Belvedere Hotel

Watson Lake, Yukon

Energy + Building Systems Analysis

Energy Upgrading Options 2001

December 2001

Prepared by:

***Energy Analysis** + Design* EA+D

Energy Efficiency, Sustainability and Innovation in Building Design

a joint venture between Kobayashi + Zedda Design Group, Dorward Engineering and Northern Climate Engineering

Commercial Energy Management Program Provided by:

energy solutions centre

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1.0 *INTRODUCTION*

The Belvedere Hotel in Watson Lake was constructed in 1988. The complex consists of the following:

- A two storey section containing the lobby and the reception desk, administration area, a gift shop, meeting rooms, guest rooms, hotel laundry, a lounge, mechanical room, plus storage areas. The total floor area is **1,614 sq. metres** (17,374 sq.ft).
- A single storey wing containing a dining room, a coffee shop, kitchen, tavern, washrooms, and storage areas. Of the **420 sq. metres** (4,521 sq.ft.) in this section, the tavern area amounts to **173 sq. metres** (1,862 sq.ft.).

The wood frame, slab-on-grade structure was built using construction methods typically used in the late 1980's. The 140mm (5.5") exterior wood frame walls are filled with batt insulation (R20), and from the construction drawings, it appears that rigid insulation was applied to the interior of the below-grade concrete foundation walls. The roof over the one and two storey sections have RSI 7.0 (R40) batt insulation in the attic. Exterior siding consists of both vinyl and wood siding. Windows are a combination of wood and vinyl frames with sealed double glazed units.

The building is heated with two propane-fired low pressure boilers in conjunction with baseboard radiant convectors and unit heaters. Ventilation is provided by four indirect-fired rooftop units, plus one direct-fired kitchen make-up air unit, all located on the single storey section. Located on the second floor, two propane-fired furnaces were provided for hallway pressurization. These units have never been used. Make-up air for the two dryers in the Laundry Room occurs through the intemperate combustion air duct and a small electric duct heater, both located in that room. Each guest room is equipped with an exhaust fan. Two small central exhaust systems serve the washroom groups at the lounge, and at the restaurant/ tavern. A propane-fired domestic hot water heater provides domestic hot water.

The two boilers used for the heating system are controlled with an outdoor re-set arrangement, whereby the heating water temperature is approximately 93C (200F) at an ambient air temperature of –40C, reducing to 68C (155F) at an outdoor temperature of –12C (10F). The current reset ratio is 0.9. Rather than using an automatic warm weather shutdown (WWSD), the boilers are manually de-energized during the summer and into the shoulder seasons. Controls in the hotel are standard electric units, using individual thermostats in each guest room. The management and staff are conscious of temperature setback in areas during unoccupied periods.

Currently, the modulating burner on the make-up air unit serving the kitchen is not operating properly and tends to be on full heat or no heat. Given the resulting discomfort, the unit is rarely used. Make-up air for the hood exhaust typically occurs through general air infiltration.

2.0 HISTORICAL ***ENERGY USE***

The electricity consumption totals 254960 kWh per year or 163 kWh per square metre per annum. The propane use of 154977 litres per year is equivalent to 1091038 kWh, or 763 kWh per square foot per annum. While the cost of propane fluctuates throughout the year, a cost per litre of $0.475 has been used for calculations in this report. This equates to an annual cost of $73,614. The total energy consumption at the building is consequently 1345998 kWh, or 926 kWh per square metre per annum. The following tables outline the electricity and propane use at the building.

Electricity Use:

Date	Days	Meas. Demand (kW)	Billed Demand (kW)	Consump. (kWh)	Ave. Daily Consump. (kWh/day)	Cost
0.05.25	0	8	3	21840	728	$3194.59
0.06.23	9	3	3	23040	794	$3351.23
0.07.25	1	3	3	26080	841	$3748.05
0.08.24	0	4	4	23440	781	$3410.95
0.09.25	2	4	4	25200	788	$3640.69
0.10.25	0	4	4	21680	722	$3163.54
0.11.23	9	4	4	20240	698	$2975.57
0.12.22	9	4	4	21520	742	$3266.40
1.01.25	4	4	4	14880	438	$2357.58
1.02.22	8	4	4	16640	594	$2598.47
1.03.26	2	4	4	21280	665	$3233.55
1.04.25	0	4	4	19120	637	$2968.24
Total	***365***			***254,960***	***698***	***$37,908.86***

Propane Use:

Date	**Consumption** *(litres)*	*Date*	**Consumption** *(litres)*
00.03.16	assumed full	00.10.07	4752
00.04.06	2000	00.10.13	2321
00.04.14	2000	00.10.24	4505
00.04.20	3000	00.10.31	1077
00.04.25	2000	00.11.06	4901
00.05.01	3000	00.11.15	7000
00.05.05	4800	00.11.24	4187
00.05.18	4100	00.11.30	674
00.05.24	1434	00.12.06	6157
00.05.29	3500	00.12.18	5800
00.06.02	4000	00.12.28	2000
00.06.08	5000	01.01.12	1600
00.06.15	3132	01.01.16	887
00.06.23	5000	01.01.19	2645
00.07.06	4561	01.01.26	3000
00.07.14	3390	01.02.01	1711
00.07.26	4008	01.02.06	4570
00.07.27	1443	01.02.09	2697
00.08.08	4342	01.02.16	4335
00.08.16	2775	01.02.23	6347
00.08.28	4786	01.03.02	3746
00.09.14	3752	01.03.08	3000
00.09.25	2031	01.03.16	3011
		Total	***154,977 litres***

3.0 *BREAKDOWN OF* ***EXISTING ENERGY USE***

The table on the following page indicates the breakdown of the existing total electricity and propane use by component, based on computer simulation of the building heating requirements and industry standard formulae for domestic hot water use.

Breakdown of Existing Energy Use, By Component:

Annual Energy Input:

Electricity	254960 kWh
Propane	1091038 kWh
Total	***1,345,998 kWh***

Annual Energy Consumption:

Roof	40800 kWh	3%
Main Floor Walls	41860 kWh	3%
Foundation	46350 kWh	3%
Windows	65225 kWh	5%
Doors	4025 kWh	<1%
Infiltration	79380 kWh	6%
Mechanical Ventilation	444120 kWh	32%
Domestic Hot Water	50000 kWh	4%
Summer Electrical Use	75000 kWh	5%
Summer Propane Use, excluding DHW & Vent.	250000 kWh	18%
Chimney Losses	272,760 kWh	20%
Total	***1,370,520 kWh***	***102% of energy use***

*4.0 **ENERGY CONSERVATION** MEASURES & CONCLUSIONS*

The energy conservation measures which follow are recommended for implementation at this building. The measures are presented in ascending order of simple payback period. It should be noted that each measure that is implemented will affect the economics of any subsequent measures. For example, if the heating system efficiency is upgraded, subsequent measures that are designed to save propane will be diminished. If the lighting is upgraded, resulting in additional propane consumption due to reduced internal heat gain from lights, then the effectiveness of measures designed to reduce heating energy consumption will improve.

