
TITLE	ISR Private Lands ILA Application Report
SECTION	4: Infrastructure Sites
SUBJECT	1: Swimming Point Infrastructure Site

INTRODUCTION

This subject supports an application for the development of a temporary infrastructure site near Swimming Point. It contains:

- an estimate of the personnel requirements
- a summary of the construction operations
- an overview map showing the site location ([Figure 4-1](#))
- construction equipment estimates
- a description of potential environmental and resource effects

[Figure 4-4](#) is a site-specific map of the Swimming Point infrastructure site. [Figure 4-5](#) is a photograph of the Swimming Point infrastructure site.

Swimming Point is a site that has been previously developed for use by the oil and gas industry. It is currently occupied by Arctic Oil and Gas Services, which rents out accommodations to industry participants. During the 1970s, 80s and 90s, the site was used by industry to support oil and gas exploration. In 2000, the site was upgraded by Petro Canada to support a drilling program.

PERSONNEL

The construction of the infrastructure site at Swimming Point will require three crews: grading, camp construction and mechanical. Each of these crews, of up to 60 people, will be obtained from the main gathering pipeline clearing and grading crews or will be established specifically for infrastructure development. They will initially reside at the existing camp at Swimming Point. The Swimming Point pad will be completed during the winter of 2006-2007 and a 120-person camp will be installed in the summer of 2007.

Initial crews will occupy the 120-person camp at the Swimming Point site in winter of 2007-2008. At full occupancy, this camp will require a camp support staff of about 12 people. These people are included in the 120-person total.

In the winter of 2007-08, the 120-person construction camp will be expanded to a capacity of about 950 personnel. This camp will require a camp support staff of about 86 people. These people are included in the 950-person total.

Construction personnel will occupy the camp over three-winter construction seasons (2006-2007 for right-of-way clearing, 2007-2008 for pipeline construction and 2008-2009 for commissioning and reclamation). Personnel will begin arriving in November of each year. Numbers will peak in mid-winter and

taper off toward spring. A limited camp support staff will remain on the site between construction seasons.

SUMMARY OF CONSTRUCTION OPERATIONS

The land use activities and operations associated with the Swimming Point infrastructure site include:

- developing and operating:
 - a redeveloped seasonal barge landing site
 - an expanded existing airstrip
 - an expanded fuel storage site to support construction activities
 - a stockpile site for the storage of materials, equipment, and pipe, and for construction equipment maintenance
 - sequentially, a 120-person camp expanding to a 950-person camp for worker accommodation during construction activities
 - an existing helipad within the site boundary

Preconstruction Activities

Before site development begins:

- a preconstruction survey will be conducted to finalize the location and site-specific layout
- geotechnical investigations will be conducted, as required, to support engineering of the infrastructure site components

Development Activities

Initial development activities at the Swimming Point site will commence in 2006 and will include clearing, grading and construction of the pad that will support the proposed infrastructure site. The pad material will be obtained from nearby borrow sites on Inuvialuit private land. More detailed discussion regarding the development of borrow sites on Inuvialuit private lands is included later in this application.

Figure 4.1 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.

The temporary infrastructure site will be developed on the north side of the East Channel. By placing all the related facilities together, operational efficiencies can be realized and the overall footprint of construction activities will be reduced.

These related facilities include:

- a module, pipe, material and equipment stockpile
- a fuel storage depot
- a camp
- an administration office
- a helipad

An artist's impression of a 950-person camp layout is shown in [Section 3](#).

Infrastructure Site Access Development

Access to the Swimming Point infrastructure site will be along winter access roads I-B1-W-1.004Pa and I-B1-W-1.004Pb to the East Channel of the Mackenzie River connecting to the gathering pipeline right-of-way at KP-T41.6. Information about this access route can be found in [Section 7.3, Borrow Site 1.004P](#). The proposed alignment of this road is shown in [Figure 4-4](#).

Fuel Storage Depot Development

The fuel storage depot will require the installation of pads of a sufficient depth to permit truck movement around the site and to safely support refuelling activities. The pads will be sufficient to stabilize the traffic areas of the site, to provide a suitable driving surface and to support the fuel tanks. The fuel depot will be located within the overall infrastructure site footprint. Additional information on typical fuel storage depots is provided in [Section 3](#).

Storage tanks will be used to supply the site requirements for electric power generation and gathering pipeline construction equipment. Tank storage for about 400,000 L will be required at the Swimming Point site. These tanks are planned to contain diesel fuel.

The fuel storage depot at the Swimming Point site will be monitored and equipped with management control systems for access, and authorization controls for fuel handling. An emergency shutdown system will also be provided.

Stockpile Site Development

The stockpile at the Swimming Point site will require the installation of pads to permit year-round truck movement around the site and to safely support unloading and storing large loads of pipe, equipment, modules and materials. The pad will be of sufficient depth to stabilize the storage areas of the stockpile site and provide a suitable driving surface for heavy truck traffic. Pad material

requirements, the stockpile layout, and size will be finalized after the preconstruction survey. Typical stockpile sites are discussed in [Section 3](#).

Camp Site Development

Development of the self-contained camp will require the installation of pads of sufficient depth to permit the transport and erection of about 230 modular camp structures. Pad material requirements, camp site layout and size will be finalized after the preconstruction survey. Typical camp layout and services are described in [Section 3](#).

Start-up of camp activities will involve the mobilization of supplies and materials.

Water for the camp will likely be obtained from the East Channel of the Mackenzie River. The water will likely be transported by pipeline from the source to the campsite for use as potable camp water and fire suppression.

