ASSOCIATION OF MANITOBA MUNICIPALITIES
MANITOBA MUNICIPAL ENERGY, WATER AND WASTEWATER EFFICIENCY PROJECT
VILLAGE OF CARTWRIGHT AND R.M. OF ROBLIN
FINAL REPORT
MAY 2006

KGS GROUP

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

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May 5, 2006 File No. 05-1285-01-1000.7

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

ATTENTION: Mr. Tyler MacAfee

RE: Municipal Energy, Water, and Wastewater
Efficiency Study for Cartwright and the R.M. of Roblin – Final Report

Dear Mr. Tyler MacAfee:

Enclosed is the Final Report of the Manitoba Municipal Energy, Water and Wastewater Efficiency Study for the Village of Cartwright and the R.M. of Roblin with all comments incorporated.

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 17, and Appendix A to G.

We thank you for giving us the opportunity to work on this project and look forward to continuing this work with the other Municipalities.

Yours Truly,

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

RBB/mg

EXECUTIVE SUMMARY

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

An energy and water efficiency audit was conducted on twelve buildings in Cartwright and the R.M. of Roblin. 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 village'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 plants
- Water – Replacing high flow water fixtures with water efficient fixtures.

Table E1 shows the energy and water consumption for each of the buildings for the period September 2004 to September 2005. This year was selected as it represents a typical year for energy and water consumption. In addition, the most recent year was selected since the conditions of the buildings throughout this time most closely resemble the buildings' current conditions. The buildings included in this audit use electricity exclusively for energy. 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 buildings. The percent of the total energy density ranges from a high of 44.4% for the Sewage Lift Station to a low of 0.6% for the Recycling Depot.

Tables E2 (a) and (b) show overall energy and water saving opportunities for all twelve buildings in the Village of Cartwright and the R.M. of Roblin. These tables also 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 twelve buildings is 191,983 kWh, or 28% 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:

- The buildings have little or no ventilation (e.g. Library).
- Some of the buildings are rarely heated (e.g. Recycling Depot).
- Some of the buildings are infrequently used (e.g. Fire Hall & Ambulance Garage).

The water saving opportunities table (Table E2(b)) shows percent water savings, water savings in litres/year, and cost savings. The percentages shown in this table indicate percent water savings that would result from replacing the current 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 is taken as $0.53 per cubic meter.

The results and recommendations from the water and wastewater audit are shown in Section 17 of this report. From the water system audit, it was determined that Cartwright's Water Treatment Plant produced a total of 37,501 m^3 of water from September 2004 to August 2005 and used approximately 10,000 m^3 of this water for backwashing the filters. The amount of water entering the distribution system was 27,889 m^3, while only 26,280 m^3 of this water was consumed. The remaining 1,116 m^3 of water is considered water losses due to either leakage in the system, inaccurate water meters, or unauthorized water use. Reducing the water losses will reduce chemical costs required for water treatment, reduce electrical energy consumed by the pumps, and extend the life of the facility.

The sewer system in Cartwright is a combined collection system for both sewage and storm water. The wastewater flows to a lift station and is then pumped into the Village's lagoon. There was no information available to determine the amount of inflow and infiltration into the system. It is recommended that a flow meter be installed to record daily flows through the system to determine whether there is a need to reduce infiltration. Reducing infiltration will reduce pumping costs and extend the life of the lagoon. The following measures could potentially help to reduce the amount of infiltration into the Village's wastewater system: sealing manholes; lining pipes; and disconnecting rain leaders, sump pumps, and weeping tiles from the sanitary sewer system.

In addition to energy, water, and cost savings, other benefits would result from implementing the saving opportunities recommended throughout this report:

- Reduction in 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 September 04 – September 05

Site	Energy Density (kWh/m^2)	% of Total Energy Density	Area (m^2)	Electricity	
				kWh	Cost
Water Treatment Plant	666	24.9%	138	91,960	$6,473
Sewage Lift Station	1642	44.4%	9	14,790	$1,510
Cartwright Centennial Auditorium	177	3.6%	511	90,480	$6,498
Cartwright Community Centre Arena	88	2.4%	1763	155,700	$10,961
Cartwright Curling Rink	178	2.4%	362	64,560	$3,815
Municipal Office Building	163	4.3%	206	33,610	$5,035
Municipal Shop	175	4.6%	362	63,480	$4,266
Lakeland Regional Library	184	5.0%	107	19,660	$1,535
Fire Hall & Ambulance Garage	136	3.5%	325	44,110	$3,079
Mather Skating Rink	39	1.0%	1895	73,860	$4,896
Mather Hall	152	3.2%	254	38,700	$2,821
Recycling Depot	22	0.6%	80	1,800	$336
Total				692,710	$51,225

Percentage of Total Energy Density for Buildings in Cartwright and the R.M. of Roblin

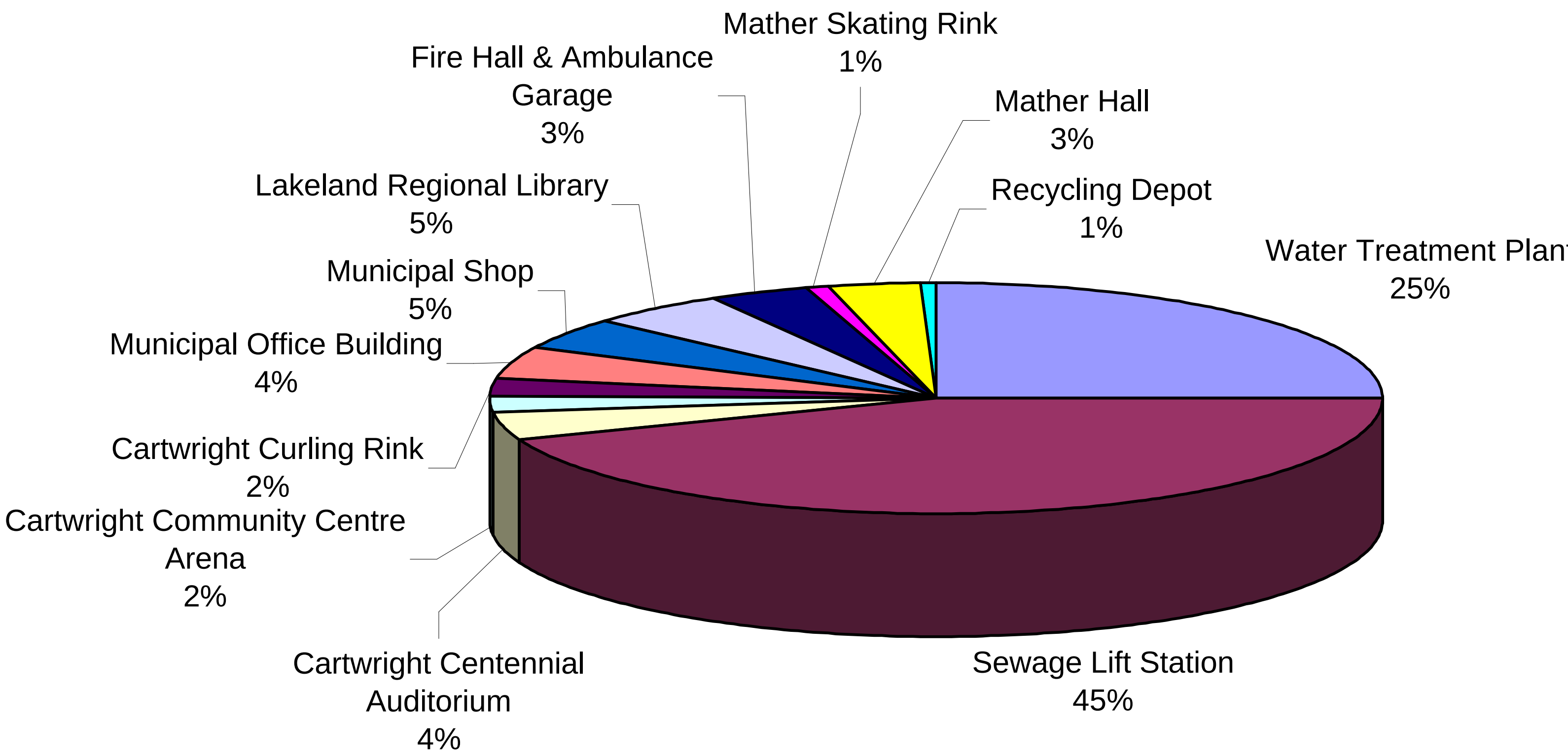

Table E2 (a) Summary of Energy Saving Opportunities for all 12 Buildings in Cartwright and R.M. of Roblin **Page 1 of 3**

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.	11	$50	$5	$80	$1,630	$1,066	1,945	$117	14.0	9.1	Community Centre, Mather Skating Rink, & Mather Hall.
Replace exterior incandescent lamps with high-pressure sodium lights.	8	$130	$93	$130	$2,371	$2,029	2,081	$125	19.0	16.2	Sewage Lift Station, Auditorium, Municipal Office, & Mather Skating Rink.
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	30	$75	$40	$75	$5,130	$3,933	6,318	$379	13.5	10.4	Community Centre, Municipal Office, Municipal Shop, & Library.
When 8' x 2 T12 ballasts burn out, replace them with T8 ballasts and tubes.	41	$47	$12	$0	$2,211	$575	2,492	$150	14.8	3.8	Auditorium, Curling Rink, & Fire Hall & Ambulance Garage.
Retrofit 8' x 1 T12 fluorescents with T8 ballast and tubes.	1	$65	$30	$65	$148	$108	223	$13	11.1	8.1	Community Centre.
Retrofit 4' x 2 T12 fluorescents with T8 ballast and tubes.	16	$55	$35	$60	$2,098	$1,733	1,505	$90	23.2	19.2	Municipal Office.
When 4' x 2 T12 ballasts burn out, replace them with T8 ballasts and tubes.	21	$41	$21	$0	$986	$508	1,298	$78	12.7	6.5	Community Centre & Library.
Replace interior incandescents with compact fluorescents.	58	$15	$10	$13	$1,818	$1,488	6,793	$408	4.5	3.6	Community Centre, Curling Rink, Municipal Office, Municipal Shop, Mather Skating Rink, & Recycling Depot.
When replacing interior incandescents, replace them with compact fluorescents.	53	$13	$8	$0	$785	$483	1,842	$111	7.1	4.4	Auditorium, Fire Hall & Ambulance Garage, & Mather Hall.
Replace incandescents with metal halides.	35	$300	$225	$300	$23,940	$20,948	15,416	$926	25.9	22.6	Water Treatment Plant, Community Centre, & Mather Skating Rink.
Install parking lot controllers.	5	$100	$75	$150	$1,425	$1,283	684	$41	34.7	31.2	Municipal Office & Municipal Shop.
Lighting & Parking Lot Controllers Subtotal					**$42,543**	**$34,153**	**40,596**	**$2,437**			

Table E2 (a) Summary of Energy Saving Opportunities for all 12 Buildings in Cartwright and R.M. of Roblin

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*	
ENVELOPE											
Replace and weatherstrip pedestrian doors.	6	$350	$350	$350	$4,788	$4,788	5,108	$307	15.6	15.6	Auditorium, Community Centre, & Mather Skating Rink.
Replace steel entrance doors.	2	$350	$350	$100	$1,026	$1,026	1,245	$75	13.7	13.7	Mather Hall.
Weatherstrip pedestrian doors.	16	$15	$15	$50	$1,186	$1,186	9,558	$574	2.1	2.1	Sewage Lift Station, Community Centre, Curling Rink, Municipal Office, Municipal Shop, Library, Fire Hall & Ambulance Garage, Mather Hall, & Recycling Depot.
Weatherstrip double/vehicle doors.	7	$30	$30	$100	$1,037	$1,037	7,765	$466	2.2	2.2	Auditorium, Curling Rink, Municipal Shop, & Fire Hall & Ambulance Garage.
Replace plexiglass windows with triple pane plexiglass windows.	7	$8,400	$6,800	$800	$10,488	$8,664	4,430	$266	39.4	32.6	Community Centre.
Replace and seal double pane windows in front.	2	$1,250	$1,000	$400	$3,762	$3,192	2,408	$145	26.0	22.1	Library.
Upgrade wall insulation to R-20.	3	$15,870	$15,870	$15,870	$36,184	$36,184	31,039	$1,864	19.4	19.4	Water Treatment Plant, Municipal Office, & Mather Skating Rink.
Upgrade roof insulation to R40.	4	$7,004	$7,004	$6,207	$15,061	$15,061	27,011	$1,622	9.3	9.3	Auditorium, Community Centre, Municipal Shop, & Mather Skating Rink.
Envelope Subtotal					**$73,531**	**$71,137**	**88,564**	**$5,317**			
HVAC											
Replace damper with motorized damper.	1	$400	$400	$300	$798	$798	1,627	$98	8.2	8.2	Water Treatment Plant.
Install programmable thermostat; setback temp to 15 ^{o}C (59 ^{o}F).	9	$300	$300	$300	$6,156	$6,156	32,069	$1,925	3.2	3.2	Water Treatment Plant, Auditorium, Community Centre, Municipal Shop, Library
Setback temp to 15 ^{o}C (59 ^{o}F).	1	$0	$0	$0	$0	$0	995	60	0.0	0.0	Municipal Office.
Insulate and plug old chimney.	1	$20	$20	$50	$80	$80	2,768	$166	0.5	0.5	Mather Skating Rink.

Table E2 (a) Summary of Energy Saving Opportunities for all 12 Buildings in Cartwright and R.M. of Roblin **Page 3 of 3**

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*	
Install geothermal heating system.	1	$20,558	$20,558	$12,000	$37,116	$37,116	22,854	$1,372	27.0	27.0	Municipal Shop.
When replacing condensing unit, replace it with a premium efficiency unit.	1	$265	$265	$0	$302	$302	544	$33	9.3	9.3	Municipal Office.
Melt ice shavings outside.	0	$0	$0	$0	$0	$0	11,212	$673	0.0	0.0	Community Centre
HVAC Subtotal					**$44,452**	**$44,452**	**71,780**	**$3,637**			
HOT WATER											
Install water efficient metering faucets.	5	$309	$309	$150	$2,615	$2,615	1,541	$114	22.8	22.8	Auditorium & Community Centre.
Install water efficient showerheads.	4	$21	$21	$50	$326	$326	835	$62	5.3	5.3	Community Centre.
Insulate hot water piping.	2	$50	$50	$50	$228	$228	931	$56	4.1	4.1	Community Centre & Municipal Office.
Install instantaneous water heater.	3	$300	$300	$900	$4,104	$4,104	4,015	$241	17.0	17.0	Municipal Shop, Library, & Fire Hall & Ambulance Garage.
Insulate hot water tank.	1	$300	$300	$700	$1,140	$1,140	3,670	$220	5.2	5.2	Mather Skating Rink.
Water Subtotal					**$8,412**	**$8,412**	**10,991**	**$694**			
MOTORS											
When 5HP distribution pump motor requires replacement, replace it with a high efficiency motor.	1	$250	$250	$0	$285	$285	549	$33	8.7	8.7	Water Treatment Plant.
Motors Subtotal					**$285**	**$285**	**549**	**$33**			

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	692,710	$49,163	20.65
Estimated Annual Savings	212,481	$12,118	6.30
Percent Savings	31%	25%	31%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).
**** This is the overall payback period and may vary for individual buildings (refer to tables throughout report for payback years for a specific building).

Table E2 (b) Summary of Water Saving Opportunities for the Village of Cartwright and R.M. of Roblin

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)	Related Buildings
		Capital	Labour					
Install water efficient metering faucets.	16	$309	$150	$8,372	80%	39,827	$21	Community Centre, Curling Rink, Municipal Office, Municipal Shop, Library, Mather Skating Rink, & Mather Hall.
Install water efficient toilets.	17	$284	$150	$8,411	55%	136,576	$73	Community Centre, Curling Rink, Municipal Office, Municipal Shop, Library, Fire Hall & Ambulance Garage, Mather Skating Rink, & Mather Hall.
Install water efficient urinals	1	$344	$200	$620	60%	11,115	$6	Mather Hall.
Install water efficient showerheads.	4	$21	$50	$324	29%	22,279	$12	Community Centre.

* The total cost column includes 14% taxes.

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

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- Colleen Mullin, Chief Administrative Officer
- Lawrence Klassen
- Mac Robinson
- Larry Isham
- PW Foreman

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1.0 INTRODUCTION

1.1 BACKGROUND

Energy and water conservation is becoming more important as environmental concerns grow and energy costs increase. For this reason it is important 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 twelve buildings in the Village of Cartwright and the R.M. of Roblin to determine how to reduce both energy and water consumption in each of these buildings. 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 Village of Cartwright and the R.M. of Roblin to reduce operating costs, conserve resources, and reduce greenhouse gas emissions. All twelve buildings were analyzed separately and the results are presented in separate sections throughout this report. The water and wastewater systems are discussed in Section 17.

1.3 METHODOLOGY

The buildings were toured on January 18 and 19, 2006 by Mr. Joel Lambert, and on October 26, 2005 by Mr. Tibor Takach, P.Eng, both of KGS Group Consulting Engineers and Project Managers. Mr. Takach toured the Water Treatment Plant to study the water and wastewater systems while Mr. Lambert toured the other ten buildings to perform the water and energy efficiency audits. The water and energy efficiency audits 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 Carwright's chief administrative officer Colleen Mullin to discuss the study objectives for identifying energy, water, and wastewater saving opportunities, and to provide information on existing incentive programs. At this time, it was determined that there are currently no construction projects underway for this village; however, the municipality is considering upgrading the lighting in the Municipal Office and the heating system in the Municipal Shop. 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 capital cost estimates are preliminary. For complex measures such as geothermal heating/cooling and major building envelope upgrades, a more detailed investigation would be required to confirm capital and installation costs for this system.

An environmental benefit that results from reducing energy consumption is a reduction in CO_2 emissions. CO_2 is a greenhouse gas and thus contributes to global warming. Although over 95% of Manitoba's electricity is produced by hydropower and thus 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 two 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 is 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 sink faucets, toilets, urinals, and showerheads. The water savings are shown as percentages of the current fixtures' water consumption and in litres per year (based on estimates of the building's occupancy). Cost savings were also calculated and are shown for individual buildings throughout the report.

Cartwright's water and wastewater systems were analyzed and results and recommendations are discussed in Section 17 of this report. In addition to an overview of the water and wastewater systems, several recommendations are made to help the Village monitor water consumption and losses and reduce operating costs.

2.0 WATER TREATMENT PLANT

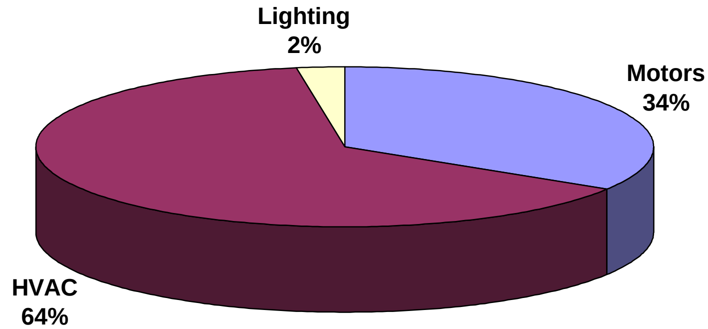
2.1 BACKGROUND

The Water Treatment Plant, constructed in 1960, is a 1,485 square foot building consisting of two sections: a front entryway and office, and the main process area. The front entryway and office area was constructed of 2x4 wood studs, R-12 insulation, interior plywood sheathing, and exterior metal cladding. The pumps for the water treatment and distribution system are located in the process area, which was constructed of concrete block walls and concrete "T" style beam roof construction.

Photo 1 – Water Treatment Plant

Aside from the Sewage Lift Station, the Water Treatment Plant consumes more energy per square meter than any other building audited in this municipality. In the previous year a total of 91,960 kWh of electrical energy was consumed. The majority of this energy was used for heating and to power the motors while only a small amount was used for lighting. The pie chart below shows the energy breakdown for the Water Treatment Plant.

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



There is no hot water required for the Water Treatment Plant. The only water fixture is a cold water sample sink.

2.2 ENERGY AND WATER SAVING OPPORTUNITIES

Table 1 shows a summary of the energy saving opportunities for the Water Treatment Plant. The following assumptions were made in determining the annual savings:

- The Water Treatment Plant is occupied for approximately 2 hours every day.
- The temperature of the Plant is maintained at 18°C (64°F).
- The outdoor lights are on 12 hours per day year round.
- One of the water distribution pumps and the water treatment pumps are assumed to be running 70% of the time.

Table 1 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										
Replace 300W incandescents with metal halides.	3	$300	$225	$300	$2,052	$1,796	767	$46	44.6	39.0
Lighting Subtotal					**$2,052**	**$1,796**	**767**	**$46**		
ENVELOPE										
Upgrade wall insulation to R-20.	1	$6,900	$6,900	$6,900	$15,732	$15,732	5,246	$315	50.0	50.0
Envelope Subtotal					**$15,732**	**$15,732**	**5,246**	**$315**		
HVAC										
Replace damper with motorized damper.	1	$400	$400	$300	$798	$798	1,627	$98	8.2	8.2
Install thermostat; setback temperature to 50 ^{o}F.	1	$300	$300	$300	$684	$684	15,394	$924	0.7	0.7
HVAC Subtototal					**$1,482**	**$1,482**	**16,453**	**$988**		
MOTORS										
When 5HP distribution pump motor requires replacement, replace it with a high efficiency motor.	1	$250	$250	$0	$285	$285	549	$33	8.7	8.7
Motors Subtotal					**$285**	**$285**	**549**	**$33**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	91,960	$6,473	2.74
Estimated Annual Savings	23,582	$1,416	0.70
Percent Savings	26%	22%	26%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

2.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary for the Water Treatment Plant is shown in Appendix B, Table B.1.3. Since the lights in this building are rarely on, the only recommended upgrade for lighting is to replace the 300W incandescent light fixtures in the main process area with metal halides. Three of the metal halides would produce the same amount of light as the 6 incandescents that are currently there.

Envelope

The walls of the water treatment plant have R-12 insulation. Table 1 above shows the energy savings that would result from upgrading this insulation to R-20. The high installation cost associated with this upgrade would result in a long payback period.

HVAC

Since the plant is rarely occupied, there is a large potential for energy savings by reducing the temperature setting when the plant is unoccupied. One option is to install a thermostat that is wired to the light switch. This should be set up such that when the lights are turned off, the temperature setting is automatically reduced to 10°C (50°F) and when the lights are on, the room temperature can be manually controlled.

Another opportunity for energy savings is to replace the back draft damper with a motorized damper. This would eliminate any cold air leakage into the room.

Motors

The energy savings shown in the Motors section of Table 1 represent the savings that would result from replacing the distribution pump motor with a premium efficiency as opposed to a standard efficiency motor once the current ones require replacement.

3.0 SEWAGE LIFT STATION

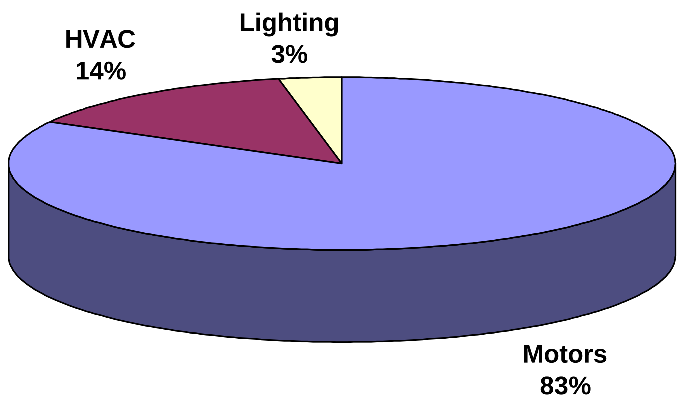
3.1 BACKGROUND

The Sewage Lift Station was constructed approximately 45 years ago to house two wastewater pumps. This station is a small 97 square foot wood building and is only occupied once a month for servicing.

Photo 2 – Sewage Lift Station

The energy density for this building is the largest of all the buildings in this study due to its small area. The total electrical energy consumption in the previous year was 14,790 kWh and was used mostly to power the motors. The pie chart below shows the breakdown of the total energy consumption.

Energy Breakdown (% of Total kWh)
for the Sewage Lift Station



There are no washrooms or water fixtures in this facility; therefore, there is no hot water consumption.

3.2 ENERGY AND WATER SAVING OPPORTUNITIES

Table 2 shows a summary of energy saving opportunities for the Sewage Lift Station. The following assumptions were made in the analysis:

- The Sewage Lift Station is occupied for 10 minutes every month.
- The temperature of the station is maintained at 10°C (50°F).
- The outdoor lights are on 12 hours per day year round.
- The wastewater pumps are assumed to be running 25% of the time

Table 3 Energy Saving Opportunities for the Sewage Lift Station

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Replace exterior incandescent lamps with high-pressure sodium lights.	1	$130	$93	$130	$296	$254	219	$13	22.5	19.3
Lighting Subtotal					**$296**	**$254**	**219**	**$13**		
ENVELOPE										
Weather-strip pedestrian door.	1	$15	$15	$50	$74	$74	788	$47	1.6	1.6
Envelope Subtotal					**$74**	**$74**	**788**	**$47**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	14,790	$1,510	0.44
Estimated Annual Savings	1,007	$60	0.03
Percent Savings	7%	4%	7%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

3.3 GENERAL RECOMMENDATIONS

Lighting

Since the Sewage Lift Station is almost always unoccupied, there would be very little energy savings from replacing the indoor lights. Assuming the exterior light is on for 12 hours every night, replacing this with a high-pressure sodium light would result in some energy savings. The lighting analysis summary table is shown in Appendix B as Table B.2.3.

Envelope

Since the station is kept at such a low temperature, there are very few opportunities for energy savings in terms of upgrading the building's envelope. The only opportunity with a reasonable payback period is to weather-strip the pedestrian door. This would reduce the cold air infiltration through the cracks around the door.

4.0 CARTWRIGHT CENTENNIAL AUDITORIUM

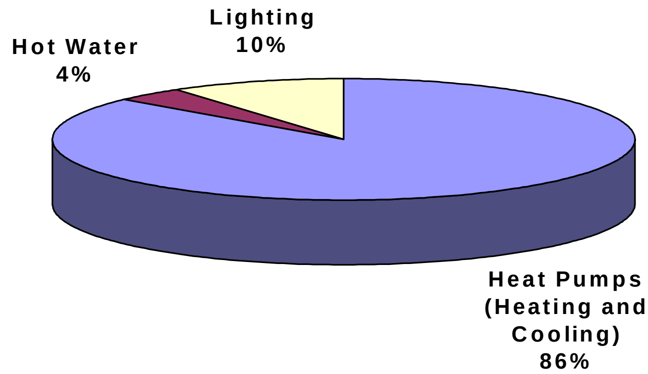
4.1 BACKGROUND

The Cartwright Centennial Auditorium was built in 1967 of concrete block walls with zonolite and fibreglass insulation. This 5,500 square foot building houses an auditorium, a kitchen, a bar, washrooms and a storage and mechanical room. There is also a small meeting room upstairs. The main floor of the auditorium is used once a week for 10 to 12 hours and the upstairs meeting room is occupied for approximately 72 hours per year.

Photo 3 – Cartwright Centennial Auditorium

The Auditorium uses electrical energy for heating, cooling, lighting and hot water. This building is heated and cooled using three geothermal heat pumps. Ventilation is provided using a heating recovery ventilator (HRV). In the previous year, a total of 90,480 kWh of electrical energy was consumed. The energy breakdown is shown in the pie chart below.

Energy Breakdown (% of Total kWh)
for the Cartwright Centennial Auditorium



The washrooms in the Cartwright Centennial Auditorium contain a total of 4 toilets and 4 sinks. A 270-litre electric hot water heater heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

4.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 3 and 4 show summaries of the energy and water efficiency improvement opportunities for the Cartwright Centennial Auditorium. The following assumptions were made in the calculations:

- The Auditorium is occupied once a week for 12 hours.
- The temperature of the building is maintained at 17°C (63°F).
- For the purpose of water consumption, the typical occupancy is 100.
- The exit lamps are on for 24 hours per day year round and the exterior lights are on 12 hours per day year round.

