SOCIO-ECONOMIC ASSESSMENT OF THE KA'A'GEE TU CANDIDATE PROTECTED AREA

PHASE 2: SOCIO-ECONOMIC ASSESSMENT OF BOUNDARY OPTIONS

Prepared for:

Ka'a'gee Tu Candidate Protected Area Working Group

Aboriginal Affairs and Northern Development Canada

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EXECUTIVE SUMMARY

As part of the process for establishing a protected area in the Northwest Territories (NWT), an assessment of the potential socio-economic effects of designating a protected area is required. The Government of Canada is currently assessing whether it should protect all or parts of the Ka'a'gee Tu (pronounced kah-ge-too) Candidate Protected Area (CPA) as a National Wildlife Area. The Ka'a'gee Tu CPA is an area of about 9,600 square kilometres in the Dehcho Region of the NWT. The Government of Canada commissioned this study to assess the potential social and economic impacts on the community of Kakisa and the surrounding communities of Fort Providence, Hay River, Hay River Reserve, and Enterprise. This study is presented in two volumes. This volume, Volume 2, describes the potential social and economic effects of three development options for the Ka'a'gee Tu CPA, ranging from no permanent protection for any of the area to full surface and sub-surface protection of the entire area. Volume 1, which was vetted by the Ka'a'gee Tu Working Group in March 2011, provides an overview of current socio economic conditions in the study region. Volume 2, examines the economic benefits and costs and impacts of various boundary options for a protected area in terms of effects on traditional, cultural, renewable and non renewable resource use and development.

Current Use of Ka'a'gee Tu

Residents of Kakisa and other communities currently use the Ka'a'gee Tu area as a source of food, fuel, for recreation and for cultural and spiritual reasons. Based on harvest data for northern communities, it is estimated that residents of Kakisa harvest between 7,585 and 7,860 kilograms (kg) of meat and fish annually. The value of this food, based on the local price of purchased food and adjusting for income differentials, is estimated to be in the range of $154,400. Many households in Kakisa use wood as their primary or secondary heating source and it is estimated that about 300 cords of wood are harvested each year. The value of this firewood, measured in terms of the costs of purchasing wood from a supplier, is estimated about $72,000 per year.

Ka'a'gee Tu CPA is also used for recreation by residents of Kakisa, as well as residents of the other four communities. Based on information from a 1996 survey of the importance of nature to Canadians, it is estimated that residents of Kakisa enjoyed about 2,750 days of recreation in the area and spent between $16,300 and $41,600 to participate in these activities. The benefits that they enjoyed over and above actual expenses, was in the range of $6,000 to $10,100 per year. For residents of the other four communities it was assumed that they spent 1% of their annual recreational activities (252,000 days) in the Ka'a'gee Tu CPA. Their annual expenditures were estimated to be in the range of $15,100 to $38,300 per year, with user benefits totaling between $5,600 and $9,300.

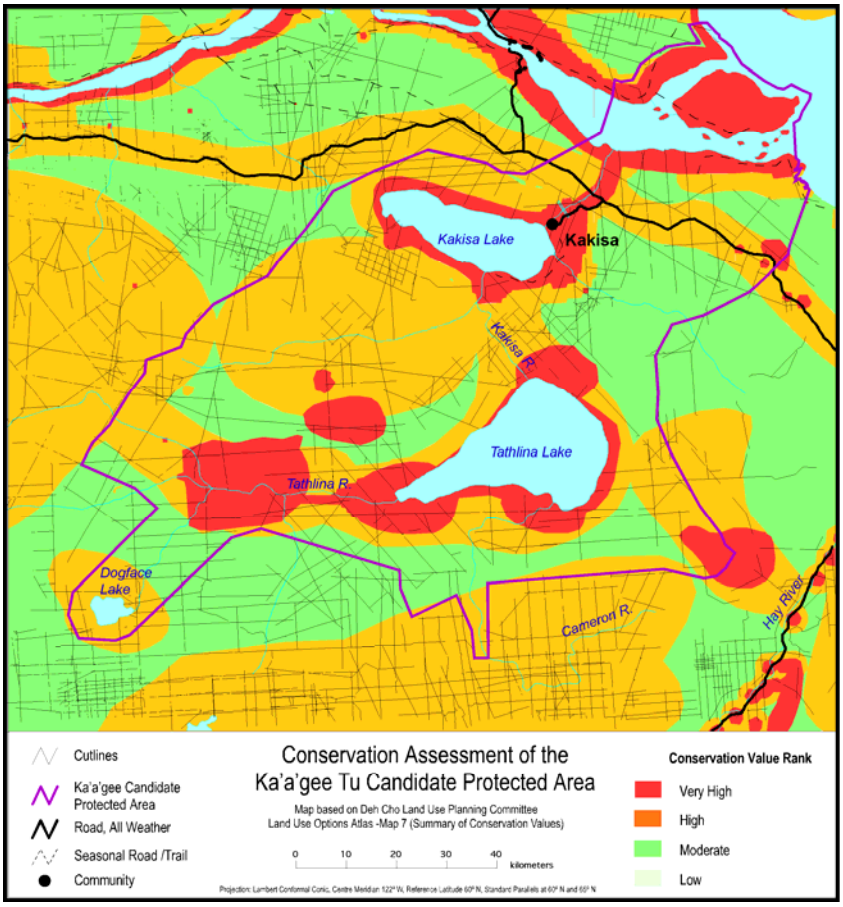
Ka'a'gee Tu CPA also provides some regional residents with a source of income. Trappers in Kakisa harvest about $10,100 of furs annually while commercial fishing produces annual harvests valued at $45,860. The area also supports some tourism. Fishing camps in the area currently generate between $48,000 and $60,000 per year of gross revenues. Tourists spend

about $10,000 per year to stay at the territorial campground at Lady Evelyn Falls and to stay at the motel in Kakisa. Residents of Kakisa also manufacture northern arts and crafts which are estimated to have a value of about $9,000 per year.

Overall, the Ka'a'gee Tu CPA is believed to generate between $0.4 and $0.5 million in user benefits for regional residents, with country food accounting for about 36% of this amount. These uses and associated values are considered to be sustainable in that they can continue without damaging the productive capacity of the area. It is believed that the area could support additional use of the renewable resource base, including trapping, timber harvesting and tourism.

Not all areas within the Ka'a'gee Tu CPA are of equal importance or value. Many of the traditional, commercial, cultural and ecological values are tied to specific landscape features that have high values. Areas with high value include:

- areas used for traditional land use and occupancy,
- areas with archeological features, cabins, historic sites and rare features of importance to the community
- importance as wildlife habitat areas (moose)



These three types of spatial features were mapped to produce a 'heat' map which portrays areas believed to be of greatest importance in dark red are on the map while areas believed to be of least importance were shown in dark green. Areas with no spatial information were shown in white.

Potential Development Opportunities

Preliminary investigations suggest that there may be oil and gas and mineral deposits in the area. At the present time it is not known if or when resource development will ever occur in the area or the size or location of this development if it were to occur. However, based on available

information and an assessment of the financial feasibility of discovering and developing viable petroleum deposits, it was concluded that:

- There is some potential for natural gas development because some gas has already been discovered in the area and there is some potential for additional natural gas resources to be discovered in four land blocks within the CPA that have the relatively high natural gas potential. It is assumed that one of the two existing wells will be produced, assuming natural gas prices are sufficient to warrant the costs of constructing a connector pipeline to the Cameron Hills facilities, and that exploration on the four land blocks will result in the discovery and production of natural gas from one new well.
- Exploration for oil in the CPA would be done in conjunction with natural gas exploration and would focus on two land blocks that are believed to have more than 100,000 barrels of recoverable oil per quarter grid. It is assumed that this exploration will result in the discovery and production of oil from one new oil well.
- There would be no mineral resource development in the Ka'a'gee Tu CPA because, although the area has potential, the resources are either too deep to be financially viable to recover (lead-zinc) or are found in other parts of the NWT where production is more financially viable (diamonds, limestone).

Boundary Options

Three options for establishing a National Wildlife Area were assessed. The first option assumes that none of the CPA would be protected (the no protection option). The second option assumes that all of the Ka'a'gee Tu CPA would be protected as a National Wildlife Area (the full protection option). The third option assumes that the majority of the CPA would be protected as a National Wildlife Area, based on boundaries proposed by the Working Group (the modified boundary option). A comparison of the three boundary options is provided in Table 1, which describes the land and resource areas and features that would be protected under each option.

No Protection Option

If all of the Ka'a'gee Tu CPA were open to development, it is expected that non-renewable resource development would occur as described above. Under this option, a total of $34.5 million would be invested. This would generate 87 person- years of employment between 2015 and 2045, and increase NWT GDP by $28.8 million. The development would create some new labour income for residents of the Kakisa, the Dehcho Region and the NWT, and would also generate tax and royalty income for the NWT and Canadian governments.

However, this non-renewable resource development would create land use disturbances, especially related to seismic exploration, and these can result in habitat loss and cause habitat fragmentation that, in turn, will adversely affect animal and migratory bird populations as well as the human use of these resources. Given the extent of seismic activity that could occur, it is believed that there would no longer be any secure patches of Woodland Caribou (>500 km^2) within the Ka'a'gee Tu CPA.

Table 1: Summary of Potential Protection and Development Afforded by Possible Boundary Options for the Ka'a'gee Tu Candidate Protected Area

				Full Protection	Modified Boundary	No Protection	Full Protection	Modified Boundary	No Protection
Type of Benefit		**Indicator**	**Units**	**Spatial Assessment**			**Percent of Total**		
Traditional Resource Use and Values	Consumption of fish	Known Fish harvesting sites	Number of sites	9	8	0	100%	90%	0%
	Traditional Use and Occupancy Areas[1]	Very high values	km^2	788	524	0	100%	67%	0%
		High values	km^2	1,250	1,089	0	100%	87%	0%
		Moderate values	km^2	3,925	3,550	0	100%	90%	0%
		Low values	km^2	3,677	3,085	0	100%	84%	0%
Commercial Resource Use and Values	Fishing Camps	Number of camps	km^2	2	1	0	100%	50%	0%
	Tourism	Number of sites	Number of sites	2	0	0	100%	0%	0%
Wildlife Habitat	Wildlife Habitat Values[2]	Very high values	km^2	3,217	2,564	0	100%	80%	0%
		High values	km^2	3,856	3,536	0	100%	92%	0%
		Moderate values	km^2	2,415	1,986	0	100%	82%	0%
	Woodland Caribou	Undisturbed areas > 500 km^2	Number of areas	One	One	None	100%	100%	0%
Cultural Values	Archeology, Cabins, Historic Sites and Rare Features[3]	Very high values	km^2	40	22	0	100%	56%	0%
		High values	km^2	109	64	0	100%	59%	0%
		Moderate values	km^2	151	107	0	100%	70%	0%
		Low values	km^2	170	126	0	100%	74%	0%
Hydrocarbon Resources	Natural Gas	Existing wells	Number	0	1	2	0%	50%	100%
		Undiscovered Recoverable > 2 BCF	Number of land block of 600 km^2	0	1	4	0%	25%	100%
	Oil	Undiscovered Recoverable > 100 MB	km^2	0	1	2	0%	50%	100%
	Land use disturbance	Disturbed area (5m width)	km^2	14.5	26.2	43.8	0.2%	0.3%	0.5%
		Seismic line density	km/km^2	0.35	0.63	1.06	100%	180%	303%
TOTAL AREA			km^2	**9,607**	**8,159**	**0**	**100%**	**85%**	**0%**

[1] Based on interpretation of Map 5: Generalized Density of Traditional Use and Occupancy, prepared as part of the Deh Cho Land Use Options Atlas.
[2] Based on interpretation of Map 4: Wildlife Habitat Value, prepared as part of the Deh Cho Land Use Options Atlas.
[3] Based on interpretation of Map 6: Archeology , Cabins, Historic Sites and Rare Features, prepared as part of the Deh Cho Land Use Options Atlas

Based on the land area that would be affected by new seismic activities it is estimated that there would be a 2% reduction in wildlife populations and that the benefits of subsistence hunting, trapping and recreation for residents of Kakisa would also be reduced by 2%. The future additional economic benefits from both non-renewable resource development and use of renewable resources for the no protection option are shown in Table 2 below and have been calculated in terms of the net present value (NPV) of future benefits in current dollars.[4]

Table 2: Present Value of Additional Economic Benefits Associated with the Ka'a'gee Tu CPA: No Protection Option

	Undiscounted	3.0% Discount Rate	8.0% Discount Rate
NPV of Net Benefits for Canada (millions)			
Non-Renewable Resources	$26.49	$17.10	$9.14
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	$26.31	$17.01	$9.10
NPV of Net Benefits for the NWT (millions)			
Non-Renewable Resources	$5.58	$3.67	$2.03
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	$5.40	$3.58	$2.00
NPV of Net Benefits for the Dehcho Region (millions)			
Non-Renewable Resources	$0.56	$0.39	$0.24
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	$0.38	$0.30	$0.21
NPV of Benefits for Kakisa (millions)			
Non-Renewable Resources	$0.09	$0.07	$0.04
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	-$0.09	-$0.02	$0.00

Note: Totals may not add due to rounding

The no protection option would provide some additional benefits for Canada, the NWT and the Dehcho Region, but not for residents of Kakisa.

Full Protection Option

If all of the Ka'a'gee Tu CPA were to be protected as a National Wildlife Area, there would be no renewable resource development and residents of Kakisa could continue to use the area as they currently do. Full protection would create a number of other benefits. First, there is evidence that Canadians are willing to pay to create protected areas; studies have shown that Canadians would be willing to pay about $5.50 per household to protect landscapes for future generations. This would amount to a NPV of $69.0 million. Second, Canadians are also willing to pay to protect Woodland Caribou herds. Information from various studies suggests willingness to pay of between $4.4 million and $21.3 million to protect the one Woodland

[4] See Appendix A for an explanation of net present value and discounting.

Caribou herd in the Ka'a'gee Tu CPA. The additional non-use benefits associated with the full protection option are summarized in Table 3 below:

Table 3: Present Value of Additional Economic Benefits Associated with the Ka'a'gee Tu CPA: Full Protection Option

	Undiscounted	3.0% Discount Rate	8.0% Discount Rate
NPV of Net Benefits for Canada (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$73.46	$73.46	$73.46
TOTAL	$73.46	$73.46	$73.46
NPV of Net Benefits for the NWT (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$0.13	$0.13	$0.13
TOTAL	$0.13	$0.13	$0.13
NPV of Net Benefits for the Dehcho Region (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$0.01	$0.01	$0.01
TOTAL	$0.01	$0.01	$0.01
NPV of Benefits for Kakisa (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$0.00	$0.00	$0.00
TOTAL	$0.00	$0.00	$0.00

The full protection option would generate large benefits for Canada but relatively small benefits for the NWT and the Dehcho Region. There would not be any noticeable benefits for residents of Kakisa, although formal designation of the CPA as a National Wildlife Area could attract more tourists to the region. However, there would be no economic benefits from increased tourism unless residents of Kakisa develop services and facilities that would capture tourist spending.

Modified Boundary Option

The Ka'a'gee Tu CPA Working Group identified another boundary option for the Ka'a'gee Tu CPA. The proposed protected area would be about 8,159 km^2 in size. Some portions of the areas left outside the protected area would have some oil and gas potential. It is predicted that oil exploration would occur on one land block and natural gas development would occur on a second land block, close to an existing natural gas well. However, these two blocks have relatively low undiscovered recoverable reserves compared to the other blocks in the Ka'a'gee Tu CPA with high potential, so it is predicted that there would be no petroleum production from these two blocks. Under this option, a total of $11.5 million would be invested and that this would generate 29 person- years of employment between 2015 and 2020, and that this would increase NWT GDP by $9.6 million. Without oil or natural gas production, there would be no taxes or royalties for the NWT or Canadian governments.

As a result of the new seismic activities on the two blocks, it is estimated that there would be a 1% reduction in wildlife populations, and this will translate into 1% decline in the amount and value of country food being harvested from the Ka'a'gee Tu CPA. Similar 1% decreases are assumed for revenues from trapping and recreation. However, establishment of a National Wildlife Area would result in the same non-use values for Woodland caribou and for a protected area that would occur under the full protection option. The economic benefits from the modified boundary option are summarized in Table 4.

Table 4: Present Value of Economic Benefits Associated with the Ka'a'gee Tu CPA: Modified Boundary Option

	Undiscounted	3.0% Discount Rate	8.0% Discount Rate
NPV of Net Benefits for Canada (millions)			
Non-Renewable Resources	$0.35	$0.29	$0.22
Loss of Renewable Resources	-$0.16	-$0.08	-$0.03
Non-Use Values	$73.46	$73.46	$73.46
TOTAL	$73.65	$73.67	$73.64
NPV of Net Benefits for the NWT (millions)			
Non-Renewable Resources	$0.35	$0.29	$0.22
Loss of Renewable Resources	-$0.16	-$0.08	-$0.03
Non-Use Values	$0.13	$0.13	$0.13
TOTAL	$0.32	$0.34	$0.31
NPV of Net Benefits for the Dehcho Region (millions)			
Non-Renewable Resources	$0.07	$0.06	$0.04
Loss of Renewable Resources	-$0.16	-$0.08	-$0.03
Non-Use Values	$0.01	$0.01	$0.01
TOTAL	-$0.08	-$0.01	$0.02
NPV of Benefits for Kakisa (millions)			
Non-Renewable Resources	$0.02	$0.01	$0.01
Loss of Renewable Resources	-$0.16	-$0.08	-$0.04
Non-Use Values	$0.00	$0.00	$0.00
TOTAL	-$0.14	-$0.06	-$0.02

Note: Totals may not add due to rounding

The modified boundary option would also generate large benefits for Canada but relatively small benefits for the NWT and the Dehcho Region. For residents of Kakisa, the costs associated with this option would exceed the benefits.

Comparison of Boundary Options

Designation of all, none or parts of the Ka'a'gee Tu CPA as a National Wildlife Area would protect a different mix of biophysical and cultural features of the landscape and allow current traditional and commercial activities to continue, while enabling different levels of oil and natural gas development to occur. The resulting benefits and costs associated with each of the boundary options are summarized in Table 5.

For Canada, the full protection and modified boundary options would provides the highest values (shaded in green) because the high non-use values exceed the benefits from petroleum development that would occur under the no protection option.

For the NWT, the highest net benefits would occur under the no protection option, regardless of which discount rate is used, while the full protection option would have the lowest net benefits (shaded in red). For the NWT, the benefits from non-renewable resource development would always exceed the potential non-use benefits from designating the area as a National Wildlife Area.

Table 5: Net Present Value of Future Economic Benefits for the Three Boundary Options

Location	Discount Rate	No Protection Option (millions)	Modified Boundary Option (millions)	Full Protection Option (millions)
Canada	Undiscounted	$26.31	$73.65	$73.46
	3.0%	$17.01	$73.67	$73.46
	8.0%	$9.10	$73.64	$73.46
NWT	Undiscounted	$5.40	$0.32	$0.13
	3.0%	$3.58	$0.34	$0.13
	8.0%	$2.00	$0.31	$0.13
Dehcho Region	Undiscounted	$0.38	-$0.08	$0.01
	3.0%	$0.30	-$0.01	$0.01
	8.0%	$0.21	$0.01	$0.01
Kakisa	Undiscounted	-$0.09	-$0.14	$0.00
	3.0%	-$0.02	-$0.06	$0.00
	8.0%	$0.0	-$0.02	$0.00

For the Dehcho Region, the greatest net benefits would occur under the no protection option, and the net benefits from full protection would be larger than the benefits from the modified boundary option. For the modified boundary option, costs would actually exceed benefits if the lower discount rates are used.

For Kakisa, the full protection option would provide the greatest net benefits for most discount rates. For the modified boundary option, the loss of renewable resource benefits associated with land use disturbances would exceed the labour income benefits resulting from petroleum development, resulting in a net loss for residents of Kakisa. For the 8% discount rate, the benefits of resource development would be just equal to the losses of renewable resources, resulting in no change in benefits for the community.

It should be noted that these estimates do not include any costs associated with possible losses of cultural values that might occur under either the no protection or modified boundary options. Similarly, the analysis does include potential benefits that might arise from tourism-related opportunities that could result from designating the Ka'a'gee Tu CPA as a National Wildlife Area. Inclusion of such benefits and costs would likely confirm the conclusion that, from the perspective of residents of Kakisa, the full protection option offers the greatest future benefits.

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1.0 INTRODUCTION

In 1999, the Government of Canada and the Government of the Northwest Territories (NWT) recognized the need to protect areas in the NWT that have unique environmental, geological, cultural or historic features and signed an agreement to establish a Protected Areas Strategy (PAS) for the NWT for this purpose.

One of the areas currently under consideration as part of the PAS is the Ka'a'gee Tu Candidate Protected Area (CPA). It consists of an area of approximately 9,600 square kilometres (km^2) located in the Dehcho region of the NWT. It is located southwest of the Mackenzie River and surrounds the community of Kakisa. Residents of Kakisa, the Ka'a'gee Tu First Nation, asked that these lands be permanently protected to help preserve their cultural heritage and the ecosystems that support them, and they are supported by the Deh Gah Got'ie, K'atl'odeeche and Dehcho First Nations. The area is rich in wildlife (moose and beaver), fish and waterfowl and is home to a number of species at risk (e.g., woodland caribou, rusty blackbirds, and some rare plants). Areas known to have high non-renewable resource development potential were purposely excluded from the candidate protected area prior to moving forward with the PAS process. Much of the candidate protected area was protected under the Dehcho Interim Measures Agreement and was identified as a Candidate Protected Area Zone under the draft Dehcho Land Use Plan.

1.1 The Protected Areas Strategy Process

The PAS is a community-driven partnership consisting of communities, Aboriginal governments and/or land claim bodies, federal and territorial governments, and industry stakeholders. It has developed an eight step process to identify, designate and manage protected areas:

1. Identify areas in need of protection, and obtain community support for protecting the area.
2. Gather information about the area. Use this information to prepare a proposal to protect the area. Obtain support for this proposal at the regional level.
3. Submit a proposal to a potential sponsoring agency for their review and approval.
4. The sponsoring agency applies for interim (short-term) protection for the area, if needed.
5. Document the candidate area's ecological, cultural and economic values. This information is used to make recommendations on the area's designation, boundaries and management.
6. Formally ask the sponsoring agency to protect the area using their legislation.
7. Approve and establish the protected area.
8. Manage, monitor and review.

In August 2009, the Canadian Wildlife Service (CWS) agreed to sponsor the Ka'a'gee Tu area as a National Wildlife Area and the studies to document the area's ecological, cultural and economic values (Step 5) are now underway.

As part of the PAS process for Ka'a'gee Tu, a Working Group was established in 2010. This group consists of two representatives from each of the Ka'a'gee Tu First Nation (Kakisa, NWT), the K'atl'odeeche First Nation (Hay River, NWT), and the Deh Gah Got'ie Dene Council (Fort Providence, NWT), as well as one representative from each of the following organizations:

- Dehcho First Nation
- West Point First Nation
- Northwest Territories Métis Nation
- Sponsoring Agency: Environment Canada, Canadian Wildlife Service (CWS)
- Aboriginal Affairs and Northern Development Canada (AANDC)
- Government of the Northwest Territories
- Ducks Unlimited Canada
- Deegahni Lake Lodge
- Northern Transportation Company Ltd., (NTCL)

As part of this process AANDC issued the terms of reference for a socio-economic assessment of the Ka'a'gee Tu Candidate Protected Area in September 2010. This report was prepared in response to these terms of reference.

1.2 Study Objectives

The terms of reference for the socio-economic assessment are as follows:

1. Develop socio-economic profiles using indicator statistics for each of the six surrounding communities, including:
    - Develop consistent data baselines
    - Describe information specific to Ka'a'gee Tu, and
    - Identify socio-economic data gaps and develop a strategy to address these gaps
2. Assess socio-economic effects for the surrounding communities, the southern NWT, the entire NWT and for Canada, based on various options, including full protection using the current boundaries, no formal protection, and boundary options to be established by the Ka'a'gee Tu Working Group. These communities were defined to include Kakisa, Fort Providence, Enterprise, Hay River and the Hay River Reserve.
3. Produce a plain language report and present information to stakeholders, communities and First Nations.

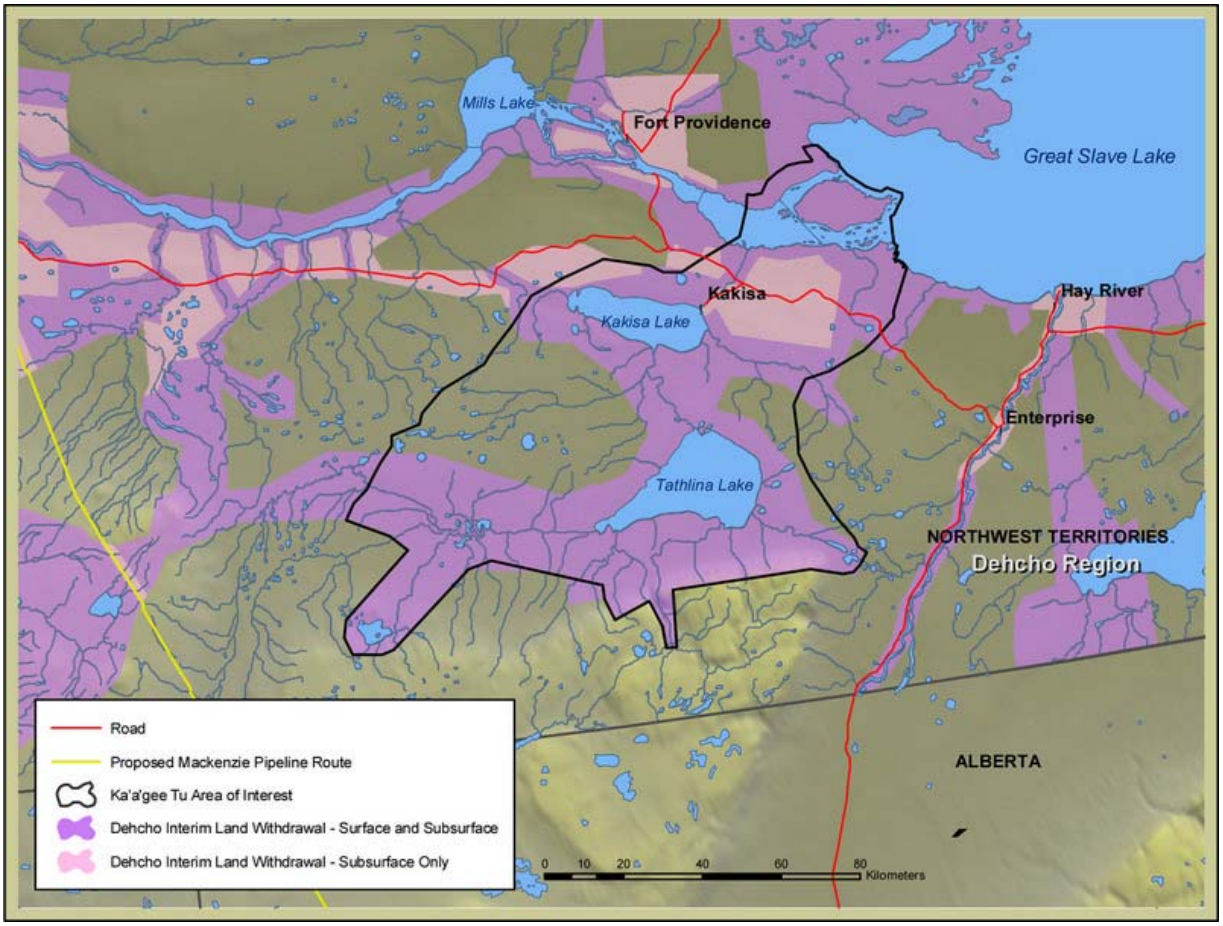
Item 1 was addressed in Volume 1 of the final report. Item 2 will be addressed in this report (Volume 2).

1.3 Study Area

A map of the Ka'a'gee Tu Candidate Protected Area is provided in Figure1-1. The area has ecological significance for a number of reasons (EBA Engineering Consultants, 2007):

1. It supports several species at risk, including threatened species (barn swallow, boreal woodland caribou, common nighthawk, olive-sided flycatcher, Canada warbler) and species of special concern (wolverine, horned grebe, peregrine falcon, short-eared owl, rusty blackbird).
2. It contains three International Biological Program (IBP) sites (Kakisa River, the southern limits of Beaver Lake and a small part of Deep Lake, a wood bison sanctuary).
3. Beaver Lake is considered a "key migratory bird terrestrial habitat site" and an Important Bird Area in the NWT and supports 1% of the national population of a number of migratory bird populations including Tundra Swans and Canvasbacks.

Figure 1-1: Proposed Ka'a'gee Tu Candidate Protected Area



Source: NWT PAS (2009).

The area is also being used for traditional socio-economic pursuits but has oil, gas, mineral and forestry development potential that could contribute to the regional economy.

1.4 Methodology

The general methodology used for this assessment is similar to that of a socio-economic assessment prepared as part of an environmental assessment of a proposed development project. Impact assessments consist of three tasks:

1. Assess current social and economic conditions in the communities that may be affected by the development using a series of selected indicators (baseline).
2. Use the project description to estimate potential demands on the communities in terms of employment, incomes, population, housing, infrastructure and services, and general well-being.
3. Compare these potential demands with baseline conditions to determine the significance of proposed changes and identify strategies for enhancing benefits and minimizing negative effects.

Volume 2 of the study will describe the potential for development in the Ka'a'gee Tu Candidate Protected Area and the socio-economic effects that could result from that development. However, in the absence of specific resource development proposals, this assessment will use generic development scenarios patterned after similar existing or proposed projects for which some information does exist. These generic scenarios will be used to predict the social and economic effects of development. There is some danger using this approach because the nature of development that ultimately may occur could be quite different from what is stated in this assessment and the scenarios may raise economic development expectations that may or may not be realized.

1.4.1 Overall Approach

The overall objective of this study was to assess the socio-economic effects for the surrounding communities, the southern NWT, the entire NWT and for Canada for the different boundary options in accordance with the NWT PAS Socio-Economic Assessment Guidelines (the Guidelines).

As per Phase 1 of the Guidelines (NWT PAS, 2011), the first step in the process involves describing current use of the Ka'a'gee Tu Candidate Protected Area. A comprehensive assessment of current use and values of the Ka'a'gee Tu Candidate Protected Area has been previously prepared as Volume 1 of the socio-economic assessment (AMEC Environment and Infrastructure 2011). Section 2.0 of this report provides a summary of this resource use and value information, including a description of the spatial distribution of activities within the candidate area based on the "heat" map provided in Volume 1.

Phase 2 of the Guidelines call for the identification of potential protection options by the Working Group. These include the no protection option (status quo), the full protection option, and possible compromise boundary options.

Phase 3 of the Guidelines involve assessing the potential socio-economic impacts of the various boundary options. This phase involved the following five tasks.