Barge Landing Site Development

Existing barge infrastructure at Swimming Point will be used for receiving barge loads of camp modules, line pipe and construction equipment needed for pipeline construction of the four gathering pipeline laterals.

Temporary spud barge landings, consisting of one or more 600 series barges, will be grounded and anchored into the river bank and used as a temporary dock, crane platform and access ramp. Larger 1000 and 1500 series barges will be used to transport materials to the spud barges. The landings will be tied to shoreline mooring points.

Within the ISR, a new temporary spud barge landing will be required at the existing Swimming Point site. The site is currently in use and will require modifications to allow for the addition of the temporary spud barge.

About 0.6 ha of additional near shore area will be required for anchoring, loading and unloading the new barges. An artist's impression of a typical spud barge landing site is shown in [Figure 4-2](#), and a schematic is shown in [Figure 4-3](#).

Figure 4.2 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.

Figure 4.3 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.

Infrastructure Site Operations Activities

The site will act as a staging area for the construction activities of the Niglintgak, Taglu and Parsons Lake gathering pipeline laterals.

Fuel Depot Operations

The fuel tanks will initially be filled by summer barge shipments. Resupply fuel will then be delivered by truck to the fuel depot from the existing main bulk storage facility in Inuvik. This will reduce the size of the depot facilities at the Swimming Point infrastructure site. Required fuel will be delivered from the depot to the construction sites. This will require daily truck traffic from the site's fuel depot during construction.

Stockpile Operations

The stockpile will be used to store line pipe, material and equipment required for construction of the gathering pipelines. These items will be barged from Hay River to Swimming Point along the Mackenzie River and the East Channel.

During the barge-unloading period (about seven weeks each year), trucks will operate continuously until all the required materials have been stockpiled. A preliminary estimate of materials to be stockpiled at the infrastructure site includes about 18,500 tonnes of pipe and 3,780 tonnes of camp modules and supplies. A list of the equipment that might potentially be stored at the site is included under the topic "Equipment" later in this section.

During construction, the material required for constructing the project will be hauled from the stockpile site and set in place at the infrastructure site. When construction is underway, truck activity will occur along the proposed 1.004P borrow site winter access road and the East Channel of the Mackenzie River.

Camp Site Operations

The camp at the Swimming Point infrastructure site will be used to feed and house construction personnel. The largest element of camp operations will be the catering and housekeeping for the residents. Other activities include the maintenance operations of the camp and restocking of fuel and supplies by truck.

Daily transport of personnel will be required during construction activities along the gathering pipeline right-of-way, and to and from the Swimming Point infrastructure site. This will be accomplished with buses and light trucks. Food and other supplies might be trucked in periodically from Inuvik. Daily water requirements (about 227 L per person daily or 216 m³ daily at full occupancy) will be shipped by pipeline a short distance from the Mackenzie River.

The camp will have attendants and facilities to handle medical situations as they arise. All project camps will have a zero tolerance policy for alcohol and illegal drugs.

Barge Site Operations

A 600-Series spud barge will be used for unloading cargo barges of pipeline materials, pipeline construction equipment and construction consumables for the Mackenzie Gas Project's construction activities. The spud barge will be berthed at the barge landing site for several weeks each season, to unload that season's materials.

Barges will be required to deliver the necessary construction materials to the Swimming Point infrastructure site each season. This material includes about 32,400 tonnes of pipe and associated pipeline transport and construction equipment during each of the two seasons.

About six 1500 Series cargo barges could be moored simultaneously near the barge landing site while waiting to be unloaded. These barges will be moored where they will not interfere with other river traffic or cause safety concerns. The immediate shore area will not need to be disturbed for mooring, as the cargo barges will be moored in the Mackenzie River. The mooring distance from the shore will depend on water depth and the draft of the barges. Tie lines to temporary mooring points on shore, such as mooring screw anchors or anchor blocks, will be required to secure the barges to the shore while they are waiting to be unloaded. The temporary mooring points will be re-established each operation season, if they are damaged or destroyed by spring ice flows.

Helipad and Airstrip Operations

The purpose of the airstrip and helipad associated with the Swimming Point infrastructure site is to support construction and operation of the project and to allow year round access to the site.

ENVIRONMENT

The following topics provide specific biophysical and human environment setting effects and mitigation information for the Swimming Point infrastructure site. This information includes data gathered during the 2004 field programs.

Biophysical Environment

Air Quality Setting

The air quality setting for this site is expected to be similar to the regional setting for the ISR described in [Section 8](#).

Air Quality Potential Effects and Mitigation

Potential effects on air quality associated with the development of the Swimming Point infrastructure site, such as dust, vehicle and equipment emissions, are expected to be limited and localized. Site-specific effects and mitigation are expected to be similar to regional effects and mitigation for the ISR, described in [Section 8](#).

Noise Setting

The noise setting for this site is expected to be similar to the regional setting for the ISR described in [Section 8](#).

Noise Potential Effects and Mitigation

Potential effects on noise levels associated with the Swimming Point infrastructure site are expected to be low, and limited to vehicle and equipment operation. Site-specific effects and mitigation are expected to be similar to regional effects and mitigation for the ISR, described in [Section 8](#).

Soils, Landforms and Permafrost Setting

This infrastructure site covers a northwest-trending glaciofluvial outwash plain that is bordered by alluvial floodplain deposits of the Mackenzie River. The site lies in a narrow zone of intermediate discontinuous permafrost along the Mackenzie River and is characterized by soils of the Cryosolic Order. The ground conditions were investigated on the glaciofluvial outwash terrace about 250 m to the northwest of the infrastructure site. At this location, the outwash plain consists of a channelled glaciofluvial terrace that stands above the Mackenzie River floodplain. The top of the terrace is flat with gently sloping sides that range from 5 to 10% slope. An Orthic Dystric Turbic Cryosol was developed of the surficial materials. The permafrost table was encountered at a depth of 30 cm in July 2004. Upper layers of the permafrost table contained about 20% visible ice crystals.

