

ENVIRONMENTAL IMPACTS

**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE VALLEY PIPELINE
VOLUME 1: PIPELINE OVERVIEW**

INTRODUCTION

3.1.1 SCOPE

The environmental impact assessment process is a key element of planning, designing, constructing, operating, and eventual decommissioning and abandonment of the Mackenzie Valley pipeline. The environmental impact statement (EIS):

- describes the predicted effects of the gas pipeline and the associated measures to reduce these effects
- provides regulatory authorities with the biophysical and socio-economic information needed to make decisions about the gas pipeline

The summary presented in this section applies primarily to the gas pipeline. The summaries presented in EIS Volume 1, Overview and Impact Summary, apply to all of the anchor fields, gathering system and gas pipeline.

3.1.2 KEY ISSUES

The EIS identifies key issues for northern communities that were identified through a public participation process that began in 2002 and will continue throughout the life of the pipeline. These key issues are:

- environmental protection and effects mitigation
- socio-economic conditions
- northern community health and wellness

3.1.3 EIS OBJECTIVES

The objectives of the EIS are to:

- contribute to the development of the Mackenzie Valley pipeline in a way that increases benefits and reduces adverse biophysical and social effects
- ensure that issues raised by communities are directly addressed in the assessment

3.1.3 EIS OBJECTIVES (cont'd)

- predict pipeline project-specific effects, including the effects of:
 - the pipeline on biophysical, social and economic conditions
 - biophysical, social and economic conditions on the pipeline
 - incidents and malfunctions
- identify suitable management and mitigation measures for pipeline-specific effects and determine the residual effects
- assess the significance of the predicted residual effects on the biophysical and socio-economic environments
- assess whether the residual effects could interact cumulatively with the effects from other past, present or future projects or activities

3.1.4 APPROACH**3.1.4.1 Methods**

The assessment process was designed to meet the EIS objectives, and was based on five stages.

3.1.4.2 Stage 1

The goal of Stage 1 was to develop key questions that focused the assessment on addressing the communities' main concerns about the pipeline's effects. These questions examine the effects of the pipeline on an issue, or group of related issues, specific to a particular subject area.

3.1.4.3 Stage 2

The goal of Stage 2 was to select valued components (VCs) and key indicators (KIs) that could be used to answer the key questions. These valued components included selected species of animals, plant communities, waterbodies, community wellness, land uses and cultural features related to the communities' concerns. Key indicators that could be used to measure the status of a VC were identified because they could provide a measure of change caused by the pipeline, and they directly relate to the condition of the VC.

3.1.4.4 Stage 3

The goal of Stage 3 was to analyze effect pathways that illustrate the expected cause-effect relationships between pipeline components and the biophysical and socio-economic environments, including the influence of effects mitigation. This analysis includes mitigation measures that have been incorporated into the gas pipeline design.

3.1.4.5 Stage 4

The goal of Stage 4 was to describe the predicted effects in ways that are meaningful and are consistent throughout the EIS. This was achieved by answering four basic questions:

- Is the effect good or bad? (The direction of an effect.)
- How intense is the effect? (The magnitude of an effect.)
- How large an area will be affected? (The geographic extent of an effect.)
- How long will the effect last? (The duration of an effect.)

These questions form the framework for describing the effects. The approach was tailored to suit specific topics for each subject area of the impact assessment.

3.1.4.6 Stage 5

The goal of Stage 5 was to evaluate the significance of potential residual effects.

The concept of environmental sustainability was used as the basis for determining significance. Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their needs.

An adverse residual effect is considered significant if the effect is either:

- moderate or high in magnitude and extends into the far future, i.e., more than 30 years after the facilities have been decommissioned and abandoned
- high in magnitude and occurs outside the local study area at any time

3.1.4.7 Public Participation

Effective stakeholder participation is integral to successfully developing and implementing the EIS. It demonstrates a sound appreciation of community-based knowledge and helps ensure that recommended mitigation measures are consistent with community capabilities and needs.

The objectives of the public participation program for the EIS were to:

- ensure that community issues and concerns about the pipeline development were understood by the proponents and the EIS assessment team
- ensure that concerns and issues were considered and addressed in the assessment process through management, mitigation or both
- provide project information in a timely and sincere manner to potentially affected and interested stakeholders to enable them to effectively engage with the proponents

3.1.4.7 Public Participation (cont'd)

- engage stakeholders in scoping issues related to pipeline development, defining effects and contributing to developing mitigation measures to reduce effects
- educate stakeholders about the assessment process

The public participation program followed a community-based process. It provided stakeholders with opportunities to register their perceptions about the pipeline. The opportunities reflected, as much as possible, the ways in which stakeholders meet to exchange information. The program was designed to take into account the needs, capabilities and schedules of the communities involved, and included:

- interviews
- group meetings
- community dinners
- open houses
- workshops
- field visits

The public participation program included three phases:

- Phase 1 – issue identification and scoping
- Phase 2 – effect assessment and mitigation
- Phase 3 – review of draft EIS

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BIOPHYSICAL EFFECTS

3.2.1 SCOPE

The biophysical resources evaluated for the gas pipeline are:

- air quality
- noise
- groundwater (hydrogeology)
- hydrology
- water quality
- fish
- soils, landforms and permafrost
- vegetation
- wildlife

The cumulative effects on these resources were also assessed.

No significant effects are predicted on any of these resources as a result of the gas pipeline development.

For a detailed assessment of the effects on biophysical resources, see EIS Volume 5: Biophysical Impact Assessment.

3.2.2 AIR QUALITY

Air quality effects during construction along the gas pipeline corridor can be related to dust generated from disturbed areas, traffic, and emissions from vehicles and construction camps. Emissions during operations can be related to compressor stations and heater facilities.

Mitigation strategies, such as dust control, are expected to effectively manage construction phase effects. Strategies to reduce emissions during operations include:

- using equipment that complies with the Canadian Council of Ministers of the Environment (CCME) standards
- ensuring flare stack design and performance are consistent with appropriate industry regulations

3.2.2 AIR QUALITY (cont'd)

- applying best management practices to reduce fuel use
- avoiding idling vehicles, where possible

Air emissions released during construction and decommissioning are not reported in the EIS because they will be minor compared to emissions during peak operations.

For all KIs at all project locations (see Table 3-1), effects are predicted to be adverse, local and long-term. The magnitude of effects is moderate or low. No significant effects on air quality are predicted.

Table 3-1: Effect of Pipeline Corridor Activities on Air Quality

Key Indicator	Phase When Impact Occurs	Direction	Attribute			
			Magnitude	Geographic Extent	Duration	Significant?
1-hour SO ₂	Operations	Adverse	Low ¹	Local	Long-term	No
24-hour SO ₂	Operations	Adverse	Low ¹	Local	Long-term	No
Annual SO ₂	Operations	Adverse	Low ¹	Local	Long-term	No
1-hour NO ₂	Operations	Adverse	Moderate ¹	Local	Long-term	No
24-hour NO ₂	Operations	Adverse	Moderate ¹	Local	Long-term	No
Annual NO ₂	Operations	Adverse	Low ⁶ to Moderate ^{2,3,4,5}	Local	Long-term	No
1-hour CO	Operations	Adverse	Moderate ⁵	Local	Long-term	No
8-hour CO	Operations	Adverse	Moderate ^{3,4,5}	Local	Long-term	No
24-hour PM _{2.5}	Operations	Adverse	Moderate ¹	Local	Long-term	No
1-hour benzene	Operations	Adverse	Low ¹	Local	Long-term	No
1-hour BTEX ⁷	Operations	Adverse	Low ¹	Local	Long-term	No
Area PAI ⁸	Operations	Adverse	Low ¹	Local	Long-term	No
Note:						
1. All stations.			5. Trail River compressor station.			
2. Little Chicago compressor station.			6. Trout River heater station.			
3. Norman Wells compressor station.			7. BTEX = Benzene, toluene, ethylbenzene and xylene			
4. Blackwater River compressor station.			8. PAI = potential acid input.			

3.2.3 NOISE

Potential effects of pipeline corridor activities on noise levels can be related primarily to the continuous operation of compressors and other equipment during operations, and to construction activities and transportation during construction and operations (see Table 3-2).

Mitigation strategies to limit noise levels include:

- ensuring that design criteria meets EUB Guide 38 noise guidelines for remote sites, i.e., 40 dB at 1.5 km
- implementing noise control measures, as necessary, such as silencers, insulation and upgraded building shells
- scheduling discretionary activities to avoid sensitive time periods in sensitive areas, where practical

No significant effects on noise levels are predicted. The effect of the pipeline corridor activities on noise is predicted to be low in magnitude and local in geographic extent.

Table 3-2: Effect of Pipeline Corridor Activities on Noise Levels

Valued Component	Phase When Impact Occurs	Direction	Attribute			
			Magnitude	Geographic Extent	Duration	Significant?
Environmental sound levels	Operations	Adverse	Low	Local	Long-term	No

3.2.4 GROUNDWATER

Potential effects of pipeline activities on groundwater can be related to:

- changes to groundwater recharge and discharge patterns, which can occur from the removal of material at borrow sites
- flow obstruction, which can occur from the development of frost bulbs around the gas pipeline
- changes in permafrost patterns, which can occur from such activities as vegetation removal

Strategies to limit effects on groundwater along the pipeline corridor include:

- monitoring, by aerial inspection, visual changes in locations or extent of groundwater discharge areas
- monitoring environmental effects of frost bulbs along the pipeline corridor
- adopting hydrology and water-quality mitigation measures

No significant effects on groundwater are predicted. The effects are predicted to be low in magnitude, i.e., within the normal range of variation and local in extent (see Table 3-3).

Table 3-3: Effect of Pipeline Corridor Activities on Groundwater

Valued Component	Phase When Impact Occurs	Direction	Attribute			
			Magnitude	Geographic Extent	Duration	Significant?
Groundwater quantity and flow patterns	Construction	Adverse	Low	Local	Far future ¹	No
	Operations	Adverse	Low ¹ to high ²	Local ²	Long-term ²	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Groundwater quality	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note:

1. Low, far future effects might be related to borrow source development.
2. Moderate to high effects might be related to flow obstruction resulting from frost bulbs. These could have a long-term magnitude.

