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TODD.

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April 2, 2004

Distribution List

RE: Draft Environmental Terms of Reference (TOR) For the Proposed Mackenzie Gas Project Released March 4, 2004

The Water Resources Division (WRD) of the Renewable Resources and Environment Directorate has reviewed the Draft Environmental Impact Statement (EIS) Terms of Reference (TOR) for the Mackenzie Gas Project as released to the public on March 4, 2004. While we understand that the strategy of the authors is to keep the TOR relatively general so as not to limit the scope of the EIS, it is our view that for a project of this magnitude, the current TOR are too general and will not effectively serve the purpose of assisting the proponents in the preparation of its EIS. We also feel that detailed and comprehensive TOR will only assist the Joint Panel in its deliberations."

The proposed Mackenzie Gas Project (the Project) is likely to be the most significant development we will ever see in the Canadian North. The environmental impact review of the Project will be precedent setting, especially north of Norman Wells where the development will be breaking new ground in varied and complex terrain. The Project has an considerable potential for significant environmental impacts. Therefore, the TOR must be detailed and comprehensive to facilitate a thorough review of the Project. Specific preliminary technical comments on water-related issues are submitted at this time to ensure they are both part of the public registry and will be considered openly and fairly to improve upon the TOR. The submission of these technical comments will not preclude additional comment by the Department (should this be considered necessary) during the public comment period for the TOR.

The TOR establishes the nature and scope of the issues that the Proponent must address in the EIS. It is important that the TOR are consistent with the information requirements of the Consolidated Information Requirements (CIR) released by the Board Chairs Committee in September 2002. It is our view that the additions proposed will ensure this consistency is achieved. The CIR

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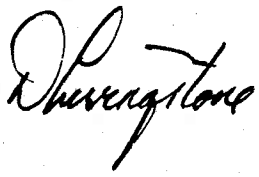
contain a synthesis of the information requirements of regulators and environmental impact agencies under the Cooperation Plan. The CIR were prepared to assist the proponent in the collection of baseline data and to plan for the preparation of a complete environmental assessment report and regulatory applications.

The following attachment contains the WRD's suggestions to improve upon certain sections of the draft TOR. The current wording of the TOR is shown in italics, the suggestions of the WRD are added in bold.

If you require further information, please contact me at (867) 669-2647.

Yours sincerely,



David Livingstone
Director, Renewable Resources and Environment

Attach.

Distribution

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The Mackenzie Gas Project
Comments on the Draft Environmental Impact Statement Terms of Reference
Water Resources Division,
Department of Indian Affairs and Northern Development
March 2004

The Water Resources Division (WRD) has reviewed the Draft Environmental Impact Statement Terms of Reference (TOR) for the Mackenzie Gas Project. It is our view that the Terms of Reference as drafted are much too general, overly vague, and loosely defined for a project of this scope and size. Detailed, thorough and comprehensive TOR will only assist the Joint Panel in its deliberations. The TOR, as drafted, will only lead to problems in the environmental assessment process as interveners struggle to obtain appropriate information from the proponent.

The proposed Mackenzie Gas Project (the Project) is likely to be the most significant development we will ever see in the Canadian North. The environmental impact review of the Project will be precedent setting, especially north of Norman Wells where the development will be breaking new ground in varied and complex terrain. The Project has an enormous potential for significant environmental impacts. Therefore, the TOR must be comprehensive to facilitate a thorough review of the Project. The WRD is submitting specific technical comments at this time to ensure they are both part of the public registry and will be considered openly and fairly to improve upon the TOR.

The TOR establishes the nature and scope of the issues that the Proponent must address in the EIS. The WRD is concerned that the TOR as drafted do not contain all of the information requirements identified in the Consolidated Information Requirements (CIR) as released by the Board Chairs Committee in September 2002. The CIR contain a synthesis of the information requirements of regulators and environmental impact agencies under the Cooperation Plan. The CIR were prepared to assist the proponent in the collection of baseline data and to plan for the preparation of a complete environmental assessment report and regulatory applications.

