PURPOSE

This section describes the proposed activities and pipeline components associated with the Mackenzie Gas Project in the Dehcho Region. It applies to both the construction and operations phases, and contains typical drawings, artists' impressions, and photographs.

An introduction to the biophysical and human environment setting is also included in this section, as is a discussion of primary mitigation strategies to reduce potential effects or development concerns that might be associated with the project.

SUMMARY OF REGIONAL ACTIVITIES

A one-kilometre wide corridor has been identified for the gas pipeline through the DCR. Within this corridor, a proposed pipeline route has been identified that extends about 532.3 km from the SSA to Alberta. This includes about 10.4 km of Sahtu private settlement land within the northernmost portion of the DCR.

Development Activities

As shown in Figure 3-1, the proposed development in the DCR will involve constructing and operating:

- about 521.9 km of gas pipeline in a 40-m wide right-of-way
- gas compressor stations near Blackwater River and Trail River
- a gas heater station near Trout River
- pipeline appurtenances such as valves and cathodic protection facilities within the three facility sites and at five sites along the pipeline right-of-way

New long-term land access arrangements, amounting to about 2,110.7 ha, will be required for the gas pipeline right-of-way and the compressor and heater station sites in the DCR. An estimated 86.8 ha of additional temporary workspace will also be needed for construction purposes, not including timber storage and pipeline shoofly areas. The workspace for these requirements will be determined as engineering and construction planning progresses.

To support the proposed pipeline construction and operations activities in the DCR, various new infrastructure developments will be needed, including:

- construction camps, stockpiles, and fuel storage at the Blackwater River, Trail River, and Trout River facility sites and at Ochre River, Camsell Bend (ferry crossing), McGill Station, and Trout Lake (near K'eotsee)
- a construction camp within the municipal boundaries of Hay River
- stockpiles and fuel storage near River Between Two Mountains and at Fort Simpson and the Liard River ferry crossing
- 76 access roads totalling 257.1 km
- temporary spud barge landings at the existing Blackwater River, Ochre River, and River Between Two Mountains sites, and at the Camsell Bend and Liard River ferry crossing sites
- an airstrip at the Blackwater River and Trail River compressor stations
- helipads at the Blackwater River, Trail River, and Trout River facility sites

Borrow Sites

To support construction activities in the DCR, a total requirement of about 945,000 m^3 of borrow materials has been estimated. Forty-two borrow sites have been identified for potential development. Together, these sites could provide about 2.6 million m^3 of borrow material.

Existing Infrastructure

In addition to the proposed development activities, existing services and transportation infrastructure will be used where practical and with permission, where required. In the DCR, examples include:

- the Mackenzie Highway
- GNWT winter roads including from the Mackenzie Highway south to Trout Lake and from Wrigley north to Fort Good Hope
- commercial airstrips and airports at Wrigley, Fort Simpson, and Hay River
- barge landings at Fort Simpson and Hay River, and at the Camsell Bend and Liard River ferry crossings
- bulk fuel storage at Hay River

Water Requirements and Sources

An estimated 1.54 million cubic metres of water will be needed in the DCR for construction purposes (see Table 3-1). These requirements are addressed in the Type A water licence application submitted to the Board.

The water will be used to build and maintain access roads and a right-of-way travel lane, for pipeline installation and pressure testing purposes, and for domestic use at the camps. Water will normally be transported by truck to sites from nearby lakes, rivers, and in certain cases, municipal systems.

Table 3-1: Water Requirements in the DCR

Purpose	Annual Quantity (m^3)	Total Quantity (m^3)
Winter Access Roads	69,600	208,00
Pipeline Right-of-Way	354,000	1,062,000
Camp Water	123,450	246,900
Horizontal Directional Drilling (HDD)	-	15,700
Pipeline Pressure Testing	-	4,500
Total	547,050	1,537,900

About 44 potential water sources are being considered in the DCR (see Figure 3-2). Their location by area, is provided on Table 3-2. Some can be accessed from several points on the pipeline right-of-way. The largest potential sources include the Mackenzie, Blackwater, Willowlake, Liard and Trout rivers.

