

DRAFT REPORT ON

RENEWABLE RESOURCE ASSESSMENT OF THE

PEHDZEH KI NDEH AREA OF

INTEREST

Submitted to:

Canadian Parks and Wilderness Society (CPAWS)
Northwest Territories Chapter
4th Floor, 4921 - 49th Street
P.O. Box 1934
Yellowknife, NWT X1A 2P5

Submitted by:

IMG-Golder Corporation
P.O. Box 2340
Suite 206 - 125 Mackenzie Road
Inuvik, NT, X0E 0T0

March 2006 March 2006

06-1334-013

EXECUTIVE SUMMARY

In accordance with the objectives outlined in the Northwest Territories Protected Areas Strategy's Renewable Resource Assessment Guidelines (NWT-PAS 2005), the purpose of this study is to conduct a draft assessment of the status of renewable resources within the Pehdzeh Ki Ndeh Study Area. This description incorporates an assessment of each resource's distribution, abundance, present use by residents of the area, future potential use and economic value. The analysis aims to assist in the determination of the social and economic implications of the renewable resources and their uses within the Study Area. For the purpose of this report, the Study Area is defined as Pehdzeh Ki Ndeh, an estimated 17,053 km² tract of land centred at approximately 123°W and 63°50'N, a 25 km buffer around the area and the community of Wrigley.

This Draft Renewable Resource Assessment analyzes seven different categories of renewable resources in order to assess their present and future uses, including potential commercial values. The resources assessed in this study are:

- Wildlife (subsistence harvest, recreational harvest, outfitting, trapping, commercial harvesting);
- Fish (subsistence fishing, recreational fishing, commercial fishing, hatcheries);
- Trees (commercial timber harvest, fuel wood harvest);
- Plants (berry picking, medicinal, spiritual, ritual and wild food plant harvesting, agriculture);
- Art and Craft Materials (birchbark baskets, beadwork, carving, quillwork, souvenirs, tufting)
- Wilderness (eco-tourism, tourism businesses, lodges); and
- Renewable Energy (wind energy, hydroelectric energy).

Wildlife

Wildlife is assessed as being a key renewable resource in Pehdzeh Ki Ndeh. Subsistence harvesting is an important resource use among Study Area residents and provides a fairly high amount of meat to the families. Moose are acknowledged as being the most important subsistence harvest species, and there are numerous areas in Pehdzeh Ki Ndeh known to be

valuable moose habitat, concentrated around the shores of its many lakes. Subsistence harvesting is strongly connected with Traditional Knowledge and possesses a high cultural value in this respect. There is a recognized economic value for wildlife subsistence harvesting because of the savings realized by Wrigley residents who do not have to purchase meat at its equivalent high replacement value.

It is unknown to what extent recreational harvesting occurs in the Study Area. Recreational hunting opportunities do exist in Pehdzeh Ki Ndeh but the few non-Aboriginal residents don't seem to use this resource. Currently, no licensed big-game outfitters exist in Pehdzeh Ki Ndeh. Consequently, there is no known economic value to this resource use.

Trapping is strongly associated with cultural traditions. Pehdzeh Ki Ndeh has known furbearer habitat, and some trapping is known to take place within the Study Area. Trapping for domestic use was found to be quite common, with several 'ative trappers' that trap for income. Overall, fur harvest returns to the community of Wrigley show that significant income is derived from this resource use. Harvest data from one trapper who utilizes Pehdzeh Ki Ndeh suggests that the Study Area contains an appreciable value for the trappers that use it.

There is currently no commercial harvest of wildlife in Pehdzeh Ki Ndeh. Commercial wildlife harvesting is assessed as having no current economic value and very minimal potential as a future renewable resource use.

Information sources describing the current distributions, abundances, critical habitats and economic values for the different wildlife species and their uses as renewable resources in Pehdzeh Ki Ndeh are limited. Harvest and trapping locations and volumes are not well documented. To better understand the use of wildlife in Pehdzeh Ki Ndeh, surveys could further assess the importance of different species, preferred hunting and trapping locations, and harvest volumes.

Fish

Fish are acknowledged as being an important renewable resource in Pehdzeh Ki Ndeh. Subsistence fishing is a commonly practiced activity, with the Mackenzie River, Wrigley River, Willowlake River, the River Between Two Mountains, Blackwater Lake, Greasy Lake and

Highland Lake being important waterbodies for subsistence harvesting. The primary species caught are lake whitefish, lake trout, inconnu and northern pike. These fish resources are considered to have an important cultural value for Wrigley residents and are also of significant economic value because of the savings realized by not purchasing fish meat at its market value.

Recreational fishing opportunities exist in Pehdzeh Ki Ndeh. There are several older cabins throughout the area, which could potentially be used for sport fishing purposes and the possibility for sport fishing opportunities exists at Blackwater and Fish lakes. Presently, only one outfitter takes tourists on sport fishing trips and these trips are understood to be limited to the Mackenzie River and its major tributaries. Recreational fishing in the Study Area is focussed on northern pike, lake trout, walleye and whitefish species.

Commercial fishing activities in Pehdzeh Ki Ndeh have been limited to attempts at Keller and Blackwater lakes, but these endeavours were found to be not economically viable. Commercial fishing efforts in the region are likely to be faced with restricting factors such as the cold climate, parasitic infestations in the fish, high transportation, fuel, labour, material and fishing gear costs.

Hatchery programs do not presently exist in Pehdzeh Ki Ndeh and are not considered to have any social or economic value to residents of the area.

Information sources that were available for review to assess fish as renewable resources in Pehdzeh Ki Ndeh were variable in quality and quantity. A better understanding of the locations and volumes of subsistence fish harvest in the area could be accomplished by conducting surveys with fishers from Wrigley. Other surveys could confirm the economic importance of the recreational sport fishing industry in the area.

Trees

Trees are utilized for many different reasons within the study area, including as construction and building materials, for fuel wood and for other purposes. The two potential uses of trees that are considered in this study are commercial logging and fuel wood harvesting. Presently, the commercial logging of trees does not exist within Pehdzeh Ki Ndeh, although high quality stands of spruce and pine are known to exist south of Wrigley, and there has been small-scale commercial horse logging endeavours in the area in the past (J. Morin pers. comm. 2006).

According to the Draft Dehcho Land Use Plan (Dehcho Land Use Planning Committee (DCUPC) November 2005), the harvest of any timber stands within the Pehdzeh Ki Ndeh Conservation Zone would not be permitted, but would be allowable in the Wrigley Special Management and the General Use zones to the west.

The harvest of fuel wood to heat individual homes is common and residents of Wrigley are granted free access to forested areas to harvest wood. The utilization of personally harvested fuel wood is acknowledged as having a high economic value for Wrigley residents because of the individual costs saved through not having to purchase fuel wood and not to heat with fuel.

Information for assessing the importance of trees for commercial harvest was readily available, but information regarding tree use for fuel wood was limited. Surveys could be conducted which would assess the current use of trees in Pehdzeh Ki Ndeh for fuel wood purposes, including harvest locations, volumes and economic values.

Plants

Plants have traditionally been used for many different purposes within Pehdzeh Ki Ndeh, such as for berry picking, medicinal, ritual and spiritual reasons, as wild plant food sources, and also, more recently, as domesticated agricultural crops (i.e., personal gardens). Berry picking is a very popular activity for Wrigley residents of all ages and is concentrated along the Mackenzie Highway and existing pipeline corridor near the community. Little information has been accessible regarding the harvest of plants for medicinal, ritual, spiritual or wild plant food reasons, but it is acknowledged that such harvesting does take place within the Study Area.

The history of agriculture is well-known over the past half-century in the central and southern Mackenzie Valley and, although no commercial endeavours have been attempted locally, several residents of Wrigley do maintain gardens and are able to harvest a variety of crops for personal consumption, which helps to offset the high costs of foods that are locally available.

Information about the use of plants in Pehdzeh Ki Ndeh was generally unavailable. Currently existing documents could be made accessible for review, and further surveys and Traditional Knowledge studies could help in the understanding of plant harvests and economic values in the area.

Art and Craft Materials

Renewable resources harvested and collected in the Study Area are utilized by artists in Wrigley for arts and crafts purposes. Animal parts such as antlers, bones, fur, hide and sinew are collected or harvested throughout the area. Moose and caribou are the primary ungulates whose antlers, hide and hair are used for carving, clothing, souvenirs and tufting. Beaver, marten, fox, wolverine and rabbit are the fur-bearing animals whose pelts are most often used for clothing and decorative trim on other items. While porcupines are present in Pehdzeh Ki Ndeh, porcupine quill work is generally not produced in Wrigley. All of these animals are known to be harvested at various locations throughout Pehdzeh Ki Ndeh, but the specific distributions, abundances and collecting and harvesting trends for such resources are unknown.

Vegetation parts are also known to be used in the creation of arts and crafts works, such as birchbark for basket making, wood for carving and as components of souvenir items, and lichens and berries for dyeing ingredients. It is acknowledged that these materials are likely gathered within Pehdzeh Ki Ndeh, but the distributions, abundances and actual harvesting trends of the different resources is unknown. Both animal and vegetation parts from Pehdzeh Ki Ndeh are acknowledged as having an economic value when utilized as art and craft materials, but the present value of such resources is not known.

Information on the harvest of renewable resources for art and craft materials is variable. Local knowledge has been able to provide estimations for the harvest of animals in Pehdzeh Ki Ndeh for such purposes, but little information was available to assess the harvest of plants for their use in the arts and crafts industry. Surveys could be conducted with Wrigley harvesters and artists that would clarify animal and plant harvest locations, volumes and economic values when used as art and craft materials.

Wilderness

The Pehdzeh Ki Ndeh wilderness has been a tourist attraction for several decades, but it is not well understood how important this industry is for the present economic stability of the community of Wrigley. The average annual number of tourists to Wrigley over the years is unknown and it is uncertain what the spending trends are of tourists once they enter the

community. Accommodation options are limited to one hotel and one designated campground, purchasing opportunities for tourists are very limited and there is a general perception that there are not an abundance of activities for tourists to participate in once they are in the community.

There are many tourism attractions in the Study Area however and independent travellers with their own boats, or tourists travelling with the community's outfitting guide, may explore the area from the Mackenzie River and its navigable tributaries. There is also the option of exploring the area from the land with a guide from Wrigley who offers hiking and biking adventures to tourists. In general, because of Wrigley's remote location and subsequent low level of tourist visitation, lack of retail outlets where tourists could support the local economy and minimal accommodations and recreational facilities within the community, it is assumed that tourism is not presently a significant industry in Wrigley, although there is the potential for its expansion.

Information on wilderness as a tourism attraction in Pehdzeh Ki Ndeh is highly variable. Significant amounts of information exist documenting the existence of and the tourism potential for many attractions in the area, but the current use of these attractions is almost entirely unknown. Surveys could assess tourism numbers in Wrigley, their utilization of the different attractions and the economic value of tourism activities in the area.

Renewable Energy

Neither wind nor hydroelectric energy are currently being utilized as a renewable energy source within the Study Area. The potential does exist for both, but further studies would need to be conducted in order to determine the economic feasibility of such development opportunities, associated environmental concerns and also the extent of support by residents of the area for such developments.

Considerations for the potential harnessing of wind energy would include assessing the suitability of different sites for the installation of a wind turbine (e.g., wind characteristics including speed and duration and distance to the Wrigley power grid), measures that would need to be taken to minimize or mitigate wildlife and habitat disturbances, the support of Wrigley residents for such a project and the residents' availabilities to construct and maintain the turbine and associated facilities over time.

Considerations for the potential harnessing of hydroelectric energy would include assessing the suitability of different sites for the development of hydroelectric dams. The construction of such projects is considered to be unlikely around the Study Area because of the historical opposition of the Dehcho to similar proposed developments in the past.

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1. INTRODUCTION

The Northwest Territories (NWT) is often regarded as being one of the world's greatest remaining wilderness areas, encompassing such variable landscapes as taiga, tundra and boreal ecosystems. The Northwest Territories Protected Areas Strategy (NWT-PAS) is community-based tool that helps guide concerned citizens and decision makers who are endeavouring to protect areas that are considered to be of cultural or ecological significance. Using the best available knowledge, it aims to provide long-term protected status to a network of such areas across the NWT and works with two goals to represent areas of concern: to protect special natural and cultural areas where development could be permitted when compatible with the values being protected; and to protect core areas to represent the NWT's 42 ecoregions where resource based development and associated development will not be permitted. The NWT-PAS follows a general planning process for protected areas which typically follows eight steps and aims to achieve a balanced approach to protecting culturally and ecologically significant areas. The specific process varies from region to region, due to differences in cultural, ecological and political settings. The eight steps are:

1. Identify priority areas of interest.
2. Prepare and review protected area proposal at the regional level.
3. Review and submit proposal for candidate protected area status.
4. Consider and, where necessary, apply interim protection for candidate area.
5. Evaluate candidate area.
6. Seek formal establishment of protected area.
7. Approve and designate protected area.
8. Implement, monitor and review protected area.

Steps 1 and 2 have been completed for the Pehdzeh Ki Ndeh Area of Interest (Pehdzeh Ki Ndeh). Step 5 requires that a detailed evaluation of the area's ecological, cultural and economic values be conducted and incorporated into the ecological evaluation is a Renewable Resource Assessment. Although the Pehdzeh Ki Ndeh Area of Interest has not reached Step 5 of the NWT-PAS planning process, currently available funding through the Canadian Parks and Wilderness Society (CPAWS) has allowed for a Draft Renewable Resource Assessment to be conducted at this stage. At its present stage, the Area of Interest has tentative boundaries and no specific land protection status such as access or development restrictions under the NWT-PAS. The Revised Revised

Draft Dehcho Land Use Plan (DLUPC 2005) designated Pehdzeh Ki Ndeh as a Conservation Zone, which would limit activities in Pehdzeh Ki Ndeh to tourism activities only.

Pehdzeh Ki Ndeh is located in the northernmost region of the Dehcho Territory to the east of the Mackenzie River. For the purpose of this study, a buffer zone of 25 km has been added to the Pehdzeh Ki Ndeh boundary limits to incorporate potentially influential areas around Pehdzeh Ki Ndeh. Together, the Area of Interest, the buffer zone and the community of Wrigley are referred to hereafter as the Study Area (Figure 1).

This document was prepared to compile all available documented information on renewable resources and their current and potential uses and significances, as outlined in the Renewable Resource Assessment Guidelines (NWT-PAS 2005).

OBJECTIVES

The objectives for this study are to:

1. Provide a draft assessment of renewable resources, their current and potential uses and their economic values in and around Pehdzeh Ki Ndeh;
2. Provide insight into and improve the state of knowledge about the variety of renewable resources and their uses in Pehdzeh Ki Ndeh; and
3. Provide information for the consideration of the social and economic implications of renewable resources and their uses.

This Draft Renewable Resource Assessment includes the following renewable resources that have potential and / or existing commercial value, or are used locally:

Resource	Resource use
Wildlife	Subsistence hunting, recreational hunting, outfitting, trapping, commercial harvesting
Fish	Subsistence fishing, sport fishing, commercial fishing, hatcheries
Trees	Commercial harvesting, small-scale harvesting, fuel wood, construction
Plants	Berry picking, medicinal plant harvest, food plant harvest, agriculture
Art & Craft Materials	Clothing, birchbark baskets, bead work, tufting, quill work, carving

Wilderness	Eco-tourism, tourism businesses, lodges
Renewable Energy	Wind power, hydroelectric power

The authors of this report recognize that Pehdzeh Ki Ndeh may be valued in a way that does not necessarily entail the usage of the area, or consumption of its resources. Pehdzeh Ki Ndeh may be appreciated for its aesthetic, ethical, future and other significant values as well. Local residents and visitors to the area take pleasure in the beauty of the environment, both in person and vicariously through literature, photographs, electronic or other media means, or by simply knowing that the area exists. Retaining an intact ecosystem for the use of future generations compounds the resource's value and recognizing that such landscape areas contribute "Ecological Function Values" such as carbon storage, oxygen production and pollution and flood mitigation are important (Aneilski and Wilson 2003). There are also the important but not measurable cultural values associated with Pehdzeh Ki Ndeh. These functions and values are acknowledged and appreciated, but not examined in this assessment.

The scope of this study limits itself to gathering information from pre-existing studies or through interviewing persons knowledgeable about the area, its renewable resources and their uses and values. This methodology restricts this report to analysis of knowledge and data sets that presently exist and that were accessible. The values taken into consideration are use-value oriented; indirect use benefits are acknowledged to have assessable market values, but these assessments fall outside the scope of this report.

2. BACKGROUND AND DESCRIPTION OF STUDY AREA

2.1 Background of Pehdzeh Ki Ndeh Area of Interest

Pehdzeh Ki Ndeh is a 17, 053 km² (1, 705, 300 ha) tract of land with the majority of it lying east of the Mackenzie River at the northern extent of the Dehcho region of the Northwest Territories (Figure 1). The Study Area encompasses four major watersheds, one major river and several substantial lakes. The community of Wrigley, located on the east bank of the Mackenzie River, lies just outside of the western boundary of the Area of Interest, but is included in the Study Area, which extends the boundary to include a 25-kilometre buffer. Just within the western boundary

of the Area of Interest are both a length of the Mackenzie River and part of the proposed Mackenzie Gas Project Pipeline Route. The northern boundary of the Area of Interest lies on the border between the Dehcho region and Sahtu Settlement Area (Figure 1).

Pehdzeh Ki Deh originally included the entire Blackwater Lake Watershed which extended into the southern boundary of the Sahtu Settlement Area (including both the Tulita Land District and Deline Land District). For the past several years, Pehdzeh Ki First Nation and the Dehcho First Nations have attempted to resolve the outstanding overlap issues with the Sahtu, however little progress has been made. Recently, Pehdzeh Ki First Nation has decided to proceed with protecting the Dehcho portion of Pehdzeh Ki Ndeh through the NWT-PAS. As such, for the purpose of this study, the northern boundary of the Pehdzeh Ki Deh is considered to be at the Dehcho and Sahtu boundary (J. Morin pers. comm. 2006).

The landscape of Pehdzeh Ki Ndeh is variable, encompassing boreal forest and taiga ecosystems in elevations ranging from approximately 100 m to 1600 m above sea level. The terrain ranges from wide gently sloping river valleys to steep mountain ranges and is home to a great diversity of wildlife species (Environment Canada 2006a).

The Dehcho and Sahtu residents have been utilizing the Pehdzeh Ki Ndeh area for centuries. As with all of the original inhabitants of the Northwest Territories, renewable resources were depended upon for survival. Wildlife, fish, trees, plants and other land and water resources played an integral role in the lives of these people and continue to do so today. Activities such as hunting, fishing, fuel wood harvesting and berry picking are still important contributors to a subsistence existence for residents of the area and augment the local economy in various ways (J. Morin pers. comm. 2006; D'Arcy Moses pers. comm. 2006; M. Moses pers. comm. 2006; T. Cli pers. comm. 2006). For the purpose of this study, only the residents of Wrigley are considered to use the renewable resources of Pehdzeh Ki Ndeh, though it is realized that the residents of Tulita, Deline and elsewhere have associations with the region and its resources as well.

Pehdzeh Ki Ndeh was identified for protection under the NWT-PAS because of its importance to the Pehdzeh Ki First Nation as a spiritual and cultural area and the significance of its relatively undeveloped landscape as habitat for a wide range of wildlife, migratory bird and fish species (NWT-PAS 2001). The interests expressed to set aside this area emphasize a desire to protect the

land from development and allow only limited uses of the area for activities such as traditional harvesting and tourism (DLUPC 2005).

Several initiatives and events have taken place which brought Pehdzeh Ki Ndeh to its present status as an Area of Interest under NWT-PAS. These are outlined in Table 1.

Table 1 Summary of Significant Events for the Pehdzeh Ki Ndeh Area of Interest
(Sources: Cizek Environmental and McCullum Environmental Services 2002; Deh Cho First Nation 2004a; NWT-PAS 2004; Cizek Environmental Services 2000)

Event Date	Event	Relevance of Event
2000 October	Pehdzeh Ki First Nation Protected Areas Workshop (for residents of Wrigley and Tulita)	- workshop on Pehdzeh Ki Ndeh (mapped traditional knowledge) - report prepared by Cizek Environmental Services (2000) for Pehdzeh Ki First Nations
2001 February	Pehdzeh Ki First Nation Band Council Resolution	- Pehdzeh Ki First Nations supported Pehdzeh Ki Ndeh as a Candidate Protected Area under NWT-PAS, Step 1
2002 February	Cizek Environmental contracted by Pehdzeh Ki First Nation	- preparation of background information on Pehdzeh Ki Ndeh - draft submission of report
2002 April	Community NWT-PAS Meeting (Wrigley)	- review of Cizek Environmental draft report
2002 April	Pehdzeh Ki Ndeh - "Rock Place Land" Candidate Protected Area report (Cizek Environmental Services and McCullum Environmental Services 2002)	- completion of NWT-PAS, Step 2 report
2003	Deh Cho Interim Land Withdrawal Agreement	- signed by Dehcho First Nation and Government of Canada - does not include withdrawal of PehzDeh Ki Deh Area of Interest
2004 March	Community NWT-PAS Meeting (Wrigley)	- update on discussions with Sahtu - additional resource / ecological info on PKD presented - P. Cizek presented 3-D virtual fly-through movie
2004 - 2009	NWT-PAS Implementation Advisory Committee	- Mackenzie Valley Five Year Action Plan: Conservation Planning for Pipeline Development produced
2006	Pehdzeh Ki First Nation Community Meetings	- Community decides to designate a special management corridor within Pehdzeh Ki Ndeh for forestry (along east and west sides of Mackenzie Highway). - Community decides to move forward through the NWT-PAS with the Dehcho portion of Pehdzeh Ki Ndeh.
2006	IMG-Golder contracted by CPAWS	- completion of NWT-PAS, Draft Pehdzeh Ki Ndeh Renewable Resource Assessment

POTENTIALLY 2006 / 2007	Pehdzeh Ki Ndeh designation as a Conservation Zone (with ratification of Dehcho Land Use Plan)	- Conservation Zone 1 with tourism being only permitted use in Pehdzeh Ki Ndeh
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Pehdzeh Ki Ndeh presently has no official protection designations. It is currently seeking to achieve Step 3 of the NWT-PAS; it is still considered an Area of Interest and is not protected by any surface or subsurface land withdrawals. However, according to the Revised Draft Dehcho Land Use Plan (DLUPC 2005), four distinct management regions will be created within the Study Area: 1) The majority of Pehdzeh Ki Ndeh will be considered a Conservation Zone (Zone Number 1) with tourism being the only permitted use of the land; 2) a length of the Mackenzie Valley to the south and extending north of Wrigley will be considered the Wrigley Special Management Zone, with tourism and forestry being the only permitted land uses; 3) the area to the west of Pehdzeh Ki Ndeh and partly included in the buffer zone will be considered a General Use Zone, with all uses permitted; and 4) the area within the community boundaries of Wrigley will not change and be regulated according to the municipal legislation.

2.2 Description of Study Area Components

Located in the Taiga Plains Ecozone, with the transitional area of the Taiga Cordillera Ecozone to the west, the Study Area encompasses several different ecoregions (Environment Canada 2006a). These include the Mackenzie River Plain ecoregion, a broad valley plain between the Mackenzie and Franklin mountain ranges in the western Study Area. The Franklin Mountains ecoregion to the east is a range reaching approximately 1525 meters (m) elevation above sea level. The Norman Range ecoregion to the east has variable terrain from gently rolling landscapes of below 500 m elevation to a series of low. The Keller Lake Plain ecoregion on the eastern edge of the Study Area is characterized by a peat-covered undulating landscape of glacial drift and outwash deposits, generally below 310 m elevation. The Great Slave Lake Plain Ecoregion in the southeast of the Study Area contains low scarps and shallow lakes, below 300 m. The Horn Plateau ecoregion is represented in the Study Area in the Willowlake River valley in the south. The Hay River Lowland ecoregion in the southwest of the Study Area has a typically low relief gently rolling landscape, while the Peel River Plateau ecoregion is found west of the Study Area but its transition zone with the Mackenzie Valley ecoregion may occur near the Study Area's buffer zone border. It is characterized by hummocky to dissected glacial drift and organic (Environment Canada 2006a).

