



Advanced Explorations Inc.

# ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

ISSUED FOR USE

1740183.004

February 2008

CREATING AND DELIVERING BETTER SOLUTIONS





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**EXECUTIVE SUMMARY**

Advanced Explorations Inc. (AEI) is considering the development of the Roche Bay magnetite project, believed to be one of the world's largest undeveloped magnetite deposits. The Roche Bay project is located at 68°26' north latitude and 82°46' west longitude, approximately 65 km southwest of Hall Beach on the Melville Peninsula. The project site is situated adjacent to a naturally deep basin with 20+ metre water depths. In February 2007, AEI signed a joint venture agreement with Roche Bay plc to undertake the required work to complete feasibility studies to develop Roche Bay's extensive magnetite iron deposits in this area.

In 2006, EBA Engineering Consultants Ltd. (EBA) was retained by Roche Bay plc (now Advanced Explorations Inc.) to complete a baseline study of existing wildlife at the Roche Bay Magnetite Project. The initial baseline field studies took place during spring, summer and fall of 2006 and 2007.

EBA began conducting wildlife surveys at Roche Bay in 2006, continuing in 2007. The wildlife program included breeding bird, raptor, marine bird, ungulate (focussing on barren-ground caribou) and marine mammal surveys. All of these surveys were conducted in June, July and August of 2006 and 2007, with the exception of the BBS, which were only carried out in June of each year. These surveys yielded a total of 44 species. There were 1,138 documented wildlife observations totalling 21,070 individuals. In addition, there were 428 observations of animal sign.

At Roche Bay, breeding bird surveys (BBS) were conducted from 25 – 28 June 2006 and 24 – 26 June, 2007. A total of 36 BBS stations were surveyed; 27 in 2006 and nine in 2007. The BBS yielded a total of 300 bird detections across the two years of the study, of which 151 were recorded as incidental (either outside the survey plot or outside the survey time). A total of 24 bird species were detected during the breeding bird surveys, 13 of which were incidentals. Lapland Longspur was the most common species recorded during the BBS, followed by Horned Lark. During 2006 and 2007, breeding bird surveys were conducted in 5 habitat types (including 2 habitat complexes). Sedge meadow and heath tundra habitat types were the most surveyed habitats during the 2006 and 2007 breeding bird surveys, which is considered to adequately represent the proportion of habitat available to breeding birds within the study area.

A total of 19,864 marine birds (seabirds and waterfowl) were observed within the study area during 2006 and 2007, 10,927 during marine bird surveys and 8,937 as incidentals. Waterfowl (ducks, geese and swans) made up 97% of the total number of birds recorded, followed by 3% seabirds (gulls, tern, jaegers and guillemots) and less than 1% loons.

Marine bird surveys were flown in conjunction with marine mammal surveys in July and August, 2006 and June, July and August, 2007. A total of 7,439 birds were recorded during the marine bird survey in 2006 and 3,488 birds were observed in 2007. These observations included 19 bird species (four loon, three seaduck, two goose, one swan, four gull, one tern, three jaeger and one alcid (guillemot)).



Aerial raptor surveys were completed in 2006 and 2007; however, raptors were also documented opportunistically during other surveys. Twenty-two raptor observations (totalling 28 individuals) were documented in 2006 and 2007 (ten in 2006 and 12 in 2007). Five raptor species were observed in 2006 and 2007 including: Common Raven, Gyrfalcon, Peregrine Falcon, Rough-legged Hawk and Snowy Owl. Four raptor nests were documented in the study area during 2006 and 2007. These nests belonged to a Common Raven, Peregrine Falcon, Rough-legged Hawk and an unidentified species of raptor.

Between 20 – 22% of the land portion of the wildlife study area was surveyed during the ungulate surveys. A total of 247 barren-ground caribou were observed within the study area during the 2006 and 2007 field programs. Aerial ungulate surveys yielded 117 caribou in 2006 and 48 caribou in 2007. The average group size observed during the ungulate surveys was 2.6 animals, with a maximum group size of 12, which was observed in July 2006. Caribou densities ranged from 0.03 caribou/km<sup>2</sup> to 0.20 caribou/km<sup>2</sup> within the study area during 2006 and 2007. The estimated number of caribou using the study area ranged from  $32 \pm 17.4$  to  $245 \pm 156.0$  (S.E.).

Marine mammal surveys were flown in conjunction with marine bird surveys in July and August, 2006<sup>1</sup> and June, July and August, 2007. These surveys yielded seven sea mammal observations in 2006 and 203 sea mammal observations in 2007. These observations comprised five mammal species, including polar bear, walrus and bearded, harbour and ringed seals.

Incidental observations of miscellaneous wildlife were also documented in 2006 and 2007. Sandhill Cranes were detected during breeding bird surveys, and an additional nine Sandhill Cranes were recorded as incidentals in 2006 and 2007. Mammals observed incidentally (either visuals or as sign) within the study area during 2006 and 2007 included arctic ground squirrels, arctic foxes, arctic hares, lemmings, muskox and weasels.

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<sup>1</sup> A marine mammal survey was not flown in June 2006, due to limited flight time.



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## 1.0 INTRODUCTION

### 1.1 BACKGROUND

EBA Engineering Consultants Ltd. (EBA) has been retained by Roche Bay plc (Roche Bay) to provide environmental services to the Roche Bay Magnetite Project (the project). In February 2007, Roche Bay entered into an option agreement with Advanced Explorations Inc. (AEI), who will be responsible for designing and building a mine at Roche Bay, Nunavut. In 2006, EBA began wildlife surveys at Roche Bay as part of the environmental baseline studies.

Borealis Exploration Limited, who originally established the project in the mid-1970s and who had first commissioned EBA to conduct the environmental baseline studies, had completed preliminary wildlife work in the general area. Therefore, objectives of this wildlife program were to build upon the wildlife database and to document baseline terrestrial and marine wildlife use of the area of interest.

EBA began conducting wildlife surveys at Roche Bay in 2006, and continued in 2007. The wildlife program included Breeding Bird Surveys (BBS), raptor, marine bird, ungulate (focussing on barren-ground caribou) and marine mammal surveys. All of these surveys were conducted in June, July and August of 2006 and 2007, with the exception of the BBS, which were only carried out in June of each year. Mr. Steve Moore and Ms. Karla Langlois conducted all 2006 wildlife work and the June wildlife work in 2007. Ms. Langlois and Mr. Patrick Kramers conducted the July 2007 wildlife surveys, while Mr. Moore and Ms. Krista Amey conducted the August 2007 surveys.

### 1.2 SITE DESCRIPTION

Roche Bay is located on the Melville Peninsula, approximately 65 kilometre (km) southwest of Hall Beach, Nunavut (Latitude 68° 42', Longitude 82° 78") (Figure 1). The entire wildlife study area, which encompasses all survey areas, covers an area approximately 2,500 km<sup>2</sup> and is roughly centered on Roche Bay proper (Figure 2).

## 2.0 METHODS

### 2.1 BREEDING BIRD SURVEYS

Breeding bird surveys were conducted in late June 2006 and 2007, when most species of songbirds are on territory and singing (Ralph and Scott 1981; Bibby *et al.* 1993). Birds were surveyed using fixed radius point count sites (Ralph *et al.* 1993).

Fixed radius point count sites were accessed by all-terrain vehicles and foot. Surveys commenced at 0400 hrs and continued until 1000 hrs when singing is considered to be the most intense (Ralph *et al.* 1993). Surveys were curtailed when observation conditions became unsatisfactory due to weather (*e.g.* wind, constant rain). Particular care was given to not disturb the birds when approaching point count sites. Observers recorded the date,



location, weather conditions, basic habitat conditions, and start time at each point count site before starting the survey. Observers waited a minimum of 2 to 5 minutes before beginning each survey to allow birds to resume their normal behaviour. At each point count site, all birds heard and seen were recorded within 0 – 50 m, 50 – 100 m, and greater than 100 m from station centre, at time intervals of 0 – 5 minutes and 5 – 10 minutes. Birds observed beyond 100 m or flying over the site were noted separately as incidental observations.

The species, sex (where possible), and behaviour (flushed, territorial display, etc.) was recorded, wherever possible. Territorial and breeding behaviour was recorded such as territorial calls, displays, distraction behaviour, and disputes. Other information recorded included nest site, anxious parents, incubation, nest building, fledged young, mating, adults carrying food to a nest, or the begging calls of nestlings. Breeding birds were also recorded between point count sites and during other aspects of the 2006 and 2007 fieldwork.

## 2.2 MARINE BIRDS

Formal marine bird surveys were conducted in conjunction with sea mammal surveys. For the purposes of this report, all bird species that were observed during the marine bird survey were documented and analysed (including waterfowl and seabirds), even though some are technically not marine birds by definition. For example, Tundra Swans are not considered marine birds; however, they occupied freshwater wetlands in close proximity to the marine shoreline at the time of the marine bird survey. Species included in the marine bird surveys were loons, geese and swans, seaducks (Common and King eiders and Long-tailed Ducks) and seabirds (gulls, terns, jaegers and alcids (guillemots)).

The marine survey route was approximately 140 km, following the Roche Bay shoreline and crossing the mouth of Roche Bay. The route included Qavvialuk Point, South Ooglit Island and the north shore of Ignertok Peninsula (Figure 3). Surveys were flown using available aircraft including a Twin Otter, Cessna 180 or Cessna 206, and an A-Star helicopter (an A-Star helicopter was used for the August 2007 survey). Three personnel flew on each survey; the pilot, a navigator/right observer and a left observer. The pilot concentrated on maintaining altitude, speed and staying on survey route. The right observer recorded animals on the right side of and beneath the aircraft, out of sight of observer in the left backseat. Flight altitude averaged 50 m (above sea level) and distance from shore averaged 150 m.

Information recorded for each marine bird observation included species, number and Global Positioning System (GPS) waypoint (hand-held with a remote antenna for increased accuracy).

## 2.3 RAPTORS

Raptor surveys focused on Peregrine Falcons, Gyrfalcons, Snowy Owls and Rough-legged Hawks and their habitats. Common Ravens were also included in the raptor surveys, as they are considered functional raptors.

Aerial raptor surveys involve a slow fly-by of known, suspected, or potential nest sites or nesting areas. The survey crew consisted of the pilot, a front-seat navigator/observer, and a rear-seat observer/recorder. The raptor survey involved following upland cliffs to scan for cliff nests and potential cliff nesting areas, as well as tundra lowlands for Snowy Owl nests. Prominent cliff faces were inspected for birds, active nests, whitewash (guano), and orange lichen.

Raptors were also documented opportunistically during other surveys, such as aerial ungulate surveys or water quality sampling.

## 2.4 UNGULATES

Six systematic ungulate surveys, focusing on barren-ground caribou, were flown in June, July and August in 2006 and 2007 (Figure 4). The size of the study area surveyed was 40 km by 40 km, encompassing 1,600 km<sup>2</sup>. The survey area was divided into nine north – south transects, each 40 km long and spaced 5 km apart. The effective survey width for each transect was 1 km wide, 500 m on each side of the aircraft, providing approximately 22.5% coverage of the study area. Approximately 24% of the study area occurred over waterbodies, where caribou are less likely to occur, therefore a survey area of 1,220 km<sup>2</sup> were used for all caribou analyses. Caribou densities were calculated using Jolly's Method (Jolly 1969).

The surveys were flown using available aircraft including: Twin Otter, Cessna 180 or Cessna 206. Three personnel flew on each survey; the pilot, a navigator/right observer and a left observer. The pilot concentrated on maintaining altitude, ground speed and staying on transect. The right observer recorded animals on the right side of and beneath the aircraft, out of sight of observer in the left-rear backseat. Flight altitude and ground speed averaged 90 m (agl) and 150 kph, respectively.

Information recorded for each ungulate observation included transect number, GPS waypoint (hand-held with a remote antenna for increased accuracy), an estimate of group size, dominant activity, group composition, habitat type and any additional incidental wildlife observations.

## 2.5 MARINE MAMMALS

Aerial marine mammal surveys were conducted in conjunction with marine bird surveys, and followed survey methods as previously described in Section 2.2. (*Marine Birds*). Species targeted in the marine mammal surveys were polar bears, seals, walruses and whales.

Information recorded for each marine mammal observation included species, number and GPS waypoint (hand-held with a remote antenna for increased accuracy). All incidental observations of marine mammals within the study area were documented throughout the 2006 and 2007 field programs.



## 2.6 MISCELLANEOUS WILDLIFE

All incidental wildlife observed within the study area during additional field programs were documented and all pertinent information collected.

## 3.0 RESULTS

A total of 44 wildlife species were documented in the study area during the 2006 and 2007 field programs. Appendix A contains a complete list of bird and mammal species observed in the study area in 2006 and 2007. There were 1,138 documented wildlife observations totalling 21,070 individuals. In addition, there were 428 observations of animal sign.

### 3.1 BREEDING BIRD SURVEYS

Breeding bird surveys (BBS) were conducted from 25 – 28 June, 2006 and 24 – 26 June, 2007, the time period coinciding with peak songbird territorial behaviour such as singing, thus allowing breeding territories to be easily identified. Appendix B presents the Universal Transverse Mercator (UTM) coordinates for each BBS plot with the locations depicted in Figure 5.

A total of 36 BBS stations were surveyed; 27 in 2006 and nine in 2007. The BBS yielded a total of 300 bird detections across the two years of the study, of which 151 were recorded as incidental (either outside survey plot or outside the survey time). A total of 24 bird species were detected during the breeding bird surveys, 14 of which were incidentals (Table 1). Lapland Longspur (Photograph 1) was the most common species recorded during the BBS followed by Horned Lark. Seventy-eight observations of Lapland Longspurs were recorded, totalling 84 individuals (an additional seven incidental Lapland Longspurs were also observed). The most common shorebird species detected during the breeding bird surveys was Baird's Sandpiper (Photograph 2), followed by Semipalmated Sandpiper (Photograph 3). The least common species detected during the BBS were Pectoral Sandpiper, Rock Ptarmigan and Semipalmated Plover, with two detections each across 2006 and 2007. The most common incidental species was the Canada Goose, with six discrete observations comprising 87 individuals.

**TABLE 1. BIRD SPECIES RECORDED DURING THE BREEDING BIRD SURVEYS, JUNE 2006 AND 2007.**

Species (Common Name)	Number Recorded (including incidentals)
American Golden-Plover	11
American Pipit	14
Baird's Sandpiper	13
<i>Canada Goose</i>	91
<i>Common Loon*</i>	1
<i>Common Raven*</i>	3
<i>Glaucous Gull</i>	6
<i>Herring Gull*</i>	2

TABLE 1. BIRD SPECIES RECORDED DURING THE BREEDING BIRD SURVEYS, JUNE 2006 AND 2007.

Species (Common Name)	Number Recorded (including incidentals)
Horned Lark	17
<i>Hoary Redpoll*</i>	3
<i>King Eider*</i>	1
Lapland Longspur	91
<i>Long-tailed Duck*</i>	3
<i>Long-tailed Jaeger*</i>	3
<i>Parasitic Jaeger*</i>	1
<i>Pacific Loon*</i>	1
Pectoral Sandpiper*	2
<i>Pomarine Jaeger*</i>	1
Rock Ptarmigan**	2
<i>Sandhill Crane*</i>	2
Semipalmated Plover**	2
Semipalmated Sandpiper	8
Snow Bunting	6
<i>Snow Goose*</i>	14
Unknown sp.*	2

*Indicates species recorded only as incidentals during the breeding bird surveys*

\* Species detected in 2006 only

\*\* Species detected in 2007 only

Existing habitat was described at each BBS station during the surveys. Habitat descriptions followed the Ecological Land Classification (ELC), wherever possible (EBA 2008) and were re-classified to correlate with the units described in Flora and Vegetation of the Roche Bay Area (Ecosat 1982). Existing habitats are briefly described in Table 2, with corresponding Ecosat (1982) units. Large homogeneous habitats were targeted for the survey; however, some habitats exist across the landscape as small pockets within larger habitats and make up a habitat complex. Therefore, a couple of breeding bird survey sites occurred in two different habitat types (habitat complex). For the purposes of this report, the dominant habitat within a complex was used during analysis.

During 2006 and 2007, breeding bird surveys were conducted in five habitat types (including two habitat complexes) (Table 2). Habitats most surveyed were sedge meadow – dry (CA), sedge meadow – wet (CE) and heath tundra (HT). This is considered to adequately represent the proportion of habitat available to breeding birds within the study area. Of the available habitats surveyed during the breeding bird surveys, CA had the highest average number of birds detected per station, followed by CE and HT. The rock outcrop (RO) had the lowest number of detections. Species diversity (ratio of the number of species recorded to the number of birds observed in each habitat) was highest in raised beach (RB) habitat, followed by HT (Table 2).