N/A = not applicable because no effect is predicted.

3.2.5 HYDROLOGY

Potential effects of pipeline corridor activities on hydrology are related to:

- site disturbance during construction
- water withdrawal for winter road construction and camp use
- thaw settlement along the pipeline right-of-way
- flow obstruction, which could result from frost bulb formation around the gas pipeline

Mitigation strategies to limit effects on hydrology include:

- grading and ditching to direct runoff through silt fences, sediment traps, vegetation, berms or isolation areas for controlled release to the watershed
- providing a minimum setback from watercourses to reduce impacts on local drainage patterns and streamflow
- designing for thaw settlement, and using insulating materials
- monitoring, by visual inspection, drainage conditions and sediment control devices within the pipeline right-of-way
- monitoring streambed conditions and bank stability at water crossings

No significant effects on hydrology are predicted. The effects of activities on hydrologic key indicators are generally predicted to be low in magnitude and local in extent (see Table 3-4), with some moderate magnitude effects predicted related to icing at frost bulbs and two infrastructure sites. High, short-term effects on sediment concentrations could occur during watercourse crossing construction.

Table 3-4: Effect on Pipeline Corridor Activities on Hydrology

Key Indicator	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Runoff amounts	Construction	Adverse	Low to moderate ¹	Local	Medium-term	No
	Operations	Adverse	Low to moderate ¹	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Drainage patterns	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Water levels and velocities	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low to high ²	Local	Long-term	No
	Decommissioning and abandonment	Neutral	N/A	N/A	N/A	No
Sediment concentration	Construction	Adverse	Low to moderate ³	Local ³	Long-term ³	No
			High ⁴	Local ⁴	Short-term ⁴	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Channel morphology	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	N/A	N/A	N/A	No

Note:

1. Moderate effects related to development of two infrastructure sites.
 2. Moderate to high effects are associated with the effects of frost bulb formation.
 3. Low to moderate long-term effects are related to land disturbance during development.
 4. High effects are associated with short-term sedimentation during watercourse crossing construction.
- N/A = Not applicable because no effect has been predicted.

3.2.6 WATER QUALITY

Potential effects of pipeline activities on water quality can be related to:

- wastewater releases at facilities and camps

3.2.6 WATER QUALITY (cont'd)

- leaks and spills
- suspended sediment inputs from land disturbance, watercourse crossings and dredging

Mitigation strategies to limit effects on water quality include:

- treating wastewater before discharging it
- controlling runoff and sediment during construction
- revegetating disturbed areas
- preventing leaks and containing spills
- limiting water withdrawal to meet regulatory standards
- monitoring waterbodies affected by domestic wastewater release and testing water release

No significant effects on water quality are predicted. Effects on water quality will not exceed moderate magnitude and will be local in extent (see Table 3-5).

Table 3-5: Effects of Pipeline Corridor Activities on Water Quality

Valued Component	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Water and sediment quality	Construction	Adverse	Low to moderate*	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No

Note: *Moderate effects are associated with short-term sedimentation during watercourse crossing construction.

3.2.7 FISH AND FISH HABITAT

Potential effects of pipeline corridor activities on fish and fish habitat can be related to:

- direct effects to fish habitat from activities such as constructing pipeline watercourse crossings
- changes in water levels and water flow related to activities such as water withdrawal or the formation of frost bulbs around the gas pipeline

- sediment suspended during water work, such as pipeline construction and dredging, which could affect fish health or fish habitat downstream

Mitigation strategies to reduce the effects on fish include:

- controlling erosion and sediment
- constructing primarily during winter conditions
- preventing spills and leaks, and preparing contingency plans
- avoiding spawning, rearing and overwintering fish habitats
- monitoring water quality and fish health at selected lakes and watercourses
- monitoring domestic and recreational fish harvest at selected lakes and watercourses

No significant effects on fish are predicted. All effects are low in magnitude (see Table 3-6).

Table 3-6: Effects of Pipeline Corridor Activities on Fish

Key Indicators	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Habitat	Construction	Adverse	Low	Regional	Long-term	No
	Operations	Adverse	Low	Regional	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Health	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Distribution and Abundance	Construction	Adverse	Low	Regional	Short-term	No
	Operations	Adverse	Low	Regional	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No

3.2.8 SOILS AND LANDFORMS

Potential effects of pipeline corridor activities on soils and landforms can be related to:

- surface disturbance during construction that can damage soils, cause erosion, and remove uncommon landforms

3.2.8 SOILS AND LANDFORMS (cont'd)

- a changed thermal regime that can cause settlement or frost heave along the flow line and pipeline rights-of-way

Mitigation strategies to minimize effects on soils and landforms includes:

- minimizing surface disturbance
- controlling erosion
- stabilizing slopes
- monitoring effects of thaw settlement and frost heave, soil erosion, slope movement and drainage conditions at selected sites along the gas pipeline right-of-way

No significant effects on soils and landforms are predicted (see Table 3-7).

Table 3-7: Effects of Pipeline Corridor Activities on Soils and Landforms

Valued Component	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Ground stability ¹	Construction	Adverse	Low to moderate ^{2, 3, 4}	Local	Long-term	No
	Operations	Adverse	Low to moderate ^{2, 3, 4, 5}	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Uncommon landforms ⁶	Construction	Adverse	Low to moderate ^{2, 3, 4}	Local	Far future	No
	Operations	Adverse	Low ⁷	Local	Far future	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No
Soil quality ⁸	Construction	Adverse	Moderate	Local	Long-term	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Adverse	Low	Local	Far future	No

Note:

1. Compiled effects on drainage disruption from thaw settlement and frost heave, erosion from wind and water flow and mass movement or slope instability.
 2. Moderate effects will occur in the Transition Forest Ecological Zone, North Taiga Plains A Ecological Zone, North Taiga Plains B Ecological Zone.
 3. Low effects will occur in the South Taiga Plains A Ecological Zone.
 4. Low effects will occur in the South Taiga Plains B Ecological Zone.
 5. Low effects will occur in the North Taiga Plains A Ecological Zone.
 6. Compiled effects on pingos in the Tundra Ecological Zone, glaciofluvial and aeolian deposits and patterned ground.
 7. Low effects will occur in all ecological zones.
 8. Compiled effects on changes in soil drainage, soil loss and changes in the physical and chemical characteristics of soil.
- N/A = Not applicable because no effect is predicted.

3.2.9 VEGETATION

Potential effects of pipeline corridor activities on vegetation can be related to:

- clearing and grading for project construction
- dust and air emissions
- changes in landforms and soils from pipeline operation and maintenance activities

Mitigation strategies to reduce effects on vegetation include:

- minimizing the areal extent of the disturbance
- controlling weeds to prevent weedy species invasion
- reclaiming disturbed areas
- monitoring vegetation composition and cover, vegetation health and vigor, and the presence of weeds at selected sites

No significant effects on vegetation abundance and distribution are predicted (see Table 3-8). No effects on the abundance and distribution of vegetation communities of concern or rare plants are predicted.

Table 3-8: Effects of Gas Pipeline Activities on Vegetation Abundance and Distribution

Valued Component	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Vegetation Types	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Adverse	Low	Local	Far future	No
Vegetation communities of concern	Construction	Adverse	Low ¹	Regional	Far future	No
	Operations	Adverse	Low ¹	Regional	Far future	No
	Decommissioning and abandonment	Adverse	Low ¹	Regional	Far future	No
Rare plants	Construction	Adverse	Low ¹	Beyond regional	Far future	No
	Operations	Adverse	Low ¹	Beyond regional	Far future	No
	Decommissioning and abandonment	Adverse	Low ¹	Beyond regional	Far future	No

Note: 1. No effect on known populations. Potential for effects on unidentified populations.

No significant effects on vegetation health are predicted. Dust and air emissions are predicted to result in low magnitude effects on vegetation types, vegetation communities of concern and rare plants (see Table 3-9).

Table 3-9: Effects of Pipeline Corridor Activities on Vegetation Health

Valued Component	Phase When Impact Occurs	Attributes				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Vegetation types	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Vegetation communities of concern	Construction	Adverse	Low	Local	Short-term	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Rare plants	Construction	Adverse	Low	Beyond regional	Far future	No
	Operations	Neutral	No effect	N/A	N/A	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note: N/A = not applicable because no effect is predicted.

3.2.10 WILDLIFE

Potential effects of pipeline corridor activities on wildlife can be related to:

- reduced habitat because of direct habitat loss from construction, or sensory disturbance that causes wildlife to avoid areas
- barriers that the project infrastructure might present to wildlife movement, such as trenches or pipelines that animals cannot cross
- increased mortality because hunters and predators can access wildlife more readily along roads or pipeline rights-of-way

Mitigation strategies to reduce effects on wildlife include:

- developing and implementing operating guidelines to:
 - address potential effects on wildlife
 - minimize sensory disturbance to wildlife
- managing access in cooperation with communities and regulatory agencies
- controlling vehicle use
- reducing the pipeline and facilities footprint and related vegetation clearing
- scheduling work activities to avoid sensitive life-cycle stages
- implementing design and work practices to reduce the barrier effects of the pipeline on wildlife movement

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- establishing reclamation plans to re-establish wildlife habitat
- managing waste effectively to avoid attracting wildlife

No significant effects on wildlife habitat availability are predicted. Effects on wildlife habitat availability will be low in magnitude and local in extent (see Table 3-10), except for effects on moose and grizzly bear, which might be moderate in magnitude during construction.