The Study Area includes several water bodies such as Blackwater, Keller, Tseepantee, Fish, Highland and Greasy lakes, and also the River Between Two Mountains, Ochre and Blackwater rivers (Figure 1). It has been a traditional harvesting area for the Dene First Nations for centuries and holds great spiritual and cultural significance, especially for the Dehcho residents of Wrigley and the Sahtu residents of Tulita and Deline (NWT-PAS 2001; NWT-PAS 2006).

The community of Wrigley, home of the Pehdzeh Ki First Nation, is located on the east bank of the Mackenzie River and is home to approximately 183 people (T. Cli pers. comm. 2006) of predominantly Dene descent. The community has year-round road access via the Mackenzie Highway leading south and in the winter months a seasonal road also allows vehicle access to the communities of Tulita, Deline, Norman Wells and Fort Good Hope to the north. For the past 10 years, the population has remained relatively stable. In 2004, 97% of the population was aboriginal, 79% of the population spoke an aboriginal language, 27% of the population who had less than a high school education was employed and 42% of the population with a high school education or higher was employed (NWT Bureau of Statistics 2004). These are both significantly lower than the NWT employment average of 39% and 82% respectively.

3. METHODS

3.1 Collection and Review of Existing Documented Information

The IMG-Golder team has reviewed and summarized the existing documented literature on renewable resources and their uses in the Pehdzeh Ki Ndeh Study Area and conducted numerous interviews with persons knowledgeable of the area to obtain additional undocumented information. Information sources included literature reviews and on-line searches for scientific publications, relevant draft and final reports, relevant draft land use plans, traditional knowledge studies, other ecology and resource assessments and surveys, maps and databases and interviews with Wrigley residents, Band Office representatives, local Business Development Officers, government and non-government agencies and other knowledgeable persons. Information sources of significant contribution to this Renewable Resource Assessment are listed in Table 2. It should be noted that although every attempt was made to compile all information available for the renewable resources and their uses in Pehdzeh Ki Ndeh, only limited information was available that was specifically to the Area of Interest. Throughout this study, conclusions are

often drawn from educated assumptions based on the best available information for the resources' uses or potential future uses and their economic values.

Table 2 Important Information Sources for the Assessment of Renewable Resources in the Study Area

Renewable Resource						
Wildlife	Fish	Trees	Plants	Art & Craft Materials	Wilderness	Renewable Energy
- DLUPC Draft Land Use Plan 2005 - Cizek Environmental Services and McCullum Environmental Services 2002 - EBA Engineering Consultants Ltd. 2003 - NWT Bureau of Statistics 2004 - Ashley 2002 - GNWT, ENR - D. Moses pers. comm. 2006	- Cizek Environmental Services and McCullum Environmental Services 2002 - Stewart and Low 2000 - Davies et al. 1987 - R.T. & Associates 1990 - M. Moses pers. comm. 2006	- Env Canada 2005 - Treeline Planning Services Ltd 1985 - PACTeam Canada 2003 - JC Bartlett & Asstes 2004 - T. Cli pers. comm. 2006 - NWT Bureau of Statistics 2004	- DLUPC Draft Land Use Plan 2005 - GNWT, Economic Development and Tourism 1990 - T. Cli pers. comm. 2006 - NWT Bureau of Statistics 2004	- D. Moses pers. comm. 2006 - M. <i>Norwegian</i> pers. comm. 2005 - GNWT, ITI - GNWT, Economic Development and Tourism 1993 - Zieba 2005	- Deh Cho Environmental report 2003 - DLUPC Draft Land Use Plan 2005 - Acres Consulting Services 1973 - Marshall & Macklin Monaghan 1985 - R.T. & Associates 1990 - T. Cli pers. comm. 2006 - M. Moses pers. comm. 2006 - Zieba pers. comm. 2006	- Canadian Wind Energy - Environment Canada 2006b (weather) - Northwest Territories Power Corporation - Deh Cho First Nations resolutions - GNWT Energy Secretariat - Owen 1973

3.2 Mapping

will be completed as soon as maps are created

3.3 Assessment and Evaluation of Data

All current and potential resource uses within the seven resource categories were described according to the following criteria (where data were available):

- distribution of resource in the Study Area;
- extent of present resource use and importance for people in the Study Area
- the potential for resource use in the Study Area in the future; and
- estimated economic value of resource in the Study Area.

The method of calculation of economic values differed depending on the particular resource use. Wildlife and fish economic values were derived from meat and fish edible weights and meat replacement values. Income through trapping was estimated via fur auction sales. Fuel wood value was calculated on the basis of estimated consumption and costs for fuel wood in the Study Area. Tourism values were derived from known visitor numbers and their estimated spending habits. Due to a lack of available documented information, little or no economic value was given to commercial timber harvest, plants, art and craft materials, or renewable energy resources. Information on these renewable resources and their uses in Pehdzeh Ki Ndeh could be effectively gathered through conducting surveys with resident harvesters to record resource harvest locations, harvest volumes, harvest species, and estimate the economic values of those harvests.

4. RENEWABLE RESOURCES AND THEIR USES

4.1 Wildlife

This section describes wildlife resources in Pehdzeh Ki Ndeh, their distribution, abundance (where available) and critical habitat. Subsistence harvest, recreational harvest, trapping, outfitting and commercial harvest are examined for current and potential future use, use of the Study Area and the economic value of these activities.

Numerous species of both large and small game and furbearing animals reside in the area. They constitute a principal resource for the residents of the Study Area. Table 3 summarizes all wildlife species that may be harvested in the Study Area. Not all of the species listed may be harvested within Pehdzeh Ki Ndeh, but are reported to occur in the Study Area.

Table 3 Commonly Harvested Wildlife Species Present in the Study Area, their Occurrence and Reported Critical Habitat and in the Study Area

<i>Family</i>	<i>Local or common name</i>	<i>Scientific name</i>	<i>Occurrence and reported critical habitat</i>
Cervidae	Moose	<i>Alces alces</i>	Found throughout the area. There are calving areas on the shores of Blackwater Lake, east of Blackwater Lake on the shores of Notsegleee Lake and Southeast of Blackwater Lake on Tonaeenlee Lake, the shores of Fish Lake and northwest of Fish Lake (Cizek Environmental Services and McCullum

			Environmental Services 2002)
	Barrenground Caribou	<i>Rangifer tarandus groenlandicus</i>	Some members of Bathurst herd found around the eastern boundary of Pehdzeh Ki Ndeh and some members of the Bluenose East herd found north of Blackwater Lake and Keller Lake (GNWT Geomatics 2002).
	Boreal woodland caribou	<i>Rangifer tarandus caribou</i>	Shores of Blackwater Lake and Fish Lake are a known calving area, there is a wintering ground in the highlands east of Blackwater Lake (Cizek Environmental Services and McCullum Environmental Services 2002)
Ursidae	Black bear	<i>Ursus americanus</i>	Found throughout the region, particularly in the spring and fall and often in higher mountain regions in the summer (Marshall Macklin Monaghan 1985)
	Grizzly bear	<i>Ursus arctos</i>	Known range east of Study Area in Mackenzie Mountains (DCLUPC 2005b).
Canidae	Wolf	<i>Canis lupus</i>	In the area (Darcy Moses pers. comm. 2006)
	Red Fox	<i>Vulpes vulpes</i>	In the area (Darcy Moses pers. comm. 2006)
Felidae	Lynx	<i>Lynx canadensis</i>	Blackwater River system southeast from the lake, the shores of Fish Lake (Cizek Environmental Services and McCullum Environmental Services 2002)
Mustelidae	Marten	<i>Martes americana</i>	Blackwater River system southeast from the lake, the shores of Fish Lake (Cizek Environmental Services and McCullum Environmental Services 2002)
	Fisher	<i>Martes pennanti</i>	In the area (Darcy Moses pers. comm. 2006)
	Wolverine	<i>Gulo gulo</i>	In the area (Darcy Moses pers. comm. 2006)
	Mink	<i>Mustela vison</i>	Blackwater River system southeast from the lake, the shores of Fish Lake (Cizek Environmental Services and McCullum Environmental Services 2002)
	Least weasel	<i>Mustela nivalis</i>	In the area (Darcy Moses pers. comm. 2006)
	Ermine	<i>Mustela erminia</i>	In the area (Darcy Moses pers. comm. 2006)
	Otter	<i>Lontra canadensis</i>	In the area (Darcy Moses pers. comm. 2006)
Leporidae	Snowshoe Hare	<i>Lepus americanus</i>	In the area (Darcy Moses pers. comm. 2006)
Castoridae	Beaver	<i>Castor canadensis</i>	Blackwater River system southeast from the lake, the chains of small lakes east of Blackwater Lake, the

			shores of Fish Lake, the shores of Spruce/Tseepantee Lake (Cizek Environmental Services and McCullum Environmental Services 2002),
Erethizontidae	Porcupine	<i>Erethizon dorsatum</i>	In the area (Darcy Moses pers. comm. 2006)
Muridae	Muskrat	<i>Ondatra zibethica</i>	In the area (Darcy Moses pers. comm. 2006)
Phasianidae	Grouse/ptarmigan e.g., Willow ptarmigan	Various e.g., <i>Lagopus lagopus</i>	In the area (Darcy Moses pers. comm. 2006)
Anatidae	Goose	Various	Blackwater River system southeast from the lake (Cizek Environmental Services and McCullum Environmental Services 2002)
	Tundra swan	<i>Cygnus columbianus</i>	Blackwater River system southeast from the lake (Cizek Environmental Services and McCullum Environmental Services 2002)
	Trumpeter swan	<i>Cygnus buccinator</i>	Blackwater River system southeast from the lake (Cizek Environmental Services and McCullum Environmental Services 2002)
	Duck	Various	Blackwater River system southeast from the lake (Cizek Environmental Services and McCullum Environmental Services 2002)

EBA Engineering Consultants Ltd.’s 2003 study of habitat use divided Dehcho landscapes into wildlife habitats and assigned different values, 1 to 4 depending on how much the habitat contributed toward critical survival needs of certain animals. The species selected for this study and which occur in the Study Area were moose, woodland caribou, black bear, grizzly bear, trumpeter swan, waterfowl and fish. The latter two animal groups were considered collectively. Areas known to serve as habitat for critical life stages such as calving, nesting, denning, staging and migrations were considered to have relatively higher ranks in this scheme while general use areas scored lower (EBA Engineering Consultants Ltd. 2003). In this study, approximately half of PehzDeh Ki Deh, in the north and east, was assigned a ranking of ‘1’, reflecting simply that the land falls within the range of the species examined. Most of the south and west of PehzDeh Ki Deh was ranked ‘2’, indicating that the land serves all habitat functions with a small portion in the north-western section in the McConnell range given a ‘3’ showing that the landscape “plays a critical role in the life requisite for a given species”. In summary, the north-western portion of the McConnell range in the west of Pehdzeh Ki Ndeh is the only area in the Study Area, considered an area of high habitat value.

Moose

Reportedly found throughout Pehdzeh Ki Ndeh in every season, moose occur in notably higher densities in the lower lying parts east of the Franklin Mountains - in the spruce forests, bogs, ponds and streams than in other places in the Study Area boundaries (Cizek Environmental Services and McCullum Environmental Services 2002). Southeast of Blackwater Lake is considered key moose habitat (Cizek Environmental Services and McCullum Environmental Services 2002; Figure 2). Moose are habitually seen on the shores of the larger lakes and along the river valleys in the area (Figure 2). Moose in the Study Area share calving grounds with boreal woodland caribou on the north and south shores of Blackwater Lake and around the shores of Fish Lake (Cizek Environmental Services and McCullum Environmental Services 2002). Moose thrive on post burn vegetative communities (Swallow et al. 2003) and there are two significant burn areas from within the last ten years. One is located in the south-east portion of the Pehdzeh Ki Ndeh and the other lies along the southwest shore of Blackwater Lake (Cizek Environmental Services and McCullum Environmental Services 2002). Bradley and Johnson (1998) reported moose to be the most significant animal south of the tree line in the NWT for meat harvesting and consumption. An aerial moose survey around the Wrigley area in 1982, found moose density to be comparatively low at 0.03 animals / km² (Bradley and Johnson 1998). Farther north, toward the Tulita area, moose densities were found to be higher with a 1999 study indicating a density of 0.11 moose per square kilometre (Swallow *et al.* 2003). Within the Dehcho region, moose numbers have not been consistently documented, but local knowledge and sporadic surveys have indicated that moose populations in the area are either decreasing (Fort Providence region) or considered to be stable (GNWT, ENR 2005a). The government of NWT has estimated the territorial moose population to be between 30,000 and 40,000 animals (GNWT, ENR 2005a). Moose are considered to have a secure status in the NWT (GNWT, ENR 2005a).

Barrenground caribou

In 2002, Gunn observed barrenground caribou and their tracks northeast of Wrigley. They were informed by a Wrigley resident that it was the first appearance of barrenground caribou in the area in 20 years and she suggested that they were representatives of the Bluenose East herd (Gunn et al. 2004). Satellite tracking indicates representatives of the Bluenose East herd frequenting the area immediately north of the Keller and Blackwater lakes and collared representatives of the Bathurst herd approaching very near the eastern boundary of Pehdzeh Ki Ndeh (GNWT Geomatics 2002).

Barrenground caribou have been assigned a “secure” status, but numbers have been declining dramatically in recent years and its position could drop to “sensitive”. A 2005 photo census of the Bluenose East herd counted 66,000 adults, a decline of about 36% since the 2000 census (GNWT, ENR 2005b). The Bathurst herd was estimated to have a population of about 186,000 in 2003, representing a decline of nearly 47% from their 1996 census population of approximately 350,000 (GNWT, ENR 2005b).

Boreal woodland caribou

Boreal woodland caribou are year-round inhabitants of Pehdzeh Ki Ndeh (Cizek Environmental Services and McCullum Environmental Services 2002; Figure 3). In the east central part of the Study Area, there is a plateau that reportedly acts as a wintering ground for caribou. Woodland caribou use the shores of Blackwater Lake and Fish Lake as calving grounds (EBA Engineering Consultants Ltd. 2003). The McConnell Range along the western border of the Study Area is a summering area and the higher areas are suspected to act as calving areas (EBA Engineering Consultants Ltd. 2003; DLUPC 2004a, Figure 3). Their preferred habitat is old growth (over 100 years old) coniferous forests that tend to foster extensive lichen growth on trees and the forest floor. In winter, they prefer upland areas with less snow and in the summer, they favour forest edges, marshes and meadows where their diet consists of new plants and grasses (DCLUPC 2004a). Burns in the area within the past fifteen years around the Blackwater Lake area have cleared some of this type of habitat (Cizek Environmental Services and McCullum Environmental Services 2002). Gunn et al. (2004) mapped historic and current caribou sightings to establish various indicators that would predict caribou occupation and found a high probability of occurrence of caribou in the east of Pehdzeh Ki Ndeh. Another factor that might influence woodland caribou distribution is the increase in numbers of large predators. Populations of wolf, grizzly bear and black bear have been reported to rise in the adjacent Sahtu region (Olsen et al. 2001). Woodland caribou in the Dehcho are believed to be declining due to changing habitat conditions and increasing moose numbers, which may attract predators such as wolves and black bears (Gunn et al. 2004; DCLUPC 2004a).

The boreal ecotype of woodland caribou number approximately 5,200 in the NWT according to the NWT government, which lists their population as “sensitive” (GNWT, ENR 2005a). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has recognized them as “threatened” (COSEWIC 2005). Prime factors adding to the boreal caribou’s population status

uncertainty are habitat loss, diseases and human activities - especially those that develop linear corridors as in oil and gas development projects.

Black and grizzly bears

Traditionally, black bears have been harvested by residents of Wrigley (D. Moses pers. comm. 2006). There has been no official effort to estimate NWT's black bear population (EBA Engineering Consultants Ltd. 2003). GNWT observations have indicated that black bear populations are stable and the population is listed as "stable", but Traditional Knowledge sources suggest that regional black bear populations are increasing (GNWT, ENR 2005a). Grizzly bear range extends across the Mackenzie Mountains just west of the western border of the study area (DCLUPC 2004a; Figure 4). They are listed as "special concern" by COSEWIC (2005) and as "sensitive" by the GNWT (GNWT, ENR 2005a).

Furbearers

No studies have been conducted specifically on Dehcho wolf populations (EBA Engineering Consultants Ltd. 2003). There is a perception that wolf populations are on the rise in the neighbouring Sahtu area (Olsen et al. 2001). The NWT populations of wolves are mostly stable, with some increasing populations (GNWT, ENR 2005a). Their status in the NWT is considered "secure" (GNWT, ENR 2005a).

Pehdzeh Ki Ndeh lies within the established lynx range. Cizek's 2002 study of Pehdzeh Ki Ndeh indicated lynx habitat throughout the Blackwater River system and along the shores of Fish Lake (Cizek Environmental Services and McCullum Environmental Services 2002). Lynx and many other furbearers' populations fluctuate with cycling prey numbers, which include small mammals and hares (GNWT, ENR 2005a).

Marten are found through the Blackwater River system and along the shores of Fish Lake. The Horn Plateau to the south of the study area is considered prime marten habitat, whose population may act as a source for surrounding areas (Cizek Environmental Services and McCullum Environmental Services 2002). Marten populations are likely stable and are considered "secure" in the NWT (GNWT, ENR 2005a).

Mink are found throughout the Blackwater River system and along the shores of Fish Lake (Cizek Environmental Services and McCullum Environmental Services 2002). Mink populations are believed to be stable. Mink populations in the NWT are ranked as “secure” (GNWT, ENR 2005a)

Beaver are found throughout the Blackwater River system, along the shores of Fish Lake and along the shores of Tseepantee Lake (Cizek Environmental Services and McCullum Environmental Services 2002). A beaver survey completed north of the Study Area, in the Sahtu Settlement Area, found beaver lodge density to be almost double that found for the Northwest Territories as a whole (Popko et al. 2002).

Red fox, fisher, wolverine, otter and muskrat are all also found in the Study Area and sometimes trapped (Darcy Moses pers. com 2006). No documented information on these animals is available for Pehdzeh Ki Ndeh. Fox populations fluctuate in 8 to 10 year cycles but are considered stable overall in the NWT. Red fox, wolverine and muskrat populations are ranked by the GNWT as “secure” (GNWT, ENR 2005a). COSEWIC (2005) ranks the western wolverine population (which includes the NWT population) as a species of “special concern”. Otters are listed by GNWT as “sensitive” (GNWT, ENR 2005a).

Figure 4 presents known furbearer habitat in the study area and is based on combined information on beaver, muskrat and marten habitat as it was assessed in a 1970’s research initiative (DCLUPC 2004a). More detailed habitat evaluations were produced during a regional wildlife workshop, where harvesters, trappers and biologists participated to collect Traditional Knowledge and observations of habitat use by wildlife (Wiebe 2003). Information was mapped individually for species of special concern (e.g., caribou, moose and bison), and in groups for other species such as fur bearers, fish and waterfowl. In a next step wildlife habitat was evaluated and ranked according to the following scheme:

- Low: areas identified as general range for species;
- Moderate: areas that provide year-round or seasonal habitat functions;
- High: areas serving a critical role for species (e.g., migration corridor); and
- Very High: areas providing habitat critical for survival (e.g., calving, nesting, staging and denning areas).

Critical habitat maps for furbearers were based on habitat that ranked as “high” and “very high” during the evaluation process. These maps could not be included in this assessment.

The abundance of small lakes, streams and wetlands in the area provide feed and rest for many species of migrating swans, geese and ducks and comprise part of a common waterfowl migratory route (Cizek Environmental Services and McCullum Environmental Services 2002; EBA Engineering Consultants Ltd. 2003; Figure 5). Five wetlands in Pehdzeh Ki Ndeh have been specifically identified as having importance to waterfowl. One wetland immediately north of Wrigley, one east of Wrigley at mile 442 on the Mackenzie Highway, one south of Smith creek and two just north of the Blackwater River (Cizek Environmental Services and McCullum Environmental Services 2002). The wetland east of Wrigley is home to many aquatic plants and so is an important food resource for waterfowl (Cizek Environmental Services and McCullum Environmental Services 2002). A spring survey in Pehdzeh Ki Ndeh in 1973, counted just under 3,000 birds with more than 20 species including surf scoter, lesser scaup, mallards (*Aythya affinis*), green winged teal (*Anas crecca*) and pintails (*Anas acuta*) (Cizek Environmental Services and McCullum Environmental Services 2002).

4.1.1 Subsistence Hunting

Subsistence hunting is defined as harvesting by Aboriginal residents for food and personal use. The NWT's prohibitive cost of imported commercial food products makes subsistence hunting one of the most familiar of the wildlife uses. The NWT spends annually approximately \$130 million on food imports (NWT Bureau of Statistics 2003). Harvesting of local country food saves Study Area residents the cost of buying imported food and in this way adds to the overall savings of each harvester. In 1988, the GNWT estimated that the foods being harvested annually in the NWT equal about \$70 million (Deloitte Haskins & Sells 1988). Food prices in Wrigley are estimated to be 74% greater than food prices in Yellowknife (NWT Bureau of Statistics 2004). This reported value is based solely on food items purchased in stores. Calculated food price indices do not take into account any harvested or farmed food items consumed in the communities.

Subsistence hunting comprises an important part of life for many northern people. A high percentage of Study Area residents are reported to hunt. The NWT's Bureau of Statistics found that 43.1% of people over the age of 15 in the Dehcho region hunted or fished for subsistence in 2002 as did 46% of Sahtu residents over the age of 15 (NWT Bureau of Statistics 2004). The large percentage of Study Area residents who partake in hunting likely translate to high numbers

of game animals harvested in the region; however, records of numbers and species harvested by subsistence hunters are not publicly available (A. de Pelham pers. comm. 2006).

D. Allaire estimates that the community harvested about 50 caribou, woodland and barrenground combined and about 75 moose in 2005 (N. Larter pers. com 2005). In the neighbouring Sahtu area, hunting pressure on boreal caribou is considered “light” with each community typically taking less than 50 animals per year (Olsen et al. 2001). Based on this estimate, moose are the most important subsistence harvest species in the area. However, Allaire’s estimates are only guesses and the actual numbers may deviate substantially from year to year.

One Wrigley trapper who harvests from Pehdzeh Ki Ndeh reported harvesting approximately 1 swan, 15 to 20 ptarmigan, 50 geese and 100 ducks in the last year (Darcy Moses pers. comm. 2006). It can be assumed that waterfowl and ptarmigan are harvested by other residents as well. Although the locations of subsistence harvest were not reported, Cizek Environmental Services and McCullum Environmental Services (2002) did collect Traditional Knowledge of mammal habitat and found that the highest concentration of moose are on the shores of the Blackwater Lake, east of Blackwater Lake on the shores of Notseglee Lake and southeast of Blackwater Lake on Tonaneenlee Lake, the shores of Fish Lake and northwest of Fish Lake. The highest concentrations of caribou are reported as being on the shores of Blackwater Lake and east of Blackwater Lake in the winter. Since caribou and moose are more likely to be found in these areas, this is also likely where they are harvested. They are also likely harvested where there is easier access into the area. The old army road traverses the Blackwater River system where moose and caribou are known to occur and to calve, (Table 3). Marshall Macklin Monaghan (1985) report that moose are hunted from areas adjacent to camps and trap lines. Several camps and traditional trails are scattered throughout Pehdzeh Ki Ndeh and it is likely that they facilitate hunting in the area. Many mineral licks are reported immediately to the east of the Mackenzie Highway (Cizek Environmental Services and McCullum Environmental Services 2002). These ungulate attractants existing next to a major transportation corridor is a likely hunter draw.