Table 3 Energy Saving Opportunities for the Cartwright Centennial Auditorium

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Replace exterior incandescent lamps with high-pressure sodium lights.	4	$130	$93	$130	$1,186	$1,015	876	$53	22.5	19.3
When 8' x 2 T12 ballasts burn out, replace them with T8 ballast and tubes.	3	$47	$12	$0	$162	$42	232	$14	11.6	3.0
When replacing interior incandescents, replace them with compact fluorescents.	22	$13	$8	$0	$326	$201	1,020	$61	5.3	3.3
Lighting Subtotal					**$1,673**	**$1,257**	**2,128**	**$128**		
ENVELOPE										
Replace and weather-strip pedestrian doors.	3	$350	$350	$350	$2,394	$2,394	1,672	$100	23.9	23.9
Weather-strip double doors.	1	$30	$30	$100	$148	$148	568	$34	4.3	4.3
Upgrade roof insulation to R40.	1	$2,500	$2,500	$2,500	$5,700	$5,700	3,322	$199	28.6	28.6
Envelope Subtotal					**$8,242**	**$8,242**	**5,561**	**$334**		
HVAC										
Install thermostats; Setback temperature to 15 ^{o}C (59 ^{o}F).	3	$300	$300	$300	$2,052	$2,052	7,810	$469	4.4	4.4
HVAC Subtotal					**$2,052**	**$2,052**	**7,810**	**$469**		
HOT WATER										
Install water efficient metering faucets.	4	$309	$309	$150	$2,092	$2,092	1,309	$97	21.5	21.5
Water Subtotal					**$2,092**	**$2,092**	**1,309**	**$97**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	90,480	$6,498	2.70
Estimated Annual Savings	16,808	$1,009	0.47
Percent Savings	19%	16%	17%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 4 Water Saving Opportunities for the Cartwright Centennial Auditorium

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	4	$309	$150	$2,093	80%	34,944	$19
Install water efficient toilets.	4	$284	$150	$1,979	55%	113,100	$60

* The total cost column includes 14% taxes.

4.3 GENERAL RECOMMENDATIONS

Lighting

A cost-effective way to reduce energy consumption is to replace interior incandescent bulbs with compact fluorescents. Compact fluorescents last approximately 10 times longer than incandescents and can save up to 75% in energy consumption. The exterior incandescents should be replaced with high-pressure sodium lights. Although compact fluorescents are much cheaper to install than high-pressure sodium lights, they are not recommended for outdoor applications. Consideration should also be given to replacing the 8' T12 fluorescent lamps with energy efficient T8s when the T12 ballasts burn out. The lighting analysis results for the Auditorium can be found in Appendix B, Table B.3.3.

Envelope

Some of the building's heat is being lost through the building's envelope. Replacing and weather-stripping the doors would eliminate some of this heat loss. Another option for reducing heat losses is to upgrade the roof insulation to R40. Since the geothermal heating system in this building is very efficient, the payback periods for these upgrades are long.

HVAC

Consideration should be given to installing programmable thermostats wired to the light switch such that the temperature is automatically reduced to 15^{o}C (59^{o}F) during unoccupied times. There is a large potential for energy savings with this opportunity and the payback period is short.

Water

Replacing the high flow water fixtures with water efficient fixtures would save from 55% to 80% of the current fixtures' water consumption. In addition to the water savings, there will also be energy savings from reduced hot water consumption. This water analysis is shown in Appendix B, Table B.3.5.

5.0 CARTWRIGHT COMMUNITY CENTRE

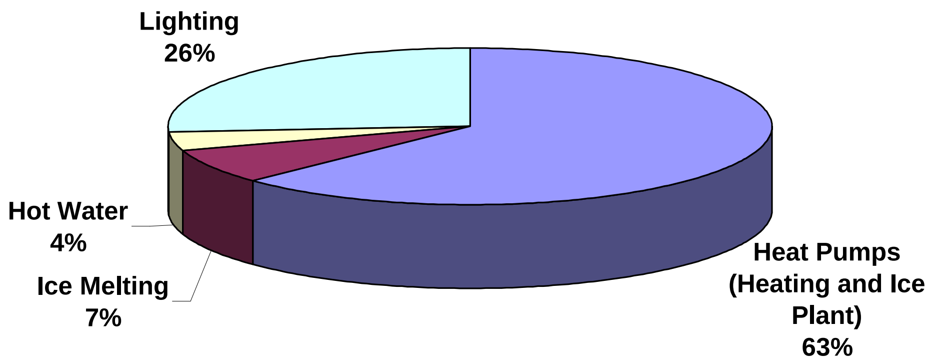
5.1 BACKGROUND

This 18,981 square foot building, constructed in 1959, consists of an unheated skating rink and a heated indoor lounge with windows overlooking the rink. The walls surrounding the heated area are insulated with both R-12 fibreglass insulation and R-1.1 homasote (tentest) and have exterior metal cladding. The Community Centre is occupied from November to the April.

Photo 4 – Cartwright Community Centre

Geothermal heat pumps are used for heating, cooling, and for the ice plant. A total of 155,700 kWh of electrical energy was consumed in the previous year. The majority of this energy was consumed by the heat pumps while the remaining was used for lighting, hot water heating, and melting the ice shavings from the rink. The pie chart below shows the breakdown of the total electrical energy consumption.

Energy Breakdown (% of Total kWh)
for the Cartwright Community Centre



The washroom in the Cartwright Community Centre contains a total of 1 toilet, 1 sink, and 4 showers. In addition, the Centre shares some of the Curling Rink's facilities. A large amount of hot water is also used for flooding the rink. There are two 150-litre electric hot water heater tanks that heat the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

5.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 5 and 6 show summaries of the energy and water saving opportunities for the building. The following assumptions were made in the calculations:

- The Community Centre is occupied from Nov 1 to March 31 for 70 hours/week.
- The heated area is maintained at 17°C (62.6°F) and the rink area is unheated.
- For the purpose of water consumption, typical occupancy of the building is assumed to be 30.

Table 5 Energy Saving Opportunities for the Cartwright Community 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										
Replace EXIT incandescent lamps with LED modules.	5	$50	$5	$80	$741	$485	526	$32	23.5	15.4
Replace ice rink incandescents with metal halides.	12	$300	$225	$300	$8,208	$7,182	9,849	$591	13.9	12.1
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	13	$75	$40	$75	$2,223	$1,704	2,370	$142	15.6	12.0
Retrofit 8' x 1 T12 fluorescents with T8 ballast and tubes.	1	$65	$30	$65	$148	$108	223	$13	11.1	8.1
Retrofit 4' x 2 T12 fluorescents with T8 ballast and tubes.	5	$41	$21	$0	$235	$121	287	$17	13.6	7.0
Replace interior incandescents with compact fluorescents.	14	$15	$10	$13	$439	$359	1,519	$91	4.8	3.9
Lighting Subtotal					**$11,994**	**$9,959**	**14,774**	**$887**		
ENVELOPE										
Replace and weather-strip steel pedestrian door between rink and zamboni room.	1	$350	$350	$350	$798	$798	734	$44	18.1	18.1
Weather-strip pedestrian doors.	4	$15	$15	$50	$296	$296	1,853	$111	2.7	2.7
Replace Plexiglas windows with triple pane Plexiglas windows.	7	$8,400	$6,800	$800	$10,488	$8,664	4,430	$266	39.4	32.6
Upgrade roof insulation.	1	$750	$750	$750	$1,710	$1,710	949	$57	30.0	30.0
Envelope Subtotal					**$13,292**	**$11,468**	**7,966**	**$478**		
HVAC										
Install programmable thermostat for second floor; setback temperature to 15°C (59°F).	1	$300	$300	$300	$684	$684	1,477	$99	6.9	6.9
Melt ice shavings outside.	0	$0	$0	$0	$0	$0	11,212	$673	0.0	0.0
HVAC Subtotal					**$684**	**$684**	**12,689**	**$762**		
HOT WATER										
Install water efficient metering faucets.	1	$309	$309	$150	$523	$523	231	$17	30.4	30.4
Install water efficient showerheads.	4	$21	$21	$50	$326	$326	835	$62	5.3	5.3
Insulate hot water piping.	1	$50	$50	$50	$114	$114	465	$28	4.1	4.1
Water Subtotal					**$963**	**$963**	**1,532**	**$107**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Production	155,700	$10,927	4.64
Estimated Annual Savings	36,960	$2,234	1.10
Percent Savings	24%	20%	24%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 6 Water Saving Opportunities for the Cartwright Community Centre

Description	Qty	Installed Cost/Unit ($)		Total Cost ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	1	$309	$150	$523	80%	6,174	$3
Install water efficient toilets.	1	$284	$150	$495	55%	19,983	$11
Install water efficient showerheads.	4	$21	$50	$324	29%	22,279	$12

* The total cost column includes 14% taxes.

5.3 GENERAL RECOMMENDATIONS

Lighting

The best opportunity for energy savings in terms of lighting is to replace the 500W incandescent lights in the rink with metal halides. Since metal halides are much more energy efficient than incandescents, the 23 incandescent lights could be replaced with twelve 250W metal halides to get the same or more light output. Consideration should also be given to replacing the T12 fluorescent lamps with T8 lamps and ballasts.

The incandescent exit signs are 15W each. Replacing these with LED exit signs would save 80% of the current exit signs' energy consumption. Another opportunity is to replace the indoor incandescents with compact fluorescents; this is a cost-effective way to save in annual energy consumption. The lighting analysis summary can be found in Appendix B, Table B.4.3.

Envelope

To reduce heat losses from the building's envelope, the windows, doors, and wall insulation surrounding the heated area of the Community Centre should be upgraded. Weather-stripping the doors would eliminate the heat losses due to infiltration with a short payback period. Another opportunity is to replace the Plexiglas windows between the lounge and the rink with triple pane Plexiglas windows.

The walls and roof currently have R-14 and R-20 insulation, respectively. Since the efficiency of the heating system is high (300% for geothermal heating), upgrades to the insulation have a long payback period. Upgrading the wall insulation is not included in Table 5 above due to the long payback period. However, the roof insulation is included above as it can be upgraded for a reasonable cost.

HVAC

The geothermal heating system is very efficient and therefore no upgrades are recommended for this system. The only recommendation is to install a programmable thermostat on the second floor and set the temperature down to 15 ^{o}C (59 ^{o}F) when the building is unoccupied.

Water

Energy consumption for hot water heating would be reduced by installing water efficient metering faucets and showerheads and by insulating the hot water piping.

Table 6 shows the reduction in water consumption that would result from replacing the current water fixtures with water efficient fixtures. Table B.4.5 in Appendix B shows more detailed results from this analysis.

Other Opportunities

The following is a list of energy saving opportunities for the ice plant that would help reduce annual costs associated with ice production:

- Natural ventilation of the rink in the winter saves energy by reducing the run time of the heat pump.
- 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 the glycol in the slab to freeze the top layer of the ice.
- 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.

- When shaving ice, take the ice shavings outside to be melted as opposed to melting the shavings in a heated area of the building. This will eliminate the energy consumed to melt this ice. Another option is to expand the geothermal heating loop and use any excess heat from this loop to melt the ice.

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

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

6.0 CARTWRIGHT CURLING RINK

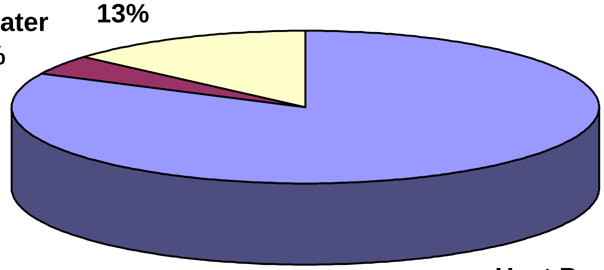
6.1 BACKGROUND

The Curling Rink is 3,896 square feet and was constructed in 1999 of 2x6 wood stud walls with exterior metal cladding. Both the walls and roof are well insulated and the building was built as an attachment to the Community Centre. This building houses a curling rink with two sheets of ice, a lounge with windows overlooking the rink, a kitchen, washrooms, and both a mechanical and an electrical room.

Photo 5 – Cartwright Curling Rink

The Curling Rink uses electricity exclusively for the geothermal heat pumps, lighting, and hot water. The heat pumps are used for heating both the rink area and the lounge, and for making the ice. A total annual energy consumption of 64,560 kWh was consumed in the previous year. The following pie chart shows the energy breakdown for the Curling Rink.

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



The washrooms in the Cartwright Curling Rink contain a total of 4 toilets, 5 sinks, and 2 urinals. A large amount of hot water is also used for flooding the rink; this water is taken from a roof water cistern and heated with an electric hot water heater. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

6.2 ENERGY SAVING OPPORTUNITIES

Tables 7 and 8 below show a summary of the energy and water saving opportunities for the Cartwright Curling Rink. The following assumptions were made in the calculations:

- The rink is occupied from the middle of October until the end of March for 12 hours/week plus 4 weekends/year (36 hours/weekend).
- The lounge and entrance areas are occupied for 30 and 56 hours per week, respectively.
- The temperature of the rink area is maintained at 0°C (32°F) when occupied and – 2°C (29°F) unoccupied.
- The lounge and entrance areas are maintained at 18°C (64.4°F).

Table 7 Energy Saving Opportunities for the Cartwright 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										
Replace interior incandescents with compact fluorescents.	10	$15	$10	$13	$314	$257	1,602	$96	3.3	2.7
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	24	$47	$12	$0	$1,294	$337	1,357	$81	15.9	4.1
Lighting Subtotal					**$1,608**	**$593**	**2,959**	**$178**		
ENVELOPE										
Weather-strip pedestrian doors.	2	$15	$15	$50	$148	$148	609	$37	4.1	4.1
Weather-strip double pedestrian doors.	1	$30	$30	$100	$148	$148	1,204	$72	2.0	2.0
Envelope Subtotal					**$296**	**$296**	**1,813**	**$109**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	64,560	$4,349	1.92
Estimated Annual Savings	4,772	$286	0.14
Percent Savings	7%	7%	7%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 8 Water Saving Opportunities for the Cartwright Curling Rink

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	5	$309	$150	$2,616	80%	9,576	$5
Install water efficient toilets.	4	$284	$150	$1,979	55%	24,795	$13

* The total cost column includes 14% taxes.

6.3 GENERAL RECOMMENDATIONS

Lighting

A cost-effective way to reduce energy consumption is to replace the incandescent bulbs with compact fluorescents. The lobby and entrance areas already have energy efficient T8 fluorescent bulbs as their light source. The ice area, however, uses T12 fluorescent lamps. Replacing these with T8s when the T12 ballasts burn out would save in annual energy consumption. The lighting analysis summary for this building is shown in Appendix B, Table B.5.3.

Envelope

Since this building is relatively new, the walls and roof are well insulated. The best opportunity for energy savings is to weather-strip the doors. New weather-stripping is inexpensive to install and would significantly reduce cold air infiltration through the cracks around the doors. Further details are shown in Appendix B, Table B.5.4.

Water

Table 8 shows the percent water savings that would result from replacing the current sink faucets and toilets with water efficient metering faucets and toilets.

Other Opportunities

Refer to the "Other Opportunities" discussion in Section 5.3 for additional energy saving opportunities for the ice plant that would help reduce annual costs associated with ice production.

7.0 MUNICIPAL OFFICE BUILDING

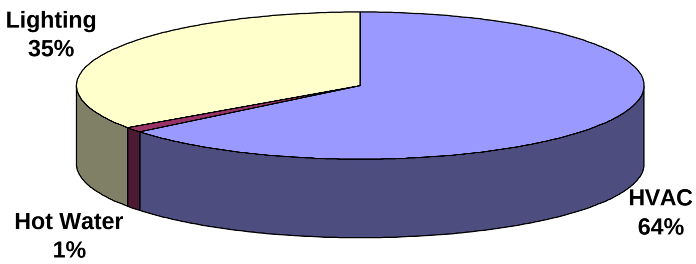
7.1 BACKGROUND

The Municipal Office Building was constructed in 1957 of concrete block walls with 2" of batt insulation, brick exterior walls, and plaster interior walls. In 2002, a new section was added on and the square footage increased from 1400 square feet to 2,216 square feet. When the addition was constructed, the insulation in the walls and roof of the old section was upgraded. The offices are occupied year round for approximately 45 hours per week.

Photo 6 – Municipal Office Building

The electrical energy consumption for this building in the previous year was 33,610 kWh. This total energy was split between lighting, heating, and water heating as shown in the pie chart below.

Energy Breakdown (% of Total kWh)
for the Municipal Office Building



The washroom in the Municipal Office Building contains a total of 1 toilet and 1 sink. A 38-litre electric hot water heater tank heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

7.2 ENERGY AND WATER SAVING OPPORTUNITIES

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

- The office is occupied from Monday to Friday for 9 hours per day plus 6 hours/month on the weekends.
- The office is maintained at 21°C (70°F) when occupied and 16°C (61°F) when unoccupied.
- For the purpose of water consumption, the typical occupancy of the Municipal Office is 10.
- The exterior lights are on for 12 hours a day year round.

Table 9 Energy Saving Opportunities for the Municipal Office 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										
Replace exterior incandescent lamps with high-pressure sodium lights.	2	$130	$93	$130	$593	$507	657	$39	15.0	12.9
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	7	$75	$40	$75	$1,197	$918	2,094	$126	9.5	7.3
Retrofit 4' x 2 T12 fluorescents with T8 ballast and tubes.	16	$55	$35	$60	$2,098	$1,733	1,505	$90	23.2	19.2
Replace interior incandescents with compact fluorescents.	2	$15	$10	$13	$63	$51	671	$40	1.6	1.3
Install parking lot controllers.	4	$100	$75	$150	$1,140	$1,026	576	$35	33.0	29.7
Lighting Subtotal					**$5,090**	**$4,235**	**5,503**	**$330**		
ENVELOPE										
Weather-strip glass pedestrian door.	1	$15	$15	$50	$74	$74	1,390	$83	0.9	0.9
Upgrade wall insulation in old part of building to R-20.	1	$2,970	$2,970	$2,970	$6,772	$6,772	8,702	$522	13.0	13.0
Envelope Subtotal					**$6,846**	**$6,846**	**10,091**	**$606**		

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
HVAC										
Seback temperature to 15 °C (59 °F)	0	$0	$0	$0	$0	$0	995	$60	0	0
When replacing condensing unit, replace it with a premium efficiency unit.	1	$265	$265	$0	$302	$302	544	$33	9.3	9.3
HVAC Subtototal					**$0**	**$0**	**1,419**	**$85**		
HOT WATER										
Insulate hot water piping.	1	$50	$50	$50	$114	$114	465	$28	4.1	4.1
Water Subtotal					**$114**	**$114**	**465**	**$28**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	33,610	$2,473	1.00
Estimated Annual Savings	17,479	$1,049	0.52
Percent Savings	52%	42%	52%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 10 Water Saving Opportunities for the Municipal Office Building

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	1	$309	$150	$523	80%	2,520	$1
Install water efficient toilets.	1	$284	$150	$495	55%	8,156	$4

* The total cost column includes 14% taxes

7.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The lighting analysis summary can be found in Table B.6.3. The largest amount of energy savings in terms of lighting comes from replacing the T12 fluorescent lamps with T8s. T8s are slim, energy efficient fluorescent lamps that generate more light per watt than conventional lighting.

Another opportunity for energy savings is to replace the indoor incandescent bulbs and the exterior incandescents with compact fluorescents and high-pressure sodium lights, respectively.

Parking lot controllers save energy by automatically adjusting the power to the car's block heater depending on the temperature. This can save up to 50% of the current plug-in expenses.

Envelope

The walls and roof of the newer part of this building are well insulated and the windows are all triple pane windows. Based on the drawings for this building, the walls in the older part are assumed to have R-6 insulation. Upgrading this to R-20 would result in a significant reduction in heat losses through these walls. The only other energy saving opportunity in terms of the building's envelope is to weather-strip the glass pedestrian door to reduce infiltration.

HVAC

An opportunity with no installation cost is to reprogram the thermostats to setback to 15°C (59°F) when unoccupied as opposed to 16°C. This would save in the costs associated with heating the building.

When the condensing unit requires replacement, installing a premium efficiency unit instead of a standard efficiency unit would save energy. The cost shown in Table 9 for this upgrade is the cost difference between a standard and a premium efficiency condensing unit.

Water

The hot water piping is not insulated and is losing heat to the surroundings. Insulating this piping would be cheap and would drastically reduce heat losses from the pipes.

Water savings would result from installing a water efficient toilet and metering faucet in the washroom. The percent savings associated with this upgrade are shown in Table 10.

8.0 MUNICIPAL SHOP

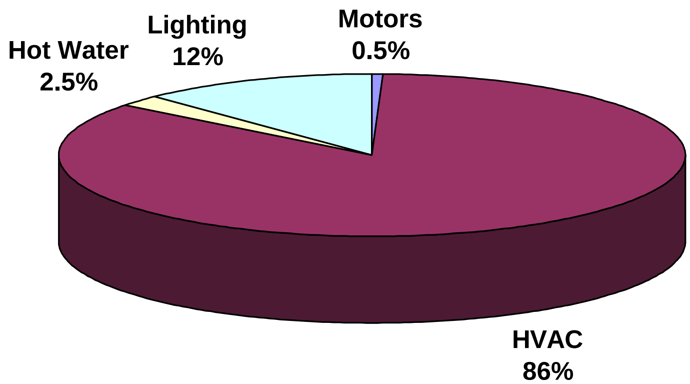
8.1 BACKGROUND

The Municipal Shop was constructed in 1987 of 2x6 wood studs with R-20 batt insulation, exterior metal cladding and drywall interior. The shop is occupied full time throughout the winter and for only 2 hours/day throughout the summer. The total area of the building is 3,896 square feet.

Photo 7 – Municipal Shop

This building uses electricity exclusively for lighting, heating, water heating, and to power the air compressor. In the previous year, the total electrical energy consumption was 63,480 kWh. The breakdown of this energy is shown in the following pie chart.

**Energy Breakdown (% of Total kWh)
for the Municipal Shop**



The washroom in the Municipal Shop contains a total of 1 toilet and 1 sink. A 200-litre electric hot water heater tank heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

8.2 ENERGY AND WATER SAVING OPPORTUNITIES

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

- In the winter, the shop is occupied from Monday to Friday, 8 am - 4:30 pm and in the summer, the shop is occupied for approximately 2 hours every day.
- The temperature of the shop is maintained at 17°C (63°F).
- The outdoor lights are assumed to be on for 12 hours every night.
- For the purpose of water consumption, the typical occupancy is 3.

Table 11 Energy Saving Opportunities for the Municipal Shop

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										
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	9	$75	$40	$75	$1,539	$1,180	1,713	$103	15.0	11.5
Replace interior incandescents with compact fluorescents.	10	$15	$10	$13	$314	$257	1,719	$103	3.0	2.5
Install Parking Lot Controllers	1	$100	$75	$150	$285	$257	108	$6	44.0	39.6
Lighting & Parking Lot Controllers Subtotal					**$2,138**	**$1,693**	**3,540**	**$213**		
ENVELOPE										
Weatherstrip pedestrian doors.	2	$15	$15	$15	$68	$68	1,211	$73	0.9	0.9
Weatherstrip and adjust vehicle doors.	2	$30	$30	$100	$296	$296	1,817	$109	2.7	2.7
Upgrade roof insulation.	1	$1,854	$1,854	$1,457	$3,775	$3,775	6,396	$384	9.8	9.8
Envelope Subtotal					**$4,140**	**$4,140**	**9,424**	**$566**		
HVAC										
Install programmable thermostat; Setback temp to 15 ^{o}C (59 ^{o}F).	2	$300	$300	$300	$1,368	$1,368	5,322	$320	4.3	4.3
Install geothermal heating system.	1	$20,558	$20,558	$12,000	$37,116	$37,116	22,854	$1,372	27.0	27.0
HVAC Subtototal					**$1,368**	**$1,368**	**28,176**	**$1,692**		
HOT WATER										
Install instantaneous water heater.	1	$300	$300	$900	$1,368	$1,368	1,513	$91	15.1	15.1
Water Subtotal					**$1,368**	**$1,368**	**1,513**	**$91**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	63,480	$4,266	1.89
Estimated Annual Savings	42,654	$2,561	1.27
Percent Savings	67%	60%	67%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 12 Water Saving Opportunities for the Municipal Shop

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	1	$309	$150	$523	80%	675	$0.36
Install water efficient toilets.	1	$284	$150	$495	55%	1,739	$0.93

* The total cost column includes 14% taxes

8.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The opportunities for energy savings in terms of indoor lighting are to replace the T12 fluorescent lamps with energy efficient T8s and to replace the incandescent bulbs with compact fluorescents. Installing a parking lot controller to control the power to the car plugs would also save energy; however, the payback period for this upgrade is long. The lighting analysis summary for the shop is shown in Table B.7.3.

Envelope

The walls of the shop are well insulated but the roof's insulation could be upgraded. Adding 6" of fiberglass batt insulation in the roof would result in large energy savings with a short payback period.

The most cost-effective opportunity for energy savings is to seal all the cracks around the doors. Replacing the weather-stripping around the pedestrian doors would reduce the infiltration around these doors with a short payback period. Two of the vehicle doors should be adjusted to reduce the gaps between the doors and the weather-stripping.

HVAC

Since the temperature of the shop is maintained at 17°C regardless of occupancy, large savings in heating requirements could be found from installing programmable thermostats. The new thermostats should be programmed to reduce the temperature to 15°C when the shop is unoccupied.

Another opportunity that was investigated for this facility was a geothermal heating system. The existing electric furnaces would be replaced with water-to-air heat pumps connected to a closed loop ground water system. The ground loop is needed as a heat exchanger to pull and return heat from the ground. The energy savings shown in Table 11 for this upgrade were calculated based on the heat load after the envelope upgrades are made. If the envelope upgrades are not made, the energy savings from the geothermal heating system will increase and the payback period will decrease.

Water

The heat losses from the hot water storage tank would be eliminated if the hot water tank were replaced with an instantaneous water heater.

From Table 12 it can be seen that installing a water efficient metering faucet and toilet in the washroom would reduce the fixtures' water consumption by 80% and 55%, respectively.

9.0 LAKELAND REGIONAL LIBRARY

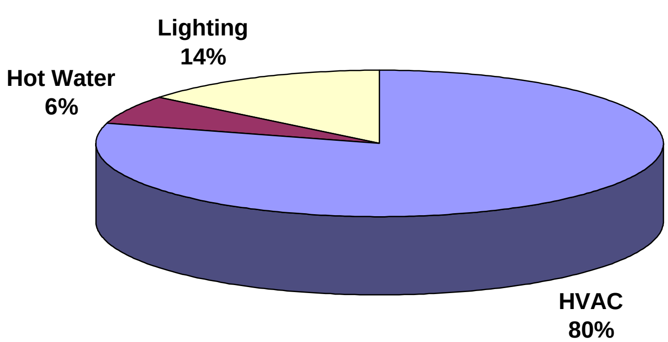
9.1 BACKGROUND

The Lakeland Regional Library was constructed approximately 70 years ago. This 1,155 square foot building is open from Tuesday to Friday, 11:30am – 5:00pm.

Photo 8 – Lakeland Regional Library

The library uses electricity exclusively for lighting, heating, cooling, and water heating. In the previous year, the total electrical energy consumption was 19,660 kWh. The breakdown of this energy is shown in the following pie chart.

**Energy Breakdown (% of Total kWh)
for the Lakeland Regional Library**



The washroom in the Lakeland Regional Library contains a total of 1 toilet and 1 sink. An electric hot water heater tank heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

9.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 13 and 14 show the energy and water saving opportunities for the Lakeland Regional Library. The following assumptions were made in the analysis:

- The library is occupied from Tuesday to Friday, 11:30am - 5:00pm.
- The temperature is maintained at 18°C (64.4°F).
- For the purpose of water consumption, the typical occupancy is 8.

