ASSOCIATION OF MANITOBA MUNICIPALITIES
MANITOBA MUNICIPAL ENERGY, WATER AND WASTEWATER EFFICIENCY PROJECT
TOWN OF THE PAS
FINAL REPORT
DECEMBER 2006

KGS GROUP
KONTZAMANIS ▪ GRAUMANN ▪ SMITH ▪ MACMILLAN INC.
CONSULTING ENGINEERS & PROJECT MANAGERS

KGS GROUP

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December 6, 2006

File No. 05-1285-01-1000.15

Association of Manitoba Municipalities
1910 Saskatchewan Avenue West
Portage la Prairie, Manitoba
R1N 0P1

RE: Municipal Energy, Water, and Wastewater
Efficiency Study for the Town of The Pas – Final Report

Dear Mr. Tyler MacAfee:

Enclosed is the Final Report of the Manitoba Municipal Energy, Water and Wastewater Efficiency Study for the Town of The Pas.

Included with this submission are 10 hard copies (3 in colour, 7 in black and white) of the report and 10 copies on compact disk in PDF format with searchable text functionality, as requested in the "Request for Proposal". The PDF file consists of the entire report, including the Executive Summary, Sections 1 to 15, and Appendix A to G.

We thank you for giving us the opportunity to work on this project.

Yours truly,

R. B. Bodnar, P.Eng.
Senior Mechanical Engineer/ Department Head

RBB/mg
Enclosure

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EXECUTIVE SUMMARY

The objective of this study was to determine energy, water and wastewater efficiency opportunities that could enable the Town of The Pas to reduce operating costs, conserve resources and reduce greenhouse gas emissions.

An energy and water audit was conducted on eleven buildings in The Pas. An audit was also done on the water distribution and wastewater collection systems. Throughout the course of these audits, water, wastewater and energy efficiency opportunities were analyzed to determine the Municipality's potential for energy and water savings. The saving opportunities were separated into the following categories:

- Lighting – Replacing the interior and/or exterior lighting with more energy efficient lights and fixtures.
- Envelope – This involves measures that would reduce the heat loss through the building's windows, doors, walls and roof.
- Motors- Replacing low efficiency motors with higher efficiency motors.
- HVAC- Improving current heating, ventilating and air conditioning systems.
- Process Equipment: Potential upgrades to ice plants and water / waste water treatment plant equipment.
- Water – Replacing high flow water fixtures with water efficient fixtures.

Table E1 shows the energy consumption for each of the buildings primarily from January 2005 to December 2005. This year was chosen as it represents the base year for energy and water consumption. This year was selected since the conditions of the buildings throughout this time most closely resemble the buildings' current conditions. All buildings included in the energy and water audit use electricity. In addition, three of the buildings, the Arena, Fire Hall/Municipal Administration Building and the Museum also use propane. The “Energy Density” column in this table is the total energy consumed in the building divided by the area of the building. This is useful in comparing the energy consumption among the different building types in the Pas. The pie chart displays the percentage of total energy density for each of the buildings. It ranges from a high of 44.5% for the Water Treatment Plant (WTP) to a low of 3.0% for the Municipal Garage.

Tables E2 (a) and (b) show overall energy and water saving opportunities for all eleven buildings in The Pas. These tables include approximate product and installation prices for each measure both with and without incentives (refer to Appendix D for a list of Manitoba Hydro incentives) and simple payback years. The “Simple Payback Years” column is the overall payback period and may vary for individual buildings.

From the energy saving opportunities table (Table E2 (a)) it can be seen that the total potential for energy savings in all eleven buildings is 896,660 kWh, or 20% of the current total energy consumption.

There were three main issues that were noted during the course of this study that limited the potential for additional energy savings:

- Some of the buildings are used infrequently (e.g. Campground Offices/Changerooms and Curling Rink).

- Some of the buildings have little or no ventilation (e.g. Fire Hall/Municipal Administration Building and Friendship Centre).
- Some of the buildings are unheated (e.g. Campground Offices/Changerooms).

Water saving opportunities are shown in Table E2 (b) and are displayed as percent water savings, water savings in litres/year and cost savings. Percentages shown in the table indicate the percent water savings that would result from replacing the existing water fixtures in all the buildings with water efficient fixtures. The water savings in litres per year are based on estimates of the various buildings occupancies. The cost of water was calculated to be $0.55 per cubic metre.

The results and recommendations from the water and wastewater audit are shown in Chapter 15 of this report. From the water system audit, it was determined that The Pas' water treatment plant produced a total of 1,703,073 m^3 (374,623,600 Igal) of water from January to December of 2005. The total amount of water sold by the Town was 22,728 m^3 (4,999,356 Igal). Of the remaining amount, 717,093 m^3 (157,738,400 Igal) is unaccounted-for water loss, 42.1% of the total water produced. Reduction in water losses would reduce chemical costs required for the water treatment, reduce electric energy consumed by the pumps and extend the longevity of the system.

The Pas' sewer collection system is separate from the storm water drainage system. However, inflow and infiltration do occur between the two. Factors such as precipitation entering through manholes, weeping tiles, sump pumps and groundwater entering the system create variations in infiltration and inflow quantities. Developing a program that would help monitor and lower the amount of unaccounted-for water loss would potentially help the Town to save in both quantity of water and costs.

In addition to energy, water and cost savings, other benefits have been identified:

- Reduction in carbon dioxide (CO_2) emissions resulting in reduced contribution to climate change– the percent reduction is shown at the bottom of each of the energy saving opportunity tables.
- Lowered maintenance costs – (e.g. replacing the current lights with longer lasting bulbs).
- Improved physical comfort – (e.g. reducing infiltration into buildings).
- Delayed need to increase water and wastewater treatment plant capacities.

Table E1: Energy Consumption for the Period from January 2005 – December 2005

Site	Energy Density (kWh/m^2)	Area (m^2)	Electricity		Propane		Total Energy	
			kWh	Cost ($)	kWh	Cost ($)	kWh	Cost ($)
Arena	265	4,071	533,760	$29,172	546,150	$23,053	1,079,910	$52,225
Campground Changerooms/Office	226	144	32,610	$2,428	0	$0	32,610	$2,428
Curling Rink	327	1,304	401,760	$23,501	24,427	$1,576	426,187	$25,076
Fire Hall & Municipal Admin.Building	323	1,145	206,240	$12,676	163,468	$10,020	369,708	$22,696
Friendship Centre	207	508	105,000	$7,172	0	$0	105,000	$7,172
Library	586	246	144,240	$9,225	0	$0	144,240	$9,225
Municipal Garage	147	802	118,249	$8,139	0	$0	118,249	$8,139
Museum	182	1,113	203,040	$12,765	0	$0	203,040	$12,765
Indoor Swimming Pool	482	632	304,920	$17,086	0	$0	304,920	$17,086
WTP	2,205	780	1,200,600	$57,845	519,060	$31,815	1,719,660	$89,660
Totals	**4,952**	**10,745**	**3,250,419**	**$180,007**	**1,253,105**	**$66,464**	**4,503,524**	**$246,471**

Percentage of Total Energy Density for Buildings in The Pas

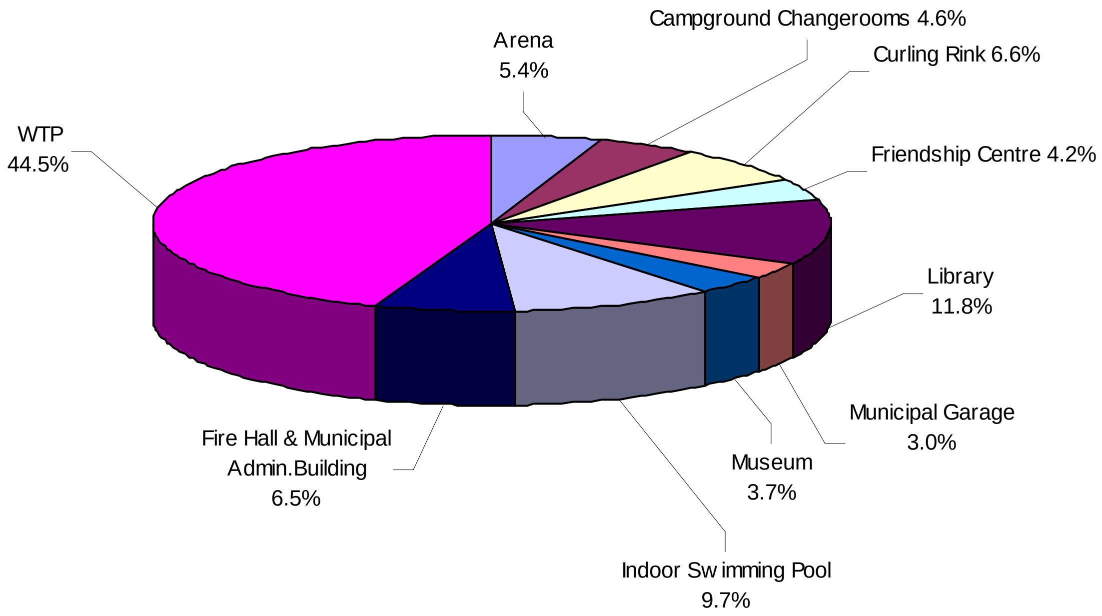

Table E2 (a): Summary of Energy Saving Opportunities for all 11 Buildings in The Pas

Page 1 of 4

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years****		Related Buildings
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*	
LIGHTING & PARKING LOT CONTROLLERS											
Replace EXIT incandescent lamps with LED modules.	51	$50	$5	$80	$7,492	$4,899	15,115	$908	8.3	5.4	Curling Rink, Fire Hall/MAB, Friendship Centre, Library, Municipal Garage, Museum, Indoor Pool & WTP.
Retrofit 4' x2 T12 fluorescents with T8 ballasts and tubes when burnt out.	1,152	$41	$21	$0	$53,372	$27,337	55,325	$3,596	14.8	7.6	Campground Office, Fire Hall/MAB, Friendship Centre, Library, Museum, Indoor Pool & WTP.
Retrofit 4' x 4 T12 fluorescents with T8 ballasts and tubes when burnt out.	160	$32	$12	$0	$5,786	$2,170	6,928	$416	13.9	5.2	Curling Rink & Museum.
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes when burnt out.	60	$47	$12	$0	$3,187	$814	9,388	$564	5.7	1.4	Curling Rink, Municipal Garage & WTP.
Replace exterior incandescents with high pressure sodium incandescents	3	$125	$100	$125	$8548	$763	2,957	$178	4.8	4.3	Campground Office.
Replace interior incandescents with compact fluorescents.	203	$15	$10	$13	$6,423	$5,3276	45,514	$2,733	2.4	1.9	Campground Office, Fire Hall/MAB, Friendship Centre, Library, Municipal Garage, Museum, Indoor Pool & WTP.

Table E2 (a): Summary of Energy Saving Opportunities for all 11 Buildings in The Pas

Page 2 of 4

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years****		Related Buildings
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*	
LIGHTING & PARKING LOT CONTROLLERS											
Install parking lot controller.	13	$100	$75	$150	$3,673	$3,305	3,120	$187	19.6	17.6	Fire Hall/MAB, Friendship Centre & Library.
Lighting Subtotal					**$80,779**	**$44,563**	**138,346**	**$8,580**			
ENVELOPE											
Add weather stripping & caulking to existing pedestrian door.	31	$15	$15	$50	$2,277	$2,277	51,776	$3,041	0.7	0.7	Arena, Curling Rink, Fire Hall/MAB, Friendship Centre, Library, Museum, Municipal Garage, Indoor Pool & WTP.
Seal & caulk standard windows.	32	$5	$5	$25	$1,085	$1,085	17,068	$1,037	1.0	1.0	Fire Hall/MAB.
Seal & caulk windows (non-standard size).	2	$30	$30	$50	$181	$181	4,930	$302	0.6	0.6	WTP.
Replace windows & seal. [1]	147	$668	$621	$100	$127,493	$119,730	176,703	$10,101	12.6	11.9	Curling Rink, Fire Hall/MAB, Friendship Centre, Library, Museum & WTP.
Add new weather stripping & caulking to vehicle door.	6	$30	$30	$50	$542	$542	21,878	$666	0.8	0.8	Municipal Garage
Upgrade roof insulation.[1]	5	$3,083	$2,271	$1,715	$27,109	$22,7521	114,110	$7,823	3.5	2.9	Curling Rink, Fire Hall/MAB, Friendship Centre & Library.
Upgrade wall insulation	1	$912	$707	$800	$1,935	$1,703	2,539	$152	12.7	11.2	Friendship Centre.
Envelope Subtotal					**$160,621**	**$148,039**	**389,005**	**$23,122**			

Table E2 (a): Summary of Energy Saving Opportunities for all 11 Buildings in The Pas **Page 3 of 4**

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years****		Related Buildings
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*	
HVAC											
Install programmable thermostat with setback function.	13	$300	$300	$300	$8,814	$8,814	125,923	$7,560	1.2	1.2	Curling Rink, Fire Hall/MAB, Friendship Centre & WTP.
Install outdoor thermostat to control rink ventilation.	1	$900	$900	$900	$2,034	$2,034	22,684	$1,362	1.5	1.5	Arena.
Install motorized damper.	8	$300	$300	$300	$5,424	$5,424	50,473	$2,689	2.0	2.0	Arena, Friendship Centre, Library & Municipal Garage.
Add CO_2 control.	4	$900	$900	$300	$5,424	$5,424	44,180	$2,653	2.0	2.0	Arena & Friendship Centre.
Install solar wall.	1	$31,500	$21,500	$18,000	$55,935	$44,635	30,709	$1,844	30.3	24.2	Municipal Garage
Upgrade existing A/C condensers with high efficiency A/C units when time for replacement.	4	$350	$350	$0	$1,582	$1,582	21,319	$1,280	1.2	1.2	Museum.
Install liquid pool covers.	110	$20	$20	$0	$2,486	$2,486	33,796	$2,029	1.2	1.2	Indoor Pool.
HVAC Subtotal					**$81,699**	**$70,399**	**329,084**	**$19,417**			
HOT WATER											
Install water efficient metering faucets.	37	$309	$309	$150	$19,178	$19,178	26,309	$1,058	18.1	18.1	Arena & Library.
Install water efficient showers.	7	$21	$21	$50	$562	$562	6,361	$452	1.2	1.2	Campground Office, Fire Hall/MAB & WTP.
Replace water heater with instantaneous water heater.	2	$300	$300	$400	$1,582	$1,582	2,389	$143	11.0	11.0	Library
Insulate piping for hot water heater tank.[1]	4	$41	$41	$41	$368	$368	1,570	$73	5.1	5.1	Fire Hall/MAB, Library, Indoor Pool & WTP.
Install timer to control domestic water heating system.	1	$100	$100	$50	$170	$170	1,756	$67	2.5	2.5	Arena.
Water Subtotal					**$21,860**	**$21,860**	**38,385**	**$1,793**			

Table E2 (a): Summary of Energy Saving Opportunities for all 11 Buildings in The Pas

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years****		Related Buildings
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*	
MOTORS[1]											
When replacing motors, install a high efficiency motor.	12	$804	$804	$0	$10,903	$10,903	27,875	$1,674	6.5	6.5	Fire Hall/MAB, Indoor Pool & WTP.
Motors Subtotal					**$10,903**	**$10,903**	**27,875**	**$1,674**			

Totals	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	4,503,524	$245,964	379.8
Estimated Annual Savings	896,660	$53,596	46.1
Percent Savings	20%	22%	12.1%

* NI = Cost does not include incentives, WI = Cost includes incentives

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro’s website) as of April 2005 and on average 0.0573 $/kWh for propane.

**** This is the overall payback period and may vary for individual buildings (refer to tables throughout report for payback years for a specific building).

[1] Average capital unit cost and installation costs were used for window upgrades, roof and wall insulation upgrades, insulating piping on hot water tanks & upgrading motors.

[2] Discounted to include the cost of replacement water tank in 10 years.

Table E2 (b): Summary of Water Saving Opportunities for all 11 Buildings in The Pas

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)	Related Buildings
		Material	Labour					
Install water efficient metering faucets.	70	$309	$150	$36,307	80%	774,325	$426	Arena, Campground Office, Fire Hall/MAB, Municipal Garage, Library, Museum & WTP.
Install water efficient toilets.	66	$284	$150	$32,368	55%	1,436,440	$790	Arena, Campground Office, Fire Hall/MAB, Library, Municipal Garage, Museum, Pool & WTP.
Install water efficient urinals	14	$344	$200	$8,606	29%	127,994	$70	Arena, Campground Office, Fire Hall/MAB, Municipal Garage, Museum & Pool.
Install water efficient showers	7	$21	$50	$562	29%	169,747	$93	Campground Office, Fire Hall/MAB & WTP.
Replace existing air conditioner in Fire Hall with a ductless split system air conditioner.	1	$2,500	$1,000	$3,955	100%	490,320	$270	Fire Hall/MAB.

* The total cost column includes 13% taxes.

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Association of Manitoba Municipalities
Manitoba Hydro
Manitoba Conservation
Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration
Manitoba Culture, Heritage, and Tourism

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- Kevin Affleck, Maintenance Director (Arena and Curling Rink).
- Nelson Fulford, Municipal Superintendent
- Carol Ham (Library)

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1.0 INTRODUCTION

1.1 BACKGROUND

As environmental concerns grow and energy costs increase, energy and water conservation is increasing in importance. For this reason it is essential to perform energy, water and wastewater efficiency audits to identify practical efficiency improvement opportunities and determine the capital costs and payback periods associated with these implementations.

An energy and water efficiency audit was conducted on eleven buildings in the Municipality of The Pas to determine how these facilities could reduce both energy and water consumption. In addition, the water distribution and wastewater collection systems were audited to determine what opportunities exist for improving the systems' efficiencies.

1.2 OBJECTIVE

The objective of this study was to determine energy, water and wastewater efficiency opportunities that could enable the Town of The Pas to reduce operating costs, conserve resources and reduce greenhouse gas emissions. All eleven buildings in The Pas were analyzed and the results are presented in separate sections throughout this report. The water and wastewater systems are discussed in Section 15.

1.3 METHODOLOGY

The buildings were toured on May 29 and 30, 2006 by Mr. Ray Bodnar and Mr. Tibor Takach, both of KGS Group Engineering Consultants. These tours involved a walkthrough of each of the buildings to determine the current condition of the building's envelope (walls, roof, windows, and doors), lighting, water fixtures, heating, ventilation and air conditioning (HVAC) systems, and motors.

During the building tours, the auditors met with the Town's Maintenance Director Kevin Affleck and Municipal Superintendent Nelson Fulford to discuss the study objectives for identifying energy, water and wastewater saving opportunities and to provide information on existing incentive programs.

While auditing the buildings, whenever possible, on-site training was done to inform the staff on energy and/or water saving opportunities in specific buildings and to point out maintenance issues where applicable.

Using the information collected during the audit, available drawings of the buildings, historical weather data, and the hydro bills from the past 12 months, calculations were performed to determine how each of the buildings are consuming energy and water. Several assumptions were made throughout these calculations including occupancies, room temperatures and envelope conditions (see Inventory Sheets in Appendix A). When no drawings were available, wall/roof R-values were assumed based on discussions with site personnel or based on knowledge of other buildings of similar type/age to the building surveyed.

Energy Saving Opportunities (ESOs) were developed for each building and are presented in tables throughout this report showing energy savings, cost savings, installation costs and simple payback periods. Simple Payback periods are calculated as the total installation cost divided by the annual cost savings. The installation costs include the material costs, both with and without incentives (see Appendix D for list of Manitoba Hydro incentives), and the labour costs for the installation using standard contractor rates. The total energy savings, the percent energy savings and the associated costs are presented at the end of each ESO table. It should be noted that the energy savings and material cost estimates are preliminary. For complex measures such as major building envelope upgrades, a more detailed investigation would be required to confirm capital and installation costs for the system.

An environmental benefit that results from reducing energy consumption is a reduction in carbon dioxide, CO_2 emissions. Carbon dioxide is a greenhouse gas thereby contributing to global warming. Although over 95% of Manitoba's electricity is produced by hydropower, which emits very little CO_2, some of the electrical generating stations in Canada and the United States burn fossil fuels and emit large quantities of CO_2 into the atmosphere. By reducing the electrical energy consumption here in Manitoba, more of Manitoba Hydro's clean hydropower is available for offsetting the fossil-fuelled electrical generating stations. At the bottom of each ESO table, the total CO_2 reduction resulting from the energy savings is shown. This was calculated using a CO_2 emissions calculator produced by Natural Resources Canada.

Many of the ESOs have low installed costs and payback periods of less than four years. Once the implementation phase begins, these ESOs are the most attractive measures. However, in order to maximize long-term savings and efficiencies for the buildings, implementation of the more capital-intensive measures with the longer payback periods are necessary. These items will become more attractive as energy costs increase in the future. It is recommended that the savings associated with the short payback ESOs be reinvested annually as a means to help finance the more expensive options.

Water Saving Opportunities (WSOs) are also presented in this report. The WSOs include installing water efficient sinks, toilets, urinals and showers. The buildings are all metered off the Town's supply. Savings are shown as percentages of the current fixtures water consumption, water savings in litres/year and cost savings.

The water and wastewater systems in The Pas were analyzed and are discussed in Section 15 of this report. In addition to an overview of the water and wastewater systems, several recommendations are made to help the Town monitor water consumption and losses and reduce operating costs.

2.0 ARENA

2.1 BACKGROUND

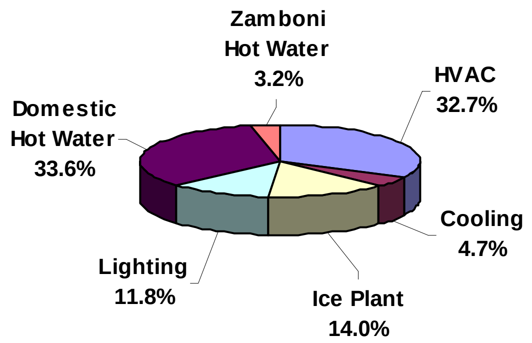
Constructed in 1976, the Arena is a 4,071 square meter building that houses an ice rink, waiting and concession area. Attached to the Arena is a separate Curling Rink. The walls are 3” of rigid concrete block with metal cladding on the outside for an R-value of 27. The roof has 6” of insulation for an R-value of 20. The Arena was renovated in 2005, adding dressing rooms, new walls and roof, new insulation, windows, HVAC and DDC controls. During these upgrades the ice plant was not renovated. The Arena is heated using propane and electric roof top units and unit heaters. The facility is occupied for seven months of the year for approximately 133 hours per week, and for 12 hours per week for the remaining five months during the summer.


05/30/2006

Photo 1 - Arena

In the previous year, the Arena consumed 533,760 kWh of electricity and 546,150 kWh of propane, costing $29,172 and $23,053 respectively. Table B.1.2 in Appendix B shows the monthly consumption of electric energy and propane. The following pie chart shows the breakdown for energy consumption for the Arena.

Energy Breakdown (% of Total kWh) for the Arena



The hot water consumed by the water fixtures was calculated by estimating the occupancy of the building and the frequency at which these fixtures are used. From this, the total annual hot water consumption was then established.

There are fifteen urinals, twenty-three sinks and toilets and eighteen showers in the Arena. The showers are already low flow auto shut off fixtures and did not require upgrades. In addition, a large portion of the annual water consumption is used to flood the rink. The Curling Rink is also supplied by the Arena’s domestic water system. Therefore, its water fixtures were also included under the Arena’s energy and water saving opportunities. An additional ten sinks; four urinals and nine toilets were added to the Arena’s water fixtures. Based on the current water fixtures, calculations were made to determine the percent reduction in water consumption when replacing the existing high flow fixtures with new water efficient fixtures.

2.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 1 and 2 show a summary of both the energy and water saving opportunities for the Arena. The following assumptions were made in determining the annual savings:

- The Arena is occupied for 133 hours per week for 7 months of the year and for 12 hours per week for the remaining 5 months.
- The temperature of waiting area is maintained at 21°C (70°F) and the rink area is at -6°C (21°F).
- For the purpose of water consumption, the typical occupancy is taken as 200 for the Arena and 60 for the Curling Rink.
- Water fixtures in the Curling Rink are supplied by the Arena's water system. Therefore, the energy and water saving opportunities from these fixtures were attributed to the Arena.

Table 1 Energy Saving Opportunities for the Arena

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
ENVELOPE										
Add weather strip to existing doors in ice plant room -all of 3'x7' size	2	$15	$15	$50	$147	$147	3,804	$145	1.0	1.0
Envelope Subtotal					**$147**	**$147**	**3,804**	**$145**		
HVAC										
Install motorized damper in ice plant room.	1	$300	$300	$300	$678	$678	11,138	$669	1.0	1.0
Install outdoor thermostat to control rink ventilation	1	$900	$900	$900	$2,034	$2,034	22,684	$1,362	1.5	1.5
Add CO_2 Control to RTUs.	3	$900	$900	$300	$4,068	$4,068	40,932	$2,458	1.7	1.7
HVAC Subtotal					**$6,780**	**$6,780**	**74,754**	**$4,488**		
HOT WATER										
Install water efficient metering faucets	33	$309	$309	$150	$17,116	$17,116	23,721	$902	19.0	19.0
Install timer to control domestic water heating system.	1	$100	$100	$50	$170	$170	1,756	$67	2.5	2.5
Water Subtotal					**$17,286**	**$17,286**	**25,477**	**$969**		

Totals	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	1,079,910	$52,225	139.21
Estimated Annual Savings	104,035	$5,602	8.14
Percent Savings	10%	11%	6%

* NI = Cost does not include incentives, WI = Cost includes incentives

** The total cost column includes 13% taxes.

*** As of April 2005, the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro's website) and the average cost of propane is 0.0573 $/kWh.

Table 2 Water Saving Opportunities for the Arena[1]

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	33	$309	$150	$17,116	80%	632,995	$348
Install water efficient toilets.	32	$284	$150	$15,693	34%	515,585	$284
Install water efficient urinals	4	$344	$200	$2,459	29%	36,309	$20

* The total cost column includes 13% taxes.

[1] Includes water fixtures from the curling rink.

2.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary for the Arena is shown in Appendix B, Table B.1.3. The lighting is already all energy efficient and does not need upgrading. Therefore, no energy saving opportunities was available for the Arena's lighting.

Envelope

The only energy saving opportunity found in the building's envelope is to add new weather stripping and caulking to the existing two pedestrian doors in the ice plant room. This would reduce energy loss due to infiltration; saving over 3,800 kWh of electric energy is less than one year. Table B.1.4 shows the details of this ESO.

HVAC

Significant ESOs in terms of the heating and ventilation system are available for the Arena. Installing an outdoor thermostat to control the rink area's ventilation would result in substantial energy savings of 22,684 kWh in one year. This thermostat would monitor outside temperatures. When temperatures are between –5°C and –15°C, exhaust fans within the arena are turned on, drawing in cool air from the outside into the rink area through the make up air unit to make ice. The existing controls on the rink makeup air unit would have to be modified to include an "ice making" cycle. This air will maintain the ice rink at the desired temperature, reducing the burden on the ice plant refrigeration systems, thus reducing energy consumption. Other ESOs associated with the Arena's HVAC system include replacing the existing back draft damper with a motorized damper in the ice plant room and installing CO_2 controls on the existing three roof top units (RTUs). Together, these ESOs would save over 52,000 kWh of energy per year.

Water

Water savings for the Arena are shown above in Table 2. As previously stated, the Curling Rink is supplied by the Arena's water system. Therefore, ESOs and WSOs associated with the Curling Rink are attributed to the Arena and are shown as such in Table 2.

Savings are shown as annual savings in litres, in percentage and cost. Table B.1.5 in Appendix B shows the estimated water consumption results that were calculated based on typical water fixtures and estimations on the occupancy of the Arena and Curling Rink.

Replacing existing faucets and toilets with water efficient fixtures would result in an 80% and 34% water savings respectively. The existing toilets use 6 litres per flush (LPF) and would be upgraded to a dual flush unit that on average uses 3.98 LPF.

The current showers are water efficient fixtures complete with auto shut off low flow capabilities. Therefore, upgrades to these fixtures were not required. Of the existing urinals, only 4 need to be upgraded to low flow fixtures, resulting in a 29% water savings opportunity.

In addition to saving water, upgrading the existing faucets to water efficient metering faucets would save nearly 24,000 kWh of energy per year. Installing a timer to control the pumps for the domestic water heating system would allow the pumps to turn off during non-occupancy, saving over 1,700 kWh per year.

Operational

The ice rink is currently flooded eight times each day the Arena is in use. The facility is in use for 258 days of the year and each ice flooding uses 50 gallons of hot water. The zamboni-shaved ice is already deposited outside, saving both energy and labour that would otherwise be used to melt the shavings indoors.

Motors

The existing ice plant motors are already high efficiency units and do not require upgrading. Table B.1.7 shows the consumption and efficiency of these units.

2.4 OPERATION AND MAINTENANCE

Based on the inspection of this facility, the following operation and maintenance activities should be performed immediately to reduce energy consumption:

- Modify the Arena rooftop unit (RTU-2) to discharge cold air for ice making, reducing the energy load on the ice plant. Use this unit to provide natural ventilation of the rink in the winter when the outdoor temperature is between –5°C and –15°C; energy is saved by reducing the runtime of the refrigeration equipment.
- Ensure that the water used for flooding is pure, the presence of salts lower the freezing point of water and air in the water acts like insulation, making it harder for the brine in the slab to freeze the top layer of the ice.
- Keep the ice thin (1” thick). Excessive ice thickness increases the load on the compressor. Shaving the ice helps to reduce the ice thickness and removes concentrations of impurities.
- Maintain the brine at a specific gravity of 1.2 to 1.22 for optimum energy use and maintain the brine temperature as high as possible.
- Significant amounts of energy can be saved by recovering heat from the refrigeration equipment and using it for flood water heating, space heating, domestic water heating or ice melting. The refrigeration cycle currently extracts heat from the ice and rejects it through the evaporative condensers to the outside. This heat could be reclaimed by installing a heat exchanger that extracts heat from the ammonia cycle and through the use of mechanical sub-systems, this heat can be used for flood water heating, space heating, domestic water heating or ice melting as mentioned above.

For additional information, refer to the Manitoba Hydro “Guidelines for Operators of Manitoba’s Rinks and Arenas”, available for downloading at the following website:

http://www.hydro.mb.ca/power_smart_for_business/recreation_manitoba_rinks.pdf

Refer to Section 12 for more information.

3.0 CAMPGROUND OFFICES & CHANGEROOMS

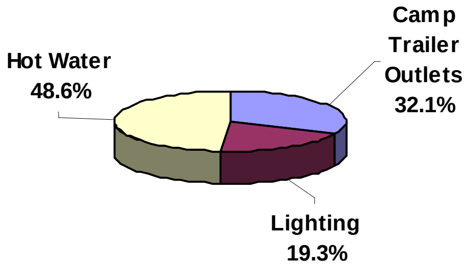
3.1 BACKGROUND

The Campground Offices and Changeroom facility is a 144 square metre building. The former owner sold the facility to a neighbouring business and it is uncertain at this time whether the Campground Offices and Changerooms will remain open in the future. For the purpose of this audit, we calculated energy and water saving opportunities based on the previous year's energy usage and occupancy. In past years the building was open during the summer season, from May to the middle of September for 12 hours a day, seven days a week.

Photo 2 - Campground Offices/Changerooms

For the previous year, the annual electricity consumption was 32,610 kWh at a cost of $2,428. The following pie chart shows the energy breakdown for the facility.

Energy Breakdown (% of Total kWh) for the Campground Offices & Changerooms



The building has four each of showers and sinks, five toilets and one urinal. All are high flow water fixtures. Estimates were made on the frequency at which the fixtures were used.

3.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 3 and 4 show a summary of energy and water saving opportunities for the Campground Offices & Changerooms. The following assumptions were made in the analysis:

- The Campground Offices/Changerooms are occupied from the start of May until the middle of September, for 12 hours per day, seven days a week.
- For the purpose of water consumption, the typical occupancy of the building is 15.
- The facility is not heated.
- All existing windows are double pane.

Table 3 Energy Saving Opportunities for the Campground Offices/Changerooms

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Fluorescents - Convert 4' T12s to 4' T8s (4' x2)	24	$41	$21	$0	$1,112	$570	708	$42	26.2	13.4
Incandescents - Convert to compact fluorescents	5	$15	$10	$13	$158	$130	218	$13	12.1	9.9
Replace outdoor incandescent lamps with high-pressure sodium lights.	3	$125	$100	$125	$848	$763	2,957	$178	4.8	4.3
Lighting Subtotal					**$2,118**	**$1,462**	**3,882**	**$233**		
HOT WATER										
Install water efficient showers	4	$21	$21	$50	$321	$321	4,025	$308	1.0	1.0
Water Subtotal					**$321**	**$321**	**4,025**	**$308**		

Totals	Energy (kWh)	Cost ($)	CO$_2$ (Tonnes)
Existing Annual Consumption/Cost/Emissions	32,610	$2,428	0.97
Estimated Annual Savings	7,907	$541	0.24
Percent Savings	24%	22%	25%

* NI = Cost does not include incentives, WI = Cost includes incentives
* *The total cost column includes 13% taxes.
*** As of April 2005, the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro's website).

Table 4 Water Saving Opportunities for the Campground Offices & Changerooms

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	4	$309	$150	$2,075	80%	12,822	$7
Install water efficient toilets.	5	$284	$150	$2,452	70%	50,809	$28
Install water efficient showers.	4	$21	$50	$321	29%	107,418	$59
Install water efficient urinals.	1	$344	$200	$615	60%	8,618	$5

* The total cost column includes 13% taxes.

3.3 GENERAL RECOMMENDATIONS

Lighting

Replacing the existing 4' T12 fluorescent lights when they are burnt out with T8 lamps would save over 700 kWh per year. Other lighting ESOs includes upgrading the indoor incandescent lights with compact fluorescents and replacing the existing outdoor lighting with high pressure sodium lamps. The lighting analysis summary table is shown in Appendix B, Table 2.3.

Water

The water analysis summer table for the Campground Changerooms/Offices is shown in Table B.2.4 in Appendix B. Replacing the existing faucets and toilets with water efficient fixtures would save 80% and 70% of their respective current water consumption. Upgrading the showers and urinals would generate a 29% and 60% water consumption savings.

4.0 CURLING RINK

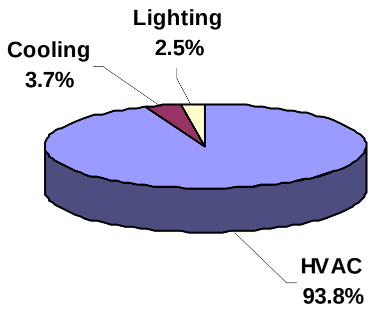
4.1 BACKGROUND

Constructed in 1976, the 290 square metre Curling Rink is attached to the Arena and is comprised of a lobby area, six rinks and a lounge on the second floor. The building is occupied for six months of the year, for 8 hours a day, seven days a week. For the remaining six months the building is closed. Maximum occupancy of the building is 60 people.

Photo 3 – Curling Rink

The Curling Rink has a metal clad exterior and interior along with a flat roof. Renovations to the facility occurred in 1985 when the second floor was added and a roof top unit was added for the lounge area. In the previous year, the building consumed 401,760 kWh of electric energy and 24,427 kWh of propane. The costs were $23,501 and $1,576 respectively. The following pie chart illustrated the breakdown of energy use for the building.

Energy Breakdown (% of Total kWh) for the Curling Rink



For the purposes of water consumption, estimates were made on the frequency at which the water fixtures are used. The Curling Rink’s water is supplied from the Arena’s system. Therefore, any water saving opportunities that were found was credited to the Arena, including the costs associated with upgrading plumbing fixtures.

4.2 ENERGY AND WATER SAVING OPPORTUNITIES

Table 5 shows the summary of energy efficiency improvement opportunities for the Curling Rink. The following assumptions were made in the calculations:

- The Curling Rink is occupied for six months of the year, 8 hours a day, seven days a week.
- Hot water is supplied by the Arena’s water system.
- All water fixtures and their associated upgrades are listed under the Arena.

Table 5 Energy Saving Opportunities for the Curling Rink

Description	Qty	Installed Cost/Unit ($)			Total Cost ** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Lounge - Convert 4' T12s to 4' T8s (7x4)	28	$32	$12	$0	$1,025	$392	795	$48	21.5	8.2
Lobby - Convert 4' T12s to 4' T8s (12x4)	48	$32	$12	$0	$1,756	$671	1,363	$82	21.5	8.2
Rink Area - Convert 8' T12s to 8' T8s (8'x2)	24	$47	$12	$0	$1,283	$334	2,167	$130	9.9	2.6
EXIT signs - Convert to LED modules	5	$50	$5	$80	$735	$480	1,183	$71	10.3	6.8
Lighting Subtotal					**$4,798**	**$1,877**	**5,507**	**$331**		
ENVELOPE										
Add weather strip to pedestrian door (3'x7').	1	$15	$15	$50	$73	$73	1,541	$93	0.8	0.8
Replace double pane window - 3'x6' + seal all windows	13	$805	$772	$100	$13,294	$12,810	13,857	$832	16.0	15.4
Replace double pane window - 44"x56" + seal all windows	16	$1,035	$1,003	$100	$20,521	$19,942	15,993	$960	21.4	20.8
Upgrade roof insulation in lobby area.	1	$9,360	$6,895	$3,500	$14,532	$11,747	15,203	$1,885	7.7	6.2
Envelope Subtotal					**$48,421**	**$44,572**	**46,594**	**$3,769**		
HVAC										
Setback Thermostats to 15°C (59°F)	1	$300	$300	$300	$678	$678	33,372	$2,004	0.3	0.3
HVAC Subtotal					**$678**	**$678**	**33,372**	**$2,004**		

Totals	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	426,187	$25,076	17.47
Estimated Annual Savings	85,472	$6,104	2.55
Percent Savings	20%	24%	15%

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 13% taxes.
*** As of April 2005 the cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the average cost of propane is 0.0573 $/kWh.