Given that 40% of Wrigley residents over 15 reported hunting or fishing in the year 2003, the current use of this resource is likely very high and probably will continue to play an important role in the future.

Future potential use of subsistence harvest is likely to follow a similar pattern to the current use with some variations in subsistence harvest composition due to range shifts of ungulate populations caused by changes in natural conditions including forest fires, development and species' dynamics. The Draft Dehcho Land Use Plan states that all traditional land uses, occupancy and harvesting are permitted uses throughout the Dehcho region and will continue in all areas at all times (DCLUPC 2005).

4.1.2 Recreational Hunting

Non-Aboriginal residents in the Dehcho harvest wildlife for 'recreational' purposes. This harvest is regulated by the Northwest Territories Hunting Regulations (GNWT, ENR 2005b; Table 4). These regulations are summarized in the following paragraphs.

The Study Area lies within Hunting Management Unit D of the GNWT's hunting regulations. Recreational harvest guidelines for Hunting Management Unit D are found in Table 4.

Table 4 **Current Hunting Regulations for Resident Recreational Hunters for Management Units D**
(Source: GNWT, ENR 2005b)

Species	Bag Limit	Season
Barrenground Caribou	2 males /year	15 Aug - 15 Nov
Woodland (Boreal) Caribou	1/year	15 July – 31 Jan
Moose	1/year	1 Sept – 31 Jan
Black Bear	1/year	15Aug - 30 June
Wolf	1+ /year	25 July – 31 May
Wolverine	1+ /year	25 July - 30 Apr
Ptarmigan and Grouse	10/day, possession limit of 40	1 Sept - 30 Apr
Squirrel, Porcupines, Hares	No limit	1 July - 30 June

Sharply declining barrenground caribou populations have spurred new more conservative resident harvest quotas. The resident harvest quota has recently been adjusted from 5 tags per year to 2 tags for males only (T. Devine pers. comm. 2006).

The amount of game taken in the area by resident recreational hunters is estimated to be quite small. Wrigley's population is comprised of 97% Aboriginal (NWT Bureau of Statistics 2004). Therefore, there are very few residents that fall into the classification of recreational hunter. For each of the five hunting seasons from 1999/2000 to 2003/2004, there has only been one licensed

recreational hunter from Wrigley, who purchased one large game and one small game tag each year (GNWT, ENR 2005c). It is unknown whether the harvest was successful.

As shown in section 4.1.1, the cost of importing food into Wrigley is quite high. Recreational harvest serves to mitigate some of this price just as subsistence hunting does. There is no information about how many recreational hunters use the Pehdzeh Ki Ndeh area although Marshall Macklin Monaghan (1985) report that few people not living in Wrigley use the areas proximate to the town. Norman Wells is the closest non-Aboriginal population, but Norman Wells residents tend to hunt in the mountains to the west or toward Deline and few hunters if any are thought to use Pehdzeh Ki Ndeh (A. Veitch pers. comm. 2006).

4.1.3 Outfitting

Currently, there is no licensed large game outfitting in Pehdzeh Ki Ndeh (G. Fricke pers. comm. 2006). Given that moose and boreal woodland caribou populations are estimated to be low and barren-ground caribou populations are perceived to be declining, there seems to be little opportunity for future development of large game outfitting in Pehdzeh Ki Ndeh.

Additionally, the Dehcho First Nations (DFN) passed resolution #04, stating that, “Dehcho First Nations will not support any Big Game outfitters in Dehcho territory” and that, “Dehcho First Nations would like to see the ultimate removal of Big Game outfitters within the Dehcho Territory” (Deh Cho First Nations 2004b; Appendix II, Resolution #04). This resolution resulted from the communities’ perception that past outfitters have wasted meat and have not been beneficial to DFN people in general. Some have claimed that outfitters waste meat although outfitting has supplied some Dehcho communities with additional meat (Dehcho Drum 2004). The DFN resolution combined with unfavourable public sentiment and low numbers of large game species makes the future potential of outfitting appear quite limited.

To the west of the Study Area, outfitting does occur in the Mackenzie Mountains (Larter and Allaire 2004; Larter and Allaire 2005). In 2003, a total of 347 non-resident hunters hunted in the Mackenzie Mountains and in 2004, 337 hunters bought licenses. Since the hunt is trophy focused, the meat from the hunted animals is sometimes unwanted by the hunting clients. The majority of the meat (sheep, caribou, moose and goat) is consumed in the outfitting camps, but in 2003, 300kg and in 2004, 4,575 kg were distributed to Wrigley or Fort Simpson (Larter and Allaire 2004; Larter and Allaire 2005). However, based on an information survey of Wrigley

residents (J. Morin pers. comm. 2006) and the observations of those residents themselves (D'Arcy Moses pers. comm. 2006), no meat was found to reach Wrigley.

4.1.4 Trapping

Trapping holds a central place in NWT's history (Berton 1988). It is still of paramount importance to many people in the NWT. 20.1% of Wrigley's population over the age of 15 were reported trapping in the year 2003 (NWT Bureau of Statistics 2004). Many people are interested in being able to follow a traditional lifestyle. However, the number of people reported to actively trap seems to be decreasing despite government incentives and comparatively high fur prices (Greater Mackenzie Valley Fur (GMVF) 2005). The NWT's annual fur sale value decreased 80% from \$6.1 million in 1987/88 to \$1 million in 1993. The GNWT estimates that the NWT's current furbearer population would stand to benefit from an additional 200-300 trappers (F. Rossouw pers. com. 2005). High wages in the non-traditional sectors are blamed for taking workers away from trapping activities (RWED 2004).

The number of pelts of different species sold to fur auctions by Study Area residents is summarized in Table 5. This table is an underestimate of the real harvest since it does not take into account income from local sales of fur or domestic use. This additional income is unreported and there are no reliable estimates (F. Rossouw pers. comm. 2006). Additionally, some furs are sold at auction but not reported because the trapper did not receive a monetary advance from the territorial government (F. Rossouw pers. comm. 2006).

Table 5 Number of Pelts Sold to Fur Auctions from Wrigley, 2000/2001 to 2004/2005 (GNWT, ITI 2005a)

	2004/05	2003/04	2002/03	2001/02	2000/01	Average
Beaver	21	26	50	0	1	19.6
Muskrat	38	26	65	0	0	25.8
Marten	151	126	105	28	181	118.2
Fox	1	2	0	0	0	0.6
Wolf	1	0	0	0	0	0.2
Mink	0	0	3	0	5	1.6
Lynx	2	3	2	0	8	3
Wolverine	0	0	1	1	0	0.4
Total	214	183	226	29	195	169.4

Marten is by far the most sold furbearer species in the area with muskrat a distant second followed by beaver. Several animals such as fox and wolf appear to experience only occasional harvesting in Pehdzeh Ki Ndeh. The number of pelts sold varies significantly from year to year, likely reflecting furbearers' natural population fluctuations and changes in market prices of fur and in trapping effort.

There are no data available identifying specific harvest locations (F. Rossouw pers. comm. 2005). However, there are five trappers from Wrigley that use Pehdzeh Ki Ndeh to harvest furbearers (Darcy Moses pers. com. 2006). One of these trappers estimated his harvest for 2005/2006 as shown in Table 6. He estimates that one quarter to one half of his harvest comes from Pehdzeh Ki Ndeh. Additionally, in other years, he has harvested wolf, otter, fisher, mink, ermine, weasel and muskrat. He states that he mainly traps for income and only a minimal number of trapped animals are used domestically or sold locally.

Table 6 Number of Animals Harvested by One Wrigley Trapper, for the 2005/2006 Season
(Darcy Moses pers. comm. 2006)

Species	Number of animals harvested
Wolverine	3-4
Marten	40
Fox	5
Beaver	12
Hare*	60
Squirrel	15-20

*mainly for domestic use

Based on the current use, it can be assumed that there is future potential for trapping in the Study Area. Trappers have regular access to healthy fur bearing populations in Pehdzeh Ki Ndeh. The composition of the harvest might change due to the cyclic nature of most fur bearers' populations and changes in market values.

4.1.6 Commercial Harvesting

Currently, there is no commercial wildlife harvest in the Study Area. The musk ox harvest on Banks Island and the reindeer harvest close to the Beaufort Sea's coast are two examples of commercial harvests in the NWT (GNWT, ENR 2005b). Given the population uncertainties of the

area's three large ungulate populations (section 4.1), a commercial harvest of any large game species in Pehdzeh Ki Ndeh does not seem likely.

4.1.7 Economic Value of Wildlife

Wildlife Harvest

The percentage of households in Wrigley whose total consumption of meat and fish consists of a minimum of 75% country foods was 41% in 2004 (NWT Bureau of Statistics 2004). This figure has increased substantially from previous years in which the survey was conducted. In 1999, only 28% of Wrigley households reported 75% or greater of their diet coming from country foods and this figure was 13% in the 1994 survey (NWT Bureau of Statistics 2004). Table 7 combines reported harvest levels (estimates provided by N. Larter pers. comm., 2005) and the estimated edible weight of harvested species (Ashley 2002) to calculate the total amount of edible weight that might be harvested in a year. Edible weights used in this assessment are estimated ranges and can differ considerably between harvest locations, gender, age and general condition of harvested animals and the season of harvest (Ashley 2002).

Table 7 Average Annual Edible Weight of Meat from Subsistence Harvest in 2005
(Source: D. Allaire's estimates provided by N. Larter pers. comm. 2006)

	Caribou (boreal woodland and barren-ground)	Moose
Total subsistence harvest / year 2005	50	75
Edible weight / animal (kg)	29 – 95 kg	159 – 204 kg
Total edible weight */ year (kg)	3,100	13,612

*This calculation is based on the average value of the provided range in edible weight (Ashley 2002)

A minimal estimate of the subsistence harvest of this area is 16,712 kg of meat per year. This estimate does not account for possible recreational harvest as information regarding the number and species of animals recreationally harvested was not available for this report. The bulk of the harvest is made up of moose. One resident hunter's account also indicates that substantial amounts of ptarmigan and waterfowl are harvested (Darcy Moses pers. comm. 2006). His reported harvest for 2005/2006 is shown in Table 8.

Table 8 Resident Hunter's 2005/2006 Reported Harvest
(Darcy Moses pers com. 2006)

	Ptarmigan/grouse	Ducks	Geese
Number	15-20	100	50

Harvested			
Average edible weight *	0.4 kg	1.0 kg	1.8 kg
Annual average edible weight	7 kg	100 kg	90 kg

*This calculation is based on the average value of the provided range in edible weight (Ashley 2002)

This reported harvest adds on average 200 kg of meat annually to the subsistence harvest of each hunter, since it can be assumed that other subsistence hunters harvest similar quantities. Locally harvested meats need not be commercially bought. To estimate subsistence (and to a lesser extent recreational) harvesting based savings, this study assumes a replacement value of \$20 per kg edible weight (Larter and Allaire 2004; Larter and Allaire 2005). This calculation takes into account only the parts of animals sold commercially even though other animal parts are used domestically. Based on the total edible weight of caribou and moose at 16,712 kg, the estimated annual meat replacement value is worth a minimum of \$334,240.

In 2004, the Aboriginal population of Wrigley was 171 (NWT Bureau of Statistics 2004). Based on this information, the minimum per capita annual value of subsistence wildlife harvest for the residents of the communities in the Study Area is approximately \$1.955 per person.

Based on the non-Aboriginal population of Wrigley, the recreational harvest of game in Pehdzeh Ki Ndeh is minimal to non-existent and thus contributes a very small amount if anything to the wildlife harvest value of the area.

Outfitting

Pehdzeh Ki Ndeh presently has no registered licensed large game outfitters. Meat may be supplied from outfitting in the Mackenzie mountains (Larter and Allaire 2004; Larter and Allaire 2005) however, the supply does not seem to reach Wrigley (J. Morin pers. comm. 2006)

Trapping

The NWT Bureau of Statistics data show that the residents of Wrigley are not as strongly integrated into the national wage economy as some NWT communities (GNWT, Bureau of Statistics 2004). It indicated that 40% of Wrigley residents over the age of 15 trapped in the year previous to the survey although this number includes trapping for domestic use (GNWT, Bureau

of Statistics 2004). In Wrigley, there are reportedly 5 active trappers that harvest animals from Pehdzeh Ki Ndeh.

An estimate of fur based income may be derived from multiplying the one respondent's harvest by five to represent the other four trappers that use the area, then multiplying this derived amount by the average fur price received for each species by the Fur Harvesters Auction which is the exclusive distributor of Genuine Mackenzie Valley Furs (GNWT, ITI 2006). The result in Table 9 is a general estimation of the amount that could be received for trapping in Pehdzeh Ki Ndeh.

Table 9 Estimated Range of Values of Furs Trapped in Pehdzeh Ki Ndeh
(Darcy Moses pers com. 2006; Fur Harvesters Auction 2005)

Species	Furbearers trapped by respondent	Average auctioned fur price 2005	Estimated price received for respondent's furs
Wolverine	3-4	\$159.90	\$560
Marten	40	\$54.40	\$2,180
Fox	5	\$43.32	\$220
Beaver	12	\$53.58	\$640
Squirrel	15-20	\$1.71	\$30
Total			\$3,630

Similar to the fur auction sales for Wrigley, marten are the most frequently trapped species. They are responsible for the majority of this trapper's income. If it is assumed that the other four trappers from Wrigley reported to trap in Pehdzeh Ki Ndeh harvest similar levels and sell them to the fur auction, the total annual income through trapping furbearers in the Area of Interest could be \$18,150.

GNWT's Department of Industry Tourism and Investment (ITI) keeps a fur harvest database, recording annual fur sales from individual trappers to fur auctions. The figures in ITI's fur harvest database (2005a) displayed in Table 10 show that over the past five years, Wrigley trappers have received an average of \$6,920.23 per year for their fur harvest. 'Active trappers' are trappers that trap for income. If divided amongst the three trappers in Wrigley that ITI lists as 'active trappers' (GNWT, ITI 2005a), the per capita average annual income works out to \$2,306.74. Information from community residents indicates that this estimation of the number of active trappers may be low (Darcy Moses pers. comm. 2006). Some residents may trap less intensively or for food or other personal use animal products.

Table 10 shows the annual income from fur auction sales for Wrigley trappers for the last five years. This figure has increased every year for the last four years, likely in response to variations of prices on the fur market and to natural cycles of furbearer populations.

Table 10 Income Derived from Pelts Sold to Fur Auctions from Wrigley, 2000/2001 to 2004/2005 (GNWT, ITI 2005a)

2004/05	2003/04	2002/03	2001/02	2000/01	Average
\$11,231.10	\$7,341	\$5,066	\$1,460	\$9,505	\$6,920.23

Commercial Harvest

There is currently no commercial harvest taking place in the Study Area, therefore, no economic value can be calculated.

4.1.7 Wildlife Conclusion

Renewable resources in Pehdzeh Ki Ndeh are not currently well studied or documented. Data to derive the current and potential future resource use and economic value of resources in the Study Area are therefore limited. Table 11 summarizes the main findings of section 4.1. Values and descriptions are based on available information and estimates provided above. It compares the economic values and potential of different uses of the wildlife resource in the Study Area through indirect and direct income, resource use inside Pehdzeh Ki Ndeh and future potential of the resource use. Examples for estimated indirect income are meat replacement values and domestic use of fur. Direct income is money received, for example from fur sales to auctions. Resource use that takes place inside the Study Area is estimated based on critical habitat mapping (DCLUP 2004a; EBA Engineering Consultants Ltd. 2003), past survey information and access from the communities to the Study Area. Future potential is based on current use and available information on status of wildlife populations.

Table 11 Estimated Economic Value and Estimated Future Potential of Wildlife Resource Uses in the Study Area

Wildlife resource use	Current estimated annual indirect income	Current estimated annual direct income	Current use inside Study Area	Future potential
Subsistence harvest	\$334,240	None	Portions of Study Area likely used for harvest.	Believed to be high, but need to consider low moose and declining caribou populations.

Recreational harvest	Limited due to very low number of non-Aboriginal residents	None	Unknown	Believed to be limited based on low resident non-Aboriginal population and low or uncertain populations of big game species.
Outfitting	None	None	No large game outfitters currently are licensed to use the Study Area	Believed to be limited due to resolution against large game outfitting and low or uncertain populations of large game species
Trapping	No estimates available. Believed to be substantial	\$6,920.23 (GNWT, ITI 2005a); \$18,950 (Darcy Moses pers. comm. 2006)	Five trappers from Wrigley are known to utilize the Study Area.	Believed to be moderate. Stable, healthy populations, few trappers in the Study Area
Commercial harvest	None	None	None	Believed to be limited, based lack of viable large game species to harvest.

The economic value of wildlife is difficult to calculate due to a lack of information. Based on limited information, it seems that subsistence harvest of wildlife is of high importance and due to low numbers of non-Aboriginals in Wrigley, recreational harvest likely experiences low use. Direct income from trapping seemingly benefits a small number of trappers in Pehdzeh Ki Ndeh. However, it is believed that many residents trap for either domestic use or local sales and are not assessed through the ITI data base. Therefore, the value of trapping can be assumed to be high as well. Both trapping and subsistence harvest possess an undeniably high cultural value and are strongly connected to the lives of people in the study area. There is no current value to outfitting and commercial harvest and future potential is likely limited. In summary, wildlife resources in Pehdzeh Ki Ndeh are currently mainly used for subsistence harvesting and trapping with both uses occurring inside the Study Area and likely having a high future potential.

4.2 Fish

This section examines subsistence fishing, recreational and commercial fishing and fish hatcheries. Pehdzeh Ki Ndeh has five larger fish bearing lakes: Keller Lake, Blackwater Lake, Fish Lake, Greasy Lake and Highland Lake (Figure 6). There are four main watersheds, three of

which drain into the Mackenzie River: Blackwater River, Ochre River and the River Between Two Mountains, and Keller Lake in the north-east which drains into Great Bear Lake (Figure 6). A variety of fish species occurring in the Study Area are known to be important food species (Stewart and Low 2000; Cizek Environmental Services and McCullum Environmental Services 2002). Table 12 summarizes all fish species that are known to be harvested in Pehdzeh Ki Ndeh and their documented habitat in the Study Area.

Table 12 Fish Species Harvested in Pehdzeh Ki Ndeh and Surroundings and Documented Habitat

(Source: Stewart and Low 2000; Cizek Environmental Services and McCullum Environmental Services 2002)

Family	Local or common name	Scientific name	Documented habitat
Cods – Gadidae	Loche (burbot)	<i>Lota lota</i> (Linnaeus)	Ochre River; Mackenzie River and tributaries; Blackwater Lake; Keller Lake
Perches – Percidae	Pickereel (walleye)	<i>Stizostedion vitreum</i> (Mitchill)	River Between Two Mountains; Fish Lake; Ochre River; Keller Lake
Pikes – Esocidae	Jackfish (Northern pike)	<i>Esox lucius</i> Linnaeus	Across the Study Area
Suckers – Catostomidae	Longnose sucker	<i>Catostomus catostomus</i> (Forster)	Across the Study Area
	White sucker	<i>Catostomus commersoni</i> (Lacépède)	Ochre River
Trout – Salmonidae	Arctic grayling (Bluefish)	<i>Thymallus arcticus</i> (Pallas)	Blackwater River; River Between Two Mountains; small tributaries; Blackwater Lake; Fish Lake; Wrigley River
	Broad whitefish	<i>Coregonus nasus</i> (Pallas)	Mackenzie River
	Chum salmon (dog-face salmon)	<i>Oncorhynchus keta</i> (Walbaum)	Mackenzie River
	Coney (inconnu)	<i>Stenodus leucichthys</i> (Güldenstadt)	Ochre River; Mackenzie River
	Lake cisco	<i>Coregonus artedii</i> (Lesueur)	Keller Lake
	Lake trout	<i>Salvelinus namaycush</i> (Walbaum)	River Between Two mountains; Blackwater Lake; Fish Lake; Keller Lake
	Lake whitefish (crooked back)	<i>Coregonus clupeaformis</i> (Mitchill)	across the Study Area
	Round whitefish	<i>Prosopium cylindraceum</i> (Pallas)	River Between Two Mountains; Ochre River; Hodgson Creek; Keller Lake
	Mountain	<i>Prosopium williamsoni</i>	River Between Two Mountains

	whitefish		
Trout-Perches – Percopsidae	Trout-perch	<i>Percopsis omiscomaycus</i> (Walbaum)	Ochre River; Johnson River

No stock assessments have been conducted in this area and estimations on the numbers for the above fish species for Pehdzeh Ki Ndeh are not available. From previous studies that documented the use of fish species in the Study Area, it can be assumed that lake whitefish and northern pike occur very frequently and that lake trout, inconnu, arctic grayling and longnose sucker are common as well (Stewart and Low 2000; Cizek Environmental Services and McCullum Environmental Services 2002).

4.2.1 Subsistence Fishing

The majority of households in Wrigley are involved in subsistence fishing (Stewart and Low 2000). Harvesting occurs mainly through the use of gill nets, but some fish are taken by angling. Lake whitefish, lake trout, inconnu and northern pike are the main harvest species for Wrigley residents, but arctic grayling, burbot, longnose sucker and walleye are also harvested. Residents usually harvest fish for subsistence in the Mackenzie River (south of Wrigley, to its confluence with the Willowlake River), the Wrigley and Willowlake rivers and the River Between Two Mountains system (including Paenfee, Fish and Greasy lakes). Blackwater, Fish, Greasy and Highland lakes are known to be fished extensively in winter (Stewart and Low 2000).

Wrigley residents eat the flesh of all fish species and the eggs and / or liver of some species (Stewart and Low 2000). Lake whitefish is used for many purposes and is the preferred source of dried fish.

During summer and fall, Wrigley residents harvest inconnu and arctic grayling, which they either eat fresh, freeze (inconnu) or feed to dogs (Stewart and Low 2000). Lesser quantities of walleye and burbot are taken. There is little fishing activity reported to occur during spring time (Stewart and Low 2000).

A number of places in Pehdzeh Ki Ndeh have been identified as being traditional subsistence fishing sites (Cizek Environmental Services and McCullum Environmental Services 2002). Known locations are summarized in Table 13.

Table 13 Known Harvest Locations for Subsistence Harvest of Fish
 (Source: Stewart and Low 2000; Cizek Environmental Services and McCullum Environmental Services 2002)

Location	Harvested Species
Blackwater Lake	Lake whitefish, lake trout, arctic grayling, northern pike and burbot
Fish Lake	Lake whitefish, longnose suckers, arctic grayling, walleye and northern pike
Paeeenfee Lake	Lake whitefish, burbot and northern pike
Long Lake	Lake trout, lake whitefish, walleye, burbot and northern pike
Tseepantee Lake	Lake whitefish
Greasy Lake	Lake whitefish, lake trout and longnose sucker
Keller Lake and surroundings	Lake whitefish and / or lake trout
Highland Lake	Lake whitefish, lake trout and northern pike
Hodgson Creek	Arctic grayling, longnose sucker and round whitefish

Fish are additionally harvested for subsistence from Notseglee Lake, Tonaeenlee Lake and Nothaykay Lake (Cizek Environmental Services and McCullum Environmental Services 2002; Figure 6). Subsistence fishing is reported to be an important resource use for residents of Wrigley. In 2004, 41 % of the residents reported that 75% or more of meat and fish consumed is locally harvested (NWT Bureau of Statistics 2004). Numbers of the actual harvest are not reported.

