2.0 PROJECT BASELINE CONDITIONS

Information on the baseline conditions for the Ulu project site was primarily obtained from the consultant reports listed below.

Ulu Project Environmental Overview, Rescan Environmental Services, December 1991, submitted to BHP. See Appendix 3.

Ulu Project: Preliminary Assessment of Acid Rock Drainage Potential, Klohn-Crippen Consultants Ltd., October, 1996. See Appendix 4.

Fisheries Assessment of Streams and Lakes in the Ulu Project Area, Nunavut, RL & L Environmental Services Ltd., November 1996. See Appendix 5.

Notes on Wildlife in the Vicinity of the Echo Bay Mines Ulu Project and Associated Transportation Corridor, Hubert and Associates and Canamera Geological Ltd., August 1996. See Appendix 6.

Wildlife and Wildlife Habitat Assessment, Canamera Geological Ltd., Environmental Resources Division, November 1996. See Appendix 7.

Ulu Mine Project Archaeological Impact Assessment: Phase I, Quaternary Consultants Limited, July 1996. See Appendix 8.

Ulu Mine Project Archaeological Impact Assessment: Phase II, Quaternary Consultants Limited, September 1996. See Appendix 9.

Wildlife Survey for the Ulu Project, 1992 Update, BHP Minerals Canada Ltd., 1992.

Ulu Gold Project Prefeasiblity Study, H.A. Simons Ltd., September 1995. See Appendix 17.

Final Report on an Airphoto and Map Study of Lupin to Ulu Alternative Haul Route Locations Examined with Terrain Mapping, J.D. Mollard and Associates Ltd., September 30, 1996. See Appendix 20.

Final Report on Resource Management Planning in West Kitikmeot, Nunavut Planning Commission Transition Team, July 1996. See Appendix 21.

2.1 CLIMATE

The weather in the Ulu site area is typical of the continental barrenlands which experience extremely cold winters and cool summers. The climatic conditions for the Ulu area were monitored by BHP and some data was collected between June and mid-September, 1990 - 1992. Comparison was made of this limited information to that published by the Atmospheric Environment Service, Environment Canada, for a number of meteorological stations in the Northwest Territories, including Contwoyto Lake and Coppermine, for which over thirty years of record are available. The preliminary data indicate close similarity in temperature range, but somewhat lesser magnitudes of rain precipitation.

Snow accumulation was observed to begin in September and remain into June. Spring breakup is complete by the third week of June and freeze-up starts by the end of September. Twenty-four hour daylight persists from May to early August due to the property's location above the Arctic Circle.

2.2 LANDFORMS AND TOPOGRAPHY

The Ulu site is situated in the treeless arctic tundra where rock and glacial features dominate the landscape. The site is located on a glacially modified bedrock outcrop bounded by a linear lake (West Lake) on the west and a small semi-circular lake (East Lake) on the southeast. The terrain is rugged, consisting of exposed bedrock, usually modified by frost action into blocky, angular boulders, relocated bedrock boulders, and occasional glacial erratics. A small area overlooking West Lake is a swale of soggy sedge tundra as are large portions of the shores of the lakes. Elevations in the vicinity of the Ulu site range from about 400 metres to 485 metres above sea level.

The selected winter road alignment between Lupin and Ulu passes through or near a number of topographic units including lakes, eskers, till in hummocky and rolling moraines, outwash plains, rock terrains of rough Precambrian rock and wetlands. Lakes are the most common unit along the winter road right- of- way; till moraines being the most common on the portage sections of the road. Short sections of the road also pass through areas of rock terrain which are high to moderate relief bedrock terrain areas characterized by their jagged rock surfaces.

2.3 GEOLOGY

This section will describe the geology at the Ulu site; geology along the winter road will not be addressed.

The Ulu deposit lies within three mineral claims which covers a 2 to 3 kilometre wide lobe of mafic metavolcanic and metasedimentary rocks. The lobe is tightly folded into a north plunging asymmetrical anticline dissected by east-west trending faults. Mineralization is within the Flood Zone of basalt with subordinate sediment and gabbro, cross cut by acidic and basic dykes. Four horizons of gabbro are noted in the succession forming the hanging wall. This succession lies on the west limb of the fold.

