6.1.1 DEVELOPMENT APPROACH

The facilities required to recover the hydrocarbon resources from Taglu will be developed with consideration for the environment and current land uses, while meeting the technical, safety and integrity needs of facilities operating in an arctic climate. The results of studies, environmental assessments and public consultation have been considered in the Taglu field development plans.

The field development plans for Taglu are in the definition phase and will continue to be refined as engineering progresses. The plans will also be refined further through a series of consultations and reviews with residents in potentially affected communities, and with other interested parties. Imperial Oil Resources Limited, as field operator for Taglu, has been conducting some of these activities in coordination with the other anchor field operators and with the gathering system and transmission pipeline proponents.

6.1.2 SCOPE OF FACILITIES

The production facilities for the Taglu field will be designed to produce and condition the reservoir fluids to Mackenzie Gas Project gathering system and pipeline specifications. The production facilities include:

- well-site facilities, which will bring fluids from the reservoir to the surface and direct them to the gas conditioning facility
- the gas conditioning facility, which will process the natural gas and the natural gas liquids (NGLs) to meet the gathering pipeline specifications
- process utility systems, which are auxiliary systems required to support the operation of the well site and gas conditioning facility
- infrastructure required to access the site and to construct, operate and maintain the facilities

The Taglu field will be developed in several stages. The activities in the first stage include:

- preparing the site and facility foundations
- drilling five to seven production wells

6.1.2 SCOPE OF FACILITIES (cont'd)

- drilling a disposal well
- installing the gas conditioning facility

Future development activities include:

- drilling additional production wells, about three years after start-up
- installing compression facilities, about five years after start-up
- drilling additional wells and adding compression about 10 years after start-up

Future activities might include drilling a second disposal well, depending on the performance of the first disposal well and the overall water production from the reservoir.

The conceptual design evaluations, and the drilling and production results of the initial wells, might result in a change to the number and location of the wells required. However, this optimization work should not result in material changes to the conceptual development plans for the Taglu field.

6.1.3 EXPANSION CAPABILITY

Although the production facilities will be designed to produce and condition the Taglu reservoir fluids, the gas conditioning facility could accommodate or be expanded to accept additional production volumes. This would depend on the timing and volume of the additional gas, the gas properties, and acceptable commercial arrangements.

6.2.1 SCOPE

The well-site facilities (see Figure 6-1) will gather the fluids coming up from the reservoir through the wellbores, and direct them to the gas conditioning facility.

The well-site facilities will consist of:

- 10 to 15 production wells
- one or two disposal wells
- flow lines
- a manifold facility
- a wellhead refrigeration system

6.2.2 WELLHEADS

Produced fluids from the reservoir will be conducted to the surface through wellbores to the wellheads. Each wellhead will have a main valve (a wing valve), which can be used to shut off the natural gas flow from individual wells.

The wellheads will be located beneath the surface of the drilling pad in a long cellar, which allows access to any well for drilling or servicing with a conventional rig, and provides a heated space for the flow lines and other support systems.

6.2.3 DISPOSAL WELLS

One or two disposal wells are planned as part of the Taglu development. In the initial drilling stage, drilling cuttings and fluids will be injected into a disposal well until production well surface casing annuli are available for injection. The disposal wells will also be used for injecting produced water, workover fluids and, possibly, grey water.

6.2.4 FLOW LINES AND MANIFOLD FACILITY

The flow lines will direct the natural gas from the wellhead to a manifold facility.

6.2.4 FLOW LINES AND MANIFOLD FACILITY (cont'd)

The flow lines will run below the surface of the well pad, through the heated wellhead cellar. When the lines leave the well pad area, they will be insulated and heat-traced, and will run above ground on a pipe rack to the manifold facility. The manifold piping might include chokes for the individual production wells.