1. The first task required describing the potential location and extent of potential non-renewable resource development that might be expected to occur in the near future if the area were to become available for development. While this description was developed based on the results of previously completed studies on hydrocarbon and mineral potential in the region, it necessitated making some assumptions about the scale and location of potential development and the timing, scale, cost, and revenues associated with this development. These assumptions and the resulting non-renewable resource potential are described in Section 3.0.
2. The second step consisted of developing a baseline socio-economic projection for the Ka'a'gee Tu Candidate Protected Area that assumes no formal protection occurs. This baseline projection assumes that all of the potential non-renewable resource development identified in Section 3.0 will proceed as described, and examines how social and economic conditions in the communities and region could change over time. The baseline will describe how community and regional employment and income will be expected to change, examines potential revenue and royalty effects for the GNWT, and predicts how community and regional use of the Ka'a'gee Tu Candidate Protected Area will change. This baseline assessment is presented in Section 4.0.
3. The third step examined the social and economic effects of formal designation of the Ka'a'gee Tu Candidate Protected Area as a National Wildlife Area with the proposed boundary intact and precluding non-renewable resource development opportunities. Social and economic conditions in the community and region will be predicted using key indicators like employment and income and reliance on country foods and resources. The effects of the full protection option are assessed in Section 5.0.
4. The fourth step examined the potential effects of the boundary option being considered by the Working Group. The economic and social implications of allowing non-renewable resource development to proceed in various parts of the Ka'a'gee Tu Candidate Protected Area are evaluated, as well the potential implications for wildlife and habitat protection and the ability of the area to supply the community and region with country foods and income. This assessment is provided in Section 6.0.
5. The fifth step involved preparing a summary of the social and economic implications of all possible boundary options, including full protection as a National Wildlife Area and the no protection option. This summary is provided in Section 7.0.

1.4.2 Assessment Methods

The evaluation of boundary options employed a number of different evaluation methods. These are described below.

1.4.2.1 Assessment of Socio-Economic Effects

Once the various development opportunities were described in terms of costs and revenues, the potential economic effects on employment and economic activity in the NWT were calculated using current information on economic multipliers (Northwest Territories Bureau of Statistics, 2011a). These multipliers represent intensity ratios that estimate the extent to which a change in consumption or output translates into employment and economic activity in the NWT. The multipliers capture direct and indirect economic effects:

> Direct effects refer to the increase in economic production in the NWT that occurs in order to meet the demands of the new economic activity.
>
> Indirect effects describe the ripple effects that results when companies that provide goods and services to the new economic activity purchase additional goods and services to meet these demands.

As the NWT economy is highly dependent on imported goods and services, the economic multipliers (also known as intensity ratios) are usually less than one. The intensity ratios used in this analysis reflect the industry sectors that will most likely be affected by future renewable and non-renewable resource development in the region. The multipliers for these industries, as published by the Northwest Territories Bureau of Statistics (2011a) are as follows:

Industry	GDP at Basic Prices per Dollar of Output	Labour Income per Dollar of Output	Jobs per $million of Output
Mining and oil and gas extraction	0.75	0.17	1.5
Oil and gas extraction	0.91	0.07	0.7
Diamond mining	0.71	0.14	1.2
Support activities for mining and oil and gas extraction	0.79	0.59	5.2
Pipeline Transportation	0.76	0.12	1.3
Construction	0.46	0.33	3.8
Retail Trade	0.72	0.59	12.0
Arts, entertainment and recreation	0.54	0.39	13.3
Accommodation and food services	0.60	0.46	10.5

The ratios show that some activities, such as retail trade and the entertainment and recreation industries, are very labour intensive (high ratios) while others, such as oil and gas extraction, have very low labour requirements (low ratio). The employment effects are actually measured in terms of person-years (PYs) which can mean 1 person working for 12 months or 12 people working for one month or any other possible combination. It should be noted that the current version of the NWT multipliers does not include information on the economic effects of metal ore mines (which includes all mining other than diamonds); for these activities the potential economic effects have been estimated using multipliers from the 2006 version of intensity rations for the NWT.

A third effect may also occur:

Induced effects occur when households that directly or indirectly benefit from the increased activity spend part of their income on consumer goods and this triggers additional economic activity.

There are concerns that economic models that calculate induced effects (closed models) overstate potential economic effects, so induced effects are not included in the analysis. However, based on information from Alberta and British Columbia, these induced effects could be nearly as large as the indirect effects, and could increase the overall impacts by 20% to 30%.

Estimation of regional effects is very difficult and requires interpreting what percentage of territorial effects would occur within the six communities. This requires comparing the labour requirements of the various development opportunities with the available skill and occupation capabilities of regional residents, and then predicting how many local workers might be engaged in new development. The estimates of regional effects were developed based on previous experience with impact assessments of mineral and oil and gas development in Alberta and British Columbia and are considered conservative. Most resource development companies will work with local communities to provide training and employment opportunities on major development projects and such programs would serve to increase regional and local employment and income.

1.4.2.2 Assessment of Economic Benefits and Costs

One of the final steps in moving forward with designating the Ka'a'gee Tu Candidate Protected Area as a National Wildlife Area will involve Environment Canada making a final recommendation to Cabinet Committee. As part of the decision-making process, the Treasury Board Secretariat requires an evaluation of the costs and benefits. Consequently this study also assessed the potential economic benefits and costs associated with the various boundary options using the techniques associated with social benefit/cost analysis. This involved:

1. Describing each of the boundary options, including the no protection option, in terms of the magnitude and timing of regional and local employment and income created by current and traditional land and resource uses as well as for non-renewable resource developments that could occur.
2. Estimating annual benefits and costs from current and traditional land and resource uses and from non-renewable resource development for each boundary option, factoring in the probability (or uncertainty) that such development is likely to occur.
3. Calculating the present value of these benefits and costs for each boundary option using discount rates. Discount rates are used to estimate what the value of future benefits or costs would be in terms of current dollars, on the realization that a dollar today is worth more than a dollar at some point in the future. The current *Canadian Cost-Benefit Analysis Guide* suggests using an 8% discount rate based on the real rate of return to capital, with a sensitivity analysis using discount rates of 3.0% and 0.0%. A brief

discussion of discount rates and their use in benefit/cost analysis is provided as Appendix A.

4. Examining how the potential benefits and costs associated with traditional land and resource uses and from non-renewable resource development will be distributed among various stakeholders, including businesses, consumers and households, and territorial and federal governments.

1.4.2.3 Accuracy of the Estimates

It should be noted that preparing estimates of economic impacts, benefits and costs for the three boundary options requires numerous assumptions about future use of the Ka'a'gee Tu Candidate Protected Area in terms of both traditional land and resource use and non-renewable resource development. The analysis will list the various assumptions used to make future projections but it is important to understand that these assumptions used in this assessment represent best guesses based on the limited knowledge about what mineral and oil and gas resources may exist in the Ka'a'gee Tu Candidate Protected Area and how current and future regional residents will make use of the renewable resources of the area.

However, as time passes, it is expected that the assumptions about renewable and non-renewable resource development in the Ka'a'gee Tu Candidate Protected Area could ultimately prove to be quite different from what actually occurs. The problem is that the only way to gain better information about non-renewable resource potential is to open up the area for exploration activities that may ultimately delineate economically-viable reserves or conclude that no viable mineral and petroleum resources actually exist but, at the same time, compromise the important renewable resource and cultural values that residents of Kakisa would like to maintain. The intent of this report is to provide sufficient information about the renewable and non-renewable resource potential in the Ka'a'gee Tu Candidate Protected Area so that decision-makers can decide how much of the area and which parts of the area need to be preserved in order to provide a reasonable balance between protection and development.

2.0 CURRENT USE OF KA'A'GEE TU

To assess the potential implications for the various boundary option for the Ka'a'gee Tu Candidate Protected Area it is necessary to understand the current use of the area, the economic values of these uses, and how these uses and values are distributed throughout the area. The current use of the Ka'a'gee Tu Candidate Protected Area was described in detail in Volume 1 of the socio-economic assessment (AMEC Environment and Infrastructure, 2011). This section of the report provides a summary of traditional resource uses and values, commercial resource uses, and cultural resources uses.

2.1 Traditional Resource Use and Values

Traditional resource uses and values include use of the Ka'a'gee Tu Candidate Protected Area as a source of country food and fuel. The benefits that local residents derive from using these lands are also assessed in terms of its recreational values.

2.1.1 Country Food

Estimates of the value of country food obtained by local residents typically involves estimating the numbers of animals killed and fish caught by subsistence (Aboriginal) and recreational (non-Aboriginal) hunters and fishermen, determining the amount of edible meat and fish that would be harvested annually, and then valuing this meat and fish in terms of what it would cost to purchase an equivalent amount of food.

Unfortunately, there is no information on the actual numbers of fish and wildlife harvested in the Ka'a'gee Tu Candidate Protected Area by residents of Kakisa. However, the Golder Associates (2010) report determined that residents of Kakisa harvested lake trout, inconnu, whitefish, walleye, arctic grayling and northern pike for subsistence purposes, gather berries and various plants with medicinal and spiritual value, and harvest between 1.0 to 1.5 moose per household per year. Other animal species are also harvested and used for food.

Harvest data are available for similar communities in the NWT, such as Deline and Colville Lake. Harvest information for 1998 to 2003 showed that harvest of fish and wildlife averaged 138 kilograms per person in Deline and 142 kilograms per person in Colville Lake, with ungulates accounting for 85% of the total meat and fish harvest, fish accounting for 12% to 14%, and waterfowl, upland birds and other animals (hare) accounting for the balance. Assuming that residents of Kakisa have the similar per capita requirements for meat and fish, regardless of species, it is estimated that it would require between 7,585 and 7,860 kilograms of fish and meat that, at $20 per kilogram, would have an annual value of about $154,400. This estimate does not include the value of country foods harvested by other residents of the larger region, including Fort Providence, Enterprise, Hay River and the Hay River Reserve.

2.1.2 Fuel

Golder Associates (2010) determined that the value of wood harvested for heating homes in Kakisa and for other purposes, including smoke houses and campfires at Lady Evelyn Falls, was about $72,000 per year. This estimate is based on the assumption that 300 cords of wood are harvested each year and the purchase cost of a cord of wood in Hay River.

2.1.3 Recreation

While 38.9% of the regional population hunted or fished in 2008, some of these activities were undoubtedly part of harvesting country food and participants in these activities are believed to have enjoyed benefits over and above the value of the food they harvested. While there is no method for assessing the value of these traditional activities (other than in terms of the value of country foods being harvested), these values have been estimated in terms of their recreational value. However, this may seriously understate the importance of traditional activities. Although there is no information on the amount of recreational hunting or fishing in the Ka'a'gee Tu Candidate Protected Area, a nation-wide study conducted in 1996 by Environment Canada (1999) determined that 85% of Canadians aged 15 and older participated in some form of nature-related activity, including participating in an outdoor activity in a natural area (44%), residential wildlife-related activities (38%), wildlife viewing (19%), fishing (18%), and hunting (5%). Although the survey did include residents of the NWT, results for residents of the Yukon showed even higher participation rates.

For the 42 residents of Kakisa aged 15 years or older in 2009, the survey information suggests Kakisa residents cumulatively enjoyed about 2,750 days of nature-based recreation per year at all locations, spent between $16,300 and $41,600 on nature-related activities per year, and derived benefits of between $6,000 to $10,100 per year, over and above what they actually spent to participate. It is assumed that these activities and values are associated with recreational activities in the Ka'a'gee Tu Candidate Protected Area.

Based on their populations, it is estimated that 3,900 residents of Fort Providence, Enterprise, Hay River and the Hay River Reserve enjoyed about 252,000 days of recreational activity at all locations, spent between $1.5 million and $3.8 million on nature related activities, and derived economic benefits of between $427,000 and $744,000 per year, over and above what they actually spent to participate. It has been assumed that only 1% of total recreational activities by residents of these four communities occur in the Ka'a'gee Tu Candidate Protected Area. Based on this assumption, spending to participate in recreational activities in the study region are expected to be between $15,100 and $38,300 per year while non-market benefits are estimated to be in the range of $5,600 to $9,300 per year.

2.2 Commercial Resource Use and Values

Resources in the Ka'a'gee Tu Candidate Protected Area are currently being used as a source of income for regional residents, These activities include trapping, commercial fishing, tourism, arts and crafts, and commercial timber harvesting.

2.2.1 Trapping

About 6.8% of the adult population in the five communities (Kakisa, Fort Providence, Enterprise, Hay River and the Hay River Reserve) participated in trapping, including 34.9% of adults in Kakisa. On average, 1,866 pelts with a value of about $93,323 are sold at fur sales in Fort Providence and Hay River. There is no information on the total number of pelts harvested from the Ka'a'gee Tu area or on the number of pelts harvested by trappers in Kakisa. However, based on the numbers of trappers in each community, it is estimated that residents of Kakisa accounted for 12% of fur sales in Fort Providence and 9% of fur sales in Hay River, resulting in a gross income of $10,100 for residents of Kakisa.

2.2.2 Commercial Fishing

Two commercial fishing licenses have been issued for the study region and Kakisa Lake was actively fished for walleye and Northern Pike, with actual harvests averaging 11,210 kilograms per year between 2006 and 2009. This harvest was estimated to have a value of $45,860 per year and is sustainable and likely to continue. Most fish products are sold locally. While Tathlina Lake once supported a commercial fishery, the extent of harvests from this lake is unknown and assumed to be small.

2.2.3 Tourism

The Ka'a'gee Tu Candidate Protected Area is located in the South Slave Region which, in 2006, had about 11,945 tourists visit for leisure purposes. About 84.6% of tourists were Canadians, 10.1% were from the United States and the balance (5.4%) was from other countries. It is estimated that tourists spent about 67,700 visitor–nights in the region and that they spent about $5.2 million in 2006, or about $77 per person per night.

The Ka'a'gee Tu Candidate Protected Area is believed to account for a very small portion of regional tourism, and has only three operations that cater to tourists: Deegahni Lake Camp on Dogface Lake which offers facilities for fishing; Brabant Lodge on Brabant Island on the north shore of the Mackenzie River which offers five-day and seven-day fishing packages; and, Mystery Tours which operates out of Hay River and offers boat cruises, birding tours, wildlife viewing and one-day fishing trips on the Mackenzie River. Additional tourism features include the Kakisa River Bridge Territorial Park on the Mackenzie Highway, Lady Evelyn Falls Territorial Park located 6.5 km off the Mackenzie Highway, the Kakisa Trail system connecting Kakisa Lake with Tathlina Lake, and the Cameron Hills. The annual value of tourism in the Ka'a'gee Tu Candidate Protected Area to be $10,000 per year, based on purchases at the River

Front Convenience Store and Motel in Kakisa and camping fees at Lady Evelyn Falls Territorial Park. Another $58,000 to $70,000 per year is generated by the Deegahni Lake Camp. The area has moderate potential to support increased tourism.

2.2.4 Arts and Crafts

In 2008 9.9% of adults in the five communities produced northern arts and crafts, including 39.5% of adults in Kakisa. Production of northern arts and crafts relies on bones and antlers, feathers, fur, animal hair and hides, porcupine quills, sinew, birch bark and materials used to construct baskets, plants used for dyes, wood from trees, and stones. It is estimated about $206,000 was spent on arts and crafts by tourists visiting the South Slave Region and this represents an average of $530 in revenues for each of the 390 residents who reported producing northern arts and crafts in 2008. Production of northern arts and crafts by residents of Kakisa generated estimates annual revenues of about $9,000 per year.

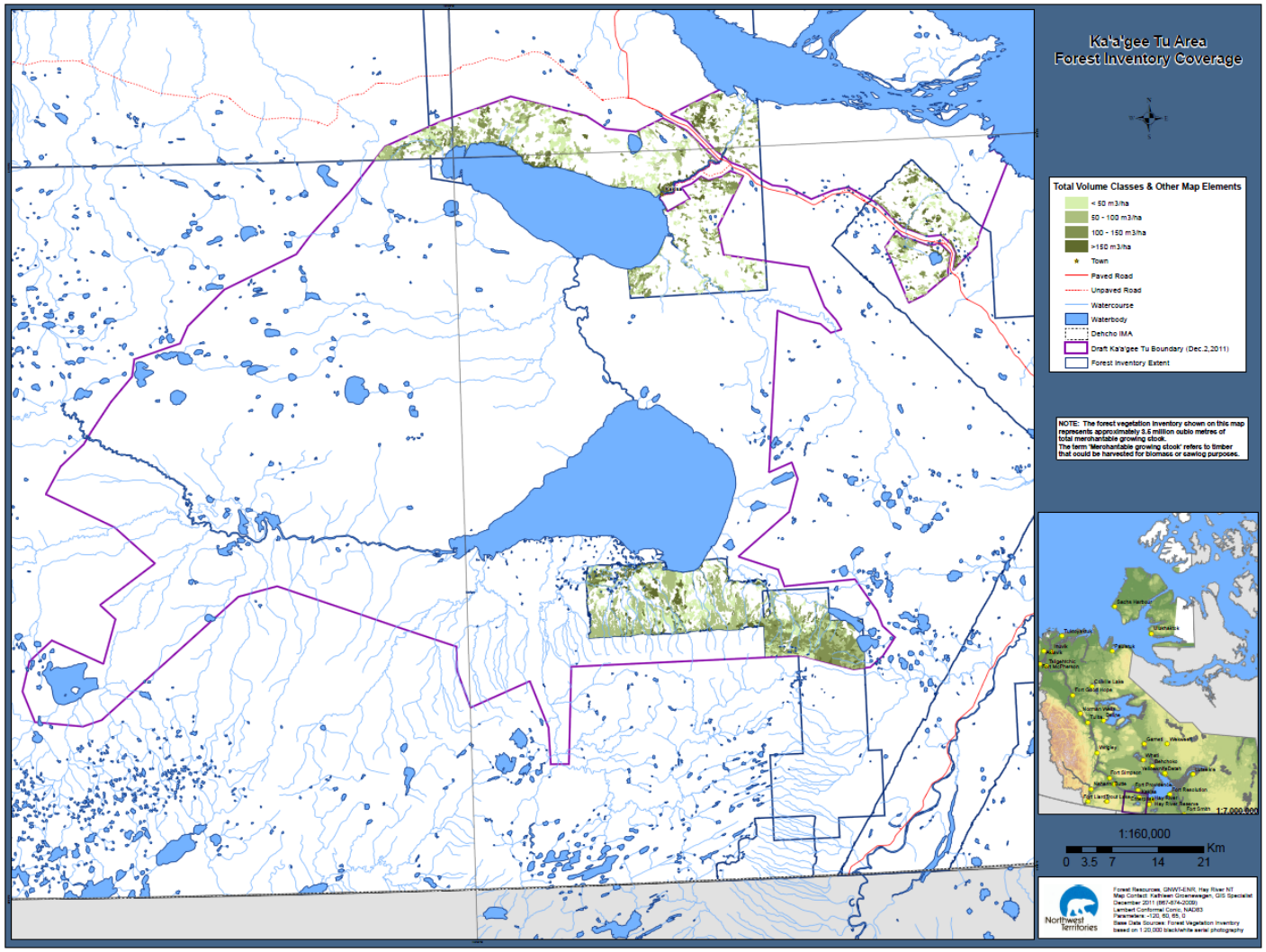
2.2.5 Commercial Logging

In the last five years one commercial permit was issued for harvesting trees in the area. It allowed logging on lands located just outside the Ka'a'gee Tu Candidate Protected Area.

A forest resource assessment of some portions of the area has been completed. These areas are shown in Figure 2-1, and include lands in the Cameron Hills south of Tathlina Lake as well as along the northwest shore of Kakisa Lake. In total there are estimated to be 3.5 million cubic metres of total merchantable growing stock that could be harvested for biomass or sawlog purposes. Less is known about forest resources in other parts of the CPA.

At the present time there are no plans to harvest timber in the region around the CPA. A study is currently underway among the federal and territorial government, five First Nations and a business entity to evaluate the potential for developing a wood pellet plant that would use timber resources from throughout the Dehcho area (Lakusta, pers. comm.). The amount of merchantable timber within those parts of the Ka'a'gee Tu Candidate Protected Area that have been inventoried has not been included in the timber supply assessment, so confirmation of the withdrawal area as a protected area would not preclude a decision to proceed with developing a wood pellet plant in the region. However, if the CPA were to become available for resource development, the timber supply from the unprotected lands in the CPA, including both inventoried areas and areas yet to be inventoried, could support additional forestry development.

Figure 2-1: Forest Inventory Coverage for the Ka'a'gee Tu Candidate Protected Area



Source: Forest Resources, GNWT-ENR 2011.

2.3 Ecological Goods and Services

Various studies have shown that landscapes can generate a variety of benefits other than those listed above. These benefits are related to the ecological goods and services generated by landscapes. Some of the key ecological goods and services related to the Ka'a'gee Tu Candidate Protected Area include the production of drinking water, existence values for species at risk, climate regulation through carbon sequestration, and recreational values for migratory waterfowl. Designation of the area as a National Wildlife Area could create additional existence values.

These values have not yet been described or quantified but Environment Canada has recently issued the terms of reference for a study to assess the value of ecological goods and services being provided by the Ka'a'gee Tu Candidate Protected Area.

2.4 Cultural Values

The Ka'a'gee Tu Candidate Protected Area has historically been used by members of the Ka'a'gee Tu First Nation for subsistence hunting, fishing and gathering other food and resources. The long history of use has left a legacy of old cabins and historical and archaeological sites. Key features are located around Tathlina Lake and its river tributaries, around Kakisa Lake and along the Kakisa River, and along the south shore of Great Slave Lake and the Mackenzie River. Based on information from the Draft Dehcho Land Use Plan (2006), about 5% of the land area in the Ka'a'gee Tu Candidate Protected Area is considered to have very high density of traditional land use and occupancy, 10 has high density, 33% has moderate density, and 41% has low density. Lakes account for the other 11% of the study region. There is no satisfactory method of placing an economic value on the cultural resources of the area. However, the importance of the area is reflected by the desire of the local communities to protect the natural and cultural features of the area, even if it means foregoing economic development that may generate jobs and income for local residents and revenues for local and territorial governments.

2.5 Summary

Based on the available information and the evaluation methods described above, it is estimated that the Ka'a'gee Tu Candidate Protected Area currently contributes between $0.4 and $0.5 million per year in benefits for residents of Kakisa and the other four communities. Table 2-1 shows that traditional resource use, including recreation, contributes 70% of the total value.

Commercial resource use, including commercial fishing, tourism and sales of arts and crafts accounts for 30% of the total. The total value does not include cultural values or the value of ecological goods and services being produced by the area. The accuracy of this estimate is uncertain because of lack of actual use data for the area. However, these values provide a useful baseline against which the benefits and costs of future development can be assessed.

Available evidence suggests that all current uses of the Ka'a'gee Tu Candidate Protected Area are sustainable and that the current patterns and rates of use of the plant, animal and water

resources of the area can continue on an ongoing basis without damaging the productive capacity (natural capital) of the area. The evidence also suggests that, for some activities, even greater levels of use may be possible on a sustainable basis and there may be opportunities for additional activities, such as commercial forestry. Thus, the annual values shown in Table 2-1 are likely conservative and can be expected to continue for the foreseeable future.

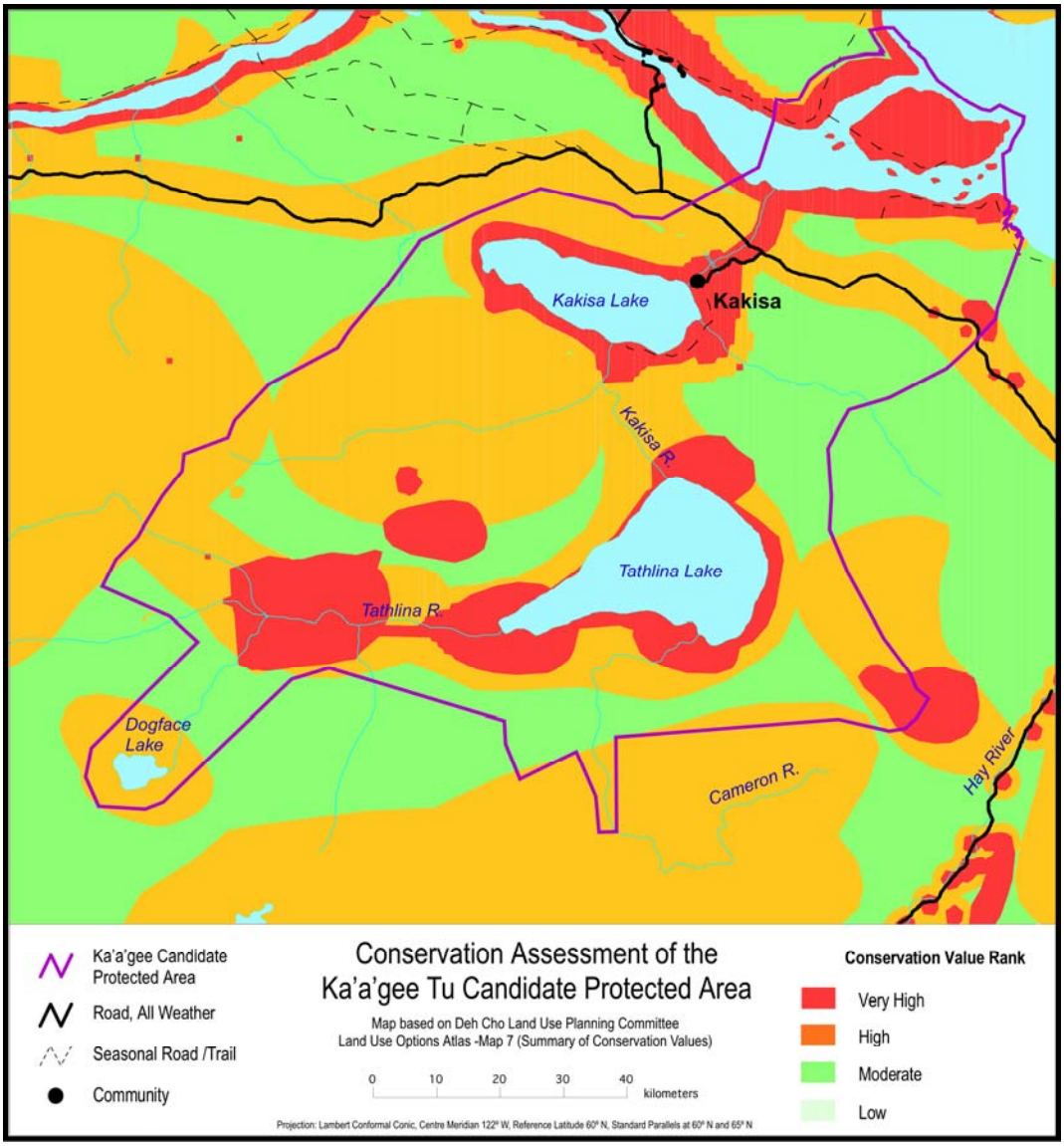
Table 2-1: Current Resource Use Values in the Ka'a'gee Tu Candidate Protected Area

Activity	Nature of Benefit	Revised Estimate
Traditional Resource Use and Values	Country food	$154,400
	Fuel	$72,000
	Recreation Expenditures	$31,400 to $79,800
	Recreation Extra-market benefits	$11,500 to $19,300
Commercial Resource Use and Values	Trapping	$10,100
	Commercial Fishing	$45,860
	Fishing Camps	$48,000 to $60,000
	Tourism Spending	$10,000
	Arts and Crafts	$9,000
	Commercial Logging	$0
	Renewable Energy	$0
Ecological Goods and Services	Unknown	Unknown
Cultural Values		Not Quantified
TOTAL		**$392,260 to $460,460**

2.5.1 Spatial Distribution of Current Uses

It is important to note that, although all the economic benefits listed in Table 2-1 can be attributed to Ka'a'gee Tu Candidate Protected Area, not all landscapes within the area are of equal importance or value. However, given the lack of spatially-specific land and resource use information and related values, it is not possible to assign economic values to specific landscape features in the study area. However, by combining spatial information from the Final Draft Dehcho Land Use Plan with information from the study by Golder Associates (2010), it is possible to identify which areas of the Ka'a'gee Tu area likely to be most important in generating the mix of economic benefits described in Table 2-1. These areas are identified in Figure 2-2, which was developed using information on traditional land use and occupancy, archaeological sites and the location of key wildlife habitat (moose). Based on this map, 34% of the Ka'a'gee Tu Candidate Protected Area is considered to have very high conservation values, 42% has high conservation values and 34% has moderate conservation value.

Figure 2-2: Landscapes Having High Conservation Values in the Ka'a'gee Tu Candidate Protected Area



3.0 POTENTIAL NON-RENEWABLE RESOURCE DEVELOPMENT OPPORTUNITIES

The assessments of non-renewable resources in the Ka'a'gee Tu CPA have concluded that, based on available information, there is some potential for oil and gas development as well as some lead-zinc and other mineral potential. To understand the potential boundary implications for the Ka'a'gee Tu CPA and to compare the non-renewable resource development potential with the traditional and ecological values of the area, it is necessary to develop forecasts of how potential oil and gas and mineral development in the region might be developed. Development scenarios were constructed for oil, gas and mineral development by using existing information to try to answer the following questions:

- What is the resource potential and where is this potential located?
- When will exploration, development and production of this resource potential be expected to occur and what factors will affect the timing?
- What will be the costs of developing these resources?
- What will be the territorial and regional impacts of developing these resources?
- What opportunities will be available for the local economy?
- What are the potential environmental concerns associated with development?
- What are the potential socio-economic concerns associated with development?

Preparation of these scenarios is particularly challenging, given the limited availability of resource information and the uncertainty about the future local, regional, national and international factors that will determine if and when non-renewable resource development in the Ka'a'gee Tu CPA will actually occur. To address these uncertainties, the development scenarios incorporate numerous assumptions about the timing and scale of development that could occur. And, since the ultimate decision to create a National Wildlife Area requires a cost/benefit analysis (as per Treasury Board requirements), the forecasts of resource development have been developed on an annual basis for the next 55 years (to 2065). This level of detail is necessary if we are to correctly compare the relatively short term benefits associated with non-renewable resource development against the long term benefits associated with the traditional use and ecological values of the area.[5]

The scenarios presented in the following section are necessarily simplistic because they do not address the multitude of factors that will ultimately determine if and when resource development

[5] It is sometimes argued that non-renewable resources should simply be valued in terms of the total value of the resource (i.e., the volume of resource multiplied by the current price) but, with this approach, traditional use and ecological values would have infinite value. Consequently, it is necessary to compare the stream of benefits and costs over time. This approach is consistent with benefit/cost analysis, as will be required by Treasury Board in reviewing an application to designate all or parts of the Ka'a'gee Tu Candidate Protected Area as a National Wildlife Area.

would occur. For example, the analyses do not take into consideration potential future changes in development policies, technological advances, royalty rates and other factors that may encourage exploration and development in the NWT. They do not consider how the eventual future devolution of responsibility for resources to the NWT[6] will result in changes to the revenues between the territorial and federal governments; this will not necessarily affect the local and regional share of development benefits. The analyses do not consider how the resources of the NWT will be developed to meet the changing future global demands for and supply of petroleum and base metals, because many of these resources can be found and may be developed in other parts of the world. It does not consider how the negotiation of access and benefits agreements and other collaborative efforts between resource developers and the Dehcho will result in enhanced employment and other benefits for local communities. There is no mention of new technologies that may reduce the costs of exploration and development.