Table 3-10: Effects of Gas Pipeline Activities on Wildlife Habitat Availability

Valued Component	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Barren ground caribou and Woodland caribou	Construction	Adverse	Low	Local	Far future ¹	No
	Operations	Adverse	Low	Local	Far future ¹	No
	Decommissioning and abandonment	Adverse	Low	Local	Far future ¹	No
Moose	Construction	Adverse	Moderate	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Grizzly bear	Construction	Adverse	Moderate	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Marten	Construction	Adverse	Low	Local	Far future	No
	Operations	Adverse	Low	Local	Far future	No
	Decommissioning and abandonment	Adverse	Low	Local	Far future	No
Beaver	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Amphibians	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Medium-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Medium-term	No
Birds ²	Construction	Adverse	Low	Local	Long-term	No
	Operations	Adverse	Low	Local	Long term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No

Note:

1. Far future effects relate to vegetation changes that will require time after decommissioning to recover.
2. Bird species addressed in the effects assessment: snow goose, scaup, peregrine falcon, lesser yellowlegs, arctic tern and boreal chickadee.

3.2.10 WILDLIFE (cont'd)

No significant effects on wildlife movement are predicted. The effects on wildlife movement in the area will be low, except for effects on caribou, which might be moderate in magnitude during construction (see Table 3-11).

No significant effects on wildlife mortality are predicted (see Table 3-12). The effects on wildlife mortality are predicted to be low in magnitude, except for moose and beaver, which might experience effects that are moderate in magnitude during construction.

Table 3-11: Effects of Gas Pipeline Activities on Wildlife Movement

Valued Component	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Barren-ground caribou	Construction	Adverse	Moderate	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Woodland caribou	Construction	Adverse	Moderate	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Moose and grizzly bear	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Marten	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Beaver	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No
Amphibians	Construction	Adverse	Low	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Neutral	No effect	N/A	N/A	No

Note: N/A = Not applicable because no effects have been predicted.

3.2.11 CUMULATIVE EFFECTS

An assessment of cumulative effects concluded that:

- the gas pipeline does not contribute to significant cumulative effects

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- there are no significant overall cumulative effects
- the gas pipeline, as part of the Mackenzie Gas Project, might lead to future gas exploration and development within the Northwest Territories. However, information to adequately assess potential cumulative effects from such developments is not currently available.

Table 3-12: Effects of Gas Pipeline Activities on Wildlife Mortality

Valued Component	Phase When Impact Occurs	Attribute				
		Direction	Magnitude	Geographic Extent	Duration	Significant?
Barren-ground caribou, woodland caribou, grizzly bear, marten, lynx and amphibians	Construction	Adverse	Low	Regional	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Short-term	No
Moose	Construction	Adverse	Moderate	Regional	Medium-term	No
	Operations	Adverse	Low	Regional	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Regional	Long-term	No
Beaver	Construction	Adverse	Moderate	Local	Medium-term	No
	Operations	Adverse	Low	Local	Long-term	No
	Decommissioning and abandonment	Adverse	Low	Local	Long-term	No

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SOCIO-ECONOMIC EFFECTS

3.3.1 SCOPE

The socio-economic key issues evaluated for the gas pipeline are the effects on:

- the regional economy
- infrastructure
- individual, family and community wellness
- traditional culture
- non-traditional land and resource use
- heritage resources

Most of the socio-economic issues are overall effects from the Mackenzie Gas Project resulting from the combined influences of all project components and activities. The effects of the gas pipeline development cannot be distinguished from those of all components acting together. This is true of many economic effects but it was possible to isolate and present in this section the direct capital investment and employment for the construction and operation of the gas pipeline and compression facilities. For details on the distribution of project economic effects, including the gas pipeline and compression facilities, see Regional Economic Effects in Section 3.3.2.

The cumulative effects on these issues were also assessed.

No significant adverse effects are predicted on any of these issues as a result of the gas pipeline development. The gas pipeline will have significant positive effects on the regional economy.

For a detailed assessment of the effects on socio-economic resources, see EIS Volume 6: Socio-Economic Impact Assessment.

3.3.2 REGIONAL ECONOMIC EFFECTS**3.3.2.1 Capital and Operating Expenditures**

The Mackenzie Gas Project will generate a large demand for goods, services and labour at various locations in the Northwest Territories. Suppliers, contractors and northern residents will respond to these demands to the extent possible. Where demand exceeds northern supply capacity, supply requirements will be fulfilled from outside the Northwest Territories.

3.3.2.1 Capital and Operating Expenditures (cont'd)

Appraisal of the effects from the gas pipeline is based on specific information on project procurement and employment opportunities. It includes estimates of expenditure, employment and labour income in the study area, considering regional capacity constraints and qualitative assessments of effects on northern wages and other northern employers. The implementation of measures to improve education and labour skill as well as to improve Aboriginal and other northern business procurement opportunities will expand the ability of the labour force and businesses to participate.

All costs are in millions of constant 2003 dollars Canadian.

Table 3-13 shows the capital expenditure for all project components.

Table 3-13: Mackenzie Gas Project Capital Expenditure

Activity	Expenditure Timing	Total
Pre-construction	January 1, 2002 to June 30, 2006	845
Construction	July 1, 2006 to June 30, 2010	6,247
Ongoing capital	July 1, 2010 to December 30, 2023	639
Total		7,732

Table 3-14 shows that, of the \$6.2 billion construction expenditures:

- 31% will be made in the Inuvialuit Settlement Region (ISR)
- 17% will be made in the Gwich'in Settlement Area (GSA)
- 27% will be made in the Sahtu Settlement Area (SSA)
- 25% will be made in the Deh Cho Region (DCR)

In addition, although no project infrastructure will be located in the industrial and commercial centres (ICCs) of Hay River and Yellowknife, \$103 million in capital expenditures will be made in these locations for module assembly, logistics and transportation.

Table 3-14: Capital Investment in the Northwest Territories

Location	2006–2007		2007–2008		2008–2009		2009–2010		Total	
	(\$M)	(%)	(\$M)	(%)	(\$M)	(%)	(\$M)	(%)	(\$M)	(%)
Project total*	1,409	100	2,261	100	1,907	100	671	100	6,247	100
ISR	301	21	580	26	672	35	362	54	1,915	31
GSA	276	20	419	19	308	16	77	11	1,079	17
SSA	433	31	657	29	483	25	121	18	1,694	27
DCR	398	28	605	27	444	23	111	17	1,559	25
ICCs	26	2	35	2	32	2	10	20	103	2
Note:										
* Project total excludes capital investment at ICCs.										
Numbers might not add up because of rounding.										

Of the estimated \$1.9 billion of capital expenditure to occur in the Inuvialuit Settlement Region during construction from 2006 to 2010, an estimated \$328 million (17%) will be spent in the region. Similarly, of the \$1.1 billion of capital expenditures to occur in the Gwich'in Settlement Area, \$353 million (33%) will be spent in that area. Of the \$1.7 billion in the Sahtu Settlement Area, \$61 million (4%) will be spent in that area. Of the \$1.6 billion of capital expenditure in the DCR, \$48 million (3%) will be spent in that area.

During operation of all project components, the annual average operating cost will be \$141 million. The gas pipeline operating costs are estimated to average \$62 million per year for the period 2010 to 2015.

The estimated total capital expenditures for the pipelines and related facilities are \$3,838 million from 2002 to 2010. The highest expenditures will be made between 2006 and 2009 (see Section 5, Capital Cost Estimate).

3.3.2.2 Employment

During Mackenzie Gas Project construction, an average of 2,921 Northwest Territories people per year would be available to seek work on the project or related indirect and induced employment opportunities in northern communities (see Table 3-15).

Table 3-15: Estimated NWT Labour Pool Available for Project-Related Work

Indicator	2006	2007	2008	2009	Average
Total unemployed persons (no.)	4,501	4,652	4,745	4,763	4,665
Will do rotational work (%)	62	65	63	60	63
Total unemployed persons adjusted for rotational work (no.)	2,790	3,039	3,009	2,846	2,921

A GNWT Labour Force Survey identified the total available labour pool and those that would be willing to accept rotational work. Acceptance of work rotation was taken as an indicator of northern labour accepting direct project employment.

The willingness to do rotational work was applied to about half the unemployed workforce because this condition only applies to direct jobs, which make up about half of the total number of project-related jobs created.

An estimate of direct employment demand for the Northwest Territories was developed by comparing the job type and occupation requirements for each project component located in the region with the expected skills of the local labour force.

The Statistics Canada Inter-Regional Input-Output Model was used to estimate the total demand generated by the project for indirect and induced employment in the Northwest Territories. Taking the capacity constraints of the available labour force into account, an estimated average of 1,445 workers in all regions are projected to be available to meet the demand for Mackenzie Gas Project direct,

3.3.2.2 Employment (cont'd)

indirect and induced jobs during construction, assuming that project-related training is made available in the Northwest Territories (see Table 3-16).

Table 3-16: Total Estimated Employment Demand in NWT

Indicator	Type of Demand	Number of Jobs					
		2006–2007	2007–2008	2008–2009	2009–2010	Total	Average
Modelled employment demand in the Northwest Territories without labour supply constraints	Direct	830	3,138	2,569	146	6,683	1,671
	Indirect	1,537	2,344	2,372	995	7,248	1,812
	Induced	457	698	684	289	2,128	532
	Total	2,823	6,180	5,626	1,431	16,059	4,015
Estimated project employment demand in the Northwest Territories with labour supply adjustments	Direct	563	1,282	1,168	146	3,160	790
	Indirect	466	540	507	373	1,886	472
	Induced	190	224	209	110	733	183
	Total	1,218	2,047	1,885	630	5,779	1,445

Note: Numbers might not add up because of rounding.

3.3.2.3 Labour Income

Project construction is estimated to lead to an increase of \$300 million in labour income in the Northwest Territories over the construction period. This will comprise \$157 million in direct project-related income and another \$111 million (indirect) and \$31 million (induced) earned by those producing goods and services for the project and its employees.

The period from 2009 to 2030 was selected as the most relevant timeframe for the analysis of operating effects because it is of sufficient duration to provide a good representation of the economic effects of project operations (see Table 3-17).