The west limb strikes north-south with a moderate westerly dip. A 15 metre thick feldspar porphyry dyke, striking north east, cross cuts the succession and coincides with a flexure in the flank of the west limb.

The Flood Zone can be traced on surface for 400 metres in a north west direction near the core of the anticline. The 2 to 5 metre thick mineralized zone dips steeply at 70° to 80° to the south west and has been intersected by diamond drilling to depths of about 600 metres. Areas of local thickening up to 10 metres correspond to flexure points along the roughly tabular body.

Mineralization is comprised of an intensely silicified zone with arsenopyrite contained in fractures and dilatancies within basalts.

2.3.1 Acid Rock Drainage Potential

Test work has been undertaken to gain insight into the potential of creating acid rock drainage (ARD) from waste rock and ore that will be stored on the surface at the Ulu site. Ore will be stored in preparation for transport to the Lupin mine for processing. Waste rock is used for site levelling and as a base for infrastructure buildings and local roads. Waste rock will be the base material for the ore storage pad which is described in Section 4.2.2: Waste Rock Disposal.

Two sets of previous acid-base accounting (ABA) test work have been carried out prior to the additional work done in 1996. In 1990, testing was performed as part of the environmental review (Rescan, 1991) and attempted to characterize the ARD potential of the various lithologies occurring in the Ulu property through the analysis of 15 samples. The 14 samples analysed in 1992 specifically addressed the ARD characteristics of the ore material and rocks in the hanging wall exposed in a trench in the NW Flood Zone. Results of the 1990 and 1992 tests indicate that the ore material is potentially acid generating while most barren rocks are not.

To supplement the previous ABA test work and to address the specific needs for the current development, 32 samples were collected or selected for detailed analysis in 1996. These include the following:

- 16 composite chip samples of the portal under construction (the source of the waste rock used for base preparation for the camp buildings and the ore storage pad), including 4 collected by Klohn-Crippen personnel while working on site (samples 1 to 4), 4 collected by EBM personnel prior to the Klohn-Crippen site visit (samples 5 to 8) and 8 collected subsequent to the Klohn-Crippen site visit (samples 25 to 32).
- 8 composite pulp samples covering two mineralized zones encountered in a diamond drill hole; both the ore material and its immediate wall rock alteration were included (samples 9 to 16).
- The fresh interior (sample 17) and the alteration rind (sample 18) of a grab sample collected by EBM personnel from the Ore Zone Surface.
- 6 barren country rocks (3 gabbro, 2 biotite schist and 1 mafic volcanic rock) sampled from drill cores by EBM personnel (samples 19 to 24).

To shed light on the extent of sulphide oxidation and to determine the availability of carbonate neutralization capacity in the sample suite, both acid-soluble sulphate and carbonate-carbon were included in the ABA test work. The acid generation potential (AP) of a given sample was calculated based on the sulphide-sulphur content (ie., total S minus sulphate-S); in other words, the acid generation potential attributable to sulphide (SAP) was calculated. The net neutralization potential (NNP) was calculated by subtracting the SAP from the measured neutralization potential (NP). The NP to AP ratio (or NPR) was also calculated using the SAP. The neutralization potential due to carbonates occurring in the samples (Carbonate-NP) was calculated based on the carbonate-carbon analyses and expressed in kilograms calcium carbonate equivalent per tonne (kg $CaCO_3$ equivalent/tonne), the same unit as SAP, NP and NNP for easy reference. Sample test results are shown in Table 1.

General Observations

As a group, the analysed samples have relatively uniform paste pH and NP, very low sulphate-S and low to very low carbonate-NP contents. The relatively high paste pH measurements (8.1 to 9.4 except for the alteration rind sample which gave 7.2) indicate the dominance of relatively fresh silicates with little contribution from reacting sulfides or carbonates. The very low sulphate-S contents affirm that sulfides present in the sample suite are largely unaltered. Alternatively, any alteration products, if present at all, are not retained in the samples as sulphates. However, in the northern environment, fast reacting sulfides usually give rise to efflorescent sulphates as an intermediate alteration product. In the sample with the highest sulphate-S content (a grab sample from an ore outcrop), the portion of oxidized sulphide amounts to only 5 percent.