4.1 Architectural:

Architectural options focus on the upgrade of the existing building envelope. These include the addition of insulation to both the roof and walls. The insulation levels in this building, while adequate, are not up to current standards. Despite the high cost of energy, the somewhat low insulation levels found cannot be economically upgraded at current estimated construction costs and the current value of saved energy. However, If one were to upgrade the exterior of the building by applying new siding, for instance, then the incremental cost of additional insulation might be justified. Another option that has been considered is the replacement of the existing windows with triple glazed units. As noted in the table below, the options suggested have considerable payback periods and are thus not economically feasible.

Measure	Propane Saving (litres)	Value of Propane Saving	Estimated Cost of Measure	Simple Payback Period
Upgrade Walls to R30	3000	$1400	$80,000	**57** years
Replace Windows with Triple Glazed Units (or equal)	5260	$2500	$90,000	**36** years

4.2 Mechanical Measures:

Option 1: Install Low Flow Shower Heads

The showerheads in use throughout the hotel will allow a flow of approximately 30 litres per minute. Showerheads are available which will reduce this flow by about half without sacrificing the quality of the shower. This will result in a substantial saving in the amount of energy used to heat the domestic hot water. Of course, like any product, some work better than others. An independent review or personal opinion may be sought prior to installing new showerheads in each unit. The saving given below has been calculated to result from reducing by one half the hot water that is currently used through shower use.

Estimated Cost:	**$1400** (for 40 heads incl. annex)
Calculated Saving:	**$1,100** (2318 L of propane)
Simple Payback Period:	**1.3 years**

Option2: Install a Wood-fired Boiler

The Owner expressed an interest in installing a self-contained remote boiler outside the mechanical room. If one assumes that the burning wood would displace up to 2/3 of the propane currently used for space heating and domestic hot water heating, calculations indicate that approximately 95 cords would be required. Using a cost of $200/cord for the supply and subsequent handling of the wood results in a cost of $19,000. The propane saved amounts to $29,000. It should be noted that the estimated costs given below include alterations in the mechanical room to accommodate domestic hot water storage tanks and associated piping, trim, etc.

Estimated Cost:	**$30,000**
Calculated Saving:	**$10,000** (21,050 L of propane)
Simple Payback Period:	**2.5 years**

Option 3: Existing Boilers with High Efficiency Propane Boilers

Based on the age and style of the existing three boilers, the estimated seasonal efficiency is 75 percent. These boilers could be replaced with new condensing propane boilers, resulting in a seasonal efficiency of approximately 90 percent. Preliminary calculations indicate that only one of the two heating system boilers is required to heat the building, leaving one for backup. A new modular boiler system consisting of six smaller boilers could result in sufficient capacity, leaving one of these boilers for backup. Since the boiler used for domestic water heating is included in this approach, a heat exchanger/storage tank will be required. One advantage of this option is the opportunity for general repiping of the Mechanical Room. The existing arrangement is poor, allowing for standby losses through the boiler that is not fired. The cost of the renovation will depend on the number and size of the boilers installed, and can only be accurately determined following detailed design, however will be in the order of magnitude given below.

Estimated Cost:	**$50,000**
Calculated Saving:	**$11,040** (23,250 L of propane)

Simple Payback Period: **4.5 years**

Given the relatively high cost of propane, the affect of switching the fuel source from propane to fuel oil was investigated. Using efficiencies of 90% and 80% for propane and fuel oil respectively, calculations indicate that further annual savings of $8200 could be achieved. Extra costs would include a min. 6800 litre aboveground containment fuel tank plus associated piping. The additional costs would be on the order of $15,000, resulting in an incremental simple payback period of 2 years.

4.3 Electrical Measures:

Electrical consumption is comprised of:

- lighting
- kitchen equipment
- propane heater blankets
- car heater receptacles
- general purpose outlets

This report will focus on lighting. It is important to note that the control of the propane heater blankets is thermostatic and must be set to ensure energization at outdoor temperatures below -30°C.

Lighting load consists of approximately:

- 19 T12 strip lights
- 37 four foot recessed and surface mounted T12 fluorescent fixtures
- 554 incandescent lamps (wattage's range from 40 to 60W)

For purposes of calculation, it is assumed that:

- hallway lamps are on 100% of the time.
- room lights are on 25% of the time.
- outdoor lights are on 50% of the time.

Option 1: Upgrade Ext. Lighting From Halogen to High Pressure Sodium.

It is recommended to upgrade eight existing 250 watt halogen lamps with 70 watt high pressure sodium. The pricing includes labour and materials.

Estimated Cost:	**$1280**
Calculated Saving:	**$853** (5800 kWh elec.)
Simple Payback Period:	**1.5** years

Option 2: Upgrade Incandescent Lighting.

It is recommended that most of the existing incandescent lamps be replaced with compact fluorescent lamps. A room-by-room assessment should be done to determine which rooms to re-lamp and which to leave. For example, rooms, which have the pot lights rarely if ever used, would not be good candidates. Compact fluorescent lamps are not available with dimmable ballasts - relamping should not be done on any fixture that requires a variable light output. The cost and saving below assumes the replacement of all 554 lamps, with an average saving of 70 percent of the current incandescent lamp consumption.

Estimated Cost:	**$20,500**
Calculated Saving:	**$11,494** (79269 kWh, less 11,250 L propane)
Simple Payback Period:	**3.3 years**

Option 3: Change All T12 Fluorescent Lamps to Electronic Ballast T8 Fixtures.

It is recommended to replace the existing T12 lamps with surface mounted, strip lights, and recessed ceiling fixtures, as applicable.

Estimated Cost:	**$6,050**
Calculated Saving:	**$783** (10,103 kWh elec. less 1,435 L. propane)
Simple Payback Period:	**7.8 years**

Option 4: Install Motion Detectors at Back Hallway for Interior Lighting Control.

It is recommended to install motion detectors to control the lighting in the back corridor.