However, given the complexity of these issues and the task at hand, the non-renewable resource development scenarios were formulated based on three fundamental questions:

1. Based on current knowledge about the resource potential of the area in terms of the quantity and quality of those resource, are there sufficient resources to warrant exploration and development?
2. What are the key impediments, such as access and the ability to move resources to markets, which will determine if and when resource development does occur?
3. Based on current practices, policies and management practices, how will the benefits and costs of development be distributed throughout the country, the territory and the region?

The following sections attempt to answer these questions for oil and, gas, mineral, and diamond developments based on available information. A generic discussion of some of the socio-economic issues associated with non-renewable resource development is provided in Section 3.7.

3.1 Natural Gas Development

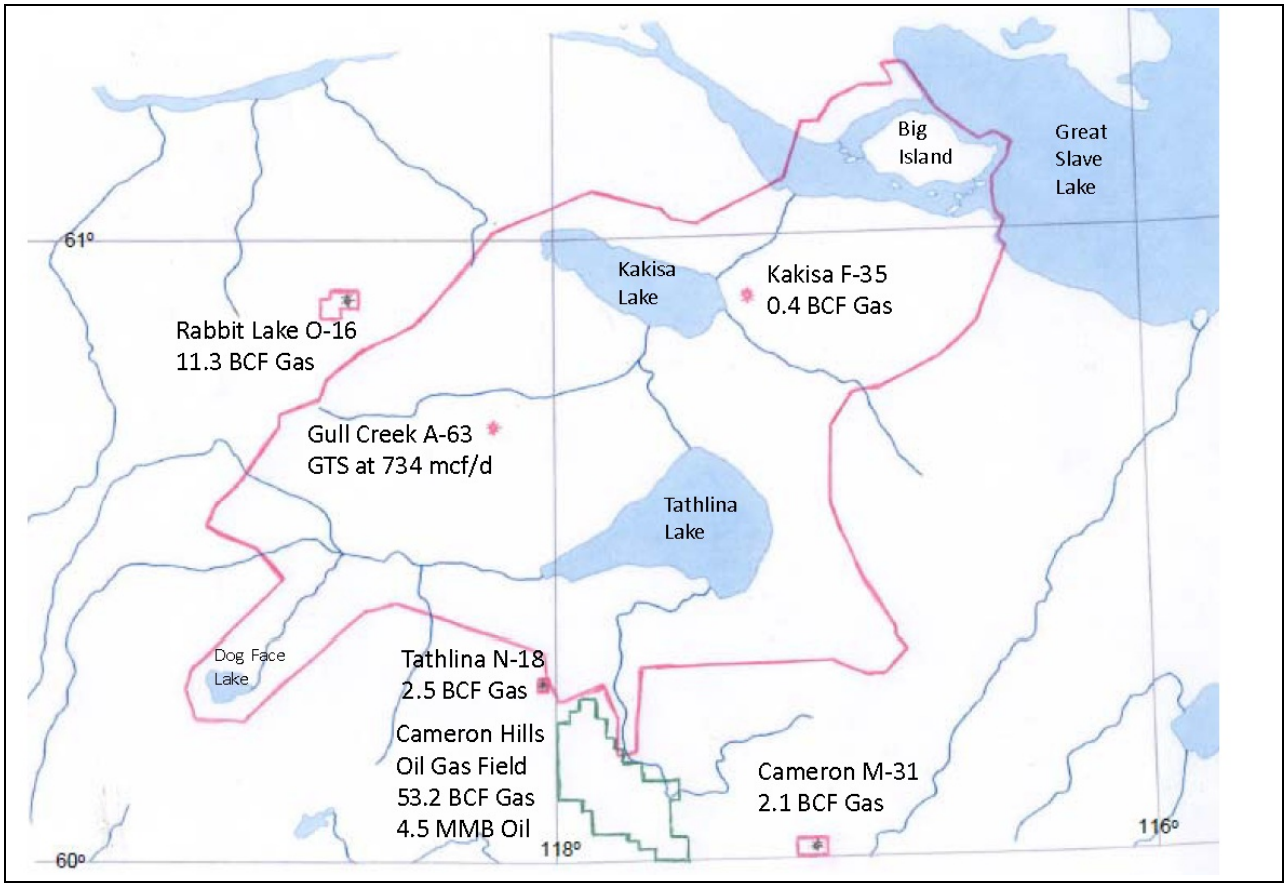
The Ka'a'gee Tu area lies in close proximity to known gas pools and gas fields in the NWT. According to Morrow (2007), nine exploratory natural gas wells have been drilled in or adjacent to the Ka'a'gee Tu CPA: three along the southern boundary in the Cameron Hills, four in the northwest corner near Rabbit Lake, one near Kakisa Lake and one within the Ka'a'gee Tu CPA. The gas fields underlying the Ka'a'gee Tu CPA were estimated to have a combined volume of 0.18 billion cubic metres (Bcm) or 6.4 billion cubic feet (Bcf) of discovered recoverable gas.

[6] A formal process is now underway to negotiate the devolution of Northwest Territories' public lands and resources and rights in respect of water from the Government of Canada to the Government of the Northwest Territories (GNWT).

	Billion cubic metres	Billion cubic feet
Tathlina N-18 gas field	0.07	2.5
Kakisa F-35 gas field	0.01	0.4
Cameron Hills (part)	0.10	3.5
Total gas volume	**0.18**	**6.4**

The location of these natural discoveries is shown in Figure 3-1. A fourth discovery (Gull Creek A-63) is also shown and, although no resources have been assigned, it has been tested at a rate of 20,700 cubic metres per day (Drummond Consulting, 2011). Thus, two of the discoveries are located inside the Ka'a'gee Tu CPA while the other two are located just outside the CPA.

Figure 3-1: Location of Natural Gas and Oil Discoveries in and Adjacent to the Ka'a'gee Tu Candidate Protected Area

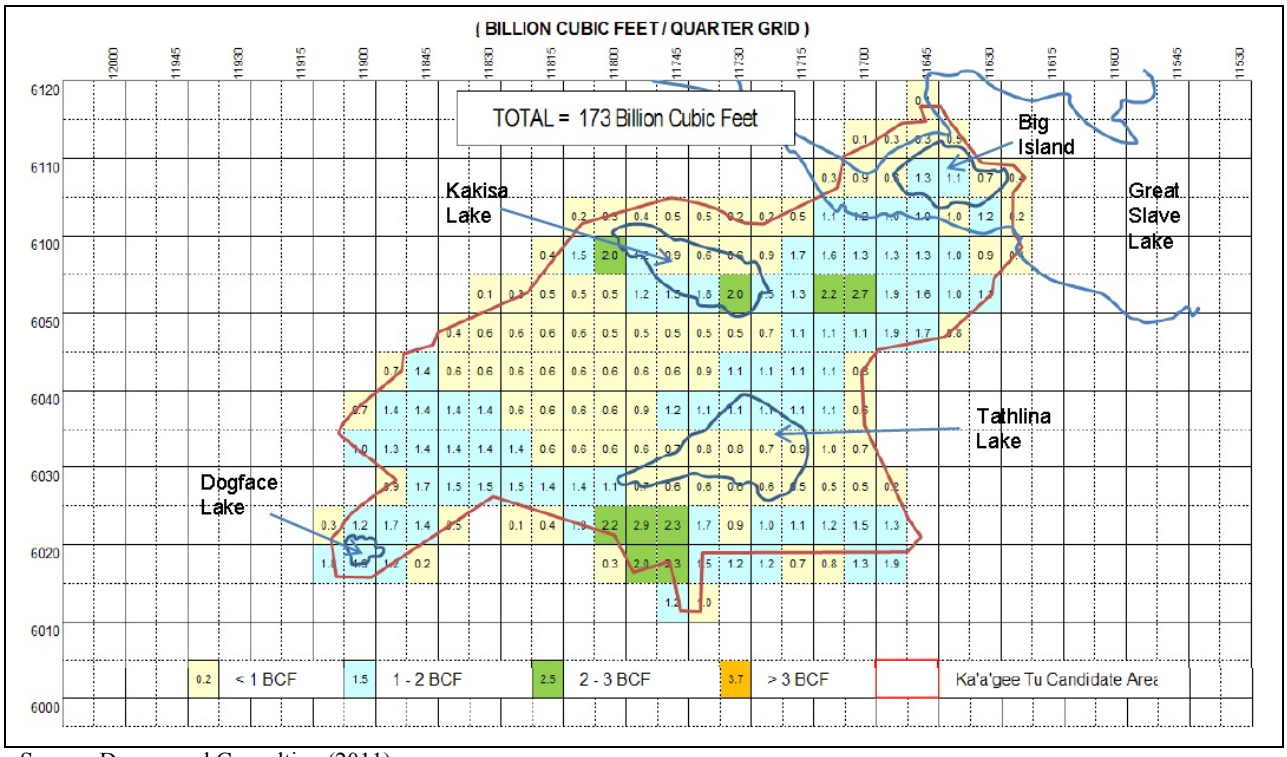


Source: Drummond Consulting (2011)

The area is generally described as low to moderate petroleum potential. Although initial estimates of undiscovered potential ranged from 150 Bcf to 200 Bcf (Morrow 2007), a subsequent analysis (Drummond Consulting, 2011) concluded that the undiscovered recoverable natural gas within the Ka'a'gee Tu CPA was 173 Bcf (4.9 Bcm) with marketable reserves being 153 Bcf (4.3 Bcm). The probable occurrence of this undiscovered recoverable gas is shown by

quarter grid in Figure 3-2. A quarter grid is an area defined by 1/8 of one degree of longitude by 1/12 of one degree of latitude, and consists of an area of approximately 36 km^2. It shows that the greatest potential for discovering larger volumes of natural gas lies in the Cameron Hills area to the south and at the east end of Kakisa Lake.

Figure 3-2: Location of Undiscovered Recoverable Gas Reserves in the Ka'a'gee Tu Candidate Protected Area



Source: Drummond Consulting (2011)

Notes: Gas potential is shown in terms of quarter grids which consist of 1/8 of one degree of longitude and 1/12 of one degree of latitude, an area of approximately 36 km^2.

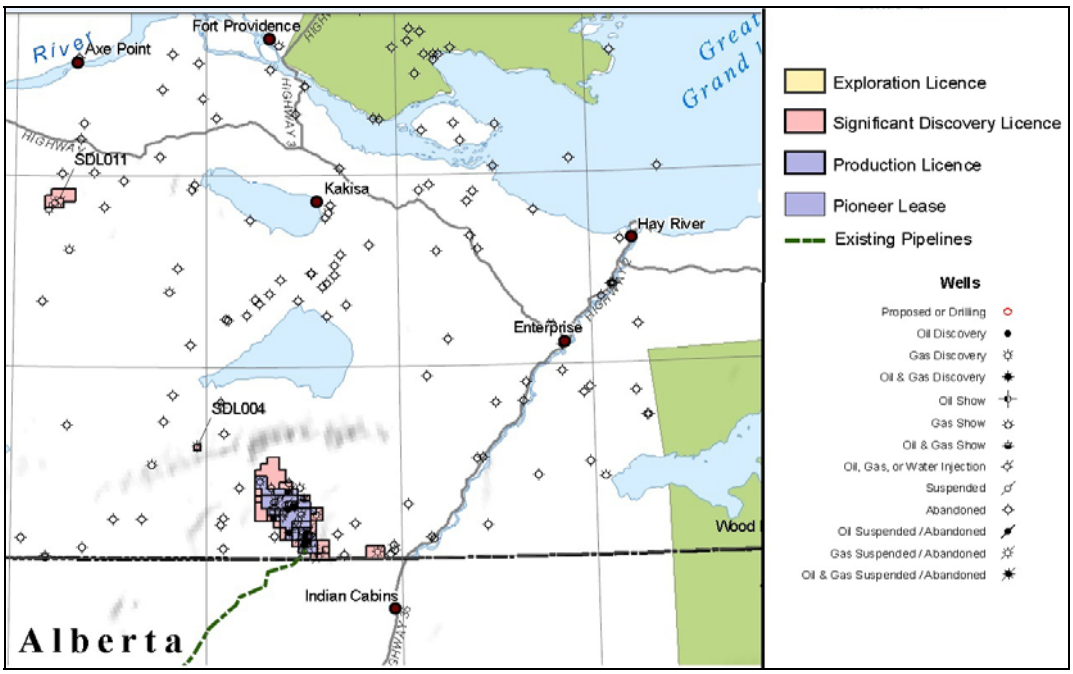
Overall, the discovered and undiscovered natural gas resources in the Ka'a'gee Tu CPA are estimated to total 180 Bcf (5.1 Bcm), indicating that only 3.6% of the potential recoverable natural gas resources have been discovered.

In a regional context, the recoverable gas resources in the Ka'a'gee Tu CPA are believed to account for 3.4% of recoverable gas resources in the entire Dehcho Region and 1.2% of recoverable natural gas reserves in the entire Mackenzie Valley (Drummond Consulting, 2011). The results suggest an average of 5.4 thousand cubic metres (Mcm) of recoverable natural gas per hectare of sedimentary area in the Ka'a'gee Tu CPA. This compares to 8.76 Mcm per hectare in the Dehcho Region and 9.74 Mcm per hectare in the entire Mackenzie Valley. This suggests that, on a per hectare basis, other parts of the Dehcho Region and the Mackenzie valley have higher recoverable gas potential than does the Ka'a'gee Tu CPA.

3.1.1 Development Potential and Timing

Given that the Ka'a'gee Tu CPA is located just north of the Cameron Hills oil and gas field (see Figure 3-3), it is likely that there would be some interest in exploration if subsurface resource exploration and development were to be allowed.

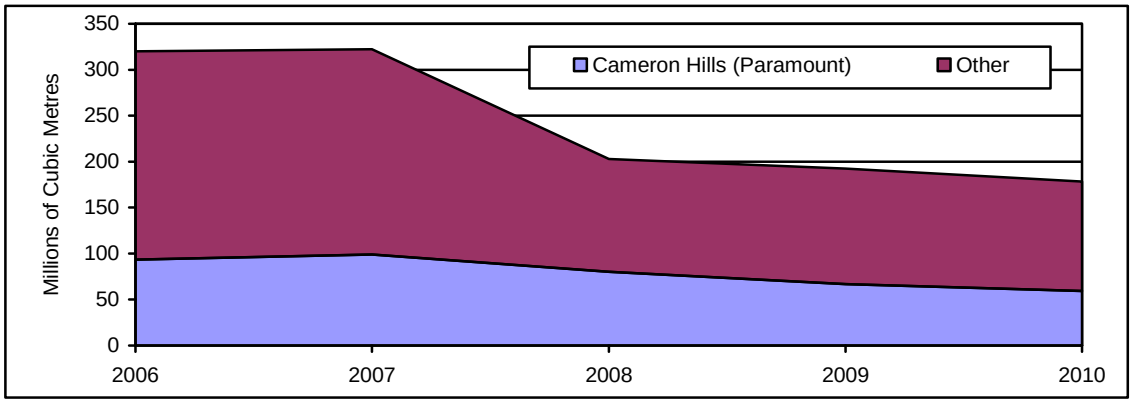
Figure 3-3: Location of the Cameron Hills Oil and Gas Field and Drilling Activity in the Region



Source: AANDC (2010)

For the period from 2006 to 2010, the Cameron Hills field has produced 399 million cubic metres (MMcm) of natural gas; this represents nearly one-third (32.8%) of total natural gas production in the NWT during this period (AANDC, 2011a). As shown in Figure 3-4, natural gas production in the NWT has dropped significantly since 2007 (by 44%).

Figure 3-4: Annual Natural Gas Production in the Cameron Hills and NWT, 2006 to 2010

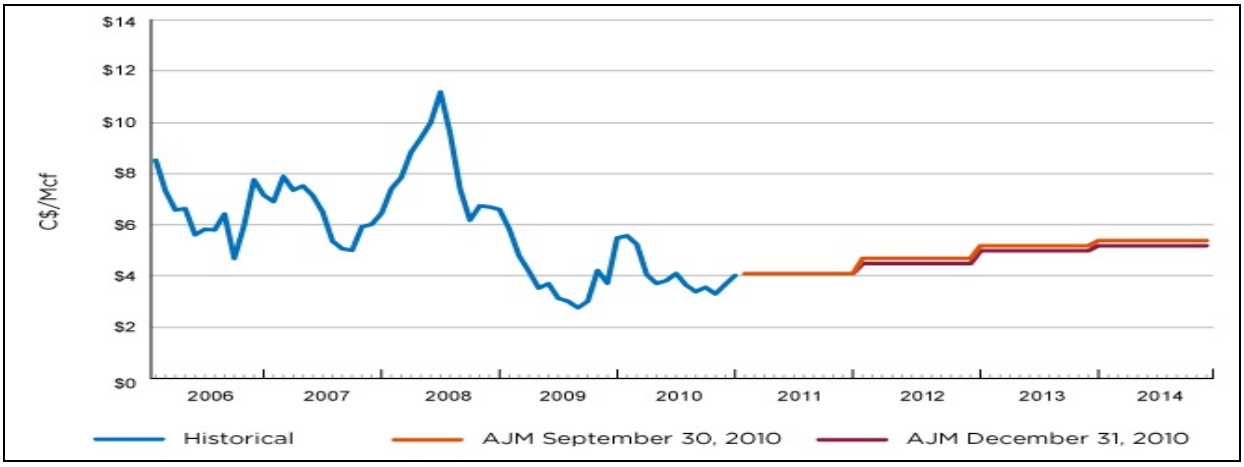


Source: AANDC (2011a)

This decrease was due to two factors: the suspension of natural gas production from two fields near Fort Liard and a 36% decline in gas production from Cameron Hills. Natural gas from the Cameron Hills is delivered by pipeline south to the Bistcho area of northern Alberta.

Given the proximity to the Cameron Hills gas field and the proximity of the infrastructure required to move natural gas to southern markets, it is likely that there will be some interest in exploring for and developing potential natural gas resources in the Ka'a'gee Tu CPA. If the area is opened to gas development, the price of natural gas will likely be the main factor that determines when natural gas exploration and development occur. Although the price of natural gas reached a peak in 2008, it dropped to about $4 per thousand cubic feet (Mcf) in early 2010 and has not risen since. Low prices have led some producers to shut in production from some wells until production is more profitable. Figure 3-5 shows that the price of natural gas is forecast to remain fairly steady for the period to 2014.

Figure 3-5: Conventional Natural Gas Price Forecast (AECO Natural Gas, Real Dollars)



Source: AJM Petroleum Consultants, 2010

Consequently, given the declining production from the Cameron Hills Field and the natural gas price forecast, it is expected that gas exploration activities would commence shortly after the area is made available to development.

3.1.2 Natural Gas Development Scenario

3.1.2.1 Discovered Natural Gas

Given the estimated natural gas potential of the area and that the CPA is opened to exploration and development, it is assumed that the companies that drilled the Kakisa F-35 and Gull Creek A-63 wells would both apply for a Significant Discovery License (SDL). The SDL would give the companies indefinite tenure to all sub-surface resources at each location and allow them to proceed to production when the companies decide it is commercially viable to do so (Aboriginal and Northern Affairs Canada [AANDC], 2011a). The companies can then apply to for a production license which is issued for a term of 25 years. It is expected that production of these

two wells would commence once the necessary surface facilities and connector pipelines are constructed. However, these activities may be delayed until other natural gas reserves in the CPA have been discovered and proven so that there are sufficient resources in the region to justify pipeline construction. If the CPA was opened to development in 2012, it is assumed that development of surface production facilities could be in place by 2015, with production of discovered gas reserves commencing in 2016.

3.1.2.2 Undiscovered Natural Gas

It is assumed that exploration activities in other parts of the Ka'a'gee Tu CPA would commence in 2015. It is assumed that Calls for Bids could be issued for exploration and drilling rights on a number of land blocks in the area. The number of land blocks will depend on the size of the blocks being offered. In the recent (February 2011) Call for Bids in the Central Mackenzie Valley, 11 land blocks were put up for bid and these averaged 81,600 hectares in size (AANDC, 2011b). However, the land blocks in the Cameron Hills oil and gas field tend to be smaller: about 60,000 ha in size.[7] As the Ka'a'gee Tu CPA has a total area of 9,600 km^2, this suggests that as many as 16 land blocks could be put up for bid, although some of the area may be subject to SDLs and production licenses. It is assumed that, because natural gas has already been discovered in the Ka'a'gee Tu CPA and that a pipeline to the area already exists, Calls for Bids on all land blocks could be issued at once.

However, as shown in Figure 3-2, about 58% of the CPA is believed to have low (1.0 to 2.0 Bcf) or moderate (2.0 to 3.0 Bcf) natural gas potential. Thus, it is expected that interest in gas exploration and development would focus on the 42% of the land base in the Ka'a'gee Tu CPA that contains 64% of the undiscovered recoverable natural gas. This represents 7 of the 16 land blocks.

On the assumption that exploratory drilling occurs and that additional natural gas is found, production drilling and related production facilities are assumed to commence five years after the commencement of exploration (in 2020) with production commencing two years later (in 2022). For purposes of analysis it is assumed that production from wells in each of the land blocks would occur over 20 years, although use of enhanced recovery techniques could extend the life of the wells.

3.1.3 Costs of Development

3.1.3.1 Discovered Natural Gas

For the two discovered gas wells in the Ka'a'gee Tu CPA, the costs of development would involve reopening the wells (the Kakisa F-35 well was drilled in 1964 and the Gull Creek A-63

[7] These estimates are based on the interpretation of drilling activity in the Cameron Hills oil and gas field based on information provided by Drummond Consulting (2007).

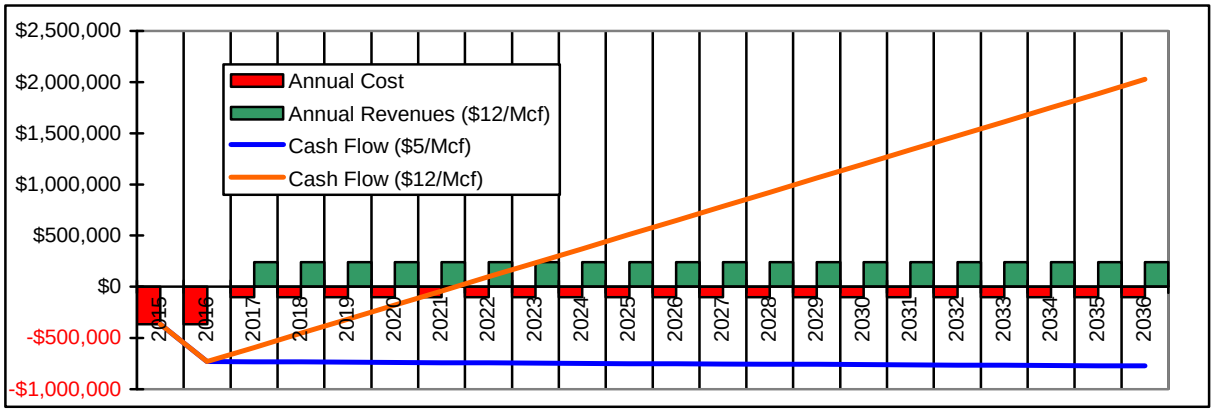
well was drilled in 1970), constructing the surface equipment including gas collection system, and then operating the wells for a period of 20 to 25 years. If the wells were to be drilled today, it is estimated that they would cost an average of $2.1 million each. This estimate is based on information from CAPP (2011) related to net cash expenditures of the petroleum industry in the NWT and Arctic Islands from 2000 to 2009 as well as the number of wells and depth drilled. During this period, the average cost per well drilled in the NWT amounted to about $6,350 per metre. However, this includes drilling in the Arctic Islands which is considerably more expensive than in the Mackenzie Valley. Equivalent costs range from $644 per metre in Alberta to $1,330 per metre in British Columbia. For the Mackenzie Valley average drilling costs are assumed to be $2,500 per metre. Based on the average depth of the two wells (about 838 metres), this suggests an average cost of $2.1 million per well.

According to CAPP (2011) for every dollar spent on development drilling in western and northern Canada, an additional $0.40 is spent on field equipment to support production, which includes pipeline gathering systems. Thus, constructing the surface equipment necessary to produce the wells represents a cost of $0.8 million per well. It is assumed that construction of the surface equipment would occur over a two-year period. Based on CAPP (2011) data, the average annual cost of operating the wells and collection systems is equivalent to about 4% of the value of capital equipment (wells and field equipment), so the average annual cost per land block would be about $0.12 million.

Potential revenues have been calculated assuming that all discovered natural gas resources are extracted over 20 years and assuming a price of $5 per thousand cubic feet (Mcf) as per Figure 3-5). For the Kakisa F-35 well, the annual revenues from 0.4 Bcf of natural gas would not be sufficient to offset the costs of constructing surface facilities and annual operations. The volume of gas is too small to be financially viable at $5 per Mcf (see Figure 3-6, and additional analysis suggests that would require a price of $12 per Mcf to generate an internal rate of return of 14%.[8] Thus, development of the Kakisa F-35 well is not likely to occur unless other natural gas resources can be discovered nearby so that the costs of production can be distributed among several wells.

[8] The internal rate of is the discount rate at which the net present value of costs (negative cash flows) of the investment equals the net present value of the benefits (positive cash flows) of the investment. The higher a project's internal rate of return, the more desirable it is to undertake the project.

Figure 3-6: Cash Flow Analysis on Gas Development from the Kakisa F-35 Well



There is no information on the recoverable reserves for the Gull Creek A-63 well but available information suggests a reported maximum flow of 734 Mcf per day (Drummond Consulting, 2011). Economic modeling suggests that these reserves would be sufficient to yield an internal rate of return of 88% at a price of $5 per Mcf or 73% at a price of $4 per Mcf, although this analysis does not include the cost of constructing a connector pipeline to the Cameron Hills gas field. Thus, it appears that the A-63 well may have sufficient natural gas reserves to warrant development in the near future.

This analysis also suggests that the Tathlina N-18 well, with reserves of 2.5 Bcf, would be financially viable at $5 per Mcf, as would the Cameron M-31 well, with reserves of 2.1 Bcf. However, the financial assessments of these wells do not include the costs of constructing a connector pipeline to the Cameron Hills gas field. Thus, the low current price of natural gas combined with the cost of constructing a connector pipeline may explain why all of the wells around the Ka'a'gee Tu CPA are not yet in production.

Thus, it is not likely that discovered natural gas reserves in the Ka'a'gee Tu CPA will be developed until other, larger natural gas deposits can be delineated and produced and/or the price of natural gas increases considerably.

3.1.3.2 Undiscovered Natural Gas

Under the terms of the bidding process, exploration licenses are issued to those companies that commit to spending the largest amount on exploration over a nine-year period. The recent Call for Bids in the Central Mackenzie Valley saw successful companies committing to spend between $17 and $2,160 per hectare over the nine years, with the average bid being $595 per hectare (AANDC, 2011b). For a block of 60,000 ha, this would suggest a total commitment of nearly $36.0 million, or nearly $4.0 million per year. However, the land in the Central Mackenzie Valley has higher potential for natural gas so the bids for lands in the Ka'a'gee Tu CPA would likely be lower. An average bid of $100 per hectare has been assumed, suggesting a total commitment of $6.0 million per block.

Although exploration licenses are issued for nine years, this consists of two consecutive periods of five and four years. Companies are required to drill one exploratory or delineation well within the first five years as a condition of obtaining tenure for the subsequent four year period. Failure to complete a well within that period of time results in the exploration license being terminated, and the rights revert to the Crown. Companies may also be required to drill a second well to delineate any significant discovery they make.

This bid amount of $6.0 million would be sufficient to drill one exploratory well at a cost of about $2.4 million[9], while the other $3.6 million would be spent on geological and geophysical exploration and possibly a second delineation well per block. Assuming that drilling is successful, construction of surface infrastructure (field equipment) to support production would cost an additional $1.0 million per well. The average annual cost of operating the wells and collection systems would be $0.14 million, based on 4% of the value of capital equipment (wells and field equipment). Given these costs, and assuming that a successful well has been discovered within the first five years of exploration, production could commence two years later. Based on these costs, and assuming a price of $5 per Mcf, such an investment would only be financially viable if reserves of 7.0 Bcf or larger were discovered; this would generate an internal rate of return of 14%. Similar results could be achieved for reserves of 6.0 Bcf at a price of $6 per Mcf, or 7.0 Bcf at a price of $7 per Mcf.

To put these numbers into perspective, the average recoverable natural gas per quarter grid, as shown in Figure 3-2, is about 1.0 Bcf. While 66 of the quarter grids (37% of the area) each have an estimated 1.0 to 2.0 Bcf in undiscovered recoverable natural gas, only 9 quarter grids (5% of the area) each have undiscovered natural gas reserves of 2.0 to 3.0 Bcf. None of the quarter grids have undiscovered natural gas reserves of greater than 3.0 Bcf. Thus, natural gas development in the Ka'a'gee Tu CPA only appears to be financially feasible if drilling identifies recoverable natural gas reserves that are significantly larger (seven times) than the estimated average for the area. Any natural gas exploration that does occur will likely be focused on the 5% of the land base that is believed to have relatively high natural gas reserves, but production will only occur if drilling identifies recoverable natural gas reserves that are two or three times larger than the 2.0 to 3.0 Bcf estimated to occur in these 9 quarter grids. It should be noted that the discovered natural gas reserves in the Cameron Hills (which accounted for 32.8% of total natural gas production in the NWT from 2006 to 2010) were determined to be 53.2 Bcf (Drummond Consulting, 2011).

[9] It is assumed that new wells drilled in the area will be 970 metres deep, based on information from Drummond Consulting (2011), so the drilling costs per well will be higher than for the two existing wells (which average 838 metres in depth).

