

Large fuel storage sites, such as the ones at the Ochre River and Camsell Bend infrastructure sites, will be equipped with:

- site lighting sufficient for safety and maintenance purposes
- a perimeter containment berm if double-walled tanks are not used
- electronic monitoring for detecting tank levels and inventory control
- an emergency shutdown system in the event of a fire or line rupture
- an access control system

Access Roads

Existing roads and highways will be used for the project wherever practical. These include the two-lane Mackenzie Highway that extends about 550 km northwest from Hay River to Wrigley and is open most of the year, as well as the existing GNWT winter roads from the Mackenzie Highway south to Trout Lake and from Wrigley north to Fort Good Hope. About 50 km of the Trout Lake winter road will require project-related upgrades.

Ice bridges are required during the winter at the Liard and Mackenzie River crossings. These crossings are closed to traffic for about one month in the spring and fall. Ferries are used in summer.

Seventy-six new roads, amounting to about 257.1 km of new access, will be required in the DCR to transport personnel, material and equipment to and from the pipeline right-of-way, pipeline facilities, camps and stockpile sites, water sources and borrow sites (see [Table 3-7](#)). The estimates include a 30% allowance for approaches, topography and routing uncertainties.

Table 3-7: Type and Length of New Access Roads in the DCR

Road Type	No. of Access Roads	Total Length (km)
Borrow sites	40	167.4
Water sources	25	42.8
Airstrips	0	0
Barge landings	3	2.6
Camps	1	5.5
Facilities	2	25.8
Stockpile	3	2.8
Pipeline (ROW access)	2	10.2
Totals	76	257.1

A travel lane will also be installed within the pipeline right-of-way for winter construction. This is shown on [Figure 3-10](#) and discussed in the pipeline right-of-way topic.



Figure 3-10: Example of Right-of-Way with Travel Lane

Types of Roads

Two types of roads will be constructed, all-weather roads and temporary winter roads. The design for the all-weather and winter roads will be site specific and will consider factors such as:

- community input
- geotechnical conditions and terrain features, including drainage patterns
- load weight and size
- existing cut lines and previously disturbed areas
- type of borrow material available, such as till, gravel, shale or rock
- seasonal reinstatement of access roads
- water sources for winter access road construction

A road allowance about 20 m wide will be required in all cases. The travel surface will differ depending on type and purpose of the road.

All-Weather Roads

Less than five kilometres of all-weather roads will be constructed in the DCR, as shown on [Table 3-8](#).

Table 3-8: All-Weather Road Requirements in the DCR

Site Location	Road Length (km)	Comments
Blackwater River compressor station	0.9	Connects the Blackwater compressor station to the airstrip and barge landing site
Ochre River infrastructure site	0.9	Connects the barge landing to the camp site and pipeline right-of-way
Camsell Bend ferry crossing	0.6	Connects the new barge landing site to the Mackenzie Highway
River Between Two Mountains infrastructure site	1.9	Connects the new barge landing site to the camp and the pipeline right-of-way
Borrow Site 11.055PB	0.4	Connects borrow site 11.055PB to the Mackenzie Highway

All-weather roads will require a compacted roadbed of locally obtained borrow material (see [Figure 3-11](#) for a typical drawing).

Tree stumps and roots might be salvaged from graded sections of the roadbeds and stored for use during reclamation. Crossings will be installed at watercourses. Erosion control devices will be installed, as necessary, on moderate and steep slopes. Culverts will be used for maintaining surface drainage across the all-weather road allowance.