The following contains the WRD suggestions to improve upon certain sections of the draft TOR. The current wording of the TOR is shown in italics, the suggestions of the WRD are added in bold.

7. PROJECT DESCRIPTION

17.1. General Requirements

Provide a description of the Project components and related undertakings and physical activities. The description shall be provided by location; ~~and Project phase,~~ **project components; spatial and temporal boundaries; schedules; cost; and be broken down by Project phase** *including ~~each~~ construction, operation, modification, decommissioning and abandonment. Include both permanent and temporary facilities*

and activities for each phase. Use plans, diagrams, photos, maps, **results of site investigations to establish site parameters,** *preliminary designs and/or design codes, as appropriate, to support the description.*

The location, scale, magnitude, spatial and temporal boundaries of all project components should be documented with emphasis on those components or activities that have the greatest likelihood to create environmental effects. Location maps should include the boundaries of the proposed site, major existing infrastructure, adjacent land uses and any important features.

Specifically, mapping should include:

- **For the pipeline route: maps at an appropriate scale (*e.g.*, 1:250,000) upon which is depicted: the project area; any alternative routes or facility sites studied; the areas of physical environment constraint (biophysical and land use or natural resource use) which limit pipeline route or facility site location; the proposed general route; and the approximate locations of all proposed ancillary facilities such as compressor, pump and meter stations, production platforms, and storage facilities; and**

- **For specific project components: maps at an appropriate scale (*e.g.*, 1:50,000) upon which is depicted: the study area, any alternative facility sites studied, the areas of physical environment constraint (biophysical and land use or natural resource use) which limit facility site location, the locations of all proposed ancillary facilities such as compressor, pump and meter stations, production platforms, storage facilities; staging areas, quarry sites and all other support facilities; and**

- **For the pipeline route where it intersects or traverses community boundaries: maps at an appropriate scale (1:10,000) upon which is depicted community infrastructure, the limits of all Block Land Transfers, municipal boundaries and Development Control Zones.**

Describe any relationship or interdependence of the Project to any previous and/or existing projects or projects under consideration (future expansion or changes, how these can be accommodated with current proposal). Provide the schedule for all project phases and activities and a statement committing the proponent to implement the project as described.

All sources of information should be accurately documented; copies of unpublished references should be provided. If additional studies are planned, a full description of these studies, their purpose, schedule, and the end use of the information to be collected should be included. Limitations to the usefulness of existing baseline information should be documented.

7.2. Cost, Workforce, Schedule, Community Resources and Boundaries

For each Project phase, describe:

Cost
- the capital cost of the Project by phase and location
- any other costs that may be incurred

Schedule
- *the scheduling and relative timing and duration of major activities*
- *the factors that influence scheduling or that could cause schedule changes*
- **the proposed start date**
- **commitment to the schedule for the proposed construction period**

Boundaries
- the spatial and temporal boundaries for facilities, undertakings and activities, including the rationale for their delineation

Workforce
- the personnel requirements by occupation and/or skill
- the numbers of workers
- the duration of work

Community Resources
- any community resources that will be drawn upon including but not limited to accommodation, medical services, and sewage disposal

7.3. Proposed Facilities

Describe the main components of the Project, including:

Permanent structures and infrastructures:

1. *wells*
2. *gathering lines (length, diameter, above ground/buried, etc.)*
3. *processing and storage facilities*
4. *compressor stations*
5. *cathodic protection*
6. *valves and meters*
7. *pigging facilities*
8. *communications systems*
9. *access roads* **and bridges**
10. *any other transportation infrastructure (airport, air strip, etc.)*

- **transmission lines**
- **aerial stream crossings**

- **power supply facilities and transmission lines**
- **waste management facilities**
- **barge landing sites**
- **maintenance facilities**
- **spill – emergency response facilities**
- **helipad sites**
- **monitoring facilities**
- **quarries and borrow pits**