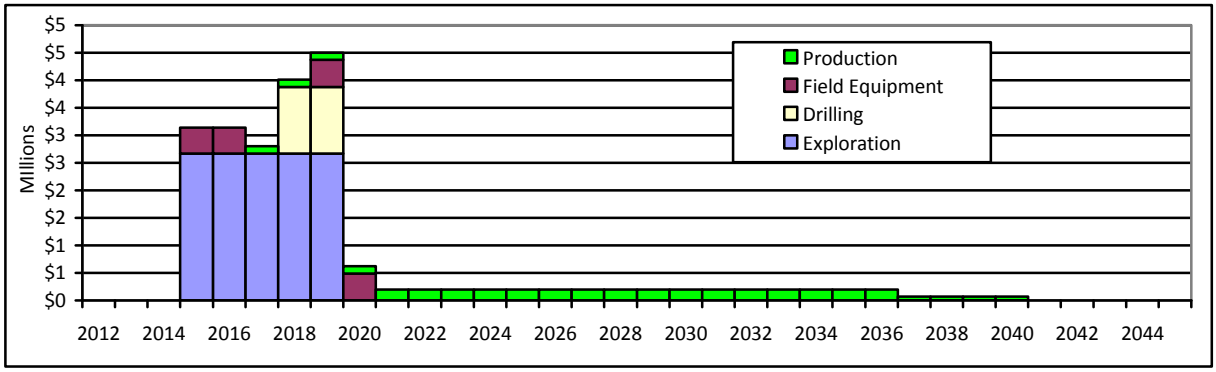
3.1.3.3 Summary

Based on the current price of natural gas and the relatively low availability of natural gas in the Ka'a'gee Tu CPA, there is unlikely to be major interest in natural gas exploration in the area if it were to be made available for exploration. The most likely scenario is that only one of the two existing wells would be developed (the Gull Creek A-63) assuming that natural gas prices are sufficient to warrant construction of a connector pipeline and/or that sufficient other financially viable natural gas reserves are discovered to warrant pipeline construction. The other well (Kakisa F-35) will remain shut-in unless other finds in the same general area warrant pipeline and surface production facilities.

In terms of undiscovered natural gas, it is assumed that the petroleum industry would nominate for exploratory purposes the four general areas within the Ka'a'gee Tu CPA that have quarter grids with undiscovered natural gas reserves of more than 2.0 Bcf. These four areas would be put up for bid, with successful bidders submitting bids of $100 per hectare. There would be some exploration and drilling activity during the first five years and that, although the drilling may be successful, the discoveries may be too small to be commercially viable unless natural gas prices increase considerably.

For purposes of the analysis it is assumed that only one well in the four blocks proves sufficiently large enough to warrant application for a Significant Discovery License and that production from this one well would last for 20 years. Exploration on the other three blocks will prove unsuccessful and will cease after five years. While additional exploration and development may occur at some time in the future if natural gas prices rise, this is likely to be more than 20 years in the future. Under this scenario, companies would spend $21.7 million on natural gas exploration and development over the period from 2012 to 2045. This represents the costs of developing the Gull Creek A-62 well, exploration on four land blocks, and developing one new well with reserves of about 7 Bcf. The overall pattern of expenditures for natural gas development over this period would be as shown in Figure 3-7.

Figure 3-7: Natural Gas Development Cost Scenario for the Ka'a'gee Tu Candidate Protected Area, 2012 to 2040



3.1.4 Impacts of Natural Gas Development on the NWT

The territorial impacts of natural gas development in the Ka'a'gee Tu CPA were estimated using the most recent economic multipliers from the GNWT. Estimates of the potential economic impacts associated with exploration, which involves both geotechnical investigations and drilling) were calculated using a blended multiplier that was based on multipliers for the professional, scientific and technical services industry and for the oil and gas extraction industry. The impacts of developing surface infrastructure (installation of field equipment) and production were calculated using multipliers for the oil and gas extraction industry. Based on the costs and revenues described in Section 3.1.3, the resulting impacts on the economy of the NWT are summarized in Table 3-1.

Table 3-1: Impact of Natural Gas Development in the Ka'a'gee Tu CPA on the Economy of the NWT

		Exploration	Drilling	Field Equipment	Production
Cost (millions)		$13.3	$2.4	$1.9	$4.0
Years		5	2	6	24
Direct and Indirect GDP (millions)	Total	$10.4	$2.2	$1.7	$3.6
	Annual	$1.2	$1.1	$0.4	$0.2
Direct and Indirect Labour Income (millions)	Total	$3.9	$0.2	$0.1	$0.3
	Annual	$0.44	$0.08	$0.03	$0.01
Direct and Indirect Employment (jobs)	Total	51	2	1	3
	Annual	5.7	0.8	0.3	0.1

Table 3-1 shows that the overall economic effect of natural gas development in the Ka'a'gee Tu CPA would be relatively small. As oil and gas development is capital intensive, the effects on employment would be quite small. There would be a minor increase in employment in the NWT (6 jobs per year) for the five years of exploration and the equivalent of 0.8 jobs per year for the two years of drilling and another 0.3 jobs per years during which field equipment is installed. Employment would then drop to about 0.1 person-year per year during production. The overall effect of natural gas development on employment in the NWT is shown in Figure 3-8.

Figure 3-8: Direct and Indirect Employment Associated with Natural Gas Development in the Ka'a'gee Tu Candidate Protected Area, 2012 to 2045

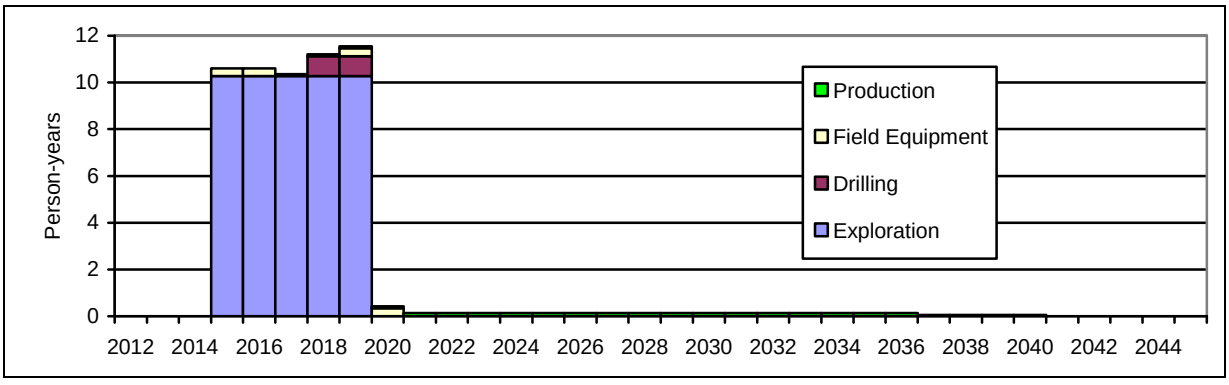


Figure 3-8 shows that annual direct and indirect employment would amount to between 10 and 12 jobs per year for the first five years of development and then drop to less than one person-year per year for the remainder of the forecast period.

This pattern of activity is consistent with the observation that the production activities undertaken by Paramount Resources Ltd. in the Cameron Hills oil and gas fields provided employment for five people between June 2009 and May 2010, including four Paramount employees and a camp operator (Paramount Resources Ltd. 2010). Paramount reported spending $14.2 million during this period, of which $2.3 million (16%) was paid to northern and northern alliance companies. One resident of Kakisa was employed to conduct environmental monitoring for Paramount on a part-time basis.

3.1.5 Opportunities for Local Employment

Development of natural gas reserves in the Ka'a'gee Tu CPA is unlikely to generate major employment or business opportunities for local or regional residents because much of the work involved in natural gas exploration and the construction of surface infrastructure is highly specialized or technical and short-term. At the present time, few if any residents of Kakisa or the Dehcho region will be qualified for this work and the development phases are too short to encourage regional residents to train for these specialized jobs. While this could change as a result of benefits agreements signed between the Dehcho and natural gas exploration and development companies, experience from other projects suggests that the best opportunities for employment of local and regional residents would be as labourers during development and construction, land clearing, camps and catering to drilling crews, and in various other service industries. Overall, it is assumed that 20% of the labour required for natural gas development will consist of residents of the Dehcho Region. Given the very small amount of employment associated with natural gas development in the Ka'a'gee Tu CPA, it is likely that only one or two local or regional residents would be employed during exploration and the installation of surface infrastructure. There would also be limited opportunities for residents of Kakisa, including some additional monitoring work.

3.1.6 Potential Environmental Concerns

Natural gas development has the potential to create a number of environmental issues. These are summarized below and are based on current experience with exploration and pipeline construction practices in Alberta as well as the biophysical effects summary from Volume 1 of the environmental impact statement for the Mackenzie Gas Project (2004). For exploration, the key environmental issues relate to seismic activity which involves cutting lines, potentially resulting in habitat fragmentation, and setting off explosive charges, which creates localized noise issues which can affect wildlife use. Seismic lines typically range in width from 1.75 to 5 metres, so creating 100 linear kilometres of seismic lines could result in the loss of 1.75 to 5 hectares of habitat.

The area around the Cameron Hills has already been heavily impact by human activity. According to Environment Canada (2011) the Ka'a'gee Tu CPA is situated in the Northwest Territories South range for Woodland Caribou, and this range is currently not considered to be capable of supporting a self-sustaining caribou population. About 38% of the range has been disturbed: 28% due to fire and 10% due to man-made disturbances. Nagy (2011) also evaluated habitat for Woodland Caribou and two of his study areas were located around or adjacent to the Ka'a'gee Tu CPA: the South Slave study area and the Cameron Hills study area. He reports that average seismic densities in the Cameron Hills area was 3.33 km of seismic line per km^2, compared to 0.44 km/km^2 in the Dehcho and South Slave study regions. Areas in the Cameron Hills were only an average 263 metres distant from a seismic line, compared to 1347 m in the South Slave area. Caribou in these areas, which had a high diversity and density of predators, avoided seismic lines during all or most of the pre-calving, calving and early summer period. Nagy concludes that caribou perceived unburned areas more than 400 m away from seismic lines as being preferred secure habitats and that Woodland Caribou populations are declining in areas with the least amounts of secure habitat in patches of greater than 500 km^2 are available. Based on these conditions, it is likely that additional seismic activity in and around the Ka'a'gee Tu CPA would reduce the amount of preferred secure habitat and the availability of large secure patches of habitat such that the rate of decline in local caribou populations would accelerate.

Drilling usually requires creating temporary or permanent access roads that can add to fragmentation issues, disrupt hydrology, affect permafrost, generates noise and light pollution during drilling, and can produce potentially hazardous drilling fluids that require disposal. The construction of surface infrastructure, notably connector pipelines, involves additional land clearing that can result in erosion and sedimentation problems, affect wildlife movement and migration, and can cause further habitat fragmentation.

During production, the potential implications of accidental natural gas releases are much less than for oil (unless it is sour gas) and the petroleum industry has developed standard practices that attempt to minimize these effects. The probability of large accidental releases of natural gas is very low. AEUB (2007) statistics indicate that 96% of releases in Alberta were less than 100 cubic metres. In addition, AEUB statistics indicate an average of 1.5 natural gas releases from all causes per 1000 kilometres of pipeline. Given the proximity of the existing Cameron Hills pipeline and the relatively small amounts of pipe needed to connect to this system, the probability of a release in the Ka'a'gee Tu CPA due to additional natural gas development would be very low. The environmental damage associated with natural gas releases would be minimal because the natural gas would dissipate into the environment and, in a worst case scenario, would be ignited and burnt, according to the terms and conditions of their approved emergency response plans.

3.1.7 Potential Benefits and Costs

For the GNWT, it is assumed that most natural gas drilling and production employment would be incremental to expected future economy activity and could be counted as benefits. However, the

employment effects shown in Figure 3-8 include both direct and indirect employment resulting from natural gas development and spin-off effects (indirect employment) are not normally included in a benefit-cost analysis. As noted previously, available information for the NWT does not allow differentiation of direct and indirect effects so, for purposes of this analysis, it is assumed that direct employment accounts for 75% of the overall employment effects shown in Figure 3-8.

The territorial labour income benefits would generally follow the same pattern as in Figure 3-8 although the average annual labour income by drillers, workers installing surface equipment and production workers ($100,000)[10] is higher than for workers doing exploration ($76,623). The actual amount of labour income that can be counted as a benefit will depend on the extent to which unemployed and underemployed labour is employed by natural gas development. If no underemployed labour is involved in natural gas development, then there would be no incremental labour income. However, if all workers were otherwise unemployed, then all of the labour income could be counted as benefits. In 2009, the NWT had an unemployment rate of 10.3%. For purposes of estimating incremental labour income in the NWT during exploration and the installation of surface infrastructure, it is assumed that 10% of labour income associated with natural gas production is estimated to be incremental income earned by workers who would otherwise be unemployed or underemployed. At a regional level, it is assumed that 20% of workers would be unemployed or underemployed, based on the observation that the Dehcho Region had an unemployment rate of 19.1% in 2006, including 22.5% of the labour force in Fort Providence and 25.0% of the labour force in Kakisa[11]. As production would generate new long-term employment, it is assumed that all associated labour income can be counted as a project benefit for both the region and the NWT.

Gas production will generate some corporate taxes and retained profits for the NWT government and NWT-based companies. NWT corporate taxes have been calculated based on 3% of gross revenues (GNWT 2000) and would generate about $0.04 million per year. Total profits have been estimated based on 10% of gross revenues (or $0.14 million per year) and it is assumed that GNWT-based businesses would retain 20% of these profits.

From a Canadian perspective, the exploration, surface infrastructure and operating activities associated with natural gas development would result in incremental labour income benefits that are the same as for the NWT, as this represents income received by workers who would otherwise be unemployed or under-employed. Natural gas production would also generate

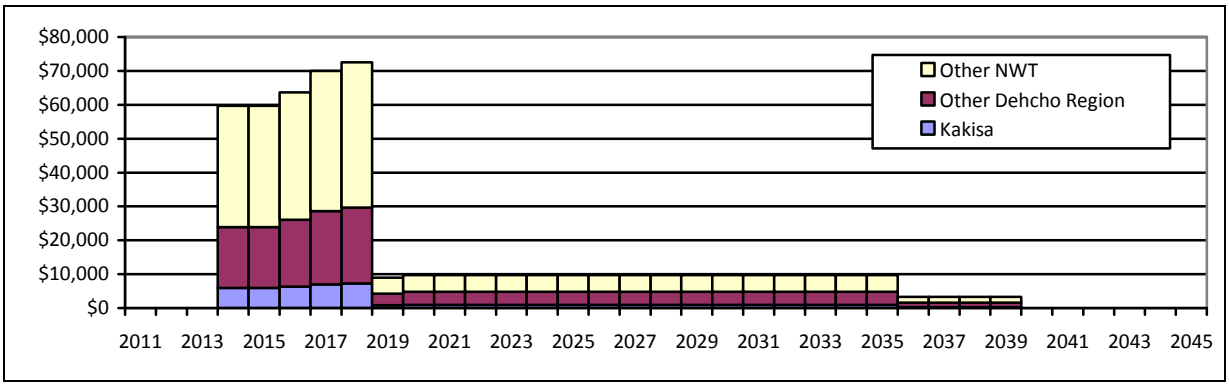
[10] Average income is estimated by dividing the expected direct and indirect labour income resulting from a $1 million in new industry activity by the new direct and indirect employment that would occur. Data are taken from the NWT Bureau of Statistics (2011a).

[11] Kakisa is located in the South Slave Region which includes Hay River and Fort Smith. In 2006 the region had an unemployment rate of 9.0%.

royalty income for the Federal Government (AANDC) [12], federal corporate income tax[13], and profits for Canadian based companies. Based on the production assumptions for the Ka'a'gee Tu CPA, payments to the Federal Government could average $0.2 million per year. Some of these revenues would be diverted to the Dehcho First Nation once the land claim is settled, and the extent of revenues may also change if royalty rates are changed.

Figure 3-9 shows the incremental labour income stream for the Dehcho Region and the NWT, assuming that all phases of natural gas development – exploration, installation of surface infrastructure and production – actually proceed as assumed.

Figure 3-9: Incremental Labour Income Potentially Associated with Natural Gas Development in the Ka'a'gee Tu Candidate Protected Area



As noted earlier, it is assumed that there will be limited opportunities for residents of Kakisa to be employed as part of natural gas development in the Ka'a'gee Tu CPA because they currently lack experience in this type of work, the drilling and exploration phases of development are too short to warrant training for this type of work, and employment during production is very low. Similarly, there is currently no corporate capability in Kakisa to provide goods and services needed to support natural gas development and so no opportunities for profits for local companies. While some opportunities for residents of Kakisa may result from access and benefits agreements and other collaborative efforts to be negotiated between resource developers and the Dehcho, there would still be relatively few opportunities for local employment because of the small amounts of labour being generated by natural gas development.

3.1.8 Summary of Benefits and Costs

Despite the potential amount of total recoverable natural gas reserves in the Ka'a'gee Tu CPA, it is expected that limited exploration and production of these reserves will occur because the estimated volumes of natural gas per quarter grid are too small to commercially produce at

[12] Royalty payments for oil are estimated to be the greater of 30% of net revenues or 5% of gross revenues after project payout (Aboriginal Affairs and Northern Development Canada, 2008).

[13] Corporate federal taxes are assumed to account for 9% of gross revenues (GNWT 2000).

current prices. While a major increase in the real price of natural gas would likely spur exploration in the Ka'a'gee Tu CPA, such large increases are not expected in the foreseeable future. It is expected that, over the next 40 years, exploration would focus on the four general areas within the Ka'a'gee Tu CPA that appear to have the largest undiscovered reserves, and it is assumed that one of the wells drilled will prove to be commercially viable.

The economic benefits of natural gas development have been calculated on the basis of these assumptions. Table 3-2 summarizes these benefits for the period from 2011 to 2045 in terms of total benefits at full value (undiscounted) and discounted using rates of 3.0% and 8.0%. Assuming a discount rate of 8.0%, the net present value (NPV) of the future stream of incremental labour income and other benefits associated with natural gas development in the Ka'a'gee Tu CPA over the period to 2045 is estimated to be $7.4 million for Canada, of which $1.6 million will occur in the NWT, and $0.18 million will accrue in the Dehcho Region. For residents of Kakisa, the NPV of future labour income benefits would be $0.03 million.

Table 3-2: Net Present Value of Benefits Associated with Natural Gas Development in the Ka'a'gee Tu Candidate Protected Area

Benefit	Undiscounted	Discounted (3.0%)	Discounted (8.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$0.5	$0.4	$0.3
Royalties	$3.1	$2.1	$1.3
Canadian taxes	$5.6	$3.8	$2.4
NWT taxes	$1.9	$1.3	$0.8
Retained profits	$6.2	$4.2	$2.6
Total	$17.2	$11.7	$7.4
NPV of Benefits for NWT (millions)			
Labour Income	$0.5	$0.4	$0.3
NWT taxes	$1.9	$1.3	$0.8
Retained profits	$1.2	$0.8	$0.5
Total	$3.6	$2.5	$1.6
Percent of Canada	21%	21%	22%
NPV of Benefits to the Dehcho Region (millions)			
Labour Income	$0.22	$0.17	$0.12
Retained profits	$0.12	$0.08	$0.05
Total	$0.34	$0.25	$0.18
Percent of NWT	10%	10%	11%
NPV of Benefits to Kakisa (millions)			
Labour Income	$0.06	$0.04	$0.03
Percent of Dehcho Region	16%	17%	18%

Note: Totals may not add due to rounding

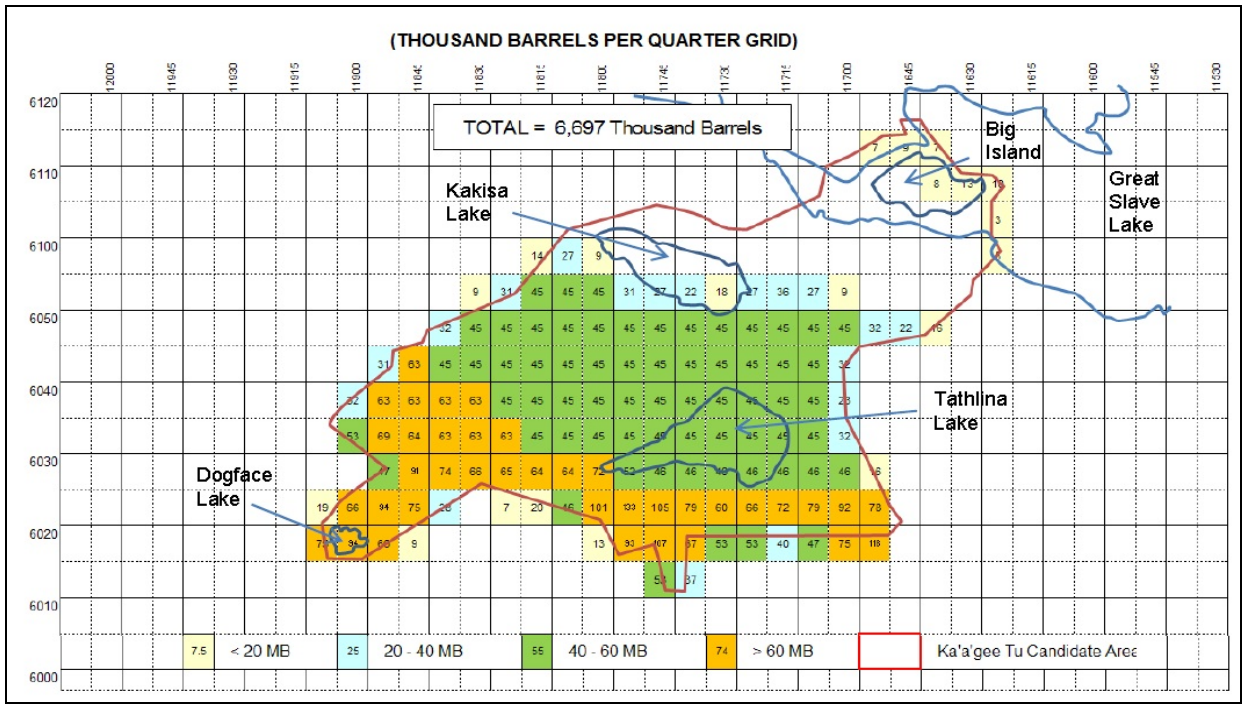
Table 3-2 shows that, of the $7.4 million in benefits of natural gas development in the Ka'a'gee Tu CPA that accrue to Canada, 36% would be in the form of retained profits for Canadian companies ($2.6 million), another 32% would be from Federal corporate taxes ($2.4 million), and 18% would be from royalties ($1.3 million). About 22% of the benefits of natural gas development in the Ka'a'gee Tu CPA would accrue to the government and people of the NWT.

Residents of Dehcho Region are expected to account for 11% of the incremental labour income and other benefits experienced in the NWT, of which residents of Kakisa could account for 18%.

3.2 Oil Development

Although no oil has been discovered in the Ka'a'gee Tu Candidate Protected Area, there is some potential for oil in the study region. According to Morrow (2007), oil prospectively is low to moderate, with preliminary estimates of 6.0 million barrels of oil, largely from reservoirs that produce both oil and gas. A more recent analysis (Drummond Consulting, 2011) concluded that there are 1.1 million cubic metres (MCM) or 6.7 million barrels of recoverable oil in the area. The probable occurrence of this undiscovered recoverable oil is shown by quarter grid in Figure 3-10. A quarter grid is an area defined by 1/8 of one degree of longitude by 1/12 of one degree of latitude, and consists of an area of approximately 36 square kilometres (km^2). It shows that the greatest potential for discovering larger volumes of oil lies in the Cameron Hills along the southern end of the area.

Figure 3-10: Location of Undiscovered Recoverable Oil Reserves in the Ka'a'gee Tu Candidate Protected Area



Source: Drummond Consulting (2011)
Notes: Gas potential is shown in terms of quarter grids which consist of 1/8 of one degree of longitude and 1/12 of one degree of latitude, an area of approximately 36 km^2.

In a regional context, the recoverable oil resources in the Ka'a'gee Tu CPA are believed to account for 10.8% of recoverable oil resources in the entire Dehcho Region and 1.1% of recoverable oil reserves in the entire Mackenzie Valley (Drummond Consulting, 2011). The results suggest an average of 1.1 cubic metres (m^3) of recoverable oil per hectare of sedimentary

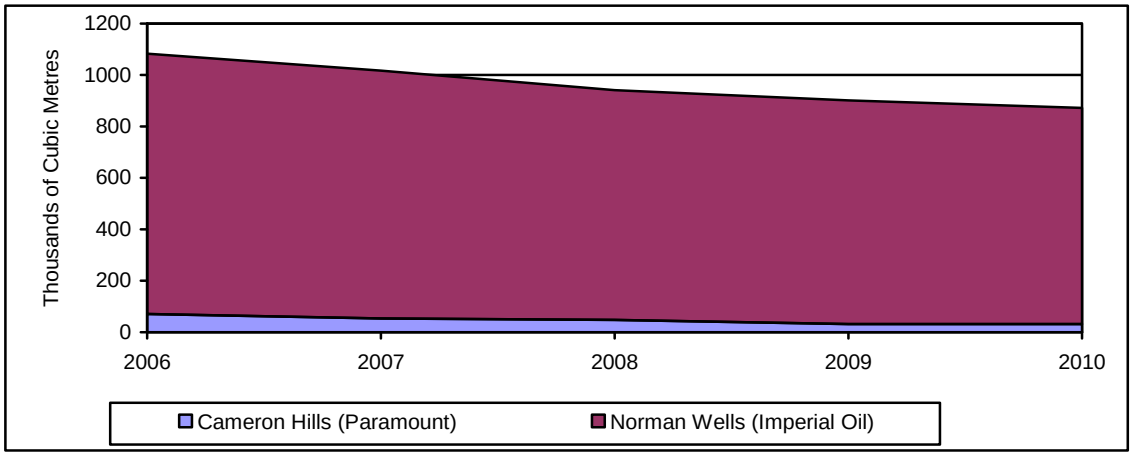
area in the Ka'a'gee Tu CPA. This compares to 0.6 m^3 per hectare in the Dehcho Region and 2.2 m^3 per hectare in the entire Mackenzie Valley. This suggests that, on a per hectare basis, the Ka'a'gee Tu CPA has higher oil potential than do other parts of the Dehcho Region, but lower oil potential than other parts of the Mackenzie valley.

3.2.1 Development Potential and Timing

There is a reasonable probability that the oil deposits in the Ka'a'gee Tu CPA would be developed in the near future if subsurface resource exploration and development were to be allowed. This conclusion is based on the observation that the Ka'a'gee Tu CPA is located just north of the Cameron Hills oil and gas field (see Figure 3-3).

For the period from 2006 to 2010, the Cameron Hills field has produced 235 thousand cubic metres (Mcm) of oil; this represents 4.9% of total oil production in the NWT during this period (AANDC, 2011a), with the balance coming from Norman Wells. As shown in Figure 3-11, oil production in the NWT has dropped significantly since 2007 (by 20%). This decrease was due to a 17% drop in production from the oil fields at Norman Wells and a 55% decline in oil production from Cameron Hills. Oil from the Cameron Hills is delivered by pipeline south to the Bistcho area of northern Alberta. Paramount Resources Ltd. is now using "fracking" in the Cameron Hills to increase the productivity of its existing wells.

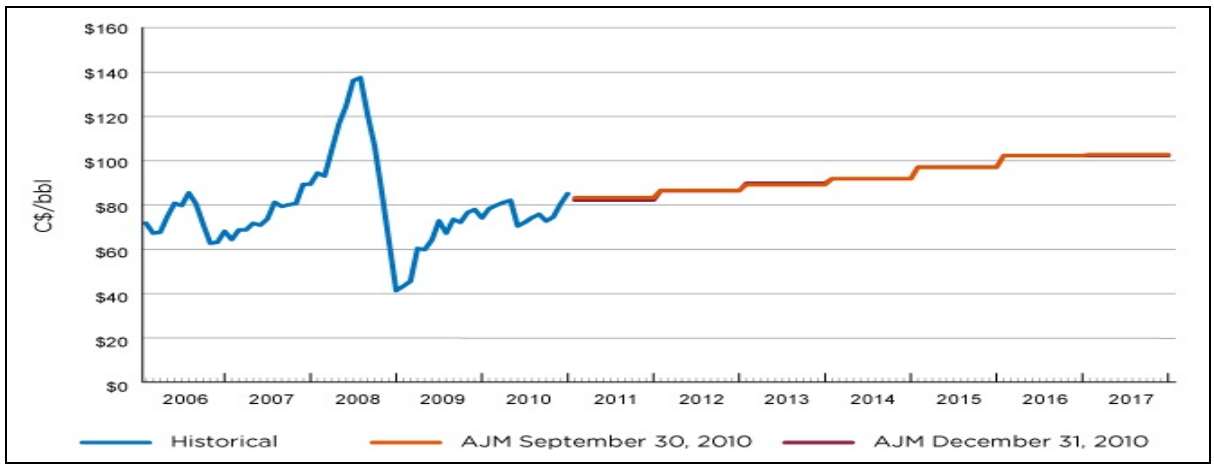
Figure 3-11: Annual Oil Production in the Cameron Hills and NWT, 2006 to 2010



Source: AANDC (2011a)

Given the proximity to the Cameron Hills oil field, the availability of the infrastructure required to move oil to southern markets and the declining production from existing oil wells in the Cameron Hills, it is likely that there could be some interest in developing potential oil resources in the Ka'a'gee Tu CPA. One of the key factors affecting potential development will be the price of oil. As shown in Figure 3-12, the long term price of conventional oil is expected to increase gradually, exceeding $100 per barrel by 2016. It is expected that this will trigger oil exploration and development in areas with higher potential reserves and low exploration and development costs.

Figure 3-12: Conventional Crude Oil Price Forecast (Edmonton Par Crude Oil, Real Dollars)



Source: AJM Petroleum Consultants, 2010

Consequently, given the declining production from the Cameron Hills field and the oil price forecast, it is expected that oil exploration activities would commence shortly after the area is made available to development.

3.2.2 Oil Development Scenario

Given that exploration to date has not yet discovered any oil in the Ka'a'gee Tu CPA to date, oil development would initially focus on exploration and drilling, with development of surface production facilities and production if financially viable oil reserves can be identified. It is assumed that oil exploration activities in the Ka'a'gee Tu CPA would commence in 2015 and would be done in conjunction with natural gas exploration. As discussed in Section 3.1.2, as many as 16 land blocks could be put up for bid. However, as shown in Figure 3-10, about 27% of the CPA is believed to have low oil potential (less than 40,000 barrels), and another 46.5% of the area is considered to have moderate potential (40,000 to 60,000 barrels) of undiscovered recoverable oil. Thus, it is expected that interest in oil exploration and development would focus on the 27% of the land base in the Ka'a'gee Tu CPA that contains 44% of the undiscovered recoverable oil on those quarter grids with more than 60,000 barrels of recoverable oil. These areas are located along the southern edge of the Ka'a'gee Tu CPA and generally coincide with some of the areas with medium to high natural gas potential. The areas with highest oil potential would represent 4 of the 16 possible land blocks that could be put up for bid.

On the assumption that exploratory drilling occurs and that oil is found, installation of field equipment production and related production facilities is assumed to commence four years after the commencement of exploration (in 2019) with production commencing in the following year (2020). For purposes of analysis it is assumed that production from wells in each of the land blocks would occur over 20 years, although use of enhanced oil recovery techniques, such as water floods, could extend the life of the wells.