The manifold facility will direct the flow from each well to either:

- a production line, for processing
- a test line, for testing

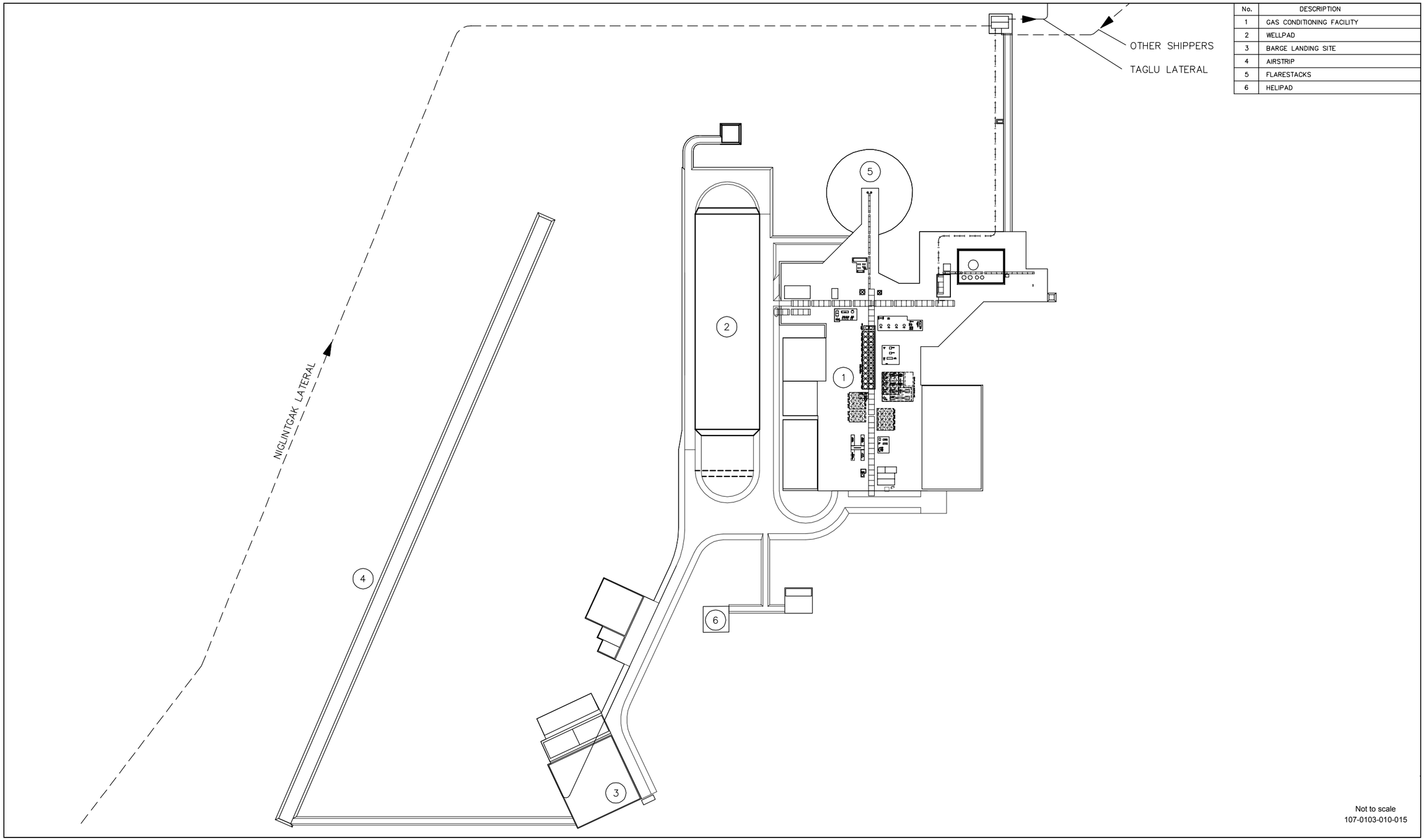
To avoid hydrate formation, the manifold facility might require a line heater to heat the natural gas before reducing the pressure in the flow lines. This will be done before the gas is directed for further processing or testing. The need for a line heater in the first few years of the operating phase will be confirmed as engineering progresses.

6.2.5 WELLHEAD REFRIGERATION SYSTEM

A refrigerant will be circulated in the annular space between the conductor casing and the surface casing of the production wells, to maintain the integrity of the permafrost.

The common refrigeration system will consist of a:

- suction scrubber
- refrigeration compressor
- refrigeration condenser
- refrigeration accumulator



No.	DESCRIPTION
1	GAS CONDITIONING FACILITY
2	WELLPAD
3	BARGE LANDING SITE
4	AIRSTRIP
5	FLARESTACKS
6	HELIPAD

Not to scale
107-0103-010-015

Figure 6-1: Taglu Site Plan

6.3.1 PROCESSING SYSTEMS

The gas conditioning facility (see Figure 6-2) will process the reservoir fluids from the well-site facilities, to meet the specifications of the gathering pipeline. The gathering pipeline will transport the conditioned gas and NGLs to the Inuvik area facility.