Table 3-2: Location of Potential Water Sources in the DCR

Location	Approximate Kilometre Post (KP)		Number of Sources
	From	To	
SSA and DCR boundary area	686.3	771.1	13
Whitesand Creek and Ochre River	771.1	785.4	1
Wrigley Bypass	785.4	802.1	4
River Between Two Mountains	802.1	851.3	5
Willowlake River	851.3	870.2	1
Ebbutt Hills	870.2	986.5	11
Fort Simpson	986.5	1028.7	3
South Deh Cho	1028.7	1055.7	2

Table 3-2: Location of Potential Water Sources in the DCR (cont'd)

Location	Approximate Kilometre Post (KP)		Number of Sources
	From	To	
Highway Crossing Area	1055.7	1091.6	2
Trout River	1091.6	1220.1	2
Total			44

Water Use and Deposits

Water will be obtained from the Mackenzie River and other potential water sources in the DCR for building winter access roads and the pipeline travel lane.

No additives or treatment to the water will be required for building the access roads and the travel lane. The water will be trucked to the sites and used to help freeze and form the travel surface. In spring, the ice and snow will melt and flow into the natural drainage system. Any fuel spills will be handled in accordance with the project spill contingency plan (SCP). The collected materials will be managed in accordance with the applicable regulatory requirements described in Section 11.

Water will be required for domestic purposes at the Blackwater River, Trail River, Trout River, Ochre River, Camsell Bend, Hay River, McGill Station and Trout Lake camps. The water will be obtained from nearby sources and from Hay River, subject to any necessary agreements with the town.

Domestic wastewater from the camps will be treated to meet the appropriate regulatory standards. Camp sewage will either be treated onsite or transported to an approved off-site location, in compliance with the applicable environmental and health standards. Off-site transport and disposal of sewage will occur primarily when smaller staffing requirements exist, such as during the operations phase.

Water for pressure testing the pipelines is expected to be obtained from nearby sources. This water will be mixed with methanol. After the tests are completed, the methanol will be separated from the water or the mixture will be salvaged or disposed of in an environmentally appropriate manner. A number of alternatives are being investigated for disposal, including recycling, flaring or evaporation.

Figure 3.1 has been moved to reduce file size. To view it, click on the link to the figure in the web page List of Figures for this document.

Figure 3.2 has been moved to reduce file size. To view it, click on the link to the figure in the web page List of Figures for this document.

SETTING FOR PROJECT ACTIVITIES IN THE DCR

This subject provides a summary of the regional biophysical and human environment setting for the project activities that will occur in the DCR. Detailed regional information is provided in Section 8.

BIOPHYSICAL SETTING

The biophysical information in this topic incorporates information from desktop studies and reconnaissance-level field investigations in 2002, 2003, and 2004. The desktop studies included a review and analysis of available literature, government data, aerial photos, and satellite imagery. The reconnaissance surveys were conducted along the pipeline route, at proposed facility sites, and at various infrastructure sites. Detailed fisheries and wildlife studies, as well as air quality monitoring and sound level surveys, were also undertaken at certain locations (see Section 8 for regional data and sections 4, 5, 6 and 7 for site-specific information).

Climate

The pipeline corridor through the DCR, including the Blackwater River and Trail River compressor stations and the Trout River heater station, is located within a 300 by 500 km area designated as the northern air shed.

The average annual temperature is –3.7°C in Fort Simpson, with temperature extremes ranging from –53.5°C in the winter to 35.4°C in summer. Normal annual precipitation is about 360.5 mm in Fort Simpson.

Noise

The acoustic environment around the proposed development in the DCR is dominated by the sounds of nature. Existing sound levels are expected to be in the range of 20 to 40 dBA, although sites near the Mackenzie Highway and GNWT winter roads will have higher ambient levels due to vehicle traffic.

Soils, Landforms and Permafrost

The area covered by this application is within the South Taiga Plains ecological zone. Most of the surficial material in the DCR was deposited during continental glaciation. Glacial or post-glacial processes created many of the landforms.

