

Dry or fully frozen crossings with sufficient mineral soil cover might not require weighting. Insulation might be applied to the pipeline at the crossings to reduce potential frost bulb formation, or thaw settlement or both.



Figure 3-44: Examples of Concrete Weights to Counter Buoyancy

Signs and Markers

Pipeline markers will be installed at the banks of all non-vegetated crossings during the construction phase and for operations purposes, after construction.

ACCESS ROAD AND TRAVEL LANE CROSSINGS

Construction vehicles will use existing bridges, where feasible. In the absence of such bridges, one of six main techniques might be used to cross watercourses encountered during construction of access roads – permanent bridges, temporary bridges, culvert crossings, timber fill crossings, ice bridges or snow fill crossings. Typical drawings for each of these techniques (excepting permanent bridges) are shown in [Figure 3-45](#) through [Figure 3-49](#).

Permanent Bridges

Permanent bridges are often used on all-weather roads that cross flowing streams and on winter roads where the travel season needs to be extended in the fall and spring. Supports will be installed on each bank and a span will be built across them. A site-specific design will be required at each of these sites.

Temporary Bridges

Temporary structures might be used on winter roads and in conjunction with the pipeline right-of-way to cross streams with unstable beds and banks or ones that are too deep, too wide, or too fast flowing for other crossing methods. Common structures include flat bed rail car frames or longer Bailey bridges.

Timber mat supports are sometimes built at each end before the temporary bridges are installed. Ramps will be built from snow, ice or granular material. Curbs might be required to prevent mud or debris from entering the watercourse.