Soils, Landforms and Permafrost Potential Effects and Mitigation

Landform-related environmental effects are not predicted for the Swimming Point infrastructure site because the glaciofluvial sediments are imperfectly to rapidly drained and gently sloping. Slopes at the edge of the glaciofluvial terrace will be excluded from disturbance by a buffer. Portions of the winter access roads from the Swimming Point infrastructure site to the gathering pipeline right-of-way will be constructed over the frozen Mackenzie River. These access roads might locally ascend slopes near the river's edge. These areas might be sensitive to erosion following potential disturbance of the surface layer. Construction of pads on the site will result in soil loss because the pads will be placed directly on the surface material.

General mitigation strategies to offset potential effects are outlined in [Section 8](#).

Vegetation Setting

The Swimming Point infrastructure site is composed of a camp site, barge landing site and airstrip. The barge landing site and airstrip are currently in operation and do not support vegetation. Therefore, vegetation surveys were limited to the proposed camp site and associated access road.

The area for the proposed Swimming Point Camp is level to gently sloping and is primarily covered in dwarf shrub heath vegetation. There is some of the high-centred polygon vegetation type in the lower lying northern corner of the proposed camp site. A reconnaissance survey of the site and surrounding area was conducted in 2002, and an area of dwarf shrub heath was surveyed for rare plants in 2004.

The areas of shrubby vegetation at this site are characterized by a moderate cover of dwarf (less than 1 m tall) shrubs including green alder and ground birch. Nonvascular plant species, notably reindeer lichens, are the dominant constituent of the ground layer, although northern Labrador tea also comprises a large amount of the ground cover (25%) in the area surveyed. Other species seen observed include red bearberry, cloudberry, sweet coltsfoot and mountain cranberry.

The high-centred polygons have not been surveyed. Surveys in similar areas of the region indicate they are characterized by a network of raised peat dome centres vegetated with dwarf shrubs similar in composition to the dwarf shrub heath vegetation type surrounded by wet or water-filled troughs dominated by grasses and sedges.

Proposed access to the camp from the Mackenzie River will cross a small area of delta sedge-cotton-grass vegetation, which will require the creation of a new disturbance. About half of the access will cross previously disturbed areas, which are currently in use. Based on air photograph interpretation and aerial reconnaissance, all vegetation types associated with the proposed development are locally and regionally common.

Vegetation Potential Effects and Mitigation

Developing this infrastructure site will affect vegetation because of:

- winter access road construction and use
- removal and mechanical damage of vegetation
- potential changes in site drainage arising from the construction of the camp facility and the modification of the existing barge landing site

Recurrent mechanical damage to potentially sensitive riparian vegetation might also arise because of the seasonal removal and subsequent re-installation of spud barges for as long as this site is used by the project.

Effects on vegetation resulting from camp construction will persist for as long as the camp is in use and are likely to extend into the far future (effect extends beyond 30 years past decommissioning and abandonment), given the slow rate of vegetation growth in the North. Vegetation growing in association with gravel pads might develop into a different vegetation community than what was there before development. Shrub heights and densities along winter access roads are likely to take decades to reach predisturbance levels following brush cutting. In addition, introductions of reclamation species and potential accidental introductions of invasive non-native plant species might occur.

Wildlife Setting

The barge landing site and airstrip are currently in operation and do not support wildlife habitat. As a result, wildlife surveys were limited to the proposed camp site and associated access road route.

Wildlife habitat at the proposed camp site is composed of dwarf and upland shrubs, primarily birch, willow and alder. These habitat types are common in the region. The proposed camp site is located near the existing airstrip and work site, and thus likely experiences some human disturbance. The area exhibits low habitat diversity, and no important wildlife features were identified at the site.

The access road to the infrastructure site crosses delta shrub, riparian shrub associated with the Mackenzie River, and riparian sedge-cotton-grass habitats. Willow is the dominant shrub species present. The river valley, adjacent wetlands, and abundance of browse, such as willow, are key habitat features associated with the access road. The diversity of habitats along the access road likely supports a variety of wildlife species.

Key wildlife species or their sign were not recorded at the camp site or along the proposed access road route during field surveys, with the exception of moose sign recorded along the access road. Key species are species selected because of their importance in the subsistence economy or because they are listed as species of conservation concern or a species of particular ecological importance.

Habitat quality for key wildlife species, as determined by the presence of key habitat features, such as percent cover of forage species, is summarized in [Table 4-1](#). Overall, the camp site provides moderate quality foraging habitat for barren-ground caribou, and moderate spring and fall foraging habitat for grizzly bear, as well moderate quality nesting habitat for tundra swan and whimbrel. The site is flat and is not suitable as grizzly bear denning habitat. The access road is considered to provide high quality spring foraging habitat for grizzly bear, greater

white-fronted goose, tundra swan, and whimbrel, and high quality nesting habitat for Arctic tern.

Overall habitat quality for wildlife at the Swimming Point camp site for wildlife, based on habitat complexity and diversity, habitat rarity, proximity to disturbance, and wildlife species occurrence, was considered low to moderate for mammals and moderate for birds. The access road was considered to have moderate quality habitat for both mammals and birds. The habitat types at the site are common in the region, and an existing disturbance occurs at the site.