High mercury levels in local fish species may be a source of apprehension to harvesters from Pehdzeh Ki Ndeh. Fisk *et al.* (2005) studied contaminant levels in fish across the Northwest Territories and Nunavut and discovered that lake trout and northern pike sampled from Willow Lake exceeded the recommended limits of 0.2 µg/g for mercury in a subsistence fishery. The average mercury concentration of fish in all 87 northern water bodies surveyed was 0.311 µg/g (Fisk et al. 2005). Table 14 presents the results of this study measured in fish species in water bodies close to the Study Area. No water bodies inside Pehdzeh Ki Ndeh were examined.

Table 14 Mercury (Hg) Concentrations (µg/g) in the Muscle of Harvested Fish Species in Willow Lake and Mackenzie River, 1999 and 2000
 (Source: Fisk et al. 2005)

Species	Water body	Year	Number of fish	Hg (µg/g) in muscle
Walleye	Mackenzie R	2000	15	0.191
Northern pike	Willow Lake	1999	30	0.283
Lake Trout	Willow Lake	1999	32	0.38
Lake Whitefish	Willow Lake	1999	167	0.085

Based on the current use of fish in the subsistence fishery, it can be assumed that the future potential of this resource use is equally high. Plentiful resources and good access to the area facilitate subsistence fishing for Wrigley residents. These include 18 cabins and one winter camp in Pehdzeh Ki Ndeh, located around Fish Lake, Blackwater Lake, Blackwater River, Highland Lake, Greasy Lake, Paeenfee Lake and Tseepantee Lake (Cizek Environmental Services and McCullum Environmental Services 2002). A system of traditional trails connects Wrigley with most of the important fish bearing lakes (Cizek Environmental Services and McCullum Environmental Services 2002). These trails are also used to connect to the old army road traversing the Study Area (Figure 1).

4.2.2 Recreational Fishing

Recreational fishing is considered to include both fishing activities by the non-Aboriginal residents of Wrigley and sport-fishing activities by non-resident visitors. Access and facilities exist for the recreational use of fish resources in Pehdzeh Ki Ndeh. There are 18 cabins and one winter camp in Pehdzeh Ki Ndeh which could be used for sport fishing purposes (Cizek Environmental Services and McCullum Environmental Services 2002; section 4.2.1) and a network of trails connects these lakes with Wrigley. M&M Tourism and River Taxi, the only outfitting company based out of Wrigley that offers sport fishing packages for tourists, guides catch and release fishing trips into Pehdzeh Ki Ndeh (M. Moses pers. comm. 2006). It is assumed that these trips generally take place on the Mackenzie River and occasionally include some the tributaries. Numerous attempts have been made to recontact M. Moses to learn more about his tourism operations including the rivers he uses for sightseeing and fishing trips, but no further details have become accessible.

The western border of the Pehdzeh Ki Ndeh touches on the Mackenzie River Management Area which has special fishing restrictions for arctic grayling, northern pike and walleye (GNWT, ENR 2005b). The fishing regulations for the Study Area are summarized in Table 15.

Table 15 Fishing Limits for Recreational Fishing in the Study Area
(Source: GNWT, ENR 2005b)

Species	Daily Catch Limit	Possession Limit	Comment
Walleye*	1	1	April 1 st – June 6 th

	3	5	June 7 th to March 31 st
Walleye	1	1	April 1 st – June 6 th
	4	7	June 7 th to March 31 st
Northern pike*	1	2	Only one northern pike in possession may be more than 70 cm. fork length
Northern pike	3	5	-
Grayling*	1	1	Minimum size for retention is 36 cm
Grayling	3	5	
Ciscoe	350	350	-
Inconnu	5	10	-
Lake trout	3	5	-
Whitefish	5	10	-

* In the Mackenzie River Management Area

One to two non-Aboriginal residents of Wrigley per year have been known to purchase year-long fishing licences between 2002 and 2005. It is assumed that there is no opportunity to purchase fishing licences in Wrigley because the ITI database indicates no licences ever being purchased there, and the Wrigley residents who do purchase licenses go elsewhere (GNWT, ITI 2005b).

In 2002, one Wrigley resident purchased a fishing license in Fort Simpson. In 2003 one Wrigley resident purchased a license in Hay River. In 2005, two Wrigley residents purchased licenses, both purchased from Fort Simpson, in the months of June and July. The license purchases for 2004 are unknown (GNWT, ITI 2005b).

No non-Aboriginal residents of Wrigley have purchased 3-day fishing licences in the years 2002, 2003 or 2005 in any community (GNWT, ITI 2005b).

It is possible that people, purchasing fishing licences in other communities, could come to Wrigley and Pehdzeh Ki Ndeh for fishing purposes. The closest community to Wrigley accessible by an all-season road is Fort Simpson, and it is assumed that some visitors could purchase their licenses there and continue travelling to Wrigley and participate in fishing activities. As an indication of possible fishers who purchase licenses in Fort Simpson but could have actively fished in the Study Area, the numbers of licenses sold in Fort Simpson are listed below.

In 2002, 90 year-long fishing licenses were sold in Fort Simpson. In 2003, only one year-long license was sold in Fort Simpson, but nine Fort Simpson residents bought licenses elsewhere. In

2005, 101 fishing licenses were purchased in Fort Simpson. It is possible that some of these licenses were used for fishing purposes in Pehdzeh Ki Ndeh (GNWT, ITI 2005b).

During 2001-2002, 2002-2003 and 2004-2005, no 3-day fishing licenses were purchased by non-Aboriginal residents of Wrigley anywhere in the NWT. Only five 3-day fishing licenses were sold during those years in Fort Simpson, all of which were purchased in 2001 by people not living in the NWT (GNWT, ITI 2005b).

No information is currently being collected to record the outcome of any fishing activities of license holders. Therefore, no data are available to estimate the amount of fish harvested recreationally.

Fish Lake and Blackwater Lake are the primary sites that have been considered for either fly-in day sport-fishing use or as sites for outfitting camps (Marshall Macklin Monaghan 1985) and there may be considerations today for establishing a lodge that would cater to sport-fishing tourists in the area (J. Morin pers. comm. 2006). In 1987, DFO estimated that a medium quality lake trout sport fishery would be feasible, if 12 guest beds were offered and a possession limit for trout would be introduced (Stewart and Low 2000).

Blackwater Lake is considered excellent for angling northern pike, lake trout and arctic grayling. Fish Lake is a good place to catch walleye, whitefish and lake trout (Marshall Macklin Monaghan 1985). Greasy and Highland Lakes may be considered for sport-fishing opportunities, but are more difficult to access and, therefore, are considered less appealing as a tourist attraction (R.T. & Associates 1990).

R.T. & Associates (1990) contemplated the sport-fishing industry of the area over time. In the 1990's the industry was not expanding and recommendations were made for the establishment of a fishing lodge near Wrigley. It was noted that the industry was very competitive (an example was given of the frequent openings and closings of lodges on Great Bear Lake) and that perhaps the most suitable tourism strategy for such an industry would be to not concentrate on just sport-fishing as a tourist activity, but incorporate it into a whole wilderness experience package.

Sport fishing opportunities exist in Pehdzeh Ki Ndeh, but its use is limited. According to the GNWT's 2002 Visitor Exit Survey, 157 tourists visited the Dehcho region for the primary purpose of fishing (GNWT, RWED 2003). It is unknown how many of these tourists enter the

Study Area to participate in fishing activities, and attempts to find out through further contacting the only sport-fishing outfitter operating out of Wrigley have failed. Developing marketing strategies may have the potential to increase fishing-based tourism. However, there have been related concerns raised by Dehcho communities about tourists depleting fish stocks and leaving garbage and gut piles behind. Dehcho residents also feel that the tourists mainly bring their own equipment and camp, so that little money is spent in the communities (DLUPC 2005). It is not well understood whether an increase in the sport-fishing industry would be feasible or even welcomed in Pehdzeh Ki Ndeh.

4.2.3 Commercial Fishing

Keller and Blackwater lakes have been commercially fished in the past (Davies et al. 1987; Stewart and Low 2000). Fishers from Fort Simpson harvested lake trout and lake whitefish from Keller Lake between 1961 and 1979 with small by-catches of walleye (Table 16). Keller Lake has a commercial harvest quota of 22,700 kg per year for lake trout and whitefish combined (Department of Fisheries and Oceans (DFO) 1998; Stewart and Low 2000). The commercial fishing quota for Blackwater Lake is 12,500 kg for the combined annual harvest of lake trout and whitefish and 2,000 kg for walleye (DFO 1998; Stewart and Low 2000). Experimental fisheries were planned for Fish Lake and Greasy Lake in the late 1970's (Stewart and Low 2000); however, there are no known reports of actual harvest. Combined quotas for lake trout and lake whitefish for these lakes are 2,000 kg and 2,268 kg per year, respectively (Stewart and Low 2000).

Similar inland lake systems in the Northwest Territories have experienced low levels of commercial fishery activity in the past since the late 1940s (Davies et al. 1987). When first attempting to commercially fish this type of area, local fishers would concentrate their harvest on one lake for a few years, then move to a different lake and not return to harvest from the first lake for at least two years. This cycle fishing proved uneconomical due to the high costs associated with creating and sustaining manifold holding facilities at several lakes during the non-harvest stage (Davies et al. 1987). Fisheries in the 1970's returned to a quota system (Stewart and Low 2000).

The key factor for the success of fishery operations was primarily dependant on facility of transportation. Where water bodies were adjacent to roads and therefore easily accessible to

southern markets, fisheries were able to develop; where transportation corridors in the form of highways or waterways were inaccessible, fisheries did not develop (Davies et al. 1987). If all aspects of production are accounted for, the cost of catching, preparing and moving fish from a remote lake (as all lakes in Pehdzeh Ki Ndeh may be classified) was calculated to cost 228% of the cost of producing a fish in Hay River which has highway access.

Table 16 shows the reported annual weights of fish harvested at Keller Lake between 1961 and 1979. The current quota for commercial fisheries in Keller Lake was either reached or exceeded only during the first three years of harvest. After that, the annual harvest decreased drastically.

Table 16 Annual Commercial Fishery Harvests (in kg round weight*) and By-Catch for Keller Lake (Source: Stewart and Low 2000)

	1979	1970	1969	1963	1962	1961
Lake whitefish	no data	1,938	1,647	14,218	34,825	15,377
Lake trout	no data	582	455	7,584	17,036	10,648
Walleye	no data	15	11	292	82	no data
Total	1,134	2,244	2,113	22,094	51,943	26,025

* Total weight of the fish

There are several factors limiting the success of commercial fisheries on remote inland lakes:

- The high costs of maintaining a fishery in these regions, such as transportation, fuel, labour, materials and fishing gear is extremely prohibitive (Stewart and Low 2000).
- The long cold periods of northern water bodies slow fish growth and delay spawning, which make more conservative harvesting regimes (with smaller quotas) necessary (Mackenzie River Basin Board (MRBB) 2002).
- Small shallow inland lakes in this region experience intermittent fish kills as a result of extreme temperatures and rapid temperature variations (Stewart and Low 2000). Several grayling stocks close to the Study Area are known to have been depleted due to these winterkills and are only now returning to normal levels (G. Low pers. comm. 2005).

Another limiting factor could be parasitic infestation (Stephen 1950). Because whitefish from Willow Lake (south of the Study Area) were small and highly infested with cists and worms, a commercial fishery for this species seemed improbable. The only recommended alternative was a trout fishery. A later study examined whitefish in Willow Lake and found that 155 whitefish out of a sample of 166 whitefish had cysts on the gut, 21 of them had worms in the swim bladder and one had a muscle cyst (Stewart et al. 2003). The observed cysts are immature stages of the

whitefish tapeworm (*Triaenophorus crassus*). These larvae, coiled in a cyst in the flesh of whitefish or ciscoes are not harmful to people, however, infected fish are condemned and classified unfit for human consumption (Stewart and Bernier 1999). The adult whitefish tapeworm lives in the intestine of northern pike. Its immature stages infect whitefish and ciscoes, Infected whitefish or ciscoes are seldom harmed. Pike infected with the adult tapeworms may become emaciated and unhealthy (Stewart and Bernier 1999).

A contaminants study revealed that lake trout, lake whitefish, walleye and northern pike sampled from Willow Lake and the Mackenzie River were well below the maximum limit of mercury that is acceptable for a commercial fishery (0.5 µg/g.). The highest level measured for fish from the Study Area was 0.38 µg/g in lake trout from Willow Lake (Fisk et al.2005; Table 14).

In summary, due to plentiful resources, there might be some potential for future commercial inland fisheries in Pehdzeh Ki Ndeh, but it is limited by the high costs of maintaining a fishery in a remote region, such as transportation, fuel, labour, materials and fishing gear. The reported occurrence of periodic winter kills and parasitic infection in some species and water bodies further reduces profitability. A potential commercial fishery would need to target certain species that are of good quality and in high demand.

Additionally, most lakes are fished domestically for subsistence. Even though numbers for that harvest are not available, it is believed that domestic fishing plays an important role in Pehdzeh Ki Ndeh (section 4.2.1) and could conflict with a commercial harvest operation.

4.2.4 Fish Hatcheries

There are currently no fish hatcheries in the Study Area. In southern Canada, fish hatcheries have helped to regenerate depleted fish stocks over the past several decades (DFO 1991). In the NWT, fish stocks are monitored closely and quotas are implemented in order to avoid similar stock depletions (Mackenzie River Basin Board 2002).

4.2.5 Economic Value of Fish

Subsistence Fishing

The percentage of households that report 75% or more of their meat or fish consumed is locally harvested is increasing during the last ten years (Table 17).

Table 17 Percentage Reporting that 75% or More of Meat and Fish Consumed is Locally Harvested (NWT Bureau of Statistics 2004)

Wrigley	2004	1999	1994
	40.7%	28.3%	13.4%

Country food is a very common food item in the Dehcho (Deloitte Haskins & Sells 1988). Many household residents are reported to consume harvested wildlife and fish on a regular basis (Table 17; NWT Bureau of Statistics 2004) and in the Dehcho 43.1% of the population over 15 indicated that they had hunted or fished in the 12 months prior to the survey in 2002. In the Sahtu, north of the Study Area, this figure was 46.6 % (NWT Bureau of Statistics 2003).

Trails and cabins throughout Pehdzeh Ki Ndeh (Cizek Environmental Services and McCullum Environmental Services 2002) facilitate access to the major fish bearing water bodies for residents of the Study Area. It is known that people from Wrigley, Fort Simpson and Deline fish for subsistence in the many lakes and rivers (section 4.2.1). Harvest numbers are not publicly available, making it inappropriate to estimate replacement values for subsistence harvest. Based on the high costs of purchasing food items in Wrigley stores (section 4.1), it is assumed that locally harvested fish is replacing \$20 per kg of purchased fish (Larter and Allaire 2004; Larter and Allaire 2005). Given that close to 41 % of residents in Wrigley consume meat and fish that is primarily locally harvested, it is likely that fish consumed through subsistence harvest in the Study Area is saving residents a significant amount of money, however due to lack of information on the subsistence harvest, detailed economic values cannot be calculated.

Recreational Fishing

With a number of larger lakes and cabins throughout the area, the potential for fishing-based tourism in Pehdzeh Ki Ndeh exists (section 4.2.2). The GNWT's 2002 Visitor Exit Survey estimates \$211 of spending for independent sport anglers and \$285 of spending per package tour fisher in the NWT. Additionally, each package fishing visitor is believed to have spent an average of \$5,155 on the tour itself (GNWT, RWED 2003; Table 18). The survey found that a total of 157 people visited the Dehcho region for the primary purpose of fishing. Of these visitors, 138 came by car and were therefore likely not on a package tour. In total, 19 visitors to the Dehcho arrived by plane and likely used a packaged tour (GNWT, RWED 2003). If

assumptions made in the survey were correct, total revenue from sports fishing to the Dehcho region can be calculated to be \$132,478 (Table 18).

Table 18 Calculated Annual Average Spending Revenue from Fishing Oriented Tourists in the Dehcho (Source: GNWT, RWED 2003)

Means of arrival	Number of visitores	Package costs	Non package spending	Total
Plane	19	\$97,945	\$5,415	\$103,360
Car	138	-	\$29,118	\$29,118
Total	157	\$97,945	\$34,533	\$132,478

It is unknown how many sport-fishing tourists use M. Moses's services annually. It may be assumed that only a small portion of the overall income generated for the Dehcho region through recreational fishing activities is actually occurring within the Study Area. Data to assess income from sport-fishing tourism in the Study Area are not available.

Commercial Fishing

There are currently no commercial fisheries in Pehdzeh Ki Ndeh. Past surveys of the Keller Lake commercial fisheries showed drastic declines during 18 years of operation with the highest harvest occurring in the second year of the fisheries (Table 16). In order to reduce the chance of over-fishing, quotas have been implemented in the major fish bearing lakes of the Study Area. The potential economic value of commercial fisheries in the Study Area is likely limited due to high operational costs and slow growth of fish resources.

Fish Hatcheries

There are currently no fish hatcheries in the Study Area. Similar to commercial fisheries, the potential economic value of such an operation would likely be minimal due to high maintenance costs.

4.2.6 Fish Conclusion

The inherent value of fish as a renewable resource in Pehdzeh Ki Ndeh is most obvious when considering the resource's importance in subsistence harvest, even though harvest numbers are not available to document this value. This is true both in the meat replacement value of the fish

(e.g., costs saved by eating wild meat) and in its capacity as a tool for the passing on of Traditional Knowledge. The cultural value of this resource use may be considered high, especially when examining the high traditional and current use of Pehdzeh Ki Ndeh for subsistence fishing purposes.

Fishing as part of the tourist trade has some potential in Pehdzeh Ki Ndeh. The current situation in the area, with its minimal infrastructure, few operating outfitters and very costly access to the area gives this resource use a low current value. A potential solution to these problems could be to market several tourist activities together in order to attract a wider variety of visitors (section 4.6).

4.3 Trees

The Study Area vegetation is mainly composed of open stands of black spruce (*Picea mariana*) with an understory of dwarf birch (*Betula nana*), labrador tea (*Ledum groenlandicum* and *Ledum decumbens*), ericaceous shrubs, lichen and moss, indicating wet and cold sites (Environment Canada 2005). White spruce (*Picea glauca*), paper birch (*Betula papyrifera*) and aspen (*Populus tremuloides*) are found at drier and warmer sites. The western boundary of Pehdzeh Ki Ndeh and the western portion of the buffer are part of the Mackenzie River Plain and as such are characterized by tall, closed stands of black spruce and jack pine (*Pinus banksiana*), with an understory of feathermoss (*Pleurozium spp.*), berries (*Vaccinium spp.*), labrador tea and lichen (Environment Canada 2006a).

Trees have been used by people throughout the Mackenzie Valley for centuries. In the past, trees were of primary importance for transportation, cooking and heating purposes (Treeline Planning Services Ltd 1985). Today, wood is harvested for similar purposes, including as construction material for houses and cabins, for transportation equipment such as boats, snowshoes and dogsleds, for furniture and as heating fuel (GNWT, ENR 2006). The following sections examine the resource use of trees in Pehdzeh Ki Ndeh for both commercial logging and as a fuel source for the residents of Wrigley.

4.3.1 Commercial Logging

Commercial logging in the NWT is of minor economic importance due to high access and transportation costs. It does occur however, when the yield is high enough to cover the costs. Annual harvest levels vary accordingly and are anywhere between 46,000 m³ and 200,000 m³ (PACTeam Canada 2003). The value for exported domestic softwood lumber for the NWT peaked in 1999 at \$6.7 million and in 2004 amounted to \$891,000 (National Forestry Database Program 2004).

No commercial logging operations currently exist within the boundaries of the Study Area, but a brief pilot project was undertaken in region where horses were used to selectively log timber stands. **It is not known what the success of this operation was (J. Morin pers. comm. 2000 – we will follow up...).** The potential zoning of Pehdzeh Ki Ndeh as Conservation Zone in the Revised Draft Dehcho Land Use Plan (DLUPC 2005) would not permit forestry operations in the future. Commercial timber harvest would be permitted in the Wrigley Special Management Zone (extending from Wrigley south to the Willowlake River; Figure 1) and in the General Use Zone in the western portion of the Study Area buffer. The DLUPC recognized the potential for a commercial logging industry in the Dehcho and initiated several studies with the stated purpose of assessing potential timber stands and the economic feasibility of a harvest (DLUPC 2005; PACTeam Canada 2003; JC Bartlett & Asstes 2004).

These studies revealed that the best timber for commercial logging purposes is generally found on upland locations with good drainage, on eskers, ridges and gravel deposits and along river valleys or on islands (PACTeam Canada 2003). The study determined high, medium and low timber potential on the basis of tree species, age, height and proximity to roads. Growth of trees, succession changes in species composition, forest fires and development of infrastructure could lead to a re-classification of the timber potential categories in the future. Currently, the areas ranked as having the highest timber potential in the Dehcho (mainly white spruce, pine and aspen saw logs; JC Bartlett & Astess 2004; DLUPC 2005) are those close to the highways, facilitating ease of transport.

Of the areas in Pehdzeh Ki Ndeh having a high to very high timber potential, white spruce and pine were the species considered harvestable. Along the Mackenzie Valley, beginning approximately 20 km north of Wrigley and extending south out of the study area, are hundreds of

potential white spruce sawlog stands (PACTeam Canada 2003). There are also numerous pine sawlog stands, including one approximately 20 km east of Wrigley and also several on the east bank of the Mackenzie River, both north and south of the River Between Two Mountains. No potential aspen saw log stands are known to exist in Pehdzeh Ki Ndeh (PACTeam Canada 2003).

Within the Study Area, sites with very high and high timber potential are located south of Wrigley (Figure 7). Extending approximately 20 km north of Wrigley, and for up to 20 km from both the east and west banks of the Mackenzie River, are areas considered to be of high timber potential, with a fringe of moderate timber potential extending north to the Ochre River. To the south, in a corridor up to approximately 30 km wide, the Mackenzie Valley is considered to have a high timber potential, excluding the mountainous area north of the River Between Two Mountains and along the Mackenzie River which is considered to have a very high timber potential. Throughout the rest of the Study Area, patches exist that either have no timber potential or marginal stands, due to either unfavourable conditions for tree growth, such as cold moist sites, or remoteness of the area without access (PACTeam 2003; JC Bartlett & Asstes 2004; Figure 7). The DLUPC in their Draft Land Use Options Atlas (2004a) identified one more potential sawlog stand north of the Ochre River.

There are several natural factors to consider when assessing the capability of an area to supply resources for commercial timber harvest. Two important phenomena that can severely impact a forest's sawlog potential are forest fires and insect outbreaks. On average, 300 fires a year burn in the NWT, consuming approximately 600,000 ha, or 1% of NWT's forested land. Also spruce worms and other destructive insects damage additional tracts of forest (PACTeam 2003).

The areas in and around the Pehdzeh Ki Ndeh have a dynamic fire history, with some areas having no recorded fire events and others (much of the western side of the Mackenzie River and an area south of Blackwater Lake) having been burnt as recently as 1995 or later (Cizek Environmental Services and McCullum Environmental Services 2002). Most of the forested area around Wrigley and the majority of Pehdzeh Ki Ndeh, have not been burnt since 1965 (PACTeam 2003).

Spruce worms, amongst other insects, are causing concerns in Dehcho forests because of their ability to cause stress and mortality to spruce trees, including potentially important stands of white spruce that could, if healthy, be considered for commercial harvest (PACTeam 2003).

The DFN have imposed restrictions on tree harvesting in that it must be in accordance with the Interim Measures Agreement which states that new forestry management permits may only be issued with the support of the affected DFN. Also, harvest is prohibited within 60 metres of the high water mark of any water body and in areas that fall under the surface and sub-surface withdrawals of the Dehcho Interim Measures Agreement (S. Gooderham pers. comm. 2005). The DCLUPC has designed a 20 year planning cycle to reassess timber stands in the area (PACTeam Canada 2003).