**TABLE 1: BIRD SPECIES RECORDED DURING BREEDING BIRD SURVEYS AT ROCHE BAY, JUNE 2006 AND 2007.**

Species (Common Name)	Number
American Golden-Plover	11
American Pipit	14
Baird's Sandpiper	13
Canada Goose	91
Common Loon*	1
Common Raven*	3
Glaucous Gull	6
Herring Gull*	2
Horned Lark	17
Hoary Redpoll*	3
King Eider*	1
Lapland Longspur	91
Long-tailed Duck*	3
Long-tailed Jaeger*	3
Parasitic Jaeger*	1
Pacific Loon*	1
Pectoral Sandpiper*	2
Pomarine Jaeger*	1
Rock Ptarmigan**	2
Sandhill Crane*	2
Semipalmated Plover**	2
Semipalmated Sandpiper	8
Snow Bunting	6
Snow Goose*	14
Unknown sp.*	2
<b>Total Number of Bird Detections</b>	<b>300</b>

*Indicates species recorded only as incidentals during the breeding bird surveys*

\* Species detected in 2006 only

\*\* Species detected in 2007 only



Several bird species were detected in multiple habitat types and are therefore considered habitat generalists. Three species, Baird's Sandpiper, Horned Lark and Lapland Longspur were detected in four of the five habitats surveyed. Pectoral Sandpiper, Rock Ptarmigan and Semipalmated Plover were each documented in only a single habitat.

Incidental birds, such as gulls and waterfowl, detected during the BBS were discussed in the marine bird section below (Section 3.2 *Marine Birds*).

## 3.2 MARINE BIRDS

A total of 19,864 marine birds (seabirds and waterfowl) were observed within the study area during 2006 and 2007, 10,927 during marine bird surveys and 8,937 as incidentals. Waterfowl (ducks, geese and swans) comprised 97% of the total number of birds, followed by seabirds (3% gulls, tern, jaegers and guillemots) and loons (less than 1%).

### Marine Bird Surveys

Marine bird surveys were flown in conjunction with marine mammal surveys on 20 July and 23 August, 2006<sup>2</sup> and 24 June, 29 July and 28 August, 2007. These surveys yielded 214 observations totalling 7,439 individuals in 2006 and 189 observations totalling 3,488 individuals in 2007 (Table 3). These observations comprised 19 bird species (four loon, three seaduck, two goose, one swan, four gull, one tern, three jaeger and one alcid (guillemot)) (Table 3).

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<sup>2</sup> A marine bird survey was not flown in June 2006, due to limited flight time.

TABLE 2: SUMMARY OF BREEDING BIRD RESULTS PER HABITAT TYPE AT ROCHE BAY, 2006 AND 2007

ELC Type Classification	Habitat Unit (Ecosat1982)	General Habitat Description	Number of BBS Stations Surveyed	Total Number of Birds Detected	Average Number of Birds Detected per Station*	Total Number of Bird Species Detected per Habitat (Species Richness)	Species Diversity
Sedge Meadow - dry (CA)	Sedge Meadow	Develops on nearly level or gentle slopes with imperfect drainage. Moderately deep to deep organic deposits are characteristic. Many sites possess patterned ground polygon features. Total plant cover is very high, ranging from 80 to over 100%. Dominant plant species are <i>Carex aquatilis</i> and <i>Bryum</i> spp. (Jaques 1982)	11	57	5.19	8	0.14
Sedge Meadow - wet (CE)	Wet sedge-moss	Commonly found adjacent to ponds or streams and in sites which are wet with surface water cover throughout the growing season. Total vegetation cover varies from 20 to 60%. Dominant species include <i>Carex aquatilis</i> , <i>Dupontia fisheri</i> and <i>Eriophorum angustifolium</i> . (Jaques 1982)	10	43	4.30	6	0.14
Heath Tundra (HT)	Dwarf shrub, Dwarf shrub-lichen, Dwarf shrub-heath-moss	Dwarf shrub develops where snow cover is deep but not usually persistent all winter. Total vegetation cover is 50 to 80%. Dominant species include <i>Dryas integrifolia</i> , <i>Carex misandra</i> , <i>Saxifraga oppositifolia</i> , <i>Carex nardina</i> , <i>Cetraria</i> spp., <i>Thamnia perniularis</i> and <i>Alectoria</i> spp. Dwarf shrub-heath-moss develops where snow cover is light to moderate but persistent until June in most years. Can develop on residual bedrock, moraine, alluvial or colluvial deposits. Dominant species include <i>Dryas integrifolia</i> , <i>Cassiope tetragona</i> , <i>Racomitrium lanuginosum</i> and <i>Tomentypnum nitens</i> . Total plant cover ranges from 50 to 75%. (Jaques 1982)	9	34	3.78	6	0.18
Raised Beach (RB)	Cushion Plant (Cushion plant-lichen, Cushion plant-sedge-moss)	Cushion plant-lichen develops on the crests and open slopes of beach ridges or alluvial-lactustrine deposits. Lichens dominate the vegetation cover with dwarf shrub, <i>Dryas integrifolia</i> , also significant though rarely exceeding 10 %. Total plant cover is low, ranging from 5 to 35%. Cushion plant-sedge-moss occupies less rapidly drained sites. Plant cover is high, ranging from 65 to 100%. <i>Dryas integrifolia</i> is the dominant plant; however, mosses and several vascular plants contribute significant amounts of cover to the total. (Jaques 1982)	5	13	2.60	6	0.46
Rock Outcrop (RO)	n/a	All rock with lichen and heath; epithitic-lichen community (EBA personal observation 2006)	1	0	0.00	0	0.00

\* Analysis does not include incidental bird observations

Four species of loons were observed within the study area in 2006 and 2007, including: Common, Pacific, Red-throated and Yellow-billed. During marine bird surveys, loons comprised approximately 1% of the total number of birds observed. Eighty-four percent of the identified loons within the study area were Red-throated Loons; Pacific Loons were the second most commonly observed loon representing 9% of the loons identified during marine bird surveys (Table 3). Five Yellow-billed Loons and one Common Loon were observed during July 2006 surveys.

Of the total number of birds (10,927) observed during the surveys, 95% were waterfowl (ducks geese and swans). Of the waterfowl observations, 81% were Snow Geese, 7% were Long-tailed Ducks, 6% Canada Geese, 5% eiders<sup>3</sup>, and less than 1% Tundra Swans (Table 3). All Tundra Swan observations recorded during the marine bird survey were located in freshwater wetlands adjacent to the marine shoreline.

A total of 463 seabirds were recorded during the marine bird surveys in 2006 and 2007, which accounted for only four percent of the total number of birds observed. Ninety-three percent of these seabirds (432) were identified to species (Table 4). The percent composition of the 432 seabirds identified to species was 81% Arctic Tern, 11% Black Guillemot, 9% gull (Glaucous, Herring, Sabine's and Thayer's). No jaegers were observed during the marine bird surveys.

During the June 2007 marine bird survey, 723 of the 962 birds (~75%) observed were seen within approximately 5 km of South Ooglit Island (a mixed breeding colony), 95% of which were eiders and Long-tailed ducks (Figure 6). As the season progressed, the proportion of seabirds and waterfowl in the vicinity of South Ooglit Island decreased to approximately 20% in July and less than 1% in August (426 of 2,102 and 68 of 7,863, respectively; Figures 7 and 8). In August, the majority of the seabird and waterfowl observations were Snow Geese and were located along the shoreline from Ignertok Peninsula, north including Roche Bay peninsula and east to include Qavvialuk Point (Figure 8).

### Incidental Observations

A total of 8,937 marine birds (seabirds and waterfowl) (5,816 in 2006 and 3,121 in 2007) were observed as incidentals (*i.e.* outside of formal marine bird surveys) (Table 3). Similar to the percent compositional breakdown of the marine bird survey results, 98% of the incidental bird observations were waterfowl, 1% were loons and 1% were seabirds.

Unlike the percent composition of loon species of the marine bird during survey, Pacific Loons dominated the incidental loon observations, representing 58% of the identified loons, while Red-throated Loons comprised 17% of the identified loons. Common and Yellow-billed loons were also observed but in fewer numbers. One of the observations of Yellow-billed Loons (August 2007) was a breeding pair and a young-of-the-year on a small lake in the vicinity of the 2006 camp location.

<sup>3</sup> Due to the nature of the seabird surveys, King and Common eiders were often difficult to distinguish and therefore have been combined in the analyses.

Similar to the results of the marine bird surveys, 78% of the waterfowl observed as incidentals were Snow Geese. Nesting Snow Geese were documented within the study area during 2006 and 2007, though the numbers are not known. A unique observation of Snow Geese nesting on south facing cliffs along Kingora River was documented (Photograph 4).

Unlike the marine bird surveys, 16% of the incidental waterfowl were eiders. A group of approximately 1,000 King Eiders was observed along the shoreline between Qavvialuk Point and Qabvigjuaq Point in June 2006.

The most common species of seabird observed as incidental was Glaucous Gull, representing 37% of the identified seabirds. The second most commonly observed seabird was Arctic Tern, followed by Thayer's Gull and Herring Gull, representing 18%, 16% and 11%, respectively (Table 3).

The least commonly observed marine bird species observed within the study area, either during the marine bird surveys or as incidental, were Sabine's Gull and Long-tailed, Parasitic and Pomarine jaegers (Table 3; Photograph 5 for Long-tailed Jaeger).

### 3.3 RAPTORS

Though formal raptor surveys were intended for each visit to Roche Bay in 2006 and 2007, due to inclement weather or time constraints, raptor surveys were completed on 23 June, 2006 and 24 July and 1 August, 2007. In 2006 and 2007, many of the raptor observations within the study area were incidental and documented during other surveys, such as aerial ungulate surveys or water quality sampling. Twenty-two raptor observations (totalling 28 individuals) were documented (ten in 2006 and 12 in 2007) (Table 4). These observations were composed of five raptor species; Common Raven, Gyrfalcon, Peregrine Falcon, Rough-legged Hawk and Snowy Owl (Table 4). Raptor observations are depicted in Figure 9.

The most commonly observed raptor in each year was the Common Raven, making up 43% of the total number of raptor observations. Rough-legged Hawks were the second most common, representing 32% of the total number (Table 4). The least commonly observed raptor was the Gyrfalcon with only a single observation in July 2007.



TABLE 3: MARINE BIRDS OBSERVED WITHIN THE STUDY AREA DURING MARINE BIRD SURVEYS AND AS INCIDENTALS IN 2006 AND 2007.

Grouping	Species	Marine Bird Surveys										Incidentals										Total Number of Birds	% of Total
		2006				2007				Total Number of Birds Observed during Survey	% of Total Number of Birds Observed during Survey	2006				2007				Total Number of Birds Observed as Incidentals	% of Total Number of Birds Observed as Incidentals		
		June*	July	August	2006 Total	June	July	August	2007 Total					June	July	August	2006 Total	June	July			August	2007 Total
Loons	Common Loon	N/A	1 (1)**	0 (0)	1	0 (0)	0 (0)	0 (0)	0	1	0.01	1 (1)	7 (5)	0 (0)	8	0 (0)	0 (0)	0 (0)	0	8	0.09	9	0.05
	Pacific Loon	N/A	2 (2)	0 (0)	2	5 (3)	1 (1)	0 (0)	6	8	0.07	1 (1)	6 (4)	0 (0)	7	2 (1)	0 (0)	21 (10)	23	30	0.34	38	0.19
	Red-throated Loon	N/A	35 (15)	2 (2)	37	0 (0)	35 (1)	0 (0)	35	72	0.66	2 (1)	7 (4)	0 (0)	9	0 (0)	0 (0)	0 (0)	0	9	0.10	81	0.41
	Yellow-billed Loon	N/A	5 (3)	0 (0)	5	0 (0)	0 (0)	0 (0)	0	5	0.05	0 (0)	1 (1)	0 (0)	1	1 (1)	0 (0)	3 (1)	4	5	0.06	10	0.05
	Unknown Loon Spp.	N/A	0 (0)	4 (1)	4	9 (7)	0 (0)	0 (0)	9	13	0.12	0 (0)	0 (0)	0 (0)	0	0 (0)	0 (0)	1 (1)	1	1	0.01	14	0.07
Ducks, Geese and Swans	Eider spp.***	N/A	42 (2)	37 (2)	79	464 (21)	2 (1)	25 (4)	491	570	5.22	1031 (3)	0 (0)	360 (4)	1391	4 (2)	0 (0)	0 (0)	4	1395	15.61	1965	9.89
	Long-tailed Duck	N/A	270 (23)	20 (2)	290	379 (18)	33 (3)	9 (3)	421	711	6.51	0 (0)	64 (6)	0 (0)	67	2 (1)	0 (0)	8 (2)	10	77	0.86	788	3.97
	Canada Goose	N/A	388 (9)	71 (4)	459	24 (3)	80 (4)	92 (8)	196	655	5.99	152 (17)	35 (1)	56 (3)	243	118 (16)	0 (0)	50 (1)	168	411	4.60	1066	5.37
	Snow Goose	N/A	780 (33)	5394 (70)	6174	15 (2)	58 (3)	2146 (75)	2219	8393	76.81	706 (28)	100 (1)	3222 (44)	4028	434 (7)	183 (10)	2236 (20)	2853	6881	76.99	15274	76.89
	Tundra Swan	N/A	17 (7)	6 (2)	23	0 (0)	0 (0)	13 (4)	13	36	0.33	5 (3)	0 (0)	16 (4)	21	5 (4)	10 (4)	6 (3)	21	42	0.47	78	0.39
Gulls, Terns, Jaegers	Glaucous Gull	N/A	10 (5)	5 (5)	15	0 (0)	0 (0)	1 (1)	1	16	0.15	8 (7)	0 (0)	7 (2)	15	7 (5)	1 (1)	4 (3)	12	27	0.30	43	0.22
	Herring Gull	N/A	6 (5)	3 (2)	9	0 (0)	0 (0)	6 (4)	6	15	0.14	2 (2)	0 (0)	1 (1)	3	1 (1)	0 (0)	4 (3)	5	8	0.09	23	0.12
	Sabine's Gull	N/A	2 (1)	0 (0)	2	0 (0)	0 (0)	0 (0)	0	2	0.02	0 (0)	0 (0)	0 (0)	0	0 (0)	0 (0)	0 (0)	0	0	0.00	2	0.01
	Thayer's Gull	N/A	2 (1)	0 (0)	2	0 (0)	1 (1)	1 (1)	2	4	0.04	0 (0)	4 (2)	0 (0)	4	1 (1)	1 (1)	6 (2)	8	12	0.13	16	0.08
	Unknown Gull Spp.	N/A	0 (0)	10 (6)	10	11 (2)	2 (1)	8 (7)	21	31	0.28	1 (1)	0 (0)	0 (0)	1	2 (1)	0 (0)	2 (2)	4	5	0.06	36	0.18
	Arctic Tern	N/A	327 (11)	0 (0)	327	9 (4)	3 (2)	10 (2)	22	349	3.19	0 (0)	2 (1)	6 (1)	8	5 (3)	0 (0)	0 (0)	5	13	0.15	362	1.82
	Long-tailed Jaeger	N/A	0 (0)	0 (0)	0	0 (0)	0 (0)	0 (0)	0	0	0.00	3 (2)	2 (1)	0 (0)	5	0 (0)	0 (0)	0 (0)	0	5	0.06	5	0.03
	Parasitic Jaeger	N/A	0 (0)	0 (0)	0	0 (0)	0 (0)	0 (0)	0	0	0.00	1 (1)	0 (0)	0 (0)	1	0 (0)	0 (0)	0 (0)	0	1	0.01	1	0.01
	Pomarine Jaeger	N/A	0 (0)	0 (0)	0	0 (0)	0 (0)	0 (0)	0	0	0.00	1 (1)	2 (1)	0 (0)	3	0 (0)	0 (0)	0 (0)	0	3	0.03	3	0.02
Alcids	Black Guillemot	N/A	0 (0)	0 (0)	0	46 (3)	0 (0)	0 (0)	46	46	0.42	0 (0)	0 (0)	1 (1)	1	2 (1)	1 (1)	0 (0)	3	4	0.04	50	0.25
	Subtotal # Individuals	N/A	1887	5552		962	215	2311				1920	230	3669		577	196	2348					
	Total # Individuals	7439				3488				10927		5816				3121				8937		19864	
	Total # Observations (n)	214				189				403		159				108				267		674	

\*A marine bird survey was not flown in June 2006, due to limited flight time.  
\*\*Italicized number in parentheses represents the number of observations (n).  
\*\*\*Due to the nature of the marine bird surveys, King and Common eiders were often difficult to distinguish and therefore have been combined in the analysis.



A total of four active raptor nests were documented within the study area during 2006 and 2007. A Common Raven nest with two young was found on South Ooglit Island in 2006 and subsequent observations in 2007 indicated the nest was being actively used again. In 2007, an active Peregrine Falcon nest (Photograph 6) was located along the Kingora River (approximately 20 km north of the 2007 camp location) and an active Rough-legged Hawk nest was documented less than one kilometre west of the 2006 camp location (Photograph 7). The remains of an old nest of an unknown raptor species was found on an unnamed river approximately 5 km southeast of the 2007 camp location (Figure 9).

### 3.4 UNGULATES

Between 20 – 22% of the land portion of the wildlife study area was surveyed during the ungulate surveys. A total of 247 barren-ground caribou were observed within the study area (including incidentals) during June, July and August 2006 and 2007 (Table 5; Figures 10 and 11).

#### Aerial Ungulate Surveys

Aerial ungulate surveys, were conducted on 24 June, 20 July and 20 August, 2006 and 26 June, 29 July and 23 August, 2007. These surveys yielded 40 observations totalling 117 caribou in 2006 and 26 observations totalling 48 caribou in 2007 (Table 5, Figure 10).

