2316	7,574	1,650	0.2

5.5.3 REPLACE CURRENT WATER CLOSETS WITH ULTRA LOW FLOW MODELS

There are a total of 125 water closets throughout the building. Each is rated at 6 litres per flush. Consider replacing the water closet flush valves with low flow valves rated at 4.8 litres per flush. This measure can be easily implemented by replacing the existing water closet flush valves with low flow units.

The water savings were calculated assuming 900 female occupants flushing 3 times per day and 900 male occupants flushing once per day for a total of 3,600 flushes per day.

$$Water\ Savings = \left[\frac{3{,}600\ flushes}{day}\right]\left[\frac{(6-4.8)\,litres}{flush}\right]\left[\frac{5\ days}{week}\right]\left[\frac{52\ weeks}{year}\right]\left[\frac{m^3}{1{,}000\ litres}\right]$$

$$= 1{,}123 m^3 / year$$

The cost savings based on a water cost of $3.27/m³ are $3,673/year.

Implementation cost is approximately $500 per water closet for a total of $62,500.

Measure	Water Savings (m^3/year)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Ultra Low Flow Water Closets	1,123	3,673	62,500	17

5.5.4 RESET MIXING VALVE ON ALL LAVATORIES

Currently the lavatories are equipped with a mixing valve to provide tempered water. Our recommendation would be to set the mixing valve on the lavatories to 10°F/ 5°C colder than the current setpoint. This reduction in water temperature would be barely noticeable to the users. This would result in a lower domestic hot water heating cost. The savings would be minor, but it is an easily achievable measure.

5.6 TECHNOLOGICAL CHANGES (LIGHTING SYSTEM ECMS)

5.6.1 LIGHTING SYSTEM

The average lighting level in the office spaces is generally at or below the lower range of lighting levels recommended by the IESNA due to switching off or removal of lamps in several open office spaces. There appears to be no discomfort or objection from the occupants to the lower ambient lighting levels with supplementary lighting from the task lights.

5.6.2 REPLACE 32 WATT T8 LAMPS WITH 25 WATT T8 LAMPS

Replace all 32 Watt, T8 fluorescent fixtures in the office spaces with 25 Watt lamps which would reduce the consumption by 7 to 21 Watts per fixture depending if the unit is a 1, 2 or 3 lamped fixture. Currently there are a total of 11,632 32 W T8 lamps throughout the building. Light levels measured in the space ranged from 120 to 1,000 Lux.

There is a potential to decrease the connected lighting load by approximately 20% through use of new generation 25 watt T8 lamps that also offer a longer lamp life of 30,000 hours. This option will achieve a reduction in demand and energy use, but only a small reduction in light levels due to a higher lumen maintenance factor of the better lamp.

This measure consists of replacing all the 11,632 F32 T8 lamps with F25 T8 lamps as a group relamping program. The measure can easily be carried out by a PWGSC electrician.

The energy savings were calculated using the hourly lamp usage as recorded from building lighting schedules used by the Andover lighting control system and multiplying it by the number of lamps on the floor to get a yearly energy use of the F32 T8 lamps, then replacing the wattage of each lamp with 25 W.

Energy Use of 32 W T8 Lamps							
Area	Lighting Fixture	Lamp (W)	Fixture Count	Existing System (Hours/Day)			
				Mon-Fri	Sat-Sun	kWh/Week	kWh/.Yr
Basement	4′ F32T8	32	340	12	12	1,828	95,048
Ground Floor	4′ F32T8	32	135	12	5	605	31,450
2nd Floor	4′ F32T8	32	529	12	12	1,422	73,942
3rd Floor	4′ F32T8	32	529	12	-	1,016	52,815
4th Floor	4′ F32T8	32	529	12	11	1,388	72,181
5th Floor	4′ F32T8	32	529	18	8	1,794	93,307
6th Floor	4′ F32T8	32	529	12	-	1,016	52,815
7th Floor	4′ F32T8	32	529	12	-	1,016	52,815
8th Floor	4′ F32T8	32	529	12	-	1,016	52,815
9th Floor	4′ F32T8	32	529	12	-	1,016	52,815
10th Floor	4′ F32T8	32	529	12	8	1,287	66,899
11th Floor	4′ F32T8	32	529	12	-	1,016	52,815

