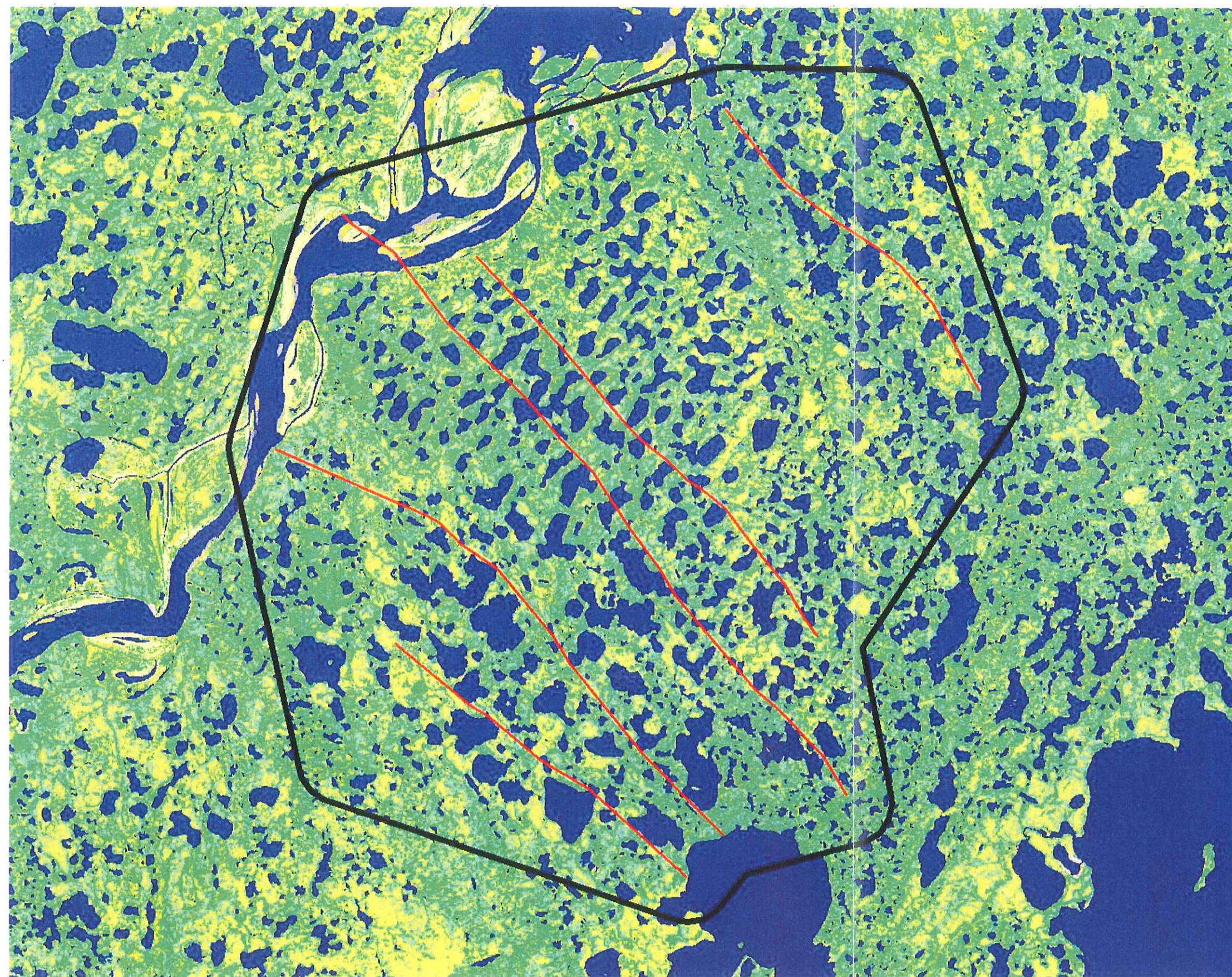


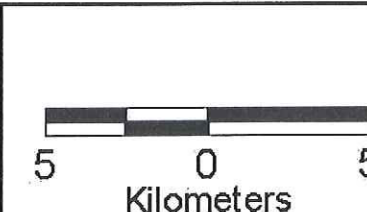
Figure 5
Biophysical Map of the
Local 2D Project Area



Land Cover

- Water
- Aquatic Vegetation
- Ice
- Mud/Silt
- Rock
- Barren Rock
- Urban/Rock
- Sparse Vegetation
- Mountain Tundra
- Graminoid
- Tussock Tundra
- Sedge
- Tall Willow/Alder
- Low Willow/Alder
- Low Birch
- Woodland Conifer
- Forest Conifer
- Forest Deciduous
- Burn
- Cloud/Urban
- Local Study Area
- Seismic Lines

Local Study
Area Location



Project Number : 5091-01
Source: Landsat TM Imagery
Image Date: August 2000
Projection: UTM (Zone 8)
Datum: NAD27
Cartographer: EED
Date: October 2001



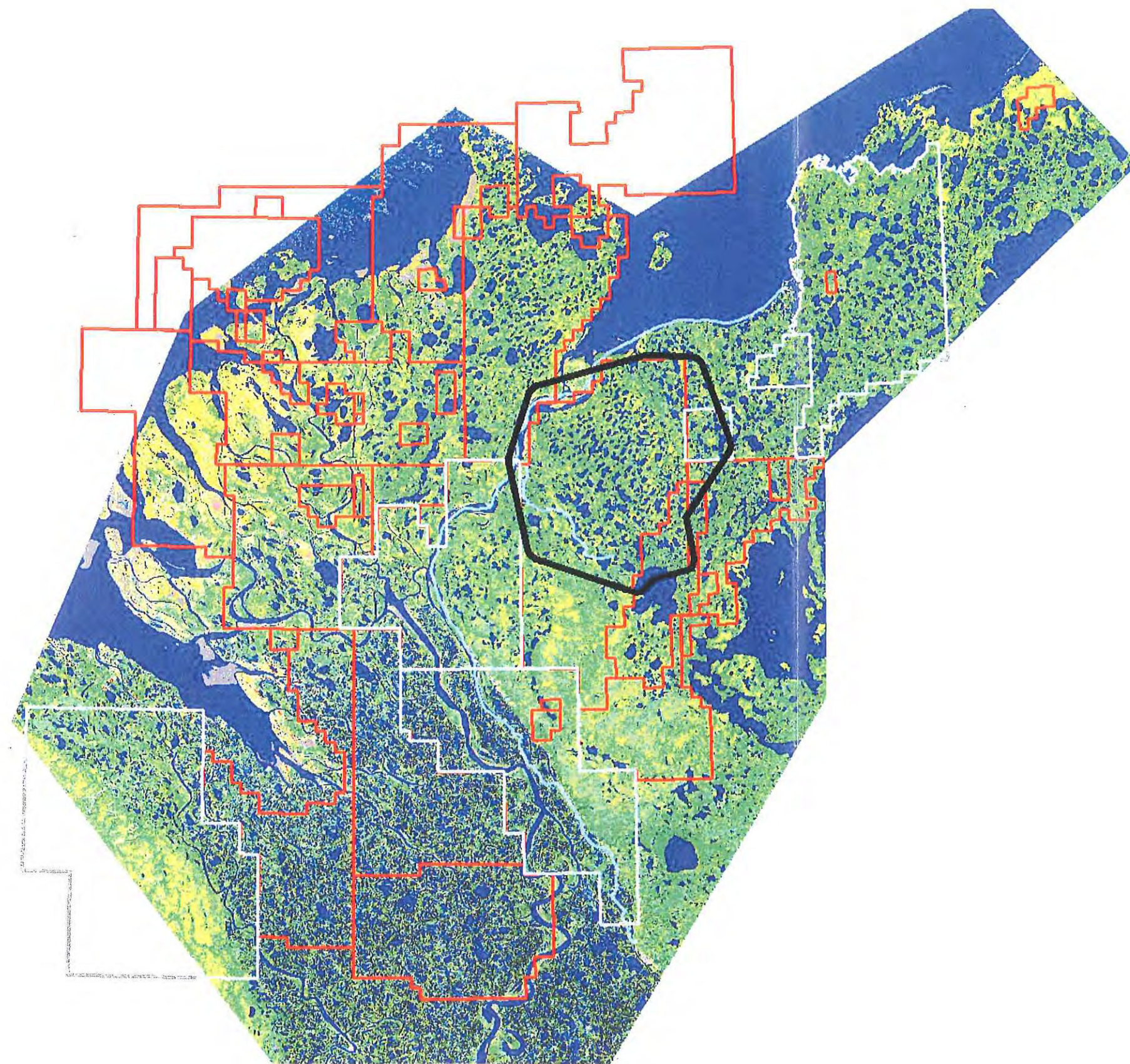
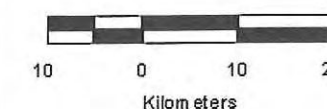


Figure 6
Biophysical Map of the Area
Occupied by Oil and Gas Leases
in the Mackenzie Delta Region

Land Cover

- Water
- Aquatic Vegetation
- Ice
- Mud/Silt
- Rock
- Barren Rock
- Urban/Rock
- Sparse Vegetation
- Mountain Tundra
- Graminoid
- Tussock Tundra
- Sedge
- Tall Willow/Alder
- Low Willow/Alder
- Low Birch
- Woodland Conifer
- Forest Conifer
- Forest Deciduous
- Burn
- Cloud/Urban
- Local Study Area
- Federal Lease Boundaries
- Inuvialuit Lease Boundaries
- Temporary Winter Access

Regional Study
 Area Location



Project Number: 5091-01
 Source: Landsat TM Imagery
 Image Date: August 2000
 Projection: UTM (Zone 8)
 Datum: NAD27
 Cartographer: EED
 Date: October 2001



'Ice, Water & Aquatic Vegetation' is the main landcover class within the proposed AEC Kamik 2D project area, and in the region as a whole (Table 12). Since this is a winter program, surface water will be frozen and impacts to this landcover class are not anticipated.