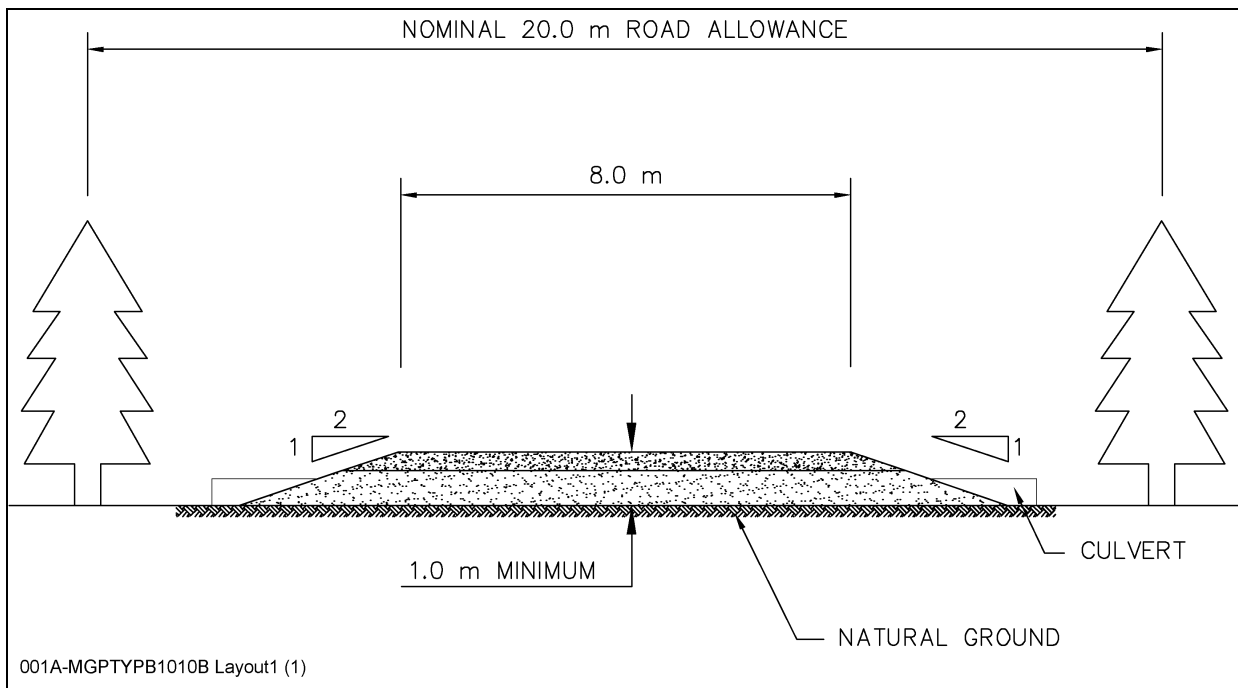


Figure 3-11: Typical All-Weather Access Road (8.0 m)

Winter Access Roads

In addition to the pipeline travel lane and existing access roads, new winter roads will be constructed and maintained for development activities. Some of these roads will be required for more than one winter construction season. A typical winter access road is shown on the schematic in [Figure 3-12](#).

Winter access road construction will start once a sufficient frozen ground depth, suitable for supporting heavy equipment, is achieved. Trees will be cut off at ground level and windrowed. Snow, brush and vegetative material will be compacted with light tracked equipment. Continued compaction will be achieved with snow and water by using progressively heavier equipment. Excess snow accumulations will be ploughed to the side of the travel surface.

By using equipment with a protected blade or equivalent, the disturbance of the surface organic layer will be limited. The road will be built up to strength by continuing to add water and snow in areas of sensitive terrain where practical. A smooth, hardwearing road surface will be achieved by dragging and surface grading. Maintenance will be done on an ongoing basis using conventional construction equipment, water and snow. Where the snow cover is limited, water will be added to the available snow cover to create the required depth of ice. Roads constructed on lakes and rivers will require minimum ice depths of about 1.2 m.

The potential water use requirements for the winter access roads and the pipeline travel lane in the DCR are estimated at about 69,600 m³ and 354,000 m³ per construction season, respectively.

