

Energy, Water and Waste Management Inventory of Backcountry Facilities: A Pilot-Study



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May 23, 2008

Acknowledgements

We wish to thank the following people who made this research possible:

- Karen Rollins of *BEES* for her capable contract supervision and friendly guidance.
- Carl Hannigan of the *Alpine Club of Canada*, Gerry Israelson of *Parks Canada*, and Glenn Campbell of *BC Parks* for their constructive contributions to the steering committee
- Members of the *Selkirk College Research Ethics Committee* for their careful review of the research methodology.

Thank you to the anonymous lodge and hut operators who took the time to answer our survey questions. Their contribution to this study and their on-going efforts to use responsible technologies for energy, water and waste management contribute to healthy mountain environments.

Table of Contents

Acknowledgements.....	i
Introduction.....	1
Goals	1
Study Area	2
Results.....	4
Facility Inventory	4
Elevation	4
Number of facilities	5
Physical description of location	5
Energy, Water and Waste Management.....	5
Literature Review.....	5
Manufacturers	6
Organizations	6
Backcountry Sanitation Manual – The Appalachian Trail Conference	8
The Australian Alps Best Practice Human Waste Management Workshop.....	9
Capturing Rainwater	11
Wood Pellets	11
Solar Water Treatment.....	11
Results of the Pilot Study Process	12
Participation	12
Conducting the Questionnaire.....	12
Results of Questionnaire	13
Drinking Water	13
Water Sources	15
Water Treatment	15
Wastewater.....	16
On-site Treatment	19
Removing Wastewater	20
Energy.....	21
Wood and Propane.....	24
Additional Responses.....	26
Discussion and Recommendations	28
The Process	28
The Product.....	30
Water, Energy and Waste Treatment Data	31
Grey Water.....	31
Black Water	31
Energy.....	31
Potable Water Treatment	31
Micro-hydro	31
Solar Photovoltaic.....	32
Septic Systems	32
Conclusions.....	33
Study Process	33

Successful Technologies	33
Technological Shortcomings	34
Further Research	35
Additional Recommendations.....	35
References.....	36
Appendix 1. Facility Inventory	37
Appendix 2. Cover letter, Consent form and Survey.....	45
Appendix 3. Recommended Contractors or Manufacturers	58

List of Tables

Table 1: Summary of Drinking Water Results	14
Table 2: Summary of Wastewater Management.....	17
Table 3: Summary of Energy Results	22

Introduction

The mountainous backcountry of British Columbia and Alberta is recognized as an internationally significant outdoor recreation destination. Much of this recreational use is supported by the many commercial and non-commercial lodges, huts and cabins located throughout these mountainous areas.

Backcountry facilities continue to be built in British Columbia and Alberta and many of the current lodges are experiencing heavy use. The majority of the backcountry facilities, by necessity, provide their own potable water, energy and waste treatment or removal – they operate *off-grid*. The cold and remote environments where they operate pose particular challenges to these off-grid services.

Some technologies¹ used to provide water, energy and to treat waste have proven to be successful while others have not met expectations, resulting in environmental impacts and/or costly maintenance, repairs and upgrades. Currently there is no coordinated record of what systems are being used and how well they are performing.

In an effort to discover which off-grid technologies are performing well, in the adverse conditions encountered in mountain environments, an inventory of the current approaches being used at mountain lodges and huts would be helpful. Learning from the experiences and successes of current operators will provide practical insights for the installation of appropriate technologies in the future. Specifically, understanding their effectiveness from a functional, economic and environmental perspective would be valuable.

Goals

The intent of this project is to contribute to the knowledge of backcountry facilities management so sound decisions can be made when selecting off-grid technologies at lodges and huts in the BC and Alberta backcountry. More specifically, the goals of this project are:

1. To develop and pilot a process for obtaining information about off-grid technologies employed by operators of mountain facilities in British Columbia and Alberta.
2. To report on the results of the pilot study from the perspectives of both the process used to collect information, and the information obtained.

¹ Technology, as referred to in this study, can be as basic as a bucket to carry water, or as sophisticated as a tertiary-level sewage treatment system.

Objectives and Methodology

Study Area

The study area consisted of the mountainous regions of British Columbia and Alberta. The lodge, huts or cabins in the study had to be off the electrical grid and public infrastructure, and located in the sub-alpine or alpine. We were interested in any recreational facility, either commercial or non-commercial, that provided some form of energy, water or waste management or disposal.

Objectives

Facility Inventory

Compile an extensive inventory of backcountry recreational off-grid facilities in the mountainous regions of British Columbia and Alberta.

Literature review

Compile information on energy, water and waste management technologies tested in other countries in similar environments and situations.

Questionnaire

Develop and deliver a questionnaire to obtain information which will identify the off-grid technologies proving to be successful for providing facilities with energy, water and wastewater treatment.

Methodology

An inventory of recreational facilities in the mountainous region of British Columbia and Alberta that were located within our study area was developed. This was put together by using personal contacts, government licensing inventories, tourism organizations and the Internet.

The fields in the inventory include: names of facility, province located in, organization they belong to, contact person, contact person's position, telephone numbers and fax numbers, e-mail address, website address, physical description of location, mountain range located in, summer use, summer access, winter use, winter access, activities, number of guest beds, number of total beds, bathroom type, heat source, electricity source, water source and waste management.

The next step was to collect qualitative information from organizations outside of Canada that have tried and tested new energy, water and waste management technologies. With the aid of research librarians and the Internet, we sought quantitative information related to this project.

A questionnaire was developed to gather information from lodge operators regarding their off-grid technologies. The questionnaire underwent considerable review by the Selkirk College Ethical Research Committee (ethics committee) because it involved human subjects. The questionnaire was revised based on feedback from the ethics committee so the data collected could not be linked to the operator providing it. This was to protect the

Objectives continued

Pilot Study

Pilot the questionnaire on a sub-set of the inventory of lodges and huts (see #1 above)

Evaluate both the process used to collect information and report on the information obtained.

Results of this evaluation will aid in deciding whether to apply this approach to the larger hut and lodge inventory.

Methodology continued

respondents from any real or perceived impact that their participation could have to their operation. The questionnaire also includes input from the BEES contract supervisor and steering committee.

A sub-set of thirty two facilities were selected from the lodge/hut inventory on which we piloted our questionnaire. We attempted to obtain a representative sample of the larger population based on the following criteria:

- i. region,
- ii. elevation,
- iii. season(s) of use,
- iv. occupancy levels, and
- v. type of access.

The members of our study group were first contacted by mail and/or e-mail. A package was sent with a cover letter explaining who we are, the nature of our research, our desire for their participation, a consent form explaining the anonymous nature of the study, a brochure explaining who and what BEES is, and a BEES newsletter.

All thirty two operators were contacted with one to four attempts following the initial mail-out. Contact was attempted primarily by telephone, but e-mail and personal visits were also used.

Means of evaluating the *process* for collecting information included:

- i the questionnaire response-rate,
- ii the relative effort required to obtain this response rate,
- iii feedback from respondents, and
- iv the level of accuracy that we believe exists in the data based on how people responded to certain questions.

A summary and analysis of the data collected via the questionnaire, is provided in order to identify patterns or notable information relating to the off-grid technologies being employed within the study group.

Results

Facility Inventory

The complete lodge and hut inventory is found in Appendix 1.

The information sources used to compile this facility inventory are accessible to the general public and so it is not necessary to provide anonymity.

The categories used to construct the inventory are:

- i. names of facility
- ii. province where facilities are located
- iii. organization they belong to
- iv. contact person
- v. contact person's position
- vi. telephone numbers and fax numbers
- vii. e-mail address
- viii. website address
- ix. physical description of location
- x. mountain range located in
- xi. summer use
- xii. summer access
- xiii. winter use
- xiv. winter access
- xv. activities
- xvi. number of guest beds
- xvii. total number of beds
- xviii. bathroom type
- xix. heat source
- xx. electricity source
- xxi. water source
- xxii. waste management

Elevation

To the best of our knowledge, all the facilities included in the inventory fit within the elevational and physiographic constraints of our study area (sub-alpine/alpine). Because the elevation of *sub-alpine* decreases with increasing latitude, there may be a few facilities whose elevations are in the margins of what is considered sub-alpine.

Number of facilities

The inventory provides information on approximately 177 facilities throughout our study area in British Columbia and Alberta. There are a few operations that have more than one facility. In these cases, we indicated the number of facilities within the operation and located them in the rows below with the operation's abbreviated name.

Physical description of location

The physical location description of the facilities varies from the drainage it is located in, to the mountain it is near or on, to the Provincial Park it is in or near. No set format was used for describing facility location since the information available was so variable.

Energy, Water and Waste Management

The columns for the source for energy, water and waste management contain little information. Information on the technologies used at each facility is usually not information accessible to the public. The operations that *did* promote their technologies are indicated in the inventory.

Literature Review

The Literature Review was challenging due to the parameters of our study. There was a large body of information on new energy, water and waste management technologies but very few of these technologies have ever been evaluated in high alpine conditions.

Manufacturers guarantee the effectiveness of their products under normal working conditions. However, many of these products and technologies have not existed for long enough to evaluate their effectiveness within the limits of our study. Many facilities have only recently started to install and equip themselves with new technologies and need more time to evaluate their effectiveness.

It is a constantly changing process that confirms the importance of this study. Many facilities continue to change and modify technologies to find the right fit for their situation.

The following information is from a variety of sources. Some is specific to the high alpine and some applies to lower elevations and general backcountry recreation. This information provides guidelines for an industry seeking to improve its environmental practices. Such guidelines may be explored and distilled in a later study.

Manufacturers

Below are examples of manufacturers who assure the reliability of their systems.

- Advance Composting Systems LLC has developed a Phoenix composting toilet that is installed in a cabin at 12,000 feet. They claim that with a well insulated building and sufficient heat from photovoltaic panels the composting toilet will work efficiently. The Lesser Slave Lake Boreal Bird Center also uses a Phoenix 20 L composting toilet, which after several alterations, is now functioning at an optimal level.
- Rota loo is a manufacturer of composting toilets. They presented at the Australian Best Practices Human Waste Management Workshop discussed below. They claim their composting toilet along with a Soltran building enables the system to become one of the most effective toilets in cold climates. They have an experimental Soltran building with a Rota loo toilet that has been in operation for several years on the Routburne Walking Track on the South Island of New Zealand at an altitude of 6000 feet. We could not find information on the toilet installed at the Routburne Walking Track. A link to there website is: <http://www.rotaloo.com>

Organizations

Many American organizations contacted were very interested in the kind of information we were searching for, but did not know where to direct us. Specifically, The Institute of Artic and Alpine Research (INSTARR) showed great interest in our project. They are in the early phases of developing off-grid zero net research cabins for their Mountain Research Station and were interested in the results and conclusions of our study.

The American Alpine Club mentioned that they are putting together a conference on human waste strategies in remote areas in Colorado in November of 2008. They recommended we speak with the Alpine Club of Canada and Parks Canada. They felt that the Alpine Club of Canada had successful models and that they would look to them when planning new renewable technologies for their huts.

Green Lodges

Europe is often considered a leader of new technologies. Many who have recently visited Europe report on well-developed hut and trail systems. It was difficult to obtain information in English regarding European renewable technologies. There is an interesting project which is part of the Intelligent Energy for Europe Program called Green Lodges. The Green Lodges is a guide for rural lodges to implement renewable energy technology and micro cogeneration. For more information on the Green Lodges Project see the following link: <http://www.greenlodges.net>

One technology the green lodges project is promoting is the use of micro combined heat and electrical power (Micro CHP) systems. Micro CHP are being implemented in lodges throughout the European Union. The manufacturers claim that they are very efficient, have low noise levels, require little maintenance, and can run off renewable fuels such as bio diesel and rape seed (canola) oil. For more information on Micro CHP systems refer to the following links: http://www.energyagency.at/publ/pdf/greenlodges_info_en.pdf
http://www.proecopolynet.info/pdf_files/CHP%20state%20of%20Art.pdf
<http://www.microchap.info/biodiesel.pdf>

Two European lodges that have installed micro CHP systems have links. The Erzherzog-Johann-Hutte, located at 3454m in Austria, receives energy from photovoltaic panels and a Micro CHP diesel engine fuelled with rape seed oil. Its source of drinking water is snowmelt. The heat from the Micro CHP and from a thermal solar system melts the snow. The link to the Erzherzog-Johann-Hutte is:

[http://www.energyagency.at/\(de\)/publ/pdf/greenlodges_erb_en.pdf](http://www.energyagency.at/(de)/publ/pdf/greenlodges_erb_en.pdf)

The second hut is the Schiestlhaus. The hut is located at 2154 m in Austria. The Schiestlhaus receives the majority of its energy from a photovoltaic system. It uses a Micro CHP backed-up with a rape seed oil powered generator. Thermal solar collectors integrated with a solid fuel oven is the source of the hut's heat. See the link below:

[http://www.energyagency.at/\(de\)/projekte/greenlodges.htm](http://www.energyagency.at/(de)/projekte/greenlodges.htm)

Below is a link relevant to our interests, but is in French:

<http://www.fddm.ch/>

The link is for the Foundation for Sustainable Development in Mountain Regions (FDDM). The purpose of FDDM is to promote, support and develop projects for sustainable development in mountain regions in Switzerland and in the rest of the world. It serves as a meeting place and provides training and research in the field.

Backcountry Sanitation Manual – The Appalachian Trail Conference

The Appalachian Trail Conference has put together a Backcountry Sanitation Manual. It provides information on composting toilets along hiking trails and at remote camping sites. It can be used as a guide and information source to those dealing with backcountry waste management.

The manual contains four parts. Part One discusses the background of sanitation management, Part Two mentions the regulatory and aesthetic issues, Part Three provides descriptions of composting systems, and Part Four discusses the installation of the composting systems and their case studies.

The three types of composting toilets discussed in Part Three are the Moldering Privy, the Batch-Bin Composting and the Liquid Separation in Composting Systems (Beyond-the-Bin-System). Of the three composting systems they have found that the Moldering Privy and the Beyond-the-Bin System have been the most effective and user friendly. The Moldering Privy is the latest composting toilet design the Appalachian Mountain Club has produced. It is a slower, cooler composting system that requires less maintenance than the two other systems described. The manual provides information on how each composting system works, how it has evolved, and the steps to build one.

Section Twelve of the manual has a Decision Matrix. The Decision Matrix lists eight different types of waste management. The matrix can be used to help decide which type of waste management would be best for a future location.

The Appendix provides information on troubleshooting and general composting tips, diagrams and designs of composting toilets and a review of literature and related information on backcountry sanitation. Below is a link to the Backcountry Sanitation Manual: <http://atfiles.org/files/pdf/atcsanitation.pdf>

The Appalachian Mountain Club (AMC) along with the Green Mountain Club (GMC) were involved with putting together the Backcountry Sanitation Manual together.

Wind Power

The AMC has been proactive in testing renewable technologies for their mountain huts. Technologies they have are using are (1) micro-hydro systems, (2) composting toilets, (3) solar energy, and (4) wind energy. The AMC is promoting and testing wind power. The AMC is currently developing, testing, and advocating for much needed wind turbine siting guidelines. More information can be found at their website: <http://www.outdoors.org/conservation/wind/index.cfm>

The Australian Alps Best Practice Human Waste Management Workshop

The Human Waste Management Workshop was held in Canberra Australia in March 2000. The proceedings contain more than 30 papers covering such subjects as personal carryout techniques using “poo-tubes,” accounts from site managers in Australia and New Zealand of “on-site” and “off-site” treatment, and disposal techniques including composting, septic and vermiculture systems. (Australian Alps National Parks 2000). The workshop provided information on a range of techniques and experiences of dealing with human waste management.

Composting Toilets

There are numerous papers on composting toilets. They contain information on the science of composting and experiences of composting toilets in Australia, New Zealand and the United States.

Common ideas and points expressed at the conference on composting toilets were when operating composting toilets the main things to consider are liquid retention and drainage, oxygen flow, and heat (internal and external) (Burrows 2000).

For the success of a composting toilet, specifically in a cold climate, it is important to induce and retain heat. The overall conclusion of the conference on cold climate composting was that composting toilets are not yet entirely viable in high alpine environments.

Many presenters in the Human Waste Management Workshop reported that the composting toilets they originally installed were not functioning as they expected. Generally, some human waste was not decomposing into compost. Most organizations that installed composting toilets redesigned and modified their composting toilets beyond the manufacturer’s recommendations. The Tasmanian Parks Service and the Centre of Environmental Studies at the University of Tasmania Mountain installed a redesigned composting toilet in their alpine for evaluation. They found that even with the challenging environment, human waste did decompose. The only byproduct was the bulking agent they used. After four years of use they found no or a negligible amount of pathogens remaining in the composted piles.

The main theme addressed in the workshop proceedings was that many things need to be considered when choosing the system best suited for each location. One group recommended installing a trial first, to educate staff on how to operate composting toilets and to analyze the performance of the composting toilet.

A study performed for the New Zealand Department of Conservation found that it was necessary to separate urine from fecal matter at the source. They also found that degradable bulking material (such as leaf litter) produced more heat energy than non-degradable material (such as sawdust), but it resulted in a structural collapse and compaction of the pile. This inhibited air access necessary for maintaining aerobic

conditions (Chapman 1993). In New Zealand they found that regular maintenance was the key to the success of composting toilets.