Table 3-17: Estimated Annual Average Employment in NWT for Operations

Indicator	Number of Jobs				
	2009–2015	2016–2020	2021–2025	2026–2030	2009–2030
Direct	210	272	120	115	182
Indirect	220	244	225	213	225
Induced	88	127	81	77	93
Total	518	643	426	405	500

Note: Numbers might not add up because of rounding.

During operations, from 2009 to 2030, annual average direct, indirect and induced jobs will range from 405 to 643 and average about 500 in the Northwest Territories. The labour income generated from the project-related direct, indirect and induced jobs in the Northwest Territories will range from about \$36 to \$69 million and average about \$47 million over the same period. However, because

of the need for experienced and qualified workers for project operations, some of these positions will have to be filled from outside the Northwest Territories.

For the estimated gas pipeline and facilities workforce contribution to the overall project construction employment, see Section 2, Engineering and Construction. Pipeline and facilities construction is estimated to generate about 14,000 direct jobs over the four-year construction period.

The gas pipeline and facilities operations and maintenance labour requirements will total about 50 workers. This includes employees, northern trainees and maintenance contract personnel. After the initial three or four years of operations, the number of workers is expected to decline to about 40, including between 10 and 15 contract personnel.

Project economic effects are expected to be positive, high in magnitude, regional and beyond in extent, and significant in all regions during construction (see Table 3-18). Project effects in the Gwich'in Settlement Area are expected to be positive and significant during operations. Other regions' economic effects during project operations will be positive but low in magnitude and not significant.

Table 3-18: Economic Effects of the Project

Location	Phase When Impact Occurs	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	Construction	Positive	High	Regional and beyond regional	Short-term	Yes
	Operations	Positive	Low	Regional and beyond regional	Long-term	No
GSA	Construction	Positive	High	Regional and beyond regional	Short-term	Yes
	Operations	Positive	Moderate	Regional and beyond regional	Long-term	Yes
SSA	Construction	Positive	High	Regional and beyond regional	Short-term	Yes
	Operations	Positive	Low	Regional and beyond regional	Long-term	No
DCR	Construction	Positive	High	Regional and beyond region	Short-term	Yes
	Operations	Positive	Low	Regional and beyond regional	Long-term	No
NWT ICCs	Construction	Positive	Moderate	Regional and beyond regional	Short-term	No
	Operations	Positive	Low	Local	Long-term	No

3.3.2.4 Demography and Population Mobility

The possibility that increases in populations will overburden community infrastructure and services is a concern. All aspects of field development and project construction will create demands for labour, and thus tend to encourage migration to regional and other centres of project activity. Relevant mitigation

3.3.2.4 Demography and Population Mobility (cont'd)

measures include hiring southern workers for project and production-related positions in selected provincial cities, from contractor lists and via media advertising. Hiring in the North will be restricted to qualified Aboriginal and other northern residents and this restriction will be publicized. Aboriginal and other northern residents will be able to sign up for project work in their home communities, which will help discourage intra-territorial migration.

However, these measures will be only partly effective because there will be many indirect and induced jobs during the Construction Phase which might cause workers to migrate within and into the Northwest Territories.

The effects of the gas pipeline are not distinguishable from combined project effects. These effects will be expressed in Inuvik, Norman Wells, Fort Simpson and Hay River, where, compared to pre-project levels, the population is expected to increase by about:

- 450 in Inuvik
- 100 in Norman Wells
- 140 in Fort Simpson
- 125 in Hay River

Table 3-19 shows that project effects on population movement in most regions are expected to be adverse, in the sense of stimulating population movement, low to moderate in magnitude, of short duration and not significant. In Inuvik, the effects might be adverse and positive but are expected to be of high magnitude.

Table 3-19: Construction Effects on Population Mobility

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	ISR total	Adverse	Low	Regional	Short-term	No
	Tuktoyaktuk	Adverse	Moderate	Regional	Short-term	No
	Aklavik	Adverse	Low	Regional	Short-term	No
GSA	GSA total	Adverse	Low	Regional	Short-term	No
	Inuvik	Adverse and positive	High	Local	Short-term	No
SSA	SSA total	Adverse	Low	Local	Short-term	No
	Norman Wells	Adverse	High	Local	Short-term	No
	Fort Good Hope	Adverse	Moderate	Local	Short-term	No
DCR	DCR total	Adverse	Low	Regional	Short-term	No
	Fort Simpson	Adverse	Moderate	Local	Short-term	No
	Wrigley, Jean Marie River and Trout Lake	Adverse	Low	Regional	Short-term	No
NWT ICCs	Yellowknife	Adverse and positive	Low	Local	Short-term	No
	Hay River	Adverse and positive	Low	Local	Short-term	No

During the Operations Phase, the effect on population will be relatively small, and there will be a marginal effect on Inuvik and other regional centres. The initial transitional effect on the total study area population from 2009 to 2015 could be an increase of about 470 people. This effect will stabilize during early operations, and by 2021 to 2025, will reach a level of about 420 people. About 60% of the population increase will be in Inuvik and a further 30% in the ICCs in the short term. However, in the long term, this distribution should change to about 50% for Inuvik and 40% for the ICCs.

During operations, the project effects on population mobility are predicted to be neutral or positive, no effect or low in magnitude, long-term and not significant in any region or regional centre.

3.3.3 INFRASTRUCTURE

3.3.3.1 Transportation

The Mackenzie Gas Project will increase demand on all transportation modes, including highway, railroad, barge and air transportation, during the Construction Phase, in addition to increasing project-related travel.

Agreements between the project and the GNWT, and between the project and applicable municipalities, will be negotiated and will include provisions for the project's use of permanent and seasonal roads. The agreements will consider:

- coordination of road maintenance activities
- coordination of road upgrading, where required
- options that could include making contributions in kind, such as constructing winter roads, maintaining and repairing highways or contributing to a portion of maintenance costs

Other general mitigation measures will include:

- continuing discussions with barge service and air transportation providers to provide them with ample lead time to ensure sufficient capacity to meet community requirements and project demands
- coordinating with the GNWT and other responsible authorities to provide construction-air and barge traffic demand projections, including provisions for assessing the need for, and completing upgrading and other improvements to, regional and municipal airports airstrips and barge landings
- continuing discussions with the Mackenzie Northern Railroad, so that the Mackenzie Northern Railroad can complete railbed upgrades and add new sidings, where required to meet existing transportation requirements and project demands

3.3.3.1 Transportation (cont'd)

Table 3-20 shows that, even with implementing effective mitigation measures, project effects on transportation infrastructure are expected to be mostly adverse because of increased demands. However, all effects are expected to be low to moderate in magnitude, of short duration and not significant.

Extensive transportation will not be required during the Operations Phase. As a result, the effects of the Operations Phase on transport infrastructure were not assessed.

Table 3-20: Project Effects on Transportation Infrastructure

Location	Mode of Transportation	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Beaufort Delta Region	Road	Adverse	Low	Regional	Short-term	No
	Marine	Adverse	Moderate	Regional	Short-term	No
	Air	Adverse	Moderate	Regional	Short-term	No
SSA	Road	Adverse	Moderate	Regional	Short-term	No
	Marine	Adverse	Moderate	Regional	Short-term	No
	Air	Adverse and Positive	Moderate	Regional	Short-term	No
DCR	Road	Adverse	Moderate	Regional	Short-term	No
	Marine	Adverse	Low	Regional	Short-term	No
	Air	Adverse	Moderate	Regional	Short-term	No
NWT ICCs	Road	Adverse	Low	Regional	Short-term	No
	Marine	Adverse	Moderate	Regional	Short-term	No
	Air	Adverse	Low	Regional	Short-term	No

3.3.3.2 Energy and Utilities

During the construction and operations phases, the project will have no effects on the energy and utilities systems of any community. Accordingly, there is no need to detail project effects on energy and utilities infrastructure during either of these phases.

All communities have sufficient capacity to accommodate any foreseeable demands created by the projected level of in-migrants or transients the project might attract to the study area.

3.3.3.3 Housing

Project effects on housing and accommodations will include direct and indirect demands for short and long-term accommodation. Demands for short-term accommodation will be reduced by providing project construction camps.

Programs to discourage speculative in-migration will help reduce pressures on accommodations (see Demography and Population Mobility in Section 3.3.2.4).

Based on population effect projections, 221 additional dwellings will be required during construction:

- 160 in Inuvik
- 16 in Norman Wells
- 45 in Hay River

Table 3-21 shows that the project effects on housing are expected to be adverse in communities where less housing is available. These effects are expected to be low or moderate in magnitude; regional in the Inuvialuit Settlement Region, Gwich'in Settlement Area and Deh Cho Region, and local elsewhere. The effects are also usually of short-term duration and not significant.

During the Operations Phase, the effects on housing in the larger centres are expected to be both positive and adverse in direction, but not significant (see Table 3-22).

Table 3-21: Project Construction Effects on Housing

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	ISR total	Adverse	Low	Regional	Short-term	No
	Tuktoyaktuk	Adverse	Moderate	Local	Short-term	No
	Aklavik	Adverse	Low	Local	Short-term	No
GSA	GSA Aboriginal communities	Adverse	Low	Regional	Short-term	No
	Inuvik	Adverse	High	Local	Short-term	No
SSA	SSA total	Adverse	Low	Local	Short-term	No
	Norman Wells	Adverse	High	Local	Short-term	No
DCR	DCR total	Adverse	Low	Regional	Short-term	No
	Fort Simpson	Adverse	Moderate	Local	Short-term	No
NWT ICCs	Yellowknife	Adverse	Low	Local	Short-term	No
	Hay River	Adverse	Moderate	Local	Short-term	No

Table 3-22: Project Operations Effects on Housing

Region	Effect Attribute				Significant?
	Direction	Magnitude	Geographic Extent	Duration	
Inuvik	Positive	Low	Local	Long-term	No
Norman Wells	Positive	Low	Local	Long-term	No
Fort Simpson	Positive	Low	Local	Long-term	No
Yellowknife	Positive and adverse	Low	Local	Long-term	No
Hay River	Positive and adverse	Low	Local	Long-term	No

3.3.3.4 Recreation Resources

Camp facilities will meet the recreation needs of the vast majority of project employees. The remaining employees will be based in the regional centres, most for relatively short periods. There will also be some speculative in-migration to the regional centres, in spite of planned mitigation measures. Except for Fort Simpson, these communities are well equipped with large-capacity recreation complexes and other facilities.

