

9 CUMULATIVE EFFECTS

9.1 Introduction

This section provides the socio-economic cumulative effects assessment for the Mackenzie Gas Project.

For an assessment of biophysical cumulative effects, see Volume 5, Section 12, Cumulative Effects.

Cumulative effects are changes to the environment that *are likely to result from the project in combination with other projects or activities that have been or will be carried out* (Government of Canada 2003a). The Mackenzie Gas Project's contribution to cumulative effects is its effect on a valued component (VC) that is also affected by other land uses. Settlements, roads and hunting are examples of land uses. Overall cumulative effects are effects by all land uses on a VC, including effects caused by the Mackenzie Gas Project.

This cumulative effects assessment is based on the predictions of the potential project-specific effects (see Sections 3 to 8), which are effects on VCs by the Mackenzie Gas Project alone. This information is necessary to identify effects on VCs that might act cumulatively with effects of other land uses.

An assessment of cumulative effects provides a more complete understanding of what might happen to VCs beyond the influence of the Mackenzie Gas Project alone. This is useful for regulatory decision makers, and land and resource managers as they review and plan future developments.

The following are those VCs for which socio-economic cumulative effects have been identified:

- the economy, including demographics
- infrastructure and community services
- individual, family and community wellness
- nontraditional land and resource use
- heritage resources

9.1.1 Summary of Results

This assessment of cumulative effects has concluded that:

- the Mackenzie Gas Project does not contribute significantly to cumulative effects
- there are no significant overall cumulative effects

- the Mackenzie Gas Project contributes to one potential cumulative effect of management concern: competition for qualified northern goods, services and labour, which could be addressed with diligent monitoring and management by responsible parties
- demand for qualified northern content in projects is expected to use all available northern capacity, which will limit the extent of both potential increased benefit and social costs among northern residents. However, it could marginally increase the temporary attraction of speculative in-migration, and associated social costs in the regional and commercial centres of Inuvik and Norman Wells.
- the Mackenzie Gas Project might encourage other development, particularly gas exploration and production in the Northwest Territories. However, information to adequately assess potential cumulative effects contributions from such developments is not yet available.
- the effect of any future hydrocarbon development, such as additional production fields, on the communities would likely be similar to effects predicted for current and reasonably foreseeable land uses. Those developments will be subject to their own environmental impact assessment, including cumulative effects.

These results indicate that, despite the size and duration of operations, the contribution to cumulative socio-economic effects by the Mackenzie Gas Project on the regions and communities of the Northwest Territories is not expected to be significant. These conclusions are based on the assumption that appropriate management and monitoring programs, outlined elsewhere in this volume, will be implemented.

9.1.2 Spatial Boundaries

The assessment of socio-economic cumulative effects was conducted within the study area, and that includes all areas in which the direct or indirect effects of gas production and transportation might affect permanent residents. As described in Volume 6, Section 1.2, Study Area, Regions, Communities and Governance, the pipeline essentially follows the Mackenzie River to within 200 km of the Alberta boundary. Therefore, this assessment includes all of the communities along or close to the Mackenzie River, and communities that are more distant but could experience some direct or indirect economic and social effects from the project. There are four settlement areas and 26 communities located in the Northwest Territories study area. Six communities in northern Alberta are also included in the study area. See Volume 4, Section 1, Introduction, for a complete listing of these communities.

Where cumulative effects can be identified as being region-specific, they are expressed as such.

9.1.3 Temporal Boundary

The assessment of socio-economic cumulative effects in the project region is based on current conditions as identified in the assessment baseline (2003), with the exception of statistics that generally refer to the most recent Statistic Canada census (2001) and heritage, which refers to the past.

Future land uses include those that are reasonably foreseeable or hypothetical (based on Hegmann et al. 1999 and Canadian Environmental Assessment Agency 1999):

- *reasonably foreseeable* land uses include those publicly disclosed land uses that have a high degree of certainty in proceeding, such as those that:
 - have confirmed funding
 - are submitted for regulatory review
 - are approved
 - are under construction
- *hypothetical land uses* are conjectural, based on currently available information, which includes land uses that are:
 - publicly announced with few details and unknown or low certainty of ever proceeding
 - implied by lease acquisition or identified through a planning process
 - possibly induced by the project

9.1.4 Past and Current Land Uses

Past and current uses are relevant to the assessment of cumulative socio-economic effects, and are taken into account as inherent to the existing baseline socio-economic conditions against which both the project-specific effects and this cumulative effects assessment are based, including:

- settlements:
 - communities
 - private lands
 - medical facilities
 - police facilities
 - military sites

- transportation:
 - all-weather roads
 - limited-use roads
 - bridges
 - airstrips
 - seaplane bases
 - barge landings
 - fuel caches
 - docks
 - wharves
 - planes
 - boats
 - automobiles
- industry (non-oil and gas):
 - forestry operations
 - sawmills
 - mining
 - quarries
 - grazing
 - herding
 - power lines
 - telecommunication lines
 - outfitting camps
 - lodges
 - cabins
 - camp sites
- industry (oil and gas):
 - exploration leases
 - significant discovery leases
 - seismic lines
 - pipelines
 - artificial islands
 - well sites
 - other facilities
- designated areas:
 - bird sanctuaries
 - national parks
 - International Biological Program sites
 - historic sites

- points of interest
- wildlife sanctuary
- other sites

- land use:
 - hunting and fishing
 - reindeer herding
 - tourism and recreation

The physical characteristics of land uses are illustrated in Volume 5, Section 12, Cumulative Effects.

9.1.4.1 Reasonably Foreseeable Land Uses

Reasonably foreseeable land uses include:

- Devon Canada Corporation (Devon) proposed Beaufort Sea Exploration Drilling Program
- Deh Cho Corporation's proposed Mackenzie River bridge at Fort Providence
- additional Government of the Northwest Territories (GNWT) Mackenzie winter road bridges
- the De Beers Snap Lake underground diamond mine

9.1.4.2 Hypothetical Projects

Hypothetical land uses include possible future:

- hydrocarbon (oil and gas) exploration
- gas production additional to the Mackenzie Gas Project anchor fields
- mineral exploration and production
- telecommunications line along the Mackenzie River
- all-weather resource access road southward from Tuktoyaktuk
- upgrading of the winter road between Wrigley and Fort Good Hope, and completion of Mackenzie Highway access between Fort Good Hope and Tsiigehtchic

Preliminary disclosure of other gas suppliers to the project has not yet been filed. Details about further gas production tied into the Mackenzie Gas Project are

therefore also not yet known. Such production would generally include well pads, conditioning facilities, gathering pipelines and winter or all-weather access roads. The project proponents could include any of the current lease holders, and possibly new lease holders, in the Mackenzie-Beaufort, Mackenzie Valley and, possibly, Yukon regions.