Yosemite National Park designed a passive solar pasteurizing device that is termed a “Hot Box”. The Hot Box treats the end product from a composting toilet to make sure it complies with the US Environmental Protection Agency regulation for surface disposal (Lachapelle and Clark 1999). The Hot Box has never been tested in a cold climate but with modifications it may be adapted for cold, alpine conditions.

Pit Toilets

Pit toilets are often cited as a form of black water² disposal that organizations and operators are trying to eliminate. Pit toilets, under moderate temperatures, generate offensive odours and attract insects. Pit toilets can contaminate local water sources if near a high water table or are up stream from a water source. In Kosciusko National Park, where the water table was close to the surface, pit toilets were found to leach into the surrounding ground water. Pit toilets require frequent relocation.

Carry Out Waste

Globally, many parks are enforcing backcountry users to carry out their own waste. Carrying out waste alleviates many of the issues faced with human waste management. There currently are many different products designed to collect and carry out waste in a sanitary fashion. Mt. Whitney in Inyo National Park provides pack-it-out kits when visitors receive their wilderness permit. Brenda Land (2000) states the success of a carry-out program depends mainly on terrain, visitor perception of need, and enforcement issues. Costs vary, but generally carry-out is a less expensive solution to managing the environmental impacts of human waste in some locations. In the proceedings and papers from the Human Waste Management Workshop there is much information regarding issues and steps to implement a carry-out program.

Below are a links to products and parks that require visitors to carry out their own waste.

Inyo National Park: <http://www.fs.fed.us/r5/inyo/recreation/wild/packitout.shtml>

Yosemite National Park: <http://www.nps.gov/yose/planyourvisit/climbingtrash.htm>

The Clean Mountain Can:

<http://www.nps.gov/archive/dena/home/mountaineering/cmc.htm>

New Zealand’s Poo Pot: <http://www.doc.govt.nz/templates/page.aspx?id=44157>

Travel John Kit - <http://www.traveljohn.com/>

Directions on how to make your own: <http://www.wikihow.com/Make-a-Poop-Tube>

Here is a link to a Poop Tube Cleaner - <http://www.thewireroller.com/pooptube.htm>

² Black water is the preferred term for what is often described as sewage or wastewater. The drawback to using either sewage or wastewater is there is no differentiation between black water or human waste contaminated water and grey water or soap and food waste contaminated water. Therefore, in this report, black and grey water will be used, while wastewater will refer to the combination of grey and black water.

Capturing Rainwater

Lesser Slave Lake designed their boreal bird center building with an inverted roof to capture rainwater. They plan to use the treated rainwater as the potable water source. Due to Provincial water restrictions they are not using the system quite yet. No studies were found that considered capturing roof top water from snowmelt and rainwater for backcountry facilities.

In Texas there are several studies and examples of harvesting rainwater. The authors spoke with a representative from a company that harvests rainwater located in Texas. The representative said although he has never installed a system in an alpine setting, he thinks it would be possible with proper insulation and an electrical source. He uses activated charcoal to filter the water.

Wood Pellets

Heating with wood pellet stoves has gained popularity in Europe. Currently there are many huts and cabins around the world using wood pellet stoves. Advantages of wood pellet stoves are they are extremely efficient, produce very little waste, and use inexpensive fuel (Emerson 2005). Disadvantages are they are more expensive than conventional wood stoves, less available than wood stoves, and require the pellets to be hauled and stored at the hut or cabin.

Examples of huts using wood pellet stoves include Pear Lake Ski Hut/Cabin located in Sequoia National Park, and Knucklehead Mountain huts on the Sunshine Coast of BC.

Solar Water Treatment

There are many examples of generating electricity from photovoltaic panels and generating heat from passive solar heating. Solar energy is also being used to disinfect water. Martin-Dominguez, Alarcon-Herra, Martin-Dominguez, and Gonzalez-Herrera (2003) found the use of solar radiation for water disinfection has proven to be an effective technique for the inactivation and destruction of pathogenic bacteria in drinking water. This technique can be used in rural areas in Third World countries that need to treat their water. Below is a link to a solar water disinfection company: <http://www.sodis.ch/> The Australian Research Council is currently examining systems that combine advanced water treatment technology using membrane processes with solar electric energy from photovoltaic panels.

Results of the Pilot Study Process

Participation

Of the thirty two lodge and hut operators sampled, we obtained 20 interviews. This represents a 61% response rate - considerably higher than many mail-out surveys. Of the 20 participants that responded to the questionnaire a few spoke on behalf of more than one lodge or hut.

The twelve facilities that did not participate in the questionnaire were contacted with a minimum of four attempts, beyond the initial mail-out. The twenty participants were contacted with phone, e-mail and personal visits. The most common form of contact was by phone. Often participants did not have time to participate in the survey, but they agreed to participate by telephone interview.

Two of the twenty participants contacted us directly after they received the survey package by mail or e-mail. Eight of the twenty participants the authors were able to contact completed the survey during one phone call. The other ten participants required several phone calls or e-mails to obtain their participation.

The majority of participants, once involved, were keen to share their experiences. Twelve of the twenty said “Yes” to the question “Would you be interested in participating in further discussions about this topic in a more open forum”. The eight that did not say “Yes” either said “No” or “Maybe” as a result of their other commitments.

Seven of the twenty participants expressed their appreciation for the level of anonymity provided.

Conducting the Questionnaire

The time to complete the survey ranged from 10 to 45 minutes. Overall the process was successful. One issue surfaced that could be improved.

The issue, especially for larger operations, was the limited level of knowledge of the technologies by the respondent. Larger operations had either a lodge manager or a public relations person as respondent. In either case, the respondents were not as familiar with technical aspects or had not been with the company long enough to know the history of the technologies. For example, questions regarding how the systems worked, when they were installed, who installed them, and how much they cost to install were unanswerable for some lodge managers or public relations people. In these cases, we were referred to someone with greater technical knowledge or knowledge of the institutional history.

Results of Questionnaire

The results of the questionnaire are summarized in their associated tables found in this report. The raw data are withheld from publication and are stored at Selkirk College in order to ensure anonymity for the respondents.

Although the authors conducted 20 interviews, we received results for 23 facilities since some respondents represent multiple lodges.

The elevation of the facilities ranged from approximately 1,000 m to 2,200 m. Six of the twenty-three operations are located between 1,000 m and 1,500 m. Six are located between 1,500 m and 2,000 m and eleven are located between 2,000 m and 2,200 m.

Of the twenty-three operations, one operated in the summer season only. Eight facilities operated in the winter season only. Fourteen operated in both the summer and winter season.

The total number of beds in the facility ranged from five to sixty. Approximately half of the facilities in the survey had twenty or less beds. Six of the operations have a total of thirty or more beds in their facility.

The results from the number of nights the facility was used in a year ranged from 100 to 200 nights per year. Thirteen of the twenty-three were able to answer this question. Many operations were not sure how many nights in a year their facility was used.

Drinking Water

Water seemed to be the least of the issues for facility operators. The questionnaire contained questions asking about the water source and how it was received, whether it was tested for potability, the kinds of tests conducted, and the uses of the water brought in (Table 1).

Energy, Water and Waste Management Pilot Study

Survey Questions	Lodge 1	Lodge 2	Lodge 3	Lodge 4	Lodge 5	Lodge 6	Lodge 7	Lodge 8	Lodge 9	Lodge 10	Lodge 11	Lodge 12
Source of Drinking water	Creek	Spring	Well	Creek	Well	Alpine Lakes	Alpine Lakes	Creek	Well	Creek	Well	Creek
How is it received	Gravity fed with reservoir	Gravity fed	pumped up	1 inch surface line or sleds and buckets	Pump	Gravity	reservoir gravity	Gravity fed 100ft above lodge	Pumped	Gravity	Pump	Filter force hose
Treated	Yes	Yes	Yes		Yes	no	Yes	Yes	Yes	No	No	No
What form of treatment	Filter System with UV treatment	Multi stage Filtration with Chlorine and UVA treatment	Filter system with UVA treatment	suggest boiling	Back wash sand filter with UVA treatment	n/a	Add Chlorine	3 stage filtrations with UVA treatment	Ozone treatment	n/a	n/a	n/a
How frequently do you test water	What is required by Health Canada	Once a week, send to 3rd party to analyses	Every 3 weeks		Once a month	n/a	Once a season	Once a year, send to government	Weekly	n/a	n/a	n/a
What kind of tests do? What do you test for?	N/A	Fecal coli form, minerals	Canadian Drinking Water Standards	n/a	Fecal coli form, Canadian drinking water Standards	n/a	n/a	n/a	e-coli	n/a	n/a	n/a

Survey Questions	Lodge 13	Lodge 14	Lodge 15	Lodge 16	Lodge 17	Lodge 18	Lodge 19	Lodge 20	Lodge 21	Lodge 22	Lodge 23
Source of Drinking water	Spring above lodge	Creek	Most are fairly close to streams or creeks	Creek	Alpine Lake	Melt snow in winter	Near by creeks, or melt snow	Alpine Lake	Creek	Spring	Creek
How is it received	Gravity fed	Gravity fed	Melt water in winter	Gravity	Pumps it up	n/a	n/a	Pulley system with buckets	n/a	Gravity fed	Gravity fed
Treated	no	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes
What form of treatment	Recommend boiling	3 stage filter with UV treatment	Bring own filter	triple filter UV treatment	sediment filter with UV treatment	Bring own filter	Bring own filter	Bleach treatment	Recommend boiling and provide filter jugs	UV Filter system	UV Filtered
How frequently do you test water	every 3 years	no	n/a	no	once a month	n/a	n/a	Every few years	n/a	Annually	yes every year
What kind of tests do? What do you test for?	Canadian Standards	n/a	n/a	n/a	Fecal coliform testing	n/a	n/a	n/a	n/a	n/a	mineral testing and bacteria

Table 1: Summary of Drinking Water Results

Water Sources

The four categories for water sources are: creeks or springs; ground wells; lakes; and, 'no water source' (or melting snow in the winter).

Thirteen of the twenty-three facilities receive their drinking water from a creek or spring. Four of the facilities have ground wells and four receive their water from a lake. The other facilities have no running water and get their water from a nearby creek or melted snow during winter.

The majority of facilities with a creek or lake as their water source receive their water by gravity. One facility uses a pump and a filter force hose system to retrieve treated water from a nearby creek. All four of the operations with wells pump water to their facility. One of the facilities is located above a lake, which is their water source. In this situation they use a two pump system. The second pump is a back up in case the first fails during the winter. During the winter the lake forms such a thick layer of ice it would be almost impossible to obtain water if a problem occurred.

Another operation that receives water from a lake has designed a pulley system with buckets to retrieve drinking water.

The main issues that facilities experienced with their water source are pipes freezing and low water flows due to seasonal fluctuations. One operation switches from a gravity fed system part way through the winter to retrieving water by hand with buckets due to low water levels.

Creeks, springs and lakes are the quickest, simplest source of drinking water. Digging a well and pumping water is a more expensive method, but it is the only option in certain circumstances.

The most cost-effective system for retrieving drinking water is by gravity. Collecting water with buckets or melting snow works, but is more labor intensive.

Water Treatment

Fourteen of the twenty-three facilities treat their water. Nine either have no treatment or recommend that their guests boil their drinking water. Of the nine facilities that do not treat their drinking water three of them have no running water to their operations. In those situations guests bring their own water and filtration system.

The types of treatment in place for the fourteen facilities that do treat their water are a multi-stage water filtration system with ultraviolet light disinfection, an ozone water treatment, a filter force hose system, and chlorine treatment.

The most common form of water treatment is a multi-stage filtration system with ultraviolet light treatment. Eight of the facilities that treat their water use this form of treatment. All the facilities that use the multi-filtration system were pleased with it. They found that it did not require much maintenance and performed well.

Two facilities of the twenty-three treat their water with chlorine only, one treats their water with ozone, and one uses a filter force hose system. All of the facilities are happy with their treatment and found that the treatment was not excessively labor intensive. The facilities that use chlorine did not like the residual taste of the chlorine.

The operation with a filter force hose system uses a pump to force the creek water through a filter for treatment. A company in Calgary that specializes in water filtration specially designed this system. The respondent that uses the filter force system is very pleased with it and recommended the company that designed it. The company is called Mountain Fresh in Calgary, Alberta.

Often participants did not know, or guessed, how often they test their water quality and for what they were testing. Consequently, some the responses regarding water quality testing are potentially incorrect or non-existent. The reported frequency of testing water quality ranged between weekly, monthly, yearly, and never.

Again, the multi-stage filtration systems for treating drinking water seem to be both popular and effective.

Wastewater

Wastewater management refers to both the safe treatment of grey and black water. The former is a concern because it contains nutrients that may adversely affect water quality and food that may attract wildlife. Black water, in addition to containing nutrients, contains pathogenic micro-organisms that may cause acute and chronic illnesses. In aggregate, wastewater management in the sub-alpine and alpine has been a learning experience for most operators. The survey contained questions regarding: what form of treatment is used, how much it cost to install the system, what kind of challenges there were, and whether they test their effluent (Table 2).

The waste management techniques are divided between *on-site treatment* and *removal of waste*. The removal of waste refers to flying out barrels filled with waste when needed. The on-site treatment deals with a variety of different methods for managing black water without removing it from the site; however, there are forms of on-site treatment that do require some removal of a lesser amount of waste. For example, septic system tanks need to be pumped out periodically to remove sludge.

Energy, Water and Waste Management Pilot Study

Survey Questions	Lodge 1	Lodge 2	Lodge 3	Lodge 4	Lodge 5	Lodge 6	Lodge 7	Lodge 8	Lodge 9	Lodge 10	Lodge 11
On-site or remove it?	On-site	On-site	On-site	Remove	Remove	On-site	Remove	On-site	On-site	On-site	Remove
Method to remove waste water?	n/a	n/a	n/a	fly out barrels	fly out 45 gallon barrels yearly	n/a	Fly out 5-6 barrels	n/a	n/a	n/a	fly out barrels once a year
What form of on site treatment do you have?	Pit toilet, bury when full and dig new hole	Septic System	Tertiary wastewater treatment	n/a	n/a	Glen Dawn Bio Filter, Fancy septic with computerized time dispersal	n/a	Incinerator toilets	Septic field	Tertiary wastewater treatment. A multi stage filtration system through wetlands	n/a
How long have you used this method?	15 years	11 years	2 stage development, 1st stage 1997, 2nd stage in 2005	n/a	n/a	7-8 years	n/a	10 years	23 years ago	7 years	n/a
Does it require much maintenance?	no	no	Daily check, daily diligence, cleaning out traps, monitoring, went from 40hr week to 1 hr week	n/a	changed barrels, plastic better than metal	clean out primary tank and pump into barrels send out by ATV	n/a	every day burning for 10 hours, then shovel out ashes	every 2 years pump tank	regular maintenance	add bacteria to help break down, Fly out once a year
What challenges have you had with this system?	n/a	n/a	Pumps - changed from 5 poorly working pumps 1 efficient pump.	n/a	n/a	The cost	n/a	n/a	n/a	n/a	n/a
Approximate cost to install?	n/a	n/a	initial \$200,000, Upgrade \$40,000 yearly \$2000	n/a	\$100 for barrels, approx \$250 1 barrel to fly	\$160,000	n/a	\$5,000	n/a	n/a	n/a
Overall are you happy with it?	yes	yes	yes	no would like other option	no other option	yes	yes	Yes-way cheaper and easier	yes	yes- but always can improve	Yes
Was it professionally installed?	n/a	yes	yes- supplier pumps were faulty, guest provided more insight into new pump	n/a	n/a	David Poltorak - distributor & designer 604-841-6452	n/a	professionally propane installer, bought from manufacturer	n/a	yes	n/a
Test effluent	n/a	no	yes	n/a	n/a	yes	n/a	no	n/a	yes	n/a
How often do you test?	n/a	n/a	every 3 weeks	n/a	n/a	Supplier does testing remotely	n/a	n/a	n/a	regularly	n/a
What do you test for?	n/a	n/a	TSS, fecal coli form,	n/a	n/a	n/a	n/a	n/a	n/a	heavy metals and bacteria	n/a
Permit	n/a	yes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	yes	n/a

Table 2: Summary of Wastewater Management

Energy, Water and Waste Management Pilot Study

Survey Questions	Lodge 12	Lodge 13	Lodge 14	Lodge 15	Lodge 16	Lodge 17	Lodge 18	Lodge 19	Lodge 20	Lodge 21	Lodge 22
On-site or remove it?	On-site	On-site	On-site	On-site	On-site	On-site	Remove	On-site	Remove	On-site	On-site
Method to remove waste water?	n/a	n/a	n/a	Pump out by truck every summer	n/a	Once a year fly out sludge that doesn't break down	Fly out barrels once a year	n/a	8 dry wells that gets pumped out every year	n/a	n/a
What form of on site treatment do you have?	septic field pump and haul out on sled once a year	Have pits were it just bio-degrades	Tertiary treatment, Orenco Advantages Filter System	2 stage septic system	Septic field	Composting	n/a	Out house that has never been moved		Pit toilet, never needed a new pit	Pit toilets, Never been moved
How long have you used this method?	n/a	n/a	2003	1998 installed (10 years)	14 years, 2 years ago increased capacity	1999 upgraded to a single unit system	n/a	n/a	9 years	n/a	n/a
Does it require much maintenance?	pump every winter	dig new pits every other year	Always monitoring loads and adjusting. clean tubes twice a week, filters, screens	Poorly installed, upwind from guest lodges changed venting system to deal with it	annual maintenance	adding carbon (wood chips, peat ect) daily	n/a	n/a	yearly pump out	n/a	n/a
What challenges have you had with this system?	pump maintenance	n/a	poorly engineered- originally, had to make many changes	Smell of it. Location of it	n/a	cold temps, high alpine, changed to single unit to make more efficient	n/a	n/a	n/a	n/a	n/a
Approximate cost to install?	n/a	n/a	n/a	n/a	the up 2nd phase was 4x cost of the first one, due to insurance	n/a	n/a	n/a	n/a	n/a	n/a
Overall are you happy with it?			yes - took some time to modify it	yes other than smell	yes	yes- trying to make more efficient	n/a	n/a	n/a	yes easy	n/a
Was it professionally installed ?	yes	n/a	yes locally engineered, manufactured in Oregon	yes	Peka big adventures	bought system installed in-house	n/a	n/a	yes	n/a	n/a
Test effluent	n/a	n/a	yes	yes- samples down stream	no	n/a	n/a	n/a	no	n/a	n/a
How often do you test?	n/a	n/a	4 times a year	once a year	n/a	n/a	n/a	n/a	n/a	n/a	n/a
What do you test for?	n/a	n/a	TSS,BOD5, e-coli,	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Permit	n/a	n/a	yes	Yes	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 2 (continued). Summary of Wastewater Management

On-site Treatment

The questionnaire shows that sixteen facilities use some form of on-site wastewater treatment. All participants were happy with the form of on-site treatment used. The cost to install the more advanced technology systems was the greatest complaint amongst respondents. A few operations feel their systems are not as efficient as expected, but are devising ways to improve them.