12th Floor	4' F32T8	32	529	12	-	1,016	52,815
13th Floor	4' F32T8	32	529	12	-	1,016	52,815
14th Floor	4' F32T8	32	529	12	-	1,016	52,815
15th Floor	4' F32T8	32	529	12	-	1,016	52,815
16th Floor	4' F32T8	32	529	12	-	1,016	52,815
17th Floor	4' F32T8	32	529	12	-	1,016	52,815
18th Floor	4' F32T8	32	529	12	-	1,016	52,815
19th Floor	4' F32T8	32	529	12	-	1,016	52,815
20th Floor	4' F32T8	32	529	12	-	1,016	52,815
21st Floor	4' F32T8	32	529	12	-	1,016	52,815
Penthouse	4' F32T8	32	102	1	-	7	339
						Total	**1,278,212**

Energy Use of 25 W T8 Lamps							
Area	**Lighting Fixture**	**Lamp (W)**	**Fixture Count**	**Existing System (Hours/Day)**			
				Mon-Fri	**Sat-Sun**	**kWh/Week**	**kWh/.Yr**
Basement	4' F25T8	25	340	12	12	1,428	74,256
Ground Floor	4' F25T9	25	135	12	5	473	24,570
2nd Floor	4' F25T10	25	529	12	12	1,111	57,767
3rd Floor	4' F25T11	25	529	12	-	794	41,262
4th Floor	4' F25T12	25	529	12	11	1,084	56,391
5th Floor	4' F25T13	25	529	18	8	1,402	72,896
6th Floor	4' F25T14	25	529	12	-	794	41,262
7th Floor	4' F25T15	25	529	12	-	794	41,262
8th Floor	4' F25T16	25	529	12	-	794	41,262
9th Floor	4' F25T17	25	529	12	-	794	41,262
10th Floor	4' F25T18	25	529	12	8	1,005	52,265
11th Floor	4' F25T19	25	529	12	-	794	41,262
12th Floor	4' F25T20	25	529	12	-	794	41,262
13th Floor	4' F25T21	25	529	12	-	794	41,262
14th Floor	4' F25T22	25	529	12		794	41,262

					-		
15th Floor	4′ F25T23	25	529	12	-	794	41,262
16th Floor	4′ F25T24	25	529	12	-	794	41,262
17th Floor	4′ F25T25	25	529	12	-	794	41,262
18th Floor	4′ F25T26	25	529	12	-	794	41,262
19th Floor	4′ F25T27	25	529	12	-	794	41,262
20th Floor	4′ F25T28	25	529	12	-	794	41,262
21st Floor	4′ F25T29	25	529	12	-	794	41,262
Penthouse	4′ F25T30	25	102	1	-	5	265
						Total	**998,603**

Subtracting the 25 W lamp energy from the 32 W lamp energy shows savings of 279,609 kWh/year, calculating the cost savings based on an electricity cost of 11.56 cents/kWh equals $32,323/year.

Implementation cost of 11, 632 lamps in 11,157 fixtures, at $3 per lamp and labour cost of $10 per fixture is $146,466

Measure	Energy Savings (kWh/year)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Replace 32 Watt, T8 fluorescent lamps with 25 Watt	279,609	32,323	146,466	4.5

5.6.3 INSTALL DAYLIGHT SENSORS TO CONTROL PERIMETER OFFICE SPACE T8 LIGHTING

Currently the lighting in the office spaces are controlled to turn off at 6:00 PM. The lights are also turned on in the morning at 6:00 AM. Based on lighting levels taken, there is an opportunity to utilize daylight in perimeter areas instead of the overhead fluorescent lighting.

This measure proposes installing daylight sensors around the perimeter of the office floors that will turn off lights when sufficient daylight is present.

This measure can be implemented by installing daylight sensors in perimeter spaces and connecting them to the ALCS. An upgrade to the ALCS front end would also be required as well as some programming to ensure that adequate lighting levels are still maintained. Circuits may need to be rewired as well to ensure that the perimeter areas are controlled separately from interior areas.

It was estimated that approximately 30% of the lighting is within 15 feet of the perimeter and that this lighting could be shut off for 25% of the time. We have also assumed the existing 32 Watt T8 lamps are still in place. Using the table in the last ECM we can use the kWh/year column for floors 2 to 21, and multiply it by the 30% of fixtures, and 25% savings.

Energy Use of 32 W T8 Lamps		
Area	kWh/.Yr	Energy Savings (kWh/yr)
2nd Floor	73,942	5,546
3rd Floor	52,815	3,961
4th Floor	72,181	5,414
5th Floor	93,307	6,998
6th Floor	52,815	3,961
7th Floor	52,815	3,961
8th Floor	52,815	3,961
9th Floor	52,815	3,961
10th Floor	66,899	5,017
11th Floor	52,815	3,961
12th Floor	52,815	3,961
13th Floor	52,815	3,961
14th Floor	52,815	3,961
15th Floor	52,815	3,961
16th Floor	52,815	3,961
17th Floor	52,815	3,961
18th Floor	52,815	3,961
19th Floor	52,815	3,961
20th Floor	52,815	3,961
21st Floor	52,815	3,961
	Total	86,353

Therefore this ECM would save a total of 86,353 kWh/year. The cost savings based on an electricity cost of 11.56 cents/kWh are $9,982/year.