Existing facilities in Fort Simpson are barely adequate for the current population. Therefore, they are expected to be highly adversely affected by the likely project-induced increase in population. Moderate adverse effects are expected in Norman Wells. In all other areas, the project is expected to have no effect, or low-magnitude adverse effects that are local or regional in extent, of short-term duration, and not significant.

Some positive effects are expected in Inuvik, where increased recreation demand and user fee revenues could lead to increases in the hours facilities are open for use.

No effects are expected on recreation facilities and use during the Operations Phase, other than a low-magnitude, localized, adverse and positive effect in Inuvik and Norman Wells.

3.3.3.5 Governance

Governance encompasses both the authority to make decisions and the ability to access and manage the funds required to make some decisions consequential. Governance arrangements in the Northwest Territories are changing as a result of ongoing devolution discussions between regional representatives and the governments of the Northwest Territories and Canada.

The project will provide a substantial source of revenue to the various levels of government from:

- benefits and access agreements
- direct taxation
- payment of royalties

During the Construction Phase, the project will generate \$136 million in personal taxes from activity in the Northwest Territories. The GNWT share, after adjustment for the formula financing grant (FFG) is taken into account, is estimated to be \$9.8 million. Estimates of corporate tax flows have not been included. During project operations, total taxes generated from activity in the Northwest Territories will amount to about \$399 million annually, of which the GNWT share, after the FFG is taken into account, is estimated to be \$22 million. The GNWT share will vary from 7% of the total during construction to 5% during operations.

The size of these various project payments should exceed the costs of sustaining adequate levels of infrastructure and services to meet project demands. However,

before a final devolution agreement is implemented, the largest part of these revenues will accrue to the federal government, while the likely costs of the project for infrastructure and services will impinge on the local, regional and territorial governments. These authorities will not have the resources to pay for the project-induced needed infrastructure and public services expenditures under current programs and budgets.

There is an issue with the timing of expenditures for the physical infrastructure necessary before and during construction, and the substantial project royalty fee and tax revenues receivable during operations. Accordingly, Construction Phase effects on governance are seen as adverse, moderate in magnitude, regional and beyond regional in extent, but short-term and not significant. The Operations Phase effects will be positive, low in magnitude, regional and beyond regional in extent, long-term and not significant.

3.3.4 INDIVIDUAL, FAMILY AND COMMUNITY WELLNESS

During the Construction Phase, elevated levels of employment and income will affect individual, family and community wellness. At the end of this phase, the unusual levels of employment and income will end. The small number of people employed for technical operations and pipeline maintenance during the Operations Phase will be stationed primarily in Inuvik, with a few in Norman Wells, and perhaps some maintenance staff in Fort Simpson. Accordingly, during the Operations Phase, there will be no need for mitigation to reduce adverse effects on wellness, and no residual effects are expected.

3.3.4.1 Community Well-Being and Delivery of Social Services

The most frequent and persistent problems that community wellness centres must address are substance abuse, primarily alcohol, and derivative violence, often in families. The increased incomes from project employment could add substantially to substance abuse-related problems, and to the burdens of the social service workers who must try to deal with the problems.

Because of Inuvik's location and central role as service centre for the Beaufort Delta Region, many of the wellness issues will express themselves there. As a result, effective mitigation will be a serious challenge, requiring a concentrated effort by all.

The single most important mitigation focuses on controlling substance abuse, and this will require initiatives by the project proponents, the GNWT and local communities. Measures initiated by the project proponents include:

- providing money-management training programs in camps, and supporting community-based money-management training programs, to reduce the potential for negative lifestyle choices
- enforcing policies for alcohol and drug-free workplaces and camps

3.3.4.1 Community Well-Being and Delivery of Social Services (cont'd)

The GNWT should ensure that the resources of RCMP detachments are adequate to strictly enforce liquor ordinances, laying charges against those guilty of violent abuse and detaining inebriated people who might endanger themselves or others.

The proponents encourage local communities to enact ordinances restricting alcohol import amounts and mobilizing their resources to discourage substance abuse and associated violence.

Measures that reduce adverse effects on community wellness reduce the demands and the stresses on social services workers, who then will be better able to deal with wellness problems.

Table 3-23 shows that the project effects on well-being during the Construction Phase are expected to be adverse and high in magnitude in Inuvik, Tuktoyaktuk, Paulatuk, Aklavik and Fort Simpson, and neutral in Holman, Sachs Harbour and Yellowknife. In the remaining communities, project effects are expected to be moderate or low. These effects will all be local, short-term and not significant.

Table 3-23: Project Effects on Well-Being

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	Aklavik, Tuktoyaktuk and Paulatuk	Adverse	High	Local	Short-term	No
	Holman and Sachs Harbour	Neutral	Low	Local	Short-term	No
GSA	GSA Aboriginal communities	Adverse	Moderate	Local	Short-term	No
	Inuvik	Adverse	High	Local	Short-term	No
SSA	Fort Good Hope and Tulita	Adverse	Moderate	Local	Short-term	No
	Norman Wells	Adverse	Moderate	Local	Short-term	No
	Déline and Colville Lake	Adverse	Low	Local	Short-term	No
DCR	Fort Simpson	Adverse	High	Local	Short-term	No
	Wrigley and Jean Marie River	Adverse	Moderate	Local	Short-term	No
	Other DCR communities	Adverse	Low	Local	Short-term	No
ICCs	Yellowknife	Neutral	Low	Local	Short-term	No
	Hay River, including satellite communities	Adverse	Low	Local	Short-term	No

The effects on social service delivery are summarized in Table 3-24. They generally parallel well-being conditions. All are expected to be short-term and not significant.

Most employment opportunities generated by the project will end once construction and associated restoration activities are complete. A small staff of technical operations and maintenance personnel will likely be stationed in Inuvik and Norman Wells, perhaps with some contract maintenance staff in Fort

Simpson. No long-term effects on well-being conditions and social services are predicted.

Table 3-24: Project Effects on Delivery of Social Services

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	Aklavik, Tuktoyaktuk and Paulatuk	Adverse	High	Local	Short-term	No
	Holman and Sachs Harbour	Neutral	Low	Local	Short-term	No
GSA	Aboriginal communities	Adverse	Moderate	Local	Short-term	No
	Inuvik	Adverse	High	Local	Short-term	No
SSA	Fort Good Hope and Tulita	Adverse	Moderate	Local	Short-term	No
	Norman Wells	Adverse	Moderate	Local	Short-term	No
	Déline and Colville Lake	Adverse	Low	Local	Short-term	No
DCR	Fort Simpson	Adverse	High	Local	Short-term	No
	Wrigley and Jean Marie River	Adverse	Moderate	Local	Short-term	No
	DCR other communities	Adverse	Low	Local	Short-term	No
ICCs	Yellowknife	Neutral	Low	Local	Short-term	No
	Hay River, including satellite communities	Adverse	Low	Local	Short-term	No

3.3.4.2 Health Conditions and Health Care Services

All project camps will have health care staff and facilities appropriate to camp size. Staffing and facility equipment will ensure that any accident victims and seriously ill patients can be stabilized for medical evacuation.

The most serious threats to health in communities are posed by:

- substance abuse and the consequential elevated risks of accidental and violent injuries
- population movement and the potential that contagious diseases might be spread by transients or workers returning from camps

Measures to mitigate substance abuse are discussed in Section 3.3.4.1.

The project proponents will work with GNWT Health and Social Services to design project health and work environment guidelines and procedures for:

- developing medical alert and quarantine protocols
- conducting fitness-for-work assessments
- assessing and caring for ill or injured workers

3.3.4.2 Health Conditions and Health Care Services (cont'd)

- enhancing communications and cooperation among medical personnel in the camps and regional and territorial health authorities

Table 3-25 shows that project effects on health conditions are expected to be adverse and of low or moderate magnitude in all areas except Fort Good Hope and Fort Simpson, where the effects might be of high magnitude. All effects will be of short-term duration and not significant.

Table 3-25: Project Effects on Health Conditions

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	ISR Total	Adverse	Moderate	Regional	Short-term	No
	Tuktoyaktuk	Adverse	Moderate	Local	Short-term	No
	Aklavik	Adverse	Moderate	Local	Short-term	No
GSA	GSA total	Adverse	Moderate	Regional	Short-term	No
	Inuvik	Adverse	Moderate	Local	Short-term	No
SSA	SSA total	Adverse	Moderate	Regional	Short-term	No
	Norman Wells	Adverse	Moderate	Local	Short-term	No
	Fort Good Hope	Adverse	High	Local	Short-term	No
DCR	Fort Simpson	Adverse	High	Local	Short-term	No
	Wrigley	Adverse	Moderate	Local	Short-term	No
	Small communities	Adverse	Moderate	Local	Short-term	No
NWT ICCs	Yellowknife	Adverse	Low	Local	Short-term	No
	Hay River	Adverse	Moderate	Local	Short-term	No

Effects on health care services are driven by changes in community and regional health conditions, and problems associated with the recruitment and morale of nurses. The GNWT is strenuously engaged in seeking to solve these recruitment and morale issues.

Mitigation measures to discourage speculative in-migration will reduce the risk of overburdening health care facilities (see Demography and Population Mobility in Section 3.3.2.4).

Table 3-26 shows that project effects on health care services are expected to be adverse and of low or medium magnitude in all areas except Tuktoyaktuk, the Inuvik Hospital, Fort Good Hope and Fort Simpson, where the effects might be high in magnitude. All effects are expected to be of short-term duration and not significant. Effects on the Inuvik Hospital will be regional in extent.

Activities during the Operations Phase are not expected to affect health care services because the increased income, and the work and separation-related stresses, will have diminished with completion of the Construction Phase.