Below is an explanation of the types of on-site treatment of black water or sewage considered in the questionnaire.

A pit toilet is a structure over a hole in the ground. Once the hole is full, the structure is moved to a new hole. Five respondents use pit toilets as their on-site treatment. The majority of facilities using pit toilets have never needed to dig a new hole. The respondents have never had any major maintenance, leaching or contaminated water issues with the pit toilets. None of the respondents have ever tested adjacent surface or groundwater.

A septic system consists of a settling or digesting tank connected to wastewater pipes that drain into the surrounding ground, or septic field, where the black water is cleaned by bacteria in the soil. A septic system is a straightforward system that requires minimal attention to maintain. However, adequate depth and quality of soil is required for septic fields to function properly. This is often a limiting factor in mountain environments. Six of the respondents use a septic system. The facilities in the survey with septic systems vary in complexity and quality of treatment. The septic systems in the survey vary from basic household systems that are mainly installed by in-house staff³ to high-tech multi-stage systems that are professionally built and monitored. The facilities in the questionnaire with septic systems all have road access in the summer or had road access at some point in the past.

One facility recently expanded the size of their septic system due to its increase in guest capacity. That facility is able to connect with the lodge during the summer by road and work with heavy machinery.

The respondents that have septic systems are happy with them. Septic systems are not very expensive to install or operate and require little maintenance.

The respondent with the Glen Dawn Bio Filter was required to install the system to meet public health regulations. This system has a multi-stage process with computerized time dispersal into the 3rd clarifying tank. From the final tank it is dispersed into a sand dispersal system. The engineer of this system monitors its effluent quality by cell phone. The owner of this system is generally pleased with the system. The system requires little

³ In BC now, all septic fields must be installed by a certified professional. (British Columbia Ministry of Health 2007)

maintenance and no monitoring from the staff. The only issue with the system was the initial installation cost.

Tertiary Wastewater Treatment is a multi-stage treatment process that produces a high standard of effluent before it is discharged in to the environment. The final stage of wastewater treatment is disinfection. This can be achieved with chlorine, ultraviolet radiation or ozone (Henry and Heinke 1996). Three respondents use a tertiary wastewater treatment system. The tertiary wastewater treatment plants considered are complex systems with many components. They require more electrical energy than septic fields or pit toilets. All the operations with tertiary treatment also have micro-hydro systems to provide electricity. Tertiary treatment is expensive and requires professional help in design, installation, and careful daily monitoring. Ultraviolet radiation is a disinfectant that leaves no chemical residue but is not effective for turbid effluent (Henry and Heinke 1996). One facility found that their tertiary treatment plant was over loaded and not working properly. The effluent being discharged was too turbid for the ultraviolet to disinfect. Since then they have made alterations to improve the system. Others had issues with the original design. Two of the three facilities with tertiary wastewater systems were not content with either their engineer or manufacturer.

Composting toilets decompose organic waste into environmentally benign mater. With an optimal environment, microbes decompose human waste. Oils and greases are considerably more difficult to decompose than human waste. One respondent has a composting toilet. The respondent advised that winter is not ideal for the microbes. Microbes require conditions including warm ambient temperature, low moisture, and lots of oxygen (Henry and Heinke 1996). The facility with the composting toilets has a separate urinal system so the solid waste is relatively waterless. The original design employed was a two toilet system funneling into two separate composting units. The design has been changed to two toilets funneling into one composting unit. The new design has proven to be more efficient. Maintenance for composting toilets is daily rotating of the unit and addition of a carbon source for the micro-organisms. Peat or wood chips are used. The respondent felt the toilets worked well but solid waste had to be flown out annually.

Incinerating toilets powdered by gas or electricity burn human waste into ash. One respondent uses an incinerating toilet. The operator using the incinerating toilet is very happy with the system. The incinerator is a Storburn model that runs on propane. It is a two-part system. When one is being used the other is being burnt. The process takes approximately 10 hours to burn the waste. The remaining ash can be spread on a garden.

Removing Wastewater

The black water management technique for six of the facilities in the survey is to transport it to a public treatment plant. The most common method to remove waste was to fly out barrels annually. In one case, a facility uses dry wells to store the black water and then has it pumped out at the end of every winter season.

Dealing with grey water is a big issue for the participants that fly out their waste. It is costly to fly out the large volumes of grey water that a lodge can produce. Many of the facilities are located on bedrock where there is no soil to disperse the grey water. None of the participants have found a solution to this issue.

Overall the majority of the participants are happy with the barrel fly out system because it is less expensive and easier for them than installing an on-site treatment system. They also feel that they don't have any other option. Two participants expressed the opinion that they would like to try other methods to deal with their waste, but found that the other options were not as cost effective.

Energy

Fossil fuels are becoming less desirable because prices are rising and they are associated with climate change. In response, many new renewable energy technologies have been developed; however, many facilities still depend on traditional energy sources. Some participants have chosen renewable energy technologies and have been satisfied with the results. Those who have changed to renewable energy technologies often still depend on their previous sources of energy part of the time.

Energy use varied from facility to facility. Questions in the survey concerning energy are separated into two sections: heat and electricity (Table 3).

Energy, Water and Waste Management Pilot Study

Survey Questions	Lodge 1	Lodge 2	Lodge 3	Lodge 4	Lodge 5	Lodge 6	Lodge 7	Lodge 8	Lodge 9	Lodge 10	Lodge 11
Heat Source	Wood	Mainly wood and some propane	Electric load management system with some propane and gas	Propane - forced air furnace	Wood and some propane	Propane	Wood and some propane	Wood	Mainly electric, some heat captured of generators	Electrical heat exchange system	Propane
Interior or exterior Wood Burner ?	Interior wood stove	Interior wood stove	n/a	n/a	Interior wood stove	n/a	Interior wood stove	Interior wood stove	n/a	Interior for aesthetic	n/a
Cords of wood used in a year?	3 cords a year	3 a year	n/a	n/a	n/a	n/a	n/a	Lots	n/a	n/a	n/a
Are you happy with it?	n/a	yes - costly	n/a	n/a	yes - works	n/a	yes - works	yes but like to change to exterior	n/a	n/a	n/a
How do you transport the propane to you facility?	Mule Pack	Fly in with helicopter when needed	Fly in with helicopter	Drive it up	Fly in tanks with Helicopter	Snow cat	Fly in tanks with Helicopter	Helicopter	n/a	n/a	Helicopter or sled
Other uses of propane?	To cook with only	Cooking, lights some heat	Heat boot room and for stoves	Kitchen, cooking, power	Heating boot room only	Cooking and Lights	Heating boot rooms and lights	Use for kitchen only	n/a	n/a	Cooking
How much propane do you burn in year?	1500 lbs	1200 lbs	5 tanks at 180 liters = 900	8,000 liters	n/a	4,000 liters	n/a	n/a	n/a	n/a	n/a
Happy with it?	Yes	yes- no other option	yes	Yes for heating no for power generation	n/a	love to change but difficult	n/a	n/a	n/a	n/a	yes
Is there a back-up?	n/a	n/a	n/a	no	n/a	Small generator	n/a	Excess power off Micro Hydro	n/a	n/a	Wood- also used for visual aspects
Electricity?	No	Need to basis only	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
What is the source of electricity?	n/a	Generators and solar	Micro hydro	Generator	Micro hydro	Generator	Propane and Solar	Micro hydro	Micro hydro and diesel generators	Micro hydro	Generator
What does it power?	n/a	Power tools, batteries, radios	Pumps, lights, heat kitchen appliances, everything	Lights, Heaters, Outlets, Kitchen	Everything they burn off excess energy	Lights, water pumps and fans for sewage treatment plant	Stove and lights solar is for radios	Lights kitchen and fans	Everything if enough water, generators power the shop	Everything	Kitchen stuff, no lights
Electrical output of the system?	n/a	2x12 volt batteries (solar)	12KW	Capacity 100KW Average 54KW	n/a	6500 watts	n/a	n/a	90 Kw System micro 75 KW -generator	120 KW	Regular generator
Max electrical demand of the lodge?	n/a	n/a	Use all different sources	92 KW	n/a	6500 watts	n/a	n/a	75 KW	85% max of 120 KW	n/a
How long has it been in place?	n/a	12 years for solar	6 years	Propane for 20 years	2.5 years	10 years, before candles & wood heat	Long time	20 years	Micro - 8years	3 years - micro	n/a
Has it been reliable?	n/a	Depends on sun, not very reliable	Very	Typically - engines are relatively easy to fix	yes- once an avalanche hit the lake and caused a plug up.	yes	Not reliable depends on sun	Yes - when water is not frozen	Yes- mechanically no - water supply, not enough during winter time	n/a	n/a
Does it require much maintenance?	n/a	Replace batteries, oil starter cords ect for generators	Need consciences staff, greasing, monitoring	Yes- daily check, oil, visual every 200 hours change oil, plugs	Drain pipes at end of season	no	n/a	Spring and Fall make adjustments & always monitoring it	Low - monthly greasing, Spring time more	Monitoring, managing loads, need experienced person to watch	Regular generator maintenance
What kind of challenges have you had?	n/a	Sun, condensation in generators	Not paying attention can cause lots of problems	On-going maintenance, Noisy	Freezing pipes and filters	n/a	n/a	Water freezing, on bedrock need snow to insulate	Water source drops	Need a good system in place and a good handle on loads through out the year	n/a
How much did it cost to install?	n/a	n/a	n/a	\$35,000 (generators+ propane cost & maintenance) 24cents KW/hr	n/a	n/a	n/a	n/a	\$200,000	n/a	n/a
Was it professionally installed?	n/a	In house	Yes Thomas And Howe	Yes	n/a	n/a	n/a	In House, Last owner did it years ago	Don Scarlet - Also Thomas and Howe system in Kimberly	yes at all stages	n/a
Are you happy with the system? Why did you go this route?	n/a	Yes- not much option	Yes, knew it would be successful and cost effective	n/a	n/a	n/a	n/a	yes	Like it but Not 100% happy summer is good	Good investment environmentally friendly	n/a

Table 3: Summary of Energy Results

Energy, Water and Waste Management Pilot Study

Survey Questions	Lodge 12	Lodge 13	Lodge 14	Lodge 15	Lodge 16	Lodge 17	Lodge 18	Lodge 19	Lodge 20	Lodge 21	Lodge 22
Heat Source	Electricity	Wood	Wood	Wood	Wood	Wood	Propane	Wood	Wood	Wood and some propane	Wood and some propane
Interior or exterior Wood Burner ?	n/a	Exterior Furnaces with boiler	Exterior Furnaces with boiler	Interior wood stove	Interior wood stove	Interior wood stove	Interior for aesthetic	Interior wood stove	Interior wood stove	Interior wood stove	Interior wood stove
Cords of wood used in a year?	n/a	15-20 cords a year	25 cords	4-5 a year	2-3 cord a winter	n/a	n/a	2-3 a year	Every other year fly some in	5 cords	4 cords
Are you happy with it?	n/a	yes	Yes - but it requires lots of work	n/a	n/a	n/a	n/a	yes	n/a	Yes- expensive & hard to get	Yes - expensive
How do you transport the propane to your facility?	Drive it up	Drive it up	Drive it up	Snow mobile	n/a	n/a	Drive it up	Snowmobile in	n/a	Helicopter	Helicopter
Other uses of propane?	It's a back up, used 5% of time, and for the stove	Heat water boiler cooking, dryer	n/a	Heating water tank	n/a	n/a	Kitchen	Cooking and lights only	n/a	Heat staff corridors, back up and for incinerator	Heat boot room, oven and Kitchen
How much propane do you burn in year?	n/a	\$10,000 a year	15,000 liters	2500 lbs	n/a	n/a	3x12,000 gallon tanks 36,000 gallons a year	3-5 400 lb tanks =1,600 lbs	n/a	4,000 lbs	100lb a week (under 2000lb)
Happy with it?	Yes	n/a	n/a	Yes	n/a	n/a	Yes	Yes	n/a	Yes	Yes- easy and simple
Is there a back-up?	Propane	n/a	Electric	n/a	n/a	n/a	no	no	n/a	n/a	no
Electricity?	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes
What is the source of electricity?	Micro hydro	Diesel generator & Small Hydro (summer only)	Diesel generator 5 months and micro 7 months	Solar	n/a	n/a	Micro hydro	Solar on one light above the stairs	n/a	Pelton wheel, micro hydro	Solar - 2 panels with back up generator
What does it power?	Everything	Everything	Everything	Lighting and pump	n/a	n/a	Lights, heat, shop tools, kitchen appliances	Radios	n/a	Everything except heat	Lights only
Electrical output of the system?	70	generator 25 KW and Micro 23 KW at max flow	80kw, micro 18 Kw	24 amps	n/a	n/a	No- it provides too much, want to harness for more heat	n/a	n/a	400 watts per hr	60-120 amp a day
Max electrical demand of the lodge?	55-60	20-23 KW generator	45 kw	n/a	n/a	n/a	n/a	n/a	n/a	n/a	120 amp
How long has it been in place?	7 years	10 years , and 7 years for micro	New generator 40 KW. Had to change not enough energy	18 years	n/a	n/a	Stage 1 installed in 1998 stage 2 installed in 2003	n/a	n/a	10 years	15 years
Has it been reliable?	Yes	Yes but it runs in the summer only	Yes but it runs in the summer only	Yes	n/a	n/a	Yes - extremely	n/a	n/a	Always minor issues, it's a learning process but yes happy	Yes
Does it require much maintenance?	Monitoring, cleaning out filters and screens and holding tanks	Clean out pipe in dams every 2 weeks	Yes weekly	No changed batteries once	n/a	n/a	No- checking water level & screens, grease propellers	n/a	n/a	Monthly, every 6 months re built alternator	No, 10 years replace a panel
What kind of challenges have you had?	Nothing major	Putting it together, pipelines for micro hard	Balancing consumption and out put, water needs, training people	n/a	n/a	n/a	Too much electricity had to burn off, now have a auto-regulator	n/a	n/a	Freezing pipes, re built dam	Sun
How much did it cost to install?	\$500,000	Suppose to be \$50,000 ended up \$125,000	\$16,000 generator and \$50,000 micro hydro	\$20,000 originally \$9,000 a battery	n/a	n/a	\$90,000	n/a	n/a	\$10,000	\$5,000
Was it professionally installed?	Yes, Don Scarlet	Yes - wasn't happy with them	Yes- hope to run in winter more but can't	Sol tek In Calgary had all components	n/a	n/a	n/a	n/a	n/a	Yes, Sun fire energy in Taghum, not there anymore	In house
Are you happy with the system? Why did you go this route?	Yes, no grid in area needed it. It is environmentally friendly	Save some money, not use diesel	Yes no other option	yes	n/a	n/a	Yes its easier on the environment	n/a	n/a	Yes, noise free, cheaper and cleaner	Yes trying to do things environmentally friendly

Table 3: (continued) Summary of Energy Results.

The questions in the survey regarding heat included source of heat, transportation of raw materials, cost, and amount of raw materials used in a year. Every facility required heat. The source of heat depended on the size the operation and the level of guest services provided.

