

ROUTE AND SITE SELECTION**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE GATHERING SYSTEM
VOLUME 2: ENGINEERING DESIGN****INTRODUCTION**

4.1.1 OBJECTIVES

The objectives of the route and site selection process included:

- avoiding sensitive environmental and cultural areas
- reducing disturbance to communities and the landscape
- satisfying engineering and construction requirements
- reducing cost

4.1.2 SELECTION PROCESS

Multidisciplinary teams were established, including engineering, construction and environmental specialists, to assess potential pipeline routes and facility sites. Previous studies and pipeline proposals were reviewed to assess available information and to determine the potential for using these previously proposed routes and site locations for the project. The gathering and NGL pipeline routes and the Inuvik area facility and pipeline facility sites were selected using a process that included:

- establishing route and site selection criteria
- identifying preliminary pipeline routes, sites and alternatives
- conducting field investigations involving community representatives
- revising preliminary site and route locations based on field investigations
- consulting with communities on sites and routes
- revising site and route locations, where practical, based on community input

This process was also used to select infrastructure sites, such as barge landings, camps and borrow sites necessary to support construction and operations

4.1.3 ROUTE SELECTION

The route selection process for the gathering and NGL pipelines began in 2001 (see Figure 4-1) and involved:

- identifying a preliminary route for further study
- refining the preliminary route by assessing the results of field investigations and considering community input

- took advantage of more favourable terrain, such as better approaches to water crossings
- used other features, such as cutlines

Table 4-1: Pipeline Route Evaluation Criteria

Criteria	Consideration
Route placement	<ul style="list-style-type: none"> • Reducing pipeline length • Locating the right-of-way: <ul style="list-style-type: none"> • close to existing infrastructure • parallel to, or using, existing linear disturbances • to avoid encroaching on existing habitation • Considering facility siting during route selection
Watercourse crossings	<ul style="list-style-type: none"> • Reducing number, complexity and width of crossings
Geotechnical	<ul style="list-style-type: none"> • Avoiding steep, ice-rich or unstable slopes • Avoiding springs and perched aquifers • Considering distribution of discontinuous permafrost
Environmental (biophysical and socio-economic concerns)	<ul style="list-style-type: none"> • Considering land use plans • Reducing pipeline length in proximity to site-specific critical wildlife habitat and important cultural or archaeological sites • Considering socio-economic concerns
Construction	<ul style="list-style-type: none"> • Reducing the length of steep, longitudinal and sidehill slopes • Reducing pipeline length through muskeg and fen areas • Reducing amount of grading required • Considering access • Avoiding difficult ground conditions, such as boulder-rich terrain and bedrock • Reducing the number of pipeline, winter road and highway crossings • Providing adequate workspace
Community interests	<ul style="list-style-type: none"> • Considering community feedback
Cost	<ul style="list-style-type: none"> • Considering the relative costs of the route alternatives

Local community representatives provided local knowledge related to cultural resources and land use. Some representatives provided input to the route evaluation teams, which was used in route selection. This input was based on personal experience with the Mackenzie Highway, the winter road, construction of the Norman Wells pipeline and local resource use.

A second reconnaissance was conducted in late August and early September 2002 to assess the larger watercourse crossings and refine their locations, where warranted.

A third reconnaissance in late July and August 2003 was conducted to confirm the refined route mapping and to align the route with the proposed pipeline facility sites.

ROUTE AND SITE SELECTION

APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE GATHERING SYSTEM
VOLUME 2: ENGINEERING DESIGN

ROUTE DESCRIPTION

4.2.1 PROPOSED ROUTE

The proposed route includes the following pipeline segments:

- four gathering pipelines, including:
 - the Niglintgak lateral, which extends about 16 km from the Niglintgak gas conditioning facility to the Taglu gas conditioning facility
 - the Taglu lateral, which starts at the Taglu gas conditioning facility and extends about 81 km to the Storm Hills pigging facility
 - the Parsons Lake lateral, which extends about 27 km to connect the Parsons Lake gas conditioning facility to the Storm Hills pigging facility
 - the Storm Hills lateral, which extends about 52 km from the Storm Hills pigging facility to the Inuvik area facility
- a 476 km NGL pipeline from the Inuvik area facility to Norman Wells, where it connects with the Enbridge pipeline. The NGL pipeline shares a 50 m right-of-way with the gas pipeline for about 475 km.