Table 1
Ulu Project Acid Base Accounting

Sample No.	Paste pH	SAP[1]	NP[2]	NNP[3]	NP:SAP	Carbonate NP
		kg/tonne $CaCO_3$			Ratio	
1	8.63	8	45	37	5.6	24.1
2	9.62	3	27	24	10.6	0.2
3	8.11	122	13	-109	0.1	0.4
4	9.26	15	22	7	1.5	1.7
5	8.56	83	21	-61	0.3	6.5
6	8.34	87	14	-73	0.2	2.2
7	8.38	98	21	-77	0.2	3.8
8	8.69	71	24	-47	0.3	6.7
9	8.76	4	30	26	6.9	6.5
10	8.87	8	26	18	3.1	8.8
11	8.79	28	33	5	1.2	12.5
12	8.75	36	33	-3	0.9	6.3
13	8.60	70	30	-39	0.4	5.3
14	8.60	50	18	-31	0.4	5.3
15	9.43	8	24	15	2.9	1.0
16	9.18	6	16	10	2.7	1.6
17	8.37	35	23	-13	0.6	<0.1
18	7.23	39	26	-14	0.6	0.2
19	8.90	29	18	-11	0.6	3.5
20	8.96	3	22	19	7.2	1.7
21	8.82	2	21	19	11.3	1.2
22	8.54	7	25	19	3.9	<0.1
23	8.95	4	18	14	4.7	1.2
24	9.27	2	15	14	9.8	1.0
25	9.03	46	22	-24	0.5	3.0
26	9.03	18	19	1	1.1	3.0
27	9.24	25	23	-2	0.9	6.0
28	9.00	10	23	13	2.4	6.0
29	9.21	23	23	1	1.0	11.0
30	9.18	11	20	9	1.8	2.0
31	8.96	10	19	9	1.9	4.0
32	9.07	6	19	13	3.2	1.0

1 Acid generation potential attributable to sulphide.
2 Measured neutralization potential.
3 Net neutralization potential.

The NP of the sample suite lies within a narrow range, about 13 to 45 kg $CaCO_3$ equivalent/tonne. Most of the NP in these samples are due to non-carbonated minerals, which in these cases are most likely mafic silicates. In only one sample does the carbonate-NP exceed the contribution from the silicates. In the absence of a significant carbonate-NP, the sulphide-S content (which in this case is essentially the same as total

S because of the low detected sulphate-S content) becomes the most important parameter determining the outcome of the NNP and NPR of a sample, regardless of rock type. Thus in the sample suite, any sample with a total S content greater than 0.9 percent invariably gives rise to a negative NNP and a NPR less than 1. In other words, based on the current data set, any sample with a total $S > 0.9\%$ is potentially acid generating (PAG).

Given the slow weathering rate at the mine site as evidenced by the freshness of both exposed silicate and sulphide minerals, it is considered appropriate to use a NPR of 1 rather than a higher value to discriminate PAG from non-PAG rocks. However, as anhedral pyrrhotite, which is highly reactive in a warmer climate, occurs both in the ore zone and its wall-rock alteration, kinetic tests are being carried out to confirm whether or not such a low ratio is acceptable. Furthermore, since arsenopyrite is closely associated with the ore and arsenic is mobile even under non-acidic conditions, kinetic tests will clarify whether or not arsenic contamination will be a concern regardless of the acid-generation potential of the ore or arsenopyrite-containing waste. Kinetic testing is scheduled to begin in January 1997.

Issues Related to the Ore Pad Construction

The eight samples collected from the portal under construction vary widely in ABA characteristics. While the most carbonate-rich rock has been identified from the working face (as of August 19, 1996, the date the sample was taken), the most PAG-rock also occurs in the close vicinity. In volume, the PAG rock constitutes only a small proportion of the north ramp, a composite sample of which gave a NPR of 10.6 and a NNP of 24 kg $CaCO_3$ equivalent /tonne. However, all four samples previously collected by the EBM staff in the earlier phase of the portal construction gave negative NNP values and a NPR less than 0.4. This suggests that the volume of the PAG rock may be significant locally. On the other hand, out of the eight waste rock samples subsequently collected from the camp pads, only one is potentially acid-generating and another one marginally so. The overall paucity of PAG-material indicates that if the waste rock used in the camp pads construction is well mixed, the probability of net acid generation will be low.