The main vegetative landcover classes within the project area are low and dwarf shrubs: 'Low Willow Alder' and 'Low Birch / Dwarf Shrub' which constitute 27.6% and 15.5%, respectively, of the AEC Kamik 2D project area. The 'Low Willow Alder' class includes shrubs that range from 0.25-1.5 m in height. In addition to willow (*Salix* spp.) and alder (*Alnus* spp.), a sparse understorey of herbaceous vegetation, such as arctic lupine (*Lupinus arcticus*) and fireweed (*Epilobium* spp.) is also present. Both willow and alder are resilient, recovering relatively quickly after disturbance.

'Low Birch/Dwarf Shrub' is a community dominated by either birch or other dwarf shrub species such as Labrador tea (*Ledum* spp.), berries (*Vaccinium* spp., and *Arctostaphylos* spp.), and cloudberry (*Rubus chamaemorus*) that are less than 0.25 m in height. This community may also include a sparse understorey of herbaceous plants. Given its low height, this community will most probably be covered by snow at the time of the proposed project.

'Tussock Tundra' also constitutes a significant portion of the proposed AEC Kamik 2D project area (11.9%). This class is dominated by cotton grasses (*Eriophorum* spp.) and will also be covered by snow at the time of the proposed project.

On a regional scale, 'Low Willow Alder' is the dominant terrestrial landcover class. It covers 17% of the region. All other classes cover smaller areas (less than 10% each), but are relatively equally abundant.

11.8 Wildlife

Areas with high habitat suitability index (HSI) values have the potential to support many different wildlife species, whereas those areas with low values do not. Habitat suitability therefore has a direct effect on wildlife species richness. Wildlife species richness (Figure 7) was inferred by averaging habitat suitability scores derived from models for ten Valued Ecosystem Components (VECs) found in the Mackenzie Delta Region (caribou, moose, snowshoe hare, beaver, brown lemming, collared lemming, great gray owl, white-fronted goose, rock ptarmigan and willow ptarmigan). VECs are important subsistence resources for the Inuvialuit or have been listed by COSEWIC (2001). Some VECs were chosen however, (e.g., lemmings) because of their important ecological role (IEG 2001). Lemmings are important prey items for both avian and mammalian predators, and can have a significant impact on vegetation communities as a result of foraging.

In terms of potential wildlife habitat, and in turn wildlife species richness, the majority of the AEC Kamik 2D project area represents fair (moderate wildlife species richness) habitat, covering 38.4% of the proposed project area, and poor (low wildlife species richness) habitat, covering 34.4% of the area (Table

13). Suitable habitat (high wildlife species richness) is less abundant, constituting 27.2% of the 2D project area. This general pattern is also seen on the regional scale.

Table 13

**Habitat Suitability For Wildlife Valued Ecosystem Components
Within The Proposed Project Area And Region**

Habitat Suitability	AEC Kamik 2D		Region	
	Local Area (ha)	% of Local Area	Regional Area (ha)	% of Regional Area
Poor	43,385.3	34.4	943,735	45
Fair	48,445.7	38.4	811,707	38
Suitable	34,201.3	27.2	361,316	17
TOTAL	126,032.3	100.0	2,116,758	100

11.8.1 Mammals

The habitats in and around the proposed AEC program area support a wide variety of terrestrial mammals including arctic fox, caribou, grizzly bear, moose, muskrat, wolf, and wolverine. While very unlikely, the potential overlap with polar bear habitat or populations also exists due to proximity with coastal areas of the Beaufort Sea. A number of these species are important to local subsistence harvesters as well as recreational users. Inuvialuit Wildlife and Environmental Monitors will be present during the program to help manage potential wildlife conflicts as the program progresses. Mammals of concern, identified as such due to their importance for subsistence, COSEWIC designation, and priority for research are listed in Table 14 if they are potentially found in the general vicinity of the program area.

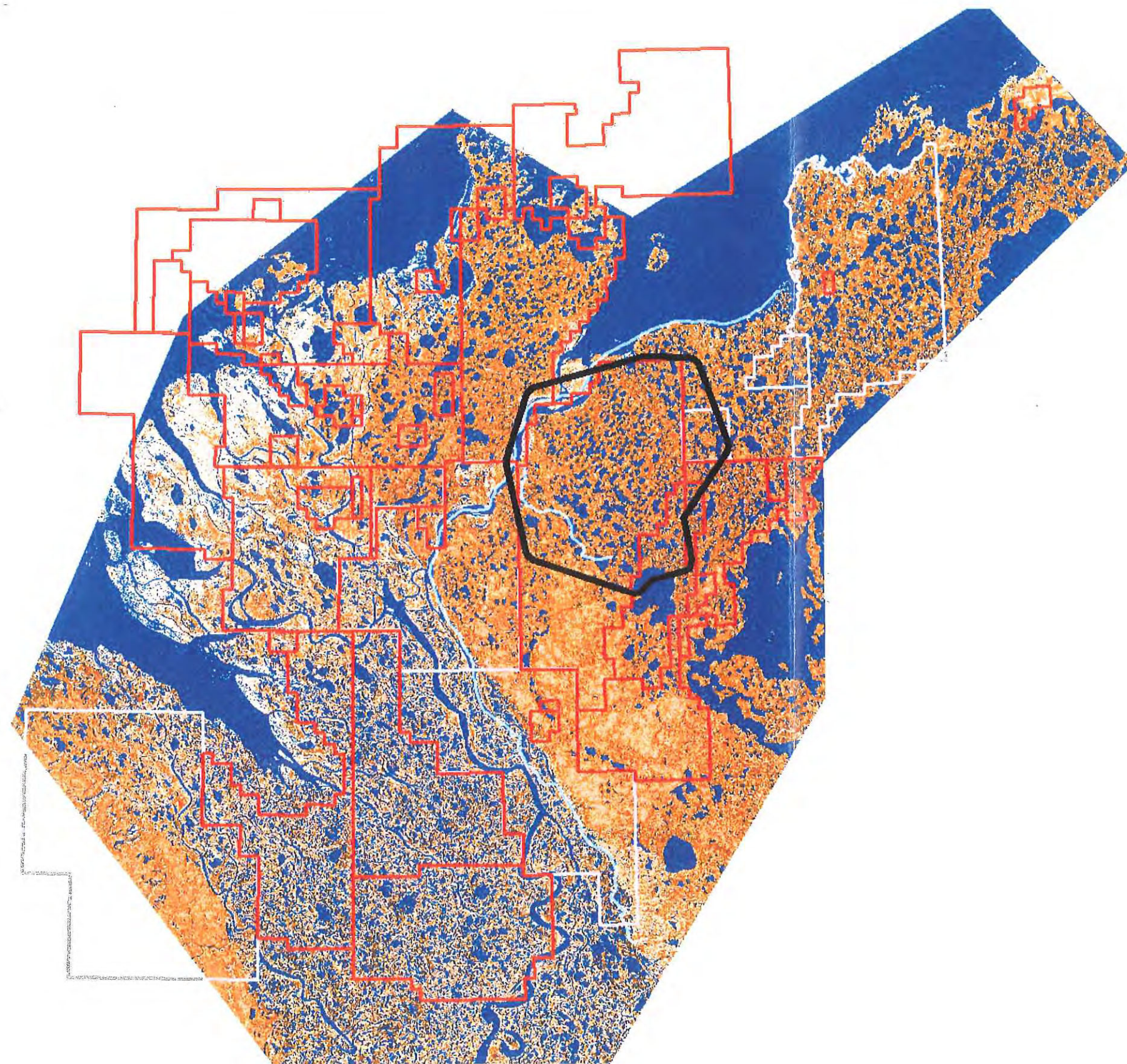
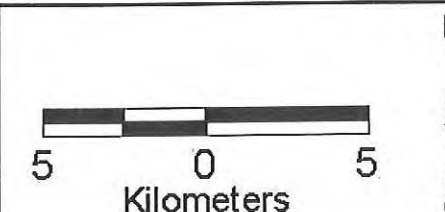


Figure 7
Species Richness of Wildlife
Valued Ecosystem Components

Legend

- 23 - 31
- 32 - 36
- 37 - 41
- 42 - 43
- 44 - 46
- 47 - 49
- 50 - 52
- 53
- 54 - 67
- Water
- Local Kamik Study Area
- Federal Lease Boundaries
- Inuvialuit Lease Boundaries
- Temporary Winter Access

Regional Study
 Area Location



Project Number: 5091-01
 Source: Landsat TM Imagery
 Image Date: August 2000
 Projection: UTM (Zone 8)
 Datum: NAD27
 Cartographer: EED
 Date: October 2001