Table 4-1: Habitat Quality for Key Wildlife Species at the Swimming Point Infrastructure Site and Access Road

Group	Species	Habitat Use	Habitat Quality ^a	
			Swimming Point Camp	Access Road
Mammals	Barren-ground caribou	Winter foraging	Moderate	Moderate
	Grizzly bear	Fall foraging	Moderate	Moderate
		Spring foraging	Moderate	High
		Denning	Low	Low
Birds	Greater white-fronted goose	Nesting	Low	Moderate
		Foraging	Low	High
	Snow goose	Nesting	Low	Low
	Tundra swan	Nesting	Moderate	Moderate
		Foraging	Low	High
	Scaup	Nesting	Low	Moderate
	Peregrine falcon	Nesting	Low	Low
	Whimbrel	Nesting	Moderate	Moderate
		Foraging	Moderate	High
	Arctic tern	Nesting	Low	High
NOTE: ^a Habitat quality was determined by comparing the vegetation/terrain characteristics at each site to each species' habitat requirements (such as shrub availability for moose).				

Based on habitat availability a variety of species might inhabit the infrastructure site. These include several species that have special status designation at the national and territorial levels, as determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Department of Environment and Natural Resources (ENR, formerly RWED). These species are summarized in [Table 4-2](#).

Table 4-2: Special Status Species That Might Occur at the Swimming Point Infrastructure Site and Access Road

Species	Status ^a			
	ENR ^b	COSEWIC ^c	SARA ^d	IUCN ^e
Grizzly bear (northwestern population)	Sensitive	Special concern	Schedule 3 – special concern ^f	Lower risk – least concern
River otter	Sensitive	-	-	Lower risk – least concern
American golden plover	Sensitive	-	-	-
American tree sparrow	Sensitive	-	-	-
Common snipe	Sensitive	-	-	-
Harris' sparrow	Sensitive	-	-	-
Lesser scaup	Sensitive	-	-	-
Long-billed dowitcher	Sensitive	-	-	-
Northern pintail	Sensitive	-	-	-
Rock ptarmigan	Sensitive	-	-	-
Short-eared owl	Sensitive	Special concern	Schedule 3 – special concern ^f	-
Spotted sandpiper	Sensitive	-	-	-
Whimbrel	Sensitive	-	-	-

NOTES:
^aA hyphen indicates no status has been assigned for that species.
^bENR – Environment and Natural Resources (formerly RWED)
^cCOSEWIC – Committee on the Status of Endangered Wildlife in Canada
^dSARA – *Species at Risk Act*
^eIUCN – The World Conservation Union
^fSARA status is to be reassigned (i.e., potentially added to Schedule 1) pending results of public consultation, stakeholder consultation and final Ministerial approval.

Wildlife Potential Effects and Mitigation

This infrastructure site and its associated winter access road are composed of low to moderate quality habitat for wildlife. The site has already experienced human disturbance, which likely has affected the wildlife present. Habitat types at the infrastructure site are common in the surrounding area, indicating they are not a limiting resource for wildlife. The site and access road provide moderate and high quality foraging habitat for grizzly bears and moderate quality habitat for caribou. The access road provides high quality nesting habitat for greater white-fronted

geese, tundra swan and Arctic tern. The access road crosses shrubby riparian habitat that provides forage for moose. Neither the road or the infrastructure site provide suitable denning habitat for grizzly bears.

General potential effects resulting from the development and operations of infrastructure sites and access roads on wildlife include direct and indirect habitat loss, disruption of wildlife movements and wildlife mortality. The timing of project activities (primarily winter), as well as the small footprint of disturbances relative to regional habitat availability, suggest that project effects on birds and mammals, including those with special status designation, will be within the range of normal variation. However, specific issues of concern at the Swimming Point infrastructure site include:

- attraction of grizzly bears to the site and potential mortality of problem bears
- displacement of grizzly bears from high quality foraging habitat
- disturbance of nesting birds during summer and potential abandonment of nest sites
- displacement of barren-ground caribou from foraging habitat during winter
- disturbance of barren-ground caribou and disruption of movements
- increased hunting/poaching of caribou resulting from increased access
- loss of riparian habitat along the Mackenzie River during winter access road construction
- disturbance of moose along the access road during winter

Implementing general mitigation measures, as outlined in [Section 8](#), will reduce effects on wildlife during infrastructure site and access road development and operations. Specifically, the following mitigation measures are considered important for this site:

- Develop and implement a waste management plan.
- Avoid known nesting sites (as determined during preconstruction surveys) to the extent practical.
- Reduce activities during the bird nesting season and grizzly bear active period to the extent practical.
- Monitor the occurrence of barren-ground caribou near the site during winter and, to the extent practical, schedule construction activities when caribou are not present in the area.

- Reduce clearing in riparian habitats.
- Establish and enforce regulations to prevent wildlife harassment.

Hydrology Setting

The Swimming Point infrastructure site is located on the banks of the East Channel of the Mackenzie River. A small lake exists between the site boundary and the East Channel. The area encompassing the infrastructure site that contributes runoff to the East Channel is about 8.6 km².

Hydrology Potential Effects and Mitigation

The effect of the potential increase in mean annual flow from the higher runoff coefficient of the disturbed area will be limited because of the existing high water volume and flow rate in the East Channel. The effect of the disturbed area on mean annual sediment concentration in the East Channel is also expected to be limited because of the high background concentration of sediment and the high dilution capacity of the East Channel.

Groundwater Setting

Soils encountered at this site consist of poorly sorted gravel and sand. The depth to permafrost could not be determined. Shallow groundwater is expected to flow towards the East Channel. A talik is expected to underlie the East Channel, however the depth and lateral extent of this talik is unknown.