7.4. Land Requirements and right-of-way (ROW) dimensions

Provide

- *dimensions and location of the facility sites and ROW*
1. *size and location of any temporary work room*
2. *ownership of lands* **and land tenure** *needed for permanent or temporary use*
3. *zoning and/or other planning designations*
- **authorizations needed for the use of the land (permits, access agreements, leases, etc.,)**
- **latitude required to implement changes in Project location (e.g. ROW, facilities, etc.)**

37.5. *Construction Phase*

Identify and describe all physical works and related undertakings, as well as, physical activities carried out in respect of the Project during the construction phase including:

Activity

1. *type*
2. *location*
3. *timing*
- *frequency and duration*

Transportation of Materials, Equipment and Workers

- *access type (land, water, air) and location*
1. *amount of material or equipment and the number of workers being transported at a given time*
2. *timing*
3. *frequency and duration*
4. *locations*
5. *type of transportation*
- **delivery of hazardous materials, explosives (TDG)**

Equipment Requirements

1• types
2• numbers
• duration of work

Temporary facilities and physical works:

1• access roads, including winter roads
2• equipment receiving, handling and storage areas, including barge landing sites
3• machinery and fuel stockpile areas
4• temporary work room
5• shoo-flys
6• disposal sites for domestic and construction waste
7• drinking or waste water treatment and distribution facilities
8• wastewater treatment facilities
9• borrow pits or any other sources of granular materials
• fuel and hazardous materials handling and storage areas

Work Camps:

1• location
2• description of the facilities
3• size and capacity
4• duration and timing of use
5• drinking water supply source
6• method of managing wastewater and sewage, including any discharge areas;
7• location and operating conditions of the solid waste disposal site
8• power supply (generator capacities, location, etc.)
9• management of any other installations (including fuel storage depots) required for the camps to function properly
• indication whether some of the camps will become permanent or be made available for various local parties interested in reusing them

Major Activities

1• site preparation and site clearing including vegetation, soil, and rock removal, and associated disposal or storage methods
2• moving of buildings and other structures or infrastructures
3• forest clearing, recovery and elimination of wood wastes for all Project areas
4• blasting activities, including explosives transportation, manufacture and storage in water and on land
5• permafrost layer disruption
6• excavation, **backfill** *and grading*
- **slope stability (e.g. use of wood chips for insulation)**

- **identify and re-establish cross drainage**
- **installation of long-term monitoring facilities**
- **ditch wall logs**

Watercourse Crossings - **Replace entire section with the following:**

Permanent Watercourse Crossings

Provide a list of all streams and lakes/ponds being crossed by the gathering system, mainline gas line and liquids line. Establish a unique identifying number for each crossing, as well as the corresponding pipeline KP.

At all water crossings defined by the above list, provide the following physical characteristics:

- **Stream type: single; split-channeled; braided; lake/pond**
- **Setting: valley/floodplain; gully; entrenched; wetlands/muskeg/peatland**
- **Valley top/bottom widths; depth**
- **Stream width**
- **Channel stability**
- **Channel bed/bank material**
- **Drainage area**
- **Presence of permafrost: valley slopes; floodplain**

For all water crossings, identify each as 'minor', 'intermediate' or 'major'. The proponent may establish his own system of separating water crossings into these three categories, but one approach would be:

- **channel width < = 12 m (minor)**
- **>12 M < = 30 m (intermediate)**
- **> 30 m (major)**

Generally: 'typical' crossing designs apply to 'minor' crossings; 'major' crossings need to be designed (there may be scour, erosion, stream control or valley wall stability issues); 'intermediate' crossings will likely require special water control methods during construction.

Identify the locations and periods of record for active and inactive hydrometric stations located within the Mackenzie River basin downstream of Ft. Providence and the Liard River confluence. Identify studies and reports that address hydrologic matters, including ice and ice jam characteristics relevant to the identified water crossings. These form the baseline data and documented set.