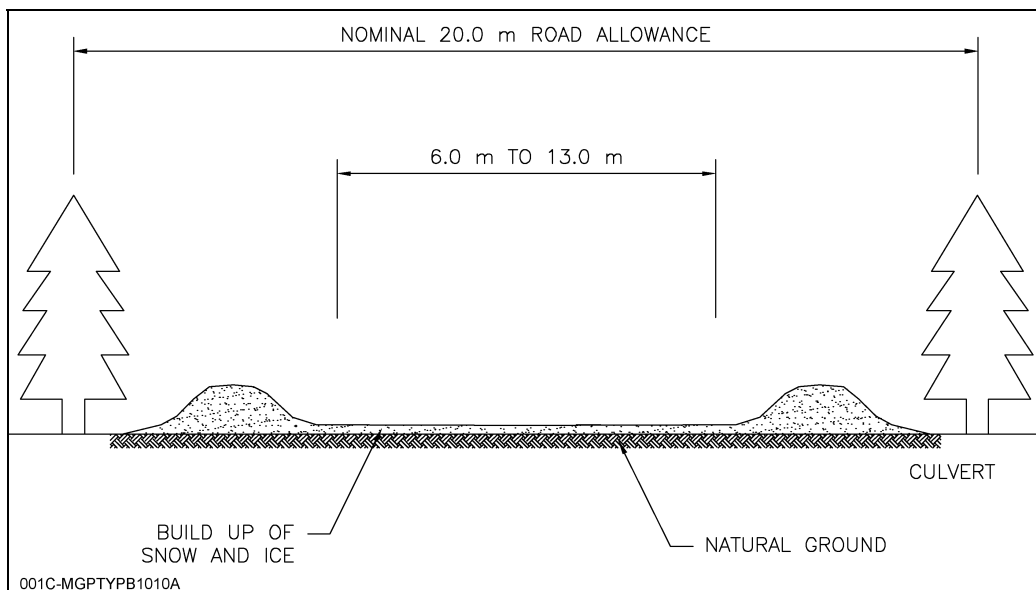


Figure 3-12: Typical Winter Access Road

Water Supply Intake Systems

Temporary water intake systems will be required to obtain water from potential water sources. These might include a temporary hose from water sources or trucks and portable pumping systems that are fed directly from openings in the ice of water sources.

Airstrips and Helipads

The Fort Simpson commercial airport, which has paved runways capable of handling heavy aircraft, will be the primary hub for transporting personnel to and from the proposed construction camps in the DCR. Airports at Hay River and Yellowknife will also be used.

In addition to the primary hubs, smaller existing airports and airstrips with gravel runways might be available for project use in various communities, such as the Wrigley commercial airport. Use of these facilities is being discussed with the communities. Upgrades to the apron at the existing Fort Simpson airport, as well as a new building, might be required. This building would be used to house personnel during weather delays.

A new airstrip will be required at the Blackwater River compressor station and at the Trail River compressor station. New airstrips are needed to support construction and operation of the project and to allow year-round access.

Airstrip construction typically involves building up three layers of compacted, consolidated construction materials. The sub-base will be made of crushed shale, limestone or well drained, unfrozen till. The base course will be made of the same materials, with a maximum aggregate size of 200 mm but will be placed in a discrete lift and compacted separately. The finishing surface will be made with 20 mm crushed gravel. Construction materials will be obtained from local borrow sites.

The new airstrips at the Blackwater River and Trail River compressor stations will be designed to accommodate Twin Otter aircraft. A drawing of a typical Twin Otter airstrip is provided in [Figure 3-13](#).

New helipads will be installed within the Blackwater River, Trail River and Trout River station yards for construction and operations purposes. During construction, cleared areas at the Ochre River, River Between Two Mountains, Camsell Bend, McGill Station, and Trout Lake infrastructure sites will be used for helicopter landings, as will the commercial airports at Wrigley, Fort Simpson and Hay River. The existing helipad at Fort Simpson might also be used.

Helipad dimensions will typically range from about 30 x 30 m (0.1 ha) to about 36 x 135 m (0.5 ha).