Communities in the Dehcho that are considering community based forestry operations stated that they would like to gain access to quality timber but would like to see any logging to operate at sustainable levels using environmentally sound practices compatible with traditional values and principles (DLUPC 2005).

Based on this community feed back and the PACTeam survey (2003), there is future potential for commercial logging operations south of Wrigley. The potential is limited by availability of quality stands, frequent forest fires and bud worm infestations as well as community perceptions of the sustainability of the timber harvest. Additional limiting factors are the availability of infrastructure for transportation of logs and equipment and high operating costs in remote areas.

4.3.2 Fuel wood

The use of trees as fuel wood is widespread throughout the area. Fuel wood consumption across the Northwest Territories is estimated to be at an approximate 9,000 to 13,000 cords per year (J. Colford pers. comm. 2005). All residents of the NWT may harvest wood for fuel with a free Timber Cutting Permit. Approximately 19% of NWT households use wood heat, compared to 38% of homes in the Dehcho (NWT Bureau of Statistics 2004).

A report from 1985 by Treeline Planning Services, details the consumption of fuel wood for several communities along the Mackenzie Valley, including Wrigley. It was estimated that at the time (for 60 buildings in Wrigley) there was an average of 324 cords of wood consumed per year (and 476,271 litres of fuel oil). 72% of the fuel wood was used by residents, 3% by commercial establishments and 25% by community establishments. Projections for the future use of fuel wood for the years 1995 and 2005 vary considerably, depending on unclear scenarios, but range

from 148 to 448 (with an average of 298) cords for the year 2005 (Treeline Planning Services 1985).

In 2003, an estimated 48 out of 54 households in Wrigley used fuel wood to heat their homes (Barichello 2004). Of these wood heat users, 40 households, or 74%, used wood as their main heating source and another 8 households or 15% used wood but also depended on other sources of fuel such as oil or propane. The annual consumption of fuel wood in Wrigley is estimated to be 10 to 11 cords for households relying completely on the type of wood (T. Cli pers. comm. 2005). It can be assumed that the households that rely on different heating sources (including fuel wood) use a maximum of 5.5 cords per year. Based on this information, a total consumption of 304 cords per year can be estimated. This estimate does not include the wood required to heat the cabins located throughout Pehdzeh Ki Ndeh. This additional fuel wood is likely harvested in close proximity to the cabins inside the Area of Interest.

It is not known where Wrigley residents harvest fuel wood to heat their homes. However, given the integrity of the timber resources in Pehdzeh Ki Ndeh and the easy access throughout Pehdzeh Kid Deh, it is likely that residents use the Area of Interest for their fuel wood harvest. Additionally, there are good timber areas along the highway south of Wrigley, which might be accessed as well.

The future potential of this resource can be assumed to remain similar to its present use. Factors that may influence this resource use are drastic changes in population size, forest fires and insect outbreaks.

4.3.3 Economic Value of Trees

The economics of commercial logging in the Dehcho have been assessed by JC Bartlett & Asstes (2004). The study estimates the average logging costs for white spruce in the study area at \$42 / m³. The authors do not provide an estimate for costs associated with harvest of jack pine but do state that the costs are slightly lower than for spruce. Table 19a shows the costs associated with logging of white spruce in the study area and estimated delivered wood prices.

Table 19a Costs Associated with Logging 1.0 m³ of White Spruce in the Study Area and Delivered Wood Prices (Source: JC Bartlett & Asstes 2004)

Species	Road development costs	Average haul costs (from stand to nearest community)	Loading costs	Royalties	Delivered wood price in High Level, Alberta (estimated 30% higher in Dehcho)	Potential profit per m ³ of saw logs
White spruce	\$5	\$6	\$25	\$6	\$45 (\$58.50)	\$16.5

The closest commercial logging operation is in Jean Marie River. It harvested 1,000m³ in 2005 and expects to harvest the same amount in 2006 (A. Cassidy pers. comm. 2005). Based on JC Bartlett & Asstes' study, the gross income of this volume of timber is \$16,500 per year. If Wrigley were to start a similar operation then likely most of the wood would be harvested from the Wrigley Special Management Zone with good access to the highway. Sawlogs would need to be transported to the sawmill in Jean Marie River, which would add additional costs to the operation and thus reduce the potential profit.

Wrigley's wood heat users are estimated to use 304 cords of fuel wood annually. This estimate does not include the wood required to heat the cabins located throughout Pehdzeh Ki Ndeh. This additional fuel wood is likely harvested in close proximity to the cabins inside the Area of Interest. Since wood is priced at about \$300 per cord in Wrigley (T.Cli pers. comm. 2006), the estimated annual fuel wood replacement value is approximately \$91,200.

Based on findings of a fuel wood study (Treeline Planning Services 1985) conducted in the area, on replacing diesel fuel with fire wood, if Wrigley were to use exclusively wood in lieu of diesel, it would spend an estimated \$209,400 per year on wood resources while saving \$384,350 from not needing to purchase the diesel. This balance would result in a total savings of \$174,950 due to the cheaper cost of wood compared to current fuel prices, as shown in Table 19b. Diesel fuel prices are calculated at \$0.807 per litre (TDC, Fort Smith pers. comm. 2005).

Table 19b provides an estimate of potential diesel fuel savings. Treeline Planning Services Ltd.'s 1985 study used a conversion rate of one cord of wood to 455 litres of diesel fuel, which was applied to Table 19b.

Table 19b Differential Cost of Diesel Fuel and Fire Wood for Heating
(Source: Treeline Planning Services 1985)

	Fuel use	Wood	Fuel cost	Fuel wood	Potential diesel
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	(litres) (1985)	equivalent in cords	(Dec. 2005)	replacement value (2005)	fuel savings
Wrigley	476,271	1,047	\$384,350.69	\$209,400	\$174,950.69

Based on the fuel wood replacement value, the savings for households of the Study Area is \$3,240 per household per year. This number does not include fuel wood harvested to heat cabins in Pehdzeh Ki Ndeh.

4.3.4 Trees Conclusion

Currently, the only resource use of trees in the study area is fuel wood harvest. The importance covers both economic (monetary value through fuel wood replacement value) and cultural aspects. Being able to heat residences and cabins in a self sufficient manner is an important component of traditional living. It allows Study Area residents to live away from infrastructure where they are better able to hunt and fish and carry out other activities associated with traditional life.

Commercial timber harvest, although currently not practised, has some limited future potential outside the Pehzeh Ki Deh Conservation Zone. Forest fires and diseases will periodically reduce suitable timber stands within the study area and limited road access remains an issue for further commercial timber operations in the study area.

4.4 Plants

Plants found in the Study Area are used by Wrigley residents for many purposes, such as berry picking, medicinal, ritual and spiritual reasons and as agricultural food crops. According to the Revised Draft Dehcho Land Use Plan (2005), the Dehcho are compiling a list of plant species found within the area that are considered culturally important. This should be completed by the end of 2007. If ratified, the Dehcho Land Use Plan will require that any new land and water use permit applications in the region incorporate a vegetation survey for the proposed development area in addition to plans for minimizing or preventing damage to traditional plant harvesting areas (DCLUPC 2005).

4.4.1 Berry Picking

Berry picking is a very common activity in Wrigley and practiced by nearly all of the residents of the community. Often the younger residents are the first to find the berries and then are followed by the rest (T. Cli pers. comm. 2006). The most common berry picking places are along the highway towards Fort Simpson and the existing gas pipeline corridor near town (both within the Study Area). People may also take advantage of the trail systems that winds through Pehdzeh Ki Ndeh to access berry patches. Many different species of berries are picked, including blueberries, low bush cranberries, cloudberry, and rose hips (T. Cli pers. comm. 2006). Table 20 lists the different species of berries potentially picked in the Study Area.

Table 20 List of Potentially Harvested Berry Species in the Study Area
(Sources: DLUPC 2005; T. Cli pers. comm. 2006)

Scientific Name (genus and species)	Common Name(s)
<i>Arctostaphylos spp</i>	Common bearberry, Alpine bearberry, Kinnikinnick
<i>Empetrum nigrum</i>	Crowberry, black berry
<i>Fragaria vesca spp.</i>	Woodland strawberry, Wild strawberry
<i>Ribes hudsonianum</i>	Northern black currant
<i>Ribes triste</i>	Wild red currant
<i>Rosa acicularis</i>	Prickly rose, rose hips
<i>Rubus spp</i>	Wild red raspberry, Dewberry, Dwarf raspberry
<i>Rubus chamaemorus</i>	Cloudberry, Baked apple berry, Yellowberry
<i>Shepherdia canadensis</i>	Buffaloberry, Soopolallie, Soapberrie
<i>Vaccinium spp</i>	Common blueberry
<i>Vaccinium vitis-idaea</i>	Lingonberry, Bog cranberry, Cowberry, Mountain cranberry

4.4.2 Medicinal / Ritual / Spiritual Uses

Many plant species have long served medicinal, ritual and spiritual purposes for the Dehcho people. Different plant species serve different functions, such as the relief of coughs and colds through herbal teas. The only known specific information that has been documented about the species, locations or harvesting practices for such plants in Pehdzeh Ki Ndeh was a mapping

exercise carried out in Wrigley in 2000 where medicinal plant harvesting sites were identified (NWT-PAS 2001). The results were not available for review, but a list has been compiled (Table 21a), which shows those species known within the Dehcho region to be used for unspecified purposes.

Table 21a List of Potentially Harvested Medicinal, Ritual and Spiritual Plants in the Study Area
(Source: DCLUPC 2005)

Scientific Name	Common Name
<i>Abies lasiocarpa</i>	Alpine fir
<i>Achillea millefolium</i>	Yarrow
<i>Actaea rubra</i>	Red baneberry
<i>Acorus americanus</i>	Sweet flag, Calamus
<i>Agastache foeniculum</i>	Giant hyssop
<i>Alnus rugosa</i>	River alder, Speckled alder
<i>Andromeda polifolia</i>	Dwarf bog rosemary
<i>Androsace septentrionalis</i>	Pygmyflower, Fairy candelabra
<i>Apocynum androsaemifolium</i>	Spreading dogbane
<i>Artemisia campestris</i>	Field sagewort
<i>Artemisia frigida</i>	Pasture sage
<i>Aster cilliolatus</i>	Lindley's aster, Fringed aster
<i>Aster laevis</i>	Smooth aster
<i>Aster puniceus</i>	Purple-stemmed aster
<i>Aster umbellatus</i>	Flat-topped white aster
<i>Astragalus americanus</i>	American milk-vetch
<i>Betula glandulosa</i>	Bog birch
<i>Betula papyrifera</i>	White birch, Paper birch
<i>Betula pumila var. glandulifera</i>	Dwarf birch
<i>Betula occidentalis</i>	Water birch
<i>Boschniakia rossica</i>	Northern ground-cone
<i>Calla palustris</i>	Water calla
<i>Campanula rotundifolia</i>	Bluebell
<i>Carex aquatilis</i>	Sedge
<i>Chenopodium album</i>	Lamb's quarters
<i>Chenopodium capitatum</i>	Strawberry blite
<i>Chimaphilia umbellata</i>	Pipssewa
<i>Dryopeteris carthusiana</i>	Spiney wood fern
<i>Epilobium angustifolium</i>	Fireweed
<i>Equisetum arvense</i>	Horsetail
<i>Galeopsis tetrahit</i>	Hemp nettle
<i>Galium boreale</i>	Northern bedstraw
<i>Gaultheria hispidula</i>	Creeping wintergreen, Teaberry
<i>Geum aleppicum</i>	Yellow avens
<i>Geum rivale</i>	Purple avens
<i>Grindelia squarrosa</i>	Gumweed
<i>Hedysarum alpinum</i>	American alpine sweet-vetch, Sweetbroom
<i>Hellenium autumnale</i>	Sneezeweed
<i>Heuchera richardsonii</i>	Alum-root
<i>Hierochloa odorata</i>	Sweet-grass

<i>Hudsonia tomentosa</i>	Sand heather
<i>Juniperus communis</i>	Common juniper
<i>Juniperus horizontalis</i>	Creeping juniper
<i>Kalmia polifolia</i>	Northern bog laurel, Pale bog laurel, Swamp laurel
<i>Larix laricina</i>	Tamarack
<i>Ledum groenlandicum</i>	Common Labrador tea
<i>Leucanthemum vulgare</i>	Ox-eye daisy
<i>Lycopodium annotinum</i>	Clubmoss
<i>Matteauccia struthiopetris</i>	Ostrich fern
<i>Mentha arvensis</i>	Wild mint
<i>Mertensia paniculata</i>	Lungwort, Tall bluebells
<i>Mitella nuda</i>	Mitrewort
<i>Myrica gale</i>	Sweet gale
<i>Nuphar lutea</i>	Yellow pond lily
<i>Oxyria digyna</i>	Mountain sorrel
<i>Pedicularis langsдорffii</i>	Lousewort
<i>Petasites sagittatus</i>	Arrow-leaved coltsfoot
<i>Picea glauca</i>	White spruce
<i>Picea mariana</i>	Black spruce
<i>Pinus banksiana</i>	Jack pine
<i>Pinus contorta</i>	Lodgepole pine
<i>Plantago major</i>	Broad-leaved plantain
<i>Polygonum amphibium</i>	Water smartweed
<i>Polygonum viviparum</i>	Bistort, Serpent grass
<i>Polypodium vulgare</i>	Rock polypody fern
<i>Populus balsamifera</i>	Balsam poplar
<i>Populus tremuloides</i>	Trembling aspen
<i>Potentilla gracillis</i>	Shrubby cinquefoil
<i>Pyrola asarifolia</i>	Pink wintergreen
<i>Rumex aquaticus</i>	Western dock
<i>Sagittaria cuneata</i>	Arrowhead
<i>Salix spp.</i>	Willow species
<i>Sarracenia purpurea</i>	Pitcher plant
<i>Schoenoplectus acutus</i>	Bulrush
<i>Scutellaria galericulata</i>	Marsh skullcap
<i>Solidago canadensis</i>	Canadian goldenrod
<i>Taraxacum officinale</i>	Dandelion
<i>Triglochin maritimum</i>	Seaside arrow-grass
<i>Urtica dioica</i>	Stinging nettle
<i>Utricularia macrorhiza</i>	Bladderwort
<i>Veratrum viride</i>	False hellebore
<i>Zigadenus elegans</i>	Mountain death camas

Table 21b describes the only reported plant harvest and its use that was available for this report (Cizek Environmental Services and McCullum Environmental Services 2002; J. Morin pers. comm. 2006).

Table 21b List of Medicinal, Ritual and Spiritual Plants Known to be Harvested in the Study Area

(Sources: Cizek Environmental Services and McCullum Environmental Services 2002; J. Morin pers. comm. 2006)

Harvest location in Study Area	Scientific name	Common name	Use
-North of old settlement	<i>Acorus calamus</i>	Ratroot	Medicinal (coughs and

across river (marshy area) -At small pond west of Tih k'ea Lake			colds)
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4.4.3 Food Harvest / Agriculture

Both wild and domestic plant foods may be harvested in the Study Area.

Mushrooms

Although no mention was found of mushroom harvests in the study area, in other parts of the NWT people pick the native morel mushrooms (*Morchella esculenta* and *Morchella angusticeps*). These mushrooms, triggered into fruiting by forest fire activity, are typically found in the year following a forest fire and are harvested on open ground during the early summer months (Underhill 1979; Territorial Farmers Association et al. 2000).

Agriculture

Agricultural activities have been undertaken in the NWT for hundreds of years. There have been successful endeavours to produce vegetable and even grain crops in the area's challenging climates, with efforts beginning as far north in the mid-1900s as the communities of Aklavik and Inuvik in the Mackenzie Delta (RMC Resource Management Consultants 1985). Numerous agricultural achievements have been accomplished in the south Mackenzie Valley and Slave Lake regions, including the 25-year operation of an Agriculture Canada experimental farm and research station located at Fort Simpson (approximately 200 km south of the Pehdzeh Ki Ndeh) between 1945 and 1970 (RMC Resource Management Consultants 1985; Territorial Farmers Association 1995).

Successful agricultural activities require several environmental factors to be within a tolerable range. Thresholds exist that must be considered when determining if a crop will mature and, particularly in northern regions such as the Mackenzie Valley, these threshold limits may become relevant restrictive forces. Factors that may influence the success of an agricultural attempt include the nature of the soil (its composition, temperature and the presence of permafrost), the land's topography and different climatic factors, such as number of growing degree days, frost-

free days, sunlight hours and precipitation (RMC Resource Management Consultants 1985; GNWT, Economic Development and Tourism 1990). Other human-controlled factors such as crop rotation, tillage, fertilizers, windbreaks, irrigation and pesticides must also be considered for different agricultural endeavours (Territorial Farmers Association et al. 2000).

An important limiting growing factor for crops in the north is the number of growing degree-days they are exposed to. This measurement incorporates the number of days where the mean temperature exceeds a certain minimal level and by how many degrees it exceeds that minimal level. For cold season crops, the mean temperature must be a minimum of 5°C, and for warm season crops, 10°C. Crops in Yellowknife, located only approximately 1 degree of latitude to the south of Pehdzeh Ki Ndeh, require 8,529 degree-days of heating (RMC Resource Management Consultants 1985). It is unknown how many degree-days would be required for crops in Pehdzeh Ki Ndeh, but it is assumed to be similar.

The number of frost-free days is also important when considering if an area is suitable for crop development. Hay River experiences an average 95 frost-free days and Yellowknife to the north an average of 70 frost-free days (Territorial Farmers Association et al. 2000). Because Pehdzeh Ki Ndeh is an even more northerly location, it may be assumed that it has even fewer frost-free days, although the sheltering factor of the Mackenzie Valley may provide warmer temperatures and possibly an increased number of frost-free days along that corridor. In the majority of agricultural areas, 50 to 100 frost-free days are required for average crop maturation (GNWT, Economic Development and Tourism 1990); it seems likely that at least selected areas within Pehdzeh Ki Ndeh would experience this number as a minimal amount.

Other climatic factors that will influence crop growth include sunlight and precipitation. In the Southern Mackenzie Valley there is an average of 20 hours of daylight in the month of June, with typically 8 hours of bright sunlight, considered favourable agricultural conditions. Pehdzeh Ki Ndeh has an annual average of 50 - 500 cm of precipitation, adequate for successful agricultural activities (Territorial Farmers Association et al. 2000; Cizek Environmental Services and McCullum Environmental Services 2002).

Soils that are considered suitable for agricultural development in the Northwest Territories are typically found in river valleys or lakesides, landscape features which are abundant in the Study

Area. These are normally soils with low organic matter and low nutrient content and a texture ranging from sandy loam to silty clay (Territorial Farmers Association et al. 2000).

While little modern documented data is available for Pehdzeh Ki Ndeh regarding its suitability for the development of agricultural activities, there have been various studies done in the past that could be used as indicators for the area's agricultural potential. The investigation of the suitability of the area's soil for agriculture has included Lavkulich's 1973 report on the soils, vegetation and landforms of the Wrigley area, and DLUPC's Draft Land Use Options Atlas (2004a) which describes the area's agricultural potential.

Lavkulich's study incorporated parts of the Study Area and findings indicated that along the Mackenzie River the soils were generally of good potential for agricultural activities (Lavkulich 1973; Territorial Farmers Association et al. 2000). However, based on previous soil surveys, the DLUPC's Draft Land Use Options Atlas (2004a) indicated that the Study Area has no potential for agriculture. The Revised Draft Dehcho Land Use Plan (2005) supports sustainable agricultural development in the Dehcho outside of community boundaries with minimal impact on environment, wildlife and traditional land use. It also states that agricultural operations should minimize clearing and draining of the land and minimize the use of chemicals.

Over the past century, many different agricultural crops have been grown, to varying degrees of success, throughout the southern Mackenzie Valley. Vegetables such as leaf lettuce, radish, turnip, broccoli, cauliflower, kale, peas, brussels sprouts, potatoes, carrots, asparagus, tomatoes, white clover, citron, pumpkin, squaw corn, beans, melons, cabbage and cucumbers, fruits such as apples, crabapples, cherries and plums and grain crops such as oats, wheat and barley have all been planted in different locations throughout the region (GNWT, Economic Development and Tourism 1990; Territorial Farmers Association 1995; Territorial Farmers Association et al. 2000).

Agricultural plants that would likely be the most suitable for growing in the Pehdzeh Ki Ndeh area would include cold-crop species (such as cabbages and carrots) and quickly maturing species (such as radishes, lettuces, squashes and peas) (RMC Resource Management Consultants 1985). Certain human influences may, however, act to dramatically increase the variety of species that would grow in such a location. Controlled environments such as greenhouses or clear plastic tunnels over plant rows can provide more favourable growing conditions for crops. According to the Revised Draft Dehcho Land Use Plan the Study Area is indicated to have no agricultural

potential (DLUPC 2005). Agriculture potential in the dehcho was assessed based on previous soil studies. No comprehensive studies were conducted to assess the soil composition and quality in the Study area (M. Templin pers. comm. 2006).

There are approximately five successful gardeners growing produce for personal consumption in the Study Area (T. Cli pers. comm. 2006). Species grown include potatoes, carrots, lettuce, tomatoes, peas and other quick-growing crops. Usually a mulch is used along with a plastic covering over the crops early in the season for protection of the plants from the frost. Garden locations include one on the Mackenzie Highway, one in the community of Wrigley, one beside the Mackenzie River and one on the Willow River (T. Cli pers. comm. 2006). These are assumed to be private gardens that have been established for a minimum of several years.

If the Revised Draft Dehcho Land Use Plan is ratified, agriculture will not be permitted in Pehdzeh Ki Ndeh, although this regulation would exclude personal gardens within community boundaries and possibly already established small-scale gardens elsewhere (DCLUPC 2005). It does however clarify that large-scale crop production (such as cereal crops or the commercial production of vegetables or fruits) would not be accepted within the Pehdzeh Ki Ndeh Conservation Zone.

4.4.4 Economic Value of Plants

It is possible that the harvesting of native morel mushrooms could generate a profit if burn sites were easily accessible and the market existed for their sale (Territorial Farmers Association et al. 2000), but these mushrooms do not have any present economic harvest in Pehdzeh Ki Ndeh.

Berry picking is one popular activity which helps to supplement food costs for Wrigley residents, although the food replacement values of berry picking are unknown. Many different species are expected to be harvested, but the exact species, specific locations of harvest and harvested quantities are unknown.

Medicinal plants may be considered to have an economic replacement value. It is difficult to quantify the values of medicinal plant use because methods of harvest, doses, frequencies of use and present market values of supplementary non-traditional medicines change over time.

Ritual and spiritual plant uses are considered for the purpose of this study to have no economic replacement value. These species are respected and utilized for specific purposes and it is assumed that no other plant species could serve the same purpose. It is also assumed that the plants gathered from Pehdzeh Ki Ndeh for such purposes are not sold. All the above resource uses are known to possess an inherent cultural value that connects the harvesters with their tradition and their land.

In northern communities, it has long been recognized that fresh produce is significantly more expensive than it is in more southern locations. Particularly for remote communities like Wrigley, where the transportation of goods can be quite costly, it may be economically feasible to promote the use of renewable resources gathered or grown within and around the community. It has been noted that most agricultural items (except cereal crops) may be grown competitively in the southern Mackenzie Valley (GNWT, Economic Development and Tourism 1990).

Within Wrigley, the only known location where fresh produce may be purchased is at the local Co-op grocery store. The selection is typically limited and costly and Wrigley residents are more likely to drive to Fort Simpson to purchase their produce items than to purchase them within the community (T. Cli pers. comm. 2006). Several individuals are known to grow small crops of vegetables and fruits (e.g. potatoes and tomatoes) for personal consumption and this is almost certainly economically worthwhile. Specific fresh food costs in the community are unknown (and likely to vary over time), but considering the known limited selection of produce available in Wrigley and the acknowledged high prices for those items (possibly as high as 74% more expensive than similar food items in Yellowknife), it is probable that home-grown produce is significantly cheaper than store-bought produce (NWT Bureau of Statistics 2004).