The proposed route for the gathering and NGL pipelines passes through the Inuvialuit Settlement Region, the Gwich'in Settlement Area, and the Sahtu Settlement Area. For an estimate of total pipeline length within each region, including private lands, see Table 4-2.

Table 4-2: Gathering and NGL Pipeline Lengths by Region

Region	Route Name	Total Length (km)	Private Lands (km)
Inuvialuit Settlement Region	Niglintgak lateral	15.7	0
	Parsons Lake lateral	26.5	0
	Taglu lateral	81.4	23.5
	Storm Hills lateral	51.6	0
Gwich'in Settlement Area	Storm Hills lateral	0.9	0
	NGL pipeline	186.3	110.0
Sahtu Settlement Area, K'ahsho Got'ine District	NGL pipeline	231.0	109.2
Sahtu Settlement Area, Tulita District	NGL pipeline	59.1	28.7

4.2.1 PROPOSED ROUTE (cont'd)

The proposed route for the NGL pipeline parallels existing linear disturbances, such as cutlines, the winter road, and the Mackenzie Highway, for about 29% of its length.

4.2.2 GATHERING PIPELINES ROUTE**4.2.2.1 Route Maps**

The route of the gathering pipelines is shown in the route maps in Volume 4. The pipelines will be located within the identified corridor, which is generally 1 km wide. This route might be revised as a result of additional engineering studies and further community consultation.

4.2.2.2 Niglintgak Lateral

The Niglintgak lateral will originate at the Niglintgak gas field's gas conditioning facility located on the east side of the Kumak Channel in the Mackenzie Delta. It will traverse the flat delta eastwards, cross three major channels, and terminate at the outlet of the Taglu gas field's gas conditioning facility. This route will also be used in the Niglintgak field development to install flow lines for about 1 km from the Kumak Channel to the inlet of Niglintgak's gas conditioning facility.

4.2.2.3 Taglu Lateral

The Taglu lateral will originate at the Taglu gas field's gas conditioning facility south of Big Lake and traverse southeast, crossing Harry Channel onto Richards Island. The lateral will leave the island and cross the East Channel north of Swimming Point. It will continue southeast and pass through North Storm Hills, where it will be joined by the Parsons Lake lateral at the Storm Hills junction.

4.2.2.4 Parsons Lake Lateral

The Parsons Lake lateral will originate at the northeast corner of Parsons Lake at the Parsons Lake gas field's gas conditioning facility, and will continue south around the lake. From there, the lateral will continue southwest between West Hans Lake and East Hans Lake to the Storm Hills junction. This route will also be used to install a future Parsons Lake flow line, extending 16 km from the south pad to the Parsons Lake gas conditioning facility.

4.2.2.5 Storm Hills Lateral

The Storm Hills lateral will traverse southeast from the Storm Hills junction and continue east of Noell Lake until it reaches the Inuvik area facility, about 20 km east of Inuvik.

For an overview of this pipeline segment, see Figure 4-2. For larger scale pipeline route maps, see the application for the *Mackenzie Gathering System, Volume 4: Gathering Pipelines and NGL Pipeline Route Maps*.

Figure 4.2 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

4.2.2.6 Topography

The topography is flat to gently rolling, with elevations ranging from a few metres near Taglu and Niglintgak to tens of metres on Richards Island. The highest elevation, about 250 m, is in North Storm Hills.

The area has many lakes and surficial materials, which consist mostly of deltaic deposits north of the East Channel and glacial tills south of the East Channel to the Inuvik area facility. Fens and ice-wedge polygons occupy the low-lying areas.

4.2.2.7 Ecoregion

The gathering pipelines will be within the Southern Arctic ecoregion, which has continuous permafrost, except below major rivers and lakes. North of Inuvik, tundra vegetation consists of dwarf shrubs, grasses, sedges and herbs.