The heat sources discussed in this study were:

- i interior wood furnaces,
- ii exterior wood furnaces with boilers,
- iii propane forced-air furnaces,
- iv generators, and
- v electric heating.

Nine of the facilities use wood as their main heat source, five use a mix of wood and propane, four use electricity, and four use propane as their main heat source. A few operations try to recover heat from their generator to warm certain areas of their facilities.

Wood and Propane

The majority of facilities burn wood. In the larger operations, the sole purpose of their wood-burning fireplace is for aesthetics. Other operations use interior wood heaters or exterior wood heaters as their primary heat source.

Seven facilities out of twelve that can sleep twenty people or less use wood. The other five facilities use a mix of wood and propane. The operations that use a mix of wood and propane as their heat source use the propane to heat the boot rooms and staff corridors.

The facilities that have interior wood heaters use approximately 2-5 cords of wood a year. The two facilities that have exterior wood heaters use 15-25 cords of wood a year.

The facilities that use wood as their main heat source are generally happy with it. The complaints they had were that it is expensive, hard to get, and requires lots of work.

Of the eighteen participants that bring propane to their facilities, nine use a helicopter, five are able to drive it up, three use either a snowmobile or snow-cat, and one uses a mule.

The majority of participants using propane is happy with it and feels it is easy to use. Two participants want to change, but feel there is no other option.

Electricity

Of all the facilities in the survey, sixteen have some form of electricity. The sources of electricity are micro-hydro systems, diesel generators, propane, and photovoltaic panels. The uses of electricity include lighting, heating, and operating kitchen appliances, pumps, fans, power tools, and radios.

Of the sixteen facilities that have electricity three do not use the electricity for lights; they use electricity only when needed to charge radios and to run power tools.

Two facilities use solar photovoltaic (solar PV) panels as a significant source of electricity for running lights and pumps. All the facilities that use photovoltaic panels have been using solar energy for twelve years or more during the summer and winter seasons. They find that photovoltaic panels are inexpensive, simple to install, and simple to operate.

All the operations that have photovoltaic panels usually have one or two panels fixed to their roof or a nearby tree. None of the facilities have panels that move with the sun. The complaints with photovoltaic panels are that during the winter storms they cannot harness energy and the batteries required a lot of storage space. The facilities that use solar panels have a back up source of electricity. Often it is a small generator or propane or both. Solar photovoltaic panels are an inexpensive method to obtain electrical energy and they are completely dependent on the sun and weather.

Micro-hydro systems and generators are the main sources of energy for the other facilities that have electricity. Ten operations have micro-hydro systems. Of the ten operations that have micro-hydro systems, two can only use their systems in the summer time. All operations that use micro-hydro also have a back up diesel generator. Some use their back up generator frequently.

Diesel generators have become more efficient over the years but are still unpleasant. The fumes, the noise, and the cost of fuel are a few of the complaints of the diesel generator. All the respondents use diesel as their fuel to operate their generators. No respondents mentioned that they use a different source of fuel. The respondents that are trying to veer away from generators installed micro-hydro systems.

Waterpower continues to be the most reliable and cost effective way to generate electrical power with renewable technology (Davis 2004). Before installing a micro-hydro system a professional analysis to measure the potential energy output of the water source and the lodge's maximum (peak) demand (load) needs to be undertaken over at least three years. Micro-hydro systems' output depends on the available water (flow) and head (drop in elevation).

A common issue with micro-hydro is that a proper analysis on the water source power output, prior to installing the system, was not conducted. During the winter-time, when energy demand is at a peak, the water level in the creeks is low. Therefore, there is not enough flow to meet the energy demand of the operation. During peak energy demand, facilities often use the micro-hydro system in combination with generators to meet their

energy demand. Two respondents experienced this issue and only operate their system during the summer.

One operation switches daily between the use of their micro-hydro and diesel generators. They closely watch the level of their water source and use the amount of energy they can harness from the system. During cold nights in the winter when their water source does not have enough flow for their energy needs, they depend fully on their diesel generators.

The respondents with a water source that produces enough energy are very happy with their micro-hydro systems. They use the energy from the micro-hydro system for heating, lights, kitchen appliances, and tools. The initial costs of the micro-hydro system commonly range from \$90,000 to \$500,000.

Micro-hydro systems are an expensive investment. One operation wished he had not invested in micro-hydro. Other respondents indicated the cost of the micro-hydro was a good investment. A few operations are recovering the cost invested in micro-hydro in lower energy costs.

Micro-hydro systems overall are proving to be successful. Micro-hydro systems are an on going learning process and require operators to manage their energy loads. They are expensive and should not be installed without proper planning. If an operation has a nearby water source with enough flow and head to meet their energy demands, then with proper consultation a micro-hydro may be a cost-effective solution to their energy needs.

Additional Responses

One of the last questions in the survey (number 34) asks, “If you were to start over, or retrofit your existing lodge/cabin/facility, would you use the same systems that you have now?”

Most respondents say they are happy with the technologies they have in place. Below are a few responses:

“I wouldn’t have bothered with the micro-hydro system. There was not enough flow in the creek. The generators we have now are very efficient and cost effective. May put in some photovoltaic panels in but I don’t think there is enough sun in the winter. I am interested in wood pellets. I heard they are more efficient to burn and cheap.”

“The location of the lodge. A system to deal with the grey water”

“Yeah, a[n] exterior wood burner and composting toilets.... if they worked”

“I would like to put in a system to reuse the grey water and capture rain water. I would also try to use the excess power from the micro-hydro system to heat the water boilers.”

“Change the designs of the buildings. Make them more energy efficient.”

“More photovoltaic panels! We need a new option for our waste management. We would put in a composting toilet that runs off solar.”

“I would like to use different systems but the ones I have now seem to work the best. I would like to use geothermal energy to heat my lodge but it is too expensive.”

“Put in more capacity for power from the micro-hydro system and use geothermal.”

The following was contributed by one experienced respondent regarding his thoughts if they were to build a new hut:

“Insulate the living daylight out of anything you build; R20 is about right. With this much insulation, you can be somewhat comfortable without a heater, even when it's -25C° at night. Suffocating may be preferable to freezing; you can always open the door and let in more air.

If you don't want to come back and paint it every 5 years, then corrugated sheet metal is the way to go. It's relatively easy to apply and weathers well. Choose your location carefully, or you may not be able to find the Hut when you need it because it is buried or taken out by snow creep. Decide what kind of clients you are servicing by building this structure. If they are learning to ski and fall a lot, a wood heater can make the stay at the hut way nicer. And an efficient heater plus a nearby forest will hardly make a noticeable effect on the surroundings. It is possible to make a structure that is both an 'emergency shelter' and 'Party Place for 15 people', by choosing the interior design carefully.”

In response to the last question, “Would you be interested in participating in further discussion about this topic in a more open forum?”, sixteen of twenty respondents said they would be interested. Four said no, they would not be interested in participating in further discussion about this topic. When asked why they would not be interested in participating in further discussion they said they were too busy.

Discussion and Recommendations

The Process

One of the goals of this project was to pilot a questionnaire to determine if it is an effective process for obtaining information about off-grid lodge and hut technologies. Obtaining twenty interviews from our thirty two invitations is a relatively high response rate to the questionnaire that we developed and circulated. The fact that only two of those interviews occurred as a result of the respondents taking the initiative to contact *us* after receiving the mail-out, suggests that the high response rate was achieved more by the perseverance of the interviewer, rather than the enthusiasm or impetus of the lodge or hut operators to participate in this process. This is further supported by the fact that twelve operations did not participate even after receiving at least four separate contacts and invitations to do so.

Of the techniques used for communications, we found phone to be the best method to contact individuals. The winter season is the busiest time of year for many of the operations so most were unwilling to meet to discuss their lodge in-person. However, it was possible to convince them to take twenty minutes to talk on the phone. Many operators did not respond to e-mails.

Contacting lodge and hut operators in the off-season (spring and fall) may increase the response rate to a future questionnaire, since many operators, especially the smaller ones with few employees, must guard their time very carefully during the operating season. This is supported by the fact that eleven of the twelve operators in our pilot study sample were either unreachable or said they were 'too busy to participate in our questionnaire', are winter operators.

Another potential way to increase response rates would be to offer some form of compensation or incentive to people who were willing to participate in the questionnaire. However, we doubt that this would significantly increase response rates of those who chose not to participate, given that dedicating one's time to running the business would probably still take precedence over whatever incentive could be provided.

The questionnaire, administered over the telephone, allows for clarification of the questions being asked, as well as responses provided, and we believe produced useful data. Though, as mentioned earlier, the accuracy of some of the respondents' answers are suspect since a few were not thoroughly knowledgeable of the systems in place at their lodge or hut.

If BEES decides to pursue this approach to obtain data for the entire inventory, we recommend that every effort be made to connect with the person within the business that is most familiar with the operation of the lodge or hut in question. Also, given that some of

the smaller facilities had very limited information to provide, a simple, 5-minute phone conversation may be all it takes to complete the inventory for those operations.

A benefit of the formal questionnaire/telephone interview format, preceded by an information package mail-out, is that it helped established BEES as an *entity*, that might benefit operators, in the minds of some.

Because the repeated attempts to contact lodge and hut owners is a time consuming process, and yields results approximately 2/3rd of the time, applying it to the entire inventory of lodges and huts will be a considerable undertaking and will not result in a complete inventory of technologies in place. However, this active approach is probably the most effective way to achieve maximum data capture compared with more passive processes such as mail-out surveys or open invitations to participate in web discussions or to attend conferences. An advantage of conferences and web-based discussions is they may generate a greater depth of discussion and thus yield a greater depth of information, from a smaller number of participants. A disadvantage of these forums is the range of technologies and information obtained will not likely be as comprehensive as would be obtained by applying the telephone interview to the entire inventory of 177 lodges and huts found in Appendix 1.

The fact that 16 of our 20 respondents expressed interest in further discussions on this subject suggests that a web-based discussion board or a conference could be reasonably well attended. If BEES decided to pursue a forum such as this, we recommend that they *actively* and personally solicit participation (similar to the approach taken in this study) from a broad spectrum of lodge and hut operations to capture the range of off-grid technologies in use.

Many participants appreciated the level of anonymity provided by this format. They did not feel comfortable sharing some of the information if it was going to be available to the general public and government representatives. Both for ethical reasons, and for effective information gathering, we recommend continuing to provide anonymity to operators who volunteer information about their facilities.

The Product

Lodge and Hut Inventory

The lodge and hut inventory in Appendix 1 contains many missing details, particularly pertaining to the technologies in use at the various facilities. We recommend calling these operations in order to complete this inventory. This effort would be less formal than the questionnaire interview and could be an opportunistic time to inform the operator about BEES and invite them to become part of the BEES' on-going efforts to find reliable off-grid technologies.

Questionnaire

To build on the usefulness of the questionnaire that we developed, we recommend adding questions pertaining to:

- grey water treatment: Often facilities separate their grey water from their black water. It would be of use to find out who separates their grey water, what do they do with their grey water, and have they ever considered re-using it.
- cost of potable water: We never asked the cost to install or treat respondents' potable water. Many of the respondents use a multi-filtration system with UV treatment. It would be interesting to know how much it cost to install and operate a multi-filtration system for future reference.
- design of the building: It would be useful to determine if the building was designed to hold and capture solar heat. Building elements that utilize passive solar heating (collect, store and distribute solar heat internally) could greatly enhance efficiency (Kreider and Kreith 1982).

While most operators seem satisfied with the technology they have in place, there is still a desire to explore other options. The large number of participants who stated they would be interested in further discussions on this topic suggests an interest in either fine-tuning what they have, or exploring alternatives.

Water, Energy and Waste Treatment Data

Even though many of the backcountry mountain lodge and hut operators interviewed seem reasonably content with the solutions they currently have, there is a high level of interest to explore means of improving or finding alternate solutions to water, energy and waste treatment in off-grid settings.

Based on responses to our questionnaire, some of the greatest off-grid challenges that operators face are:

Grey Water

The fact that grey water surfaced as an issue for operators was a surprise for us. Operators feel that there are not many inexpensive or effective options to deal with grey water. This result was unexpected since grey water tends to be overlooked as an issue.

Black Water

Dealing with black water, especially for smaller operations that can't afford some kind of treatment plant is a big concern. This result was anticipated since black water is largely seen as the most difficult challenge to deal with in mountain settings.

Energy

In general it remains a challenge to find adequate energy to run all the systems associated with other off-grid technologies *e.g.* wastewater plant or potable water treatment plant.

Some of the most effective technologies within our pilot group appear to be:

Potable Water Treatment

That fact that treated water at lodges does not appear to be an issue for operators, suggests that this particular off-grid challenge has largely been successful.

Micro-hydro

In those situations where sufficient, reliable water flow exists, operators have been happy with this technology. Being a *renewable* energy places this technology far above the fossil fuel technologies from a sustainability standpoint, but not all operators have access to conditions suitable for micro-hydro.

Solar Photovoltaic

Most users of solar photovoltaic cells were happy with this technology, however since they all required generator back up, this energy source currently is not sufficient on its own. Solar PV systems require batteries, which are heavy, costly and expensive to maintain, and solar PV electricity is considerably more expensive per unit of energy than micro-hydro.

Septic Systems

The septic systems in our study required the least maintenance and monitoring, making them a popular technology among users. The fact that they require specific soil depth and percolation rates can be a limiting factor on some sites.

Conclusions

Study Process

The process of the phone interview yields a large response rate and reliable data. If BEES would like to obtain information about off-grid technologies for the entire inventory of lodges and huts listed in Appendix 1, this technique, combined with abridged telephone calls for the smaller operations, will be an effective one.

If, however, BEES desires to establish more in-depth information with lodge and hut operators about particular technologies, a web-based discussion board or a physical conference would probably be more effective forums.

The vast majority of responses to our questions (about technologies being used) were positive. In other words, operators are content for the most part with the technologies that they have in place. While this may be true, the authors are well aware of a number of shortcomings of the technologies in question. Therefore, we believe that operators have found ways of making their technologies work, when they may not in fact be the ideal solutions. For example, while many of the solutions appear to be working, some of them require large inputs of fossil fuels, maintenance and monitoring. Therefore, if BEES wants an objective analysis of off-grid technologies being used, this may not be the most effective process.

Successful Technologies

Even though many of the backcountry mountain lodge and hut operators interviewed seem reasonably content with the solutions they currently have in place, there is a high level of interest on the part of these operators to explore ways of improving or finding alternate solutions to water, energy and waste treatment in off-grid settings. Most of the operators surveyed appear to be conscious and concerned about the impacts of their operations on the environment and are seeking ways to minimize these impacts. This suggests an on-going and important role that BEES might play in helping to find cost-effective, sustainable and efficient technologies.

The technologies below were deemed to be effective in this study based on the operators' judgment. While many appear to be satisfactory, they would not be viewed as sustainable due to the large inputs of fossil fuels required. Also, given the small sample size, the data should be considered subjective.

Water

Technologies that our study found successful for providing potable water include:

- Multi-filtration system with ultra violet treatment,
- boiling water (for smaller operations), and
- chlorination.

Energy

Technologies that have proven effective in our study group for providing energy include:

- micro-hydro,
- solar photovoltaic,
- diesel or gasoline-powered generators, and
- interior wood-burning stoves.

Black Water

Technologies that have proven effective for dealing with black water include:

- septic fields,
- tertiary wastewater treatment plants, and
- propane-fired incineration.

Technological Shortcomings

While most technologies were proving to be satisfactory to lodge and hut operators, several did emerge as concerns.

- It appears that external wood-fired furnaces are consuming larger amounts of wood than facilities using interior wood-burning appliances.
- In some cases, micro-hydro installations are not satisfactory because insufficient flow-data and calculation of electrical load requirements were collected prior to installation.
- There does not appear to be suitable options for disposing of grey water.
- Composting toilets are not performing as well as manufacturers claim.
- While both operators of tertiary black water treatment systems are generally happy with their systems, these systems have required significant retro-fittings and expensive maintenance.

An additional note with respect to technologies is that the more complex systems have been problematic, not because of a failure of the technology itself, but because of a failure on the part of operators to understand fully the system, and to monitor properly and maintain them. This leads us to support the notion that particularly in the backcountry, *simple is better*.

Further Research

Pit Toilets

Some of the complaints regarding pit toilets centre on the aesthetics of smell and flies. However, there appears to be a lack of empirical data to conclude whether or not pit toilets are a safe way to dispose of sewage. In cases where water tables are suitable, pit toilets may be an appropriate technology for black water disposal. Research into the condition of sewage in abandoned pit toilets would be helpful in determining the actual effectiveness of this technology.

Sustainability

Many of the solutions to off-grid facility challenges involve a range of technologies, some of which consume large amounts of energy to construct, install and maintain. When considering 'sustainable technology', it would be valuable to do a 'total environmental footprint' analysis of one of these technologies compared to technically less complex, but energy intensive solutions. The authors were unable to find a published study comparing energy required to fly toilet barrels out compared to energy required to install, monitor and maintain a tertiary treatment sewage system.

Grey Water

Because operators in higher alpine locations were challenged with dealing with grey water and because the literature review produced little material on this topic, further work into options for dealing responsibly with grey water need to be conducted.