Table 3-26: Project Effects on Health Care Services

Region	Location	Effect Attributes				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	ISR community health care centres	Adverse	Moderate	Local	Short-term	No
	Tuktoyaktuk health care centres	Adverse	High	Local	Short-term	No
GSA	GSA health care centres	Adverse	Moderate	Local	Short-term	No
	Inuvik Hospital out-patient	Adverse	High	Local	Short-term	No
	Inuvik Hospital in-patient	Adverse	Moderate	Regional	Short-term	No
SSA	SSA health care centres	Adverse	Moderate	Local	Short-term	No
	Norman Wells	Adverse	Moderate	Local	Short-term	No
	Fort Good Hope	Adverse	High	Local	Short-term	No
DCR	Fort Simpson	Adverse	High	Local	Short-term	No
	Wrigley	Adverse	Moderate	Local	Short-term	No
	Other small communities	Adverse	Low	Local	Short-term	No
NWT ICCs	Yellowknife Hospital	Adverse	Low	Beyond regional	Short-term	No
	Hay River Hospital	Adverse	Moderate	Local	Short-term	No

3.3.4.3 Human Health Risks

The project will have no effects on air, water or soil quality during construction or operations that could induce adverse effects on the health of humans, plants or animals.

Concerns were expressed in some communities about emissions from diesel trucks parked with engines idling near communities. Relevant mitigation includes using vehicles that burn low sulphur diesel fuel and avoiding idling vehicles near communities. The effects of diesel exhaust health risks are expected to be adverse, low-magnitude, local and short-term, and not significant.

3.3.4.4 Public Safety and Protection Services

Many RCMP detachments in the Beaufort Delta Region report that they are overburdened. During the Construction Phase, police will be affected by having to address any increased problems in the communities they serve, and occasional problems in camps.

Controlling alcohol and drug abuse will be the most effective way to mitigate many policing problems. The relevant measures are the same as those listed in Section 3.3.4.1, Community Well-Being and Delivery of Social Services. However, because substance abuse problems are resistant to solution, these measures will only be moderately effective.

Given the increased likelihood of substance abuse and derivative problems that the increased community earnings from project construction might bring,

3.3.4.4 Public Safety and Protection Services (cont'd)

Construction Phase effects on local policing are expected to be adverse, ranging from low to high in magnitude. The geographic extent will be local and of short-term duration. Thus, these effects are judged to be not significant.

There will be no need for mitigation and no residual effects on policing services during the Operations Phase.

3.3.4.5 Education Attainment and Services

Education attainment and services in the study area will be somewhat affected by the project. Some adolescents will respond to employment opportunities by leaving school prematurely, and some former dropouts might return to qualify for more training. Children of in-migrants could increase enrollment pressures. Therefore, enrollment pressures and project-related changes in education and training programs might increase or decrease. Some effects might tend to carry on from construction into operations.

The schools, project personnel and community members will seek to discourage adolescents from leaving school early. Measures previously described in Demography and Population Movement (see Section 3.3.2.4) to discourage in-migration to regional centres, which might increase enrollment, will be relevant as well.

The attributes of project effects on education attainment during the Construction Phase are expected to be positive and adverse in all communities, and of moderate magnitude and local extent in Inuvik and Fort Good Hope. These effects are expected to be moderate and regional in Fort Simpson, and of low to moderate magnitude in Wrigley and Jean Marie River. The effects in the remaining communities are expected to be low in magnitude.

Construction Phase effects on education facilities and services are expected to be:

- positive and adverse, moderate in magnitude and local in Tuktoyaktuk
- positive and neutral, low in magnitude and regional in Inuvik
- generally neutral in the remaining study area communities

During the Operations Phase, effects on education attainment are expected to be positive, low in magnitude and local in most study area communities. Inuvik is an exception, with expected moderate-magnitude, local effects, as are Norman Wells and Fort Simpson, where low-magnitude regional effects are expected. Effects in Yellowknife and Hay River will be neutral.

Project effects on education facilities and services during the Operations Phase are expected to be neutral in all communities, except:

- Inuvik, where effects are expected to be positive, low-magnitude and regional

- Tuktoyaktuk, where effects are expected to be positive, low magnitude-and local

None of the project effects on education attainment or education facilities and services are predicted to be significant for either the construction or the operations phases.

3.3.5 TRADITIONAL CULTURE

3.3.5.1 Traditional Harvesting and Land Use

Harvesting and seasonal wage employment are now symbiotic, because low incomes from trapping necessitate wage employment to pay for the expensive equipment now needed for efficient harvesting. The project will provide wage employment that might support harvesting equipment and expense requirements.

Project employment could jeopardize harvester lore and disciplines by pre-empting harvesting opportunities because of time needed for employment. Some Aboriginal workers might find the paid work more rewarding than harvesting, promoting interest in a southern lifestyle. However, Aboriginal workers could also react negatively and strengthen their appreciation of the more traditional relationships and the lifestyle they enjoy at home.

Elders are powerful influences for sustaining tradition. The project will aid their efforts and help meet the traditional food requirements of communities by providing Aboriginal workers with flexible work schedules to accommodate traditional pursuits, where feasible.

The project will also provide cultural-awareness training to workers and support community-based initiatives that promote traditional harvesting, lifestyles and positive community relationships, such as:

- traditional harvesting training camps for young people
- traditional skills proficiency demonstrations or competitions

Low-magnitude adverse effects on harvesting activity are expected in most communities (see Table 3-27). The availability of project employment in the Beaufort Delta Region is expected to have moderate adverse effects on harvesting in Tuktoyaktuk, Fort McPherson and Tsiigehtchic. These effects are not significant.

3.3.5.2 Preserving Traditional Language and Culture

The effects of the project on cross-generation transference of traditional language skills as well as the knowledge of, and identification with, traditional culture are central to questions about language and culture retention. As in the case of resource harvesting, project influences might either strengthen or weaken language and culture.

3.3.5.2 Preserving Traditional Language and Culture (cont'd)

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 languages is already strongly influenced by the use of English in the media, schools and most work situations. As a result, project employment will likely have little effect on language and cultural retention.

Table 3-27: Project Effects on Traditional Harvesting

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	ISR total	Adverse	Moderate	Regional	Short-term	No
	Sachs Harbour, Paulatuk and Holman	Neutral	Low	Regional	Short-term	No
	Tuktoyaktuk	Adverse	Moderate	Local	Short-term	No
GSA	GSA total	Adverse	Low	Regional	Short-term	No
	Aboriginal communities	Adverse	Moderate	Regional	Short-term	No
	Inuvik	Adverse	Low	Local	Short-term	No
SSA	Aboriginal communities	Adverse	Low	Regional	Short-term	No
	Norman Wells	Neutral	No effect	Local	Short-term	No
DCR	DCR total (not including Fort Simpson)	Adverse	Low	Regional	Short-term	No
	Fort Simpson	Adverse	Low	Local	Short-term	No
ICCs	Yellowknife	Neutral	No effect	Local	Short-term	No
	Hay River	Adverse	Low	Local	Short-term	No

Nevertheless, to help counteract these influences, the project will support community-based initiatives that promote traditional culture, lifestyle and positive community relationships, such as:

- Aboriginal language-proficiency demonstrations or competitions
- cultural activities and events that are consistent with the proponents' principles and practices for community involvement

Workers will have access in camps to Aboriginal language reading material, radio and television broadcasts, and tapes and CDs, where available.

Because previous exposure to English has been so great, only low-magnitude adverse effects on traditional language and culture retention are expected in most communities. These effects are not significant. No effects are expected in Inuvik, Norman Wells, Yellowknife and Hay River (see Table 3-28).

Table 3-28: Project Effects on Language and Traditional Culture Retention

Region	Location	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
ISR	ISR total	Adverse	Low	Regional	Short-term	No
	Coastal communities	Adverse	Low	Local	Short-term	No
GSA	GSA total	Adverse	Low	Regional	Short-term	No
	Aboriginal communities	Adverse	Low	Local	Short-term	No
	Inuvik	Adverse	No effect	Local	Short-term	No
SSA	SSA total	Adverse	Low	Regional	Short-term	No
	Aboriginal communities	Adverse	Low	Local	Short-term	No
	Norman Wells	Neutral	No effect	Local	Short-term	No
DCR	DCR total	Adverse	Low	Regional	Short-term	No
	Fort Simpson, Fort Liard and Fort Providence	Adverse	Low	Local	Short-term	No
NWT ICCs	Yellowknife and Hay River	Neutral	No effect	Local	Short-term	No

3.3.6 NON-TRADITIONAL LAND AND RESOURCE USE

Project effects on the administrative regions of the Mackenzie Valley were assessed for all project components, i.e., the production area, the gathering system, the gas pipeline, associated facilities and infrastructure, and borrow sites.

Table 3-29 identifies the combined effects of the project on each of the identified valued components, in terms of direction, magnitude, geographic extent, duration and significance. The project components often have differing effects on the individual valued components. However, none of these effects is significant.

Construction of the gas pipeline will overlap with some areas designated for limited development. Construction of the various project components will result in an increase in the disturbed area within these areas. However, in all cases, the project will be developed to meet the recommendations or requirements of the various land-use plans and regulations that apply.

The presence of additional temporary and permanent roads for the project could change access to other land uses within protected and proposed protected areas. This could result in changes to other land uses already present in these areas or an increase in other land uses. Other land users are expected to follow the requirements and recommendations of the applicable land-use plan or regulation for development in protected or proposed protected areas.

3.3.6.1 Protected Areas

The NWT Protected Areas Strategy has been reviewed and considered in the assessment of the project effects. Only two areas identified under the protected areas strategy are encountered by the project. There is potential for other areas

3.3.6.1 Protected Areas (cont'd)

along the pipeline corridor to be identified in the future under the protected areas strategy. However, the project has taken a landscape-based approach to the environmental and socio-economic impact assessments, resulting in a 30-km corridor centred on the pipeline. This approach provides an information base for assessing potential impacts of the project on any future areas identified under the Protected Areas Strategy and situated within the corridor.