The following systems will be part of the gas conditioning facility:

- inlet separation
- dehydration
- product chilling
- produced water handling and disposal
- fluid measurement
- relief and blowdown

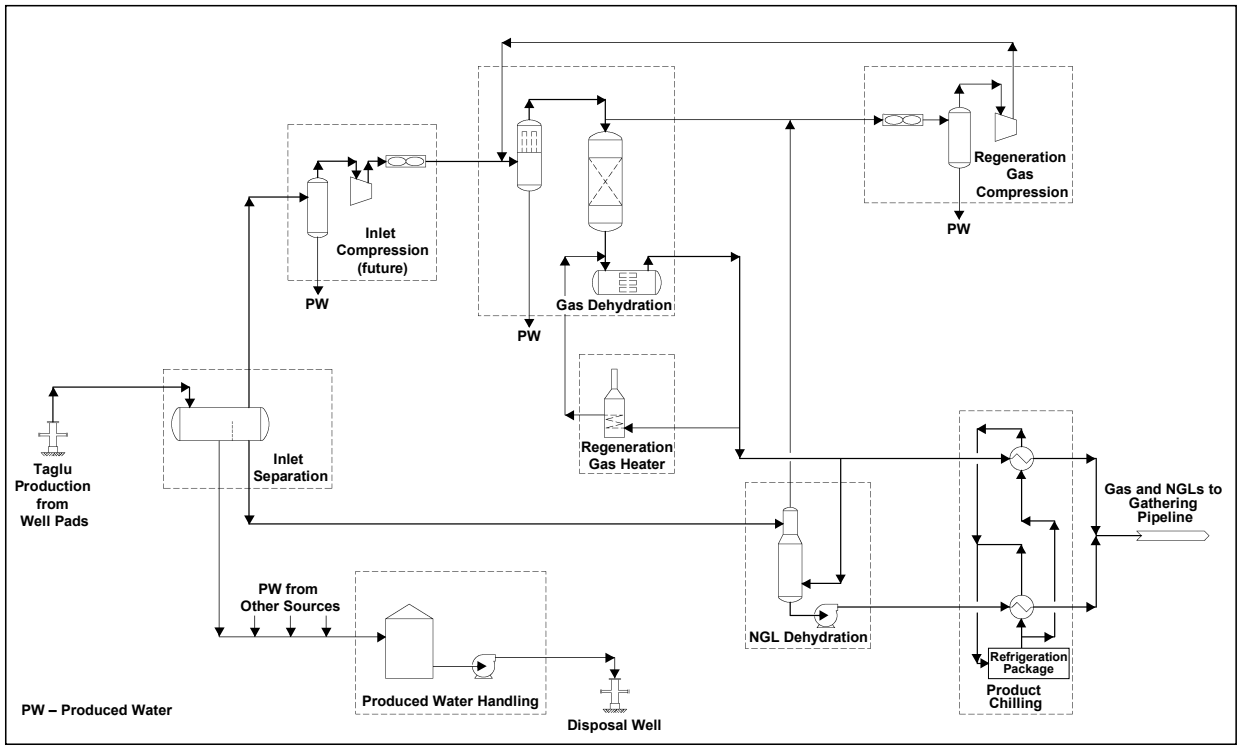


Figure 6-2: Taglu Gas Conditioning Facility Process Flow

6.3.2 INLET SEPARATION

Reservoir fluids produced from the Taglu field will flow from the wellheads, via a manifold facility, to a three-phase group inlet separator, where the liquids will be separated from the gas stream for further processing.

The group separator will be parallel with a test separator, to permit individual wells to be tested. By directing the flow of one well to the test separator, individual well performance can be monitored. The three-phase test separator will separate the gas, NGLs and produced water, then each stream will be measured.

6.3.3 FUTURE GAS COMPRESSION

Initially, compression will not be required, because the flowing wellhead pressure will meet the required operating pressure of the gathering pipeline. However, once the flowing wellhead pressure begins to decline over time, compression will be required to deliver the gas into the gathering pipeline.