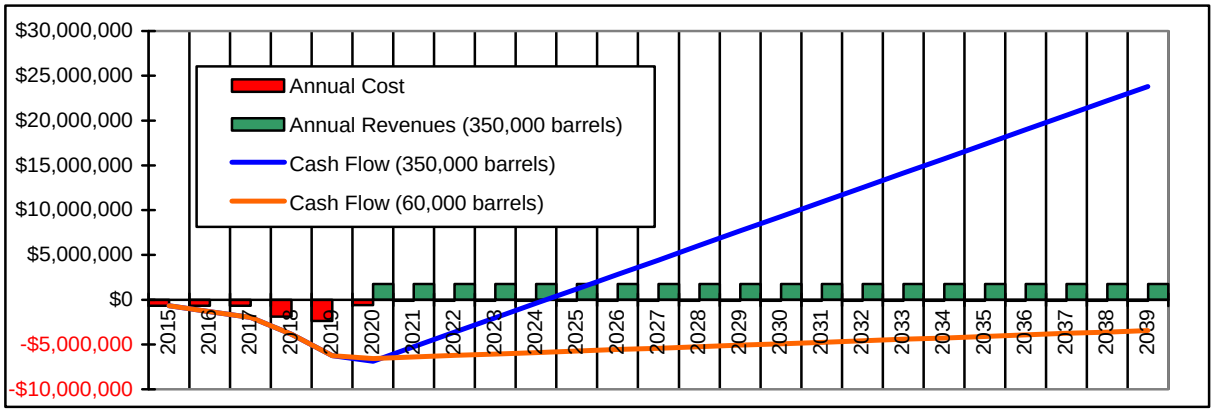
3.2.3 Costs of Development

As noted in Section 3.1.3, it is assumed that companies would commit to spend $100 per hectare in each land block over nine years and that the land blocks put up for bid would be would be 60,000 ha in size. This suggests a total exploration commitment of $6.0 million per block. For the four land blocks with high oil potential, this suggests that the total cost of exploring for oil reserves in the Ka'a'gee Tu CPA would be $24.0 million.

The bid amount of $6.0 million amount would be sufficient to drill one exploratory well at a cost of about $2.4 million, based on a depth of 970 metres and an average cost of $2,500 per metre. The other $3.6 million would be spent on geological and geophysical exploration and possibly a second delineation well per block, Assuming that drilling is successful, construction of surface infrastructure (field equipment) to support production would cost an additional $1.0 million per well. The average annual cost of operating the wells and collection systems would be $0.14 million, based on 4% of the value of capital equipment (wells and field equipment). Given these costs, and assuming that a successful well has been discovered within the first five years of exploration, production could commence two years later.

Based on these costs, and assuming a price of $100 per barrel, actual production of a well would only be financially viable if reserves of 350,000 barrels or larger were discovered. Total revenues from such a reservoir would amount to $35 million, compared to total costs of $9.4 million, and would generate an internal rate of return of 17% (see Figure 3-13). The analysis also shows that a reservoir with only 60,000 barrels would not generate sufficient revenues to cover costs.

Figure 3-13: Cash Flow Analysis for Oil Development



To put these numbers into perspective, Figure 3-10 shows that the highest oil potential is located in 38 quarter grids that have more than 60,000 barrels of undiscovered recoverable oil, and the recoverable oil from these quarter grid average 77,400 barrels. Only five of the quarter grids are estimated to have more than 100,000 barrels, and the highest is estimated to have 118,000 barrels. These amounts are well below the threshold of 350,000 barrels that would be required

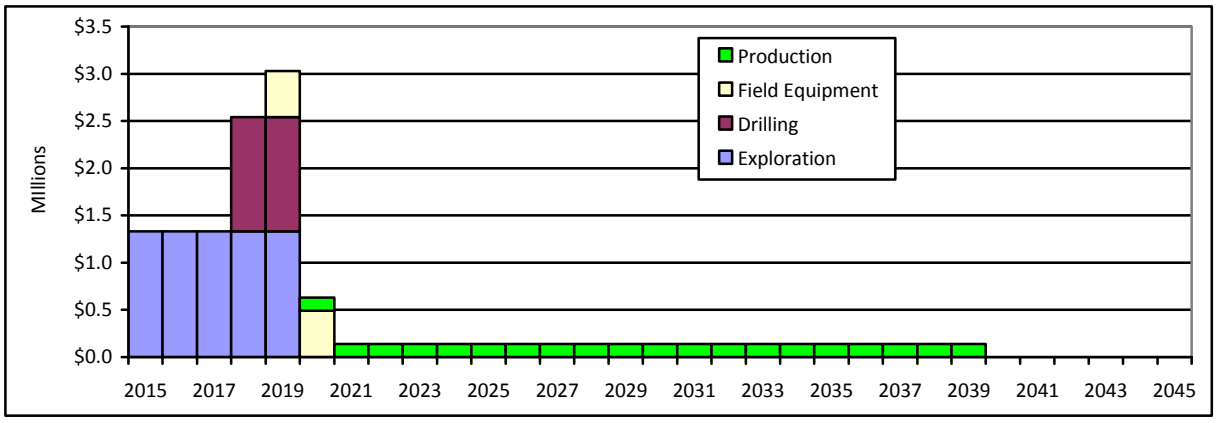
for oil extraction to be financially viable. It should be noted that the discovered oil reserves in the Cameron Hills were determined to be 4.5 million barrels (Drummond 2011).

Thus, oil development in the Ka'a'gee Tu CPA only appears to be financially feasible if drilling identifies recoverable oil reserves that are significantly larger (4.5 times) than the estimated average for the 27% of the area that is believed to have the highest oil potential. Any oil exploration that does occur will likely be focused on the 5 quarter grids (3.5% of the land base) that are believed to have the highest oil reserves, but production will only occur if drilling identifies recoverable oil reserves that are three times larger than 100,000 barrels estimated to occur in these 5 quarter grids.

Thus, it is assumed that the petroleum industry would nominate for exploratory purposes the two general areas within the Ka'a'gee Tu CPA that have quarter grids with undiscovered oil reserves of more than 100,000 barrels. These two areas would be put up for bid, with successful bidders submitting bids of $100 per hectare. There would be some exploration and drilling activity during the first five years and that, although the drilling may be successful, the discoveries may prove too small to be commercially viable.

For purposes of the analysis it is assumed that only one well in the two blocks will prove sufficiently large enough to warrant application for a Significant Discovery License and that production from this one well would last for 20 years. Exploration on the other block will prove unsuccessful and will cease after five years. Under this scenario, companies would spend $12.8 million on oil exploration and development over the period from 2012 to 2045. The overall pattern of expenditures for natural gas development during this period would be as shown in Figure 3-14.

Figure 3-14: Oil Development Cost Scenario for the Ka'a'gee Tu Candidate Protected Area, 2015 to 2045



3.2.4 Impacts of Oil Development on the NWT

The territorial impacts of oil development in the Ka'a'gee Tu CPA were estimated using the most recent economic multipliers from the GNWT. Estimates of the potential economic impacts associated with exploration were calculated using multipliers for the professional, scientific and

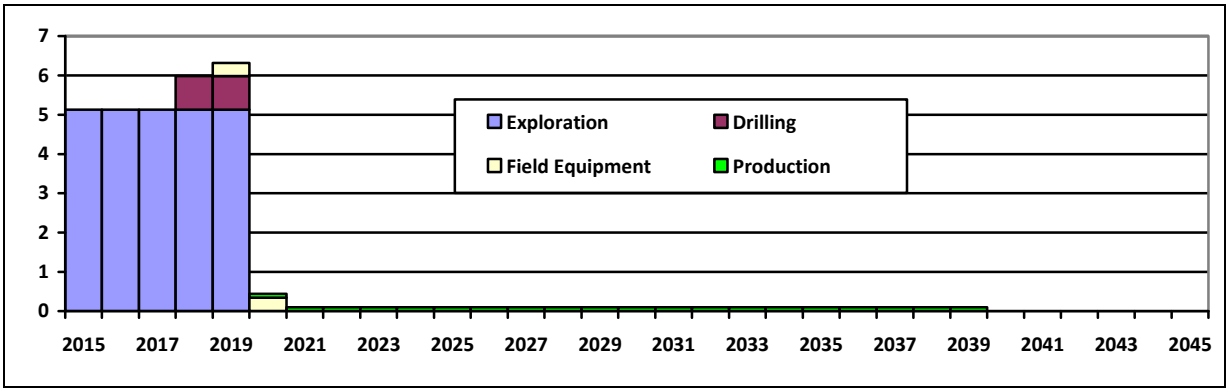
technical services industry. The potential economic impacts associated with drilling and the installation of field equipment and were calculated using multipliers for the oil and gas extraction industry. The economic impacts of operations were estimated using the multipliers for the pipeline transportation industry. Based on the costs and revenues described in Section 3.2.3, the resulting impacts on the economy of the NWT are summarized in Table 3-3.

The table shows that oil exploration would produce a relatively small increase in employment in the NWT (about 5 direct and indirect jobs) during each year of exploration. Drilling would provide 0.8 jobs per year while installation of field equipment would create 0.3 jobs per year. Production would generate about 0.1 jobs per year. The overall effect of oil development on employment in the NWT is shown in Figure 3-15.

Table 3-3: Impact of Oil Development in the Ka'a'gee Tu Candidate Protected Area on the Economy of the NWT

		Exploration	Drilling	Field Equipment	Production
Cost (millions)		$6.7	$2.4	$1.0	$2.7
Years		5	2	2	20
Direct and Indirect GDP (millions)	Total	$5.2	$2.2	$0.9	$2.5
	Annual	$1.0	$1.1	$0.4	$0.1
Direct and Indirect Labour Income (millions)	Total	$2.0	$0.2	$0.1	$0.2
	Annual	$0.39	$0.08	$0.03	$0.01
Direct and Indirect Employment (jobs)	Total	26	2	1	2
	Annual	5.1	0.8	0.3	0.1

Figure 3-15: Direct and Indirect Employment Associated with Oil Development in the Ka'a'gee Tu Candidate Protected Area, 2015 to 2045



3.2.5 Opportunities for Local Employment

Development of the oil reserves in the Ka'a'gee Tu CPA is also unlikely to generate major employment or business opportunities for local or regional residents. As noted in Section 3.2.4, much of the work involved in oil exploration, drilling, or the construction of surface infrastructure is highly specialized or technical and short-term. At the present time, few if any

residents of Kakisa or the Dehcho region will be qualified for this work and the development phases are too short to encourage regional residents to train for these specialized jobs. Experience from other projects suggests that the best opportunities for employment of local and regional residents would be as labourers during development and construction, land clearing, camps and catering to drilling crews, and in various other service industries. Overall, it is assumed that 20% of the labour required for natural gas development will consist of residents of the Dehcho Region. Given the very small amount of employment associated with natural gas development in the Ka'a'gee Tu CPA, it is likely that only one or two local or regional residents would be employed during exploration and the installation of surface infrastructure. These numbers could be higher as a result of benefits agreements to be signed between the Dehcho and oil exploration and development companies. As was the case for natural gas development, there would also be limited opportunities for residents of Kakisa by providing some additional monitoring work.

3.2.6 Potential Environmental Concerns

Oil development has the potential to create the same types of environmental issues as gas development (see Section 3.1.6). For exploration, the key environmental issues relate to seismic activity which involves cutting lines, potentially resulting in habitat fragmentation, and setting off explosive charges, which creates localized noise issues. As noted previously, there has been extensive seismic activity in the Cameron Hills (3.33 km of seismic per km^2), and any increased seismic activity as a result of exploration in the Ka'a'gee Tu CPA could cause further reductions in Woodland Caribou populations in the region.

Drilling usually requires creating temporary or permanent access roads that can add to fragmentation issues, generates noise and light pollution during drilling, and can produce potentially hazardous drilling fluids that require disposal. Pipeline construction involves land clearing that can result in erosion and sedimentation problems, affect wildlife movement and migration, and can cause further habitat fragmentation. It is estimated that drilling one well would result in disturbance of 1.0 hectares of land plus additional habitat losses where roads and pipelines are constructed. Assuming a corridor width of 10 metres, development of 10 kilometres of pipeline to the Cameron Hills would result in the loss of an additional 10 hectares of land. Additional land would be needed for collector pipelines. For this analysis it is assumed that an equivalent amount of habitat would be lost due to these connector pipelines and associated corridors.

During operations, potential environmental issues include accidental releases (oil spills) and the continued maintenance of the pipeline will perpetuate issues related to erosion and sedimentation, wildlife movements, and habitat fragmentation. According to statistics from the Alberta Energy and Utilities Board (2007), there was an average of 1.3 oil pipeline incidents (including hits, leaks and ruptures) per 1,000 kilometres of pipelines of all ages and sizes in Alberta between 2000 and 2006. Furthermore, the AEUB statistics indicate that 96% of releases were less than 100 cubic metres in volume.

3.2.7 Potential Benefits and Costs

To assist in assessing the potential implications of various boundary options for the Ka'a'gee Tu CPA, the benefits and costs of oil production must be assessed for inclusion in a project benefit/cost analysis. Consequently, it is necessary to estimate the extent to which a proposed activity would add to or subtract from the flow of benefits and costs if the activity did not occur.

From the perspective of the GNWT, it is assumed that most exploration, drilling and production employment would be incremental to expected future economy activity and could be counted as benefits. However, the employment effects shown in Figure 3-15 include both direct and indirect employment resulting from oil development and spin-off effects (indirect employment) are not normally included in a benefit-cost analysis. As was noted in Section 3.1.7, information for the NWT does not allow differentiation of direct and indirect effects so it is assumed that direct employment accounts for 75% of the overall employment effects shown in Figure 3-15.

The territorial labour income benefits would generally follow the same pattern as in Figure 3-15 although the average annual labour income by drillers and workers constructing field equipment and doing production ($100,000) is higher than for workers doing exploration ($76,623). The actual amount of labour income that can be counted as a benefit will depend on the extent to which unemployed and underemployed labour is employed by oil and gas development. If no underemployed labour is involved in oil development, then there would be no incremental labour income. However, if all workers were otherwise unemployed, then all of the labour income could be counted as benefits. As noted earlier, the NWT had an unemployment rate of 10.3% in 2009. For purposes of estimating incremental labour income in the NWT during exploration and the installation of surface infrastructure, it is assumed that 10% of labour income associated with oil production is estimated to be incremental income earned by workers who would otherwise be unemployed or underemployed.

As was assumed for the natural gas development scenario, it is expected that 20% of regional workers would be unemployed or underemployed, based on the observation than, in 2006, the Dehcho Region had an unemployment rate of 19.1% in 2006, including 22.5% of the labour force in Fort Providence. Locally, 25.0% of the labour force in Kakisa was unemployed in 2006. As production would generate new long-term employment, it is assumed that all associated labour income can be counted as a project benefit for both the region and the NWT.

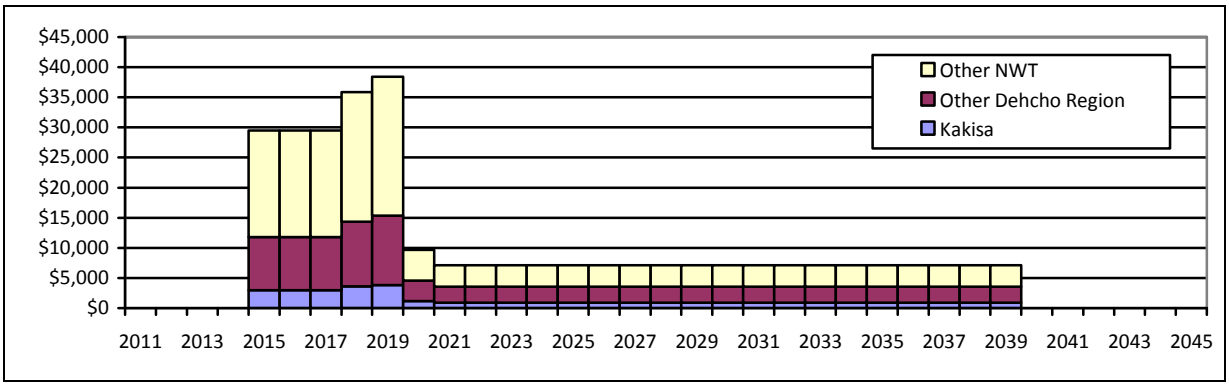
Oil production would also generate additional benefits for the NWT in terms of corporate taxes, as well as any profits that are retained by companies that are based in the NWT. Assuming that corporate taxes would be equivalent to 3% of gross revenues (GNWT 2000), oil development in the Ka'a'gee Tu CPA could generate an average of about $0.05 million per year in corporate tax payments. Total profits have been estimated based on 10% of gross revenues (or $0.18 million per year) and it is assumed that GNWT-based businesses would retain 20% of these profits.

From a Canadian perspective, the exploration, drilling and pipeline activities associated with oil development in the Ka'a'gee Tu CPA would result in incremental labour income benefits that are the same as for the NWT. Oil production would also generate royalty income for the Federal

Government (AANDC)[14], federal corporate income tax[15], and profits for Canadian based companies. Based on the production assumptions for the Ka'a'gee Tu CPA, payments to the Federal Government could average $0.25 million per year.

Figure 3-16 shows the incremental labour income stream for Kakisa, the Dehcho Region and the NWT, assuming that all phases of oil development – exploration, installation of surface infrastructure and production – actually proceed as assumed.

Figure 3-16: Incremental Labour Income Potentially Associated with Oil Development in the Ka'a'gee Tu Candidate Protected Area



As noted earlier, it is assumed that there will be limited opportunities for residents of Kakisa to be employed as part of oil development in the Ka'a'gee Tu CPA because they currently lack experience in this type of work, the drilling and exploration phases of development are too short to warrant training for this type of work, and employment during production is very low. Similarly, there is currently no corporate capability in Kakisa to provide goods and services needed to support oil development and so no opportunities for profits for local companies. There are expected to be some opportunities for environmental monitoring. While some opportunities for residents of Kakisa may result from access and benefits agreements and other collaborative efforts to be negotiated between resource developers and the Dehcho, there would still be relatively few opportunities for local employment because of the small amounts of labour being generated by natural gas development.

3.2.8 Summary of Benefits and Costs

Based on available information about the size of oil reserves and the costs of development, it is expected that limited exploration and production of potential oil reserves will occur because the estimated volumes of oil per quarter grid are too small to commercially produce at current prices. It is expected that, if the area was open to development, exploration for oil would focus on the

[14] Royalty payments for oil are estimated to be the greater of 30% of net revenues or 5% of gross revenues after project payout (Aboriginal Affairs and Northern Development Canada, 2008).

[15] Corporate federal taxes are assumed to account for 9% of gross revenues (GNWT 2000).

two general areas within the Ka'a'gee Tu CPA that appear to have the largest undiscovered reserves, and it is assumed that one well will prove to be commercially viable.

The economic benefits of oil development have been calculated on the basis of these assumptions. Table 3-4 summarizes these benefits for the period from 2011 to 2045 in terms of total benefits at full value (undiscounted) and discounted using rates of 3.0% and 8.0%. Assuming a discount rate of 8.0%, the net present value (NPV) of the future stream of incremental labour income and other benefits associated with oil development in the Ka'a'gee Tu CPA over the period to 2045 is estimated to be $2.4 million for Canada, of which $0.6 million will occur in the NWT, and $0.08 million will accrue in the Dehcho Region. For residents of Kakisa, the NPV of future labour income benefits would be $0.02 million.

Table 3-4: Net Present Value of Benefits Associated with Oil Development in the Ka'a'gee Tu Candidate Protected Area

Benefit	Undiscounted	Discounted (3.0%)	Discounted (8.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$0.3	$0.2	$0.1
Royalties	$1.7	$1.0	$0.4
Canadian taxes	$3.0	$1.7	$0.8
NWT taxes	$1.0	$0.6	$0.3
Retained profits	$3.3	$1.9	$0.8
Total	$9.3	$5.4	$2.4
NPV of Benefits for NWT (millions)			
Labour Income	$0.3	$0.2	$0.1
NWT taxes	$1.0	$0.6	$0.3
Retained profits	$0.7	$0.4	$0.2
Total	$2.0	$1.2	$0.6
Percent of Canada	21%	22%	23%
NPV of Benefits to the Dehcho Region (millions)			
Labour Income	$0.14	$0.10	$0.06
Retained profits	$0.07	$0.04	$0.02
Total	$0.20	$0.14	$0.08
Percent of NWT	10%	11%	14%
NPV of Benefits to Kakisa (millions)			
Labour Income	$0.03	$0.02	$0.02
Percent of Dehcho Region	17%	18%	20%

Note: Totals may not add due to rounding

Table 3-4 shows that, of the $2.4 million in benefits of oil development in the Ka'a'gee Tu CPA that accrue to Canada, 35% would be in the form of retained profits for Canadian companies ($0.8 million), another 31% would be from Federal corporate taxes ($0.8 million), and 17% would be from royalties ($0.4 million). About 23% of the benefits of natural gas development in the Ka'a'gee Tu CPA would accrue to the government and people of the NWT. Residents of Dehcho Region are expected to account for 14% of the incremental labour income and other benefits experienced in the NWT, of which residents of Kakisa could account for 20%.

3.3 Mineral Development

A Phase I assessment of the non-renewable resource potential of the Ka'a'gee Tu CPA was recently completed by Gebert (2008). The study determined the mineral potential as being

- C3 (moderate to high potential based on some information) for MVT zinc-lead deposits, and
- F4 (low potential based on very little or unreliable information) for diamonds.

A second study (Watson and Ketchum, 2010) examined the potential limestone resources on the south-central Northwest Territories, including the Ka'a'gee Tu CPA. A third minerals assessment was completed by Watson (2011) to address knowledge gaps identified in the Phase I reports, but it largely corroborated the previous work.

The results of these studies are summarized below.

3.3.1 Lead-Zinc Development

Although the geological setting of the Ka'a'gee Tu CPA is similar to the Pine Point area that contains world class Mississippi Valley-Type (MVT) deposits, these deposits are located at some depth and are very difficult to locate. Although some limited exploration was undertaken in the Ka'a'gee Tu area in the late 1970s and early 1980s, these activities only detected minor concentrations of lead and zinc in widely-spaced drill holes. Gebert (2008) concluded that, unless there are future improvements in exploration technology, the short-term outlook for base metal exploration in the Ka'a'gee Tu CPA is probably low. Although the mineral potential of the area is moderate to high for MVT deposits and the area is accessible to both road and rail networks, the challenges in locating these resources and the potential costs in extracting them suggests that lead-zinc exploration or development in the Ka'a'gee Tu CPA in the near future is highly unlikely. This conclusion was shared by Watson (2011) who noted that the short term potential for exploration for and development of MVT lead-zinc deposits in the Ka'a'gee Tu CPA was low.

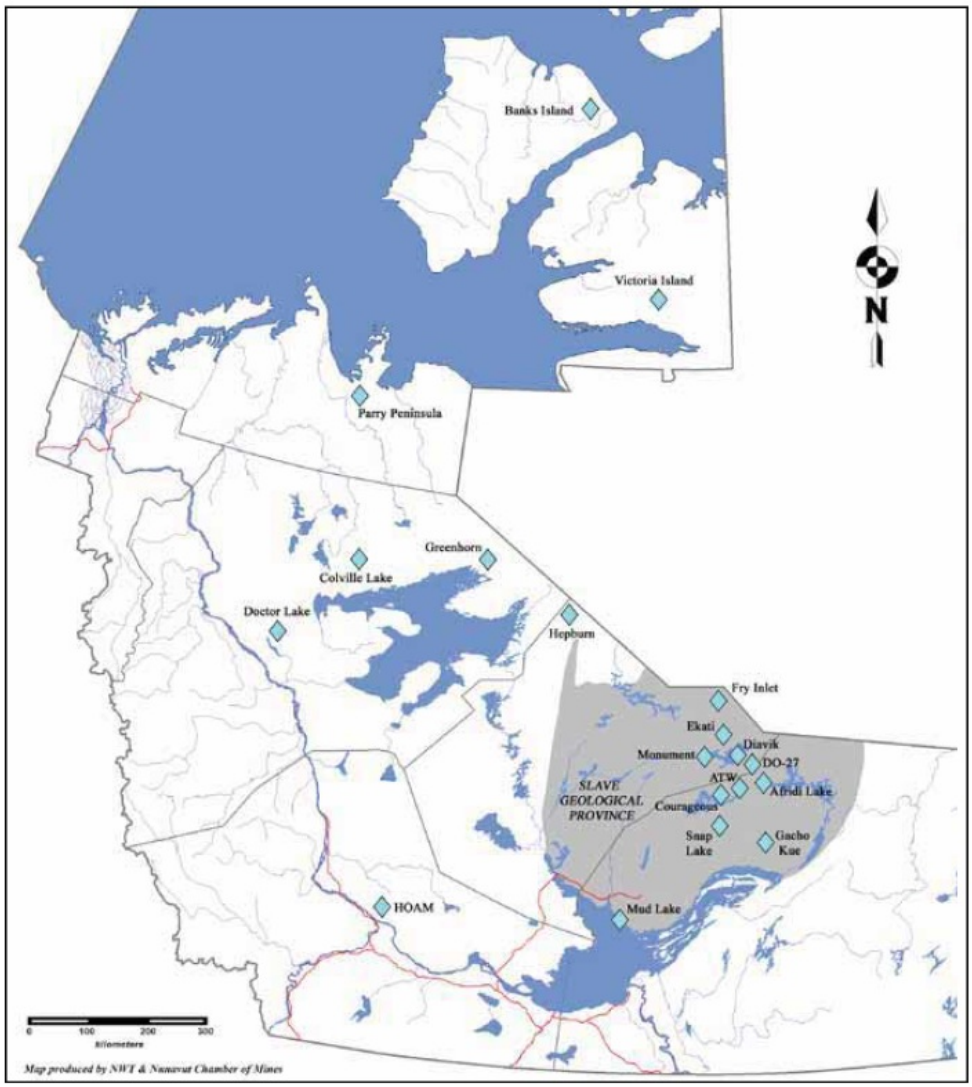
3.3.2 Diamond Development

The limited available public information suggests the basement rocks along the eastern edge of the Ka'a'gee Tu CPA have the potential for diamondiferous kimberlite intrusions in the study area. Exploration in adjacent areas with similar basement rocks has detected diamondiferous kimberlite that could be detectable by surficial mineral surveys. Based on the lack of available information, Gebert (2008) concluded that the study area has low potential for diamonds, but additional evaluation of diamond potential may be warranted.

Based on recent trends in exploration activities, it is unlikely that exploration for diamonds in the Ka'a'gee Tu CPA will occur within the near future. According to 2008 information, 16 companies were actively involved in diamond exploration in the NWT (NWT & Nunavut Chamber of Mines, 2009). Ten of these companies were assessing diamond potential at locations in the Slave Geological Province which is the location of the three active diamond

mines and the proposed diamond mine at Gahcho Kué. Thus, the focus of most diamond exploration continues to be at locations north of Great Slave Lake (see Figure 3-17).

Figure 3-17: Diamond exploration in the NWT, 2008



Source: NWT & Nunavut Chamber of Mines (2009)

The other six companies have been assessing diamond potential at seven locations in different parts of the NWT. The closest diamond exploration to the Ka'a'gee Tu CPA is at the HOAM project areas near Fort Simpson, which is being explored by Olivut Resources Ltd., and at the Mud Lake site, which is being explored by Snowfield Development Corporation and Dave Smith, with bulk sampling activities in 2008.

The Phase II minerals assessment (Watson 2011) also concluded that the Ka'a'gee Tu area has low to moderate potential for diamonds and that evaluation of this potential will require additional geophysics and till sampling. However, he concluded that it is unlikely there will be

any short term interest in exploration in the Ka'a'gee Tu area because current focus on diamond exploration is elsewhere in the NWT. Thus, there is no indication of if or when exploration for diamondiferous material in the Ka'a'gee Tu area might commence. However, the available information suggests that diamond exploration in the Ka'a'gee Tu CPA will not commence in the near future.

3.3.3 Limestone Development

An assessment of the limestone potential on the region was undertaken by Watson and Ketchum (2010) to determine whether high-quality limestone resources suitable for industrial use occur in the southwest NWT. Samples were taken at various locations along the Yellowknife Highway (Highway 3) from Behchoko to the junction with Highway 1, east to Enterprise on Highway 1, and then north to Hay River on Highway 2, with some additional samples collected near Pine Point. The study determined that high-quality limestone is widely distributed throughout the area and that the potential for finding a locally minable deposit is high. The study did not identify any specific deposits within the Ka'a'gee Tu CPA.

Given the widespread distribution of high-quality limestone in south-central NWT, there is no evidence to suggest that establishing a Ka'a'gee Tu National Wildlife Area would preclude development of significant limestone resources or would hinder industrial development in the NWT. Consequently, no assessment of the costs or benefits of possible limestone development are considered in this assessment.

3.4 Summary

The results of the non-renewable resource assessments for the Ka'a'gee Tu CPA can be summarized as follows:

- There is some potential for natural gas development because some natural gas has already been discovered in the area and there is some potential for additional natural gas resources to be discovered in four land blocks within the CPA that have the highest natural gas potential. It is assumed that one of the existing wells will be produced, assuming natural gas prices are sufficient to warrant the costs of constructing a connector pipeline to the Cameron Hills facilities, and that exploration on the four land blocks will result in the discovery and production of natural gas from one new well.
- Exploration for oil in the CPA would be done in conjunction with natural gas exploration and would focus on two land blocks that are believed to have more than 100,000 barrels of recoverable oil per quarter grid. It is assumed that this exploration will result in the discovery and production of oil from one new oil well.
- There will be no exploration for or development of possible lead-zinc resources in the CPA

- There will be no exploration for or development of possible diamond resources in the CPA
- There will be no development of possible limestone resources in the CPA

Thus, future non-renewable resource development in the Ka'a'gee Tu CPA will likely entail petroleum exploration and development and not mineral exploration and development. A summary of the assumptions used to estimate the potential economic impacts, benefits and costs from the resulting non-renewable resource development in the Ka'a'gee Tu CPA is provided in Table 3-5.