Table 13 Energy Saving Opportunities for the Lakeland Regional 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										
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	1	$75	$40	$75	$171	$131	142	$9	20.1	15.4
When the 4' x 2 T12 ballasts burn out, replace them with T8 ballast and tubes.	16	$41	$21	$0	$751	$387	1,011	$61	12.4	6.4
Lighting Subtotal					**$922**	**$518**	**1,153**	**$69**		
ENVELOPE										
Replace and seal double pane windows in front.	2	$1,250	$1,000	$400	$3,762	$3,192	2,408	$145	26.0	22.1
Weather-strip pedestrian doors.	2	$15	$15	$50	$148	$148	1,390	$83	1.8	1.8
Envelope Subtotal					**$3,910**	**$3,340**	**3,798**	**$228**		
HVAC										
Install thermostat; setback temp to 15 ^{o}C (59 ^{o}F).	2	$300	$300	$300	$1,368	$1,368	1,896	$114	12.0	12.0
HVAC Subtototal					**$1,368**	**$1,368**	**1,896**	**$114**		
HOT WATER										
Install instantaneous water heater.	1	$300	$300	$900	$1,368	$1,368	1,164	$70	19.6	19.6
Water Subtotal					**$1,368**	**$1,368**	**1,164**	**$70**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	19,660	$1,535	0.59
Estimated Annual Savings	8,011	$481	0.24
Percent Savings	41%	31%	39%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 14 Water Saving Opportunities for the Lakeland Regional Library

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	1	$309	$150	$523	80%	1,281	$1
Install water efficient toilets.	1	$284	$150	$495	55%	4,147	$2

* The total cost column includes 14% taxes

9.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary for the library is shown in Appendix B, Table B.8.3. Energy savings would result from replacing the T12 fluorescent lighting with energy efficient T8 lamps.

Envelope

The large double pane windows in the front have very little resistance to heat loss. Unfortunately, the cost involved in replacing these windows with triple pane windows is high resulting in a long payback period. Another energy saving opportunity with a much shorter payback period is to weather-strip the pedestrian doors. This will help to reduce cold air infiltration through the cracks.

HVAC

The thermostats in the library should be replaced with new programmable thermostats. These thermostats should the programmed such that the temperature is reduced to 15°C (59°F) during unoccupied times.

Water

The hot water tank was not accessible at the time of the audit and therefore it was assumed that the hot water tank holds 150 litres of water. With this assumption, energy savings associated with replacing the hot water tank with an instantaneous water heater were calculated. These savings are shown in Table 13 above.

From Table 14 it can be seen that installing a water efficient metering faucet and toilet in the washroom would reduce the fixtures' water consumption by 80% and 55%, respectively.

10.0 FIRE HALL AND AMBULANCE GARAGE

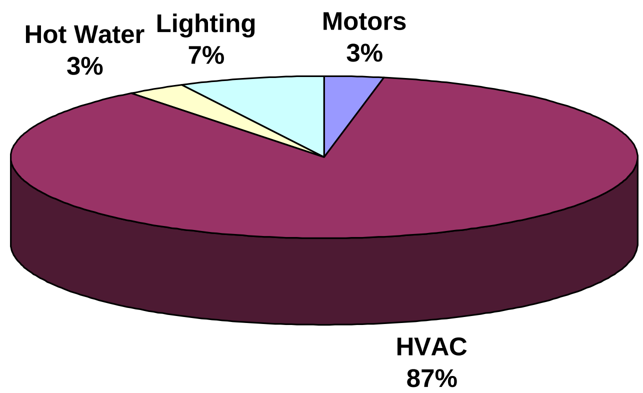
10.1 BACKGROUND

The Fire Hall and Ambulance Garage was constructed approximately 15 years ago of 2x6 wood studs, R-20 insulation, and exterior metal cladding. The building is 3,500 square feet and consists of a garage and a training room.

Photo 9 – Fire Hall and Ambulance Garage

The training room, washroom and shower room are heated with electric baseboards and the garage has an electric boiler for in-floor heating. In the previous year, the total electrical energy consumption was 44,110 kWh. The breakdown of this energy is shown in the following pie chart.

**Energy Breakdown (% of Total kWh)
for the Fire Hall and Ambulance Garage**



The washroom in the Fire Hall and Ambulance Garage contains a total of 1 toilet and 2 sinks. A 175-litre electric hot water heater tank heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

10.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 15 and 16 show the energy and water saving opportunities for the Fire Hall and Ambulance Garage. The following assumptions were made in the analysis:

- The garage is occupied for 10 hours every month.
- The temperature of the garage is maintained at an average temperature of 15°C (59°F).
- The outdoor lights are assumed to be on for 12 hours every night.
- For the purpose of water consumption, the typical occupancy is 8.

Table 15 Energy Saving Opportunities for the Fire Hall and Ambulance 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										
Retrofit 8' x 2 T12 fluorescents with T8 ballast and tubes.	14	$47	$12	$0	$755	$196	903	$54	13.9	3.6
When replacing interior incandescents, replace them with compact fluorescents.	3	$13	$8	$0	$44	$27	112	$7	6.6	4.1
Lighting Subtotal					**$799**	**$224**	**1,015**	**$61**		
ENVELOPE										
Weather-strip pedestrian doors.	2	$15	$15	$50	$148	$148	1,178	$71	2.1	2.1
Weather-strip vehicle doors.	2	$30	$30	$100	$296	$296	4,005	$240	1.2	1.2
Envelope Subtotal					**$445**	**$445**	**5,183**	**$311**		
HOT WATER										
Install instantaneous water heater.	1	$300	$300	$900	$1,368	$1,368	1,338	$80	17.0	17.0
Water Subtotal					**$1,368**	**$1,368**	**1,338**	**$80**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	44,110	$3,079	1.31
Estimated Annual Savings	7,536	$452	0.22
Percent Savings	17%	15%	17%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 16 Water Saving Opportunities for the Fire Hall and Ambulance Garage

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient toilets.	1	$284	$150	$495	55%	4,894	$3

* The total cost column includes 14% taxes.

10.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary is shown in Appendix B, Table B.9.3. The opportunities for energy savings in terms of the building's lighting are to replace the T12 fluorescent lamps with energy efficient T8 lamps and ballasts and to replace the incandescent bulbs with compact fluorescents.

Envelope

Heat losses due to infiltration around the vehicle and pedestrian doors would be reduced if new weather-stripping were installed. The energy savings and payback periods for these upgrades are shown in Table 15 above.

Water

Consideration should be given to replacing the 175-litre hot water heater with an instantaneous water heater. This would eliminate heat losses from the storage tank.

From Table 16 it can be seen that installing a water efficient toilet in the washroom would reduce the water consumption by 55%.

11.0 MATHER SKATING RINK

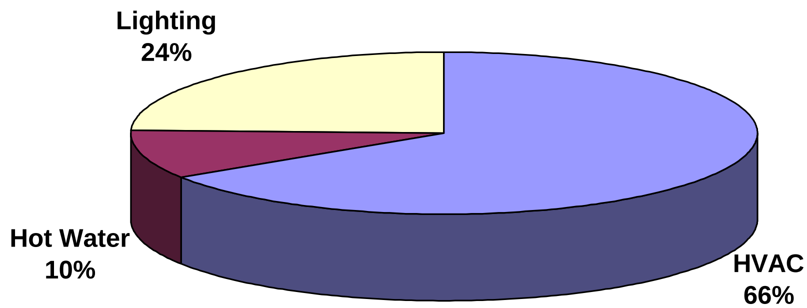
11.1 BACKGROUND

The Mather Skating Rink was constructed in 1967. This 20,400 square foot building contains an unheated rink and a heated lobby with windows overlooking the rink. The walls of this building have OSB sheeting on the interior and metal cladding on the exterior. The wall cavities were visible in two locations in the building and there was no insulation present in either location.

Photo 10 – Mather Skating Rink

This building uses electricity exclusively for heating, lighting and water heating. In the previous year, the total electrical energy consumption was 73,860 kWh. The breakdown of this energy is shown in the following pie chart.

**Energy Breakdown (% of Total kWh)
for the Mather Skating Rink**



The washrooms in the Mather Skating Rink contain a total of 2 toilets and 2 sinks. A 1325-litre electric hot water heater tank heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

11.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 17 and 18 show the energy and water saving opportunities for the Mather Skating Rink. The following assumptions were made in the analysis:

- The lights in the skating rink are assumed to be on for 4 months of the year, for 4 hours per day.
- The outdoor lights are assumed to be on for 12 hours every night and the exit signs run 24 hours per day.
- For the purpose of water consumption, the typical occupancy is 10.
- The temperature of the heated area is maintained at an average of 10°C (50°F).

Table 17 Energy Saving Opportunities for the Mather Skating 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										
Replace EXIT incandescent lamps with LED modules.	2	$50	$5	$80	$296	$194	473	$28	10.4	6.8
Replace exterior incandescent lamps with high-pressure sodium lights.	1	$130	$93	$130	$296	$254	329	$20	15.0	12.9
Replace 300W incandescents in rink with metal halides.	20	$300	$225	$300	$13,680	$11,970	4,800	$288	47.5	41.5
Replace interior incandescents with compact fluorescents.	16	$15	$10	$13	$502	$410	645	$39	13.0	10.6
Lighting Subtotal					**$14,774**	**$12,828**	**6,247**	**$375**		
ENVELOPE										
Replace and weather-strip wood pedestrian doors.	2	$350	$350	$100	$1,026	$1,026	2,702	$162	6.3	6.3
Upgrade wall insulation.	1	$6,000	$6,000	$6,000	$13,680	$13,680	17,091	$1,026	13.3	13.3
Upgrade roof insulation.	1	$1,900	$1,900	$1,500	$3,876	$3,876	16,344	$981	3.9	3.9
Envelope Subtotal					**$18,582**	**$18,582**	**36,137**	**$2,170**		
HVAC										
Insulate and plug old chimney.	1	$20	$20	$50	$80	$80	2,768	$166	0.5	0.5
HVAC Subtotal					**$80**	**$80**	**2,768**	**$166**		
HOT WATER										
Insulate hot water tank.	1	$300	$300	$700	$1,140	$1,140	3,670	$220	5.2	5.2
Water Subtotal					**$1,140**	**$1,140**	**3,670**	**$220**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	73,860	$4,896	2.20
Estimated Annual Savings	48,822	$2,931	1.46
Percent Savings	66%	60%	66%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 18 Water Saving Opportunities for the Mather Skating Rink

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	2	$309	$150	$1,047	80%	5,040	$3
Install water efficient toilets.	2	$284	$150	$990	55%	16,313	$9

* The total cost column includes 14% taxes

11.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary table is shown in Appendix B, Table B.10.3. One recommendation is to replace the 300W incandescent lights with metal halides. Metal halides are one of the most efficient white light sources available and from Table 17 it can be seen that large energy savings would result from this upgrade. The most cost-effective energy saving opportunity is to replace the smaller indoor incandescent bulbs with compact fluorescents when they burn out; this is an easy upgrade with significant energy savings.

Another opportunity that is available is to replace the incandescent exit signs with LED signs. This upgrade would save up to 90% of the current sign's energy consumption.

Envelope

The envelope of this building has very little resistance to heat losses. If this building continues to be heated for several years, the walls and roof of the heated area should be insulated and the pedestrian doors should be considered for replacement.

HVAC

The exhaust duct from the old oil furnace is letting cold air into the building. This duct should be insulated and plugged to prevent further heat losses due to infiltration into building.

Water

The hot water tank in this building is very large and has very little insulation. Insulating this tank would result in significant energy savings with a short payback period.

12.0 MATHER HALL

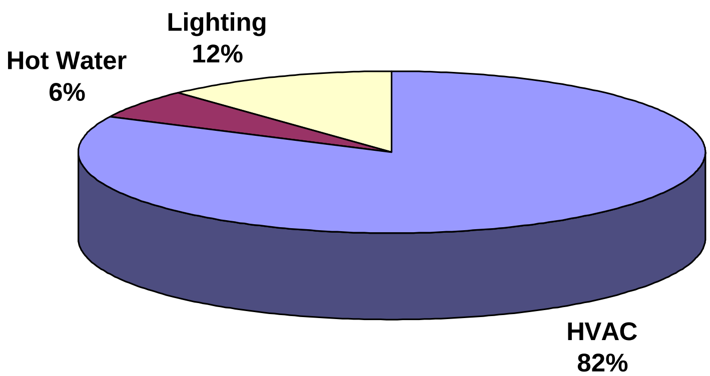
12.1 BACKGROUND

Mather Hall is a 2,739 square foot building constructed of wood studs with R-20 fiberglass insulation. The hall is occupied approximately 1 evening every week for various gatherings.

Photo 11 – Mather Hall

The hall uses electrical energy for lighting, heating, and water heating. In the previous year a total of 38,700 kWh of energy was consumed. The pie chart below shows the breakdown of the total energy consumption.

Energy Breakdown (% of Total kWh)
for Mather Hall



The washrooms in Mather Hall contain a total of 6 toilets, 5 sinks, and 1 urinal. A 175-litre electric hot water tank and a 40-litre electric hot water tank heat the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

12.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 19 and 20 show the energy and water saving opportunities for Mather Hall. The following assumptions were made in the analysis:

- The hall is occupied for 8 hours per week year round.
- The temperature of the hall is maintained at an average of 15°C (59°F).
- The outdoor lights are assumed to be on for 12 hours every night.
- For the purpose of water consumption, the typical occupancy is 3.

Table 19 Energy Saving Opportunities for the Mather Hall

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Replace EXIT incandescent lamps with LED modules.	4	$50	$5	$80	$593	$388	946	$57	10.4	6.8
When replacing interior incandescents, replace them with compact fluorescents.	28	$13	$8	$0	$415	$255	711	$43	9.7	6.0
Lighting Subtotal					**$1,008**	**$643**	**1,657**	**$99**		
ENVELOPE										
Replace steel entrance doors.	2	$350	$350	$100	$1,026	$1,026	1,245	$75	13.7	13.7
Weatherstrip back steel door.	1	$15	$15	$50	$74	$74	1,066	$64	1.2	1.2
Envelope Subtotal					**$1,100**	**$1,100**	**2,311**	**$139**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	38,700	$2,821	1.15
Estimated Annual Savings	3,968	$238	0.12
Percent Savings	10%	8%	10%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 20 Water Saving Opportunities for the Mather Hall

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Water Savings ($)
		Material	Labour				
Install water efficient metering faucets.	5	$309	$150	$2,616	80%	14,560	$8
Install water efficient toilets.	6	$284	$150	$2,969	55%	56,550	$30
Install water efficient urinals.	1	$344	$200	$620	60%	11,115	$6

* The total cost column includes 14% taxes

12.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis summary for Mather Hall is shown in Appendix B, Table B.11.3. Since the indoor lights are used so infrequently, replacing the T12 fluorescents with T8s would have a very long payback period. The opportunities for lighting presented in Table 19 include replacing the interior incandescents with compact fluorescents and upgrading the incandescent exit signs to LED exit signs.

Envelope

The walls and roof of this building currently have adequate insulation. The only energy saving opportunities listed in Table 19 above are to replace the steel entrance doors with insulated doors and weather-strip the back door.

Water

Table 20 shows the water savings that would result from replacing the toilets, sinks, and urinals in the washrooms with water efficient fixtures.

13.0 RECYCLING DEPOT

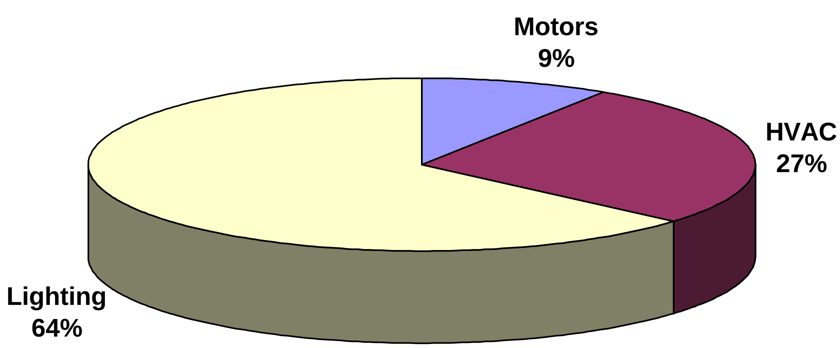
13.1 BACKGROUND

The Recycling Depot is a 864 square foot building constructed of 2x4 studs and exterior and interior steel cladding. The Depot is occupied Monday to Thursday from 8-4:30pm.

Photo 12 – Recycling Depot

This building uses electricity exclusively for lighting, heating, and to power the baler and glass shredder motors. In the previous year, the total electrical energy consumption was 3,392 kWh. The breakdown of this energy is shown in the following pie chart.

Energy Breakdown (% of Total kWh)
for the Recycling Depot



There are no water fixtures in the Recycling Depot and thus no hot water consumption.

13.2 ENERGY AND WATER SAVING OPPORTUNITIES

Table 21 shows the energy saving opportunities for the Recycling Depot. The following assumptions were made in the analysis:

- The recycling depot is occupied from Monday to Thursday from 8-4:30pm.
- The outdoor lights are assumed to be on for 12 hours every night.
- The temperature is maintained at 5°C (42°F) when unoccupied.

Table 21 Energy Saving Opportunities for the Recycling Depot

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
LIGHTING										
Replace interior incandescents with compact fluorescents.	6	$15	$10	$13	$188	$154	636	$38	4.9	4.0
Lighting Subtotal					**$188**	**$154**	**636**	**$38**		
ENVELOPE										
Weather-strip vehicle door.	1	$30	$30	$100	$148	$148	171	$10	14.4	14.4
Weather-strip pedestrian door.	1	$15	$15	$50	$74	$74	74	$4	16.6	16.6
Envelope Subtotal					**$222**	**$222**	**245**	**$15**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	1,800	$336	0.05
Estimated Annual Savings	882	$53	0.026
Percent Savings	49%	16%	52%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

13.3 GENERAL RECOMMENDATIONS

Lighting

A cost-effective energy saving opportunity for the Recycling Depot is to replace the interior incandescent bulbs with compact fluorescents.

Envelope

Both the pedestrian door and the vehicle door require new weather-stripping.

14.0 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 14.1 to 14.5) and maintenance activities (Section 14.6) that will result in energy / water savings for all the buildings.

14.1 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 incandescents 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. Photo 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.

14.2 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” around the frames. 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.

14.3 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 6°C “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 aluminum 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 thus 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.

14.4 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, dual-flush volume models that use either 6 L (1.6 Imp. gal.) or 3 L (0.8 Imp. gal.) per flush. These toilets reduce water usage by over 70% compared with the traditional 13 L, and by 40% over a "low flush" 6 L toilet. Refer to the toilet and drainline 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.

14.5 ICE RINKS

Ventilate Rink - Natural ventilation of the rink in the winter saves energy by reducing the run time of 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 the 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 heated 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.

14.6 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 equipment.

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

15.0 IMPLEMENTATION OF ENERGY AND WATER SAVING OPPORTUNITIES

15.1 IMPLEMENTATION

The energy and water saving opportunities suggested in this report range from simply changing a light bulb to installing a geothermal heating system. Some of the simpler recommended upgrades can 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 the 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 involves 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 vehicle doors, and upgrading the wall and/or roof insulation.

In terms of HVAC, a contractor should be hired to install programmable thermostats and motorized dampers.

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

For the water saving opportunities involving installing water efficient 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

The only energy saving opportunity for the Village of Cartwright that requires a consultant to implement is the geothermal heating system in the Municipal shop. This system will require a detailed site investigation, bore hole testing, and energy modeling of the building to properly size the geothermal system.

Consulting services should also be considered for any major upgrades to building and services.

15.2 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 and windows, wall insulation upgrades, and geothermal heating systems. 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 Municipality Trading Company of Manitoba Limited. Details of this can be found in Appendix G of this report.

15.3 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 program are included in Appendix D of 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 Cartwright and the R.M. of Roblin

The Village of Cartwright and the R.M. of Roblin have undergone some energy efficient upgrades in the past including a geothermal heating system in 3 of the 12 buildings audited in this study. This municipality is also considering upgrading the lighting in the Municipal Office and the heating system in the Municipal Shop. The knowledge gained from this efficiency study will therefore be useful in future energy efficient upgrades to the buildings. In addition, since no water or wastewater system audits have been done in Cartwright in the past, the discussion and results presented in Section 17 of this report will be valuable in understanding the current system and ways to improve the system.

The Chief Administrative Officer of Cartwright and the R.M. of Roblin expressed interest in this study and in using the results from this study to implement some of the more cost-effective measures in the future. 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 the council and current members leave.

16.0 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 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:

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

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. This data can be found for the town of Morden on the following website:

http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=29593&Year=2006&Month=1&Day=1

Once the “Billed Energy Consumption” 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.

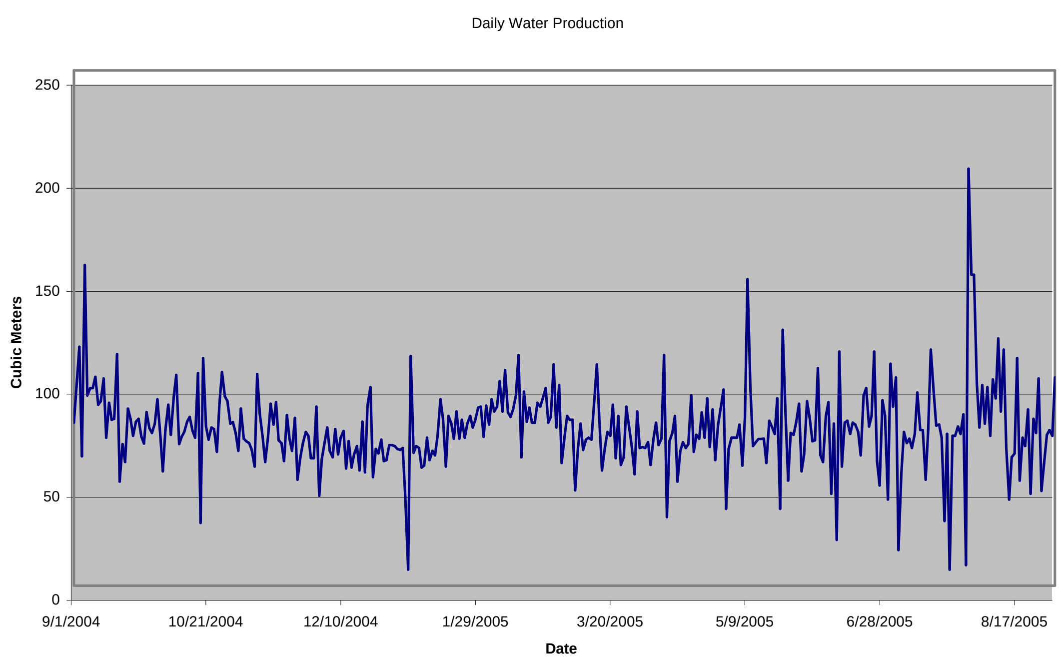
17.0 WATER DISTRIBUTION AND WASTEWATER COLLECTION SYSTEM AUDITS

17.1 WATER DISTRIBUTION SYSTEM OVERVIEW

The Village of Cartwright constructed a water supply and distribution system in 1962. Water is pumped from a water well to the Cartwright Water Treatment Plant where it is treated by salt softening, green sand filtration, and chlorination. After treatment, two 5-horsepower pumps pump the water to the distribution system.

Based on data provided, the average amount of water produced from September 2004 through August 2005 was approximately 76.4 m^3 per day with a maximum daily flow of approximately 107.7 m^3. Water is stored in an underground reservoir that has a storage capacity of approximately 318 m^3. From this data, the average water produced per capita is approximately 251.3 litres per day. Chart 1 shows the amount of treated water entering the distribution system on a daily basis for the period from September 2004 through August 2005.

Chart 1 Treated Water Entering the Distribution System



The water plant and original distribution system was built in 1962. According to data provided, the distribution system is approximately 5,212 m (17,100 ft) in length and consists of approximately 244 m (800 ft) of PVC piping and 4,968 m (16,300 ft) of asbestos concrete piping. There is currently no program in place for replacing old piping, but the distribution system is repaired and replaced as breaks occur.

Table 22 lists the amount of water entering the reservoir, the amount of water used for backwashing, the amount of water sent to the distribution system by the water treatment plant, and the amount of water consumed by clients. The values are based on meter readings for the period from September 2004 through August 2005.

Table 22 Water Use from September 2004 Through August 2005

Months	Consumption (m^3)	Distribution (m^3)	Reservoir (m^3)	Backwash (m^3)
Sept - Nov 2004	6,853	7,202	9,847	2,867
Dec 2004 - Feb 2005	7,353	6,735	9,088	2,668
March - May 2005	5,966	6,784	9,156	2,631
June - Aug 2005	6,109	7,168	9,410	2,560
Total	26,280	27,889	37,501	10,726

It should be noted that, according to operation staff, water flows through the reservoir meter into the reservoir, and then is split into two lines, the backwash line and the distribution line. If this is the case, the summation of the distribution meter readings and the backwash meter readings should equal the reservoir meter readings plus or minus any change in water volume in the reservoir. From the data provided, it can be seen that from September 2004 to August 2005, the reservoir readings are 1114 m^3 less than the summation of the other two readings. This difference is larger than can be accounted for by any change in the water volume in the reservoir since the reservoir can only hold 318 m^3. This difference in meter readings is likely due to meter errors.

According to published literature, all meters experience some amount of error. This error will increase with the age and degradation of the meter. The backwash meter in the water treatment plant is quite old and is corroded. These two conditions could cause the meter to have an increased error. The distribution meter and the reservoir meter are newer and apparently less worn than the backwash meter. However, these meters are still quite old and would therefore also have larger errors than a new meter. If the three meters are assumed to have a significantly higher error than new meters, the discrepancy between the reservoir meter and the summation of the backwash and distribution meters can be accounted for. Photo 13 shows the backwash water meter.

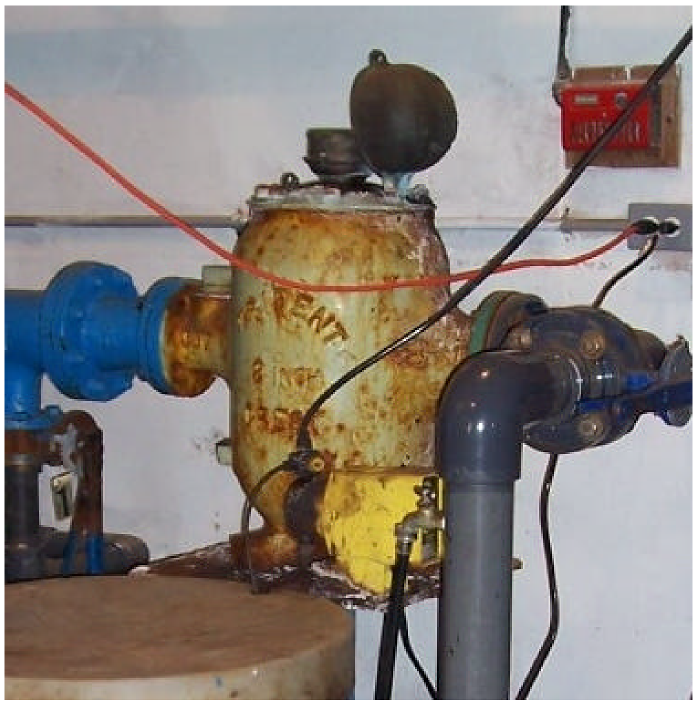


Photo 13 - Backwash Water Meter

It is recommended that the Village either calibrate and repair the meters at the water treatment plant, or replace them altogether. If the Village decides to replace the water meters, two meters that are recommended due to their high level of accuracy are magnetic water meters or ultrasonic water meters. After the meters have been either repaired and calibrated, or replaced, the Village should monitor the readings from the meters to ensure that the readings make sense. The reservoir reading should be equal to, or even slightly greater than, the summation of the backwash and distribution meters, while taking into account any changes in the reservoir level.

Based on received data, the annual operating and maintenance cost of the water treatment and distribution system is approximately $20,000. This cost includes chemical costs, pumping costs, and general repairs to the distribution system, including hydrants. From this annual operating and maintenance cost data, the cost associated with the Village of Cartwright's unaccounted-for water loss can be calculated, as shown in Table 23.

Table 23 Water Losses and Associated Costs from Sep/2004 – Aug/2005

Description	Amount
Total Water Produced	37,501
Total Water Entering Distribution System	27,889
Total Water Sold	26,280
Total Unaccounted-for Water Loss	1,609
Percent Unaccounted-for Water Loss	5.80%
Unit Cost per Cubic Meter*	$0.53
Cost of Unaccounted-for Water Loss	$857.62

* Annual Operating and maintenance costs divided by the total water produced at the Water Treatment Plant.

Water Meters

A 2-inch Rockwell International water meter measures the amount of softened water (in imperial gallons) that flows into the reservoir, and 3-inch Neptune Trident meters measure both the water used for backwashing the filters and the amount of water in the distribution system at the water treatment plant.