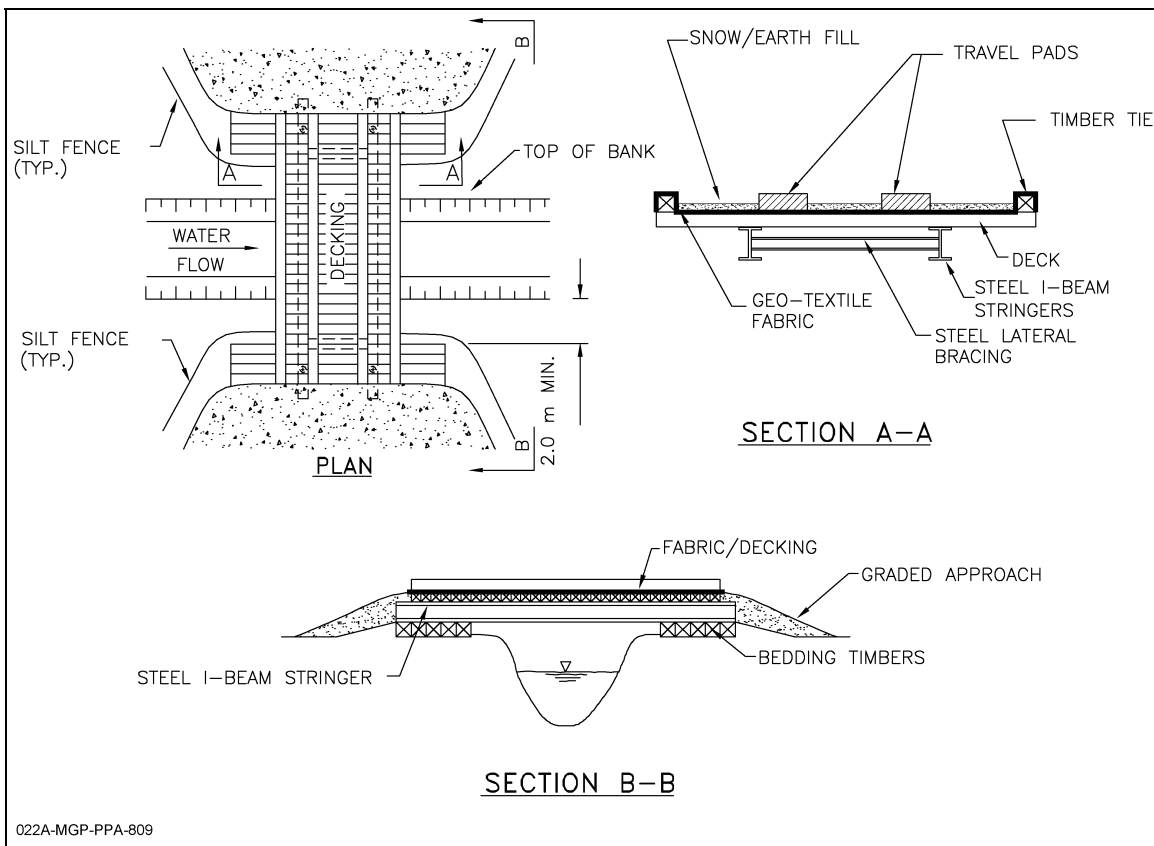


Figure 3-45: Typical Temporary Bridge Structure

Culvert Crossings

Culverts might be used where sediment control and continuous passage of fish is required. Culverts are often used in all-weather roads. The culverts will be put into place, the ends are sandbagged and ramps will be installed, covered with clean granular fill, and compacted for traffic. The outlet sides might be rip-rapped for erosion control. If used for winter construction only, the culverts and ramps will be removed before spring breakup.