Additional Recommendations

There are a number of events where it may be effective for BEES to participate. The BCLBC is meeting May 8th, 2008. A facility operator recommended BEES present their goals at this meeting as an efficient means of passing information to active backcountry operators and starting discussions regarding BEES objectives.

The American Alpine Club will be staging a conference at the American Mountaineering Center in Golden, Colorado on "Exit Strategies: Managing Human Waste in the Wild". The meeting date is November 2008.

A participant recommended BEES contact the Tourism Industry Association of Canada to identify common interests and partnerships for communication and research. When we attempted to contact TIAC, we were informed that they could not share any information with us because the project was still in its planning phase. They agreed to inform us after the planning is complete. Since it is a publicly funded project, BEES is advised to contact TIAC later for more information.

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Appendix 1. Facility Inventory

Lodge Name	Prov	Club (see Appendix 1)	Contact Person	CP Position	Area Code	Phone	Toll Free	Fax	E-mail	Website	Physical Location Description
Abbot Pass Hut	AB	ACC			403	678-3200		678-3224	info@AlpineClubofCanada.ca		Mt Victoria, Yoho and Banff National Park
Arum Lodge	AB	Eco Tourism Group			403	721-2117		721-2118	info@arumlodge.com	http://www.arumlodge.com	E of Banff National Park / 45 km W of Nordegg
Amiskwi Lodge	BC	BCLBC	Lorne Short		403	678-1800		678-4106	info@amiskwi.com	www.amiskwi.com	Blaeberry Valley, Amiskwi Pass, Yoho National Park
Asulkan Cabin	BC	ACC							info@AlpineClubofCanada.ca		Asulkan Valley, Rodgers Pass
A.O. Wheeler Hut	BC	ACC							info@AlpineClubofCanada.ca		SW of Rogers Pass, Glacier National Park
Baldface Lodge	BC	Cat Skiing	Jeff Pensiro Jim Frapps	Owner / Operator	250	352-0006		352-0800	info@baldface.net	www.baldface.net	In the Selkirk Mountains, just NW of Nelson
Barrett Lake Hut	BC										Bonnington Range, South of Nelson
Battle Abbey Lodge	BC	BCLBC	Rodger Laurilla Robson Gmoser		250	344-5292			mail@battleabbey.ca	www.battleabbey.ca	South of Rodgers Pass
Berg Lake Shelter	BC	Parks									Berg Lake in Mt Robson Provincial Park
Benjermain Ferris (Great Cairn) Hut	BC	ACC							info@AlpineClubofCanada.ca		NNW of Mt Sir Stanford in the Adamant Range N of Glacier National Park between Golden and Revelstoke
Bill Putnam (Fairy Meadow Hut)	BC	ACC							info@AlpineClubofCanada.ca		Near Granite Glacier in the Adamant Range N of Glacier National Park, between Golden and Revelstoke
Blanket Glacier Chalet	BC	BCLBC	AI & Marion Schaffer		403	678-4102		678-4102	info@blanketglacierchalet.com	www.blanketglacierchalet.com	Monashee, S of Revelstoke, Blanket Creek Prov Park
Bonnington Yurts (Colony Lakes)	BC		Patric Maloney								Bonnington Range South of Nelson
Bonnington Yurts (Commonwealth Ridge)	BC		Patric Maloney								Bonnington Range South of Nelson
Bow Hut	AB	ACC							info@AlpineClubofCanada.ca	http://www.ubc-voc.com/huts/	Wapta Ice field, Banff National Park
Brian Waddington Hut (Phelix)	BC	VOC							info@ubc-voc.com	http://www.ubc-voc.com/huts/	Phelix Creek (Birkenhead Park) area.
Brew Hut	BC	VOC							info@ubc-voc.com		The new Brew Hut is located at a high col just south of Mt. Brew
Bryant Creek Cabin	AB										Halfway up Bryant Creek Valley, W of Spray Lake, S of Banff AB
Burnie Glacier Chalet	BC	BCLBC	Christoph Dietzfelbinger		250	847-3351		847-2854	info@bearmountaineering.ca	www.bearmountaineering.ca	Smither, 50 KM SW, Burnie Glacier, 6km NE of Howson Peak
Burton Hut (Sphinx)	BC	VOC							info@ubc-voc.com	http://www.ubc-voc.com/huts/	Sphinx Bay, on the east side of Garibaldi Lake
Callaghan Country	BC	BCLBC	Brad Sills		604	932-7779		932-6659	brad@callaghancountry.com	www.callaghancountry.com	Whistler B.C
Campbell Icefield Chalet	BC	BCLBC	Bernie Schieser Eric Lomas		250 403	344-4646 673-2198		678-3238	info@skigolden.com	www.skigolden.com	Golden BC, near continental divide, Rocky Mnt
Canaidan Mountain Holidays (10 lodges)	BC	Heli Skiing	Dave Butler		403	762-7100	800-861-0252	762-5879	DaveB@cmhinc.com	www.cmhmountaineering.com	Banff Alberta
Adamant Lodge (CMH)	BC	Heli Skiing	Eric Unterberger								N of Glacier National Park between Golden and Revelstoke
Bobbie Burns Lodge (CMH)	BC	Heli Skiing	Bruce Howatt (LM)	Lodge Manager							Purcells Mountains, N of Bugaboo Prov Park
Bugaboo Lodge (CMH)	BC	Heli Skiing	Dave Cochrane (LM)	Lodge Manager							Purcells Mountains, inside Bugaboo Prov Park
Cariboo Lodge (CMH)	BC	Heli Skiing	John Mellis (LM)	Lodge Manager							In the Caribou Mountains, NE of Kamloops
Galena Lodge (CMH)	BC	Heli Skiing	Mike Welch (LM)	Lodge Manager							Selkirk Mountains, SE of Revelstoke
Gothic Lodge (CMH)	BC	Heli Skiing	Claude Duchesne (LM)	Lodge Manager							Selkirk & Monashee
Mc Bride (CMH)	BC	Heli Skiing	Greg Yavorsky (LM)	Lodge Manager							Caribous
Monashee Lodge (CMH)	BC	Heli Skiing	Roger Laurilla (LM)	Lodge Manager							Monashees
Silvertip Lodge (CMH)	BC	Heli Skiing	Willy Trinker(LM)	Lodge Manager							Caribous
Valemount Lodge (CMH)	BC	Heli Skiing	Danny Stoffel (LM)	Lodge Manager							Caribous
Cariboo Cabin	BC	Parks			250	837-7500		837-7536	revglacier_reception@pch.gc.ca	www.parkscan.harbour.com/mtrev	In Mt Revelstoke National Park
Castle Mountain Hut	AB	ACC							info@AlpineClubofCanada.ca		Castle Mountain, Banff National Park
Char Creek Cabin	BC										Near Kootenay Summit Pass
Chatter Creek Lodge	BC	Heli/cat skiing	Dale McKnight Dan Josephson		250	344-7199	877-311-7199	344-2229		www.chattercreek.ca	Golden B.C
Conrad Kain Hut	BC	ACC							info@AlpineClubofCanada.ca		
Conner Lake Cabin	BC	BC Parks									On South Connor Lake at southern end of Height of the Rockies Provincial Park, 75 km from Sparwood BC
Copper Hut	BC	KMC	Sandra McGuinness	Hut Keeper	250	352-3545			president@kootenaymountaineering.bc.ca	http://www.kootenaymountaineering.bc.ca	Bonnington Range South of Nelson
Crusader Creek Cabin	BC	Snowmobile Club									Head of Crusader Creek, W of Kokanee Prov Park
Dave Henry Lodge	BC	BCLBC	Brian McKirdy & Liz Norwell		250	566-4718		566-4718	headwaters@davehenry.com	www.davehenry.com	Near Dave Henry Lake, Mount Robson Prov. Park
Dave White Memorial Cabin	BC	CVHS			250	342-5005			contact@cvhsinfo.org	http://www.cvhsinfo.org/hut.htm	50 meters above Forster Creek meadow
Diana Lake Lodge	BC		Pure West Expeditions Tours		403		877-894-9378	932-0591	mntmck@telusplanet.net	www.dianalake.com	Near Headwaters of Pinnacle CR, Kootenay National Park
Doctor Creek Cabin	BC	Snowmobile Club	Al Bergen	President	250	354-4598					Purcells mountains, SW of canal flats
Edwards Lake Cabin	BC	TOC	Joan Schuppli		604	885-2210			info@tetoutdoor.ca	http://www.tetoutdoor.ca/	Tetrahedron Provincial Park Boundaries
Egypt Lake Shelter	AB	Banff Park									On egypt lake, Banff
Elfin Lakes Shelter	BC	BC Parks									Garibaldi Provincial Park
Elizabeth Parker Hut	AB	ACC			403	678-3200		687-3224	info@AlpineClubofCanada.ca		Lake O'Hara, Yoho National Park

Energy, Water and Waste Management Pilot Study

Lodge Name	Mountain Range	Elevation (m)	Elevation (ft)	Summer Use (see Appendix 1)	Summer Access	Winter Use	Winter Access	Activities	No. Guest Beds	Total Beds	Bathroom Type (see Appendix 1)	Heat Source	Electricity Source	Waste Management	Water Source
Abbot Pass Hut	North Rockies	2925	9589	Y	Hike	I	Hike	Climbing, Hiking	24	30	O	Propane and Wood			Snow Melt
Arum Lodge	North Rockies	1350	4500	Y	Drive	Y	Drive	Hiking, Cross country Dog sledding	12		P				
Amiskwi Lodge	Central Rockies	2104	6900	Y	Hike	Y	Hike or Helicopter	ski touring, hiking	12	16	O or P	Propane			
Asulkan Cabin	Central Columbia's	2100	6890	Y	Hike	Y	Hike		12	12	O	Propane			
A.O. Wheeler Hut	Central Columbia's	1250	4100	Y	Drive	Y	Hike		24	30	O	Propane and Wood			Creek
Baldface Lodge	South Columbia's	2042	6700	Y	Drive	Y	Snow cat or Snowmobile	Cat skiing, Mountain biking	36	60	P	Propane and Wood		Septic Field	Well
Barrett Lake Hut	South Columbia's	1840	6035	Y	Hike	Y	Hike	Skiing, Hiking	5	6	O	Wood			
Battle Abbey Lodge	Central Columbia's	2100	6900	Y	n/a	Y	Helicopter	Skiing	14		P	Wood	Solar and Wind		
Berg Lake Shelter	North Rockies	1640	5380	n/a	n/a	Y	Hike		6	6	n/a	Wood			
Benjermain Ferris (Great Cairn) Hut	North Columbia's	1884	6200	Y	Hike	I	Hike	Hiking and Skiing	6	6	O	Wood			
Bill Putnam (Fairy Meadow Hut)	North Columbia's	2042	6700	Y	Hike or Helicopter	Y	Helicopter	Hiking, Skiing	20	20	O	Propane and Wood			
Blanket Glacier Chalet	Central Columbia's	1782	5800	n/a	n/a	Y	Helicopter	Skiing	20		P	Propane and Wood	Solar		
Bonnington Yurts (Colony Lakes)	South Columbia's	2040	6710	n/a	n/a	Y	Helicopter	Skiing	8		O	Propane and Wood	Solar		
Bonnington Yurts (Commonwealth Ridge)	South Columbia's	1640	5340	n/a	n/a	Y	Helicopter	Skiing	9		O	Propane and Wood	Solar		
Bow Hut	Central Rockies	2350	7700	Y	Hike	Y	Hike	Hiking the Wapta Traverse	30	30	O	Propane and Wood			
Brian Waddington Hut (Phelix)	South Coast Mnt	1715	5627	Y	Hike	Y	Hike		24	24	O				
Brew Hut	South Coast Mnt	1686	5530	Y	Hike	Y	Hike		12	16	O	Wood			
Bryant Creek Cabin	South Rockies	1860	6100	Y	Hike	Y	Hike		18	18	O	Wood			
Burnie Glacier Chalet	Northern Coastal	1000	3300	Y	Helicopter	Y	Helicopter	Skiing, Ice Climbing	11	11	O				
Burton Hut (Sphinx)	South Coast Mnt	1450	4750	Y	Hike	Y	Hike		10	15					
Callaghan Country	South Coast Mnt	1371	4500	n/a	n/a	Y	multi	Snow cat, Hiking	22		P				
Campbell Icefield Chalet	North Rockies	2088	6950	Y	Helicopter	Y	Helicopter	Skiing, Climbing	12	12	O	Propane			
Canaidan Mountain Holidays (10 lodges)	North Rockies	1200	3900	n/a	n/a	Y	Helicopter	Helicopter skiing and Hiking							
Adamant Lodge (CMH)	North Columbia's	1100	3610	Y	Helicopter	Y	Helicopter	Helicopter skiing and Hiking	44		O				
Bobbie Burns Lodge (CMH)	Central Columbia's	1370	4490	Y	Helicopter	Y	Helicopter	Helicopter skiing and Hiking	44		P				
Bugaboo Lodge (CMH)	Central Columbia's	1490	4890	Y	Helicopter	Y	Helicopter	Helicopter skiing and Hiking	44		P	Wood			
Cariboo Lodge (CMH)	North Columbia's	1100	3608	Y	Helicopter	Y	Helicopter	Helicopter skiing and Hiking	44		P				
Galena Lodge (CMH)	Central Rockies	1050	3440	n/a	n/a	Y	Helicopter	Helicopter Skiing	44		P	Propane and Wood			
Gothic Lodge (CMH)						Y	Helicopter	Helicopter Skiing	44		P				
Mc Bride (CMH)						Y	Helicopter	Helicopter Skiing	10		P				
Monashee Lodge (CMH)						Y	Helicopter	Helicopter skiing and Hiking	48		P				
Silvertip Lodge (CMH)						Y	Helicopter	Helicopter Skiing	10		P				
Valemount Lodge (CMH)						Y	Helicopter	Helicopter skiing and Hiking	10		P				
Cariboo Cabin	North Columbia's	1527	5200	N	no	Y	Hike		6	6	O	Propane and Wood			
Castle Mountain Hut	Central Rockies	2390	7850	Y	Hike	Y	Hike	Hiking	6	6	O				
Char Creek Cabin	South Columbia's	1550	5100	Y	Hike	Y	Helicopter		24	24	O	Wood			
Chatter Creek Lodge	North Rockies	1670	5500	N	n/a	Y	Helicopter	Snocat / Heli skiing	36		P				
Conrad Kain Hut	Central Columbia's	2195	7200	Y	Hike	N	n/a	Hiking	40	40	O	Propane and Wood	Micro Hydro in Summer only		
Conner Lake Cabin	South Rockies	1815	5950	Y	Hike	n/a	n/a	Fishing, Hiking	5	5	O	Wood			
Copper Hut	South Columbia's	1970	6461	I	Drive	Y	Hike	Hiking Bonnington Travers	4	6	O	Wood			
Crusader Creek Cabin	South Columbia's	1730	5700	I	Drive	Y	Snowmobile	Snowmobile, Hiking	8	8	O	Propane and Wood			
Dave Henry Lodge	North Rockies	1829	5925	Y	Hike or Horseback	Y	Hike or Helicopter	Horse back, Hiking	10	10	O	Propane and Wood			
Dave White Memorial Cabin	Central Columbia's	2190	7117	N	n/a	Y	Snowmobile	Skiing			n/a				
Diana Lake Lodge	Central Rockies	2140	7020	Y	Hike or Helicopter	Y	Hike or Helicopter		6	6	n/a	Propane and Wood	Solar		
Doctor Creek Cabin	South Columbia's	2280	7500	N	Drive	Y	Snowmobile	Skiing, Hiking, Snowmobile	4	6	O	Wood			
Edwards Lake Cabin	Coastal Mountains			Y	Hike	n/a	n/a		18	20	n/a				
Egypt Lake Shelter	South Rockies	1996	6550	Y	Hike	Y	Hike		18	18	n/a				
Elfin Lakes Shelter	South Coast Mnt	1550	5085	Y	Hike	Yes	Hike		33	33	O	Propane			
Elizabeth Parker Hut	Central Rockies	2040	6700	Y	Hike	Y	Hike		20	24	O	Propane and Wood			Creek

Appendix 1 Facility Inventory (continued)