There are currently 204 water meters along the distribution system that measure water consumption quarterly on a per client basis. Data received indicated that the Fire Department fill was not metered, and also that 4 household meters were stuck and not making any measurements. Table 24 shows the breakdown of the meters along the distribution system by meter size.

Table 24 – Water Meter Breakdown by Size

Meter Size	5/8"	3/4"	1"	Total
Number of Meters	197	4	3	204

Pumps

All of the pumps for the water treatment and distribution system are located within the water treatment plant. Table 25 lists the relevant available pump data.

Table 25 – Water Pump Data

Function	Motor Size (hp)	Motor Manufacturer	Pump Age (years)
Backwash Pump	7.5	WEG	~11
Domestic Pumps (2)	5	WEG	8
Fire Pump	Unknown	Unknown	~40

Water Rates

Based on information provided, meters are read and clients are charged quarterly. Clients pay a flat service charge of $6.66 per quarter for water and sewer service, which includes a certain amount of water, based on the size of the client's water meter. For the first 20,000 imperial gallons of water used per quarter over the minimum included with the service charge, clients are billed at a rate of $10.15 per 1,000 imperial gallons for water, and $3.21 per 1,000 imperial gallons for sewer service. After the first 20,000 imperial gallons a client consumes per quarter over the minimum included with the service charge, the client is billed at a rate of $8.84 per 1,000 imperial gallons for water, and $3.21 per 1,000 imperial gallons for sewer service. Table 26 lists the minimum quarterly fees based on the size of a client's water meter.

Table 26 - Minimum Quarterly Water Rates for the Village of Cartright

Minimum Charges per Quarter	Meter Size			
	5/8"	3/4"	1"	1.5"
Service Charge	$6.66	$6.66	$6.66	$6.66
Water	$45.68	$91.35	$182.70	$424.00
Sewer	$14.45	$28.89	$57.78	$144.45
Total Quarterly Minimum	$66.79	$126.90	$247.14	$575.11
Water Included in Rate (Imp. Gal.)	4,500	9,000	18,000	45,000

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.

According to information received, the distribution system is flushed twice a year and the hydrants are inspected at these times as well. The water used for flushing is not metered, and no calculations are made for the amount of water used. Records of water main breaks are kept, but there have been no main breaks in the past 5 years. There have been two leaking hydrants, and one of them has been replaced.

17.2 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. From information provided, it appears that the Village of Cartwright has taken all of these factors into consideration in its determination of appropriate water and sewer rates. However, reducing the amount of water lost can have an impact on the overall cost of water treatment.

By reducing water loss, the Village 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 required to supply the water. Over a long-term prospect, 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 client water meter accuracy can also increase revenues for the Village 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 Village to bill for the correct amount and recover production costs that would otherwise be attributed to unaccounted-for water loss.

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

17.2.1 Unaccounted-For Water Loss

As calculated from the data supplied by the Village of Cartwright, the Village has an unaccounted-for water loss of approximately 5.8% over the period from September 2004 through August 2005. This amount of water loss seems quite low considering the age and type of piping used for the majority of the distribution system. It is possible that due to meter errors at the water treatment plant, the amount of water loss is being underestimated. If the meters were calibrated and refurbished, or even replaced, it is likely that the Village would see a marked increase in the amount of unaccounted-for water loss through the system.
There are several factors that could account for this water loss:

Leakage

Every distribution system experiences some amount of leakage. 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 goes on to report 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 Cartwright is below this 10 to 15 percent range, a leak detection program is probably not cost effective at this time. However, since the water meters at the water treatment plant likely have substantial errors, and information on the accuracy of client water meters is unknown, it is recommended that the Village recalculate the unaccounted-for water loss after refurbishing or replacing the water meters in the water treatment plant, and determining the average error on client water meters. If it is then noted that the Village has an unaccounted-for water loss of over 10 to 15 percent, it is recommended that the Village develop a leak detection program at that time.

Meter Accuracy

It is important to check not only the water meters in the water treatment plant, but also client water meters. Ensuring client water meters are accurate will increase revenues for the Village if these meters had previously been reading less than the client's actual water consumption. Accurate client meters will also allow the Village 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.

It is also important that the meters in the water treatment plant are accurate. If the reservoir water meter is inaccurate, the Village will not have reliable data on the amount of water it is treating. By assuming that less water is being treated than is actually the case, the cost of producing water per unit volume (either cost per imperial gallon or cost per cubic meter) will be inflated. Also, if the distribution water meter is inaccurate, problems could arise when trying to assess the amount of unaccounted-for water leaving the system, as more water will be leaving the system than is actually recorded.

If the Village is not fully aware of the amount of water lost from the system, it is much more difficult to develop a leakage prevention program.

Other

Other sources of unaccounted-for water loss include water main breaks and water main flushing. It is recommended that the Village keep track of the dates when breaks or flushing occur and that the Village estimates the amount of water lost or used. Knowing the amount of water lost or used will increase the accuracy of any water audit performed in the future.

17.2.2 Maintenance Program

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

The Village should also inspect the main water meters at the water treatment plant and complete meter calibration on a routine basis. This will allow the Village to have accurate records pertaining to total water production and will give some indication as to whether leaks or breaks have occurred in the distribution system, which would be evidenced through an increase in overall water production without a corresponding increase in water consumption.

17.2.3 Potential Cost Savings

According to information received, the Village of Cartwright's water treatment and distribution system appears to be working efficiently. If the meters at the water treatment plant are measuring accurately, it would be difficult for the Village to reduce the amount of unaccounted-for water loss in the system, since according to published data, older distribution systems can expect an average unaccounted-for water loss due to leakage of approximately 10%, and the Village is only experiencing an unaccounted-for water loss of 5.8%. If, on the other hand, it is found that the meters at the water treatment plant are not measuring accurately, the volume of unaccounted-for water loss should be recalculated to see if it is large enough to make a leakage detection and prevention plan worthwhile. The cost of hiring a contractor to perform leakage detection ranges from approximately $100 to $325 per kilometer of water main. In the Village of Cartwright's case, the cost of performing leakage detection on the entire system would be approximately $750 to $1,700, according to information provided.

The one area that, based on data received, could use some improvement appears to be the filter backwash procedure. From information received, approximately 10,726 m^3 (2,359,431 imperial gallons) of water was used for backwashing the filters for the period from September 2004 through August 2005. Comparing this volume to the measured volume of treated water produced at the treatment plant shows that backwash water accounts for approximately 28.6% of the water produced at the water treatment plant. Published data states that typical values for the amount of processed water used to backwash filters range from 1% to 6%. If the Village of Cartwright was able to reduce the amount of water used to backwash the filters to 6%, the amount of water produced at the water treatment plant would be reduced, which would lead to cost savings by reducing the chemical costs and pumping costs. Over the period from September 2004 through August 2005, this reduction in water production would have allowed the water treatment plant to produce approximately 4,500 cubic meters less treated water, while still meeting consumer demand. Based on the unit cost of water of $0.533 per cubic meter, for the period from September 2004 through August 2005, the town could have saved approximately $2,400. It is recommended that the Town of Cartwright perform a filter audit to determine if a decrease in the amount of water used for backwashing would be feasible.

17.3 WASTEWATER COLLECTION SYSTEM OVERVIEW

The Village of Cartwright's sewer collection and treatment system was constructed in 1962. The system is approximately 5,212 m (17,100 ft) in length, and consists of approximately 366 m (1,200 ft) of PVC pipe and approximately 4,846 m (15,900 ft) of asbestos concrete pipe. According to data provided, there are 63 manholes located throughout the collection system, which allow access for any maintenance that is required.

The waste flows to a lift station that was constructed at the same time as the rest of the collection system. The sewage lift station then pumps the sewage to the Village's lagoon. Information on the size and number of lagoon cells was not provided. The lagoon discharges treated wastewater into Gimby Creek.

The sewage collection system is a combined system collecting both sewer flow and storm water. Both infiltration and runoff are collected and treated along with the wastewater.

The annual operation and maintenance costs of the sewage collection system are approximately $5,070, based on information provided. This cost includes the cost of flushing part of the sewer system as well as the general maintenance at the lift station.

Pumps

Both of the pumps used to pump the wastewater to the lagoon are located in the sewage lift station. Table 27 provides the available relevant pump data.

Table 27 Lift Station Pump Data

Function	Motor Size (hp)	Pump Manufacturer	Motor Age (years)
Sewage Collection Pump 1	5	Flygt	4
Sewage Collection Pump 2	3	Flygt	~12

Sewer Rates

Sewage rates are included in the quarterly water bills. The rate structure is given in Table 26 in the Water System Overview.

Maintenance Programs

The lift station is inspected in both the spring and fall, and regular preventative maintenance is conducted at these times. Also, approximately one quarter of the sewer lines is flushed each year, so every line is flushed at least once every four years.

17.4 WASTEWATER COLLECTION SYSTEM AUDIT RESULTS

Due to the fact that Cartwright operates a combined sewer system, there will be a large discrepancy in the volume of water pumped to the lagoon over the course of a year. These variations will be caused by precipitation entering the system through sump pumps, weeping tiles, or infiltration.

The information required in order to perform a sewer system audit was not available. In order to determine the amount of infiltration and inflow into the system, daily flows through the system would be required. With at least a year's worth of daily flows, average dry and wet weather flows could be determined; and using these two numbers, the infiltration and inflow into the system can be determined. It is recommended that the Village install a flow meter, such as a magnetic flow meter, at the sewage lift station and record the daily meter reading so that the amount of wastewater flowing through the system can be determined.

Through measures such as sealing manholes; lining pipes; and disconnecting rain leaders, sump pumps, and weeping tiles from the sanitary sewer system; the Village could potentially decrease infiltration and inflows to the sewer system. Further study should be conducted to determine the feasibility of these infiltration reduction options, since they may not be cost effective in the Village of Cartwright's specific case. Since information on the amount of infiltration and inflow into the system is unavailable, the actual potential savings cannot be calculated, but reducing infiltration will reduce pumping costs and extend the effective life of the lagoon.

It is recommended that the Village conduct a study in order to determine feasible options to deal with extraneous storm water sources once a flow meter has been installed and meter readings have been recorded for a sufficient length of time to determine the infiltration and inflow into the system. This study would likely include a detailed review of the manholes within the system and the televising of the sewage collection system.

Maintenance Program

The Village may wish to start a scheduled maintenance program for the collection system, such as actively replacing old pipe, to help minimize potential problems with the sewer system and to spread out the cost of repairing and replacing old piping.

By-Laws

In order to limit the amount of storm water entering the sewer system, the Village 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 construction of a storm sewer system, but it will greatly decrease the amount of water entering the lagoon, and will decrease pumping costs since less water will be flowing through the sanitary sewer system.

17.5 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 initiatives such as installing water meters, low flush toilets, or water saving showerheads; fixing leaky taps and toilets; only watering lawns once per week; and using drip irrigation for trees and shrubs.

17.6 RECOMMENDATIONS

It is recommended that the Village:

1. Calibrate and refurbish, or replace the backwash, reservoir, and distribution water meters at the water treatment plant.

2. Develop a program for assessing the accuracy of client water meters, and the water meters at the water treatment plant.

3. Commence determining the annual unaccounted-for water loss percentage to determine when a leakage prevention program would be justified.

4. Conduct a filter audit to determine if the filter backwash procedure could be optimized.

5. Seal manholes and line sewer pipes to reduce the effects and costs of infiltration entering the sanitary sewer system.

6. Conduct a study on the feasibility of options such as creating a separate storm water sewer system.

7. Install flow meters at the sewage lift stations and take daily meter readings so that the amount of water entering the lagoons is known.

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 on the water and wastewater treatment systems as discussed in Section 17.5.

APPENDIX A

INVENTORY SHEETS

TABLE OF CONTENTS – APPENDIX A

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Cartwright		**Date:** October 26, 2005
Toured By: Tibor Takach, Larry Isham, PW Foreman		**Construction Date:** Approximately 1960
Building: Water Treatment Plant		**Renovations:** None – Building is recent construction
Address:		
L x W x H: 14m x 7m x 4m (main process area) 5m x 8m x 3m (front entry and office area)	**Area:** 138 m^2	
Building Capacity:		
Building Floor Plan: Two rooms: Front entryway 5m x 8m; main process area approximately 7m x 14m.		**Occupied Times:** Approximately 2 hrs per day

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- Front entryway and office area – 2x4 wood frame construction, insulated, plywood interior sheathing, vapour barrier, caulked at all joints, metal clad exterior sheathing.
- Main process Area – Concrete block construction, unknown if voids filled with zonolite.

Roof Type/R-value:

- Front entryway and office area –4-ply built up roofing, 150 mil poly vapour barrier, 18.5 mm plywood sheathing, 38x235 joists @ 300 mm 0/c, RSI 4.9 fibreglas insulation, 11mm exterior grade plywood, sealed and painted.
- Main Process Area – Concrete "T" style beam roof construction; tar and gravel built up roof. Unknown if roof was insulated.

Door Type/weather stripping:

- 36" insulated double door set at entrance, weather stripping.

Window type/caulking:

- Front entryway and office area has 26"x30" double pane window, PVC casement.

Other:

MECHANICAL

Heating System:

- 1 – 4 foot electrical baseboard unit located in office area, rated capacity unknown assumed 1500W
- 3 – 5 kW, coil type, suspended electric unit heaters in main process area.

Cooling System:

- No cooling system in place

Ventilation System:

- 1 – wall mounted exhaust fan located in main process area. Dampers not motorized. 18" x 18" dampers.
-

HVAC Controls:

- temperature control located on heaters

HVAC Maintenance/Training:
Water Supply System: • System pressure
Domestic Hot Water System: • None
Water Fixtures: • Single sample sink with cold fixture located in sample room.
ELECTRICAL
Indoor Lighting: • Office area - 2, double lamp, 40W fluorescent light fixtures, standard efficiency • Front entrance - 1, double lamp, 40W fluorescent light fixtures, standard efficiency. • Main process area – 6, 300W incandescent light fixtures in main process area
Outdoor Lighting: • 1 – sodium light at entrance, wattage unknown.
Exit Signs: • 1 – standby emergency light system
Motors:
Parking Lot Plugs: • 1 exterior electrical outlet.
OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

Backwash Pump and Motor

- Motor – WEG; 7 ½ hp; 60hz; 3 phase; model JMI84JM; Type ET; TEFC; Ins. B; S.F. 1.15; code J
- Pump – Peerless; Type C20; Impeller # 2683846; impeller diameter 5.25”; centrifugal end suction pump.

Domestic Distribution Pump and Motors

- Motor – WEG; 5 hp; 60hz; 3 phase; model W184JM; 3490 rpm; TEFC; ins. B; code K; S.F. 1.15
- Pump information not legible
- 2 distribution pumps provided

Backup Power

- 6 cylinder; gas fired backup pump

Water Meters

- Main Distribution Meter – 3” Neptune Trident (3” HPT 1202)
- Backwash Water Meter – 3” Trident Crest; unit is old but reported to keep accurate readings
- Reservoir Water Meter – 2” Rockwell International; used for metering flows to softened water reservoir.

Chemical Feed Pumps

- Chlorine Feed Pump – LMI, 120V; 21 gph @ 150 psi
- Permanganate Feed Pump – LMI; 120V; 1 gph @ 100 psi

Brine Pump

- 1/3 hp; Monarch; 115 V; 1.95 SF; 6.6A; 115V; Type T pump

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

- Main power supply – 200 A, 208 V, 3 phase

NOTES

- Distribution system pressure is maintained at approximately 40-60 psi
- No raw water pump information was available from the Town at the time of the visit. Have requested the information and am awaiting response.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright		**Date:** October 26, 2005
Toured By: Tibor Takach, Larry Isham, PW Foreman		**Construction Date:** Approximately 45 years in age
Building: Cartwright Sewage Lift Station		**Renovations:** None
Address:		
L x W x H: 3.6m x 2.5m	**Area:** 9 m^2	
Building Capacity:		
Building Floor Plan: Square open floor plan		**Occupied Times:** Monthly for approximately 10 minutes

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: • 2x4 wood construction; plywood sheathing for both interior and exterior wall; insulated.
Roof Type/R-value: • 2x4 wood construction; insulated; metal clad.
Door Type/weather stripping: • 36" solid wood core door; no weather stripping.
Window type/caulking: • 4 – 3' x 1' single pane windows
Other:
MECHANICAL
Heating System: • 1 – GE; 3000W; wall mount heating unit
Cooling System: • None
Ventilation System: • 1 – ½ hp; wet well ventilation fan • intake fan and exhaust for gas fired back-up genset located through walls. Motorized dampers on ventilation.
HVAC Controls: • Integral to wall mount unit
HVAC Maintenance/Training: • none
Water Supply System: • None
Domestic Hot Water System: • None
Water Fixtures: • None.

ELECTRICAL
Indoor Lighting: • 2 – 100W, incandescent light fixtures
Outdoor Lighting: • 1 – 100W, incandescent fixture.
Exit Signs:
Motors:
Parking Lot Plugs:
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
Wastewater Pumps • 1 – 3hp; Flygt submersible; model 3085.181.6017, 230V; 8.7A; 3 phase; 60 hz; cosθ 0.83; 51% • 1 – 5hp; Flygt submersible; other information not available. Assumed to model 3085. **Backup Power** • Onan; gas fired backup genset
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
• Main power supply – 60 A, 230 V, 3 phase
NOTES

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin	**Date: January 18/19, 2006**
Toured By: Joel Lambert	**Construction Date: 1967**
Building: Cartwright Centennial Auditorium	**Renovations:**
Address: 575 North Railway Street	
L x W x H: 110' x 50' x 17' — **Area: 5,500 ft^2**	
Building Capacity: 250 on liquor permit	
Building Floor Plan: Auditorium, stage, kitchen, coatroom, washrooms, bar, storage room, and mech room.	**Occupied Times: 1 event per week at 10-12 hours per week for hall and 72 hours per year for upstairs.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: 6" concrete block construction – cavities filled with zonolite, 2" thick rigid fiberglass, 4" concrete block (total of approx R14).
Roof Type/R-value: 6" fibreglass batts – R20.
Door Type/weather stripping: Front double steel door 6' x 6'8" needs weather-stripping. 3 single pedestrian doors, poor insulation, two of them need weather-stripping.
Window type/caulking: None
Other:
MECHANICAL
Heating System: 3 water-to-air heat pumps – 2 - VXH070 water furnace Versatec set at 16 ^{o}C, 1 - P046TL – set at 19 ^{o}C. Each heat pump has 10 kW emergence electric resistance heaters.
Cooling System: Heat pumps.
Ventilation System: Van EE 700 cfm damper defrost model 7000 DD – manual switch.
HVAC Controls: Digital stats – no setback (one for each heat pump) in locked stat covers.
HVAC Maintenance/Training:
Water Supply System: Town Water
Domestic Hot Water System: 270 L electric HWT, 4.5 kW connected to de-superheater on small heat pump.
Water Fixtures: 4 high flow sinks, 4 high flow toilets and 2 kitchen sinks.

ELECTRICAL
Indoor Lighting: 6 – 75W flood lights on dimmer, 5 – 60W incandescent lights on stage, 6 – 150W incandescents behind stage, 2 – 60W incandescents, 3 – 150W incandescents, 3 – 8’x2 T12s, 45 – 4’x2 T12s, 9 – 4’x2 T12s.
Outdoor Lighting: 4 60W incandescents (off), 5 flood lamps (off).
Exit Signs: 6 LEDs.
Motors: Ground loop pump (1.5HP) comes on when any one of the 3 heat pumps call for it.
Parking Lot Plugs: None
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES
Upstairs has wall exhaust fan (kitchen type – old) can see light through it – BDD is poor (see photo).

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin		**Date: January 18/19, 2006**
Toured By: Joel Lambert		**Construction Date: 1959**
Building: Cartwright Community Centre		**Renovations: Contemplating new lighting – updating remaining incandescent bulbs with metal halides.**
Address: 600 North Railway Street		
L x W x H: 204' x 90' x 8' + 23' x 27' x 8'	**Area: 18,981 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times: November 1 – End of March – 70 hours/week.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: R12 fiberglass insulation (with paper backing and no vapor barrier) – ¾" "tentest" (like buffalo board). The ice rink has no insulation.
Roof Type/R-value: 6" of zonolite – R20.
Door Type/weather stripping: 2 – 3' x 7' between ice rink and entrance needs weather-stripping. 2 – 3' x 7' steel doors to outside need weather-stripping and adjustment. 1-3' x 7' steel pedestrian door between rink and zamboni room – no insulation and no weather-stripping.
Window type/caulking: 7 – 4' x 7'6" single Plexiglas.
Other:
MECHANICAL
Heating System: water-to-air heat pump, water furnace – Premier P046TL, 50 Amp (says 10 kW heater but it's not Installed). 5 ton WF Premier water - water (floor temperature 65F – mass temperature 95F). 3 kW electric heater in changeroom, 15kW emergency electric heater below window to ice rink.
Cooling System: Water to air heat pump can be used for cooling but is typically not used.
Ventilation System: 2 exhaust fans in kitchen, 1 duct in old chimney to outside.
HVAC Controls: 17 ^{o}C all the time – electronic stat in locked box in waiting room upstairs. Stat in downstairs dressing room.
HVAC Maintenance/Training:
Water Supply System: Town Water for domestic water, well for flooding ice.
Domestic Hot Water System: 2 (40 gal) electric HWT, 4.5 kW +4.5 kW and desuperheater off of air-to-air heat pump. No pipe insulation.
Water Fixtures: 1 high flow sink, 1 high flow toilet, 1 kitchen sink, and 4 residential type showers.

ELECTRICAL
Indoor Lighting: Ice rink – 25 metal halides (400W), 23 incandescents (500W), 2 100W incandescents run 24/7, 1 – 8' T12 over scoreboard on 24/7 because it doesn't come on when cold. 1 – 4'x2 T8, 12 – 8'x2 T12s, 4 – 100W incandescents in zamboni room, 3 – 4'x2 T12s in heat pump room, 1 – 60W incandescent in freezer room, 2 – 4'x2 T12s, 1 40W incandescent, 1 – 60 W incandescent, 2- 100W incandescents. 8'x2 T12 in kitchen. One switch for all upstairs lights, one switch for all downstairs lights (except kitchen and landings).
Outdoor Lighting: 1 wall pack.
Exit Signs: 5 – 15W incandescent exit signs, 2 LEDs.
Motors:
Parking Lot Plugs: 1 unused.
OTHER BUILDING SYSTEMS
Roof vents over ice rink 7 – 8'x32". Water heaters for flooding water: 2 x 4.5 kW (270L each) and one very old cast iron water heater with external insulation in bad shape (may be asbestos) 5 kW, 90gal.
PROCESS SYSTEMS
Snow melts inside – fan blows air from ceiling level into snow melt pit. Resurface ice on average 14 – 15 times per week. Flood water heated with electric HWT Ice plant heat pumps WF Versatec VL360 x 2. 2" Styrofoam below ice
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES
Metal halides are on when building is occupied. Incandescents in ice rink are on 2/3 of the 70 hours. In floor heat below changerooms has 2" of styrofoam below concrete. Ice rink ceiling is wood (not painted) above 10', painted white from ground to 10' high.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin	**Date: January 18/19, 2006**
Toured By: Joel Lambert	**Construction Date: 1999**
Building: Cartwright Curling Rink	**Renovations:**
Address: 605 North Railway Street	
L x W x H: 193' x 33' x 11' + 45' x 44' x 11' / **Area: 3,896 ft^2**	
Building Capacity:	
Building Floor Plan: Curling rink (2 sheets of ice), lounge/lobby, washrooms, kitchen, mech room and elec room.	**Occupied Times: Rink - Mid Oct – End of March. 12 hours/week + 4 weekends/year (36 hrs/weekend).** **Lounge – 30 hours/week, Entrance – 56 hrs/week.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: R20 fibreglass batt insulation. 2x6 wood studs with metal clad exterior and interior walls.
Roof Type/R-value: R40 blown in insulation.
Door Type/weather stripping: 3 insulated ped doors in curling rink – 3'x7' (one needs weather-stripping). 1 insulated double ped door in entrance – 6'x7' (needs weather-stripping badly). 1 ped door between rink and lobby with good weather-stripping. 1 ped door from machine room to outside (needs weather-stripping).
Window type/caulking: 2 – 5'x6' double panes and 2 – 5'x7' double panes between rink and lobby (1999).
Other:
MECHANICAL
Heating System: Lobby and Entrance – in-floor heating from geothermal heat pump. Ice area – 2 hydronic heaters from heat pump (modine).
Cooling System: none.
Ventilation System: Van EE HRV on humidistat, 215 cfm on high (62% effective) for lobby. One exhaust fan and two intakes for rink on humidistat (with BDD and manual doors).
HVAC Controls: Ice area – manual stats set at 29 ^oF unoccupied, 32 ^oF occupied. Lobby and entrance set at 64 ^oF (temperature was at 68 ^oF during visit).
HVAC Maintenance/Training:
Water Supply System: 3000 gallon pit collects soft water from roof for flooding. Well is also used to flood - submersible pump (also used for arena). Domestic water from town.
Domestic Hot Water System: 1 electric HWT for cistern 4.5 kW and de-superheater (for flooding). 1 electric HWT 4.5 kW and de-superheater disconnected. Both are set at 110 ^oF

Water Fixtures: 3 high flow sinks, 1 high flow toilet, 2 urinals (3.8 lpf) and 3 kitchen sinks. 2 high flow sinks and 3 high flow toilets shared with arena.
ELECTRICAL
Indoor Lighting: ice area: 24 – 8'x2 T12s, 10 – 150W incandescents in south part. Lobby and entrance: 35 – 4'x2 T8s.
Outdoor Lighting: 2 wall packs.
Exit Signs: 4 LEDs.
Motors: 1 HP pump for each ice sheet (2). ¾ HP pump runs 12 hours per year to flood ice. 1 HP pump for ground loop (seven frac HP pumps).
Parking Lot Plugs: 1 unused.
OTHER BUILDING SYSTEMS
Uses both a roof water cistern (3000 gal) for flooding and a well for flooding. Water is only partially heated for flooding (mix with cold).
PROCESS SYSTEMS
Ice temperature sensor – keep ice at 21 ^{o}F. Approx 1.5" thick – fairly uniform. 2- 5 ton heat pump water furnaces for heating building (lobby and ice area). 2 – 5 ton heat pump water furnace for ice making. (one heating heat pump is used for ice making 2-3 wks/yr) At time of visit, loop return temperature was at 43.2 ^{o}F.
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES
Under the ice there is 4" thick styrofoam with tubes layed on top and covered with sand – no concrete. 2" styrofoam on inside of foundation ice area. Methanol/water (1/3 / 2/3) load source 1 HP pump for each ice sheet.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin		**Date: January 18/19, 2006**
Toured By: Joel Lambert		**Construction Date: 1957, addition in 2002**
Building: Municipal Office Building		**Renovations: More planned**
Address: 485 Curwen Street		
L x W x H: old – 40' x 35' x 9', new – 24' x 34' x 9'.	**Area: 2,216 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times: 8:15 – 5:30 for 5 days/week plus 6 hours/month in evenings.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Old section - Concrete block, 2" batt insulation, plaster interior walls, brick exterior walls. New section – metal clad exterior walls, R20 insulation
Roof Type/R-value: 20 year T & G roofing, 1.5" rigid insulation, 1 ply vapor barrier, ¾" diagonal ship lap.
Door Type/weather stripping: 3' x 7' glass door needs weather-stripping. 3' x 6'8" steel door in good condition.
Window type/caulking: 9 – 36" x 60" triple pane new windows (half picture, half awning). 1 – 24" x 54" triple casement (1997). 120" x 54", 5 panels wide triple pane windows (3 picture, 2 casement).
Other:
MECHANICAL
Heating System: Electric baseboards in new part and in Colleen's office. Electric forced air for old part.
Cooling System: 2 ton keeprite condensing unit, evaporator in furnace – serves old part only.
Ventilation System: none – looks like fresh air intake duct was removed from furnace when addition was added.
HVAC Controls: Old part served by furnace. 1 programmable stat, 5 regular stats. New part has normal wall stats with baseboards. 21 ^{o}C during the day (6:00 am – 5:30 pm), otherwise set at 16 ^{o}C.
HVAC Maintenance/Training:
Water Supply System: Town water.
Domestic Hot Water System: 10 gal electric HWT. Hot water piping is uninsulated.
Water Fixtures: 1 high flow sink, 1 high flow toilet and 1 kitchen sink.