4.3 GENERAL RECOMMENDATIONS

Lighting

Energy saving opportunities to the Curling Rink's lighting includes converting the 4' T12s both in the lounge and lobby areas to 4' T8s and upgrading the 8' T12s in the rink area to T8s. Over 4,000 kWh of energy would be saved by these ESOs with payback periods ranging from 2.6 to just over 8 years. Upgrading the existing exit signs to LED modules would save nearly 1,200 kWh in less than 7 years. The lighting analysis summary table for the Curling Rink is listed as Table B.3.3 in Appendix B.

Envelope

Substantial energy saving opportunities are found within the Curling Rink's building envelope. ESOs with short payback periods include adding new weather stripping to the existing pedestrian door and upgrading the roof insulation in the lobby area. Estimated energy savings for these ESOs range from 1,500 to over 15,200 kWh. Replacing all existing double pane windows with energy efficient triple pane units, complete with caulking would save nearly 30,000 kWh in 15.5 to 21 years.

HVAC

Installing a setback feature on the thermostat would reduce the building's temperature to 15 °C when it is unoccupied, saving 33,372 kWh of energy per year in less than half a year. Details for this ESO are found in Table B.3.4 in Appendix B.

Water

As previously stated, the Curling Rink is supplied by the Arena's water system. The energy and water used by the Rink are billed to the Arena; therefore any water or energy savings associated with the Rink's water system are located under the Arena.

4.4 OPERATION AND MAINTENANCE

The following operation and maintenance activities should be performed immediately to reduce energy consumption:

- Replace the damaged condenser coil and economizer on the roof top unit.
- Keep the ice thin (1” thick). Excessive ice thickness increases the load on the compressor. Shaving the ice helps to reduce the ice thickness and removes concentrations of impurities.
- Maintain the brine at a specific gravity of 1.2 to 1.22 for optimum energy use and maintain the brine temperature as high as possible.
- Significant amounts of energy can be saved by recovering heat from the refrigeration equipment and using it for flood water heating, space heating, domestic water heating or ice melting.

For additional information, refer to the Manitoba Hydro “Guidelines for Operators of Manitoba’s Rinks and Arenas”, available for downloading at the following website:

http://www.hydro.mb.ca/power_smart_for_business/recreation_manitoba_rinks.pdf

Refer to Section 12 for more information.

5.0 FIRE HALL & MUNICIPAL ADMINISTRATION BUILDING

5.1 BACKGROUND

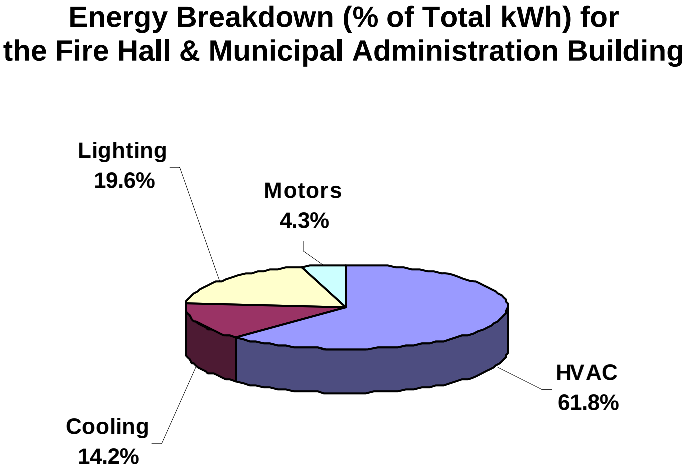
The Fire Hall and Municipal Administration Building share the same facility. Both areas share energy meters and bills, despite operating on different hours. For the purpose of this audit, we are analyzing the areas together.

The entire facility was constructed in 1971 with the Fire Hall portion occupying 602 square meters and the Municipal Administration area occupying 543 square meters. On average the Fire Hall is occupied for 45 hours a week all year long whereas the Municipal Administration area for 40 hours a week. The building is constructed of masonry interior and exterior along with metal cladding. The roof is a flat built up type and was upgraded in 1994 along with the walls.

Photo 4 - Fire Hall

For the previous year, the Fire Hall and Municipal Administration Building consumed 206,240 kWh of electricity and 163,468 kWh of propane. Total costs were $12,676 and $10,020 respectively.

Photo 5 - Municipal Administration Building



The Fire Hall has six sinks, four toilets, two urinal and two showers. The Municipal Administration area has an additional eight sinks, six toilets and two urinals. All of these units are high flow water fixtures. Assumptions were made on the frequency with which the water fixtures are used.

5.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 6 and 7 show summaries of the energy and water saving opportunities for the Fire Hall & Municipal Administration Building. The following assumptions were made in the calculations:

- The Fire Hall is occupied for 45 hours per week, whereas the Municipal Administration area is occupied for 40 hours per week.
- The temperature of the building is maintained at 21°C (70°F).
- For the purpose of water consumption, typical occupancy for the Fire Hall is 10 and for the Municipal Administration area 20.
- The parking lot controllers are used for 8 hours a day, 100 days of the year.

Table 6 Energy Saving Opportunities for the Fire Hall & Municipal Admin. Building

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$	NI*	WI*
LIGHTING & PARKING LOT CONTROLLERS										
Fire Hall										
Main floor fluorescents - Convert 4' T12s to 4' T8s (4' x2)	86	$41	$21	$0	$4,003	$2,059	3,924	$510	7.9	4.0
Second floor fluorescents - Convert 4' T12s to 4' T8s (4'x2)	100	$41	$21	$0	$4,633	$2,373	4,563	$274	16.9	8.7
Incandescents - Convert to compact fluorescents	5	$15	$10	$13	$158	$130	842	$51	3.1	2.6
EXIT signs - Convert to LED modules	9	$50	$5	$80	$1,322	$864	2,129	$128	10.3	6.8
Install parking lot controllers.	5	$100	$75	$150	$1,413	$1,271	1,200	$72	19.6	17.6
Municipal Admin.Building										
Basement fluorescents - Convert 4' T12s to 4' T8s (4'x2).	110	$41	$21	$0	$5,096	$2,610	4,462	$268	19.0	9.7
First floor fluorescents - Convert 4' T12s to 4' T8s (4'x2)	160	$41	$21	$0	$7,413	$3,797	6,490	$390	19.0	9.7
Main floor fluorescents - Convert 4' T12s to 4' T8s (4'x2)	150	$41	$21	$0	$6,950	$3,560	6,084	$365	19.0	9.7
EXIT signs - Convert to LED modules	9	$50	$5	$80	$1,322	$864	2,129	$128	10.3	6.8
Lighting Subtotal					**$32,309**	**$17,529**	**31,822**	**$2,185**		
ENVELOPE										
Fire Hall										
Add weather stripping & caulking to doors - 3'x7' size.	3	$15	$15	$50	$220	$220	5,706	$343	0.6	0.6

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$	NI*	WI*
Upgrade double pane windows (4'x3' size).	14	$400	$380	$100	$7,910	$7,594	14,554	$874	9.1	8.7
Add new caulking to double pane windows (4'x3' size).	14	$5	$5	$15	$316	$316	7,456	$448	0.7	0.7
Upgrade roof insulation when roof replacement is required.	1	$8,294	$6,934	$4,000	$13,893	$12,355	20,420	$1,226	11.3	10.1
Municipal Admin.Building										
Add weather stripping & caulking to doors - 4'x7' size	4	$15	$15	$50	$294	$294	8,369	$513	0.6	0.6
Upgrade double pane windows (48"x40" size).	10	$425	$400	$100	$5,933	$5,650	11,551	$708	8.4	8.0
Add new caulking to windows (48"x40" size).	10	$5	$5	$15	$226	$226	5,580	$342	0.7	0.7
Upgrade double pane windows (30" x 12" size).	2	$180	$175	$100	$633	$622	433	$27	23.8	23.4
Add new caulking to windows (30" x 12" size).	2	$5	$5	$15	$45	$45	533	$33	1.4	1.4
Add new caulking to double pane windows (36"x56" size)	6	$5	$5	$15	$136	$136	3,500	$214	0.6	0.6
Upgrade roof insulation when roof replacement is required.	1	$7,475	$6,249	$4,000	$12,967	$11,581	22,585	$1,356	9.6	8.5
Envelope Subtotal					**$42,572**	**$39,039**	**100,687**	**$6,082**		
HVAC										
Fire Hall										
Setback Thermostats to 15°C (59°F)	2	$300	$300	$300	$1,356	$1,356	16,775	$1,007	1.3	1.3
Municipal Admin. Building										
Setback Thermostats to 15°C (59°F)	2	$300	$300	$300	$1,356	$1,356	17,455	$1,048	1.3	1.3
HVAC Subtotal					**$2,712**	**$2,712**	**34,230**	**$2,055**		
MOTORS										
Fire Hall										
Upgrade motor on air handler with a premium efficiency motor.	1	$212	$212	$0	$240	$240	470	$28	8.5	8.5
Municipal Admin.Building										
Upgrade fan motor with a premium efficiency motor (3 HP).	1	$212	$212	$0	$240	$240	112	$7	35.7	35.7
Upgrade fan motor with a premium efficiency motor (5 HP).	1	$236	$236	$0	$267	$267	186	$11	23.9	23.9
Motor Subtotal					**$746**	**$746**	**768**	**$46**		
HOT WATER										
Install water efficient metering showerheads.	2	$21	$21	$50	$160	$160	2,077	$125	1.3	1.3
Insulate hot water piping.	1	$50	$50	$50	$113	$113	488	$29	3.9	3.9
Hot Water Subtotal					**$273**	**$273**	**2,564**	**$154**		

Totals	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	369,708	$22,696	43.05
Estimated Annual Savings	170,071	$10,522	15.31
Percent Savings	46%	46%	36%

* NI = Cost does not include incentives, WI = Cost includes incentives

* *The total cost column includes 13% taxes.

*** As of April 2005 the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro's website) and the average cost of propane is 0.0573 $/kWh.

Table 7 Water Saving Opportunities for the Fire Hall & Municipal Admin. Building

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	18	$309	$150	$9,336	80%	39,786	$22
Install water efficient toilets.	12	$284	$150	$5,885	70%	95,444	$52
Install water efficient showers.	2	$21	$50	$160	29%	55,414	$30
Install water efficient urinals.	5	$344	$200	$3,074	51%	31,122	$17
Replace existing air conditioner in Fire Hall with a ductless split system air conditioner.	1	$2,500	$1,000	$3,955	100%	490,320	$270

* The total cost column includes 13% taxes

5.3 GENERAL RECOMMENDATIONS

Lighting

Upgrading the existing T12s to T8s when they are burnt out, in both areas of the building would save over 25,500 kWh of energy a year. Payback periods associated with these ESOs range from just over 4 years to less than 10 years. Replacing the EXIT incandescent light with LED modules would save nearly 4,300 kWh per year, reducing their current energy consumption by over 80%. Converting the indoor incandescent lamps to compact fluorescents would save nearly 850 kWh in just over 2.5 years. Installing parking lot controllers would save 1,200 kWh per year in less than 18 years. Table B.4.3 in Appendix B shows the lighting summary analysis for the Fire Hall & Municipal Administration Building.

Envelope

Energy saving opportunities to the building's envelope generates over 100,500 kWh of savings per year, 27% of the current energy consumption. Short term ESOs for this component include adding new weather stripping and caulking to the existing pedestrian doors, adding new caulking to the windows and upgrading the roof insulation. These ESOs would generate over 60,500 kWh of savings per year with payback periods ranging from 0.6 to 3.3 years. Longer term ESOs include replacing double pane windows with high efficiency triple pane units, both in the Fire Hall and Municipal Administration area. Together, these ESOs would save over 40,100 kWh per year. Associated payback periods range from 5.9 to less than 20 years.

HVAC

Installing setback features on the existing thermostats in both areas of the facility would save over 34,200 kWh per year in less than 1.5 years. This feature would program the temperature of the building to be lowered to 15°C (59°F) during unoccupied times and to be maintained at 21°C (70°F) during occupancy. Table B.4.4 in Appendix B shows details of these ESOs.

Motors

Replacing the existing motors in the Fire Hall and Municipal Administration areas with premium efficiency motors would save over 760 kWh of energy annually.

Water

Table B.4.5 in Appendix B shows the results from the Fire Hall/Municipal Administration Building's water usage. Plumbing fixtures from the Friendship Centre are supplied by the Fire Hall/Municipal Administration Building's water supply. Therefore, those fixtures were included under the Fire Hall/Municipal Administration Building's when determining energy and water saving opportunities.

Replacing the existing faucets and toilets with low flow fixtures would save 80% and 70% of the current water consumption. Replacing the showers and urinals would save 29% and 51%

respectively. Insulating the existing hot water tank piping would save 488 kWh of energy per year.

The existing air-conditioning unit in the Fire Hall runs on cold water. It operates for three months of the year, for 4 hours each day at 22.7 litres per minute. By replacing this unit with a ductless split system air conditioner, 490,320 litres of water would be saved per year.

Other Issues

In addition to the ESOs discussed above, other building issues were noted during the audit. Gas fumes from the truck bay were leaking into other areas of the building. It is recommended that an exhaust fan be installed in the garage area to provide negative pressure in the garage relative to the building. A negative pressure in the garage would ensure that exhaust from the vehicles does not leak into other areas of the building. A vehicle exhaust detector should also be considered to monitor levels of exhaust in the garage and control the exhaust fan.

6.0 FRIENDSHIP CENTRE

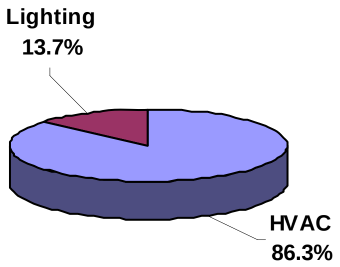
6.1 BACKGROUND

The Friendship Centre is 508 square meters in area and is attached to the Fire Hall & Municipal Administration Buildings. The Centre has its own energy meter and is billed separate to the other two areas. It is occupied from Monday to Friday, 8 hours each day, all year long. The walls are composed of below grade concrete and a substandard roof with R12 values in both areas.

Photo 6 - Friendship Centre

For the previous year, the Friendship Centre consumed 105,000 kWh of electric energy at a cost of $7,172. The following pie chart shows how the energy is utilized.

Energy Breakdown (% of Total kWh) for the Friendship Centre



The Friendship Centre has four sinks, two toilets and one urinal, all high flow fixtures. To estimate water saving opportunities, assumptions were made on the frequency of use of these fixtures. These fixtures are supplied by the water system from the Fire Hall/Municipal Administration Building, which is billed both for the energy and water consumed. Therefore, any WSOs and associated ESOs for the Friendship Centre are listed under the Fire Hall/Municipal Administration Building.

6.2 ENERGY SAVING OPPORTUNITIES

Table 8 shows the summary of the energy saving opportunities for the Friendship Centre. The following assumptions were made in the calculations:

- The Centre is occupied for 40 hours a week, all year long.
- The temperature is maintained at 21°C (70°F).
- Domestic water is supplied by the Fire Hall/Municipal Administration Building and billed to that facility.
- Water saving opportunities and their associated energy saving opportunities are listed under the Fire Hall/Municipal Administration Building.

Table 8 Energy Saving Opportunities for the Friendship Centre

Description	Qty	Installed Cost/Unit ($)			Total Cost ** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Fluorescents - Convert 4' T12s to 4' T8s (4' x2)	124	$41	$21	$0	$5,745	$2,943	5,029	$302	19.0	9.7
Incandescents - Convert to compact fluorescents	6	$15	$10	$13	$190	$156	899	$54	3.5	2.9
EXIT signs - Convert to LED modules	2	$50	$5	$80	$294	$192	473	$28	10.3	6.8
Install parking lot controllers.	4	$100	$75	$150	$1,130	$1,017	960	$58	19.6	17.6
Lighting Subtotal					**$7,359**	**$4,308**	**7,361**	**$442**		
ENVELOPE										
Add new weather stripping & caulking to existing door - 3'x7' size	1	$15	$15	$50	$73	$73	1,541	$93	0.8	0.8
Upgrade double pane windows - (3.5' x 1') + seal all.	9	$320	$314	$100	$4,271	$4,205	3,391	$150	28.5	28.1
When replacing the roof, upgrade insulation.	1	$12,312	$9,576	$2,000	$16,173	$13,081	26,664	$1,601	10.1	8.2
Upgrade insulation on one wall.	1	$912	$707	$800	$1,935	$1,703	2,539	$152	12.7	11.2
Envelope Subtotal					**$22,452**	**$19,062**	**34,135**	**$1,996**		
HVAC										
Setback Thermostats to 15°C (59°F)	2	$300	$300	$300	$1,356	$1,356	6,915	$415	3.3	3.3
Add CO_2 sensor on ventilation system.	1	$900	$900	$300	$1,356	$1,356	3,248	$195	7.0	7.0
Replace leaky motorized damper with insulated dampers.	1	$300	$300	$300	$678	$678	4,511	$271	2.5	2.5
HVAC Subtotal					**$3,390**	**$3,390**	**14,674**	**$881**		

Totals	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	105,000	$7,172	3.13
Estimated Annual Savings	56,171	$3,319	1.67
Percent Savings	53%	46%	53%

* NI = Cost does not include incentives, WI = Cost includes incentives

* *The total cost column includes 13% taxes.

*** As of April 2005 the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro’s website).

6.3 GENERAL RECOMMENDATIONS

Lighting

Replacing the existing 4’ T12s with 4’ T8s would save over 5,000 kWh of energy per year. By waiting to upgrade the lighting until the current units are burnt out, the payback period is kept under 10 years. Converting the incandescent lamps to compact fluorescents would save nearly 900 kWh in less than 3 years. Other ESOs include replacing the incandescent EXIT lights with LED modules and installing parking lot controllers. Together, over 1,400 kWh of energy would be saved per year. The lighting analysis summary for the Friendship Centre is founding Appendix B, Table B.5.3.

Envelope

Installing new weather stripping and caulking on the existing pedestrian door would save 1,541 kWh of energy that is currently lost to infiltration. The payback period associated with this ESO is very short at less than one year. Longer ESOs include upgrading the existing double pane windows with high efficiency triple pane units, complete with new sealant and upgrading the insulation both in the roof and one wall. These ESOs should be considered long-term projects and be undertaken as such. In total, 34,135 kWh of energy could be saved by ESOs available to the Friendship Centre’s building envelope, nearly 33% of the current energy consumption. Details of these ESOs are shown in Table B. 5.4 in Appendix B.

HVAC

Installing setback features on the thermostats is the only ESO available in the Centre’s HVAC. By programming the thermostats to 15°C (59°F) during unoccupied times and 21°C (70°F) during occupancy only, nearly 7,000 kWh of energy would be saved. With a payback period of just over 3 years, this ESO is a very feasible option. Other ESOs include replacing the existing leaky damper with an insulated damper and installing a CO_2 sensor on the ventilation system. Together these two ESOs would save over 7,700 kWh of energy per year.

Water

As previously stated, the Friendship Centre gets its domestic water from the Fire Hall/Municipal Administration Building. The latter is billed for both the energy and water used by the plumbing fixtures. Therefore, any WSOs and associated ESOs for the Centre are shown under the Fire Hall/Municipal Administration Building and credited to there.

6.4 OPERATION AND MAINTENANCE

Based on the inspection of this facility, the following operation and maintenance activities should be performed immediately to reduce energy consumption:

- Clean both electric unit heaters.
- Replace the existing dirty furnace filter.
- Provide a duct access door for damper maintenance.
- Repair fresh air damper that is currently disconnected.

Refer to Section 12 for more information.

7.0 LIBRARY

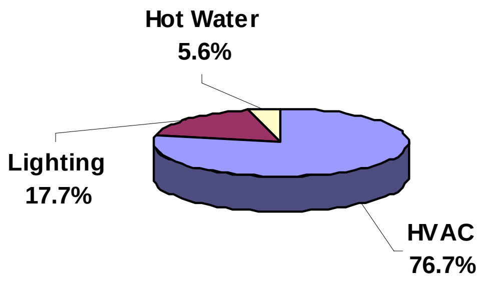
7.1 BACKGROUND

Built in 1929, the Library is a 246 square metre facility that contains a basement level and main floor. The main floor contains the library (open concept, 2 storeys high) and annex in the back. This building was formally a powerhouse and still contains a large industrial grade makeup air Renovations to the Library were done in 1975 and included high bay metal halide lighting and some T8 lamps. The Library is occupied from Monday to Friday for 11.5 hours each day and for four hours on Saturdays. The building has a masonry exterior and plaster interior with a flat roof. R-values for the walls and roof were unknown but likely poor as this building has the highest energy consumption per area of the buildings we toured.

Photo 7 - Library

In the previous year, the Library used 144,240 kWh of electric energy at a cost of $9,225. The following pie chart shows how the facility consumes the energy.

Energy Breakdown (% of Total kWh) for the Library



The Library has four toilets and four sinks, all high flow fixtures. Estimates were made on the frequency of use of these fixtures.

7.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 9 & 10 show the energy and water saving opportunities for the Library. The following assumptions were made in the analysis:

- The Library is occupied from 8:30am until 8:00 pm Monday to Friday and for four hours on Saturdays.
- For the purpose of water consumption, typical occupancy of the Library is assumed to be 40.

Table 9 Energy Saving Opportunities for the Library

Description	Qty	Installed Cost/Unit ($)			Total Cost ** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Fluorescents - Convert 4' T12s to 4' T8s (4' x2).	112	$41	$21	$0	$5,189	$2,658	6,984	$419	12.4	6.3
Incandescents - Convert to compact fluorescents.	14	$15	$10	$13	$443	$364	3,224	$194	2.3	1.9
EXIT signs - Convert to LED modules.	6	$50	$5	$80	$881	$576	1,419	$85	10.3	6.8
Install parking lot controllers.	4	$100	$75	$150	$1,130	$1,017	960	$58	19.6	17.6
Lighting Subtotal					**$7,643**	**$4,615**	**12,587**	**$756**		
ENVELOPE										
Add weather strip to existing doors - 3'x7' size	2	$15	$15	$50	$147	$147	3,081	$185	0.8	0.8
Replace window - 40"x40" + seal.	7	$380	$340	$100	$3,797	$3,480	8,331	$500	7.6	7.0
Replace window - 48"x48" + seal.	6	$465	$425	$100	$3,831	$3,560	9,694	$582	6.6	6.1
Replace window - 36"x24" + seal.	4	$425	$385	$100	$2,373	$2,192	2,917	$175	13.6	12.5
Replace window - 24"x48" + seal.	4	$430	$390	$100	$2,396	$2,215	3,725	$224	10.7	9.9
Upgrade roof insulation when roof is being replaced.	1	$7,000	$6,440	$3,000	$11,300	$10,667	29,237	$1,755	6.4	6.1
Envelope Subtotal					**$23,843**	**$22,261**	**56,985**	**$3,421**		
HVAC										
Replace existing dampers with insulated dampers.	2	$300	$300	$300	$1,356	$1,356	18,044	$1,083	1.3	1.3
Install HRV.	1	$950	$950	$1,000	$2,204	$2,204	13,169	$791	2.8	2.8
HVAC Subtotal					**$3,560**	**$3,560**	**31,212**	**$1,874**		
HOT WATER										
Install water efficient metering faucets	4	$309	$309	$150	$2,075	$2,075	2,589	$155	13.3	13.3
Insulate copper piping on HWT	1	$25	$25	$25	$57	$57	244	$15	3.9	3.9
Replace HWT with instantaneous water heater.****	2	$300	$300	$400	$1,582	$1,582	2,389	$143	11.0	11.0
Water Subtotal					**$3,713**	**$3,713**	**5,221**	**$313**		

Totals	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	144,240	$9,225	4.30
Estimated Annual Savings	106,005	$6,364	3.16
Percent Savings	73%	69%	73%

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 13% taxes.
*** As of April 2005 the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro’s website).
**** Discounted to include the cost of replacement water tank in 10 years.

Table 10 Water Saving Opportunities for the Library

Description	**Qty**	**Installed Cost/Unit ($)**		**Total Cost* ($)**	**Annual Water Savings (%)**	**Annual Water Savings (L)**	**Annual Cost Savings ($)**
		Material	**Labour**				
Install water efficient metering faucets.	4	$309	$150	$2,075	80%	69,077	$38
Install water efficient toilets.	4	$284	$150	$1,962	70%	333,511	$183

* The total cost column includes 13% taxes

7.3 GENERAL RECOMMENDATIONS

Lighting

Replacing the 4’ T12s with 4’ T8 lamps and ballasts would save nearly 7,000 kWh of energy per year. By waiting to replace the existing lights until they are burnt out, the payback period is kept to a reasonable length of just over 6 years. Upgrading the existing incandescent lamps with compact fluorescents would save over 3,200 kWh in under two years. Other ESOs include replacing the incandescent EXIT lights with LED modules and installing parking lot controllers. Together, over 2,300 kWh of energy would be saved per year. The lighting analysis summary for the Library is found in Appendix B, Table B.6.3.

Envelope

Significant ESOs are available with the building’s envelope, all under a 13-year payback period. Weather stripping and caulking the existing pedestrian door saves over 3,000 kWh a year. With a payback period of less than one year, this ESO is a feasible option. Other ESOs for the Library’s envelope are to upgrade existing double pane windows with high efficiency triple pane windows, complete with new caulking. Paybacks associated with these ESOs range from 6.2 to just less than 13 years.

HVAC

The existing makeup air unit is grossly oversized for the library, contributing to very high ventilation costs in the winter. A much smaller HRV should be installed to save ventilation-heating costs. Over 13,100 kWh of energy would be saved annually by installing the smaller HRV. Upgrading the existing dampers with insulated dampers would save a significant 18,004 kWh per year with a short payback period of just over one year.

Envelope

An ESO with a longer payback period is to upgrade the existing roof insulation to R-40 when the roof needs replacement. Nearly 30,000 kWh would be saved by this energy saving opportunity in just over 6 years.

Water

Replacing the existing water fixtures with low flow, water efficient faucets and sinks would save 80% and 70% respectively of the current water use. Other ESOs associated with this building component are installing hot water heaters and insulating the copper piping on the tanks. Table B.6.5 in Appendix B shows the current and proposed water usage in the Library.

7.4 OPERATION AND MAINTENANCE

Based on the inspection of this facility, the following operation and maintenance activities should be performed immediately to reduce energy consumption:

- Provide duct access doors to allow for servicing of the dampers. Due to hard access for servicing, these dampers are likely not closing properly, contributing to high infiltration losses.
- The temperature should be reduced when the area is unoccupied. Temperature should be lowered to 15°C (59°F) during non occupied times and returned to 21°C (70°F) during occupancy.

Refer to Section 12 for more information.

8.0 MUNICIPAL GARAGE

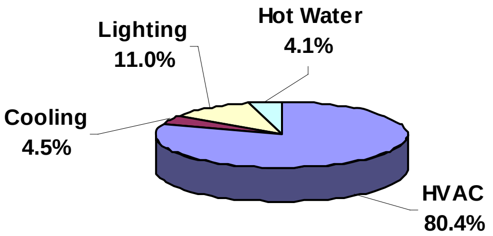
8.1 BACKGROUND

Built in 1974, the Municipal Garage is a 1,070 square metre metal clad structure that is occupied for 40 hours a week, all year long. There have been no renovations to the facility since its original construction.

Photo 8 - Municipal Garage

In the previous year, electric energy bills for the Municipal Garage totalled a very low 12,270 kWh at a cost of $1,048. Despite efforts of checking the energy bills with the town to confirm that they are correct, no additional energy bills were obtained for the building. Energy saving opportunities for the building were determined as if the existing energy bills were not accurate. Energy consumption for this building was estimated by using data from similar buildings and taking the building age and type of energy used into consideration. For the purpose of energy saving opportunities and breakdown of energy consumption, the estimated electrical consumption was used for the analysis. The following pie chart shows the breakdown of energy consumption for the building using the estimated total of 118,249 kWh.

Energy Breakdown (% of Total kWh) for the Municipal Garage



The Municipal Garage has four sinks, two toilets and one urinal, all high flow fixtures. Hot water consumed by these fixtures was calculated by estimating the occupancy of the building and the frequency at which these fixtures are used. From this, the total annual hot water consumption was established.

8.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 11 and 12 show the energy and water saving opportunities for the Municipal Garage. The following assumptions were made in the analysis:

- The Municipal Garage is occupied for 40 hours per week, year round.
- For the purpose of water consumption, typical occupancy is 6 in the building.
- The temperature of the building is maintained at 21°C (70°F).

Table 11 Energy Saving Opportunities for the Municipal Garage

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Fluorescents - Convert 8' T12s to 8' T8s (8'x2)	28	$47	$12	$0	$1,487	$380	5,773	$347	4.3	1.1
Incandescents - Convert to compact fluorescents	3	$15	$10	$13	$95	$78	906	$54	1.7	1.4
EXIT signs - Convert to LED modules	3	$50	$5	$80	$441	$288	355	$21	20.7	13.5
Lighting Subtotal					**$2,023**	**$746**	**7,033**	**$422**		
ENVELOPE										
Add weather stripping & caulking to existing pedestrian door.	2	$15	$15	$50	$147	$147	3,081	$185	0.8	0.8
Add weather stripping & caulking to existing overhead doors (various sizes).	6	$30	$30	$50	$542	$542	21,878	$666	0.8	0.8
Envelope Subtotal					**$689**	**$689**	**24,960**	**$851**		
HVAC										
Install solar wall.	1	$31,500	$21,500	$18,000	$55,935	$44,635	30,709	$1,844	30.3	24.2
Replace leaky dampers with insulated dampers.	4	$300	$300	$300	$2,712	$2,712	18,044	$1,083	2.5	2.5
HVAC Subtotal					**$58,647**	**$47,347**	**48,753**	**$2,927**		

Totals	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	118,249	$8,139	3.52
Estimated Annual Savings	80,746	$4,200	2.41
Percent Savings	68%	52%	68%

* NI = Cost does not include incentives, WI = Cost includes incentives

** The total cost column includes 13% taxes.

*** As of April 2005, the cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

**** Discounted to include the cost of replacement water tank in 10 years.

Table 12 Water Saving Opportunities for the Municipal Garage

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	4	$309	$150	$2,075	80%	7,987	$4
Install water efficient toilets.	2	$284	$150	$981	70%	14,461	$8
Install water efficient urinals	1	$344	$200	$615	69%	8,892	$5

* The total cost column includes 13% taxes.

8.3 GENERAL RECOMMENDATIONS

Lighting

Replacing the existing 8’ T12s with 8’ T8s would save over 5,770 kWh per year with a payback period just over one year. Other ESOs include upgrading the existing incandescent EXIT lamps with LED modules, reducing the energy consumption to 10% of the current usage and converting interior incandescent lamps to compact fluorescents. In total, over 7,000 kWh of energy could be saved by ESOs to the building’s lighting. Table B. 7.3 in Appendix B has the lighting analysis summary for the Municipal Garage.

Envelope

Adding weather stripping and caulking to the existing pedestrian doors and to the vehicle doors would save close to 25,000 kWh of energy that is currently lost due to infiltration. Payback periods are below one year with low associated capital expenditures, making these ESOs worthwhile to implement.

HVAC

The greatest ESOs for the Municipal Garage are found within the building’s HVAC. Replacing the leaky dampers with insulated dampers would save over 18,000 kWh of energy per year with a short payback period of 2.5 years. Installing a solar wall is an ESO with high capital expense, however nearly 31,000 kWh could be saved by this single option. The solar wall covers the entire south surface of the building and uses free heating from the sun to heat the make up air. In addition, the solar wall also reduces building heat loss during the winter. On the south wall, heat lost to the cavity between the building and the exterior metal panels of the solar wall is captured by the incoming air and returned to the building. The energy savings that would result from installing the solar wall are shown in Table 11. Unfortunately, the high installation cost associated with this opportunity results in a high payback period.

Water

As shown in Table 12, replacing the existing high flow water fixtures would reduce water consumption anywhere from 69% for the urinals to a high to 80% for the faucets.

9.0 MUSEUM

9.1 BACKGROUND

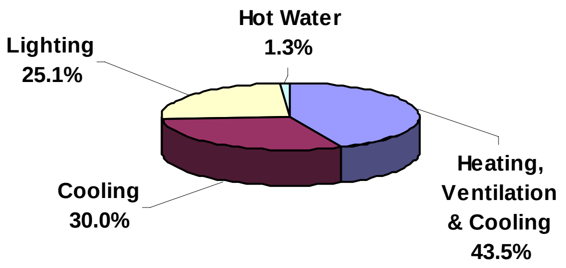
Originally a Court House constructed in 1916, the Museum is a three-story building with a masonry exterior. Insulation values in the roof and walls are an estimated R30 and R20 respectively. The main level of the building is approximately 371 square metres in area. The Museum is occupied for 40 hours per week, year round.

Photo 9 - Museum

In the previous year, the Museum consumed 203,040 of electricity at a cost of $12,765. The following pie chart shows the breakdown of energy consumption for this building.

The Museum's HVAC systems have been upgraded in recent years to conform to strict temperature and humidity requirements for museum artefacts. For this reason HVAC efficiency upgrades are limited in scope in comparison to standard buildings.

Energy Breakdown (% of Total kWh) for the Museum



The Museum has five sinks, six toilets and two urinals, all high flow fixtures. Assumptions were made on the occupancy of the building and the frequency at which these fixtures are used. From this, total annual hot water consumption was estimated.

9.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 13 and 14 show summaries of the energy and water efficiency improvement opportunities for the Museum. The following assumptions were made in the calculations:

- The Museum is occupied for 40 hours each week, year round.
- For the purpose of water consumption, the typical occupancy of the Museum is 5 people.
- The building is maintained at 21°C (70°F).

Table 13 Energy Saving Opportunities for the Museum

Description	Qty	Installed Cost/Unit ($)			Total Cost ** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Fluorescents - Convert 4' T12s to 4' T8s (4'x2)	116	$41	$21	$0	$5,374	$2,753	6,587	$395	13.6	7.0
Fluorescents - Convert 4' T12s to 4' T8s (4'x4)	84	$32	$12	$0	$3,037	$1,139	4,770	$286	10.6	4.0
Incandescents - Convert to compact fluorescents	71	$15	$10	$13	$2,246	$1,845	14,886	$894	2.5	2.1
EXIT signs - Convert to LED modules	6	$50	$5	$80	$881	$576	1,656	$99	8.9	5.8
Lighting Subtotal					**$11,540**	**$6,313**	**27,899**	**$1,675**		
ENVELOPE										
Add weather strip to existing doors -all of 3'x7' size	9	$15	$15	$50	$661	$661	13,867	$833	0.8	0.8
Replace single pane windows - 60"x24"+ seal all windows	58	$770	$696	$100	$57,020	$52,170	77,434	$4,649	12.3	11.2
Envelope Subtotal					**$57,681**	**$52,831**	**91,300**	**$5,482**		
HVAC										
Upgrade existing A/C condensers with high efficiency A/C units when time for replacement.	4	$350	$350	$0	$1,582	$1,582	21,319	$1,280	1.2	1.2
HVAC Subtotal					**$1,582**	**$1,582**	**21,319**	**$1,280**		

Totals	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	203,040	$12,765	6.05
Estimated Annual Savings	140,518	$8,437	4.19
Percent Savings	69%	66%	69%

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 13% taxes.
*** As of April 2005, the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro’s website).

Table 14 Water Saving Opportunities for the Museum

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	5	$309	$150	$2,593	80%	7,921	$4
Install water efficient toilets.	6	$284	$150	$2,943	70%	37,117	$20
Install water efficient urinals	2	$344	$200	$1,229	70%	4,150	$2

* The total cost column includes 13% taxes

9.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary table for the Museum is found in Appendix B as Table B. 8.3. All of the energy saving opportunities for the building's lighting have payback periods of 7 years or less. The single largest ESO in terms of lighting is converting the existing indoor incandescent lights to compact fluorescents. Nearly 15,000 kWh of energy would be saved by this one upgrade, in just over two years. Converting the existing 4' T12 lamps to 4' T8 lamps would save over 12,000 kWh in total. By waiting until the current lights are burnt out to upgrade to T8s, payback periods are kept to a realistic four years. Replacing the EXIT signs to LED modules would save over 1,600 kWh of energy in less than 6 years.

Envelope

Energy saving opportunities within the Museum's building envelope produces the largest savings for the facility. Installing new weather stripping and caulking on the pedestrian doors would save nearly 14,000 kWh of energy that is currently lost due to infiltration. With a payback period under one year this ESO is a realistic and feasible option. Upgrading the single pane windows with high efficiency triple pane models would generate a substantial 77,434 kWh of savings each year in just over 11 years. Over 91,000 kWh of energy, 45% of the current energy would be saved by ESOs within the building's envelope. Details of these ESOs are found in Appendix B in Table B.8.4.

HVAC

Temperature setback is typically not recommended for museums due to the need to provide constant environmental conditions for the artefacts. Upgrading the existing air-conditioner condensers with high efficiency units when time for replacement would save over 21,000 kWh per year. By waiting to replace the existing units until replacement is needed, the capital expenditure of this ESO is kept to a minimal

Water

The water analysis summary for this building is shown in Table B.8.5 in Appendix B. Upgrading the existing high flow faucets and toilets would save 80% and 70% respectively of the annual water consumption for the current fixtures. Replacing the urinals with low flow urinals would save 29% of the current water consumption.

10.0 INDOOR SWIMMING POOL

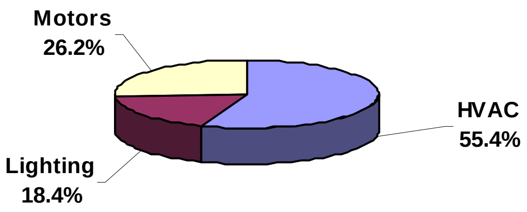
10.1 BACKGROUND

Built in 1970, the Winton Indoor Swimming Pool and changerooms occupies an 806 square metre area. The actual pool size is 312 square metres. The facility is enclosed within to the Margaret Barbour Collegiate, which was not included in the scope of this audit. As a result, there is limited building exposure to the outside elements. The changerooms located in the school are included in the audit. The pool is open 70 hours a week for 10 months of the year. For the remaining two summer months, it is open for 35 hours per week.