Details about exploratory drilling or geophysical programs are also not known. Such projects would generally include 2-D or 3-D seismic and exploration drilling plus delineation drilling to appraise the extent of potential resources.

9.1.5 Assessment Method

Current and reasonably foreseeable land uses are assessed in Section 9.2, Cumulative Effects – Reasonably Foreseeable Land Uses. Cumulative effects are assessed qualitatively as quantitative information for other projects is incomplete or unknown at this time.

Hypothetical land uses, referred to here as projects, are assessed in Section 9.3, Cumulative Effects – Hypothetical Land Uses. Cumulative effects are assessed qualitatively based on a possible future scenario. Effects are not assessed quantitatively because of the considerable uncertainty associated with characterizing specific project details, e.g., location, timing, amount of disturbance or size of footprint, capital expenditures, labour force. This approach is based on the view that a useful and meaningful assessment of cumulative effects of future projects is best accomplished by providing useful information to communities, government and regulators sufficient to assist their ongoing decision-making regarding future land and resource management options.

In most cases, this does not require a highly detailed numerical analysis because of the high uncertainties involved. This approach is considered reasonable in consideration of existing federal guidelines on interpreting and assessing hypothetical projects (CEAA 2003).

Cumulative effects for hypothetical projects are assessed in recognition of the considerable interest by northern residents in possible future outcomes if the Mackenzie Gas Project proceeds, particularly in regard to future potential hydrocarbon development.

9.1.6 Significance

In evaluating significance of both projected socio-economic effects and cumulative effects, three key attributes were used:

- magnitude
- geographic extent
- duration

Cumulative effects can be either positive or adverse in direction, and sometimes both. If the effect is both positive and negative, the net effect is estimated and the predominant direction stated.

Significance is shown in tabular form as the result of a combination of these attributes, summarized by example in Table 9-1. All other combinations of effect attributes are judged to be not significant.

Table 9-1: Examples of Significance of Socio-Economic Cumulative Effects Attributes

Magnitude	Geographic Extent	Duration	Significant
High	Regional or beyond regional	Short term	Yes
High	Local	Long term	Yes
Moderate or high	Beyond regional or national	Long term	Yes

9.2 Cumulative Effects – Reasonably Foreseeable Land Uses

9.2.1 The Economy

9.2.1.1 Potential Interactions

Specific reasonably foreseeable projects that could be in competition for Northwest Territories goods, services and labour are described below:

- Devon Canada Corporation’s proposed Beaufort Sea Exploration Drilling Program – an offshore program north of Richards Island that includes various sites to be drilled during winter 2005–2006 and an ongoing winter drilling program over the next four winters to 2008–2009. Devon Canada submitted a Comprehensive Study Report to the National Energy Board in April 2004, showing that employment for the drilling program, including logistics and camp personnel, would peak at about 90 people during each winter drilling season.
- Deh Cho Corporation’s proposed Mackenzie River bridge at Fort Providence, at the current ferry crossing at Highway No. 3 near Fort Providence. This two-lane, 1-km bridge could have nine spans. The project was referred to Fisheries and Oceans Canada by the Mackenzie Valley Environmental Impact Review Board in January 2004. Construction could begin in 2004–2005, continue through summer 2005 and be complete in winter 2005–2006. The winter construction workforce is estimated to average about 50 people and then increase to a peak of 150 to 200 workers during summer 2005.
- additional GNWT Mackenzie winter road bridges at 23 water crossings along the existing winter road between Wrigley and Fort Good Hope (seven bridges have already been built):
 - Blackwater River

- Great Bear River
- Strawberry (Raspberry) Creek
- Bob's Canyon Creek
- Little Smith Creek
- Big Smith Creek
- Jungle Ridge Creek
- Notta Creek
- Christina Creek
- Hellava Creek
- Francis Creek
- Billy Creek
- Oscar Creek
- Elliot Creek
- Hanna Creek
- No Name Creek (Gibson North)
- No Name Creek (Gibson South)
- Donnelly River
- South Snafu (Denise) Creek
- Snafu (Rachelle) Creek
- Tsintu (Bluefish) Creek
- Lynn Creek
- Jackfish Creek

All bridges, with the exception of those over the Blackwater and Great Bear rivers, will be completed by 2005–2006. The Blackwater River crossing is scheduled to be built during winters 2006–2007 and 2007–2008. Bridging of the Great Bear River is less certain than the others because of the size of the river, the number spans involved and the capital investment required. Funding for the bridge is not in place and could be dependent on the results of the 2004 federal election. If funding for the Great Bear River bridge is secured, construction will take two winter seasons and the work will be complete by winter 2008–2009. The employment estimates for the winter road bridge construction are unknown.

- De Beers Snap Lake underground diamond mine received approval by the Mackenzie Valley Environmental Impact Review Board in 2003. Pre-production development work is occurring during 2004, construction will take place during 2005–2006 and production will begin in 2007. During construction, an average of 450 workers, including contract workers, will be required. During operations, the mine is expected to employ about 500 people per annum. It is estimated that about 150 of the 500 jobs will be northern hires, 150 will be southern hires who will take up permanent residence in the Northwest Territories, and 250 will be hired from, and maintain a permanent residence outside the Northwest Territories, returning home on a rotating work schedule.

These potential interactions form the basis for all of the socio-economic cumulative effects assessments and will not be repeated in the following individual subject discussions.

9.2.1.2 Assessment and Management of Cumulative Effects

Table 9-2 shows the four possible projects described previously that, along with the Mackenzie Gas Project, could result in competition for qualified northern goods, services and labour. It also shows how those effects could be managed.