One other interesting economical consequence of the increased use of plants in Wrigley could be increased tourism. Many communities in the NWT, including Fort Simpson and Hay River, participate in the Communities in Bloom program. Judgement is based the communities' abilities to improve their appearance (with flowers, trees and green spaces) and environmental awareness (e.g. composting practices) through the use of plants (Territorial Farmers Association et al. 2000). If Wrigley was to partake in such activities and become involved in community beautification through the use of plants, its tourism industry may be boosted, with a resulting boost in the local economy.

4.4.5 Plants Conclusion

Historically, plants have been utilized for many different purposes in and around Pehdzeh Ki Ndeh. They are an important renewable resource, harvested as food, for medicinal, ritual and spiritual reasons. The relative importance of the different plant uses in Pehdzeh Ki Ndeh is difficult to quantify because it is unclear which particular species or what quantities of those species are harvested in various areas. It is generally acknowledged that fresh plant products, independent of whether they are harvested from the land or grown in privately-owned gardens, are beneficial for residents who consume them because they encourage healthier eating (fresher products) and promote the local economy (cheaper produce and decreased dependence on food products brought in from the south) (DLUPC 2005).

4.5 Art and Craft Materials

Historically, clothing and household items were made directly from renewable resources such as hide, fur, sinew and bone. Over time, the people responsible for creating these items began to incorporate a less utilitarian methodology in their design and arts and crafts items became popular (GNWT, Economic Development and Tourism 1997). Many arts and crafts items are still entirely functional, such as knives with bone handles, or bowls made from wood, but many items are also decorative in nature, such as porcupine quill pictures or miniature souvenirs of drums or canoes. Renewable resources today play an important role as raw materials for modern arts and crafts pieces and many of these materials may be found within Pehdzeh Ki Ndeh.

4.5.1 Arts and Crafts Description

In the Dehcho region in general, of 2,525 people over 15 years of age, 24.6% of the people were found to be involved in making arts and crafts (NWT Bureau of Statistics 2003). Pehdzeh Ki Ndeh is one source of renewable resource materials for artists residing in Wrigley. Materials harvested or collected include animal parts such as hide, fur, sinew and vegetation matter, such as lichen, bark and berries. Information on the distribution, use and harvesting trends of these art and craft materials is scarce, but it is acknowledged that the Study Area is utilized for such purposes (D'Arcy Moses pers. comm. 2006).

Wrigley Artists

For the purpose of this study, only artists residing in Wrigley are considered to be harvesting renewable resource materials from Pehdzeh Ki Ndeh for art and craft materials, although the area may be used sporadically by residents from other communities for the purpose of harvesting or collecting art and craft materials. In 1988 it was estimated that 15.0% of the residents of Wrigley participated in arts and crafts activities, but that number decreased by 50% over the next 5 years. In 1993, it was found that only 7.5% of Wrigley residents participated in arts and crafts activities (NWT Bureau of Statistics 2001). Today, approximately 12 people participate in arts and crafts activities, an estimated 6.5% of the community's residents (D'Arcy Moses pers. comm. 2006).

According to M. Norwegian and D'Arcy Moses (pers. comm. 2006), there are one or two painters and drawers, one world-renowned fashion designer and several crafters in Wrigley. Works that are produced have been sold through the local co-op in the past, but are not anymore, though efforts are underway to restore such an arrangement (D'Arcy Moses pers. comm. 2006). Options for Wrigley artists for selling their works include selling privately or taking their work to Fort Simpson or another community for sale through shops found there (M. Norwegian pers. comm. 2006), but the majority of artists creating arts and crafts items in Wrigley do not do so for selling purposes; these works are usually distributed amongst family members (D'Arcy Moses pers. comm. 2006).

Renewable Resources as Art and Craft Materials

Concerns have been raised in the Dehcho region regarding the harvesting of renewable resources by non-residents. Traditional materials such as birch bark, fur and hides are valued by residents of the area and they want assurance that these resources will be properly used and not wasted in order to maintain sustainable harvest levels. It is recommended that individuals wishing to harvest such resources contact the First Nations for approval and guidance on how best to utilize these materials (DLUPC 2005).

The different renewable resources that exist in Pehdzeh Ki Ndeh and may be harvested and utilized for arts and crafts purposes are summarized in Table 22. Also shown are the resource's potential uses as art and craft materials and locations where the harvestings of these materials are thought to take place.

Table 22 Renewable Resources that may be Found in Pehdzeh Ki Ndeh and Used for Arts and Crafts Purposes (Sources: Cizek Environmental Services and McCullum Environmental Services 2002; GNWT, ITI 2005c; D. Kumar pers. comm.2005; C. Oteiza pers. comm.2005; D'Arcy Moses pers. comm. 2006)

Renewable Resource	Use in Arts and Crafts	Probable and Possible Sources
Birchbark	-Birchbark baskets -Souvenir boats	-Usually Fort Liard area -Possibly also mouth of Willowlake River, or small areas north of Willowlake River but minimal harvesting
Lichen, berries, flowers, plants, bark	-Dyes for porcupine quills -Tanning agents	-Possibly throughout Pehdzeh Ki Ndeh but minimal harvesting
Spruce roots / gum	-Birchbark baskets	-Fort Liard, Trout Lake and the Hay River Reserve -Possibly also areas of Pehdzeh Ki Ndeh but minimal harvesting
Wood of various trees and shrubs	-Carving -Tanning agents -Souvenirs -Miniature snowshoes bows and arrows canoes -Birchbark baskets (reinforcement) -Beadwork -Canes -Drums	-Anywhere in Pehdzeh Ki Ndeh where trees and shrubs exist
Antler / bone	-Carvings -Knife handles	-Parts from animals harvested or collected in Pehdzeh Ki Ndeh are used in arts and crafts
Feathers	-Decoration	-Not likely in Pehdzeh Ki Ndeh
Fur (beaver, fox, wolverine, marten, wolf, mink, lynx, rabbit)	-Clothing (mitts, mukluks, parkas) -Souvenirs -Decoration	-Parts from animals harvested in Pehdzeh Ki Ndeh are used in arts and crafts -Likely areas inc. Blackwater Lake river system, the lowlands of lakes south of Blackwater River and Hodgson Creek, lakes east of Blackwater Lake, northwest corner of study area north of Mackenzie River, Spruce / Tseepantee Lake, area east of Franklin Mnts, Fish Lake, marshlands and lakes in Sahtu area north of border
Hair (caribou, moose)	-Hair tufting (on pictures, clothing...)	-Parts from animals harvested in Pehdzeh Ki Ndeh are used in arts and crafts -Likely areas inc. floodplain of Blackwater River, Blackwater Lake area, lower reaches of Ochre River, area east of Franklin Mnts, Fish Lake area, Keller Lake Area and areas north of border in Sahtu
Hide (caribou and more commonly moose)	-Clothing (mitts, mukluks, parkas) -Canvas (for beadwork) -Souvenirs -Miniature	-Parts from animals harvested in Pehdzeh Ki Ndeh are used in arts and crafts -Likely areas inc. floodplain of Blackwater River, Blackwater Lake area, lower reaches of Ochre River, area east of Franklin Mnts, Fish Lake area, Keller Lake area and areas north of border in Sahtu

	snowshoes canoes -Drums	
Quills (porcupine)	-Quillwork -Beadwork -Birchbark baskets -Decorative trim on clothing	-Fort Liard, Nahanni and Trout Lake -Minimal harvesting in Pehdzeh Ki Ndeh
Sinew	-Souvenirs -Miniature snowshoes -Beadwork -lothing (mitts, mukluks, parkas)	-Parts from animals harvested in Pehdzeh Ki Ndeh are used in arts and crafts -Likely areas inc. floodplain of Blackwater River, Blackwater Lake area, lower reaches of Ochre River, area east of Franklin Mnts, Fish Lake area, Keller Lake Area and areas north of border in Sahtu
* Stone	-Carvings -Different arts and crafts items	-Unlikely in Pehdzeh Ki Ndeh area; no known carving rocks in area

* Acknowledged as not being a renewable resource, but included here because of its potential importance as an arts and crafts resource material.

Vegetation Matter

Birchbark is used to create traditional lightweight, waterproof and rot-resistant birch bark baskets. The bark of the paper birch is harvested preferably in late spring or early summer (GNWT, ITI 2005c). There are not many sources of birchbark in the Pehdzeh Ki Ndeh area. Most likely it is harvested from other areas for use by Wrigley artists (D'Arcy Moses pers. comm. 2006a), but it is possible that it is also harvested from areas within Pehdzeh Ki Ndeh where deciduous forest patches might contain birch trees, such as small areas north of Blackwater River, or at the mouth of Willowlake River (C. Oteiza pers. comm. 2005, Cizek Environmental Services and McCullum Environmental Services 2002).

Traditionally, different lichen, berries, flowers, plants and bark materials were valued for their abilities to dye art and craft materials, in particular porcupine quills. Today these resources have become less important in the industry as commercial dyes and other modern dying agents are readily accessible to artists. It is possible that some of these natural renewable resources are still harvested within Pehdzeh Ki Ndeh, but it is unknown which areas are most intensely used for such purposes (GNWT, ITI 2005c; D'Arcy Moses pers. comm. 2006).

Spruce roots and spruce gum are important in the creation of birch bark baskets. The roots are used to sew the pieces of bark together and the gum is used as a sealant in the basket's seams, aiding in its waterproofing. Spruce roots are best when gathered in June and are typically harvested from the Fort Liard and Trout Lake areas of the Deh Cho. It is probable that they are also harvested in areas of Pehdzeh Ki Ndeh, for there are extensive areas of needleleaf forest cover with black spruce stands throughout the study area (GNWT, ITI 2005c; C. Oteiza pers. comm. 2005; Cizek Environmental Services and McCullum Environmental Services 2002).

The wood of various trees and shrubs is often used in arts and crafts, or during the traditional tanning process for hides. The wood may be used solely for or incorporated into carvings, souvenirs (such as miniature snowshoes, bows and arrows, miniature canoes), birch bark baskets (red willow strips are commonly used for reinforcing the basket and its lid), beadwork and canes (GNWT, ITI 2005c). The different types of wood from trees and shrubs may be harvested in various areas of the Pehdzeh Ki Ndeh, but the exact distribution or abundance of these renewable resource uses is unknown (D'Arcy Moses pers. comm. 2006).

Animal Parts

Antler and bone materials are often used for or incorporated into carvings, used in beadwork, or used as decoration for other arts and crafts. The bones and antlers of animals harvested or collected in Pehdzeh Ki Ndeh are used by artists in Wrigley (GNWT, ITI 2005c, D'Arcy Moses pers. comm. 2006).

Feathers can be incorporated into arts and crafts items for their decorative value. In Pehdzeh Ki Ndeh, feathers are not gathered very often. The use of feathers in arts and crafts, decoratively or as a down filling, has nearly ceased over time in Wrigley and it is unlikely that feathering gathering is an important activity for artists in Pehdzeh Ki Ndeh).

Pelts from animals such as fox, beaver, wolverine, marten, wolf, mink, rabbit and others are often used in the arts and crafts industry in the creation of clothing and souvenirs and as decoration on different items (GNWT, ITI 2005c). The pelts of animals harvested in Pehdzeh Ki Ndeh are used by artists in Wrigley (D'Arcy Moses pers. comm. 2006).

The hair of the moose and caribou are particularly prized for their value in the art of tufting. The modern art of tufting, involving the collecting, dyeing and sewing of bunches of hair into designs on hide or other canvas material, originated in the Fort Simpson area. The preferred hair to use are the white ones on the shoulder and rump of the animal. Hair from animals harvested in Pehdzeh Ki Ndeh area is used in the creation of quality tufting works in Wrigley (D'Arcy Moses pers. comm. 2006).

The hide from animals, in particular moose and caribou, is a very important renewable resource used in the arts and crafts industry. Tanned hide is used to make clothing items such as pants, mitts, mukluks and parkas and is also used in various arts and crafts projects such as for canvas material for beadwork, for pieces of souvenir items such as miniature snowshoes and canoes and as handles on birch bark baskets. Hides are tanned in Wrigley by at least one artist (15 moose and 2 caribou in 2005 / 2006) and the animals from which the hides were gathered were typically harvested in Pehdzeh Ki Ndeh (D'Arcy Moses pers. comm. 2006).

Porcupine quills have been used for hundreds of years by artists in the communities of the Dehcho region and the use of them precedes the use of beadwork as a form of artistic enhancement for clothing and other works of art. Quillwork is typically incorporated into sewing, weaving and birch bark basket designs (GNWT, ITI 2005c). The quills can be obtained from either live or dead porcupines and in the Dehcho, porcupines are usually harvested for their quills in the Fort Liard, Nahanni and Trout Lake regions (GNWT, ITI 2005c; Oteiza pers. comm. 2005). Artists in Wrigley today do not produce a large amount of quillworks and it is estimated that only between 2 and 3 porcupines per year are harvested in Pehdzeh Ki Ndeh for arts and crafts purposes (D'Arcy Moses. pers. comm. 2006).

Sinew is important in the arts and crafts industry as a quality stitching material. It was traditionally used for sewing projects, in beadwork and incorporated into other items such as snowshoes, but has become less utilized in recent times as other materials such as dental floss are more readily accessible. Sinew from large animals harvested in Pehdzeh Ki Ndeh is used by artists in Wrigley (D'Arcy Moses pers. comm. 2006).

Animals from Pehdzeh Ki Ndeh are important in the arts and crafts industry in Wrigley. It is roughly estimated that 75 animals per year (typically moose and caribou, with fewer beaver, fox, wolverine and an assortment of other mostly fur-bearing animals) are harvested in the area for

arts and crafts purposes. Animals are taken from throughout the area, with certain harvesting sites perhaps being more readily accessed by the trail system that exists in Pehdzeh Ki Ndeh. The only known preferred harvesting sites are for one species, moose, in undisclosed moose pasture sites (D'Arcy Moses pers. comm. 2006).

Stone

Stones, though not recognized as being a renewable resource, are discussed here because of their importance to some aspects of the arts and crafts industry, particularly as carving materials. The artists in Wrigley are not well known for their carvings and any carvings that are created are not likely done using rocks gathered from the Pehdzeh Ki Ndeh area. The region does not contain the metamorphic terrain where the serpentine and soapstone materials most commonly used for carvings are found (J. Lariviere pers. comm. 2005). Artists may however gather stones from Pehdzeh Ki Ndeh for other arts and crafts purposes such as decoration.

4.5.2 Economic Value of Art and Craft Materials

In the Dehcho region in 1989 it was estimated that 181 artists worked to produce arts and crafts items. The most popular items sold were baskets, apparel, tuftings and jewellery, generating an estimated \$0.5 million in the Dehcho (GNWT, Economic Development and Tourism 1993). During the 1990's it was determined that throughout the Northwest Territories (prior to separation with Nunavut) 46% of art items went to tourists, 30% to collectors and 23% to non-tourists (GNWT, Economic Development and Tourism 1993).

More recently, tourists have been found to spend an estimated \$2 million per year on arts and crafts in the Northwest Territories. It was found that handmade goods such as pottery, baskets and textiles were the most sought-after arts and crafts items, while clothing and footwear were less popular. A survey conducted of American visitors to the NWT established that unique and original art items were most highly valued and that an average of 40% of those people interviewed had planned to spend between \$100 and \$300 on arts and crafts items while visiting (Zieba 2005).

Little information is available on the economic value of arts and crafts in the Dehcho region today, or specifically for the community of Wrigley. Considering most local artists do not create

their works for sale and because there is no retail location in the community for the sale of arts and crafts items (D'Arcy Moses pers. comm. 2006), it is assumed that arts and crafts activities have a minimal influence on the economy of Wrigley. It is only known that one lady makes approximately 5 pairs of gloves and booties each for sale every year and that one man tans hides which will be worth approximately \$1,000 each for 15 moose and 2 caribou. If the gloves and booties sold for an average of \$150 per pair and the man tanning the hides were able to sell them at the expected price, then it may be estimated that residents in the community of Wrigley generate at a minimum \$18,500 per year from the arts and crafts industry.

It may be concluded that, while renewable resources from Pehdzeh Ki Ndeh are utilized by Wrigley artists for arts and crafts purposes, these resources are not significant contributors to the local economy when used as art and craft materials.

4.5.3 Art and Craft Materials Conclusion

The importance of the arts and crafts industry in the community of Wrigley is debatable. According to D'Arcy Moses and M. *Norwegian* (pers. comms. 2006) there are practicing artists in the community who do harvest renewable resources from Pehdzeh Ki Ndeh for art and craft materials. While the number of animals harvested from the area for such purposes may be tentatively quantified, the amounts and locations of vegetation matter harvested for arts and crafts purposes in Pehdzeh Ki Ndeh are almost entirely unknown. While important locally as a source of art and craft materials, not enough information is known about the distribution, use or harvesting trends of Pehdzeh Ki Ndeh renewable resources for art and craft materials to determine how valuable the area is for such an industry comparative to other potential harvest areas (e.g. the region to the west of Wrigley, across the Mackenzie River).

4.6 Wilderness

In the following section, all wilderness resource uses (eco-tourism, tourism business and lodges and use by independent travellers) will be referred to as tourism activities and may include sport fishing (section 4.2.2), wildlife viewing, bird watching, scenery watching or sight-seeing, photography, boating (canoeing, rafting, kayaking, motor-boating), hiking, backpacking, cross-

country skiing, snowshoeing, snowmobiling, picnicking, swimming, or interpretive activities (concerning cultural or traditional sites such as burial sites or traditional cabins or trails) but not big-game hunting (section 4.1.3). These activities may be undertaken by the independent visitor to the area or be done through a local lodge, guide, outfitter, or charter company.

4.6.1 Wilderness Description

The use of renewable resources for wilderness activities in and around the Pehdzeh Ki Ndeh Study Area is variable. A report in 2003 summarized that overall, the tourism industry in the Dehcho Region was not developed to its potential capacity, but that certain areas, in particular the Mackenzie River and Valley, were designated as having a very high tourism potential (Dehcho Environmental 2003). The area around Wrigley has been described as being good overall for recreational activities such as hiking, scenery and wildlife viewing, boating, photography, sport fishing and sport hunting (Marshall Macklin Monaghan 1985; R.T. Associates 1990), but within Pehdzeh Ki Ndeh, various lakes, rivers and mountains were considered to have medium, low or no tourism potential (as described in the following sections). According to the Revised Draft Dehcho Land Use Plan (DCLUPC 2005), Pehdzeh Ki Ndeh has an overall less than moderate tourism potential, but if the Land Use Plan were to be ratified, tourism would be the only activity (apart from traditional ones) that would be permitted in the area.

For specific areas within the Study Area, high tourism potential areas are ones that are considered to have noteworthy and obvious draws for tourists by having a significant site such as natural or cultural feature, or by being easily accessible. Medium tourism potential areas are areas with less obvious drawing features but that are still utilized and areas considered to have a low tourism potential are areas with low appeal for tourists, or areas that are too difficult to readily access (Deh Cho Environmental 2003).

Places designated as being suitable for "hard adventure" activities refer to areas most suitable for independent tourists requiring little commercial support and seeking moderate to high levels of physical activities in their travels. Places designated as being suitable for "soft adventure" activities refer to areas most suitable for tourists, generally requiring commercial support or guides, short traveling distances and low to moderate levels of physical activities in their travels. Ecotourism activities refer to those where the main objective is conserving, observing and

understanding the area being visited, with or without commercial support or guides. It can be a consumptive or non-consumptive form of tourism (Deh Cho Environmental 2003).

Although it may not presently be developed to its full capacity (Deh Cho Environmental 2003), the potential does exist for future development of the tourism industry within Pehdzeh Ki Ndeh (Marshall Macklin Monaghan 1985; R.T. & Associates 1990; Deh Cho Environmental 2003; DLUPC 2005).

Tourism in the Community of Wrigley

Wrigley is the only community within or in the immediate vicinity of the Pehdzeh Ki Ndeh Area of Interest. Any tourism activities taking place within the Study Area will most likely be based out of Wrigley. This community is the only one considered in detail for its historical, present and potential future tourism industry, as the activities of visitors to Wrigley are those most likely to have both direct and indirect effects on Pehdzeh Ki Ndeh. The historical aspect of tourism in Wrigley is examined briefly in this Renewable Resource Assessment in order to acknowledge how numerous attempts have been made to understand and plan to promote tourism in Wrigley, but that these attempts over time have not been very successful.

Wrigley is considered a "remote" community (Deh Cho Environmental 2003). Prior to the completion of the Mackenzie Highway in 1994, Wrigley was only accessible by air or water transportation during the summer, or a winter road between Fort Simpson and Norman Wells, and tourism opportunities within the community were limited (Marshall Macklin Monaghan 1985). Several detailed reports have been created since the 1970's on the tourism potential for Wrigley. Each acknowledges the beauty of the area and the outdoor recreational opportunities that could be exploited there, but each report also acknowledges the inaccessibility of the area, the lack of infrastructure to accommodate or entertain tourists within the community and the concerns expressed by residents that any tourism development would compromise their peaceful lifestyle and traditional activities such as hunting, trapping and fishing (Acres Consulting Services 1973; Marshall Macklin Monaghan 1985; R.T. & Associates 1990).

Acres Consulting Services (1973), in a report on the tourism potential for four Mackenzie Valley communities, noted that Wrigley held the most aesthetic lure for visitors because of its beautiful

surrounding mountains and waterways. The report mentions the possibilities of establishing a hunting and fishing lodge in the Mackenzie Mountains near Wrigley or a sport-fishing lodge at Keller Lake, but neither was built (J. Morin pers. comm. 2006). It suggests that the nearby hot springs at Smith Creek could be exploited for their future tourism potential and also recommends that a hotel be built in the community and that airline package tours into the community be examined as tourism options. No other detailed areas within Pehdzeh Ki Deh are mentioned as having tourism potential (Acres Consulting Services 1973).

In 1985, Marshall Macklin Monaghan created the "Wrigley Community Tourism Plan." This comprehensive report addresses the rather undeveloped state of tourism in the community, the environmental, social, political and cultural concerns with developing such an industry and identifies priorities and phased plans for the community in further developing a tourism economy. The report indicated that community interest for establishing a tourist guide business was minimal and of particular interest is the noted concern that the residents of Wrigley voiced when reviewing a proposal for a Territorial Park along the highway near the River Between Two Mountains. The different land resources in the area are described in detail (i.e. geological features and renewable resources such as wildlife) and the potentials that each has for tourism exploitation. Specific information on those resources that occur in and around Pehdzeh Ki Ndeh is provided below (Marshall Macklin Monaghan 1985).

Another report on the tourism industry in Wrigley was created in 1990 by R.T. & Associates. This development plan identifies what Wrigley had already in terms of infrastructure and human resources to support such an industry and discusses what would be required to boost the industry. Very specific recommendations are made on how tourism may be better accommodated within the community, while remaining sensitive to the personal needs of the community's residents. These included recommendations on resident training for work in the industry, service upgrading and the further development of attractions such as community events. Phased planning steps were detailed for the preparation of the community for the opening of the Mackenzie Highway in 1994 and an extensive examination of the resources of the area, including those within Pehdzeh Ki Ndeh, are discussed in terms of their tourism potentials (R.T. & Associates 1990). These resources are shown in detail below.