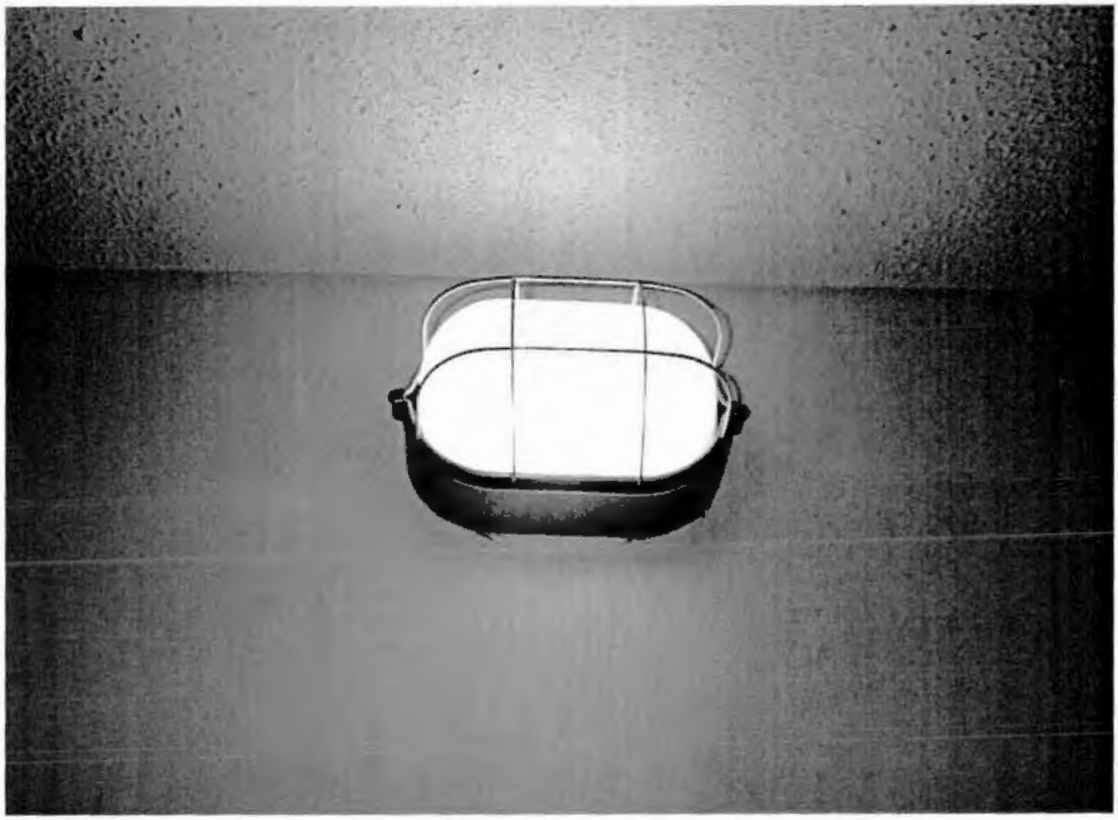
Estimated Cost:	**$730**
Calculated Saving:	**$86** (1,110 kWh elec. less 158 L. of propane)
Simple Payback Period:	**8.5 years**

5.0 APPENDICES

APPENDIX A: *Photo Documentation*

Photograph One
Banquet room 40W incandescent bulb to be replaced with 7W compact fluorescent.

Photograph Two
Lobby 40W incandescent light bulb to be replaced with 7W fluorescent.

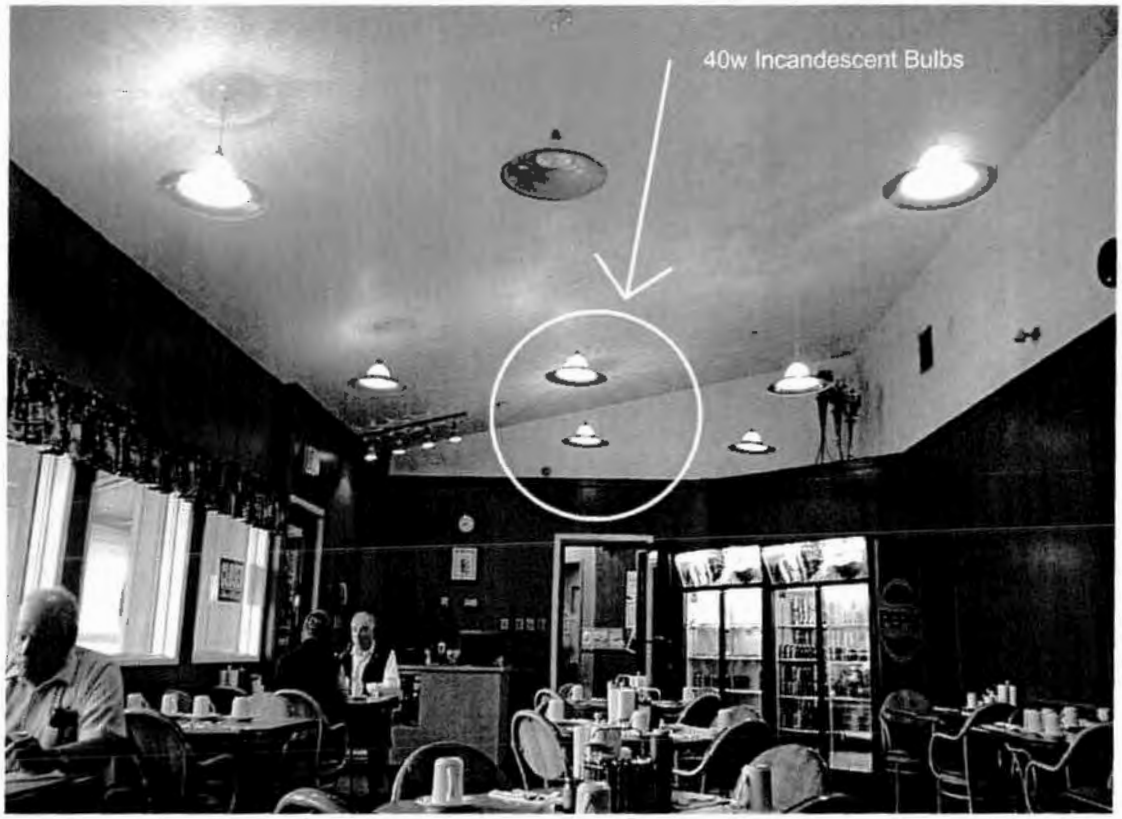


Photograph Three
Upper Hallway 40W incandescent to be replaced with 7W compact fluorescent.

Photograph Four
Lower hallway 40W incandescent to be replaced with 7W compact fluorescent.