Groundwater Potential Effects and Mitigation

Groundwater effects and mitigation information for this infrastructure site are expected to be similar to regional ISR data described in [Section 8](#).

Water Quality Setting

The Swimming Point infrastructure site is located on the north bank of the East Channel of the Mackenzie River. Water quality data collected in the East Channel during summer 2002, along with historical data, is summarized in the following section.

Summer pH values in the East Channel of the Mackenzie River were in the range of the aquatic life and drinking water guidelines (see [Table 4-3](#)). Historically, some winter pH values measured in the Mackenzie River were above the maximum drinking water guideline value of 8.5.

The East Channel was well oxygenated in summer. The single recorded historical dissolved oxygen level for winter is below the aquatic life guideline.

Table 4-3: East Channel, Mackenzie River – Water Quality

Parameter	Units	July 30, 2002 ^c	Mackenzie River, East Channel							
			Historical Data (1972–1987) ^{a,b}							
			Summer				Winter			
			Median or Value	Min.	Max.	n ^d	Median or Value	Min.	Max.	n ^d
Field Measured										
pH	N/A ^e	7.8	8.0	8.0	8.0	2	8.2	8.0	8.8 ^w	5
Conductance	µS/cm	240	-	-	-	-	277	190	301	5
Temperature	°C	14.1	15	-	-	1	-1	-	-	1
Dissolved oxygen	mg/L	9.3	9.5	9.0	10.0	2	5.2 ^{b,c}	-	-	1
Turbidity	NTU	284	-	-	-	-	-	-	-	-
Conventional Parameters										
Colour	TCU ^f	28 ^{b,w}	-	-	-	-	-	-	-	-
Conductance	µS/cm	272	-	-	-	-	-	-	-	-
Dissolved organic carbon	mg/L	5	-	-	-	-	-	-	-	-
Hardness	mg/L	124	120	112	120	3	127	125	131	4
pH	N/A	7.8	8.2	-	-	1	-	-	-	-
Total alkalinity	mg/L	90	120	100	137	3	124	123	124	4
Total dissolved solids	mg/L	149 ^g	-	-	-	-	-	-	-	-
Total organic carbon	mg/L	6	18	-	-	1	9	4	11	4
Total suspended solids	mg/L	200	128	51	205	2	6	4	7	3

Table 4-3: East Channel, Mackenzie River – Water Quality (cont'd)

Parameter	Units	July 30, 2002 ^c	Mackenzie River, East Channel							
			Historical Data (1972–1987) ^{a,b}							
			Summer				Winter			
Median or Value	Min.	Max.	n ^d	Median or Value	Min.	Max.	n ^d			
Major Ions										
Bicarbonate	mg/L	109	-	-	-	-	-	-	-	-
Calcium	mg/L	34	-	-	34	34	-	34	34	4
Carbonate	mg/L	<5	-	-	-	-	-	-	-	-
Chloride	mg/L	5	11	-	12	11	1	12	13	4
Magnesium	mg/L	9	-	-	10	10	-	10	12	4
Potassium	mg/L	1	-	-	-	-	-	-	-	-
Sodium	mg/L	6	-	-	-	-	-	-	-	-
Sulphate	mg/L	40	26	-	49	35	1	49	64	4
Sulphide	mg/L	0.004	-	-	-	-	-	-	-	-
Nutrients										
Nitrate + nitrite	mg/L	<0.1	-	-	-	-	-	-	-	-
Nitrogen – ammonia	mg/L	<0.05	-	-	-	-	-	-	-	-
Nitrogen – Kjeldahl	mg/L	1.4	-	-	-	-	-	-	-	-
Phosphorus – total	mg/L	0.118	-	-	-	-	-	-	-	-

Table 4-3: East Channel, Mackenzie River – Water Quality (cont'd)

		Mackenzie River, East Channel								
		Historical Data (1972–1987) ^{a,b}								
Parameter	Units	July 30, 2002 ^c	Summer			Winter				
			Median or Value	Min.	Max.	n ^d	Median or Value	Min.	Max.	n ^d
Nutrients (cont'd)										
Phosphorus – dissolved	mg/L	0.005	-	-	-	-	-	-	-	-
NOTES: ^a A hyphen indicates data not available. ^b Concentrations in boldface are higher than water quality guidelines. ^c Reported value is the average of two split samples. ^d n – number of samples ^e N/A – not applicable ^f TCU – true colour unit ^g Calculated total dissolved solids value is reported. ^h Concentration higher than the relevant chronic aquatic life guideline or outside the recommended dissolved oxygen range ^{D>C} Analytical detection limit is higher than the relevant chronic aquatic life guideline (C). ^w Concentration higher than the relevant drinking water guideline or beyond the recommended pH range										
SOURCES: Historical data – MacDonald et al. 1988; Mann and Snyder 1975; Slaney, F.F. & Company Ltd. 1974a										

Seasonal data is limited for the East Channel of the Mackenzie River. However, at other long-term seasonal monitoring locations in the Mackenzie River, such as, 240 km south of Swimming Point at Tsiigehtchic, turbidity and colour levels were found to be lowest during fall and winter, variable in spring, and peaked over summer. During summer 2002 in the East Channel, the water was moderately coloured, with values above the drinking water guideline. Turbidity and total suspended solids (TSS) levels were high during summer and low during winter.

Major ion concentrations, reflected by total dissolved solids and conductance values, were moderately low in the East Channel during summer 2002. Historical winter conductance values were also moderately low. At other long-term monitoring locations in the Mackenzie River, such as, at Tsiigehtchic, conductance and total dissolved solids levels were found to be generally moderately low, with occasional moderate values. Alkalinity levels were indicative of waterbodies not sensitive to acid deposition.