4.2.3 NGL PIPELINE ROUTE

The Inuvik area facility will be the terminus of the gathering pipelines. From there, the NGL pipeline and gas pipeline will share a common right-of-way, which will trend south-southeast, crossing gently undulating terrain and passing on the east side of Travaillant Lake to Thunder River.

From Thunder River, the route will parallel the Mackenzie River to the Fort Good Hope area. South of Fort Good Hope, the route will continue south-southeast, towards Gibson Gap between the eastern slopes of the Franklin Mountains and the Mackenzie River. From Gibson Gap, the route will follow the bench of the Norman Range to Norman Wells. The NGL pipeline will terminate at Norman Wells, where it will interconnect with the Enbridge pipeline.

For an overview of this pipeline segment, see Figure 4-3. For larger scale pipeline route maps, see the application for the *Mackenzie Gathering System, Volume 4: Gathering Pipelines and NGL Pipeline Route Maps*.

4.2.3.1 Topography

The topography varies from flat to rolling, with elevations ranging from 10 m, near Campbell Lake, to 300 m where the route crosses the Travaillant uplands north of the Thunder River and where the route crosses the Ramparts Plateau north of Fort Good Hope.

4.2.3.2 Ecoregion

The route will cross from the Southern Arctic ecoregion near Inuvik to the North Taiga Plains ecoregion. The forest consists of black and white spruce and white birch. Tree size and forest density increase from north to south.

Figure 4.3 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

ROUTE AND SITE SELECTION

ROUTE DESCRIPTION

ROUTE AND SITE SELECTION

**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE GATHERING SYSTEM
VOLUME 2: ENGINEERING DESIGN**

ROUTE ALTERNATIVES

4.3.1 ROUTES EVALUATED

The proposed pipeline route has evolved from a preliminary 1 km corridor selected in March 2001, and has been revised, based on:

- desktop studies
- field reconnaissance
- community consultation

The preliminary route for the gathering pipelines was divided into 15 segments to assist with the assessment and selection process. A route within each segment was selected and formed the basis for the next phase of reconnaissance and consultation. The 1-km-wide study corridor, centred on the preliminary route, was expanded or moved to accommodate the route refinements.

Table 4-3 identifies, for each route segment, the number of routes assessed and the rationale for the route selected. This revised route formed the basis of community consultation in late 2002.

Route evaluations with multiple alternatives and community interest included:

- Ikhil (see Section 4.4)
- Travaillant Lake (see Section 4.5)

4.3.2 ROUTE REFINEMENTS

Several refinements to the gathering and NGL pipeline route were suggested and assessed as a result of additional public consultation, facility site selection and route reconnaissance in 2003.

Table 4-4 summarizes the route refinements required to connect the proposed locations of project facilities, or refinements to the location of the gas conditioning facilities at anchor fields, and a rationale for the route selection.