Photo 10 - Indoor Swimming Pool

The total electricity consumption over the past year was 304,920 kWh at a cost of $17,086. The following pie chart shows the breakdown of energy for the facility.

Energy Breakdown (% of Total kWh) for the Indoor Swimming Pool



There are twelve showers, four toilets and one urinal, all high flow fixtures. In addition, there are two low flow auto shut off faucets. The pool is serviced by the school's ventilation and domestic water heating system.

10.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 15 show a summary of the energy saving opportunities for the Indoor Pool. The following assumptions were made in the analysis:

- The Indoor Pool is occupied for 70 hours per week for 10 months of the year and for 35 hours for two months.
- The Margaret Barbour Collegiate is attached to the pool and provides the water and HVAC.
- The Collegiate is not included in the scope of this audit.

Table 15 Energy Saving Opportunities for the Indoor Swimming Pool

Description	Qty	Installed Cost/Unit ($)			Total Cost ** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Fluorescents - Convert 4' T12s to 4' T8s (4' x2) & add occupancy sensors to changerooms.	58	$41	$21	$0	$2,797	$1,486	4,117	$247	11.3	6.0
Incandescents in mechanical room + hallway - Convert to compact fluorescents & add occupancy sensor.	11	$15	$10	$13	$403	$341	4,444	$267	1.5	1.3
EXIT signs - Convert to LED modules.	4	$50	$5	$80	$588	$384	946	$57	10.3	6.8
Lighting Subtotal					**$3,788**	**$2,211**	**9,507**	**$571**		
ENVELOPE										
Add weather strip to existing doors- 3'x7' size.	4	$15	$15	$50	$294	$294	6,163	$370	0.8	0.8
Envelope Subtotal					**$294**	**$294**	**6,163**	**$370**		
HVAC										
Install liquid pool covers.	110	$20	$20	$0	$2,486	$2,486	33,796	$2,029	1.2	1.2
HVAC Subtotal					**$2,486**	**$2,486**	**33,796**	**$2,029**		
MOTORS										
Upgrade filter pump motor to high efficiency motor.	2	$220	$220	$220	$994	$994	2,352	$141	7.0	7.0
Motors Subtotal					**$994**	**$994**	**2,352**	**$141**		
HOT WATER										
Insulate hot water piping for pool water heating.	1	$38	$38	$38	$85	$85	359	$22	3.9	3.9
Hot Water Subtotal					**$85**	**$85**	**359**	**$22**		

Totals	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	304,920	$17,086	9.09
Estimated Annual Savings	18,381	$1,104	0.55
Percent Savings	6%	6%	6%

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 13% taxes.
*** As of April 2005, the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro's website).

Table 16 Water Saving Opportunities for the Indoor Swimming Pool

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient toilets.	4	$284	$150	$1,962	78%	382,746	$211
Install water efficient urinals	1	$344	$200	$615	13%	38,903	$21

* The total cost column includes 13% taxes

10.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary is shown in Table B.9.3 in Appendix B. The metal halide lights and underwater pool lights are energy efficient units and do not need upgrading. Replacing the existing 4' T12 lamps with 4' T8 and adding an occupancy sensor when they burn out would save over 4,100 kWh of energy per year in just over six years. Converting the incandescent lights to compact fluorescents would save nearly 4,500 kWh of energy in just over a year. A longer ESO would be to convert the EXIT signs to LED modules, saving close to 950 kWh of energy per year in under seven years.

Envelope

The only ESO available to the facility's envelope is to add new weather stripping and caulking to the existing pedestrian doors. Over 6,100 kWh of energy would be saved in less than one year. Table B.9.4 in Appendix B illustrates the details this ESO.

HVAC

The only ESO available for the Pool is to add liquid pool covers to reduce energy loss due to evaporation. The specific type of pool cover that has been chosen for this building is a liquid solar cover. Similar to conventional solar blankets, the purpose of liquid pool covers is to reduce evaporation. Each unit will cover 800 square feet of area for approximately one month. The liquid pool covers sink to the bottom of the pool and as the pressure increases they secrete a non-toxic chemical that forms a thin barrier on the surface of the water, slowing the evaporation from the pool's surface and reducing hourly evaporation. The chemical does not harm the pool's filtration system, chemical balance or human skin. For this particular pool, 9 liquid pool covers are needed per month. Unlike solar blankets, these units are inexpensive and require no installation expense.

Motors

When the existing filter pumps need replacement, they should be upgraded to high efficiency models. Over 2,300 kWh would be saved with these incentives with a payback period just over seven years.

Water

Insulating the pool's hot water piping would save nearly 360 kWh of energy annually. The existing 12 showers for the pool are already of auto shut off type and do not require upgrading. However, the toilets and urinals are currently high flow water fixtures. Upgrading these fixtures to low flow toilets and urinal would save 78% and 13% of their current water consumption.

11.0 WATER TREATMENT PLANT

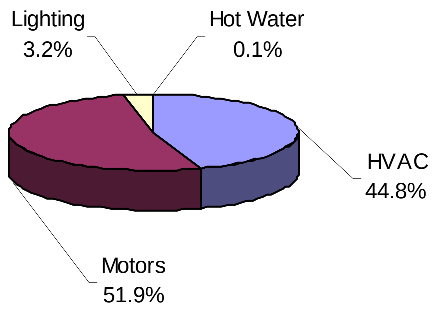
11.1 BACKGROUND

An irregular shaped building, the Water Treatment Plant is a 780 square metre structure with a brick face and built up tar and gravel roof. Some upgrades to the facility were completed in 1997. The plant is occupied for 8 hours a day, for a total of 2920 hours a year.

Photo 11 - Water Treatment Plant

The Plant uses electric energy and propane. In the previous year 1,200,600 kWh of electricity and 519,060 kWh of propane were consumed. The costs were $57,845 and $31,815 respectively. The following pie chart shows how the energy is consumed in a typical year.

Energy Breakdown (% of Total kWh) for the Water Treatment Plant



There are two sinks, one toilet and one shower in the building, all high flow fixtures. Assumptions were made on the occupancy of the building and the frequency at which these fixtures are used. From this, total annual hot water consumption was estimated.

11.2 ENERGY SAVING OPPORTUNITIES

Tables 16 and 17 show a summary of the energy and water saving opportunities for the Water Treatment Plant. The following assumptions were made in the analysis:

- The Water Treatment Plant is occupied for 8 hours a day, approximately 2920 hours a year.
- Temperature in the building is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy of the Water Treatment Plant is 2 people.

Table 16 Energy Saving Opportunities for the Water Treatment Plant

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Pump Floor - convert 4' T12s to 4' T8s (4'x2).	44	$41	$21	$0	$2,039	$1,044	2,505	$150	13.6	6.9
Operating Floor - convert 4' T12s to 4' T8s (4'x2).	68	$41	$21	$0	$3,150	$1,614	3,872	$232	13.6	6.9
Operating Floor - convert 8' T12s to 8' T8s (8'x2).	8	$47	$12	$0	$425	$108	1,448	$87	4.9	1.2
Incandescents - convert to compact fluorescents.	88	$15	$10	$13	$2,784	$2,287	20,095	$1,207	2.3	1.9
EXIT signs - Convert to LED modules.	7	$50	$5	$80	$1,028	$672	1,656	$99	10.3	6.8
Lighting Subtotal					**$9,426**	**$5,726**	**29,577**	**$1,776**		
ENVELOPE										
Add weather strip to existing doors -all of 3'x7' size.	3	$15	$15	$50	$220	$220	4,622	$283	0.8	0.8
Add weather strip to existing rolling windows - 11'x5' size (2).	2	$30	$30	$50	$181	$181	4,930	$302	0.6	0.6
Replace semicircular arched double pane windows (10' bottom x 5' radius).	4	$1,105	$1,037	$100	$5,447	$5,139	11,325	$421	12.9	12.2
Envelope Subtotal					**$5,848**	**$5,540**	**20,877**	**$1,006**		
HVAC										
Setback Thermostats to 15°C (59°F)	6	$300	$300	$300	$4,068	$4,068	51,406	$3,086	1.3	1.3
HVAC Subtotal					**$4,068**	**$4,068**	**51,406**	**$3,086**		
HOT WATER										
Install water efficient showers	1	$21	$21	$50	$80	$80	259	$20	4.1	4.1
Insulate hot water piping.	1	$50	$50	$50	$113	$113	479	$29	3.9	3.9
Water Subtotal					**$193**	**$193**	**738**	**$49**		
MOTORS										
When required, upgrade 100 HP motors with high efficiency motors.	2	$2,405	$2,405	$0	$5,435	$5,435	13,029	$782	6.9	6.9
When required, upgrade 50 HP motors with high efficiency motors.	2	$1,214	$1,214	$0	$2,744	$2,744	6,514	$391	7.0	7.0
When required, upgrade 40 HP motor with a high efficiency motor.	1	$1,072	$1,072	$0	$1,211	$1,211	2,606	$156	7.7	7.7
When required, upgrade 30 HP motor with a high efficiency motor.	1	$678	$678	$0	$766	$766	1,954	$117	6.5	6.5
When required, upgrade 10 HP motor with a high efficiency motor.	1	$281	$281	$0	$318	$318	651	$39	8.1	8.1
Motors Subtotal					**$10,474**	**$10,474**	**24,755**	**$1,486**		

Totals	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	1,719,660	$89,153	152.98
Estimated Annual Savings	127,353	$7,403	7.87
Percent Savings	7%	8%	5%

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 13% taxes.
***As of April 2005, the cost assigned to electricity is 0.06004 $/kWh (rate taken from Manitoba Hydro's website) and the average cost of propane is 0.0573 $/kWh.

Table 17 Water Saving Opportunities for the Water Treatment Plant

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	2	$309	$150	$1,037	80%	3,738	$2
Install water efficient toilets.	1	$284	$150	$490	70%	6,767	$4
Install water efficient urinals	1	$21	$50	$80	29%	6,915	$4

* The total cost column includes 13% taxes

11.3 GENERAL RECOMMENDATIONS

Lighting

Substantial ESOs are available for the building with its lighting and all in a reasonable payback period. The largest lighting ESO would be to convert the existing incandescent lamps to compact fluorescents. Over 20,000 kWh of energy would be saved by this single ESO in less than two years making it a very lucrative option. Other ESOs include upgrading the 4' T12s and 8' T12s lights with 4' and 8' T8 lamp when time for replacement. Nearly 8,000 kWh would be saved by these energy saving opportunities with payback periods ranging from just over one year to seven years. Converting the existing EXIT signs to LED modules would save over 1,600 kWh of energy in under seven years. In total, nearly 30,000 kWh of energy would be saved by ESOs applied to the facility's lighting.

Envelope

Adding new weather stripping and caulking to the existing pedestrian doors and rolling windows generates nearly 10,000 kWh of energy savings per year. With paybacks under one year and low capital cost expense, these are very lucrative ESOs to implement. Replacement of the existing semi-circular arched double pane windows with high efficiency triple pane units would save over 11,000 kWh in just over 12 years. Table B.10.4 in Appendix B shows the details behind these ESOs.

HVAC

The single largest ESO for the Water Treatment Plant is found within its HVAC component. Installing a setback feature on the thermostats would allow the temperature of the building to be lowered to 15°C (59°F) when it is unoccupied saving over 51,000 kWh per year, with a short payback period of just over one year.

Hot Water

The water analysis summary for the Water Treatment Plant is shown in Table B. 10.5 in Appendix B. Upgrading the existing high flow faucets and toilet would save 80% and 70% respectively of the annual water consumption for the current fixtures. Replacing the current showerhead with a low flow water efficient fixture would save 29% of the current water usage and over 250 kWh of energy each year. Insulating the hot water piping would save nearly 480 kWh of energy that is currently lost as heat loss.

Motors

Table B. 10.7 in Appendix B shows the energy consumption and savings for the motors in the Water Treatment Plant. When it is time for replacement, upgrading the motors with high efficiency motors would save over 24,700 kWh per year without additional labour expense. The motors that are feasible to replace (determined by their payback period) are the 100 HP units, 50 HP, 40 HP, 30HP and 10 HP.

12.0 GENERAL UPGRADES AND MAINTENANCE RECOMMENDATIONS FOR REDUCING ENERGY AND WATER CONSUMPTION

The following energy and water saving opportunities exist in many buildings including those toured in this study. The saving opportunities are generic in nature and include both capital upgrades (Sections 12.1 to 12.4) and maintenance activities (Section 12.5) that will result in energy / water savings for all the buildings.

12.1 LIGHTING AND ELECTRICAL

Light Switches – Place signs or stickers adjacent to switches to remind occupants to shut off switches when leaving rooms unoccupied. Occupancy sensors can be provided to shut off lights automatically when not in use. Timers can also be used in a similar fashion.

Fluorescent Lighting Systems – T12 lights should be upgraded to premium T8 or T5 electronic ballasts and lamps. This may be done when current T12 ballasts need replacement or in a planned retrofit program. T12 light fixtures will become obsolete by 2010. Use cold-weather rated ballasts for retrofits in areas where the temperature is below 15°C (59°F). When selecting T8 electronic ballasts, please refer to Manitoba Hydro’s Power Smart Lighting program for current listings of eligible ballasts. Contact Manitoba Hydro for details.

EXIT Signs – Replace all incandescent exit signs with 3W LED signs.

Incandescent Bulbs – All incandescent bulbs should be converted to compact fluorescents. Compact fluorescent bulbs last approximately 10 times longer than incandescent bulbs and save up to 75% of the energy costs.

Exterior Lights – Compact fluorescent bulbs do not function at low temperatures, therefore, the exterior lights should be replaced with high-pressure sodium lighting. High-pressure sodium lights are the most energy efficient type of lighting available today. Savings of approximately 50% would result from replacing exterior incandescent fixtures with these high-pressure sodium lights. Photos cells should be considered for automatically shutting off outdoor lights during day light conditions.

Parking Lot Controllers – Parking lot controllers save energy by automatically adjusting the power at the car plugs depending on the outside temperature.

Motors – When installing new motors, consider using premium efficiency as opposed to standard efficiency motors.

Other Recommendations - Dispose of all fluorescent lamps and ballasts through a recycling company to reduce toxins entering the landfills.

Refer to Appendix D for a list of Manitoba Hydro’s Power Smart incentives and listings of other incentive programs.

12.2 BUILDING ENVELOPE

Window/Door Infiltration – Seal drafts on windows and doors. This can be done by installing or upgrading weather-stripping, or with removable silicone caulking such as “Draft Stop” or “Peel and Seal”. Doors with high usage should be inspected twice per year for damaged weather stripping.

Window/Door Replacement – Windows and doors with low R-values should be considered for replacement. Manitoba Hydro offers incentives for new windows.

Wall / Roof Insulation – The wall insulation in older buildings typically has a resistance of R-12 or less. Large energy savings would result from upgrading this insulation to R-20. Similarly, roof insulation should be upgraded to R40. In addition to the energy savings, upgrading insulation also extends the life of a building by avoiding the rotting of wood framing from the development of mould and mildew in the walls. Vapour barriers in walls can also be upgraded at the same time to reduce infiltration. Upgrading insulation is typically quite costly. When this is done, more insulation will pay dividends in the future.

Electrical Outlets – Install draft-reducing foam pads in all electrical receptacles.

12.3 HEATING, VENTILATION, AND AIR CONDITIONING

Temperature Control – Use programmable electronic thermostats where appropriate. Use the recommended “set-back” and “set forward” temperatures during unoccupied periods. A 6C “set-back” over a 12-hour period can reduce heating costs by 8%. Reduce room temperature at night in the winter to as low as comfort conditions permit (typically 15°C in occupied buildings and 10°C in unoccupied buildings). Terminate ventilation during un-occupied periods.

Furnaces – Replace standard efficiency furnaces with premium efficiency furnaces. Old standard efficiency furnaces can be as low as 60% efficient. Replacing these with 95% efficient furnaces would save 35% of the annual energy consumed for heating.

Air Conditioning – Reduce the cooling load on the air conditioner by keeping the facility a few degrees warmer and using fans at workstations to augment cooling of personnel. Provide an economizer to supply “free cooling” when it is cool outside and air conditioning is required.

Remove or insulate wall or window-mounted air conditioners for the winter season.

When replacing condensing units or rooftop units, install high efficiency units.

CO_2 Sensors – Install CO_2 sensors to control ventilation. CO_2 sensors monitor the level of carbon dioxide in the air. Once the level exceeds an accepted limit, the ventilation system will turn on. This will ensure that the room is ventilated only when required and will thus save in energy required for heating and/or cooling.

Vehicle Emission Sensors - For garages and fire halls, a vehicle emission sensor will monitor the level of vehicle emissions in the air and could be set up to control the ventilation such that the room is ventilated only when required. This is an energy saving feature and provides increased safety for occupants.

Motorized Dampers – Backdraft dampers on intake and exhaust ducts are often leaky and let cold air into the building on windy days. Insulated motorized dampers provide a better seal when they are closed and drastically reduce the cold air infiltration into the building throughout the winter.

Heating Recovery Ventilators (HRVs) - An HRV moves stale contaminated air from inside the building to outside while at the same time it draws fresh air from outside and distributes it throughout the building. When intake and exhaust air pass through the HRV they do not mix. In the wintertime, the air passes on either side of an aluminium heat exchange core, which transfers heat from the outgoing air to the incoming air. In the summertime, the HRV works in reverse and transfers heat from the incoming air to the exhaust air.

Solar Wall – Another option for pre-heating ventilation air is to install a solar wall. A solar wall is installed on the south wall of the building and uses free heating from the sun to heat the make up air. In addition, a solar wall reduces building heat losses during the winter. Heat lost to the cavity between the building and the exterior metal panels of the solar wall is captured by the incoming air and returned to the building. In summer, the solar wall is ventilated naturally thereby reducing the wall temperature, which saves air conditioning energy costs.

Geothermal Heating – A geothermal heat pump is one of the most energy efficient heating and cooling systems available. Compared to electrical heat, a heat pump decreases energy consumption by 50-70%. In the wintertime, the heat pump moves heat from the earth into your building and in the summertime the heat is moved from inside the building back into the earth. Geothermal systems are most effective in arenas where they are used to make ice. The waste heat obtained from ice making can be used to heat a nearby building using little energy.

HVAC Ductwork – Seal duct joints with duct tape to reduce losses of heated or cooled air where the ducts traverse cold or hot areas respectively. Insulate ductwork passing through unconditioned spaces.

Thermostat Equipped Electric Baseboard Heaters – Mark the thermostat “normal” setting to provide a visual cue as to when they are on or set too high.

12.4 WATER CONSUMPTION

Excessive water usage wastes energy, increases water / sewage treatment costs and further risks damage to the environment.

Toilet Tanks – Install flush volume reduction devices in existing toilet tanks to reduce the quantity of water used per flush by about 25%. “Early closing flapper valves” are inexpensive and are easily installed**.**

Toilets – When replacing older toilets or installing new ones, use high efficiency, low-flush volume models that require only 6 L (1.3 Imp. gal.) or 3 L (0.8 Imp. gal.) per flush. These toilets reduced water usage by over 70% compared with traditional 13 L, and by 40% over a "low flush" 6 L toilet. Refer to the toilet and drain line reports on the Canadian Water and Wastewater Association (CWWA) website for advice in selecting a toilet that will perform well.

Urinals - Waterless urinals function on gravity flow and use absolutely no water. These urinals resemble conventional wall-hung urinals but do not require a water supply or a flush valve.

Hot Water – In facilities where large volumes of hot water are not required, set the hot water tank thermostat to 55°C (131°F). A reduction from 60°C to the recommended value of 55°C saves approximately 3% of the energy related to hot water generation. Insulate the first 2 meters (6 ft) of the cold water line and as much of the hot water distribution lines as practical, particularly where hot water lines traverse cold spaces.

Shower Controls – In facilities where large amounts of water are used, consider retrofitting single actuator, short cycle (adjustable), self-closing control valves, with pressure-balancing temperature controls to reduce water consumption. These controls limit flow and allow for a preset water temperature (recommended 40°C) for the showers in order to reduce water heating costs and wastage of water.

Auto-Shut Off Fixtures - Consider using spring-loaded fixtures that automatically shut off water flow in public areas.

Tankless Water Heaters – Consider replacing the hot water storage tanks with instantaneous water heaters to avoid storage tank losses and save energy.

12.5 ICE RINKS

Ventilate Rink – Natural ventilation of the rink in the winter saves energy by reducing the run time on the compressors/heat pumps.

Quality of Ice – Ensure that the water used for flooding is pure – salts lower the freezing point of water and air in water acts like an insulation, making it harder for glycol in the slab to freeze the top layer of the ice.

Ice Thickness – Keep the ice thin (1 inch thick) because excessive ice thickness increases the load on the compressor. Shaving ice helps to reduce the ice thickness and removes concentrations of impurities.

Melt Ice Outdoors – When shaving ice, take the ice shavings outside to be melted as opposed to melting the shavings in a heating area of the building. This will eliminate the energy consumed to melt this ice.

High Efficiency Boilers – Use high efficiency boilers for zamboni water heating. Annual energy savings for zamboni water heating of up to 30% can be achieved by upgrading to high efficiency boiler systems.

Specific Gravity of Brine – Maintain the brine at a specific gravity of 1.2 to 1.22 for optimum energy use and maintain the brine temperature as high as possible.

Heat Recovery – Significant amounts of energy can be saved by recovering heat from the refrigeration equipment and using it for flood water heating, space heating, domestic water heating, or ice melting.

12.6 MAINTENANCE

Maintenance activities are important to ensure that the equipment in a building is operating efficiently and to reduce the potential for future equipment breakdown. One option is to hire a maintenance contractor to perform inspections four times annually to clean, lubricate, test, and adjust the building's HVAC.

The following is a list of HVAC maintenance procedures that should be performed two to four times annually:

Heating/Ventilation Systems

- Change filters
- Inspect belts
- Inspect and clean heating coils
- Inspect operation of blower
- Inspect and lubricate motor and fan bearings
- Inspect and lubricate fresh air, exhaust air, and return air dampers

Air Conditioning/Ice Plant Systems

- Clean outdoor condensers
- Clean filters
- Check refrigerant and oil levels
- Inspect ice plant and refrigerant piping for leaks
- Inspect and lubricate brine pumps
- Inspect and lubricate motorized and back draft dampers
- Inspect A/C operation and adjust as required

13.0 IMPLEMENTATION OF ENERGY AND WATER SAVING OPPORTUNITIES

13.1 IMPLEMENTATION

The energy and water savings opportunities suggested in this report range from simply changing a light bulb to installing a wall panel. Many of the simpler recommended upgrades could be completed in-house while others would require hiring a contractor to complete the work. Major renovation projects will require a consulting engineer to design and help implement the upgrade. The various energy/water saving opportunities discussed throughout this report are separated into three levels of implementation: (1) in-house implementations, (2) contractor implementations, and (3) consulting engineer implementations. The following sections discuss which upgrades fall into each of these three categories.

In-House Implementations

Some of the energy saving opportunities can be completed in-house. Replacing the incandescent light bulbs with compact fluorescent bulbs involves simply replacing the bulb and could easily be done by one of the building's maintenance personnel. Installing weather-stripping around the doors and sealing the windows could also be done in-house. For the saving opportunities that involve replacing the doors, some could be done in-house while for others, such as vehicle doors, it is best to hire a contractor.

Contractor Implementations

The majority of the energy saving opportunities will require a contractor. In terms of lighting, replacing the T12s with T8s requires replacing the ballast as well as the bulbs. An electrician should be hired to complete this function. Replacing the exterior incandescent lights with high-pressure sodium lights and replacing the exit incandescent lamps with LED modules involve replacing the fixture and will therefore require an electrician.

Upgrades on a building's envelope not mentioned in the "In-House Implementations" section should be done by a contractor. This includes replacing windows and upgrading the wall and/or roof insulation.

In terms of HVAC, a contractor should be hired to install programmable thermostats and high efficiency air conditioner units.

Electricians should be hired to replace motors with high-efficiency motors.

For the water saving opportunities involving installing low-flow water fixtures, a contractor will likely be required. Insulating the hot water tank and installing an instantaneous water heater will also require a contractor.

Consulting Engineer Implementations

A consulting engineer should be consulted regarding any major renovations to the building envelope as well as the building HVAC systems to ensure the work is done properly and in accordance with building code requirements.

13.2 FINANCING

There are several incentive programs listed in Appendix D of this report that will help finance the implementation of the energy and water saving opportunities. In the "Energy Saving Opportunity" tables throughout this report, the capital costs are listed both with and without incentives. The incentives in these tables are from Manitoba Hydro's Power Smart Incentives and apply to energy efficient lighting, windows and wall insulation upgrade. For more information on these incentives, contact your local Manitoba Hydro Energy Services Coordinator or the contact listed in Table D.1.

Table D.2 lists other incentive programs that are available for energy saving upgrades. These programs are:

- Energy Innovators Initiative: Energy Retrofit Assistance (ERA)
- Municipal Rural Infrastructure Fund (MRIF)
- Renewable Energy Development Initiative (REDI)
- Community Places Program
- Sustainable Development Innovations Fund (SDIF)

For further information on these programs refer to the website listed in the table.

Members of the Association of Manitoba Municipalities also have the option of purchasing products and services in bulk at reduced prices through the Municipalities Trading Company of Manitoba Ltd. (MTCML). Details on this can be found in Appendix G of this report.

13.3 POLITICAL FRAMEWORK

General Municipal Environment in Manitoba

In Manitoba, municipal elections are set every 4 years. The next municipal election will be in October 2006, which may mean that some councils will see a change in members. However, we do not expect this to have a major impact on the plans to implement the recommendations of this report.

There are currently no Provincial or Federal targets or goals set that municipalities must achieve. 'Green Projects' have become common in Manitoba and often programs like the Municipal Rural Infrastructure Fund (MRIF) targets such projects. Details of this project are included in this report. Manitoba has been a leader in energy efficiency and many municipalities have partnered with other levels of government and companies like Manitoba Hydro on innovative projects. We believe the MMEP project is an excellent example of an innovative project and believe all of the participating communities are receptive to innovative ideas because they have agreed to participate.

A recent trend in municipal government has been toward longer-term planning. This is seen with the recent changes to the provincial Planning Act and the requirements for community sustainability plans in the New Deal agreement. The recommendations in this report certainly complement this direction.

Political Environment in The Pas

Knowledge gained from this efficiency study will be useful in future development projects. A potential barrier that could affect the implementation of the opportunities discussed throughout this report is a change in council members. It is important that the information gained here be passed on as new members enter and current members leave the council.

14.0 PERFORMANCE VERIFICATION

Following the implementation of the recommended energy and water saving opportunities, it is important to continuously monitor the annual energy consumption to keep a record of the resulting energy savings.

Appendix F contains a spreadsheet and graph for each of the buildings audited. These spreadsheets should be used as a tool to monitor the energy consumption on a monthly basis. The first three columns in each spreadsheet are for year 2004-2005 and have already been completed.

Following the implementation of the measures discussed in this report, the energy consumption should be recorded. The year headings may need to be re-entered, depending on when the implementations are completed. The monthly energy consumption in kWh taken from the building's hydro bill should be recorded in the "Billed Energy Consumption" column. The monthly propane consumption in litres (L) should be recorded in the "Billed Propane" column. The monthly energy consumption for heating depends on the outdoor temperatures for that month. The "Billed Energy Consumption" is therefore normalized to the year 2004-2005 such that a fair comparison can be made.

The normalized energy consumption is determined as follows:

$$\begin{aligned} NEC = BEC \times (\%\, Energy\, Used\;\; for\; Heating) \times \left(\frac{HDD(present)}{HDD(2004-2005)} \right) \\ + BEC \times (1 - \%\, Energy\, Used\;\; for\; Heating) \end{aligned}$$

Where *NEC* is the Energy Normalized to year 2004-2005, *BEC* is the billed energy consumption and *HDD* is the heating degree-days.

The heating degree-days (HDD) for a given day are the number of Celsius degrees that the mean temperature is below 18°C. For The Pas, this data can be found on the following website:

http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3864&Year=2005&Month=6&Day=7

Once the “Billed Elec. Energy”, the ‘Billed Propane Energy” and “HDD” columns are filled in, the “Energy Normalized to 2004-2005” column is automatically calculated and the graph is updated. From this graph, the energy consumption can be monitored on a monthly basis to ensure that the upgrades are resulting in a reduction in energy consumption.

15.0 WATER AND SEWER AUDIT

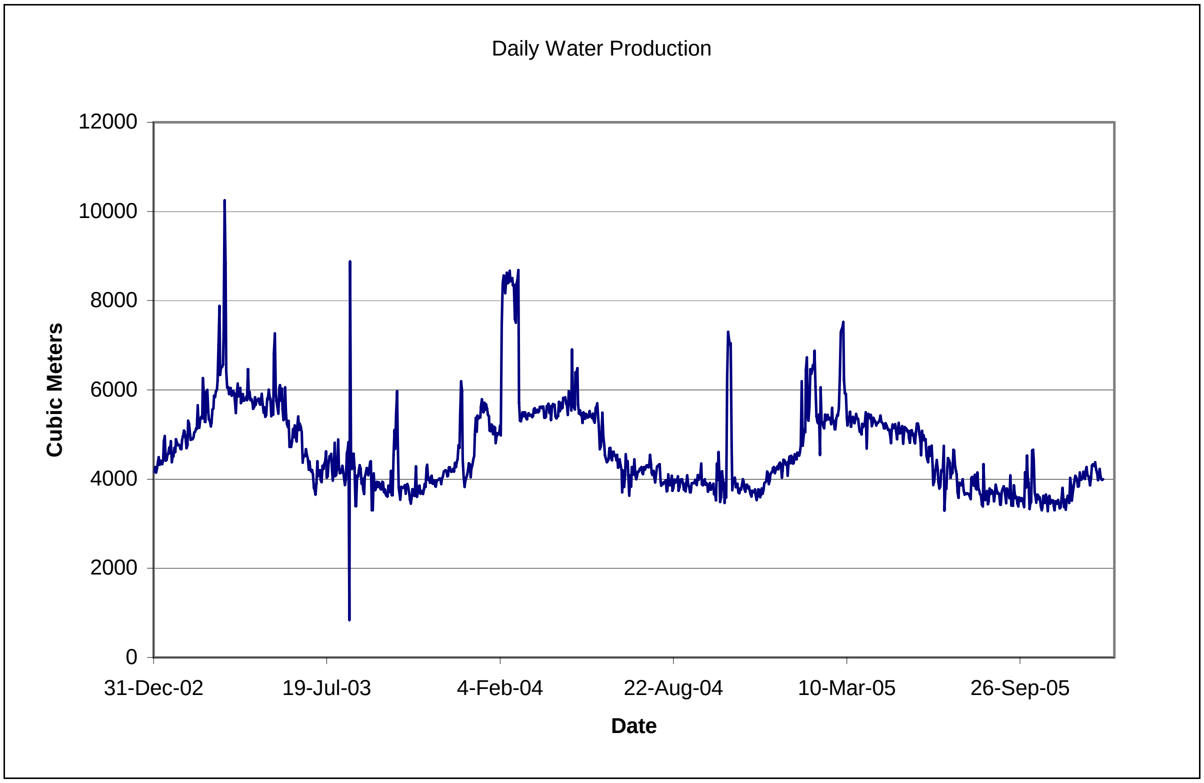
15.1 WATER SYSTEM OVERVIEW

In the early 1900's, the Town of The Pas constructed a water supply and distribution system that draws its water from the Saskatchewan River, which flows through the Town. The water treatment process and treatment plant were built in 1971 and upgraded to a filtration process in approximately 2001.

There are two pumps that pump water from the Saskatchewan River to The Pas Water Treatment Plant. At the treatment plant, the water is treated by activated carbon or potassium permanganate addition, coagulation, clarification, filtration, fluoridation and chlorination. After the water has been treated, it is stored in three clear wells that are used in series and total 2,273 m^3 (500,000 Igal) of storage. From the reservoirs, two 100 horsepower pumps and one 50 horsepower pump are used to pump the water through the distribution system.

Based on data provided, the average amount of water produced at the water treatment plant in 2005 was approximately 4469 m^3 (983,000 Igal) per day with a maximum day flow of approximately 7,525 m^3 (1,655,000 Igal) per day. From the information received, the plant has a design flow of 10,214 m^3 (2,246 Mgal) per day. The average water produced per capita is approximately 770 lpcd (litres per capita-day). Chart 1 shows the daily production of treated water for 2003 until 2005.

Chart 1: Treated Water Production



Portions of the original distribution system were built as early as 1914. According to provided information, there is approximately 36 km of distribution system piping where 2.7 km of it is older than 60 years. Table 18 illustrates the age of the piping. The piping consists of mechanical joint cast iron (31.6%), PVC (13.9%), ductile iron (6.7%), steel (1.2%), cast iron (27.1%), and ductile iron- coupled (3.2%). PVC has been the preferred replacement material for approximately the last 10 years. The piping consists of diameters from 150 mm to 300 mm (150 mm (43%), 200 mm (37%), 250 mm (19%) and 300 mm (11%)). It should be noted that two lists were supplied that were slightly different in the quantity of distribution system piping present.

Table 18 Water Distribution System Age

Age (Years)	Percent of Total
0-5	4.6%
5-10	4.9%
10-15	0.3%
15-20	2.1%
20-30	5.4%
30-40	43.7%
40-50	18.7%
50-60	12.2%
> 60	8.0%

There is currently no program in place for replacing old distribution piping. The distribution system is repaired and replaced as breaks occur. The number of breaks has varied from 10 to 36 from 1983 to 2005 with an average of 18 breaks per year. The Town has in place a program to replace old hydrants with new 4" pumper port hydrants.

Table 19 shows the amount of accounted-for water for the last three years.

Table 19 Accounted-For Water

Year	2003	2004	2005	Total
Water Main Breaks (Igal)	13,678,000.00	23,202,000	7,775,000	44,655,000
Hydrant Bleeders (Igal)	7,257,600.00	9,859,600	8,136,000	25,253,200
Residential/Commercial Bleeders (Igal)	29,708,472	16,671,216	17,819,904	64,199,592
Water Main/Sewer Dead-end Bleeders (Igal)	3,714,478	2,744,615	7,356,158	13,815,251
Flush Deep Well (Igal)	60,000.00	60000	60000	180,000
Water Main Flushing (Igal)	1,130,000	1,130,000	1,130,000	3,390,000
Water Sold (Igal)	172,794,270	165,627,782	153,826,345	492,248,397
Customer Meter Inaccuracy (Igal)	5,615,813	5,382,902	4,999,356	15,998,073
Total (Igal)	233,958,633	224,678,115	201,102,763	659,739,512

Table 20 lists the total water produced and shows the amount of unaccounted-for water.

Table 20 Water Use

Year	2003	2004	2005
Backwash (Igal)	11,826,000	11,826,000	11,826,000
Filter To Waste (Igal)	3,956,600	3,956,600	3,956,600
Entering the Distribution System (Igal)	381,913,000	387,923,000	358,841,000
Total Water Produced (Igal)	397,695,600	403,705,600	374,623,600
Unaccounted For (Igal)	147,954,366	163,244,884	157,738,237
% Accounted For (Accounted for Water/Total Water Produced)	62.8%	59.6%	57.9%
Unaccounted for water (m^3)	672,600	742,111	717,078

There are three magnetic flow meters in the water treatment plant located on the influent line, backwash line and distribution system line. At the time of the site visit, only the meter located on the distribution line was read and recorded daily.

Based on information provided, the cost associated with the Town's unaccounted-for water loss can be calculated, as shown in Table 21.

Table 21 Unaccounted-For Water Loss Cost

Water (igal)			
	2003	2004	2005
Total Water Produced	397,695,600	403,705,600	374,623,600
Total Water Entering Distribution System	381,913,000	387,923,000	358,841,000
Total Water Accounted-For	249,741,234	240,460,716	216,885,363
Total Unaccounted-For Water Loss	147,954,366	163,244,884	157,738,237
Percent Unaccounted-For Water Loss	37.2%	40.4%	42.1%
Total Cost of Producing Water	$ 1,085,533	$ 953,866	$ 936,705
Unit Cost per 1000 imperial gallon[1]	$ 2.73	$ 2.36	$ 2.50
Total Cost of Unaccounted-For Water Loss	$ 403,850	$ 385,711	$ 394,407,289
Variable Water Costs[2]	$ 149,740	$135,929	$145,052
Variable Sewage Costs[3]	$ 27,051	$ 23,088	$ 40,034
Potential Annual Savings from Eliminating Unaccounted-For Water[4]	$ 63,076	$ 61,849	$ 72,609

[1] Based on total annual budget of utilities department minus sewer system operations
[2] Based on chemical and water heating costs
[3] Based on the costs of lift station electricity and effluent disinfection
[4] Based on reduced variable water costs and reduced variable sewage costs and assuming 60% of the unaccounted for water reaches the sewer system.

The Town lost approximately $72,600 due to unaccounted-for water loss in 2005. This amount may not be completely accurate, since the error on the distribution meter was unknown and the overall error on the client water meters was estimated. If the distribution water meter did not have an accuracy of 100%, the value for the amount of water produced would be higher, yielding a larger value for the total unaccounted-for water loss and thus a higher cost for this loss. If, on the other hand, it were found that the client water meters were actually more accurate than estimated, the amount of unaccounted-for water loss due to meter inaccuracies and the associated cost of this loss would decrease.

Filtration

Based on a maximum day flow of 7525 m^3/day (1,655,000 Igal) and with one filter out of service, the filtration rate of the filters would be 5.74 m/h. This is within the typical range of 5 to 12.5 m/h for rapid sand filters.

Based on a backwash rate of 204.6 L/s (2700 gpm), the backwash rate of the filters is 40.4 m/h. Typical backwash rates range between 36 and 45 m/h. The backwash rate of The Pas' filters is in the range of typical values. The total amount of water used for backwashing is usually 5-10% of the total produced water. For The Pas, it appears that 3.0% of the water produced is utilized for backwashing. A time versus water quality profile of the backwash water may be useful to complete in that a reduction of the time to complete a backwash could be reduced if the data supported such an action.