Of the total number of caribou (165) observed during the 2006 and 2007 surveys, greater than 50% were documented in June and July 2006 (Table 5). The average group size of caribou observed during the ungulate surveys was 2.6 animals, with a maximum group size of 12, which was observed in July 2006. Caribou densities within the study area ranged from 0.03 caribou/km<sup>2</sup> during the July 2007 survey to 0.20 caribou/km<sup>2</sup> in July 2006 (Table 5). The estimated number of caribou using the study area in 2006 and 2007 ranged from 32 ± 17.4 to 245 ± 156.0 (S.E.) (Table 5).

**TABLE 4: SUMMARY OF RAPTOR OBSERVATIONS WITHIN THE STUDY AREA, JUNE, JULY AND AUGUST 2006 AND 2007**

Species	2006					2007					Total Number of Raptors	% of Total
	June	July	August	2006 Total	% of 2006 Total	June	July	August	2007 Total	% of 2007 Total		
Common Raven	4 (3)*	5 (2)	1 (1)	10	71.43	2 (1)	0 (0)	0 (0)	2	14.29	12	42.86
Gyr Falcon	0 (0)	0 (0)	0 (0)	0	0.00	0 (0)	1 (1)	0 (0)	1	7.14	1	3.57
Peregrine Falcon	0 (0)	1 (1)	1 (1)	2	14.29	1 (1)	0 (0)	0 (0)	1	7.14	3	10.71
Rough-legged Hawk	0 (0)	1 (1)	1 (1)	2	14.29	2 (2)	2 (1)	3 (3)	7	50.00	9	32.14
Snowy Owl	0 (0)	0 (0)	0 (0)	0	0.00	0 (0)	0 (0)	3 (3)	3	21.43	3	10.71
<b>Subtotal # Individuals</b>	4	7	3			5	3	6				
<b>Total # Individuals</b>	<b>14</b>					<b>14</b>					<b>28</b>	
<i>Total # Observations (n)</i>	<i>10</i>					<i>12</i>					<i>22</i>	

\*Italicized number in parentheses represents the number of observations (n).

### Incidental Observations

A total of 82 caribou (39 in 2006 and 43 in 2007) were observed as incidentals (*i.e.* outside of formal ungulate surveys) (Table 5, Figure 11). Of the total numbers of caribou observed as incidentals within the study area, 34% were observed in June 2007 and 28% in June 2006. The average group size of caribou observed as incidentals was 2.28 animals, with a maximum group size of nine, which were observed in August 2007 feeding on a ridge within a kilometre west of camp (Table 5). Caribou were most commonly observed as solitary animals or in groups of two (Photograph 8).

A variety of caribou sign was also documented within the study area. A total of 222 discrete observations of sign composed primarily of pellets and tracks was documented (Photograph 9), representing 82% and 17% of the observations of sign, respectively. Antler sheds and bones were also recorded.

## 3.5 MARINE MAMMALS

### Marine Mammal Surveys

Marine mammal surveys were flown in conjunction with marine bird surveys on 20 July and 23 August, 2006<sup>4</sup> and 24 June, 29 July and 28 August, 2007. These surveys yielded six records totalling seven individuals in 2006 and 74 records totalling 203 individuals in 2007 (Table 6). A total of five marine mammal species were recorded, including: polar bear, walrus and bearded, harbour and ringed seals (Table 6, Figures 12-14).

Of the total number of marine mammals (210) observed during the 2006 and 2007 surveys, 84% were ringed seals and 11% were bearded seals. Of the total number of ringed seals observed, 98% were observed in June 2007 (Table 6).

### Incidental Observations

A total of 60 marine mammals (44 in 2006 and 16 in 2007) were observed as incidentals (*i.e.* outside of formal marine mammal surveys). Of the total number of marine mammals observed as incidentals within the study area, 47% were unidentified seals and 30% were ringed seals. Forty-eight percent of the total numbers of marine mammals observed as incidentals were seen in June 2006 (Table 6).

The least commonly observed marine mammal observed within the study area, either during survey or as incidental, was the walrus with only a single observation during the June 2007 marine mammal survey (Table 6; Photograph 10).

Polar bears were observed on seven occasions, totalling nine individuals (Photograph 11), including a mother and cub (Photograph 12), which were likely observed on two occasions, 20 and 22 August 2006, just 5 km apart.

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<sup>4</sup> A marine mammal survey was not flown in June 2006, due to limited flight time.



**TABLE 5: SUMMARY OF BARREN-GROUND CARIBOU OBSERVATIONS WITHIN THE STUDY AREA, 2006 AND 2007**

Caribou Observations		2006				2007				Grand Total
		June	July	August	2006 Total	June	July	August	2007 Total	
Number Observed During Ungulate Surveys	# Individuals (# Observations)	46 (21)*	54 (12)	17 (7)	<b>117</b>	31 (14)	7 (5)	10 (7)	<b>48</b>	<b>165</b>
	% of Total # Individuals	28%	33%	10%	<b>71%</b>	19%	4%	6%	<b>29%</b>	
	Average Group Size	2.56	4.50	2.43		2.21	1.40	1.43		
	Relative Density (# / sq-km)	0.17	0.20	0.06		0.14	0.03	0.04		
	Population Estimate**	209 ± 60.3	245 ± 156.0	77 ± 34.2		168 ± 70.2	32 ± 17.4	45 ± 12.2		
Number Observed As Incidentals	# Individuals (# Observations)	23 (10)	10 (4)	6 (5)	<b>39</b>	28 (12)	2 (2)	13 (3)	<b>43</b>	<b>82</b>
	% of Total # Individuals	28%	12%	7%	<b>48%</b>	34%	2%	16%	<b>52%</b>	
	Average Group Size	2.30	2.50	1.20		2.33	1.00	4.33		

\*Italicized number in parentheses represents the number of observations (n).

\*\* ± 95% Confidence Interval

### 3.6 MISCELLANEOUS WILDLIFE

Mammals observed incidentally (either visually or as sign) within the study area during 2006 and 2007 included arctic ground squirrels, arctic foxes, arctic hares, lemmings, muskox and weasels (Figure 15).

Arctic ground squirrels were observed and photographed (Photograph 13) within the study area in June 2006. In addition, a total of fifteen arctic ground squirrel colonies were documented (Photograph 14). Six arctic foxes were observed on six separate occasions in 2006 (Photograph 15). In addition, five observations of fox scat were also documented in 2006. There were no actual observations of arctic hare within the study area; however there were 59 observations of sign (pellets). Similar to arctic hares, there were no observations of lemmings within the study area; however there were eight observations of sign (pellets) (Photograph 16) and colonies. There were six observations of weasel sign (scat and dens) and a single observation of a weasel within the study area in July 2006.

Muskox sign was documented on one occasion on June 24, 2007 less than 1 km from the 2007 camp location (Figure 15), during the breeding bird surveys (Photograph 17).

In addition to the two Sandhill Cranes detected during breeding bird surveys, an additional nine Sandhill Cranes were observed within the study area in 2006 and 2007.

## 4.0 DISCUSSION

### 4.1 BREEDING BIRD SURVEYS

Thirty-six breeding bird stations were surveyed within the study area, 27 in 2006 and nine in 2007. These surveys yielded 148 bird detections comprising ten species of breeding birds. An additional 152 bird detections were recorded as incidental, detected outside the survey time or station. The total number of 24 bird species was detected during breeding bird surveys within the study area in 2006 and 2007. This number of bird species is comparable to past reports for the region. Montgomerie *et al.* (1983) reported 22 breeding bird species at Sarcpa Lake; while at Igloolik Island Forbes *et al.* (1992) reported 26 breeding bird species. Boothroyd (1983) had confirmed 16 and 21 probable or likely breeding bird species, respectively for the Roche Bay area, and Borealis Exploration Limited (1982a) documented 21 confirmed breeding bird species with an additional three suspected breeding species for the development area<sup>5</sup>.

In 2006 and 2007, habitats that were surveyed most often were sedge meadow – dry, sedge meadow – wet and heath tundra, which were considered to adequately represent the proportion of habitat available to breeding birds within the study area. Of the available habitats surveyed, sedge meadow – dry had the highest average number of birds detected

<sup>5</sup> The Borealis Exploration Limited (1982a) development area is an area of 66 km<sup>2</sup>, considerably smaller than the current study area.

per survey site, followed by sedge meadow – wet and heath tundra. At Sarcpa Lake, Montgomerie *et al.* (1983) surveyed primarily rock upland plateau and lake habitats; Forbes *et al.* (1992) surveyed sedge meadow and *Dryas* slope at Igloodik Island.

## 4.2 MARINE BIRDS

A total of 19,864 marine birds (seabirds and waterfowl) were observed within the study area during 2006 and 2007, 10,927 during marine bird surveys and 8,937 as incidentals. Waterfowl (ducks, geese and swans) made up 97% of the total number of birds, followed by 3% seabirds (gulls, tern, jaegers and guillemots) and less than 1% loons.

Of the loons observed within the study area during 2006 and 2007, Red-throated Loons were most common during the marine bird surveys, making up 84% of the total identified loon species, whereas, Pacific Loons were more commonly observed as incidentals, comprising 58%. This discrepancy may be explained by a combination of survey modes and the habitat use of the two loon species. Pacific Loons have a greater tendency to use inland freshwater habitats, whereas Red-throated Loons have a stronger affinity to marine environments, foraging strictly in near shore marine habitats (Russell 2002).

The marine bird and mammal surveys were the only marine surveys conducted within the study area. All other surveys (during which all loon observations would have been recorded as incidentals) were either ground-based or were flown predominantly over land (e.g. aerial ungulate surveys); thereby explaining the propensity toward Red-throated Loon detections in the marine environment and Pacific Loon detections in the terrestrial environment.

Boothroyd (1983) reported a total of 12 Pacific Loons (then called Arctic Loons) (or 28% of the identified loons) along the shoreline section, which included north of Roche Bay, Roche Bay itself and south of Roche Bay, whereas, 31 Red-throated Loons were observed (or 72% of the identified loons) along the same survey route. Boothroyd (1983) also reported that very few loons were observed during the straight-line transects over land during the same study. Borealis Exploration Limited (1982b) reported having observed Pacific Loons and Red-throated Loons on lakes and flying throughout the development area. Forbes *et al.* (1992) described Red-throated Loons as abundant breeders and Pacific Loons as uncommon breeders at Igloodik.

Within the study area in 2006 and 2007, Snow Geese dominated all waterfowl observations (marine bird surveys and as incidental). A total of 15,274 Snow Geese were observed within the study area during 2006 and 2007. Approximately, 1,100 Snow Geese were observed during June and July, while approximately 13,000 were seen in August. The increase in Snow Geese from July to August can likely be explained by the inclusion of juvenile birds (young-of-the-year) and the beginning of pre-migration congregation in the marine environment.

Forbes *et al.* (1992), Boothroyd (1983) and Borealis Exploration Limited (1982a, 1982b) reported considerably lower numbers of Snow Geese (<100) in the Igloodik / Roche Bay area than were observed within the study area in 2006 and 2007. Breeding populations in

the southern Foxe Basin area (including Southampton Island and southern Baffin Island) number in the range of 2.5 million, likewise central Arctic Snow Geese numbers are approximately 1.4 million (Mowbray *et al.* 2000).

Eiders were the second most commonly observed waterfowl species. In June and perhaps part of July, before males depart the breeding ground to commence their moult migration (Goudie *et al.* 2000), male eiders are easy to distinguish. Typically breeding eider surveys are conducted during pairing (before egg-laying) in late May / early June depending on the latitude. Eider males attend females until at least one week after nest initiation and therefore aerial counts of the highly visible males during this time have been successfully used to census eiders to an accuracy of 1.1:1 males per nest (Mawhinney *et al.* 1999 and references therein).

King and Common eider males are easily distinguishable as Common Eider males have considerably more white on their backs. Females of the two eider species are virtually impossible to distinguish during aerial surveys and therefore are classified as eider species. Eiders were counted within the study area in 2006 and 2007 during marine bird surveys and as incidentals. A total of 1,965 eiders were observed. Generally only during June surveys were eider species differentiated (490 Common Eiders and 1,009 King Eiders) possibly due to the aforementioned reasons or they staged in the study area before continuing north to their breeding grounds. Forbes *et al.* (1992) described Common Eiders as occasional transients and King Eiders as abundant spring migrants during early snow-melt periods near Igloolik. In 2006 and 2007, July surveys yielded the lowest numbers (four Common Eiders and 40 unidentified eiders) as eiders had either moved out of the area and were now on their breeding grounds, males had departed and/or females were incubating. Eider numbers had increased again during the August surveys (422 unidentified eiders) as females and young had left the nest sites and were on the water, or staging for fall migration had commenced.

Past studies conducted at Roche Bay have reported few nesting eiders (Boothroyd 1983; Borealis Exploration Limited 1982a, 1982b) and Borealis Exploration Limited (1981) reported that a NWT Wildlife Officer had stated that hundreds of geese and eiders stop in the Roche Bay area as part of the northward migration in spring. Borealis Exploration Limited (1982b) reported only one nesting pair of eiders in the development area. Boothroyd (1983) observed most Common Eiders between Ignertok and Amitioke peninsulas. Along the mainland shoreline, Boothroyd (1983) observed considerably more King Eiders than Common and reported that most of the breeding King Eiders were on the Amitioke Peninsula, with only eight of the 20 breeding pairs in Roche Bay.

A total of 788 Long-tailed Ducks were observed within the study area during 2006 and 2007. Boothroyd (1983) had observed approximately 1,400 Long-tailed Ducks (then called Oldsquaw), more than 1,200 were seen during an ice edge survey in July 1982.

A total of 541 seabirds were observed within the study area in 2006 and 2007. As previously mentioned, for the purposes of this report, seabirds include Glaucous Gulls, Herring Gulls,



Sabine's Gulls, Thayer's Gulls, Arctic Terns, Long-tailed Jaegers, Parasitic Jaegers, Pomarine Jaegers and Black Guillemots. The majority of the seabird observations were Arctic Terns, most of which were in the vicinity of South Ooglit Island at the mouth of Roche Bay, where they are known to breed. Black Guillemots were the next most commonly observed seabird species, representing 9% of the total number of observed seabirds.

Of the three most commonly observed gull species within the study area in 2006 and 2007, Glaucous Gulls were more often observed as incidentals during non-marine surveys than were Herring and Thayer's gulls. This can be explained by the stronger tendency for Glaucous Gulls to use freshwater / inland habitats while away from the nest (Gilchrist 2001), compared to Thayer's and Herring gulls, which are typically found using the marine environment. Herring Gulls forage at sea, in intertidal, on sandy beaches and mudflats (Perotti and Good 1994) and while on breeding grounds Thayer's Gulls are almost exclusively maritime in its activity and rarely seen inland (Snell 2002). Two Sabine's Gulls were observed on one occasion in July 2006 at South Ooglit Island.

All three species of jaeger were observed within the study area in 2006 and 2007, though very infrequently, representing only a combined 2% of the total number of seabirds observed. It is likely that Long-tailed and Parasitic jaegers are breeders in the study area; but it is unclear if Pomarine Jaegers breed in the Roche Bay area (Haven Wiley and Lee 2000).

Borealis Exploration Limited (1982a, 1982b) reported Glaucous Gulls, Herring Gulls, Sabine's Gulls, Thayer's Gulls, Arctic Terns and Black Guillemots were observed but no nests were found in the development area. Borealis Exploration Limited (1982a) stated Pomarine and Parasitic jaegers occurred in the development area rarely to occasionally, while Long-tailed Jaegers were common to abundant.

#### 4.3 RAPTORS

EBA observed Rough-legged Hawks, Peregrine Falcons, a Gyrfalcon, Snowy Owls and Common Ravens within the study area in 2006 and 2007. Borealis Exploration Limited (1981, 1982a, 1982b) reported Rough-legged Hawks and Snowy Owls commonly occurred in the development area (primarily on the Roche Bay peninsula), while Peregrine Falcons were rarely sighted, and Gyrfalcons and eagles were not sighted at all.

Two Rough-legged Hawks were observed within the study area in 2006, while in 2007 there were seven observations. An active nest was also documented in 2007, less than 1 km west of the 2006 camp location (Figure 9). In the early 1980s, Rough-legged Hawks were not documented as nesting in the development area, though one pair was found nesting at Sarcpa Lake. A second nest was located and found to be occupied the following year, approximately 9 km west of Sarcpa and thought to be the same pair observed at Sarcpa Lake in the previous year. As a result of very comprehensive surveying, it was determined that Rough-legged Hawks were not nesting in the Roche Bay development area from 1979 – 1982 (Borealis Exploration Limited 1981, 1982a, 1982b). During aerial transect surveys flown in the Roche Bay area on July 9, 10 and 11, 1981, Boothroyd (1983) observed only a single Rough-legged Hawk, which was located along the Ignertok Peninsula.

Snowy Owls were observed on three occasions within 5 km of each other in August 2007, two on the peninsula and one approximately 2 km west of the peninsula (within the study area) (Figure 9). Breeding territories of Snowy Owls may be as little as 1 km apart (Parmelee 1992), making it possible that the owls observed in 2007 could be three discrete individuals. In the early 1980s, Snowy Owls were reportedly common on vegetated areas of the low flat terrain in the general Hall Beach – Roche Bay areas (Borealis Exploration Limited 1981, 1982a, 1982b).