Table 4-3: Route Refinement by Route Segment – 2002

Route Segment	Initial Segment Length (km)	Routes Assessed	Rationale for Route Selection
Niglintgak lateral	17.0	2	<ul style="list-style-type: none"> • Is shorter and less costly than the preliminary route
Taglu area	5.6	4	<ul style="list-style-type: none"> • Is straighter, slightly shorter and less costly to construct than the three other routes considered
Trapp Hills area	24.6	2	<ul style="list-style-type: none"> • Is realigned slightly from the preliminary route to avoid lakes, lakeshores and old or active slump areas • Is less costly to construct • Involves fewer sidehill slopes
Mackenzie River East Channel area	19.8	4	<ul style="list-style-type: none"> • Is straighter and less costly than other alternatives • Crosses less wet, or possibly less ice-rich, floodplain • Crosses the Mackenzie River East Channel at a narrower reach and more favourable crossing angle • Avoids cabin ruins and an erosion area on the East Channel's south shore • Avoids known archaeological sites, lakes and lakeshores • Avoids a scour hole in the river channel • Avoids crossing Holmes Creek
North Storm Hills area	54.4	5	<ul style="list-style-type: none"> • Is straighter, slightly shorter and less costly than alternative routes • Results in a shorter route for the Parsons Lake lateral • Avoids crossing lakes and lakeshores
Parsons Lake lateral	24.6	2	<ul style="list-style-type: none"> • Avoids crossing lakes and lakeshores • Reduces the number of steep sidehill slopes crossed • Reduces the amount of NPS 30 pipe used in the gathering system
Jimmy and Noell Lakes area	23.1	3	<ul style="list-style-type: none"> • Is straighter, shorter and less costly than the alternative routes • Avoids several lakes, lakeshores and drainages
Travaillant Lake area	224.2	7	<ul style="list-style-type: none"> • Is substantially shorter than most of the other route alternatives, although 1 km longer than one alternative • Is the least costly alternative • Avoids difficult terrain in the Travaillant upland • Reduces the number of sidehill slopes crossed • Reduces the steepness and length of the longitudinal slopes crossed • Provides better access during construction, as it is closer to existing linear disturbances and the Mackenzie River
Ramparts Plateau area	103.9	2	<ul style="list-style-type: none"> • Is 1 km shorter than the preliminary route • Reduces the length and severity of the sidehill slopes encountered • Is less costly • Allows for simpler watercourse crossings • Eliminates a costly gully crossing
Hare Indian River Valley area (Rabbitsskin River)	17.4	4	<ul style="list-style-type: none"> • Avoids known archaeological sites and sidehill slopes • Parallels existing linear disturbances for much of its length • Is farther from Fort Good Hope • Improves the Hare Indian River crossing • Avoids difficult terrain at the Fort Good Hope esker crossing

Table 4-3: Route Refinement by Route Segment – 2002 (cont'd)

Route Segment	Initial Segment Length (km)	Routes Assessed	Rationale for Route Selection
Hare Indian River Valley area (cont'd)			<ul style="list-style-type: none"> Eliminates three crossings of the winter road Is less costly
Tsintu River and Chick Lake area	53.5	2	<ul style="list-style-type: none"> Is straighter and runs parallel to, or uses, existing disturbances Is less costly Eliminates a lake crossing Provides a less steep north approach to the Donnelly River Reduces the number of sidehill slopes crossed
Gibson Ridge area	7.2	4	<ul style="list-style-type: none"> Encounters fewer sidehill slopes than another alternative and avoids a narrow ridge traversed by the preliminary route Is required to link the route in the adjacent pipeline segment
Gibson Gap area	6.5	3	<ul style="list-style-type: none"> Is straighter, shorter and less costly than the alternatives Runs parallel to, or uses, existing linear disturbances for its entire length Eliminates a lake crossing, three winter road crossings and a proposed Mackenzie Highway crossing Avoids two crossings of unnamed tributaries to the Hanna River
Paige Mountain area	18.4	3	<ul style="list-style-type: none"> Is straighter and runs parallel to, or uses, existing linear disturbances for some of its length, and is less costly Reduces the amount of bedrock encountered Is farther away from Norman Range and an area of large historical rockfalls and rock slides Eliminates one crossing of a winter road and the proposed Mackenzie Highway corridor Avoids an unstable area on the south bank of the Hanna River Avoids a narrow passage between two lakes and traversing a lakeshore Reduces the number of springs crossed
Oscar Creek area	49.1	4	<ul style="list-style-type: none"> Avoids areas with bedrock and numerous small drainages and springs Offers a more easily constructed crossing of Oscar Creek Avoids sidehill slopes and a large lake Is less costly

Table 4-4: Route Refinements to Connect Project Facilities

Facility	Length of Reroute (km)	Rationale for Route Alignment
Niglintgak	1	<ul style="list-style-type: none"> To connect the barge location
Parsons Lake	<1	<ul style="list-style-type: none"> Parsons Lake lateral extended to the north pad location
Inuvik area facility	12	<ul style="list-style-type: none"> Route realigned up to 3 km west to tie in the proposed location of the Inuvik area facility
Fish Trap Lake	5	<ul style="list-style-type: none"> Route realigned up to 0.4 km east to tie in the proposed valve site
Thunder River	1.3	<ul style="list-style-type: none"> Route realigned up to 0.3 km east to tie in the proposed valve site
Chick Lake	8	<ul style="list-style-type: none"> Route realigned up to 0.6 km east to tie in the proposed valve site