Table 14

Mammals Of Concern Found In The Vicinity Of The Proposed Program

Species ¹	Habitat	Program Interaction	COSEWIC ²
TERRESTRIAL MAMMALS			
Arctic fox (<i>Alopex lagopus</i>)	Widespread above treeline and coastal areas. Herschel Island to Shallow Bay, Kendall and Hooper Islands, parts of the Tuktoyaktuk Peninsula, and from Cape Dalhousie to Bathurst Peninsula.	Program completely overlaps with potential habitat, including denning habitat in the vicinity of Richards Island.	Not listed
Caribou (<i>Rangifer tarandus</i>)	Calving on Cape Bathurst Peninsula, Brock, Hornaday and Horton Rivers; winter habitat north and northeast of Inuvik. Upland habitats with abundant lichen cover.	Program overlaps with home range of Cape Bathurst herd and winter range of Bluenose West herd.	Not listed
Grizzly bear (<i>Ursus arctos</i>)	Prefers open areas of alpine tundra, subalpine mountains or subarctic tundra. Richards Island, Mackenzie Delta.	Program completely overlaps with critical denning habitat.	Special Concern
Mink (<i>Mustela vison</i>)	Vicinity of lakes, rivers and creeks throughout forests of the Mackenzie Delta, occasionally tundra rivers as far north as arctic coast.	Infrequent; suitable lakes, ponds and rivers of program area.	Not listed
Moose (<i>Alces alces andersoni</i>)	Treeline-tundra transition zone, river valleys, floodplains, Holmes Creek, lowlands adjacent to East Channel, lower Mackenzie Valley.	Variable and infrequent.	Not listed
Muskrat (<i>Ondatra zibethicus spatulatus</i>)	Mackenzie Delta, coastal Beaufort region, Mackenzie River Valley. Lakes and ponds with aquatic vegetation where water does not freeze to the ground.	Suitably deep lakes and ponds of program area.	Not listed
Red Fox (<i>Lupes lupus</i>)	Forest and forest-tundra transition zones, river valleys and clearings, occasionally tundra.	Variable and infrequent.	Not listed
Snowshoe Hare (<i>Lepus americanus</i>)	Foothills to the arctic coast, Mackenzie Delta, forests, areas of brushy cover.	Variable and infrequent.	Not listed
Wolf (<i>Canis lupus arctos</i>)	Treeline-tundra transition zone. Bluenose caribou wintering range. Caribou Hills.	Variable and infrequent.	Data deficient
Wolverine (<i>Gulo gulo</i>)	On tundra between treeline and arctic coast. North Slope, Cache Creek, Sheep Creek, Big Fish River, Foothills west of Aklavik. Relatively few in delta.	Infrequent; potential denning habitat in rocky scree slopes or large snowdrifts of program area.	Special Concern
MARINE MAMMALS			
Polar bear (<i>Ursus maritimus</i>)	Coastline, southern broken edge of the arctic ice pack, denning in coastal areas from Kay Point to Kugmallit Bay.	Infrequent. Denning habitat northwest of program area.	Special Concern

Notes:

- Species are included due to their listing in Community Conservation Plans as species of interest or declining in population.
 - Committee on the Status of Endangered Wildlife in Canada 2000.
- Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural events.
- Data deficient = A species for which there is insufficient scientific data to support status designation.
- Not listed = A species which does not appear in COSEWIC documentation.

Arctic Fox (*Alopex lagopus*)

The Arctic fox is widespread in northern Canada and are commonly found above treeline in tundra, forest-tundra and near coastal areas (Martell et al. 1984). Throughout most of their range arctic fox are terrestrial animals; however, foxes from Arctic coastal populations generally move onto the nearshore landfast ice during winter (Dome et al. 1982a). In the Mackenzie Delta region Arctic fox are associated with coastal areas from Herschel Island to Shallow Bay, Kendall and Hooper Islands, parts of the Tuktoyaktuk Peninsula, and from Cape Dalhousie to Bathurst Peninsula (Martell et al. 1984). During spring and summer they occupy areas near terrestrial denning sites, remaining there during the relatively snow-free period from May until August (Dome et al. 1982a). Den construction occurs in areas of early snow melt where soils are well drained and stable (Martell et al. 1984). Important known denning sites in the coastal Mackenzie Delta region include the coast of Richards Island (Dome et al. 1982a).

Movements and fluctuations of coastal populations are related to the availability and abundance of prey species and appropriate denning sites (Banfield 1974). Arctic fox may move great distances over the course of the year in response to low food supplies in customary hunting areas. Regular migrations occur from the outer Mackenzie Delta and Tuktoyaktuk Peninsula to the sea ice in winter, with a return in spring; occurring in mass movements at times (Martell et al. 1984).

While historically a common species along the coast, the size and density of the Arctic fox population in coastal areas of the Beaufort Sea has not been documented (Dome et al. 1982a). The population status of Arctic fox can vary from year to year, and tends to display a cyclical relationship to prey abundance (Banfield 1974).

Arctic fox are mainly solitary until they form breeding pairs in mid February to late April (Dome et al. 1982a). As landfast ice is at or near its maximum winter extent during this time, it can be assumed that courtship and mating often occurs offshore on landfast ice. Mating pairs then move onshore to occupy dens often excavated the previous summer, generally found in light, stable, sandy soils in river banks, eskers, or small hillocks (Banfield 1974). Litters of 8 to 20 young are born between mid May and mid June (TCCP 2000). In years of low prey abundance, the breeding season may be late or missed entirely (Banfield 1974). The weaned litter emerges from the den around mid July, and are abandoned by both parents by mid August (Banfield 1974).

Caribou (*Rangifer* spp.)

Three subspecies of caribou are found in the Inuvialuit Settlement Region: barren ground caribou (*Rangifer tarandus groenlandicus*), Grant's caribou (*R. t. granti*), and Peary caribou (*R. t. pearyi*). Barren ground caribou are the most abundant of these subspecies, and three distinct populations have been identified based on the location of their calving grounds: Cape Bathurst, Bluenose-West, and Bluenose-East. The proposed program area overlaps with documented home range of the Cape Bathurst herd and the winter range of the Bluenose West herd (RWED 1999, TCCP 2000), although exact range boundaries may vary from one year to the next. Suitable spring/summer and winter habitat for caribou, as well as a

large amount of optimal winter habitat has been identified within and surrounding the proposed program area (IEG 2001).

In general, the Cape Bathurst herd ranges eastward to the east coast of Bathurst Peninsula, northward to the north tip of Bathurst Peninsula, westward to the Mackenzie River East Channel, and southward to the vicinity of Lost Reindeer Lakes (southeast of Inuvik) (RWED 1999). The Bluenose-West herd range reaches its westernmost extent at the Mackenzie River East Channel, its northernmost point at the tip of Bathurst Peninsula, its easternmost point being slightly east of the boundary between the ISR and the Territory of Nunavut and reaching its southern extent slightly south of the Smith Arm of Great Bear Lake in the Sahtu Settlement Area (RWED 1999).

Caribou are highly migratory with well established migration patterns. In spring, cows lead the herds northward from wintering habitat in the boreal forest to calving grounds and summer ranges on the coastal tundra (Dome et al. 1982a). The migration tends to follow frozen lakes and rivers, as well as open, snow-free uplands and eskers. Important calving areas are the Bathurst Peninsula, and Brock, Hornaday, and Horton Rivers (AICCP, IICCP, and TCCP 2000), located to the east and outside of the proposed program area. Calves are born between late May and early June, and although only one calf tends to be produced per cow, healthy caribou are able to reproduce every year. Intensive grazing starts shortly after calving and continues throughout the summer. Herds move to mating grounds in October, and then return to the boreal forest. These herds overwinter north, east, and southeast of Inuvik (AICCP, IICCP, and TCCP 2000). In general, females and juveniles overwinter near the tree line, whereas males move farther into the forest.

While large-scale, semi-annual movements to calving and wintering grounds are somewhat predictable; the precise movements of caribou for the remainder of the year are extremely variable. Areas with thousands of caribou one year may have none the next (Case et al. 1996). This is likely in response to the availability of food and the extent of predation (Case et al. 1996). There is, however, high calving ground fidelity (Case et al. 1996).

Caribou are an important component of the arctic ecosystem. Wolves tend to follow the caribou throughout their range, and prey on them frequently (Case et al. 1996). Grizzly bears are an infrequent predator (Case et al. 1996).

The combined population of these herds was estimated at 88,000 to 106,000 individuals in 1992 (AICCP, IICCP, and TCCP 2000). RWED has initiated a Cape Bathurst/Bluenose-West caribou herd satellite tagging program. The study will provide information on caribou locations during the winter months to better understand habitat use in order to assess effects of exploration activities on the herd.

Grizzly Bear (*Ursus arctos*)

There are three distinct populations of grizzly bears in the Inuvialuit Settlement Region: arctic coastal, arctic mountain, and barren ground. Both arctic coastal and barren ground grizzlies are found in the

vicinity of the proposed program area, residing year round, albeit in low densities. Particularly important habitat for these populations includes Richards Island and Husky Lakes, as well as areas east and outside of the proposed program area (TCCP 2000). Richards Island provides critical denning habitat for grizzlies (Nolan et al. 1973, Harding 1976, TCCP 2000). The proposed program area overlaps completely with the Grizzly Bear Denning Special Management Area (see Section 8.0, Traditional and other Land Uses) and falls within the Tuktoyaktuk West Grizzly Bear Management Area, which, in combination with the Tuktoyaktuk East Grizzly Bear Management Area, has an estimated population of 354 grizzly bears greater than two years old (TCCP 2000).

Grizzly bears require large areas for feeding (Knight 1977 in Martinika and McArthur 1980). Grizzlies are omnivorous, primarily feeding on vegetation, but taking advantage of higher energy food sources when available (AICCP, IICCP, and TCCP 2000). They generally thrive best when anthropogenic disturbances are minimized (Knight 1977 in Martinika and McArthur 1980). Habitat structure is very important for territory selection. In all parts of their range, grizzlies prefer open or semi-open areas of vegetation (Dome et al. 1982a). In contrast, dens are found in association with thick vegetative cover, particularly willow and alder, as this likely provides structural stability and aids in snow accumulation above the den (Harding 1976, Martell 1984). Denning areas are quite specific and are usually found on banks of lakes, creeks, or rivers (Harding 1976, Martell 1984), and occasionally in pingos or snowdrifts (Harding 1976). Grizzly bears typically den from October to May (AICCP, IICCP, and TCCP 2000). They breed in June and July, and females have a pair of cubs every four to five years (AICCP, IICCP, TCCP 2000).