Organic deposits form the most extensive surficial unit in the development area and cover about 50% of the development area. Moraine and glaciolacustrine deposits account for about 25 to 30%, with glaciofluvial, aeolian, colluvial, fluvial and other deposits making up the balance. Abundant fens and bogs occupy depressions and low-lying areas.

The DCR is situated primarily in a zone of sporadic discontinuous permafrost. Extensive discontinuous permafrost is found in the northernmost 40 km. Areas of intermediate discontinuous permafrost and isolated patches of continuous permafrost are located elsewhere in the region. The permafrost layer is typically up to 10 m thick.

Vegetation

The South Taiga Plains ecological zone extends throughout the DCR. In the uplands, there are closed forests of aspen, white spruce, Alaska birch, and jack pine. In the level, poorly-drained terrain, there are extensive forests of open to scattered black spruce and tamarack. Broad areas have been burned near the Great Bear River, Willowlake River and K'eotsee (Trainor Lake).

Seventeen major vegetation types have been identified within the South Taiga Plains. The most common are black spruce-Labrador tea/mountain cranberry and upland white spruce-trembling aspen-jack pine. Uncommon vegetation communities include patterned fens, stands of closed canopy mature tree communities that occur on fluvial, eroded, and saturated areas and on eskers, kames and other less common terrain features.

There are six vegetation types of concern in the South Taiga Plains:

- riparian willow
- riparian willow-red osier dogwood
- black spruce/cloudberry-lichen bog
- leatherleaf/bog rosemary-peat moss
- graminoid fens, including patterned fens
- white spruce/stair-step moss

There are also four vegetation communities of concern - tall forest stands and vegetation growing on rock outcrops, near human communities, and around alkaline lakes.

Sixteen rare plant species have been identified in field reconnaissance in the DCR study area. One is a nationally rare species, the dwarf clubbrush (*Solidago graminifolia*).

Wildlife

The DCR is home to about 44 species of terrestrial mammals, including ungulates, large carnivores, furbearers, and small mammals. Characteristic species include moose, woodland caribou, black bear, wolverine, marten, fisher, beaver and muskrat. Grizzly bears occur at low densities and are widely dispersed. Bison might also roam through the region, especially south of the Mackenzie River.

Some special status species occur in the DCR. Examples are the woodland caribou (boreal population), grizzly bear (northwestern population), wolverine, northern flying squirrel and river otter.

Important habitats for many terrestrial mammal species have been identified throughout the DCR. These are located primarily within the lakes and tributaries of the Mackenzie River. Riparian zones are important movement corridors for a number of wildlife species. Forest and shrub communities along these narrow riparian habitat bands provide food, protective cover and thermal cover during the winter months.

Approximately 176 bird species occur in the DCR, of which about 145 species occur as breeders and the remainder (mostly shorebirds, waterbirds, and several raptors) as migrants. Species that migrate through the region include snow geese and tundra swans. Breeding species include several species of waterfowl, raptors, shorebirds and passerines. Only 23 species occur as year-round residents. Thirty-four special status species have been identified, including peregrine falcon, short-eared owl, golden eagle, and boreal chickadee.

The wetlands, lakes and watercourses in the DCR provide important nesting and migrating habitats for waterfowl and shorebirds. The Mackenzie River supports migrating waterfowl in the spring. Upland habitats support hawks, owls, upland game birds, woodpeckers and various passerines. Other important nesting habitat includes bogs and fens as well as wetlands, lakes, sandbars, watercourses and other permanent waterbodies.

Only two species of amphibians, the boreal chorus frog and wood frog, are known to occur in the study area. The boreal chorus frog is considered "sensitive" by ENR.

Hydrology

The Mackenzie River basin contains the longest drainage system in Canada, the second largest in North America, and the sixth largest in the world. The two largest tributaries to the Mackenzie River, in terms of drainage basin area, are the Liard River (about 277,000 km^2) in the DCR and the Great Bear River (about 155,000 km^2) in the SSA.