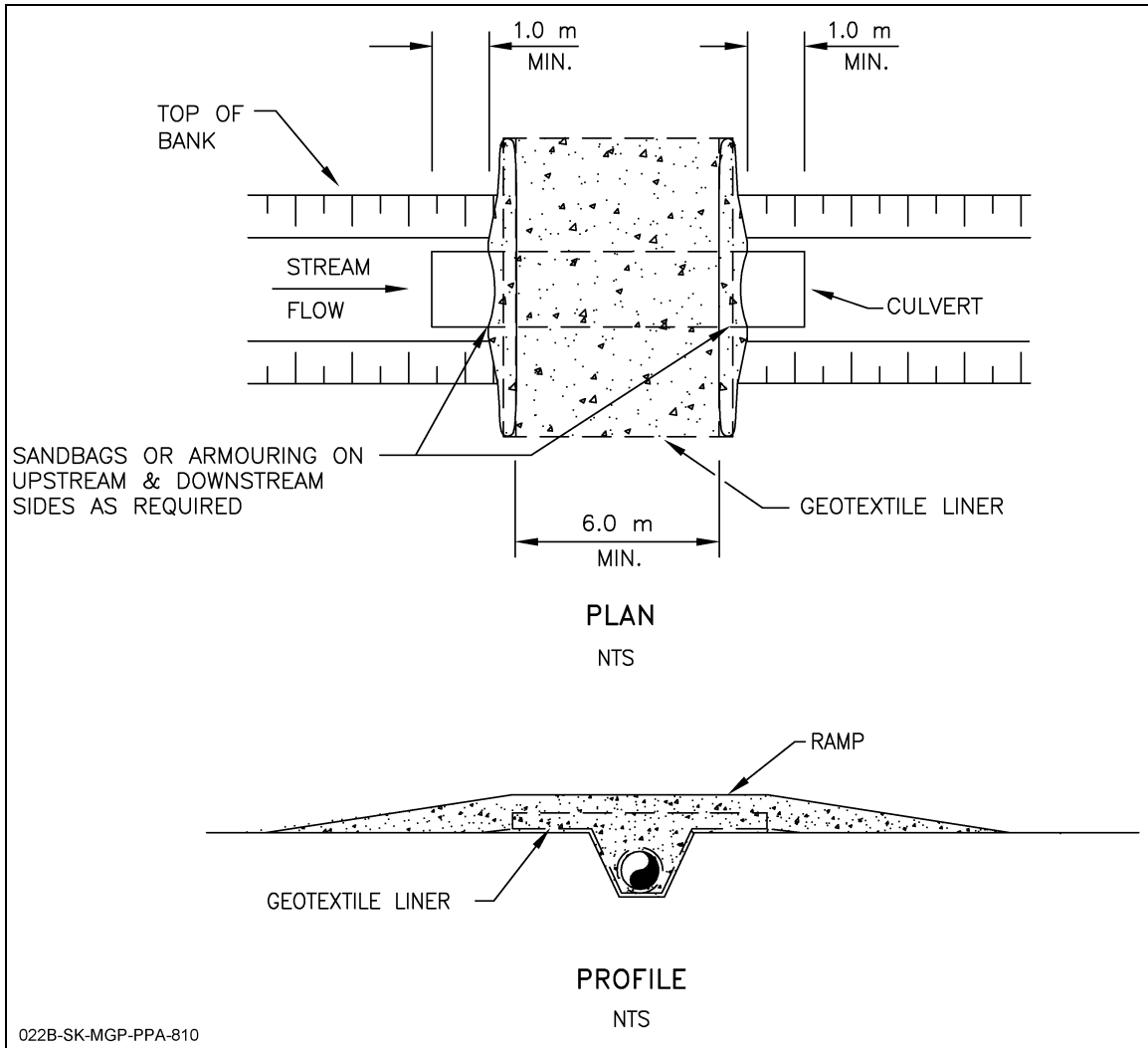


Figure 3-46: Typical Culvert Crossing

Timber Fill Crossings

Timber fill crossings might be used to cross shallow streams with intermittent flow, gently sloping banks, and no fish passage concerns. They might also be warranted in seasons or areas with low snow, where there might not be enough material for a snow or ice fill crossing. Timber mats or timber logs cabled together are used as a base, which is covered with compacted snow to bring the crossing up to grade. Timber and debris will be removed before spring breakup.