Energy, Water and Waste Management Pilot Study

Lodge Name	Prov	Club (see Appendix 1)	Contact Person	CP Position	Area Code	Phone	Toll Free	Fax	E-mail	Website	Physical Location Description
Elk Lakes Cabin	BC	ACC							info@AlpineClubofCanada.ca		Elk Lakes Prov. Park, B.C.
Enterprise Creek Cabin	BC	TVS			250	358-2333		358-7950	vws@vws.org	www.rmec.org/valhalla	Enterprise Creek, Slokan Valley
Eva Lake Cabin	BC	Parks			250	837-7500		837-7536	revglacier_reception@pch.gc.ca	parkscan.harbour.com/mitrev	Shore of Eva Lake, NE of Revelstoke
Evans Lake Cabin	BC	TVS			250	358-2333		358-7951	vws@vws.org	www.rmec.org/valhalla	Center of Valhalla Prov Park, NW of Slokan
Fay Hut	BC	ACC							info@AlpineClubofCanada.ca		Prospector's Valley, Kootenay National Park
Fish Lake Cabin	BC	BC Parks	Kootenay District Parks Office		250	422-4200		422-3326		www.alp.gov.bc.ca/bcparks/explore/kootenay.htm	Beside Fish Lake in Top of the World Provincial Park
Fortress Lake Lodge	BC		Mike Furfaro		250	343-6386					The Shore of Lake Fortress, Hamber Prov Park
Foster Creek Cabin	BC	Windermere Valley Snowmobile Club	Al Bergen	President	250	345-4598					Near Headwaters of Foster Creek, NW of Invermere
Glacier Circle Hut	BC	Roger Pass Center			250	814-5232					In Glacier National Park, S of Rodgers Pass
Golden Alpine Holidays (4 lodges) (GAH)	BC	BCLBC	John Bell		250	344-7273		344-7274	info@gah.ca	http://www.sentrymountainlodge.com/	Selkirk Mountains B.C.
Sunrise Lodge (GAH)	BC	BCLBC	John Bell		250	344-7273			info@gah.ca	www.gah.ca	Selkirk Mountains B.C. NE of Rodgers Pass
Meadow Lodge (GAH)	BC	BCLBC	John Bell		250	344-7273			info@gah.ca	www.gah.ca	Selkirk Mountains B.C. NE of Rodgers Pass
Sentry Lodge (GAH)	BC	BCLBC	John Bell		250	344-7273			info@gah.ca	www.sentrymountainlodge.com	Selkirk Mountains B.C.
Vista Lodge (GAH)	BC	BCLBC	John Bell		250	344-7273			info@gah.ca	www.gah.ca	Selkirk Mountains B.C.
Grassy Hut	BC	KMC	Sandra McGuinness	Hut Keeper	250	352-3545			president@kootenaymountaineering.bc.ca	http://www.kootenaymountaineering.bc.ca	Bonington Range South of Nelson
Great Northern Snocat	BC	Cat Skiing	Brent McCorquodale	Owner	403		800-889-0765	239-4133	info@greatnorthernsnowcat.com	http://www.greatnorthernsnowcat.com/	Selkirk Mountains west of Bugaboos, Near Trout Lake
Halfway Lodge	AB		Ron Warner	Owner	403	762-4551	800-661-8352	762-8130	muleman@telusplanet.net	www.horseback.com/otherholiday.html	SW Banff near Sundance Ski Hill. Towards Mt Assiniboine
Harrison Hut	BC	VOC							info@ubc-voc.com	http://www.ubc-voc.com/huts/	Near Meager Hot springs, West of Pemberton.
Himmelsbach Hut	BC	BC Parks									Russet Lake
Huckleberry Hut	BC	KMC	Sandra McGuinness	Hut Keeper	250	352-3545			president@kootenaymountaineering.bc.ca	http://www.kootenaymountaineering.bc.ca	Bonington Range South of Nelson
Ice Creek Lodge	BC	BCLBC	Russel Hulbert		250	2267607			info@icecreeklodge.com	www.icecreeklodge.com	Slokan Valley Valhalla's. Mid-mountain on the NW side of Urd Peak
					250	3552647					
Icefall Lodge	BC	BCLBC	Larry Doleki		250	8370898			info@icefall.ca	www.icefall.ca	North of Golden
					250	8149516					
Interior Alpine Recreation (2 lodges) (IAR)	BC	BCLBC	Bernie Teufele				778-859-1147		interioralpine@shaw.ca	www.interior-alpine.com	Blue River B.C. Moanashees Mountain Range
Moanshee Hut (IAR)	BC								interioralpine@shaw.ca	www.interior-alpine.com	Blue River B.C. Moanashees Mountain Range
Memorial hut (IAR)	BC								interioralpine@shaw.ca	www.interior-alpine.com	Blue River B.C. Moanashees Mountain Range
International Basin Hut (Kingsbury Hut)	BC	CVHS			250	342-5005			contact@cvhsinfo.org	http://www.cvhsinfo.org/hut.htm	Headwaters of Bobbie Burns Creek, International Basin
Island Lake Lodge	BC	Snow cat Skiing	Kyle Hamilton	Building Service Manager	250	423-3700	888-422-8754		info@islandlakeresorts.com	http://www.interior-alpine.com/	Fernie BC Rocky Mountains, Lizard Range
Jim Haberl Hut	BC	ACC							info@AlpineClubofCanada.ca		Tantalus Range, B.C.
Jumbo Pass Cabin	BC	CVHS			250	342-5005			contact@cvhsinfo.org	http://www.cvhsinfo.org/hut.htm	On the Purcell Divide, W of Invermere
Kakwa & Jarvis Lakes Cabins	BC	Parks									Kakwa Provincial Park, Near Prince George
Keith's Hut (Cerise Creek Hut)	BC										Located 4 km from parking lot on Duffy Lake Road Joffre Peaks Region
Keystone-Standard Basin Hut	BC										In the Selkirk Mountains, NNE from Revelstoke
KMH Flint Lakes Huts	BC	BCLBC	Jeff Groerer		250	353-7180			info@skihikebc.com	www.skihikebc.com	Kokanee Range at Keen Creek Road
Knucklehead Cabin (The Hilton)	BC	Knuckleheads Winter Recreation Association								http://www.thesunshinecoast.com/whattodo/knucklehead.html	Located in the Powell River area
Kokanee Glacier Cabin	BC	ACC	Peter Mackie, Kevin Giles		250	354-6946			info@AlpineClubofCanada.ca	http://www.kokanee-glacier.com/	Kokanee Glacier Prov. Park, B.C.
Lake O'Hara Lodge	BC		Bruce Millar		403	678-6812			millar@interbaun.com	www.lakeohara.com	Lake O'Hara Yoho National Park
Lakit Lookout Shelter	BC										Near Summit of Mt Lakit, NE of Cranbrook BC
Lawrence Grassi (Mt Clemenceau) Hut	BC	ACC							info@AlpineClubofCanada.ca		Clemenceau Ice field, SSW of Mt Clemenceau
Lloyd MacKay (Mt. Alberta) Hut	AB	ACC							info@AlpineClubofCanada.ca		Mt. Alberta, Jasper National Park
Lizzy Lake Cabin	BC										Near Pemberton, Lillooet Range
Lost Lake Hut	BC										West of the Kallahne Creek
Maligne Lake	AB		Pat Crowley						pat@malignelake.com	http://www.malignelake.com/	Jasper National Park, Maligne Lake
McMurdo Creek Cabin	BC	CVHS			250	342-5005			contact@cvhsinfo.org	http://www.cvhsinfo.org/hut.htm	In the Spillamacheen Range, E of Purcell Divide
Mica Lodge	BC	Heli-skiing			250	837-6191	877-837-6191		info@micaheli.com	www.micaheli.com/	Western Slopes of the Rocky Mountains
Mistaya Lodge	BC	BCLBC	Dave Birnie & Cindy Galligan		250	344-6689	866-647-8292	344-6689	info@mistayalodge.com	www.mistayalodge.com	Golden B.C. Wapta Ice fields, Continental Divide
Mitchell River Shelter	BC										Mitchell River Mt Assiniboine Park
Monashee Powder Tsuius Lodge	BC	Snow cat Skiing		Owner	250	545-0661	866-678-7669	545-0672	bookings@monasheepowder.com	www.monasheepowder.com	On Tsuius Mountain, N of Cherryville. In The Monashees
			Carolyn Morgan								
Mountain High Recreation/ Valhalla Lodge	BC	BCLBC	Leo Jansma & Brain Cross	Owners	250	2294661			info@valhallamountainlodge.com	www.valhallamountainlodge.com	South Valhalla Mountain Range, At Mckean Lakes
					250	3552269					
Mountain Lake Hut	BC	BCMC	David Scanlon Peter Woodsworth	Chair Members	604	5725051			info@bcmc.ca	http://bcmc.ca/huts	Mount Sheer, Britannia Beach
					604	2547076					

Appendix 1 Facility Inventory (continued)

Energy, Water and Waste Management Pilot Study

Lodge Name	Mountain Range	Elevation (m)	Elevation (ft)	Summer Use (see Appendix 1)	Summer Access	Winter Use	Winter Access	Activities	No. Guest Beds	Total Beds	Bathroom Type (see Appendix 1)	Heat Source	Electricity Source	Waste Management	Water Source
Elk Lakes Cabin	Rockies	1740	5709	Y	Hike	Y	Hike		10	10	O	Propane and Wood			Creek
Enterprise Creek Cabin	South Columbia's	1220	4000	Y	Hike	Y	Hike	Ski touring, Hiking	6	8	O	Wood			
Eva Lake Cabin	North Columbia's	1920	6300	Y	Hike	Y	Hike		6	8	O				
Evans Lake Cabin	South Columbia's	1555	5100	Y	Hike	I	Hike	Hiking	5	5	O	Wood			
Fay Hut	Central Rockies	2108	6915	Y	Hike	Y	Hike		12	12	O	Wood	Micro Hydro and Solar		Creek
Fish Lake Cabin	South Rockies	1768	5227	Y	Hike or Bike	Y	Hike	Hiking, Skiing, Fishing	25	25	n/a	Wood			
Fortress Lake Lodge	North Rockies	1340	4396	Y	Hike or Float Plane	N	n/a	Fishing, Hiking	12	12	P	Propane and Wood			Lake
Foster Creek Cabin	Central Columbia's	1885	6200	n/a	n/a	Y	Snowmobile	Skiing, Snowmobile	4	6	O	Wood			
Glacier Circle Hut	Central Columbia's	1800	5900	Y	Hike	I	Hike		8	8	O	Wood			
Golden Alpine Holidays (4 lodges) (GAH)	North Columbia's	n/a	n/a	n/a	n/a	n/a	n/a	n/a			n/a				
Sunrise Lodge (GAH)	North Columbia's	2200	7000	Y	Helicopter	Y	Helicopter	Skiing, Hiking	12		O	Propane and Wood			
Meadow Lodge (GAH)	North Columbia's	2200	7000	Y	Helicopter	Y	Helicopter	Skiing, Hiking	12		O	Propane and Wood			
Sentry Lodge (GAH)	North Columbia's	2109	6920	Y	Helicopter	Y	Helicopter	Skiing, Hiking	8		P	Propane and Wood	Micro Hydro		
Vista Lodge (GAH)	North Columbia's	2200	7000	Y	Helicopter	Y	Helicopter	Skiing, Hiking	12		O	Propane and Wood			
Grassy Hut	South Columbia's	1840	6035	Y	Hike	Y	Hike	Hiking Bonington Travers	4	6	O	Wood			
Great Northern Snocat	Central Columbia's			n/a	n/a	Y	Drive				P				
Halfway Lodge	South Rockies	1800	6000	Y	Hike or Horseback	Y	Hike	Horse Back Trips	14	19	O	Propane and Wood	Solar	Pit Toilet	Well
Harrison Hut	South Coast Mnt	1760	5774	n/a	n/a	Y	Hike		15	15	n/a				
Himmelsbach Hut		1890	6200	Y	Hike	Y	Hike		14	14	n/a				
Huckleberry Hut	South Columbia's	1560	5132	Y	Hike	Y	Hike	Skiing, Hiking	4	4	O	Wood			
Ice Creek Lodge	South Columbia's	1850	6100	N	n/a	Y	Helicopter	Skiing, Hiking	8		O				
Icefall Lodge	Central Rockies	1900	6300	N	n/a	Y	Helicopter	Skiing, Hiking	13		O				
Interior Alpine Recreation (2 lodges) (IAR)	North Columbia's	n/a	n/a	n/a	n/a	n/a	n/a				n/a				
Moanshee Hut (IAR)		1800	5900	n/a	n/a	Y	Snow cat or Snowmobile	Skiing, Hiking, Snow Shoeing			n/a				
Memorial Hut (IAR)		2000	6562	n/a	n/a	Y	Snow cat or Snowmobile	Skiing, Hiking, Snow Shoeing			n/a				
International Basin Hut (Kingsbury Hut)	Central Columbia's	2185	7170	Y	Hike	Y	Multi	Skiing, Hiking	6	6	O	Wood			
Island Lake Lodge	South Rockies	1402	4600	Y	Drive	Y	Snow cat	Cat Skiing, Hiking	36		P	Mix	Micro Hydro		
Jim Haberl Hut	Coast Mountains			Y	Hike or Helicopter	Y	Helicopter		12	12	n/a	Propane			
Jumbo Pass Cabin	Central Columbia's	2350	7710	Y	Hike	I	Hike or Snowmobile		8	8	O	Propane and Wood			
Kakwa & Jarvis Lakes Cabins	North Rockies	1483	4880	Y	Hike	Y	Hike or Snowmobile	Skiing, Snowmobile	10	12	n/a				
Keith's Hut (Cerise Creek Hut)	Coast Mountains	1650	5413	Y	Hike	Y	Hike		20	20	O				
Keystone-Standard Basin Hut	North Columbia's	2030	6700	Y	Hike	Y	Snowmobile	Hiking	8	10	O	Wood			
KMH Flint Lakes Huts	South Columbia's	1950	6390	n/a	n/a	Y	Helicopter	Skiing	8	8	P	Propane and Wood			
Knucklehead Cabin (The Hilton)	Coast Mountains	975	3200	Y	Drive	Y	Hike		8	8	O	Wood			
Kokanee Glacier Cabin	South Columbia's	1920	6300	Y	Hike	Y	Helicopter	Skiing, Hiking	12		P		Micro Hydro	Tertiary	
Lake O'Hara Lodge	Central Rockies	2042	6700	Y	Hike	Y	Hike	Skiing, Hiking	16 in winter	50-60	P	Propane		Tertiary	Well
Lakit Lookout Shelter	South Rockies	2360	7720	Y	Hike	I	Hike		5	5	n/a	Wood			
Lawrence Grassi (Mt Clemenceau) Hut	North Rockies	2100	6900	Y	Helicopter	Y	Helicopter		16	18	n/a				
Lloyd MacKay (Mt. Alberta) Hut	North Rockies	2720	8900	Y	Hike	Y	Helicopter		6	6	n/a				
Lizzy Lake Cabin	Central Coast Mnt	1880	6167	Y	Hike	Y	Hike	Snow Shoeing, Hiking	8	8	O	Wood			
Lost Lake Hut	Coastal Mountains	1174	38507	Y	Hike	Y	Hike		4	4	O				
Maligne Lake	North Rockies			Y							n/a				
McMurdo Creek Cabin	Central Columbia's	1760	5775	Y	Hike	Y	Hike or Snowmobile		5	7	O	Wood			
Mica Lodge	North Columbia's	1280	4200	Y	Helicopter	Y	Helicopter	Skiing, Hiking, Fishing	16		P				
Mistaya Lodge	Central Rockies	2042	6700	Y	Helicopter	Y	Helicopter	Skiing, Hiking	14	15	O		Micro Hydro		
Mitchell River Shelter	South Rockies	1616	5300	Y	Hike or Horseback	N			6	6	n/a				
Monashee Powder Tsuius Lodge	Central Columbia's	1616	5300	n/a	n/a	Y	Snow Cat		24		P	Propane	Micro Hydro in Summer only		
Mountain High Recreation/ Valhalla Lodge	South Columbia's	2130	6980	Y	Hike	Y	Helicopter	Skiing, Hiking	12		O	Propane and Wood	Solar		
Mountain Lake Hut	South Coast Mnt	1630	5340	Y	Hike	N	no	Hiking	10	10	O	Wood			

Appendix 1 Facility Inventory (continued)