Information supplied indicates that filter to waste is completed for 20 minutes after the completion of a backwash. The filter to waste cycle should be based upon water quality parameters such as turbidity or particle counts. It may be that 20 minutes is an appropriate amount of time to complete the filter to waste, however some savings of water may be realized by determining the time-turbidity or time-particle count filter-to-waste profile. Reducing this water would result in a cost savings for the community.

Water Meters

There is a magnetic water meter that measures raw water entering the treatment plant and another magnetic meter that measures water entering the distribution system. Both of which read in imperial gallons. There is another water meter on the backwash line that is not regularly read.

There are currently 1,929 water meters along the distribution system that measure water consumption on a per client basis. These meters are Invensys SR 11 (94), Invensys (248), Sensus (462), other (3), or unknown (1120). The Table below indicates the age of the meters.

Table 22 Customer Water Meter Age

Age of Meter (Years)	Number of Meters
0-5	555
5-10	419
10-15	209
15+	129
Unknown	619
Total	1931

*Based on supplied information

Age can have a significant impact on the accuracy of water meters. According to data published in the American Water and Wastewater Association journal, meters with plastic components that are 15 years old have an accepted accuracy of 95.12%. If the meters were constructed of all-brass components, the accuracy would be 99.0%. If the meters have plastic components and based on the age of the existing meters, approximately 3.25% of the water provided to customers could be unaccounted for. Table 23 shows the breakdown by meter size.

Table 23 Water Meter Breakdown by Size

Meter Size	5/8"	3/4"	1"	1.5"	2"	3"	4”	6”	Bulk	**Total**
Number	1787	46	52	22	25	3	6	6	1	1948

Based on 2000 Water Rates Bylaw.

Water Rates

Clients are charged on a quarterly basis. The minimum charge is a customer service charge plus the value of the included quarterly water usage.

For the first 18,000 gallons of water used per quarter, clients are billed at a rate of $6.32 per 1000 gallons for water, and at $2.4 per 1000 gallons for sewer service. The next 82,000 imperial gallons per quarter used by a client is billed at a rate of $4.11 per 1000 gallons for water, and $2.4 per 1000 gallons for sewer service. All usage over 100,000 gallons is charged at a rate of $2.34 per thousand gallons plus $2.4 per 1000 gallons for sewer service. Table 25 lists the minimum quarterly fees based on the size of water meter.

Table 24 Water Charge Rates

Commodity Rates	Water Only	Sewer Only	Water & Sewer
First 18,000 Gallons per Quarter	$ 6.32	$ 2.40	$ 8.72
Next 82,000 Gallons per Quarter	$ 4.11	$ 2.40	$ 6.51
Over 100,000 Gallons per Quarter	$ 2.34	$ 2.40	$ 4.74

Table 25 Minimum Quarterly Water Rates for the Town of The Pas

Meter Size	Water Included	Customer Service Charge	Water Charge	Sewer Charge	Total Quarterly Minimum
5/8"	4000	$ 9.59	$ 25.28	$ 9.60	$ 44.47
3/4"	8000	$ 9.59	$ 50.56	$ 19.20	$ 79.35
1"	16000	$ 9.59	$ 101.12	$ 38.40	$ 149.11
1 1/2"	40000	$ 9.59	$ 204.18	$ 96.00	$ 309.77
2"	100000	$ 9.59	$ 450.78	$ 240.00	$ 700.37
3"	180000	$ 9.59	$ 637.98	$ 432.00	$ 1,079.57
4"	360000	$ 9.59	$ 1,059.18	$ 864.00	$ 1,932.77

In addition to these fees, hydrants usage is charged, which generated $26,700 of revenue in 2000, and bulk sales are charged at a rate of $6.96 per 1000 imperial gallons.

Maintenance Programs

There is currently no scheduled maintenance program in place; however, the facility and equipment are inspected daily when the daily water meter reading is taken. Any problems that arise are dealt with as soon as possible.

From the data received, it is concluded that the distribution system is flushed once a year. The water used for flushing is not metered, and the Town estimates that 1,130,000 imperial gallons (5,137 m^3) or 0.3% of the total water produced are utilized for this purpose each year. It appears that approximately four times the volume of the distribution system is used for flushing. It may be possible to reduce the amount of water used for flushing purposes by examining the flushing program and optimizing it based on unidirectional flushing principles. It appears that from supplied information 258,000 Igal (1,175 m^3) of water can be held in the distribution system. This may also increase the effectiveness of the program at the same time.

Records of water main breaks are kept, and the volume of water lost is estimated. During the flushing program, some distribution system valves are operated. According to supplied information, the Town is working towards a program where each valve will be exercised yearly.

15.2 WATER DISTRIBUTION SYSTEM AUDIT RESULTS

In general, community water rates should be set at a level that covers the cost of supplying water to clients, including treating the water, distributing the water, maintaining the treatment and distribution systems, and replacing key pumping and process equipment. Reducing the amount of water lost can have an impact on the overall cost of water treatment.

By reducing water loss, the Town will realize savings through reduced chemical costs related to treating the water, and reduced electrical costs associated with a reduction in the amount of pumping, particularly if variable frequency drive pumps are installed, required to supply the water. The overall life of the facility and major process components can be extended, reducing the replacement frequency and equipment maintenance requirements.

A program for checking meter accuracy can also increase revenues for the Town by ensuring that customers are being billed for the actual amount of water they use. This program will not actually change the amount of water a client uses, it simply allows the Town to bill for the correct amount and recover production costs that would otherwise be attributed to unaccounted losses.

Although the Town repairs leaks in the distribution system as they are detected, a program of regular scheduled leak detection can help prevent water loss from occurring in the future.

15.2.1 Unaccounted-For Water Loss

As calculated from the data supplied by the Town of The Pas, the Town has an unaccounted-for water loss of approximately 42.1% for the year 2005.

There are several factors that could account for this water loss:

Leakage

All distribution systems experience a certain amount of leakage. Leakage can occur on transmission or distribution mains, at storage reservoirs (includes overflows) and on service connections up to the point of metering. According to Environment Canada, municipalities that have an unaccounted-for water loss exceeding 10 to 15 percent find that a leak detection program is cost-effective. Environment Canada reports that some studies have shown that for every $1.00 spent in communities with leak detection programs, up to $3.00 can be saved. Since The Pas exceeds the 10 to 15 percent range, it is recommended that the Town develop a leak detection program for use in the near future. In addition, reducing the system leakage creates excess capacity in the system, which may allow the Town to defer expensive capacity upgrades to the water treatment system.

At the present time, since the Town is not completely aware of the amount of water lost as leakage, it may be difficult to develop a comprehensive leakage prevention program.

Meter Accuracy

As previously mentioned, it is important to check not only client water meters, but the water meters at the treatment plant as well. If the production water meter is inaccurate, the Town will not have reliable data on the amount of water that it is treating. This may lead to problems when trying to assess the amount of unaccounted-for water leaving the system, since more water will be leaving the system than is actually recorded.

Ensuring the client meters are accurate will increase revenues for the Town since clients will be paying for the actual amount of water used. Accurate client meters will also allow the Town to better assess the amount of unaccounted-for water leaving the system, since water that would be unaccounted-for if the meters were inaccurate would actually be included in water consumption data. The amount revenue lost based on estimated residential meter inaccuracy is approximately $24,000.

Authorized Un-Metered Water Usage

Authorized un-metered water usage is water used for authorized purposes but not accounted for. This includes activities such as fire department training and practice, un-metered pool filling and rink flooding, street sweeping and other like activities. Activities such as this should be recorded and the amount of water used estimated.

Other

Other sources of unaccounted-for water loss can be due to unauthorized consumption. Meter bypasses, and non-permitted use of hydrants and abandoned service connections can all contribute to unauthorized consumption. If this type of water usage is occurring, it can be very difficult to identify.

15.2.2 Maintenance Program

It is suggested that the Town develop a program for testing the accuracy of client water meters. One cost effective method would be to hire a summer student who would test the accuracy of the meters.

The Town should inspect the main water treatment plant meters and complete meter calibration on a routine basis. This will allow them to have accurate records pertaining to total water production and may help with determining the sources of the unaccounted for water.

15.2.3 Required Information for Future Water Distribution System Audits

In order to provide the Town with a more complete water audit in the future, certain information would be required, such as:

- In-plant water flows such as filter-to-waste and backwash flows.
- Estimates of sewer main flushing water quantities.
- Estimates of dead-end water main flushing water quantities.
- Estimates of other authorized un-metered water use.
- The most recent installation date and model of all water meters throughout the distribution system and water treatment plant.

15.2.4 Cost Saving Opportunities

According to information received, the Town of The Pas' water treatment and distribution system appears to have a significant amount of water unaccounted for. It may be possible for the Town to cost effectively reduce the amount of unaccounted-for water loss in the system, since, according to Environment Canada, The Pas' unaccounted for water loss of 42.1% falls above the 10-15% range where a leakage detection and prevention program may become economically advisable. For each 1% reduction of unaccounted for water loss, the Town could save approximately $726 annually based on the cost of producing water at the water treatment plant and treating the associated wastewater.

The accuracy of water meters throughout the Town should be tested. Since it is uncertain whether the meters had brass or plastic components, a meter replacement program may or may not be economically feasible. If the client water meters have brass components, the estimated accuracy would be approximately 99% while 15-year-old meter with plastic components have an accuracy of approximately 95%. Using an estimated weighted average error of 3.25%, clients would have consumed approximately 5,000 Mgal (22,730 m^3) of water that they were not billed for in 2005, corresponding to a loss of $23,700 in revenue. If the water meters have brass components instead of brass components, the estimated error of the meters would be only 1% and clients would have consumed approximately 1,540 Mgal (6,990 m^3) of water that they were not billed for in 2005, corresponding to a loss of $7,290 in revenue.

15.2 WASTEWATER COLLECTION SYSTEM OVERVIEW

The Town of The Pas' sewer system began construction in 1971. The collection system is estimated to contain approximately 33 km of piping. The collection system consists of clay tile, concrete and PVC piping in diameters from 102 mm to 1067 mm. When piping needs to be replaced the Town currently utilizes PVC pipe. According to supplied information, there are 414 manholes on the collection system.

The lagoon system consists of one cell with 102 Helixor aeration systems. The sewage is pumped into the lagoon is steps. The liquid flows through the aeration zone to the settling zone after which it enters a 5-foot diameter chlorine contactor with three baffles. Operations staffs estimate that an average of 800,000 to 900,000 imperial gallons is discharged per day. In 1998, the cell was desludged, a new blower installed and the Helixor aerators installed.

The annual cost for the operation and maintenance of the sewage lagoon and sewage collection system was $345,246.09 in 2005 or approximately 0.1¢ per imperial gallon.

Infiltration and Inflow

The sewage collection system is separate from the storm water drainage system, however inflow and infiltration may be occurring. Inflow is defined as storm water runoff that is directed into the sanitary sewer form areas such as weeping tile, foundation drains, eaves troughs. Operations staff reports that some eaves troughs at some of the older buildings, all weeping tile and potentially a few sump pumps may be connected to the sanitary sewer system. Infiltration refers to water entering the collection system from the ground via defective pipes, pipe joints, and manholes. Some infiltration into the system is likely occurring at the manholes and elsewhere in the system.

Lift Stations

There are five lift stations along the distribution system that located at Bell Avenue, 4th Street, 10th Street, 16th Street and Head Avenue. These five lift stations are located throughout The Pas and move the sewage to the lagoon. If the amount of sewage flowing through the system were decreased, there would be savings associated with reduced pumping and maintenance costs

Previously, the town has metered the flow discharged from the sewage lagoon. However, this metering system ceased functioning at some point in the past. There are also no other meters through the collection system. Based on provided values, it is estimated that the collection system pumps an average of 900,000 Igal (4,100 m^3) of sewage to the lagoon per day. It is recommended that sewage flow monitoring equipment be installed at the lift stations and on the treated effluent discharge line at the lagoon.

Sewer Rates

Sewage rates are included in the quarterly water bills. The rate structure is given in Table 25 in the Water System Overview.

Maintenance Programs

There is currently no scheduled maintenance program in place for the collection system however repairs are conducted as required.

The lift stations are checked daily and any problems that arise are dealt with as soon as possible. Dead-ends in the collection system are flushed regularly as are known problem areas.

15.3 WASTEWATER COLLECTION SYSTEM AUDIT RESULTS

The Town of The Pas operates a sanitary sewer system that appears to collect and treat significant amount of inflow and infiltration.

Supplied information was used to estimate the wastewater flow from the lagoon system. However, the non-functional water meter of the effluent line from the lagoon should be reinstalled in order to provide a better estimate of sewage flows.

From information provided by the Town of The Pas, it appears that the sewer system is experiencing significant infiltration, approaching approximately 35 per cent of the total annual flow through the sewer system as a worst-case scenario. The Town could potentially decrease infiltration and inflows to the sewer system by sealing manholes; lining pipes; and disconnecting rain leaders, sump pumps, and weeping tiles from the sanitary sewer system. Further study should be conducted to determine the feasibility of these infiltration reduction options, since they may not be cost effective in this specific case.

Typical infiltration and inflow rates for a system such as The Pas' would be from 8,425,000 Igal/yr to 842,800,000 Igal/yr. The calculated infiltration rate for 2005 was 113,195,400 Igal, which is within the typical rates. Based on the 2005 results, the inflow and infiltration water appears to be 32% of the effluent and therefore accounts for $110,800 of the $345,246 operating budget of the wastewater collection and treatment system. However, as much of the administration and infrastructure is a fixed cost, reducing the inflow and infiltration water to 0% would result in annual savings of $12,640 based on chemical usage and lift station electricity. Additional yearly savings will be realized by a decreased amount of maintenance and parts for infrastructure, as less flow results in less wear and tear. Table 26 demonstrates that infiltration and inflow volumes and potential yearly operational savings. In addition, reducing the infiltration and inflow create excess capacity in the system which will allow the Town to defer expensive capacity upgrades to the lagoon and collection systems.

Table 26 Wastewater Flows and Potential Savings

Year	2003	2004	2005
% Of Water usage that becomes Wastewater	60%	60%	60%
Wastewater Generation (Igal/yr)	238,617,360	242,223,360	224,774,160
Estimated Flow of Treated Effluent (Igal/day)	900,000	900,000	900,000
Estimated Flow of Treated Effluent (Igal/yr)	328,500,000	328,500,000	328,500,000
Estimated Infiltration & Inflow	89,882,640	86,276,640	103,725,840
Percentage of Flow Attributed to I/I	27%	26%	32%
Annual Savings (electricity and chemicals)	$ 7,401	$ 6,064	$ 12,641

The Town should conduct a study in order to determine feasible options to deal with the extraneous storm water sources. This study should include a detailed review of manholes within the system and the televising of the sewage collection system.

It should also be noted that cost savings can be realized within the sewage system by reducing the unaccounted for water. Each 1% reduction of unaccounted for water reaching the wastewater system, will result in a savings of approximately $400 based on electrical and chemical costs. If the 60% of unaccounted for water that reaches the sewer system was completely eliminated, it may be possible to realize a savings of $40,000 per year.

Maintenance Program

The Town may wish to start a scheduled maintenance program, such as actively replacing sections of old pipe, to help minimize potential problems with the sewer system and to spread out the inevitable replacement costs.

By-Laws

In order to limit the amount of storm water entering the sewer system, the Town should consider instituting a by-law that prohibits any future hook-ups of sump pumps or weeping tiles to the sewer system. This may require the expansion of the existing storm sewer system, but it will decrease the amount of water entering the lagoons, and will decrease pumping and treatment costs since less water will be flowing through the sanitary sewer system.

Required Information for Future Wastewater Collection Audits

In order for a sewer audit to be completed in the future, the following minimum information would be required:

- Daily flows through the sewer system.
- Daily flows discharged from the lagoon system.
- Effluent discharge rates.
- The rated flows and head of the pumps.

15.4 PUBLIC EDUCATION

Providing public education will create a better understanding of the water and wastewater treatment systems. If residents are aware of the processes and costs involved with treating and distributing drinking water and collecting and treating sewage, they will be more accepting of cost reduction efforts. A program that highlights the environmental and monetary benefits of water use reduction can help the community gain support for the following initiatives:

- Installing water meters, low flush toilets, or water saving showerheads.
- Fixing leaky taps and toilets.
- Only watering lawns once per week.
- Using drip irrigation for trees and shrubs.

15.5 RECOMMENDATIONS

It is recommended that the Town:

1. Either calibrate or repair the existing meters at the water treatment plant, and record readings.

2. Based on water quality parameters, optimize the backwash and filter-to-waste processes to reduce in-plant water use.

3. Examine and redesign the system where possible according to unidirectional flushing principles to reduce the amount of water used during flushing activities.

4. Develop a program for assessing the accuracy of water meters at the water treatment plant, as well as client water meters.

5. Develop a program for scheduled leak detection of the water distribution system.

6. Conduct a study on the feasibility of options for reducing infiltration inflow to the sewage collection system. This may include sealing manholes, lining pipes, televising the system and developing a staged collection system upgrade strategy.

7. Install flow meters at the sewage lift stations and at the effluent discharge pipe in order to take daily meter readings so that the influence of storm water and runoff on the overall flow through the system can be more accurately determined.

8. Establish a by-law that prevents the connection of sump pumps or diversion of water from weeping tiles into the sewer system.

9. Provide public education to create a better understanding of the water and wastewater treatment systems.

APPENDIX A

INVENTORY SHEETS

TABLE OF CONTENTS – APPENDIX A

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas

Date: May 30, 2006

Toured By: Ray Bodnar & Kevin Affleck

Construction Date: 1976

Building: Johnston Arena

Address:

L x W x H:

Area: 43,824 SF

Building Capacity: 200

Renovations:

Completely renovated in 2005 – dressing rooms were added then; new walls, roof, insulation, windows, HVAC, DDC control.

Ice plant was not renovated.

Building Floor Plan:

Rink, waiting area & concession area and dressing rooms.

Occupied Times:

Winter (7 months): 6 am – 1 am, 7 days/wk.

Summer (5 months): 2 evenings/wk @ 6 hrs/day

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: 3” rigid concrete block; R27 metal cladding on exterior.

Roof Type/R-value: 6” insulation in roof @ R20 value.

Door Type/weather stripping: All in good condition.

2- pedestrian doors to ice plant mechanical room – poor caulking & stripping.

Window type/caulking: All in good condition.

Other:

MECHANICAL

Heating System: Propane radiant heat in bleachers. RTUs use propane.

RTU-1-in lobby - Eng. Air FWA153/DJ6010; RTU-2- in rink – Eng. Air DG18010

RTU-3- dressing rooms – Eng. Air DJ6010

Propane unit heaters in mechanical rooms & electric also.

Cooling System: DX cooling in RTU-1 in the lobby.

Ventilation System: Rink ventilation – older propeller exhaust fans (2), motorized damper on pressure sensor.

OA damper control on RTU –2. Economizers on all units. Grease (1000 cfm) exhaust fan in concession area + runs 24/7, otherwise it will ice up and freezes.

HVAC Controls:

DDC control on HVAC. Count down timer on MR room vent. CO_2 and CO sensors in the rink

HVAC Maintenance/Training: All new HVAC in 2005.

Water Supply System:

Domestic Hot Water System:

New propane water heater c/w 3 storage tanks.

AO Smith 520/429 MBH.

Water Fixtures:

Urinals – 3.8LPF – 15

Mid flow sinks - 23

Toilets – 6LPF - 23

Auto shut off showers – low flow - 18

ELECTRICAL

All T8 fixtures (Model #: F32T8).

4’x4 bulbs = 82

4’x2 bulbs = 127

Rink lights – metal halide = 32.

Outdoor Lighting:

Exit Signs: All new type.

Motors:

Parking Lot Plugs: None.

OTHER BUILDING SYSTEMS

BDD on ice plant exhaust fan – replace 24”x24”.

PROCESS SYSTEMS

Ice plant shared with curling rink. Ice dumped outside.

Compressor (Ammonia): 50HP @ 93% efficiency (newer motor).
-75HP @ 94.1% efficiency (newer motor).

Brine Pumps: 20 HP @ 91% efficiency
-15 HP @ 91% efficiency.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

Grease fan MUA comes from RTU-1.

NOTES

Ice rink AHU discharges 7°C min. – makes ice plant work harder. Wall fans have no intake @ opposite end except RTU.

Manual control of RTU-2.

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas	**Date:** May 29, 2006
Toured By: Tibor Takach	**Construction Date:**
Building: Campground Office	**Renovations:**
Address:	
L x W x H: **Area:** 1,550 SF	
Building Capacity: 15	
Building Floor Plan:	**Occupied Times:** Summer use only. 18 wk season @ 12hrs/day, 7 days/wk.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- Concrete block interior, insulation, 1-1/2" thick wood log plank exterior.

Roof Type/R-value:

- Wood truss roof, vapour barrier, R20 batt insulation, asphalt shingles.

Door Type/weather stripping:

- Exterior doors metal, insulation, weather stripping and sweeps in place.

Window type/caulking:

- 5-40" x 40" double pane windows, wood casing, vertical sliding.
- 1-4' x 4' window, dual pane.
- 2 – 24" x 60" slider windows on the bottom.

Other:

MECHANICAL

Heating System:

Cooling System:

Ventilation System:

HVAC Controls:

HVAC Maintenance/Training:

Water Supply System:

- Domestic water supply system.

Domestic Hot Water System:

- 1-2 element, 6000 W per element, single phase, model JWE1202A, John Wood domestic water heater.

Water Fixtures:

- Men's washroom – 2 toilets, 2 showers, 2 sinks, 1 urinal. All toilets are standard flush units.
- Woman's washroom – 3 toilets, 2 showers, 2 sinks. All toilets are standard flush units.

ELECTRICAL

Indoor Lighting:

- Mechanical room contains 2 – 100W incandescent light fixtures.
- Office contains 9 dual lamp standard efficiency fluorescent light fixtures (T12).
- Men’s washroom contains three incandescent light fixtures ~ 100W and one dual lamp fluorescent fixture (T12).
- Maintenance room contains 2 dual lamp fluorescent light fixtures (T12).
- One ceiling fan with a three lamp light fixture located in the office area.

Outdoor Lighting: 3 – exterior lights appear to be incandescent fixtures.

Exit Signs: None

Motors: None

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

- Campground electrical outlets have a 30 Amp feed for each plug. Used for trailer hook-ups.

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

- 200 Amp main power supply.

NOTES

- The Campground is no longer in use as the former owner has retired and portions for the property have been sold to the neighbouring retail unit. It is uncertain at this time whether the Campground will remain in operation.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: The Pas	**Date:** May 30,2006.
Toured By: Ray Bodnar & Kevin Affleck	**Construction Date:** 1976.
Building: Curling Rink	**Renovations:** 2nd floor added in 1985. RTU added for the bar.
Address: Attached to Arena.	
L x W x H: 90’x156’x24’ **Area:** 14,040 SF	
Building Capacity: ~60	
Building Floor Plan: Rink, lobby & second floor lounge (6 rinks).	**Occupied Times:** 6 months: 5pm – 1am for 7days/wk. Closed for other 6 months.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: R8 Batt. Metal clad in + out.

Roof Type/R-value: R12 Batt. Flat roof.

Door Type/weather stripping: One pedestrian door in good condition w/ good caulking.

One ped door - poor condition with ¾” gap.

Window type/caulking: None to outside.

Rink: 13 @ 3’ x 6’ – double pane (1990 in the lounge).

Lobby: 16 @ 44” x 56” – double pane.

Other:

MECHANICAL

Heating System: Electric force flows in lobby c/w integral stats.

RTU for lobby + lounge. Electric unit heaters in the rink.

Older Carrier RTU (~7.5 ton).

Vandalized condenser – damaged unit.

Cooling System: Lounge has Carrier RTU.

Ventilation System: Economizer on RTU. Large wall fan c/w BDD in rink.

HVAC Controls: Standard stat for RTU.

HVAC Maintenance/Training: Damaged condenser coil + economizer on RTU.

Domestic Hot Water System: Supplied from the Arena.

Water Fixtures:

All high flow fixtures: 10 sinks; 4 urinals; 9 toilets.

ELECTRICAL

Indoor Lighting: T12 – 4’x4 – 40W – 7 in lounge and 12 in the lobby.

Rink- T12 – 8’x2 – 66.

Outdoor Lighting:

Exit Signs: 5

Motors:

Parking Lot Plugs: None.

OTHER BUILDING SYSTEMS

Ceiling fans.

PROCESS SYSTEMS

See Arena.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas		**Date:** May 29,2006
Toured By: Ray Bodnar		**Construction Date:** 1971
Building: Fire Hall & RCMP		**Renovations:** Wall insulation upgraded to R24
Address: Part of Civic Centre (MAB).		
L x W x H: 90'x72'x24	**Area:** 6480 SF	
Building Capacity: ~ 10		
Building Floor Plan: Offices on second floor. Vehicle garage on the main floor.		**Occupied Times:** 8:30 am – 4:30 pm: M-F 6pm – 11 pm: Wed.

ARCHITECHTURAL/STRUCTURAL
Wall Type/ R-value: ~ R14 Masonry inside + outside. Upgraded to R24 in 1994.
Roof Type/R-value: ~ R18 flat roof – upgraded in 1994.
Door Type/weather stripping: 3 pedestrian doors – poor caulking + stripping. Vehicle doors – good condition.
Window type/caulking: 14 – 4' x 3' - dual pane old windows with poor caulking.
Other:
MECHANICAL
Heating System: Hot water unit heater in garage. Ceiling fans. 208V-3phase-3HP- AHU for garage + offices. Water baseboards in office.
Cooling System: Water-cooled A/C used sparingly – domestic water. Training room – no ductwork –no A/C on air handler.
Ventilation System: No truck bay exhaust. Upstairs – bad odour. One air handler c/w economizer. Vent – positive pressure. Gas fumes (exhaust needed).
HVAC Controls: Old stats.
HVAC Maintenance/Training:
Water Supply System:
Domestic Hot Water System: See Civic Centre – uses their tank.
Water Fixtures: All high flow fixtures. 4 – toilets; 2-urinals; 6-sinks; 2-showers.

ELECTRICAL

Indoor Lighting: Compact fluorescent in hallway

5 – 100W incandescent.

2nd Floor: 43 – 4’x2 T12 @ 40W.

Main Floor: 50 – 4’x2 T12 @ 40W

Outdoor Lighting:

Exit Signs: 9 – incandescent.

Motors:

Parking Lot Plugs: 5.

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas		**Date:** May 29, 2006
Toured By: Ray Bodnar		**Construction Date:** 1971
Building: Friendship Centre		**Renovations:** Wall + roof insulation not done.
Address: Part of Civic Centre		
L x W x H: 72'x76'x12'	**Area:** 5472 SF	
Building Capacity: 10		
Building Floor Plan: Open renovation area + offices.		**Occupied Times:** Mon – Fri: 8:30am – 4:30pm

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Concrete R12 – 2 sides are partially (3/4) done. Below grade + not upgraded.
Roof Type/R-value: ~ R12. Not upgraded.
Door Type/weather stripping: 1 – pedestrian door – good caulking + poor stripping.
Window type/caulking: 9 – old double pane windows with poor caulking (3' x 12")
Other:
MECHANICAL
Heating System: Electric furnace + exhaust fan (3 HP). Outdoor air damper disconnected. No access door for maintenance. 2 – electric unit heaters. Boiler removed; electric baseboards.
Cooling System: No A/C.
Ventilation System: No heat recovery.
HVAC Controls: Standard stats.
HVAC Maintenance/Training: 2 Unit heaters very dirty. Furnace filters – dirty.
Water Supply System:
Domestic Hot Water System: Uses Civic Centre water heater.
Water Fixtures: All high flow fixtures: 2 – toilets; 4 – sinks; 1 –urinal.

ELECTRICAL

Indoor Lighting:

62 – 4’x2 – T12 @ 40W

6 – 100 W incandescent

Outdoor Lighting:

Exit Signs: 2 – incandescent.

Motors:

Parking Lot Plugs: 4

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas

Date: May 29, 2006

Toured By: Ray Bodnar & Carol Ham

Construction Date: 1929

Building: Library

Address:

L x W x H: See under floor plan.

Area: Library: 2650 SF

Annex: 2000 SF

Building Capacity: 40

Renovations:

Renovated in 1975. New high bay lighting in library – metal halide – 3 T8s.

Building Floor Plan: Basement, main floor + annex. Open concept to roof.

Occupied Times:

Mon – Fri: 8:30am-8pm

Sat: 1-5pm

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: Masonry outside + plaster inside. R-value unknown.

Roof Type/R-value: Flat roof. R-value unknown.

Door Type/weather stripping: Old entrance door for library – poor stripping + caulking.

One good door. One door in annex – poor stripping + caulking.

Window type/caulking: 6 – 48”x48” Single pane with storm window.

7- 40”x40” – all with poor stripping. 4- 36”x24” 4 – 24”x48”

Other:

MECHANICAL

Heating System:

Electric baseboards in (many) wall stats.

Cooling System: Free cooling only.

Ventilation System: Maintenance relief damper poor access. MUA with electric heat was on timer, now manual control – no access to damper; 5680 cfm. 300cfm exhaust fan c/w motorized damper – no access to dampers; washroom exhaust.

HVAC Controls: Many manual stats.

Old MUA + exhaust fan controls. Work? Timer?

HVAC Maintenance/Training: Poor damper access.

Water Supply System:

Domestic Hot Water System: 3000 W – 175L – electric – no pipe insulation- annex basement.

3000 W – 175L – electric – in other end – no insulation at tank.

Water Fixtures: 4 – toilets & 4 – sinks. All high flow fixtures.

ELECTRICAL
Indoor Lighting: T12s – 4’x2 – 3 in basement; 31 in library; 22 in annex. 14 – 100 W - incandescent
Outdoor Lighting:
Exit Signs: 6 incandescent
Motors:
Parking Lot Plugs: 4 plugs
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas		**Date:** May 29, 2006.
Toured By: Ray Bodnar		**Construction Date:** 1971.
Building: Municipal Admin. Bldg (Civic Centre)		**Renovations:** Cladding replaced; R20 added to walls and roof insulation upgraded – 1994.
Address:		
L x W x H: 80'x73' x 2 floors	**Area:** 5840 SF	
Building Capacity: 20		
Building Floor Plan: 2 storey building – offices + council chambers		**Occupied Times:** M-F: 8:30am – 4:30 pm

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Plaster inside, masonry outside ~R12. Metal clad exterior + masonry. Upgraded to R24.
Roof Type/R-value: ~R16 – built up flat roof. Upgraded.
Door Type/weather stripping: 4'x7' heavy wood door – no stripping, poor caulking.
Window type/caulking: Old double pane sliders – 10 @ 48"x40" size – poor caulking. 2 @ 30"x12"; 6@ 36"x56" Window A/C has large gap on second floor. Some new double pane windows – added as extra in 1995.
Other:
MECHANICAL
Heating System: Propane boiler. 2nd floor AHU; HW baseboard heat. Weil McLain Hot water – for entire complex – including Fire Hall.
Cooling System: 1st RTU – DX ~ 5 HP. No A/C in council chambers. 2nd floor RTU – in council chambers –on timer – Bryan 569DPX09000AH – only A/C; ~3yrs old.
Ventilation System: Broan exhaust fan in each washroom. Economizer standard fan motor F8 air handler – 2 air handlers (council chambers + civic centre). Count down timer on council chamber ventilation.
HVAC Controls: Basic electric controls .Old stats – no setback. No temperature setback. No occupancy control – on 24/7 all the time.
HVAC Maintenance/Training:
Water Supply System: Town water.
Domestic Hot Water System: 270L electric water heater for complex. 4500W. No pipe insulation. Recirc pump.
Water Fixtures: All high flow fixtures. 8-sinks; 6-toilets; 2-urinals.

ELECTRICAL

Indoor Lighting: Basement: T12s – 4’x2 @ 40W = 55

Second Floor: T12s- 4’x2 @ 40W = 80

Main Floor: T12s – 4’x2 @ 40W = 75

Outdoor Lighting:

Exit Signs: 9 old incandescent.

Motors:

Parking Lot Plugs: Need upgrade.

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

Propane for boiler.

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas	**Date:** May 29, 2006
Toured By: Tibor Takach	**Construction Date:** 1974
Building: Municipal Garage	**Renovations:**
Address:	
L x W x H: Refer to floor plan. / **Area:** 11,520 SF	
Building Capacity:	
Building Floor Plan: 144' x 80' x 19'	**Occupied Times:** 40 hrs/wk, year round.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

Roof Type/R-value:

Door Type/weather stripping:

Municipal Garage Area:

Overhead Doors: 3 of 12'x12' size; 1 of 10'x8'; 2 of 12'x14'

All overhead doors are metal insulated doors c/w door sweeps. Some gaps were observed along the bottom of the doors as well as the sides.

Rear Door: 36" double door set, metal, insulated, no weather stripping or door sweeps present.

School Division Shop:

Overhead Doors: 2 of 12'x13'; 2 of 12'x14'; 1 of 14'x14'

All overhead doors are metal, insulated doors c/w door sweeps. Some gaps were observed along the bottom of the doors as well as the sides.

Window type/caulking:

Other:

MECHANICAL

Heating System:

Municipal Garage Area:

4- 20 kW unit heater; 1-15 kW unit heater; 1-10 kW unit heater

3 –500 W baseboard heaters; 1-2 kW baseboard heater

2-1 kW wall mounted force flow heater; 2-2 kW wall mounted force flow heater; 1-3 kW wall mounted ff heater.

1-2000 W baseboard heater (bbh) in upper level; 1-750 W bbh in upper level; 1-500 W bbh in upper level

1-5 kW suspended unit heater; 1-2 kW wall fan

School Division Area:

4 –15 kW unit heaters; 1-2500 W bbh; 1-500 W bbh.

Cooling System: 1 – Electrohome A801 Wall Mount AC unit.

Ventilation System:

1 – centrifugal exhaust fan, Joy model 12-7-8H c/w exhaust and auto outlet to shutter. Located in M.Garage.

1-Joy, 30”x30” heavy-duty damper c/w Honeywell M445-A operator, manual switching. In M.Garage.

1 - Joy DC24C5, ½ hP, Type S auto shutter. In M.Garage

1 – Joy DC20CS with Type S auto shutter. In School Division Shop.

1 – Joy model 12-7-8H centrifugal fan c/w exhaust and auto outlet shutter. In School Division Shop.

1- 30”x30” heavy-duty damper c/w Honeywell M445-A operator, manual switching. In School Division Shop.

1 – Joy DC14CS with Type S with auto damper.

HVAC Controls: 1 – Vanee Gold series HRV located in upstairs storeroom and servicing the office area only.

HVAC Maintenance/Training:

Water Supply System:

Domestic Hot Water System:

2 – John Wood, JWE1204A, upper element 2x4500W, lower element 2x4500W, 405L capacity.

1-Rheme, 100 imperial gallons, upper element 2x4500W, lower element 2x4500W.

Water Fixtures:

1 – sink with hot/cold water fixtures in upstairs area;

Ladies washroom – one sink & one standard flush toilet;

Men’s washroom – 2 sinks, 1 urinal, 1 standard flush toilet.

ELECTRICAL

Indoor Lighting:

Upper Level & Office Area:

4 – compact fluorescent lights in the upper level storeroom.

10 – dual lamp, 32W, T8 fluorescent light fixtures in the lunchroom.

2-T8 fluorescent fixtures in stairwell.

4 – compact fluorescents in the stairwell; 1 – compact fluorescent at the rear door.

7 – 8’ T12 fluorescent light fixtures, dual lamp.

1 – 150 W incandescent light in the mechanical room.

Municipal Garage Area:

7 – 8’ T12, dual lamp, fluorescent light fixtures

3 – 4’ T8 dual lamp fluorescent lights.

16 – high bay, sodium metal halide, luminaries.

Outdoor Lighting:

Exit Signs:

3 exit signs (1 each in upstairs stairwell, rear door & man door).

Motors:

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

Sewage Pumps

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

600V, 1500 amp main service.

NOTES:

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas	**Date:** May 29,2006
Toured By: Tibor Takach	**Construction Date:**
Building: Museum	**Renovations:**
Address:	
L x W x H: See below. **Area:** 371 m^2 (main floor)	
Building Capacity:	
Building Floor Plan: Three storey building ~ 3m high each. Each floor ~ 17.5m x 21.2m	**Occupied Times:** 5 days per week. 40 hrs/wk, year round.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

Basement Exterior Wall:

16mm type "X" gypsum board; 65mm framing at 400mm on centre with airspace b/w framing; 13mm type "X" gypsum board; metal "T" stud; 100mm rigid insulation; liquid applied waterproofing.

Upper Floor Exterior Wall:

Existing masonry; 100mm rigid insulation; 6 mil poly vapour barrier; 13 mm drywall; 90 mm steel studs with airspace b/w studs; 13 mm drywall; 6 mil poly vapour barrier; 13 mm drywall type "X"; 65mm metal framing; 16 mm drywall.

Roof Type/R-value:

16 mm drywall; strapping; 9" batt insulation; wood joists; tar & gravel built-up roof.

Door Type/weather stripping:

- 1 – 36" side door, double set, metal, insulated, c/w weather stripping & door sweeps. Gaps were noted & visible draft. Each door has a 36" x 28" dual pane window.
- Interior vestibule door, 36" metal insulated door c/w 24" x 36" glazing. No weather stripping or door sweeps. Large gaps noted.
- 1 – double wooden door set at main entrance c/w 24" x 48" dual pane windows. Weather stripping & door sweeps in place, but gaps visible.
- 1 – double wooden door set at interior main entrance vestibule. Each door contains a 60" x 24" single pane window. No weather stripping or door sweeps.
- Rear entrance has 1 – 36" metal insulated door with a 24" metal insulated side panel. No weather stripping or door sweeps. One 24" x 48" dual pane window above door.
- Rear interior vestibule door is a 36" metal door with a 24" side panel. Weather stripping in place with visible gaps. No door sweeps in place.
- One side door entrance at basement level consists of 36" metal, insulated door c/w weather stripping & door sweeps.