Mink (*Mustela vison*)

Mink are relatively common in the vicinity of lakes, rivers and creeks throughout the forests of the Mackenzie Delta, and are occasionally found along rivers on the tundra as far north as the Arctic coast (Martell et al. 1984). Within their range mink prefer densely vegetated areas (IICCP 2000). In winter, mink live under the shoreline ice ledge of waterbodies, and are seldom seen (Martell et al. 1984). Travel under river ice during the winter is made possible by the use of air pockets (Halfpenny and Biesiot 1986).

Mink are usually solitary with the exception of family groups. In the ISR mink generally occur at densities of 1 to 8 animals per km² (IICCP 2000), and males may range several miles along a stream (Burt and Grossenheider 1980). They den in vacant beaver or muskrat houses, burrows, and under tree roots or stones near water. Burrows may be up to 3 m long and 1 m beneath the surface with more than one entrance (IICCP 2000). Breeding occurs from February to April, and young are born between late April and early May. Mink are typically nocturnal, feeding on small mammals and birds, fish, and insects. Distances of up to 25 km may be traveled in one night if food is scarce (IICCP 2000).

Moose (*Alces alces andersoni*)

Areas of important habitat for moose include the Husky Lakes, Sitidgi Lake, and Miner River (TCCP 2000). The lowlands adjacent to the East Channel of the Mackenzie River also provide important moose habitat (Prescott et al. 1973 in Dome et al. 1982a). Moose are generally solitary, commonly ranging

throughout the boreal forest and occasionally the forest tundra transition zone and tundra areas (Kelsall 1972 *in* Dome et al. 1982a). They are likely infrequent users of the proposed program area due to the poor to fair suitability of the habitat for moose (IEG 2001), however the potential for overlap still exists. The bulk of their diet consists of twigs of shrubs, especially willow and riparian vegetation.

Winter habitat is extremely important for moose because during this time they live off fat reserves accumulated over the summer months (Gasaway and Coady 1974 *in* Dome et al. 1982a). Early successional-stage vegetation (willows, birch, alder), such as that found in riparian areas or recently burned areas, provides good quality winter moose habitat, which is important as moose rely on young deciduous vegetation in both summer and winter. River valleys and associated floodplains provide the best year-round habitat, and are particularly important in winter (Watson et al. 1973). Areas to the south of the proposed program area, such as the lower Mackenzie River Valley, offer preferred winter habitat and are used heavily by moose during this time.

Muskrat (*Ondatra zibethicus spatulatus*)

In the ISR and in relation to the proposed program area, muskrats occur in particular concentrations in the Mackenzie Delta and coastal Beaufort region (Dome et al. 1982a, 1982b, TCCP 2000), and are likely most abundant in standing water habitats of the upper Mackenzie Delta and adjacent areas (Dome et al. 1982a, Martell et al. 1984). An intermediate number of muskrat pushups on upland lakes near the Parsons Lake area and on Richards Island have been recorded (Slaney 1974a *in* Dome et al. 1982a).

Muskrats burrow into the banks of lakes and streams in areas where aquatic plants are accessible for food and building materials (Dome et al. 1982a, 1982b, Jelinski 1989). While muskrats are not migratory animals, seasonal differences in habitat use do occur. In the spring and summer virtually all suitable waterbodies are occupied (Westworth 1977). The severe climatic conditions in the arctic restrict the numbers of waterbodies that are suitable to support muskrats (Dome et al. 1982a). The optimum depth of water required to support muskrat in winter is between 1.2 m and 3 m (Hawley 1974 *in* Dome et al. 1982a). Prior to the onset of winter, muskrats relocate to areas of deeper water, and burrow in higher, steeper banks (Dome et al. 1982a). This shift appears to maintain the accessibility of food, and allows muskrats to forage on high-energy roots and rhizomes of submerged aquatic vegetation, thereby increasing overwinter survival. Muskrats are able to swim considerable distances under the ice to reach foraging areas. The winter range is often extended by the construction of pushups, which are small mounds of vegetation and mud built over holes in the ice that afford cover for feeding (Dome et al. 1982a, 1982b, Martell et al. 1984). During the spring muskrats are highly mobile, feeding on submergent aquatic vegetation (Jelinski 1989).

Muskrats in the Mackenzie Delta region typically breed during spring breakup (mid to late June), and years with late breakup may result in delayed breeding (Martell et al. 1984). Generally all mature females produce one litter, and half of the fecund females tend to breed again to produce another litter later in the summer (Martell et al. 1984). Following a four-week gestation period, young are born from June through mid August (Westworth 1977, TCCP 2000).

Polar Bear (*Ursus maritimus*)

The occurrence of polar bears within the proposed program area is unlikely, given that suitable habitat is found in closer association with the coastline and sea ice, and the coastal mainland is used infrequently. From freeze-up in the fall to break-up in the spring, polar bears are generally restricted to areas with sea ice, although they prefer areas with suitable combinations of pack ice (preferably relatively free of snow cover), open water, and land (Banfield 1974). A study looking at Canadian Beaufort data from 1971 to 1979 showed that during the winter and spring, most adult males, non-breeding females, females with yearlings and two year olds, and subadults preferred the ice floe edge and areas of moving ice with 7/8th or more ice cover (Stirling et al. 1975, Stirling et al. 1981b in Dome et al. 1982a). This is likely due to the accessibility of seals in these areas. In contrast, adult females with cubs-of-the-year preferred stable landfast ice with deep snow drifts along the pressure ridges (Stirling et al. 1981b in Dome et al., 1982a).

Red Fox (*Vulpes vulpes*)

The red fox is widely distributed in northern latitudes and occurs throughout the mainland Northwest Territories (Banfield, 1974), ranging as far north as some of the arctic islands (RWED 2001). They are most abundant below treeline (IICCP 2000), with population densities typically greater in forest and forest-tundra transition zones than on the tundra (Dome et al. 1982b). However, red fox are currently expanding their range northward (Macpherson 1964, Sklepkovych and Montevecchi 1996).

Within their range, red fox occupy a variety of habitats, including forest areas, natural clearings, river valleys, and tundra. Typical home ranges vary between 5 and 35 km² (RWED 2001). The versatile diet of the red fox has been a main contributor to their wide distribution, allowing them to encroach on arctic fox terrain (Smits et al. 1989). Lemmings, voles and bird species are the primary prey, although small mammals, insects, carrion and vegetation are also consumed.

Red fox tend to den in areas with dense shrub cover on well drained, usually south facing slopes of river banks, ridges, eskers and moraines (Dome et al. 1982b, Martell et al. 1984). Breeding occurs from February to April, and young are born between April and June.

Snowshoe Hare (*Lepus americanus*)

Snowshoe hare occur in forests and areas of brushy cover (Barta et al. 1989), with important habitat occurring from the foothills to the coast and in the Mackenzie Delta (TCCP 2000). Dense vegetation cover is preferred; including recently disturbed areas with stands of young conifers or brushy deciduous growth. These areas provide food resources and cover for the avoidance of predators.

Snowshoe hare consume a variety of herbaceous plants during the summer (Banfield 1974) with a more limited diet of small twigs, stems, and branches of various woody shrubs and saplings in the winter (Keith et al. 1984). Snowshoe hare are an important food resource for predators such as lynx, fox, owls, and eagles (TCCP 2000). Populations of snowshoe hare follow cyclic patterns in response to factors such as winter food availability and predation pressure (Keith et al. 1984).

Wolf (*Canis lupus*)

Wolves occur in forested and tundra habitats in the ISR and are closely associated with various species of ungulates, including caribou and moose (Banfield 1974). A wolf research program undertaken by RWED in the Western Arctic from 1987-1988 indicated that wolves also commonly occur in the Caribou Hills (Clarkson and Liepins 1989), southwest of the proposed program area.

Wolf packs establish well-defined territories when the predominant prey species is non-migratory (Mech 1970, Peters and Mech 1975 *both in* Dome et al. 1982a). During the winter, packs often hunt over long distances along ridges, trails, seismic lines, lakeshores, and frozen lakes and rivers (Mech 1970, Peters and Mech 1975 *both in* Dome et al. 1982a). During the summer, wolves typically restrict their movements, frequently returning to pup-rearing areas. Wolves that live within migratory caribou ranges prey primarily on caribou and do not appear to be territorial, moving as required to remain with the caribou herds (Heard and Williams 1992). Studies in northern areas have indicated that other prey items include beaver, small mammals, snowshoe hares, birds, and vegetation (Theberge and Cottrell 1977, Stephenson 1978 *both in* Dome et al. 1982b).

Wolverine (*Gulo gulo*)

The distribution of wolverines is circumpolar in tundra and tundra-taiga zones (Landa et al. 1998). In the ISR the species occurs at low population densities and is a solitary resident of tundra, boreal forest, and mountainous regions (Martell et al. 1984, Banci and Harestad 1990, Wilson et al. 2000).

While not considered migratory, the wolverine periodically roams over large areas in search of food (Wilson et al. 2000), and has been known to travel up to 45 km per day through dispersal corridors (TCCP 2000). Wolverines remain active both day and night throughout the year, and in the north may be active for 3-4 hour long periods between rests (TCCP 2000). Males are typically more mobile than females (Wilson et al. 2000), and are known to use larger home ranges than resident females (Landa et al. 1998). During spring and summer, males become increasingly active and expand their home ranges, which results in the overlapping of home ranges with several females in an apparent breeding strategy (Banci and Harestad 1990). Although wolverines are highly mobile and maintain large home ranges, most individuals exhibit fidelity to discrete areas, particularly their natal site (Wilson et al. 2000). Movement patterns, home range size, and density estimates have not yet been made for the wolverine populations in the ISR (TCCP 2000).

Wolverine dens range in complexity, from temporary rest beds to natal dens with extensive tunnel systems (Lee and Niptanatiak 1996). Natal dens on the tundra are often associated with rocky scree slopes and large snowdrifts (Lee and Niptanatiak 1996), habitat that is abundant throughout the ISR. Caves, rock crevices, fallen logs, holes in the snow, and burrows are also used for shelter (TCCP 2000). Breeding occurs between April and October with a peak in mid summer. Following delayed implantation, young are born in late winter and spring. Most females breed annually, but do not necessarily produce young every year (Banci and Harestad 1988).