The direction, magnitude, geographic extent and expected duration of the expected project effects on protected areas throughout the project area have been assessed. The impacts are not significant.

Table 3-29: Effects on Non-Traditional Land and Resource Use

Valued Component	Impact	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Land ownership	Contravention of zoning bylaws or land access requirements	Neutral	No effect	N/A	N/A	No
Granular resources	Decrease in available land base for granular extraction	Neutral to adverse	No effect to low	Local	Short-term to long-term	No
	Change to existing granular operations	Positive or adverse	Moderate	Local to regional	Short-term	No
		Positive	Low	Regional	Long-term	No
	Loss of granular resources	Adverse	Moderate	Regional	Short-term to long-term	No
		Adverse	Low	Regional	Long-term	No
Net effect on granular resources	Adverse	Low	Regional	Long-term	No	
Timber resources	Decrease in available land base for timber resources	Adverse	Low	Local	Short-term to long-term	No
	Disruption to existing forest industry practices	Neutral	No effect	N/A	N/A	No
	Changes to existing timber harvesting practices	Adverse	Low	Regional	Short-term	No
		Neutral to positive	No effect to low	Regional	Long-term	No
Loss of timber resources	Neutral to adverse	No effect to low	Local to regional	Long-term	No	
Mineral resources	Decrease in available land base for mining	Neutral to adverse	No effect to low	Local	Short-term to long-term	No
	Disruption to existing mining operations	Neutral	No effect	N/A	N/A	No
Oil and gas activities	Decrease in available land base for other oil and gas activities	Adverse	Low	Local	Short-term to long-term	No
	Changes in other oil and gas activities	Positive to adverse	No effect to low	Local to regional	Short-term to long-term	No

Table 3-29: Effects on Non-Traditional Land and Resource Use (cont'd)

Valued Component	Impact	Effect Attribute				Significant?
		Direction	Magnitude	Geographic Extent	Duration	
Non-traditional resource harvesting	Decrease in available land base for resource harvesting activities	Adverse	Low	Local	Short-term to long-term	No
	Change in non-traditional hunting and fishing success	Adverse	Low to moderate	Regional	Short-term	No
		Neutral to adverse	No effect to low	Local	Long-term	No
	Change in resource harvesting opportunities	Positive or adverse	Low	Local	Short-term to long-term	No
Other commercial activities	Decrease in available land base for other commercial activities	Neutral to adverse	No effect to low	Local	Short-term to long-term	No
	Change in other commercial activities	Neutral to adverse	No effect to low	Regional	Short-term	No
		Positive to adverse	Low	Regional	Long-term	No
Tourism and recreation	Decrease in available land base for tourism and outdoor recreation activities	Neutral to adverse	No effect to low	Local to regional	Short-term to long-term	No
	Change to tourism and recreation activities	Neutral to adverse	No effect to low	Local to regional	Short-term	No
		Positive to adverse	No effect to low	Local to regional	Long-term	No
	Change in quality of tourism and outdoor recreation	Neutral to adverse	No effect to low	Local to regional	Short-term	No
		Positive to adverse	No effect to low	Local to regional	Long-term	No
	Change to summer tourist and recreational boat traffic in the Mackenzie River and Mackenzie Delta	Neutral to adverse	No effect to low	Local to regional	Short- to long-term	No
Marine operations	Disruption of current marine shipping and operation activities	No effect	None	None	None	No

Note: N/A = not applicable.

3.3.6.2 Visual and Aesthetic Resources

Project effects on visual and aesthetic resources along the pipeline corridor will vary and will be noticeable on the ground at a local scale or from the air on a regional level.

The combined effects of the project on visual and aesthetic resources for the pipeline corridor are not expected to be significant.

3.3.7 HERITAGE RESOURCES

Heritage resources are non-renewable resources that might be located at or near the ground surface and, therefore, are highly susceptible to any activities disturbing the ground. They are defined and managed by GNWT legislation.

Based on community and regulatory input, the key issues relating to heritage resources include loss of, or damage to, historical, cultural, archaeological or palaeontological resources. The methods used for project-focused field reconnaissance and heritage resources impact assessment are considered standard for archaeological investigations of this type in the region. As the infrastructure and borrow sites are not specific to the anchor fields, they are included in this discussion.

The field program consisted of a reconnaissance-level study of:

- the three anchor fields
- segments of a 1 km-wide corridor along the selected pipeline route
- 67 potential locations for project-related infrastructure sites
- 159 potential borrow sites

A total of 114 heritage resources were found:

- 28 in the Inuvialuit Settlement Region
- 32 in the Gwich'in Settlement Area
- 34 in the Sahtu Settlement Area
- 20 in the Deh Cho Region

Thirty-two of these sites were rated as high in significance, 37 as medium and 45 as low.

The studies completed to date have focused on key resources and landforms within zones that might be developed for the project, with the intent of assisting in planning future research strategies and formulating recommendations for the impact assessment part of the project. The heritage resources program has adopted a staged approach that will provide increasing levels of precision for assessing the heritage resource effects of the project as heritage resources are identified and as project details are finalized. Mitigation strategies will be devised when full information on effects is known, and will be made in consultation with the regulatory agency responsible for heritage resource management in the Northwest Territories – the Prince of Wales Northern Heritage Centre.

A full heritage resources impact assessment will be undertaken once the alignment and facility sites are finalized.

3.3.8 TRADITIONAL KNOWLEDGE

Traditional knowledge studies are being conducted with affected communities along the proposed pipeline right-of-way. Traditional knowledge is being collected to help in project planning and to provide information for the regulatory process. As the traditional knowledge studies are still being undertaken, supplemental information will be provided on this subject. For further information of the traditional knowledge study process, see EIS Volume 1: Overview and Impact Summary.

Traditional knowledge studies have been designed to maximize community participation, and will highlight key aspects that will allow the communities in the study area to participate effectively. The proponents have approached the studies with the intention of ensuring that real benefits will be achieved through project planning, design, assessment, mitigation and monitoring.

The traditional knowledge program includes:

- reviewing existing information
- collecting new information
- producing traditional knowledge baseline reports

The project proponents have engaged community or regional organizations to undertake traditional knowledge studies relevant to the project. A traditional knowledge working group has been or will be established in each of the communities and regions conducting a traditional knowledge study. The purpose of the traditional knowledge working group is to develop a framework, determine content, establish a schedule and provide guidance for the traditional knowledge study.

The data collected during the traditional knowledge program will be integrated with the other components of the environmental and socio-economic studies being undertaken for the project. Available and relevant traditional knowledge will be given full consideration and incorporated into each of the studies associated with the project.

As the community and regional traditional knowledge studies are still underway, existing traditional knowledge sources have been reviewed as an interim measure to provide as much information as possible for the EIS. The information collected during this review has been provided to appropriate members of the project environmental team for use in the EIS and will be distributed to traditional knowledge working groups that have not completed their studies. The working groups will be asked to review and validate the documented information and will be encouraged to incorporate any relevant information into the traditional knowledge studies being conducted.

PUBLIC CONSULTATION**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE VALLEY PIPELINE
VOLUME 1: PIPELINE OVERVIEW****CONSULTATION APPROACH**

4.1.1 PURPOSE

Effective public consultation will continue throughout the life cycle of the Mackenzie Gas Project. The proponents' goal is to conduct consultation that is meaningful and effective. Consultation activities are planned in a manner that allows for well-documented, inclusive, dynamic and transparent engagement with the communities affected by the project.

4.1.2 CONSULTATION PRINCIPLES

Consultation is an integrated and iterative process based on the following principles:

- Begin consultation early, conduct it often, and deal with issues and concerns in a timely manner.
- Leave the communities with time to digest and review information, issues and development plans.
- Consider community workload and seasonal availability.
- Provide information about plans, locations and timing of the project in a respectful, appropriate, non-technical way.
- Show how input from the community and local and traditional knowledge affected decisions or plans.
- Help people to understand the dynamic and changing nature of projects as they proceed from idea to preliminary design, final design, construction and operations.
- Be consistent with messages.
- Be consistent with personnel, where possible.

4.1.3 CONSULTATION PROGRAM OBJECTIVES

Public consultation is an integral part of the project. A primary goal of the consultation program is to increase public awareness of the project and of the

4.1.3 CONSULTATION PROGRAM OBJECTIVES (cont'd)

technology involved in developing natural gas resources and in transporting them to market. The program has been designed to provide up-to-date and accurate information on the project and production technology, as well as on safety and environmental protection.

The objectives of the program are to provide consistent information, seek input and engage relevant and interested stakeholders throughout the project design and regulatory approval process. The proponents have undertaken an extensive consultation program to provide information to the public, to receive feedback on the project, and to identify and confirm issues, as well as to establish mitigation options that are central to the Environmental Impact Statement (EIS).

The project covers a considerable geographical and political landscape within the jurisdictions of federal, provincial, territorial, regional and specific land claim areas in the Northwest Territories and the Province of Alberta. To maintain a consistent approach across all jurisdictions, the proponents developed an organizational structure that included regional and community representation, and involved regular staff meetings to convey information about consultation strategy, project updates, successes and areas of improvement.

4.1.4 CONSULTATION STRUCTURE

The project's consultation team provides a multi-layered communication support system. The consultation team is staffed to allow stakeholders to engage in information exchange through a multitude of resources. These resources include resident community representatives in the pipeline corridor, regional representatives who are beneficiaries of the region and live within the region, and Calgary-based representatives who routinely travel within the region.

The project's consultation team is responsible for consultation on the gathering and NGL pipelines and related facilities, and the gas pipeline and facilities. Consultation on Taglu, Parsons Lake and Niglintgak gas fields is the responsibility of the individual field operator. Where possible, to ease the burden of meetings on the community, consultation activities were combined and coordinated by the project consultation team. However, because of scheduling requirements, in some cases the field operators conducted separate forums to discuss specific gas field development matters. Open-house information sessions and workshops included gas field, pipeline, facility and EIS activities, reflecting a broad range of topics, including:

- facility design, siting, and operations
- infrastructure requirements
- construction and logistics
- issues scoping
- assessment and mitigation

For a detailed description of the project's public consultation activities, see the *Mackenzie Gas Project Public Consultation, Volume 1: Consultation Program* and each of the development plan applications for the three anchor fields. For a description of the public participation program conducted for the EIS, see EIS Volume 1: Overview and Impact Summary.