ROUTE AND SITE SELECTION

**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE GATHERING SYSTEM
VOLUME 2: ENGINEERING DESIGN****IKHIL ROUTE ALTERNATIVES****4.4.1 ROUTE CONSIDERATIONS**

During consultation in early 2003, the Inuvialuit Game Council asked the project proponents to consider an alignment parallel to the existing Ikhil pipeline, which is generally located about 15 km west of the proposed route. A March 2003 letter from the Inuvik Hunters and Trappers Committee to the Inuvialuit Game Council, which was copied to the project proponents, also supported a review of the same alternative route.

4.4.2 ALTERNATIVE ROUTES CONSIDERED

The proponents identified and assessed three alternative routes for the Taglu and Storm Hills laterals that incorporated the existing Ikhil pipeline route (see Figure 4-4):

- an Ikhil central alternative
- an Ikhil eastern alternative
- an Ikhil western alternative

These alternatives included a 38 km segment from Inuvik east to realign with the gas and NGL pipelines south of the Inuvialuit and Gwich'in boundary east of Campbell Lake.

These three alternative routes affected:

- the route of the Taglu, Parsons Lake and Storm Hills laterals
- the location of the Inuvik area facility
- the route of the NGL and gas pipelines
- other system design considerations

Following this assessment, the Ikhil reroute alternatives were not accepted because the proposed route:

- is at least 19 km shorter
- would cause less impact because of the smaller footprint
- crosses fewer and shorter areas of sidehill slopes
- has fewer or the same frost heave concerns
- is shorter or the same length within the Kendall Island Bird Sanctuary
- has less of its length close to lakes
- is less costly

4.4.3 CONSULTATION ON ROUTE ASSESSMENT RESULTS

The proponents provided the rationale for rejecting the Ikhil reroute alternatives to the Inuvialuit Game Council on October 3, 2003. Meetings with hunter and trapper committees and other community groups were held in Tuktoyaktuk and Inuvik in late November 2003. The Inuvik Hunter and Trapper Committee indicated that its primary concern was the potential for pipeline construction to disrupt caribou movements in the area between North Storm Hills and Campbell Lake.

As a result of these meetings, the project team compiled information on caribou migration studies in the area and conducted a caribou habitat modelling study based on vegetation classification. Resources, Wildlife and Economic Development (RWED) representatives were consulted about the latest data on the movements of radio-collared caribou.

At the Inuvialuit Game Council workshop in Inuvik on February 2, 2004, project representatives summarized:

- the Ikhil route alternatives
- the results of the caribou habitat modelling study and RWED's caribou movement studies over the past few decades
- the rationale for retaining the proposed route

At the meeting, an RWED time lapse video was shown. This video showed the migration patterns of caribou with global positioning system (GPS) radio collars.

The caribou habitat modelling and movement studies indicated that habitat is present along the proposed route. Caribou use these lands in the fall and early winter and move onto other high-quality habitat east of the proposed route later in winter.

The caribou habitat modelling study concluded that:

- the amount of caribou habitat disturbed does not differ between the proposed route and the Ikhil alternatives
- during construction, the proposed route would affect caribou movements more than the Ikhil alternatives, if it were constructed when caribou were in the area

The Inuvialuit Game Council issued a letter dated April 15, 2004, indicating its preference for the Ikhil eastern route alternative. The council members indicated that they understood that the overall footprint would be increased, but that this was justified as it paralleled the existing Ikhil right-of-way.

The timing of construction activities and potential caribou movements will be considered as construction planning progresses for the proposed route that extends south through the Storm Hills, east of Noell Lake to the Inuvik area facility.