Table 9-2: Assessment and Management of Cumulative Effects

Project	Potential Overlapping Years	Potential Overlapping Activity	Management of Effects
Devon BSEDP	2007 to 2009	Assuming regulatory approval and an extended drilling program, there is a potential for competition with the Mackenzie Gas Project anchor field drilling program for qualified business and labour, particularly in the ISR and Inuvik area	Socio-economic mitigation and management measures, including provisions to control migration, benefits plans and benefits and access agreements
Deh Cho bridge	None, as bridge is scheduled for completion in 2005–2006	None, assuming regulatory approval in 2004	Ongoing monitoring of the schedule by the Mackenzie Gas Project
Bridge construction	2007–2009 Two of 23 bridge crossings (Blackwater and Great Bear rivers) could overlap the Mackenzie Gas Project construction schedule	The Blackwater River crossing is currently scheduled to overlap the Mackenzie Gas Project winter construction schedule in 2007–2008 The Great Bear River crossing, if it proceeds, could overlap the project's winter construction in 2007–2008 and 2008–2009	Socio-economic mitigation and management measures, including provisions to control migration, benefits plans, and benefits and access agreements Ongoing monitoring of the schedule by the Mackenzie Gas Project
De Beers Snap Lake	None, as construction is scheduled for completion in 2006	None, assuming schedule of activities is maintained	Ongoing monitoring of the schedule by the Mackenzie Gas Project
<p>NOTES: BSEDP = Beaufort Sea Exploration Development Program ISR = Inuvialuit Settlement Region</p>			

Unless the GNWT can reschedule bridge construction at the Blackwater and Great Bear rivers, these projects will be in competition with the Mackenzie Gas Project for goods, services or labour associated with bridge construction. Bridge construction at the remaining 21 watercourses on the winter road between Wrigley and Fort Good Hope is currently scheduled to be complete by winter 2005–2006, and would not result in any cumulative effects issues for the Mackenzie Gas Project.

Assuming the Deh Cho bridge receives regulatory approval in 2004, construction could begin during winter 2004–2005, continue through summer 2005 and be

completed during winter 2005–2006. This schedule would not put the Deh Cho bridge in competition with the Mackenzie Gas Project for construction-related goods, services or labour.

The DeBeers Snap Lake diamond mine will begin preconstruction in 2004. Construction is scheduled during 2005 and 2006, and the mine would begin operations in 2007. Based on this schedule, construction of the Snap Lake project will have an opportunity to access qualified Northwest Territories construction contractors and labour before project construction. However, as the Snap Lake construction work is completed in late 2006 and early 2007, the project construction workforce will be ramping up for peak construction during winter 2007.

Assuming that these schedules are maintained, there should be opportunities for Mackenzie Gas Project procurement and recruitment of qualified construction contractors and labour force released from these other projects, particularly in the case of Snap Lake construction. This will help level the peak-and-trough demand cycle associated with construction projects.

Even if the Snap Lake diamond mine schedule is delayed, minimal competition should occur because it is an underground mining operation. Unlike the BHP and Diavik open-pit diamond mines in the Northwest Territories, where most construction jobs can carry over into mine operations, only the underground mining construction jobs at Snap Lake will carry over. As underground mining, both construction and operations, is specialized work and little or no training is available in the Northwest Territories at this time, most of these jobs will be filled via media advertisements and recruitment in the Northwest Territories, elsewhere in Canada and abroad. Further, the underground work environment is generally less appealing than an above-ground working environment for most people. Therefore, competition would only exist for those individuals involved in above-ground construction. However, as discussed previously, given the proposed schedule, the project proponents should be in a position to access these individuals at completion of the Snap Lake construction period.

Furthermore, as the Mackenzie Gas Project is expected to use the available qualified labour force to its full capacity, there would be no opportunity cost to the northern work force from this competition, should it occur. There would be no additional benefit obtained, but it is possible that adverse effects for existing businesses and employers could increase because of wage inflation and recruitment costs.

Taking these factors into consideration, potential competition between the Snap Lake mine and the Mackenzie Gas Project for qualified Northwest Territories contractors, suppliers and labour is not expected to be an impediment to either project.

Project activities occurring within a similar period as the Mackenzie Gas Project, such as the Beaufort Sea Exploration Drilling Program and winter road bridge construction, could attract transient job seekers and northern residents from other areas to Inuvik and Norman Wells.

The temporary populations of Inuvik and Norman Wells could increase because:

- travellers might arrive on project-related business
- southerners might be exploring business opportunities
- opportunity-seeking in-migrants might be looking for employment
- Aboriginal people might be attracted from outlying communities by the activity and opportunities stimulated by the Mackenzie Gas Project

The Devon project and the two winter road bridges are the only projects that will potentially interact with the Mackenzie Gas Project to create cumulative demographic effects. This effect is most likely to occur in Inuvik and Norman Wells. However, Devon's initial activity is expected to occur two years before the Mackenzie Gas Project employment peak in the Beaufort Delta Region (BDR). Because the work force demands are relatively small and seasonal, only a small cumulative migration effect is expected to result, and only for the period if and when employment for the two projects demands overlap. In the case of the two winter road bridges, the overlap could occur during peak Mackenzie Gas Project winter construction. However, the extent of the competition for northern labour, goods and services is unclear because details regarding bridge construction are unavailable.

9.2.1.3 Residual Effects

Table 9-3 shows the residual cumulative effects on the economy because of the potential interaction of several projects. These effects will:

- result from competition of northern goods, services and labour
- affect all existing employers
- encourage some additional in-migration

They are expected to be adverse, but moderate, short term and not significant.

9.2.2 Infrastructure and Community Services

The primary cause of socio-economic cumulative effects is expected to be a temporary and marginal increased potential for in-migration of people from outside the study area to the regional commercial centres. These effects are not expected to be sufficiently large to result in transportation, recreation, energy or

utility service provision effects. However, some cumulative effect on housing is expected.

Table 9-3: Summary of Cumulative Effects on the Economy

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
BDR	Adverse	Moderate	Regional	Short term	No
SSA, DCR	Adverse	Moderate	Regional	Short term	No
NOTES: BDR = Beaufort Delta Region DCR = Deh Cho Region SSA = Sahtu Settlement Area					

9.2.2.1 Housing

Potential Interactions

Cumulative effects on housing would occur only if more than one of the projects described previously occurred within the same period as the Mackenzie Gas Project. If this happens, the interactions described in Section 9.2.1.1, Potential Interactions, would also apply. These interactions are expected to result in effects related to temporary population increases.

Assessment and Management of Cumulative Effects

In-migration, particularly if individuals are unsuccessful in finding jobs, can cause increased demands for housing, particularly temporary accommodation. These effects are expected to be most pronounced in Inuvik and Norman Wells, but should only represent a marginal addition to project-specific effects.