The proposed pipeline crosses seven large watercourses (drainage basins >1,000 km^2) in the DCR. These are the Blackwater River (10,400 km^2), Ochre River (1,160 km^2), River Between Two Mountains (4,520 km^2), Willowlake River (19,900 km^2), Mackenzie River (992,000 km^2), Jean Marie Creek (1,570 km^2), and Trout River (6,372 km^2).

The development area in the DCR is, for the most part, poorly drained with flat gradients and watercourses that are continually affected by beaver activity. Thaw proceeds slowly in the spring and summer, as vegetation and muskeg provide good insulation. Organic material holds considerable volumes of water at or near the surface, which are released slowly through the summer.

About 60% of the watercourses in the DCR are vegetated channels with poorly defined flow paths or with drainage dispersed through shrubs and trees. Another 18% are small watercourses that have discernable banks and substrate, but are likely to freeze to the bottom during winter and do not provide fish with overwintering habitat.

Groundwater

Groundwater in the DCR is linked to surface flow that, in turn, responds to short- and long-term variations in precipitation or snowmelt.

Watercourses between the boundary with the SSA and the Willowlake River originate in the Franklin Mountains, immediately east of the pipeline corridor. Karst features are common and perennial springs related to karstification occur upstream of, and along, this part of the corridor.

In the White Sand Creek area, and between the Ochre River and Smith Creek, the pipeline is parallel to, and immediately west of, the McDonnell Range of the Franklin Mountains. Water percolates downward and moves through the rocks until it discharges from springs at the base of the mountains. These springs are mainly perennial so sheets of ice on the ground surface, known as icings, might extend substantial distances along the watercourses.

Icings occur on the proposed pipeline crossings between Smith Creek and River Between Two Mountains, even though the corridor in this area is about five kilometres west of the base of the Franklin Mountains.

South of Smith Creek, the corridor veers away from the Franklin Mountains. Icings were observed along this stretch of the pipeline, although only one spring was identified in the reconnaissance.

Karst features and springs are not common in the southern part of the DCR, except possibly between Jean Marie Creek and Trout River. This area is located in the region of sporadic discontinuous permafrost.

Water Quality

Waters in the Mackenzie River basin flow through varied lithology and receive drainage waters from several subdrainage basins.

Waterbodies are well oxygenated during summer, fall and winter, with dissolved oxygen concentrations mostly above the minimum aquatic life guidelines. Turbidity levels are mostly low during winter, summer and fall, with occasional moderate and high values in some watercourses. Water is moderately coloured in summer and fall, and values are above the drinking water guideline. Total dissolved solids (TDS) and conductance levels are variable and range from low to very high.

Due to variations in geological terrain, nutrient levels are variable. Most metals are present at levels below aquatic life and drinking water guidelines.

Fish and Fish Habitat

The Mackenzie River and its tributaries throughout the DCR support both diadromous and resident fish species. None of these species are listed as endangered, threatened, or of special concern.

About 30 species of fish are potentially present in DCR watercourses. Of these species, 13 spawn in the fall or winter. These include the salmonid species, except arctic grayling. Fall spawning generally occurs in larger watercourses with perennial flow. Spring spawning is typically in smaller tributaries and can occur in intermittent or ephemeral drainages.

HUMAN ENVIRONMENT SETTING

This topic discusses various aspects of the human environment in the DCR, including traditional culture, heritage resources and protected areas, logistics, employment, the economy, infrastructure, and community services. It includes feedback from the public involvement program, interviews and a review and analysis of available literature and government data. A detailed discussion is provided in Section 8.

People and the Economy

The DCR includes the village of Fort Simpson, a moderately sized administrative center, and several smaller communities, including Fort Providence, Fort Liard, Wrigley, Nahanni Butte, Trout Lake Jean Marie River, Kakisa, Hay River Reserve and West Point Reserve. All of these communities have mostly Aboriginal populations. Hay River is located within the South Slave administrative boundary.