Implementation cost is estimated based on installing one daylight sensor per elevation of each office floor for a total of 80 sensors. Total cost of sensors is $32,700. Upgrading of the ALCS is estimated at $5,000 and design is estimated at an additional $10,000. Therefore, the total cost for the measure is approximately $47,700.

Measure	Energy Savings (kWh)	Cost Savings ($)	Capital Cost ($)	Payback (years)
Install day lighting sensors	86,353	9,982	47,700	4.8

5.6.4 TASK LIGHTING

While task lights are part of the FFE and are the responsibility of the tenants, they consume electricity and contribute to cooling loads in summer. The utility cost for their operation is part of the base building energy costs.

We recommend a detailed study to investigate task lighting usage patterns, number of task lights, fixture and lamp types in order to accurately assess the associated energy consumptions and possible conservation measures.

An alternative to the existing task lighting is to consider light emitting diodes (LEDs). They are energy efficient,

last 30 times longer, and provide focused lighting.

Task lighting should be accompanied by a reduction of ambient light in order to effectively accomplish energy saving objectives.

To ensure the task lights are switched off when they are not required, we recommend a new awareness campaign, directed to the occupants, to turn off task lighting (and other un-necessary plug loads) when not in use or required. Savings cannot be estimated, and are not necessarily permanent.

Table 5-1 Summary of Proposed Energy Efficiency Measures

[To be included in the FINAL Report]

6 CONCLUSIONS AND RECOMMENDATIONS

Several ECMs and WCMs were identified during the detailed energy assessment**.** The following table summarizes the recommended ECMs and WCMs] along with estimated costs, savings and simple payback.

The HVAC ECMs are fully described in section 5.4. Calculations concerning energy savings, capital cost, and payback time will be completed and included in the final submission.

ECM		Savings				Simple Payback (years)
		Electricity (kWh)	**Steam (ekWh)**	**Chilled Water (ekWh)**	**Potable Water (m^3)**	
ECM1	High-Performance Glazing Replacement	**Measures are fully described in section 5.3, calculations to be performed at the final submission.**				
ECM2	Weather Stripping Maintenance					
ECM3	Exhaust Heat Recovery					
ECM4	Demand Controlled Ventilation					
ECM5	VFD for Interior AHUs					
ECM6	Implement Temperature Setback Schedule					
ECM7	Replace Urinal with Low Flow	Not Applicable	Not Applicable	Not Applicable	889	6.3
ECM8	Replace Lavatory Aerators	Not Applicable	Not Applicable	Not Applicable	2316	0.2
ECM9	Ultra Low Flow Water Closets	Not Applicable	Not Applicable	Not Applicable	1,123	17.0
ECM10	Reset Mixing Valve on all Lavatories	**Measure is fully described in section 5.4, calculations not applicable.**				
ECM11	Replace 32 Watt, T8 fluorescent lamps with 25 Watt	279,609	Not Applicable	Not Applicable	Not Applicable	4.5
ECM12	Install day lighting Sensors	86,353	Not Applicable	Not Applicable	Not Applicable	4.8
ECM13	Task Lighting	**Measure is fully described in section 5.5, calculations not applicable.**				

7 REFERENCES

- 2013 ASHRAE Handbook – Fundamentals. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta, Georgia.
- Energy Standard for Buildings Except Low-Rise Residential Buildings. 2010 ANSI/ASHRAE/ IESNA Standard 90.1-2010.
- Knebel, D. 1983. Simplified Energy Analysis Using The Modified Bin Method. ASHRAE, Atlanta, Georgia.
- CBECS 1999 Energy Use Benchmark Data. www.eia.doe.gov/emeu/cbecs/set3.html.
- LEED® Canada Reference Guide for Green Building Design and Construction, 2009

Appendix A

HISTORICAL UTILITY DATA

Appendix B

DETAILED CALCULATIONS

Appendix C

PHOTOGRAPHS

Appendix A

Normalized Weather Data

Heating and cooling degree days: 1971-2000 normals for Ottawa International Airport

	Jan	Feb		May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
HDD	891.4	755.6		155.2	41.3	7.3	21.7	124.2	317.5	510.7	776.5	4602.4
CDD	0	0		13.1	49	98.5	68.6	14.2	0.4	0	0	244.6