To avoid potential environmental problems, the use of PAG rocks for building the foundation of the prospective ore pad or in mine road construction should be avoided. As rock excavation is a slow process, a field geologist's expertise in mineral identification may be utilized in selecting the right material for construction purposes. Using the threshold value of 0.9 weight percent sulphur as a discriminator, any rock containing more than approximately 2.5 percent pyrrhotite or 2 percent pyrite or 4.5 percent arsenopyrite by volume or their combined equivalents should be isolated. Such sulphide-rich material can be stockpiled in an impervious structure and later be capped in-situ or utilized as an ore diluent in the milling process.

A comparison of the ABA characteristics of the fresh interior and the alteration rind of an ore sample exposed by trenching in 1992 suggest that the sulphide oxidation rate is very slow at the mine site. In spite of the near absence of carbonate-NP, a minimum of four years of exposure to the weathering elements has only led to a depression in paste pH from 8.4 (sample 17) to 7.2 (sample 18) as a result of sulphide oxidation. As indicated by the relatively low sulphate-S content in the alteration rind, the stable alteration product resulting from this slow weathering process is iron oxide rather than a leachable intermediate sulphate mineral. Thus, it is not expected that acid drainage will be generated from ore stockpiled on a surface pad for up to four years (it is unlikely that any ore will be stored for as long as 4 years).

As shown by the ABA characteristics of samples from a drill hole exhibiting different degrees of mineralization, the total sulphur content is the controlling factor determining whether or not a sample will be classified as PAG. Given the fact that a neutralization pond has already been included in the mining plan to treat prospective acid drainage from the ore pad, sub-ore material containing greater than about 2.5 percent pyrrhotite or 2 percent pyrite or 4.5 percent arsenopyrite by volume or their combined equivalents should be stockpiled together with the ore. Pending confirmation by kinetic tests, the inclusion of such sulphide-rich material in the ore stockpile is unlikely to lead to acid generation in a few years because of the extremely slow sulphide oxidation rate apparently occurring at the site.

2.4 WATER RESOURCES AND FISHERIES

2.4.1 Lakes

Five lakes (Reno Lake North, Reno Lake South, West Lake, East Lake, and Ulu Lake), shown on Figure 2[1], in the immediate vicinity of the Ulu site have the potential to be impacted by daily activities at the site. Impacts at the Reno Lakes will be primarily due to angling. The other lakes are a source of water for the site (West Lake) or receive sewage treatment plant effluent and surface runoff from the site (East Lake, which potentially drains to Ulu Lake). Lake surveys were done on four of the lakes to determine fish species composition and relative abundance. East Lake is a very small, shallow water body without the potential of sustaining a permanent fish population so surveys were not done. East Lake drains by exfiltration to Ulu Lake,

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1 East Lake is not shown due to the scale of Figure 2. Reno Lake North and Reno Lake South are also collectively known as Reno Lake.