ELECTRICAL
Indoor Lighting: 7 – 8'x2 T12s, 16 – 4'x2 T12s, 1 60W incandescent in furnace room and 1 150W incandescent on timer (on all night).
Outdoor Lighting: 2 incandescents in front, 1 wall pack in back.
Exit Signs: none.
Motors: none.
Parking Lot Plugs: 4 at rear for 4 vehicles.
OTHER BUILDING SYSTEMS
2 ceiling fans for counsel chamber.
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES
Colleen's office has baseboard heater and stat and is also served by forced air furnace.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin		**Date: January 18/19, 2006**
Toured By: Joel Lambert		**Construction Date: 1987**
Building: Municipal Shop		**Renovations: Considering geothermal in-floor heating.**
Address: 485 Curwen Street		
L x W x H: 79.5' x 49' x 15'	**Area: 3,896 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times: Winter (6 mo) 8 – 4:30 for 5 days/week. Summer (6 mo) 2 hours/day.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: 2x6 wood studs with metal clad exterior, drywall interior, and R20 fiberglass batt insulation.
Roof Type/R-value: Asphalt shingles – 6" fiberglass batt (likely R20)
Door Type/weather stripping: 3' x 6'8" door – needs weather-stripping. 3' x 6'8" door with 22" x 36" double pane window – needs weather-stripping and window is sweating. 3 Vehicle doors – 16' x 14' with 2 – 2'x1' double pane windows (windows are sweating). 1 of the vehicle doors needs weather-stripping at bottom and needs to be adjusted, 1 vehicle door just needs to be adjusted (gap between door and weather-stripping).
Window type/caulking: 2 – 58" x 34" double pane windows.
Other:
MECHANICAL
Heating System: 2 electric furnaces – 1 20 kW in north half, 1 24 kW in south half (not ducted).
Cooling System: none.
Ventilation System: none – except for two small wall exhaust fans used to eliminate welding fumes.
HVAC Controls: 2 wall thermostats set at 17 ^{o}C.
HVAC Maintenance/Training:
Water Supply System: Well and pump.
Domestic Hot Water System: 52 gallon, 3000W electric HWT.
Water Fixtures: 1 high flow sink, 1 high flow toilet.

ELECTRICAL
Indoor Lighting: 9 – 8'x2 T12s in north part, 10 – 150W incandescents in south part.
Outdoor Lighting: 3 yard lights on building on sentinels.
Exit Signs: none.
Motors: none.
Parking Lot Plugs: 1 receptacle.
OTHER BUILDING SYSTEMS
One ceiling fan in north part, Two ceiling fans in south part. Two fans blow air across two southernmost vehicle doors to keep them dry and ice free in the winter. One exhaust fan in south part on humidistat runs continuously in winter when plows go in and out a lot (snow melts and floor is wet for a few days after).
PROCESS SYSTEMS
Compressed air 5 HP runs ½ hour/day in the winter.
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES
Cold storage shed has 5 incandescents (150W) bulbs but are very rarely turned on.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin	**Date: January 18/19, 2006**
Toured By: Joel Lambert	**Construction Date: 1930s/1940s**
Building: Lakeland Regional Library	**Renovations:**
Address: 483 North Railway Street	
L x W x H: old – 55' x 21' x 10' (addition is 13.5' long) — **Area: 1,155 ft^2**	
Building Capacity:	
Building Floor Plan:	**Occupied Times: Tuesday – Friday, 11:30am – 5:00pm.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: R-20
Roof Type/R-value: R-40
Door Type/weather stripping: 3' x 7' double pane glass door – needs weather-stripping. 3' x 7' door with 22" x 66" double pane window – needs weather-stripping, door fits poorly and needs stripping at sill.
Window type/caulking: 82" x 60" double pane windows need caulking (old). 82" x 60" double pane. 24" w casement (newer). 48" x 32" old slider, two singles thick, badly iced up. Windows sweat badly.
Other:
MECHANICAL
Heating System: Electric baseboards in addition at rear. Electric forced air furnace for front.
Cooling System: Window AC.
Ventilation System: none.
HVAC Controls: 1 wall stat in front, 1 wall stat for baseboards in addition. Set at 65 ^{o}F all the time.
HVAC Maintenance/Training:
Water Supply System: Town water.
Domestic Hot Water System: 1 electric HWT (not accessible).
Water Fixtures: 1 high flow sink, 1 high flow toilet.

ELECTRICAL
Indoor Lighting: 16 – 4'x2 T12s (one stays on 24/7). 1 – 8'x2 T12.
Outdoor Lighting: 1 incandescent at rear – never on.
Exit Signs: none.
Motors: none.
Parking Lot Plugs: 1 plug for 1 vehicle.
OTHER BUILDING SYSTEMS
1 Dehumidifier.
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin		**Date: January 18/19, 2006**
Toured By: Joel Lambert		**Construction Date: approx 1990**
Building: Fire Hall & Ambulance Garage		**Renovations:**
Address: 155 Gimby Street		
L x W x H: 70' x 50' x 14'	**Area: 3,500 ft^2**	
Building Capacity:		
Building Floor Plan: Garage and training room.		**Occupied Times: Lights are on 8-10 hours/month**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: 2x6 wood studs, metal clad exterior and interior, R20.
Roof Type/R-value: Wood truss, 12" of blown in insulation, R40.
Door Type/weather stripping: 2 – 3'x7' steel doors (one needs weather-stripping and to be adjusted). Vehicle door 1 – 14'x12' with 3 – 2'x1' dbl pane windows, Vehicle doors 2 & 3 – 12'x9' with 2 – 2'x1' dbl pane windows. All three vehicle doors need weather-stripping and adjustment (Vd2 doesn't close tight to floor so you can see light – seals ok if you push down on it)
Window type/caulking: 1 – 48"x44" triple pane window and 2 – 22"x44" triple pane windows.
Other:
MECHANICAL
Heating System: Electric baseboards in training room, washroom, and shower room. Shop has in-floor heat with 25 kW Chromalex 2 stage electric boiler.
Cooling System: none
Ventilation System: none – except for bathroom and shower exhaust fans.
HVAC Controls: 1 stat for training room – set at 13 ^{o}C unoccupied. 1 stat in washroom, 1 stat in shower, 1 stat in Shop set at 15 ^{o}C unoccupied.
HVAC Maintenance/Training:
Water Supply System: Town water.
Domestic Hot Water System: 175 L, 4500W electric HWT. Hot water piping is uninsulated but very little of it is exposed.
Water Fixtures: 2 low flow sinks, 1 high flow toilet, 1 kitchen sink, and 1 shower (unused).

ELECTRICAL
Indoor Lighting: 14 – 8'x2 T12s, 2 – 4'x2 T12s and 3 – 100W incandescents.
Outdoor Lighting: 2 yard lights on sentinel.
Exit Signs: none.
Motors: 3 speed Grundfos circulating pump for in-floor heating, 85W on high.
Parking Lot Plugs: none
OTHER BUILDING SYSTEMS
One ceiling fan at back of shop.
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES
- All shop lights were turned on when I got there – maybe recommend occupancy sensors. Should recommend this for ceiling fan in training room and 2 more in shop. - Would have real estate for geothermal.

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: RM of Roblin		**Date: January 18/19, 2006**
Toured By: Joel Lambert		**Construction Date: 1967**
Building: Mather Skating Rink		**Renovations: They're considering shutting it down if it costs any money to fix**
Address: 515 Curwen Street		
L x W x H: 20' x 85' x 8' and 20' x 20' x 8' for 2nd floor.	**Area: 2,100 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times:**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Metal clad exterior, 6" of air space (no insulation), OSB sheeting on inside.
Roof Type/R-value: ?
Door Type/weather stripping: 6' x 7' steel double doors (look new). 2 x 32" uninsulated wood doors (big gaps around edges).
Window type/caulking: 9 x 5.5' x 3.5' double pane with aluminum spacer (1990) between rink and lobby.
Other:
MECHANICAL
Heating System: Electric forced air furnace, 25 kW (a few years old) and a few electric baseboards.
Cooling System: none
Ventilation System: none
HVAC Controls: 1 new wall stat for furnace set at 10 ^{o}C. 1 wall stat for baseboard in furnace room.
HVAC Maintenance/Training:
Water Supply System: Well
Domestic Hot Water System: Very old, very large electric DHW tank – 36" dia, 78" high (6 kW). Very little insulation.
Water Fixtures: 2 old sinks, 2 old toilets, and 1 kitchen sink.

ELECTRICAL
Indoor Lighting: Rink – 50 incandescents (approx 300W), 5 – 300W incandescents, 12 – 120W incandescents, and 4 - 100W incandescents.
Outdoor Lighting: 150W Incandescent.
Exit Signs: 2 Incandescent exit signs (1 is broken).
Motors: 1/3 HP sewage pump, well pump.
Parking Lot Plugs: none
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
NOTES
- Old chimney for former oil furnace is open to atmosphere (8” diameter). - When outdoor temperature is –3 ^{o}C, furnace runs about 50% of the time

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: RM of Roblin		**Date: January 19, 2006**
Toured By: Joel Lambert		**Construction Date:**
Building: Mather Hall		**Renovations:**
Address: Lot 6 Block 1 - Mather		
L x W x H: 14' x 33' x 10' plus 69' x 33' x 12'8".	**Area: 2,739 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times:**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Mostly R20 (R40 in some areas). Drywall interior.
Roof Type/R-value: R40
Door Type/weather stripping: Front steel double doors – poorly insulated but weather-stripping is in good condition. Steel back door – needs weather-stripping.
Window type/caulking: none
Other:
MECHANICAL
Heating System: 5 – 5kW electric heaters with built in thermostat, 1kW baseboard heater in upstairs bathroom, 1 wall heater in entrance, 3 ceiling fans in hall, 1 ceiling fan in entrance.
Cooling System: none
Ventilation System: Range hood and a central 3 speed exhaust.
HVAC Controls: Built in stats set at 15 ^{o}C. There is one wall stat on south wall by stage but it may have controlled the old oil furnace.
HVAC Maintenance/Training:
Water Supply System: Well
Domestic Hot Water System: 175 L, 4500W electric HWT and a 40 L, 4500W electric HWT.
Water Fixtures: 5 high flow sinks, 6 high flow toilets, 1 urinal, and 2 kitchen sinks.

ELECTRICAL
Indoor Lighting: Basement – 17 – 100W incandescents and 2 – 4'x2 T12s. Upstairs - 23 – 4'x2 T12s, 11 – 60W incandescents.
Outdoor Lighting: 6 Incandescent pot lights.
Exit Signs: 4 Incandescent exit signs.
Motors: Sewage pump and well pump.
Parking Lot Plugs: none
OTHER BUILDING SYSTEMS
Elevator
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Cartwright & RM of Roblin		**Date: January 18/19, 2006**
Toured By: Joel Lambert		**Construction Date: 1959**
Building: Recycling Depot		**Renovations: They would like to insulate overhead vehicle door.**
Address: Lot 9, Block 8, Plan 35.		
L x W x H: 36' x 24' x 8'	**Area: 864 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times: Mon-Thu – 8-4:30pm.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Steel clad inside and out – has R5 styrofoam behind electrical panel. 2x4 studs with R12 fibreglass.
Roof Type/R-value: R20 either batt insulation or blow in fibreglass.
Door Type/weather stripping: 3' x 6'8" pedestrian door needs caulking and weatherstripping baddly (sounds hollow). Vehicle door – steel, not insulated, weatherstripping is present but needs to be adjusted tighter to door.
Window type/caulking: None
Other:
MECHANICAL
Heating System: 4800W (240V) portable construction heater. Only heated from 8-4:30pm, 4 days/week. (55 – 60 F) when occupied.
Cooling System: None.
Ventilation System: None
HVAC Controls: Thermostat is built-in in construction heater.
HVAC Maintenance/Training: none – he already shuts heat off when doors are open and building is unheated when unoccupied.
Water Supply System: None
Domestic Hot Water System: None
Water Fixtures: None

ELECTRICAL
Indoor Lighting: 6 incandescent bulbs (100W each) controlled by a wall switch.
Outdoor Lighting: 1 with sentinel.
Exit Signs: 5 – 15W incandescent exit signs, 2 LEDs.
Motors: Baler – 1.5 hours/week – 2HP, glass shredder – 1 hour/week - 1.5HP
Parking Lot Plugs: none
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
Hydro
NOTES

APPENDIX B

TABLES TO CALCULATE ENERGY SAVINGS

TABLE OF CONTENTS – APPENDIX B

Table B.1.1 Annual Energy Consumption for Water Treatment Plant

	Energy Consumption (kWh)	% of Total Energy Consumption
Motors	31,211	34%
HVAC	58,564	64%
Lighting	2,186	2%
Total	**91,960**	

Table B.1.2 - Electricity Usage for Water Treatment Plant

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	0	0	8,750	$0	$513	$610
October	0	0	4,940	$0	$289	$355
November	0	0	9,140	$0	$536	$636
December	0	0	5,760	$0	$338	$410
January	0	0	12,100	$0	$689	$810
February	0	0	6,070	$0	$356	$430
March	0	0	11,030	$0	$646	$762
April	0	0	5,560	$0	$326	$402
May	0	0	9,850	$0	$591	$699
June	0	0	4,230	$0	$254	$315
July	0	0	10,160	$0	$610	$720
August	0	0	4,370	$0	$262	$324
TOTALS		**0**	**91,960**	**$0**	**$5,410**	**$6,473**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.1.3 - Lighting Analysis Summary for Water Treatment Plant

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Office 4' T12 fluorescents - Convert to T8s (2x2).	4	143	$9	86	$5
Front entrance 4' T12 fluorescents - Convert to T8s (1x2).	2	72	$4	43	$3
Main process area 300W incandescents - Convert to metal halides.	6	1,314	$79	548	$33
Outdoor High Pressure Sodium - No upgrade recommended.	1	657	$39	657	$39
TOTALS		**2,186**	**$131**	**1,334**	**$80**

Annual Energy Savings (kWh)	**852**
Annual Cost Savings	**$51**
Percent Annual Energy Savings	**39%**

These calculations are assuming that the Water Treatment Plant is occupied for 2 hours per day.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.1.4 (a) Wall/Roof Insulation Upgrade for Water Treatment Plant

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
Upgrade wall insulation to R-20.	2300	12.000	13,114	$787	20	7,869	$472	5,246	$315
Upgrade roof insulation to R-40.	1485	20.000	5,080	$305	40	2,540	$153	2,540	$153
TOTALS			**18,194**	**$1,092**		**10,409**	**$625**	**7,786**	**$467**

The Water Treatment Plant is assumed to be kept at 64 F.

Table B.1.5 Energy Savings with Heating, Ventilating, and Air Conditioning for Water Treatment Plant

Description	Quantity	Flow Rate (cfm)	Heating Degree Days below 64 F	Heating Efficiency	Energy Savings (kWh)
Replace energy deficient damper with motorized damper.	1	20	10711.26	100%	1,627

Description	% of Time Unoccupied	Heating Degree Days below 65 F	Heating Degree Days below 50 F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats in process area to 50 F	100.00%	9727.7	6074.8	40,995	15,394

Table B.1.6 Energy Consumption and Savings Calculations for Motors in Water Treatment Plant

Description	Rated HP	Required HP	# of hours	Current, 85 % Efficient Motor			Energy Savings of Premium Efficiency Versus Standard Efficiency Motor		
				Actual HP	kW	kWh	Actual HP	kW	kWh
Backwash motor	7.50	6.00	1,533	7.06	5.26	8,066	0.18	0.13	206
Distribution pump	5.00	4.00	6,132	4.70	3.51	21,510	0.12	0.09	549
Chlorine feed pump	0.03	0.02	6,132	0.02	0.02	108	0.00	0.00	3
Permanganate pump	0.03	0.02	6,132	0.02	0.02	108	0.00	0.00	3
Brine pump	0.33	0.26	6,132	0.31	0.23	1,420	0.01	0.01	36
TOTALS						**31,211**			**796**

Table B.2.1 Annual Energy Consumption for Sewage Lift Station

	Energy Consumption (kWh)	% of Total Energy Consumption
Motors	12,291	83%
HVAC	2,060	14%
Lighting	438	3%
Total	**14,790**	

Table B.2.2 - Electricity Usage for Sewage Lift Station

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
September	0	0	2,070	$0	$121	$223
October	0	0	0	$0	$0	$0
November	0	0	2,460	$0	$144	$250
December	0	0	0	$0	$0	$0
January	0	0	2,900	$0	$170	$280
February	0	0	0	$0	$0	$0
March	0	0	2,500	$0	$147	$253
April	0	0	0	$0	$0	$0
May	0	0	2,190	$0	$131	$235
June	0	0	0	$0	$0	$0
July	0	0	2,670	$0	$160	$269
August	0	0	0	$0	$0	$0
TOTALS		**0**	**14,790**	**$0**	**$874**	**$1,510**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.2.3 - Lighting Analysis Summary for Sewage Lift Station

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Indoor incandescents - replace with compact fluorescents.	2	0.40	0.02	0.11	$0
Outdoor incandescents - replace with high pressure sodium lights.	1	438	26	219	$13
TOTALS		**438**	**$26**	**219**	**$13**

Annual Energy Savings (kWh)	**219**
Annual Cost Savings	**$13**
Percent Annual Energy Savings	**50%**

These calculations are assuming that the Sewage Lift Station is occupied for 10 minutes every month.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.2.4 (a) Window and Door Replacement Calculations for Sewage Lift Station

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 with triple pane windows (4 - 3'x1')	12	1.000	513	$31	6.25	82	$5	431	$26
TOTALS			**513**	**$31**		**82**	**$5**	**431**	**$26**

Table B.2.4 (b) Window and Door Infiltration Calculations for Sewage Lift Station

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
Wood pedestrian door (1)	5	0.05	125	17	2,689,059	788	$47
TOTALS						**788**	**$47**

The Sewage Lift Station is assumed to be kept at 50 F

The crack lengths are taken as a quarter of the perimeter of the door

Table B.2.5 Energy Consumption and Savings Calculations for Motors in Sewage Lift Station

Description	Rated HP	Required HP	# of hours	Current, 85 % Efficient Motor			Energy Savings of Premium Efficiency Versus Standard Efficiency Motor		
				Actual HP	kW	kWh	Actual HP	kW	kWh
Wastewater pump 1	3	2	2,190	2.82	2.10	4,609	0.07	0.05	118
Wastewater pump 2	5	4	2,190	4.70	3.51	7,682	0.12	0.09	196
TOTALS						**12,291**			**314**

Table B.3.1 Annual Energy Consumption for Cartwright Centennial Auditorium

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	78,070	86%
Hot Water	3,673	4%
Lighting	8,736	10%
Total	**90,480**	

Table B.3.2 - Electricity Usage for the Cartwright Centennial Auditorium

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
September	56	6	2,560	$50	$150	$246
October	49	0	3,280	$0	$192	$237
November	53	3	7,920	$25	$464	$575
December	60	10	10,240	$83	$600	$797
January	62	12	16,640	$100	$864	$1,116
February	62	12	14,160	$100	$768	$1,007
March	49	0	11,360	$0	$660	$771
April	50	0	8,320	$0	$488	$581
May	32	0	6,080	$0	$365	$434
June	20	0	2,720	$0	$163	$204
July	32	0	4,560	$0	$274	$330
August	24	0	2,640	$0	$159	$199
TOTALS		**43**	**90,480**	**$358**	**$5,146**	**$6,498**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.3.3 - Lighting Analysis Summary for Cartwright Centennial Auditorium

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
60W Incandescents - Convert to compact fluorescents.	7	262	$16	70	$4
75W Flood Lights - Convert to compact fluorescents.	6	281	$17	82	$5
150W Incandescents - Convert to compact fluorescents.	9	842	$51	213	$13
8' T12 Fluorescent Lamps - Convert to T8s (3x2).	6	436	$26	204	$12
4' T12 Fluorescent Lamps (Downstairs) - Convert to T8s (45x2).	90	2,752	$165	1,657	$99
4' T12 Fluorescent Lamps (Upstairs) - Convert to T8s (9x2).	18	64	$4	38	$2
Outdoor Incandescents - Convert to high pressure sodium lights.	4	1,752	$105	876	$53
Outdoor Flood Lights - No upgrade recommended.	5	2,190	$131	2,190	$131
LED Exit Signs - No upgrade recommended.	6	158	$9	158	$9
TOTALS		**8,736**	**$525**	**5,488**	**$329**

Annual Energy Savings (kWh)	**3,248**
Annual Cost Savings	**$195**
Percent Annual Energy Savings	**37%**

These calculations are assuming that the Auditorium is occupied for 12 hours per week (624 hours per year) and the upstairs is occupied for 72 hours/year.

The Exit signs are assumed to be on 24 hours a day, 365 days per year

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.3.4 (a) Window and Door Replacement Calculations for Cartwright Centennial Auditorium

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 pedestrian doors with insulated doors (3).	63	1.500	1,015	$61	6.5	234	$14	780	$47
TOTALS			**1,015**	**$61**		**234**	**$14**	**780**	**$47**

Table B.3.4 (b) Window and Door Infiltration Calculations for Cartwright Centennial Auditorium

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
Front Double Door (1)	6.375	0.05	125	22	1,938,380	568	$34
Pedestrian doors (2)	10	0.05	125	34	3,040,596	891	$54
TOTALS						**1,459**	**$88**

Table B.3.4 (c) Upgrade Wall/Roof Insulation for Cartwright Centennial Auditorium

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
Upgrade roof Insulation to R40.	5500	20.000	6,643	$399	40	3,322	$199	3,322	$199
TOTALS			**6,643**	**$399**		**3,322**	**$199**	**3,322**	**$199**

The crack lengths around the doors are assumed to be a quarter of the doors perimeter.

The auditorium is assumed to be kept at 63 F.

Table B.3.5 - Water Usage for Cartwright Centennial Auditorium

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	10.9	27,300	1.60	43,680	0.32	8,736	34,944	1,309	$79
Toilets	4	6.3	15,600	13.25	206,700	6.00	93,600	113,100	NA	NA
Total					**250,380**		**102,336**	**148,044**	**1,309**	**$79**

Frequency at Which Fixtures are Used			
	Females	Males	Totals
Number of People	50	50	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	4.69	1.56	6.25
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	4.69	6.25	10.94

Current Hot Water Usage (kWh)		
Fixture	L/Yr	kWh
Sinks	43,680	1,637
Total		**1,637**

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 1.5 gallons per flush

Table B.3.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Cartwright Centennial Auditorium

Description	% of Time Unoccupied	Heating Degree Days below 63 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback thermostats to 59 F	92.88%	9,337	8,219	70,263	7,810

Table B.4.1 Annual Energy Consumption for the Cartwright Community Centre

	Energy Consumption (kWh)	% of Total Energy Consumption
Heat Pumps (Heating and Ice Plant)	97,703	63%
Ice Melting	11,213	7%
Hot Water	6,036	4%
Lighting	40,748	26%
Total	**155,700**	

Table B.4.2 - Electricity Usage for Cartwright Community Centre

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	0	0	210	$0	$12	$22
October	0	0	2,040	$0	$120	$179
November	0	0	19,010	$0	$955	$1,282
December	60	10	25,210	$83	$1,109	$1,680
January	72	22	27,780	$183	$1,169	$1,690
February	58	8	36,580	$67	$1,375	$2,543
March	77	27	23,800	$225	$1,076	$1,733
April	72	22	17,440	$183	$894	$1,377
May	72	22	1,640	$183	$98	$155
June	0	0	1,170	$0	$70	$123
July	0	0	600	$0	$36	$84
August	0	0	220	$0	$13	$58
TOTALS		**111**	**155,700**	**$924**	**$6,926**	**$10,927**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.4.3 - Lighting Analysis Summary for the Cartwright Community Centre

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Ice Rink Metal Halides - No upgrade recommended.	25	14,700	$883	14,700	$883
Ice Rink Incandescents (500W) - Convert to metal halides.	23	16,905	$1,015	7,056	$424
100W Incandescents (run 24/7) - Convert to compact fluorescents.	2	720	$43	202	$12
100W Incandescents (zamboni room) - Convert to compact fluorescents.	4	588	$35	165	$10
60W Incandescent (freezer room) - No upgrade recommended.	4	353	$21	94	$6
40W Incandescent - Convert to compact fluorescent.	1	59	$4	16	$1
60W Incandescent - Convert to compact fluorescent.	1	88	$5	24	$1
100W Incandescent - Convert to compact fluorescent.	2	294	$18	82	$5
8' T12 Fluorescents - Convert to T8s (13x2)	26	4,449	$267	2,079	$125
8' T12 Fluorescent (over scoreboard) - Convert to T8.	1	419	$25	196	$12
4' T12 Fluorescents - Convert to T8s (5x2).	10	720	$43	434	$26
4' T8 Fluorescent lamps - No upgrade recommended (1x2).	2	87	$5	87	$5
Outdoor wall pack - no upgrade recommended.	1	657	$39	657	$39
Incandescent exit signs - convert to LEDs.	5	657	$39	131	$8
LED Exit signs - no upgrade recommended.	2	53	$3	53	$3
TOTALS		**40,748**	**$2,447**	**25,975**	**$1,560**

Annual Energy Savings (kWh)	**14,774**
Annual Cost Savings	**$887**
Percent Annual Energy Savings	**36%**

These calculations are assuming that the centre is occupied from Nov 1 - Mar 31 for 70 hrs/week.

The Exit signs are assumed to be on 24 hours a day, 365 days per year

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.4.4 (a) Window and Door Replacement Calculations for the Cartwright Community 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 steel pedestrian door between rink and zamboni room with an insulated steel door.	21	1.500	352	$21	6.5	81	$5	270	$16
Replace plexiglass windows with triple pane windows (7 - 4' x 7'6").	210	1.000	5,274	$317	6.25	844	$51	4,430	$266
TOTALS			**5,625**	**$338**		**925**	**$56**	**4,700**	**$282**

Table B.4.4 (b) Window and Door Infiltration Calculations for the Cartwright Community 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 door between rink and zamboni room.	5	0.05	125	17	1,580,475	463	$28
Pedestrian doors between rink and entrance.	10	0.05	125	34	3,160,950	926	$56
Pedestrian doors to outside.	10.00	0.05	125	34	3,160,950	926	$56
TOTALS						**2,316**	**$139**

Table B.4.4 (c) Upgrade Wall/Roof Insulation for the Cartwright Community 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
Upgrade Wall Insulation to R20.	1977.6	13.100	3,791	$228	20	2,483	$149	1,308	$79
Upgrade Roof Insulation to R40	1512	20.000	1,899	$114	40	949	$57	949	$57
TOTALS			**5,690**	**$342**		**3,432**	**$206**	**2,257**	**$136**

The heated areas are assumed to be kept at 64.4 F and the rink is unheated.
The crack lengths are taken as a quarter of the perimeter of the doors.