Year 2009 / 10	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m³)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr '09	534,334			$49,693.07	13.9	1.29	108	29,939	$2,621.26	0.8	0.07	319	88,619	$7,761.96	2.3	0.20	2,000	$5,520.00	652,892	17	$65,596	333	8
May '09	582,978			$54,216.93	15.2	1.41	709	196,936	$17,242.15	5.1	0.45	146	40,625	$3,558.26	1.1	0.09	1,900	$5,244.00	820,539	21	$80,261	185	11
Jun '09	611,111			$56,833.33	15.9	1.48	1,769	491,478	$43,029.84	12.8	1.12	25	6,944	$608.25	0.2	0.02	1,900	$5,244.00	1,109,533	29	$105,715	69	57
Jul '09	527,778			$49,083.33	13.7	1.28	1,876	521,083	$45,621.89	13.6	1.19	-	0	$0.00	0.0	0.00	1,700	$4,692.00	1,048,861	27	$99,397	34	59
Aug '09	534,722			$49,729.17	13.9	1.29	2,190	608,314	$53,259.07	15.8	1.39	-	0	$0.00	0.0	0.00	2,300	$6,348.00	1,143,036	30	$109,336	38	92
Sep '09	506,944			$47,145.83	13.2	1.23	1,375	381,944	$33,440.00	9.9	0.87	-	0	$0.00	0.0	0.00	1,700	$4,692.00	888,889	23	$85,278	123	27
Oct '09	500,000			$46,500.00	13.0	1.21	272	75,502	$6,610.39	2.0	0.17	150	41,667	$3,649.50	1.1	0.09	1,500	$4,140.00	617,169	16	$60,900	356	0
Nov '09	472,222			$43,916.67	12.3	1.14	71	19,676	$1,722.70	0.5	0.04	700	194,444	$17,031.00	5.1	0.44	1,800	$4,968.00	686,343	18	$67,638	416	0
Dec '09	527,778			$49,083.33	13.7	1.28	-	0	$0.00	0.0	0.00	1,600	444,444	$38,928.00	11.6	1.01	1,700	$4,692.00	972,222	25	$92,703	757	0
Jan '10	562,500			$52,312.50	14.6	1.36	-	0	$0.00	0.0	0.00	1,800	500,000	$43,794.00	13.0	1.14	1,500	$4,140.00	1,062,500	28	$100,247	786	0
Feb '10	520,833			$48,437.50	13.6	1.26	-	0	$0.00	0.0	0.00	1,298	360,504	$31,575.81	9.4	0.82	1,700	$4,692.00	881,337	23	$84,705	653	0
Mar '10	555,556			$51,666.67	14.5	1.34	-	0	$0.00	0.0	0.00	1,000	277,778	$24,330.00	7.2	0.63	7,950	$21,942.00	833,333	22	$97,939	461	0
Total	**6,436,756**			**$598,618**	**167.5**	**15.58**	**8,370**	**2,324,873**	**$203,547**	**60.5**	**$5.30**	**7,038**	**1,955,026**	**$171,237**	**50.9**	**$4.46**	***27,650***	***$76,314***	**10,716,655**	**279**	**$1,049,716**	4,211	254

Year 2010 / 11	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m³)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr '10	472,222			$44,388.89	12.3	1.16	373	103,646	$9,037.08	2.7	0.24	47	12,958	$1,123.73	0.3	0.03	2,610	$7,960.50	588,825	15	$62,510	259	7
May '10	471,262			$44,298.62	12.3	1.15	1,313	364,778	$31,805.73	9.5	0.83	50	13,889	$1,204.50	0.4	0.03	3,540	$10,797.00	849,929	22	$88,106	123	57
Jun '10	472,222			$44,388.89	12.3	1.16	1,683	467,386	$40,752.34	12.2	1.06	-	0	$0.00	0.0	0.00	2,500	$7,625.00	939,608	24	$92,766	52	48
Jul '10	457,249			$42,981.40	11.9	1.12	2,288	635,487	$55,409.42	16.5	1.44	-	0	$0.00	0.0	0.00	2,400	$7,320.00	1,092,736	28	$105,711	11	157
Aug '10	527,778			$49,611.11	13.7	1.29	2,123	589,601	$51,408.47	15.3	1.34	-	0	$0.00	0.0	0.00	2,200	$6,710.00	1,117,379	29	$107,730	25	94
Sep '10	527,778			$49,611.11	13.7	1.29	1,139	316,329	$27,581.37	8.2	0.72	-	0	$0.00	0.0	0.00	1,600	$4,880.00	844,107	22	$82,072	115	29
Oct '10	500,000			$47,000.00	13.0	1.22	506	140,426	$12,244.00	3.7	0.32	200	55,556	$4,818.00	1.4	0.13	1,500	$4,575.00	695,981	18	$68,637	308	0
Nov '10	472,222			$44,388.89	12.3	1.16	374	103,784	$9,049.14	2.7	0.24	1,037	287,976	$24,974.40	7.5	0.65	1,700	$5,185.00	863,982	22	$83,597	485	0
Dec '10	527,778			$49,611.11	13.7	1.29	120	33,209	$2,895.58	0.9	0.08	2,084	578,896	$50,204.19	15.1	1.31	1,600	$4,880.00	1,139,883	30	$107,591	728	0
Jan '11	513,889			$48,305.56	13.4	1.26	11	2,917	$254.35	0.1	0.01	2,578	716,030	$62,096.95	18.6	1.62	1,700	$5,185.00	1,232,836	32	$115,842	881	0
Feb '11	500,000			$47,000.00	13.0	1.22	-	0	$0.00	0.0	0.00	2,011	558,672	$48,450.26	14.5	1.26	1,550	$4,727.50	1,058,672	28	$100,178	714	0
Mar '11	527,778			$49,611.11	13.7	1.29	-	0	$0.00	0.0	0.00	1,483	411,965	$35,727.23	10.7	0.93	1,600	$4,880.00	939,743	24	$90,218	630	0
Total	**5,970,178**			**$561,197**	**155.4**	**14.60**	**9,927**	**2,757,564**	**$240,437**	**71.8**	**$6.26**	**9,489**	**2,635,940**	**$228,599**	**68.6**	**$5.95**	**24,500**	**$74,725**	**11,363,681**	**296**	**$1,104,958**	4,331	392