Wolverines have a varied diet that includes small mammals, roots and berries (Banci and Harestad 1988, 1990, TCCP 2000). The wolverine will scavenge carrion from kills of wolves and bears (Clarkson and Liepins 1993), ungulate carcasses being the principal food item (TCCP 2000).

11.8.2 Birds

Very few species of birds are adapted to overwinter in the Mackenzie Delta region. The vast majority migrate into or through the area to nest, raise young, molt, and accumulate fat reserves, and then migrate south in the fall to overwinter in other regions (Martell et al. 1984). Migrating species are not likely to be found in the program area during the time proposed, as they generally move south for winter by early September and do not generally arrive in spring until mid May. Birds that may overwinter in the area include the snowy owl, golden eagle and gyrfalcon, as well as both species of ptarmigan found in the ISR. Birds of concern that may use habitat in the vicinity of the proposed program area are listed in Table 15. Species that may overwinter in the area and are included in Inuvialuit Community Conservation Plans or have received COSEWIC designation receive further discussion below.

Table 15
Bird Species Of Concern Found In The Vicinity Of The
Proposed Program

Species ¹	Habitat	Program Interaction	COSEWIC ³
WATERFOWL AND SHOREBIRDS			
Brant ² (<i>Branta bernicla</i>)	Mackenzie Delta, Tuktoyaktuk Peninsula.	Limited to transient periods of migration and impacts to habitat.	Not listed
Eskimo curlew (<i>Numenius borealis</i>)	Formerly bred in the tundra and woodland transition zones of the Mackenzie District.	Low potential though generally unknown.	Endangered
King eider ² (<i>Somateria spectabilis</i>)	Tuktoyaktuk Peninsula, tundra ponds on coastal mainland.	Limited to transient periods of migration and impacts to habitat.	Not listed
Lesser snow goose ² (<i>Chen caerulescens caerulescens</i>)	Kendall Island during nesting, bays, estuaries, and ocean during migration.	Limited to transient periods of migration and impacts to habitat.	Not listed
Long-tailed duck ² (<i>Clangula hyemalis</i>)	Coastal and tundra ponds during summer; large lakes, bays, estuaries, and ocean during migration.	Limited to transient periods of migration and impacts to habitat.	Not listed
Mallard ² (<i>Anas platyrhynchos</i>)	Polynas and leads on open water in the Mackenzie Delta, limited to the transient periods of spring and fall migration.	Limited to transient periods of migration and impacts to habitat.	Not listed
Northern pintail ² (<i>Anas acuta</i>)	Mackenzie Delta, tundra areas.	Limited to transient periods of migration and impacts to habitat.	Not listed
Red-throated loon ² (<i>Gavia stellata</i>)	Coastal and tundra ponds during summer; large lakes, bays, estuaries, and ocean during migration.	Limited to transient periods of migration and effects to habitat.	Not listed
Sandhill crane ² (<i>Grus canadensis</i>)	Shallow Bay, coastal areas, upland areas.	Limited to transient periods of migration and effects to habitat.	Not listed
Scaup ² (<i>Aythya</i> spp.)	Mackenzie Delta, coastal areas.	Limited to transient periods of migration and effects to habitat.	Not listed
Scoter ² (<i>Melanitta</i> spp.)	Mackenzie Delta, shallow bays along arctic coast	Limited to transient periods of migration and effects to habitat.	Not listed

Species ¹	Habitat	Program Interaction	COSEWIC ³
Tundra swan ² (<i>Cygnus columbianus columbianus</i>)	Coastal and tundra marshes during summer, bays, estuaries, and ocean during migration.	Limited to transient periods of migration and impacts to habitat.	Not listed
White-fronted goose ² (<i>Anser albifrons frontalis</i>)	Polynas and leads on open water in the Mackenzie Delta, limited to the transient periods of spring and fall migration.	Limited to transient periods of migration and impacts to habitat.	Not listed
Yellow billed loon ² (<i>Gavia adamsii</i>)	Arctic tundra on large lakes or in backwater areas of flooded rivers. Winter in the Gulf of Alaska.	Limited to transient periods of migration and impacts to habitat.	Not at risk
RAPTORS			
Bald eagle ² (<i>Haliaeetus leucocephalus</i>)	Lakes, rivers, marshes, seacoasts. Willow River, Fish Creek, First Creek, Mackenzie Delta.	Limited to transient periods of migration and impacts to habitat.	Not at risk
Golden eagle ² (<i>Aquila chrysaetos</i>)	Mountain forests and open grasslands; can be found in any habitat during migration. Willow River, Fish Creek, First Creek, Mackenzie Delta.	Aircraft use or other disturbance near any rocky outcrops or other suitable nesting areas.	Not listed
Gyr Falcon ² (<i>Falco rusticolus</i>)	Arctic tundra and rocky cliffs near water, nests in cliffs and occasionally trees. Richardson Mountains.	Aircraft use or other disturbance near any rocky outcrops or other suitable nesting areas.	Not at risk
Northern harrier (<i>Circus cyaneus</i>)	Open freshwater and salt marshes, tundra and prairie	Limited to transient periods of migration and impacts to habitat.	Not listed
Northern hawk owl (<i>Surnia ulula</i>)	Forested areas of Mackenzie Delta. May be found on open tundra where there are tree-lined watercourses.	Infrequent and variable.	Not listed
Peregrine falcon ² (<i>Falco peregrinus tundrius</i>)	Coastal areas, nests on cliffs and occasionally trees, hunts over open tundra habitats. Richardson Mountains.	Limited to transient periods of migration and impacts to habitat.	Special Concern
Rough-legged hawk ² (<i>Buteo lagopus</i>)	Coastal areas with suitable cliff nesting habitat. Richardson Mountains and Herschel Island.	Limited to transient periods of migration and impacts to habitat.	Not listed
Short-eared owl (<i>Asio flammeus</i>)	Open habitat in the winter, prairies, grassy plains or tundra in the summer.	Limited to transient periods of migration and impacts to habitat.	Special Concern
Snowy owl ² (<i>Nyctea scandiaca</i>)	Coastal areas. Open tundra during breeding. Prefers to nest on elevated ground.	Open tundra near high points of land, erratics or rock promontories within project area.	Not listed
GROUND BIRDS			
Rock ptarmigan ² (<i>Lagopus mutus</i>)	Coastal areas and open tundra, forested areas east of the Anderson River in winter. Remain in burrows in snow during winter, emerging mid-day to feed.	Snow burrows may be encountered within project area.	Not listed
Willow ptarmigan ² (<i>Lagopus lagopus</i>)	Widely distributed throughout forest and tundra areas. Remain in burrows in snow during winter, emerging mid-day to feed.	Snow burrows may be encountered within project area.	Not listed

Notes:

- Bird species are included only if they are confirmed, possible or probable breeders within a particular subregion that the proposed program interacts with.
- Species are included due to their listing in Community Conservation Plans as species of interest or declining in population.
- Committee on the Status of Endangered Wildlife in Canada 2001.
 Endangered = A species facing imminent extirpation or extinction.
 Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural events.
 Not at risk = A species that has been evaluated and found to be not at risk
 Not listed = A species which does not appear in COSEWIC documentation.

11.8.2.1 Waterfowl

Various species of waterfowl utilize the Mackenzie Delta and environs as migratory staging and nesting grounds. Within the program vicinity, coastal areas surrounding the East Channel outflow into Kugmallit Bay provide spring staging areas for large numbers of tundra swans and snow, white-fronted, and Canada geese, and critical nesting and molting areas for white-fronted and Brant geese, long-tailed duck, scaup and scoters (Martell et al. 1984). Both suitable and optimal waterfowl habitats are located immediately adjacent to the majority of waterbodies in and around the proposed program area (IEG 2001). Depending on the location of overwintering habitat, waterfowl may reach the Delta area by inland or coastal migratory routes. Arrival and departure of many migratory waterfowl are closely related to break-up and freeze-up of the ice (TCCP 2000), with the earliest arrival of ducks occurring in early to mid May. Tundra swans (*Cygnus columbianus*) begin to arrive on nesting grounds in mid May (Stewart and Bernier 1989), as do lesser snow geese (*Chen caerulescens caerulescens*) and brant (*Branta bernicla*) (TCCP 2000). Loons (*Gavia* sp.) and white-fronted geese (*Anser albifrons frontalis*) begin to arrive in late May and early June (Dome et al. 1982a, Bailey et al. 1933 in Johnson and Herter 1989).

Waterfowl generally start to move to staging areas in preparation for fall migration by about mid-August (Martell et al. 1984). Some migratory bird species do not leave the area until most waterbodies are frozen in late September (Johnson and Herter 1989). The migration of white-fronted geese from the area is gradual, beginning possibly as early as mid August and continuing until late September or early October (Barry 1967 in Dome et al. 1982a). Greater scaup (*Aythya marila*) may be present in the area until late September (Johnson and Herter 1989).

11.8.2.2 Shorebirds and Wading Birds

Many species of shorebirds migrate through the Mackenzie Delta and Beaufort Sea during spring and fall. Concentrations of several species can be found feeding together in coastal bays, estuaries and nearshore Beaufort Sea during late summer prior to southward migration (Hawkings 1987; Alexander et al. 1988, 1991; Johnson and Herter 1989). The Eskimo Curlew (*Numenius borealis*) has been designated as 'endangered' by COSEWIC and has been sighted only occasionally in recent years, by experienced birdwatchers in the woodland zones of the Mackenzie Delta. However, these sightings have not been confirmed by professional researchers (COSEWIC 2001). The sandhill crane (*Grus canadensis*), considered a wading bird, arrives from late April to early May, inhabiting upland and coastal areas (TCCP 2000). They depart in late August or early September.