Total organic carbon concentrations were moderate, total Kjeldhal nitrogen concentrations were high, and total phosphorus levels were indicative of eutrophic (nutrient-rich) conditions. A large proportion of the nutrients in the Mackenzie River are bound to suspended materials and are not readily available for biological uptake. The 2002 summer total phosphorus concentration was probably related to an elevated level of TSS because less than 5.0% of total phosphorus was in the dissolved form.

Metal concentrations were usually below water quality guidelines, with some exceptions (see [Table 4-4](#)). In summer 2002, total aluminum and iron levels were above the aquatic life and drinking water guidelines, and total manganese concentrations were above the drinking water guideline. Elevated levels of these parameters were most likely related to elevated TSS levels in the Mackenzie River. Total chromium, copper, lead and zinc concentrations were also above the aquatic life guideline during summer 2002. These parameters, along with cadmium and silver, are often present at levels above aquatic life guidelines throughout the year at other long-term monitoring locations in the Mackenzie River, such as at Tsiigehtchic.

Hydrocarbon inputs to the Mackenzie River are from natural sources such as:

- natural petroleum seeps
- erosion of petroleum-containing bedrock
- aquatic and terrestrial plants

In the East Channel, historical levels of dissolved polycyclic aromatic hydrocarbons (PAHs), including naphthalene, acenaphthene and fluorine, were below guidelines in the single sample collected.

Most PAHs do not dissolve well in water and tend to be associated with sediment particles. In the Mackenzie River, hydrocarbon concentrations in suspended particulates are low in winter. These concentrations are higher in the open-water season, when river flow and concentrations of suspended sediments are high. Winter levels of naphthalene and 2-methylnaphthalene in suspended sediments have occasionally been above the interim sediment quality guidelines. These PAHs, along with phenanthrene, acenaphthene, fluorene, pyrene, chrysene, benzo[a]pyrene and dibenz[a,c/a,h] anthracene have also been detected at levels above the interim sediment quality guidelines in suspended sediment of the Mackenzie River during the open-water season.

Table 4-4: East Channel, Mackenzie River – Water Quality (Metals and PAHs)

Parameter	Units	Mackenzie River, East Channel	
		July 30, 2002 ^a	Historical Data (1972–1987) ^{b,c} Summer (n=1) ^d
Total Metals			
Aluminum	mg/L	5.55 ^{C,W}	-
Antimony	mg/L	0.001	-
Arsenic	mg/L	0.0021	-
Barium	mg/L	0.156	-
Beryllium	mg/L	<0.001	-
Boron	mg/L	<0.02	-
Cadmium	mg/L	<0.0002 ^{D>C}	-
Chromium	mg/L	0.0075 ^C	-
Cobalt	mg/L	0.0028	-
Copper	mg/L	0.007 ^C	-
Iron	mg/L	5.66 ^{C,W}	-
Lead	mg/L	0.0053 ^C	-
Lithium	mg/L	0.008	-
Manganese	mg/L	0.091 ^W	-
Mercury ^e	mg/L	0.0000074	-
Molybdenum	mg/L	0.0016	-
Nickel	mg/L	0.0089	-
Selenium	mg/L	<0.0004	-
Silver ^e	mg/L	0.00005	-
Strontium ^f	mg/L	0.22	-
Thallium	mg/L	0.0001	-

**Table 4-4: East Channel, Mackenzie River – Water Quality (Metals and PAHs)
(cont'd)**

Parameter	Units	Mackenzie River, East Channel	
		July 30, 2002 ^a	Historical Data (1972–1987) ^{b,c} Summer (n=1) ^d
Total Metals (cont'd)			
Titanium	mg/L	0.0495	-
Uranium	mg/L	0.001	-
Vanadium	mg/L	0.0198	-
Zinc	mg/L	0.05 ^c	-
Dissolved Metals			
Aluminum	mg/L	0.07	-
Antimony	mg/L	0.0005	-
Arsenic	mg/L	0.0006	-
Barium	mg/L	0.057	-
Beryllium	mg/L	<0.001	-
Boron	mg/L	0.01	-
Cadmium	mg/L	<0.0001	-
Chromium	mg/L	0.0005	-
Cobalt	mg/L	0.0001	-
Copper	mg/L	0.0021	-
Iron	mg/L	0.06	-
Lead	mg/L	0.0003	-
Lithium	mg/L	0.005	-
Manganese	mg/L	0.002	-
Mercury	mg/L	<0.0001	-
Molybdenum	mg/L	0.0013	-
Nickel	mg/L	0.0007	-
Selenium	mg/L	0.0005	-
Silver	mg/L	<0.0002	-
Strontium ^f	mg/L	0.19	-
Thallium	mg/L	<0.00005	-
Titanium	mg/L	0.0022	-
Uranium	mg/L	0.0008	-
Vanadium	mg/L	0.0006	-
Zinc	mg/L	<0.002	-

Table 4-4: East Channel, Mackenzie River – Water Quality (Metals and PAHs) (cont'd)

Parameter	Units	Mackenzie River, East Channel	
		July 30, 2002 ^a	Historical Data (1972–1987) ^{b,c} Summer (n=1) ^d
Target PAHs and Alkylated PAHs			
Naphthalene	µg/L	-	0.2
Acenaphthene	µg/L	-	0.03
Fluorene	µg/L	-	0.032
NOTES: ^a Reported value is the average of two split samples. ^b A hyphen indicates not available, that is, no data for that parameter. ^c Concentrations in boldface are higher than water quality guidelines. ^d n – number of samples ^e Ultra-low metal analysis was conducted on total mercury and silver. The same level of precision is not available for the dissolved mercury and silver analysis. ^f The accuracy of reported total and dissolved strontium levels is uncertain, because of irregularities in QC sample results, which might be indicative of sample contamination. ^C Concentration higher than the relevant chronic aquatic life guideline ^{D>C} Analytical detection limit is higher than the relevant chronic aquatic life guideline (C). ^W Concentration higher than the relevant drinking water guideline			
SOURCES: Historical data – Carey et al. 1990			

Water Quality Potential Effects and Mitigation

Developing this infrastructure site might affect water quality through the release of treated domestic wastewater from the camp, leaks and spills, sediment releases from disturbed land, and changes in surface water flow and level associated with changes in surface runoff or water withdrawals.