Year 2011 / 12	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m³)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr '11	444,444			$50,666.67	11.6	1.32	105	29,232	$2,839.27	0.8	0.07	472	131,000	$12,351.25	3.4	0.32	1,802	$6,072.74	604,677	16	$71,930	352	2
May '11	417,312			$47,573.56	10.9	1.24	1,051	291,897	$28,351.33	7.6	0.74	-	0	$0.00	0.0	0.00	3,048	$10,271.76	709,209	18	$86,197	149	23
Jun '11	335,705			$38,270.37	8.7	1.00	1,718	477,354	$46,364.46	12.4	1.21	-	0	$0.00	0.0	0.00	2,970	$10,008.90	813,059	21	$94,644	33	75
Jul '11	427,602			$48,746.62	11.1	1.27	2,120	588,941	$57,202.67	15.3	1.49	-	0	$0.00	0.0	0.00	3,069	$10,342.53	1,016,543	26	$116,292	9	152
Aug '11	400,000			$45,600.00	10.4	1.19	1,800	500,000	$48,564.00	13.0	1.26	-	0	$0.00	0.0	0.00	(481)	-$1,620.97	900,000	23	$92,543	19	94
Sep '11	410,000			$46,740.00	10.7	1.22	1,301	361,356	$35,097.79	9.4	0.91	-	0	$0.00	0.0	0.00	2,052	$6,915.24	771,356	20	$88,753	72	45
Oct '11	409,722			$46,708.33	10.7	1.22	554	154,024	$14,960.04	4.0	0.39	68	19,014	$1,792.72	0.5	0.05	2,175	$7,329.75	582,760	15	$70,791	270	7
Nov '11	416,667			$47,500.00	10.8	1.24	205	56,944	$5,530.90	1.5	0.14	425	118,056	$11,130.75	3.1	0.29	2,050	$6,908.50	591,667	15	$71,070	383	0
Dec '11	430,556			$49,083.33	11.2	1.28	68	18,854	$1,831.29	0.5	0.05	1,223	339,707	$32,028.89	8.8	0.83	2,075	$6,992.75	789,116	21	$89,936	659	0
Jan '12	437,500			$49,875.00	11.4	1.30	-	0	$0.00	0.0	0.00	1,842	511,667	$48,241.98	13.3	1.26	2,125	$7,161.25	949,167	25	$105,278	825	0
Feb '12	430,556			$49,083.33	11.2	1.28	-	0	$0.00	0.0	0.00	1,433	398,095	$37,533.99	10.4	0.98	1,284	$4,327.08	828,651	22	$90,944	660	0
Mar '12	444,444			$50,666.67	11.6	1.32	206	57,216	$5,557.32	1.5	0.14	759	210,801	$19,875.13	5.5	0.52	1,575	$5,307.75	712,462	19	$81,407	465	8
Total	**5,004,508**			**$570,514**	**130.2**	**14.85**	**9,129**	**2,535,819**	**$246,299**	**66.0**	**$6.41**	**6,222**	**1,728,339**	**$162,955**	**45.0**	**$4.24**	**23,744**	**$80,017**	**9,268,666**	**241**	**$1,059,785**	3,896	406