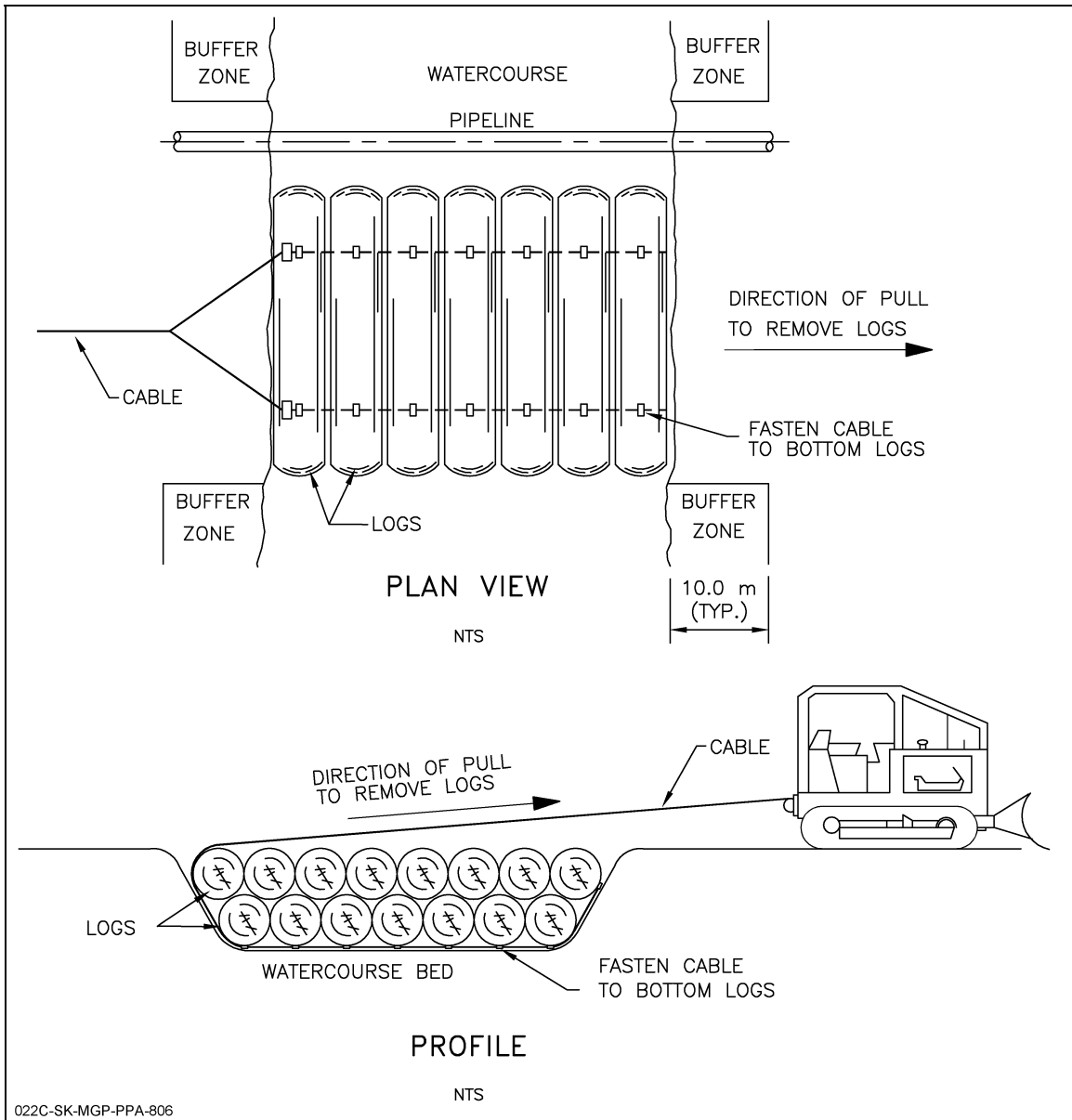


Figure 3-47: Typical Timber Fill Crossing

Ice Bridge Crossings

Ice bridges might be used where there is ample supply of water and the crossing location has gently sloping banks. Once a safe ice thickness at the crossing is reached, snow cats will be used to push snow berms onto each side of the crossing. The travel surface will be flooded in repeated lifts, between the snow berms, to increase the load bearing capacity. Regular maintenance will be required and the bridges will be notched before spring breakup, thereby ensuring free flowing melt water.