Today, the tourism industry in Wrigley appears as stagnant as it was when first seriously investigated over thirty years ago. Visitor numbers remain low, accommodations minimal,

recreation activities within the community scarce, and only two functional outfitting / guiding companies in operation (R. Zieba pers. comm. 2006; Inns North 2006; D'Arcy Moses pers. comm. 2006; M. Moses pers. comm. 2006; T. Cli pers. comm. 2006). The area is recognized as having a definite tourism potential, but at present is not well developed (DLUPC 2005). Table 23 highlights what resources have existed for visitors to Wrigley over the years. It should be noted that tourists are not known to utilize the trail system that crosses through Pehdzeh Ki Ndeh and therefore are not likely to explore the overland portions of Pehdzeh Ki Ndeh independently (T. Cli pers. comm. 2006), although they may access inland areas via the different river systems.

Table 23 Wrigley Community Resources over Time

Accommodation	Transportation	Food Services	Retail Outlets	Outfitters / Guides	Recreational Opportunities
1985¹					
-No commercial accommodation or services	-Mackenzie Hwy not completed -Northwest Territorial Airways Ltd. via Fort Simpson / Yellowknife (weekly service) -Water Aerodrome -Winter road Fort Simpson to Norman Wells -Barge service summer by Northern Transportation Company Ltd. (NTCL) -No automobile services -Fuel for boats -Commercial river boat service F. Simpson - Inuvik (infrequent)	-Petanea Co-op limited products (no restaurant)	-Limited co-op supplies (inc. locally made arts & crafts)	-Significant local knowledge, no organizations	-Three churches -Playground -Community hall -Outdoor rink
1990²					
-Petanea Hotel (24 people, 6 rooms) established 1987 -Campground at Hodgson Creek (6 sites); poor location, unkempt	-Airstrip -Water adrodrome w/ dock -Winter road -Barging service -Air charters nearly daily (summer) -Scheduled air service (to Fort Simpson and Yellowknife) 3 x / week -Gas available	-Arctic Cooperatives Ltd. with Petanea Co-op (not open evenings and weekends) includes coffee shop w/ standard meals and fast food	-Limited co-op supplies (w/out basics like vehicle parts or postcards) (no arts and crafts)	-No licensed outfitters or guides -No boat rentals -No tour companies	-1 Recreation Complex -No signage -Trails unmarked -No Visitor Information Centre -Benches overlooking river need repair

	during day -No taxi -Canoeists (60), anticipated 80 - 130 people / year visit when road opens				
2003³					
	-Canoeists (12) -Kayakers (24)				
2006⁴					
-Petanea Hotel (10 people, 5 rooms) \$200 Cdn/person	Petanea Hotel can arrange: -Airport shuttle service -Vehicle rentals -Food supplies, equipment, transportation	-Petanea Co- op includes coffee shop, catering, traditional Dene and Canadian dishes	-Limited co-op supplies (arts and crafts when available)	-M & M Tourism and River Taxi (jetboat river tours) -Wrigley's Wonders (hiking and biking tours) -Above outfitters in Wrigley offer: canoeing, hiking, fishing, bird-watching, Northern Lights tours, trips to Roche Qui Trempe a L'eau (interesting landmark north of Wrigley)	-Conference facilities at hotel -1 Recreation Complex
2006⁵					
-Petanea Hotel -Campground at Hodgson Creek -Campground on river bank by Wrigley	-Taxi service -No vehicle rentals -Gas station sometimes functional; call ahead to see if in service and enough gas to sell -"Many" boaters on Mackenzie River (typically stop by on journey down river to other destinations) -Winter road to Deline, Tulita, Norman Wells, Fort Good Hope	-Petanea Co- op w/ basic food items -Restaurant / coffee shop in hotel but usually only open to hotel guests	-Limited co-op supplies (no arts and crafts items)	-Wandering Spirit (old Wrigley's Wonders) does hiking and biking tours -M & M Tourism and River Taxi does boat tours (inc. to Tulita and Deline) and fishing (catch and release) -No big-game outfitting	-1 Rec Complex -2 churches -1 playground (soon to complete a 2nd one) -1 outdoor rink -Hotel w/ "conference" space but not used as such -Interpretive activities not in community, are located elsewhere
2006⁶					
-Petanea Hotel only open sometimes; must call ahead and make reservation; usually not in operation -3 campgrounds	-M & M Tourism and River Taxi can take tourists to Deline, Tulita, Norman Wells, N. Nahanni, Blackwater River, Root River,	-Minimal	-Minimal	-Same as above, also outfitter from Normal Wells hunting west of Wrigley	-Jetboat tours, hiking, biking, camping at 3 site options

(Hodgson Creek, Mackenzie River bank, Airport Lake; only Airport Lake campground is "designated", with minimal infrastructure)	Redstone River and others				
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¹ Marshall Macklin Monaghan (1985)

² R.T. & Associates (1990)

³ Deh Cho Environmental (2003)

⁴ Inns North (2006), Petanea Hotel Representative pers. comm. (2006) and J. Morin pers. comm. (2006)

⁵ D'Arcy Moses pers. comm. (2006) and T. Cli pers. comm. (2006)

⁶ M. Moses pers. comm. (2006) and J. Morin pers. comm. (2006)

Wilderness Resources in and around Pehdzeh Ki Ndeh

Within and around the Study Area numerous natural sites exist that are of interest to the tourism industry. Some sites have seen tourism activities in the past or are presently used for various activities including hiking, fishing and hunting (sections 4.1 and 4.2), boating and wildlife viewing. Other sites may have seen minimal activity, but are believed to hold the potential for the future expansion of tourism into the area. Sites such as various lakes, rivers and mountains are summarized below for their value as tourism resources in and around Pehdzeh Ki Ndeh .

Sites marked with a ** are within Pehdzeh Ki Ndeh.

Sites marked with a * are within the Study Area.

Sites without any marking are located outside the Study Area.

Antoine Lake Antoine Lake is located southeast of Pehdzeh Ki Ndeh and is considered to have a medium tourism potential within the Dehcho region. It is more likely to be accessed from Fort Simpson than from Wrigley, where the potential for tourist packages such as fly-in day fishing trips could be arranged for a reasonable price (Deh Cho Environmental 2003).

Bear Rock Hoodoos ** The Bear Rock Hoodoos are located southeast of Wrigley on the east side of the Mackenzie River. They are an interesting geological feature where differential erosion has caused the formation of a series of pillars up to 100 meters in height. The hoodoos are considered to have low tourism potential, primarily because Wrigley's low tourist numbers makes it unrealistic to market the hoodoos as a stand-alone tourism draw, but trips that may occur to the hoodoos are likely of an ecotourism nature and for day trips only (Deh Cho Environmental 2003).

Blackwater Lake and River ** Blackwater Lake is located in north-central part of Pehdzeh Ki Ndeh and Blackwater River drains it westward into the Mackenzie River. They are accessed from either Wrigley or Norman Wells and the lake is considered to have a medium tourism potential (Figure 8). There is no commercial infrastructure on the lake to take tourists to, but if a lodge were to be established there, multi-day trips could be

promoted for boating or Arctic grayling, lake trout or northern pike fishing enthusiasts (Marshall Macklin Monaghan 1985; Deh Cho Environmental 2003). Another consideration for the lake is to promote it for fly-in day use or outfitting camp sites (Marshall Macklin Monaghan 1985). The river is used by M&M Tourism and River Taxis operating out of Wrigley for sightseeing and fishing trips for tourists (M. Moses pers. comm. 2006, section 4.2.2)

Cop Mountain (McConnell Range)
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Cop Mountain is located northeast of Wrigley and is within Pehdzeh Ki Ndeh (R.T. & Associates 1990). It is considered to have a medium tourist potential (Figure 8) for hard tourism day-trip enthusiasts seeking activities such as backpacking, hiking and mountain climbing (the mountain's peak is at 1578 m). It is only 23 km away from Wrigley and is considered easily accessible (typically via water routes), but despite this, is unlikely to be a stand-alone tourism product because of Wrigley's low number of visitors (Marshall Macklin Monaghan 1985; Deh Cho Environmental 2003).

Fish Lake / Greasy Lake / Highland Lake
**

Fish Lake is located southeast of Wrigley and is within Pehdzeh Ki Ndeh. It is considered to have a medium tourism potential (Figure 8), particularly for tourists who enjoy hard adventure activities. Day and multi-day trips to the lake may entail fishing for whitefish and lake trout (Marshall Macklin Monaghan 1985), backpacking and hiking opportunities. There are presently no commercial packages available for trips to the lake, but its close proximity to Wrigley may have some appeal for such development. Fish Lake may be accessed from Wrigley by water via the River Between Two Mountains, by air (potential day-trip tour product), or by land (hiking) (Deh Cho Environmental 2003). It may be a primary lake for consideration for fly-in day use or outfitting camp sites (Marshall Macklin Monaghan 1985). According to Deh Cho Environmental (2003), neither Greasy Lake nor Highland Lake has any tourism potential (Figure 8).

Keller Lake
**

Mr. Baton, chief of the Wrigley Indian Band in 70's, considered building a fishing lodge at this lake (Acres Consulting Services 1973) but it was never established (J. Morin pers. comm. 2006). According to Deh Cho Environmental (2003) the lake has no current tourism potential (Figure 8).

Mackenzie River
**

The Mackenzie River, the world's 10th largest river, is the primary reason that most visitors to Wrigley have stopped to explore the area. It will likely always be an important attraction for tourists, especially for both powered and non-powered boaters (Inns North 2006; Marshall Macklin Monaghan 1985).

Within the Dehcho the Mackenzie River is considered to have a very high tourism potential (Figure 8). Day and multi-day soft adventure, hard adventure and ecotourism opportunities exist for activities such as canoeing, rafting, kayaking and camping along the river banks. The Mackenzie River is considered to have very marketable features, including its impressive size and scenery, the fact that it is part of the TransCanada Trail route and its accessibility from any community that exists along its length. Its banks and islands are ideal for camping and there are fishing opportunities for many different sport-fishing species (Deh Cho Environmental 2003).

Present-day tourism activities taking place along the river include the occasional passing of the M. S. Norweta, a river cruise ship that operates both north and

southbound between Hay River and Inuvik several times per year. It does not stop in the community of Wrigley and therefore has little influence on the study area, except to expose its passengers to the scenery of the area and perhaps inspire them to return and visit Wrigley or PezDeh Ki Deh at a later point. Another draw of the river is for boaters. It is expected that a nomination document will be submitted in May of 2007 aiming to have the Mackenzie River designated as a Canadian Heritage River (Canadian Heritage Rivers System 2006). If it were to be accepted, the river may see more boating action, as many canoeing enthusiasts paddle Canadian Heritage rivers in particular. In 1985 it was estimated that 12 people canoe and 24 people kayak down the river each year (Deh Cho Environmental 2003). It is unknown how many people on average boat along the river in modern years, though Wrigley residents acknowledge that there are many (D'Arcy Moses pers. comm. 2006; T. Cli pers. comm. 2006; M. Moses pers. comm. 2006). One jetboat service, M&M Tourism and River Taxis, operates out of Wrigley today and takes tourists up and down the Mackenzie River approximately 10 times per year to Tulita, Deline, the North Nahanni and many of the other rivers emptying into the Mackenzie for sight-seeing and fishing purposes (M. Moses pers. comm. 2006).

During the summer, when the water levels are low, beaches are exposed along parts of the river's banks and these terraces offer excellent scavenging opportunities for both renewable (e.g. bones, feathers, driftwood) and non-renewable (rock) resources (Marshall Macklin Monaghan 1985). The bank near the community of Wrigley also serves as a popular campground for tourists in the summer months (D'Arcy Moses pers. comm. 2006; T. Cli pers. comm. 2006).

Mackenzie River Bluffs The bluffs, located 0.5 km south of Wrigley, are a feature best viewed in summertime from the river. If climbed, the bluffs provide an excellent view of the river (Marshall Macklin Monaghan 1985).

**

Mackenzie Mountains The Mackenzie Mountains west of the Mackenzie River are considered excellent big-game hunting ground, particularly for Dall's sheep (Marshall Macklin Monaghan 1985). There was consideration for building a fishing and hunting lodge in mountains for tourists in the 1970's; it was the only area where non-residents could hunt big game in the Mackenzie Valley (Acres Consulting Services 1973), but the lodge was never constructed (J. Morin pers. comm. 2006). Near the Yukon / Northwest Territories border, the mountains include a famous geological feature, the Cirque of the Unclimbables, a series of 2,743.2 m (9,000 ft) granite walls that serious climbers enjoy the challenge of. It may be accessed from Wrigley and there is considered the potential for limited flightseeing opportunities into the range from this community, but at present there is no such commercial package (M. Moses pers. comm. 2006). More typically the range is accessed from the Yukon Territory, with tourists flying in from the Inconnu Lodge located across the territorial border (Deh Cho Environmental 2003; Lafave pers. comm. 2006), or from the Nahanni country, with trips being offered by Nahanni River Adventures. The Cirque of the Unclimbables gets an average 100 visitors per year from typically the Yukon or the Nahanni areas, flying in or boating in and includes sight-seers and climbers on either day trips or camping adventures (Lafave pers. comm. 2006).

Mount Mount Gaudet and Roche Qui Trempe are located on the Mackenzie River north

Gaudet / Roche Qui Trempe-a- L'eau **	of Wrigley. These are geological features offering backpacking, hiking and wildlife viewing opportunities for visitors. Roche Qui Trempe-a-L'eau, a 350 m cliff which plunges into the river's waters, is a nesting ground for large populations of peregrine falcons and swallows (Marshall Macklin Monaghan 1985). Localized thermal springs have exposed the rock strata and views of the Mackenzie Valley are also an attraction. The area is considered to have a medium tourism potential (Figure 8); it is appealing because of the uniqueness of the features and their close proximity to Wrigley, but not marketable as a stand-alone product because of the low level of visitation that Wrigley typically experiences. Tourism activities that do take place are likely to be ecotourism-oriented one-day trips (Deh Cho Environmental 2003).
Mount Clark	Mount Clark is located outside of Pehdzeh Ki Ndeh, northwest of the Study Area. It is considered to be of relevance to the tourism industry as a geological feature and wildlife and bird viewing area. It is considered to have a low tourism potential and not feasible as a stand-alone product, but tourism opportunities do exist. Options for the development of tourism in this area focus on ecotourism activities for either day or multi-day trips and centre around the local landmark and wildlife and bird viewing, in particular for raptors (Deh Cho Environmental 2003).
Ochre River **	The Ochre River is considered a beautiful area according to Marshall Macklin Monaghan (1985), but of no tourism potential according to Deh Cho Environmental (2003; Figure 8). However, M&M Tourism and River Taxits may take visitors up the river several times per year for sight-seeing and fishing purposes (M. Moses pers. comm. 2006).
Redstone River *	The Redstone River is located in a picturesque area, but is difficult to navigate (Marshall Macklin Monaghan 1985). According to Deh Cho Environmental (2003) the river has no tourism potential (Figure 8), but M. Moses of M&M Tourism and River Taxits takes sight-seeing and fishing tourists to the river up to several times per year (pers. comm. 2006).
River Between Two Mountains **	Considered an aesthetically pleasing river and valley, the River Between Two Mountains is difficult to navigate due to such hazards as deadfall, shoal water and remote location; extreme caution is needed to successfully navigate the river (Marshall Macklin Monaghan 1985). According to Deh Cho Environmental (2003) the river has no tourism potential (Figure 8), but there have been discussions of establishing a new campground at the river (G. Fricke pers. comm. 2006).
Tseepantee Lake **	Tseepantee Lake is located near the southeast border of Pehdzeh Ki Ndeh (Figure 1). There is no mention in any available information sources that would indicate that the lake has any tourism potential.
Willowlake River *	The Willowlake River is located south of Pehdzeh Ki Ndeh and drains the northern portion of the Horn Plateau (located within the EDehzhie Candidate Protected Area) into the Mackenzie River 61 km southwest of Wrigley. It is considered to have a medium tourism potential (Figure 8) for hard tourism multi-day activities such as kayaking, canoeing and rafting (there are several scenic rapids along its length) (Marshall Macklin Monaghan 1985; Deh Cho

Environmental 2003) and it also contains several excellent sport-fishing areas. It is not overly popular with independent travellers, as other, more accessible routes exist in the Deh Cho region for similar tourist activities, but the river is known to be a heritage canoeing attraction with an established boating route and is recognized for its historical significance (Marshall Macklin Monaghan 1985; Deh Cho Environmental 2003).

With an outboard motor, boaters can do a return trip to the base of Gunn Rapids on the Willowlake River within 3 or 4 days, or may travel further up the river to Willow Lake or Hornell Lake, located on the Horn Plateau (Deh Cho Environmental 2003). Other draws to the river may include wildlife viewing opportunities and interpretive activities such as the exploration of the old trading post Fort Alexander, located at the river's mouth. If there were to be an increase in demand for boaters wanting to access the river, it has been suggested that a boat rental service could be offered out of Fort Simpson or Wrigley (Marshall Macklin Monaghan 1985).

**Wrigley
River**

*

Wrigley River is located southwest of Pehdzeh Ki Ndeh and empties into the Mackenzie River 5 km northwest of the community of Wrigley. It is considered to have a medium tourism potential (Figure 8) for such activities as backpacking and hiking and would draw mostly tourists of the soft-adventure type seeking day trips out of Wrigley. There is no known commercial product to take advantage of this unique attraction and Wrigley's low tourist numbers could make such an endeavour difficult. One draw to the river is for the scenic views it offers, but a challenge is that it is normally only navigable near the river's mouth (Deh Cho Environmental 2003).

Various sites of historical, cultural, traditional, sacred, archaeological or interpretive interest also exist in and around Pehdzeh Ki Ndeh. These are briefly discussed for their potential as tourist attractions.

**Fort
Alexander**

This fort was established at the junction of the Willowlake and Mackenzie rivers and was operated by the NorthWest Company between 1817 and 1821. It is located 62 south km from Wrigley and is accessible by land or water (Marshall Macklin Monaghan 1985).

**Jones
Landing**

Jones Landing is located on the Mackenzie River south of Wrigley. It is an interpretive attraction, one of the original sites for the community of Wrigley. It is considered to have a low tourism potential because of the distance required to access the site (approximately 50 km south of Wrigley) and is not considered a probable area for a stand-alone tourism product. Visitors to Jones Landing are likely on day trips of an ecotourism nature (Deh Cho Environmental 2003).

**Old Fort
Island**

Old Fort Island was opened after Fort Alexander was closed in 1821 and the Hudson's Bay operated its trading post there until 1870. It is located 32 km north of Wrigley and is accessible by land or water (Marshall Macklin Monaghan 1985).

**Old Fort
Wrigley**

Old Fort Wrigley was established between 1901 and 1905. It is located 16 km from Wrigley's present site and is accessible by land or water (Marshall Macklin

Monaghan 1985).

- Rocky Mountain Fort** This fort was operated by the Northwest Company between 1800 and 1804. It is located 106 km from Wrigley and is accessible by land or water (Marshall Macklin Monaghan 1985).
- Archaeology Sites** Archaeology sites are clustered at the north and west ends of Blackwater Lake, the mouth of the Blackwater River, the shores of Fish Lake and at the mouths of different creeks and rivers along the Mackenzie River, including the Ochre River and the River Between Two Mountains (Cizek Environmental Services and McCullum Environmental Services 2002).
- General High Rank Conservation Sites** There are numerous locations within Pehdzeh Ki Ndeh that are valued as conservation sites. These include cabins, rare features, historic sites and archaeological sites. Over 15 such sites have been identified along the Mackenzie River within Pehdzeh Ki Ndeh, at least 8 along the River Between Two Mountains and the Fish Lake area, at least 2 around Tseepantee Lake, at least one 1 at Keller Lake and at least 8 along the Blackwater River and Blackwater Lake area (DLUPC 2004a).
- Cabins** Historical cabins are located along the Mackenzie River both north and south of Wrigley. These are accessible by land or water and are often used seasonally by local trappers (Marshall Macklin Monaghan 1985; Cizek Environmental Services and McCullum Environmental Services 2002). There are also cabin clusters on Fish Lake, Tah the tié Lake (at the headwater of the Blackwater River) and single cabins scattered elsewhere in Pehdzeh Ki Ndeh (Cizek Environmental Services and McCullum Environmental Services 2002).
- Lookout Towers** Several lookout towers exist in Pehdzeh Ki Ndeh. One is located in the area's northwest corner, one west of Fish Lake and one on the east bank of the Mackenzie River north of Wrigley (Cizek Environmental Services and McCullum Environmental Services 2002). These may be of interest to the tourism industry if they could be promoted as goals for sight-seeing ventures.
- Old Army Road** An old army road exists in Pehdzeh Ki Ndeh, allowing vehicle access into the area from Tulita, Fort Simpson or Fort Providence. It enters the study area on the north-east side, dissecting it as it passes close to Blackwater Lake and crosses the middle of the northern boundary into the Sahtu. It is not connected to the community of Wrigley except through a trail system that is only accessible by snowmobile or ATV and the trails are not normally used by tourists visiting Wrigley (T. Cli pers. comm. 2006). The seasonal road may, however, draw in occasional tourists from the other communities such as Fort Simpson (Figure 8).
- Traditional Trails** Although not necessarily welcome for use by visitors, a network of traditional trails exist throughout Pehdzeh Ki Ndeh that may allow tourists access into its wilderness areas, including to Blackwater and Fish lakes (Cizek Environmental Services and McCullum Environmental Services 2002). According to T. Cli of Wrigley (pers. comm. 2006), tourists are not known to use these trails.

Through a review of the literature available on the tourism industry in Wrigley and discussions with knowledgeable residents of the area on what is available for and used by tourists now (D'Arcy Moses pers. comm. 2006; M. Moses pers. comm. 2006; T. Cli pers. comm. 2006), it appears that, although the possibilities of boosting tourism have been examined for decades, and a multitude of recommendations made on how to accomplish such a goal, tourism within and around that community is minimal (R.T. & Associates 1990; DLUPC 2005; R. Zieba pers. comm. 2006). It is generally acknowledged that tourism potentials do exist throughout the Study Area, but that these are not presently well developed (DLUPC 2005). Indications exist that the residents of Wrigley would like to continue (Wrigley's Wonders and M&M Tourism and River Taxis) or even expand (with the establishment of a new campground at the River Between Two Mountains) tourism activities in the area, but it is unknown whether sufficient tourism numbers could be generated to support any significant development in the industry (D'Arcy Moses pers. comm. 2006; G. Fricke pers. comm. 2006).

4.6.2 Economic Value of Wilderness

According to R. Zieba (pers. comm. 2006), an estimated 50 out-of-territory vehicles per year enter the community (estimated by counting their numbers as they cross the Ndulee Ferry en route to Wrigley). The majority of tourists only drive into the community for a day-trip, but some leave Wrigley too late and miss the ferry exiting town or choose to stay overnight (T. Cli pers. comm. 2006). If each out-of-town vehicle entering the community carried an average of 3 passengers, and an average of 25% of those visitors stayed in the hotel (based on educated assumptions) at \$200/person/night for one night (Inns North 2006), an estimated \$7,000 would be spent for accommodations per year in the Petanea Hotel in Wrigley. It may be assumed that the tourists entering the community via the Mackenzie River on boats would likely stay in the free campgrounds and contribute only negligible amounts to the local economy for accommodation purposes (R.T. & Associates 1990).

Other tourism activities that may increase the revenue generated for Wrigley in the industry include sales at the local co-op for basic food and hardware supplies (no arts and crafts items have been available for sale in recent years, D'Arcy Moses, pers. comm. 2006). If Wrigley hosts an average of 150 vehicle-bound visitors and 80 boat-bound tourists every year (numbers based on educated assumptions), and each visitor spent an average of between \$10 and \$50 on food and

miscellaneous items in the co-op, this would generate an additional \$2,300 to \$11,500 for some Wrigley residents associated with the co-op.