Year 2012 / 13	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m^3)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr '12	117,714			$13,537.16	3.1	0.35	107	29,769	$3,135.70	0.8	0.08	359	99,722	$10,285.28	2.6	0.27	1,846	$6,276.40	247,205	6	$33,235	357	3
May '12	396,122			$45,554.02	10.3	1.19	1,026	285,046	$30,025.60	7.4	0.78	21	5,745	$592.56	0.1	0.02	1,890	$6,426.00	686,913	18	$82,598	114	46
Jun '12	362,062			$41,637.12	9.4	1.08	1,389	385,950	$40,654.45	10.0	1.06	-	0	$0.00	0.0	0.00	2,310	$7,854.00	748,012	19	$90,146	53	99
Jul '12	365,328			$42,012.73	9.5	1.09	1,956	543,470	$57,246.95	14.1	1.49	-	0	$0.00	0.0	0.00	2,110	$7,174.00	908,798	24	$106,434	14	169
Aug '12	387,472			$44,559.31	10.1	1.16	1,803	500,924	$52,765.33	13.0	1.37	-	0	$0.00	0.0	0.00	2,100	$7,140.00	888,396	23	$104,465	23	108
Sep '12	365,767			$42,063.23	9.5	1.09	971	269,695	$28,408.60	7.0	0.74	-	0	$0.00	0.0	0.00	2,400	$8,160.00	635,462	17	$78,632	127	32
Oct '12	382,145			$43,946.66	9.9	1.14	412	114,515	$12,062.60	3.0	0.31	101	28,036	$2,891.61	0.7	0.08	1,800	$6,120.00	524,696	14	$65,021	261	3
Nov '12	373,286			$42,927.94	9.7	1.12	96	26,578	$2,799.66	0.7	0.07	942	261,540	$26,975.25	6.8	0.70	2,170	$7,378.00	661,405	17	$80,081	542	0
Dec '12	385,539			$44,336.93	10.0	1.15	-	0	$0.00	0.0	0.00	1,536	426,573	$43,996.74	11.1	1.14	1,170	$3,978.00	812,112	21	$92,312	700	0
Jan '13	450,031			$51,753.52	11.7	1.35	42	11,567	$1,218.44	0.3	0.03	1,881	522,591	$53,900.07	13.6	1.40	1,570	$5,338.00	984,189	26	$112,210	823	0
Feb '13	367,198			$42,227.78	9.6	1.10	39	10,801	$1,137.79	0.3	0.03	1,627	451,970	$46,616.14	11.8	1.21	1,350	$4,590.00	829,969	22	$94,572	714	0
Mar '13	374,305			$43,045.07	9.7	1.12	-	0	$0.00	0.0	0.00	1,163	323,038	$33,318.09	8.4	0.87	1,350	$4,590.00	697,343	18	$80,953	601	0
Total	**4,326,969**			**$497,601**	**112.6**	**12.95**	**7,842**	**2,178,316**	**$229,455**	**56.7**	**$5.97**	**7,629**	**2,119,214**	**$218,576**	**55.1**	**$5.69**	**22,066**	**$75,024**	**8,624,500**	**224**	**$1,020,657**	4,329	460