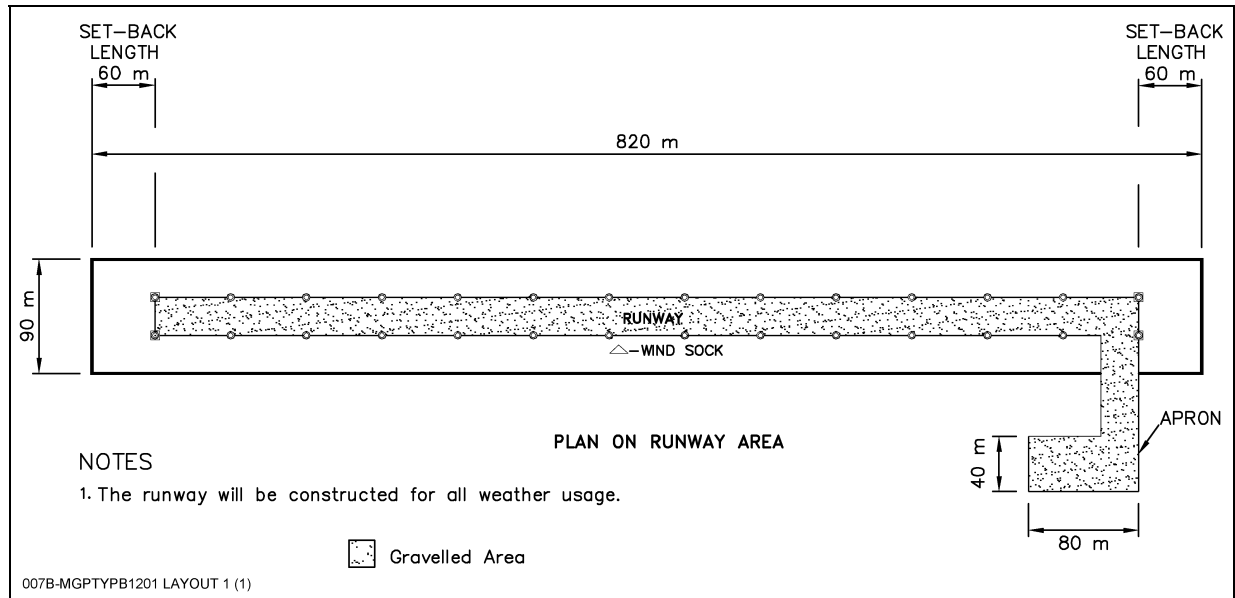


Figure 3-13: Typical Airstrip (Twin Otter)

Communications

Communication equipment will be installed in the Blackwater River, Trail River, and Trout River station yards and temporarily, at the pipeline construction camps (Ochre River, Camsell Bend, McGill Station, Trout Lake and Hay River). It will be housed in self-contained buildings, if required. The communications will be through public systems, such as the NorthwesTel network or by satellite. A backup system will be provided in case the primary system fails.

The communication infrastructure will support:

- telephone and fax systems
- Internet and e-mail service
- multiple channel very high frequency radio, both hand-held and in-vehicle radios
- satellite telephones
- satellite television and radio at the camps
- air-to-ground communication at airstrips and helipads
- communication links with the truck, barge and air transport providers

Repeater towers might be required to increase communication coverage along the pipeline corridor. The repeater tower range is estimated at between 10 and 20 km.

At the Blackwater River, Trail River, and Trout River station sites, or at other locations along the right-of-way, personnel will use hand-held radios to communicate within work parties. Portable satellite phones will be used for external communication. Air-to-ground communication will be provided for areas with airstrips and helipads. Marine communication will be available, as required for river transport.

TITLE	DCR Application for a Type A Water Licence
SECTION	3: Overview of Activities in the DCR
SUBJECT	5: Project Activities – Borrow Sites

SCOPE

Natural materials needed to construct the project will be obtained from new and existing borrow sites, commonly known as sand or gravel pits and rock quarries. These sources will be accessed along the proposed pipeline corridor.

About five million cubic metres of borrow materials will be required for the project, including for the pipeline right-of-way, access roads and facility sites. Of this project total, an estimated 945,000 m³ of borrow material will be needed for developments in the DCR.

About 127 potential borrow sites have been identified for the project. This includes 42 potential sites in the DCR. Fourteen are on lands where new surface and subsurface interests have been withdrawn under an interim withdrawal order (see [Table 3-9](#)). An estimated 2.6 million m³ of borrow material could be obtained from the 42 sites.

Table 3-9: Summary of Potential Borrow Sites in the DCR

Borrow Source	Potential Borrow Material	Existing	Expected Year(s) In Use	Status under Interim Withdrawal Orders	Land Use Zone Proposed in June 2005 Draft Land Use Plan
9.044PA	Gravel	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
9.044PB	Gravel	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
9.091P	Sand and gravel	New borrow pit	2007-2009	Surface and subsurface	Pehdzéh Ki Deh
10.001P	Sand and gravel	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.003P	Limestone	New rock quarry	2007-2008	No withdrawal	Pehdzéh Ki Deh
10.004P	Sandy gravel	New borrow pit	2007-2008	No withdrawal	Pehdzéh Ki Deh
10.007P	Sand and gravel	New borrow pit	2007-2008	No withdrawal	Pehdzéh Ki Deh
10.013P	Limestone	New rock quarry	2007-2008	No withdrawal	Pehdzéh Ki Deh
10.014AP	Sand and gravel	New borrow pit	2007-2008	No withdrawal	Pehdzéh Ki Deh
10.020P	Sand and gravel	Existing borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.022P	Sand and gravel	Existing borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.030P	Gravel	Existing borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.033P	Gravel	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh

Table 3-9: Summary of Potential Borrow Sites in the DCR (cont'd)

Borrow Source	Potential Borrow Material	Existing	Expected Year(s) In Use	Status under Interim Withdrawal Orders	Land Use Zone Proposed in June 2005 Draft Land Use Plan
10.037P	Gravel and sand	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.038PA	Gravel and sand	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.043P	Gravel	Existing borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.044BP	Sandy gravel	Existing borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.055P	Sand, silt and gravel	Existing borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.071P	Gravel with sand	New borrow pit	2007-2009	No withdrawal	Pehdzéh Ki Deh
10.072P	Sand and gravel	Existing borrow pit	2008-2009	No withdrawal	Sibbeston Plains
10.120P	Sand and gravel	New borrow pit	2008-2009	Subsurface	Pehdzéh Ki Deh
11.019P	Sand and gravel	Existing borrow pit	2008-2009	No withdrawal	Fort Simpson
11.021P	Sand and gravel	New borrow pit	2008-2009	No withdrawal	Fort Simpson
11.033P	Sand and sandy gravel	New borrow pit	2008-2009	No withdrawal	Fort Simpson
11.055PA	Gravelly sand	Existing borrow pit	2006-2008	Surface and subsurface	Sibbeston Plains
11.055PB	Gravelly sand	Existing borrow pit	2006-2008	Surface and subsurface	Sibbeston Plains
11.067P	Gravel and sand	New borrow pit	2007-2008	Surface and subsurface	Sibbeston Plains
11.071P	Sand and gravel	New borrow pit	2007-2008	Subsurface	Sibbeston Plains, Mackenzie Valley Pipeline Corridor
11.174P	Sand and gravel	New borrow pit	2006-2008	Subsurface	Jean Marie
11.192P	Sand and gravel	New borrow pit	2006-2008	Surface and subsurface	JMR Five Lakes
11.204PA	Gravel and sand	Existing borrow pit	2006-2009	Subsurface	Jean Marie, Mackenzie Valley Pipeline Corridor
11.204PB	Gravel and sand	Existing borrow pit	2006-2009	Subsurface	Jean Marie, Mackenzie Valley Pipeline Corridor
20.002P	Till	New borrow pit	2007-2009	No withdrawal	Trout River
20.004PA	Sand and gravel	Existing borrow pit	2007-2009	Surface and subsurface	Sambaa K'e/ Redknife River

Table 3-9: Summary of Potential Borrow Sites in the DCR (cont'd)

Borrow Source	Potential Borrow Material	Existing	Expected Year(s) In Use	Status under Interim Withdrawal Orders	Land Use Zone Proposed in June 2005 Draft Land Use Plan
20.004PC	Sand and gravel	Existing borrow pit	2007-2009	Surface and subsurface	Sambaa K'e/ Redknife River, Mackenzie Valley Pipeline Corridor
20.006P	Till	New non-granular pit	2007-2009	No withdrawal	Cameron Hills, Blackstone, Arrowhead River
20.008P	Sand and gravel	New borrow pit	2008-2009	No withdrawal	Cameron Hills, Blackstone, Arrowhead River
20.015P	Sand	New borrow pit	2008-2009	No withdrawal	Edézhzié
20.018P	Sand	New borrow pit	2007-2008	Subsurface	Sibbeston Plains
20.057P	Sand and gravel	Existing borrow pit	2007-2009	Surface and subsurface	JMR Five Lakes
20.064P	Sand	New borrow pit	2007-2009	No withdrawal	Sambaa K'e/ Redknife River
20.068P	Sand and gravel	New borrow pit	2008-2009	No withdrawal	Cameron Hills, Blackstone, Arrowhead River

Borrow Site Development

A typical borrow site development is depicted in [Figure 3-14](#). The development schedule for borrow sites will be determined by project needs during construction and, potentially, during operations. The sites will be developed for the components they will supply and will be reclaimed, as required.