Effects of discharges of domestic wastewater will be managed using water treatment and disposal techniques that meet regulatory requirements.

Effects of small-scale leaks will be reduced through management practices, contingency plans, mitigation and emergency response plans.

Changes to surface water levels and flow in the East Channel because of development are predicted to not affect water quality.

Effects on water quality because of sediment releases are expected to be limited and are not expected to result in concentrations above water quality guidelines for the protection of aquatic life or drinking water.

Fish and Fish Habitat Setting

Fish species captured or reported in the East Channel of the Mackenzie River near Swimming Point include Arctic cisco, lake whitefish, broad whitefish, inconnu,

least cisco, longnose sucker, northern pike, burbot, trout-perch, rainbow smelt, ninespine stickleback and spoonhead sculpin. The most abundant large-bodied fish reported were broad whitefish, lake whitefish and least cisco. Fish captured in 2003 surveys are listed in [Table 4-5](#).

Fish and Fish Habitat Potential Effects and Mitigation

Developing this infrastructure site might affect fish and fish habitat through improvements to the existing barge landing site and introduction of sediment carried by surface runoff from the site.

The temporary spud barge landing at Swimming Point is currently in use. Although upgrades to the facility might be required to accommodate increased use by the project, dredging is not anticipated. Any effects on shoreline and nearshore habitat associated with this site occurred when the barge landing was initially developed and additional effects are not expected to occur. Disturbance to nearshore or riparian habitat might occur through the continued use of the barge landing, but will be small and of short duration, and will be associated with the annual placement and removal of the spud barge.

Implementing site-specific erosion and sediment control plans and the establishment of vegetated buffer zones between the site and local waterbodies will prevent sediment from the site reaching surface waters.

Table 4-5: Fish Species Captured During 2003 Fish Surveys at Swimming Point

Species	Number Captured				Fork Length	
	Fry	Juveniles	Adults	Total	Number Measured	Range (mm)
Broad whitefish	0	1	6	7	7	278-565
Lake whitefish	0	2	5	7	7	162-507
Inconnu	0	0	1	1	1	509 ^a
Least cisco	0	2	1	3	3	137-209
Northern pike	0	0	2	2	2	636-676
Longnose sucker	1	0	0	1	1	56 ^a
NOTE: ^a No range is given because only one fish was measured.						

The channel habitat is classified as deep and flat. Channel widths range from 844 to 2,797 m, with a mean of width 1,610 m. Water depths range from 0.3 to 17.1 m, with a mean depth of about 5 m. Channel bed material is primarily silt, with some gravel and cobble along the shorelines. Water depth and high turbidity provide most of the in-stream cover. Riparian areas next to the channel were almost exclusively bare ground.

A temporary spud barge landing site exists on the left downstream bank of the East Channel, about 500 m south of the Swimming Point camp. Riparian and nearshore habitat at this location has been disturbed by previous activities.

The cover provided by high turbidity makes this channel suitable for rearing, adult feeding and holding habitat by northern pike, longnose sucker, whitefish species and burbot (see [Table 4-6](#)). Use of this channel by Arctic grayling for rearing, adult feeding and holding is unlikely because of high turbidity and a lack of coarse substrate. The absence of coarse substrates and riffle and run habitats also makes this section of the channel unsuitable for spawning by Arctic grayling, longnose sucker and whitefish species. Burbot have been reported spawning over fine substrate in some delta channels and consequently, it is possible that this channel also provides spawning habitat for burbot.

Because of depth and expected winter flow, this channel is not expected to freeze to the bottom. Therefore, the channel could be used for overwintering by all species. Use of delta channels for overwintering has been confirmed for several species, including least cisco and inconnu. The East Channel also provides a corridor for movement of diadromous fish species, that is, fish that migrate between fresh and saltwater, between the Beaufort Sea and upstream areas of the Mackenzie River.

Table 4-6: Potential Use of Habitat at Swimming Point

Species ^a	Overwintering	Spawning and Incubating	Rearing	Adult Feeding and Holding
Arctic grayling	Yes	No	No	No
Northern pike	Yes	Yes	Yes	Yes
Longnose sucker	Yes	No	Yes	Yes
Whitefish species	Yes	No	Yes	Yes
Burbot	Yes	Yes	Yes	Yes
NOTE: ^a Of the species and species groups listed, only broad whitefish, lake whitefish, northern pike and longnose sucker were confirmed near the barge landing site during the present study.				

Human Environment

This topic provides a description of the protected areas and heritage resource setting and potential effects and mitigation for the Swimming Point infrastructure site. Other human environment information is described in [Section 8](#).

Protected Areas Setting

The Swimming Point infrastructure site is located in an area classified as Inuvialuit Category C lands for Fall Goose Harvesting (312C), and Grizzly Bear

Denning Areas (322C). The East Channel, next to this site, is rated as Inuvialuit Category D lands, as part of the Central Mackenzie Delta (718D).