Figure 4.4 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

ROUTE AND SITE SELECTION

**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE GATHERING SYSTEM
VOLUME 2: ENGINEERING DESIGN****TRAVAILLANT LAKE ROUTE ALTERNATIVES****4.5.1 ROUTE CONSIDERATIONS**

The Gwich'in communities have identified the area around Travaillant Lake as having important social, cultural and environmental significance, which must be considered in the route selection process. Considerations along this segment of the route included:

- reducing the proximity to waterbodies
- avoiding known archaeological sites
- avoiding or reducing the pipeline corridor length within the Travaillant Lake Gwich'in Protected Area
- reducing the overall pipeline length
- reducing the number of sidehill slopes
- reducing the amount of difficult terrain crossed
- reducing the number and complexity of major watercourse crossings
- increasing the length of existing linear disturbances followed

4.5.2 ALTERNATIVE ROUTES CONSIDERED

The following seven route alternatives were assessed in August and September 2002:

- the preliminary route
- an adjusted preliminary route
- Travaillant Lake Route 1
- Travaillant Lake Route 2
- the Mackenzie Highway alternative
- the Dempster Highway alternative
- the Polar Gas east alternative

During consultation in late 2002, the route evaluation team, with input from representatives of the community of Tsiigehtchic, developed an eighth alternative route, known as the Tsiigehtchic alternative route. This route was selected as the

4.5.2 ALTERNATIVE ROUTES CONSIDERED (cont'd)

proposed route for this segment of the pipeline. For the location of these alternatives, see Figure 4-5.

4.5.3 PRELIMINARY ROUTE

The preliminary route segment originates south of Noell Lake in the Inuvialuit Settlement Region and extends south 224.2 km through the Gwich'in Settlement Area to the Little Chicago area in the Sahtu Settlement Area. This route encounters:

- 17 longitudinal slopes and 10 sidehill slopes
- moderately steep approach slopes at the deeply incised Thunder River valley
- high ice content terrain
- crossings of the Travaillant and Thunder rivers and many minor watercourses
- about 26 km of the Travaillant Lake Gwich'in Protected Area
- lakeshores

4.5.4 ADJUSTED PRELIMINARY ROUTE

The 224.2 km adjusted preliminary route parallels existing disturbance for 16 km and encounters the same features as the preliminary route, except for lakeshores.

The adjusted preliminary route was selected for consultation and further study, as it:

- is shorter than the other route alternatives, except for the Polar Gas east route
- is less costly than the other alternatives
- avoids difficult terrain in the Travaillant Lake upland area
- reduces the number of sidehill slopes crossed and has substantially fewer steep slopes to be crossed than the other route alternatives
- has better access, as it is closer to existing linear disturbances and the Mackenzie River

4.5.5 TRAVAILLANT LAKE ROUTE 1

The 235 km Travaillant Lake Route 1 parallels existing disturbance for 7 km and avoids the Travaillant Lake Gwich'in Protected Area. This route encounters:

- 32 longitudinal slopes and 20 sidehill slopes
- one moderately steep approach slope at the tributary to the Thunder River
- the lowest amount of high ice content terrain
- many minor watercourses

Figure 4.5 has been removed for the purposes of reducing file size and can be viewed as a graphic separately. This document can be accessed through the link in the Table of Contents reference web page.

4.5.6 TRAVAILLANT LAKE ROUTE 2

The 233.6 km Travaillant Lake Route 2 avoids the Travaillant Lake Gwich'in Protected Area and encounters:

- 34 longitudinal slopes and 17 sidehill slopes
- one moderately steep approach slope at the tributary to the Thunder River
- a low amount of high ice content terrain
- many minor watercourses

4.5.7 MACKENZIE HIGHWAY ALTERNATIVE

The 274 km Mackenzie Highway alternative parallels existing disturbance for 25 km and is longer than the shortest routes by about 50 km. This route is within the Travaillant Lake Gwich'in Protected Area for about 57 km, and is close to known archaeological sites. The route encounters:

- 19 longitudinal slopes and 18 sidehill slopes
- moderately steep approach slopes at the Thunder River and Caribou Creek
- a low amount of high ice content terrain
- many minor watercourses

4.5.8 DEMPSTER HIGHWAY ALTERNATIVE

The 312.2 km Dempster Highway alternative parallels existing disturbance for 53.5 km and is the longest route. This route avoids the Travaillant Lake Gwich'in Protected Area and passes close to the community of Tsiigehtchic.