Although Snowy Owls may have occasionally nested on the Roche Bay peninsula, no nests were found (Borealis Exploration Limited 1981, 1982a, 1982b). During aerial transect surveys flown in the Roche Bay area on July 9, 10 and 11, 1981, Boothroyd (1983) observed 17 Snowy Owls. Of the 17 Snowy Owls observed, nine were documented along two aerial transects south of the Roche Bay peninsula and eight were documented on transects along area north of the Roche Bay peninsula, northeast to Hall Beach and then north northwest to Foster Bay.

Within the study area in 2006 and 2007, Common Ravens were observed on seven occasions, totalling 12 individuals. A Common Raven nest was observed to be active in both 2006 and 2007. Borealis Exploration Limited (1981, 1982a, 1982b) reported ravens occasionally occurred in the development area.

There were three Peregrine Falcons observed within the study area during 2006 and 2007, and an active nest was recorded. Borealis Exploration Limited (1981, 1982a, 1982b) reported Peregrine Falcons were very rare in the development area and none were also observed in the Sarcpa Lake area from 1979 – 1981. In May 1982, one Peregrine Falcon was seen flying south along the escarpment at the west end of the Roche Bay peninsula. Another Peregrine Falcon was observed at Sarcpa Lake in June 1982. Two additional sightings of Peregrine Falcons were made in July and August 1982 near the southwestern part of the development area. None of these observations yielded any evidence that Peregrine Falcons were nesting (Borealis Exploration Limited 1981, 1982a, 1982b).

In July 2007, EBA personnel observed a Gyrfalcon on the Roche Bay peninsula. Borealis Exploration Limited (1981, 1982a, 1982b) state that there were no Gyrfalcons observed in or near the development area in the early 1980s.

#### 4.4 UNGULATES

A total of 247 barren-ground caribou were observed within the study area during June, July and August 2006 and 2007. The average group size within the study area ranged from 1.4 to 4.5 caribou, while the density ranged from 0.03 to 0.20 caribou/km<sup>2</sup>. The estimated number of caribou using the study area in 2006 and 2007 ranged from 32 ± 17.4 to 245 ± 156.0 (S.E.)(Table 5).

Caribou surveys conducted on the Melville Peninsula in the early 1960s and 1980s indicated very few caribou occur in the Roche Bay region (Borealis Exploration Limited 1981 and references therein). Caribou have been reported to be “sometimes plentiful” in the

Ajaqutalik River valley, within four miles of Roche Bay and occasionally plentiful southeast of Hall Lake; both of these areas are near or within the current study area.

Caribou on the Melville Peninsula are part of the Wager Bay Herd (Heard *et al.* 1986). The winter range of the Wager Bay caribou herd includes southeastern Melville Peninsula north to within about 40 km of the southern edge of Roche Bay. Occasionally, caribou are found during the winter on the Amitioke Peninsula (Borealis Exploration Limited 1981), approximately 10 km south of the current Roche Bay study area. Very few caribou use the Roche Bay – Hall Beach area during late winter and early spring, although Inuit hunters have reported their presence along the Ajaqutalik River Valley (Borealis Exploration Limited 1981).

Recent satellite telemetry data collected on the Wager Bay caribou herd indicated use of the southern portion of the Melville Peninsula during calving season, with the largest calving aggregation along the east coast of Melville Peninsula, from Cape Penrhyn (approximately 60 km south of Roche Bay) south to the mouth of Lyon Inlet (Government of Nunavut 2005). Some of the cows from the Wager Bay herd move north post-calving (Heard *et al.* 1986). Heard *et al.* (1986) reported no calves were observed at the Sarcpa Lake Research Station before mid-July.

From 1972 to 1974, caribou populations on the Melville Peninsula were estimated to decrease from 4,400 - 6,600 in 1972 to 1,520 - 2,280 in 1974 (Borealis Exploration Limited 1981 and references therein). In 1976 and 1977 further wildlife studies carried out by the NWT Wildlife Service, yielded an estimate of 42,000 caribou on the Melville Peninsula (Borealis Exploration Limited 1981 and references therein). Heard *et al.* (1986) report Wager Bay caribou herd densities were 0.31 caribou / km<sup>2</sup>, with a mean group size of  $8.8 \pm 0.66$  (S.E.) and a population size of  $15,200 \pm 2,330$  (S.E.).

Recent population estimates were calculated from caribou surveys conducted in 1995, suggesting that the entire Northeastern mainland caribou population (Melville, Wager Bay and Lorillard herds) had dropped from  $119,800 \pm 13,900$  (S.E.) in 1983 to  $73,994 \pm 11,670$  (S.E.) in 1995 (Government of Nunavut 2005).

## 4.5 MARINE MAMMALS

Ringed seals were the most commonly observed marine mammal within the study area during 2006 and 2007, with a total of 194 observations. Borealis Exploration Limited (1981, 1982a, 1982b) also reported ringed seals as the most common marine mammal in the Roche Bay area, and indicated ringed seals were the only marine mammal occurring in Roche Bay over the winter. Ringed seals have also been known to den on Roche Bay when ice conditions were optimal (Borealis Exploration Limited 1981, 1982a, 1982b); pupping season for ringed seals occur in late March or April (Richard 2001; Borealis Exploration Limited 1981).

Bearded seals were the second most common marine mammal observed within the study area in 2006 and 2007, with a total of 26 individuals. Borealis Exploration Limited (1981)

reported bearded seals sometimes enter the mouth of Roche Bay in August, September and October and commonly occur in the Foxe Basin. Bearded seals may den near Roche Bay (Borealis Exploration Limited 1982b).

Five harbour seals were observed within the study area during 2006 and 2007. According to Borealis Exploration Limited (1981), harbour seals were seen occasionally in Foxe Basin and were very rare in Parry and Roche Bays. Richard (2001) reported harbour seals were distributed only in the southern portion of Foxe Basin.

A single walrus was observed in June 2007 within the study area, approximately 4 km east of Qavvialuk Point (Figure 12). In past years, walrus have been quite numerous at the mouth of Parry Bay and have occasionally entered the mouth of Roche Bay for feeding, but only for a short period (Borealis Exploration Limited 1981). Walrus were reported as sometimes entering the mouth of Roche Bay in August, September and October and were common in Foxe Basin. Walrus may den near Roche Bay (Borealis Exploration Limited 1982b).

Polar bears were observed within the study area in 2006 and 2007. Polar bears have been reported to occur in the Roche Bay area rarely to occasionally, predominantly in the winter (Borealis Exploration Limited 1981, 1982a, 1982b). Borealis Exploration Limited (1981, 1982a, 1982b) stated an absence of polar bear denning areas occur near Roche Bay, and also suggested the mine project would have little negative impact on polar bears following appropriate mitigation.

No whales were observed within the study area in 2006 and 2007. Borealis Exploration Limited (1981, 1982a, 1982b) reported Inuit hunters described beluga whales, narwhals and possibly bowhead whales as occasional or rare near Roche Bay. Borealis Exploration Limited (1982; and references therein), excludes Parry Bay and central Foxe Basin from the beluga whale range. However, their range does include Foxe Basin but with no regular pattern.

Narwhals, preferring deep water, would not be expected to enter Roche Bay. Foxe Basin is considered outside their known range (Borealis Exploration Limited 1981, 1982a, 1982b; and references therein). COSEWIC (2004) stated the distribution of narwhals in Foxe Basin is uncertain, although they are known to occur in Fury and Hecla Strait (north of the Melville Peninsula) and in Foxe Channel (between Baffin and Southampton islands). However, Borealis Exploration Limited (1981, 1982a, 1982b) did report a small number of narwhal that migrated past the mouth of Roche Bay (approximately 10 – 40 km to the east) around the end of June in the late 1970s and early 1980s.

Borealis Exploration Limited (1981, 1982a, 1982b) reported local Inuit telling that very few, if any, bowhead whales occur near Roche Bay. COSEWIC (2005) described the range of the Hudson Bay – Foxe Basin population as including the westernmost part of Foxe Basin, just skirting Parry Bay (the larger bay containing Roche Bay).

A notably important polynya is located approximately 29 km east of the mouth of Roche Bay. Polynyas are areas of year-round open water, created and maintained by winds and/or

water currents, often in combination with ocean floor contours. Polynyas are important to marine mammals and birds as they normally contain high abundances of food. Borealis Exploration Limited (1982; and references therein) stated polynyas of northern Foxe Basin “support high densities of walrus, bearded and ringed seals on a year-round basis”.

#### 4.6 MISCELLANEOUS WILDLIFE

Eleven Sandhill Cranes were observed within the study area (six in 2006 and five in 2007). Boothroyd (1983) reported Sandhill Cranes but stated their occurrence in the study area as uncommon; while Borealis Exploration Limited (1981, 1982a, 1982b) described rare flyovers of Sandhill Cranes in the early 1980s.

Borealis Exploration Limited (1981, 1982a, 1982b) stated that due to relative paucity of vegetation in the Roche Bay area, arctic fox, arctic wolf, arctic hare and arctic ground squirrel are less than or equal to their numbers in the surrounding areas. Denning of arctic fox, arctic hare, arctic ground squirrel and lemmings was reported as occurring in the Roche Bay area (Borealis Exploration Limited 1981, 1982a, 1982b). Arctic ground squirrel, lemming and weasel dens were observed within the study area in 2006 and 2007.

Six arctic foxes were observed within the study area in 2006 and 2007, in addition to five counts of sign. Arctic fox were described by Borealis Exploration Limited (1981, 1982a, 1982b) as occurring occasionally or commonly in the Roche Bay area. All of the arctic fox observations in the early 1980s were on the western part of the Roche Bay peninsula, on the escarpment and on the Precambrian plateau near the iron deposits. Borealis Exploration Limited (1981, 1982a, 1982b) also suggested foxes may den in the Roche Bay area and stated an arctic fox den was discovered near the southwestern corner of Roche Bay.

Possible arctic wolf sign had been documented near Roche Bay in the past (Borealis Exploration Limited 1981, 1982a, 1982b). Local Inuit had informed past researchers that a wolf den was located south of the Ajaqutalik River and that three wolves had been shot in the area around the same time. EBA did not document any sign of arctic wolves within the study area in 2006 or 2007.

Arctic ground squirrels and numerous colonies were observed within the study area in 2006 and 2007. Borealis Exploration Limited (1981, 1982a, 1982b) stated arctic ground squirrels occur throughout the development area and were common on the escarpment and on western Roche Bay peninsula.

Arctic hare pellets, but no actual sightings were observed within the study area in 2006 and 2007. Borealis Exploration Limited (1981, 1982a, 1982b) described occasional sightings in the upland parts of the development area

Lemming dens were also documented within the study area in 2006 and 2007, but lemmings were not observed. Brown and collared lemmings were described as rarely seen in the development area during the 1981 and 1982 field seasons (Borealis Exploration Limited 1981, 1982a, 1982b), but lemmings at that time may have been on their cycle lows.



Borealis Exploration Limited (1981 and references therein) stated the unlikelihood that muskoxen have ever existed on Melville Peninsula and on Baffin Island. Similarly, local Inuit elders indicated no muskoxen have occurred anywhere on the Melville Peninsula since 1900 and probably none in the Roche Bay area. This was supported by the muskox distribution presented in Lent (1988), which excludes the Melville Peninsula. However, one account of muskox sign, a single pellet group, was documented in June 2007. Local Inuit from Hall Beach and Igloolik had informed EBA personnel in 2007 that small groups of muskoxen have come up to the region, though uncommon.

Weasels were observed within the study area in July 2006 approximately 6 km north of the 2006 camp location. In addition, five scats and one den were also documented. There was no mention of weasels in historical Roche Bay documents.

## 5.0 CONCLUSIONS

EBA conducted wildlife surveys at Roche Bay in 2006 and 2007. The wildlife program included breeding bird surveys (BBS), raptor, marine bird, ungulate (focussing on barren-ground caribou) and marine mammal surveys. All of these surveys were conducted in June, July and August of 2006 and 2007, with the exception of the BBS, which were only carried out in June of each year. These surveys yielded a total of 44 species. There were 1,138 documented wildlife observations totalling 21,070 individuals. In addition, there were 428 observations of animal sign.

At Roche Bay, breeding bird surveys (BBS) were conducted from 25 – 28 June 2006 and 24 – 26 June, 2007. A total of 36 BBS stations were surveyed; 27 in 2006 and nine in 2007. The BBS yielded a total of 300 bird detections across the two years of the study, of which 151 were recorded as incidental (either outside the survey plot or outside the survey time). A total of 24 bird species were detected during the breeding bird surveys, 13 of which were incidentals. Sedge meadow – dry (CA), sedge meadow – wet (CE) and heath tundra (HT) habitat types were the most surveyed habitats during the 2006 and 2007 breeding bird surveys.

A total of 19,864 marine birds (seabirds and waterfowl) were observed within the study area during 2006 and 2007, 10,927 during marine bird surveys and 8,937 as incidentals. Waterfowl (ducks, geese and swans) made up 97% of the total number of birds recorded, followed by 3% seabirds (gulls, tern, jaegers and guillemots) and less than 1% loons.

Marine bird surveys were flown in conjunction with marine mammal surveys in July and August, 2006 and June, July and August, 2007. A total of 7,439 birds were recorded during the marine bird survey in 2006 and 3,488 birds were observed in 2007. These observations included 19 bird species (four loon, three seaduck, two goose, one swan, four gull, one tern, three jaeger and one alcid (guillemot)).

Aerial raptor surveys were completed in 2006 and 2007; however, raptors were also documented opportunistically during other surveys. Twenty-two raptor observations (totalling 28 individuals) were documented in 2006 and 2007 (ten in 2006 and 12 in 2007).

Five raptor species were observed in 2006 and 2007 including: Common Raven, Gyrfalcon, Peregrine Falcon, Rough-legged Hawk and Snowy Owl. Four raptor nests were documented in the study area during 2006 and 2007. These nests belonged to a Common Raven, Peregrine Falcon, Rough-legged Hawk and an unidentified species of raptor.

Between 20 – 22% of the land portion of the wildlife study area was surveyed during the ungulate surveys. A total of 247 barren-ground caribou were observed within the study area during the 2006 and 2007 field programs. Aerial ungulate surveys yielded 117 caribou in 2006 and 48 caribou in 2007. The average group size observed during the ungulate surveys was 2.6 animals, with a maximum group size of 12, which was observed in July 2006. Caribou densities within the study area ranged from 0.03 caribou/km<sup>2</sup> to 0.20 caribou/km<sup>2</sup>. The estimated number of caribou using the study area ranged from 32 ± 17.4 to 245 ± 156.0 (S.E.).

Marine mammal surveys were flown in conjunction with marine bird surveys on July and August, 2006 and June, July and August, 2007. These surveys yielded seven sea mammal observations in 2006 and 203 sea mammal observations in 2007. These observations comprised five mammal species, including polar bear, walrus and bearded, harbour and ringed seals.

Incidental observations of miscellaneous wildlife were also documented in 2006 and 2007. Sandhill Cranes were detected during breeding bird surveys, and an additional nine Sandhill Cranes were recorded as incidentals in 2006 and 2007. Mammals observed incidentally (either visuals or as sign) within the study area during 2006 and 2007 included arctic ground squirrels, arctic foxes, arctic hares, lemmings, muskox and weasels.

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<sup>6</sup> A marine mammal survey was not flown in June 2006, due to limited flight time.

## 6.0 CLOSURE

Information in this report is based on observations, surveys, historical information, and information that were available at the time of this assessment. This report has been conducted in accordance with generally accepted scientific methods. No other warranty is made, either expressed or implied. This report is also subject to EBA's General Terms and Conditions located in Appendix C.