The first phase of compression will likely be installed about five years after start-up. Additional phases will be installed as required.

Each compression train will consist of:

- a suction scrubber
- a compressor
- an aftercooler

The suction scrubber will remove liquids from the gas stream that is going to be compressed, because liquids remaining in the gas stream could damage the compressor. An inlet compressor aftercooler is required downstream of the compressor to cool the gas stream, because during the compression process, the temperature of the gas will increase.

6.3.4 DEHYDRATION

Water must be removed from the gas and NGLs, to prevent hydrates from forming in the gathering pipelines. The water removed will be sent to the produced water handling systems for disposal.

The dehydration unit will be composed of:

- a gas dehydration system
- an NGL dehydration system

Gas from the inlet separator will be directed to the gas dehydration unit, where the water vapour in the gas will be removed using a molecular sieve dehydration process. The use of molecular sieve dehydration will be confirmed as engineering

progresses. NGLs from the inlet separator will be sent to the NGL dehydration unit, where the water entrained in the NGL stream will be removed.

6.3.5 PRODUCT CHILLING

From the dehydration units, the gas and NGLs will be sent to the product chilling section of the plant, where the streams will be cooled to meet the gathering pipeline temperature specification. The product-chilling unit will be a mechanical refrigeration system.

6.3.6 PRODUCED WATER HANDLING AND DISPOSAL

Produced water from the inlet separator and the dehydration and compression units will be sent to the produced water flash drum, where dissolved gases and vapour will be flashed from the produced water. The separated vapour will be sent to a low-pressure flare system. The remaining produced water will be sent to a produced water storage tank, where it will be stored before being pumped to a disposal well for downhole injection.

6.3.7 FLUID MEASUREMENT

Liquid and gas meters will be provided on both the single-phase NGL line and the single-phase gas line exiting the Taglu gas conditioning facility. These meters will be used to determine Taglu's portion of the total production. A gas chromatograph might also be used to measure the composition and energy content of the gas and liquid streams as they leave Taglu.

The gas and liquid streams will then be recombined before entering the gathering pipeline for transportation to the Inuvik area facility. The streams will undergo further processing at the Inuvik area facility.

6.3.8 RELIEF AND BLOWDOWN SYSTEM

The pressure relief and blowdown system is a safety system used to lower the gas conditioning facility pressure and to direct hydrocarbon fluids in a safe and controlled manner to the flare system.

The system will be activated automatically during an abnormal event, such as:

- blocked flow
- a fire

It will be manually activated during scheduled events, such as depressurizing for inspection and plant maintenance.

The flare system will consist of a high-pressure system and a low-pressure system to handle all emergency relief and flaring.

6.3.8 RELIEF AND BLOWDOWN SYSTEM (cont'd)

The high-pressure flare system will be a sonic flare and will be designed with a flow capacity that accommodates the largest source supplying the system. The stack height will be determined based on dispersion requirements. Flare technology to be used will be confirmed as engineering progresses.

The low-pressure flare system will be a conventional atmospheric flare with a maximum relief rate that accommodates the largest source supplying the system.

Provision will be made to protect the permafrost from the radiated heat of the flare system.

6.3.9 ALTERNATIVES EVALUATED

During the preparation of the Taglu development plan, facility alternatives were evaluated against a number of criteria to arrive at the preferred alternative. These criteria included:

- safety
- technical feasibility
- environmental impact
- life-cycle cost
- maintainability and operability

An alternative considered was to place the gas conditioning facility on an ocean-going barge. The gas conditioning facility would be constructed offsite and towed to the Taglu site. An area of land adjacent to the Kuluarpak Channel would be dredged and the barge would be grounded in this slip, adjacent to the proposed well pad. Once installed, the facility would operate as it would on land.

This alternative was rejected because:

- excavation of a slip to locate the barge out of the mainstream of the Kuluarpak Channel would result in an environmental footprint comparable to the land-based design

- this excavation would disturb the soils and permafrost at Taglu, and cause additional technical challenges in designing the foundation

- the length and width of the barge required would limit the ability to maneuver through the narrower sections of the river channels, especially the Kuluarpak Channel

6.4.1 SCOPE

The process utilities planned for Taglu include:

- electrical power
- instrument and utility air
- utility heating
- fuel systems
- closed and open drain systems
- chemical inhibition systems

6.4.2 ELECTRICAL POWER

Two on-site electrical power generators will be fuelled by natural gas. The main power distribution module will be designed to accommodate initial power generation requirements and the increased loads for future development of the facility, as required. The expected facility power load is about 2 MW. Each power generator will have the capacity to handle the entire Taglu electrical load.