Mitigation and management measures described in Section 3.3.4, Mitigation Measures – Construction, and Section 4.3.4, Mitigation Measures, are relevant to limiting these potential incremental population and related housing effects. These measures focus on project recruitment and hiring processes designed to discourage speculative in-migrants, and on providing self-contained camps for most project personnel. Cooperative action by government employment agencies would be warranted to address migrants seeking indirect and induced employment opportunities. Government management measures specific to the housing sector could include repairs to existing substandard housing and incentives to the private sector to construct additional accommodation.

As pointed out in Section 4.3.3, Assessment and Management of Project-Specific Effects, the Inuvik housing market, in particular, is expected to adjust to the expected increment in demand in time to meet project-specific needs. This capacity adjustment should be sufficient to address cumulative effects as well. The Norman Wells market is much more constrained, and meeting the temporary

increased need for accommodation could pose a challenge. The need for government management action is related primarily to low-cost housing for vulnerable populations that could be affected by price increases.

Residual Effects

Implementing the recommended measures for population and housing described previously is expected to facilitate the management of cumulative effects on housing. However, an increase in service demands is likely in Inuvik and Norman Wells. Accordingly, cumulative project effects on housing are expected to be adverse and high magnitude. However, they will be restricted to these two communities when projects occur within the same period, and only last for the time that the projects overlap. Table 9-4 shows these residual cumulative effects.

Table 9-4: Summary of Cumulative Effects on Housing

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
Inuvik	Adverse	High	Local	Short term	No
Norman Wells	Adverse	High	Local	Short term	No

9.2.3 Individual, Family and Community Wellness

With the exception of educational attainment and services, most of the individual, family and community wellness services described below are working at or beyond capacity as described in Volume 4, Socio-Economic Baseline and previous sections of this volume. Therefore, potential interactions are described for and pertain to future projects only.

The potential effects discussed in this section would be consequences of the economic interactions discussed above. As most existing capacity for benefit will have been used, the primary social implication is expected to be a marginal addition to the attraction for in-migrants from outside the study area. The resulting effects would occur mainly because of temporary population increases and associated demand for public wellness, health and protection services. As no net additional income or benefit is likely to accrue to Aboriginal or other northern residents, social and health problem conditions normally associated with increases in disposable incomes are not expected to increase beyond project-specific effect levels among these people. Furthermore, it is likely that any cumulative effects on services will occur only in the regional or commercial centres most associated with the overlapping interactions, i.e., Inuvik and Norman Wells.

9.2.3.1 Community Well-Being and Delivery of Social Services

Potential Interactions

As described previously, cumulative effects on community well-being and delivery of social services would occur only if more than one of the projects described previously occurred within the same period. If this happened, the interactions described in Section 9.2.1.2, Assessment and Management of Cumulative Effects, would also apply. These interactions are expected to result in public service delivery effects related to temporary population increases.

Assessment and Management of Cumulative Effects

In-migration, particularly if individuals are unsuccessful in finding jobs, can cause increased demands for wellness services. These adverse effects could result in an increased strain on the social services delivery system. Wellness conditions, whether cumulative or project-specific, also affect provision of related services. As a result, all of the mitigation measures suggested in Section 5.2.4, Mitigation Measures, will also contribute to limiting and controlling potential cumulative effects. Of particular relevance will be those actions identified as community or government responsibility. These measures focus on enhanced social service delivery, as well as on-job and community-based support for workers and their families, and address such issues as alcohol abuse control and treatment, and personal financial management.

The cumulative migration effect could lead to an increase in the demand for social services in Inuvik because of the Devon project, and in Norman Wells for the Great Bear River bridge project if peak labour force demand periods overlap. These effects should be more pronounced in Inuvik because of the scale of the cumulative activity, and relatively less pronounced in Norman Wells because of the smaller size of the incremental demand.

Appropriate monitoring, as described in Section 10, Monitoring and Follow-Up, will help communities, the GNWT, contractors and service providers to cooperatively monitor and measure cumulative socio-economic indicators and adjust to service needs if necessary.

Residual Effects

Implementing the recommended measure for social services delivery, as described in Section 5.2.4, Mitigation Measures, is expected to increase the effectiveness of wellness centres in dealing with cumulative effects on community wellness. However, an increase in service demands is likely in Inuvik and, to a lesser extent, in Norman Wells. Accordingly, cumulative project effects on wellness services are expected to be adverse and high to moderate magnitude, but restricted to these two communities when projects occur within the same period. Effects will

last only for the time that the projects overlap. Table 9-5 shows these residual cumulative effects.

Table 9-5: Summary of Cumulative Effects on Delivery of Social Services

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
Inuvik	Adverse	High	Local	Short term	No
Norman Wells	Adverse	Moderate	Local	Short term	No

9.2.3.2 Health Conditions and Health Care Services

Potential Interactions

As described previously, cumulative effects on community health and delivery of health services would occur only if more than one of the projects described previously occurs within the same period. If this happens, the interactions described in Section 9.2.1.2, Assessment and Management of Cumulative Effects, would also apply. These interactions are expected to result in public service delivery effects related to temporary population increases.

As discussed above for wellness, cumulative effects on health are more likely to be related to increased demands for services from marginally increased in-migrant populations.

Assessment and Management of Cumulative Effects

A central aspect of effective delivery of services if an increase in population occurs will be coordinating arrangements between various health care facilities and centres. In addition, Volume 4, Socio-Economic Baseline, and Section 5, Individual, Family and Community Wellness, provide information on the health centres in the study area and discuss GNWT plans for enhanced service delivery. Implementing these measures will help increase health centre staff effectiveness in dealing with induced cumulative effects on community health services. However, an increase in workloads of the health centres is likely, if these projects occur simultaneously.

Mitigation and management measures, described in Section 5.3.4, Mitigation Measures, and those referred to in Section 9.2.3.1, Community Well-Being and Delivery of Social Services, also apply. Of particular relevance will be those actions identified as community or government responsibilities. These measures focus on coordination of project and community health services, enhanced health service delivery, and on-the-job and community-based support for workers and their families that address such issues as alcohol abuse control and treatment.

Residual Effects

In Inuvik and Norman Wells, some additional transient job seekers might be attracted by the possibility of two projects occurring within a similar period. Possible cumulative residual effects could challenge current levels of health service delivery. These effects are expected to be of high magnitude in Inuvik and moderate magnitude in Norman Wells. However, in all cases, the cumulative effects will be short term and localized (see Table 9-6).