For major crossing streams, provide the following hydrologic characteristics:

- **flood frequencies**

- monthly average flows
- low flows (winter)
- freeze-up and breakup dates (typical and range)
- ice cover thickness
- ice jam potential
- whether stream is tidally-influenced and/or subject to storm surges

For intermediate crossing streams, provide the following hydrologic characteristics:

- flood frequencies
- low flows (winter)
- freeze-up and break-up dates (typical)
- ice cover thickness
- ice jam potential

For minor crossing streams, provide the following hydrologic characteristics:

- low flows (winter)
- type of ice cover (aufies; thermal ice and interflow)
- ice cover thickness

Temporary Watercourse Crossings

Identify locations on streams to be crossed by access roads. At all road watercourse crossing sites identified, provide the following physical characteristics:

- Stream type: single; split-channeled; braided; lake/pond
- Setting: valley/floodplain; gully; entrenched; wetlands/muskeg/peatland
- Valley top/bottom widths; depth
- Stream width
- Channel stability
- Channel bed/bank material
- Drainage area
- Presence of permafrost: valley slopes; floodplain

Hydrological characteristics to be provided include:

- low flows (winter)
- flood frequencies
- winter ice characteristics

Barge Landing Sites

Identify all barge landing sites. For all barge landing sites identified provide:

- **topography of the bed and bank**
- **bank stability**
- **presence of permafrost**
- **ice jam potential**
- **operational period**
- **dredging requirements**

Hydrotechnical characteristics to be provided include:

- **flood frequencies**
- **open water monthly averaged discharges**

Testing of the Pipeline Prior to Use

1• methods
2• timing
- **source of testing materials**
- **disposal of testing materials**

Clean-up and Restoration

1• activities
2• timing
3• final condition of work area
4• criteria selected to measure clean-up success (quantitative and qualitative)
- **as built surveys and installation of permanent survey hubs**

7.6. Operation and Maintenance Phase

Describe the operation of the major Project components and activities, including:

Operation of Facilities

1• wells, pipelines, valves, compressor stations, processing and storage facilities
2• access and transportation systems (air, land and water), with estimates of traffic types, frequency and duration
3• worker accommodation
4• communication systems
5• solid and liquid waste storage, handling and treatment facilities
6• Project systems with air and water effluents and emissions
7• storage, handling and disposal of hazardous materials including explosives and petroleum products
8• power generation and distribution
- **risk management program**

Maintenance and Repair

1• anticipated repair and maintenance activities, and associated undertakings, that could result in interactions with the environment, including replacement of Project components, blowdowns or venting of natural gas
2• general locations
3• timing
4• duration and frequency
5• type of transportation

Inspection, Monitoring and Surveillance (see also section 21.1 Facility Monitoring)

1• methods and related mode(s) of transportation
2• general locations
3• timing
• duration and frequency

Modification

1• description of any anticipated modifications to the physical works or activities described above
2• locations
3• timing
• duration and frequency

7.7. Decommissioning and Abandonment and Restoration *Phase*

Provide the regulations, industry standards and government agreements with respect to the end of the construction phase, including any plans for mitigating social and economic impacts related to the end of this phase. Describe the reclamation procedures during and after construction, including:

- **soil and reclamation material salvage and handling procedures**
- **soil replacement and re-vegetation**
- **re-establishment of self-sustaining topography, drainage and surface watercourses**
- **restoration and/or replacement of habitat**
- **constraints to reclamation (e.g., timing, availability of material, and influence of process and cycles).**

Provide the regulations, industry standards and government agreements that are required with respect to the closure phase of the project including any plans for mitigating social and economic impacts of closure.

Detail the restoration concepts and objectives, including proposed end land use and other factors necessary for the abandonment and restoration plan to be implemented, and consideration of pre-development information related to land capability, vegetation, forest productivity, recreation, wildlife, fisheries, birds, aesthetics and land use.

Present the methods to be used for the clean-up of any contaminants found on site, as well as the methods to be used for the disposal of all equipment and all wastes, including specific disposal sites.