Protected Areas Potential Effects and Mitigation

This infrastructure site is located within Category C lands and next to the East Channel, which is rated as Category D. The Inuvialuit CCPs permit development in these lands, but recommend managing it to eliminate, to the greatest extent possible, potential damage and disruption.

Heritage Resources Setting

The Swimming Point infrastructure site was assessed as part of the 2004 field program. This location was considered to have low potential for discovery of heritage resources. Heritage resource sites have been previously recorded within a 5 km range of this location, indicating prior use of this region. No new heritage resources were recorded during the 2004 investigations.

The nature of the heritage resource potential and results of preliminary investigations at this location were provided to the Prince of Wales Northern Heritage Centre in a report under permit 2004-956.

Heritage Resources Potential Effects and Mitigation

Before the development of this site, a Heritage Resource Impact Assessment will be conducted, if required, and provided to the Prince of Wales Northern Heritage Centre. If it is determined that the development will affect any heritage resources, mitigation plans will be prepared.

PUBLIC INVOLVEMENT

No concerns regarding the Swimming Point infrastructure site have been expressed by the local ISR communities in meetings or discussions with Imperial. The public involvement activities are documented in [Section 10](#) of this application.

EQUIPMENT

The following tables show an estimate of the equipment that might be required at the Swimming Point infrastructure site. An exact list and numbers of pieces of equipment will not be known until immediately before construction commences. [Table 4-7](#) lists the site construction equipment. [Table 4-8](#) lists site operations equipment.

Table 4-7: Estimate of Site Construction Equipment

Type and Approximate Number per Site	Size, Model or Equivalent	Proposed Use
Crew cabs and pick-ups – 2	4x4	Transporting crews
Bulldozers with GP buckets, U blades and brush rakes – 2	Large sized bulldozer (405 HP)	Site grading, pad and access road development, spreading granular material, snow removal
Dump trucks (double axle) – 2	Truck with trailer (12 m ³)	Hauling granular material
Front end loader with GP bucket – 1	Large sized loader (5.5 m ³ bucket loader)	Site preparation work
Road grader – 1	Large sized grader (4.9 m blade)	Site preparation work, grading ramps and access roads
Tracked mechanical ditcher – 1	Medium sized excavator (1.45 m ³ bucket)	Excavating and removing organic material
Compactor – 1	Medium sized compactor (20,879 kg sheepfoot packer)	Compaction of camp site pad fill materials and access road construction
Crane (tracked) – 1	Medium sized crane (100 tonne)	Unloading and placement of camp modules
Mechanic's truck with welder – 1	4x4	Equipment repair
Water truck – 1	Tandem axle, 16-24 m ³	Site and road work
Sea containers – 2	6 m	Storage
Fuel trucks – 1	3785 Litre	Fuel for equipment
Skid steer loaders – 2	Large sized skid steer (80 HP)	Site work

Table 4-8: Estimate of Equipment to Operate the Infrastructure Site

Type and Approximate Number per Site	Size, Model or Equivalent	Proposed Use
Sea containers – 4	6 m	Storage
Tractor trailers – 4	Warehouse van	Parts and supplies
Graders – 2	Medium sized grader (4.3 m blade)	Earthwork, road maintenance and snow removal
Front end loader with bucket – 1	Medium sized loader (5.5 m ³ bucket loader)	Movement of camp supplies and snow removal
Snow machines – 6	Small sized snow machine (400 cc)	Personnel transport

Table 4-8: Estimate of Equipment to Operate the Infrastructure Site (cont'd)

Type and Approximate Number per Site	Size, Model or Equivalent	Proposed Use
Crew cabs and pick-ups – 4	4x4	Transporting crews
Crane (tracked) – 1	Medium sized crane (100 tonne)	Loading and unloading pipe, equipment and materials
Flatbed trucks with pickers – 2	10 ton truck	Transporting materials and maintenance
Truck and water tank trailers – 5	Tandem axle (16-24 m ³)	Bringing water to the camp for domestic use and fire protection
Skid steer loaders – 2	Large sized skid steer (80 HP)	Site work

FUELS

Storage of fuel at the Swimming Point infrastructure site will involve the use of existing fuel storage capacity. In addition, other tanks will be installed. [Table 4-9](#) itemizes estimated fuel storage requirements for the site.

Table 4-9: Estimate of Fuel Storage

Fuels	Number of Containers	Capacity of Containers	Location
Diesel	2	200,000 L	Fuel depot

PERIOD OF OPERATIONS

Operations at the Swimming Point infrastructure site will be continuous from 2007 through the winter of 2008-09 (see [Section 3](#) for a schedule of development activities in the ISR).

LOCATION OF ACTIVITIES BY MAP COORDINATES

Map coordinates of the infrastructure site centroids are shown in [Table 4-10](#), and a map showing the location of the site is provided in [Figure 4-4](#).

Table 4-10: Map Coordinates for Site Centroids – Swimming Point Infrastructure Site

Site	Latitude (DD)	Longitude (DD)	UTM Easting (m)	UTM Northing (m)	UTM Zone
Swimming Point airstrip	69.1048	-134.4071823	523596	7666158	8
Swimming Point barge landing site	69.0998	-134.4013	523836	7665605	8
Swimming Point camp site	69.1092	-134.4149	523286	7666645	8

See [Figure 4-5](#) for a photograph of the present day Swimming Point infrastructure site.

LAND USE

The total land area required for activities associated with the Swimming Point infrastructure site is 21.4 ha.

A calculation of land requirements associated with the site is in [Appendix A](#).

Figure 4.4 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.

Figure 4.5 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.