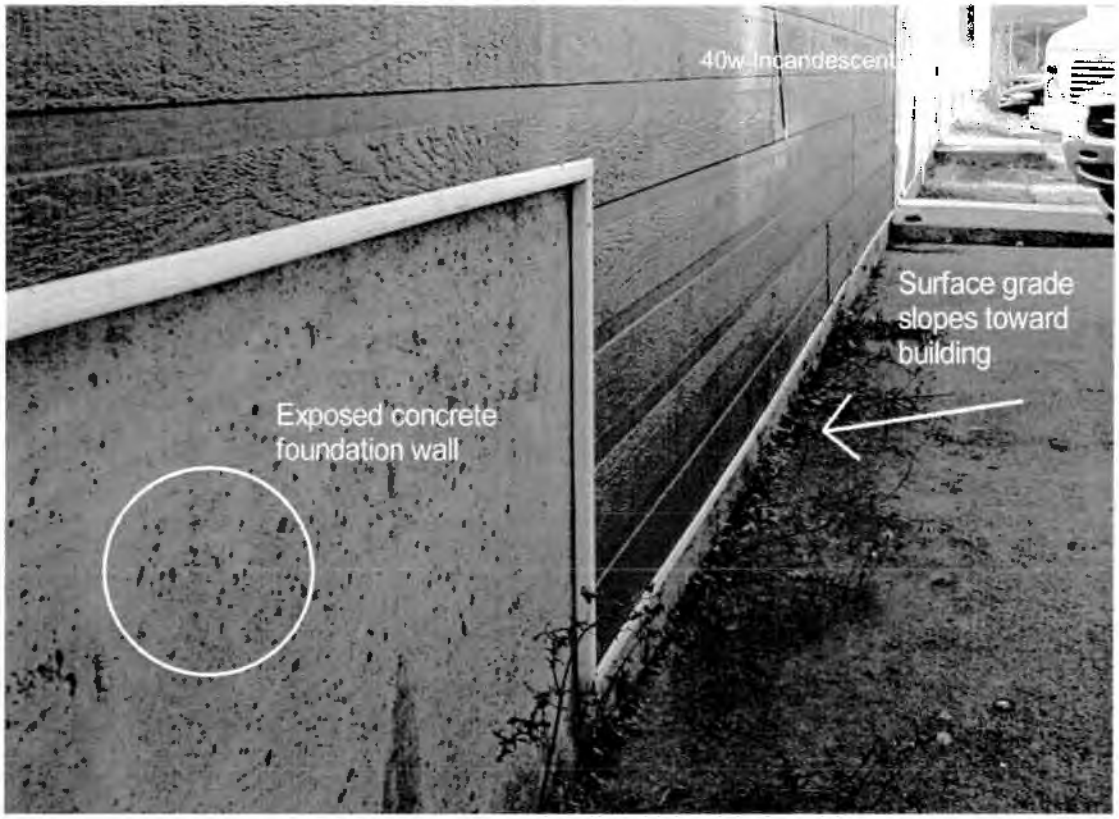
Photograph Five
Outside 250W quartz halogen to be replaced with 70W high pressure sodium.

Photograph Six
Office 4 lamp T12 fixture to be replaced with 2 lamp T8 fixture.



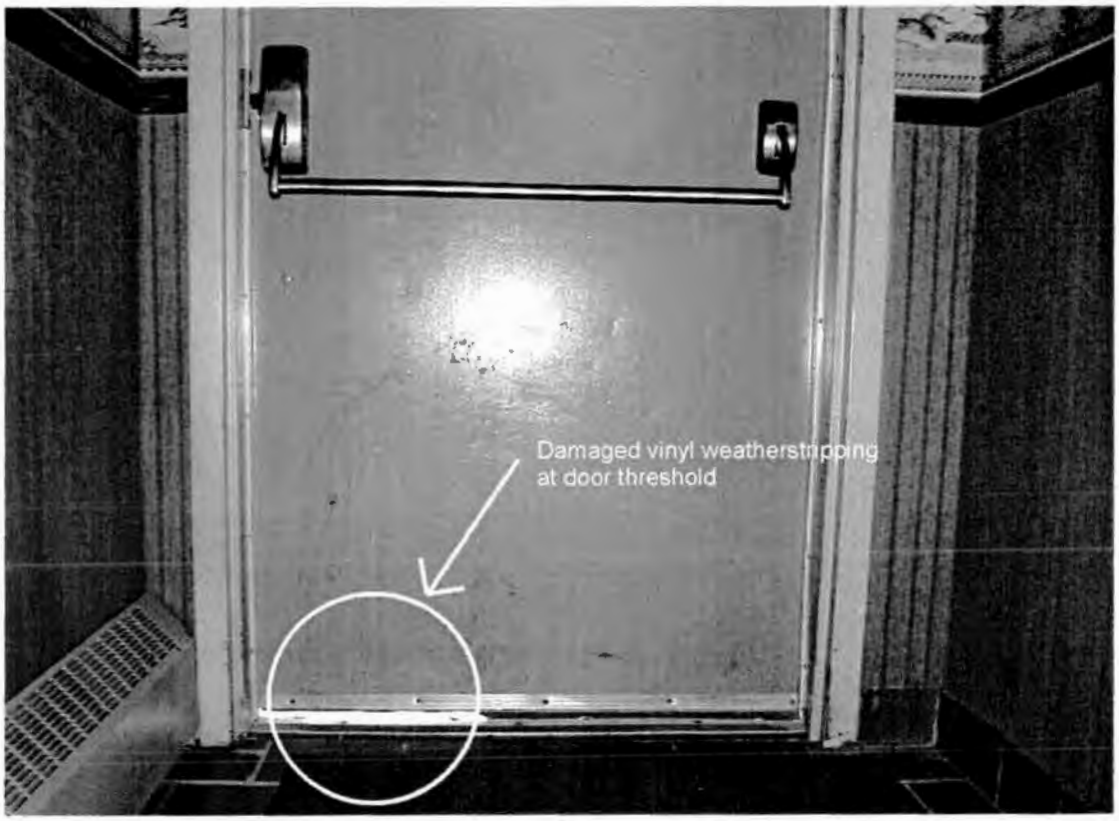
Photograph Seven
Restaurant 40W incandescent to be replaced with 7W compact fluorescent.

Photograph Eight
Stairwell T12 fixture to be replaced with T8 fixture.