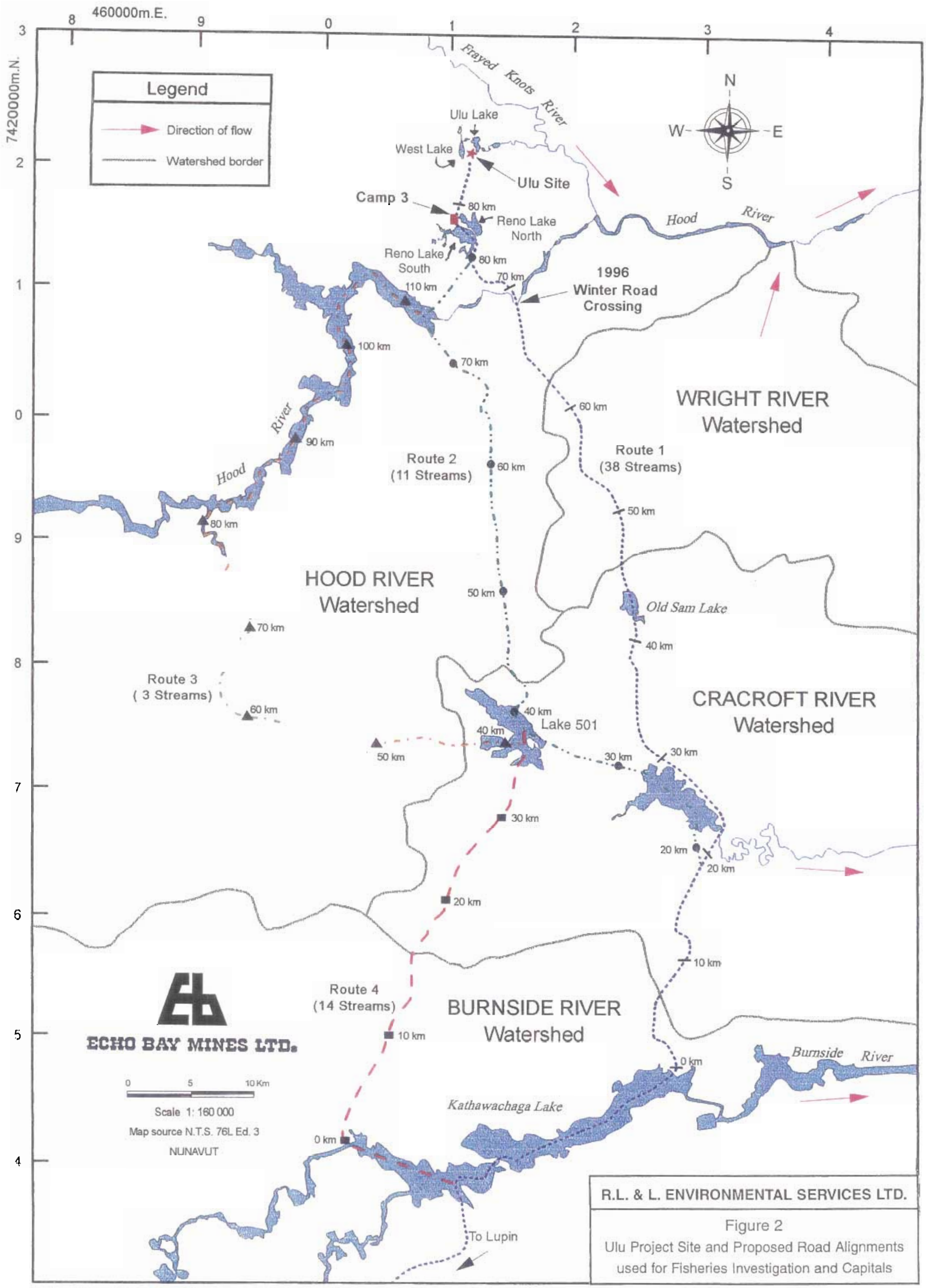

Figure 2
Ulu Project Site and Proposed Road Alignments used for Fisheries Investigation and Capitals

though a channel will allow surface flow to Ulu Lake during periods of unusually high water. East Lake is shallow enough to freeze to depth, preventing overwintering of any fish that may enter from Ulu Lake during high water periods. Analyses of water and sediments were also done on the lakes surveyed.

Analysis of the water samples obtained from the four lakes in July 1996 indicate that all are oligotrophic. Concentrations of essential nutrients (ie., nitrogen, phosphorus and carbon) were all at very low levels. Previous research has shown that carbon:nitrogen (C:N) ratio of approximately 12:1 is indicative of autochthonous organic matter produced by the decomposition of plankton. C:N ratios ranging from 6:1 to 8:1 in the four lakes studied in July 1996 suggest that these lakes receive very little allochthonous organic material and rely on autochthonous carbon fixation to supply new carbon to the lakes' food webs. This supposition is supported by the water clarity (ie., secchi readings of 4 to 7 metres) which indicates that there is very little suspended material in the water column.

Water and sediment samples were analysed for metals and hydrocarbons in order to provide an indication of what the pre-development concentrations were. These tests have shown that, with exception of strontium in West Lake, concentrations of metals in all the lakes sampled were low and that hydrocarbons were not detectable.