Describe the proposed approach to, and conceptual plans for, decommissioning or abandoning Project facilities, including demolition, site clean-up, **standards of closure** *and rehabilitation activities.*

Specify ownership, transfer, and control of the different Project components and responsibility for maintaining the integrity of decommissioned or abandoned facilities. Include, but not be limited to:

Temporary Facilities:

1• work camps
2• access infrastructure
3• fuel storage areas
4• borrow pits
5• waste disposal
6• equipment staging or storage areas
• temporary work room

Permanent Facilities

1• wells
2• pipelines (gathering and transmission)
3• compression and processing facilities
4• valve and meter station sites
5• communications systems
6• access
7• worker accommodation
- **aerial stream crossings**
- **power supply facilities and transmission lines**
- **waste management facilities**
- **barge landing sites**
- **maintenance facilities**
- **spill – emergency response facilities**
- **helipad sites**
- **monitoring facilities**
- **quarries and borrow pits**

Monitoring (see also sections 21.1 Facility Monitoring and section 23 Monitoring)

1• Project components
2• monitoring requirements and criteria
3• frequency, timing
4• reporting
5• responsibility
• type of transportation

Estimate the present day costs associated with closure and reclamation. Specify any reclamation modeling and what models have been used to arrive at the estimated costs for reclamation.

17.8. Need for, purpose of, and alternatives to the Project

- **This section needs to be moved to following 7.1 General Requirements.**

Describe, from the perspective of the Proponent, the need for, **objectives** *and purpose of the Mackenzie Gas Project. The need for the Project is defined as the problem or opportunity that the Project is intending to solve or satisfy from the perspective of the Proponent and should clearly identify the fundamental rationale for the Project.* **Document any important factors (*e.g.*, timing to meet market needs) affecting project need. If the project objectives relate to broader private or public sector policies, programs or plans, this relationship should be documented to assist in placing the project's objectives in a broader context.**

Describe alternatives to the Project, which are defined as functionally different ways to achieve the Project need and purpose.

For each alternative, the Proponent shall describe any criteria used to identify the major environmental, social, cultural, economic and technical costs and benefits of the alternatives considered.

7.9. Alternative Means of Carrying out the Project

Identify the technically and economically feasible ways that the Project can be carried out and summarize the Proponent's consideration of alternative means. Detailed discussion of specific issues may be cross-referenced and provided in other sections of the EIS (e.g., selection of construction methods at watercourse crossings). At a minimum, the discussion of alternative means should include:

Facility Siting and Routing:

1• wells
2• pipeline routes (gathering and transmission)

3• *processing facilities at the northern terminus*
4• *compressor stations and valve sites*
5• *access roads (temporary and permanent)*
6• *temporary work room*
7• *work camps*
8• *equipment and materials landing and storage areas*
9• *disposal sites*
- **barge landing sites**

9. EXISTING ENVIRONMENT

19.1. Introduction

The description of the existing environment characterizes the setting and state of the physical, biological and human environments in which a Project is proposed to be situated. It provides the foundation for predicting Project-related impacts on the environment.

The description of the environment should, when read in combination with the Project description (section 7), allow the Panel to reasonably identify and understand the selection of Valued **Ecosystem** ~~*Environmental*~~ *Components (VECs) (section 10.1), potential interactions, and potential impacts that may be caused by the Project.*

Where possible, the description should identify and explain important interrelationships in the environment, its processes and systems (e.g., the contribution of the Mackenzie Delta to critical habitat, population stocks, the presence of particular species in select areas, the harvesting economy in important community harvest areas, or the levels and range of services provided by regional centres). The inclusion of maps, photos or other diagrams to illustrate key points is encouraged.

In describing the existing environment, consideration must be given to the current state, including trends and recent changes. The description of the baseline, while necessarily relying on recent and current data, must recognize that the dynamic nature of the environment. To assist in identifying and accounting for trends and changes in the environment that are unrelated to the Project:

21. *describe any substantive changes to the environment of the Project area that have occurred since circa 1940 and indicate whether those changes are ongoing;*

32. *describe how the environment has changed in relation to recent hydrocarbon exploration and mining activities; and*

13. *predict the condition of the environment within the expected lifespan of the Project, if the Project did not proceed. Considerations shall include but not be limited to global climate change,* **changes in permafrost conditions,**

variation in wildlife abundance and distribution, and demographic and socio-economic trends.