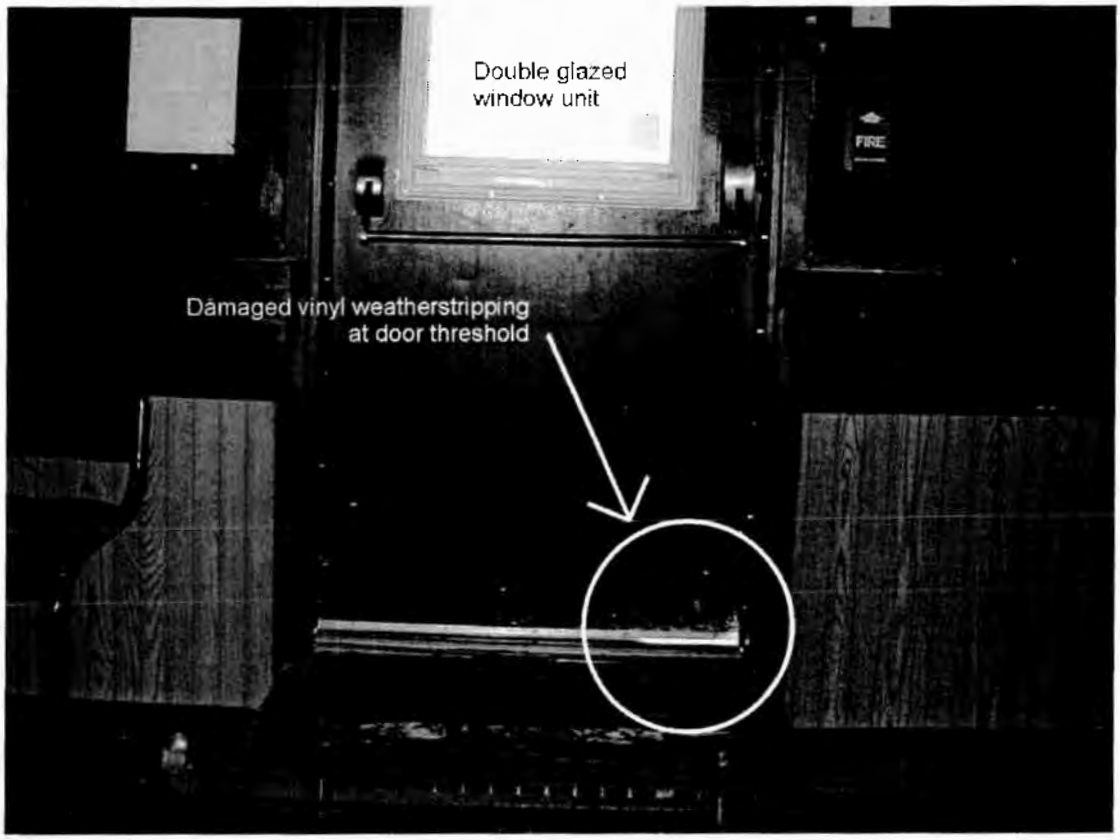


Photograph Nine
Exterior foundation wall could benefit from externally applied rigid foam insulation (50mm - R12)

Photograph Ten
Exterior foundation wall could benefit from externally applied rigid foam insulation (50mm - R12)



Photograph Eleven
Air infiltration at exterior exit door



Photograph Twelve
Air infiltration at exterior exit door

Photograph Thirteen
Hotel exterior window - windows could be replaced with double low-e, triple glazed units.

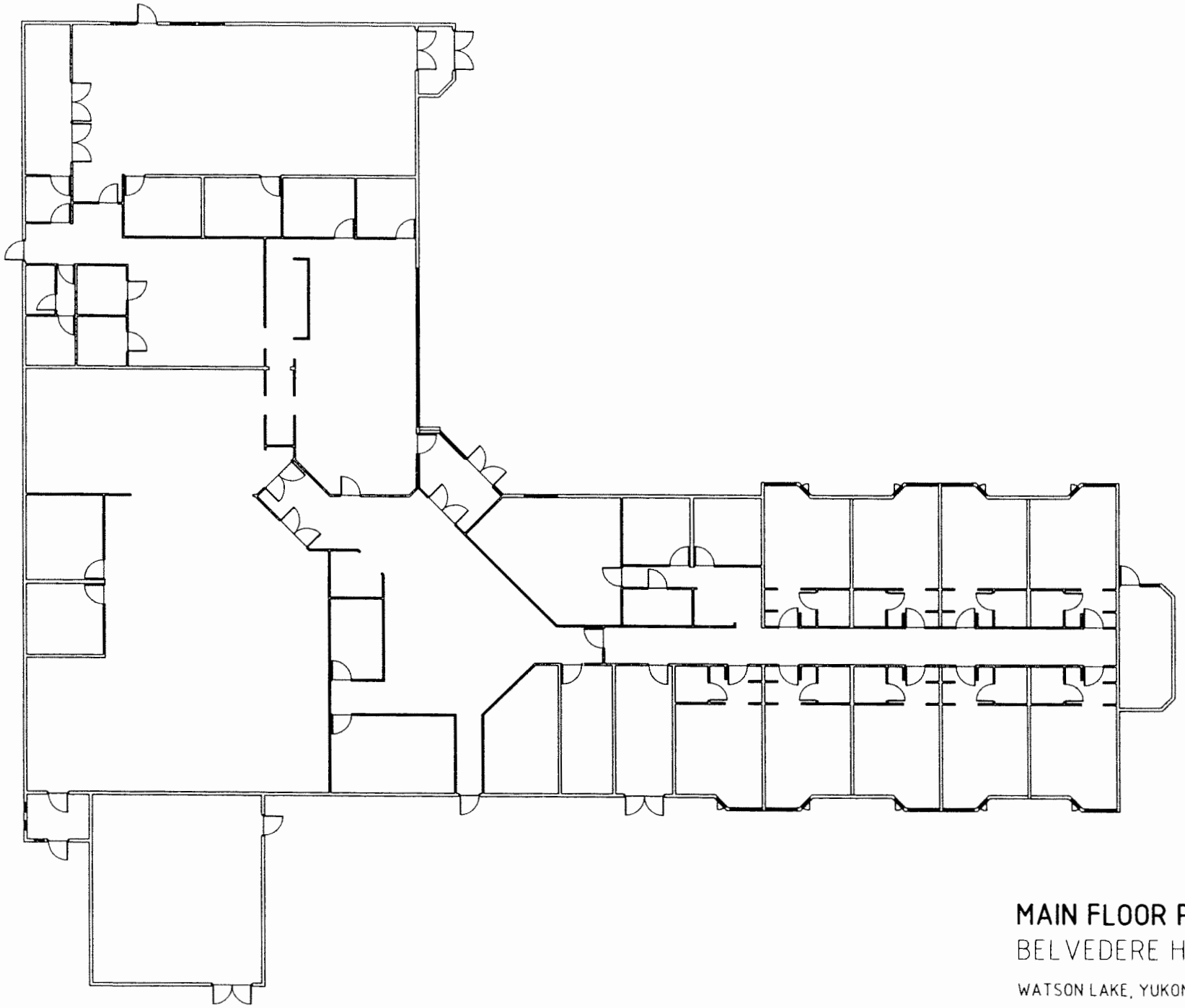
Photograph Fourteen
Hotel Component - Adequate levels of fibreglass batt insulation in roof attic area (R40)

APPENDIX B: *Architectural Data & Building Floor Plan*

Total Elevation Surface Areas of Wall + Glazing.