The levels of sodium, chloride and calcium as well as the extremely high conductivity in West Lake indicate that the lake has received some form of saline discharge. The levels of strontium (a metal often associated with drill bits) suggests that this discharge may be a result of some previous exploration activity that has occurred in the vicinity. Based on the results of the initial water chemistry results reported by Rescan (1991), there was an increase in the surface water conductivity, water hardness and dissolved solids from June, 1990 to August, 1991. Water conductivity increased from 10 to 208 micro Siemens per centimetre and water hardness increased from 8 to 52.4 milligrams per litre (as equivalents of $CaCO_3$). Dissolved solids increased from less than 10 to 166 milligrams per litre during the same period. This occurred was about four years prior to EBM purchasing the Ulu site lease. The concentrations of these elements are not at levels which could pose a risk to the resident fish population or to human health. If water hardness continues to increase, there may be some aesthetic concerns with the Ulu site water supply, for example, soaps not lathering, etc.

The only hydrocarbon to be detected in any of the water samples was xylene. Xylene was detected at Station 4 on Ulu Creek, which flows out of Ulu Lake, in the Frayed Knots River (immediately downstream of the confluence with Ulu Creek) and in the Hood River (downstream of the confluence with Frayed Knots River) (see Figure 3). Xylene is part of the volatile BTEX fraction of refined petroleum. Its presence in the