The schedule at each site will be influenced by the ice content of the borrow material. Sites with a high ice content might be excavated at least one year in advance, with the borrow material likely to be excavated and stockpiled. The piles of high ice content material might be allowed to melt and drain over the summer for use the following winter. Other activities that might be required at various borrow sites during the summer include stripping overburden, excavating borrow material, and stockpiling.

Most borrow sites contain material that will meet the applicable specifications for road and pad construction. However, where the material does not meet specifications for pipeline backfill, it will be crushed or screened during site excavation. Materials might be screened to separate borrow material for different uses. Large material might be crushed to make it suitable for use on the project.

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PIPELINE COMPONENTS

Gas Pipeline

The gas pipeline route through the DCR extends about 532.3 km from the SSA to the Alberta boundary, including a 10.4 km segment of Sahtu private land in the northernmost portion of the DCR.

For the purpose of this application, the gas pipeline in the DCR has been divided into two segments - one north and one south of Sahtu private land segment (see [Table 3-10](#) and [Figure 3-15](#)). These are labeled C1 and C2, respectively.

Table 3-10: Pipeline Segments in the DCR

Pipeline Segment	Land Use Zone in June 2005 Draft Land Use Plan	Length (km)	Start (KP)	Finish (KP)	Status Under Interim Withdrawal Orders
Crown Land - C1	Pehdzéh Ki Deh	0.3	687.9	688.2	No withdrawal
Crown Land - C2	Pehdzéh Ki Deh Sibbeston Plains Edézhzhíe Fort Simpson JMR Five Lakes Sambaa K'e/Redknife River Jean Marie Trout River Cameron Hills, Blackstone, Arrowhead River Mackenzie Valley Pipeline Corridor	521.6	698.6	1220.2	No withdrawal Subsurface Surface and subsurface

The 40 m wide right-of-way through the DCR traverses five proposed conservation zones, four special management zones, and one special infrastructure corridor in the June 2005 draft land use plan.

All of pipeline segment C1 and about 130 km of C2 traverse the western edge of Pehdzéh Ki Deh. This area extends from the SSA boundary to a point south of the proposed River Between Two Mountains infrastructure site. This area is not currently subject to a time-limited withdrawal from new surface and surface interests under P.C. 2003-1230.

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South of Pehdzéh Ki Deh, about 40 km of pipeline segment C2 crosses through Edézhzhíe, which has interim protection from new surface and subsurface interests under P.C. 2002-1805. This withdrawal order is subject to a 4.0 km wide corridor for the gas pipeline and associated infrastructure.

The proposed Fort Simpson special management zone extends from Edézhzhíe to a point north of Fort Simpson. There are no time-limited restrictions on new subsurface or surface and subsurface interests along this segment of pipe.

From Fort Simpson to Alberta, pipeline segment C2 traverses lands containing three proposed conservation zones and three special management zones, as well as the special infrastructure corridor. Parts of this segment are subject to time-limited withdrawals from new subsurface or surface and subsurface interests under P.C. 2003-1230. There are provisions in this order for a gas pipeline corridor generally centered along the existing Norman Wells pipeline right-of-way.

Pipeline Facilities

For the DCR, there are three pipeline facilities being proposed - the Blackwater River and Trail River compressor stations and the Trout River heater station. The compressor stations are described next in general terms and in detail in [Section 7](#). Information on the heater station is also provided in [Section 7](#).

The Blackwater River facility site is situated on lands within the proposed Pehdzéh Ki Deh conservation zone. The Trout River facility site lies within both the proposed Trout River special management zone and the Mackenzie Valley Pipeline Corridor special infrastructure corridor. The Trail River facility site is located in the proposed Fort Simpson special management zone. There are no time-limited withdrawals from new subsurface, or surface and subsurface interests, currently in place at any of the three facility sites.

Compressor Stations

Compressor stations are required to increase the pressure of the gas in the pipeline, to offset pressure losses caused by friction. They will be located at intervals of about 225 km along the gas pipeline route.

The site for each compressor station will occupy about 9.5 ha, of which approximately 6.2 ha will be fenced. Site preparation for the compressor stations is expected to start in 2006.

Compressor stations will be designed for remote, unstaffed operation and will be accessible by helicopters and roads. Living quarters will be provided for about eight operations and maintenance staff at the Blackwater River and Trail River compressor stations. A workshop will be installed to accommodate maintenance activities at these sites.