The 2003 estimated population of the DCR communities was 3,428, including a total of 1,237 in Fort Simpson. Census data for 1991 and 2001 showed most communities had slight increases in population, with Fort Providence, Nahanni Butte and Hay River Reserve experiencing higher increases than the other communities.

Employment rates in the DCR communities generally increased from 1991 to 2001, while unemployment rates decreased. In 2001, average employment income was about $31,444 in Fort Simpson, $21,977 in Fort Providence, and $27,458 in Fort Liard.

Community Services

Community wellness, measured in terms of the physical, emotional, social and economic well being of individuals and families in the DCR communities, is challenged by a number of issues. These longstanding issues include alcohol abuse and related violence and illness, smoking, sexually transmitted infections (STIs) and suicides. This places additional burdens on health care, public safety and protection services in the communities.

The Dehcho communities are served by the Deh Cho Health and Social Services Authority (DCHSSA), headquartered out of Fort Simpson. The DCHSSA runs health and social service centers in Fort Simpson, Fort Liard and Fort Providence. Wrigley has a health center, with social services provided by Fort Simpson. Nahanni Butte, Trout Lake and Jean Marie River have health stations, and associated social services are provided by Fort Simpson. The health care needs of Hay River Reserve and West Point Reserve residents are met by Hay River health care facilities. Kakisa depends on the Fort Providence health and social services.

Hospital services in the DCR are available in Yellowknife. Air ambulances are stationed in Yellowknife to ensure speedy response to medical emergencies in the other communities. Services that are not available from the DCHSSA might be sought in Yellowknife or outside the Northwest Territories, upon referral of DCHSSA staff.

There are RCMP detachments in Fort Simpson, Hay River and Fort Liard. The Fort Simpson RCMP detachment consists of three officers. The Hay River detachment has nine officers.

By 2004, all of the Dehcho communities had kindergarten to grade 12 schools, except Wrigley, Kakisa, and Nahanni Butte, which offer kindergarten to Grade 10. All of the schools had substantial excess capacity.

The proportion of the adult population with high school diplomas decreased slightly to 46 from 47.9% between 1994 and 2001. The graduation rate increased in Fort Simpson, Wrigley and Jean Marie River, decreased in Fort Providence and was unchanged in Fort Liard.

Physical Infrastructure

Dehcho communities in the northern and western parts of the DCR use Fort Simpson as a transportation hub. Hay River serves as the hub for communities in the southern and eastern parts of the DCR. Fort Simpson and Hay River have scheduled air service. None of the smaller Dehcho communities is linked to Fort Simpson or Hay River by scheduled air service. When necessary, these communities depend on periodic air charters.

Most of the DCR communities (Fort Simpson, Fort Providence, Fort Liard, Wrigley, Jean Marie River, Kakisa and Hay River Reserve) have at least seasonally restricted access to an all-weather highway. Nahanni Butte and Trout Lake are the most isolated, with only rough ice road connections to a highway and no driveable summer connections.

The highway connections for all the Dehcho communities, except Trout Lake, facilitate truck-based re-supply. Fort Simpson, Fort Liard and Fort Providence have bus service, although the Fort Providence service is, for now, seasonally restricted. The DCR bridge project will replace a seasonal ferry with a permanent bridge over the Mackenzie River to Fort Providence.

Hay River is the only community in the southern NWT with a railroad connection. Barging service is available to both Fort Simpson and Fort Providence, but these communities do not depend on marine re-supply as they receive their deliveries by truck. Jean Marie River, Wrigley and Fort Liard also have barging service available, as does Nahanni Butte by special charter.

Water, mostly trucked, and liquid and solid waste disposal services are available in all of the Dehcho communities except Trout Lake. Trout Lake has outdoor pits or privies and residents burn much of their solid waste before disposal.

Diesel-fuelled generators supply power in all communities except Jean Marie River and the Hay River Reserve, which are connected to the NWT Power Corporation grid. The main heating fuel is P-50 fuel oil, with wood as a supplement in many communities.