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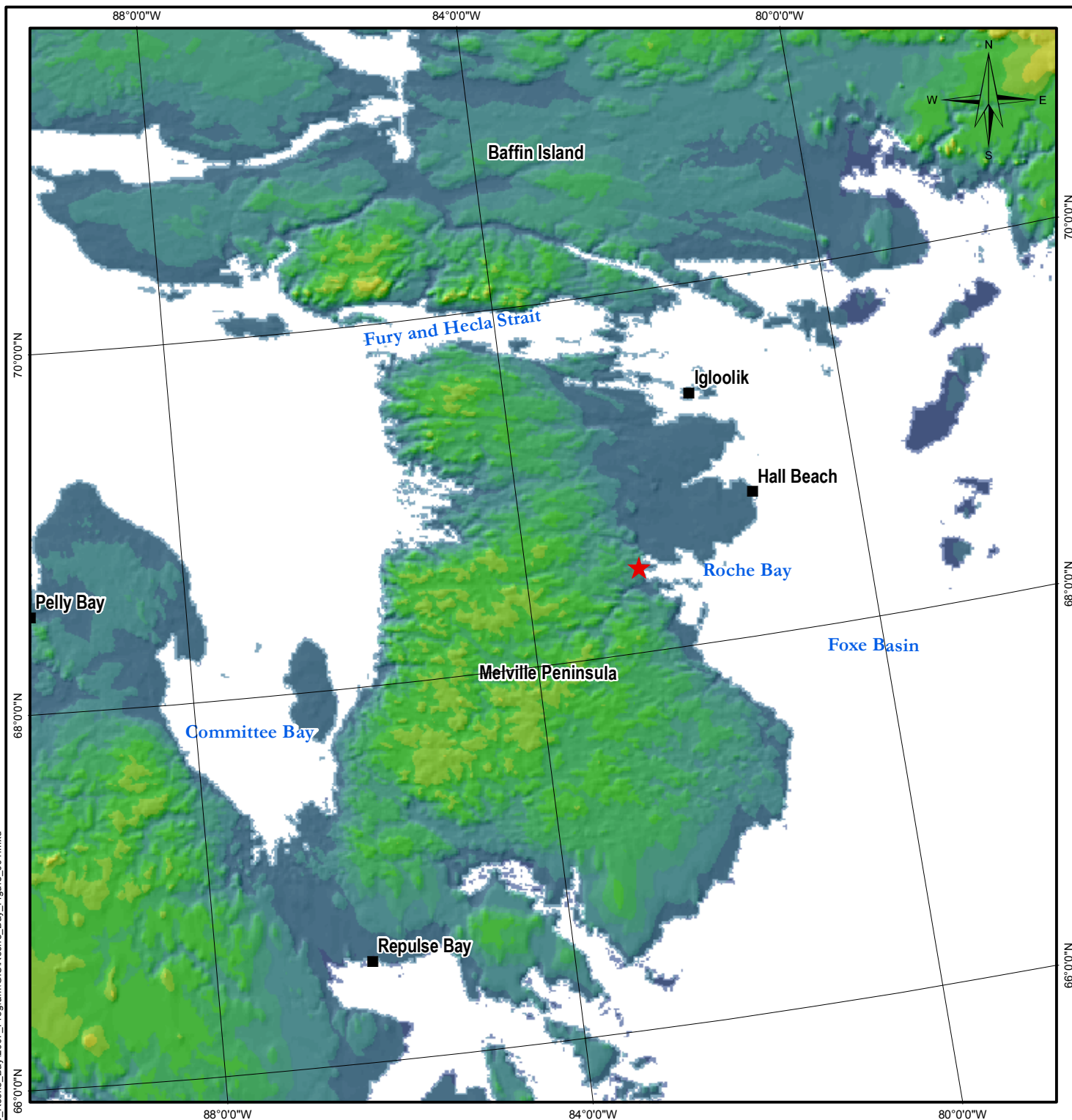


# FIGURES





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#### LEGEND

- Settlement
- ★ Site Location

#### NOTES

Base data source:  
ESRI DATA and Maps

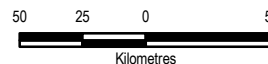
### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Site Location Map

PROJECTION  
Canadian Lambert Conf. Conic

DATUM  
NAD83

Scale: 1:3,000,000



FILE NO.  
Roche\_Bay\_Wildlife\_Figure\_1

PROJECT NO.  
1740183.008

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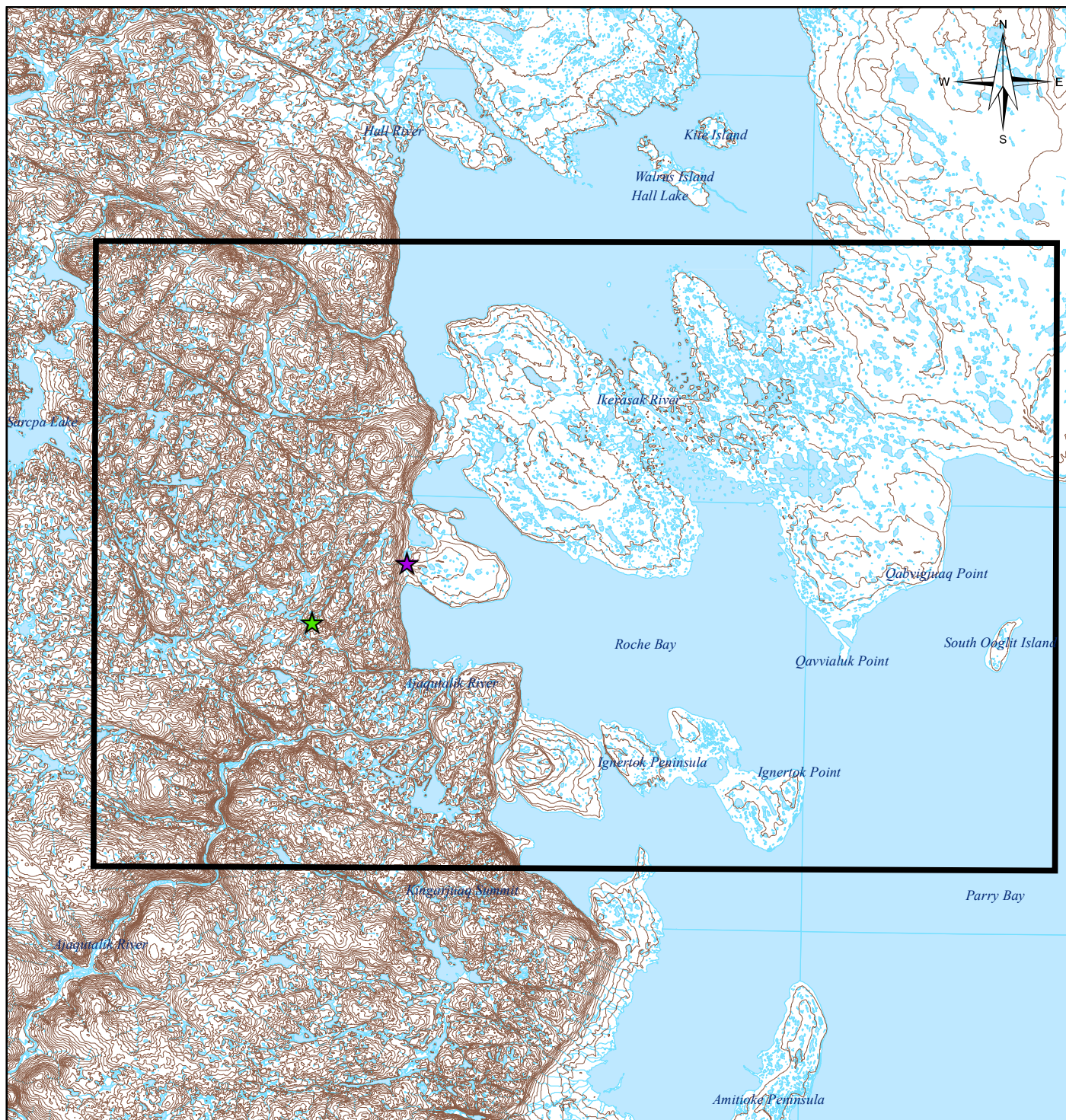
DATE  
December 3, 2007

EBA Engineering  
Consultants Ltd.



Figure 1





## LEGEND


- Contour
- Waterbody
- Watercourse
- ★ 2006 Camp
- ★ 2007 Camp
- Wildlife Study Area

## NOTES

Base data source: NTDB 1:50 000

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

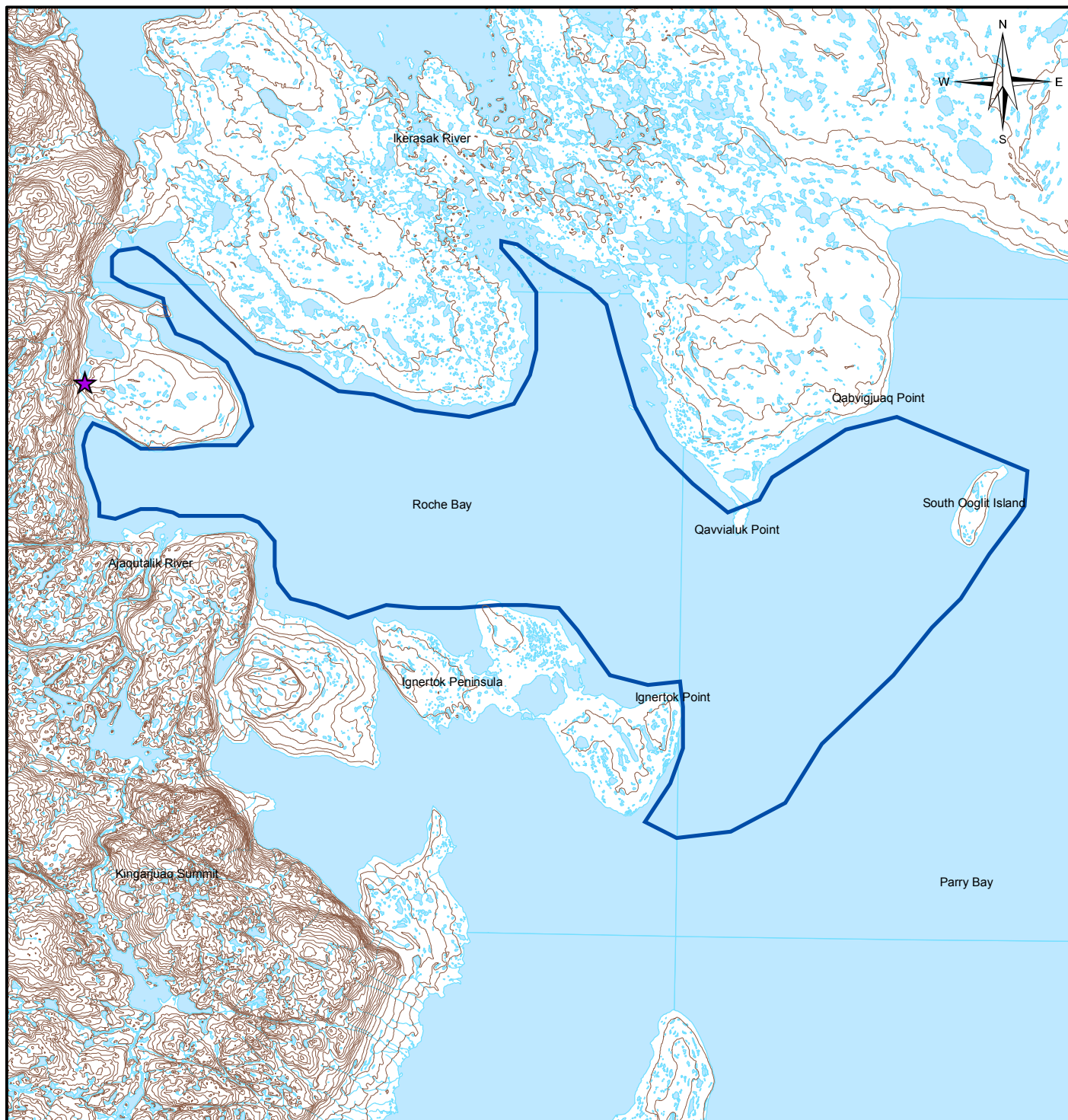
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Kilometres			
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PROJECT NO.	DWN	CKD	REV
1740183.003/004	KDA	KLL	0
OFFICE	DATE		
EBA-YEL	February 20, 2008		

EBA Engineering Consultants Ltd. 

Figure 2





## LEGEND


- Contour
- Waterbody
- Watercourse
- ★ 2007 Camp
- ★ 2006 Camp
- Marine Survey Area

## NOTES

Base data source: NTDB 1:50 000

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

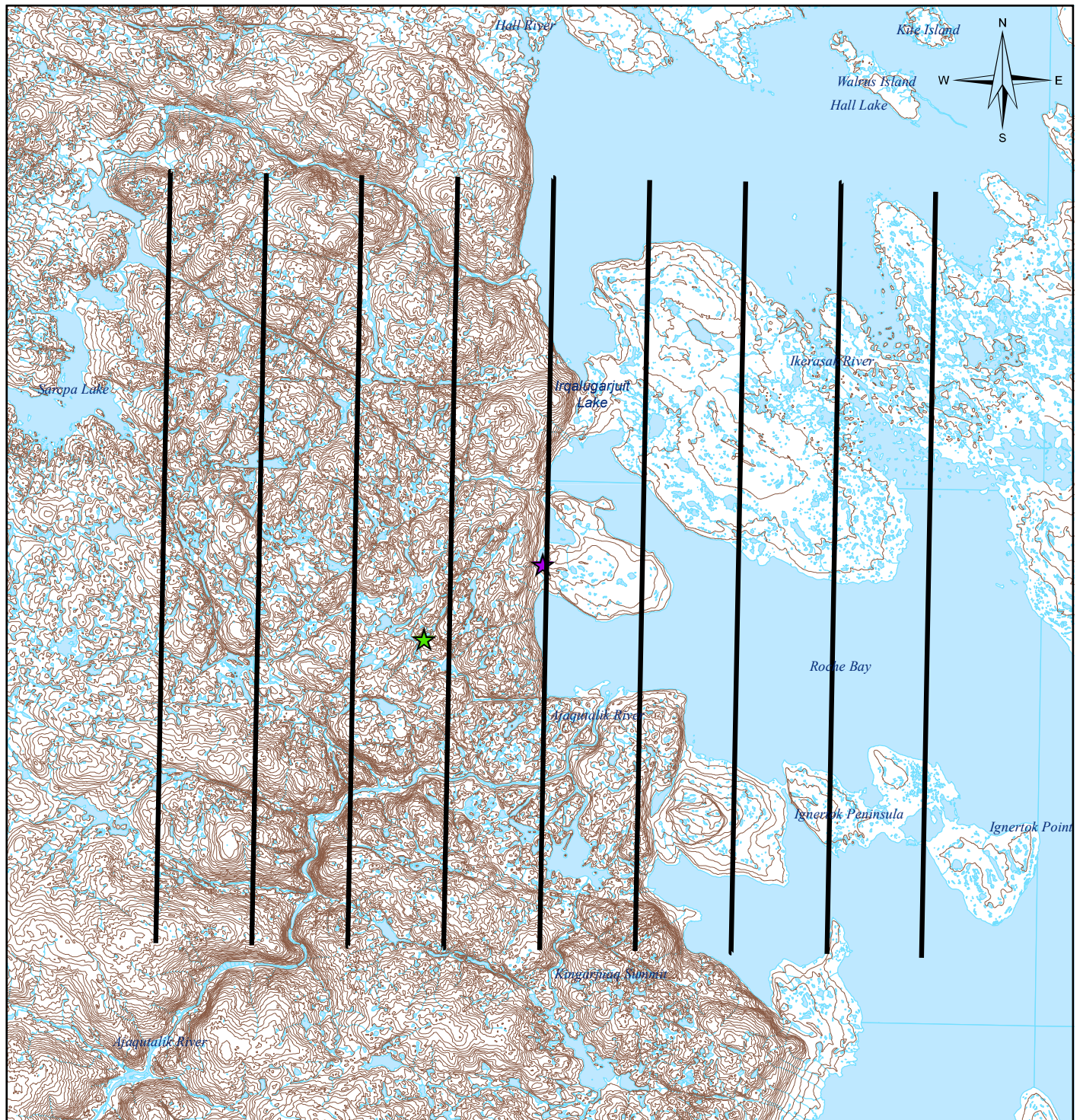
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Kilometres			
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PROJECT NO. 1740183.003/.004	DWN KDA	CKD KLL	REV 0
OFFICE EBA-YEL	DATE February 20, 2007		

EBA Engineering  
Consultants Ltd. 