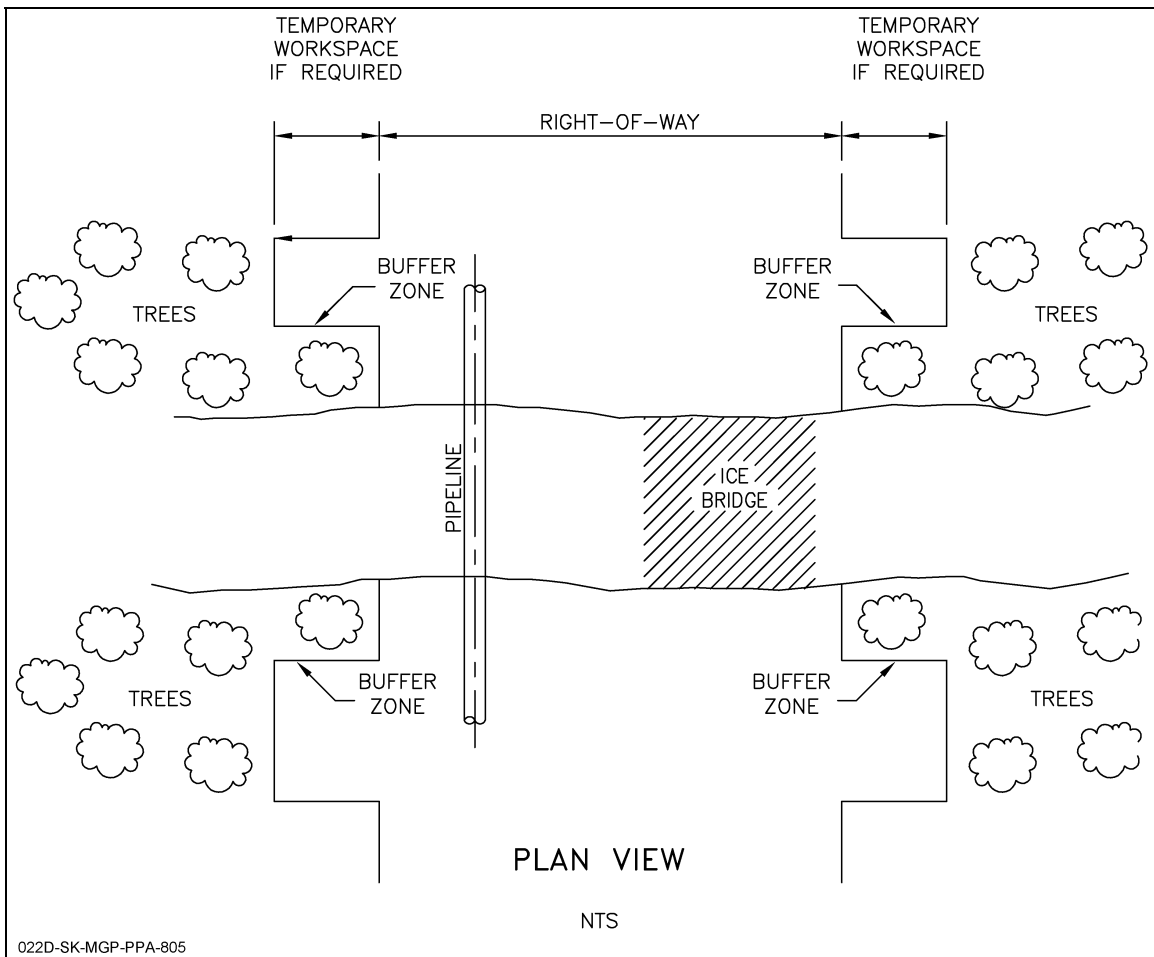


Figure 3-48: Typical Ice Bridge Crossing

Snow Fill Crossings

Snow fill crossings might be used where there is intermittent or no winter flow, the crossing has gently sloping banks, there is ample snow supply, and an ice bridge or temporary bridge structure is not warranted. Snow will be collected from nearby areas or made artificially by snowmaking systems. The travel surface will be built up with repeated lifts of compacted snow and water. As with ice bridges, snow fill crossings will be notched before spring breakup.