Table 9-6: Summary of Cumulative Effects on Health Services

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
Inuvik	Adverse	High	Local	Short term	No
Norman Wells	Adverse	Moderate	Local	Short term	No

9.2.3.3 Public Safety and Protection Services

Potential Interactions

As described previously, cumulative effects on public safety and protection services would occur only if more than one of the projects noted previously occurred within the same period. If this happened, the interactions described in Section 9.2.1.2, Assessment and Management of Cumulative Effects, would also apply. These effects, like those discussed previously for wellness and health, are expected to result from an increased demand for public services related to a marginally increased attraction to the regional commercial centres of in-migrants from outside the study area.

Assessment and Management of Cumulative Effects

The cumulative demographic effects could affect public safety conditions and demands on protection services. Appropriate mitigation could help limit or control these effects. The project will be responsible for security of project camps and for setting policies regarding behaviour in project camps, but will coordinate with the RCMP regarding project activities and plans that could influence RCMP work loads. Shared responsibility for effects management by communities and governments will also be required.

Appropriate monitoring, as described in Section 10, Monitoring and Follow-Up, will help communities, the GNWT, contractors and protective services to cooperatively monitor and measure cumulative socio-economic indicators and make any necessary service adjustments.

Mitigation and management measures, described in Section 5.5.4, Mitigation Measures, and those referred to in Section 9.2.3.1, Community Well-Being and

Delivery of Social Services, and Section 9.2.3.2, Health Conditions and Health Care Services, also apply.

Residual Effects

If the Devon Beaufort Sea Exploration Drilling Project occurs within the same period as the project, Inuvik could experience some short-term, adverse, high-magnitude cumulative effects to protection services because of likely increases in population and income levels. Moderate effects are expected in Norman Wells. In both cases, they would only last as long as the employment demand overlaps (see Table 9-7).

Table 9-7: Summary of Cumulative Effects on Delivery of Safety and Protective Services

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
Inuvik	Adverse	High	Local	Short term	No
Norman Wells	Adverse	Moderate	Local	Short term	No

9.2.3.4 Educational Attainment and Services

Potential Interactions

Even if none of the previously described projects overlap, potential exists for these projects to affect educational attainment and services because education and training needs to occur in anticipation of projects. Thus, if any of the four projects, described in Section 9.1.4.1, Reasonably Foreseeable Land Uses, occur within five years of each other, as they are expected to, a cumulative effect will occur on educational attainment and services.

Assessment and Management of Cumulative Effects

The various projects and their activities will create substantial employment opportunities for both men and women, including teenagers. Cumulative effects on education services and attainment because of several projects operating within a similar time span include:

- increased student enrolments from dropouts returning to school to get the education and pre-employment training needed to access jobs
- students leaving school with the hope of securing well-paying project jobs

In addition, temporary population increases could lead to increased enrolments.

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A number of mitigation measures, described in Section 5.6.5, Mitigation Measures, could be undertaken. These measures focus on Mackenzie Gas Project cooperation with schools and training providers to:

- develop awareness among students of job opportunities, and related education and training requirements
- enhance opportunities for women to be trained for, and employed in, nontraditional occupations
- emphasize the need for students to complete high school to qualify for these and other post-secondary learning, employment and career opportunities

Other employers should be encouraged to participate in these programs to help address cumulative effects.

Residual Effects

Measures to discourage migration from outside the study area to activity centres will reduce possible population increases in the larger centres such as Inuvik, Yellowknife and Norman Wells. The effects on school facilities and services are expected to be adverse. However, there is currently excess capacity in the school system.

Even the most effective mitigation measures will fail to deter all adolescent students from dropping out of school to seek short-term project opportunities. However, in the larger communities, in-migration and former dropouts returning to complete their schooling could increase enrolment and therefore overall educational attainment. As can be seen in Table 9-8, the residual cumulative effects of projects on adolescent students are expected to be both adverse and positive in these larger centres. To the extent that the ongoing activity in the BDR influences educational decisions, the positive effect on attainment and services in this region could persist into the long term.

Table 9-8: Summary of Cumulative Effects on Educational Attainment and Services

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
Inuvik	Positive and adverse	Moderate	Local	Short term to long term	No
Norman Wells	Positive and adverse	Low	Local	Short term	No
Yellowknife	Positive and adverse	Low	Local	Short term	No

9.2.4 Traditional Harvesting and Culture

Survival by harvesting the food resources nourished by the land is central to Aboriginal cultures. This is sustained today by community influences that communicate preferences for, and encourage harvesting of, traditional foods. Sustaining the knowledge, lore and skills necessary for harvesting these foods depends on motivation and availability of time.

Harvesting and seasonal wage employment are symbiotic, because low incomes from trapping necessitate wage employment to pay for the expensive equipment and supplies now needed for efficient harvesting. The projects will provide cumulative wage employment opportunities that will support harvesting expense requirements. However, these influences are unlikely to be greater than the Mackenzie Gas Project-specific effects alone for the capacity constraint reasons discussed previously.

Employment could jeopardize harvester lore and disciplines by bringing Aboriginal and non-Aboriginal workers together on the job, and by pre-empting harvesting traditions because of time needed for employment cycles. Some Aboriginals might experience the paid work as more comfortable, and more rewarding than harvesting, promoting interest in a southern lifestyle.

Elders are powerful influences for sustaining tradition. The Mackenzie Gas Project will support their efforts, and help meet the traditional food and other cultural requirements of communities by providing flexible work schedules to accommodate traditional harvesting and other Aboriginal cultural, family and community needs, where practical, recognizing that work flexibility will be limited in the peak winter construction seasons.

The effect on cross-generation transference of traditional language facility, and knowledge of and identification with traditional culture, are central to questions about language and cultural retention. As in the case of resource harvesting, cumulative influences might either strengthen or weaken language and culture.

Recent surveys have shown a decline in the use of Aboriginal languages in all regions. Fluency declined by 11% between 1989 and 1999 in the Northwest Territories as a whole. This erosion of fluency in Aboriginal language is already strongly influenced by use of English in the media, schooling and most work situations. As a result, cumulative employment opportunities are expected to have little additional effect on language and cultural retention (see Table 9-9).