Table B.4.5 - Water Usage for the Cartwright Community Centre

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	1	3.3	4,823	1.60	7,718	0.32	1,544	6,174	231	$14
Toilets	1	1.9	2,756	13.25	36,520	6.00	16,538	19,983	NA	NA
Showers	4	0.2	1,176	66.25	77,904	47.30	55,625	22,279	835	$50
Total					**122,142**		**73,706**	**48,436**	**1,066**	**$64**

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	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	1.40625	1.875	3.28125

Current Hot Water Usage (kWh)		
Fixture	L/Yr	kWh
Sinks	7,718	289
Showers	77,904	2,919
Total		**3,209**

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 1.5 gallons per flush

The current showers are assumed to use 3.5 gpm and the new showers use 2.5 gpm

Table B.4.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Cartwright Community Centre

Description	% of Time Unoccupied	Heating Degree Days below 62.6 F	Heating Degree Days below 59 F	Current Energy Used to Heat Second Floor (kWh)	Heat Savings (kWh)
Setback thermostats to 55 F	83.22%	9224.9	8219.3	32,568	1,477

Description	Volume (m^3/day)	Mass (kg)	Daily Energy Savings (kJ)	Daily Energy Savings (kWh)	Annual Energy Savings (kWh)
Melt ice shavings outside	1.59	763	269,083	74.75	11,213

Table B.5.1 Annual Energy Consumption for Cartwright Curling Rink

	Energy Consumption (kWh)	**% of Total Energy Consumption**
Heat Pumps (Heating and Ice Plant)	53,073	82%
Hot Water	2,776	4%
Lighting	8,711	13%
Total	**64,560**	

Table B.5.2 - Electricity Usage for Cartwright Curling Rink

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	0	0	540	$0	$32	$54
October	0	0	2,820	$0	$165	$206
November	0	0	8,100	$0	$475	$559
December	0	0	7,140	$0	$418	$495
January	0	0	16,740	$0	$867	$1,007
February	0	0	8,340	$0	$489	$575
March	0	0	13,680	$0	$750	$872
April	0	0	4,740	$0	$278	$339
May	0	0	1,380	$0	$83	$113
June	0	0	120	$0	$7	$26
July	0	0	840	$0	$50	$76
August	0	0	120	$0	$7	$26
TOTALS		**0**	**64,560**	**$0**	**$3,621**	**$4,349**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.5.3 - Lighting Analysis Summary for Cartwright Curling Rink

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Lobby and Entrance 4' T8s - No upgrade recommended (35x2).	70	3,007	$181	3,007	$181
150W Incandescents - Convert to compact fluorescents.	10	2,184	$131	582	$35
Ice Area 8' T12 Fluorescents - Convert to 8' T8s (24x2).	48	2,539	$152	1,182	$71
Outdoor wall packs - No upgrade recommended.	2	876	$53	876	$53
LED Exit Signs - No upgrade recommended.	4	105	$6	105	$6
TOTALS		**8,711**	**$523**	**5,752**	**$345**

Annual Energy Savings (kWh)	**2,959**
Annual Cost Savings	**$178**
Percent Annual Energy Savings	**34%**

The rink is occupied from mid Oct to the end of March for 12 hrs/week plus 4 weekends per year (36 hrs/weekend).

The lounge is occupied for 30 hours/week and the entrance is occupied for 56 hours/week.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

The Exit signs are assumed to be on 24 hours a day, 365 days per year

Table B.5.4 (a) Window and Door Infiltration Calculations for Cartwright 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 door in curling rink (1).	5	0.05	125	17	495,972	145	$9
Double pedestrian door in entrance (1).	13	0.05	125	44	4,109,235	1,204	$72
Pedestrian door from machine room to outside (1).	5	0.05	125	17	1,580,475	463	$28
TOTALS						**1,813**	**$109**

The lobby and entrance area are assumed to be kept at 64.4 F and the rink at 32 F

The crack lengths are taken as a quarter or a half the perimeter of the doors.

Table B.5.5 - Water Usage for Cartwright Curling Rink

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	3.3	7,481	1.60	11,970	0.32	2,394	9,576	359	$22
Toilets	4	1.9	3,420	13.25	45,315	6.00	20,520	24,795	NA	NA
Urinals	2	2.8	2,565	3.80	9,747	3.80	9,747	0	NA	NA
Total					**67,032**		**32,661**	**34,371**	**359**	**$22**

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 Urinals	-	2	
Number of Urinal Uses/day	-	3	
Urinal Uses/hr/fixture	-	2.8125	2.8125
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	1.40625	1.875	3.28125

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	11,970	449
Total		**449**

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 1.5 gallons per flush

The urinals consume 3.8 litres per flush

Table B.6.1 Annual Energy Consumption for Municipal Office Building

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	21,577	64%
Hot Water	409	1%
Lighting	11,624	35%
Total	**33,610**	

Table B.6.2 - Electricity Usage for Municipal Office Building

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
September	0	0	1,110	$0	$65	$92
October	0	0	1,890	$0	$111	$144
November	0	0	2,900	$0	$170	$212
December	0	0	3,320	$0	$195	$240
January	0	0	7,530	$0	$441	$521
February	0	0	3,740	$0	$219	$268
March	0	0	4,830	$0	$283	$341
April	0	0	2,580	$0	$151	$193
May	0	0	2,140	$0	$128	$165
June	0	0	940	$0	$56	$82
July	0	0	1,660	$0	$100	$132
August	0	0	970	$0	$58	$84
TOTALS		**0**	**33,610**	**$0**	**$1,978**	**$2,473**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.6.3 - Lighting Analysis Summary for Municipal Office Building

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
8' T12 Fluorescents - Convert to T8s (7x2).	14	3,917	$235	1,823	$109
4' T12 Fluorescents - Convert to T8s (16x2).	32	3,782	$227	2,277	$137
60W Incandescent - Convert to compact fluorescent.	1	145	$9	39	$2
150W Incandescent - Convert to compact fluorescent.	1	657	$39	92	$6
Outdoor Incandescents - Convert to High Pressure Sodium	2	1,314	$79	657	$39
Outdoor wall pack - No upgrade recommended.	1	657	$39	657	$39
Parking lot plugs - Install parking lot controllers.	4	1,152	$69	576	$35
TOTALS		**11,624**	**$698**	**6,121**	**$367**

Annual Energy Savings (kWh)	**5,503**
Annual Cost Savings	**$330**
Percent Annual Energy Savings	**47%**

These calculations are assuming that the municipal office is occupied for 9 hours/day, 5 days a week plus 6 hours per month in the evening.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.6.4 (a) Window and Door Infiltration Calculations for Municipal Office 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
Weather-strip pedestrian glass door.	5	0.05	125	17	4,741,425	1,390	$83
TOTALS						**1,390**	**$83**

Table B.6.4 (c) Upgrade Wall/Roof Insulation for the Municipal Office 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
Upgrade Wall Insulation to R20.	990	6.000	12,431	$746	20.00	3,729	$224	8,702	$522
TOTALS			**12,431**	**$746**		**3,729**	**$224**	**8,702**	**$522**

The office is assumed to be kept at 21 ^oC when occupied and 16 ^oC unoccupied.

The crack lengths are taken as a quarter the perimeter of the door

Table B.6.5 - Water Usage for Municipal Office 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
Main Floor Washroom										
Sinks	1	1.1	1,969	1.60	3,150	0.32	630	2,520	94	$6
Toilets	1	0.6	1,125	13.25	14,906	6.00	6,750	8,156	NA	NA
Total					**18,056**		**7,380**	**10,676**	**94**	**$6**

Frequency at Which Fixtures are Used			
	Females	Males	Totals
Number of People	5	5	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	0.46875	0.15625	0.625
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.46875	0.625	1.09375

Current Hot Water Usage (kWh)		
Fixture	L/Yr	kWh
Sinks	3,150	118
Total		**118**

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 1.5 gallons per flush

Table B.6.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Municipal Office Building

Description	% of Time Unoccupied	Heating Degree Days below 61 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 59 F	72.47%	8778.0	8219.3	18,988	876

Description	Current Energy Used to Cool (kWh)	% Energy Savings	Energy Savings (kWh)
Replace condensing unit with a high efficiency condensing unit.	2,589	21%	544

Table B.7.1 Annual Energy Consumption for Municipal Shop

	Energy Consumption (kWh)	% of Total Energy Consumption
Motors	316	0.5%
HVAC	53,925	84.9%
Hot Water	1,544	2.4%
Lighting	7,695	12.1%
Total	**63,480**	

Table B.7.2 - Electricity Usage for the Municipal Shop

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	6	0	660	$0	$39	$62
October	48	0	480	$0	$28	$50
November	43	0	3,900	$0	$229	$278
December	50	0	7,920	$0	$464	$547
January	50	0	17,400	$0	$893	$1,036
February	49	0	13,620	$0	$747	$870
March	48	0	8,760	$0	$513	$603
April	43	0	7,320	$0	$429	$513
May	25	0	1,320	$0	$79	$108
June	10	0	540	$0	$32	$55
July	8	0	720	$0	$43	$67
August	10	0	840	$0	$50	$76
TOTALS		**0**	**63,480**	**$0**	**$3,547**	**$4,266**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

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

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
8' T12 Fluorescents - Convert to 8' T8s (9x2)	18	3,205	$192	1,492	$90
150W Incandescents - Convert to compact fluorescents.	10	2,303	$138	583	$35
Outdoor yard lights on sentinel - No upgrade recommended.	3	1,971	$118	1,971	$118
Parking lot plug - install parking lot controller.	1	216	$13	108	$6
TOTALS		**7,695**	**$462**	**4,154**	**$249**

Annual Energy Savings (kWh)	**3,540**
Annual Cost Savings	**$213**
Percent Annual Energy Savings	**46%**

These calculations are assuming that the shop is occupied for 2 hours/day throughout the summer and 45 hours per week throughout the winter.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.7.4 (a) Window and Door Infiltration Calculations for the Municipal Shop

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 (2)	5	0.05	125	17	4,132,921	1,211	$73
Vehicle Doors (2)	7.5	0.05	125	26	6,199,381	1,817	$109
TOTALS						**3,028**	**$182**

Table B.7.4 (b) Upgrade Wall/Roof Insulation for the Municipal Shop

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
Upgrade roof insulation to R40	3896	20.00	12,793	$768	40.00	6,396	$384	6,396	$384
TOTALS			**12,793**	**$768**		**6,396**	**$384**	**6,396**	**$384**

The shop is assumed to be kept at 63 F

The crack lengths are taken as a quarter the perimeter of the pedestrian doors and an eighth of the perimeter of the vehicle doors.

Table B.7.5 - Water Usage for the Municipal Shop

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	1	0.3	528	1.60	844	0.32	169	675	25	$2
Toilets	1	0.2	240	13.25	3,178	6.00	1,439	1,739	NA	NA
Total					**4,022**		**1,608**	**2,414**	**25**	**$2**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	1	2	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	0.09375	0.0625	0.15625
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.09375	0.25	0.34375

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	844	32
Total		**32**

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 1.5 gallons per flush

Table B.7.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Municipal Shop

Description	% of Time Unoccupied	Heating Degree Days below 63 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 59 F	82.48%	9336.6	8219.3	53,925	5,322

Description	Annual Energy Savings (kWh)	Annual Cost Savings ($)	Installation Cost	Simple Payback Years
Install Geothermal Heating System	22,854	$1,372	$37,116	27.05

Table B.7.7 Energy Consumption and Savings Calculations for Motors in Municipal Shop

Description	Rated HP	Required HP	# of hours	Current, 85 % Efficient Motor		
				Actual HP	kW	kWh
Compressor 1	5	4	90	4.70	3.51	316
TOTALS						**316**

Table B.8.1 Annual Energy Consumption for Lakeland Regional Library

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	15,631	80%
Hot Water	1,224	6%
Lighting	2,806	14%
Total	**19,660**	

Table B.8.2 - Electricity Usage for Lakeland Regional Library

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
September	0	0	520	$0	$30	$53
October	0	0	1,110	$0	$65	$92
November	0	0	1,330	$0	$78	$107
December	0	0	2,250	$0	$132	$168
January	0	0	4,650	$0	$272	$329
February	0	0	2,580	$0	$151	$190
March	0	0	3,090	$0	$181	$224
April	0	0	1,640	$0	$96	$129
May	0	0	1,090	$0	$65	$93
June	0	0	370	$0	$22	$43
July	0	0	650	$0	$39	$63
August	0	0	380	$0	$23	$44
TOTALS		**0**	**19,660**	**$0**	**$1,156**	**$1,535**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.8.3 - Lighting Analysis Summary for Lakeland Regional Library

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
8' T12 Fluorescents - Convert to 8' T8s (1x2)	2	265	$16	124	$7
4' T12 Fluorescents - Convert to 4' T8s (16x2)	32	2,540	$153	1,529	$92
TOTALS		**2,806**	**$168**	**1,653**	**$99**

Annual Energy Savings (kWh)	**1,153**
Annual Cost Savings	**$69**
Percent Annual Energy Savings	**41%**

These calculations are assuming that the library is occupied from Tuesday - Friday from 11:30am - 5pm.

The outdoor light is never on and therefore is not included in this table.

Table B.8.4 (a) Window and Door Replacement Calculations for Lakeland Regional Library

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 large double pane windows in front with triple pane windows (2 - 82"x60").	68.33	2.00	2,574	$155	6.25	824	$49	1,750	$105
48" x 32" old slider - replace with triple pane slider.	10.67	2.00	402	$24	6.25	129	$8	273	$16
TOTALS			**2,976**	**$179**		**952**	**$57**	**2,024**	**$121**

Table B.8.4 (b) Window and Door Infiltration Calculations for Lakeland Regional 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 (2)	5	0.05	125	17	4,741,425	1,390	$83
Large window in front (1 - 82"x60")	6	0.025	50	8	2,244,275	658	$39
TOTALS						**2,047**	**$123**

The library is assumed to be kept at 65 F

The crack lengths are taken as a quarter of the perimeter of the windows and an eighth of the perimeters of the doors

Table B.8.5 - Water Usage for Lakeland Regional 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	1	0.9	1,001	1.60	1,602	0.32	320	1,281	48	$3
Toilets	1	0.5	572	13.25	7,579	6.00	3,432	4,147	NA	NA
Total					**9,181**		**3,752**	**5,428**	**48**	**$3**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	4	4	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	0.375	0.125	0.5
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.375	0.5	0.875

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	1,602	60
Total		**60**

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 1.5 gallons per flush

Table B.8.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Lakeland Regional Library

Description	% of Time Unoccupied	Heating Degree Days below 70 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Heat Savings (kWh)
Setback Thermostats to 59 F	86.94%	9727.7	8219.3	14,068	1,896

Table B.9.1 Annual Energy Consumption for Fire Hall and Ambulance Garage

	Energy Consumption (kWh)	% of Total Energy Consumption
Motors	1,352	3.1%
HVAC	38,118	86.4%
Hot Water	1,379	3.1%
Lighting	3,261	7.4%
Total	**44,110**	

Table B.9.2 - Electricity Usage for Fire Hall and Ambulance Garage

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	0	0	560	$0	$33	$55
October	0	0	2,220	$0	$130	$166
November	0	0	2,580	$0	$151	$190
December	0	0	4,980	$0	$292	$351
January	0	0	15,050	$0	$802	$933
February	0	0	9,470	$0	$555	$651
March	0	0	4,100	$0	$240	$292
April	0	0	0	$0	$0	$0
May	0	0	4,280	$0	$257	$328
June	0	0	770	$0	$46	$71
July	0	0	50	$0	$3	$22
August	0	0	50	$0	$3	$22
TOTALS		**0**	**44,110**	**$0**	**$2,513**	**$3,079**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.9.3 - Lighting Analysis Summary for Fire Hall and Ambulance Garage

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
8' T12 Fluorescents - Convert to 8' T8s (14x2)	28	1,689	$101	786	$47
4' T12 Fluorescents - Convert to 8' T8s (2x2)	4	102	$6	61	$4
100W Incandescents - Convert to compact fluorescents.	3	156	$9	44	$3
Outdoor yard lights on sentinel - No upgrade recommended.	2	1,314	$79	1,314	$79
TOTALS		**3,261**	**$196**	**2,205**	**$132**

Annual Energy Savings (kWh)	**1,056**
Annual Cost Savings	**$63**
Percent Annual Energy Savings	**32%**

These calculations are assuming that the indoor lights are on for 8-10 hours per week.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.9.4 (a) Window and Door Infiltration Calculations for Fire Hall and Ambulance 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 door (1)	5	0.05	125	17	4,019,299	1,178	$71
Vehicle doors (3)	17	0.05	125	58	13,665,618	4,005	$240
TOTALS						**5,183**	**$311**

The temperature of the garage is assumed to be kept at 59 F.

The crack lengths are taken as a quarter of the perimeter of the doors

Table B.9.5 - Water Usage for Fire Hall and Ambulance 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	2	0.9	3,375	0.32	1,080	0.32	1,080	0	0	$0
Toilets	1	0.4	675	13.25	8,944	6.00	4,050	4,894	NA	NA
Total					**10,024**		**5,130**	**4,894**	**0**	**$0**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	2	6	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	0.1875	0.1875	0.375
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.1875	0.75	0.9375

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	1,080	40
Total		**40**

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 1.5 gallons per flush

Table B.9.6 Energy Consumption and Savings Calculations for Motors in Fire Hall and Ambulance Garage

Description	Rated HP	Required HP	# of hours	Current, 85 % Efficient Motor		
				Actual HP	kW	kWh
Pump	1	1	1,752	1.03	0.77	1,352
TOTALS						**1,352**

Table B.10.1 Annual Energy Consumption for the Mather Skating Rink

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	59,841	81%
Hot Water	4,753	6%
Lighting	9,266	13%
Total	**73,860**	

Table B.10.2 - Electricity Usage for the Mather Skating Rink

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	0	0	2,280	$0	$134	$188
October	0	0	4,260	$0	$250	$320
November	0	0	-2,580	$0	-$151	-$136
December	0	0	4,740	$0	$278	$353
January	0	0	22,980	$0	$1,056	$1,318
February	0	0	4,080	$0	$239	$308
March	0	0	24,930	$0	$1,102	$1,463
April	0	0	5,790	$0	$339	$432
May	0	0	5,580	$0	$335	$418
June	0	0	600	$0	$36	$77
July	0	0	600	$0	$36	$77
August	0	0	600	$0	$36	$77
TOTALS		**0**	**73,860**	**$0**	**$3,690**	**$4,896**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.10.3 - Lighting Analysis Summary for the Mather Skating Rink

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Rink 300W Incandescents - Convert to metal halides.	50	7,200	$432	2,400	$144
120W Incandescents - Convert to compact fluorescents.	12	691	$41	184	$11
100W Incandescents - Convert to compact fluorescents.	4	192	$12	54	$3
Outdoor Incandescents - Convert to High Pressure Sodium	1	657	$39	329	$20
Exit Signs - Convert Incandescents to LEDs	2	526	$32	53	$3
TOTALS		**9,266**	**$556**	**3,019**	**$181**

Annual Energy Savings (kWh)	**6,247**
Annual Cost Savings	**$375**
Percent Annual Energy Savings	**67%**

These calculations are assuming that the skating rink is occupied 4 months of the year, 4 hours per day (480 hours per year)

The Exit signs are assumed to be on 24 hours a day, 365 days per year

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.10.4 (a) Window and Door Replacement Calculations for the Mather Skating Rink

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 wood pedestrian doors with insulated doors (2)	42	1.578	1,138	$68	6.67	11	$1	1,126	$68
TOTALS			**1,138**	**$68**		**11**	**$1**	**1,126**	**$68**

Table B.10.4 (b) Window and Door Infiltration Calculations for the Mather Skating 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
Weatherstrip wood pedestrian doors (2).	10	0.05	125	34	5,378,118	1,576	$95
TOTALS						**1,576**	**$95**

Table B.10.4 (c) Upgrade Wall/Roof Insulation for the Mather Skating Rink

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
Upgrade wall insulation to R20	2000	4.000	21,364	$1,283	20	4,273	$257	17,091	$1,026
Upgrade roof insulation to R40	1700	4.000	18,160	$1,090	40	1,816	$109	16,344	$981
TOTALS			**39,524**	**$2,373**		**6,089**	**$366**	**33,435**	**$2,007**

The skating rink is assumed to be kept at 50 F

The crack lengths are taken as a quarter of the perimeter of the doors

Table B.10.5 - Water Usage for the Mather Skating Rink

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	1.1	3,938	1.60	6,300	0.32	1,260	5,040	189	$11
Toilets	2	0.6	2,250	13.25	29,813	6.00	13,500	16,313	NA	NA
Total					**36,113**		**14,760**	**21,353**	**189**	**$11**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	5	5	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	0.46875	0.15625	0.625
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.46875	0.625	1.09375

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	6,300	236
Total		**236**

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 1.5 gallons per flush

Table B.10.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Mather Skating Rink

Description	Quantity	Flow Rate (cfm)	Heating Degree Days below 50 F	Heating Efficiency	Energy Savings (kWh)
Insulate and cap exhaust for old oil furnace.	1	60	6074.8	100%	2,768

Table B.11.1 Annual Energy Consumption for Mather Hall

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	31,771	82%
Hot Water	2,340	6%
Lighting	4,588	12%
Total	**38,700**	

Table B.11.2 - Electricity Usage for Mather Hall

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
September	0	0	60	$0	$4	$22
October	0	0	2400	$0	$141	$178
November	0	0	3060	$0	$179	$222
December	0	0	4920	$0	$288	$347
January	0	0	7380	$0	$432	$511
February	0	0	4080	$0	$239	$291
March	0	0	4440	$0	$260	$315
April	0	0	2400	$0	$141	$182
May	0	0	2160	$0	$130	$166
June	0	0	5700	$0	$342	$408
July	0	0	1020	$0	$61	$88
August	0	0	1080	$0	$65	$92
TOTALS		**0**	**38,700**	**$0**	**$2,282**	**$2,821**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.11.3 - Lighting Analysis Summary for Mather Hall

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4' T12 Fluorescents - Convert to 4' T8s (25x2).	48	978	$59	589	$35
100W Incandescents - Convert to compact fluorescents.	17	707	$42	198	$12
60W Incandescents - Convert to compact fluorescents.	11	275	$16	73	$4
Outdoor Incandescent pot lights - no upgrade recommended.	6	1,577	$95	1,577	$95
Exit Signs - Convert Incandescents to LEDs.	4	1,051	$63	105	$6
TOTALS		**4,588**	**$275**	**2,542**	**$153**

Annual Energy Savings (kWh)	**2,046**
Annual Cost Savings	**$123**
Percent Annual Energy Savings	**45%**

These calculations are assuming that the hall is occupied once per week for 8 hours.

The Exit signs are assumed to be on 24 hours a day, 365 days per year

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.11.4 (a) Window and Door Replacement Calculations for Mather Hall

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 front steel double doors with insulated steel doors.	42	1.500	1,619	$97	6.5	374	$22	1,245	$75
TOTALS			**1,619**	**$97**		**374**	**$22**	**1,245**	**$75**

Table B.11.4 (b) Window and Door Infiltration Calculations for Mather Hall

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
Back steel door (1)	5	0.05	125	17	3,638,339	1,066	$64
TOTALS						**1,066**	**$64**

The hall is assumed to be kept at 59 F

The crack lengths are taken as a quarter of the perimeter of the doors

Table B.11.5 - Water Usage for Mather Hall

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	5.5	11,375	1.60	18,200	0.32	3,640	14,560	546	$33
Toilets	6	3.1	7,800	13.25	103,350	6.00	46,800	56,550	NA	NA
Urinals	1	4.7	1,950	9.50	18,525	3.80	7,410	11,115	NA	NA
Total					**140,075**		**57,850**	**82,225**	**546**	**$33**

Frequency at Which Fixtures are Used			
	Females	Males	Totals
Number of People	25	25	
Number of Toilet Uses/day	3	1	
Number of Toilets	4	4	
Toilet Uses/hour/fixture	2.34375	0.78125	3.125
Number of Urinals	-	2	
Number of Urinal Uses/day	-	3	
Urinal Uses/hr/fixture	-	4.6875	4.6875
Number of Sinks	4	4	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	2.34375	3.125	5.46875

Current Hot Water Usage (kWh)		
Fixture	L/Yr	kWh
Sinks	18,200	682
Total		**682**

The current urinals are assumed to consume 2.5 gallons per flush and the new urinals consume 1 gallon per flush

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 1.5 gallons per flush

Table B.12.1 Annual Energy Consumption for the Recycling Depot

	Energy Consumption (kWh)	% of Total Energy Consumption
Motors	164	9%
HVAC	489	27%
Lighting	1,147	64%
Total	**1,800**	

Table B.12.2 - Electricity Usage for Recycling Depot

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
September	0	0	300	$0	$18	$56
October	0	0	0	$0	$0	$0
November	0	0	270	$0	$16	$54
December	0	0	0	$0	$0	$0
January	0	0	400	$0	$23	$63
February	0	0	0	$0	$0	$0
March	0	0	350	$0	$21	$59
April	0	0	0	$0	$0	$0
May	0	0	240	$0	$14	$52
June	0	0	0	$0	$0	$0
July	0	0	240	$0	$14	$53
August	0	0	0	$0	$0	$0
TOTALS		**0**	**1,800**	**$0**	**$106**	**$336**

Notes

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

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

Table B.12.3 - Lighting Analysis Summary for the Recycling Depot

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
100W Incandescents - Convert to compact fluorescents.	6	884	$53	248	$15
Outdoor Incandescents - No upgrade recommended	1	263	$16	263	$16
TOTALS		**1,147**	**$69**	**510**	**$31**

Annual Energy Savings (kWh)	**636**
Annual Cost Savings	**$38**
Percent Annual Energy Savings	**56%**

These calculations are assuming that the recycling depot is occupied from Mon-Thu from 8-4:30pm.

The Exit signs are assumed to be on 24 hours a day, 365 days per year.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

Table B.12.4 (a) Window and Door Replacement Calculations for the Recycling Depot

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 vehicle door with an insulated vehicle door	132	1.500	355	$21	6.67	80	$5	275	$17
Replace pedestrian door with an insulated pedestrian door	21	1.500	56	$3	6.67	13	$1	44	$3
TOTALS			**355**	**$21**		**80**	**$5**	**275**	**$17**

Table B.12.4 (b) Window and Door Infiltration Calculations for the Recycling Depot

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 door (1)	5	0.05	125	17	253,643	74	$4
Vehicle door (1)	11.5	0.05	125	39	583,379	171	$10
TOTALS						**245**	**$15**

The Recycling Depot is assumed to be kept at 0 C when occupied.

The crack lengths are taken as half the perimeter of the doors

Table B.12.5 Energy Consumption and Savings Calculations for Motors in the Recycling Depot

Description	Rated HP	Required HP	# of hours	Current, 85 % Efficient Motor		
				Actual HP	kW	kWh
Baler	2	2	78	1.88	1.40	109
Glass Shredder	2	1	52	1.41	1.05	55
TOTALS						**164**

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.

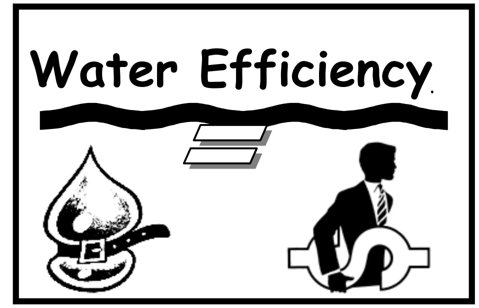
For More Information, Please Contact:

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

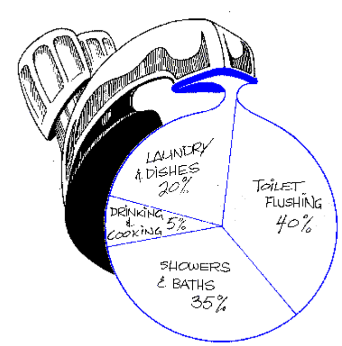
Pollution Prevention
Manitoba Conservation



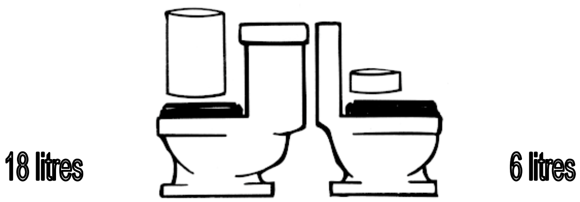
Water Use

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.

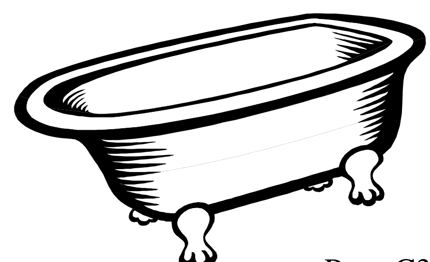
- Ensure a water softener regenerates only when the resin is exhausted.

- 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 204-474-3615
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 204-474-3615
LED Exit Signs	$45 per new sign	Kelly Epp at kepp@hydro.mb.ca or 204-474-3615
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 204-474-3615
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
High Efficiency Furnaces	$245 for each furnace installed.	Jamie Hopkins at jhopkins@hydro.mb.ca or 204-474-4018
Condensing Boilers	Boilers < 300MBH, Manitoba Hydro will pay $500 + $5/MBH input. Boilers > 300MBH, Manitoba Hydro will pay $2000 + $8/MBH input (retrofits) and $2000 + $5/MBH input (new construction).	Jamie Hopkins at jhopkins@hydro.mb.ca or 204-474-4018
Air Conditioners	Depends on the EER, the cooling capacity, and the incentive factor.	Jamie Hopkins at jhopkins@hydro.mb.ca or 204-474-4018

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	Ref. Page	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.	13	$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.	23, 46, 54		2/3 of the approved costs	On-going	Good	Canada-Manitoba Infrastructure Programs		infra@gov.mb.ca	http://www.infrastructure.mb.ca/e/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	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.	55		$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

<u>Vehicle Construction</u>

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.