Energy, Water and Waste Management Pilot Study

Lodge Name	Prov	Club (see Appendix 1)	Contact Person	CP Position	Area Code	Phone	Toll Free	Fax	E-mail	Website	Physical Location Description
Mount Colin Centennial Hut	AB	ACC							info@AlpineClubofCanada.ca		Colin Range, Jasper National Park
Mount Steel Cabin	BC	Parks									North of Sechelt Tetrahedron Provincial Park
Mt Assiniboine Lodge	BC	BCLBC	Sepp & Barb Renner		403	678-4194		678-2883	info@assiniboinelodge.com	www.assiniboinelodge.com	Mount Assiniboine Prov. Park B.C
Mt Carlyle Lodge	BC	KMH	Jeff Groerer Leri Neumaier	Owners			888-564-8747		info@skihikebc.com	www.skihikebc.com	Kokanee Range at Keen Creek Road
Mustang Powder Lodge	BC	Snow cat Skiing	Nick & Ali Holmes-Smith	Owners	250	679-8125	888-884-4866	679-2999	info@mustangpowder.com	www.mustangpowder.com	NW of Revelstoke, Monashee Mountains
Naiset Cabins (4 cabins)	BC	ACC									Center of Mt Assiniboine Park BC, West of Continental Divide
Neil Colgan Hut	BC	ACC							info@AlpineClubofCanada.ca		Valley of Ten Peaks, Banff National Park
North Creek	BC	BCMC	David Scanlon		804	575-5051			info@bcmc.ca	http://bcmc.ca/index.asp	North Creek, Lillooet Valley, Sampson Range, Pemberton
North Rockies Ski Tours	BC	BCLBC	Craig Evanoff Bonnie Hooge		250	962-5272			info@northrockies.bc.ca	www.northrockies.bc.ca	Dezako Range, East of Prince George
Olive Hut	BC	CVHS	Al Bergen		250	342-7229			contact@cvhsinfo.org	http://www.cvhsinfo.org/hut.htm	Near Catamount Glacier, NW of Invermere
Peter and Catharine Whyte (Peyto) Hut	AB	ACC			403	678-3200		678-3224	info@AlpineClubofCanada.ca		Wapta Ice field, Banff National Park
Peter Huser Memorial Chalet	BC	IAR	Bernie Teufele		604	540-1477		736-1477	bernet@oanet.com	www.interior-alpine.com	S of Valemont to Heli Pad, then E by air to Dominion Basin
Plummer	BC	BCMC								http://bcmc.ca/huts	Taita Lake Waddington Range, Claw Ridge, Mt Waddington
Police Meadow Cabin	BC										In Mt Assiniboine Park, near Headwaters of Simpson River
Powder Creek Lodge	BC	BCLBC	Heather Smith & Guus Diks		250	505-2030		505-2030	info@powdercreeklodge.com	www.powdercreeklodge.com	Southern Purcell's Mountains Near Kaslo
Ptarmigan Tours (2 lodges)	BC	BCLBC	Mark & Sarah Yancey				888-255-1310		info@ptarmigantours.com	www.ptarmigantours.com	Purcell's Mountains, North of Kimberley
Boulder	BC	BCLBC	Mark & Sarah Yancey				888-255-1311		info@ptarmigantours.com	www.ptarmigantours.com	Southern Purcell's Mountains W of Kimberley
Ptarmigan lodge	BC	BCLBC	Mark & Sarah Yancey				888-255-1312		info@ptarmigantours.com	www.ptarmigantours.com	Southern Purcell's Mountains W of Kimberley
Purcell Lodge	BC	BCLBC	Paul Lesson		250	344-2639		344-5620	paul@placeslesstravelled.com	www.purcelllodge.com	Near boarder of Glacier National Park, on Plateau E of Beaver river
Queen Mary	BC	ACC							info@AlpineClubofCanada.ca		Rockies Provincial Park
Ralph Forster Hut	BC										Below Summit of Mt Robson in Mt Robson Prov Park
Ralph Lake Shelter	BC										Rockies Provincial Park
R.C Hind Hut	BC										Base of Mt Assiniboine
Red Tit Hut	BC	ACC							info@AlpineClubofCanada.ca		Serratus-Dione Col in the Tantalus Range.
Retalack Lodge	BC	Snow cat Skiing	Phil Pinfold	Owner	250	354-5324	800-330-1433		powder@retalack.com	http://www.retalack.com	Southern Selkirk Mountains
Ripple Ridge Cabin	BC										South of the Kootenay Pass Summit
R.J Ritchie (Balfour) Hut	AB	ACC							info@AlpineClubofCanada.ca		Wapta Ice field, Banff National Park
Rocky Mountain Escape	AB		Laura and Chris		780	865-0124			ecolodge@xplornet.com	http://www.ecolodge.com	Mossehead Mountain, Willmore Mountains
Sapphire Col Shelter	BC									http://www.pc.gc.ca/pn-np/bc/	Located at Sapphire Col between The Dome and Castor Peaks.
Scott Duncan Hut	AB	ACC							info@AlpineClubofCanada.ca		Wapta Icefield, Yoho National Park
Sentinel Bay Glaciology Huts (2 small huts)	BC										Ganbald Lake 500 m back
Selkirk Lodge	BC				250	344-5129	800-663-7080	344-5177	info@selkirbackcountrylodge.com	http://selkirbackcountrylodge.com/	Alberta Ice field, Near Revelstoke
Selkirk Tangiers Lodge	BC	Heli-skiing			250	837-5378	800-663-7080	837-5766	info@selkirk-tangiers.com	http://selkirk-tangiers.com/	Near SW corner of Glacier National Park,
Selkirk Wilderness Meadow Mountain Lodge	BC	Cat Skiing	Brenda Dury, Eric Jurgenson	Owner / Operator	250	366-4424	800-799-3499	366-4419	info@selkirkwilderness.com	http://www.selkirkwilderness.com	In the Goat Range of South Selkirk's, N of Kaslo
Durrand Glacier Chalet	BC	BCLBC	Ruedi & Noline Beglinger		250	837-2381		837-4685	info@selkirkexperience.com	www.selkirkexperience.com	North Selkirk Mountains, B.C. Revelstoke
Mt Moloch Chalet	BC	BCLBC	Ruedi & Noline Beglinger		250	837-2381		837-4685	info@selkirkexperience.com	www.selkirkexperience.com	North Selkirk Mountains, B.C. Revelstoke
Brewster's Shadow Lake Lodge	BC		Bryan Meihaus Alison Brewster		403	762-0116	866-762-0114	760-2866	info@shadowlakelodge.com	www.shadowlakelodge.com	Banff National Park, near Shadow Lake
Shangri-La Cabin	AB	Maligne Lake Ski Club	Bete Weir		780	825-3665					Near Snowbowl Campground in Jasper National Park
Shovel Pass lodge	AB				780		888-852-7787	865-1553	skyline@telusplanet.net	www.skylinetrail.com	Big Shovel Pass on Skyline Trail, Jasper National Park
Silver Spray Cabin	BC	ACC								http://www.kokanee-glacier.com/	Kokanee Glacier Prov. Park, B.C
Skoki Lodge	AB		Jude Hanen	Manager	403	256-8473	877-822-7669	228-1544	jhanen@skirc.co, info@skircr.com	http://www.skoki.com/	Banff National Park, In the Skolki Valley
Snowspider Hut	BC	VOC									Twin One - Van Horlick Pass
Snowwater Hilton Hut ?	BC										Headwaters of Snowwater Creek SW of Nelson
Snowwater Lodge	BC	Heli-skiing	Patric Maloney	Owner	250		866-722-7669	359-7650	info@snowwater.com	www.snowwater.com	N of Mt Snowwater, SW of Nelson
Sol Mountain Lodge	BC	BCLBC	Aaron Cooperman		250	674-3707			info@solmountain.com	www.solmountain.com	Southern Monashee, East of Monashee Provincial Park
Sorcerer Lodge	BC	BCLBC	Tannis Dakin		250	344-2804		344-2805	info@socererlodge.com	http://www.socererlodge.com/	Golden National Park, Selkirk Mountains B.C
Stanley Mitchell Hut	BC	ACC									Little Yoho Valley in Yoho National Park
Steed / Marble Hut	BC	KMC	Sandra McGuinness	Hut Keeper	250	352-3545			president@kootenaymountaineering.bc.ca	http://www.kootenaymountaineering.bc.ca	Bonington Range South of Nelson
Sultana Creek Cabin	BC										Purcell's Mountains, W of Invermere
Sundance Lodge	AB		Ron Warner		403	762-4551	800-661-8352	762-8130	muleman@telusplanet.net	www.horseback.com/otherholiday.html	SW Banff near Sundance Ski Hill

Appendix 1 Facility Inventory (continued)

Energy, Water and Waste Management Pilot Study

Lodge Name	Mountain Range	Elevation (m)	Elevation (ft)	Summer Use (see Appendix 1)	Summer Access	Winter Use	Winter Access	Activities	No. Guest Beds	Total Beds	Bathroom Type (see Appendix 1)	Heat Source	Electricity Source	Waste Management	Water Source
Mount Colin Centennial Hut	North Rockies	2000	6560	Y	Hike	I	Hike	Hiking	6	6	n/a				
Mount Steel Cabin	South Coast Mnt	1650	5410	Y	Hike	Y	Hike		12	15	n/a	Wood			
Mt Assiniboine Lodge	South Rockies	2180	7152	Y	Hike	Y	Hike or Helicopter	All Winter Sports	28	28	O	Propane			
Mt Carlyle Lodge	South Columbia's	2200	7200	Y	Drive, Hike	Y	Helicopter		10	10	O		Micro Hydro		
Mustang Powder Lodge	North Columbia's	1750	5700	n/a	n/a	Y	Snow cat	Cat Skiing			P				
Naiset Cabins (4 cabins)	South Rockies	2180	7152	Y	Hike	Y	Hike or Helicopter	Skiing, Hiking	5	8	n/a	Wood			
Neil Colgan Hut	Central Rockies	1463	4800	Y	Hike	Y	Hike	Hiking	16	18	O				
North Creek	South Coast Mnt	1230	4035	N	n/a	Y	Helicopter	Skiing	18	18	O	Wood			
North Rockies Ski Tours	North Rockies	1500	4900	Y	Helicopter	Y	Helicopter	Skiing, Hiking	8	10	P	Propane and Wood			
Olive Hut	Central Columbia's	2850	8700	Y	Hike	Y	Helicopter or Snowmobil	Skiing, Hiking	6	6	O	Propane and Wood			
Peter and Catharine Whyte (Peyto) Hut	Central Rockies	2500	8200	Y	Hike	Y	Hike	Hiking the Wapta Traverse	16	18	O	Propane			
Peter Huser Memorial Chalet	North Columbia's	2000	6500	Y	Hike or Helicopter	Y	Helicopter	Skiing, Hiking	12		P	Propane and Wood			
Plummer	South Coast Mnt	2680	8790	n/a	n/a	n/a	n/a				n/a				
Police Meadow Cabin	South Rockies	1953	5400	Y	Hike	N	n/a	Hiking	6	6	n/a	Wood			
Powder Creek Lodge	South Columbia's	2164	7100	N	n/a	Y	Helicopter	Skiing	12		Com	Propane	Micro Hydro		
Ptarmigan Tours (2 lodges)	South Columbia's	n/a	n/a	n/a	n/a	Y	Helicopter	Skiing	12		n/a				
Boulder	South Columbia's	1980	6500	n/a	n/a	Y	Helicopter	Skiing	12		O	Wood	Micro Hydro		
Ptarmigan lodge	South Columbia's	1525	5000	n/a	n/a	Y	Helicopter	Skiing	12		n/a	Wood	Micro Hydro		
Purcell Lodge	South Columbia's	2194	7200	Y	Helicopter	Y	Hike or Helicopter	Skiing, Hiking	20	30	P	Propane and Wood	Micro Hydro		
Queen Mary	Rockies	2090	6850	Y	Hike	Y	Snowmobile		8	8	O	Wood			
Ralph Forster Hut	North Rockies	2522	8300	Y	Hike	I	Hike	Hiking	8	8	n/a				
Ralph Lake Shelter	Rockies	2160	7100	Y	Hike	N	no	Fishing	7	7	n/a				
R. C Hind Hut	South Rockies	2710	8900	Y	Hike or Helicopter	n/a	n/a		12	15	n/a	Propane			
Red Tit Hut	Tantalus Range			Y	Hike	n/a	n/a		4	6	n/a				
Retalack Lodge	South Columbia's	1000	3000	Y	Drive	Y	Drive	Cat Skiing	24		P		Micro Hydro		
Ripple Ridge Cabin	South Columbia's	1950	6400	I	Hike	Y	Hike		6	8	n/a	Wood			
R. J Ritchie (Balfour) Hut	Central Rockies	2470	8100	Y	Hike	Y	Hike	Hiking the Wapta Traverse	16	18	O				
Rocky Mountain Escape	North Rockies			Y	Drive	Y	Drive	Hiking, Cross Country	8		P				
Sapphire Col Shelter	Central Columbia's			Y	Hike	n/a	n/a		8	8	n/a				
Scott Duncan Hut	Central Rockies	2773	9100	Y	Hike	Y	Hike	Hiking the Wapta Traverse	12	12	O				
Sentinel Bay Glaciology Huts (2 small huts)	South Coast Mnt			n/a	n/a	n/a	n/a		2	5	n/a				
Selkirk Lodge	Central Columbia's	2200	7200	Y	n/a	Y	Helicopter	Skiing, Hiking	12		P		Solar		
Selkirk Tangiers Lodge	Central Columbia's	2200	7218	Y	Helicopter	Y	Helicopter	Skiing, Hiking	12		P	Wood	Solar		
Selkirk Wilderness Meadow Mountain Lodge	South Columbia's	1280	4210	Y	Drive	Y	Snow cat		24	40	P	Propane and Wood	Micro Hydro		
Durrand Glacier Chalet	North Columbia's	1939	6360	Y	Helicopter	Y	Helicopter	Skiing, Hiking	20		O & P	Propane and Wood	Solar		
Mt Moloch Chalet	North Columbia's	2225	7300	Y	Helicopter	Y	Helicopter	Skiing, Hiking	11		n/a				
Brewster's Shadow Lake Lodge	South Rockies	1829	6000	Y	Hike or Bike	Y	Hike	Skiing, Hiking	32	32	P	Propane and Wood		Septic	
Shangri-La Cabin	North Rockies	2000	6550	N	n/a	Y	Hike	Skiing	6	6	n/a	Propane and Wood			
Shovel Pass lodge	North Rockies	2250	7380	Y	Hike or Horseback	N	n/a	Hiking, Horse back Riding	18	20	n/a	Propane and Wood			
Silver Spray Cabin	South Columbia's	2340	7670	Y	Hike	N	n/a	Hiking	11	11	O	Propane and Wood			
Skoki Lodge	Central Rockies	2165	7100	I	Hike	Y	Hike	Skiing, Hiking	22	22	P	Wood			
Snowspider Hut	Coastal Mountains	1542	5059	Y	Hike	Y	Hike		4	4	n/a				
Snowwater Hilton Hut ?	South Columbia's	1900	6250	n/a	n/a	n/a	n/a				n/a				
Snowwater Lodge	South Columbia's	1900	6250	N	Drive	Y	Helicopter or Snow cat	Helicopter Skiing	12		P	Propane and Wood	Micro Hydro in Summer only		
Sol Mountain Lodge	South Columbia's	1890	6200	n/a	Drive	Y	Helicopter	Skiing, Hiking	16	18	P				
Sorcerer Lodge	North Columbia's	2050	6700	Y	Helicopter	Y	Helicopter	Skiing, Hiking	18		P	Propane and Wood	Solar		
Stanley Mitchel Hut	Central Rockies	2055	6742	Y	Hike	Y	Hike		22	26	O	Propane and Wood			Creek
Steed / Marble Hut	South Columbia's	2090	6855	Y	Hike	Y	Hike		4	6	O	Wood			
Sultana Creek Cabin	Central Columbia's	2225	7300	Y	Hike	Y	Hike	Skiing, Hiking	6	8	O	Wood			
Sundance Lodge	South Rockies	1600	5500	Y	Hike or Horseback	Y	Hike	Horse Back, Cross Country	20	30	P	Propane and Wood	Solar	Septic	Well

Appendix 1 Facility Inventory (continued)