An important objective is to distinguish between the Project's effects on the environment, and the effects of other factors, particularly those referenced in (1) and (2) above and the analysis should reflect this intent. ~~without requiring new research for this purpose.~~

19.3.1. Terrain, Geology and Soils

Describe the existing terrain, geology, and soils in the Project area, including a description, location, and geographic extent of the following features, including:

Provide the *regional/area setting, topography and geological, including key terrain features such as mountains, rivers, lakes and other important features.*

Bedrock, Surficial Materials and Soils

1• bedrock type and depth
2• unconsolidated materials
3• landforms
4• soil types, including group, series and type, as applicable

- **soil profile descriptions, including aspects such as horizons, thickness of horizons, texture, colour, chemical properties and organic matter content**
- **areas susceptible to compaction and loss of structure**
- **karst**
- **regional assessment of acid rock drainage potential of exposed bedrock**

5Areas of geotechnical and geological instability, geological hazards and seismicity, **with the potential to affect the Project** *including:*

1• areas of ground instability such as landslides, mudflows, slumping and subsidence **(with risk ranking);**
2• *areas of unstable or metastable soil* **and/or rock**

- **for areas of unstable or metastable soil and/or rock, include an assessment of geotechnical and geological hazards and geothermal regimes that may be encountered during construction and operation of the facilities and an assessment of special designs and measures required to safeguard the pipeline.**

1• fault zones, **including an assessment of activity level**
2• active seismic areas (with risk ranking)
• avalanche zones
• areas susceptible to water, ice or wind erosion and scour

- **identification of potentially liquefiable soils**
- **geotechnical investigations in places where geological hazards could impact the line**
- **migration of river channels in floodplains**

- **relationship between ground instability and permafrost conditions**
- **forest fires inducing geotechnical instability**

1The sources of information and any classification systems relied upon must be referenced and, as necessary, described to assist in understanding the information provided.

Predict and evaluate the potential effects of the project on terrain, geology and soils. Identify mitigation measures, including changes to project design, to effectively minimize or eliminate adverse effects. Identify any residual effects predicted to remain after successful implementation of mitigation measures.

29.3.2. Permafrost

Provide a description **including the use of maps and diagrams** *of permafrost and ice-rich soils in the Project area, including:*

1• continuous, discontinuous and sporadic permafrost
2• permafrost configuration including the frozen/unfrozen interfaces
3• high–ice content soils and thaw-sensitive slopes and stream banks
- **ground ice content**
- **ground temp profiles and envelopes**
- **depth of the active layer**

Describe existing trends related to the distribution and characteristics of permafrost in the Project area. ~~*The use of maps and diagrams is highly encouraged.*~~

49.3.3. Climate

Provide a description of the existing or baseline climate conditions and climatic variability and trends, including, but not necessarily limited to:

• the location of recording stations and length of record for any meteorological data presented including: **Tuktoyaktuk, Inuvik, Norman Wells, Fort Simpson and Hay River**
1• prevailing climatic conditions, seasonal variations, predominant winds including direction and velocity, temperature and precipitation (snow, **depth of snow on the ground, snow water equivalent,** *rain, fog)*
2• spatial and temporal boundaries for the description of climate
3• any current climate-related extreme events that may affect the Project, and frequency of occurrence

5

6In support of the baseline description:

1• identify the spatial boundaries for the description of climate conditions (e.g. any regional scale(s))

2• *define the 'current' climate normal period (baseline period) relied upon, ~~and~~ describe how it was determined* **and any trends occurring within the normal period**

3• *identify any guidelines followed when describing the baseline period (e.g. IPCC[3] 1999 guidelines)*

4• *identify the location of recording stations and length of record for any meteorological data presented*

• *identify any synthetic climate data generated for the purposes of establishing the baseline climate conditions and describe the models used to generate this information*