Table 9-9: Summary of Cumulative Effects on Traditional Harvesting and Culture

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
BDR	Adverse	Moderate	Regional	Short term	No
SSA, DCR	Adverse	Low	Regional	Short term	No

9.2.5 Nontraditional Land and Resource Use

9.2.5.1 Potential Interactions Overview

There are several activities, associated facilities and infrastructure already present within the study area that could act in conjunction with the effects of the Mackenzie Gas Project, thus creating a cumulative effect on nontraditional land and resource use. These activities include:

- oil and gas exploration, such as seismic programs and drilling
- some oil and gas development, e.g., Ikhil well and pipeline
- granular extraction operations
- telecommunications (infrastructure)
- hunting and fishing
- reindeer herding
- tourism and recreation
- urban development
- creation and use of access roads
- air travel
- boat traffic on the Mackenzie River

In addition, the following reasonably foreseeable projects have been included in the nontraditional land and resource use cumulative effects assessment:

- Devon Beaufort Sea Exploration Development Program
- GNWT Mackenzie Valley winter road bridges

Following are more detailed descriptions of specific nontraditional land and resource use that could have the potential to interact with the Mackenzie Gas Project, thus causing cumulative effects. The attributes of these effects are summarized in Table 9-10.

9.2.5.2 Granular Resources

Potential Interactions

The main existing development that will affect granular resources is other borrow sites. A few borrow sites are currently in place in the study area. Project construction will greatly increase the number of active borrow sites in the study area. Other existing developments in the study area, such as roads, bridges and well sites, could occasionally require granular material for maintenance purposes. This requirement, combined with Mackenzie Gas Project requirements, could lead to cumulative effects on available granular resources.

Table 9-10: Summary of Cumulative Effects on Nontraditional Land and Resource Use

Valued Component	Effect	Direction	Magnitude	Geographic Extent	Duration	Significant
Granular resources	Loss of granular resources	Adverse	Moderate	Regional	Short term to long term	No
	Change to existing granular resource operations	Positive and adverse	Low	Regional	Short term to long term	No
Timber resources	Changes to existing timber harvesting practices	Positive	Low	Regional	Short term to long term	No
	Loss of timber resources	Adverse	Low	Regional	Short term to long term	No
Oil and gas activities	Changes in other oil and gas activities	Positive	Low	Regional	Short term to long term	No
		Neutral	No effect	Regional	Long term	No
Nontraditional resource harvesting	Change in nontraditional fishing, trapping and hunting success	Positive and adverse	Low to moderate	Regional	Short term to long term	No
	Change in resource harvesting opportunities	Positive and adverse	Low	Regional	Short term to long term	No
Other commercial activities	Change in other commercial activities	Positive	Low	Regional	Short term to long term	No
Tourism and recreation	Change to tourism and outdoor recreation activities	Positive and adverse	Low	Regional	Short term to long term	No
	Change in quality of tourism and outdoor recreation	Positive and adverse	Low	Regional	Short term to long term	No

Reasonable foreseeable projects include construction of 23 bridges along the Mackenzie River winter road. These projects will require granular resources. The use of granular resources for these projects in conjunction with the Mackenzie Gas Project needs for granular materials will have an adverse cumulative effect on the total amounts of granular material available within the RSA.

Assessment and Management of Cumulative Effects

Some of the new borrow sites required for the project will be left in place for use by local operations, provided there are remaining granular materials and the source is not depleted by the Mackenzie Gas Project. In addition, following decommissioning of the Mackenzie Gas Project, some gravel pads at infrastructure sites could be either returned to borrow sites or stockpiled for use by GNWT Transportation and the local communities.

Residual Effects

Mackenzie Gas Project use of borrow sites, combined with existing borrow sites, will result in a cumulative reduction in total granular resources in the RSA.

On the other hand, these combined effects could result in new resources being identified and developed, and a net increase in the accessible granular resources for use by local communities or other developments.

9.2.5.3 Timber Resources

Potential Interactions

Currently, small areas of timber have been removed by surface disturbance from development activities in the RSA. These disturbances include:

- well sites
- airstrips
- camps
- dock sites
- seismic lines
- ice roads, including the ones from Inuvik to Wrigley and the Mackenzie Highway to Trout Lake
- borrow sites along the Mackenzie Highway

Past wildfires have also affected vegetation in the area. Small amounts of timber are harvested for fuel wood and a few sawmills exist in the region that use lumber for small projects.

Some of the existing activities within the Mackenzie Valley and Delta could require occasional clearing of existing vegetation, such as other oil and gas developments, borrow sites, and road maintenance.

Assessment and Management of Cumulative Effects

Mackenzie Gas Project construction, combined with other ongoing or future developments in the RSA, could disrupt existing timber harvest practices by temporarily blocking or changing access to harvest areas. However, the temporary or permanent roads to be provided by the Mackenzie Gas Project and other land uses will result in improved access to timber harvesting areas and could open up new areas for harvesting.

Residual Effects

Within the RSA, current developments and activities, combined with the project, could lead to a very small additional decrease in the total timber resources because of clearing and removing trees and other vegetation. Hence, an adverse cumulative effect is expected on the total amount of timber resources in the RSA because of construction.

Alternatively, the net cumulative effect on timber harvesting within the RSA is expected to be positive because of improved access.

9.2.5.4 Oil and Gas Activities

Potential Interactions

Oil and gas activities within the RSA are probably the most active nontraditional land uses present.

A reasonably foreseeable project in the ISR is the Devon Beaufort Sea Exploration Drilling Program. This project will be located north of Kugmallit Bay and Richards Island, and will involve summer and winter drilling that could commence in 2004 and, depending on results, could extend until 2009.

Assessment and Management of Cumulative Effects

In general, increased oil and gas activity will be positive for the Northwest Territories and northwestern Alberta. Specific effects of increased oil and gas activities, e.g., procurement and employment opportunities, are dealt with in other parts of this section.

Residual Effects

The Devon Beaufort Sea Exploration Development Program, combined with other existing oil and gas operations in the Northwest Territories and northwestern Alberta, will lead to a cumulative effect on oil and gas developments in the RSA.

During Mackenzie Gas Project construction and operations, combined with other developments in the region, there will be a positive cumulative effect on the growth of oil and gas activity in the RSA.

9.2.5.5 Nontraditional Resource Harvesting

Potential Interactions

Some existing developments or activities within the Mackenzie Valley and Delta could affect nontraditional resource harvesters both positively and negatively by providing them with additional access to areas that were previously difficult to

reach or displacing them in certain regions where activities are taking place. These activities include other oil and gas developments and industrial developments such as borrow sites, and the Mackenzie Highway and winter roads.