Energy, Water and Waste Management Pilot Study

Lodge Name	Prov	Club (see Appendix 1)	Contact Person	CP Position	Area Code	Phone	Toll Free	Fax	E-mail	Website	Physical Location Description
Surprise Creek Cabin	BC										Simpson River, Inside Western boundary of Mt Assiniboine Park
Swift Creek Cabins	BC	Headwaters Outfitting	Liz Norwell or Brian McKirdy								Near Headwaters of Swift Creek, Border of Mt Robson Park
Sydney Vallance (Fryatt) Hut	AB	ACC									Fryatt Valley, Jasper National Park
Talus Lodge	BC	BCLBC	Chris Espinel & Dan Verral		250	342-9358			info@taluslodge.com	www.taluslodge.com	Invermer BC, South East of Banff National Park
Tantalus Hut	BC	ACC									Outflow end of Lake Lovely Water in the Tantalus Range
Thunder Meadow Cabin	BC	Elk Valley Ski Touring Association	Patrick Gilmar		250	423-3905					About 8km (5min) SW of Fernie BC
Tobermory Creek Cabin	BC										Near Elk River, Elk Provincial Park
Tonquin Valley Adventures Lodge	AB		Mike Day		780	858-1188			info@tonquinadventres.com	www.tonquinadventures.com/lodge	In Tonquin Valley, Jasper National Park
Tonquin Valley Backcountry Lodge	AB								info@tonquinvalley.com	www.tonquinvalley.com	At N end of Amethyst Lake, In Tonquin Valley, Jasper National Park
Twin Falls Chalet	BC		Fran Drummond		403	228-7079					At the Base of Twin Falls near Yoho River in Yoho Park
Tyax Lodge (THL Heli-skiing)	BC	Heli-skiing			250	558-5379	800-667-4854	558-5389		http://www.tiheliskiing.com/	On the Tyaughton Lake, 200 km north of Vancouver
Valhalla Mountain Touring (Ruby Lodge)	BC	BCLBC	Dale & Lynda Caton		250	358-7905			sales@tiheli.com, lodge@tiheli.com	www.vmt.ca	Just N of Valhalla Prov Park Mountains, NW of New Denver
Valkyr Adventures	BC	BCLBC	Shelly & Martin Glasheen		250	269-7237	888-482-5597	269-7237	info@valkyradventures.com	www.valkyradventures.com	Valkyr range, Selkirk's near Fauquier
Wates-Gibson Hut	AB	ACC							info@AlpineClubofCanada.ca		Tonquin Valley, Jasper National Park
Wee Sandy Creek (Jules Holt) Cabin	BC	BC Parks									Near N Boundary of Valhalla Prov Park, W of New Denver
Wedgemount Lakes	BC	BC Parks									Garibaldi Provincial Park, near inlet from Armchar Glacier
Wendego Lodge	BC				250	819-1713			info@wendegolodge.com	http://www.wendegolodge.com/	N of Kamloops, On wendego Lake
Wells Gray Adventures (three lodges)	BC	BCLBC	Ian Eakins & Tay Briggs		250		888-754-8735	587-6446	info@skihike.com	www.skihike.com	In Wells Gray Park, NE of Kamloops
Trophy Mounin Lodge	BC	BCLBC							info@skihike.com		In Wells Gray Park, NE of Kamloops
Discovery Cabin	BC	BCLBC							info@skihike.com		In Wells Gray Park, NE of Kamloops
Flight Meadow Lodge	BC	BCLBC							info@skihike.com		In Wells Gray Park, NE of Kamloops
Wendy Thompson Hut	BC	ACC							info@AlpineClubofCanada.ca		Marriot Basin on the north side of Duffey Lake Road.
West Range Lodge	AB		Shawn Vinson		780	865-4777			horsebac@telusplanet.net	www.horsebacadventuresltd.com	Solomon Creek Valley, E of Jasper National Park
White Cap Alpine (Mcgillivray Pass Lodge)	BC	BCLBC	Ron Andrews		604	462-8145			rga@shaw.ca	www.whitecapalpine.ca	Lies between the Bendor and Cadwallader Ranges on the Southern edge of the Chilcotin Mountains.
White Grizzly Cat Skiing	BC	Cat Skiing					800-843-5557				
Woodbury Cabin	BC	ACC							info@AlpineClubofCanada.ca	http://www.kokanee-glacier.com/	Kokanee Glacier Prov. Park, B.C
Ymir Yurts	BC	Touring /Cat ski	Trevor Holsworth	Owner	250	354-4441	888-488-4327		yurts@kootenayexperience.com	www.kootenayexperience.com/Yurts/	Ymir Valley, Ymir, B.C
Qua Yurt	BC	Touring /Cat ski	Trevor Holsworth	Owner	250	354-4441	888-488-4327		yurts@kootenayexperience.com	www.kootenayexperience.com/Yurts/	Ymir Valley, Ymir, B.C
Yurtopia	BC	Touring /Cat ski	Trevor Holsworth	Owner	250	354-4441	888-488-4327		yurts@kootenayexperience.com	www.kootenayexperience.com/Yurts/	Ymir Valley, Ymir, B.C

Appendix 1 Facility Inventory (continued)

Energy, Water and Waste Management Pilot Study

Lodge Name	Mountain Range	Elevation (m)	Elevation (ft)	Summer Use (see Appendix 1)	Summer Access	Winter Use	Winter Access	Activities	No. Guest Beds	Total Beds	Bathroom Type (see Appendix 1)	Heat Source	Electricity Source	Waste Management	Water Source
Surprise Creek Cabin	South Rockies	1450	4750	Y	Hike	Y	Hike	Hiking	8	8	n/a	Wood			
Swift Creek Cabins	North Rockies	1920	6300	N	n/a	Y	Hike or Helicopter	Skiing	8	8	n/a	Propane and Wood	Solar		
Sydney Vallance (Fryatt) Hut	North Rockies	1980	6485	Y	Hike	Y	Hike	Skiing, Hiking	12	12	n/a	Wood			
Talus Lodge	North Rockies	2300	7400	Y	Helicopter	Y	Helicopter	Skiing, Hiking	10		P	Propane and Wood			
Tantalus Hut	South Coastal Mnt	1174	3850	Y	Hike or Boat	n/a	n/a		20	20	n/a				
Thunder Meadow Cabin	South Rockies	1890	6200	Y	Hike	Y	local ski hill	Skiing, Hiking	12	12	n/a	Propane			
Tobermory Creek Cabin	North Rockies	1950	6397	Y	Drive	Y	Snowmobile	Skiing, Hiking, Snowmobile	3	4	n/a	Wood			
Tonquin Valley Adventures Lodge	North Rockies	1980	6500	Y	Hike	Y	Hike	Skiing, Hiking, Fishing	20	20	n/a	Propane and Wood			
Tonquin Valley Backcountry Lodge	North Rockies	1980	6500	Y	Hike, HorseBack	Y	Hike	Skiing, Hiking	18	18	n/a	Wood			
Twin Falls Chalet	Central Rockies	1800	5905	Y	Hike	N	n/a		14	14	O	Wood			
Tyax Lodge (THL Heli-skiing)	Central Coast Mnt	1036	3400	n/a	Drive	Y	Helicopter or Drive	Skiing			P				
Valhalla Mountain Touring (Ruby Lodge)	South Columbia's	1768	5760	Y	Drive	Y	Helicopter or Snow cat	Skiing, Hiking	12	15	P	Propane and Wood			
Valkyr Adventures	South Columbia's	2220	7280	n/a	n/a	Y	Helicopter	Skiing, Hiking	12		P				
Wates-Gibson Hut	North Rockies	1900	6235	Y	Hike	Y	Hike	Skiing, Hiking	24	30	O	Wood			
Wee Sandy Creek (Jules Holt) Cabin	South Columbia's	1490	4900	Y	Hike or Drive	I	Hike	Fishing, Hiking	2	2	O	Wood			
Wedgemount Lakes	Coastal Mountains	1920	6299	Y	Hike	Y	Hike		6	6	n/a				
Wendego Lodge	North Columbia's	1400	4600	Y	Drive	Y	Drive	Fishing, Hiking	6	6	P				
Wells Gray Adventures (three lodges)	North Columbia's	n/a	n/a	n/a	n/a	yes	Helicopter or Snow cat				P				
Trophy Moutin Lodge	North Columbia's	2153	7000	Y	Helicopter	Y	Snow cat or Helicopter	Skiing, Hiking	12		P	Propane			
Discovery Cabin	North Columbia's	1870	1650	Y	Helicopter	Y	Snow cat or Helicopter	Skiing, Hiking	12		P	Propane			
Flight Meadow Lodge	North Columbia's	1845	6000	Y	Helicopter	Y	Snow cat or Helicopter	Skiing, Hiking	12		P	Propane			
Wendy Thompson Hut	South Coastal Mnt	1800	5900	Y	Helicopter	Y	Hike		16	16	n/a				
West Range Lodge	North Rockies	1380	4526	Y	Horseback	Y	n/a	Hiking, Skiing Horseback riding	12	12	P	Propane			
White Cap Alpine (Mcgillivray Pass Lodge)	Coast Mountains	1860	6100	n/a	n/a	Y	Helicopter	Skiing	12		O				
White Grizzly Cat Skiing				n/a	n/a	n/a	n/a	N/A			P				
Woodbury Cabin	South Columbia's	2070	6790	Y	Hike	N	no	Hiking	8	10	O	Propane and Wood			
Ymir Yurts	South Columbia's	1855	6086	n/a	n/a	Y	Mutli	Skiing			n/a				
Qua Yurt	South Columbia's	1720	6100	n/a	n/a	Y	Mutli	Skiing	6		O	Propane			
Yurtopia	South Columbia's	1855	5600	n/a	n/a	Y	Mutli	Skiing	8		O	Propane			

Appendix 1 Facility Inventory (continued)

Appendix 2. Cover letter, Consent form and Survey

Dear lodge or hut owner/operator,

RE: ENERGY, WATER AND WASTE RESEARCH

I am working with Selkirk College, undertaking a research study of off-grid alpine facilities on behalf of Backcountry Environmental Energy Solutions (BEES). BEES is an initiative of the Alpine Club of Canada, Parks Canada and BC Parks in an effort to gather and share knowledge about off grid systems for the benefit of facility operators and the environment in which they operate.

I am attempting to identify common problems that facility managers are having, as well as solutions that you have found, to address the challenges of providing energy, potable water and waste disposal or treatment at off-grid huts, cabins or lodges in backcountry, alpine settings.

Information collected will be used to make recommendations for safe, energy efficient, environmentally benign, successful alpine solutions to off-grid technologies. Responses to this questionnaire will be held in confidence. Final results will be published, but no individual names or other identifying information will appear.

If you are willing to participate in a 15-30 minute questionnaire, then research protocol requires that you are aware of, and understand how the data are stored and used, and consent to this.

I sincerely hope that you are willing to participate in this project, as I believe the results will advance our understandings of off-grid technologies, ultimately benefiting alpine environments. I will be calling you shortly to ask for your participation.

If you have any further questions concerning matters related to this research, please contact me at (250) 304-5916.

Sincerely,

Tessa MacDonald
Researcher
Selkirk College

Informed Consent to Participate in
Selkirk College Research

This consent form, has been mailed or faxed to you prior to receiving a phone call from a Selkirk College researcher. It should give you the basic idea of what the research is about. If you would like more detail about something mentioned here, or information not included here, please feel free to call the principle investigator Tessa MacDonald, at (250) 304-5916.

As a lodge or hut operator, your voluntary participation is requested because practitioners have information and have developed knowledge that will advance understandings of the effectiveness of off-grid technologies. While it is hoped that the results of this research will be of benefit to hut and lodge operators, it is possible that there may be no direct benefit to you.

The upcoming telephone interview will take approximately 15-30 minutes to complete.

The identities of the participants will be known only to the current and potentially future researchers, but will not be shared with the sponsors of this research (Alpine Club of Canada, BC Parks, Parks Canada) or the public. Any information that will be shared with our sponsors or the general public will not include names of facilities, names of respondents, or the location of facilities.

Information collected will be used to determine which off-grid technologies are actually proving to be useful, low maintenance options. Final results will be made publicly available, but no individual names or other identifying information will appear. By sharing the results, it is hoped that operators will have access to information to help make informed choices for safe, energy efficient, environmentally sound, proven off-grid technologies.

If you chose to withdraw from the study at any point, we will disregard any data associated with your responses to this questionnaire.

Once the study is complete we will store the data on a CD for 3 years. After 3 years we will destroy all the data.

As a participant, you must understand that there may be no direct benefits to yourself from this procedure.

Choosing to participate in the upcoming phone interview indicates that you have understood the information regarding participation in this project. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities.

Lodge Name

Identifier code #	
Respondents Position/Title:	
Physical Location of facilities:	
Mountain Range:	
Elevation:	
Latitude and Longitude	
Aspect	
Contact Information	
Mailing Address	
Phone Number	
Fax Number	
Email address	
Website	

Date of contact

Method of contact

Comments

- 1
- 2
- 3
- 4
- 5

Questionnaire

Energy, Water and Waste Management Systems at Off-grid Backcountry Facilities in BC and Alberta

Hi, my name is Tessa MacDonald I am working with Selkirk College, undertaking a research study of off-grid facilities on behalf of BEES (Backcountry Environmental Energy Solutions) and the Alpine Club of Canada.

I recently sent your company some information on my research study by mail. Have you received it or become familiar with the information I sent?

Are you willing to participate in a 15-30 min. survey regarding your sources of energy/heat, drinking water and sewage disposal or treatment?

If 'no', is there a better time or method to contact you?

How can we get you interested and involved in this project?

The purpose of this survey is to find off-grid technologies that are proving to be successfully for huts/ cabins/ lodges in backcountry alpine settings. We would like to identify and solve common problems that operators are having or fill gaps in knowledge.

Information collected will be used to make recommendations for safe, energy efficient, environmentally benign, successful alpine solutions. Responses to this questionnaire will be held in confidence. Final results will be published, but no individual names or other identifying information will appear.

If you are willing to participate in this 15 min., then research protocol requires that I explain how the data are stored and used and that you are aware of, and consent to this.

This consent form, a copy of which can has been mailed or faxed to you prior to this interview, should give you the basic idea of what the research is about. If you would like more detail about something mentioned here, or information not included here, please feel free to ask.

I am conducting a survey regarding off-grid backcountry facilities and their sources of energy, water and disposal wastewater. As a lodge or hut operator, your voluntary participation is requested since practitioner have information that will further understandings of the effectiveness of off-grid technologies. The questionnaire will take approximately 15 minutes.

The identities of the participants will be known only to the current and potentially future researchers, but will not be shared with the sponsors of this research or the public.

Information collected will be used to help lodge and hut operators chose safe, energy efficient, environmentally sound, proven off-grid technologies. Final results will be published and shared with interested parties, but no individual names or other identifying information will appear.

Any information that will be shared with our sponsors or the general public will not include: names of facilities, location of facilities or other characteristics that might identify the facilities in our survey.

If you chose to withdraw from the study at any point, we will disregard any data associated with your responses to this questionnaire.

Once the study is complete we will store the data on a CD for 3 years. After 3 years we will destroy all the data.

“Do you realize that there are may be no direct benefit to yourself from participating in this questionnaire?” Yes
No

“Choosing to continue to the survey indicates that you understand the information regarding your participation in this project. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities.”

“I agree to participate as a subject.” Yes
No

Signature of interviewer:
(on behalf of the interviewee)

(Tessa MacDonald)

Date:

Questions

1.	Are you off the electrical grid? If 'no', end survey and "thank you".
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About the lodge/cabin

Knowing a bit about the size and operation of your facility will help us focus our questions.

2	In which season(s) do you operate? Year round: Summer: Winter: Fall Spring:
3	What is the approximate elevation of your facility? Meters: Feet:
4	Approximately how many beds are there (guest and staff beds)? Guest: Staff: Total: Winter: Summer:
5	Approximately how many nights per year is your facility used?

Heat

6	What is your main source of heat? If wood go to question 7 If propane go to question 8
7	If wood, what types of heaters do you use i.e. interior wood heater (high efficiency), exterior furnaces with boiler
7a	Approximately how many cords of wood do you burn in a year?
7b	Are you happy with this source of heat? If 'no', why not?
8	If propane, how do you transport the propane to the site?
8a	Do you use the propane for anything else? i.e. cooking, lights etc.
8b	Do you know how much propane you burn in a year?
8c	Are you happy with propane for heat? If 'no', why not?
9	Do you have a secondary or back-up source of heat? If 'yes', what is it?

Electricity

10	Do you have electricity? If 'no', go to question 22
11	What is the source of your electricity?
12	What does it power? i.e. lights, heaters, outlets, refrigeration, cooking, exhaust fans etc.
13	Do you know the approximate output of your electrical system? i.e. how many watts it generates?
14	Do you know the maximum electrical demand your facility?
15	How long have you used this system?
16	Has it been reliable for you?

17	Does it require much maintenance?
18	What challenges have you had with this form of electricity?
19	Do you know the approximate cost to install the system?
19a	Did you have it Professionally Installed? Was it done in house or by a 3rd party?
20	Overall, have you been happy with your electrical source? Why did you choose to go this route? Has it met your expectations?

21	Any other thoughts or experiences you want to share with your present or past heat source?
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Drinking Water

22	What is your source for drinking water? i.e., surface water (creek, lake, pond), well, snow, other?
22a	How do you receive your drinking water?
23	Does your drinking water receive treatment for potability? If no, go to question 24
23a	What form of water treatment do you have in place?

23b	How frequently do you test water quality? What kind of test do you do?
24	What are the uses of the water you bring in? Drinking water: Toilets: Showers:
25	Has this system been reliable?

Sewage disposal/treatment

26	Do you treat your sewage on-site or remove it? If 'remove it', go to question 26a If 'on-site', go to question 27
26a	What is your method to remove your waste water?
27	What form of on-site treatment do you have?

28	How long have you been using this method?
29	Does it require much maintenance?
30	What challenges have you had with this system?
31	Do you know the approximate cost to install the system?
32	Overall, have you been happy with your sewage treatment system? Explain
32a	Did you have it professionally designed or installed? Was it done in house or by a 3rd party?
33	Do you test your effluent? If no, go to question 34

33a	How often do you test it?
33b	What do you test it for? (BOD5, suspended solids (SS), TKN, P, <i>E-coli</i> ?)
33c	Do you have a permit? If no go to question 34

Additional questions

34	If you were to start over, or retrofit your existing lodge/cabin/facility, would you use the same systems that you have now? If 'no', go to question 36
35	What would you do differently?

36	Do you have any other comments or thoughts about energy, sewage disposal or drinking water?
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Wrap-Up

Would you like a record of your responses read back to you over the phone to check for accurateness?

Would you be interested in participating in further discussions about this topic in a more open forum? Y N

If yes, would you like your name added to a list for this purpose (keeping in mind that it will not be connected to any of the data collected in this interview)
Please provide the contact information that you would like used for future discussion.

Thank you; I appreciate the time you have taken to contribute information for this research project!

Appendix 3. Recommended Contractors or Manufacturers

The following are contractors or manufactures that were recommended by participants in the questionnaire:

- David Poltrak 604-841-6452 – Designs and distributes wastewater treatment plants
- Don Scarlett – Designs micro-hydro systems. He is based out of Kalso BC
- Mountain Fresh – Specializes in water filtration. Based out of Calgary
- Thomas and Howe – Distributor of micro-hydro equipment.
- Storburn – Ontario – Distributes incinerating toilets.
- Sol Tek – Specializes with solar energy. Based out of Calgary