19.3.6. Water quality and quantity

Provide a description and maps of the existing water resources within or near the boundaries of the Project area including:

1• *waterbodies, watercourses and major drainage areas*

2• *watercourses that have year round flow*

3• *the extent of connectivity to adjacent watercourses*

- **ephemeral drainage areas**

2

3*For each major drainage, drainages or major watercourse, as appropriate, provide a description of it hydrological characteristics, including:*

1• *flow regimes*

2• *seasonal flow patterns*

3• *channel and bed stability*

4• *freeze/thaw timing*

5• *variability and sources*

- **channeled and unchanneled surface water flow**
- **floodway and floodplain data**

3*In the vicinity of communities and site-specific Project components (e.g., compressor stations, valves), describe:*

1• *flood regimes*

2• *ice-jamming and scour*

4

5*In each major drainage, identify locations of existing and planned water use (domestic, municipal, camp, etc.) in relation to proposed facilities. For each area* **potentially impacted by Project activities** ~~*of water use that may be affected by the Project,*~~ *identify:*

1• *quantity of use*

2• *existing water quality, including federal and territorial guidelines or criteria*

3• *seasonal or other temporal variation of water quality and use*

4• *existing sources of water quality impairment and their locations in relation to Project facilities*
- **waterbodies and watercourses used for subsistenence purposes, and describe the nature of use**

2*Provide a description and maps of existing groundwater resources within the Project area, including:*

1• *quality and quantity*
2• *hydrogeological conditions, including depth, flow patterns, recharge and discharge areas*
• *existing and planned water usage*

3
Predict and evaluate the potential effects of the Project on surface and groundwater resources and their users, including, for example, any changes in permafrost or ground thermal regime that may result in release of increased sediment loads to waterbodies.

Identify effective mitigation measures proposed to minimize or eliminate these potential effects. Also, identify any residual effects predicted to remain after successful implementation of mitigation.

19.4.2. Vegetation

Provide a description and maps of the existing vegetation in the Project area, including:

- *vegetation and vegetation assemblages*
- *any classification system followed, as appropriate*
- *identification of species or assemblages that are rare, valued, protected or designated (e.g., vulnerable, threatened, endangered)*
- *for species of concern (see section 12.1), also describe specific location, population status, limits and size, sensitivity and limiting factors*
- *historic and current human use of vegetation, including subsistence and commercial harvesting, (e.g., medicinal herb gathering, berry picking, forestry)*
- *locations and quantities of merchantable timber*
- **identify areas where forest fires have occurred**
- **assess the potential for forest fires in the project area**

10. IMPACT ASSESSMENT METHODOLOGY

10.1. Selection of Valued Ecosystem ~~*Environmental*~~ *Components*

It is not appropriate to leave selection of VECs entirely up to the proponent. Several must be specified in order to be sure that they will be considered. The Northwest Territories Cumulative Impact Monitoring Program (http://www.nwtcimp.ca/searchVC.html) has identified the following water related VECs:

- **water and sediment quality**
- **water quality**
- **snow, ground ice and permafrost**

11. PHYSICAL ENVIRONMENT IMPACT ANALYSIS

1*11.1. Terrain, Geology and Soils*

2Describe and evaluate the potential impacts of the Project on terrain, geology and soils, including a consideration of:
3
1• slope and soil stability
2• terrain profile (e.g. impacts related to subsidence)
- **erosion**
- **seismicity**
- **acid rock drainage**

1*11.2. Permafrost*

4Describe and evaluate the potential impacts of the Project on permafrost, including a consideration of:
1• permafrost
2• ice rich soils
3• thermokarst development
- **frost heave**
- **interaction with permafrost of pipe operating under chilled conditions**
- **pipe - soil interactions (thermal, displacement)**

1*14.1. Climate Change*

2Climate change is defined by the United Nations Framework Convention on Climate Change as, "a change of climate which is attributed directly or indirectly to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over comparable time periods". Climate change, as opposed to climate variability, is considered to be changes over relatively long periods of time (e.g., 30 years) that do not represent variability around average values for year-to-year or decade-to-decade.