Window type/caulking:

- Window construction for all windows on the building consists of the original single pane vertical sliding casement windows. Dimensions are approximately 60" x 24".
- On the interior side of the original windows, new vertical sliding dual pane casement windows have been installed. Some windows have been covered with clear plastic.

Other:

MECHANICAL

Heating System:

Basement Level:

2 – 0.75 kW basement unit (BU); 6 – 1.0 kW BU; 3 – 1.5 kW BU; 1 – 1.75 kW BU; 6-2 kW BU; 1-4 kW BU.

First Level:

2 – 3 kW force flow units; 1-2 kW BU; 1-4 kW force flow unit.

Third Level:

1 – 0.5 kW BU; 2 – 1 kW BU; 6 –2 kW BU; 3 –3 kW BU

All baseboard units are manufactured by Westcan & are thermostatically controlled.

1 –50 kW heating coil; 139.0 A, 208 V, 3 phase.

Cooling System:

Equipment #	Description	HP/kW	Amp	Volt/Phase
AH – 1	Air Handling	22.8 kW	103.2	208/1
AH – 2	Air Handling	5.6 kW	29	208/1
AH – 4	Air Handling		17	208/1
AH – 5	Air Handling		22.6	208/3
AH – 6	Air Handling		15.9	208/1
AH – 11	Air Handling	15 HP	46.2	208/3
AH – 12	Air Handling		17.4	208/1
CU – 1	Cond. Unit		39.9	208/1
CU - 2	Cond. Unit		11.8	208/1
CU – 4	Cond. Unit		22.0	208/1
CU – 5	Cond. Unit		41.0	208/1
H – 2	Humidifier	5.8 kW	27.8	208/1
H – 3	Humidifier	4.0 kW	29.2	208/1
H – 4	Humidifier	2.0 kW	9.6	208/1
H – 5	Humidifier	4.0 kW	19.2	208/1
S – 1	Booster Fan	¾ HP	13.0	120/1
S – 2	Booster Fan	½ HP	9.8	120/1
C – 1	Air Compressor	½ HP	9.8	120/1
D - 1	Air Dryer	¼ HP	5.8	120/1

Ventilation System:

HVAC Controls:

HVAC Maintenance/Training:

Water Supply System:

Domestic water supply

Domestic Hot Water System: DHW – 1; Hot water tank, 3.0 kW, 14.4 A, 208 V, single phase.

DHW – 2; Hot water tank, 1.5 kW, 12.5 A, 208 V, single phase.

Water Fixtures: Men's washroom – 2 sinks, 2 urinals & 2 toilets.

Women's washroom – 4 toilets & 2 sinks; 3rd floor staff room – 1 sink.

ELECTRICAL

Indoor Lighting:

Basement Level:

8 – Sylvania, KAC-93-248, 2 lamp, F40RS/WW, fluorescent lamp fixture.

6 – Sylvania, KACW-14-248, 2 lamp, F4RS/WW, fluorescent lamp fixture.

2 – Sylvania, K-402-248, 2 lamp, F40RS/WW, fluorescent lamp fixture.

1 – Sylvania, KAC-93-448, 4 lamp, F40RS/WW, fluorescent lamp fixture.

9 - Sylvania, K12A-45-448, 4 lamp, F40RS/WWX, fluorescent lamp fixture.

6 - Sylvania, K12A-58-448, 4 lamp, F40RS/WWX, fluorescent lamp fixture.

First Level:

71 – incandescent, track mounted light fixtures. Operated with dimmer switches. This lighting may be required for display purposes and should conform to museum standard requirements.

Third Level:

11- Sylvania, KAC-93-248, 2 lamp, F40RS/WW, fluorescent lamp fixture.

1 - Sylvania, KACW-14-248, 2 lamp, F4RS/WW, fluorescent lamp fixture.

5 - Sylvania, K12A-58-448, 4 lamp, F40RS/WWX, fluorescent lamp fixture.

30 – Sylvania, K12AF-45-248, 2 lamp, F40RS/WWX fluorescent lamp fixture.

Outdoor Lighting: All external yard lights are on time clock.

Exit Signs: 7 – exit signs located within the building.

Motors:

Parking Lot Plugs: 4 – parking lot plugs located at the rear of the building.

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

Main power supply is a 1000 amp, three phase.

NOTES

Renovations to this building were completed in accordance with the building requirements for a Museum/Conservatory Structure. This building requires strict temperature and humidity controls for artefact conservation.

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas		**Date:** May 29, 2006.
Toured By: Ray Bodnar		**Construction Date:** 1970
Building: Indoor Pool (Winton Pool)		**Renovations:**
Address:		
L x W x H: 100'x68'	**Area**: 6800SF	
Building Capacity:		
Building Floor Plan: Pool + changing rooms within the school (Margaret Barbour Collegiate). School not included in scope of work.		**Occupied Times:** 10 months: M-F: 9am-9pm S+S: Noon-5pm. July 1- Aug. 31: 9am – 2pm.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

N/A

Roof Type/R-value:

N/A

Door Type/weather stripping:

2 doors – poor stripping.

2 doors – in good condition.

Window type/caulking:

No windows.

Other:

MECHANICAL

Heating System:

Hot water from school boiler – not in scope of work.

Cooling System:

None.

Ventilation System:

AHU in school – not in scope of work.

HVAC Controls:

HVAC Maintenance/Training:

Water Supply System:

Domestic Hot Water System:

School system.

Water Fixtures: All very high flow fixtures.

Auto shut off sinks – 2; 12 showers; 4 toilets; 1- urinal.

ELECTRICAL

Indoor Lighting: 10 pool lights (under water); 24 high bay lights in pool – metal halide

150W – incandescent- 6 in mechanical room + 5 in hallway; T12s 40W @ 4'x2 – 26 in changerooms + 3 hallway.

Outdoor Lighting:

Exit Signs:

4 incandescent.

Motors:

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

Ceiling fans in pool.

PROCESS SYSTEMS

2-Filter pumps @ 7.5HP standard efficiency 230 V.

Insulation missing on HW heating piping @ H.E. 15' of 3" pipe.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

School charges Town $4000/month hydro cost.

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: The Pas

Date: May 29, 2006

Toured By: Tibor Takach

Construction Date:

Building: **Water Treatment Plant**

Renovations:

Some upgrades have been completed in 1997.

Address:

L x W x H: See below.

Area: See below.

Building Capacity:

Building Floor Plan:

Irregular with the following dimensions:

66’x44’; 34’x89’; 30’6” x 81’.

Occupied Times:

Daily on an 8-hour basis.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- 4” face brick; airspace; ½” rigid insulation; vapour barrier.

Roof Type/R-value:

- Roll roofing; 2 ½” rigid insulation; 1 ½” steel deck joists; built-up tar and gravel roof.

Door Type/weather stripping:

- 2 – rolling doors at loading doc with dimensions 11’ high x 5’ wide for the set. Located at the south elevation.
- 1 – pedestrian door at the south elevation. Slab type metal insulated door 36” wide.
- West entrance – 1 doubled or set with dual pane inserts. 36” width per door with two windows per door. For foot wide window panel located beside the double door set.

Window type/caulking:

- 4 – semicircular arched windows with slider inserts located on the north, south, east & west elevations. Window dimensions are 10’ across the bottom with 5’ radius. Slider insert dimensions or 1’x3’.

Other:

- Building reservoirs have been constructed above grade and backfilled along the sides to the finished floor elevation. The finished floor elevation is approximately equivalent to one story above grade. Rigid foam insulation has been installed on the outside of the concrete wall to a depth of approximately 8’. Boiler room floor elevation is 67.92’. Roof elevation is 95’8”.

MECHANICAL

Heating System:

- 5- baseboard heaters 120V, 24 amp, single phase.
- 9 – Trane 84H unit heater, 1648 cfm, 1/8 HP, 1075 rpm, 120V, single phase, 60 Hz, 68.5 MBH.
- 10 – Trane 72H unit heater, 571 cfm, 1/30 HP, 1500 rpm, 120V, 19.7 MBH.
- 1 – Trane No. 3 force flow heater, 300 cfm, 1050 rpm, 120V, 1.5A, single phase, 60 Hz, 27.0 MBH.
- Unit heaters are fed by one of two steam boilers. Boiler #1 was the existing boiler, boiler #2 was the new boiler headed in the 1997 upgrade.
- Boiler #2 serves as the hot water system feeding to three zones for plant heating process.

Cooling System:

Ventilation System:

- 1 – Penn “Domex” roof exhauster model AQ-10; 1100 cfm @ 1/8” standard pressure, ¼ HP, 1750 rpm, 120V, single phase, 60 Hz (Exhaust Fan 1).
- 2 – Penn “Centrex” in-line ventilator model REX-07Q 100cfm, 1/12 HP, 1750 rpm, 120V, single phase, 60 Hz (Exhaust Fan 2 and 3).
- Airolite T-638 louver with screen and background damper, 12”x12” located on exhaust fan 3.
- Chlorine room has makeup air vent with motorized damper tied onto exhaust fan 1.
- 1 – Centrifugal roof fan; Greenheck model Cube 161-5 belt drive upblast centrifugal roof exhaust fan, 1200L/s, 93 Pa standard pressure, 1034 rpm, 0.32 kW, 575V, 60 Hz, three phase, Aluminium dampers with vinyl seals.
- 1 – Greenheck model BSQ-90-4 centrifugal in-line fan, 300L/s, 62 Pa standard pressure, 1292 rpm, 0.09 kW. Motor size: ¼ HP, 115V, 60 Hz, single phase, 1725 rpm. Gravity actuated aluminium damper with vinyl seals on closing edge.
- 1 – Greenheck model Cube – 180-10, 1850 L/sec, 93 Pa standard pressure, 1137 rpm, 0.66 kW. Motor size: 1 HP, 208V, 60Hz, three phase, and 1725 rpm. Damper size: 457 x 457 mm gravity actuated aluminium dampers with vinyl seals on closing edge.
- Eastside ventilation: Tamco series 9000 thermally insulated damper with motorized actuator.
- Louvers: Airolite K638X fixed blade louver; 1-19.5 x 19.5”, 1-15.5 x 19.5”, 1- 47.5 x 35.5”. Aluminium blades.

HVAC Controls:

HVAC Maintenance/Training:

Water Supply System: Domestic water supply.

Domestic Hot Water System: 240 V, 12 amp, single phase.

Water Fixtures:

- 1 – standard flush toilet; 1- sink; 1 – double stainless steel laboratory sink; 1-shower facility.
- 2 – emergency eye wash stations (used only in the event of an emergency/testing).

ELECTRICAL

Indoor Lighting:

Pump House:

- 22- 4’ T12 fluorescent light fixtures;
- 30 – external single lamp ballasts; high pressure sodium/metal halide;
- 30 – internal light fixtures.

Operating Floor:

- 34 – 4’ T12s
- 4 – 8’ T12s
- 44 – internal light fixtures;
- 5 – wall mounted interior luminaire c/w integral photocell, cast aluminium housing, bronze finish, 25W metal halide lamp, 120V, glass lens.
- 14 – existing ceiling mounted low bay light; 150W; 120V.

Outdoor Lighting:

Exit Signs:

Motors:

- Distribution pump #1 (DP-1); 100 HP, 99 amp, 600 V, soft start/stop. Pump upgraded in 1997.
- Distribution pump #2 (DP-2); 50 HP bar, 52 amp, 600 V, three phase, soft start/stop.
- DP-3; 100 HP, 99 amp, 600 V, three phase, soft start/stop.
- Air scour blower; 30 HP, 32 amp, 600 V, three phase, control FVNR.
- Potassium permanganate; 1/6 HP, 4.4 amp, 120 V, single phase, manual start.
- Potassium permanganate slurry feeder; ¼ HP from 5.8 amp, 120V, single phase, manual start.
- Potassium permanganate mixer; ¼ HP from 5.8 amp, 120V, single phase, manual start.
- Backwash pump (BWP-1); 50 HP, 52 amp, 600 V, three phase, control FVNR. Pump upgraded in 1997.
- Raw water pump 1 (RP-1); 10 HP; 11 amp, 600 V, three phase, control FVNR. Pump upgraded in 1997.
- RP-2; 40 HP Park, 41 amp, 600 V, three phase, control FVNR. Pump upgraded in 1997.
- Solids contact clarifier; 3 HP, 3.9 amp, 600 V, three phase, control FVNR. Upgraded in 1997.
- Carbon feeder; ¼ HP, 5.8 amp, 120 V, single phase, manual control. Upgraded in 1997.
- Fluoride feeder; ¼ HP, 5.8 amp, 120 V, single phase, manual control. Upgraded in 1997.
- Alum feeder; ¼ HP, 5.8 amp, 120 V, single phase, manual control. Upgraded in 1997.
- Aquafloc feeder 1; ¼ HP, 5.8 amp, 120 V, single phase, manual start. Upgraded in 1997.
- Aquafloc feeder 2; ¼ HP, 5.8 amp, 120 V, single phase, manual start. Upgraded in 1997.
- Claraid feeder 1; ¼ HP, 5.8 amp, 120 V, single phase, manual start. Upgraded in 1997.
- Claraid feeder 2; ¼ HP, 5.8 amp, 120 V, single phase, manual start. Upgraded in 1997.
- Carbon hopper vibrator; 1/8 HP, 4.4 amp, 120 V, single phase, manual start. Upgraded in 1997.
- Sump pump 1; 3.7 HP, 6.1 amp, 600 V, three phase, control FVNR.
- Alum transfer pump; ½ HP, 0.8 amp, 600 V, three phase, control FVNR.
- Monorail hoist; 2.5 HP, 2.5 amp, 600 V, three phase.
- Air compressors 1 & 2; 2 HP, 2.7 amp, 600 V, three phase.
- Dumbwaiter; 1.7 HP, 2.1 amp, 600 V, three phase.
- Circulation pumps 1 & 2; 1 HP, 1.4 amp, 600 V, three phase, control FVNR.
- Recirculation pump; ¾ HP, 1.1 amp, 600 V, three phase, control FVNR.
- Dust collector; ¾ HP, 1.1 amp, 600 V, three phase, control FVNR.
- Condensate pump; 1 HP, 1 amp, 600 V, three phase.
- Fuel oil pump; ½ HP, 0.8 amp, 600 V, three phase, control FVNR.

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

Distribution Pumps:

- Distribution pumps run24/7 with pressure control being provided by pressure relief valves. Pumps have soft start/stop control with no VFD's.

Water Treatment System: The water treatment system consists of the following unit processes –

- Raw water carbon feed system including hopper storage & feeding equipment; note currently using potassium permanganate instead of carbon;
- Lime feed, lime hopper, lime slaker;
- Alum feed system & storage tank;
- Contact clarification;
- Multimedia filtration;
- Gaseous chlorine disinfection system;
- Magnetic flow meters have been installed on the influent line, backwash line & distribution line.

Filter media consists of anthracite, sand & gravel. Air scour has been provided for filter but washing. New underdrains and media installed in 1997.

A raw water heating system is in place and is used to heat the raw water supply for a period of approximately 6-8 weeks annually from February to April. This is used to raise the raw water temperature for 39℉ from 32℉ to assist the water treatment process.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

- Main power supply is 600 amp, 575 fold, three phase, three water.

NOTES

- System pressures maintained from 75 to 120 psi.

APPENDIX B

TABLES TO CALCULATE ENERGY SAVINGS

TABLE OF CONTENTS – APPENDIX B

Table B.1.1- Annual Energy Consumption for Arena

	Energy Consumption (kWh)	**% of Total Energy Consumption**
HVAC	352,952	33%
Cooling	51,000	5%
Ice Plant	151,228	14%
Lighting	127,488	12%
Domestic Hot Water	362,460	34%
Zamboni Hot Water	34,782	3%
Total	**1,079,910**	

Table B.1.2 (a) - Electricity Usage for the Arena

	Consumption Data			Calculated Costs		
Month (2004)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
January	154	104	67,200	$865	$2,091	$3,395
February	154	104	62,880	$865	$1,990	$3,280
March	154	104	67,680	$865	$2,102	$3,408
April	144	94	25,920	$782	$1,125	$2,199
May	48	0	13,440	$0	$740	$869
June	29	0	5,760	$0	$338	$410
July	29	0	7,200	$0	$422	$506
August	144	94	34,080	$782	$1,316	$2,417
September	144	94	62,880	$782	$1,990	$3,185
October	144	94	68,640	$782	$2,124	$3,338
November	144	94	65,760	$782	$2,057	$3,262
December	144	94	52,320	$782	$1,743	$2,903
TOTAL		**876**	**533,760**	**$7,288**	**$18,037**	**$29,172**

Table B.1.2 (b) - Propane Consumption for the Arena

Month (2004)	Propane (L)	Energy (kWh)	Total Charge
January	18,360	130,301	$4,976
February	12,044	85,476	$3,260
March	12,042	85,462	$3,260
April	0	0	$0
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
October	10,707	75,988	$3,586
November	11,861	84,178	$3,972
December	11,941	84,745	$3,999
TOTAL	**76,955**	**546,150**	**$23,053**

Notes

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.
The electricity consumption for the Arena is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.1.3 - Lighting Analysis Summary for the Arena

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Fluorescents 4' T8s (82x4')	328	41,162	$2,471	41,162	$2,471	0	$0
Fluorescents 4' T8s (127x2')	254	31,875	$1,914	31,875	$1,914	0	$0
Metal Halide (400 W) - rink lights	32	54,451	$3,269	54,451	$3,269	0	$0
TOTALS		**127,488**	**$7,654**	**127,488**	**$7,654**	**0**	**$0**

Annual Energy Savings (kWh)	**0**
Annual Cost Savings	**$0**
Percent Annual Energy Savings	**0%**

Notes:

These calculations are based on an occupancy rate of 4254 hours/year.
All lighting is energy efficient and does not need upgrading.

Table B.1.4 - Window and Door Infiltration Calculations for the Arena

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors in ice plant mech. room - 3'x7' (2)	10	0.05	125	34	12,980,700	3,804	$145
TOTALS						**3,804**	**$145**

Notes:

Crack length for the doors and windows is 1/4 of their respective perimeters.

Table B.1.5 - Water Usage for the Arena

Fixtures	**Qty**	**Est. # of Uses/Hr/ Fixture**	**Est. # of Uses/Yr**	**Current Flow (LPF or LPC)**	**Current Water Usage (L/Yr)**	**New Flow (LPF or LPC)**	**New Water Usage (L/Yr)**	**Water Saved (L/Yr)**	**Hot Water Savings (kWh)**	**Cost Savings**
Sinks	33	3.5	494,528	1.60	791,244	0.32	158,249	632,995	23,721	$1,424
Toilets	32	1.9	255,240	6.00	1,531,440	3.98	1,015,855	515,585	NA	NA
Urinals - low flow	15	1.0	62,970	3.80	239,288	3.80	239,288	0	NA	NA
Urinals - high flow	4	1.1	6,370	9.50	60,515	3.80	24,206	36,309	NA	NA
Showers - auto shut off	8	6.1	207,383	47.30	9,809,192	47.30	9,809,192	0	0	$0
Total					**12,431,679**		**11,246,790**	**1,184,889**	**23,721**	**$1,424**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	110	150	
Number of Toilet Uses/day	3	1	
Number of Toilets	32	32	
Toilet Uses/hour/fixture	1.289063	0.585938	1.875
Number of Sinks	33	33	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	1.25	2.272727	3.522727
Number of Urinals	0	19	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0.986842	0.986842
Number of Showers	8	8	
Number of Shower Uses/day	3	3	
Shower Uses/hr/fixture	2.578125	3.515625	6.09375

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	791,244	29,651
Showers	9,809,192	367,590
Zamboni	390,096	34,782
Total	**10,600,436**	**397,241**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 1.58 gallons per flush and the new toilets use 1.05 gallons per flush

Water fixtures from the curling rink were added to the arena. Water supply from the arena also feeds the curling rink.

Occupancy for curling club was also added into this assessment.

Table B.1.6 Energy Savings with Heating, Ventilation and Air Conditioning for Arena

Description	Quantity	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Install motorized damper in ice plant room.	1	100	38,004,480	11,138	$669

Description	Quantity	Current Energy Consumption (kWh)	Energy Savings (kWh)	Cost Savings ($)
Install outdoor thermostat to control rink ventilation	1	151,228	22,684	$1,362

Description	Quantity	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Add CO_2 Control to RTUs.	1	500	46,555,488	13,644	$819

Table B.1.7 Energy Consumption and Savings Calculations for Motors in the Large Arena (Includes Small Arena)

Description	**Rated HP**	**Required HP**	**# of hours**	**Current Motors**			
				Eff.	**Actual HP**	**kW**	**kWh**
Compressor	50.0	47	1,530	93%	47.4	35.37	54,114
Compressor	50.0	47	1,530	94%	48.0	35.79	54,754
Brine pump motor	20.0	18	1,530	91%	18.6	13.84	21,180
Brine pump motor	20.0	18	1,530	91%	18.6	13.84	21,180
Domestic Water Pump	0.25	0.23	4,506	90%	0.23	0.17	771
TOTAL							**151,228**

Table B.2.1- Annual Energy Consumption for Campground Offices/Changerooms

	Energy Consumption (kWh)	% of Total Energy Consumption
Camp Trailer Outlets	10,475	32%
Lighting	6,295	19%
Hot Water	15,840	49%
Total	**32,610**	

Table B.2.2 - Electricity Usage for the Campground Offices/Changerooms

	Consumption Data			Calculated Costs		
Month (2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
January	0	0	4,810	$0	$282	$339
February	0	0	4,120	$0	$241	$293
March	0	0	3,910	$0	$229	$279
April	0	0	3,170	$0	$190	$235
May	0	0	2,270	$0	$136	$173
June	0	0	2,120	$0	$127	$163
July	0	0	1,350	$0	$81	$110
August	0	0	1,040	$0	$62	$89
September	0	0	1,060	$0	$64	$91
October	0	0	1,830	$0	$110	$143
November	0	0	2,200	$0	$132	$169
December	0	0	4,730	$0	$284	$342
TOTAL		**0**	**32,610**	**$0**	**$1,939**	**$2,428**

Notes

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Campground Offices is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.2.3- Lighting Analysis Summary for the Campground Changerooms/Offices

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Fluorescents - Convert 4' T12s to 4' T8s (4' x2).	24	1,778	$107	1,070	$64	708	$42
Incandescents in mechanical room - Convert to compact fluorescents.	2	302	$18	85	$5	218	$13
Incandescents in office area - Convert to compact fluorescents.	3	272	$16	68	$4	204	$12
Outdoor incandescents - convert to high pressure sodium bulbs.	3	3,942	$237	986	$59	2,957	$178
TOTALS		**6,295**	**$378**	**2,209**	**$133**	**4,086**	**$245**

Annual Energy Savings (KWH)	**4,086**
Annual Cost Savings	**$245**
Percent Annual Energy Savings	**65%**

Notes:

These calculations are based on an occupancy rate of 1512 hours/year.
Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.2.4 - Water Usage for the Campground Offices/Changerooms

Fixtures	Qty	Est. # of Uses/Hr/ Fixture	Est. # of Uses/Yr	Current Flow (LPF or LPC)	Current Water Usage (L/Yr)	New Flow (LPF or LPC)	New Water Usage (L/Yr)	Water Saved (L/Yr)	Hot Water Savings (kWh)	Cost Savings
Sinks	4	1.7	10,017	1.60	16,027	0.32	3,205	12,822	480	$29
Toilets	5	0.7	5,481	13.25	72,623	3.98	21,814	50,809	NA	NA
Urinals	1	1.0	1,512	9.50	14,364	3.80	5,746	8,618	NA	NA
Showers	4	0.9	5,670	66.25	375,609	47.30	268,191	107,418	4,025	$242
Total					**478,624**		**298,956**	**179,667**	**4,506**	**$271**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	7	8	
Number of Toilet Uses/day	3	1	
Number of Toilets	5	5	
Toilet Uses/hour/fixture	0.525	0.2	0.725
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.65625	1	1.65625
Number of Urinals	0	1	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	1	1
Number of Showers	4	4	
Number of Shower Uses/day	4	4	
Shower Uses/hr/fixture	0.4375	0.5	0.9375

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	16,027	601
Showers	375,609	14,076
Total	**391,636**	**14,676**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm.

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.05 gallons per flush.

Table B.3.1- Annual Energy Consumption for Curling Rink

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	399,798	94%
Cooling	15,600	4%
Lighting	10,790	3%
Total	**426,187**	

Table B.3.2 - Electricity Usage for the Curling Rink

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	131	81	23,640	$674	$1,072	$2,015
October	141	91	57,960	$757	$1,875	$3,025
November	143	93	59,280	$774	$1,905	$3,079
December	147	97	57,720	$807	$1,869	$3,076
January	147	97	70,320	$807	$2,164	$3,412
February	147	97	55,200	$807	$1,810	$3,008
March	150	100	59,400	$832	$1,908	$3,149
April	22	0	2,640	$0	$159	$206
May	22	0	0	$0	$0	$25
June	0	0	0	$0	$524	$622
July	0	0	0	$0	$524	$622
August	79	29	15,600	$241	$843	$1,262
TOTAL		**685**	**401,760**	**$5,699**	**$14,652**	**$23,501**

Table B.3.2 (b) - Propane Consumption for the Curling Rink

Month (2004-2005)	**Propane (L)**	**Energy (kWh)**	**Total Charge**
September	0	0	$0
October	353	2,504	$155
November	481	3,414	$221
December	973	6,904	$448
January	919	6,524	$423
February	716	5,083	$330
March	0	0	$0
April	0	0	$0
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	0	0	$0
TOTAL	**3,442**	**24,427**	**$1,576**

Notes

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Curling Rink is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.3.3 - Lighting Analysis Summary for the Curling Rink

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Lounge - Convert 4' T12s to 4' T8s (7x4)	28	1,998	$120	1,203	$72	795	$48
Lobby - Convert 4' T12s to 4' T8s (12x4)	48	3,425	$206	2,062	$124	1,363	$82
Rink Area - Convert 8' T12s to 8' T8s (8'x2)	24	4,054	$243	1,887	$113	2,167	$130
EXIT signs - Convert to LED modules	5	1,314	$79	131	$8	1,183	$71
TOTALS		**10,790**	**$648**	**5,283**	**$317**	**5,507**	**$331**

Annual Energy Savings (KWH)	**5,507**
Annual Cost Savings	**$331**
Percent Annual Energy Savings	**51%**

Notes:

These calculations are based on an occupancy rate of 1456 hours/year.

Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.3.4 (a) Window and Door Replacement Calculations for the Curling Rink

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Replace double pane 3'x6' windows -in lounge (13).	234	2.000	9,774	$587	6.25	3,128	$188	6,646	$399
Replace double pane 44"x56" windows in lobby area (16).	274	2.000	11,435	$687	6.25	3,659	$220	7,776	$467
TOTALS			**21,209**	**$1,273**		**6,787**	**$407**	**14,422**	**$866**

Table B.3.4 (b) Window and Door Infiltration Calculations for the Curling Rink

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (1)	5	0.05	125	17	5,257,184	1,541	$93
Windows- 13 of 3'x6' size in rink area	59	0.025	50	80	24,603,619	7,211	$433
Windows - 16 of 44"x 56" size in lobby area.	67	0.025	50	91	28,038,313	8,217	$493
TOTALS						**16,969**	**$1,019**

Table B.3.4 (c) Wall/Roof Insulation Upgrade for the Curling Rink

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Upgrade roof insulation in lobby.	3120	12.000	21,719	$1,304	40.000	6,516	$391	15,203	$913
TOTALS			**21,719**	**$1,304**		**6,516**	**$391**	**15,203**	**$913**

Notes:

Crack length for the doors and windows is 1/4 of their respective perimeters.

Table B.3.5 Energy Savings with Heating, Ventilation and Air Conditioning for the Curling Rink

Description	% of Time Unoccupied	HDD below 70℉	HDD below 59℉	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 15℃ (59℉)	83.38%	11876.4	10,177.9	399,798	33,372

Table B.4.1- Annual Energy Consumption for Fire Hall & Municipal Admin Building

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	228,643	62%
Cooling	52,640	14%
Lighting	72,434	20%
Motors	15,991	4%
Total	**369,708**	

Table B.4.2 - Electricity Usage for the Fire Hall & Municipal Admin. Building

	Consumption Data			Calculated Costs		
Month (2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
January	58	8	23,680	$67	$1,073	$1,324
February	56	6	17,120	$50	$882	$1,087
March	48	0	16,640	$0	$864	$1,009
April	49	0	18,240	$0	$947	$1,105
May	43	0	13,920	$0	$777	$911
June	52	0	17,760	$0	$928	$1,083
July	50	0	16,320	$0	$872	$1,019
August	51	0	18,560	$0	$960	$1,119
September	54	0	15,520	$0	$840	$983
October	40	0	14,880	$0	$815	$954
November	41	0	16,800	$0	$891	$1,040
December	49	0	16,800	$0	$891	$1,040
TOTAL		**14**	**206,240**	**$116**	**$10,739**	**$12,676**

Table B.4.2 (b) - Propane Consumption for the Fire Hall & Municipal Admin.Building

Month (2005)	Propane (L)	Energy (kWh)	Total Charge
January	4,173	29,613	$1,815
February	1,736	12,320	$755
March	6,859	48,677	$2,984
April	996	7,071	$433
May	1,419	10,069	$617
June	6	42	$3
July	0	0	$0
August	0	0	$0
September	0	0	$0
October	2,438	17,300	$1,060
November	2,030	14,409	$883
December	3,377	23,967	$1,469
TOTAL	**23,033**	**163,468**	**$10,020**

Notes:

The Fire Hall & Municipal Admin.Building (Civic Centre) are housed in the same facility and share the same meters.

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Fire Hall/MAB is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.4.3 - Lighting Analysis Summary for the Fire Hall & Municipal Garage

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Fire Hall							
Main floor fluorescents - Convert 4' T12s to 4' T8s (4' x2)	86	9,861	$592	5,937	$356	3,924	$236
Second floor fluorescents - Convert 4' T12s to 4' T8s (4'x2)	100	11,466	$688	6,903	$414	4,563	$274
Incandescents - Convert to compact fluorescents	5	1,170	$70	328	$20	842	$51
EXIT signs - Convert to LED modules	9	2,365	$142	237	$14	2,129	$128
Install parking lot controllers.	5	2,400	$144	1,200	$72	1,200	$72
Municipal Garage							
Basement fluorescents - Convert 4' T12s to 4' T8s (4'x2)	110	11,211	$673	6,750	$405	4,462	$268
First floor fluorescents - Convert 4' T12s to 4' T8s (4'x2)	160	16,307	$979	9,818	$589	6,490	$390
Main floor fluorescents - Convert 4' T12s to 4' T8s (4'x2)	150	15,288	$918	9,204	$553	6,084	$365
EXIT signs - Convert to LED modules	9	2,365	$142	237	$14	2,129	$128
TOTALS		**72,434**	**$4,349**	**40,611**	**$2,438**	**31,822**	**$1,911**

Annual Energy Savings (KWH)	**31,822**
Annual Cost Savings	**$1,911**
Percent Annual Energy Savings	**44%**

Notes:
These calculations are based on an occupancy rate of 2340 hours/year.
Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.4.4 (a) Window and Door Replacement Calculations for the Fire Hall & Municipal Admin.Building

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Fire Hall									
Replace double pane 4'x3' windows (14).	168	1.000	17,326	$1,040	6.25	2,772	$166	14,554	$874
Municipal Admin. Building									
Replace double pane windows - 48"x40"(10).	133	1.000	13,751	$843	6.25	2,200	$135	11,551	$708
Replace double pane windows 30"x12" size (2).	5	1.000	516	$32	6.25	83	$5	433	$27
TOTALS			**31,592**	**$1,914**		**5,055**	**$306**	**26,537**	**$1,608**

Table B.4.4 (b) Window and Door Infiltration Calculations for the Fire Hall & Municipal Admin. Building

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Fire Hall							
Pedestrian doors - 3'x7' (3)	15	0.05	125	51	19,471,050	5,706	$343
Windows - 4'x3' (14)	49	0.025	50	67	25,442,173	7,456	$448
Municipal Admin.Building							
Door - 4'x7' (4)	22	0.05	125	75	28,557,541	8,369	$513
Windows - 48"x40" size (10)	37	0.025	50	50	19,038,360	5,580	$342
Windows -30"x12" (2)	4	0.025	50	5	1,817,298	533	$33
Windows - 36"x56" (6)	23	0.025	50	31	11,942,244	3,500	$214
TOTALS						**31,144**	**$1,892**

Table B.4.4 (c) Wall/Roof Insulation Upgrade for the Fire Hall & Municipal Admin. Building

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (^oF ft^2hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (^oF ft^2hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Fire Hall									
Upgrade roof insulation.	6480	18.000	37,127	$2,229	40.000	16,707	$1,003	20,420	$1,226
Municipal Admin. Building									
Upgrade roof insulation.	5840	16.000	37,642	$2,307	40.000	15,057	$923	22,585	$1,384
TOTALS			**74,769**	**$4,536**		**31,764**	**$1,926**	**43,005**	**$2,610**

Notes:
Crack length for the windows is 1/4 of their respective perimeters.

Table B.4.5 - Water Usage for the Fire Hall & Municipal Admin. Building

Fixtures	Qty	Est. # of Uses/Hr/ Fixture	Est. # of Uses/Yr	Current Flow (LPF or LPC)	Current Water Usage (L/Yr)	New Flow (LPF or LPC)	New Water Usage (L/Yr)	Water Saved (L/Yr)	Hot Water Savings (kWh)	Cost Savings
Fire Hall										
Sinks	6	0.8	11,115	1.60	17,784	0.32	3,557	14,227	533	$32
Toilets	4	0.4	3,640	13.25	48,230	3.98	14,487	33,743	NA	NA
Urinals	2	0.5	2,340	9.50	22,230	3.80	8,892	13,338	NA	NA
Showers	2	0.6	2,925	66.25	193,767	47.30	138,353	55,414	2,077	$125
Municipal Admin. Building										
Sinks	12	0.8	19,968	1.60	31,949	0.32	6,390	25,559	958	$58
Toilets	8	0.4	6,656	13.25	88,192	3.98	26,491	61,701	NA	NA
Urinals	3	0.5	3,120	9.50	29,640	3.80	11,856	17,784	NA	NA
Total					**431,791**		**210,025**	**221,766**	**3,568**	**$214**

Frequency at Which Fixtures are Used - Fire Hall			
	Females	**Males**	**Totals**
Number of People	2	8	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	0.1875	0.25	0.4375
Number of Sinks	6	6	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.125	0.666667	0.791667
Number of Urinals	0	2	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0.5	0.5
Number of Showers	2	2	
Number of Shower Uses/day	2	2	
Shower Uses/hr/fixture	0.125	0.5	0.625

Frequency at Which Fixtures are Used - MAB			
	Females	**Males**	**Totals**
Number of People	17	3	
Number of Toilet Uses/day	3	1	
Number of Toilets	6	6	
Toilet Uses/hour/fixture	1.0625	0.0625	1.125
Number of Sinks	8	8	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.796875	0.1875	0.984375
Number of Urinals	0	2	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0.1875	0.1875
Number of Showers	0	0	
Number of Shower Uses/day	2	2	
Shower Uses/hr/fixture	0	0	0

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	49,733	1,864
Showers	193,767	7,261
Total	**243,499**	**9,125**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.05 gallons per flush.

MAB = Municipal Admin. Building

Water fixtures from the Friendship Centre are supplied by the Municipal Admin. Building and were added into this table accordingly.

Table B.4.6 Energy Savings with Heating, Ventilation and Air Conditioning for Fire Hall & Municipal Admin. Building

Description	% of Time Unoccupied	HDD below 70℉	HDD below 59℉	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Fire Hall					
Setback Thermostats to 15℃ (59℉)	73.29%	11,876.4	10,177.9	228,643	16,775
Municipal Admin. Building					
Setback Thermostats to 15℃ (59℉)	76.26%	11,876.4	10,177.9	228,643	17,455

Table B.4.7 Energy Consumption and Savings Calculations for Motors in the Fire Hall & Municipal Admin.Building

Description	Rated HP	Required HP	# of hours	Current Motors				Energy Savings of Premium Efficiency Versus Standard Efficiency Motor		
				Eff.	**Actual HP**	**kW**	**kWh**	**Actual HP**	**kW**	**kWh**
Fire Hall										
Air handler motor	3.0	2	8,760	85%	2.4	1.83	15,991	0.07	0.05	470
Municipal Admin.Building										
Fan motor	5.0	4	2,080	85%	4.1	3.04	6,328	0.12	0.09	186
Fan motor	3.0	2	2,080	85%	2.4	1.83	3,797	0.07	0.05	112
TOTAL							**15,991**			**470**

Notes:

Air handler motor runs for 24/7, 365 days/year.

Fan motors run for occupancy duration in Municipal Admin. Building.