One diesel generator will generate start-up and standby emergency power. Essential utilities, heat tracing, lighting, uninterruptible power supply (UPS), heaters and exhaust fans will be on the emergency power bus.

6.4.3 INSTRUMENT AND UTILITY AIR

The instrument air system is designed to provide dry air at 689 kPa(g) (100 psig) for use with instrumentation and as utility air. The package will consist of:

- instrument air compression
- an instrument air dryer package
- an instrument air receiver

6.4.4 UTILITY HEATING

A utility heating system will provide a heat source for:

- building heaters

6.4.4 UTILITY HEATING (cont'd)

- drilling pad cellar heating
- tank heating coils
- aerial cooler freeze protection coils
- a high-pressure fuel gas heater
- an inlet gas superheater

6.4.5 FUEL SYSTEMS

Three levels of fuel gas will be required within the facility:

- a high-pressure fuel gas system to supply fuel gas to the compressor gas turbine drivers
- a medium-pressure fuel gas system to supply fuel gas to the power generators
- a low-pressure fuel gas system to supply fuel gas for burners, blanketing, flare pilots and flare header purging

Under normal plant operating conditions, fuel gas will come from the dry gas leaving the gas dehydration unit. A connection to the gathering pipeline will also provide a fuel gas source, if required.

6.4.6 CLOSED AND OPEN DRAIN SYSTEMS

Liquids from vessel and equipment drains will be collected in a hydrocarbon drain drum. Any vapours will be directed to a low-pressure flare knockout drum. Liquids will be pumped intermittently to the hydrocarbon liquid dehydration column.

6.4.7 CHEMICAL INHIBITION SYSTEMS

6.4.7.1 Hydrate Inhibition

Hydrate formation can be prevented by:

- removing the water from the system (dehydration)
- injecting glycol or methanol into the production stream to lower the hydrate formation temperature

Methanol injection will likely be used to inhibit the formation of hydrates in the wellheads and flow lines. The use of methanol injection will be confirmed as engineering progresses.

Hydrates are not expected to form during normal, steady-state operation. The normal operating temperature of the natural gas will be above the hydrate

formation temperature at all of the flowing wellhead pressures and facility operating pressures expected throughout the life of the development. However, hydrate inhibition will likely be required:

- at surface, intermittently, during start-up and shutdown
- subsurface during start-up and shutdown, using an initial charge of methanol per well

6.4.7.2 Corrosion Inhibition

A corrosion inhibition system will be provided, including a:

- corrosion inhibitor pump
- corrosion inhibitor storage tank

The corrosion inhibitor has not yet been selected.

All chemicals will be stored in double-walled tanks to provide secondary containment.

6.5.1 SCOPE

The following infrastructure will be provided for site access and to support facilities construction, operations and maintenance:

- pads and foundations
- a barge landing site
- an airstrip and helicopter pad
- roads
- living quarters
- a control room
- office and administration buildings
- a domestic water system
- a sewage treatment system
- storage
- telecommunication facilities

6.5.2 PADS AND FOUNDATIONS

6.5.2.1 Design Considerations

Two basic foundation designs will be considered to address geotechnical issues at Taglu:

- shallow foundations supported by gravel pads
- pile-supported elevated structures

The current conceptual design is based on pile-supported elevated structures, using adfreeze piles. The piles, which are set in drilled holes and frozen in place, will elevate structures to the required height and provide free airflow between the gravel and heat sources, maintaining the ground temperature. Ground temperature is important in determining the time required to develop the desired adfreeze or freeze back strength.

The foundation design will be further evaluated as engineering progresses.

6.5.2.2 Well Pad and Rig Foundations

The well pad will be either a gravel-filled pad with a matted and fluid sealed surface or a steel deck supported by piles. It will be elevated to protect it from floods. The drilling rig will be supported on piled skid beams over a well cellar that provides shelter for the wellheads and flow lines. Actively refrigerated conductors will maintain the integrity of the foundations.