Traditional Culture

Traditional culture includes the knowledge, skill and disciplines required to harvest and survive on the land. Traditional or country foods, the traditional economy, and Aboriginal language use and retention, are important aspects. Within the DCR, survey findings indicate:

- about 41% of the adult population hunted or fished in 2002
- country food represented at least half of the food consumed in 2002 by 61% of DCR households

- trapping has been declining in DCR Aboriginal communities since the late 1980s

- fluency in Aboriginal languages declined between 1989 and 1999, with about 65% of Aboriginal adults in the DCR speaking Aboriginal languages in 1999

Non-Traditional Land and Resource Use

Non-traditional land and resource use within the DCR includes extracting borrow material, small-scale commercial fuel wood harvesting, a saw mill and a log home operation, oil and gas activities, non-traditional resource harvesting, and tourism and recreation.

Mineral showings for copper, iron and zinc have been identified north of Wrigley. A gold deposit (placer) has been reported near the River Between Two Mountains and a zinc deposit has been identified in the Ebbutt Hills area. There are also several mineral claims south of Fort Simpson in the pipeline corridor, although there are no known mineral deposits in this area.

Existing petroleum industry activity in the DCR includes the Enbridge Norman Wells pipeline, Fort Liard and Cameron Hills areas.

Sport hunting and game bird hunting are permitted for specific species. No commercial or domestic fishing licences have been issued in the DCR near the proposed development activities. Sport fishing is licensed by ENR.

Several tourism-based businesses operate in the area that might be traversed by the pipeline corridor and recreationalists frequently use all-weather and winter road corridors for touring by snowmobiles and all-terrain vehicles.

Protected Areas

The gas pipeline and related infrastructure are located within three candidate areas for protected area status under the Northwest Territories Protected Areas Strategy (NWT-PAS). These candidates are Edéhzhíe, Pehdzéh Ki Deh, and Sambaa K'e, which are shown in Figure 3-10.

The Edéhzhíe area includes the Horn Plateau and extends west to the Mackenzie River along the Willowlake River Valley. It also includes the Enbridge Norman Wells pipeline right-of-way and the Mackenzie Highway. The ecological, cultural and economic values of the area are currently being assessed under the NWT-PAS process, and a final protected area proposal is being developed. Edéhzhíe has interim protection from new surface and subsurface interests under P.C. 2002-1805, but provides for a gas pipeline corridor along the western edge of the area.

The Pehdzéh Ki Deh has been identified for its cultural significance and traditional use. A protected area proposal is being developed under the NWT-PAS

process and community support, as well as a sponsoring agency, is being sought. There are no limitations on new subsurface or surface interests as a result of the NWT-PAS, although there is local and regional support for this protected area initiative.

The Sambaa K'e area has been identified by the Trout Lake community for consideration under the NWT-PAS, although it does not currently fit into any single step of the PAS process. Most of the area is already protected, on an interim basis, by P.C. 2003-1230. There are provisions in this order for a gas pipeline and related infrastructure.

In addition to the NWT-PAS process, Edéhzhíe, Pehdzéh Ki Deh, and Sambaa K'e have been proposed as conservation zones in the June 2005 version of the Dehcho June 2005 draft land use plan. This draft proposes four types of land use zones for the DCR – conservation, special management, general use, and a special infrastructure corridor for the gas pipeline and related infrastructure.

Development activities in the DCR will be required in five of the proposed conservation zones, as well as in four special management zones and the special infrastructure corridor.

The five proposed conservation zones are:

- Pehdzéh Ki Deh
- JMR Five Lakes
- Sibbeston Plains
- Edéhzhíe
- Sambaa K'e/Redknife River

The four proposed special management zones are:

- Jean Marie
- Cameron Hills, Blackstone River, Arrowhead River
- Trout River
- Fort Simpson

As the June 2005 draft land use plan is still in the preparation and comment phase, revisions and modifications might be required before, and after, the land use plan is approved.

Heritage Resources

About 24 previously unrecorded heritage sites were identified in, or relatively close to, proposed project development locations during the field reconnaissance programs in 2002 and 2003. These results have been provided to the Prince of Wales Northern Heritage Centre.