One reasonably foreseeable project is construction of winter bridges along the Mackenzie Valley winter road from Wrigley north to Fort Good Hope. This development will extend and stabilize the period of use of the winter road, and could lead to increased use of the road.

Assessment and Management of Cumulative Effects

It will be important to monitor the locations of new activity sites to determine that nontraditional land and resource users are not displaced from their areas of use or that new accessible areas are made available to them.

Residual Effects

The project will act cumulatively with other activities in the region by providing access for nontraditional harvesters to conduct their activities in previously unreachable areas. This will be particularly evident where permanent roads are installed into rather remote areas, such as at the Inuvik area facility. There could be an adverse cumulative effect in the immediate vicinity of the Mackenzie Gas Project during construction and operations because of restricted access that could displace nontraditional harvesters. However, a positive cumulative effect on access to lands for harvesting purposes is expected because of improved access.

9.2.5.6 Other Commercial Activities

Potential Interactions

Other commercial activities in the RSA are very limited and include transportation of goods to communities by truck or barge. The improved access because of upgrades to the winter road from Wrigley to Fort Good Hope and the Mackenzie River Bridge at Fort Providence could open up the area to other commercial and business opportunities.

Assessment and Management of Cumulative Effects

No assessment or management of cumulative effects will be required.

Residual Effects

The reasonably foreseeable projects outlined previously, combined with the Mackenzie Gas Project, could lead to positive cumulative effects on the growth of other commercial activities in the RSA. However, the effect is expected to be low magnitude, given the remoteness of the area.

9.2.5.7 Tourism and Recreation

Potential Interactions

Tourists and recreational users could be displaced by some existing developments or activities within the Mackenzie Valley and Delta. These activities include other oil and gas development, and industrial developments such as borrow sites.

Reasonably foreseeable projects, including the bridges along the ice road from Wrigley to Fort Good Hope and the Mackenzie River bridge at Fort Providence will open up the area to improved access, and could lead to new tourist and recreation opportunities.

Assessment and Management of Cumulative Effects

With the existence of several construction and operations projects, it will be important to monitor tourism operations in the immediate vicinity of the project, particularly those in the Mackenzie Delta, to determine if tourists and recreational users are displaced from their areas of use.

Residual Effects

Addition of the project to the activities in the study area could result in a low adverse cumulative effect on how tourists or recreational users perceive their experiences because of further degradation of the local landscape, particularly in areas where other linear developments occur.

The cumulative increase in access and an increase in the quality of existing infrastructure provided by road developments, combined with the project, could result in opening up new areas to tourism and recreational opportunities in the RSA. This could lead to a positive cumulative effect on the potential tourism and recreation opportunities in the RSA.

9.2.5.8 Summary of Cumulative Effects on Nontraditional Land and Resource Use

Table 9-10, shown previously, provides a summary of the cumulative effects on the nontraditional land and resource uses described previously.

9.2.6 Protected Areas

9.2.6.1 Potential Interactions

With the exception of human settlements, seismic lines and the occasional clearing, the Mackenzie Delta and Valley are largely undeveloped. In most cases, the Mackenzie Gas Project is the first development to occur within the protected areas. Therefore, there are no potential interactions with other projects.

9.2.6.2 Assessment and Management of Cumulative Effects

The effects of the Mackenzie Gas Project in conjunction with existing developments and reasonably foreseeable projects in the RSA will lead to an increase in disturbance to protected or proposed protected areas. However, as no other industrial projects occur within the Mackenzie Gas Project area, there will be no cumulative effects.

9.2.6.3 Residual Effects

Although the effect of the Mackenzie Gas Project on protected areas will be adverse, the cumulative effect will be low to moderate magnitude as no other projects exist in, or are proposed for, the protected areas within the project area (see Table 9-11).

Table 9-11: Summary of Cumulative Effects on Protected Areas

Region	Direction	Magnitude	Geographic Extent	Duration	Significant
ISR, GSA, SSA, DCR	Adverse	Low to moderate	Local and regional	Short term to long term	No

9.2.7 Visual and Aesthetic Resources

The existing and reasonably foreseeable activities, associated developments and infrastructure will have an effect on the visual and aesthetic resources in the areas in which they are located. Specifically, they will reduce the visual and aesthetic quality or nature of the area.

9.2.7.1 Potential Interactions

As there is little existing activity in the area, the Devon project, combined with the Mackenzie Gas Project, is expected to have a cumulative effect on visual and aesthetic resources. However, the Devon project is located far from the project area. There will be an increase in industrial presence, and this will affect the visual and aesthetic resources in the region. However, in areas where there are no existing effects on visual and aesthetic resources, there will be no cumulative effects. For example, if a person is travelling across the land and sees one of the project flare stacks, but there are no other signs of visual disturbance, there will be no cumulative effects.

9.2.7.2 Assessment and Management of Cumulative Effects

The effects of the Mackenzie Gas Project, in conjunction with existing developments and reasonably foreseeable projects in the RSA, will have an effect on the visual and aesthetic resources in the areas in which they are located.

However, as no other industrial projects occur within or have been proposed for the LSA, there will be no cumulative effects.

9.2.7.3 Residual Effects

Although Mackenzie Gas Project effects on visual and aesthetic resources could be adverse, no cumulative effects are expected as no other projects exist or are proposed within the project area.

9.2.8 Heritage Resources

9.2.8.1 Potential Interactions

The project inclusion list (see Volume 5, Section 12, Cumulative Effects) provides a basis for addressing the potential heritage resource effects of the Mackenzie Gas Project combined with other existing and foreseeable regional developments. The projects listed include a series of all-weather and limited-use roads that currently exist, and hypothetical development of the Mackenzie Valley winter road from Tsiigehtchic to Fort Good Hope. With the potential exception of the extension of the Mackenzie Valley Highway, all of these developments currently exist and there is no indication that heritage resource assessments preceded their construction. Therefore, the heritage resource effects of these projects and the likelihood of potential interactions with the Mackenzie Gas Project are unknown.

With regard to the Mackenzie Valley Highway, a series of heritage resource investigations preceded development of this facility as an ice road (Millar and Fedirchuk 1975). These investigations considered a potential corridor from Fort Providence to Tsiigehtchic and focused on select drainage crossings because of the large size of the development area and the undefined nature of the route. Intervening areas received little or no attention. These investigations often encompassed several kilometres on either side of the potential drainage crossing route to allow for variation in the final design and to provide context for the study. Although the banks near the proposed crossing might have been examined, it is doubtful that any areas lacking surface visibility were examined as no subsurface testing accompanied this work.