4.1.5 FUTURE CONSULTATION

The project's consultation program is a continuing process. Consultation will extend beyond the regulatory submission to ensure that the stakeholders are prepared to further manage their involvement in the regulatory process and beyond. Community, public, and stakeholder groups will continue to have opportunities to review the project with project staff to discuss their interests and concerns. This interaction will continue throughout the Operations Phase.

PUBLIC CONSULTATION

**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
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VOLUME 1: PIPELINE OVERVIEW****KEY CONCERNS AND RESPONSES**

4.2.1 STAKEHOLDER CONCERNS

The public consultation program primarily focuses on Aboriginal groups. In most cases, interactions with the public, northern residents, governments, regulatory authorities, local businesses, some non-government organizations (NGOs), and people directly affected by the project development involved Aboriginal people of Inuit, Dene and Métis heritage.

Aboriginal people have a strong connection to the land. They are emphatic that any development be environmentally and culturally respectful, and reduce negative, long-term impacts. Also, although the communities recognize the potential for benefit from the project, community members have commented on the increased social pressures that might affect them and the potential drain on community resources to handle this pressure.

Generally, the concerns expressed by the communities fall into three broad categories:

- economic
- social
- environmental

4.2.2 ECONOMIC CONCERNS

The economic concerns expressed by the communities included:

- the need for benefits and contracting opportunities for community members and community businesses
- the limited number of permanent jobs associated with the project
- the need for training and education to be timed appropriately for community members to take advantage of opportunities
- the lack of economic security in the existing economy
- the potential implications of unions' participation in the project
- the opportunities for young people to benefit

4.2.3 SOCIAL CONCERNS

The social concerns expressed by the communities included:

- increased disposable income for the short construction period, leading to increased pressures on already taxed community health and social services
- increased drug and alcohol abuse
- dependence on the resource sector
- the increased number of people from outside the community having a negative effect on communities from a labour and social perspective

Concerns were also expressed about construction and pipeline operations safety.

4.2.4 ENVIRONMENTAL CONCERNS

The environmental concerns expressed by the communities included the project's effects on:

- fisheries
- migration routes of caribou and geese
- water quality from:
 - the pipeline
 - the runoff from related developments
- the traditional way of life on the land
- the quality of life

Concerns were also expressed about air emissions affecting climate in the fragile arctic environment.

4.2.5 RESPONSE TO CONCERNS

In response to the concerns that were raised, the project proponents:

- modified the project design, where practical, such as changing pipeline routes and infrastructure sites
- changed procurement practices and consultation approach processes to enhance participation by northerners
- initiated traditional knowledge studies
- developed a labour relations plan
- provided funding for capacity enhancements

- implemented training programs
- conducted a tour of a winter pipeline construction site

CAPITAL COST ESTIMATE

**APPLICATION TO THE
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COST ESTIMATE BASIS

5.1.1 ESTIMATE SCOPE

An estimate has been prepared of the total capital costs related to the design and construction of the gas pipeline and related facilities.

The cost of all facilities is expressed in constant Q1 2003 Canadian dollars. Based on the current scope, this estimate has an equal probability of overrun and underrun.

The capital cost estimates have been developed for:

- materials and equipment
- construction
- owners', engineering and project management costs
- allowances

5.1.1.1 Materials and Equipment

Materials and equipment costs have been estimated as follows:

- the cost of major materials and equipment is based on budgetary estimates from North American and international (pipe only) manufacturers and subsequent discussions with those suppliers. These materials and equipment include:
 - pipe
 - large-diameter valves
 - compressors and drivers
 - aerial coolers and condensers
 - power generation packages
 - glycol heaters
- the cost of other smaller equipment and materials is based on:
 - owners' data
 - recent purchases
 - suppliers' price lists

5.1.1.2 Capital Spares

Costs for major capital spares, based on manufacturers' recommendations, and pre-commissioning spares have been included in the capital estimate.

5.1.1.3 Construction

The construction costs were estimated based on detailed construction activity estimates for the pipeline and infrastructure. Construction costs were factored from major mechanical and electrical equipment for the compressor stations and other facilities. These cost estimates were completed by:

- assessing appropriate productivity rates, based on previous construction experience
- holding discussions with contractors
- considering the project's remote locations and large resource requirements
- assuming that prefabricating facilities took into consideration logistics and transportation limitations

In preparing the construction cost estimate, the following bases were used:

- the labour and construction equipment costs used reflect the pipeline industry and building trades rates in effect in Q1 2003
- adequate contractor and labour resources will be available to execute the project as planned
- logistics costs are based on the volume and weight of required temporary and permanent project components
- infrastructure costs reflect the remoteness of the project and the resources needed to complete the project within the planned time frame

5.1.1.4 Owners', Engineering and Project Management

Common costs allocated to both owners' cost and the engineering and project management cost categories include:

- project personnel costs, including consultants needed to plan, manage and supervise the project
- services for the environmental impact assessment, socio-economic impact assessment, and geotechnical and hydrological investigations and reports
- all testing and inspection requirements

Owners' Costs

Owners' costs include:

- public notification and consultation

- land access and use costs
- applicable risk insurance costs
- management, administration and legal costs for head office functions, which are business development and regulatory requirements directly applicable to the project

Engineering and Project Management Costs

Engineering and project management costs to develop the project include:

- engineering surveys related to developing and selecting the final route, and legal as-built requirements
- conceptual design studies of pipeline and facility options
- preliminary and detailed engineering design

5.1.1.5 Exclusions From Estimate

Goods and services tax (GST) and provincial sales taxes are not included in the estimate for any project materials, equipment or services.

5.1.2 ALLOWANCES

5.1.2.1 Contingency

A contingency allowance, based on the level of definition for each major project component, has been included for the gas pipeline and related facilities. The contingency allowance reflects current uncertainties related to:

- design changes
- manufacturers' pricing
- the availability of the required resources
- the remoteness of the facility locations

Contingency levels were established for each category of costs. Lower contingency levels were assigned to those costs for which recent experience or other supporting information provided additional certainty in estimating the costs. Higher contingency levels were assigned to costs for which less reliable information or limited applicable experience was available. The resulting weighted average contingency was included in the estimate.

5.1.2.2 Special Risk Allowance

Guidelines were established for special risk allowances, based on:

- project component types
- project component locations

5.1.2.2 Special Risk Allowance (cont'd)

- technology used
- magnitude of investment

As a result, an additional risk allowance has been included in the project cost estimate for specific probability-weighted events that might occur during project execution.

5.1.2.3 AFUDC

An allowance for funds used during construction (AFUDC), based on the expected spending schedule and financing rates, was included for the gas pipeline and related facilities.

Capital structure assumptions used in calculating the AFUDC include:

- debt equity ratio – 70:30
- cost of debt – 6.1%
- return on equity – 11.77%

CAPITAL COST ESTIMATE

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CAPITAL COST

5.2.1 TOTAL COST

Table 5-1 summarizes the estimated total capital cost related to the design and construction of the gas pipeline. The cost is expressed in constant Q1 2003 Canadian dollars.

Table 5-1: Gas Pipeline Cost Estimate Summary

Component	\$Million (Q1 2003)
Gas Pipeline	2,034.8
Measurement and Regulation	6.1
Compression Facilities	278.0
Other Facilities	12.9
SCADA and Telecommunications	11.0
Engineering and Project Management	193.9
Owners' Costs	461.9
Subtotal	2,998.6
Contingency	692.2
Risk Allowance	146.8
Project Total	3,837.6
AFUDC	650.8
Grand Total	4,488.4

5.2.2 DETAILED COSTS

Details of the capital cost estimates for the gas pipeline and facilities are shown in:

- Table 5-2 – Gas Pipeline
- Table 5-3 – Compression Facilities
- Table 5-4 – Measurement and Regulation
- Table 5-5 – Heater Station
- Table 5-6 – SCADA and Telecommunications

Table 5-2: Gas Pipeline Capital Costs

Component	\$Million (Q1 2003)
Land and Land Rights	13.4
Material	477.1
Installation	1,544.3
Subtotal	2,034.8
Engineering and Project Management	150.7
Owners' Costs	397.6
Contingency	598.5
Risk Allowance	126.9
Total	3,308.5
AFUDC	561.1
Grand Total	3,869.6

Table 5-3: Gas Pipeline Compression Facilities Capital Costs

Component	\$Million (Q1 2003)
Land and Land Rights (included with gas pipeline)	0.0
Material	114.2
Installation	163.8
Subtotal	278.0
Engineering and Project Management	39.6
Owners' Costs	60.1
Contingency	87.5
Risk Allowance	18.6
Total	483.8
AFUDC	82.0
Grand Total	565.8

Table 5-4: Gas Pipeline Measurement and Regulation Capital Costs

Component	\$Million (Q1 2003)
Land and Land Rights (included with gas pipeline)	0.0
Material	3.3
Installation	2.8
Subtotal	6.1
Engineering and Project Management	0.9
Owners' Costs	1.3
Contingency	1.9
Risk Allowance	0.4
Total	10.6
AFUDC	1.8
Grand Total	12.4

Table 5-5: Gas Pipeline Heater Station Capital Costs

Component	\$Million (Q1 2003)
Land and Land Rights (included with gas pipeline)	0.0
Material	4.0
Installation	8.9
Subtotal	12.9
Engineering and Project Management	2.7
Owners' Costs	2.9
Contingency	4.3
Risk Allowance	0.9
Total	23.7
AFUDC	4.0
Grand Total	27.7

Table 5-6: Gas Pipeline SCADA and Telecommunications Capital Costs

Component	\$Million (Q1 2003)
SCADA and Telecommunications	11.0
AFUDC	1.9
Grand Total	12.9