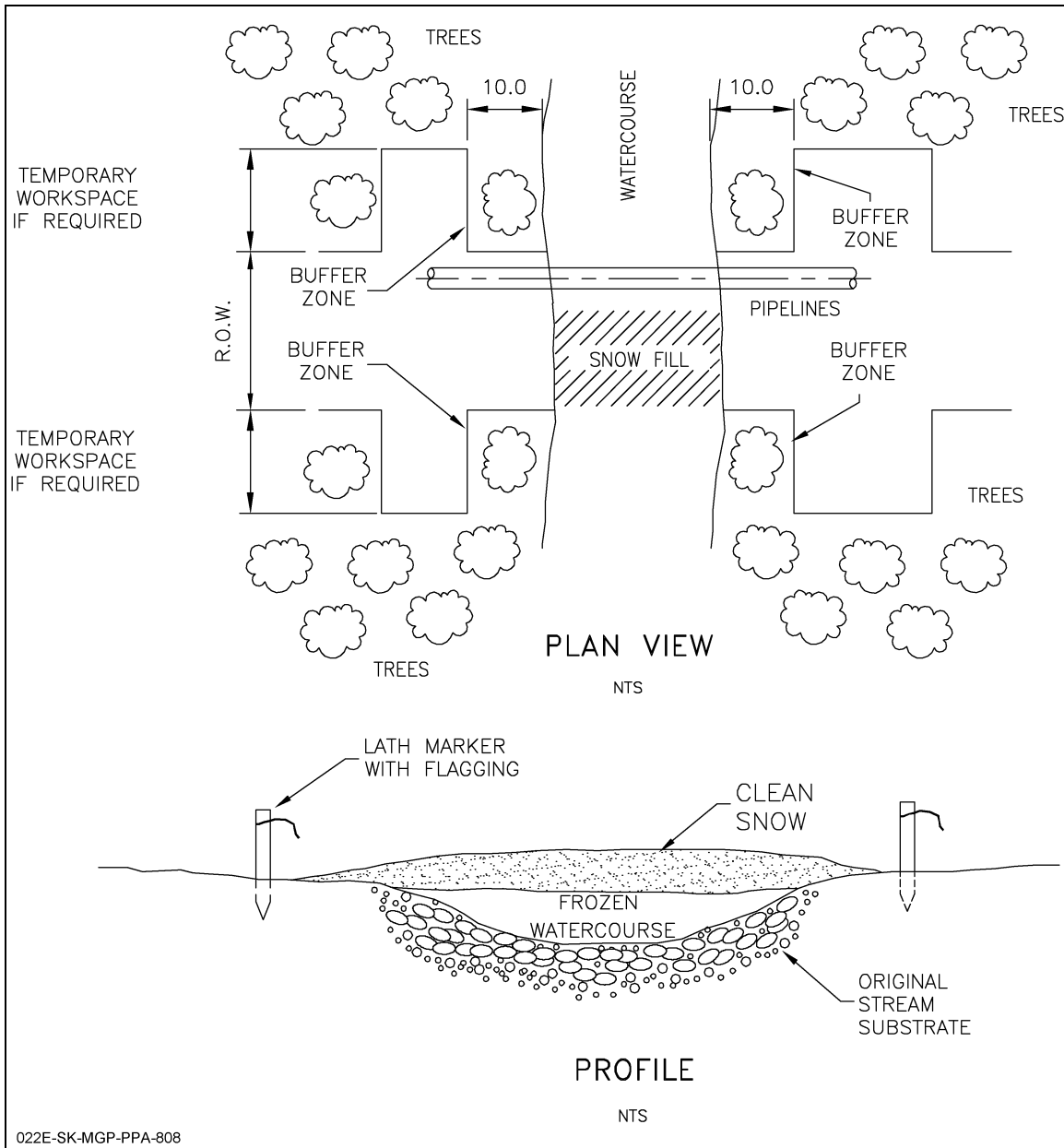


Figure 3-49: Typical Snow Fill Crossing

HIGHWAY, ROAD AND PIPELINE CROSSINGS

The minimum cover at road crossings will comply with the requirements of the jurisdiction responsible for the road. Six pipeline and 29 road crossings, requiring an estimated 10.4 ha of temporary workspace, will be required in the SSA.

Crossings will generally be installed using an open cut method. However, if the road has a high usage rate, or if required by the responsible jurisdiction, the road crossing will be bored, if the soil conditions are suitable for this method.

All existing pipelines will be positively located before the pipeline is installed. A 0.3 m minimum vertical separation distance will be maintained from other pipelines crossed. Test leads will be attached to each pipeline to enable potential cathodic protection interference to be identified and resolved.

The potential for frost heave or thaw settlement will be investigated during detailed engineering. If it is a potential concern for a road, highway or pipeline crossing, mitigative measures will be used, such as constructing the pipeline with a deeper burial depth, using imported fill, insulating around the pipeline, placing insulation in the pipeline trench, or a combination of these methods.

Typical crossings are shown in [Figure 3-50](#) and [Figure 3-51](#).

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Figure 3.51 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.

TITLE	Application for Land Use Permits for Land within the Municipal Boundaries of Norman Wells, Fort Good Hope and Tulita
SECTION	3: Overview of Activities in the SSA
SUBJECT	8: Project Effects and Mitigations

SUMMARY OF PROJECT EFFECTS AND MITIGATION

An overview of the potential effects of the proposed development activities on the biophysical and human environmental settings in the SSA, along with a brief description of the primary strategies for mitigating those effects, is contained in this subject. Detailed descriptions of potential effects and primary mitigation strategies are provided in [Section 8](#). Site-specific environmental protection plans (EPPs) will be developed. The framework is described in [Section 11](#).

The potential biophysical effects of the proposed pipelines and components have been assessed within a 1 km wide corridor generally centred along the proposed pipeline route.

In addition, environmental studies have been conducted outside the pipeline corridor where needed to include infrastructure sites required for construction, such as barge landings, borrow sites, camps, access roads and water sources. The study results have been used to identify the potential environmental effects of the development activities in this application.

Biophysical Effects

Typical project activities could result in a number of potential effects on the biophysical environment in the SSA, depending on the type of activity, location, climate and the timing of construction. Typical effects from construction, before mitigation, include but are not limited to:

- increased gaseous emission
- changes in ground and slope stability, drainage patterns and water and wind erosion
- alteration of uncommon landforms
- soil loss and changes in soil quality, drainage, and physical and chemical characteristics
- removal, burial, mechanical damage or alteration of vegetation
- removal, burial, mechanical damage or alteration of heritage sites

- localized direct and indirect effects on wildlife habitat, localized disruptions to wildlife movement and limited wildlife mortality
- localized alteration to fish and fish habitat
- changes in water and sediment quality
- increased intermittent and continuous noise levels

Primary Biophysical Mitigation

Examples of typical measures that might be used to reduce the effects of development activities include but are not limited to:

- employment of local environmental and wildlife monitors
- constructing primarily in the winter and other periods that avoid sensitive wildlife and fish timing windows
- reducing the footprint of disturbance
- reducing grading and levelling to that required for a safe and efficient working surface
- implementing appropriate drainage, sediment, erosion and slope stability controls
- enforcing traffic and access controls
- avoiding environmentally sensitive areas where practical
- protecting heritage resources
- applying best site management practices for dust suppression
- considering efficiency in equipment selection
- applying best management practices to reduce fuel use
- maintaining equipment exhaust systems

EFFECTS ON THE HUMAN ENVIRONMENT

An overview of the potential effects of the proposed development activities on the human environment in the SSA, including effects on the people and the economy of the region, on traditional culture, on non-traditional land and resource use, on protected areas and on heritage resources is contained in this topic.