Figure 3





#### LEGEND

- Contour
- Waterbody
- Watercourse
- ★ 2006 Camp
- ★ 2007 Camp
- Aerial Caribou Survey Transects

#### NOTES

Base data source: NTDB 1:50 000

#### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Aerial Caribou Survey Transects 2006 & 2007

PROJECTION  
UTM Zone 17N

DATUM  
NAD83

Scale: 1:300,000  
6 3 0 6  
Kilometres

FILE NO.  
Roche\_Bay\_wildlife\_Cari\_transects\_Figure4

PROJECT NO.  
1740183.003/004

OFFICE  
EBA-YEL

DWN  
KDA

CKD  
KLL

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DATE  
February 20, 2008

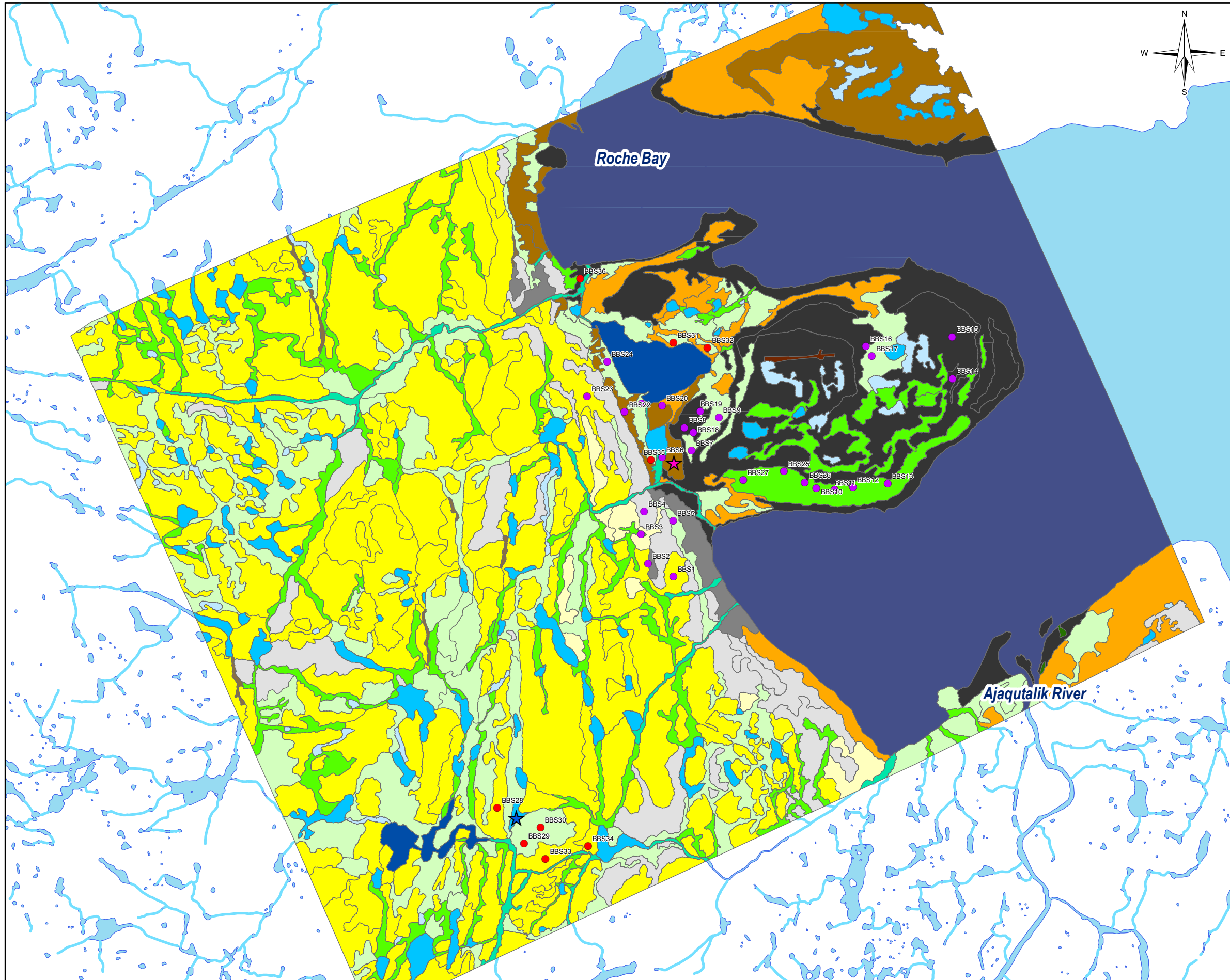
EBA Engineering  
Consultants Ltd.



Figure 4



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#### LEGEND

★ 2006 Camp

★ 2007 Camp

#### Breeding Bird Survey Plot

● 2006

● 2007

#### Ecosystem Type

CA - Sedge meadow - dry

CE - Sedge meadow - wet

SM - Salt Marsh

DSL - Dwarf shrub - lichen

HT - Dwarf shrub / dwarf shrub - heath moss

CPL - Cushion plant - lichen

CPS - Cushion plant - sedge moss

RO - Bedrock outcrop

BF - Boulder field, large cobbles

RB - Raised beach

RP - All riparian units

OW - Water - small and shallow (< 2 m deep)

PD - Water - < 50 ha, > 2 m deep

LA - Water - > 50 ha, > 2 m deep

OC - Ocean

SB - Snow Bed



AP - Disturbed

#### NOTES

Base data source: NTDB 1:50 000

### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Breeding Bird Survey Locations June 2006 & 2007

PROJECTION UTM Zone 17N		DATUM NAD83		<div>EBA Engineering Consultants Ltd. </div>
Scale: 1:75,000				
<div>0 0.35 0.7 1.4 2.1 2.8</div> <div> Kilometres</div>				
FILE NO. Roceh_Bay_wildlife_BBS_Figure_5_11x17				
PROJECT NO. 1740183.003/004	DWN KDA	CKD KLL	REV 1	<div>Figure 5</div>
OFFICE EBA-YEL	DATE February 20, 2008			





## LEGEND

— Contour	<b>Survey</b>	<b>Incidental</b>
Waterbody	● Arctic Tern	▲ Goose / Swan
Watercourse	● Black Guillemot	▲ Seaduck
★ 2007 Camp	● Goose / Swan	▲ Gull
★ 2006 Camp	● Seaduck	▲ Loon
■ Marine Survey Area	● Gull	▲ Jaeger
	● Loon	

## NOTES

Base data source: NTDB 1:50 000

"Geese and Swan" includes Canada Goose, Snow Goose and Tundra Swan; "Seaduck" includes Common Eider, King Eider and Long-tailed Duck; "Gull" includes Glaucous, Herring, Sabine's and Thayer's gull; "Loon" includes Common, Pacific, Red-throated and Yellow-billed loon; "Jaeger" includes Long-tailed, Pomarine and Parasitic jaeger

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

### Marine Bird Observations June 2006 & 2007

PROJECTION UTM Zone 17N	DATUM NAD83
Scale: 1:450,000	
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Kilometres	

FILE NO.  
Roche\_Bay\_wildlife\_seabird&waterfowl\_Jun\_Fig6

PROJECT NO. 1740183.004	DWN KDA	CKD KLL	REV 0
OFFICE EBA-YEL	DATE February 20, 2008		

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Figure 6



\\eba.local\corp\Yellowknife\Data\0701\Projects\2006\Environmental\1740183\_Roche\_Bay\2007\_Program\GIS\Roche\_Bay\_wildlife\_seabird&waterfowl\_Jul\_Fig7.mxd



#### LEGEND

— Contour

Waterbody

Watercourse

★ 2007 Camp

★ 2006 Camp

Marine Survey Area

#### Survey

● Arctic Tern

● Goose / Swan

● Seaduck

● Gull

● Loon

#### Incidental

▲ Arctic Tern

▲ Black Guillemot

▲ Goose / Swan

▲ Seaduck

▲ Gull

▲ Loon

▲ Jaeger

#### NOTES

Base data source: NTDB 1:50 000

"Geese and Swan" includes Canada Goose, Snow Goose and Tundra Swan; "Seaduck" includes Common Eider, King Eider and Long-tailed Duck; "Gull" includes Glaucous, Herring, Sabine's and Thayer's gull; "Loon" includes Common, Pacific, Red-throated and Yellow-billed loon; "Jaeger" includes Long-tailed, Pomarine and Parasitic jaeger

### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Marine Bird Observations July 2006 & 2007

PROJECTION

UTM Zone 17N

DATUM

NAD83

Scale: 1:450,000

9

4.5

0

9

Kilometres

FILE NO.

Roche\_Bay\_wildlife\_seabird&waterfowl\_Jul\_Fig7

PROJECT NO.

1740183.003/.004

DWN

KDA

CKD

KLL

REV

0

OFFICE

EBA-YEL

DATE

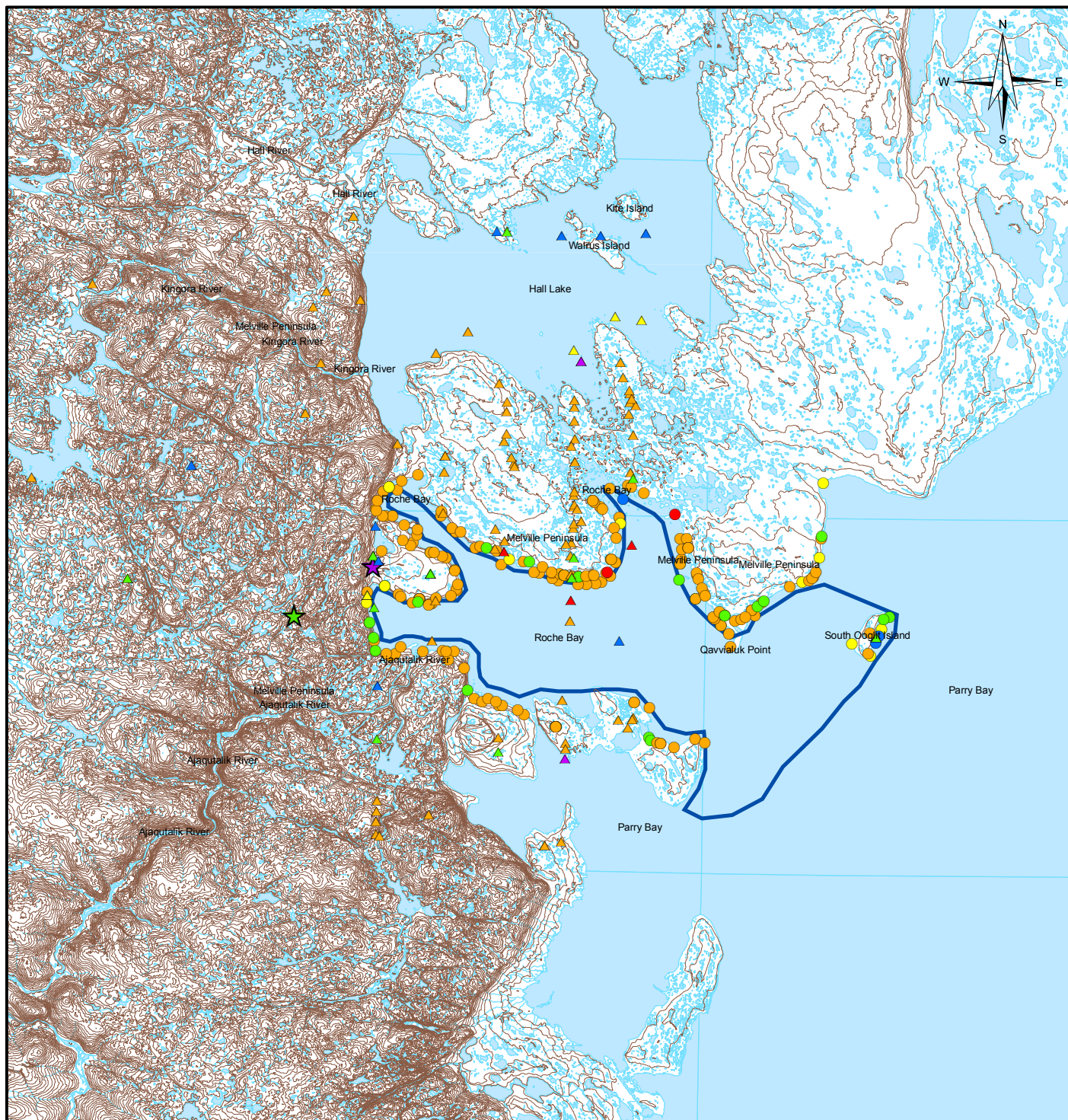
February 20, 2008

EBA Engineering  
Consultants Ltd.



Figure 7





### LEGEND


- |                      |                |                   |
|----------------------|----------------|-------------------|
| — Contour            | <b>Survey</b>  | <b>Incidental</b> |
| Waterbody            | ● Arctic Tern  | ▲ Arctic Tern     |
| Watercourse          | ● Goose / Swan | ▲ Black Guillemot |
| ★ 2007 Camp          | ● Seaduck      | ▲ Goose / Swan    |
| ★ 2006 Camp          | ● Gull         | ▲ Seaduck         |
| ■ Marine Survey Area | ● Loon         | ▲ Gull            |
|                      |                | ▲ Loon            |

### NOTES

Base data source: NTDB 1:50 000  
 "Geese and Swan" includes Canada Goose, Snow Goose and Tundra Swan; "Seaduck" includes Common Eider, King Eider and Long-tailed Duck; "Gull" includes Glaucous, Herring, Sabine's and Thayer's gull; "Loon" includes Common, Pacific, Red-throated and Yellow-billed loon; "Jaeger" includes Long-tailed, Pomarine and Parasitic jaeger

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

### Marine Bird Observations August 2006 & 2007

PROJECTION		DATUM	
UTM Zone 17N		NAD83	
Scale: 1:450,000			
9	4.5	0	9
			
Kilometres			
FILE NO.			
Roche_Bay_wildlife_seabird&waterfowl_Aug_Fig8			
PROJECT NO.	DWN	CKD	REV
1740183.003/.004	KDA	KLL	0
OFFICE	DATE		
EBA-YEL	February 20, 2008		

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Figure 8





### LEGEND

— Contour

Waterbody

Watercourse

★ 2007 Camp

★ 2006 Camp

Visual / Auditory

● Common Raven

● Gyrfalcon

● Peregrine Falcon

● Rough-legged Hawk

● Snowy Owl

Nest

★ Common Raven

★ Peregrine Falcon

★ Rough-legged Hawk

★ Unidentified Raptor

### NOTES

Base data source: NTDB 1:50 000

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

### Raptor Observations, 2006 & 2007

PROJECTION

UTM Zone 17N

DATUM

NAD83

Scale: 1:300,000

7

3.5

0

Kilometres

FILE NO.

Roche\_Bay\_wildlife\_Raptor\_Figure9

PROJECT NO.

1740183.003/004

DWN

KDA

CKD

KLL

REV

0

OFFICE

EBA-YEL

DATE

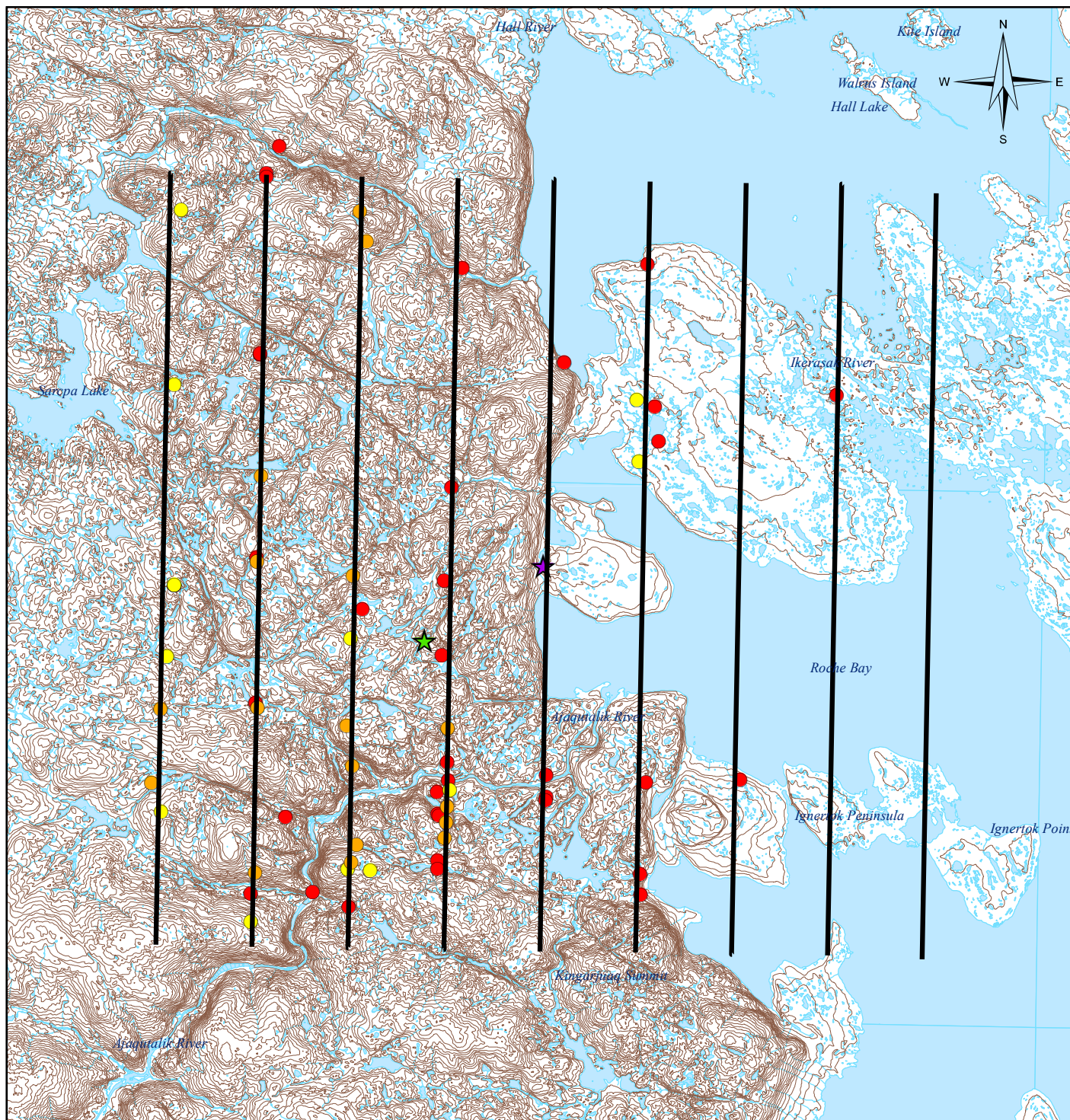
February 20, 2008

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Figure 9





### LEGEND


- Contour
- Waterbody
- Watercourse
- ★ 2006 Camp
- ★ 2007 Camp
- Aerial Ungulate Survey Transects
- Caribou Survey Observations
- June
- July
- August