Belvedere Hotel	***Sq ft***
North wall (NET)	1793
North glazing	191
South wall (NET)	1817
South glazing	34
East wall (NET)	2810
East glazing	367
West wall (NET)	2133
West glazing	457

Tavern	***Sq ft***
North wall (NET)	190
North glazing	0
South wall (NET)	253
South glazing	0
East wall	(N/A)
East glazing	(N/A)
West wall (NET)	525
West glazing	19



ALASKA HIGHWAY

MAIN FLOOR PLAN

BELVEDERE HOTEL

WATSON LAKE, YUKON

KOBAYASHI + ZEDDA DESIGN GROUP

APPENDIX C: *Mechanical Report Data*

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*****************************************
*                                       *
*              HOT2000                  *
*           Version 8.600               *
*              CANMET                   *
*       Natural Resources CANADA        *
*            Jun  1, 2001               *
*         Reg. # H2K-8600-000           *
*****************************************
```

File = Belvedere.hdf

Application type : General

Weather Data for WHITEHORSE, YUKON TERRITORY

Builder Code =
Data Entry by: F.Smith Date of entry 03/11/2001
Company: Northern Climate Eng.

Client name: Belvedere Hotel
Street address: Alaska Highway
City: Watson Lake Region: Yukon
Postal code: Telephone: 536-7712

Mailing address: Po Box 370
City: Watson Lake Region: Yukon
Postal code: Y0A 1C0

*** GENERAL HOUSE CHARACTERISTICS ***

House type: Single detached
Number of storeys: Two storeys
Plan shape: L shape
Front orientation: South
Year House Built: 1980-89
Wall colour: Blue 0.51 Absorptivity: .510
Roof colour: Medium brown 0.84 Absorptivity: .840

Soil Condition: Normal conductivity: dry sand, loam, clay

Water Table Level: Normal (7-10 m, 23-33 Ft)

House Thermal Mass Level: (A) Wood frame construction, 12.5 mm (0.5 in.) gyproc walls and ceiling, wooden floor

Effective mass fraction 1.000

Occupants : 0 Adults for 50.0 % of the time
0 Children for 50.0 % of the time
0 Infants for .0 % of the time

Sensible Internal Heat Gain From Occupants = .00 kWh/day

*** HOUSE TEMPERATURES ***

Heating Temperatures	Main Floor	= 69.8 F
	Basement	= 68.0 F
	TEMP. Rise from 69.8 F	= 5.0 F

Indoor design temperatures for equipment sizing

Heating	= 71.6 F
Cooling	= 75.2 F

*** WINDOW CHARACTERISTICS ***

Label	Location	#	Overhang Width Ft	Header Height Ft	Tilt deg	Curtain Factor	Shutter R
Southeast							
Upper,large	Hotel SE	8	2.00	1.00	90.0	.00	.00
Upper,small	Hotel SE	8	2.00	1.00	90.0	.00	.00
lower,large	Hotel SE	5	.00	.00	90.0	.00	.00
lower,small	Hotel SE	5	.00	.00	90.0	.00	.00
Northeast							
Window - 2	RestDine NE	5	1.00	2.00	90.0	.00	.00
Window - 2	Hotel NE	1	2.00	1.00	90.0	.00	.00
Northwest							
Ground,Large	Hotel NW FHt	4	.00	.00	90.0	.00	.00
Ground,lower	Hotel NW FHt	4	.00	.00	90.0	.00	.00
Tavern	Tavern NW	5	.00	.50	90.0	1.00	.00
Upper,large	Hotel NW FHt	7	2.00	1.00	90.0	.00	.00
Upper,small	Hotel NW upper	5	2.00	1.00	90.0	.00	.00
Upper,large	Hotel NW upper	5	2.00	1.00	90.0	.00	.00
Upper,small	Hotel NW FHt	7	2.00	1.00	90.0	.00	.00
front door	Hotel NW FHt	3	2.00	1.00	90.0	.00	.00

Label	Type	Window #	Window Width Ft	Window Height Ft	Total Area Ft	Window R	SHGC
Southeast							
Upper,large	Hotel,large	8	6.00	3.00	144.00	1.546	.6961
Upper,small	Upper small	8	2.00	3.00	48.00	1.349	.6555
lower,large	lower,large	5	6.00	3.00	90.00	1.546	.6961
lower,small	lower,small	5	2.00	3.00	30.00	1.349	.6555
Northeast							
Window - 2	Window 2	5	5.00	6.00	150.00	1.648	.7129
Window - 2	Window 3	1	8.00	5.00	40.00	1.682	.7181

Northwest							
Ground,Large	Lower,ground	4	6.00	3.00	72.00	1.546	.6961
Ground,lower	Ground,lower	4	2.00	3.00	24.00	1.349	.6555
Tavern	Tavern	5	6.00	6.25	187.50	1.681	.7180
Upper,large	Window Room	7	6.00	3.00	126.00	1.546	.6961
Upper,small	Upper,small	5	2.00	3.00	30.00	1.349	.6555
Upper,large	Upper, large	5	6.00	3.00	90.00	1.546	.6961
Upper,small	Upper,small	7	2.00	3.00	42.00	1.349	.6555
front door	front entry	3	2.50	6.67	50.00	1.510	.6896

*** Window Code Schedule ***

Name	Internal Code	Description (Glazings, Coatings, Fill, Spacer, Type, Frame)
Hotel,large	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Upper small	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
lower,large	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
lower,small	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Window 2	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Window 3	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Lower,ground	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Ground,lower	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Tavern	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Window Room	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Upper,small	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
Upper, large	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55
front entry	200000	Double/Double with 1 coat, Clear, 13 mm Air, Metal, Picture, Aluminum, ER* = -31.1, Eff. R= 1.55

* Window Standard Energy Rating estimated for assumed dimensions, and
Air tightness type: CSA - A1; Leakage rate = 2.79 m3/hr/m

*** BUILDING PARAMETER DETAILS ***

CEILING COMPONENTS

	Construction Type	Code Type	Roof Slope	Heel Ht. Ft	Section Area Ft2	R-Value R
Hotel	Attic/Gable	User specified	4.00/12	1.00	8685.00	40.00
Rest/Dining	Cathedral	User specified	2.00/12	1.00	2669.00	15.00
Tavern	Cathedral	User specified	2.00/12	1.00	1861.00	15.00

MAIN WALL COMPONENTS