Effects

The focus has been on identifying the potential effects of development sites and activities that are closest to the communities, or that could affect resources and activities with high local values, or that might be important to the functioning of the community. Examples of the latter include roads, airports and barge landings.

Economic effects were determined from simulations using employment and expenditure estimates. The simulations (of direct, indirect and induced economic effects) were done using the Statistics Canada's inter-regional input-output model. However, because this model only produces results at a territorial or provincial level, effects in the Northwest Territories were allocated to the SSA and the other regions.

Summary of Effects on the People and Economy of the SSA

The proposed development activities are expected to have a long term, positive influence on the people and economies in the communities and in the SSA as a whole. Among other things, this influence will be reflected in increased employment, income and business opportunities, capacity development, and the potential for new infrastructure. The influences are assessed and explained at a regional level. General trends are applicable to all SSA communities, and where appropriate, community specific effects are described.

In the shorter term, however, spending decisions by some individuals will affect the quality of life of these income earners, their families and their communities. These decisions will also increase the demands on resources and facilities that deliver social, health and protection services to the communities. Inflationary pressures, including on housing, might also occur in the early phases of the project.

Both facilitating and inhibiting influences on traditional harvesting might result from the development. Time spent on harvesting activities might be reduced for some workers and families. However, the wages from project employment might also be used to acquire new and better equipment for more efficient and productive harvesting. Project-related employment might also add to a slow, ongoing decline in Aboriginal language use and culture preservation within the SSA.

During construction, the potential project effects on the people and economy of the SSA include:

- capital expenditures and project-related procurement estimated at over \$61 million
- some expanded business and labour force capacity and opportunities

- increased labour force participation rates, to 71.7% from 62.6%
- decreased unemployment rates, to 9.9% from 21.4%
- population increases, mostly in Norman Wells, estimated at about 100 people in the peak activity year of 2007. However, the effects on the local populations in Fort Good Hope should be moderate. Effects on populations in other SSA communities will likely be low in magnitude.
- temporary creation of up to 190 project-related positions filled by SSA residents
- generation of about \$41 million in labour income, including \$27 million in direct project related income
- increased levels of alcohol abuse and related violence and illness, family relationship stress, contagious diseases and STIs

During the operations phase, potential project effects on the people and economy of the SSA include:

- a part of \$140 million in average annual operations expenditures in the NWT will be spent in the SSA
- some expanded business and labour force capacity and opportunities
- an average of 38 positions filled by SSA residents, generating about \$3 million a year in labour income

Norman Wells, an SSA regional centre, is expected to experience most of the procurement, employment and labour income effects from activities in the SSA because of its size, location and function as a regional transportation and administrative centre. However, as only 10% of the operations and maintenance jobs created during operations will relate to the activities of the Norman Wells operations centre, only a minor population increase is expected in Norman Wells.

Primary Human Environmental Mitigation

In recognition of the potential for adverse effects, mitigation strategies have been developed that might be implemented by the project in conjunction with the GNWT, communities, local authorities, service providers, and other third parties. Given the range and magnitude of potential effects, a co-coordinated and collaborative response from the project and these other parties is necessary.

Examples of primary mitigation strategies include:

- developing a procurement plan to build business capacity in the SSA and manage project-related procurement and expenditures
- giving preference to qualified, competitive businesses for the provision of certain good and services
- working with the GNWT, educational institutions, and Aboriginal associations and communities to address education and training needs to optimize project-related employment for NWT residents
- developing a database of potential workers to match skill sets and identify training needs
- implementing hiring policies that provide preference for direct project hiring in the North
- initiating money management programs and enabling workers to assign part of their wages to savings accounts to encourage positive lifestyle choices
- enforcing policies for alcohol and drug-free workplaces and camps
- implementing measures to help sustain community health
- providing Aboriginal workers with flexible work schedules to accommodate traditional harvesting and other Aboriginal cultural, family and community needs, where practical
- supporting community-based traditional lifestyle initiatives that promote traditional harvesting and positive relationships with communities
- negotiating harvester compensation agreements with the hunters' and trappers' committees or other relevant authorities
- providing cultural awareness training to all workers on the project to promote appreciation and respect for Aboriginal people and their culture
- supporting cultural activities and events that are consistent with the project principles and practices
- periodically providing country foods in the construction camps
- providing construction camps with Aboriginal language reading material, and Aboriginal language radio and television broadcasts, tapes and CDs, where available