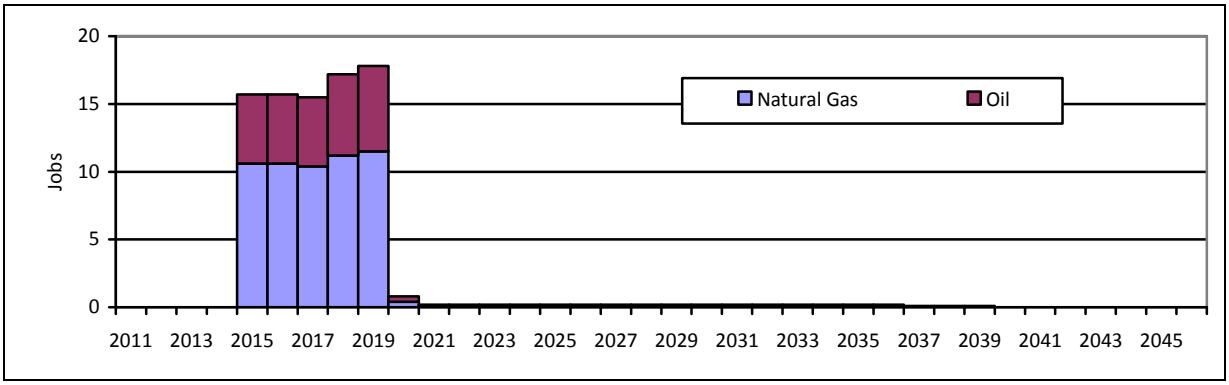
Table 3-5: Summary of Assumptions Used to Assess Potential Development of Petroleum and Mineral Development in the Ka'a'gee Tu Candidate Protected Area

		Natural Gas	Oil
Resource Potential		180 Billion Cubic Feet	6.7 Million Barrels
Resource Recovered		7 BCF	350,000 Barrels
Exploration	Start	2015	2015
	Duration	5	5
	Cost (millions)	$13.3	$6.7
Drilling	Start	2018	2018
	Duration	2	2
	Cost (millions)	$2.4	$2.4
Field Equipment	Start	2015	2019
	Duration	6	2
	Cost (millions)	$1.9	$1.0
Operation	Start	2017	2020
	Duration	24	20
	Annual Cost (millions)	$0.2	$0.1

3.4.1 Potential Labour Requirements

Based on the various assumptions in Table 3-5 it is possible to estimate the total direct and indirect employment requirements for non-renewable resource development. These requirements are shown in Figure 3-18 and assume that oil and natural gas development proceeds as assumed. The largest labour requirements would occur during exploratory drilling and the installation of field equipment. Once oil and gas production commences, the labour requirements drop considerably. Overall, petroleum development would provide between 14 and 18 jobs for NWT residents from 2015 to 2019 and would then drop to 0.2 jobs per year during production.

Figure 3-18: Total Direct and Indirect Labour Requirements Associated with Petroleum Development in the Ka'a'gee Tu Candidate Protected Area

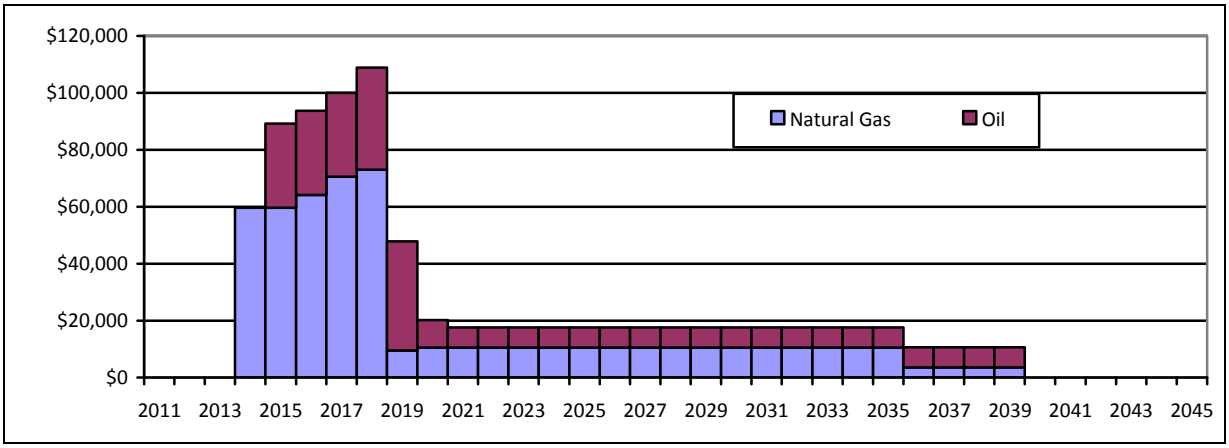


If all phases of petroleum development proceed as assumed, the total capital investment would amount to $34.5 million, and these expenditures would result in 87 person-years of direct and indirect employment in the NWT over the period from 2011 to 2040, and would increase GDP in the NWT by $28.8 million.

3.4.2 Incremental Labour Income Benefits

The actual amount of employment benefits that can be attributed to this development can be estimated by combining the employment requirements in Figure 3-18 with some assumptions about the extent to which unemployed and under-employed labour in the NWT will be hired for each phase of development. For both oil and natural gas development it is assumed that 10% of labour income associated with exploration, drilling, and production would consist of workers who would otherwise be unemployed or underemployed. Employment during the operational phase for each of the five resources is considered to be new employment. The resulting estimate of incremental annual labour income, which represents one measure of the benefits of resource development, is provided in Figure 3-19.

Figure 3-19: Incremental Labour Income Potentially Associated with Petroleum Development in the Ka'a'gee Tu Candidate Protected Area



This information can then be used to estimate the NPV of the incremental labour benefits associated with each type of non-renewable resource development in the Ka'a'gee Tu Candidate Protected Area. These NPV estimates, calculated using discount rates of 8.0% and 3.0%, are summarized in Table 3-6, which also shows the undiscounted values for reference. Assuming an 8.0% discount rate, non-renewable resource development in the Ka'a'gee Tu CPA will generate labour income with a NPV of $420,400 in the NWT, with $44,700 occurring in Kakisa and $178,800 in the Dehcho Region (including Kakisa). These amounts increase to $621,300 in the NWT, $67,600 in Kakisa and $270,300 in the Dehcho Region if a 3.0% discount rate is used.

Table 3-6: Net Present Value of Incremental Labour Income Associated with Non-Renewable Resource Development in the Ka'a'gee Tu Candidate Protected Area

	Natural Gas	Oil	Total
8.0% Discount Rate (thousands)			
Kakisa	$29.7	$15.1	$44.7
Dehcho Region	$118.6	$60.2	$178.8
NWT	$279.3	$141.1	$420.4
Kakisa %	11%	11%	11%
3.0% Discount Rate (thousands)			
Kakisa	$43.3	$24.2	$67.6
Dehcho Region	$173.3	$97.0	$270.3
NWT	$399.8	$221.5	$621.3
Kakisa %	11%	11%	11%
Undiscounted (thousands)			
Kakisa	$57.2	$29.7	$91.5
Dehcho Region	$228.7	$118.7	$366.1
NWT	$519.1	$249.7	$827.1
Kakisa %	11%	11%	11%

Note: Totals may not add due to rounding

Table 3-6 shows that natural gas development will generate the greatest potential labour income benefits. For the 8.0% discount rate, oil development will account for 34% of labour income in the NWT. It also shows that residents of Kakisa residents would account for 11% of the total incremental labour income NWT.

3.4.3 Total Benefits

Petroleum development in the Ka'a'gee Tu CPA will also generate royalties and corporate income taxes for the Canadian Government and corporate taxes for the NWT government. Canadian, NWT and regional businesses will also generate profits that may be re-spent in the Canadian economy. The NPV of the total benefits of petroleum development, including labour income, royalty, tax and profit benefits are summarized in Table 3-7, for discount rates of 8.0%, 3.0% and 0.0% (undiscounted).

Table 3-7: Net Present Value of Total Benefits Associated with Non-Renewable Resource Development in the Ka'a'gee Tu Candidate Protected Area

Benefit	Undiscounted	Discounted (3.0%)	Discounted (8.0%)
NPV of Benefits for Canada (millions)			
Labour Income	$0.8	$0.6	$0.4
Royalties	$4.8	$3.1	$1.6
Canadian taxes	$8.6	$5.5	$2.9
NWT taxes	$2.9	$1.8	$1.0
Retained profits	$9.5	$6.1	$3.2
Total	$26.5	$17.1	$9.1
NPV of Benefits for NWT (millions)			
Labour Income	$0.8	$0.6	$0.4
NWT taxes	$2.9	$1.8	$1.0
Retained profits	$1.9	$1.2	$0.6
Total	$5.6	$3.7	$2.0
Percent of Canada	21%	21%	22%
NPV of Benefits to the Dehcho Region (millions)			
Labour Income	$0.37	$0.27	$0.18
Retained profits	$0.19	$0.12	$0.06
Total	$0.56	$0.39	$0.24
Percent of NWT	10%	11%	12%
NPV of Benefits to Kakisa (millions)			
Labour Income	$0.09	$0.07	$0.04
Percent of Dehcho Region	16%	17%	18%

Note: Totals may not add due to rounding

Table 3-7 shows that the Government of Canada will receive the majority of benefits of non-renewable resource development in the Ka'a'gee Tu CPA. In combination, royalties and corporate tax payments to the federal government will account for 50% of the benefits identified in Table 3-7. Private industry would receive the next largest portion of total benefits from petroleum development in the Ka'a'gee Tu CPA, with retained profits accounting for 35% of total benefits. The Government of the NWT would receive 11% of net benefits. Overall, 22% of the benefits of petroleum development in the Ka'a'gee Tu CPA would occur in the NWT, with 12% of these (or 2.7% of total benefits) occurring in the Dehcho Region. Residents of Kakisa are estimated to enjoy 18% of the regional benefits; however, this represents 0.5% of the benefits to Canada. As noted previously, this distribution of benefits could change as a result of devolution, with regional governments obtaining a higher portion of total benefits.

3.5 Socio-Economic Effects

Oil and gas development can have both positive and negative socio-economic effects. Positive effects include employment and higher incomes for regional residents, increased capacity and

educational levels as a result of training, higher self-reliance and self-esteem, regional economic diversification and increased stability, improved availability of consumer goods and service, and perhaps the development of infrastructure (roads, recreation centres, health facilities, etc.) that would not otherwise occur. Increased economic activity will also generate more revenues for the NWT government through taxes and royalties, with some of these revenues shared with regional and Aboriginal governments.

On the negative side, the higher incomes can lead to an increased incidence of substance abuse and associated problems like crime, violence and prostitution, especially if workers continue to maintain their permanent residence in another community. Long shifts and work rotations, which are common in remote areas, also create mental and physical stress, leading to a higher risk of accidents and can also strain family life (Gibson and Klinck, 2005). The permanent introduction of workers from outside the local communities can change the social structure of these communities and their demands for better quality housing can result in the creation of separate subdivisions that can effectively split a community. A sudden influx of workers with higher incomes can lead to inflationary pressures in communities and this may disadvantage vulnerable people living on fixed incomes. The introduction of workers and their families can result in more demands for social, educational and enforcement services as well as infrastructure (water, sewer, power) and the additional demands may strain the capacity of existing communities, resulting in more costs to regional or territorial governments and/or a reduction in the quality of services. And, when projects are no longer financially viable and operations end, the employment and income benefits also cease, resulting in more social and other economic problems for communities.

Project proponents have developed two general approaches to addressing the socio-economic effects of development. The first approach, which relates specifically to development in more isolated areas or for very short-term projects, is to house all workers in a camp to be developed at or near the development site. This approach has been used to accommodate workers at the existing diamond mines in the NWT and Nunavut and for the oilsands development near Fort McMurray. The benefit of this approach is that potential adverse effects on nearby communities can be minimized. Workers are shuttled in and out of the work camps with minimal contact with local residents. This approach helps minimize problems related to substance abuse, crime and violence in the local communities by keeping the most of the workforce away from the community. It also means that the adverse effects associated with the cessation of project operations are minimized. However, housing workers in camps also means that the potential economic benefits to the local community are also minimized. Benefits to the community are limited to employment of those residents who have the appropriate skills to work on the project or who can provide goods and services in a timely and cost-competitive manner. As noted in Phase 1 of the socio-economic assessment (AMEC, 2011), most residents of Kakisa do not currently have the training necessary to work on any of the development projects except in a limited capacity: as labourers, land clearing, equipment operators, expediters, and camp operations and catering.

The other approach is to try to maximize project benefits to local communities by having the project workforce take up permanent or temporary residence in one or more nearby communities or to actually create a new community. This approach has been taken for pulp mills and coal mines in Alberta and British Columbia. This approach offers local communities the potential for significant economic and population growth, economic diversification, and improved services. For communities that would otherwise have limited development opportunities, the introduction of a large new workforce is very attractive. However, as noted above, the introduction of large numbers of new workers and their families can have a very disruptive effect on the structure and functioning of existing communities. Such problems can be particularly acute where the host communities were relatively homogeneous prior to development and, as noted in Phase 1 of the socio-economic study, 56% of the current regional population is Aboriginal, including 91% of the residents of Kakisa. Housing workers in local communities also creates the potential for significant adverse effects when the project ceases operation and large numbers of local residents are no longer employed.

There is no single best approach for optimizing the socio-economic effects of oil and gas development. It is up to the communities to work with developers in advance of a project to agree on which approach is preferred and to establish the procedure for monitoring and managing any problems than may occur. There is increasing recognition that neither the proponent nor the community can address social or economic problems on its own; management of these problems is a shared responsibility. Thus, mechanisms like access and benefits agreements form a key step in having communities work with developers and governments to determine the terms and conditions under which development can proceed.

With respect to non-renewable resource development opportunities, it is likely that the camp model will be used to accommodate most of the workers involved in the exploration phases of any petroleum or mineral development that occurs in the Ka'a'gee Tu Candidate Protected Area. Although there is road access into the area, oil and gas exploration and facilities construction will be short term and there is no accommodation or other facilities for workers in Kakisa.

4.0 NO PROTECTION OPTION

Under the no protection option, all of the lands in the Ka'a'gee Tu CPA protected by the Dehcho Interim Measures Agreement interim land withdrawal would revert to unprotected status, meaning that non-renewable resource development would be allowed to occur in all of the land that is currently subject to the interim withdrawal. There would be no formal protection of the land or biological resources in the area. However, as part of the approvals process, it is expected that resource developers would be required to implement various environmental management strategies that are designed to minimize adverse effects.

4.1 Non-Renewable Resources Development

If the area becomes available for non-renewable resource development, it is expected that this development will occur as described in Section 3.0. This would involve exploration for oil and natural gas. It is assumed that exploration will prove successful, resulting in the production from one new oil well, one of the existing natural gas wells and one new gas well. Under this option, a total of $34.5 million would be invested. This expenditure would result in 87 person-years of direct and indirect employment in the NWT over the period from 2011 to 2040, and would increase GDP in the NWT by $28.8 million. The resulting employment effects would be distributed over time as shown in Figure 4-1.

Figure 4-1: Estimated Direct and Indirect Employment in the NWT from New Non-Renewable Resource Development: No Protection Option

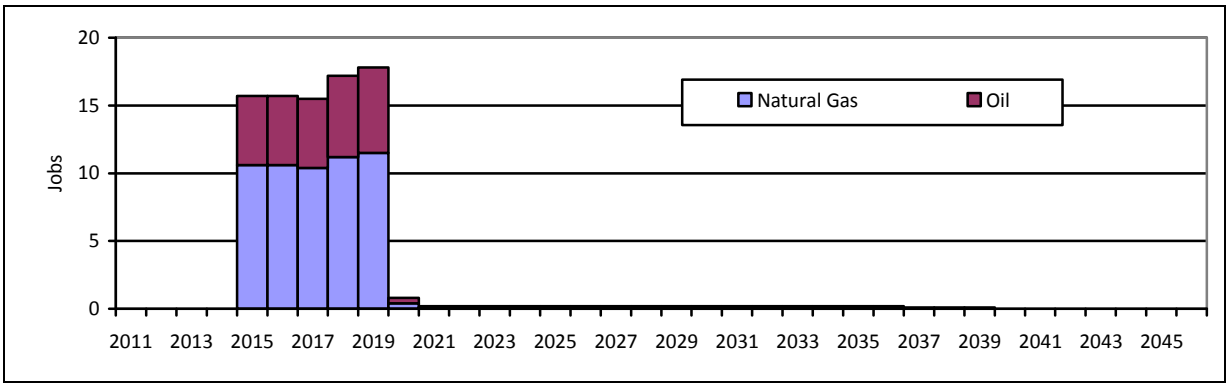


Figure 4-1 shows relatively high levels of activity would occur between 2015 and 2020 related to oil and natural gas exploration and drilling followed by relatively low levels of employment during production.

As described in Section 3.4, the economic benefits resulting from non-renewable resource development would be equivalent to a current value of $9.1 million for Canada (assuming an 8.0% discount rate), with $2.0 million of this occurring in the NWT, $0.24 million occurring in the Dehcho Region, and $0.04 million occurring in Kakisa (see Table 4-1).

Table 4-1: Present Value of Economic Benefits Associated with Non-Renewable Resource Development in the Ka'a'gee Tu Candidate Protected Area: No Protection Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	8.0% Discount Rate (millions)
Canada	$26.5	$17.1	$9.1
NWT	$5.6	$3.7	$2.0
Dehcho Region	$0.56	$0.39	$0.24
Kakisa	$0.09	$0.07	$0.04

If a lower discount rate is used (3.0%), the resulting values are higher: $17.1 million for Canada, of which $3.7 million will occur in the NWT, $0.39 million in the Dehcho Region and $0.07 million in Kakisa.

4.2 Renewable Resources

If non-renewable resource development were to occur as proposed, it is expected that exploration activities and any resulting oil and gas or mineral development would result in land use disturbances that could adversely affect land and resource use in the Ka'a'gee Tu CPA.

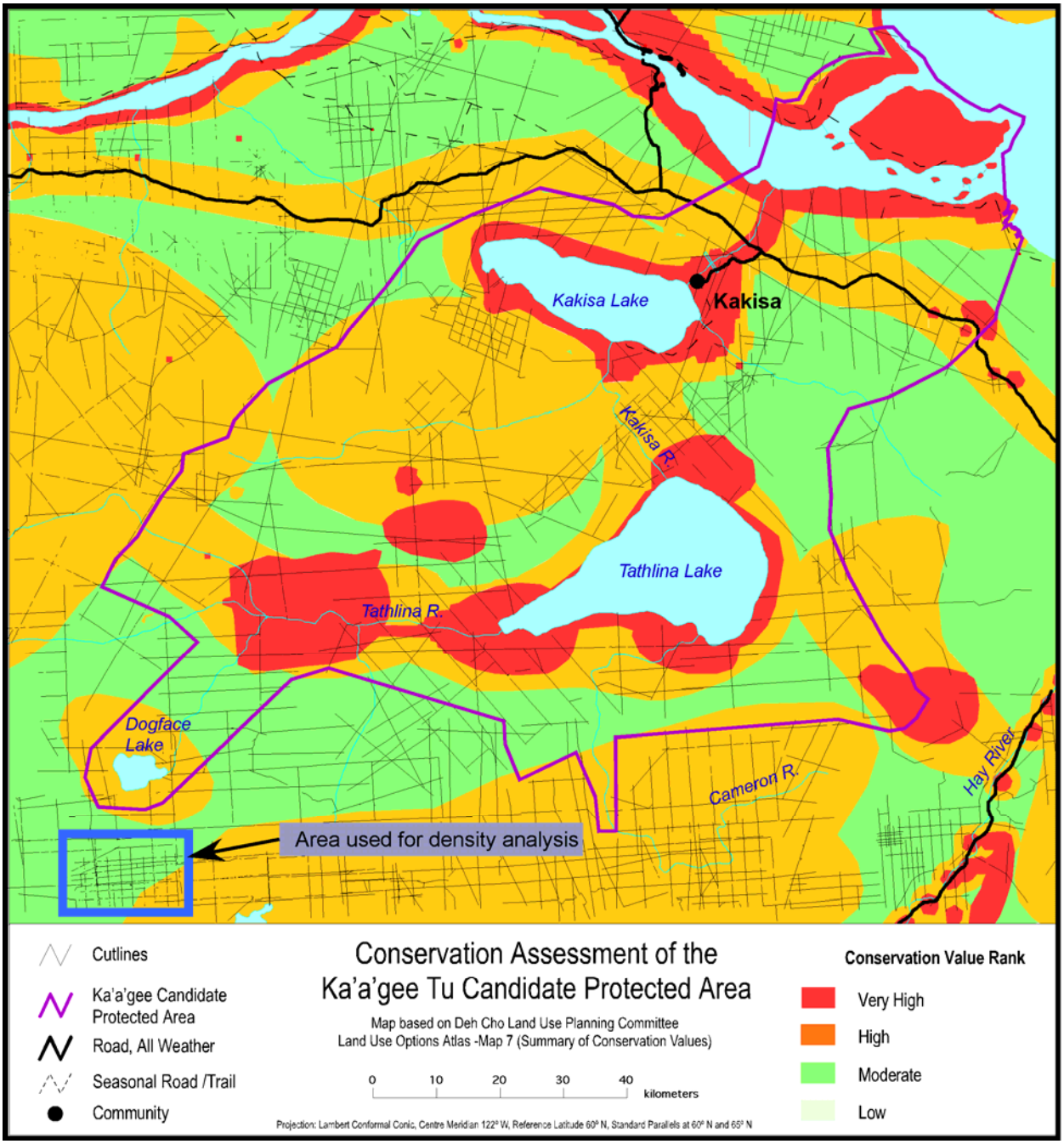
4.2.1 Extent of Land Disturbance

The greatest potential for land use disturbances will be related to seismic exploration for oil and natural gas. The linear disturbances associated with seismic activity can directly result in habitat loss, cause habitat fragmentation, and create corridors that can be used by predators, humans and alternate prey. This has the potential to adversely affect animal and migratory bird populations as well as the human use of these resources.

As discussed in Section 3.1.6, the area around the Cameron Hills has already been heavily impacted by human activity. According to Nagy (2011) seismic densities in the Cameron Hills area averaged 3.33 km of seismic line per km^2, compared to 0.44 km/km^2 in the Dehcho and South Slave study regions. Analysis of seismic line data for the Ka'a'gee Tu CPA (see Figure 4-2) indicates the current density of seismic lines to be 0.35 km/km^2, based on 2,905 km of seismic lines in the CPA. Based on an average width of 5 metres, it is estimated that 14.5 km^2 of land, or 0.2% of the land base in the Ka'a'gee Tu CPA has disturbed by seismic activities.

The extent of new seismic lines and the resulting effects on renewable resources will be directly dependent on future natural gas and oil development. As described in Section 3.0, it is assumed that exploration rights would be issued for 4 land blocks of 60,000 ha each for natural gas and 2 land blocks for oil. These land blocks would focus on those quarter grids having the highest undiscovered reserves of natural gas (> 2 BCF, as per Figure 3-2) and for oil (>100 MB, as per Figure 3-10). As one land block would be of interest for both natural gas and oil, it is expected that exploration would focus on five land blocks in total. Thus, the oil and gas development scenario assumes that 300,000 ha (3,000 km^2) of land would be of interest for oil and natural gas exploration and development.

Figure 4-2: Existing Seismic Line Density in the Ka'a'gee Tu Candidate Protected Area



At the present time, each 600 km^2 land block is estimated to have an average of 210 km of existing seismic lines. Future oil or natural gas development is predicted to result in an additional 1,170 km of seismic lines per block. This density reflects the extent of seismic activity in a sample area just south of the Ka'a'gee Tu CPA that has been extensively explored. This area is shown in Figure 4-2. It is about 200 km^2 in area and has 460 km of seismic lines,

indicating an average seismic line density of 2.3 km/km^2. This is less than 3.33 km/km^2 reported for the Cameron Hills (Nagy, 2011).

Assuming that similar levels of seismic activity occur on all five land blocks, there could be a total of 5,850 km of new seismic lines in the Ka'a'gee Tu CPA. When added to existing disturbances, there would be a total of 8,755 km of seismic lines, resulting in an average seismic density of 1.2 km/km^2 for the entire area. Assuming an average width of 5 metres, the amount of disturbed land in the Ka'a'gee Tu CPA would increase to 43.8 km^2, or 0.5% of the area. Thus, the overall impact of oil and natural gas development would be an additional 29.3 km^2 of land disturbance; this represents a 0.4% decrease in undisturbed land and available habitat for wildlife.

However, the potential disturbance effects of seismic activity could extend beyond the actual 5 m. width of the seismic line. If the actual zone of influence resulting from each seismic line was 10 m. from the centre line, total additional land disturbance and habitat loss would be about 1.4% of the area. If the zone of influence was increased to 25 m., total habitat loss would amount to 3.5% of the area.

4.2.2 Effects on Woodland Caribou

Woodland Caribou are particularly susceptible to land-use disturbances. While seismic lines may result in a relatively small direct disturbance of the land, the resulting corridors provide access for predators and humans that may significantly limit the amount of secure caribou habitat in a specific area.

The implications of linear disturbances on boreal caribou habitat were recently addressed by Nagy (2011) who used data from seven different study areas, two of which were located in or around the Ka'a'gee Tu CPA: the South Slave study area and the Cameron Hills study area. Based on radio collar information, he observed that caribou in this area avoided seismic lines during all or most of the pre-calving, calving and early summer periods but also avoided them during late winter and breeding periods. He found that during these seismic avoidance periods, caribou in the South Slave area avoided seismic lines by 400 m. or more while caribou in the Cameron Hills avoided seismic lines by 100 m or more. The lower avoidance distance for caribou in the Cameron Hills was due to the high density of seismic lines in the area: areas in the Cameron Hills were only an average 263 metres distant from a seismic line, compared to 1347 m in the South Slave area. Based on this information, Nagy concluded that preferred secure habitats for Woodland Caribou consisted of unburnt areas greater than 400 m from seismic lines. Nagy also concluded that Woodland Caribou populations are declining in areas with the least amounts of secure habitat in patches of greater than 500 km^2 are available.

Based on this information, about 56% of the Ka'a'gee Tu CPA is considered to be preferred secure habitat for Woodland Caribou and there was determined to be one large secure patch of habitat (greater than 500 km^2) in the area around Tathlina Lake. With the predicted oil and natural gas development under the no protection option, the additional 5,850 km of seismic lines

would result in no preferred secure habitat for Woodland Caribou remaining. There would also no longer be any secure habitat in patches of greater than 500 km^2. Thus, the analysis suggests that the no protection option would result in Woodland Caribou avoiding the Ka'a'gee Tu CPA. Environment Canada (2011) has already determined that the Northwest Territories South range is not considered capable of supporting a self-sustaining Woodland Caribou population, and the additional oil and natural gas development in the Ka'a'gee Tu CPA would accelerate the rate of decline in the local caribou population. This would mean that residents of Kakisa could no longer be able to harvest Woodland Caribou in the Ka'a'gee Tu CPA and would have to travel to other areas in order to hunt caribou. The current annual caribou harvest by residents of Kakisa is already very low, about one or two animals per year, because of concerns about overharvesting (Chicot, pers. comm.).

4.2.3 Effects on Other Renewable Resources and Use

In terms of potential impacts on other renewable resources, the seismic lines and other linear disturbances associated with oil and gas development would be expected to increase access to the area, resulting in increased predation as well as increased hunting by residents of other communities. As a result, is estimated that disturbances associated with oil and gas development would result in a 2% decline in wildlife populations, and this would translate into 2% decline in the amount and value of country food being harvested from the Ka'a'gee Tu CPA. There is expected to be no change in the availability of fuel for subsistence use, but revenues from trapping are also predicted to decrease by 2%. In terms of recreation, the additional seismic activity is unlikely to affect total activity or expenditures, but residents of Kakisa would have to travel farther to find undisturbed areas with equivalent values and so a 2% decrease in extra-market benefits is assumed. There is expected to be no change in tourism activity, as most current tourist activities occur along the highway or in the community of Kakisa. There would be no change in water-based activities such as fish camps or commercial fishing.

The potential effects on cultural values could be large, although it is expected that, as a condition of land use permits, seismic activities and other activities that would disturb the land would not be allowed in the immediate vicinity of known cultural sites.

4.2.4 Summary of Effects on Renewable Resources

Based on the assumptions noted above, the total value of annual renewable resource benefits from the Ka'a'gee Tu CPA, assuming that oil and gas and mineral development were allowed, would decrease by about 1% from current conditions. The annual benefits with no protection would be as shown in Table 4-2. It shows that, when compared to current conditions (Table 4-2), the annual benefits would drop by about $5,000 per year, with most of the decrease being related to the loss of country food.

Table 4-2: Summary of Annual Economic Benefits from Renewable Resource Use in the Ka'a'gee Tu CPA: No Protection Option

Activity	Nature of Benefit	Effect of Development	Revised Estimate
Traditional Resource Use and Values	Country food	-2%	$151,300
	Fuel	0%	$72,000
	Recreation Expenditures	-2%	$30,800 to $78,200
	Recreation Extra-market benefits	-2%	$11,300 to $18,900
Commercial Resource Use and Values	Trapping	-2%	$9,900
	Commercial Fishing	0%	$45,860
	Fishing Camps	0%	$48,000 to $60,000
	Tourism Spending	0%	$10,000
	Arts and Crafts	0%	$9,000
	Commercial Logging	0%	$0
	Renewable Energy	0%	$0
Cultural Values		Unknown	Not Quantified
TOTAL			**$388,100 to $455,160**

The decrease in economic benefits from renewable resource development shown in Table 4-2 would not occur immediately. It is expected that the value of these benefits will start to decline starting in 2015 when exploration for oil is expected to commence, reaching the amounts shown in Table 4-2 by 2020. It shows that, for a discount rate of 8.0%, the NPV of benefits from renewable resources in the Ka'a'gee Tu CPA would decline by $0.04 million. The difference would be $0.09 million if the lower discount rate (3.0%) is used. However, these values do not include any reduction in cultural values that might result from non-renewable resource development, nor does it include any reduction in the range of ecological goods and services being provided by the area. It does not include any changes in values for other residents of the Dehcho Region or the NWT.

Table 4-3: Present Value of Economic Benefits Associated with Renewable Resource Use in the Ka'a'gee Tu CPA: No Protection Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	8.0% Discount Rate (millions)
Current Situation	$19.19	$10.77	$5.58
No Protection	$19.01	$10.68	$5.54
Difference	**-$0.18**	**-$0.09**	**-$0.04**

4.3 Change in Economic Value

Under the no protection option there would be economic benefits from non-renewable resource development, but there would be a slight decline in the economic value of renewable resources

being provided by the Ka'a'gee Tu CPA. The total economic value under this option can be estimated by combining the value estimates in Table 4-1 and Table 4-3. The results are shown in Table 4-4. It shows that, when using an 8.0% discount rate, the Ka'a'gee Tu CPA would generate benefits for Canada with a net present value (NPV) of $9.1 million over the period to 2065. Benefits to the NWT would have a NPV of $2.0 million; this represents 22% of the Canadian total. The NPV of benefits to the Dehcho Region would be $0.21 million, or 10% of the NWT total.

Table 4-4: Present Value of Net Economic Benefits Associated with the Ka'a'gee Tu CPA: No Protection Option

	Undiscounted	3.0% Discount Rate	8.0% Discount Rate
NPV of Net Benefits for Canada (millions)			
Non-Renewable Resources	$26.49	$17.10	$9.14
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	$26.31	$17.01	$9.10
NPV of Net Benefits for the NWT (millions)			
Non-Renewable Resources	$5.58	$3.41	$2.03
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	$5.40	$3.58	$2.00
NPV of Net Benefits for the Dehcho Region (millions)			
Non-Renewable Resources	$0.56	$0.39	$0.24
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	$0.38	$0.30	$0.21
NPV of Benefits for Kakisa (millions)			
Non-Renewable Resources	$0.09	$0.07	$0.04
Loss of Renewable Resources	-$0.18	-$0.09	-$0.04
TOTAL	-$0.09	-$0.02	$0.00

Note: Totals may not add due to rounding

4.4 Effects on Kakisa

For residents of Kakisa, there would small net benefits ($0.01 million) under the 8.0% discount rate because the potential new labour income associated with non-renewable resource development would be nearly offset by the loss of benefits from renewable resources. If lower discount rates are used, the costs associated with the loss of renewable resources would be greater than the benefits from non-renewable resource development.