11.8.2.3 Raptors

While the majority of raptor species found in the ISR are migratory, arriving at the earliest in late April and departing by September, overwintering raptors may occur in AEC's proposed program area during operations. Many raptor species migrate south from northern areas for the winter, when their prey have either migrated from the area or have become unavailable under the snow. A few species remain in northern areas throughout the winter, but these stragglers will often move locally in response to availability and abundance of food (Dome et al. 1982a). Raptors remaining in the ISR year-round, which are of importance to the project, are the gyrfalcon, the golden eagle and the snowy owl (Fleck 1981;

Savage 1985; Martell et al. 1984). Those raptors that are likely to overwinter in the program vicinity and are either of special significance to the Inuvialuit peoples or have been designated status by COSEWIC are outlined below.

Golden Eagle (*Aquila chrysaetos*)

The golden eagle is a year-round resident of the Northwest Territories. The migratory portion of the northern Golden eagle population arrives in northern breeding areas by mid March (Roseneau et al. 1981 in Dome et al. 1982b). Golden eagle nest in mountainous areas, primarily on cliffs, cutbanks, and outcrops, and occasionally in trees (Campbell and Davies 1973 in Dome et al. 1982b). The nests are quite impressive, some reaching over ten feet in diameter (Daum 1994). In the Mackenzie Delta area, egg-laying occurs during the first two weeks of May, hatching after the first two weeks of June and fledging from mid-July to late August (Fyfe and Prescott 1973, Salter et al. 1980 in Dome et al. 1982b).

Golden eagles are both predators and scavengers. Their prey is primarily mammalian, but they will also take birds and carrion. Common prey items include ground squirrels, marmots, snowshoe hares, ptarmigan and waterfowl (Campbell and Davies 1973, Roseneau et al. 1981 both in Dome et al. 1982b).

Gyrfalcon (*Falco rusticolus*)

The chosen symbol of the Inuvialuit people and the world's largest falcon, the gyrfalcon can sustain flight speeds higher than that of any other bird of prey (IDC 1998). The gyrfalcon resides in the ISR year-round with its breeding range including the northern Mackenzie District (AOU 1983 in Johnson and Herter 1989). In the Beaufort Sea area, the gyrfalcon is relatively uncommon outside of the foothills and mountains. The gyrfalcon breeds in small numbers throughout the Arctic. Within their range they are a fairly common permanent breeding and resident species on cliffs, rocky outcrops and river bluffs (Garner and Reynolds 1986 in Johnson and Herter 1989).

Gyrfalcons nest much earlier than most other raptor species. Pair formation may occur as early as February or March (Platt 1976 in Dome et al. 1982a, Roseneau et al. 1981 in Dome et al. 1982b). The species nests primarily on cliffs, bluffs and outcrops, but they will occasionally nest in trees (Kuyt 1980, White and Roseneau 1970 in Dome et al. 1982a, Cade 1960, White and Cade 1971, both in Dome et al. 1982b). Egg laying usually occurs during April and early May, hatching by mid June, and fledging by August (Platt and Tull 1977 in Dome et al. 1982a, Cade 1960, Roseneau et al. 1981 both in Dome et al. 1982b). Some adults will remain near their nests all winter (Platt 1976 in Dome et al. 1982a, Roseneau et al. 1981 in Dome et al. 1982a). The winter range of the gyrfalcon in North America includes the majority of its breeding range, especially for adult birds and during years of abundant prey (AOU 1983, Palmer 1988 both in Johnson and Herter 1989).

Gyrfalcons typically rely on only a few kinds of prey for their diet. During the summer ptarmigan are often the principal prey, and arctic ground squirrels are often important (Cade 1960, White and Cade 1971, Roseneau 1972 all in Dome et al. 1982b). Arctic hares are also important in some areas (Muir 1973

in Dome et al. 1982a). Gyrfalcons may become nomadic in years of ptarmigan population lows, following prey further south (Fleck 1981).

Snowy Owl (*Nyctea scandiaca*)

The most numerous of the arctic owls, the snowy owl's wintering range extends from the northern extremities of the United States to the Arctic Archipelago. The snowy owl winters in all types of habitats, however the species prefers open rangeland, prairie or tundra environments where a commanding view of the landscape may be achieved. Individuals who do not spend the entire winter in the tundra begin the northward migration to the arctic breeding grounds in February and March.

During breeding, snowy owls are found on the open tundra (Parmelee 1972). Each pair of snowy owls defends a breeding territory of 1 to 2 km². Courtship and mating occurs in mid-May and laying in late May. Nests are located on high points of land, erratics or rock promontories and are basically a shallow, unlined scraping in the substrate. The first owlets hatch 30 to 32 days after laying and the remaining eggs hatch at 48 hour intervals. Fledging from the nest is extended due to the large age distribution between young (Parmelee 1972), and typically occurs at seven to eight weeks of age. The family group stays together during the entire summer, and if the family is migratory, fall migration occurs in late September and early October (Salter et al. 1980 in Dome et al. 1982b, Garner and Reynolds 1986, Smith 1973 both in Johnson and Herter 1989).

Snowy owls are diurnal hunters and the chief prey item is lemming (TCCP 2000). The breeding cycle of the snowy owl is closely linked with the lemming cycle of abundance and scarcity. Every three to five years, the lemming population in the arctic will crash, making the rodents almost impossible to find (Parker 1974). When lemming shortages occur, owl mortality increases and fewer pairs breed. During lemming shortages, alternative prey items include snowshoe and arctic hare, ptarmigan, songbirds, waterfowl and fish, and occasionally carrion (Savage 1985). Some owls may also migrate in search of lemmings.

11.8.2.4 Ground Birds

Ptarmigan (*Lagopus* spp.)

Two species of ptarmigan are common in the Delta area, willow ptarmigan (*Lagopus lagopus*) and rock ptarmigan (*Lagopus mutus*). Portions of the local ptarmigan population overwinter throughout their home range (Johnson and Herter 1989). Both willow and rock ptarmigan may overwinter within the vicinity of the proposed program area. Both species form flocks in late summer, and by late fall groups of males will separate from the larger flocks as the ptarmigan move to wintering areas. Willow ptarmigan generally move further from their nesting areas than do rock ptarmigan. During the winter, ptarmigan remain in burrows in the snow, venturing outside for only a few hours of light around mid-day. They feed on a wide variety of plants in the summer, but fewer species are consumed in the fall (Martell et al. 1984).

Willow ptarmigan are widely distributed throughout forest and tundra areas. Within their range, willow ptarmigan inhabit open tundra, brushy tundra, heath areas, and clearings in northern forests (Johnsgard

1973a, Cramp and Simmons 1980 *both in* Johnson and Herter 1989). They nest on tundra habitats in the Mackenzie Delta (Martell et al. 1984), but they mostly find poor to fair habitat within the proposed program area (IEG 2001). In late April and early May, willow ptarmigan move from tall willow wintering areas to upland shrub tundra. In winter the species feeds almost exclusively on willow buds, and maintains this diet throughout the winter months (Martell et al. 1984).

Rock ptarmigan are commonly found in areas of open tundra during summer months and are frequently found in coastal areas. There is abundant optimal habitat for rock ptarmigan throughout the proposed program area (IEG 2001). In winter the species feeds mostly on birch buds. The spring diet of the rock ptarmigan is more varied than that of the willow ptarmigan, probably due to early snow melt in exposed locations on the tundra (Martell et al. 1984).

11.8.3 Fish

A large number of fish species occur within the freshwater and marine environments of the mainland western Arctic. The impacts of oil and gas developments may be of particular concern to these aquatic environments and their inhabitants. Fish species of concern due to their sensitivity or importance for subsistence are listed in Table 16 if they are potentially found in the general vicinity of the program area. Those species that may overwinter in the program vicinity receive further discussion below.

Fish populations are generally considered to be most sensitive to environmental disturbance during spawning, incubation, emergence, rearing, overwintering and migration (Dome et al. 1982b). Overwintering success of any fish species in the arctic is influenced primarily by the amount of overwintering habitat available and the quality of the habitat in terms of its ability to support fish. Many of the waterbodies in the arctic coastal plain are too shallow to support fish during the winter when ice depth can approach 2 m. Identified fish overwintering habitat in the vicinity of the proposed program area was drawn from a government-funded research document compiled by Sekerak et al. in 1992.

In general, lakes of sufficient depth with connections to river channels are used more extensively for wintering than are small channels. Lakes and streams along the Tuktoyaktuk Peninsula support populations of least cisco, lake and broad whitefish, lake trout, burbot, northern pike, and arctic grayling, among others. While a few species known to overwinter in the outer delta are likely resident to a waterbody (e.g. lake trout), the majority of species are migratory, given the good connections between overwintering waterbodies and other major streams (Sekerak et al. 1992).

In the context of this section, the term "anadromous" refers to fish that either spend most of their lives in the sea and migrate to freshwater to spawn (e.g. salmon) or to fish that migrate from freshwater to the sea, or vice versa, regularly at some definite stage in their life cycle for purposes other than spawning (e.g. least cisco).