Table B.5.1- Annual Energy Consumption for Friendship Centre

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	90,588	86%
Lighting	14,412	14%
Total	**105,000**	

Table B.5.2 - Electricity Usage for the Friendship Centre

	Consumption Data			Calculated Costs		
Month (2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
January	45	0	16,320	$0	$851	$995
February	47	0	12,780	$0	$715	$840
March	35	0	12,540	$0	$706	$829
April	31	0	8,760	$0	$526	$625
May	38	0	8,280	$0	$497	$592
June	31	0	5,340	$0	$321	$391
July	16	0	3,780	$0	$227	$284
August	25	0	4,320	$0	$259	$321
September	22	0	4,260	$0	$256	$317
October	29	0	6,060	$0	$364	$440
November	38	0	9,120	$0	$548	$649
December	47	0	13,440	$0	$758	$890
TOTAL		**0**	**105,000**	**$0**	**$6,027**	**$7,172**

Notes:

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Friendship Centre is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.5.3 - Lighting Analysis Summary for the Friendship Centre

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Fluorescents - Convert 4' T12s to 4' T8s (4' x2)	124	12,638	$759	7,609	$457	5,029	$302
Incandescents - Convert to compact fluorescents	6	1,248	$75	349	$21	899	$54
EXIT signs - Convert to LED modules	2	526	$32	53	$3	473	$28
Install parking lot controllers.	4	1,920	$115	960	$58	960	$58
TOTALS		**14,412**	**$865**	**8,011**	**$481**	**6,401**	**$384**

Annual Energy Savings (KWH)	**6,401**
Annual Cost Savings	**$384**
Percent Annual Energy Savings	**44%**

Notes:

These calculations are based on an occupancy rate of 2080 hours/year.
Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.5.4 (a) Window and Door Replacement Calculations for the Friendship Centre

Description	Existing				New			Savings	
	Area (ft^2)	R-Value ($^oF\ ft^2hr/BTU$)	Annual Heat Loss (kWh)	Cost ($)	R-Value ($^oF\ ft^2hr/BTU$)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Replace double pane 3.5'x1' windows - 9	31.5	2.000	1,316	$79	6.25	421	$25	895	$54
TOTALS			**1,316**	**$79**		**421**	**$25**	**895**	**$54**

Table B.5.4 (b) Window and Door Infiltration Calculations for the Friendship Centre

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (1)	5	0.05	125	17	5,257,184	1,541	$93
Windows - 3.5'x1' (9)	20	0.025	50	28	8,516,637	2,496	$150
TOTALS						**4,037**	**$242**

Table B.5.4 (c) Wall/Roof Insulation Upgrade for the Friendship Centre

Description	Existing				New			Savings	
	Area (ft^2)	R-Value ($^oF\ ft^2hr/BTU$)	Annual Heat Loss (kWh)	Cost ($)	R-Value ($^oF\ ft^2hr/BTU$)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
When roof is being replaced, upgrade the insulation.	5472	12.000	38,092	$2,287	40.000	11,428	$686	26,664	$1,601
Upgrade wall insulation on one side.	912	12.000	6,349	$381	20.000	3,809	$229	2,539	$152
TOTALS			**38,092**	**$2,287**		**11,428**	**$686**	**26,664**	**$1,601**

Notes:

Crack length for the doors and windows is 1/4 of their respective perimeters.

Table B.5.5 Energy Savings with Heating, Ventilation and Air Conditioning for the Friendship Centre

Description	% of Time Unoccupied	HDD below 70°F	HDD below 59°F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 15°C (59°F)	76.26%	11876.4	10,177.9	90,588	6,915

Description	Quantity	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Add CO_2 Control to RTUs.	1	300	11,082,106	3,248	$195

Description	Quantity	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Replace leaky motorized dampers with insulated dampers.	1	50	15,391,814	4,511	$271

Table B.6.1- Annual Energy Consumption for Library

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	112,841	78%
Lighting	25,525	18%
Hot Water	5,875	4%
Total	**144,240**	

Table B.6.2 - Electricity Usage for the Library

	Consumption Data			Calculated Costs		
Month (2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
January	58	8	27,360	$67	$1,159	$1,422
February	58	8	14,160	$67	$768	$976
March	48	0	20,400	$0	$996	$1,160
April	48	0	11,760	$0	$692	$814
May	38	0	7,920	$0	$476	$567
June	24	0	7,200	$0	$432	$518
July	24	0	5,040	$0	$303	$370
August	24	0	7,200	$0	$432	$518
September	24	0	6,240	$0	$375	$452
October	24	0	7,200	$0	$432	$518
November	34	0	11,760	$0	$692	$814
December	48	0	18,000	$0	$938	$1,094
TOTAL		**16**	**144,240**	**$133**	**$7,695**	**$9,225**

Notes:

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Library is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.6.3 - Lighting Analysis Summary for the Library

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Basement Fluorescents - Convert 4' T12s to 4' T8s (4'x2)	6	940	$56	566	$34	374	$22
Library Fluorescents - Convert 4'T12s to 4' T8s (4'x2)	62	9,716	$583	5,849	$351	3,866	$232
Annex Fluorescents - Convert 4'T12s to 4'T8s (4'x2)	44	6,895	$414	4,151	$249	2,744	$165
Incandescents - Convert to compact fluorescents	14	4,477	$269	1,254	$75	3,224	$194
EXIT signs - Convert to LED modules	6	1,577	$95	158	$9	1,419	$85
Install parking lot controllers.	4	1,920	$115	960	$58	960	$58
TOTALS		**25,525**	**$1,532**	**12,937**	**$777**	**12,587**	**$756**

Annual Energy Savings (KWH)	**12,587**
Annual Cost Savings	**$756**
Percent Annual Energy Savings	**49%**

Notes:

These calculations are based on an occupancy rate of 3198 hours/year.
Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.6.4 (a) Window and Door Replacement Calculations for the Library

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Replace 40"x40" windows (7)	78	1.000	6,497	$390	6.25	1,040	$62	5,458	$328
Replace 48"x48" windows (6)	96	1.000	8,019	$481	6.25	1,283	$77	6,736	$404
Replace 36"x24" windows (4)	24	1.000	2,005	$120	6.25	321	$19	1,684	$101
Replace 24"x48" windows (4)	32	1.000	2,673	$160	6.25	428	$26	2,245	$135
TOTALS			**19,195**	**$1,152**		**3,071**	**$184**	**16,123**	**$968**

Table B.6.4 (b) Window and Door Infiltration Calculations for the Library

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (2)	10	0.05	125	34	10,514,367	3,081	$185
Windows- 7 of 40"x40"	23	0.025	50	32	9,803,596	2,873	$173
Windows- 6 of 48"x48"	24	0.025	50	33	10,093,793	2,958	$178
Windows- 4 of 36"x24"	10	0.025	50	14	4,205,747	1,233	$74
Windows- 4 of 24"x48"	12	0.025	50	16	5,046,896	1,479	$89
TOTALS						**11,624**	**$698**

Table B.6.4 (c) Roof Insulation Upgrade for the Library

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Upgrade roof insulation.	2000	5.000	33,414	$2,006	40.000	4,177	$251	29,237	$1,755
TOTALS			**33,414**	**$2,006**		**4,177**	**$251**	**29,237**	**$1,755**

Table B.6.5 - Water Usage for the Library

Fixtures	**Qty**	**Est. # of Uses/Hr/ Fixture**	**Est. # of Uses/Yr**	**Current Flow (LPF or LPC)**	**Current Water Usage (L/Yr)**	**New Flow (LPF or LPC)**	**New Water Usage (L/Yr)**	**Water Saved (L/Yr)**	**Hot Water Savings (kWh)**	**Cost Savings**
Sinks	4	4.2	53,966	1.60	86,346	0.32	17,269	69,077	2,589	$155
Toilets	4	2.8	35,978	13.25	476,702	3.98	143,190	333,511	NA	NA
Total					**563,048**		**160,460**	**402,588**	**2,589**	**$155**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	25	15	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	2.34375	0.46875	2.8125
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	2.34375	1.875	4.21875
Number of Urinals	0	0	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0	0
Number of Showers	0	0	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0	0	0

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	86,346	3,236
Total	**86,346**	**3,236**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.05 gallons per flush

Table B.6.6 Energy Savings with Heating, Ventilation and Air Conditioning for Library

Description	Quantity	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Replace existing motorized dampers with insulated dampers.	1	100	30,783,629	9,022	$542

Description	Quantity	Flow Rate (cfm)	Heat Loss (kWh)	Total Energy Savings for HRV (kWh)	Cost ($)
Install HRV	1	800	36,078	13,169	$791

Table B.7.1- Annual Energy Consumption for Municipal Garage

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	2,378	19%
Cooling	550	4%
Lighting	4,498	37%
Hot Water	4,844	39%
Total	**12,270**	

Table B.7.2 - Electricity Usage for the Municipal Garage

	Consumption Data			Calculated Costs		
Month (2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
January	0	0	2,210	$0	$130	$166
February	0	0	1,220	$0	$71	$99
March	0	0	1,440	$0	$84	$114
April	0	0	1,670	$0	$100	$132
May	0	0	820	$0	$49	$74
June	0	0	820	$0	$49	$74
July	0	0	440	$0	$26	$48
August	0	0	440	$0	$26	$48
September	0	0	440	$0	$26	$48
October	0	0	330	$0	$20	$41
November	0	0	820	$0	$49	$74
December	0	0	1,620	$0	$97	$129
TOTAL		**0**	**12,270**	**$0**	**$730**	**$1,048**

Notes:

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Municipal Garage is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.7.3 - Lighting Analysis Summary for the Municipal Garage

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Upper level fluorescents - 4' T8s (4' x2)	24	187	$11	187	$11	0	$0
Garage area - fluorescents - 4'T8s (4'x2)	6	374	$22	374	$22	0	$0
Upper level fluorescents - convert 8' T12s to 8' T8s (8'x2)	14	422	$25	197	$12	226	$14
Garage area fluorerscents - convert 8' T12s to 8' T8s (8'x2)	14	1,689	$101	786	$47	903	$54
Indoor compact fluorescents.	9	66	$4	66	$4	0	$0
High pressure sodium luminaires.	16	1,248	$75	1,248	$75	0	$0
Convert incandescent light in mechanical room to compact fluorescent.	3	117	$7	30	$2	87	$5
EXIT signs - Convert to LED modules	3	394	$24	39	$2	355	$21
TOTALS		**4,498**	**$270**	**2,928**	**$176**	**1,570**	**$94**

Annual Energy Savings (KWH)	**1,570**
Annual Cost Savings	**$94**
Percent Annual Energy Savings	**35%**

Notes:
These calculations are based on an occupancy rate of 2080 hours/year.
The high pressure sodium luminaires & indoor compact fluorescent lights are already energy efficient units and do not need to be upgraded.
Assume exit signs are on for 12 hours a day, 365 days of the year.

Table B.7.4 - Door Infiltration Calculations for the Municipal Garage

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (2)	10	0.025	30	8	2,523,448	740	$44
Overhead doors - 3 of 12'x12' size	36	0.025	30	30	9,084,413	2,662	$160
Overhead doors - 1 of 10'x8' size	9	0.025	30	7	2,271,103	666	$40
Overhead doors - 2 of 12'x14' size	26	0.025	30	21	6,560,965	1,923	$115
TOTALS						**5,990**	**$360**

Table B.7.5 - Water Usage for the Municipal Garage

Fixtures	Qty	Est. # of Uses/Hr/ Fixture	Est. # of Uses/Yr	Current Flow (LPF or LPC)	Current Water Usage (L/Yr)	New Flow (LPF or LPC)	New Water Usage (L/Yr)	Water Saved (L/Yr)	Hot Water Savings (kWh)	Cost Savings
Sinks	4	0.8	6,240	1.60	9,984	0.32	1,997	7,987	299	$18
Toilets	2	0.4	1,560	13.25	20,670	3.98	6,209	14,461	NA	NA
Urinals	1	0.8	1,560	9.50	14,820	3.80	5,928	8,892	NA	NA
Total					**45,474**		**14,134**	**31,340**	**299**	**$18**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	0	6	
Number of Toilet Uses/day	3	1	
Number of Toilets	2	2	
Toilet Uses/hour/fixture	0	0.375	0.375
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0	0.75	0.75
Number of Urinals	0	1	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0.75	0.75
Number of Showers	0	0	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0	0	0

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	9,984	374
Total	**9,984**	**374**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.05 gallons per flush

Table B.7.6 Energy Savings with Heating, Ventilation and Air Conditioning for Municipal Garage

Description	% of Time Unoccupied	HDD below 70°F	HDD below 59°F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 15°C (59°F)	97.03%	11,876.4	10,178	2,378	231

Description	Quantity	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Replace leaky dampers with insulated dampers.	1	50	15,391,814	4,511	$271

Description	Quantity	Flow Rate (cfm)	Energy Required to Heat Intake Air (kWh)	Energy Savings from Solarwall (kWh)	Energy Savings from upgrading wall insulation	Total Energy Savings from Solarwall
Install Solarwall.	1	2000	43,294	28,474	2,235	30,709

Table B.8.1- Annual Energy Consumption for Museum

	Energy Consumption (kWh)	**% of Total Energy Consumption**
Heating, Ventilation & Air Conditioning	88,377	44%
Cooling	60,912	30%
Lighting	51,052	25%
Hot Water	2,699	1%
Total	**203,040**	

Table B.8.2 - Electricity Usage for the Museum

	Consumption Data			Calculated Costs		
Month (2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
January	78	28	3,240	$233	$190	$507
February	102	52	48,120	$433	$1,644	$2,393
March	96	46	29,880	$383	$1,218	$1,850
April	47	0	1,440	$0	$86	$124
May	45	0	13,560	$0	$763	$895
June	60	10	12,360	$83	$716	$936
July	60	10	20,520	$83	$1,023	$1,286
August	58	8	17,400	$67	$914	$1,143
September	47	0	13,080	$0	$744	$873
October	37	0	11,520	$0	$683	$803
November	37	0	9,600	$0	$576	$682
December	53	3	22,320	$25	$1,069	$1,272
TOTAL		**157**	**203,040**	**$1,306**	**$9,627**	**$12,765**

Notes:

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the Museum is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.8.3 - Lighting Analysis Summary for the Museum

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Basement Fluorescents - Convert 4' T12s to 4' T8s (4'x2).	32	4,566	$274	2,749	$165	1,817	$109
Basement Fluorescents - Convert 4' T12s to 4' T8s (4'x4).	64	9,132	$548	5,498	$330	3,634	$218
First Level Incandescents - Convert to compact fluorescents.	71	20,675	$1,241	5,789	$348	14,886	$894
3rd Floor Fluorescents - Convert 4' T12s to 4' T8s (4'x2).	84	11,986	$720	7,216	$433	4,770	$286
3rd Floor Fluorescents - Convert 4' T12s to 4' T8s (4'x4).	20	2,854	$171	1,718	$103	1,136	$68
EXIT signs - Convert to LED modules	7	1,840	$110	184	$11	1,656	$99
TOTALS		**51,052**	**$3,065**	**23,154**	**$1,390**	**27,899**	**$1,675**

Annual Energy Savings (KWH)	**27,899**
Annual Cost Savings	**$1,675**
Percent Annual Energy Savings	**55%**

Notes:

These calculations are based on an occupancy rate of 2912 hours/year.

Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.8.4 (a) Window and Door Replacement Calculations for the Museum

Description	Existing				New			Savings	
	Area (ft^2)	R-Value ($^oF\ ft^2hr/BTU$)	Annual Heat Loss (kWh)	Cost ($)	R-Value ($^oF\ ft^2hr/BTU$)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Replace single pane windows 60"x24" size (58)	696	1.000	58,140	$3,491	6.25	9,302	$559	48,838	$2,932
TOTALS			**58,140**	**$3,491**		**9,302**	**$559**	**48,838**	**$2,932**

Table B.8.4 (b) Window and Door Infiltration Calculations for the Museum

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (9)	45	0.05	125	154	47,314,652	13,867	$833
Windows- 58 of 6' x 2' size	232	0.025	50	317	97,573,328	28,596	$1,717
TOTALS						**42,462**	**$2,549**

Table B.8.5 - Water Usage for the Museum

Fixtures	**Qty**	**Est. # of Uses/Hr/ Fixture**	**Est. # of Uses/Yr**	**Current Flow (LPF or LPC)**	**Current Water Usage (L/Yr)**	**New Flow (LPF or LPC)**	**New Water Usage (L/Yr)**	**Water Saved (L/Yr)**	**Hot Water Savings (kWh)**	**Cost Savings**
Sinks	5	0.4	6,188	1.60	9,901	0.32	1,980	7,921	297	$18
Toilets	6	0.2	4,004	13.25	53,053	3.98	15,936	37,117	NA	NA
Urinals	2	0.1	728	9.50	6,916	3.80	2,766	4,150	NA	NA
Total					**69,870**		**20,682**	**49,187**	**297**	**$18**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	3	2	
Number of Toilet Uses/day	3	1	
Number of Toilets	6	6	
Toilet Uses/hour/fixture	0.1875	0.041667	0.229167
Number of Sinks	5	5	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.225	0.2	0.425
Number of Urinals	0	2	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0.125	0.125
Number of Showers	0	0	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0	0	0

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	9,901	371
Total	**9,901**	**371**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.05 gallons per flush

Table B.8.6 Energy Savings with Heating, Ventilation and Air Conditioning for the Museum

Description	Current Efficiency	New Efficiency	Energy Used for Cooling (kWh)	Energy Savings (kWh)
Upgrade existing condensing units with a high efficiency units	8.00	13.00	60,912	21,319

Table B.8.7 - Energy Consumption and Savings Calculations for Motors in the Museum

Description	Rated HP	Required HP	# of hours	Current Motors				Energy Savings of Premium Efficiency Versus Standard Efficiency Motor		
				Eff.	Actual HP	kW	kWh	Actual HP	kW	kWh
Air Handler Motor	2.0	2	4,380	80%	1.6	1.22	5,330	0.05	0.04	157
Air Handler Motor	2.0	2	4,380	80%	1.6	1.22	5,330	0.05	0.04	157
Air Handler Motor	2.0	2	4,380	80%	1.6	1.22	5,330	0.05	0.04	157
Air Handler Motor	1.0	1	4,380	80%	0.8	0.61	2,665	0.02	0.02	78
Air Handler Motor	1.0	1	4,380	80%	0.8	0.61	2,665	0.02	0.02	78
TOTAL							**21,322**			**627**

Table B.9.1- Annual Energy Consumption for Indoor Swimming Pool

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	168,978	55%
Lighting	55,986	18%
Motors	79,956	26%
Total	**304,920**	

Table B.9.2 - Electricity Usage for the Indoor Swimming Pool

	Consumption Data			Calculated Costs		
Month (2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
January	50	0	23,760	$0	$1,075	$1,250
February	50	0	25,560	$0	$1,117	$1,298
March	65	15	21,960	$125	$1,033	$1,344
April	65	15	30,960	$125	$1,278	$1,625
May	72	22	18,000	$183	$938	$1,303
June	65	15	31,680	$125	$1,296	$1,645
July	65	15	18,720	$125	$966	$1,269
August	65	15	28,800	$125	$1,225	$1,564
September	65	15	25,200	$125	$1,138	$1,464
October	58	8	22,320	$67	$1,067	$1,317
November	58	8	27,360	$67	$1,190	$1,458
December	58	8	30,600	$67	$1,269	$1,548
TOTAL		**136**	**304,920**	**$1,132**	**$13,592**	**$17,086**

Table B.9.3 - Lighting Analysis for the Indoor Swimming Pool

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Fluorescents - Convert 4' T12s to 4' T8s (4' x2) & add occupancy sensors to changerooms.	58	10,345	$621	6,228	$374	4,117	$247
Incandescents in mechanical room + hallway - Convert to compact fluorescents & add occupancy sensor.	11	6,006	$361	1,562	$94	4,444	$267
Metal Halide (400 W) - pool lights	24	34,944	$2,098	34,944	$2,098	0	$0
Underwater pool lights (100W)	10	3,640	$219	3,640	$219	0	$0
EXIT signs - Convert to LED modules	4	1,051	$63	105	$6	946	$57
TOTALS		**55,986**	**$3,361**	**46,479**	**$2,791**	**9,507**	**$571**

Annual Energy Savings (KWH)	**9,507**
Annual Cost Savings	**$571**
Percent Annual Energy Savings	**17%**

Notes:

These calculations are based on an occupancy rate of 3640 hours/year.

The metal halide lights & underwater pool lights do not need an upgrade, therefore no improvements were made to them.

Assume exit signs are on for 24 hours a day, 365 days of the year.

Table B.9.4 - Window and Door Infiltration Calculations for the Indoor Swimming Pool

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (4)	20	0.05	125	68	21,028,734	6,163	$370
TOTALS						**6,163**	**$370**

Table B.9.5 - Water Usage for the Indoor Swimming Pool

Fixtures	Qty	Est. # of Uses/Hr/ Fixture	Est. # of Uses/Yr	Current Flow (LPF or LPC)	Current Water Usage (L/Yr)	New Flow (LPF or LPC)	New Water Usage (L/Yr)	Water Saved (L/Yr)	Hot Water Savings (kWh)	Cost Savings
Toilets	4	1.9	27,300	18.00	491,400	3.98	108,654	382,746	NA	NA
Urinals	1	1.9	6,825	9.50	64,838	3.80	25,935	38,903	NA	NA
Showers	12	1.3	54,600	47.30	2,582,580	47.30	2,582,580	0	0	$0
Total					**3,138,818**		**2,717,169**	**421,649**	**0**	**$0**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	15	15	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	1.40625	0.46875	1.875
Number of Sinks	0	0	
Number of Sink Uses/day	0	0	
Sink Uses/hr/fixture	0	0	0
Number of Urinals	0	1	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	1.875	1.875
Number of Showers	12	12	
Number of Shower Uses/day	8	8	
Shower Uses/hr/fixture	0.625	0.625	1.25

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Showers	2,582,580	96,780
Total	**2,582,580**	**96,780**

Notes:

The current toilets are assumed to use 4.8 gallons per flush and the new toilets use 1.05 gallons per flush

Table B.9.6 - Energy Consumption and Savings Calculations for Motors in the Indoor Swimming Pool

Description	Rated HP	Required HP	# of hours	Current Motors				Energy Savings of Premium Efficiency Versus Standard Efficiency Motor		
				Eff.	Actual HP	kW	kWh	Actual HP	kW	kWh
Filter pump motor	7.5	6	8,760	85%	6.1	4.56	39,978	0.18	0.13	1176
Filter pump motor	7.5	6	8,760	85%	6.1	4.56	39,978	0.18	0.13	1176
TOTAL							**79,956**			**2,352**

Table B.10.1- Annual Energy Consumption for Water Treatment Plant

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	770,241	44.8%
Motors	891,925	51.9%
Lighting	55,249	3.2%
Hot Water	2,245	0.1%
Total	**1,719,660**	

Table B.10.2 - Electricity Usage for the Water Treatment Plant

	Consumption Data			Calculated Costs		
Month (2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
January	208	158	147,000	$1,315	$3,957	$6,028
February	208	158	85,200	$1,315	$2,512	$4,380
March	211	161	102,600	$1,340	$2,919	$4,872
April	210	160	101,400	$1,331	$3,000	$4,955
May	200	150	90,000	$1,248	$2,721	$4,543
June	200	150	128,400	$1,248	$3,660	$5,613
July	200	150	66,000	$1,248	$2,135	$3,874
August	198	148	102,600	$1,231	$3,029	$4,875
September	198	148	88,800	$1,231	$2,692	$4,491
October	201	151	91,800	$1,256	$2,765	$4,603
November	201	151	112,200	$1,256	$3,264	$5,171
December	205	155	84,600	$1,290	$2,589	$4,440
TOTAL		**1840**	**1,200,600**	**$15,309**	**$35,242**	**$57,845**

Table B.10.2 (b) - Propane Consumption for the Water Treatment Plant

Month (2005)	Propane (L)	Energy (kWh)	Total Charge
January	10,028	71,166	$4,362
February	9,709	68,905	$4,223
March	23,812	168,995	$10,358
April	11,778	83,587	$5,123
May	5,884	41,756	$2,559
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
October	2,862	20,310	$1,245
November	4,642	32,943	$2,019
December	4,424	31,398	$1,924
TOTAL	**73,138**	**519,060**	**$31,815**

Notes

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

The electricity consumption for the WTP is charged based on the General Service Small, Triple Phase Manitoba Hydro rates.

Table B.10.3 - Lighting Analysis Summary for the Water Treatment Plant

Description	Quantity	Current Conditions		After Improvements		Savings	
		Annual Energy Consumption (kWh)	Annual Cost ($)	Annual Energy Consumption (kWh)	Annual Cost ($)	Energy (kWh)	Annual Cost ($)
Pump Floor - convert 4' T12s to 4' T8s (4'x2).	44	6,296	$378	3,790	$228	2,505	$150
Pump Floor - convert incandescents to compact fluorescents.	30	8,760	$526	2,453	$147	6,307	$379
High pressure sodium luminaires.	30	6,570	$394	6,570	$394	0	$0
Operating Floor - convert 4' T12s to 4' T8s (4'x2).	68	9,729	$584	5,858	$352	3,872	$232
Operating Floor - convert 8' T12s to 8' T8s (8'x2).	8	2,710	$163	1,261	$76	1,448	$87
Operating Floor - convert incandescents to compact fluorescents.	44	12,848	$771	3,597	$216	9,251	$555
Operating Floor - wall mounted luminaire c/w photocell.	5	365	$22	365	$22	0	$0
Operating Floor - upgrade low bay lights to compact fluorescents.	14	6,132	$368	1,594	$96	4,538	$272
EXIT signs - Convert to LED modules	7	1,840	$110	184	$11	1,656	$99
TOTALS		**55,249**	**$3,317**	**25,673**	**$1,541**	**29,577**	**$1,776**

Annual Energy Savings (KWH)	**29,577**
Annual Cost Savings	**$1,776**
Percent Annual Energy Savings	**54%**

Notes:

These calculations are based on an occupancy rate of 2920 hours/year. Assume exit signs are on for 24 hrs/day, 365 days/yr.

The wall mounted luminaires & high pressure sodium luminaires do not require upgrading.

Table B.10.4 (a) Window and Door Replacement Calculations for the Water Treatment Plant

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost ($)	Energy (kWh)	Cost ($)
Replace semicircular arched windows (4).	157	2.000	6,558	$402	6.25	2,098	$129	4,459	$273
TOTALS			**6,558**	**$402**		**2,098**	**$129**	**4,459**	**$273**

Table B.10.4 (b) Window and Door Infiltration Calculations for the Water Treatment Plant

Description	Crack Length (ft)	Crack Width (in)	Leakage on typical door (cfm)	Leakage on these doors (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost ($)
Pedestrian doors - 3'x7' (3)	15	0.05	125	51	15,771,551	4,622	$283
Rolling doors - 11'x5' (2)	16	0.05	125	55	16,822,988	4,930	$302
Windows- 4 semicircular windows	56	0.025	50	76	23,426,010	6,865	$421
TOTALS						**16,418**	**$1,006**

Table B.10.5 - Water Usage for the Water Treatment Plant

Fixtures	Qty	Est. # of Uses/Hr/ Fixture	Est. # of Uses/Yr	Current Flow (LPF or LPC)	Current Water Usage (L/Yr)	New Flow (LPF or LPC)	New Water Usage (L/Yr)	Water Saved (L/Yr)	Hot Water Savings (kWh)	Cost Savings
Sinks	2	0.5	2,920	1.60	4,672	0.32	934	3,738	140	$8
Toilets	1	0.3	730	13.25	9,673	3.98	2,905	6,767	NA	NA
Showers	1	0.1	365	66.25	24,179	47.30	17,265	6,915	259	$16
Total					**38,524**		**21,104**	**17,420**	**399**	**$24**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	0	2	
Number of Toilet Uses/day	3	1	
Number of Toilets	1	1	
Toilet Uses/hour/fixture	0	0.25	0.25
Number of Sinks	2	2	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0	0.5	0.5
Number of Urinals	0	0	
Number of Urinal Uses/day	0	1	
Urinal Uses/hr/fixture	0	0	0
Number of Showers	1	1	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0	0.125	0.125

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	4,672	175
Showers	24,179	906
Total	**28,851**	**1,081**

Notes:

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.05 gallons per flush

Table B.10.6 Energy Savings with Heating, Ventilation and Air Conditioning for Water Treatment Plant

Description	% of Time Unoccupied	HDD below 70°F	HDD below 59°F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 15°C (59°F)	66.67%	11876.4	10,178	770,241	51,406

Table B.10.7 - Energy Consumption and Savings Calculations for Motors in the Water Treatment Plant

Description	Rated HP	Required HP	# of hours	Current Motors				Energy Savings of Premium Efficiency Versus Standard Efficiency Motor		
				Eff.	Actual HP	kW	kWh	Actual HP	kW	kWh
Distribution Pump 1	100.0	80	3,640	85%	81.6	60.85	221,491	2.40	1.79	6514
Distribution Pump 2	50.0	40	3,640	85%	40.8	30.42	110,745	1.20	0.89	3257
Distribution Pump 3	100.0	80	3,640	85%	81.6	60.85	221,491	2.40	1.79	6514
Air Scour Blower	30.0	24	3,640	85%	24.5	18.25	66,447	0.72	0.54	1954
Slurry Feeder	0.17	0	3,640	85%	0.1	0.10	369	0.00	0.00	11
Slurry Feeder	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Backwash Pump 1	50.0	40	3,640	85%	40.8	30.42	110,745	1.20	0.89	3257
Raw Water Pump 1	10.0	8	3,640	85%	8.2	6.08	22,149	0.24	0.18	651
Raw Water Pump 2	40.0	32	3,640	85%	32.6	24.34	88,596	0.96	0.72	2606
Clarifier	3.0	2	3,640	85%	2.4	1.83	6,645	0.07	0.05	195
Carbon Feeder	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Fluoride Feeder	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Alum Feeder	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Aqualoc Feeder 1	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Aqualoc Feeder 2	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Claraid Feeder 1	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Claraid Feeder 2	0.25	0	3,640	85%	0.2	0.15	554	0.01	0.00	16
Carbon Hopper Vibrator	0.13	0	3,640	85%	0.1	0.08	277	0.00	0.00	8
Sump Pump 1	3.7	3	3,640	85%	3.0	2.25	8,195	0.09	0.07	241
Alum Transfer Pump	0.5	0	3,640	85%	0.4	0.30	1,107	0.01	0.01	33
Monorail Hoist	2.5	2	3,640	85%	2.0	1.52	5,537	0.06	0.04	163
Air Compressor 1	2.0	2	3,640	85%	1.6	1.22	4,430	0.05	0.04	130
Air Compressor 2	2.0	2	3,640	85%	1.6	1.22	4,430	0.05	0.04	130
Dumbwaiter	1.7	1	3,640	85%	1.4	1.03	3,765	0.04	0.03	111
Circulation Pump 1	1.0	1	3,640	85%	0.8	0.61	2,215	0.02	0.02	65
Circulation Pump 2	1.0	1	3,640	85%	0.8	0.61	2,215	0.02	0.02	65
Recirculation Pump	0.75	1	3,640	85%	0.6	0.46	1,661	0.02	0.01	49
Dust Collector	0.75	1	3,640	85%	0.6	0.46	1,661	0.02	0.01	49
Condensate Pump	1.0	1	3,640	85%	0.8	0.61	2,215	0.02	0.02	65
Fuel Oil Pump	0.5	0	3,640	85%	0.4	0.30	1,107	0.01	0.01	33
TOTAL							**891,925**			**26,233**

APPENDIX C

WATER EFFICIENCY

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Leaks

- A leak of one drop per second wastes 10,000 litres of water per year. A toilet that runs after a flush can waste 200,000 litres of water per year. Fixing a hot water leak will save energy as well as water.

- Check for differing water meter readings at bedtime and in the morning. If no water has been intentionally used, a difference in meter readings indicates a leak.
- If a few drops of food colouring put in your toilet tank seep into the toilet bowl (without flushing), check the flapper valve, valve seat and flapper lift chain for the source of the leak.
- Conduct a periodic “leak check” a minimum of twice a year on water using fixtures and appliances, including outside hose connections. Replace worn washers, O-rings and faulty fixtures.

On-Site Wastewater Systems

- Wise water management is necessary. All septic systems have limitations and water conservation should be practiced.
- Do not use substitutes for toilet paper. These products may not decompose in the tank and could clog the system.
- Perform regular maintenance checks on your entire system, including regular pump outs of the septic tank and inspection of the disposal field for signs of saturation or leakage.

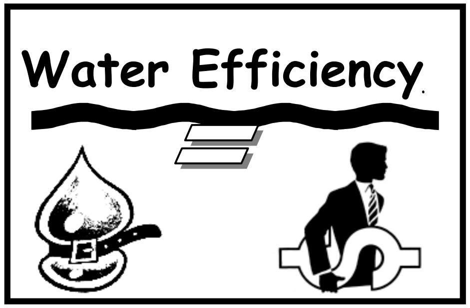
For More Information, Please Contact:

Water Efficiency Coordinator
Pollution Prevention
Manitoba Conservation
123 Main Street, Suite 160
Winnipeg MB R3C 1A5

Phone: (204) 945-8980 or
1-800-282-8069 ext. 8980
Fax: (204) 945-1211
E-mail: lliebgott@gov.mb.ca

Publication Number: 98-06E

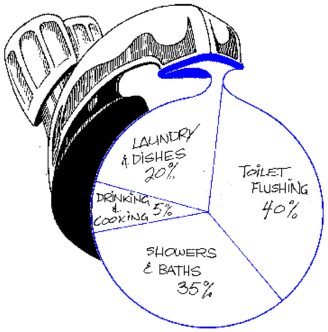
Pollution Prevention
Manitoba Conservation



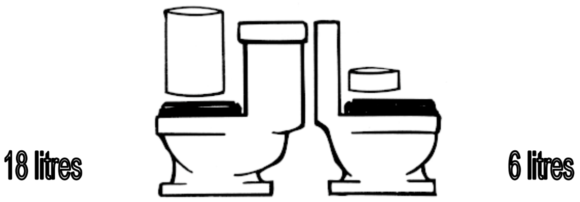
Water Use

How you can reduce yours!

- Save money.
- Delay the need to expand our water and wastewater treatment plants.
- Prolong the life of in-ground sewage disposal systems, i.e., septic fields.
- Protect our water sources.



Bathroom



- Replace toilets that flush 13 to 26 litres of water with 6 litre or dual flush toilets, cutting water used by toilets by half or more. See www.cwwa.ca for toilet performance ratings. In the mean time, reduce water per flush in toilets by up to 35% by installing early closure devices (don't use bricks – as they break down, pieces interfere with the flapper seal).

- Refrain from using the toilet to dispose of trash.

- A partially filled tub uses less water than a long shower; a short shower uses less than a full tub.

- Replace your 20 litre per minute showerhead with a low-flow 9.5 litre per minute showerhead. You'll use less than half the water.

- Make it a habit to be finished your shower in less than 5 minutes.

- Install a water conserving 3.5 litre per minute aerator on your bathroom tap.

- When shaving, rinse the razor in a cup or a partially filled sink instead of letting the tap run.

- Brush teeth using a glass of water to rinse.

Kitchen & Laundry

- Install a water saving 9 litre per minute aerator on the kitchen tap.

- Rinse dishes in a stoppered sink or basin, not with running water.

- Wash vegetables in a basin or stoppered sink, then quickly rinse using running water.

- Keep drinking water in the fridge. Wash the container and change the water every few days.

- Thaw food in the fridge rather than under a running tap. This conserves both energy and water.

- Compost organic wastes instead of using a sink garbage disposal.

- Buy a low water use dishwasher to save on energy, water and detergent costs.

- Wash only full loads of laundry and dishes.

- Front loading washing machines use less water than top-loading washers do. If unavailable, choose a clothes washer with a suds saver, and water saving cycle.

General Water Use

- Only use water treatment or softening systems, if required. If possible, only use softened water for bathing and cleaning – use unsoftened water for cooking, drinking and watering plants.

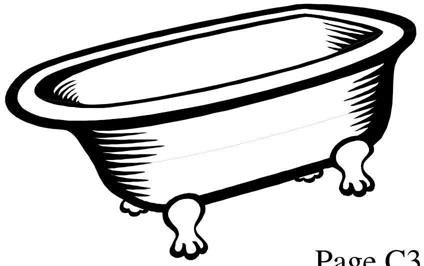
- Ensure a water softener regenerates only when the resin is exhausted.

- Turn the system off if you will be away for more than a few days.

- Insulate hot water tank and pipes to reduce the need to run water until it is hot. Install a heat trap on the pipe above your water heater to save energy and water.

- Know location of sink, toilet and main shut off valves in case a pipe or water heater blows, or so you can turn off your water when you are away.

- If your water pipes tend to freeze, do not let the tap run continuously. This wastes water, and overloads sewer systems. Instead, install heat tape or connect a pump-back reservoir system (discuss options with your plumber, electrician or call Manitoba Conservation).