### NOTES

Base data source: NTDB 1:50 000

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

### Caribou Observations During Ungulate Surveys, 2006 & 2007

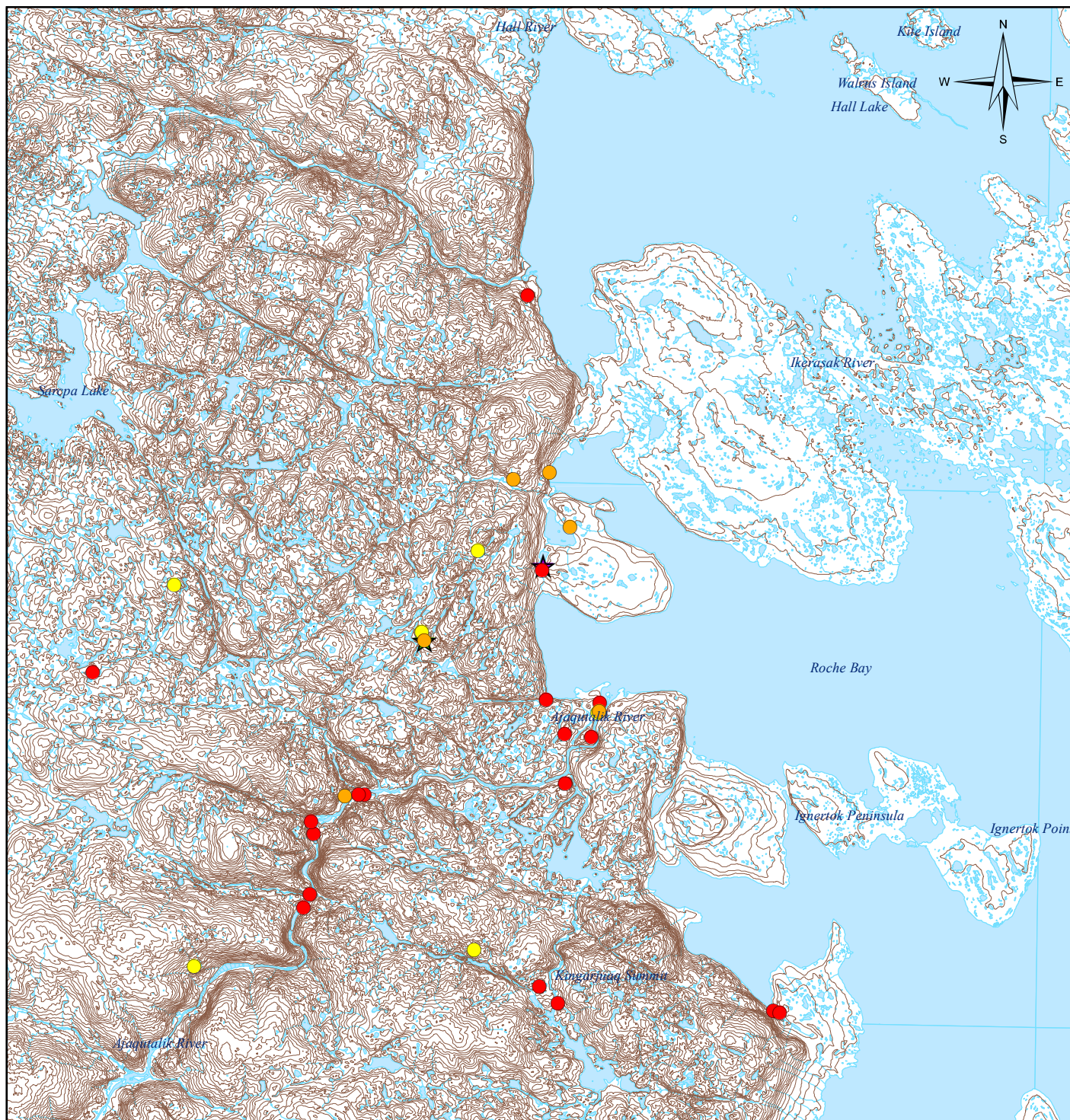
PROJECTION		DATUM	
UTM Zone 17N		NAD83	
Scale: 1:300,000			
6	3	0	6
			
Kilometres			
FILE NO.			
Roche_Bay_wildlife_Cari_survey_observ_Fig10			
PROJECT NO.		DWN	CKD
1740183.004		KDA	KLL
		REV	0
OFFICE		DATE	
EBA-YEL		February 20, 2008	

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Figure 10



\\eba.local\corp\Yellowknife\Data\0701\Projects\2006\Environmental\1740183\_Roche\_Bay\2007\_Program\GIS\Roche\_Bay\_wildlife\_Cari\_Incidental\_observations\_Figure11.mxd



#### LEGEND


- |             |                                 |
|-------------|---------------------------------|
| — Contour   | Incidental Caribou Observations |
| Waterbody   | ● June                          |
| Watercourse | ● July                          |
| ★ 2006 Camp | ● August                        |
| ★ 2007 Camp |                                 |

#### NOTES

Base data source: NTDB 1:50 000

#### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Incidental Caribou Observations, 2006 & 2007

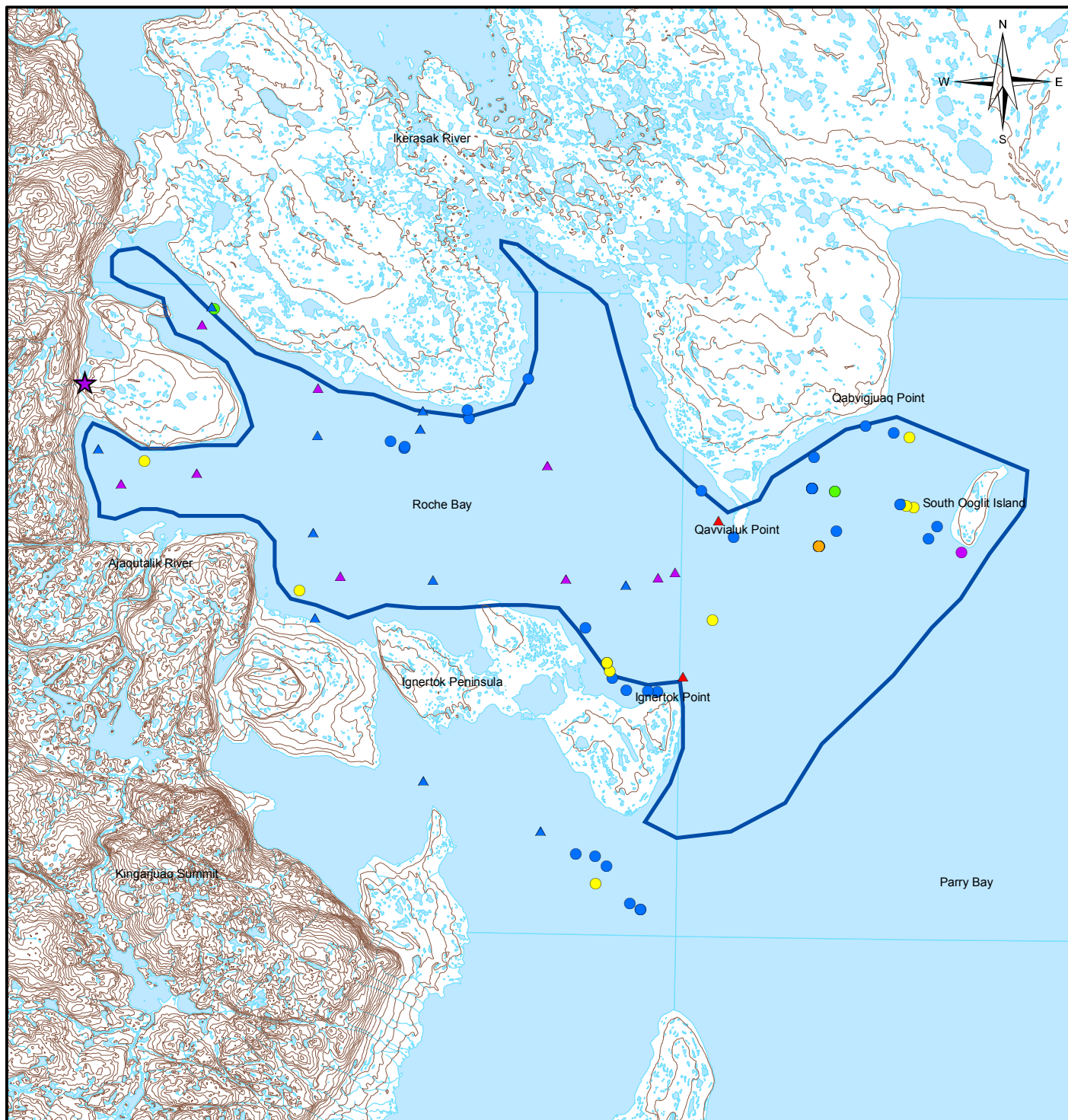
PROJECTION		DATUM	
UTM Zone 17N		NAD83	
Scale: 1:300,000			
6	3	0	6
			
Kilometres			
FILE NO.			
Roche_Bay_wildlife_Cari_incid_observ_Fig11			
PROJECT NO.	DWN	CKD	REV
1740183.003/.004	KDA	KLL	0
OFFICE	DATE		
EBA-YEL	February 20, 2008		

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Figure 11





#### LEGEND

— Contour

Waterbody

Watercourse

★ 2007 Camp

★ 2006 Camp

■ Marine Survey Area

#### Survey

● Bearded Seal

● Harbour Seal

● Ringed Seal

● Unidentified Seal

● Walrus

#### Incidental

▲ Polar Bear

▲ Ringed Seal

▲ Unidentified Seal

#### NOTES

Base data source: NTDB 1:50 000

### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Marine Mammal Observations June 2006 & 2007

PROJECTION UTM Zone 17N	DATUM NAD83
Scale: 1:250,000	
5 2.5 0 5	
Kilometres	

FILE NO.  
Roche\_Bay\_marine\_mammal\_june\_Figure\_12

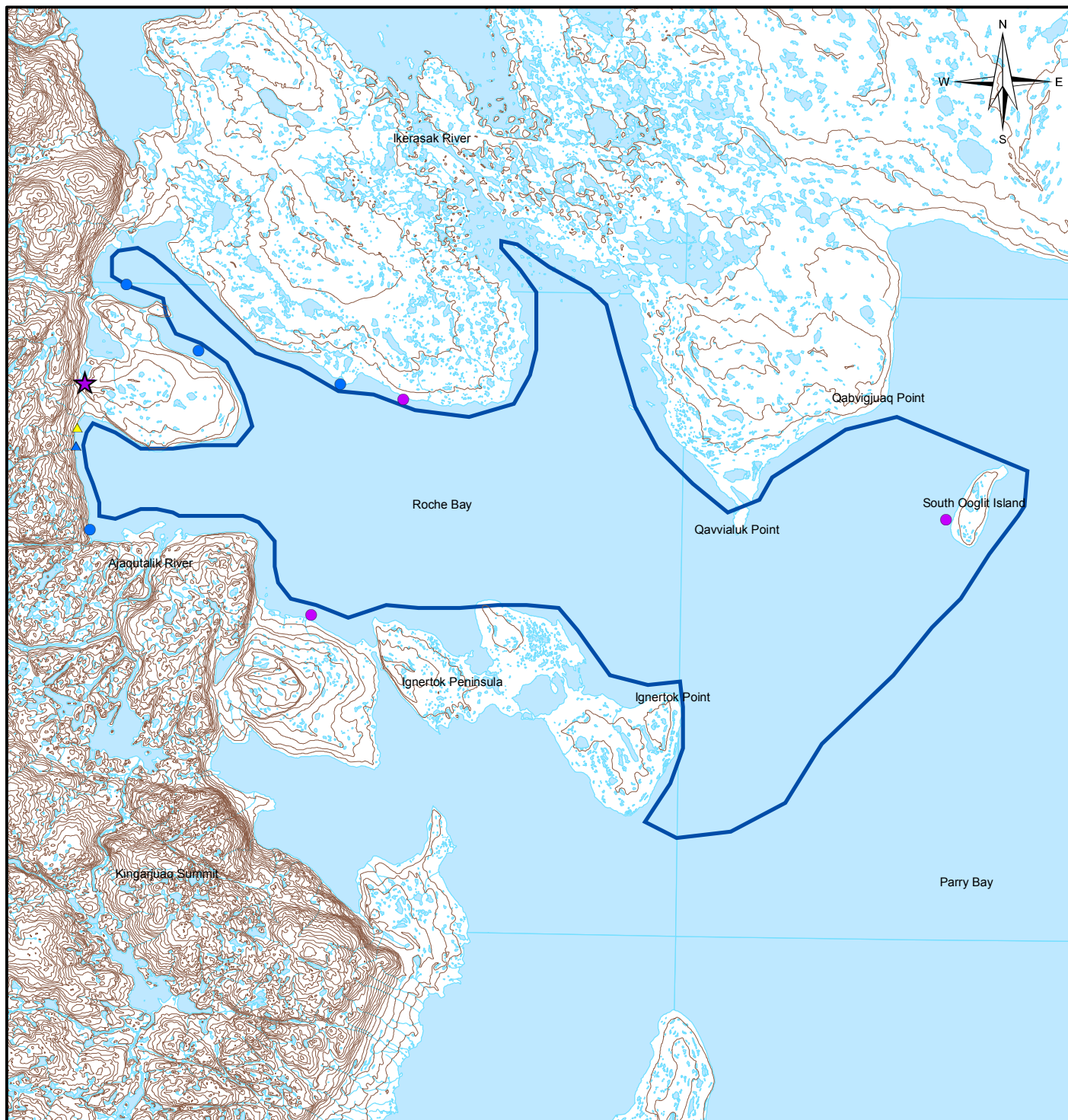
PROJECT NO. 1740183.003/004	DWN KDA	CKD KLL	REV 0
OFFICE EBA-YEL	DATE February 20, 2008		

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Figure 12





#### LEGEND

- |                      |                     |
|----------------------|---------------------|
| — Contour            | Survey              |
| Waterbody            | ● Ringed Seal       |
| Watercourse          | ● Unidentified Seal |
| ★ 2007 Camp          | Incidental          |
| ★ 2006 Camp          | ▲ Bearded Seal      |
| ■ Marine Survey Area | ▲ Ringed Seal       |

#### NOTES

Base data source: NTDB 1:50 000

#### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Marine Mammal Observations July 2006 & 2007

PROJECTION UTM Zone 17N	DATUM NAD83
Scale: 1:250,000	
5 2.5 0 5	
Kilometres	

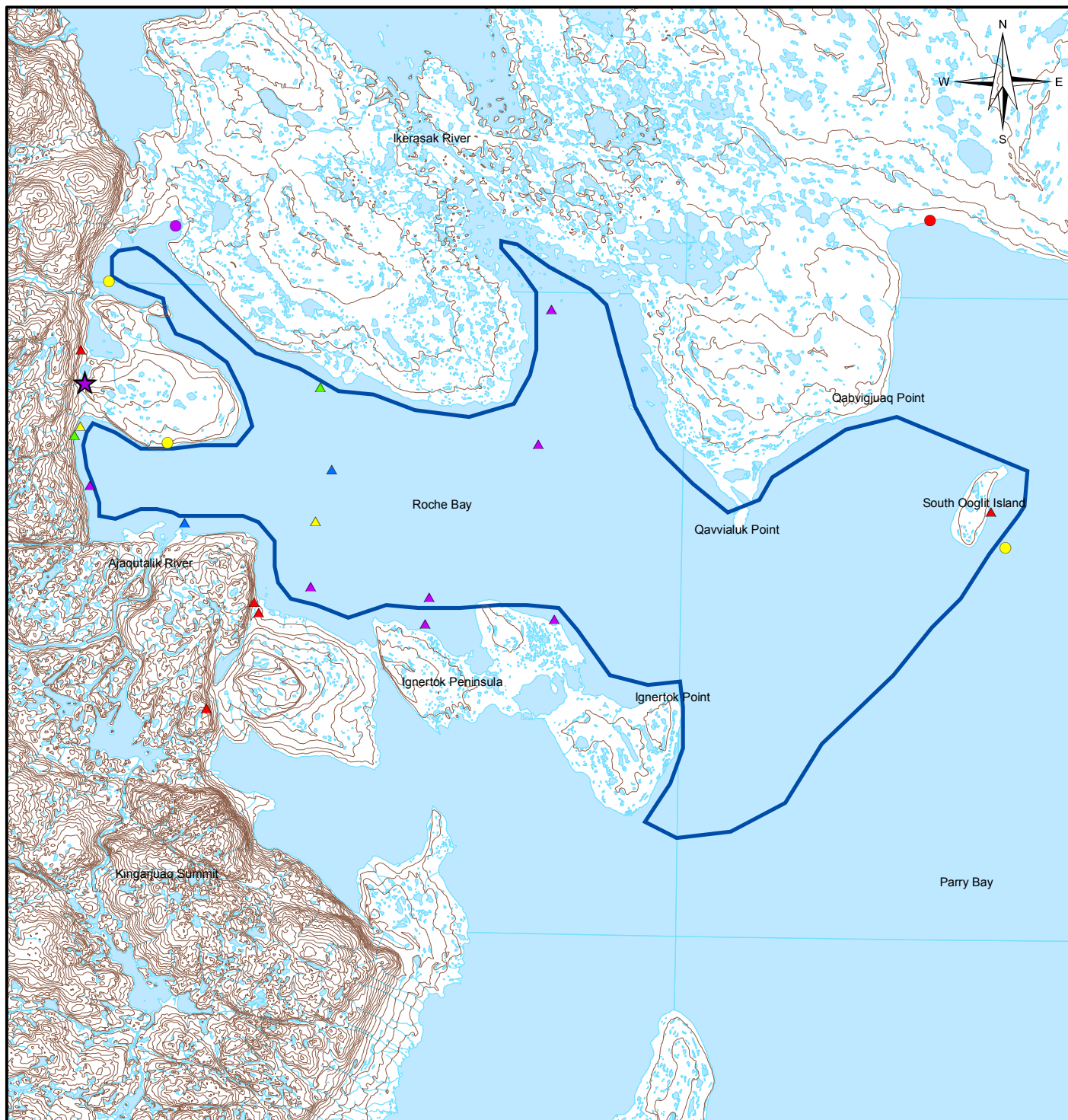
FILE NO.  
Roche\_Bay\_marine\_mammal\_august\_Figure\_13