Important considerations in the design of the well pad and rig foundations include:

- maintaining the integrity of the foundation
- providing the capability for skid-moving the rig
- protecting the environment through the use of a fluid-sealed pad
- positioning the wellhead and production trees at a different elevation from the rig substructure, to facilitate the use of a conventional rig substructure

6.5.2.3 Gas Conditioning Facility Module Foundations

Facility modules will be elevated to the same level as the drilling pad, to remain operable and accessible during possible flooding.

Borrow material will be spread beneath the modules at varying depths, between 1 and 1.5 m thick, to provide a:

- construction travel surface
- firm base for the construction equipment, which will set the modules

Modules will be set on steel piles, which constitute the actual supporting foundation system. This will leave an air space between the surface of the borrow material and the bottom of the modules, to protect the permafrost.

Elevated gravel roads and elevated steel walkways will provide vehicle and foot access between the modules and other parts of the Taglu site.

6.5.3 BARGE LANDING SITE

A dock will accommodate the unloading of facility modules and materials from barges.

6.5.4 AIRSTRIP AND HELICOPTER PAD

A gravel airstrip will be constructed. Because annual short duration flooding of the airstrip is possible, a helipad is also planned.

6.5.5 ROADS

Site roads will be gravel with variations in thickness, depending on location and use. Roads critical to accessing the barge landing, well pad and gas conditioning facility pad on a daily basis will be elevated above the flood level. Secondary roads, such as the access road to the airstrip, will be subject to periodic flooding.

6.5.6 LIVING QUARTERS

6.5.6.1 Permanent Living Quarters

The permanent living quarters will be large enough to accommodate about 15 people. They will be located a safe distance from the well pad and gas conditioning facility.

6.5.6.2 Drilling and Construction Camps

The drilling and construction camps will both be temporary structures. The drilling camp will be sized to house about 130 people, and the construction camp will house about 150 people, during peak activities.

6.5.7 CONTROL ROOM

The control room will be located at the south end of the gas conditioning facility. Because of its location, it will be blast hardened and will have gas detection equipment in the heating, ventilation and air conditioning (HVAC) system.

The control room will have sufficient space for three operators and will have a small amount of office space for visiting staff.

6.5.8 OFFICE AND ADMINISTRATION BUILDINGS

The office and administration buildings will be mechanically heated and air conditioned.

6.5.9 DOMESTIC WATER SYSTEM

Domestic water will be piped to the facilities at the Taglu field. The primary source will be the Kuluarpak Channel or Big Lake. Potable water might be transported to the site rather than being withdrawn and treated on site.

6.5.10 SEWAGE TREATMENT SYSTEM

Solid and liquid waste streams will be generated during drilling, construction and operations. Various disposal options have been investigated to determine the most cost effective and environmentally sound waste management plan for the Taglu facility.

6.5.10 SEWAGE TREATMENT SYSTEM (cont'd)

Sanitary sewage will be biotreated in a sludge-free system that will treat sewage to a level that is acceptable for discharge to the environment or to a disposal well. Effluent will be tested for compliance with the applicable regulatory standards before being discharged. If the effluent does not meet the required standards, it will be recycled through the treating system. Produced water and wash water will be sent to the facilities produced water system for downhole injection.

Domestic waste, including kitchen, office and burnable construction waste, will be incinerated. Residual ash and any solid waste will be temporarily stored on site and disposed of according to the overall Mackenzie Gas Project Waste Management Plan.

6.5.11 STORAGE AREAS

6.5.11.1 Tank Farm

A tank farm will provide on-site storage for fuels, chemicals, produced water and propane.

6.5.11.2 Garage and Warehouses

The garage and warehouse facilities, which will be used by drilling during the first drilling program, will become the permanent garage and warehouse facilities for operations support. These buildings will be heated and will be located at the barge dock.

6.5.12 TELECOMMUNICATIONS FACILITIES

The site will be equipped with a telephone system linked to Inuvik and Calgary by a Geostationary Orbit Satellite network. The network will use the C-Band frequency range. A secondary back-up satellite system will be provided. The recommended medium is a low earth orbit satellite employing an L-Band frequency range. The secondary system will only provide supervisory control and data acquisition (SCADA) data and voice data to each site if the primary system fails.

Hand-held radios will be used for communications between operations and maintenance personnel and the control room.