APPENDIX D

INCENTIVE PROGRAMS

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Table D.1 Manitoba Hydro Power Smart Incentives

Item	Incentives	Contacts
Compact Fluorescents	$5 - Non-reflectorized screw in lamp, $10 - Reflectorized screw-in lamp, $45 - New hard wired fixture	Kelly Epp at kepp@hydro.mb.ca or 204-474-4051
T8 Electronic Fluorescents	T8 Premium Ballast - $20, T8 Standard Ballast - $15, T8 Dimmable Ballast - $60, 8 Foot T8 Ballast - $35	Kelly Epp at kepp@hydro.mb.ca or 204-474-4051
LED Exit Signs	$45 per new sign	Kelly Epp at kepp@hydro.mb.ca or 204-474-4051
High Pressure Sodium Lighting	The lesser of $500 per kilowatt saved or $100 of lighting fixture cost	Kelly Epp at kepp@hydro.mb.ca or 204-474-4051
Parking Lot Controllers	$25 for each controlled circuit	May Arason-Li at marasonli@hydro.mb.ca or 204-474-7813
Air Barrier System	$0.46 per square foot or $5 per square meter of net wall area	May Arason-Li at marasonli@hydro.mb.ca or 204-474-7813
Windows	Depends on replacement window's U-Value and net window area	May Arason-Li at marasonli@hydro.mb.ca or 204-474-7813
Geothermal Heat Pump	Manitoba Hydro will pay up to half the cost of a feasabillity study to help decide whether a geothermal heat pump is the right choice for you building. Manitoba Hydro also offers a custom incentive towards the capital cost of your heat pump system, based on the energy savings calculated in the feasability study.	Domenic Marinelli at dmarinelli@hydro.mb.ca or 204-474-4273

Notes

For general information and information kits contact:
Power Smart for Business
Phone: 474-3676
Email Address: powersmartforbusiness@hydro.mb.ca

Table D.2. Other Incentive Programs

Program Name	Eligibility	What Type of Projects are Available	Available Funding	Funding Maximums	Deadline For Applications	Prospect of Funding	Project Sponsor	Contact	Email	Website
Energy Innovators Initiative: Energy Retrofit Assistance (ERA)	Comm. & Institutional Bldgs. Aboriginal, northern, rural or remote communities may receive special consideration.	Projects that reduce energy consumption. Includes costs for project planning and development, materials and labour, monitoring and tracking and staffing training and awareness.	$7.50/GJ (277.8 kW H)	up to 25% of costs based on energy savings ($250,000 max)	On-going	Good	NRCan	MarieLynn Tremblay	Marie_Lyne.Tremblay@nrcan-rncan.gc.ca	http://oee.nrcan.gc.ca/commercial/financial-assistance/existing/retrofits/implementation.cfm?attr=0
Municipal Rural Infrastructure Fund (MRIF)	All MB local governments	Projects that construct, restore or improve infrastructure that ensures sustainable use and management of water and wastewater resources. Projects that construct, restore or improve public arts and heritage infrastructure, such as museums, heritage sites, sites for performings arts, and cultural or community centres. - See detailed program info for more info. Program has many requirements and caveats.		2/3 of the approved costs	On-going	Good	Canada-Manitoba Infrastructure Programs		infra@gov.mb.ca	http://www.infrastructure.mb.ca/index.html
Renewable Energy Development Initiative (REDI)	…Municipalities…, solar air/water heating, biomass	Projects involving solar air or water heating and clean burning biomass combustion projects.	25% of purchase and install of qualifying system	$80,000	31-Mar-07		NRCan		redi.penser@nrcan.gc.ca	http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=455
Community Places Program	Non-profit community organizations in MB, except public schools, universities, hospitals, nursing homes, monnercial coops, federal, provincial and city of Winnipeg departments.	Projects involving the upgrading, construction or acquisition of community facilities available to the general community. Priority given to proposals for critical repairs to extend the life of existing well-used facilities. Projects must provide lasting, long-term benefits to the community.	Up to 50% of first $15,000 and 1/3 of the rest of project	$50,000			Manitoba Culture, Heritage and Tourism	Varies by region	www.gov.mb.ca/chc/grants	http://www.gov.mb.ca/chc/grants
Sustainable Development Innovations Fund (SDIF)	Municipal corporations, local governments, private and non-profit organizations and businesses	Sustainable community development, Eco-efficiency initiatives, environmental stewardship. Emphasis on youth involvement, first nations and northern communities.		$50,000 (usually $25,000 or less)		fair	Manitoba Conservation		sdif@gov.mb.ca	http://www.gov.mb.ca/conservation/pollutionprevention/sdif/index.html

APPENDIX E

TRANSPORTATION AND EQUIPMENT EFFICIENCY

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Transportation and Equipment Efficiency for Small Municipalities (< 10,000 population).

Municipal governments may wish to:

- Assess Regulatory, Standards & Industry "Best Practices" to ensure compliance and demonstrated "Due Diligence". Includes Provincial, Federal, Society of Automotive Engineers (SAE), Canadian Standards Association (CSA), American National Standards Institute (ANSI), Workplace Safety & Health audits, Safety inspections, Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods regulation (TDG), etc.

- Review current fuelling habits & education on "economical operation" (Driver training, minimal idling, proper lubricants for seasonal operation etc.)

- Review "Alternative Fuel" options, e.g., Diesel and Biodiesel, Propane, Compressed Natural Gas (CNG). Note: Electric Vehicles are not an option yet due to initial cost and the prevailing ambient temperatures experienced in Manitoba

- Consider recycling initiatives for disposal of Fleet Waste Stream products, eg. tires, lubricating oil, anti-freeze, aerosol cans, paints, controlled products, ferrous & non-ferrous scrap metal, plastics etc.

Other Opportunities:

Transportation Demand Management

- Education & awareness programs on ride-sharing, telecommuting & teleconferencing

Encouragement of Alternative Modes of Transportation

- Possibility of van based transit or "pool" operations for commuting within towns & outlying areas. May be viable for transporting groups of employees to & from work locations

- Provision of bike racks, lockable bike containers or small fenced compounds at key locations

- Education & awareness programs on vehicle emissions, "fuel saving" driving habits etc.

Traffic & Parking Management

- Possibility of synchronizing traffic lights (if installed) and implementing parking fees etc. to manage parking

CHOOSING A VEHICLE

Vehicle Construction

The following points are important when considering fuel efficiency.

- A five speed manual transmission is about 5% more efficient than an automatic.
- Smaller engines use less fuel.
- Front wheel drive vehicles are lighter and therefore more fuel efficient than rear wheel drive vehicles
- SUV's tend to have low fuel efficiency
- Front wheel drive vehicles provide better traction than rear wheel drive in most cases.
- Small engines with a turbocharger can help make up the power difference between large and small engines by using energy from hot exhaust.

Vehicle Ratings

The Office of Energy Efficiency of Natural Resources Canada, issues a list of the most fuel efficient vehicles in each of a number of categories. See their website for the latest list.

Extra Features

Air conditioning, power steering, and roof racks are some of the big energy using extras. Air conditioning can increase your fuel consumption by 10 to 20 percent in city driving. A fully loaded roof rack can add 25% to your fuel costs. Even empty, it will add about 1% due to wind resistance

DRIVING ECONOMICALLY

Driving technique is critical to fuel economy.

- Maintain recommended tire pressure to maximize fuel efficiency and tire life.
- Keep your engine well tuned and maintained.
- One minute of idling uses more fuel than restarting the engine.
- Avoid jack-rabbit starts.
- An open sun roof and open windows increase air resistance, especially on the highway. Use the car's ventilation system instead.
- Most cars use 10% less fuel when driven at 55 miles per hour as opposed to 62, or 90 kilometers as opposed to 100.
- Adjust your speed in advance of changes in traffic flow. Take your foot off the accelerator and progressively gear down rather than accelerating up to a stop sign and breaking hard.

ENGINE BLOCK HEATERS - IS THERE A SAVINGS?

- In sub-freezing temperatures, the first 15 to 20 minutes of driving, after a cold start cause the engine to use about 30% more fuel than a warm engine.
- A timer can be installed for your vehicle's block heater to start warming the engine a couple hours before you head out.
-

- With the cost of electricity accounted for, you should still come out ahead, over the course of a winter.

FUEL OPTIONS

- Diesel engines are more fuel efficient than gasoline engines, as Diesel contains 10% more energy per unit volume than gasoline. Higher diesel engine costs are offset by increased fuel economy and engine life.
- Many fleet operators are converting their vehicles to biodiesel for cost advantages and a cleaner burn.
- There are many advantages to a dual-fuel system, which allows you to switch between gasoline and propane or natural gas with the flick of a switch.
- Hybrid vehicles…

From the Office of Energy Efficiency, Natural Resources Canada:

Buying a Fuel-Efficient Vehicle

- Fuel consumption can vary widely from one vehicle to the next. Whether you're buying new or used, the choices you make today will either save you money (through reduced fuel consumption) or cost you money for years to come.

- How big is big enough? It's always a good idea to avoid buying more vehicle than you need. Larger vehicles tend to be heavier and have bigger and more powerful engines, so consider buying the most fuel-efficient vehicle that meets your everyday needs.

- If you're buying a new vehicle, check the EnerGuide label for its fuel consumption rating. EnerGuide labels are now affixed to all new light-duty vehicles sold in Canada.

- Fuel consumption ratings for all new cars, light-duty trucks and vans sold in Canada are also available in the free Fuel Consumption Guide. You can download a PDF version of the Guide, or call 1 800 387-2000 to order your free copy. Past editions are available, so you can also check fuel consumption ratings for used vehicles.

- Have a look at the list of the most recent winners of the EnerGuide Awards, presented each model year to the manufacturers of the most fuel-efficient vehicles in different classes – two-seater, subcompact, compact, mid-sized and large cars, as well as station wagons, vans, pickup trucks and special purpose vehicles.

- Your choice of transmission will directly affect the cost of the vehicle and its fuel consumption. As a general rule, a manual transmission is more fuel efficient than an automatic, assuming you shift properly. If you buy an automatic, the more gears, the better.

- Four-wheel drive and all-wheel drive offer superior traction and braking under slippery conditions, but the weight and friction of additional drivetrain parts can increase fuel consumption by 5 to 10 percent compared with two-wheel drive vehicles. How often would you need to use this option, and is it worth the extra fuel cost for as long as you own the vehicle?

- Under normal driving conditions, smaller engines deliver better fuel economy than larger engines. Choose the smallest engine that meets your everyday needs.
- Are you willing to pay a fuel penalty for as long as you own your vehicle just to have the convenience of options such as power windows, seats and mirrors? Many options increase fuel consumption by adding weight, increasing aerodynamic drag, or drawing extra power from the engine.

- Do you really need an air conditioner? Operating an air conditioner in hot weather can increase fuel consumption by more than 20 percent in city driving. Consider using the car's ventilation system and options such as a sunroof and tinted glass.
- For most drivers, cruise control saves fuel on the highway by keeping your speed constant and avoiding inadvertent speeding.

- Explore your fuel options. Will a fuel-efficient diesel vehicle meet your needs? What about propane or natural gas, which produce fewer greenhouse gas emissions and are cheaper to use than gasoline or diesel fuel? Ethanol fuel blends are also widely used by Canadian motorists. And hybrid vehicles, which use a combination of high-power batteries and an internal combustion engine, are beginning to appear on the North American market.

Please note – this list of websites is not comprehensive. They have not been reviewed for accuracy, but may provide ideas and options appropriate for some municipalities.

Other vehicle and equipment information can be found on the Internet at:
http://oee.nrcan.gc.ca/publications/infosource/home/index.cfm?act=category&PrintView=N&Text=N

http://www.betterroads.com/articles/NewProds/oct05bid.htm

http://www.edmunds.com/advice/specialreports/articles/102946/article.html

http://www.betterroads.com/articles/NewProds/oct05bid.htm

http://snow.grounds-mag.com/ar/grounds_maintenance_september_2/

http://www.missoulian.com/articles/2003/11/15/news/local/news03.txt

http://rocktoroad.com/grader.html

http://news.thomasnet.com/fullstory/29180/3281

http://www.forester.net/gx_0501_graders.html

http://www.epa.gov/greenkit/quick_start.htm#greenfleet

Self Audit

Municipal Operations -Efficiency Survey
(Transportation, Road Repair, Snow Clearance, Waste Disposal, etc.)

Name of Organisation: ____________________________
Address: ____________________________
____
____
Contact Name: ____________________________
Phone No. ______________
Name of person completing form: ______________________________
Date: ______________________

Vehicles and Construction Equipment						
	Gasoline	**Diesel**	**CNG**	**Propane**	**Other**	**Total**
Total Fuel Usage L/Year						▨
Greenhouse Gas Emissions (tonnes)						

Fuel Use Minimization Considerations

☐ What type of vehicles/equipment, if any, are you planning to replace in the next few years?___________________________________
____
____

☐ Can you downsize these vehicles/equipment?
Comments:____
____
____

☐ Can you make process or other changes to minimize use of, or eliminate these vehicles/equipment? Comments:_________________
____
____

☐ Do you have a policy in place to make fuel efficiency one of the vehicle/equipment purchase requirements? Yes ___ No ___

☐ Have you made operational changes such as reducing idling time of vehicles and equipment, and using block heaters and timers to reduce warm up time?
Yes ___ No ___

☐ Have you encouraged more energy efficient driving behaviour through training, policies, and ongoing reminders? Yes ___ No ___

☐ Do you have procedures in place to detect and rectify leakage of above-ground and under-ground fuel storage tanks? Yes __ No ___

☐ Do you use automatic shut-off fill nozzles at pumps? Yes ___ No ___

Comments

APPENDIX F

ENERGY CONSUMPTION MONITORING SPREADSHEETS AND GRAPHS

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Table F.1 - Energy Consumption Monitoring Data for the Arena

	2005					2006					2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	67,200	18,360	80,221	1218.2	80,221			0		#DIV/0!			0		#DIV/0!
February	62,880	12,044	71,421	924.6	71,421			0		#DIV/0!			0		#DIV/0!
March	67,680	12,042	76,220	878.8	76,220			0		#DIV/0!			0		#DIV/0!
April	25,920	0	25,920	413.2	25,920			0		#DIV/0!			0		#DIV/0!
May	13,440	0	13,440	285.7	13,440			0		#DIV/0!			0		#DIV/0!
June	5,760	0	5,760	116.7	5,760			0		#DIV/0!			0		#DIV/0!
July	7,200	0	7,200	42	7,200			0		#DIV/0!			0		#DIV/0!
August	34,080	0	34,080	83.8	34,080			0		#DIV/0!			0		#DIV/0!
September	62,880	0	62,880	197	62,880			0		#DIV/0!			0		#DIV/0!
October	68,640	10,707	76,233	410.5	76,233			0		#DIV/0!			0		#DIV/0!
November	65,760	11,861	74,172	654.1	74,172			0		#DIV/0!			0		#DIV/0!
December	52,320	11,941	60,788	900.3	60,788			0		#DIV/0!			0		#DIV/0!
TOTAL	533,760	76,955	588,335	6124.9	588,335	0	0	0		#DIV/0!	0	0	0	0	#DIV/0!

	2008					2009					2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
February			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
March			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
April			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
May			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
June			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
July			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
August			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
September			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
October			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
November			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
December			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
TOTAL	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) and the "Billed Propane Energy" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.1 - Energy Consumption Monitoring Graph for the Arena

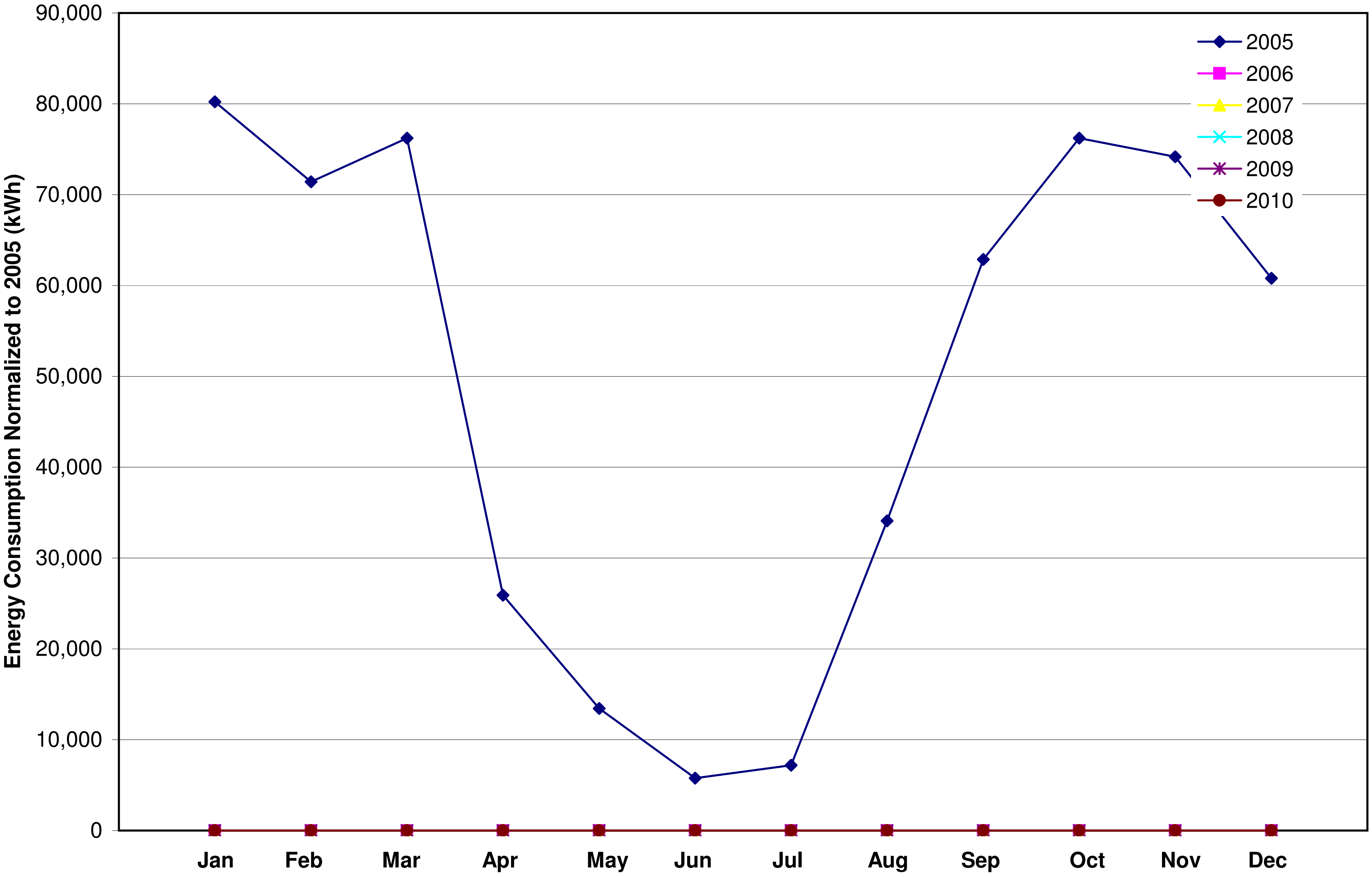


Table F.2 - Energy Consumption Monitoring Data for the Campground Offices & Changerooms

	2005				2006				2007			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	4,810	4,810	1218.2	4,810		0		#DIV/0!		0		#DIV/0!
February	4,120	4,120	924.6	4,120		0		#DIV/0!		0		#DIV/0!
March	3,910	3,910	878.8	3,910		0		#DIV/0!		0		#DIV/0!
April	3,170	3,170	413.2	3,170		0		#DIV/0!		0		#DIV/0!
May	2,270	2,270	285.7	2,270		0		#DIV/0!		0		#DIV/0!
June	2,120	2,120	116.7	2,120		0		#DIV/0!		0		#DIV/0!
July	1,350	1,350	42	1,350		0		#DIV/0!		0		#DIV/0!
August	1,040	1,040	83.8	1,040		0		#DIV/0!		0		#DIV/0!
September	1,060	1,060	197	1,060		0		#DIV/0!		0		#DIV/0!
October	1,830	1,830	410.5	1,830		0		#DIV/0!		0		#DIV/0!
November	2,200	2,200	654.1	2,200		0		#DIV/0!		0		#DIV/0!
December	4,730	4,730	900.3	4,730		0		#DIV/0!		0		#DIV/0!
TOTAL	32,610	32,610	6124.9	32,610	0	0	0	#DIV/0!	0	0	0	#DIV/0!

	2008				2009				2010			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January				#DIV/0!		0		#DIV/0!		0		#DIV/0!
February		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
March		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
April		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
May		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
June		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
July		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
August		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
September		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
October		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
November		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
December		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
TOTAL	0	0	0	#DIV/0!	0	0	0	#DIV/0!	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) taken from the electricity bills, next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.2 - Energy Consumption Monitoring Graph for the Campground Offices & Changerooms

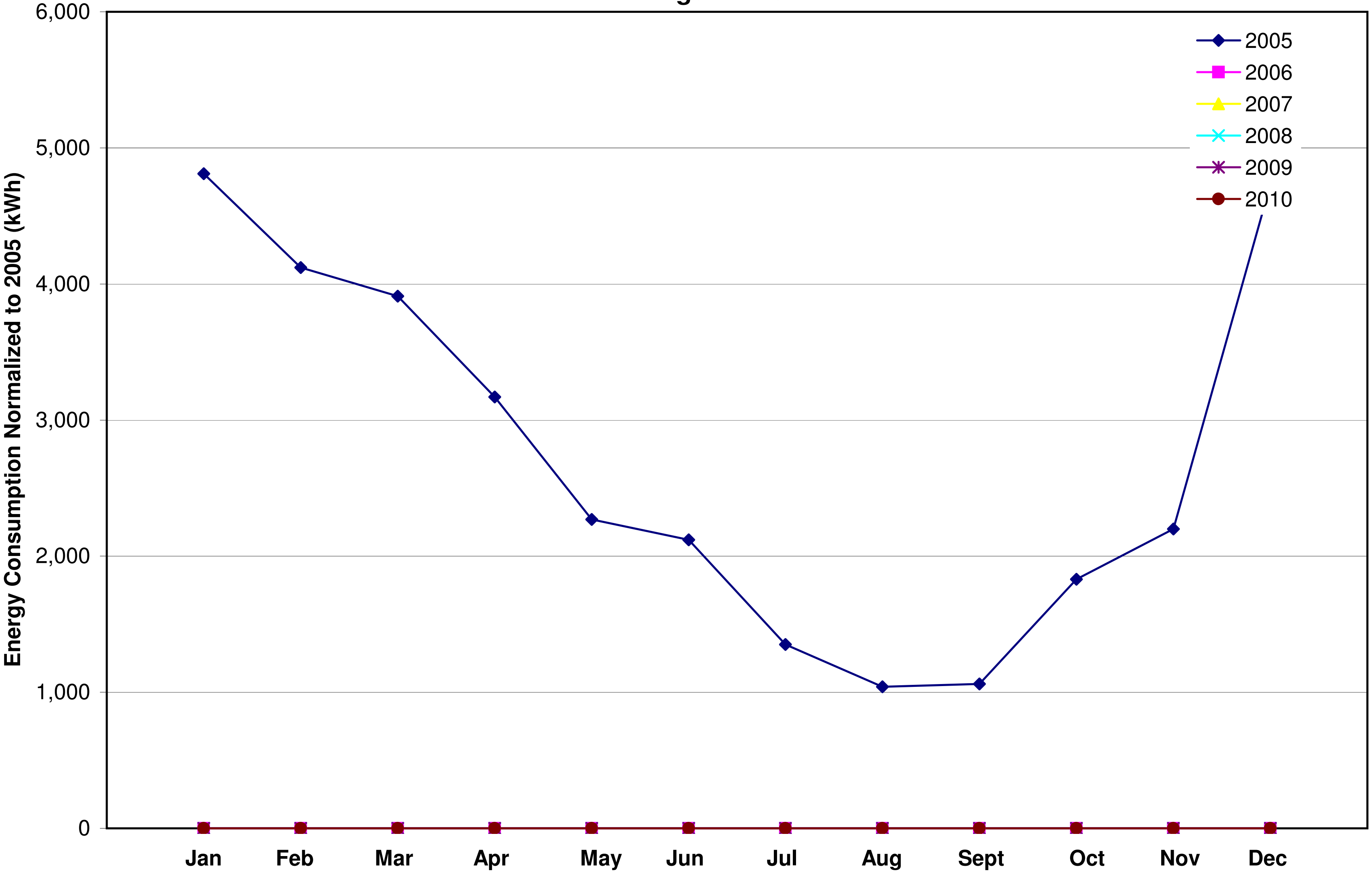


Table F.3 - Energy Consumption Monitoring Data for the Curling Rink

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	23,640	0	23,640	207.6	23,640			0		#DIV/0!			0		#DIV/0!
October	57,960	353	58,210	479.2	58,210			0		#DIV/0!			0		#DIV/0!
November	59,280	481	59,621	670.3	59,621			0		#DIV/0!			0		#DIV/0!
December	57,720	973	58,410	1227.8	58,410			0		#DIV/0!			0		#DIV/0!
January	70,320	919	70,972	1218.2	70,972			0		#DIV/0!			0		#DIV/0!
February	55,200	716	55,708	924.6	55,708			0		#DIV/0!			0		#DIV/0!
March	59,400	0	59,400	878.8	59,400			0		#DIV/0!			0		#DIV/0!
April	2,640	0	2,640	413.2	2,640			0		#DIV/0!			0		#DIV/0!
May	0	0	0	285.7	0			0		#DIV/0!			0		#DIV/0!
June	0	0	0	116.7	0			0		#DIV/0!			0		#DIV/0!
July	0	0	0	42	0			0		#DIV/0!			0		#DIV/0!
August	15,600	0	15,600	83.8	15,600			0		#DIV/0!			0		#DIV/0!
TOTAL	401,760	3,442	404,201	6547.9	404,201	0	0	0		#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
September			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
October			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
November			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
December			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
January			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
February			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
March			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
April			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
May			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
June			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
July			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
August			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
TOTAL	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) and the "Billed Propane Energy" in (L) taken from the electricity and [propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
   http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2004-2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.3 - Energy Consumption Monitoring Graph for the Curling Rink

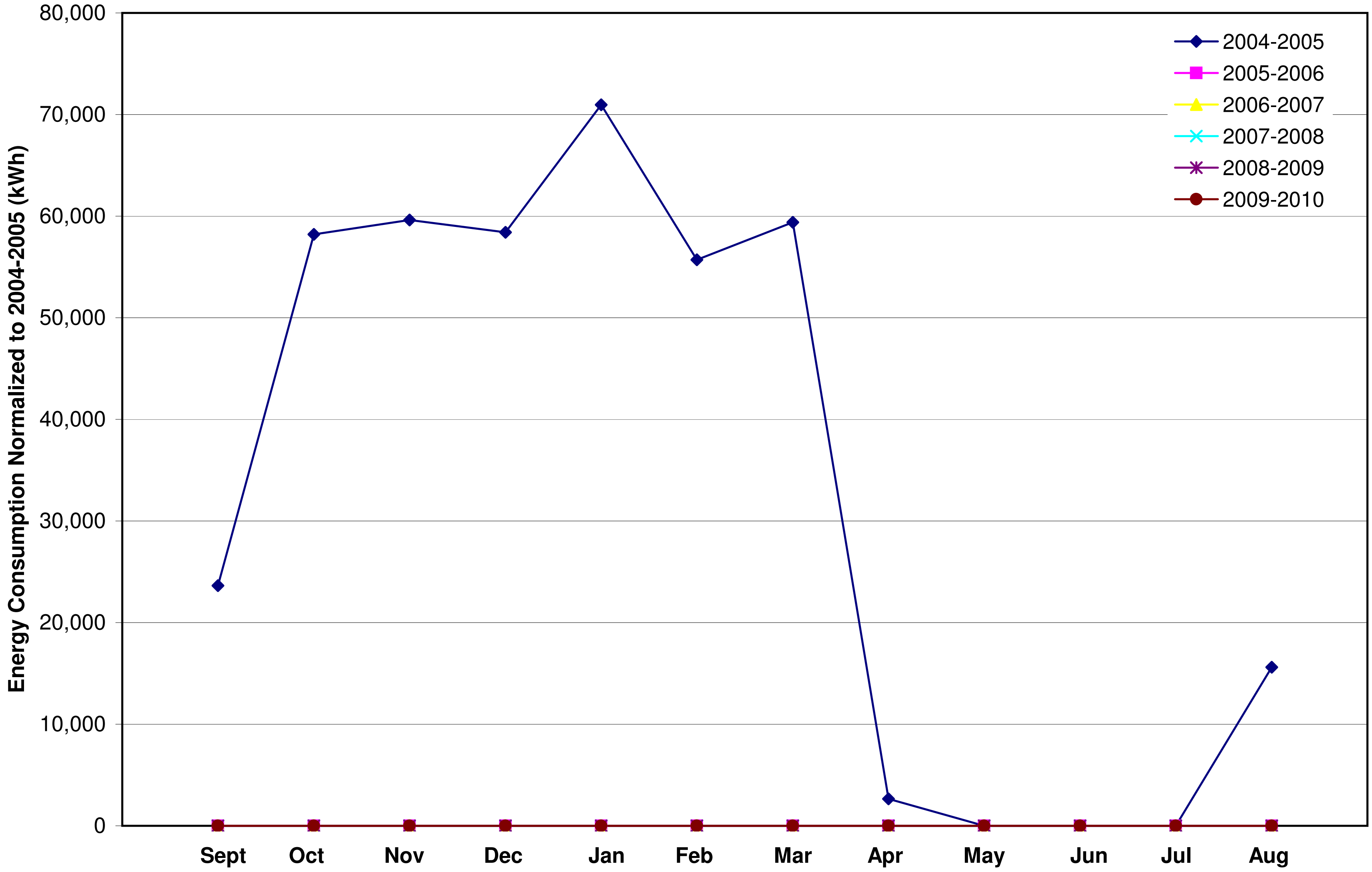


Table F.4 - Energy Consumption Monitoring Data for the Fire Hall_MAB

	2005					2006					2007				
Month	Billed Elect Energy (kWh)	Billed Propane Energy (L)	Total Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Billed Propane Energy (L)	Total Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Billed Propane Energy (L)	Total Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2005 (kWh)
January	23,680	4,173	26,639	1218.2	26,639			0		#DIV/0!			0		#DIV/0!
February	17,120	1,736	18,351	924.6	18,351			0		#DIV/0!			0		#DIV/0!
March	16,640	6,859	21,504	878.8	21,504			0		#DIV/0!			0		#DIV/0!
April	18,240	996	18,947	413.2	18,947			0		#DIV/0!			0		#DIV/0!
May	13,920	1,419	14,926	285.7	14,926			0		#DIV/0!			0		#DIV/0!
June	17,760	6	17,764	116.7	17,764			0		#DIV/0!			0		#DIV/0!
July	16,320	0	16,320	42	16,320			0		#DIV/0!			0		#DIV/0!
August	18,560	0	18,560	83.8	18,560			0		#DIV/0!			0		#DIV/0!
September	15,520	0	15,520	197	15,520			0		#DIV/0!			0		#DIV/0!
October	14,880	2,438	16,609	410.5	16,609			0		#DIV/0!			0		#DIV/0!
November	16,800	2,030	18,240	654.1	18,240			0		#DIV/0!			0		#DIV/0!
December	16,800	3,377	19,195	900.3	19,195			0		#DIV/0!			0		#DIV/0!
TOTAL	206,240	23,033	222,575	6124.9	222,575	0	0	0		#DIV/0!	0	0	0	0	#DIV/0!

	2008					2009					2010				
Month	Billed Elect Energy (kWh)	Billed Propane Energy (L)	Total Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Billed Propane Energy (L)	Total Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Billed Propane Energy (L)	Total Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2005 (kWh)
January			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
February			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
March			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
April			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
May			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
June			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
July			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
August			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
September			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
October			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
November			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
December			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
TOTAL	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) and the "Billed Propane Energy" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.4 - Energy Consumption Monitoring Graph for the Fire Hall_MAB

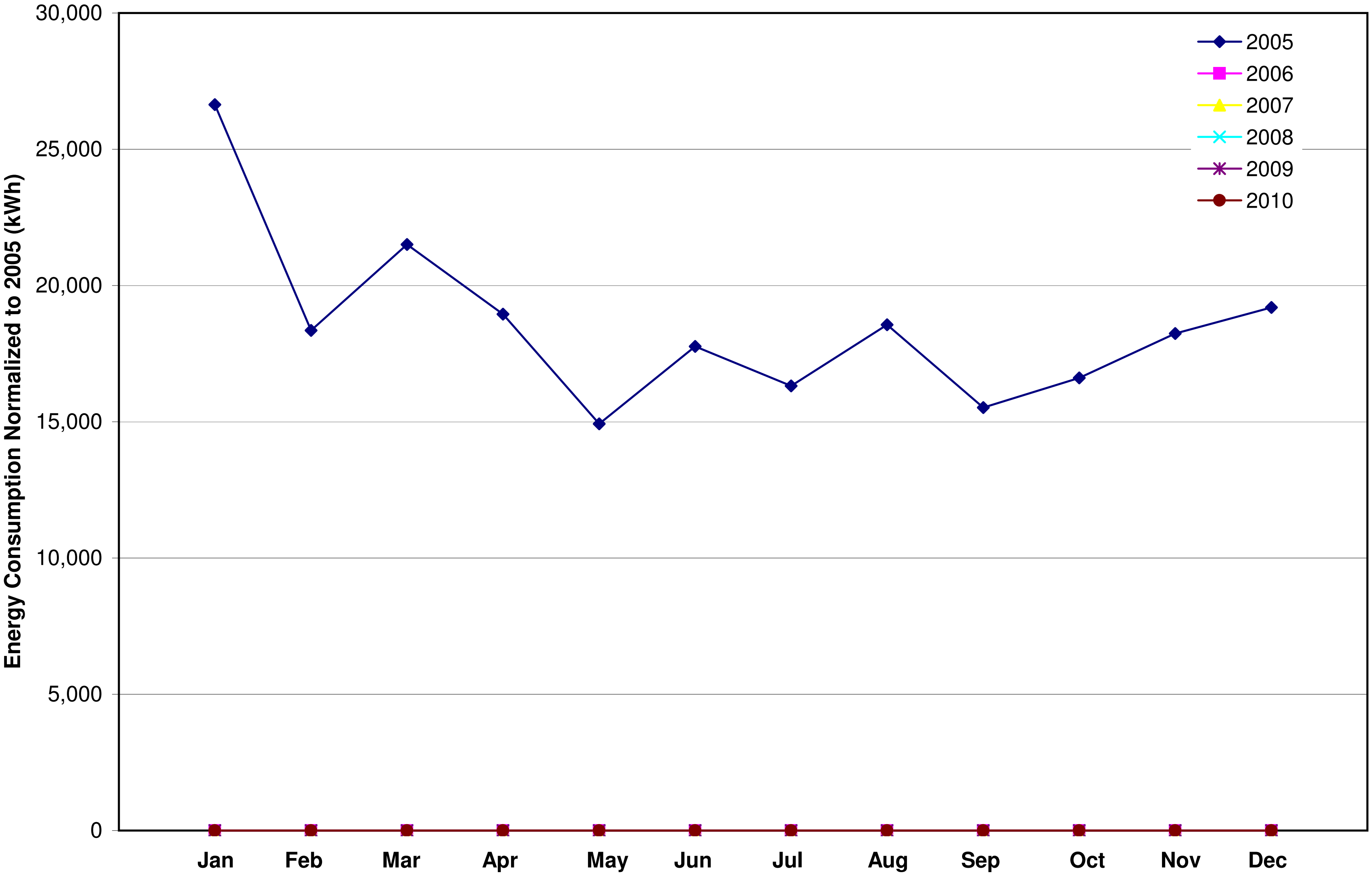


Table F.5 - Energy Consumption Monitoring Data for the Friendship Centre

	2005				2006				2007			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	16,320	16,320	1218.2	16,320		0		#DIV/0!		0		#DIV/0!
February	12,780	12,780	924.6	12,780		0		#DIV/0!		0		#DIV/0!
March	12,540	12,540	878.8	12,540		0		#DIV/0!		0		#DIV/0!
April	8,760	8,760	413.2	8,760		0		#DIV/0!		0		#DIV/0!
May	8,280	8,280	285.7	8,280		0		#DIV/0!		0		#DIV/0!
June	5,340	5,340	116.7	5,340		0		#DIV/0!		0		#DIV/0!
July	3,780	3,780	42	3,780		0		#DIV/0!		0		#DIV/0!
August	4,320	4,320	83.8	4,320		0		#DIV/0!		0		#DIV/0!
September	4,260	4,260	197	4,260		0		#DIV/0!		0		#DIV/0!
October	6,060	6,060	410.5	6,060		0		#DIV/0!		0		#DIV/0!
November	9,120	9,120	654.1	9,120		0		#DIV/0!		0		#DIV/0!
December	13,440	13,440	900.3	13,440		0		#DIV/0!		0		#DIV/0!
TOTAL	105,000	105,000	6124.9	105,000	0	0	0	#DIV/0!	0	0	0	#DIV/0!