Year 2013 / 14	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m^3)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr '13	364,076			$41,140.60	9.5	1.07	123	34,123	$3,591.95	0.9	0.09	670	186,032	$18,852.51	4.8	0.49	1,840	$6,568.80	584,232	15	$70,154	379	2
May '13	365,933			$41,350.44	9.5	1.08	1,010	280,574	$29,534.33	7.3	0.77	-	0	$0.00	0.0	0.00	1,850	$6,604.50	646,507	17	$77,489	137	43
Jun '13	327,290			$36,983.80	8.5	0.96	1,086	301,581	$31,745.57	7.8	0.83	-	0	$0.00	0.0	0.00	1,620	$5,783.40	628,871	16	$74,513	72	53
Jul '13	432,030			$48,819.43	11.2	1.27	1,872	520,107	$54,748.57	13.5	1.42	-	0	$0.00	0.0	0.00	2,010	$7,175.70	952,138	25	$110,744	25	129
Aug '13	388,889			$43,944.44	10.1	1.14	1,486	412,781	$43,450.97	10.7	1.13	-	0	$0.00	0.0	0.00	2,220	$7,925.40	801,670	21	$95,321	36	81
Sep '13	368,056			$41,590.28	9.6	1.08	784	217,838	$22,930.53	5.7	0.60	-	0	$0.00	0.0	0.00	1,870	$6,675.90	585,894	15	$71,197	135	22
Oct '13	340,639			$38,492.19	8.9	1.00	516	143,421	$15,097.05	3.7	0.39	136	37,661	$3,816.59	1.0	0.10	1,770	$6,318.90	521,721	14	$63,725	266	6
Nov '13	344,015			$38,873.70	9.0	1.01	201	55,838	$5,877.68	1.5	0.15	827	229,719	$23,279.71	6.0	0.61	1,560	$5,569.20	629,571	16	$73,600	545	0
Dec '13	358,145			$40,470.39	9.3	1.05	209	58,090	$6,114.83	1.5	0.16	1,875	520,964	$52,794.45	13.6	1.37	1,220	$4,355.40	937,199	24	$103,735	841	0
Jan '14	388,889			$43,944.44	10.1	1.14	207	57,554	$6,058.39	1.5	0.16	2,250	625,080	$63,345.56	16.3	1.65	1,370	$4,890.90	1,071,523	28	$118,239	900	0
Feb '14	341,706			$38,612.79	8.9	1.00	211	58,664	$6,175.25	1.5	0.16	1,823	506,310	$51,309.43	13.2	1.34	1,310	$4,676.70	906,680	24	$100,774	773	0
Mar '14	341,812			$38,624.75	8.9	1.01	228	63,280	$6,661.14	1.6	0.17	1,487	413,146	$41,868.17	10.8	1.09	1,150	$4,105.50	818,238	21	$91,260	756	0
Total	**4,361,480**			**$492,847**	**113.5**	**12.82**	**7,934**	**2,203,852**	**$231,986**	**57.3**	**$6.04**	**9,068**	**2,518,911**	**$255,266**	**65.5**	**$6.64**	**19,790**	**$70,650**	**9,084,243**	**236**	**$1,050,750**	4,865	336

Year 2014 / 15	Electricity						Chilled Water					Steam					Water & Sewage		Totals			Weather Data	
	Usage (kWh)	Demand (kW)	Load Factor (%)	Bill ($)	Electrical Intensity (kWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (GJ)	Usage (ekWh)	Bill ($)	Energy Intensity (ekWh/m²)	Cost Index ($/m²)	Usage (m^3)	Bill ($)	Totals Usage (ekWh)	Energy Intensity (ekWh/m²)	Total Bill ($)	HDD (@ 18°C)	CDD (@ 18°C)
Apr '13	361,111			$41,527.78	9.4	1.08	301	83,640	$8,340.56	2.2	0.22	687	190,836	$18,666.06	5.0	0.49	1,580	$6,035.60	635,587	17	$74,570		
May '13	365,278			$42,006.94	9.5	1.09	980	272,286	$27,152.36	7.1	0.71	125	34,853	$3,409.04	0.9	0.09	1,520	$5,806.40	672,417	17	$78,375		
Jun '13	362,500			$41,687.50	9.4	1.08	1,507	418,513	$41,734.10	10.9	1.09	-		$0.00	0.0	0.00	1,550	$5,921.00	781,013	20	$89,343		
Jul '13	416,667			$47,916.67	10.8	1.25	1,624	451,065	$44,980.16	11.7	1.17	-		$0.00	0.0	0.00	1,820	$6,952.40	867,731	23	$99,849		
Aug '13	402,778			$46,319.44	10.5	1.21	1,502	417,143	$41,597.52	10.9	1.08	-		$0.00	0.0	0.00	1,600	$6,112.00	819,921	21	$94,029		
Sep '13	375,000			$43,125.00	9.8	1.12	1,113	309,190	$30,832.41	8.0	0.80	-		$0.00	0.0	0.00	1,940	$7,410.80	684,190	18	$81,368		
Oct '13	368,056			$42,326.39	9.6	1.10	553	153,632	$15,320.21	4.0	0.40	-		$0.00	0.0	0.00	1,700	$6,494.00	521,688	14	$64,141		
Nov '13	381,944			$43,923.61	9.9	1.14	294	81,605	$8,137.69	2.1	0.21	817	226,891	$22,192.63	5.9	0.58	1,560	$5,959.20	690,440	18	$80,213		
Dec '13	494,044			$56,815.04	12.9	1.48	265	73,491	$7,328.50	1.9	0.19	1,537	426,889	$41,754.82	11.1	1.09	920	$3,514.40	994,423	26	$109,413		
Jan '14	341,706			$39,296.20	8.9	1.02	211	58,664	$5,850.02	1.5	0.15	1,823	506,310	$49,523.17	13.2	1.29		$0.00	906,680	24	$94,669		
Feb '14										0.0	0.00			$0.00	0.0	0.00							
Mar '14										0.0	0.00			$0.00	0.0	0.00				0			
Total	**3,869,083**			**$444,945**	**100.7**	**11.58**	**8,349**	**2,319,229**	**$231,274**	**60.3**	**$6.02**	**4,989**	**1,385,778**	**$135,546**	**36.1**	**$3.53**	**14,190**	**$54,206**	**7,574,090**	**197**	**$865,970**	0	0