<u>Vehicle Ratings</u>

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.

<u>Extra Features</u>

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

TABLE OF CONTENTS – APPENDIX F

Table F.1 - Energy Consumption Monitoring Data for Water Treatment Plant

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	8,750	108.8	8,750			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	4,940	347.4	4,940			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	9,140	498.2	9,140			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	5,760	912	5,760			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	12,100	1072.4	12,100			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	6,070	800	6,070			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	11,030	736.9	11,030			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	5,560	299.9	5,560			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	9,850	230.1	9,850			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	4,230	43.7	4,230			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	10,160	21.9	10,160			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	4,370	32	4,370			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	91,960	5103.3	91,960	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.1 - Energy Consumption Monitoring Graph for Water Treatment Plant

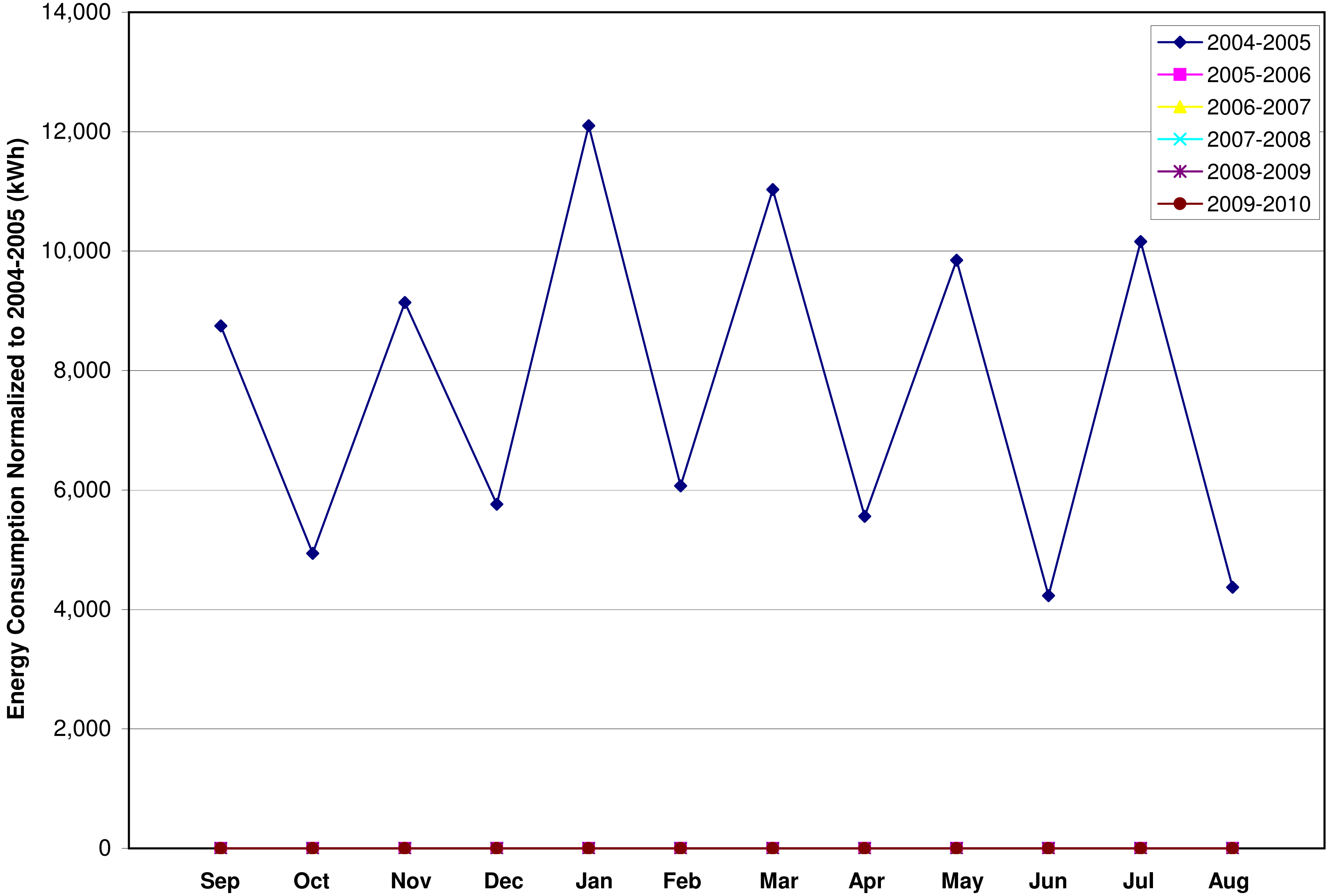


Table F.2 - Energy Consumption Monitoring Data for Sewage Lift Station

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	2,070	108.8	2,070			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	0	347.4	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	2,460	498.2	2,460			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	0	912	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	2,900	1072.4	2,900			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	0	800	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	2,500	736.9	2,500			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	0	299.9	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	2,190	230.1	2,190			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	0	43.7	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	2,670	21.9	2,670			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	0	32	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	14,790	5103.3	14,790	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.

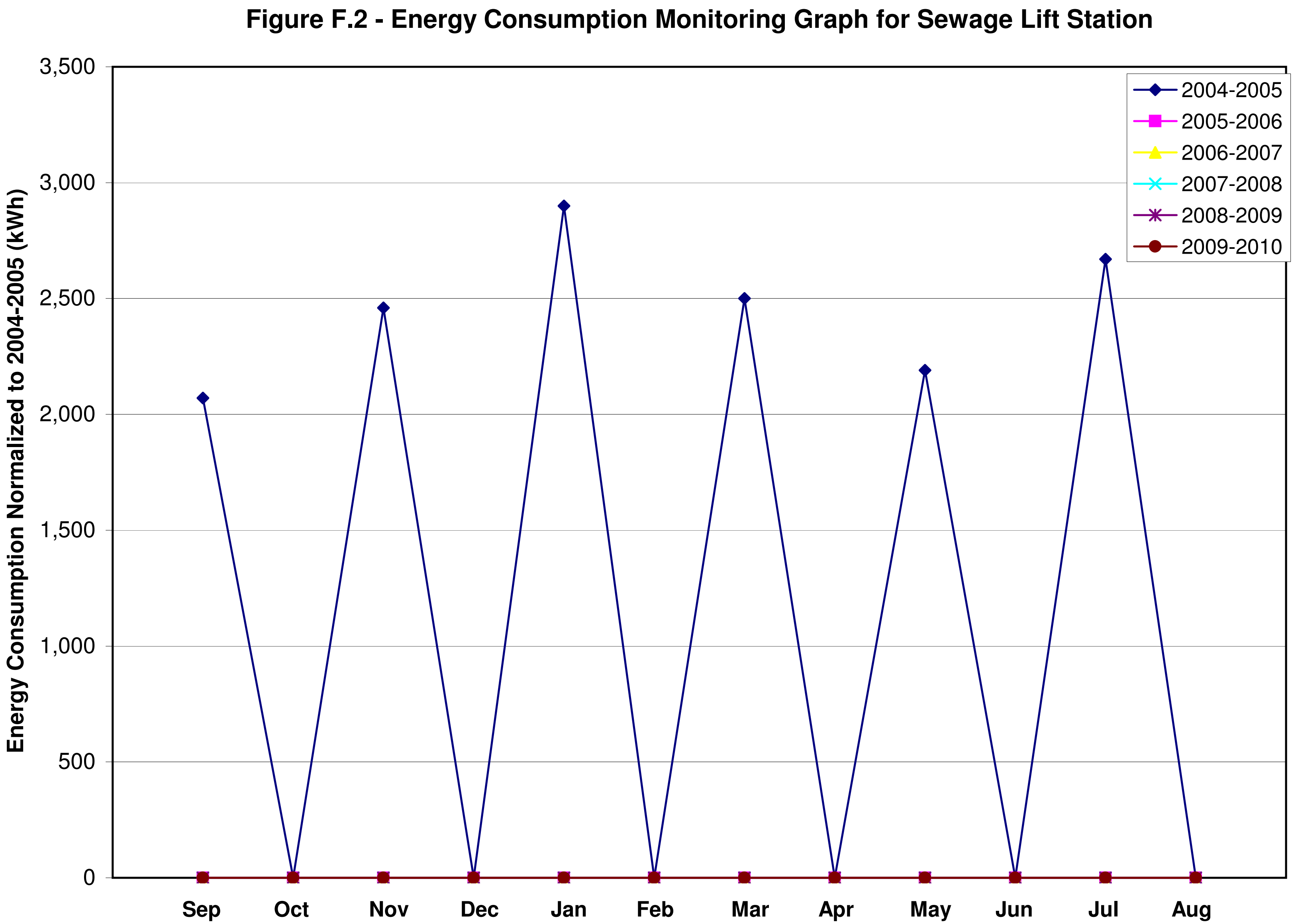


Figure F.2 - Energy Consumption Monitoring Graph for Sewage Lift Station
Energy Consumption Normalized to 2004-2005 (kWh)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010

Table F.3 - Energy Consumption Monitoring Data for Cartwright Centennial Auditorium

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)
September	2,560	108.8	2,560			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	3,280	347.4	3,280			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	7,920	498.2	7,920			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	10,240	912	10,240			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	16,640	1072.4	16,640			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	14,160	800	14,160			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	11,360	736.9	11,360			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	8,320	299.9	8,320			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	6,080	230.1	6,080			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	2,720	43.7	2,720			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	4,560	21.9	4,560			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	2,640	32	2,640			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	90,480	5103.3	90,480	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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 Cartwright Centennial Auditorium

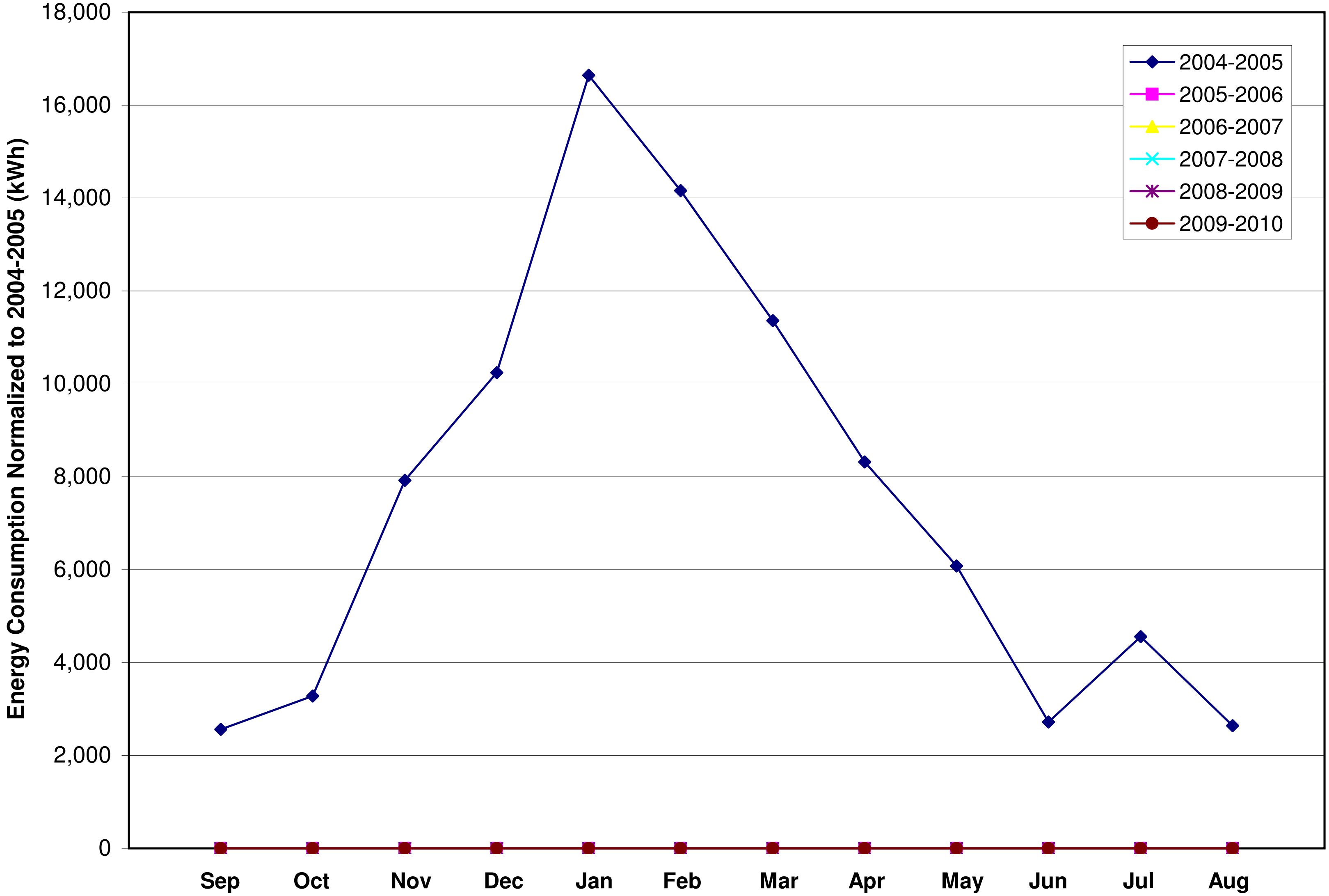


Table F.4 - Energy Consumption Monitoring Data for Cartwright Community Centre

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)
September	210	108.8	210			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	2,040	347.4	2,040			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	19,010	498.2	19,010			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	25,210	912	25,210			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	27,780	1072.4	27,780			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	36,580	800	36,580			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	23,800	736.9	23,800			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	17,440	299.9	17,440			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	1,640	230.1	1,640			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	1,170	43.7	1,170			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	600	21.9	600			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	220	32	220			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	155,700	5103.3	155,700	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.4 - Energy Consumption Monitoring Graph for Cartwright Community Centre

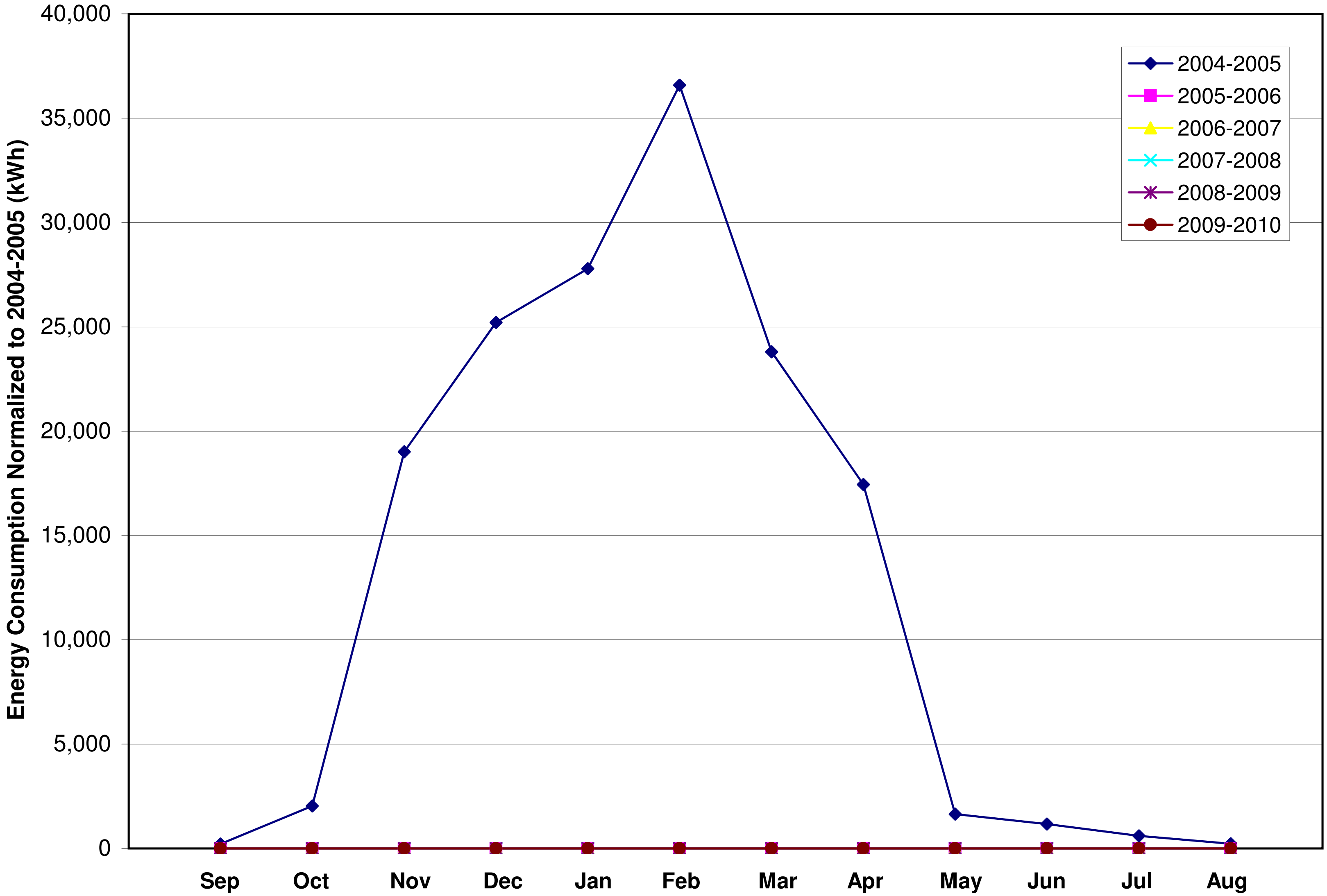


Table F.5 - Energy Consumption Monitoring Data for Cartwright Curling Rink

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	540	108.8	540			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	2,820	347.4	2,820			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	8,100	498.2	8,100			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	7,140	912	7,140			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	16,740	1072.4	16,740			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	8,340	800	8,340			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	13,680	736.9	13,680			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	4,740	299.9	4,740			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	1,380	230.1	1,380			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	120	43.7	120			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	840	21.9	840			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	120	32	120			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	64,560	5103.3	64,560	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.5 - Energy Consumption Monitoring Graph for Cartwright Curling Rink

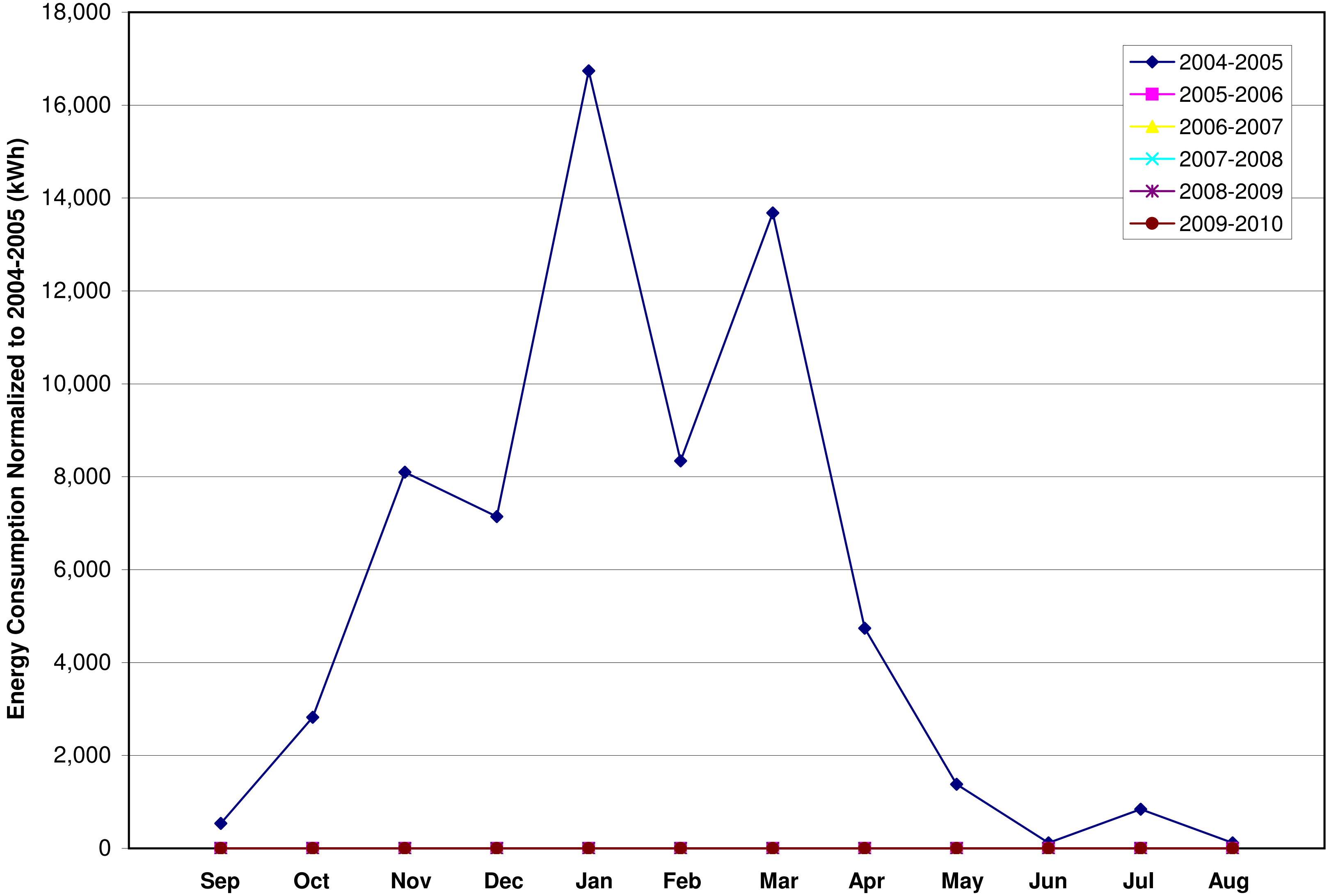


Table F.6 - Energy Consumption Monitoring Data for Municipal Office

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	1,110	108.8	1,110			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	1,890	347.4	1,890			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	2,900	498.2	2,900			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	3,320	912	3,320			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	7,530	1072.4	7,530			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	3,740	800	3,740			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	4,830	736.9	4,830			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	2,580	299.9	2,580			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	2,140	230.1	2,140			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	940	43.7	940			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	1,660	21.9	1,660			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	970	32	970			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	33,610	5103.3	33,610	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.

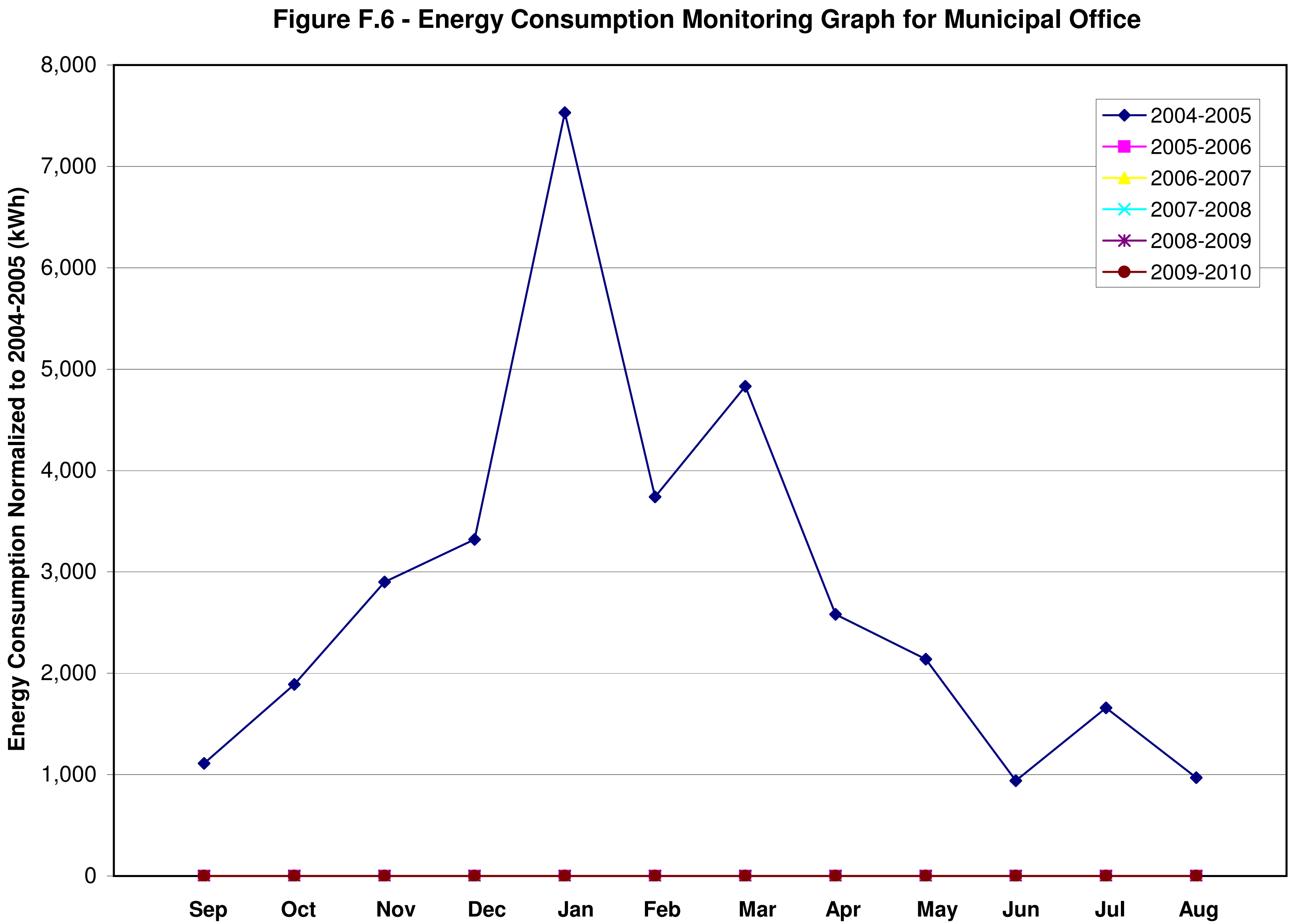


Figure F.6 - Energy Consumption Monitoring Graph for Municipal Office
Energy Consumption Normalized to 2004-2005 (kWh)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010

Table F.7 - Energy Consumption Monitoring Data for Municipal Shop

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)
September	660	108.8	660			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	480	347.4	480			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	3,900	498.2	3,900			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	7,920	912	7,920			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	17,400	1072.4	17,400			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	13,620	800	13,620			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	8,760	736.9	8,760			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	7,320	299.9	7,320			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	1,320	230.1	1,320			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	540	43.7	540			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	720	21.9	720			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	840	32	840			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	63,480	5103.3	63,480	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.7 - Energy Consumption Monitoring Graph for Municipal Shop