Label	Lintel Type	Fac. Dir	Number of Corn.	Number of Inter.	Height Ft	Perim. Ft	Area Ft2	R-Value R
Hotel NE								
Type: User specified	N/A	NE	1	0	20.00	57.0	1140.00	20.00
Hotel NW FHt								
Type: User specified	N/A	NW	1	0	20.00	117.0	2340.00	20.00
Hotel NW upper								
Type: User specified	N/A	NW	1	0	8.00	62.0	496.00	20.00
Hotel SE								
Type: User specified	N/A	SE	2	0	20.00	181.0	3620.00	20.00
Hotel SW								
Type: User specified	N/A	SW	1	1	20.00	75.0	1500.00	20.00
RestDine NE								
Type: User specified	N/A	NE	1	0	10.00	40.0	400.00	20.00
RestDine SW								
Type: User specified	N/A	SW	0	1	10.00	42.0	420.00	20.00
Tavern NE								
Type: User specified	N/A	NE	1	1	10.00	28.0	280.00	20.00
Tavern NW								
Type: User specified	N/A	NW	1	1	10.00	69.0	690.00	20.00
Tavern SW								
Type: User specified	N/A	SW	0	1	10.00	34.0	340.00	20.00

DOORS

Label	Type	Height Ft	Width Ft	Gross Area Ft2	R-value R
Door Loc: Hotel NE	Specified RSI/R	6.79	3.00	20.37	5.00
Door Loc: Hotel SW	Specified RSI/R	6.79	3.00	20.37	5.00
Door Loc: Hotel SE	Specified RSI/R	6.79	12.00	81.50	5.00
Door Loc: Hotel NW FHt	Specified RSI/R	6.79	3.00	20.37	5.00
Door Metal Loc: RestDine SW	Specified RSI/R	6.79	3.00	20.37	5.00
Tavern Loc: Tavern NE	Specified RSI/R	6.79	6.00	40.75	5.00
Tavern Rear Loc: Tavern SW	Specified RSI/R	6.79	3.00	20.37	5.00

FOUNDATIONS

Foundation - 1

Foundation type : Slab on Grade
Data Type : Library
Attached to : Not applicable
Attachment length: .00 Ft

Thermal break R-value : 10.00 R
Skirt R-value : 10.00 R

Rectangular
Floor length : 264.00 Ft
Floor width : 50.00 Ft

Added to slab type : R-value : .00 R

Configuration: SCN_7
- concrete or soil (for crawl space) floor
- thermal break around edge of slab
- vertical skirt extends from bottom of slab
- first storey is non-brick veneer or bricks thermally broken from concrete floor

Roof Cavity Inputs

Gable Ends Total Area 964.0 Ft2
Sheathing Material: Plywood/Part. bd 9.5 mm (3/8 in) .47 R
Exterior Material: Hollow metal/vinyl cladding .62 R

Sloped Roof Total Area 9153.9 Ft2
Sheathing Material: Plywood/Part. bd 12.7 mm (1/2 in) .63 R
Roofing Material: Asphalt shingles .44 R

Total cavity volume 55016.6 Ft3 Ventilation rate .50 ACH/hr

*** BUILDING PARAMETERS SUMMARY ***

Component	Area (Ft2) Gross	Area (Ft2) Net	Effective R	Heat Loss Mil.BTU	% Annual Heat Loss
ZONE 1 : ABOVE GRADE					
Ceiling	13215.00	13215.00	25.46	157.927	14.67
Main Walls	11226.00	9878.39	20.00	162.322	15.08
Doors	224.11	224.11	5.00	15.618	1.45
Southeast windows	312.00	312.00	1.49	72.875	6.77
Northeast windows	190.00	190.00	1.65	40.011	3.72
Northwest windows	621.50	621.50	1.55	140.100	13.01
Slab on Grade	13200.00	13200.00	-	179.797	16.70
		ZONE 1 Totals:		768.650	71.40

Ventilation

House Volume	Air Change	Heat Loss Mil.BTU	% Annual Heat Loss
219000.0 Ft3	.177 ACH	307.903	28.60

*** AIR LEAKAGE AND VENTILATION ***

Building Envelope Surface Area = 37641.0 Ft2
Air Tightness Level is Present (3.57 ACH @50 Pa.)

Terrain Description		Height	Ft
@ Weather Station :	Open flat terrain, grass	Anemometer	32.8
@ Building site :	City centre	Bldg. Eaves	19.0

Local Shielding- Walls: Light local shielding
Flue : Light local shielding

Leakage Fractions - Ceiling: .200 Walls: .600 Floors: .200

Estimated Equivalent Leakage Area @ 10 Pa.	= 1216.0	in2
Normalized Leakage Area @ 10 Pa.	= .0323	in2/ft2
Estimated Airflow to cause a 5 Pa Pressure Difference	= 1056	cfm
Estimated Airflow to cause a 10 Pa Pressure Difference	= 1657	cfm
ELA used to calculate Estimated Airflows	= 486.4	in2

*** ANNUAL SPACE HEATING SUMMARY ***

Design Heat Loss at -41.8 F	=	1.89 BTU/hr/Ft3	=413190. BTU/hr
Gross Space Heat Loss			=******* Mil.BTU
Gross Space Heating Load			=******* Mil.BTU
Usable Internal Gains			= 13.015 Mil.BTU
Usable Internal Gains Fraction			= 1.2 %
Usable Solar Gains			=116.461 Mil.BTU
Usable Solar Gains Fraction			= 10.8 %
Auxiliary Energy Required			=947.076 Mil.BTU
Space Heating System Load			=947.076 Mil.BTU
Furnace/Boiler Seasonal efficiency			= 100.0 %
Furnace/Boiler Annual Energy Consumption			=947.076 Mil.BTU

*** BASE LOADS SUMMARY ***

	kwh/day	Annual kWh
Interior Lighting	.0	.0
Appliances	11.0	4015.0
Other	.0	.0
Exterior use	.0	.0
Total Average Electrical Load	11.0	4015.0

*** ENERGY CONSUMPTION SUMMARY REPORT ***

Estimated Annual Space Heating Energy Consumption	=	999218. MJ	=277560.7 kWh
Ventilator Electrical Consumption: Heating Hours	=	0. MJ	= .0 kWh
Estimated Annual DHW Heating Energy Consumption	=	0. MJ	= .0 kWh
ESTIMATED ANNUAL SPACE + DHW ENERGY CONSUMPTION	=	999218. MJ	=277560.7 kWh

Estimated Greenhouse Gas Emissions 150054. kg/Year

*** ESTIMATED ANNUAL FUEL CONSUMPTION SUMMARY ***

Fuel	Space Heating	Space Cooling	DHW Heating	Appliances	Total
Electricity (kWh)	277560.6	.0	.0	4015.0	281575.6

****

Energy units: MIL.BTU = Million British Thermal Units (3413 BTU = 1 kWh)

The calculated heat losses and energy consumptions are only estimates, based upon the data entered and assumptions within the program. Actual energy consumption and heat losses will be influenced by construction practices, localized weather, equipment characteristics and the lifestyle of the occupants.

APPENDIX D: *Electrical Report Data*

Building Energy Management Report

Belvedere Motor Hotel

Watson Lake, Yukon

Electrical Audit conducted by:

Dorward Engineering Services Ltd

Whitehorse, Yukon

September 19 , 2001

Belvedere Motor Hotel