	2008				2009				2010			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January				#DIV/0!		0		#DIV/0!		0		#DIV/0!
February		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
March		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
April		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
May		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
June		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
July		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
August		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
September		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
October		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
November		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
December		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
TOTAL	0	0	0	#DIV/0!	0	0	0	#DIV/0!	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) taken from the electricity bills, next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.5 - Energy Consumption Monitoring Graph for the Friendship Centre

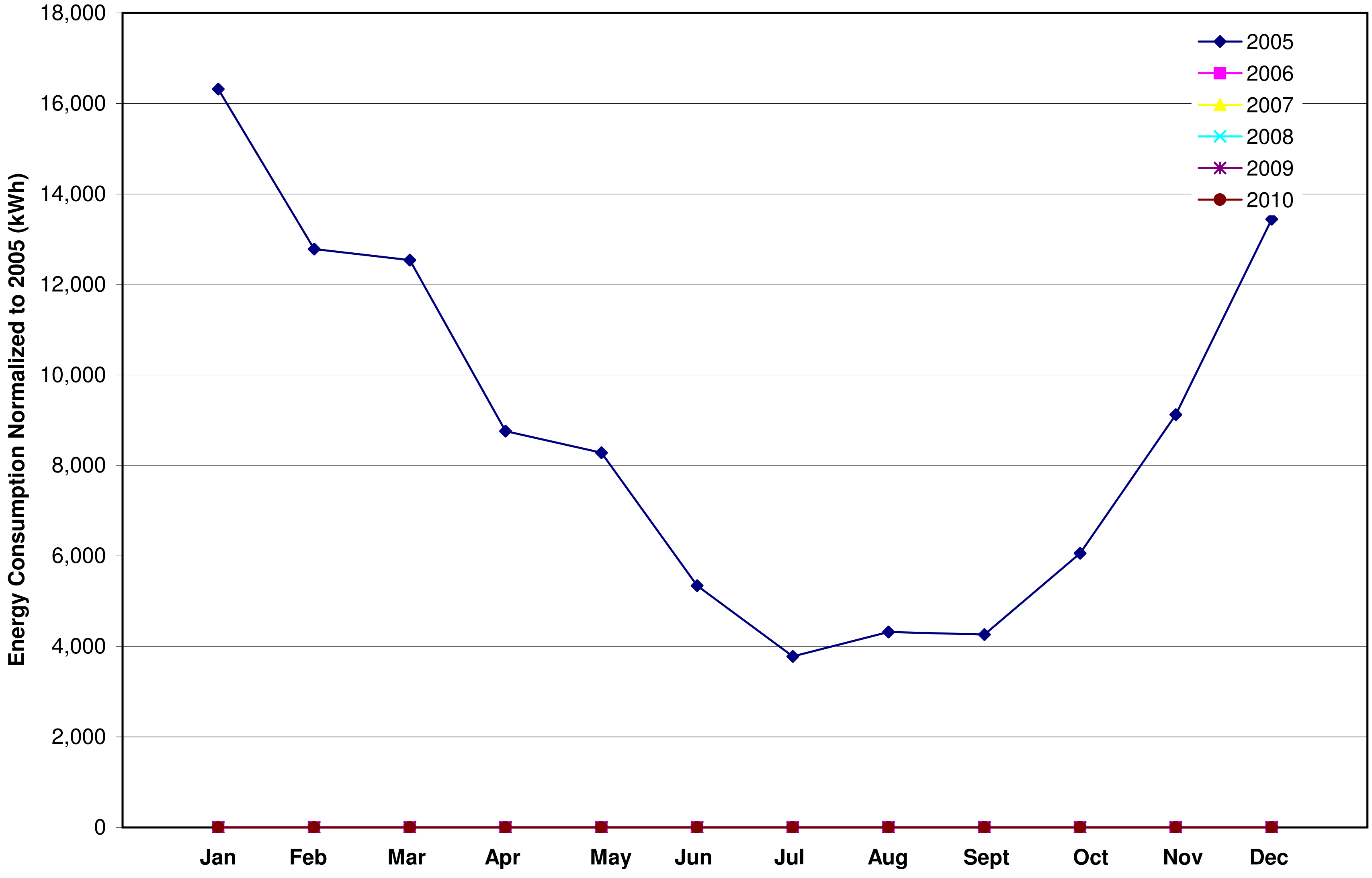


Table F.6 - Energy Consumption Monitoring Data for the Library

	2005				2006				2007			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	27,360	27,360	1218.2	27,360		0		#DIV/0!		0		#DIV/0!
February	14,160	14,160	924.6	14,160		0		#DIV/0!		0		#DIV/0!
March	20,400	20,400	878.8	20,400		0		#DIV/0!		0		#DIV/0!
April	11,760	11,760	413.2	11,760		0		#DIV/0!		0		#DIV/0!
May	7,920	7,920	285.7	7,920		0		#DIV/0!		0		#DIV/0!
June	7,200	7,200	116.7	7,200		0		#DIV/0!		0		#DIV/0!
July	5,040	5,040	42	5,040		0		#DIV/0!		0		#DIV/0!
August	7,200	7,200	83.8	7,200		0		#DIV/0!		0		#DIV/0!
September	6,240	6,240	197	6,240		0		#DIV/0!		0		#DIV/0!
October	7,200	7,200	410.5	7,200		0		#DIV/0!		0		#DIV/0!
November	11,760	11,760	654.1	11,760		0		#DIV/0!		0		#DIV/0!
December	18,000	18,000	900.3	18,000		0		#DIV/0!		0		#DIV/0!
TOTAL	144,240	144,240	6124.9	144,240	0	0	0	#DIV/0!	0	0	0	#DIV/0!

	2008				2009				2010			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January				#DIV/0!		0		#DIV/0!		0		#DIV/0!
February		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
March		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
April		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
May		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
June		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
July		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
August		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
September		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
October		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
November		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
December		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
TOTAL	0	0	0	#DIV/0!	0	0	0	#DIV/0!	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) taken from the electricity bills, next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.6 - Energy Consumption Monitoring Graph for the Library

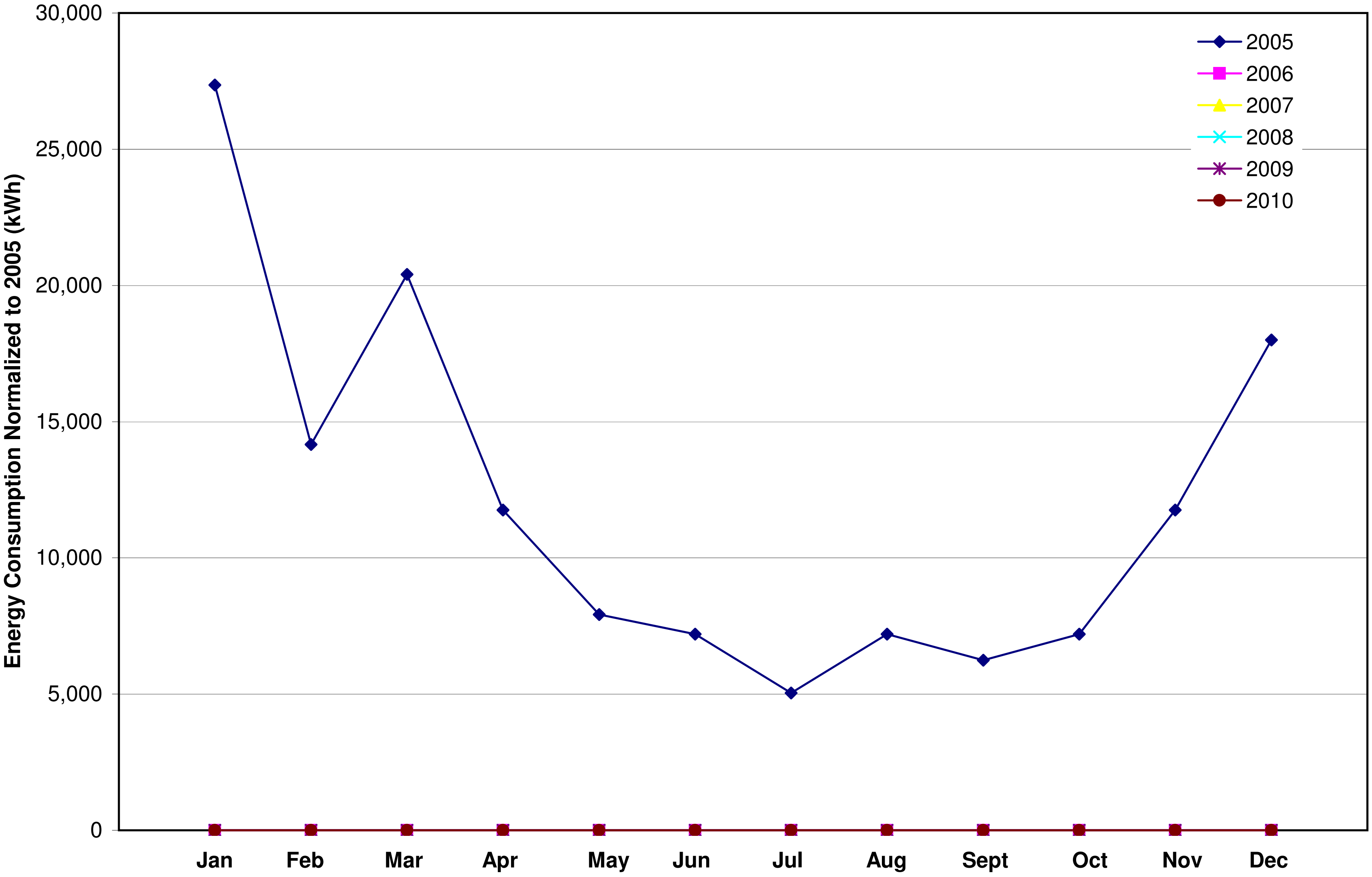


Table F.7 - Energy Consumption Monitoring Data for the Municipal Garage

	2005				2006				2007			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	24,633	24,633	1218.2	24,633		0		#DIV/0!		0		#DIV/0!
February	20,431	20,431	924.6	20,431		0		#DIV/0!		0		#DIV/0!
March	14,395	14,395	878.8	14,395		0		#DIV/0!		0		#DIV/0!
April	16,438	16,438	413.2	16,438		0		#DIV/0!		0		#DIV/0!
May	7,622	7,622	285.7	7,622		0		#DIV/0!		0		#DIV/0!
June	8,479	8,479	116.7	8,479		0		#DIV/0!		0		#DIV/0!
July	2,878	2,878	42	2,878		0		#DIV/0!		0		#DIV/0!
August	2,096	2,096	83.8	2,096		0		#DIV/0!		0		#DIV/0!
September	3,463	3,463	197	3,463		0		#DIV/0!		0		#DIV/0!
October	2,583	2,583	410.5	2,583		0		#DIV/0!		0		#DIV/0!
November	9,934	9,934	654.1	9,934		0		#DIV/0!		0		#DIV/0!
December	5,297	5,297	900.3	5,297		0		#DIV/0!		0		#DIV/0!
TOTAL	118,249	118,249	6124.9	118,249	0	0	0	#DIV/0!	0	0	0	#DIV/0!

	2008				2009				2010			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/mo)**	**Energy Normalized to 2005 (kWh)**
January		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
February		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
March		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
April		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
May		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
June		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
July		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
August		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
September		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
October		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
November		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
December		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
TOTAL	0	0	0	#DIV/0!	0	0	0	#DIV/0!	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) taken from the electricity bills, next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.7 - Energy Consumption Monitoring Graph for the Municipal Garage

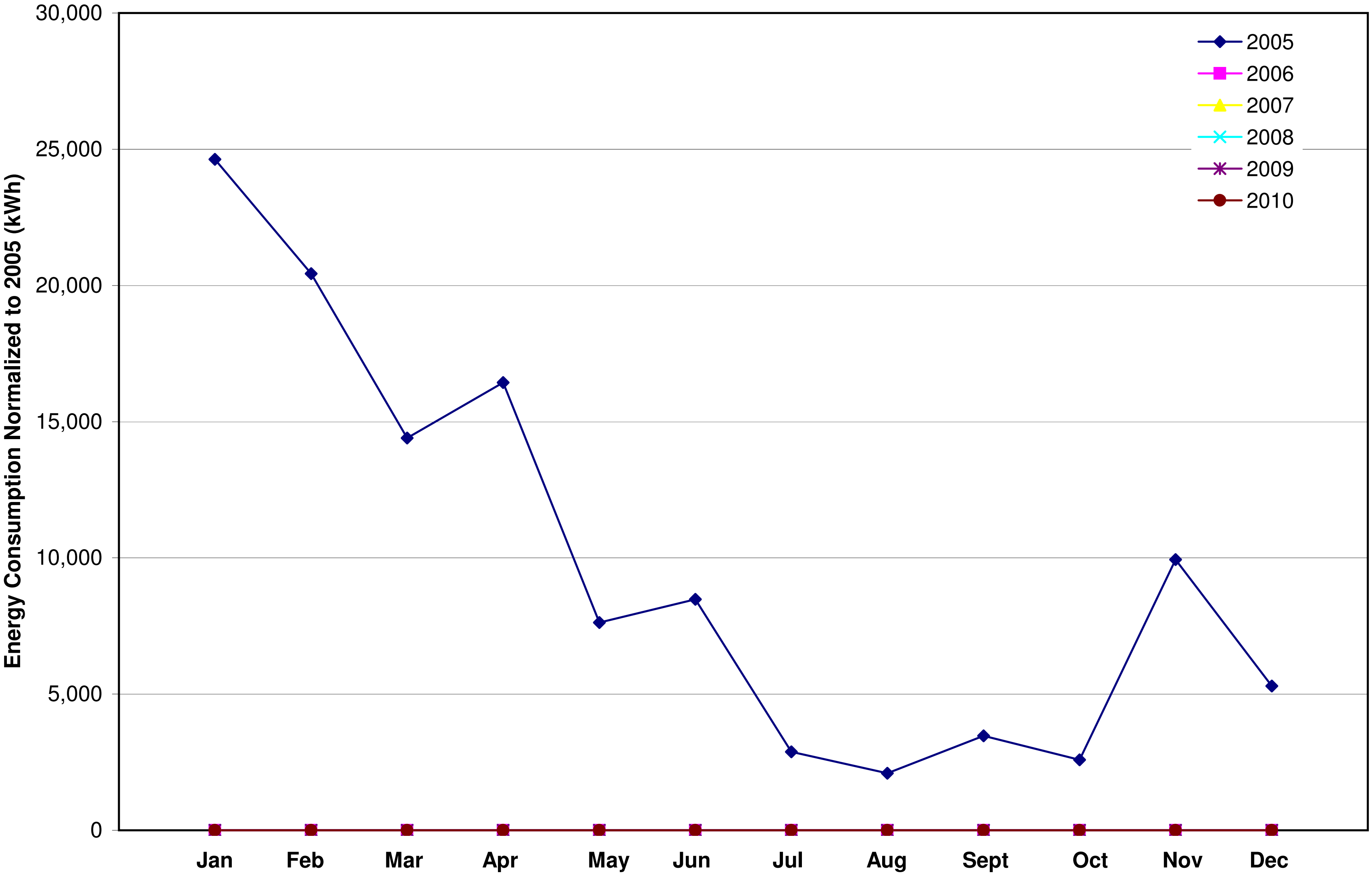


Table F.8 - Energy Consumption Monitoring Data for the Museum

	2005				2006				2007			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	3,240	3,240	1218.2	3,240		0		#DIV/0!		0		#DIV/0!
February	48,120	48,120	924.6	48,120		0		#DIV/0!		0		#DIV/0!
March	29,880	29,880	878.8	29,880		0		#DIV/0!		0		#DIV/0!
April	1,440	1,440	413.2	1,440		0		#DIV/0!		0		#DIV/0!
May	13,560	13,560	285.7	13,560		0		#DIV/0!		0		#DIV/0!
June	12,360	12,360	116.7	12,360		0		#DIV/0!		0		#DIV/0!
July	20,520	20,520	42	20,520		0		#DIV/0!		0		#DIV/0!
August	17,400	17,400	83.8	17,400		0		#DIV/0!		0		#DIV/0!
September	13,080	13,080	197	13,080		0		#DIV/0!		0		#DIV/0!
October	11,520	11,520	410.5	11,520		0		#DIV/0!		0		#DIV/0!
November	9,600	9,600	654.1	9,600		0		#DIV/0!		0		#DIV/0!
December	22,320	22,320	900.3	22,320		0		#DIV/0!		0		#DIV/0!
TOTAL	203,040	203,040	6124.9	203,040	0	0	0	#DIV/0!	0	0	0	#DIV/0!

	2008				2009				2010			
Month	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January				#DIV/0!		0		#DIV/0!		0		#DIV/0!
February		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
March		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
April		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
May		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
June		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
July		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
August		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
September		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
October		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
November		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
December		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
TOTAL	0	0	0	#DIV/0!	0	0	0	#DIV/0!	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) taken from the electricity bills, next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.8 - Energy Consumption Monitoring Graph for the Museum

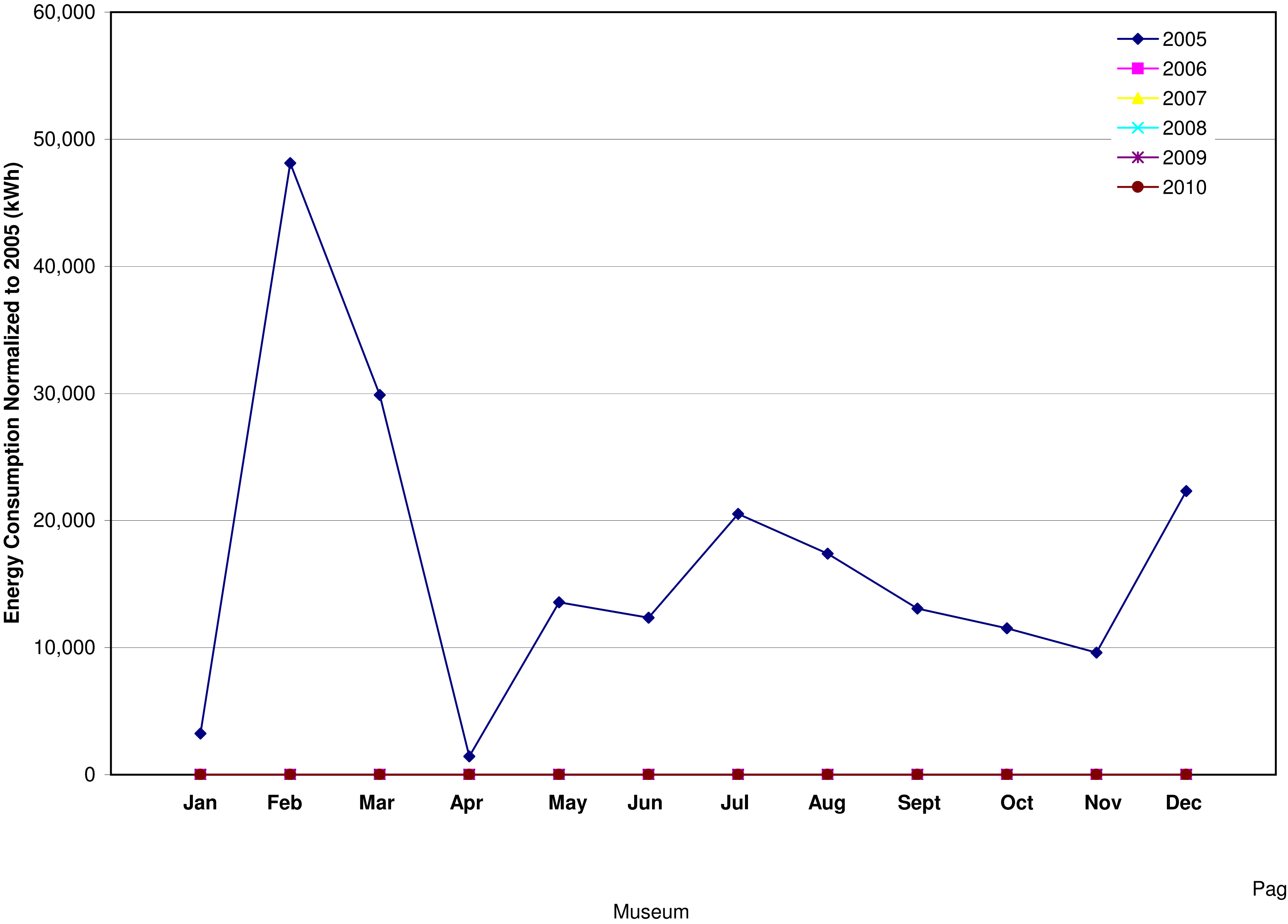


Table F.9 - Energy Consumption Monitoring Data for the Indoor Swimming Pool

	2005				2006				2007			
Month	Billed Elect Energy (kWh)	Total Energy Consumption (kWh)	HDD (^{o}C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Total Energy Consumption (kWh)	HDD (^{o}C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Total Energy Consumption (kWh)	HDD (^{o}C days/mo)	Energy Normalized to 2005 (kWh)
January	23,760	23,760	1218.2	23,760		0		#DIV/0!		0		#DIV/0!
February	25,560	25,560	924.6	25,560		0		#DIV/0!		0		#DIV/0!
March	21,960	21,960	878.8	21,960		0		#DIV/0!		0		#DIV/0!
April	30,960	30,960	413.2	30,960		0		#DIV/0!		0		#DIV/0!
May	18,000	18,000	285.7	18,000		0		#DIV/0!		0		#DIV/0!
June	31,680	31,680	116.7	31,680		0		#DIV/0!		0		#DIV/0!
July	18,720	18,720	42	18,720		0		#DIV/0!		0		#DIV/0!
August	28,800	28,800	83.8	28,800		0		#DIV/0!		0		#DIV/0!
September	25,200	25,200	197	25,200		0		#DIV/0!		0		#DIV/0!
October	22,320	22,320	410.5	22,320		0		#DIV/0!		0		#DIV/0!
November	27,360	27,360	654.1	27,360		0		#DIV/0!		0		#DIV/0!
December	30,600	30,600	900.3	30,600		0		#DIV/0!		0		#DIV/0!
TOTAL	304,920	304,920	6124.9	304,920	0	0	0	#DIV/0!	0	0	0	#DIV/0!

	2008				2009				2010			
Month	Billed Elect Energy (kWh)	Total Energy Consumption (kWh)	HDD (^{o}C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Total Energy Consumption (kWh)	HDD (^{o}C days/mo)	Energy Normalized to 2005 (kWh)	Billed Elect Energy (kWh)	Total Energy Consumption (kWh)	HDD (^{o}C days/mo)	Energy Normalized to 2005 (kWh)
January		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
February		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
March		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
April		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
May		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
June		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
July		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
August		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
September		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
October		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
November		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
December		0		#DIV/0!		0		#DIV/0!		0		#DIV/0!
TOTAL	0	0	0	#DIV/0!	0	0	0	#DIV/0!	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) taken from the electricity bills, next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.9 - Energy Consumption Monitoring Graph for the Indoor Swimming Pool

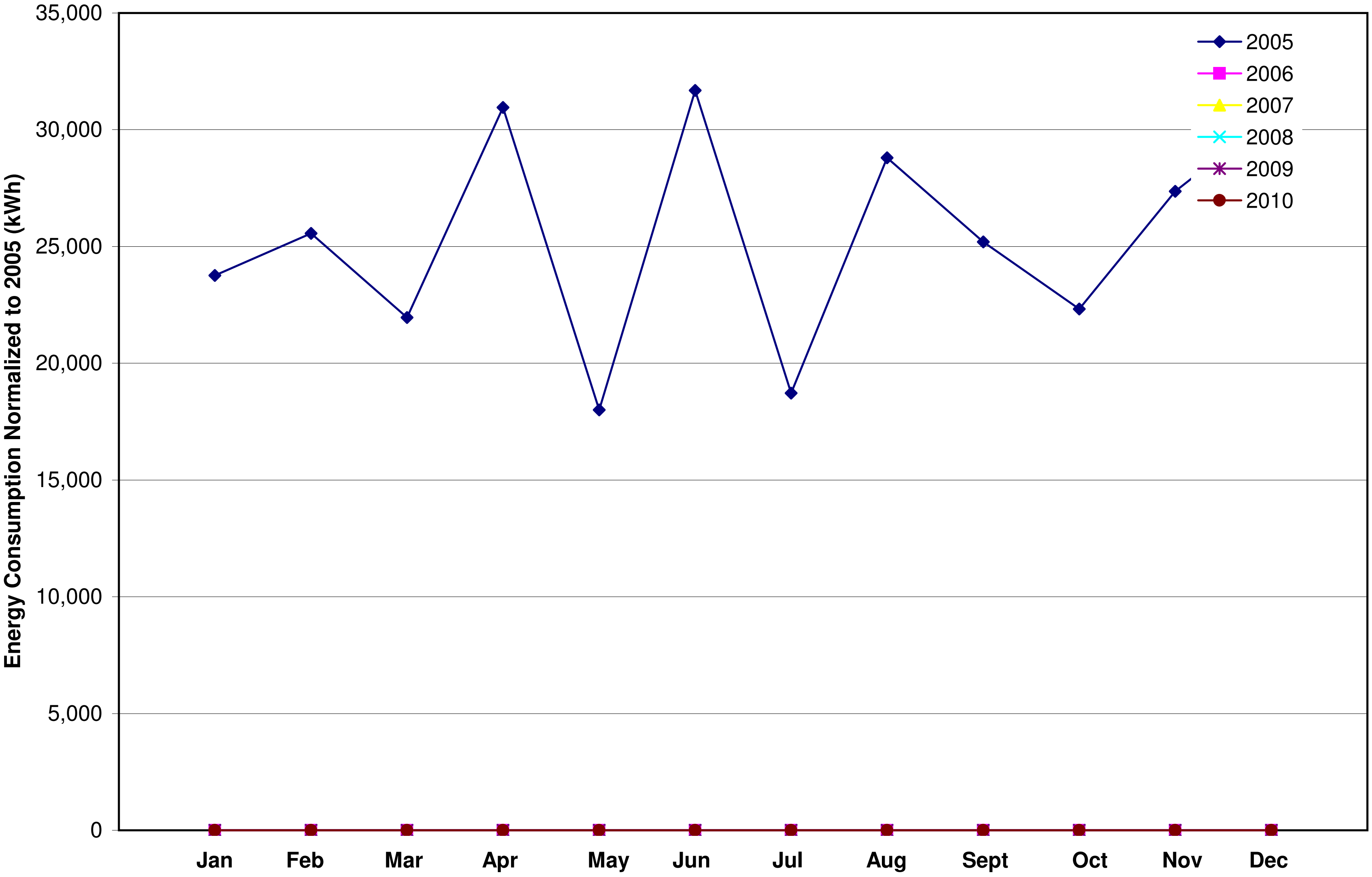


Table F.10 - Energy Consumption Monitoring Data for the Water Treatment Plant

	2005					2006					2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January	147,000	10,028	154,111	1218.2	154,111			0		#DIV/0!			0		#DIV/0!
February	85,200	9,709	92,085	924.6	92,085			0		#DIV/0!			0		#DIV/0!
March	102,600	23,812	119,487	878.8	119,487			0		#DIV/0!			0		#DIV/0!
April	101,400	11,778	109,753	413.2	109,753			0		#DIV/0!			0		#DIV/0!
May	90,000	5,884	94,173	285.7	94,173			0		#DIV/0!			0		#DIV/0!
June	128,400	0	128,400	116.7	128,400			0		#DIV/0!			0		#DIV/0!
July	66,000	0	66,000	42	66,000			0		#DIV/0!			0		#DIV/0!
August	102,600	0	102,600	83.8	102,600			0		#DIV/0!			0		#DIV/0!
September	88,800	0	88,800	197	88,800			0		#DIV/0!			0		#DIV/0!
October	91,800	2,862	93,829	410.5	93,829			0		#DIV/0!			0		#DIV/0!
November	112,200	4,642	115,492	654.1	115,492			0		#DIV/0!			0		#DIV/0!
December	84,600	4,424	87,737	900.3	87,737			0		#DIV/0!			0		#DIV/0!
TOTAL	1,200,600	73,138	1,252,468	6124.9	1,252,468	0	0	0		#DIV/0!	0	0	0	0	#DIV/0!

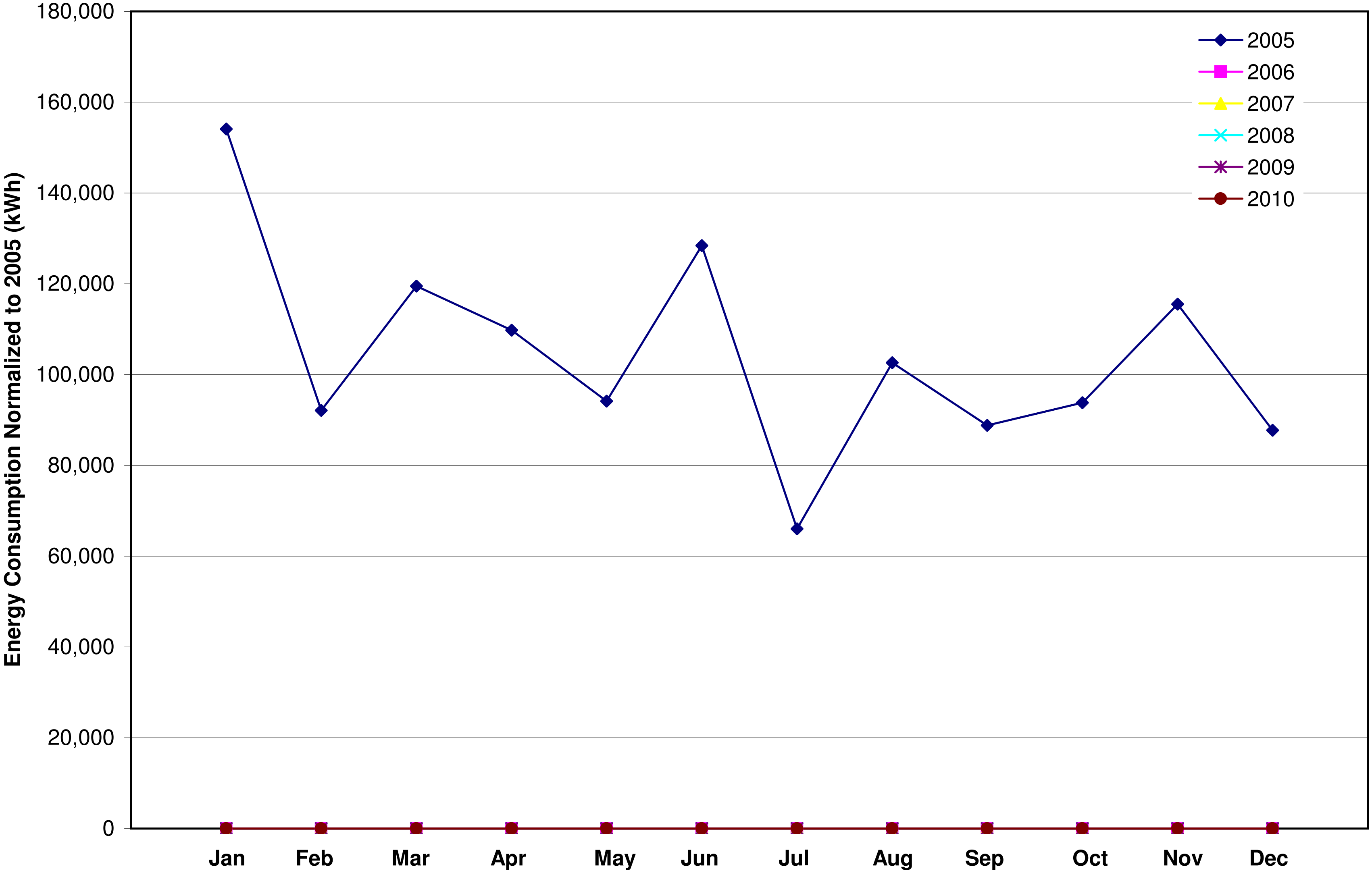
	2008					2009					2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane Energy (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2005 (kWh)**
January			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
February			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
March			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
April			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
May			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
June			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
July			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
August			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
September			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
October			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
November			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
December			0		#DIV/0!			0		#DIV/0!			0		#DIV/0!
TOTAL	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

Notes

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) and the "Billed Propane Energy" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for The Pas, Manitoba:
http://climate.weatheroffice.ec.gc.ca/climateData/monthlydata_e.html?timeframe=3&Prov=CA&StationID=3864&Year=2005&Month=10&Day=17
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F22) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

Figure F.10 - Energy Consumption Monitoring Graph for the Water Treatment Plant



Environment Canada Environnement Canada

Daily Data Report for June 2005

Notes on Data Quality.

THE PAS A
MANITOBA

Latitude: 53° 58' N **Longitude**: 101° 6' W **Elevation**: 270.40 m
Climate ID: 5052880 **WMO ID**: 71867 **TC ID**: YQD

Daily Data Report for June 2005

Day	Max Ter °C	Min Ter °C	Mean Te: °C	Heat Deg D C	Cool Deg D C	Total Ra mm	Total Sn cm	Total Pre mm	Snow on G cm	Dir of Max (10's Deg	Spd of Max (km/h
01	24.5	13.0	18.8	0.0	0.8	T	0.0	T	0		
02	16.0	11.4	13.7	4.3	0.0	9.8	0.0	9.8	0		
03	11.8	5.8	8.8	9.2	0.0	5.0	0.0	5.0	0		
04	9.0	5.7	7.4	10.6	0.0	0.4	0.0	0.4	0		
05	9.7	6.5	8.1	9.9	0.0	T	0.0	T	0		
06	11.0	5.3	8.2	9.8	0.0	T	0.0	T	0		
07	15.4	3.0	9.2	8.8	0.0	0.0	0.0	0.0	0		
08	18.0	3.9	11.0	7.0	0.0	0.0	0.0	0.0	0		
09	22.4	9.1	15.8	2.2	0.0	0.0	0.0	0.0	0		
10	23.1	7.9	15.5	2.5	0.0	T	0.0	T	0		
11	22.8	8.1	15.5	2.5	0.0	0.0	0.0	0.0	0		
12	17.3	9.5	13.4	4.6	0.0	0.0	0.0	0.0	0		
13	22.5	9.8	16.2	1.8	0.0	0.0	0.0	0.0	0		
14	18.9	10.4	14.7	3.3	0.0	0.0	0.0	0.0	0		
15	22.6	6.9	14.8	3.2	0.0	0.0	0.0	0.0	0		
16	23.9	12.0	18.0	0.0	0.0	0.0	0.0	0.0	0		
17	24.0	10.2	17.1	0.9	0.0	7.4	0.0	7.4	0		
18	16.8	13.1	15.0	3.0	0.0	30.6	0.0	30.6	0		
19	22.3	13.1	17.7	0.3	0.0	T	0.0	T	0		
20	19.6	7.8	13.7	4.3	0.0	0.0	0.0	0.0	0		
21	21.9	8.1	15.0	3.0	0.0	0.0	0.0	0.0	0		
22	29.4	14.5	22.0	0.0	4.0	T	0.0	T	0		
23	24.6	12.2	18.4	0.0	0.4	20.8	0.0	20.8	0		
24	13.2	5.8	9.5	8.5	0.0	5.0	0.0	5.0	0		
25	18.3	5.2	11.8	6.2	0.0	0.0	0.0	0.0	0		
26	16.9	8.6	12.8	5.2	0.0	5.2	0.0	5.2	0		
27	20.9	8.3	14.6	3.4	0.0	0.0	0.0	0.0	0		
28	22.6	9.8	16.2	1.8	0.0	0.0	0.0	0.0	0		
29	21.9	13.2	17.6	0.4	0.0	0.0	0.0	0.0	0		
30	25.0	13.0	19.0	0.0	1.0	0.0	0.0	0.0	0		
Sum				116.7	6.2	84.2	0.0	84.2			
Avg	19.5	9.0	14.3								
Xtrm	29.4	3.0									

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APPENDIX G

THE MUNICIPALITIES TRADING COMPANY OF MANITOBA LTD. REPORT

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MEMBER SERVICES

M.T.C.M.L.

The Municipalities Trading Company of Manitoba Ltd. (MTCML) allows AMM members to purchase products and services at lower prices through the power of bulk buying. This year was another great success. Sales remained consistent and the stable pool of official suppliers continued to change and grow. The products sales have consistently remained between 6.5 and 7.4 million dollars for the last 4 years.

The MTCML provides a major source of revenue for the AMM and allows the AMM membership dues to remain one of the lowest in Canada. This past year, the MTCML was able to rebate another $350,000 to our members based on their MTCML sales, bringing the cumulative rebate over the past four years to $1,250,000.

MTCML Official Suppliers

Official Suppliers are very important to the success of the MTCML. These suppliers offer hundreds of products and services that municipalities use. The Trading Company has individual contracts with each of these suppliers that ensure the best possible pricing for the purchasing members. In return, suppliers have direct contact with Manitoba's municipal market and can be a part of regular marketing opportunities through the AMM (mailings, Convention, trade shows, etc.) Each of our suppliers has shown long term commitment to the MTCML, creating a stable purchasing environment for the members of the AMM.

Corporate Members

At present fourteen companies make up the Corporate Members list of the AMM, five of these new for 2004/2005. These members assist the buying group in providing many services and hosting various events throughout the year.

> *Last year, the MTCML was able to rebate **$350,000** to our members based on their MTCML sales, bringing the total rebate over the past four years to **$1,250,000**.*

Major Programs

There are also two major buying programs offered by the Trading Company. These programs are owned by the AMM membership, managed by the AMM and each administered by a company that has expertise in the program area.

Petroleum Products Buying Group (PPBG)

AMM has entered into contracts with both Imperial Oil and Petro Canada, on behalf of all of our participating Members, for the supply of gasoline, diesel and lubricants. Our objective is to combat one-sided pricing advantages enjoyed by petroleum suppliers and to assist our Members to purchase fuel at a lower cost while still supporting the local fuel dealers. Currently there are 77 AMM Members who purchase over 6,000,000 litres of fuel each year and about 130 other municipalities in Saskatchewan and Alberta who purchase an additional 29,000,000 litres of fuel annually.

The concept of AMM purchasing large volumes of fuel on behalf of our Members and the careful analysis of industry pricing means fuel savings for member municipalities in all three provinces. At the same time, local fuel dealers are supported. The program is administered by Prairie Fuel Advisors Inc., who also act as our purchasing agent.

The only cost for joining the PPBG is 1.2¢ per litre for the fuel purchased and 10¢ per litre for lubricants. A municipality may withdraw from the PPBG at any time, and there is no cost to withdraw.

MEMBER SERVICES

Insurance

All AMM members outside of Winnipeg participate in the insurance program, administered by Hayhurst Elias Dudek on behalf of the AMM. Coverage includes property/road machinery and equipment; crime (loss of money); comprehensive general liability; errors and omissions liability; environmental impairment (pollution) liability; fire vehicle insurance; plus accident insurance for Councils, fire departments, ambulance services, and other 'volunteers'.

A major part of the program is the $3,500,000 annual self-insurance loss pool that keeps premiums much lower than if individual municipalities purchased their own coverage. Insurance is purchased from various providers for coverage in excess of the $3,500,000 annual loss pool amount, to provide complete protection. This allows the opportunity for significant refunds in low-claims years.

Last year, the AMM was able to offer an average 5% reduction in our insurance rates. As well, as a result of excellent risk management by municipalities, the AMM was able to refund $918,000 to municipalities out of the insurance loss pool.

Official Suppliers have shown long-term commitment to the MTCML.

MTCML Official Suppliers

Acklands Grainger Inc.
Airmaster Sales
Armtec
Bridgestone Canada Inc.
CD Awards
Darwen Road Technologies Ltd.
Denray Tire
Dust Free Road Maintenance
Fort Distributors Ltd.
Grand & Toy
Guardian Traffic Services Manitoba Ltd.
Hayhurst Elias Dudek Inc.
Kal Tire
MTS
Michelin
Norquay Printers Ltd.
PCO Orkin Swat Team
Prairie Fuel Advisors Inc.
Shippam & Associates Inc.
Souris Rock Shop
Tirecraft
Westcon Equipment & Rentals
Westman Steel Industries

AMM Corporate Members

Borland Construction
Cochrane Engineering
Guertin Equipment
Hayhurst Elias Dudek
Innovative Municipal Products Inc.
Manitoba Aboriginal and Northern Affairs
Manitoba Heavy Construction Association
Manitoba Hydro
Manitoba Mixed Concrete Association
Manitoba Pork Council
Mazer Group Construction Equipment
Robert Watson, Attorney
Strong-Coley & Associates
Westcon Equipment & Rentals Ltd.