Describe how any changes to the climate in the Project area could affect the Project over its lifespan **using the Canadian Environmental Assessment Agency entitled "Incorporating climate considerations in environmental assessment: general guidance for practitioners, November 2003".**

Future conditions:

To assist in the evaluation of how climate change could affect the Project over its lifespan, provide ~~*a scenario of possible future climate conditions*~~ **a range of climate scenarios representing both mean and upper level forecasts of potential climate change in the region should be presented from the GCM simulations approved by IPCC. (Water Resources Division: Climate Change Scenarios for the Mackenzie Gas Project, November 2003).** ~~For certain portions of the Project area, it may be necessary to identify potential changes in sea level that could occur because of climate change.~~
~~More than one scenario may be required to cover the Project lifespan, to address regional differences or uncertainties, or to clarify potential responses of specific climate variables~~. *For any scenario provided, the methodology, resolution, validity, unknowns, assumptions, and level of uncertainty with respect to its development must be provided. In particular, the description of future conditions should:*

1 • *estimate and discuss the extent to which the key weather and climate parameters are projected to be affected by climate change over the Project lifespan. Discuss trends or changes in climate anticipated to occur over the lifespan of the Project; and associated hazards or limitations presented to the Project*

2 • *identify the climate parameters that may change and to which the Project, or Project components, would be sensitive*

2Changes to the Project caused by Climate Change:

Identify the sensitivity of the Project, or Project components, to specific climate parameters.

Describe how changes in these parameters may change the Project over its lifespan. Provide this description in general, by project phase (design, construction, operation etc), by facility type, location, time of year, etc, as appropriate, **including:**

- **ground temperatures and permafrost degradation**
- **sea level changes**
- **water quantity changes**
- **forest fire frequency**
- **winter road access**

Identify any Project-related risk(s) to the public that may be sensitive to changes in climate parameters and describe how any risk(s) may change through the Project lifespan.

Mitigation and Monitoring:

Describe any specific ways in which the Project would be designed, constructed, or operated to reduce the Project's vulnerability to changes in specific climate parameters. Discuss the economic and technical feasibility of each option and, for each feasible option, describe the broad impacts on the environment impacts, including any social, cultural or economic considerations.

Describe ways in which the Project could be designed, constructed, or operated to address any potential risk to the public from the Project that could result from changes in climate parameters.

Identify any planned monitoring of climate parameters or of the Project with respect to climate change (see also sections 22.1 Facility Monitoring and section 23 Monitoring).

120. GREENHOUSE GAS EMISSIONS

2

3Increases in greenhouse gases (GHG) in the atmosphere have been linked to human activity. In this case, Project emissions of GHG may warrant the application of a precautionary approach (see section 3.5 Precautionary Approach).

4

*5*To provide clarity, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) are collectively referred to here as GHG for the purposes of the following information *requirements.*

Identify the sources, quantities, and frequency of Project-related emissions of GHG, including:

1• anticipated during operation of project components and during project activities such as maintenance and repair
2• that could result from accidents or malfunctions
3• that could result from fugitive emissions
- **data on the emissions profile of natural gas production and end users of the gas**

2Identify the various ways that reductions in GHG emissions could be realized, including a discussion on the technical and economic feasibility of options. As appropriate, provide an estimate of emissions volume and frequency for each option considered.

Identify any required permits with respect to the emission of greenhouse gasses from the operation of the Project facilities, including maintenance and repair. Indicate whether permits would be issued for each source of emissions or combination of sources.

1

Describe any relevant federal, territorial or provincial actions and/or initiatives, including policies or accords, that currently exist to identify, track, report or manage GHG.

Present a carbon budget for the Valley, indicating the present carbon sources and sinks, and the present storage of carbon in forests, bogs and wetlands, and how these will be affected by the Project.

Describe the means by which GHG emissions would be managed. Describe any proposed verification, monitoring and/or reporting of GHG emissions that would be carried out during operation, including the identification of facilities, frequency and methods.