9.2.8.2 Assessment and Management of Cumulative Effects

The recommendations arising from the 1975 study call for additional research to refine the assessment, particularly for sections of the route from Tsiigehtchic to Fort Good Hope (Millar and Fedirchuk 1975). Similar recommendations pertain to other segments of the route, which the Mackenzie Gas Project follows in many locations. At the time these studies were conducted, no regulatory agency was in place to require additional study or mitigation, and development of the highway proceeded without systematic consideration for heritage resources. Therefore,

because of the preliminary nature of the 1975 study and considering that the extension of the highway is currently undefined, it cannot be said that the heritage resources effects of the Mackenzie Valley Highway extension are known or could be predicted with accuracy.

9.2.8.3 Residual Effects

No other projects other than the ones discussed in the Project Inclusion List currently exist or are predicted for the Mackenzie Gas Project study area. The cumulative effects of the project, combined with other existing or currently planned developments on historical resources, cannot be predicted with confidence.

9.3 Cumulative Effects – Hypothetical Land Uses

As indicated previously, hypothetical land uses (projects) include possible future:

- hydrocarbon (oil and gas) exploration
- gas production to the Mackenzie Gas Project, additional to the Mackenzie Gas Project anchor fields
- mineral exploration and production
- telecommunications line along the Mackenzie River
- all-weather resource access road southward from Tuktoyaktuk
- upgrading of the winter road between Wrigley and Fort Good Hope, and completion of Mackenzie Highway access between Fort Good Hope and Tsiigehtchic

Proponents, locations, timing and descriptive details for hydrocarbon exploration and production projects are not known at this time. It is assumed that exploration or geophysical programs would include 2-D or 3-D seismic and delineation drilling. Ancillary activities would include winter and ice road construction.

Hydrocarbon production would include well pads, processing facilities, collector pipelines and access roads (winter or all-weather). Proponents could include any of the historical and current holders of leases in the Beaufort-Delta, Mackenzie Valley and Yukon regions.

Installing intermediate compressor stations could expand the capacity of the gas pipeline. At full expansion, 10 additional intermediate compressor stations would be required.

Conceptual routing and the preliminary capital cost estimate for the 22-km road from Tuktoyaktuk to a granular deposit southwest of the community have been prepared but details are not available, funding is not secured and there are no firm commitments that the road will be constructed.

Similarly, the GNWT upgrading of the winter road from Wrigley to Fort Good Hope to all-weather status and construction of a new winter road between Fort Good Hope and Tsiigehtchic would, if constructed, require realignment of the existing winter road to improve sight lines and improve motor vehicle safety. A route would also have to be established for a winter road between Fort Good Hope and Tsiigehtchic.

No information is available regarding a telecommunications line in the Mackenzie Valley. Presumably, if it was constructed, it would follow either the Mackenzie Gas Project pipeline right-of-way or the winter road right-of-way.

For all these hypothetical land uses, it is impossible to consider them in a meaningful way in a cumulative effects assessment without additional information, specifically:

- spatial and temporal information
- size of footprint and amount of land disturbance
- capital and operations cost information
- goods and services required during construction and operations
- labour force requirement during construction and operations

Without this information, consideration of the potential cumulative interactions and additive socio-economic effects of the Mackenzie Gas Project and other reasonably foreseeable projects is not possible. However, it is assumed that if any or all of these hypothetical land uses come to fruition, they would happen some time during project operations and not during construction (2006–2007 to 2009–2010). As a result, any potential competition for northern goods, services and labour would be minimal. It is also assumed that they would not occur simultaneously, but rather would be spread out over operations.

9.3.1 Assessment and Management of Cumulative Effects

9.3.1.1 Economy

The hypothetical projects would create additional and more sustained demand for skills and capacity developed by the northern people and economy for the Mackenzie Gas Project, resulting in increased procurement, employment and income. This, in turn, would allow longer-term and more manageable growth and diversification of the economy.

The effects on population would include the probable sustained growth of Inuvik as the commercial and governance centre for the BDR. However, it is unlikely that the smaller Aboriginal communities or the rest of the study area will be affected.

9.3.1.2 Infrastructure and Community Services

The additional cumulative effects would also include generation of higher government revenues at both the federal and territorial levels. Distribution of these revenues will depend on federal–territorial devolution and revenue-sharing negotiations. However, governments and communities should be better able to adjust to public infrastructure and service delivery demands resulting from this additional development. This is because Mackenzie Gas Project revenues will be flowing and the gap between these demands and increased revenues from industry, which is predicted for the Mackenzie Gas Project construction period, should be more manageable.

9.3.1.3 Wellness

Both past experience and available research show that participation in longer-term and more stable employment opportunities and the increased disposable income that results have very different effects from short-term spurts of activity. People seem to learn to adjust more effectively, to better manage and balance their work and home responsibilities, and importantly, better manage their personal lifestyle choices. As a consequence, the wide range of social problem conditions that are normally associated with increased incomes will tend to diminish and a much more positive balance between the benefits and costs of development activity should emerge.

9.3.1.4 Traditional Harvesting and Culture

The additional cumulative effects of these hypothetical projects are not expected to noticeably alter the existing trends or increase the effects predicted for the Mackenzie Gas Project and reasonably foreseeable projects. Aboriginal people in the study area will continue to highly value both harvesting and their culture. The institutions are in place to provide protection, and additional development could provide additional resources to support traditional values and activities. Much will depend on decisions made by individuals and governments.

9.3.1.5 Nontraditional Land and Resource Use

Construction of the all-weather road south of Tuktoyaktuk could affect nontraditional resource harvesting by allowing access to previously inaccessible areas. However, only a slight improvement in access will occur as the road only extends 22 km south of Tuktoyaktuk. The road will require large quantities of granular material and therefore would increase the cumulative effects on regional granular resources.

9.3.1.6 Heritage Resources

It is not possible to predict potential cumulative effects of hypothetical projects on heritage resources because there is inadequate site-specific information available.

9.3.2 Residual Effects

There is not enough information available to determine the specific attributes or significance of the additional cumulative effects of the hypothetical projects combined with the Mackenzie Gas Project and reasonably foreseeable projects.