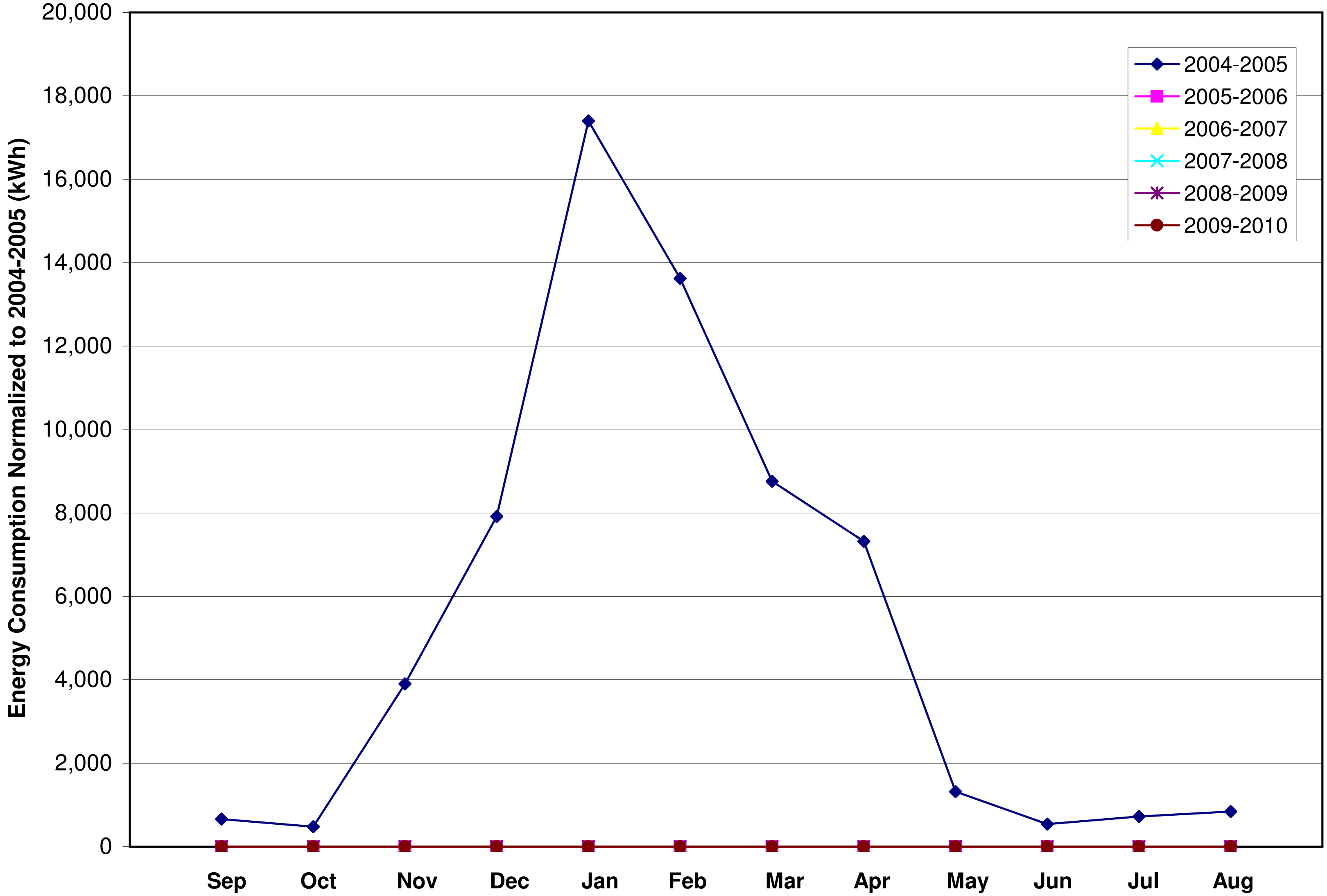


Table F.8 - Energy Consumption Monitoring Data for Lakeland Regional Library

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	520	108.8	520			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	1,110	347.4	1,110			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	1,330	498.2	1,330			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	2,250	912	2,250			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	4,650	1072.4	4,650			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	2,580	800	2,580			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	3,090	736.9	3,090			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	1,640	299.9	1,640			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	1,090	230.1	1,090			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	370	43.7	370			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	650	21.9	650			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	380	32	380			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	19,660	5103.3	19,660	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.8 - Energy Consumption Monitoring Graph for Lakeland Regional Library

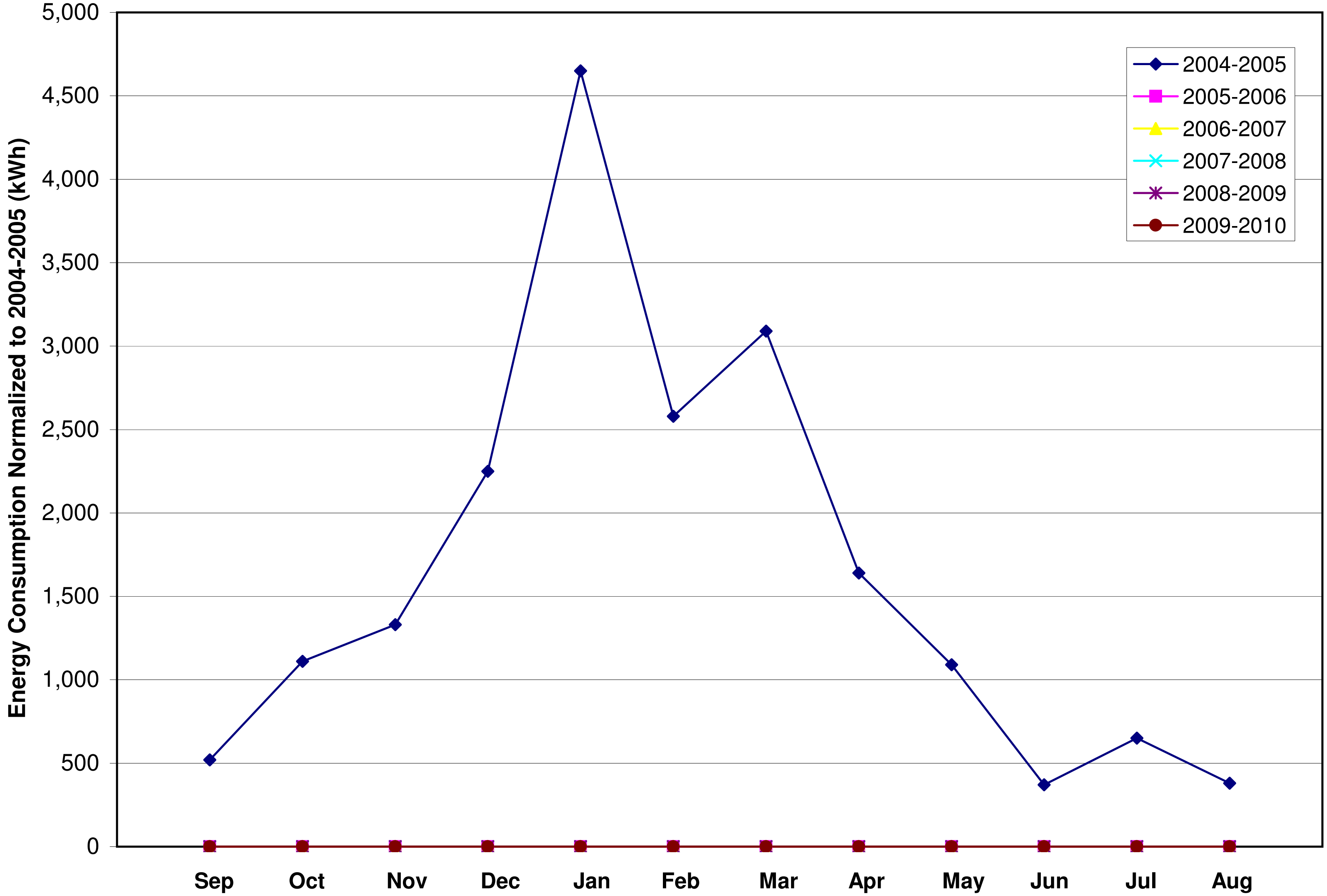


Table F.9 - Energy Consumption Monitoring Data for Fire Hall & Ambulance Garage

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	560	108.8	560			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	2,220	347.4	2,220			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	2,580	498.2	2,580			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	4,980	912	4,980			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	15,050	1072.4	15,050			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	9,470	800	9,470			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	4,100	736.9	4,100			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	0	299.9	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	4,280	230.1	4,280			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	770	43.7	770			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	50	21.9	50			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	50	32	50			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	44,110	5103.3	44,110	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.9 - Energy Consumption Monitoring Graph for Fire Hall & Ambulance Garage

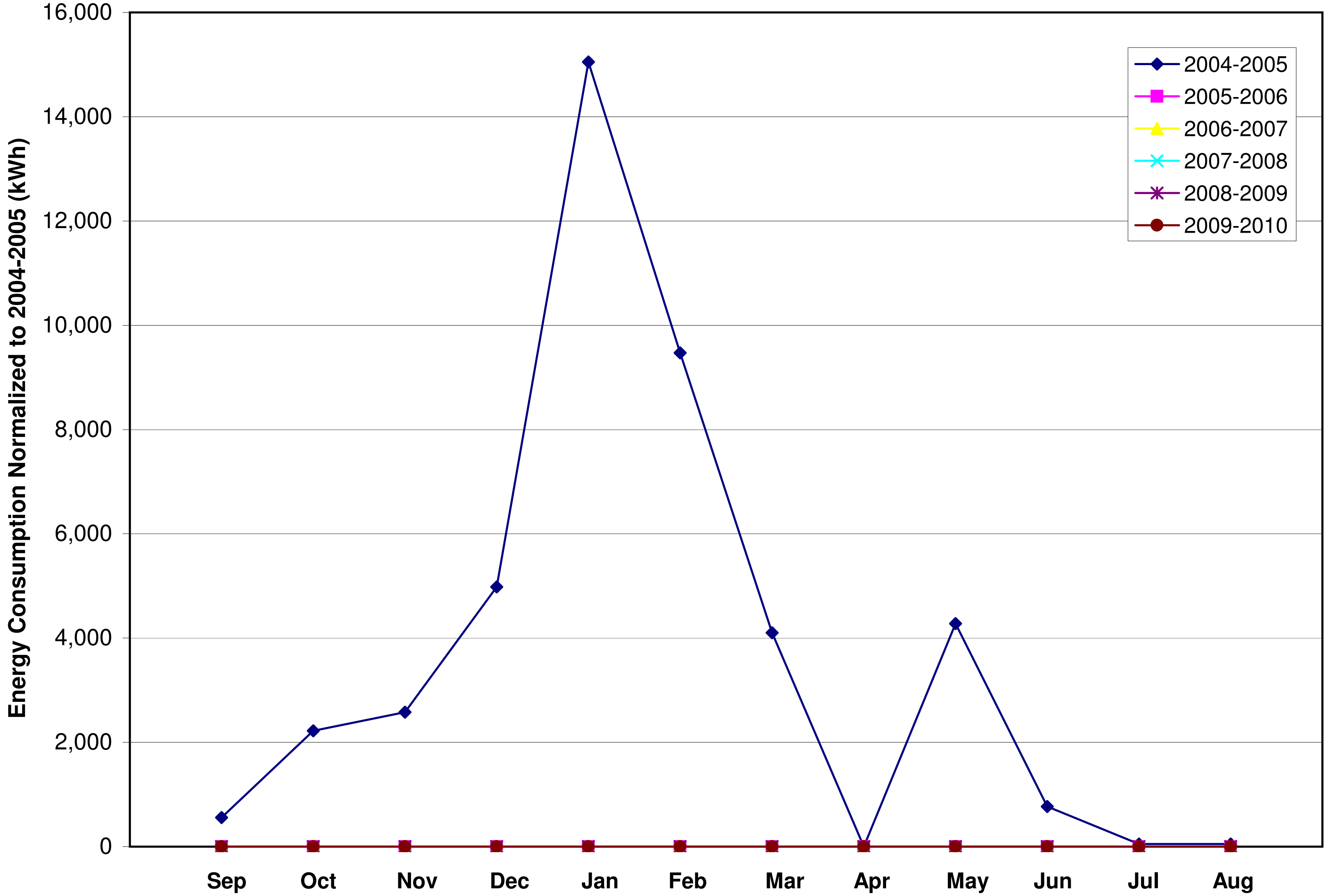


Table F.10 - Energy Consumption Monitoring Data for Mather Skating Rink

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)
September	2,280	108.8	2,280			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	4,260	347.4	4,260			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	-2,580	498.2	-2,580			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	4,740	912	4,740			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	22,980	1072.4	22,980			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	4,080	800	4,080			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	24,930	736.9	24,930			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	5,790	299.9	5,790			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	5,580	230.1	5,580			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	600	43.7	600			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	600	21.9	600			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	600	32	600			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	73,860	5103.3	73,860	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.

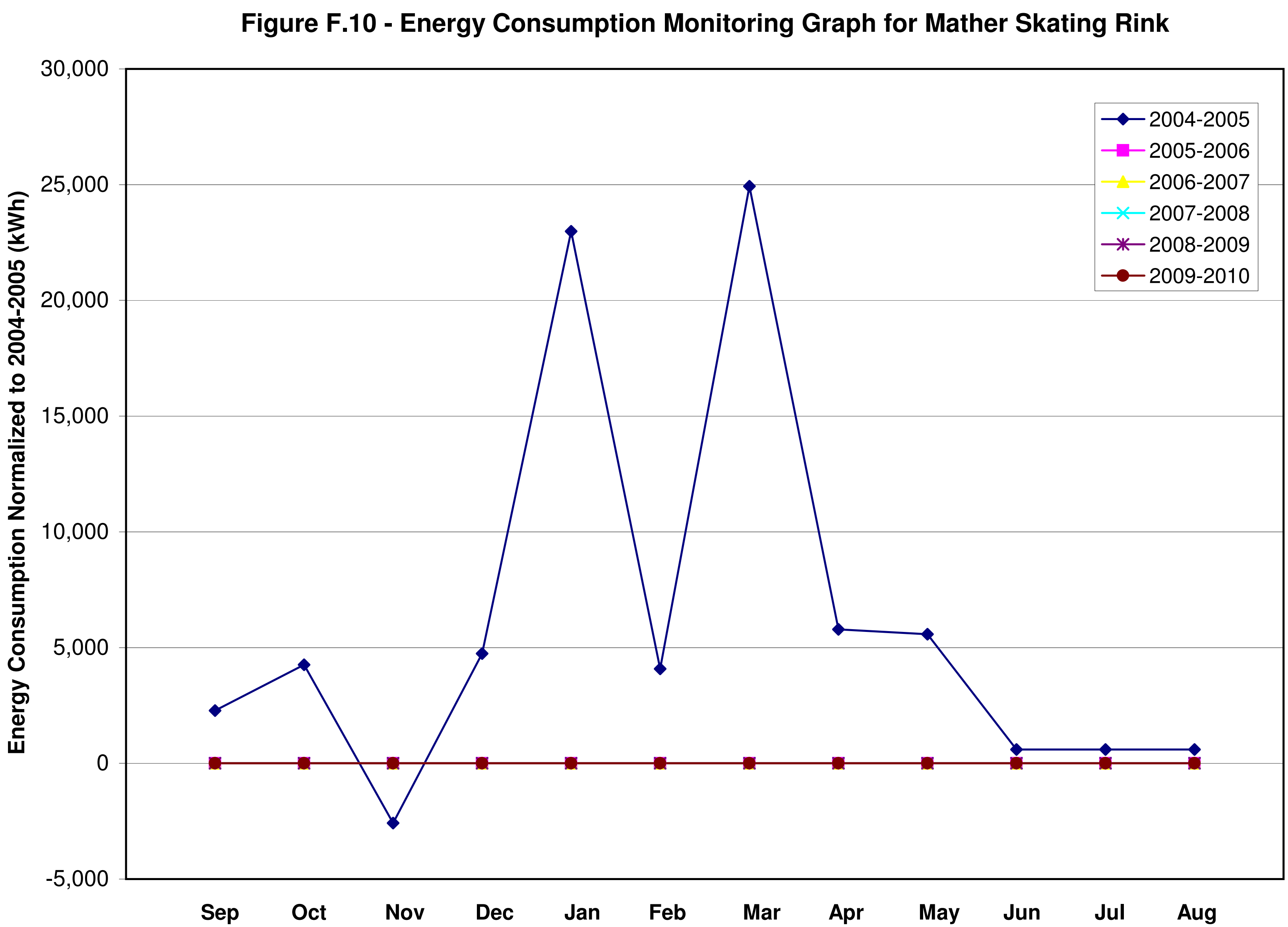


Figure F.10 - Energy Consumption Monitoring Graph for Mather Skating Rink
Energy Consumption Normalized to 2004-2005 (kWh)
30,000
25,000
20,000
15,000
10,000
5,000
0
-5,000
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
2004-2005
2005-2006
2006-2007
2007-2008
2008-2009
2009-2010

Table F.11 - Energy Consumption Monitoring Data for Mather Hall

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Energy Consumption (kWh)**	**HDD (°C days/mo)**	**Energy Normalized to 2004-2005 (kWh)**
September	60	108.8	60			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	2400	347.4	2,400			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	3060	498.2	3,060			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	4920	912	4,920			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	7380	1072.4	7,380			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	4080	800	4,080			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	4440	736.9	4,440			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	2400	299.9	2,400			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	2160	230.1	2,160			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	5700	43.7	5,700			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	1020	21.9	1,020			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	1080	32	1,080			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	38,700	5103.3	38,700	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.11 - Energy Consumption Monitoring Graph for Mather Hall

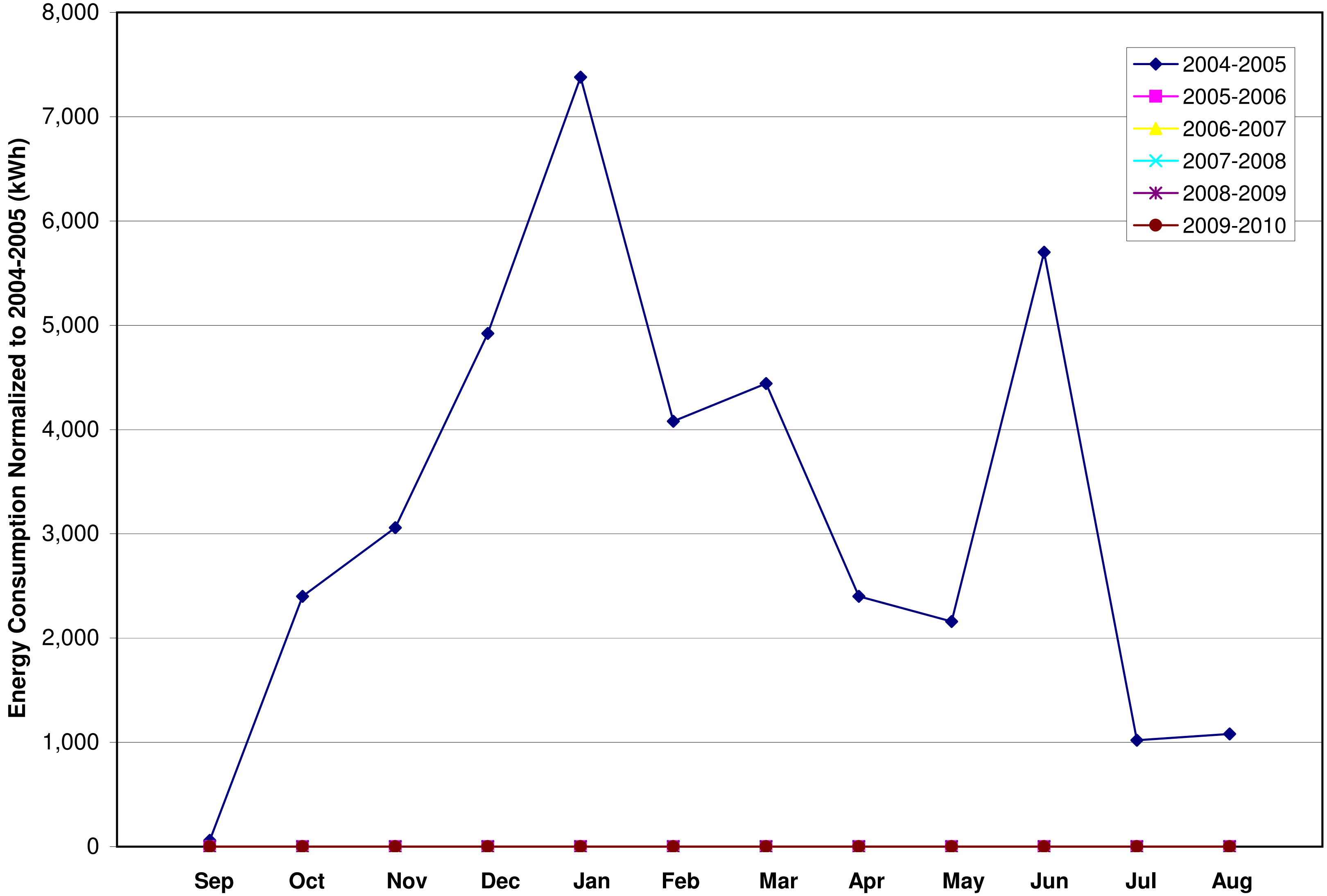


Table F.12 - Energy Consumption Monitoring Data for Recycling Depot

	2004-2005			2005-2006			2006-2007			2007-2008			2008-2009			2009-2010		
Month	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)	Billed Energy Consumption (kWh)	HDD (°C days/mo)	Energy Normalized to 2004-2005 (kWh)
September	300	108.8	300			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
October	0	347.4	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
November	270	498.2	270			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
December	0	912	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
January	400	1072.4	400			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
February	0	800	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
March	350	736.9	350			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
April	0	299.9	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
May	240	230.1	240			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
June	0	43.7	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
July	240	21.9	240			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
August	0	32	0			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!			#DIV/0!
TOTAL	1,800	5103.3	1,800	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/0!	0	0	#DIV/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 Energy Consumption" (in kWh) taken from the hydro bill next to the appropriate month.

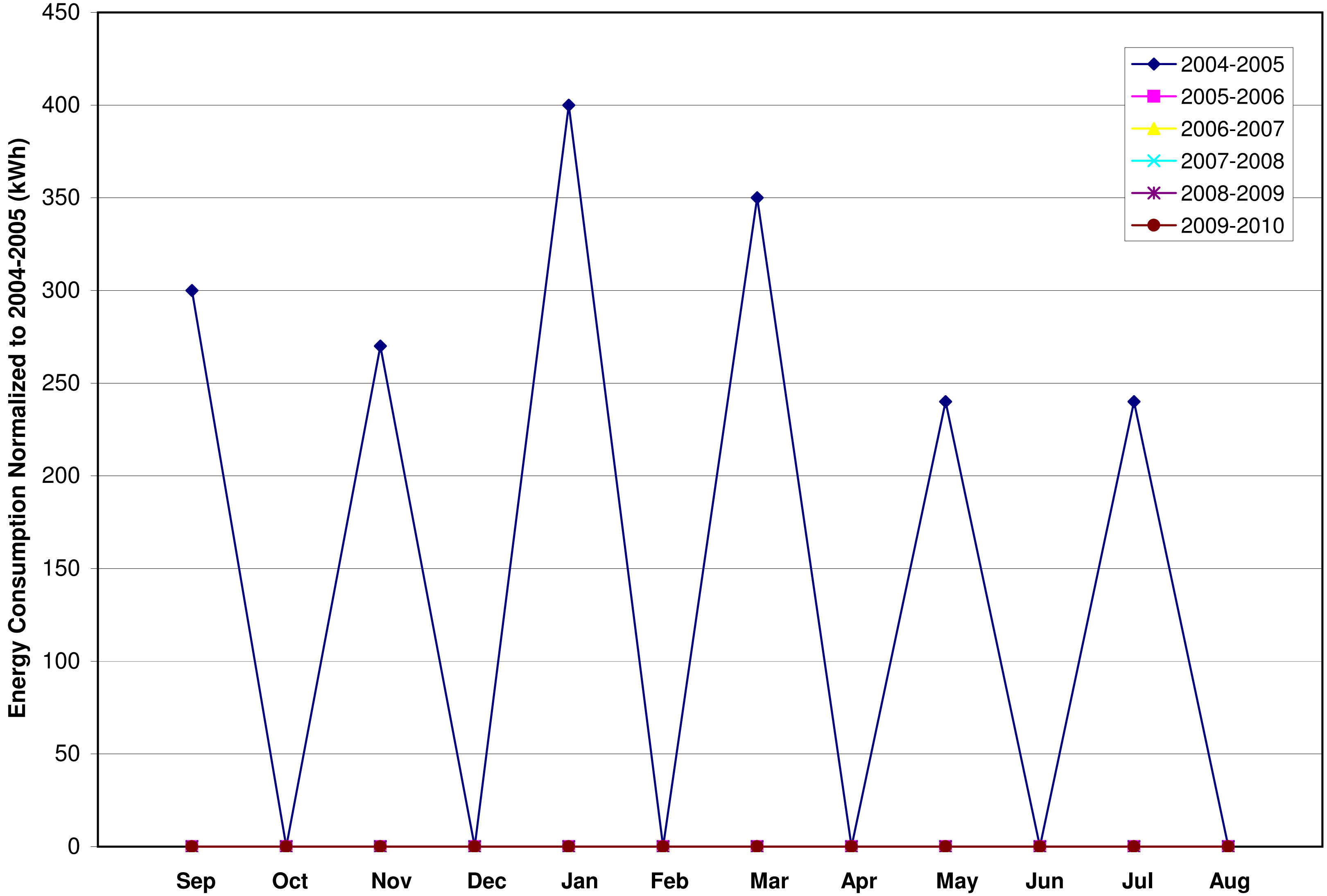
3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8&Day=

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 F26) 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.12 - Energy Consumption Monitoring Graph for Recycling Depot



Environment Canada Environnement Canada

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Daily Data Report for August 2005

Notes on Data Quality.

MORDEN CDA CS
MANITOBA

Latitude: 49° 10' N Longitude: 98° 4' W Elevation: 297.50 m
Climate ID: 5021849 WMO ID: 71564 TC ID: XMD

Daily Data Report for August 2005

Day	Max Temp °C	Min Temp °C	Mean Temp °C	Heat Deg Days C	Cool Deg Days C	Total Rain mm	Total Snow cm	Total Precip mm	Snow on Grnd cm	Dir of Max Gust 10's Deg	Spd of Max Gust km/h
01	32.4	15.3	23.9	0.0	5.9	0.0	0.0	0.0	0		
02	32.7	19.3	26.0	0.0	8.0	0.2	0.0	0.2	0		
03	25.7	16.3	21.0	0.0	3.0	0.0	0.0	0.0	0		
04	25.7	13.9	19.8	0.0	1.8	0.2	0.0	0.2	0		
05	30.6	13.9	22.3	0.0	4.3	0.0	0.0	0.0	0		
06	32.4	17.6	25.0	0.0	7.0	0.0	0.0	0.0	0		
07	31.0	13.2	22.1	0.0	4.1	0.0	0.0	0.0	0		
08	26.8	17.1	22.0	0.0	4.0	0.2	0.0	0.2	0		
09	24.8	11.2	18.0	0.0	0.0	0.0	0.0	0.0	0		
10	25.5	10.5	18.0	0.0	0.0	0.0	0.0	0.0	0		
11	19.7	13.4	16.6	1.4	0.0	6.0	0.0	6.0	0		
12	19.7	11.4	15.6	2.4	0.0	0.0	0.0	0.0	0		
13	20.4	10.6	15.5	2.5	0.0	0.0	0.0	0.0	0		
14	24.4	10.8	17.6	0.4	0.0	0.0	0.0	0.0	0		
15	22.7	13.2	18.0	0.0	0.0	0.0	0.0	0.0	0		
16	22.3	12.6	17.5	0.5	0.0	0.0	0.0	0.0	0		
17	17.9	11.7	14.8	3.2	0.0	9.8	0.0	9.8	0		
18	21.6	15.1	18.4	0.0	0.4	1.4	0.0	1.4	0		
19	23.3	13.4	18.4	0.0	0.4	0.0	0.0	0.0	0		
20	19.9	10.0	15.0	3.0	0.0	0.0	0.0	0.0	0		
21	18.8	7.9	13.4	4.6	0.0	0.0	0.0	0.0	0		
22	22.0	4.8	13.4	4.6	0.0	0.0	0.0	0.0	0		
23	24.8	10.2	17.5	0.5	0.0	0.0	0.0	0.0	0		
24	21.5	14.9	18.2	0.0	0.2	14.2	0.0	14.2	0		
25	24.8	13.9	19.4	0.0	1.4	0.0	0.0	0.0	0		
26	20.2	11.3	15.8	2.2	0.0	0.0	0.0	0.0	0		
27	22.0	12.0	17.0	1.0	0.0	0.0	0.0	0.0	0		
28	21.9	13.2	17.6	0.4	0.0	0.0	0.0	0.0	0		
29	23.3	10.7	17.0	1.0	0.0	0.0	0.0	0.0	0		
30	24.1	9.3	16.7	1.3	0.0	0.0	0.0	0.0	0		
31	18.8	11.2	15.0	3.0	0.0	1.0	0.0	1.0	0		
Sum				**32.0**	**40.5**	**33.0**	**0.0**	**33.0**			
Avg	**23.9**	**12.6**	**18.3**								
Xtrm	**32.7**	**4.8**									

Legend

[empty] = No data available

M = Missing

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APPENDIX G

THE MUNICIPALITIES TRADING COMPANY OF MANITOBA LTD. REPORT

TABLE OF CONTENTS - APPENDIX G

Member Services

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

M.T.C.M.L.

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

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