The Dempster Highway alternative encounters:

- 37 longitudinal slopes and 12 sidehill slopes
- a moderately steep, potentially unstable approach slope at the Mackenzie River and Caribou Creek, which could result in longer term integrity issues
- the highest amount of high ice content terrain
- many minor watercourse crossings
- three difficult watercourse crossings, including two Mackenzie River crossings

4.5.9 POLAR GAS EAST ALTERNATIVE

The 223.3 km Polar Gas east alternative crosses 11 km of the Travaillant Lake Gwich'in Protected Area, is close to known archaeological sites, and does not parallel any existing linear disturbances. This alternative encounters:

- 45 longitudinal slopes and 29 sidehill slopes (the most slopes of any alternative)
- a moderately steep approach slope at the Thunder River
- many minor watercourses
- the most lakes and lakeshores of all route alternatives and, therefore, the highest probability of longer term integrity problems because of lakeshore instability

4.5.10 TSIIGEHTCHIC ALTERNATIVE

The Tsiigehtchic route alternative has been selected for the proposed route. This alternative is about 25 km long and is located east of the adjusted preliminary route.

The Tsiigehtchic alternative added about 3 km to the adjusted preliminary route, but addressed the main concerns expressed by members of the community. This route is farther away from Travaillant Lake and also avoids gravesites that are understood to be near the adjusted preliminary route.

In addition, as compared to the adjusted preliminary route, this alternative:

- is 2 km shorter within the Travaillant Lake Gwich'in Protected Area
- encounters more side slopes and more ice-rich terrain
- parallels 2.5 km less of existing linear disturbances

The Travaillant Lake area was of particular interest to the Tsiigehtchic community and is important because of its social, cultural and environmental significance. Discussions with the community have been ongoing since the start of the project, to ensure that the Travaillant Lake segment selected for the application is the best possible route.

ROUTE AND SITE SELECTION

**APPLICATION TO THE
NATIONAL ENERGY BOARD FOR APPROVAL
OF THE MACKENZIE GATHERING SYSTEM
VOLUME 2: ENGINEERING DESIGN**

FACILITIES SITE SELECTION

4.6.1 SCOPE

Facilities required for operating the gathering and NGL pipelines and associated facilities include:

- interconnections with the anchor field facilities
- the Storm Hills pigging facility
- the Inuvik area facility
- an interconnection with Enbridge at Norman Wells
- pig launching and receiving facilities

4.6.2 SELECTION PROCESS**4.6.2.1 Site Selection Process**

The facility sites were selected using a process that included:

- establishing site selection criteria
- identifying preliminary sites and alternatives
- conducting field investigations involving community representatives
- revising preliminary site locations based on field investigations
- consulting with communities on sites
- revising site locations, where practical, based on community input

The locations of the Storm Hills pigging facility and the Inuvik area facility were initially identified within a 5 km target area determined by a hydraulic analysis of the gathering and gas pipelines. Facility site alternatives were then identified within this target area (see Figure 4-6), considering the:

- hydraulic requirements
- proximity to the proposed pipeline route within the 1-km-wide pipeline corridor
- site-specific conditions

These alternatives included locations:

- at the optimal hydraulic point along the route

4.6.2.1 Site Selection Process (cont'd)

- within 2.5 km upstream or downstream of the optimal points along the route, to avoid adversely affecting system hydraulic efficiency
- within 2.5 km upstream or downstream of the optimal points within the 1 km width of the pipeline corridor, but not on the route
- outside the target areas

Additional specific evaluation criteria for these facility sites included:

- impact on pipeline route and hydraulics
- site-specific environmental considerations, such as proximity to waterbodies
- site-specific construction considerations, such as drainage and slopes
- operations and maintenance requirements, including access

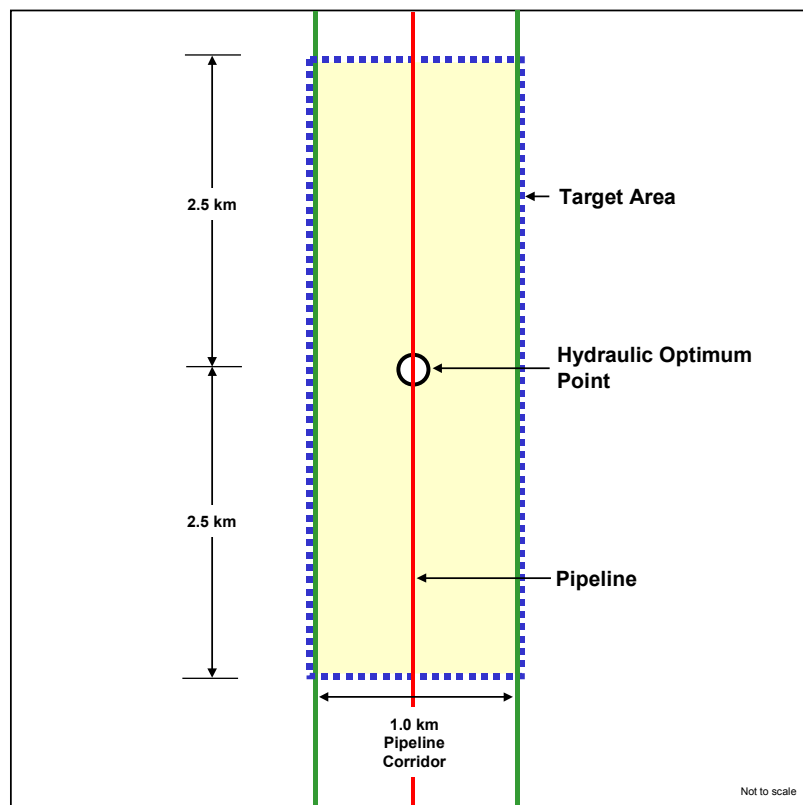


Figure 4-6: Facility Site Selection Schematic

Table 4-5 identifies the proposed facility site locations, the number of alternative locations assessed, and the rationale for selecting the proposed sites.

Table 4-5: Proposed Sites for the Gathering and NGL Pipeline Facilities

Facility Type	Total Locations Assessed	Facility Name	Proposed Location				Rationale for Proposed Site
			KP	UTM			
				Easting	Northing	Zone	
Meter station Piggings facility	N/A	Niglintgak gas conditioning facility	N0 Niglintgak lateral	489,526	7,688,252	8	<ul style="list-style-type: none"> Based on anchor field site selection process
Meter station Piggings facility	N/A	Taglu gas conditioning facility	T0 Taglu lateral	501,374	7,696,121	8	<ul style="list-style-type: none"> Based on anchor field site selection process
Meter station Piggings facility	N/A	Parsons Lake gas conditioning facility	P0 Parsons Lake lateral	557,150	7,653,525	8	<ul style="list-style-type: none"> Based on anchor field site selection process
Piggings facility	2	Storm Hills	T81.3 Taglu lateral	546,872	7,634,029	8	<ul style="list-style-type: none"> At the junction of the Parsons Lake and Taglu laterals Is a relatively well drained site
Gas processing facility	9	Inuvik area facility	0	568,815	7,589,867	8	<ul style="list-style-type: none"> Satisfies pipeline hydraulic requirements Has acceptable drainage Is relatively flat, which reduces grading and gravel requirements Closer to the edge of Campbell Creek Special Management Area than other alternatives Avoids encroaching upon waterbodies Reduces length of access roads
Pig receiver Block valve	N/A	Enbridge interconnection	476.4	598,520	7,242,238	8	<ul style="list-style-type: none"> Based on existing Enbridge pump station location