Potential Energy Cost Savings Summary

Lighting

Estimated Cost:	$28,566	Payback:	2.1	years	
Estimated Savings:	$13,812	Elec. Saving:	78,643	kWh	23.996 kW

Energy Analysis Summary

	Electricity		
	($)	(kW)	(kWh)
Before Measures Implemented:	$ 19,887	33	114,480
Est. Savings:	13,812	24	78,643
% Saving:	69.5	73.8	68.7

Fluorescent Lighting

Project Description:

Upgrade interior lighting as follows:

- replace all existing T12 fixtures with new electronic ballast T8 fixtures

Cost Breakdown:

Materials:		
T8 surface mounted 1x4 Fixtures (33 @ $71 each)	$	2,343
T8 8' Strip Lights (8 @ $75 each)	$	600
T8 4' Strip Lights (11 @ $42 each)	$	495
T8 T-bar Fixtures (5 @ $68 each)	$	340
Subtotal:	$	3,778
Labour:		
Installation: 57 fixtures @ 2/3 hour each and $60 per hour	$	2,280
Subtotal:	$	2,280
Total Cost:	$	6,058
Total Saving:	$	1,465
Payback:		4.14 years

Incandescent Lighting

Project Description:

Upgrade interior lighting as follows:

- replace all existing incandescent light lamps with self ballasted compact fluorescent lamps (excluding outdoor and bar fixtures)

Cost Breakdown:

Materials:	
Replacement for Incandescent lamps (554 @ $22)	$ 12,188
Subtotal:	$ 12,188
Labour:	
Installation: 554 fixtures @ 1/4 hour each and $60 per hour	$ 8,310
Subtotal:	$ 8,310
Total Cost:	$ 20,498
Total Saving:	$ 11,494
Payback:	1.78 years

Back Stairwell Lighting

Project Description:

Upgrade interior lighting as follows:

- Add two motion sensors to back hallway

Cost Breakdown:

Materials:		
2 motion sensors @ 245 each	$	490
Subtotal:	$	490
Labour:		
Installation: 2 sensors @ 2 hour each and $60 per hour	$	240
Subtotal:	$	240
Total Cost:	$	730
Total Saving:	$	161
Payback:		4.54 years

Outside Lighting

Project Description:

Upgrade exterior lighting as follows:

- Replace existing 250W halogen lights with 70W high pressure sodium

Cost Breakdown:

Materials:		
8 high pressure sodium fixtures @ $100 each	$	800
Subtotal:	$	800
Labour:		
Installation: 8 fixtures @ 1 hour each and $60 per hour	$	480
Subtotal:	$	480
Total Cost:	$	1,280
Total Saving:	$	853
Payback:		1.50 years

Belvedere Motor Hotel

Lighting -- Electricity Use and Demand for Energy Balance & Savings Calculations

Area	#	kW Before	Total kW Before	kW After	Total kW After	Time Before (Hrs/ Wk)	Time After (Hrs/ Wk)	Time (Wks)	Cost/ kW ($)	Cost/ kWh ($)	El. Use Before (kWh)	El. Cost Use & Demand ($)	El. Use Saving ($)	El. Use Saving (kWh)	El. Saving (kW) ($)	El. Saving Total ($)
Main Stairwell																
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	3	0.080	0.240	0.060	0.180	168	168	52	7.49	0.1482	2,097	332	78	524	5	83
Restaurant																
Replace 40w incandescent with 7W compact fluorescent	11	0.040	0.440	0.007	0.077	126	126	52	7.49	0.1482	2,883	467	352	2,378	33	385
Washrooms (Restaurant)																
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	2	0.080	0.160	0.060	0.120	126	126	52	7.49	0.1482	1,048	170	39	262	4	42
Replace 60W incandescent with 11W compact fluorescent	2	0.060	0.120	0.011	0.022	126	126	52	7.49	0.1482	786	127	95	642	9	104
Lobby																
Replace 40W incandescent with 7W compact fluorescent	39	0.040	1.560	0.007	0.273	168	168	52	7.49	0.1482	13,628	2,160	1,666	11,243	116	1,782
Replace 60W incandescent with 11W compact flurescent	1	0.060	0.060	0.011	0.011	168	168	52	7.49	0.1482	524	83	63	428	4	68
Gift Shop																
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	1	0.080	0.080	0.060	0.060	126	126	52	7.49	0.1482	524	85	19	131	2	21
Lower Hallway																
Replace 40W incandescent with 7W compact fluorescent	7	0.040	0.280	0.007	0.049	168	168	52	7.49	0.1482	2,446	388	299	2,018	21	320
Upper Hallway																
Replace 40W incandescent with 7W compact fluorescent	12	0.040	0.480	0.007	0.084	168	168	52	7.49	0.1482	4,193	665	513	3,459	36	548
Electrical Room																
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	4	0.080	0.320	0.060	0.240	28	28	52	7.49	0.1482	466	98	17	116	7	24
Motel Rooms																
Replace 60W incandescent with 11W compact fluorescent	48	0.060	2.880	0.011	0.528	28	28	32	7.49	0.1482	2,580	641	312	2,107	211	524
Replace 40W incandescent with 7W compact fluorescent	16	0.040	0.640	0.007	0.112	28	28	32	7.49	0.1482	573	143	70	473	47	118
Kitchen																
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	17	0.080	1.360	0.060	1.020	140	140	52	7.49	0.1482	9,901	1,590	367	2,475	31	397
Replace 60W incandescent with 11W compact fluorescent	3	0.060	0.180	0.011	0.033	140	140	52	7.49	0.1482	1,310	210	159	1,070	13	172
Banquet Room																
Replace 40W incandescent with 7W compact fluorescent	26	0.040	1.040	0.007	0.182	56	56	52	7.49	0.1482	3,028	542	370	2,498	77	447
Laundry Room																
Replace 2 T-12 tubes with 2 T-8 tube & IS ballast	2	0.080	0.160	0.060	0.120	126	126	52	7.49	0.1482	1,048	170	39	262	4	42
Staff Room																
Replace 60W incandescent with 11W compact fluorescent	4	0.060	0.240	0.011	0.044	126	126	52	7.49	0.1482	1,572	255	190	1,284	18	208

Belvedere Motor Hotel

Lighting -- Electricity Use and Demand for Energy Balance & Savings Calculations

Area	#	kW Before	Total kW Before	kW After	Total kW After	Time Before (Hrs/ Wk)	Time After (Hrs/ Wk)	Time (Wks)	Cost/ kW ($)	Cost/ kWh ($)	El. Use Before (kWh)	El. Cost Use & Demand ($)	El. Use Saving ($)	El. Use Saving (kWh)	El. Saving (kW) ($)	El. Saving Total ($)
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