The most important regional socio-economic effect arising from the baseline or no protection option is that non-renewable resource development would create some jobs and wage employment for residents of Kakisa. Cumulatively, this employment would amount to 0.63 person-years of employment over 24 years, or the equivalent of 0.03 jobs per year. In 2009, Kakisa had a potential labour force of 43 people of whom 18 were employed and 6 were unemployed, and an unemployment rate of 25.0%. The creation of an additional 0.03 job per year, which is the equivalent of one person working 8 to 10 days per year, would be a minor

benefit for the community. This level of employment would not change the local unemployment rate. These employment effects could increase, however, as a result of any economic and access agreements negotiated with non-renewable resource development companies.

On the other hand, non-renewable resource development in the Ka'a'gee Tu CPA will affect the amount and value of food and income that residents of Kakisa currently obtain from the area. As noted above, there is predicted to be a 2% decline in the value of country foods, recreation and trapping from the area as a result of land use disturbances associated with non-renewable resource development. The value of this loss is estimated to be equal to or greater than the benefits from oil and natural gas-related employment. The losses could be even greater if the effects of petroleum development are greater than 2% or if there are any losses of cultural values.

5.0 FULL PROTECTION OPTION

Under this option, all of the land temporarily withdrawn for the Ka'a'gee Tu Candidate Protected Area would be designated as a National Wildlife Area and no non-renewable resource development activities would be allowed.

5.1 Non-Renewable Resources

Despite the apparent resource potential of the area, oil, gas, or mineral development would not be allowed within the National Wildlife Area. Thus, no employment or income benefits from non-renewable resource development would be possible.

5.2 Renewable Resources

Designation of the entire Ka'a'gee Tu Candidate Protected Area as a National Wildlife Area would essentially protect all renewable resources and allow traditional and commercial resource use to continue as at present. Thus, the current benefits associated with the Ka'a'gee Tu CPA, as described in Table 3-7, would continue to be provided. However, formal designation of the area as a National Wildlife Area will create two other types of benefits.

5.2.1 Existence Values for Protected Areas

There is evidence that Canadians are willing to pay to protect landscapes because they benefit from knowing that these landscapes exist (existence values), that they can visit these areas in the future (option value) and these landscapes will be available to future generations (bequest value). In 1997, Rollins et al. completed a study for Parks Canada and found that, in 1991, Canadian households would be willing to pay an average of $235.18 for the creation of four new national parks in the NWT and would be willing to pay $261.51 for the creation of 10 new parks. To date, three new national parks have already been established in the NWT since 1991 and establishment of a fourth park on the East Arm of Great Slave Lake is being considered. The results of the study then suggest that Canadians would be willing to pay an average of $6.09 per household to create a fifth new park in the NWT, $5.15 per household for a sixth park, $4.46 per household for a seventh park, $3.93 for an eighth park, $3.52 for a ninth park and $3.18 per household for a tenth park.

For this assessment it was assumed that formal designation of the Ka'a'gee Tu CPA as a National Wildlife Area would be equivalent to creating a seventh northern park. This assumption was made because several other areas in the NWT are also being considered for designation as National Wildlife Areas and may receive these designations before the Ka'a'gee Tu CPA is formally designated as a protected area . On this basis, it is assumed that Canadian households would be willing to pay $4.46 per household to protect the Ka'a'gee Tu National Wildlife Area, and this would be equivalent to $5.50 per household in 2011 dollars. Thus, total Canadian willingness to pay to protect the Ka'a'gee Tu CPA as a National Wildlife Area could be as high as $69.0 million, or $2.1 million per year in perpetuity, based on a discount rate of

3%, or $5.5 million per year, based on a discount rate of 8.0%. Based on the number of households in each area, the benefits for Kakisa would be $110, the benefits for the Dehcho Region would be $6,070, and the benefits for the NWT would be $79,050.

Without formal designation of the Ka'a'gee Tu CPA as a National Wildlife Area, it is not clear that Canadians would be left with the option to visit the areas in the future or that the landscape will be available for future generations.

5.2.2 Existence Values for Woodland Caribou

There is also evidence that Canadians derive some measure of well-being from knowing that Woodland Caribou continue to exist in various parts of the country and that they would be willing to pay to continue to conserve caribou. In Saskatchewan, a survey of households conducted in 1993 determined that they would be willing to pay to an average of $14.66 per household (1992 dollars) to implement a hypothetical conservation program that would preserve Woodland Caribou in northern Saskatchewan (Tanguay et al., 1995). A 1995 survey of households in Edmonton determined that they would be willing to pay an average of $76.50 per household to remove lands from forestry activities and create a wilderness area that would allow the number of caribou in the region to increase from 400 animals to what is considered a viable population (600 animals) (Adamowicz et al., 1995). Based on these two willingness to pay estimates, it is estimated that Canadian households would be willing to pay between $250 million and $1.2 billion to protect boreal caribou in all of Canada. With 57 Woodland Caribou herds in Canada (Environment Canada, 2008), this suggests that average willingness to pay to protect the a single one herd, such as the one that uses the Ka'a'gee Tu CPA, would be between $4.4 million and $21.3 million

Although Environment Canada (2011) has determined that the Northwest Territories South range, which includes the Ka'a'gee Tu CPA, is not considered to be capable of supporting a self-sustaining population of Woodland Caribou, protection of parts of this range may help slow the rate of population decline. Thus, creation of a National Wildlife Area at Ka'a'gee Tu may help ensure the survival of the Woodland Caribou herd in this area and will create and maintain existence values for caribou. Consequently, it has been assumed that the potential existence values associated with establishing a National Wildlife Area that would help protect Woodland Caribou will range between $4.4 million and $21.3 million. This is equivalent to an annual willingness to pay of between $131,700 and $637,700 (2010$), based on a discount rate of 3.0%, and between $351,200 and $1,700,400 based on a discount rate of 8.0%.

5.3 Change in Economic Value

When these non-use values are combined with economic benefits that are currently being generated by the Ka'a'gee Tu CPA (Table 3-7), the resulting estimates of the economic benefits of establishing a National Wildlife Area would be as shown in Table 5-1. It shows that, when compared to the current benefits from renewable resources, there would be no change in the economic benefits to households in Kakisa, because of the very small population. The net

present value of benefits to households in the Dehcho Region would increase by $0.01 million, while the NPV of benefits to households in the NWT would increase by $0.13 million. For all households in Canada, NPV the economic benefits from designating all of the Ka'a'gee Tu CPA as a National Wildlife Area would increase by $73.5 million. These amounts are the same, regardless of which discount rate is used, because the values are based on a one-time payment. With designation of all of the CPA as a National Wildlife Area, there is expected to be no change in the cultural values of the area or the value of the ecological goods and services being provided.

Table 5-1: Present Value of Net Economic Benefits Associated with the Ka'a'gee Tu CPA: Full Protection Option

	Undiscounted	3.0% Discount Rate	8.0% Discount Rate
NPV of Net Benefits for Canada (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$73.46	$73.46	$73.46
TOTAL	$73.46	$73.46	$73.46
NPV of Net Benefits for the NWT (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$0.13	$0.13	$0.13
TOTAL	$0.13	$0.13	$0.13
NPV of Net Benefits for the Dehcho Region (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$0.01	$0.01	$0.01
TOTAL	$0.01	$0.01	$0.01
NPV of Benefits for Kakisa (millions)			
Non-Renewable Resources	$0.00	$0.00	$0.00
Non-Use Values	$0.00	$0.00	$0.00
TOTAL	$0.00	$0.00	$0.00

Note: Totals may not add due to rounding

5.4 Effects on Kakisa

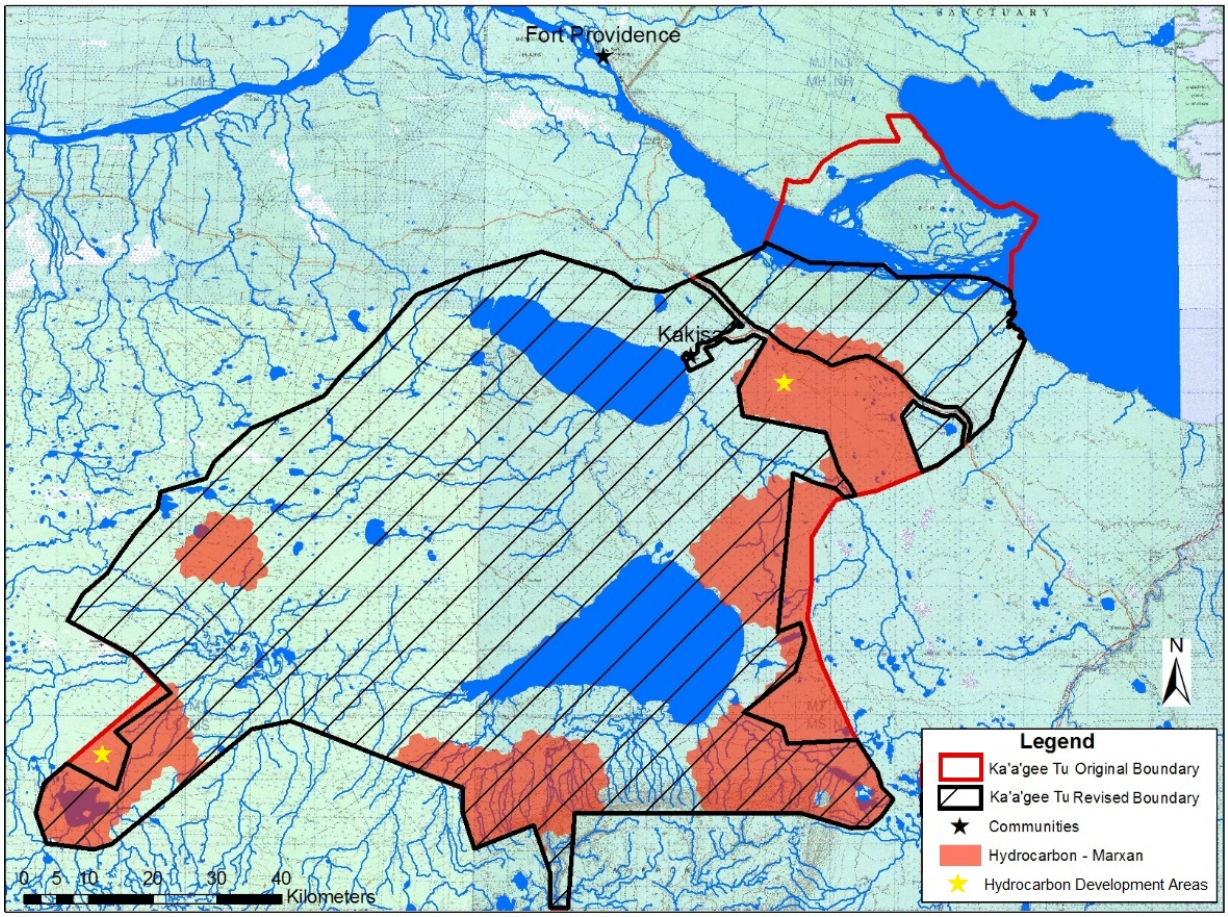
For residents of Kakisa, designation of all of the Ka'a'gee Tu CPA as a National Wildlife Area would have no effect on their ability to use the area as they currently do so there would be no change in the benefits they are obtaining from the area. At the same time, the preclusion of non-renewable resource from the area would mean that there would be no opportunities for oil and gas-related jobs and wage employment for residents of Kakisa. However, with designation of the area as a National Wildlife Area, there may be an increase in tourism as people travelling Highway 1 may choose to stop to see the area. This could result in an increased demand for tourism-related facilities and services that could generate some new employment and income benefits for residents of Kakisa. However, capturing these benefits will require some investment to develop tourist facilities and services in or around Kakisa.

6.0 MODIFIED BOUNDARY OPTION

An alternate boundary option was identified by the Ka'a'gee Tu Working Group. This boundary option was identified based on a combination of Marxan analysis, the heat map described in Figure 6-1 and through discussions with members of the community of Kakisa and the Working Group. The Marxan analysis compared available information about the location of potential oil, gas, and mineral deposits with selected conservation and cultural targets to determine which parts of the candidate protected area could be excluded from the proposed National Wildlife Area so as to allow development without significantly compromising conservation objectives. This option represents the modified boundary option

With the modified boundary, the resulting National Wildlife Area would be approximately 8,159 km^2 in area; this represents about 85% of the Ka'a'gee Tu CPA.

Figure 6-1: Proposed Ka'a'gee Tu National Wildlife Area with Modified Boundary



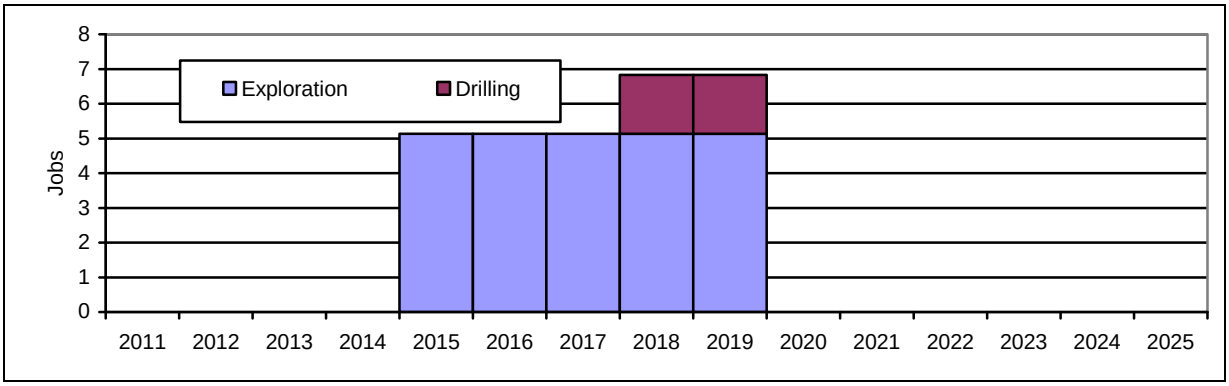
6.1 Non-Renewable Resources Development

The boundaries of the National Wildlife Area would preclude three of the five areas identified in Section 4.1 that have the highest undiscovered reserves of natural gas (> 2 BCF, as per Figure 3-2) and for oil (>100 MB, as per Figure 3-10). Petroleum development would like focus on the one land block just east of Kakisa that includes the existing Kakisa F-35 well and has relatively high potential for natural gas and the one land block just north of Dogface Lake that has relatively high potential for oil (see Figure 6-1). Most of the other parts of the Ka'a'gee Tu CPA left outside the National Wildlife Area boundaries have relatively low potential for oil or natural gas and would likely not be explored. Thus, it is assumed that the oil and gas development scenario for this option assumes two land-blocks of 600 km^2 each (1,200 km^2 in total) would be of interest for oil and natural gas exploration and development.

As was described in Section 3.0, it is assumed that seismic exploration would be conducted in each of the two land blocks and that one exploratory well would be drilled in each block. While the oil development scenario for the no protection option assumed a 50% success rate, it is unlikely that drilling in the area north of Dogface Lake will prove economically viable. The undiscovered reserves of oil in that area are relatively low compared to the four other areas that would be inside the National Wildlife Area. Thus, it is expected that while seismic exploration and drilling might occur, there would be no oil production. For natural gas, the development scenario for the no protection option assumed a 25% success rate for new wells, and it is unlikely that drilling in the area east of Kakisa will also prove economically viable. This area includes the existing Kakisa F-35 well and, as noted in Section 3.1.3.1, this natural gas deposit is not financially viable to produce by itself, and could only occur if other natural gas resources can be discovered nearby so that the costs of production can be distributed among several wells. As this, is unlikely to happen, it is expected that, while there may be some seismic exploration and drilling, there would be no natural gas production.

Under this option, a total of $11.5 million would be invested and that this would generate 29 person- years of employment between 2015 and 2020, and that this would increase NWT GDP by $9.6 million. The resulting employment effects would be distributed over time as shown in Figure 6-2. There would be relatively low levels of employment during the early part of the forecast period because the labour requirements for mineral exploration are quite small. It is estimated that there would be 5 person-years of employment per year for exploration and another 1.7 person-years of employment per year during the two years of drilling activity.

Figure 6-2: Estimated Direct and Indirect Employment in the NWT from Petroleum Development: Modified Boundary Option



The economic benefits resulting from petroleum development would be equivalent to a net present value of $0.22 million for Canada (assuming an 8% discount rate), with $0.22 million of this occurring in the NWT, of which $0.04 million would occur in the Dehcho Region and $0.01 million occurring in Kakisa (see Table 6-1).

Table 6-1: Present Value of Economic Benefits Associated with Petroleum Development in the Ka'a'gee Tu CPA: Modified Boundary Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	8.0% Discount Rate (millions)
Canada	$0.35	$0.29	$0.22
NWT	$0.35	$0.29	$0.22
Dehcho Region	$0.07	$0.06	$0.04
Kakisa	$0.02	$0.01	$0.01

6.2 Renewable Resources

Land disturbances associated with oil or gas development would be limited to the two areas in the Ka'a'gee Tu CPA that would be outside the National Wildlife Area. Land use disturbances would occur on the two land blocks with a combined area of about 1,200 km^2. As noted in Section 4.0, each of these land blocks currently has an average of 210 km of existing seismic lines and future petroleum development would result in an additional 1,170 km of seismic lines per block. The resulting seismic lines density in the two blocks (2.3 km/km^2) would be similar to areas located south of the Ka'a'gee Tu CPA that have been extensively explored (see Figure 4-2). This would result in a total of 2,340 km of new seismic lines in the two blocks. This level of seismic exploration would increase the average density of seismic lines in the Ka'a'gee Tu CPA from 0.35 km/km^2 at present to 0.63 km/km^2. Assuming an average width of 5 metres, the amount of disturbed land in the Ka'a'gee Tu CPA would increase to 26.2 km^2, or 0.3% of the area. Thus, the overall impact of oil and natural gas development would be an additional 11.7 km^2 of land disturbance; this represents a 0.1% decrease in undisturbed land and available habitat for wildlife within the Ka'a'gee Tu CPA.

This level of development should have little effect on Woodland Caribou. Although the average density of seismic lines in the Ka'a'gee Tu CPA would increase, this would be focused in two areas that collectively would account for the 14% of the total area. Given the location of these two areas, the resulting seismic exploration is not expected to affect the one large secure patch of habitat (greater than 500 km^2) in the area around Tathlina Lake. While this area is already considered incapable of supporting a self-sustaining Woodland Caribou population (Environment Canada, 2011), the additional oil and natural gas development expected under the modified boundary option should not affect the rate of decline in the local caribou population.

In terms of potential impacts on other renewable resources, the seismic lines and other linear disturbances associated with oil and gas development would increase access to the area and could result in increased predation as well as increased hunting by residents of other communities. For the modified boundary option, the resulting oil and gas development is expected to result in a 1% decline in wildlife populations, and this would translate into 1% decline in the amount and value of country food being harvested from the Ka'a'gee Tu CPA. Revenues from trapping are also predicted to decrease by 1% and the extra-market benefits associated with recreation would also decrease by 1%. There is expected to be no change in tourism activity, water-based activities such as fish camps or commercial fishing, or the ability to collect wood for fuel.

The potential effects on cultural values could be large, although it is expected that, as a condition of land use permits, seismic activities and other activities that would disturb the land would not be allowed in the immediate vicinity of known cultural sites.

Based on these assumptions, the total value of annual renewable resource benefits from the Ka'a'gee Tu CPA, assuming a modified boundary for the National Wildlife Area, would decrease by about 1% from current conditions. The annual benefits would start to drop in 2015, when oil and gas exploration would be expected to commence, and would reach a maximum of about $2,400 per year by 2020, when seismic exploration and drilling activities would be completed. The net present value of renewable resource benefits for both the current situation and the modified boundary option is shown in Table 6-2. It shows that, for a discount rate of 8.0%, the NPV of benefits from renewable resources in the Ka'a'gee Tu CPA would decline by $0.04 million; this is essentially the same as for the no protection option.

Table 6-2: Present Value of Economic Benefits Associated with Renewable Resource Use in the Ka'a'gee Tu CPA: Modified Boundary Option

	Undiscounted (millions)	3.0% Discount Rate (millions)	8.0% Discount Rate (millions)
Current Situation	$19.19	$10.77	$5.58
Modified Boundary	$19.03	$10.69	$5.54
Difference	**-$0.16**	**-$0.08**	**-$0.03**

The difference would be $0.08 million if the lower discount rate (3.0%) is used. However, these values do not include any reduction in cultural values that might result from non-renewable

resource development, nor does it include any reduction in the range of ecological goods and services being provided by the area. It does not include any changes in values for other residents of the Dehcho Region or the NWT.

However, designation of the majority of the Ka'a'gee Tu CPA as a National Wildlife Area would also generate non-use values (existence, option and bequest values) for protected areas and for caribou, as described in Sections5.2.1 and 5.2.2. There is evidence that Canadian households believe that creating protected areas and protecting Woodland Caribou is important and that they are willing to pay amounts of $5.50 per household to create protected areas and $20.12 or more per household to protect Woodland Caribou. These estimates of willingness to pay are not directly related to the area of land being protected, so would be the same as for the full protection option. Consequently, the net present value of these non-use benefits is estimated to be $73.5 million for all households in Canada, with $0.13 million for households in the NWT and $0.01 million for households in the Dehcho Region. There would be no change in the economic benefits to residents of Kakisa, because of the very small population and number of households.

6.3 Change in Economic Value

The change in total economic value associated with the Ka'a'gee Tu CPA under the modified boundary option can be estimated by combining the potential non-use benefits associated with designation of most of the area as a National Wildlife Area with the benefits and costs of allowing oil and gas development in some parts of the CPA that would no longer be protected. The resulting estimates are shown in Table 6-3.

The results show that the modified boundary option would generate large benefits for Canada: the net present value of these benefits is estimated to be $73.6 million, regardless of which discount rate is used. Under this option, the labour income benefits associated with non-renewable resource use would slightly exceed any losses in renewable resources, but there would be extremely large non-use values associated with creating a new National Wildlife Area.

From the perspective of the NWT, the modified boundary option would create benefits with a NPV of just over $0.3 million. The labour income benefits in the NWT associated with non-renewable resource use would slightly exceed any losses in renewable resources, and there would be a small increase in non-use values associated with creating a new National Wildlife Area.

For the Dehcho Region, the loss of renewable resources associated with petroleum development would be larger than or equal to the potential labour income benefits associated with non-renewable resource development and these would be a small increase in non-use values. The results show that the modified boundary option would generate relatively small net benefits for the 8.0% discount rate, but would result in a net loss of benefits if a lower discount rate were used.

For residents of Kakisa, there would be no change in non-use benefits and the loss of renewable resources would exceed any labour income benefits associated with petroleum development.

Thus, the modified boundary option would result in a net loss for Kakisa, regardless of which discount rate is used.

Table 6-3: Present Value of Net Economic Benefits Associated with the Ka'a'gee Tu CPA: Modified Boundary Option

	Undiscounted	3.0% Discount Rate	8.0% Discount Rate
NPV of Net Benefits for Canada (millions)			
Non-Renewable Resources	$0.35	$0.29	$0.22
Loss of Renewable Resources	-$0.16	-$0.08	-$0.03
Non-Use Values	$73.46	$73.46	$73.46
TOTAL	$73.65	$73.67	$73.64
NPV of Net Benefits for the NWT (millions)			
Non-Renewable Resources	$0.35	$0.29	$0.22
Loss of Renewable Resources	-$0.16	-$0.08	-$0.03
Non-Use Values	$0.13	$0.13	$0.13
TOTAL	$0.32	$0.34	$0.31
NPV of Net Benefits for the Dehcho Region (millions)			
Non-Renewable Resources	$0.07	$0.06	$0.04
Loss of Renewable Resources	-$0.16	-$0.08	-$0.03
Non-Use Values	$0.01	$0.01	$0.01
TOTAL	$0.08	-$0.01	$0.02
NPV of Benefits for Kakisa (millions)			
Non-Renewable Resources	$0.02	$0.01	$0.01
Loss of Renewable Resources	-$0.16	-$0.08	-$0.04
Non-Use Values	$0.00	$0.00	$0.00
TOTAL	-$0.14	-$0.06	-$0.02

Note: Totals may not add due to rounding

6.4 Effects on Kakisa

For residents of Kakisa, designation of most of the Ka'a'gee Tu CPA as a National Wildlife Area, under the modified boundary option, would provide some labour income benefits, but these would be very small because it is assumed that petroleum exploration will not identify any reserves that are economically viable to recover, so there would be no production and no long term employment. At the same time, the land disturbances associated with seismic exploration and drilling would affect their wildlife harvests, and the resulting costs would be larger than any labour income being generated. Thus, modifying the boundaries of the National Wildlife Area to allow petroleum development in a couple of locations will result in no benefits for Kakisa. However, there may be some opportunities for tourism-related employment as a result of an increased number of people travelling Highway 1choosing to stop to see the area.

7.0 SUMMARY AND RECOMMENDATIONS

Table 7-1 provides a comparison of the no protection option and the two boundary options for National Wildlife Area for the Ka'a'gee Tu CPA. It shows that, under the full protection option, the proposed National Wildlife Area would be 9,640 km^2 in area, but this would be reduced to 8,159 km^2 (85%) under the modified boundary option. While the full protection option would protect all of the traditional and commercial resource use and values and maintain the production of ecological goods and services, the petroleum and mineral resources of the area would not be developed. Under the no protection option, petroleum and mineral development would be allowed, and the resulting land uses are expected to compromise the ability of the area to continue to provide the full range of renewable resources that benefit residents of Kakisa. While the modified boundary option protects the balance of renewable resources in the Ka'a'gee Tu CPA, some petroleum development would be allowed in two parts of the Ka'a'gee Tu CPA that would be situated outside the National Wildlife Area.

7.1 Non-Renewable Resource Development

Chapter 3.0 summarizes the nature, extent and timing of non-renewable resource development that could occur in the Ka'a'gee Tu CPA in the absence of protection. It concludes that:

- There is some potential for natural gas development because some natural gas has already been discovered in the area and there is some potential for additional natural gas resources to be discovered in four land blocks within the CPA that have the highest natural gas potential. It is assumed that one of the two existing wells will be produced, assuming natural gas prices are sufficient to warrant the costs of constructing a connector pipeline to the Cameron Hills facilities, and that exploration on the four land blocks will result in the discovery and production of natural gas from one new well.
- Exploration for oil in the CPA would be done in conjunction with natural gas exploration and would focus on two land blocks that are believed to have more than 100,000 barrels of recoverable oil per quarter grid. It is assumed that this exploration will result in the discovery and production of oil from one new oil well.

There would be no mineral resource development in the Ka'a'gee Tu CPA because, although the area has potential, the resources are either too deep to be financially viable to recover (lead-zinc) or are found in other parts of the NWT where production is more financially viable (diamonds, limestone).

Table 7-1: Summary of Potential Protection and Development Afforded by Possible Boundary Options for the Ka'a'gee Tu Candidate Protected Area

				Full Protection	Modified Boundary	No Protection	Full Protection	Modified Boundary	No Protection
Type of Benefit		**Indicator**	**Units**	**Spatial Assessment**			**Percent of Total**		
Traditional Resource Use and Values	Consumption of fish	Known Fish harvesting sites	Number of sites	9	8	0	100%	90%	0%
	Traditional Use and Occupancy Areas[16]	Very high values	km^2	788	524	0	100%	67%	0%
		High values	km^2	1,250	1,089	0	100%	87%	0%
		Moderate values	km^2	3,925	3,550	0	100%	90%	0%
		Low values	km^2	3,677	3,085	0	100%	84%	0%
Commercial Resource Use and Values	Fishing Camps	Number of camps	km^2	2	1	0	100%	50%	0%
	Tourism	Number of sites	Number of sites	2	0	0	100%	0%	0%
Wildlife Habitat	Wildlife Habitat Values[17]	Very high values	km^2	3,217	2,564	0	100%	80%	0%
		High values	km^2	3,856	3,536	0	100%	92%	0%
		Moderate values	km^2	2,415	1,986	0	100%	82%	0%
	Woodland Caribou	Undisturbed areas > 500 km^2	Number of areas	One	One	None	100%	100%	0%
Cultural Values	Archeology, Cabins, Historic Sites and Rare Features[18]	Very high values	km^2	40	22	0	100%	56%	0%
		High values	km^2	109	64	0	100%	59%	0%
		Moderate values	km^2	151	107	0	100%	70%	0%
		Low values	km^2	170	126	0	100%	74%	0%
Hydrocarbon Resources	Natural Gas	Existing wells	Number	0	1	2	0%	50%	100%
		Undiscovered Recoverable > 2 BCF	Number of land block of 600 km^2	0	1	4	0%	25%	100%
	Oil	Undiscovered Recoverable > 100 MB	km^2	0	1	2	0%	50%	100%
	Land use disturbance	Disturbed area (5m width)	km^2	14.5	26.2	43.8	0.2%	0.3%	0.5%
		Seismic line density	km/km^2	0.35	0.63	1.06	100%	180%	303%
TOTAL AREA			km^2	**9,607**	**8,159**	**0**	**100%**	**85%**	**0%**

[16] Based on interpretation of Map 5: Generalized Density of Traditional Use and Occupancy, prepared as part of the Deh Cho Land Use Options Atlas.
[17] Based on interpretation of Map 4: Wildlife Habitat Value, prepared as part of the Deh Cho Land Use Options Atlas.
[18] Based on interpretation of Map 6: Archeology , Cabins, Historic Sites and Rare Features, prepared as part of the Deh Cho Land Use Options Atlas

As noted in Table 7-1, the establishment of a National Wildlife Area based on the modified boundaries would allow development on one land block with high potential for oil and one land block with high potential for natural gas, and development of one existing gas. However, these two blocks have relatively low undiscovered recoverable reserves compared to the other blocks in the Ka'a'gee Tu CPA with high potential, so it is expected that, under this option, there would be no petroleum production from these two blocks. If all of the Ka'a'gee Tu CPA were designated as a National Wildlife Area, there would be no petroleum exploration or development.