Table 16

Fish Species Of Concern Found In The Vicinity Of the Proposed Program

Species ¹	Habitat	Spawning Period	COSEWIC ²
FRESHWATER			
Arctic grayling (<i>Thymallus arcticus</i>)	Kugalak River, coastal rivers of North Slope. Occasionally Richards Island.	Spring	Not listed
Broad whitefish (<i>Coregonus nasus</i>)	Several overwintering areas in East Channel, Whitefish Bay. Tuktoyaktuk Harbour, Mason Bay, Mallik Bay, Shallow Bay, streams of Tuktoyaktuk Peninsula, spawning throughout the Mackenzie system.	October, November	Not listed
Burbot (<i>Lota lota</i>)	Mouths of creeks. Winter and spring may be abundant in fresh or brackish waters of Kugmallit Bay's coastal embayment.	January – March	Not listed
Inconnu (<i>Stenodus leucichthys</i>)	Mackenzie River and estuary (rearing habitat). Turbid lakes on Richard Island throughout summer, Mallik and Mason Bays.	Late September – early October	Not listed
Lake trout (<i>Salvelinus namaycush</i>)	Outer delta lakes (including minor channels) with high oxygen levels, a good connection to adjacent water bodies, small to moderate volumes available and poor to moderate water quality.	Fall	Not listed
Lake whitefish (<i>Coregonus clupeaformis</i>)	Lakes and large rivers, brackish coastal waters.	Late September	Not listed
Least cisco (<i>Coregonus sardinella</i>)	Mackenzie River and estuary, tributaries to the Mackenzie (spawning habitat), inland lakes. Inner Shallow Bay / Niakunak Bay and Kugmallit Bay are important overwintering and nursery areas.	Early October	Not listed
Ninespine stickleback (<i>Pungitius pungitius</i>)	Shallow vegetated areas of lakes, ponds, and pools of sluggish streams. Sometimes in open water over sand. Seining locations Shallow Bay, Kendall Island, Swan Channel and East Channel.	Spring	Not listed
Northern pike (<i>Esox lucius</i>)	Tributaries, creeks and shallow lakes in Mackenzie delta.	Early spring	Not listed
Rainbow smelt (<i>Osmerus mordax</i>)	Found only along mainland coast from Bathurst Inlet westward.	Spring	Not listed
ANADROMOUS			
Chum salmon (<i>Oncorhynchus keta</i>)	Pacific and Arctic oceans, spawning in rivers from the Mackenzie westward.	Fall	Not listed
Dolly Varden ³ (<i>Salvelinus malma</i>)	Fish Hole, Rat River, Big Fish River, Fish Creek, Babbage River, Peel River, Shingle Point, occasionally travel the Mackenzie near Inuvik and Aklavik. Travel from stream to stream along the Beaufort Coast.	August, early September	Not listed
Pink salmon (<i>Oncorhynchus gorbusha</i>)	Pacific and Arctic oceans, spawning in rivers from the Mackenzie westward.	Fall	Not listed

Notes:

1. Fish species are included only if they are known to be confirmed, possible or probable breeders within a particular subregion that the proposed program impacts.
2. Committee on the Status of Endangered Wildlife in Canada 2000.
Threatened = A species likely to become endangered if limiting factors are not reversed.

Special Concern = A vulnerable species because of characteristics that make it particularly sensitive to human activities or natural event

Not listed = A species which does not appear in COSEWIC documentation.

3. Historically, fish of the genus *Salvelinus* caught along the Beaufort Sea coast have been identified as Arctic char (*Salvelinus alpinus*). Haas and McPhail (1991) note that Dolly Varden char (*Salvelinus malma*) are formally separated from the Arctic char complex.

Arctic Grayling (*Thymallus arcticus*)

Arctic grayling are typically found in shallow water for much of their lifecycle (TCCP 2000). They commonly form large aggregations prior to spawning and overwintering (McCart and Den Beste 1979 in Dome et al. 1982a). Spawning occurs in the spring as the ice is breaking up. While some small lakes in the region support Arctic grayling, spawning generally occurs in tributary streams (de Bruyn and McCart 1974 in Dome et al. 1982a). Arctic grayling have been observed overwintering in outer delta lakes near Parsons Lake (Sekerak et al. 1992). In the spring, mature grayling move to the outflows of overwintering lakes (Martell et al. 1984).

Broad Whitefish (*Coregonus nasus*)

Broad whitefish are commonly found in coastal habitats with an extensive freshwater influence (Percy 1975, Bond 1982, Lawrence et al. 1984, Bond and Erickson 1991, 1992). The life-history pattern of broad whitefish in this area is dominated by the year round flow of the Mackenzie River into the Beaufort Sea, whereas all other rivers stop flowing during the winter months (Bond 1982, Lawrence et al. 1984). This continuous flow allows young-of-the-year broad whitefish to move in late winter within the freshwater plume under the landfast ice, eastward along the Tuktoyaktuk Peninsula, arriving at mouths of freshwater streams along the Tuktoyaktuk Peninsula during breakup (Bond 1982, Lawrence et al. 1984, LGL 1990). These yearlings then enter freshwater lakes along the peninsula where they spend 3 to 4 years before beginning a lifelong cycle of moving to coastal waters for summer feeding, and returning to overwintering sites in the Mackenzie Delta (Bond 1982, Lawrence et al. 1984).

Broad whitefish mainly overwinter in lower Mackenzie drainage areas and along the Tuktoyaktuk Peninsula (Dome et al. 1982a, Sekerak et al. 1992). Within the vicinity of the proposed program area broad whitefish are known to overwinter in outer delta lakes and the estuarine coastal habitat of Kugmallit Bay (Sekerak et al. 1992). Coastal areas and bays along the Tuktoyaktuk Peninsula, as well as Mackenzie Bay, Mallik Bay, and the south coast of Kugmallit Bay, are important rearing areas for older juvenile and both spawning and non-spawning adult broad whitefish (Percy 1975, Kendel et al. 1975 in Dome et al. 1982a, Lawrence et al. 1984, LGL 1990). In the coastal waters, primary food sources are crustaceans, small bivalves, and insect larvae (Dome et al. 1982a). In August and September, the spawning portion of the population moves into the Mackenzie Delta prior to migrating to spawning habitat in October (Dome et al. 1982a).

Burbot (*Lota lota*)

Commonly known as 'loche', burbot is a freshwater species also found in brackish coastal waters, ranging from Herschel Island to Atkinson Point, with concentrations in the Kendall Island area (Percy 1975, Martell et al. 1984). This species generally prefers deep lakes (Martell et al. 1984). They are

bottom-feeding predators, consuming sculpins, other burbot, smelt, and mysids on the coast (Percy 1975). The burbot spawns in mid winter (January to March) under the ice of lakes and rivers (Martell et al. 1984, TCCP 2000). Spawning typically occurs in 3 m or less of water over sand or gravel substrate in shallow bays (TCCP 2000). Within the vicinity of the proposed program area, commonly used overwintering habitats include outer delta lakes and the Mackenzie River East Channel (Sekerak et al. 1992). In late winter and early spring, burbot move into tributary rivers before continuing on to deeper water in the summer, including the fresh or brackish waters of Kugmallit Bay (TCCP 2000).

Inconnu (*Stenodus leucichthys*)

Inconnu, commonly known as 'coney', are the largest member of the whitefish family. The species is often anadromous, making long migrations between freshwater and coastal areas, however exclusively freshwater populations do reside in some lakes (TCCP 2000). Spawning usually occurs in late September, approximately 2-3 weeks prior to the average date of first ice formation. The preferred spawning habitat is characterized by gravel substrate in relatively shallow, fast-flowing, and clear water. Following spawning, inconnu migrate back downstream to coastal areas. In the vicinity of the proposed program area, Sekerak et al. (1992) noted inconnu to overwinter in the East Channel, while Howland et al. (2000) were unclear if inconnu overwinter in rivers.

Lake Trout (*Salvelinus namaycush*)

Lake trout are the largest and among the longest lived freshwater fish in the Northwest Territories (Dome et al. 1982a). Lake trout are most common in large, deep lakes; but are occasionally captured in large rivers or brackish water (TCCP 2000). This species spawns in early September over the rocky substrate of lake bottoms (Dome et al. 1982a, TCCP 2000). Areas of important habitat for lake trout include the King Point Lakes and the Husky Lakes (TCCP 2000). Within the vicinity of the proposed program area, lake trout are likely resident to a particular waterbody, and have been observed overwintering in outer delta lakes (Sekerak et al. 1992).

Lake Whitefish (*Coregonus clupeaformis*)

Commonly known as 'crooked backs' or 'humpback whitefish', lake whitefish along the coast of the southern Beaufort Sea are thought to originate in the Mackenzie River, with the Colville River being a secondary source (Dome et al. 1982a). Larger fish of this species tend to remain in estuaries with a large freshwater influence during the summer months (Kendel et al. 1975 in Dome et al. 1982a). Juveniles rear in delta areas and nearshore coastal habitats (Dome et al. 1982a). During the summer lake whitefish feed on crustaceans and small bivalves in outer delta habitats, and on insect larvae in inner delta habitats (Percy 1975). Whitefish return to inner delta areas to begin their upstream movement for spawning. Spawning occurs in late September and early October (Mann 1975 in Dome et al. 1982a, TCCP 2000). Primarily immature lake whitefish have been observed overwintering in freshwater areas (Mann 1975 in Dome et al. 1982a). Within the vicinity of the proposed program area, lake whitefish commonly overwinter in both outer delta lakes and the East Channel (Sekerak et al. 1992).

Least cisco (*Coregonus sardinella*)

The least cisco, commonly known as 'big-eyed herring' (TCCP 2000), occurs in offshore waters, coastal regions, lakes and rivers. This species is present in all drainage systems in the delta region, and in coastal waters of the southeastern Beaufort Sea (Martell et al. 1984). Some populations are anadromous, spawning in fresh water and spending the remainder of their life in marine environments, while others remain in freshwater lakes all year. Spawning generally occurs over gravel or sand substrate from mid-September to after freeze-up (Martell et al. 1984). Anadromous least cisco overwinter in coastal and estuarine waters, as well as in the Mackenzie Delta (Martell et al. 1984). Within the vicinity of the proposed program area, least cisco overwinters in both outer delta lakes, including Parsons Lake, and the East Channel (Sekerak et al. 1992). Many lakes and streams of the Tuktoyaktuk Peninsula are small and shallow. Studies have shown however, that this area does provide important cisco overwintering habitat (Dome et al. 1982a) because deep lakes do occur on the Peninsula, increasing the probability of fish survival (Chang-Kue and Jessop 1992).