PROJECT NO. 1740183.003/004	DWN KDA	CKD KLL	REV 0
OFFICE EBA-YEL	DATE February 20, 2008		

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Figure 13



#### LEGEND

- Contour
- Waterbody
- Watercourse
- ★ 2007 Camp
- ★ 2006 Camp
- Marine Survey Area

- Survey selection**
- Bearded Seal
  - Polar Bear
  - Unidentified Seal

- Incidental selection**
- ▲ Bearded Seal
  - ▲ Harbour Seal
  - ▲ Polar Bear
  - ▲ Ringed Seal
  - ▲ Unidentified Seal

#### NOTES

Base data source: NTDB 1:50 000

#### ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

#### Marine Mammal Observations August 2006 & 2007

PROJECTION UTM Zone 17N	DATUM NAD83
Scale: 1:250,000	
<div> <div>5</div> <div>2.5</div> <div>0</div> <div>5</div> </div> <div>Kilometres</div>	

FILE NO.  
Roche\_Bay\_marine\_mammal\_aug\_Figure\_14

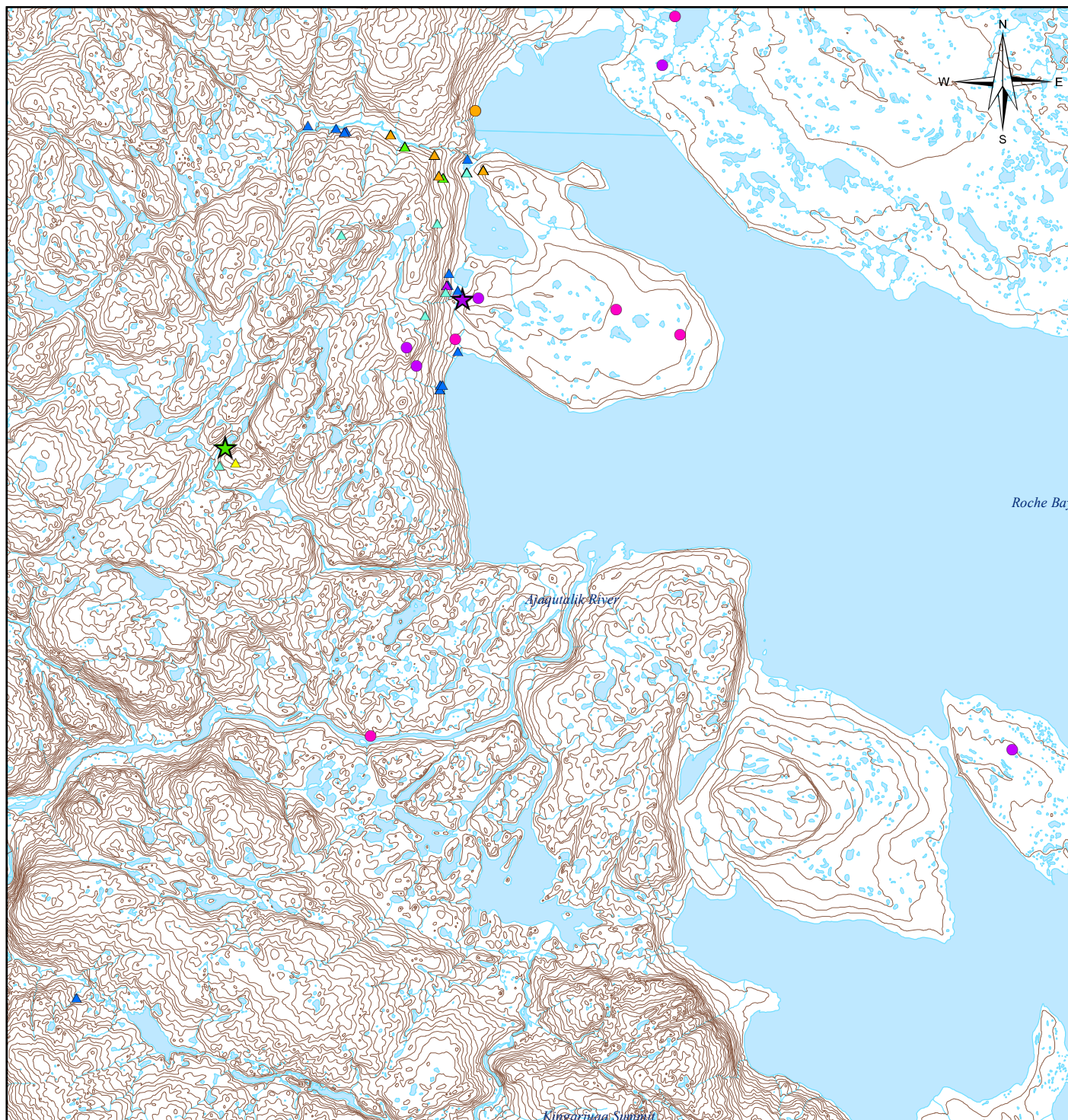
PROJECT NO. 1740183.003/004	DWN KDA	CKD KLL	REV 0
OFFICE EBA-YEL	DATE February 20, 2008		

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Figure 14





## LEGEND

— Contour	Visual / Auditory	Sign
Waterbody	● Sandhill Crane	▲ Arctic Fox
Watercourse	● Arctic Fox	▲ Arctic Ground Squirrel
★ 2006 Camp	● Weasel	▲ Arctic Hare
★ 2007 Camp		▲ Lemming
		▲ Muskox
		▲ Weasel

## NOTES

Base data source: NTDB 1:50 000

## ROCHE BAY MAGNETITE PROJECT ENVIRONMENTAL BASELINE STUDIES 2006 & 2007 WILDLIFE RESOURCES

### Miscellaneous Wildlife Observations, 2006 & 2007

PROJECTION UTM Zone 17N	DATUM NAD83
Scale: 1:150,000	
3 1.5 0 3	
Kilometres	
FILE NO. Roche_Bay_wildlife_Misc_observations_Figure15	
PROJECT NO. 1740183.003/.004	DWN KDA
OFFICE EBA-YEL	CKD KLL
DATE February 20, 2008	REV 0

EBA Engineering  
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Figure 15



# PHOTOGRAPHS







**Photograph 1**

Lapland Longspur, the most common breeding bird, was located in various habitats including this rock outcrop (June 29, 2006).



**Photograph 2**

Baird's Sandpiper, the most common shorebird species, were observed in sedge meadow habitats (July 18, 2006).





**Photograph 3**

Semipalmated Sandpipers were a common shorebird observed within the study area (June 27, 2007).



**Photograph 4**

Unique observations of Snow Geese nesting along cliffs were recorded in the study area (June 27, 2007).





**Photograph 5**

Territorial defense behaviour observed from a Long-tailed Jaeger within the study area (June 24, 2007).



**Photograph 6**

An active Peregrine Falcon nest present along a north facing cliff within the study area (June 27, 2007).





**Photograph 7**

An active Rough-legged Hawk nest documented on a north facing cliff within the study area (June 25, 2007).



**Photograph 8**

Barren-ground caribou within the study area were most often seen as solitary individuals or in groups of two (June 27, 2006).





**Photograph 9**

Barren-ground caribou sign (pellets and tracks) were observed throughout the study area in various habitats (July 31, 2006).



**Photograph 10**

A solitary walrus was recorded along the ice flow within the study area (June 24, 2007).



**Photograph 11**

One of several polar bears observed within the study area (this one approximately 10 km north of Qabvigjuaq Point) (August 28, 2007).



**Photograph 12**

Polar bear sow and cub between Ajaqutalik River and Ignertok Peninsula, within the study area (August 22, 2006).



# APPENDIX

## APPENDIX A BIRDS AND MAMMALS OBSERVED WITHIN THE STUDY AREA, 2006 AND 2007

## APPENDIX A: BIRDS AND MAMMALS OBSERVED AT ROCHE BAY, 2006 AND 2007

Common Name	Latin Name
<b>Birds</b>	
American Golden-Plover	<i>Pluvialis dominica</i>
American Pipit	<i>Anthus spinoletta</i>
Arctic Tern	<i>Sterna paradisaea</i>
Baird's Sandpiper	<i>Calidris bairdii</i>
Canada Goose	<i>Branta canadensis</i>
Common Eider	<i>Somateria mollissima</i>
Common Loon	<i>Gavia immer</i>
Common Raven	<i>Corvus corax</i>
Glaucous Gull	<i>Larus hyperboreus</i>
Gyr Falcon	<i>Falco rusticolus</i>
Horned Lark	<i>Eremophila alpestris</i>
Hoary Redpoll	<i>Carduelis hornemanni</i>
King Eider	<i>Somateria spectabilis</i>
Lapland Longspur	<i>Calcarius lapponicus</i>
Long-tailed Duck	<i>Clangula hyemalis</i>
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>
Parasitic Jaeger	<i>Stercorarius parasiticus</i>
Pacific Loon	<i>Gavia pacifica</i>
Peregrine Falcon	<i>Falco peregrinus anatum</i>
Pectoral Sandpiper	<i>Calidris melanotos</i>
Pomarine Jaeger	<i>Stercorarius pomarinus</i>
Rough-legged Hawk	<i>Buteo lagopus</i>
Red-necked Phalarope	<i>Phalaropus lobatus</i>
Rock Ptarmigan	<i>Lagopus mutus</i>
Red-throated Loon	<i>Gavia stellata</i>
Sandhill Crane	<i>Grus canadensis</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>
Semipalmated Sandpiper	<i>Calidris pusilla</i>
Snow Bunting	<i>Plectrophenax nivalis</i>
Lesser Snow Goose	<i>Chen caerulescens</i>
Snowy Owl	<i>Nyctea scandiaca</i>
Thayer's Gull	<i>Larus thayeri</i>
Tundra Swan	<i>Cygnus columbianus</i>
White-rumped Sandpiper	<i>Calidris fuscicollis</i>
Yellow-billed Loon	<i>Gavia adamsii</i>
<b>Mammals</b>	
Arctic Fox	<i>Alopex lagopus</i>
Arctic Ground Squirrel	<i>Spermophilus parryi</i>
Arctic Hare	<i>Lepus arcticus</i>
Bearded Seal	<i>Erignathus barbatus</i>
Barren-ground Caribou	<i>Rangifer tarandus</i>
Harbour Seal	<i>Phoca vitulina</i>
Lemming	<i>Dicrostonyx sp. or Lemmus sp.</i>
Muskox	<i>Ovibos moschatus</i>
Polar Bear	<i>Ursus maritimus</i>
Ringed Seal	<i>Phoca hispida</i>
Walrus	<i>Odobenus rosmarus</i>



# APPENDIX

## APPENDIX B UTM COORDINATES FOR ROCHE BAY BREEDING BIRD SURVEY SITES, JUNE 2006 AND 2007

**APPENDIX B. UTM COORDINATES FOR ROCHE BAY BREEDING BIRD SURVEYSITES, JUNE 2006 & 2007.**

Station Name	Easting_X	Northing_Y
BBS1	431793.0538	7593357.902
BBS2	431533.4953	7593830.068
BBS3	431732.0332	7594362.335
BBS4	432014.4382	7594678.189
BBS5	432369.4472	7594233.629
BBS6	432864.5818	7595335.839
BBS7	433398.1003	7595129.844
BBS8	433523.0748	7595563.793
BBS9	434165.9173	7595353.966
BBS10	434944.8886	7593233.458
BBS11	435207.4472	7593011.436
BBS12	435522.4432	7592865.065
BBS13	436102.5361	7592558.091
BBS14	438214.1323	7593511.607
BBS15	438656.2037	7594168.923
BBS16	437208.8626	7594925.046
BBS17	437197.3359	7594708.95
BBS18	433608.7411	7595393.108
BBS19	433942.2512	7595655.399
BBS20	433407.1557	7596140.178
BBS21	433108.3669	7596383.442
BBS22	432756.6578	7596437.415
BBS23	432339.0546	7597073.233
BBS24	433018.0062	7597407.575
BBS25	434614.7561	7593837.611
BBS26	434819.3085	7593437.469
BBS27	433891.2828	7594131.961
BBS28	426612.2764	7591598.992
BBS29	426653.3365	7590764.513
BBS30	427078.4988	7590840.338
BBS31	434245.049	7597004.944
BBS32	434725.9389	7596564.129
BBS33	426826.481	7590290.982
BBS34	427626.6454	7590049.315
BBS35	432666.7075	7595415.847
BBS36	433465.8355	7598981.849

Note: Stations BBS28 – BBS36 (inclusive) were surveyed in 2007.

# APPENDIX

## APPENDIX C EBA TERMS AND CONDITIONS

## ENVIRONMENTAL REPORT – GENERAL CONDITIONS

This report incorporates and is subject to these “General Conditions”.

### 1.0 USE OF REPORT

This report pertains to a specific site, a specific development, and a specific scope of work. It is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site or proposed development would necessitate a supplementary investigation and assessment.

This report and the assessments and recommendations contained in it are intended for the sole use of EBA’s client. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than EBA’s client unless otherwise authorized in writing by EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of EBA. Additional copies of the report, if required, may be obtained upon request.

### 2.0 LIMITATIONS OF REPORT

This report is based solely on the conditions which existed on site at the time of EBA’s investigation. The client, and any other parties using this report with the express written consent of the client and EBA, acknowledge that conditions affecting the environmental assessment of the site can vary with time and that the conclusions and recommendations set out in this report are time sensitive.

The client, and any other party using this report with the express written consent of the client and EBA, also acknowledge that the conclusions and recommendations set out in this report are based on limited observations and testing on the subject site and that conditions may vary across the site which, in turn, could affect the conclusions and recommendations made.

The client acknowledges that EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the client.

### 2.1 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of this report, EBA may have relied on information provided by persons other than the client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

### 3.0 LIMITATION OF LIABILITY

The client recognizes that property containing contaminants and hazardous wastes creates a high risk of claims brought by third parties arising out of the presence of those materials. In consideration of these risks, and in consideration of EBA providing the services requested, the client agrees that EBA’s liability to the client, with respect to any issues relating to contaminants or other hazardous wastes located on the subject site shall be limited as follows:

1. With respect to any claims brought against EBA by the client arising out of the provision or failure to provide services hereunder shall be limited to the amount of fees paid by the client to EBA under this Agreement, whether the action is based on breach of contract or tort;
2. With respect to claims brought by third parties arising out of the presence of contaminants or hazardous wastes on the subject site, the client agrees to indemnify, defend and hold harmless EBA from and against any and all claim or claims, action or actions, demands, damages, penalties, fines, losses, costs and expenses of every nature and kind whatsoever, including solicitor-client costs, arising or alleged to arise either in whole or part out of services provided by EBA, whether the claim be brought against EBA for breach of contract or tort.



#### 4.0 JOB SITE SAFETY

EBA is only responsible for the activities of its employees on the job site and is not responsible for the supervision of any other persons whatsoever. The presence of EBA personnel on site shall not be construed in any way to relieve the client or any other persons on site from their responsibility for job site safety.

#### 5.0 DISCLOSURE OF INFORMATION BY CLIENT

The client agrees to fully cooperate with EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The client acknowledges that in order for EBA to properly provide the service, EBA is relying upon the full disclosure and accuracy of any such information.

#### 6.0 STANDARD OF CARE

Services performed by EBA for this report have been conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Engineering judgement has been applied in developing the conclusions and/or recommendations provided in this report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of this report.

#### 7.0 EMERGENCY PROCEDURES

The client undertakes to inform EBA of all hazardous conditions, or possible hazardous conditions which are known to it. The client recognizes that the activities of EBA may uncover previously unknown hazardous materials or conditions and that such discovery may result in the necessity to undertake emergency procedures to protect EBA employees, other persons and the environment. These procedures may involve additional costs outside of any budgets previously agreed upon. The client agrees to pay EBA for any expenses incurred as a result of such discoveries and to compensate EBA through payment of additional fees and expenses for time spent by EBA to deal with the consequences of such discoveries.

#### 8.0 NOTIFICATION OF AUTHORITIES

The client acknowledges that in certain instances the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by EBA in its reasonably exercised discretion.

#### 9.0 OWNERSHIP OF INSTRUMENTS OF SERVICE

The client acknowledges that all reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

#### 10.0 ALTERNATE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EBA shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancies, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EBA shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. The Client warrants that EBA's instruments of professional service will be used only and exactly as submitted by EBA.

The Client recognizes and agrees that electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.