It is difficult to assess the real annual economic value of tourism in a community such as Wrigley. Based on the above assumptions, it may be tentatively calculated that between \$9,300 and \$18,500 is generated each year through accommodation charges and retail sales at the local co-op, but these numbers are rough estimations only due to a lack of available data. It should be noted that tourists may potentially spend money in Wrigley on other products, such as arts and crafts items or sport-fishing tours, but these are dealt with in the relevant sections of this study (section 4.2.2 and 4.5).

4.6.3 Wilderness Conclusion

Pehdzeh Ki Ndeh is not recognized overall as having any especially competitive tourism attractions, and information regarding the possibilities of creating more tourism activities in the area is minimal, incomplete, or undesired because residents of the area do not generally seem eager to embark on tourism industry enhancement schemes (Acres Consulting Services 1973; Marshall Macklin Monaghan 1985; R.T. & Associates 1990; DLUPC 2005). A generalized opinion over time of the residents of Wrigley has been that small-scale tourism activities such as eco-tourism would be supported (although considerations for visitor quotas exist) (Marshall Macklin Monaghan 1985; R.T. & Associates 1990; DLUPC 2004a). Opposition does exist for larger-scale commercial tourism activities such as big-game outfitting, reinforced through the Dehcho First Nations' *Resolution #04 - Resolution Against Big-Game Outfitters in the Deh Cho* (Deh Cho First Nations 2004b) stating that new big-game outfitting licences will not be issued in Deh Cho territory.

If Pehdzeh Ki Ndeh is established as a Conservation Zone with the ratification of a Final Dehcho Land Use Plan, tourism will be the only industrial activity permitted within the area, but will likely be monitored through visitor quotas and focussed on eco-tourism (DLUPC 2005).

4.7 Renewable Energy

4.7.1 Wind Energy

Wind energy is considered a form of solar energy where the earth's air, heated by sunlight, causes surface air movements. It is possible to harness this wind energy commercially through the use of turbines and generators, and this energy source is typically regarded as an efficient, reliable and environmentally responsible method of generating electricity (The Pembina Institute 2005).

Across Canada it is presently possible to generate 682 megawatts of electricity through various wind-energy powered generation stations (Canadian Wind Energy Association (CWEA) 2006). This power is harnessed in many of Canada's provinces and also in the Yukon Territory. Over the past 20 years, wind turbines were installed in the Yukon (two at the Haeckell Hill wind farm outside of Whitehorse; one in 1993 and one in 2000) and in several locations across what are now the Northwest Territories and Nunavut, including Sachs Harbour and Rankin Inlet. The only turbines believed to still be functional are the two in Whitehorse where there is the combined capacity for 1 megawatt of power to be generated (CWEA 2006; M. Phelan, pers. comm. 2006).

Presently the community of Wrigley gets its electricity supply through a diesel generator-derived power source (Northwest Territories Power Corporation 2005). Considerations for assessing the feasibility of incorporating wind-energy electricity into this community would include analyzing the patterns (strength, consistency, duration and direction) of wind energy in the region. A meteorological station is located at the Wrigley Airport (Environment Canada 2006b) from which most daily, monthly and yearly weather data is available for Wrigley for as far back as August 1943. It has been noted that the wind data available publicly through Environment Canada's online climate data is incomplete or missing for all but approximately the most recent month only (in hourly readings) which includes wind speed, speed of maximum gust and direction of maximum gust. It may be presumed that information prior to the most recent month investigated is stored by Environment Canada and may be made available with further requests if desired (Environment Canada 2006b).

Higher wind speeds (without exceeding a threshold level) are better suited to the generation of electricity using wind energy. Higher elevations are generally sites of higher wind speeds than lower elevations (The Pembina Institute 2005; M. Phelan, pers. comm. 2006). Pehdzeh Ki Ndeh encompasses areas of variable terrain and may contain sites that would prove suitable for the installation of wind turbines within reasonable proximity of Wrigley for the transmission of wind-generated electricity from the turbines to the community.

In order for it to be economically viable, a wind-turbine generally requires an average wind speed of above 5 metres/second (m/s) (GNWT Energy Secretariat 2003). A map created by Environment Canada for the Canadian Wind Energy Atlas (2005a) shows the wind speeds of the Pehdzeh Ki Ndeh area at three different heights above ground level. Maps for wind speeds at 30m and 50m and 80m height are available, with the 30m height map and 50m height map showing slower, less favourable wind conditions for the area. This is because the average mean speed of wind increases with an increase in height above the earth's surface (CWEA 2006; The Pembina Institute 2005). Therefore, the map showing the wind speed in m/s at 80 m height is the one that best demonstrates the area's potential for the generation of electricity through wind-energy sources (Figure 9) (CWEA 2006; Environment Canada 2005a).

Across much of Pehdzeh Ki Ndeh, the average wind speeds are at or exceed 5 m/s at 30m height, and reach speeds in excess of an average of 8.0 m/s in at least one isolated area at 80m height (Figure 9). It has been found that a 10 percent increase in wind speed increased a turbine's power output by 20 percent (GNWT Energy Secretariat 2003), so erecting turbines in areas where the average wind speed is 7.0 m/s (there are several areas in Pehdzeh Ki Ndeh where this exists) would be 80 percent more efficient than erecting them where the wind speed is only 5 m/s.

Feasibility studies would need to be conducted to further assess the characteristics of wind patterns in the area, in particular the suitability of wind patterns near the community of Wrigley for wind-turbine electricity generation. Establishing turbines closer to the community would be preferable because of the easier construction and maintenance of infrastructure and because shorter electricity transmission lines are more cost-efficient (American Wind Energy Association 2005). In general, it has been noted that the Mackenzie River Valley where Wrigley is located does not have favourable wind speeds for wind turbines, but that areas do exist within a 20 km proximity of the town where wind speeds could be suitable (Environment Canada 2005a; M. Phelan, pers. comm. 2006).

Concerns exist which should be examined when considering the potential for the development of wind-powered energy generation in Pehdzeh Ki Ndeh. Wildlife concerns include the noise generated by wind turbines, wildlife (e.g. birds and bats) collisions with turbine blades, and habitat alterations. In recent years, turbine blades have been designed to both minimize noise and deter wildlife contact (American Wind Energy Association 2005). Habitat alterations such as fragmentation may have serious effects on different wildlife species through the installation of wind turbines, the building and maintenance of roads, and the building and maintenance of transmission power lines (Fish and Wildlife Service 2003; American Wind Energy Association 2005). These disturbances, including the actual infrastructure and the dissection of the Pehdzeh Ki Ndeh landscape through the creation of right-of-ways for transmission lines and access roads may seriously alter the integrity of the Pehdzeh Ki Ndeh landscape. The benefits of wind-energy derived electricity should be carefully weighed against any possible negative effects that may be observed for other resources in the area (Fish and Wildlife Service 2003).

Human-related concerns must also be addressed when considering obstacles to the potential development of wind-energy electricity generation in Pehdzeh Ki Ndeh. The opinion of local residents regarding such a development would have to be thoroughly researched, likely an important issue when considering the strong opposition of the Dehcho to the suggestion of hydroelectric dams being built on various waterways in the region (Deh Cho First Nations 2001). Human labour availability within the area would also need to be assessed in order to determine if there were enough skilled labourers for the maintenance of the wind-turbines over time (such as the seasonal need for de-icing of the turbine blades).

Costs associated with such a project would also need to be investigated in order to determine if such a venture was economically feasible. Cost concerns could include environmental assessments and permitting, construction and maintenance of infrastructure, and other costs.

Drawing from these generalized conclusions it may be assumed that there is the future potential for the generation of electricity using wind energy in Pehdzeh Ki Ndeh. The issue would have to be investigated thoroughly to determine if such a development would be environmentally sound, locally supported, maintainable over time, and economically feasible.

4.7.2 Hydroelectric Energy

Today in Canada, 62% of the country's electricity demands are met through the generation of power using hydroelectric energy, but as electricity demands increase, new energy sources are being sought. The further harnessing of the country's abundant water resources, including those found in the Northwest Territories is one proposed solution (Environment Canada 2005b).

Presently, two hydro-powered generating systems are operated in the NWT by the Northwest Territories Power Corporation (NTPC). The Snare Hydro Site is located in the North Slave Region north of Yellowknife and the Taltson Hydro Site is located in the South Slave Region, north of Fort Smith, neither of which affects the community of Wrigley (NTPC 2005).

In the Northwest Territories, several locations are presently being assessed to determine their potential for small scale hydroelectric power development, defined as producing up to 100 megawatts and suitable for household, community and industrial use. These proposed developments would be located on sites on the Snare River, La Martre River and Taltson River, none of which affect Pehdzeh Ki Ndeh (GNWT Energy Secretariat 2003). However, two known suggestions have been put forth in the past for the development of hydroelectric projects which would affect water resources in and around the Study Area. Neither proposed project is known to have been supported locally or investigated very extensively.

One project, the potential development of a hydroelectric dam on the Willowlake River at Gunn Rapids, was investigated in the 1970's by Owen, and proposed the construction of a 60-foot dam that would fill a shallow reservoir for approximately 10 miles upstream of the Rapids. No further studies are known to have been done regarding the prospects for this site, but it may still be considered a valid location for the future development of a hydroelectric dam (Owen 1973).

A potential larger-scale hydroelectric project involved the proposed damming of the Mackenzie River at different sites, including one near the community of Wrigley. In 2001, the GNWT (RWED department) set out to determine the feasibility and public support for the construction of several mega-dams. A resulting examination of the proposed hydroelectric developments showed that flooding of cultural and ecological sites, bridges, pipelines, potential pipelines and important tributaries would likely be the repercussions of such projects, and local support for the proposed dams was found to be minimal (Owen 1973; Cizek 2003; D. Jessiman pers. comm. 2005).

The extent of local opposition to the Mackenzie River hydroelectric projects was expressed in the creation of the Dehcho First Nation's (2001) "*Resolution Against Proposed Hydro Dams on the Mackenzie River*" (Resolution # 02) (Appendix II). This Resolution called for the government to "immediately abandon plans to dam the Mackenzie River and its tributaries," as traditional land use mapping by the Dehcho First Nations had found that 30% of harvesting activities were occurring within 1 km of the river and its tributaries.

While the potential does still exist for the development of hydroelectric dams in the Study Area, serious consideration would have to be given to the opposition that Dehcho people have stated against related large-scale projects (Deh Cho First Nations 2001). However, there may be community support for the development of small-scale run-of-river hydroelectric projects that would not involve the complete damming of the river systems (J. Morin pers. comm. 2006). New community consultations and other studies could be undertaken to assess the opinions of the area's residents regarding hydroelectric projects today, but it should be noted that without the general support of local residents, such developments would be difficult to undertake.

Solar energy will be included

4.7.3 Economic Value of Renewable Energy

Wind Energy

At this time wind energy is not a renewable resource with any economic value in Pehdzeh Ki Ndeh, though it could be considered for such development. Across Canada, the Federal government has proposed to initiate a new program, the High Penetration Wind-Diesel system, into different remote Canadian communities. For communities such as Wrigley, there is the possibility of fuel costs being as high as \$500,000 / 100 people / year for the production of electricity through diesel generators (CWEA 2006). The potential to offset some of that cost through the integration of a supplemental renewable energy source might prove to be an economical consideration, although issues such as construction, operation and maintenance costs for the wind turbines, power houses and transmission lines would need to be investigated, as would the costs of incorporating the power into the community's present power grid. The Arctic

Energy Alliance may be contacted to conduct a proper wind-energy feasibility study which would assess the monetary practicality of using wind-turbines in Wrigley (M. Phelan pers. comm. 2006).

Hydroelectric Energy

Currently, this renewable resource is not used within the study area and therefore has no economic value. There is however the potential for a hydroelectric energy to generate revenue in Pehdzeh Ki Ndeh. According to Dehcho First Nations (2001), the proposed Mackenzie River dams were intended to generate electricity for export, bringing in money from different regions for a renewable resource industry. The proposed dam to be built near Wrigley could have the potential to generate thousands of megawatts of electricity to be generated. Nerysoo (2004) maintains that hydroelectric development in the NWT is economically profitable, displacing the need for remote community diesel electricity generation, allowing lower and more stable electricity rates for community residents, allowing investment opportunities, and encouraging a long-term revenue source for the NWT.

4.7.4 Renewable Energy Conclusion

There is the potential for the utilization of both wind and water as renewable energy sources within Pehdzeh Ki Ndeh. Detailed investigations would need to be carried out in order to understand the feasibility of installing wind turbines in Pehdzeh Ki Ndeh, and the support of residents in the area for such a project. Hydroelectric projects around the study area, in particular the damming of the Mackenzie River, have been strongly opposed by the Dehcho, and it may be tentatively concluded that there would be opposition to the damming of any rivers around the Study Area for hydroelectric purposes.

5. KNOWLEDGE GAPS, POTENTIAL FUTURE STUDIES AND FINAL CONCLUSION

5.1 Knowledge Gaps and Potential Future Studies

Wildlife

Current data on distribution and abundance of wildlife species for the Pehdzeh Ki Ndeh area are scarce. Some critical habitat information exists for a number of species in the Dehcho region as a whole, but population estimates and distributions for Pehdzeh Ki Ndeh are limited.

Neither harvest numbers nor locations are reported for both subsistence and recreational harvests. Some data on trapping success and income were available but no estimation on domestic use or local sales of trapped furbearers exists.

Surveys could be conducted that would record the numbers and locations of wildlife species being harvested or trapped. This would enable an assessment of current wildlife harvests, key harvest areas, their economic values, and their future potential use as a renewable resource.

Fish

Although some documented information exists for the distribution of fish resources within Pehdzeh Ki Ndeh, it is not detailed, and current information on the abundance of this resource is not known to exist. Subsistence harvesting is recognized as being an important traditional activity for many of the residents of Wrigley and there is documentation of which water bodies are most commonly used for such purposes, but the harvest locations and volumes are not recorded. Similarly, no documented records are available to calculate recreational fisheries. Some information is available for the past importance of commercial fishing in Pehdzeh Ki Ndeh, but it is not known why these fisheries ceased.

In order to better understand the distribution and abundance of fish resources in Pehdzeh Ki Ndeh, stock assessments could be conducted with simultaneous studies of contaminant levels and parasite infestations. To clarify the use of this resource, surveys could be conducted that would document subsistence harvesting activities such as harvest species, volumes, locations and frequencies. Similarly, surveys could assess the current use for recreational fishing and potential for the establishment of a commercial fishery in the area.

Trees

Detailed information is available regarding the potential for commercial timber harvest in the Study Area. The resource's distribution and potential for such use is documented, but the economic feasibility of this resource's commercial use is unclear. Tree harvests for fuel wood purposes are known to exist, and rough estimations of harvest volumes and economic importance could be determined as part of this report. However, detailed harvest information was unavailable.

A feasibility study could be conducted in order to determine the economic viability of establishing a commercial timber harvest in Wrigley. Surveys could be conducted which would document the harvest of trees for fuel wood consumption to establish patterns such as preferred harvest areas, specific harvest volumes and individual fuel wood consumption.

Plants

The distribution and abundance of plant resources within Pehdzeh Ki Ndeh has been documented in recent vegetation surveys of the area, but there is very little information available regarding the use of plant resources within PehzDeh Ki Deh. General berry picking areas are known, but information for plant harvest trends for medicinal, spiritual and ritual reasons have been inaccessible for this report. At least one map and one Traditional Knowledge study are known to exist, which contain locations and descriptions of some medicinal plant harvest sites and perhaps other plant uses, but these documents have not been made available for examination. Incidences of wild plant harvest for food are unknown. Domestic plant crop growing has been reported for Wrigley. Based on the lack of information, the economic value of plants in PehzDeh Ki Deh could not be assessed.

It is uncertain what plant use information has already been documented. Traditional Knowledge studies could be reviewed to determine any gaps in knowledge regarding preferred plant harvest locations within Pehdzeh Ki Ndeh, species and purpose of harvest (i.e., food, medicine, spiritual) and volumes of plants harvested. If information is incomplete or missing, further Traditional Knowledge studies and surveys on current use could be conducted in order to clarify plant use in Pehdzeh Ki Ndeh. If there were hesitations about documenting the details of harvest locations or species, generalized information could be recorded, indicating areas instead of specific sites for harvests, or even simply recording whether harvests occurred within or outside of the Pehdzeh Ki Ndeh boundaries.

Art and Craft Materials

Renewable resources are known to be collected and harvested throughout Pehdzeh Ki Ndeh for art and craft materials. Local knowledge has been able to provide estimated abundances of wildlife species harvested for art and craft materials, but little information is available for the distribution of such harvests, and very little information is available for the distribution or abundance of plant species harvested. Several surveys have been conducted that assess the involvement of NWT residents in the arts and crafts industry, and local knowledge has been able to provide estimations for the number of artists that currently participate in this industry in Wrigley, but detailed evaluations of their use of renewable resources collected and harvested from Pehdzeh Ki Ndeh do not exist.

Surveys or interviews could be conducted with Wrigley artists that would clarify their use of art and craft materials that are collected or harvested from Pehdzeh Ki Ndeh. The identification of harvest areas, and numbers or volumes of animal or plant species harvested would aid in a more thorough assessment of the area's importance as a source of renewable resources for the arts and crafts industry in the community of Wrigley. Surveys could also be conducted to determine where artists were selling their works, and the importance of those sales to the local economy.

Wilderness

There is an ample amount of information available for the existence and distribution of tourism resources in the Pehdzeh Ki Ndeh Study Area, but current information on the frequency of such resource use is not available. The history of tourism in the area is well documented, and details about different tourist attractions (e.g., landscape features and interpretive activities) are accessible. It is not well understood how many tourists actually visit the area annually (either by plane, vehicle or boat), what they specifically do once in the area, or what their contributions are to the local economy.

Information about the strength of the tourism industry in Wrigley today could be gathered through surveys. Numbers of tourists could be more closely monitored through tourist exist surveys, outfitters and guides could be interviewed to assess the locations of tourism activities and frequencies of use, and local knowledge collected to record observations such as number and

nature of boaters visiting the community, campground usage, hotel usage and the importance of tourists' contributions to the local economy.

Renewable Energy

Generalized information is available which has been used to assess the distribution and abundance of renewable energy resources in PehzDeh Ki Deh, but very little area-specific information was found for the potential utilization of either wind energy or hydroelectric energy in the Study Area.

To properly assess the potential for the use of renewable energy in Pehdzeh Ki Ndeh, surveys could be conducted which would determine in more detail the distribution and abundance of these resources. The economic feasibility of wind energy could be determined through a wind feasibility study conducted by the Arctic Energy Alliance, and similar studies could be conducted to assess the potential for hydroelectric energy development. Environmental risks and the support of the residents of Wrigley for such projects would need to be considered.

5.2 Final Conclusion

There is limited information available on the distribution, abundance, current and potential future use and economic value of the different renewable resources examined in the Study Area. There are variable sources of information for each resource examined, including reports, datasets, maps, Traditional Knowledge studies, surveys and the knowledge of various persons that were interviewed. The presence, accuracy and availability of information sources for the different resources varied significantly. To allow for the comparison of the renewable resources, their uses and the information available for each one, Table 24 was created. It presents all of the resources and their identified uses and assigns them to one of several categories. They are ranked according to their known importance to the residents of Wrigley based on their current and future potential uses and economic value. The resources are also ranked according to the amount and quality of information available for their assessment.

Table 24 Evaluation of Renewable Resource Uses in the Study Area based on Estimated Importance and Availability of Information

Importance of Resource	Amount and Quality of Information			
	Abundant	Moderate amount	Limited	Very little

(based on current and future potential use in Study Area and economic value)	information; specific to study area	of information; some specific to study area	information; partially specific to study area	information; not specific to study area
High Importance		- Wildlife (trapping)	- Wildlife (subsistence) - Fish (subsistence) - Trees (fuel wood)	
Moderate Importance		- Plants (domestic food) - Art and craft materials (animal parts)	- Plants (berry picking)	
Low Importance		- Fish (commercial) - Wilderness (tourism)	- Fish (recreational) - Art and craft materials (plant parts)	
Very Low Importance	- Wildlife (commercial, outfitting) - Fish (hatcheries) - Trees (commercial)		- Wildlife (recreational)	- Renewable energy
Unknown				- Plants (medicinal, ritual, spiritual, wild food)

Wildlife is acknowledged as having a high importance through subsistence harvesting and trapping by the residents of Wrigley. Moose, woodland caribou, ptarmigan and waterfowl are known to be harvested on a frequent basis, but it is unknown where these harvests occur or what percentage occurs within the Study Area. Marten, beaver and muskrat seem to be sold in higher numbers but other furbearers are harvested as well. Trapping provides some value to Study Area residents through direct income although it is acknowledged that many more residents likely trap for food (hares), other domestic use (parka trims) and local sales. Additionally to their economic value, both resource uses are known to be of high cultural importance to the residents. The harvest of wildlife for recreational purposes is assumed to be limited and no outfitting or commercial harvest operations exist within the Study Area.

Fish are known to be very important subsistence food sources for the residents of Wrigley and are harvested extensively in the Study Area. Only general harvest locations and species are known, and it uncertain what volumes of fish are harvested. The recreational use of fish is known to occur but on a limited basis, and the commercial use of fish has occurred in the past but does not currently have any value. Hatcheries are known to not exist in Pehdzeh Ki Ndeh and therefore have no value. The economic value of fish is not well understood. Fish taken through subsistence harvest have a meat replacement value but because the amount of harvest is not

known, their overall economic value cannot be determined. Fish taken through recreational fishing generate some income for the one guide in Wrigley who takes tourists sport fishing but it is unknown how significant this activity is for the local economy.

Information on trees as timber for commercial logging in the Study Area is available but currently this resource use is not practiced. Trees are considered very important renewable resources for their use as fuel wood. The distribution and quantities of such harvests are not known. The only known economic value of trees in Pehdzeh Ki Ndeh is their estimated replacement value

The extent of plant use in Pehdzeh Ki Ndeh is largely unknown. Berry picking is known to take place, and it is generally understood where the important berry picking areas are. Information regarding the harvest of plants for medicinal, spiritual, ritual or wild food reasons was not available. Within the community of Wrigley the residents are known to maintain gardens and harvest domestic plant crops. Outside of the community borders it is understood that the potential Dehcho Land Use Plan would not permit the establishment of any agricultural activities.

The use of renewable resources as art and craft materials is known to exist in Pehdzeh Ki Ndeh. Animal parts are collected and harvested throughout the area for use in the arts and crafts industry, primarily for their hides and fur, but specific harvest locations are unknown. The extent of plant matter harvest for art and craft materials in the area is unknown, but is assumed to be of low importance. The art and craft materials collected and gathered from Pehdzeh Ki Ndeh are acknowledged as having an economic value, but their significance within the economy of Wrigley is not known.

Wilderness as a resource in the tourism industry is assessed as having a low importance. There is detailed information available describing the attractions that exist in the Study Area but little information describing the current use or economic importance of those attractions. It can be assumed that tourists do visit the area on an infrequent basis, usually by boat or vehicle.

There is very little current information available that describes the possibilities for the use of renewable energy sources in Pehdzeh Ki Ndeh. They have been assigned a status of very low importance because they are currently not utilized in the area, but the potential for their future exploitation does exist. It may be assumed that it would be difficult to gather support for

hydroelectric dams in Pehdzeh Ki Ndeh but the opportunity to investigate wind energy potential could be promoted.

In conclusion, there is a wealth of renewable resources within the Pehdzeh Ki Ndeh Study Area. Many of these, such as wildlife fish and fuel wood resources, are presently well used through subsistence harvest by the residents of Wrigley, but not commercially exploited. Other resources, such as commercial timber, plants, art and craft materials, and wilderness for tourism purposes, have distribution and utilization patterns that are not well understood or not exploited to their potential capacity. Renewable energy resources are presently not utilized in the Study Area, but the potential for their exploitation does exist if further studies proved their developments to be economically, environmentally and socially acceptable.

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