Northern Pike (*Esox lucius*)

The northern pike is primarily a freshwater fish, found in the warm waters of shallow lakes and bays or quiet rivers. Northern pike are found throughout the Mackenzie Drainage area and likely most of the Eastern Coastal Drainage area. In addition, pike frequent the brackish coastal waters near the mouths of rivers off Tuktoyaktuk Peninsula and Richards Island (Martell et al. 1984).

Northern pike spawn in the spring following ice melt, about mid June to early July. Spawning mainly occurs in heavily vegetated marshes, lakes and river floodplains (Scott and Crossman 1973). Following spawning, pike generally remain in shallow, warm waters for the duration of summer. Mature pike feed mainly on small fish, including small pike and on small mammals and invertebrates. Pike move out of shallow waters to wintering habitats during the period between mid August and freeze-up, often concentrating at the mouths of creeks in November and December. They require deep channels and lakes for overwintering (Martell et al. 1984), of which there are a limited number within the vicinity of the proposed program area. Within the vicinity of the program area northern pike have been observed to overwinter in the outer delta lakes, including Parsons Lake (Sekerak et al. 1992).

Rainbow Smelt

Rainbow smelt are spring spawners, entering the lower reaches of rivers just prior to and during breakup (Percy, 1975). Once spawning is complete, they return to marine waters for the summer season (Dome et al., 1982). Rearing of juveniles takes place in brackish waters (Fenco and Slaney, 1978 in Dome et al., 1982a). The rainbow smelt feeds on amphipods, isopods, and mysids in coastal areas (Percy, 1975). They overwinter at river mouths, occurring in large numbers under the ice at the mouth of the Mackenzie River and rivers outside of the project area (Bendock, 1977; Craig and Haldorson, 1980 both in Dome et al., 1982a; Percy, 1975), and in some coastal bays along the Tuktoyaktuk Peninsula (Fenco and Slaney, 1978 in Dome et al., 1982). Rainbow smelt are known to overwinter in the East Channel adjacent to the proposed program (Sekerak et al. 1992).

11.9 Cultural and Historic Resources

Cultural and historic resources include the physical traces of culture and societies from the past as well as resources currently utilized by local people. Heritage sites recognized by Federal agencies are considered and these sites include: archaeological sites, historic structure sites, traditional trails, campsites, berry picking areas, sacred or medicinal plant picking areas, burial sites, ceremonial sites, traditional hunting grounds, and places associated with traditional names or legends.

11.9.1 Methods

Baseline information provided in this report was synthesized from existing archival records, maps, and air photos held in databases at the Prince of Wales Northern Heritage Centre. Records of known, mapped heritage resource sites on file at the Canadian Museum of Civilization were searched to identify sites within the project area.

In the summer and fall of 2001, a heritage resource inventory was conducted to confirm the locations and extent of known archaeological sites and to survey for additional sites. Field reconnaissance included aerial surveys as well as extensive on-the-ground inspections.

Potential impacts of the proposed program on archaeological and cultural resources are described in Section 12.0, Proposed Mitigation and Anticipated Environmental Impacts.

11.9.2 Known Archaeological and Cultural Resources

This program, being located in an upland environment of the Mackenzie Delta, offers excellent fishing lakes, and a well-drained cover with exposed sandy ridges. Because of these natural features, it is of moderate to high potential in supporting the presence of heritage sites.

The following thirteen (13) heritage sites are located immediately outside the proposed 2D seismic lines (Figure 8) and their location is further detailed in Table 17:

NhTr-3

NhTr-3 is located on a hill overlooking a lake on the Radio Creek system about 45 km south of Tuktoyaktuk. Material found consists of three poles that have been notched and carved to fit together to create a tripod representative of a possible tent frame.

NhTr-4

NhTr-4 is located on a hill overlooking a lake on the Radio Creek system about 45 km southeast of Tuktoyaktuk. Material found consists of a small quartzite and chert flake scatter with no diagnostics.

NgTs-1

Observed from the air and recorded by Swayze in 1993 as a single log grave on the east shore of East Channel approximately 5.5 kilometres north of the mouth of Holmes Creek. No graves were noted in this vicinity during the 2001 survey but the remains of a timber channel marker in this location may be what Swayze originally recorded.

NhTs-9

Observed from the air and recorded by Swayze in 1993 as a single log grave on the east shore of East Channel approximately 4.5 kilometres south of the mouth of Pete's Creek. The site consists of a single large lichen-encrusted log covered burial. No grave furnishings or bone were observed.

Temporary Designation: MDHS82

This prehistoric site is a lithic scatter/campsite in a blowout atop a prominent hill overlooking a small lake to the north and east. The site consists of a diffuse scatter of quartzite debitage, principally representing primary core reduction, and a small green chert graver. The identifying coordinates for the site delineate a triangular area with one of the proposed 2D seismic lines lying just north of the site.

Temporary Designation: MDHS8

Billy Emaghok reported this bone scatter along the lakeshore. On-site investigations during the summer survey failed to confirm the presence of any remains at this location.

Temporary Designation: TLU5

This recent traditional land-use camp area consists of a collapsing ice-house, tent frame, hearth and scattered household debris on a small, low spit of land jutting into the embayment behind Kittigazuit.

Temporary Designation: TLU7

This possible traditional land-use locality consists of an abandoned komatik. The sled is of recent construction, with particleboard walls and plastic runner-shoes.

Temporary Designation: TLU43

This traditional land-use camp consists of a series of drying and smoking stages, shelters, abandoned boats, buildings and collapsed icehouses. A 12" x 16" shiplap sided building with a peaked roof may be the former RCMP post from Herschel Island. These remains are on a broad low southwest projecting spit of land in the bay south of Kittigazuit.

Temporary Designation: TLU44

This traditional land-use camp consists of a series of smoking stages, shelters, shacks, tent frames, outhouses, a boat dock and icehouse. Known locally as "Indian Camp", these remains are located on a broad low south-projecting lobe of land in the bay south of Kittigazuit.

Temporary Designation: TLU45

This traditional land-use locality is a small, dispersed scatter of driftwood logs on the point above "Indian Camp".

Temporary Designation: TLU36

This traditional land use locality is a camp area on a low point projecting northeastward from the west shore of a large lake. The remains of at least one stone circle, a hearth, wooden tent frame fragments, wooden stakes, and scattered caribou racks were noted.

Temporary Designation: TLU37

This traditional use locality is a camp area on the west side of the creek, which flows north towards Kittigazuit. The remains of at least two hearths, wooden parts, wire nails, and calcined bird bones were noted.



Plate 1: TLU44 - RCMP Camp.



Plate 2: TLU43 - RCMP Camp



Plate 3: MDHS82



Plate 4: TLU44 - "Indian" Camp.

Table 17

Historical Sites In The Vicinity Of The Proposed 2D Seismic Program

Site	Type	COORDINATES	Location	Association	Distance To Project (Km)
NgTs-1	Possible Grave	69°9'2.47"N, 134°16'19.50"W	Located on the east shore of the East Channel approximately 5.5 km north of the mouth of Holmes Creek.	Pre-Contact	~ < 4 km south of line 02 Kam-07.
NhTr-3	Historic use	69°13'36.54"N, 133°50'27.69"W	On a hill overlooking a lake on the Radio Creek system.	Pre-contact	~ 2km north of line 02 Kam-03.
NhTs-9	Grave	69°10'2.19"N, 134°15'1.09"W	Located on the east shore of East Channel approximately 4.5 km south of the mouth of Pete's Creek.	Pre-contact	Possibly impacted with line 02 Kam-07.
NhTr-4	Scatter	69°13'23.65"N, 133°50'32.80"W	On a hill overlooking a lake on the Radio Creek system.	Pre-contact	~ 2km north of line 02 Kam-03.
MDHS8	Possible bone scatter	69°11'51.90"N, 133°54'57.76"W	Possibly located along the lakeshore.	Pre-Contact	~ < 0.5 km north of line 02 Kam-05.
MDHS82	Lithic Scatter	69°13'47.97"N, 134°6'6.05"W; 69°13'50.60"N, 134°5'57.81"W; 69°13'49.77"N, 134°5'56.22"W	On a blowout atop a prominent hill overlooking a small lake to the north and east.	Pre-contact	~ 1 km south of line 02 Kam-05.
TLU 5	Camp	69°20'4.81"N, 133°42'2.11"W	Located on a small, low spit of land jutting into the embayment behind Kittigazuit.	TLU	May be impacted.
TLU 36	Campsite	69°12'6.00"N, 133°54'4.95"W	On a low point projecting northeastward from the west shore of a large lake.	TLU	~ 2 km south of line 02 Kam-03.
TLU 37	Campsite	69°16'49.55"N, 133°39'7.62"W	On the west side of the creek which flows north towards Kittigazuit.	TLU	~ 2 km south of line 02 Kam-03.

TLU43	Campsite	69°19'3.04"N, 133°42'18.57"W	On a broad spit of land in the bay south of Kittigazuit.	TLU	~ 5 km northwest of line 02 Kam-01.
TLU44	Campsite	69°18'50.91"N, 133°42'42.04"W	On a broad south projecting lobe of land in the bay south of Kittigazuit.	TLU	~ 5 km northwest of line 02 Kam-01.
TLU45	Wood scatter	69°18'55.98"N, 133°42'49.31"W	Located on the point above "Indian Camp".	TLU	~ 5 km northwest of line 02 Kam-01.
TLU7	Historic use	68°59'20.23"N 133°43'38.21"W	North shore of Parsons Lake	Historic	~<1km north of line 02 Kam-09.