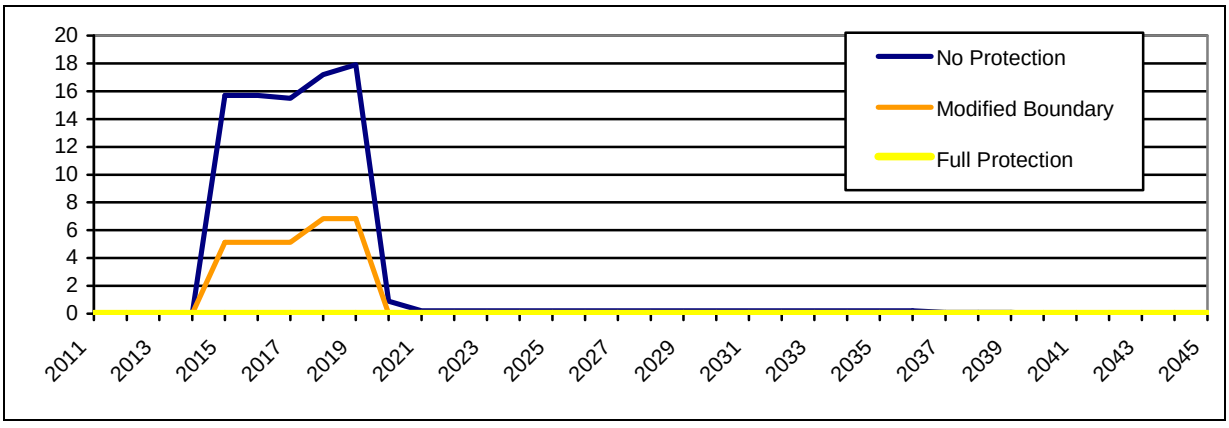
Based on these assumptions, the extent and economic impacts of non-renewable resource development under the three options are summarized in Table 7-2. It shows that non-renewable resource development under the modified boundary option would be equivalent to about 33% of the full potential under the no protection option.

Table 7-2: Non-Renewable Resource Development and Impacts for the Boundary Options

	No Protection Option	Modified Boundary Option	Full Protection Option
Investment Costs (millions)	$34.5	$11.5	$0
Direct and Indirect Impact on NWT GDP (millions)	$28.8	$9.6	$0
Direct and Indirect Employment in the NWT (person-years)	87	29	0
Direct and Indirect Labour Income (millions)	$6.9	$2.3	$0

The timing and magnitude of direct and indirect employment resulting from non-renewable resource under the boundary options is shown in Figure 7-1.

Figure 7-1: Summary of Direct and Indirect Employment in the NWT for the Three Boundary Options



It shows that, under the no protection option, there would be major burst of employment activity between 2015 and 2020 associated with exploration and drilling for oil and natural but during the

production phase of development (2020 to 2040) very little labour would be required. For the modified boundary option, the employment effects are much lower between 2015 and 2020 because there would be less petroleum exploration and there would be no employment after 2020 because no production is expected.

The economic benefits resulting from non-renewable resource development under the boundary options have been estimated in terms of the net present value (NPV) of benefits during the period from 2011 to 2045, calculated using various discount rates. The benefits include employment income for workers who would not otherwise be employed, corporate profits, royalty payments, and corporate taxes. The resulting benefit estimates are summarized in Table 7-3. It shows that, when the highest discount rate is used (8.0%), the NPV of non-renewable resource development benefits for all of Canada under the no protection option is $9.1 million, but this drops to $0.2 million under the modified boundary option because without production, there would be no royalty or tax payments to the federal government.

Table 7-3: Net Present Value of Future Benefits from Non-Renewable Resource Development for the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Modified Boundary Option (millions)	Full Protection Option (millions)
Canada	Undiscounted	$26.49	$0.35	$0
	3.0%	$17.10	$0.29	$0
	8.0%	$9.14	$0.22	$0
NWT	Undiscounted	$5.58	$0.35	$0
	3.0%	$3.67	$0.29	$0
	8.0%	$2.03	$0.22	$0
Dehcho Region	Undiscounted	$0.56	$0.07	$0
	3.0%	$0.39	$0.06	$0
	8.0%	$0.24	$0.04	$0
Kakisa	Undiscounted	$0.09	$0.02	$0
	3.0%	$0.07	$0.01	$0
	8.0%	$0.04	$0.01	$0

7.2 Renewable Resource Implications

The Ka'a'gee Tu CPA is an important natural area that has been used by residents of Kakisa for traditional harvesting of fish and wildlife for food, as well as for commercial activities such as trapping. The economic benefits being generated by the Ka'a'gee Tu CPA under current conditions are in the range of $0.39 million to $0.46 million per year, but this estimate is considered conservative because it does not include the cultural value of the area.

7.2.1 Costs Associated with Petroleum Development

If all or parts of the Ka'a'gee Tu CPA are not protected and petroleum development is allowed to occur, the resulting exploration activities will result in land disturbances that will adversely affect renewable resources and their associated benefits. The greatest concern relates to the creation of seismic lines. Although seismic lines have already been cut through much of the area (at an average density of about 0.35 km of seismic line per km^2 throughout the area), this is expected to increase to an average of 2.3 km/km^2 of linear disturbance on those land blocks where seismic exploration occurs, based on seismic line density in other nearby locations in the Cameron Hills. In total, six land blocks totaling 3,000 km^2 would be affected by petroleum development. While the additional seismic lines will increase the extent of land disturbance in the area (from 0.2% of the area at present to 0.5% under the no protection option), the effects of these disturbances extend beyond the area actually cleared. Seismic lines provide increased access for resident hunters, can lead to increased predation of some species, and would change the wilderness character of the area.

It is estimated that, under the no protection option, there would be a 2% reduction in habitat for most game species, and the resulting benefits for residents of Kakisa would be reduced accordingly. For Woodland Caribou, which prefer habitats that are greater than 400 m from open areas and are larger than 500 km^2, the additional seismic activity would eliminate the one available piece of secure preferred Woodland Caribou habitat in the Ka'a'gee Tu CPA. Environment Canada (2011) has already determined that the Northwest Territories South range is not considered to be capable of supporting a self-sustaining population of Woodland Caribou, and the additional seismic activity in this area could accelerate the rate of decline in Woodland Caribou populations.

Under the modified boundary option, the extent of land use disturbances would be much less because non-renewable resource development would be limited to two land blocks with a combined area of 1,200 km^2. It is assumed that these disturbances associated with seismic activities would result in a 1% reduction in wildlife populations, and this would translate into 1% decline in the amount and value of country food and fur bearing animals being harvested from the Ka'a'gee Tu CPA. Under this option, the one available piece of secure preferred Woodland Caribou habitat larger than 500 km^2 would be maintained. However, by designating part of the Ka'a'gee Tu CPA as a National Wildlife Area, the resulting willingness to pay to create a protected area and to protect a Woodland Caribou herd would result in an overall increase in the annual benefits being generated by the area.

The NPV of future renewable resources costs under the boundary options is provided in Table 7-4, and is based on the costs experienced by residents of Kakisa and assumes that there would be no other costs for people living outside Kakisa. It shows that, for the highest discount rate, the total costs associated with petroleum development (-$0.04 million) would slightly higher than for the no protection option or protection with a modified boundary (-$0.03 million) when

using an 8.0% discount rate. For the lower discount rate, the renewable resource costs for the no protection option would also be slightly higher than for the modified boundary option.

Table 7-4: Net Present Value of Future Renewable Resource Costs Associated with the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Modified Boundary Option (millions)	Full Protection Option (millions)
TOTAL COSTS	Undiscounted	-$0.18	-$0.16	$0.0
	3.0%	-$0.09	-$0.08	$0.0
	8.0%	-$0.04	-$0.03	$0.0

7.2.2 Non-Use Benefits Associated with a National Wildlife Area

If all or parts of the Ka'a'gee Tu CPA are designated as a National Wildlife Area, two types of non-use benefits will occur. Canadians value protected areas and they value Woodland Caribou, and have indicated a willingness to pay to have protected areas and to protect caribou. Under the full protection option, the annual non-use benefits from establishing a National Wildlife Area would be expected to be $73.46 million, based on willingness to pay to protect Woodland Caribou ($4.4 million) and willingness to pay to create protected areas ($69.1 million). As this is based on a one-time payment, the values would be the same regardless of the discount rate being used. Based on the number of households, these non-use values would amount to $0.13 million for households in the NWT and $0.01 million for households in the Dehcho Region. There would be no measurable non-use economic benefits to households in Kakisa, because of the very small population.

7.3 Changes in Economic Value

The total changes in the economic value of the Ka'a'gee Tu CPA under the three boundary options can then be determined by combining the information on non-renewable resource benefits (Table 7-3) with the information on renewable resources costs (Table 7-4) and changes in non-use values associated with protected area. The results are provided in Table 7-5.

Table 7-5 shows that, for Canada, both the full protection and modified boundary options would provide the highest values (shaded in green) because the high non-use values exceed the benefits from petroleum development that would occur under the no protection option. The analysis indicates that even if the extent of non-use values were to decreased by $50 million (undiscounted) to $65 million (8.0% discount rate), the net benefits from the full protection and modified boundary options would still exceed the benefits from the no protection option.

For the NWT, the highest net benefits would occur under the no protection option, regardless of which discount rate is used, while the full protection option would have the lowest net benefits (shaded in red). For the NWT, the benefits from non-renewable resource development would

always exceed the potential non-use benefits from designating the area as a National Wildlife Area.

Table 7-5: Net Present Value of Future Benefits for the Boundary Options

Location	Discount Rate	No Protection Option (millions)	Modified Boundary Option (millions)	Full Protection Option (millions)
Canada	Undiscounted	$26.32	$73.65	$73.46
	3.0%	$17.01	$73.67	$73.46
	8.0%	$9.10	$73.64	$73.46
NWT	Undiscounted	$5.40	$0.32	$0.13
	3.0%	$3.58	$0.34	$0.13
	8.0%	$2.00	$0.31	$0.13
Dehcho Region	Undiscounted	$0.38	-$0.08	$0.01
	3.0%	$0.30	-$0.01	$0.01
	8.0%	$0.21	$0.02	$0.01
Kakisa	Undiscounted	-$0.09	-$0.14	$0.00
	3.0%	-$0.02	-$0.06	$0.00
	8.0%	$0.00	-$0.02	$0.00

For the Dehcho Region, the greatest net benefits would occur under the no protection option, and the net benefits from full protection would be larger than the benefits from the modified boundary option. Table 7-5 shows that, for the modified boundary option, costs would actually exceed benefits if the lower discount rates are used.

7.4 Effects on Kakisa

From the perspective of Kakisa, the full protection option would provide the greatest net benefits, regardless of which discount rate is used. For the other options, the loss of renewable resource benefits associated with land use disturbances would generally exceed the labour income benefits resulting from petroleum development, resulting in net costs for the community. The one exception is that, for an 8.0% discount rate, the benefits of development under the no protection would be equal to the costs of development, resulting in no change in benefits for residents of Kakisa.

It should be noted that these estimates do not include any costs associated with possible losses of cultural values that might occur under either the no protection or modified boundary options. Similarly, the analysis does include potential benefits that might arise from tourism-related opportunities that might result from designating the Ka'a'gee Tu CPA as a National Wildlife Area. It is expected that if such benefits and costs were to be include, they would confirm the conclusion that, from the perspective of residents of Kakisa, the full protection option offers the greatest future benefits.

7.5 Uncertainties and Issues

There are many uncertainties inherent in undertaking this type of analysis. To begin, the assessment of the benefits that residents of Kakisa, the Dehcho Region and the NWT derive from the Ka'a'gee Tu CPA relies on information about renewable resource use and values that is known to be incomplete, especially in terms of actual use of the area. In addition, there is even less information about the spatial distribution of these activities within the Ka'a'gee Tu CPA. Despite these problems, this analysis has used whatever information is available to describe the use and value of the Ka'a'gee Tu CPA. The heat map that was developed to show areas of high use and importance was prepared using available information from the Deh Cho Planning Study and was validated through discussions with the community and is believed to provide a reasonably reliable description of spatial information.

The second challenge is to develop reasonable non-renewable resource development scenarios given the uncertainties related to the extent of oil and gas and mineral resources in the area as well as the range of complex factors that will determine if and when such development actually occurs. There are many factors that will affect future development in the area and, to the extent possible, the scenarios presented in this report attempt to focus on those factors that are likely to be of greatest importance, those being commodity prices, the cost of development, and the ease with which commodities could be transported to market. Available information suggests that, for oil and gas, the recoverable reserves are, generally speaking, too small to be economically produced. That conclusion is supported by the amount of seismic activity that has already occurred, the number of dry wells that have been drilled, and that successful wells have reserves that are currently too small to be economically viable to produce. This is not to say that there will be no oil and gas development in the area if it becomes available for exploration and development. Available information suggests that it may be a challenge to locate and extract oil and gas reserves that are financially viable and the only way of confirming resource potential would be to allow parts of the Ka'a'gee Tu CPA to be fully explored. However, such activities could significantly and adversely affect the very resources that the community of Kakisa believes to be of great importance.

The third challenge is to try to predict the extent to which any non-renewable resource development that does occur will provide employment and income for residents of Kakisa. At present, residents do not appear to have the skills related to oil and gas development, so that the there may be little opportunity for them to participate in any development that does occur. Based on experience with other resource projects in remote communities, there are initially limited opportunities for individual or corporate participation in development. This can change quickly, however. Communities can take the initiative to develop benefits agreements that will create opportunities for local residents to acquire the training or resources they need to be able to take advantage of any employment activities that occur. However, until such time as a benefits agreement is in place, resource industries typically bring in the experts they need to do the job, leaving little opportunities for local residents.

A fourth challenge is to look forward and describe the extent to which the Ka'a'gee Tu CPA will continue to provide benefits for residents of Kakisa and the surrounding region. Climate change may result in long-term changes in the landscape, the range and distribution of plants and animals, biological productivity, and the incidence of fire. Changes in any of these could affect the ability of the Ka'a'gee Tu CPA to continue to support the residents of Kakisa as it has in the past. However, demographic changes in the community will also affect future use of the Ka'a'gee Tu CPA. Future levels of use will depend on whether the current generation continues to participate in the traditional and cultural use of the landscape to the same extent as their parents or their grandparents, and whether they pass these interests on to future generations. It is challenging to even speculate on what the future will bring, but all or partial protection of the Ka'a'gee Tu CPA will at least provide current and future residents of Kakisa with the option of participating in these activities, whereas opening the area to development may preclude these opportunities.

One final challenge is to predict the extent to which non-renewable resource development, if allowed, would adversely affect the existing landscape and the functionality of its ecosystems. While predictions can be made based on evidence in areas where non-renewable resource development has already occurred, it is not clear that these same effects would occur in the Ka'a'gee Tu CPA because its ecosystems may be more or less resilient to change. In addition, the regulatory regime for non-renewable resource development in that area could be quite different from the regimes in other areas, possibly providing better levels of protection. The only way of addressing this challenge would be to undertake a more detailed ecological assessment of the potential effects of non-renewable resource development possibly as part of the ecological assessment required by the PAS process. Another option would be to undertake a sensitivity analysis to determine the point at which changes in the landscape would result in environmental costs that exceed the economic benefits associated with non-renewable resource development.

There is no easy way to address all these methodological issues and information gaps. The only approach involves clearly laying out all of the assumptions and data sources used in the analysis so that the readers can fully understand the strengths, weaknesses, and implications of the study and its findings so that they can draw their own conclusions about the future of the Ka'a'gee Tu CPA.

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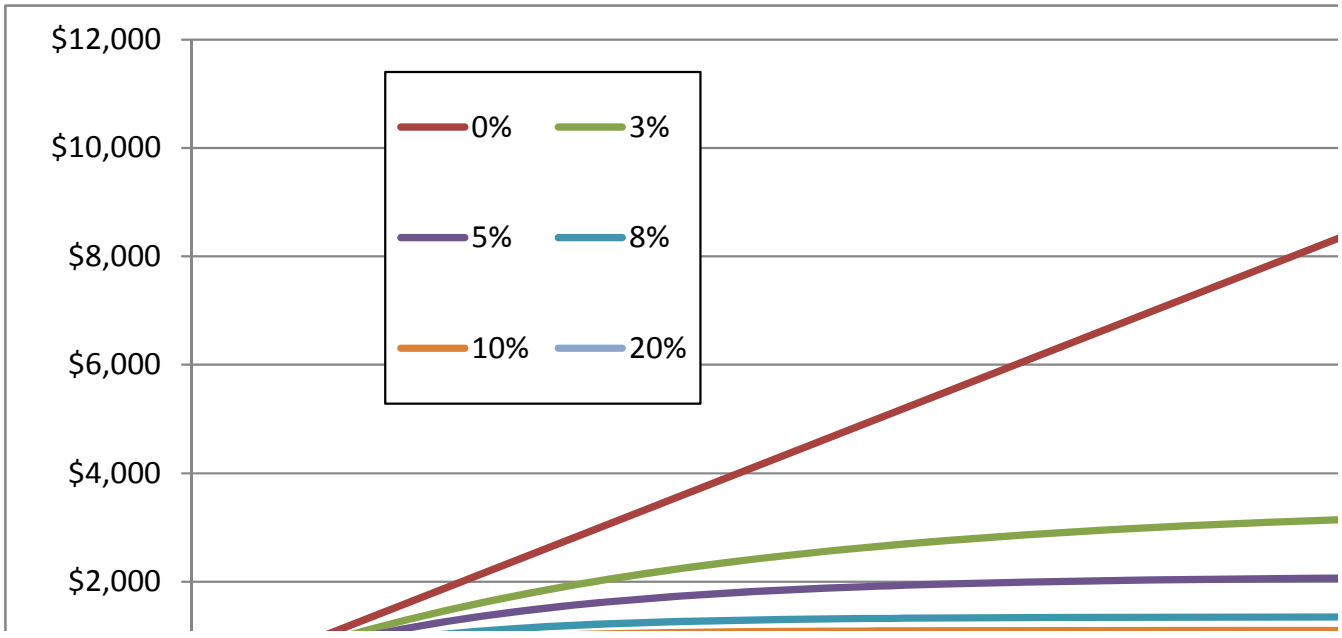
APPENDIX A: WHAT IS DISCOUNTING?

One of the challenges facing decision-makers or investors is how benefits and costs that may occur at different times in the future can be effectively compared to each other. How does an investment that offers a lot of money 20 years from now compare to another investment that offers smaller amounts of money steadily over the next 20 years? To address this issue, economists use the concept of net present value or NPV. This concept is based on the idea that a dollar today is worth more than a dollar one or more years from now, regardless of inflation. This reflects the idea that there is some risk and uncertainty as to whether that future dollar will ever be received. Thus, future values are discounted to give a current dollar equivalent.

The question then becomes how much less is a dollar tomorrow compared to a dollar today? In financial terms, the answer relates to how much interest you would have to get in order not to spend the dollar now but to wait for a year. So if banks are offering 3% interest, it means that $1 today would be the same as $1.03 a year from now or alternatively, $1 a year from now would be worth $0.97 today. The farther into the future, the more heavily the value the dollar is discounted. For 3% discount rate, a payment of $1 five years from now would currently be worth $0.86. One dollar 10 years from now would have a net present value of $0.74. The higher the discount rate, the more heavily future values are discounted. Current direction from the Treasury Board of Canada suggests that public sector investments should be evaluated using a discount rate of 8%, but also at 3% for sensitivity analysis. For private sector investments, investors often use discount rates of 15% or greater

The effects of discounting can be shown in the chart below.



The graph shows the accumulating net present value of receiving $100 per year over 100 years. For the undiscounted case (0%) the graph shows that the cumulative value would amount to $10,000. For a 3% discount rate the net present value would amount to $3260. For a 7% discount rate the net present value would be $1530. The graph also shows that past 50 years in the future, the net present value changes relatively little depending on a discount rate. For example, in year 50, the net present value at 3% will be 82% of its total value in 100 years while at 5%, the net present value in year 50 will be 92% of its total value in 100 years. Thus, in economic terms, any values beyond 50 years will have very little effect on the net present value, meaning that it is unnecessary to develop forecasts of much longer than 50 years.

APPENDIX B: SAMPLE CALCULATIONS

Calculation of the benefits and costs associated with oil and gas development under each of the proposed boundary options is fairly complicated and, as noted in the text, involves numerous assumptions.

The spreadsheet on the following page has been provided to help readers understand how the benefits and costs were calculated. This spreadsheet shows how potential investment in oil development in the Ka'a'gee Tu CPA is translated into new labour income in the NWT, the Dehcho Region and Kakisa and how this is translated into the net present values (NPV) used in the analysis.

The first rows of the sheet show the annual discounting factors to be used to calculate the present value (in 2011$) of income received in future years. The analysis uses discount rates of 3.0% and 8.0%. To estimate the net present value of a steam of future benefits, the benefit for each year is multiplied by the discount factor and then the annual amounts are added to get the NPV. These calculations are shown at the bottom of the spreadsheet. It should be noted that, while the spreadsheet shows values for the period from 2012 to 2038, the calculation of NPV was actually based on values for the period from 2012 to 2065.

The next rows of information summarize estimated annual spending on oil development in the Ka'a'gee Tu CPA under the assumption that the area was available for exploration and production. The annual costs for exploration, drilling, installation of surface production equipment and operation are shown. This information is then converted into estimates of new labour income in the NWT by:

1. Multiplying by the appropriate industry employment multipliers from the NWT Bureau of Statistics. This converts expenditures into estimates of direct and indirect employment in the NWT. Direct employment is assumed to be 75% of the direct and indirect employment estimates. The assumptions used in the calculations are highlighted in yellow.
2. Multiplying the annual costs by the appropriate industry income multipliers from the NWT Bureau of Statistics. This converts expenditures into estimates of direct and indirect labour income. Direct employment income is assumed to be 75% of the direct and indirect income. The assumptions used in the calculations are highlighted in yellow.
3. Multiplying the direct labour income estimates for the NWT by the annual unemployment rates (highlighted in yellow) to estimate "new" employment income. For the NWT, the exploration and construction phases of development are short term so the current rate of unemployment in the NWT (10%) was used to estimate "new" employment income. For operations, all employment and associated income was assumed to be new. The spreadsheet shows that, for 2015, oil development expenditures in the NWT would generate new labour income of $29,500.

4. The NPV of new labour income was then calculated by multiplying the amount of labour income in each year by the discount factor. In 2015, the present value of $29,500 is calculated to be: $29,500 * 0.73502985 = $21,638 for a discount rate of 8%. The cumulative NPV for the 8% discount rate is estimates to be $141,122 or $0.14 million.

The same general process was used to estimate labour income benefits for the Dehcho region:

5. The total labor income for the region was calculated by multiplying the labour income estimate for the NWT by the estimated percentage of labour that would be supplied by the region (highlighted in yellow). This was assumed to be 50% for operations and 20% for the other phases of oil development.
6. The "new" labour income for the region was estimated by multiplying the direct labour income estimates for the region by the annual regional unemployment rates (highlighted in yellow) to estimate "new" employment income. The current regional rate of unemployment (20%) was used for the exploration and construction phases of development while all employment and associated income associated with operations was assumed to be "new". The spreadsheet shows that, for 2015, oil development expenditures would generate new direct regional labour income of $11,800.
7. The NPV of new labour income in the region was then calculated by multiplying the amount of labour income in each year by the discount factor. In 2015, the present value of $11,800 is calculated to be: $11,800 * 0.73502985 = $8,673 for a discount rate of 8%. The cumulative NPV for the 8% discount rate is estimates to be $60,231 or $0.06 million.

Estimated new labour income for residents of Kakisa was based on the assumption that 25% of new employment in the region would involve residents of the community.

The resulting estimates of the NPV of new labour employment associated with oil development in the Ka'a'gee Tu CPA are then summarized at the bottom of the worksheet. It shows that the NPV for new labour income would be as follows:

Discount Rate	Kakisa	Rest of Region	Rest of NWT	NWT
$ Millions (2011)				
0.0%	$0.03	$0.10	$0.20	$0.34
3.0%	$0.02	$0.07	$0.15	$0.25
8.0%	$0.02	$0.05	$0.10	$0.16

These values correspond to the new labour income reported in Table 3-4.

Discounting Factors

Discounting Factors	Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	26
	3.0%	0.970874	0.94259591	0.91514166	0.88848705	0.8626088	0.8374843	0.81309151	0.789409	0.766417	0.744094	0.722421	0.70138	0.680951	0.661118	0.641862	0.623167	0.605016	0.587395	0.570286	0.553676	0.537549	0.521893	0.506692	0.491934	0.477606	0.463695	0.463695
	8.0%	0.925926	0.85733882	0.79383224	0.73502985	0.6805832	0.6301696	0.5834904	0.540269	0.500249	0.463193	0.428883	0.397114	0.367698	0.340461	0.315242	0.29189	0.270269	0.250249	0.231712	0.214548	0.198656	0.183941	0.170315	0.157699	0.146018	0.135202	0.135202

Estimated Spending on Oil Development

Expenditures	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Exploration	$0	$0	$0	$1,333,333	$1,333,333	$1,333,333	$1,333,333	$1,333,333	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Drilling	$0	$0	$0	$0	$0	$0	$1,212,500	$1,212,500	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Field Equipment	$0	$0	$0	$0	$0	$0	$0	$485,000	$485,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operations	$0	$0		$0	$0	$0	$0	$0	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800	$135,800
TOTAL	**$0**	**$0**	**$0**	**$666,667**	**$666,667**	**$666,667**	**$1,879,167**	**$2,364,167**	**$620,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**	**$135,800**

Calculation of Employment Impacts using NWT Multipliers

Direct and Indirect Employment	Multiplier per $ Million	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Exploration	3.85	0.0	0.0	0.0	5.1	5.1	5.1	5.1	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Drilling	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Field Equipment	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Operations	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
TOTAL		**0.0**	**0.0**	**0.0**	**5.1**	**5.1**	**5.1**	**6.0**	**6.3**	**0.4**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**
Direct Employment	**75%**	**0.0**	**0.0**	**0.0**	**3.9**	**3.9**	**3.9**	**4.5**	**4.7**	**0.3**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**	**0.1**

Calculation of Income Impacts using NWT Multipliers

Direct and Indirect Labour Income	Avg. Income	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Exploration	$76,623	$0	$0	$0	$393,333	$393,333	$393,333	$393,333	$393,333	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Drilling	$100,000	$0	$0	$0	$0	$0	$0	$84,875	$84,875	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Field Equipment	$100,000	$0	$0	$0	$0	$0	$0	$0	$33,950	$33,950	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operations	$100,000	$0	$0	$0	$0	$0	$0	$0	$0	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506
TOTAL		**$0**	**$0**	**$0**	**$393,333**	**$393,333**	**$393,333**	**$478,208**	**$512,158**	**$43,456**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**
Direct Income	**75%**	**$0**	**$0**	**$0**	**$295,000**	**$295,000**	**$295,000**	**$358,656**	**$384,119**	**$32,592**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**

Calculation of Income Benefits to NWT Based on Use of Unemployed Labour

NWT Unemployed Income	% Unemployed	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Exploration	10%	$0	$0	$0	$39,333	$39,333	$39,333	$39,333	$39,333	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Drilling	10%	$0	$0	$0	$0	$0	$0	$8,488	$8,488	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Field Equipment	10%	$0	$0	$0	$0	$0	$0	$0	$3,395	$3,395	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operations	100%	$0	$0	$0	$0	$0	$0	$0	$0	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506	$9,506
TOTAL		**$0**	**$0**	**$0**	**$39,333**	**$39,333**	**$39,333**	**$47,821**	**$51,216**	**$12,901**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**	**$9,506**
Direct Income	**75%**	**$0**	**$0**	**$0**	**$29,500**	**$29,500**	**$29,500**	**$35,866**	**$38,412**	**$9,676**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**	**$7,130**

Discounted Values		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
$307,914	0.0%	$0	$0	$0	$29,500	$29,500	$29,500	$35,866	$38,412	$9,676	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130	$7,130
$221,531	3.0%	$0	$0	$0	$26,210	$25,447	$24,706	$29,162	$30,323	$7,416	$5,305	$5,151	$5,000	$4,855	$4,713	$4,576	$4,443	$4,313	$4,188	$4,066	$3,947	$3,832	$3,721	$3,612	$3,507	$3,405	$3,306	$3,210
$141,122	8.0%	$0	$0	$0	$21,683	$20,077	$18,590	$20,927	$20,753	$4,840	$3,302	$3,058	$2,831	$2,622	$2,427	$2,248	$2,081	$1,927	$1,784	$1,652	$1,530	$1,416	$1,311	$1,214	$1,124	$1,041	$964	$893

Calculation of Regional Income Impacts

Regional Employed Income	Percent of NWT	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Exploration	20%	$0	$0	$0	$78,667	$78,667	$78,667	$78,667	$78,667	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Drilling	20%	$0	$0	$0	$0	$0	$0	$16,975	$16,975	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Field Equipment	20%	$0	$0	$0	$0	$0	$0	$0	$6,790	$6,790	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operations	50%	$0	$0	$0	$0	$0	$0	$0	$0	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753
TOTAL		**$0**	**$0**	**$0**	**$78,667**	**$78,667**	**$78,667**	**$95,642**	**$102,432**	**$11,543**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**
Direct Income	**75%**	**$0**	**$0**	**$0**	**$59,000**	**$59,000**	**$59,000**	**$71,731**	**$76,824**	**$8,657**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**

Calculation of Income Benefits to Region Based on Use of Unemployed Labour

Regional Unemployed Income	% Unemployed	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Exploration	20%	$0	$0	$0	$15,733	$15,733	$15,733	$15,733	$15,733	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Drilling	20%	$0	$0	$0	$0	$0	$0	$3,395	$3,395	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Field Equipment	20%	$0	$0	$0	$0	$0	$0	$0	$1,358	$1,358	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Operations	100%	$0	$0	$0	$0	$0	$0	$0	$0	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753	$4,753
TOTAL		**$0**	**$0**	**$0**	**$15,733**	**$15,733**	**$15,733**	**$19,128**	**$20,486**	**$6,111**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**	**$4,753**
Direct Income	**75%**	**$0**	**$0**	**$0**	**$11,800**	**$11,800**	**$11,800**	**$14,346**	**$15,365**	**$4,583**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**	**$3,565**

Discounted Values		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
$137,425	0.0%	$0	$0	$0	$11,800	$11,800	$11,800	$14,346	$15,365	$4,583	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565	$3,565
$96,986	3.0%	$0	$0	$0	$10,484	$10,179	$9,882	$11,665	$12,129	$3,513	$2,653	$2,575	$2,500	$2,427	$2,357	$2,288	$2,221	$2,157	$2,094	$2,033	$1,974	$1,916	$1,860	$1,806	$1,754	$1,703	$1,653	$1,605
$60,231	8.0%	$0	$0	$0	$8,673	$8,031	$7,436	$8,371	$8,301	$2,293	$1,651	$1,529	$1,416	$1,311	$1,214	$1,124	$1,041	$963	$892	$826	$765	$708	$656	$607	$562	$521	$482	$446

Kakisa	25.0%	of Deh Cho Region effects

SUMMARY

Discount Rate	Kakisa	Rest of Region	Rest of NWT	NWT
0.0%	$34,356	$103,068	$204,845	$342,270
3.0%	$24,246	$72,739	$148,792	$245,778
8.0%	$15,058	$45,173	$95,949	$156,180

Millions	Kakisa	Rest of Region	Rest of NWT	NWT
0.0%	$0.03	$0.10	$0.20	$0.34
3.0%	$0.02	$0.07	$0.15	$0.25
8.0%	$0.02	$0.05	$0.10	$0.16