Floor Area (m²):	38,430	Floor area taken from Jeanne Mance FSA report Jan13_2015.docx

Baseline Energy Use

Typical Year	Electricity Usage (kWh)	Electricity Demand (kW)	Electricity Load Factor (%)	Electricity Bill ($)	Electrical Intensity (kWh/m²)	Electricity Cost Index ($/m²)	Chilled Water Usage (GJ)	Chilled Water Usage (ekWh)	Chilled Water Bill ($)	Chilled Water Energy Intensity (ekWh/m²)	Chilled Water Cost Index ($/m²)
Apr	382,317			40,159	9.9	1.04	186	51,725	4,928	1.3	0.13
May	433,147			45,833	11.3	1.19	1,015	281,919	27,352	7.3	0.71
Jun	411,815			43,300	10.7	1.13	1,525	423,710	40,713	11.0	1.06
Jul	437,776			46,593	11.4	1.21	1,956	543,359	52,535	14.1	1.37
Aug	440,273			46,627	11.5	1.21	1,817	504,794	48,508	13.1	1.26
Sep	425,591			45,046	11.1	1.17	1,114	309,392	29,715	8.1	0.77
Oct	416,760			44,162	10.8	1.15	469	130,253	12,716	3.4	0.33
Nov	410,060			43,588	10.7	1.13	207	57,404	5,520	1.5	0.14
Dec	453,973			48,233	11.8	1.26	110	30,607	3,028	0.8	0.08
Jan	449,086			47,581	11.7	1.24	78	21,784	2,230	0.6	0.06
Feb	432,059			45,072	11.2	1.17	50	13,893	1,463	0.4	0.04
Mar	448,779			46,723	11.7	1.22	87	24,099	2,444	0.6	0.06
Total	**5,141,635**			**$542,920**	**133.8**	**14.13**	**8,615**	**2,392,941**	**$231,151**	**62.3**	**$6.01**

Typical Year	Steam Usage (GJ)	Steam Usage (ekWh)	Steam Bill ($)	Steam Energy Intensity (ekWh/m²)	Steam Cost Index ($/m²)	Water & Sewage Usage (m³)	Water & Sewage Bill ($)	Totals Usage (ekWh)	Totals Energy Intensity (ekWh/m²)	Total Bill ($)	Weather Data HDD (@ 18°C)	Weather Data CDD (@ 18°C)
Apr	426	118,194	11,507	3.1	0.30	1,946	6,406	552,236	14	$62,999	336	4.4
May	57	15,852	1,461	0.4	0.04	2,291	7,525	730,919	19	$82,171	141.6	36
Jun	4	1,157	101	0.0	0.00	2,142	7,073	836,683	22	$91,188	55.8	66.4
Jul	0	0	0	0.0	0.00	2,185	7,276	981,135	26	$106,404	18.6	133.2
Aug	0	0	0	0.0	0.00	1,657	5,436	945,067	25	$100,571	28.2	93.8
Sep	0	0	0	0.0	0.00	1,927	6,456	734,983	19	$81,217	114.4	31
Oct	109	30,322	2,828	0.8	0.07	1,741	5,830	577,336	15	$65,536	292.2	3.2
Nov	791	219,771	20,931	5.7	0.54	1,807	5,995	687,235	18	$76,033	474.2	0
Dec	1,642	456,245	43,285	11.9	1.13	1,448	4,735	940,826	24	$99,282	737	0
Jan	2,029	563,613	53,484	14.7	1.39	1,653	4,453	1,034,482	27	$107,748	843	0
Feb	1,638	455,110	35,914	11.8	0.93	1,439	4,603	901,062	23	$87,052	702.8	0
Mar	1,178	327,345	25,853	8.5	0.67	2,725	8,165	800,224	21	$83,185	582.6	1.6
Total	**7,875**	**2,187,610**	**$195,363**	**56.9**	**$5.08**	**22,959**	**$73,950.75**	**9,722,187**	**253**	**$1,043,384**	4,326	369.6

	Jeanne-Mance Building	Benchmark Data
Electrical Energy Intensity (kWh/m².yr)	134	161
Chilled Water Energy Intensity (kWh/m².yr)	62	92
Steam Energy Intensity (kWh/m².yr)	57	103
BEPI (kWh/m².yr)	253	356
Peak Demand Intensity (W/m²)	0	50 to 55
Water Consumption Index (m³/m².yr)	0.60	1.1 to 1.75