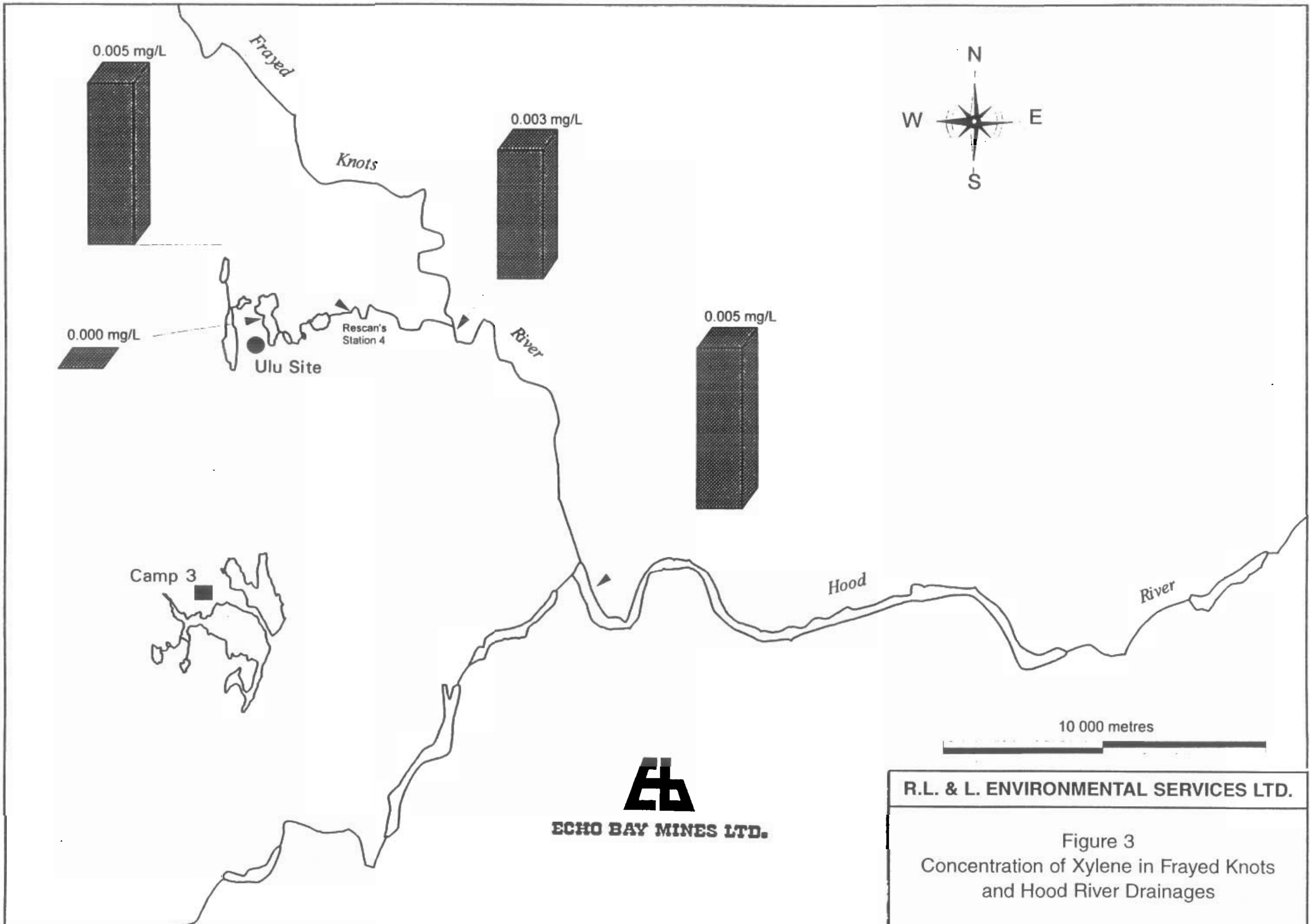

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Figure 3
Concentration of Xylene in Frayed Knots and Hood River Drainages

Ulu Creek drainage as well as downstream areas suggests that there is a small source of hydrocarbons present.

Fish were captured in all four of the lakes sampled. The catch per unit effort (CPUE), which is the number of fish captured per hour of net set time per 100 square metres of net, was very low in all of the lakes. The CPUE, ranging from 0.21 to 1.09, is comparable or higher than the levels reported in previous research for stations on the Hood River and James River.

Lake trout were captured in all of the lakes sampled. Only in Reno Lake North were species other than lake trout encountered, these included round whitefish and Arctic charr.

As with the streams in the study area, overwintering habitat is critical to the survival of the lake resident fish populations. In each lake there are small areas where water depth is sufficient to support fish when there is 2.4 metres of ice on the lakes. It should be stressed that these areas are a small percentage of the lakes' total area, thus making resident fish populations susceptible to over exploitation by recreational angling, particularly in the late spring.

All of the fish captured in the gill nets were very small, with only one fish exceeding 1,000 grams. The lake trout in these lakes are typical of high latitude populations (ie., they are very slow growing and slow to reach maturity). An examination of several otolith taken from fish captured by anglers showed that fish 400 millimetres in length, weighing 600 to 800 grams, were between 10 and 14 years of age. The length at age relationship is similar to other research reported for Dismal and Maze Lake which are located at similar latitudes. As lake trout populations at this latitude are not sexually mature until they are 13 years old, the fish targeted by anglers are just reaching maturity, thus the populations are very sensitive to angling pressure.

As all three of the lake resident species encountered are fall spawners, spawning areas were not identified, such areas most likely correspond with the fringes of the deep water overwintering areas.

2.4.2 Potential Winter Haul Road Stream Crossings

Four potential winter haul road routes were studied to determine what the possible impacts may be on the local fish population. The study area was between Kathawachaga Lake and Ulu. The route from Lupin to Kathawachaga Lake was not examined as this is a relatively short. The four routes examined are shown on Figure 2.

The four proposed winter haul road routes traverse a rugged landscape of bedrock, boulders and relic glacial features. These features have contributed to the formation of streams which generally cannot support resident fish populations. The majority of the streams that are crossed by the proposed routes are small (often less than 1 metre across), shallow (frequently less than 20 centimetres deep), with very little instream habitat that is suitable for supporting fish.

In the southern portion of the study area the majority of the streams are in the Cracroft River and Burnside River watersheds. While these major rivers are known to support both resident and anadromous fish populations, the small headwater streams are effectively cut off from downstream populations by lakes which freeze to the bottom and sections of shallow, bog streams which are intermittent. Therefore, species such as Arctic grayling and Arctic charr were absent from all but one stream (which was connected to Kathawachaga Lake).

In the northern part of the study area, streams are located in the Wright and Hood River watersheds. Again these streams were generally found to be isolated, intermittent streams with very poor quality habitat.

A total of 75 streams and portions of the Hood River were assessed during the June and August, 1996 stream surveys: 43 streams along Route 1, 12 streams along Route 2, 3 on Route 3 and 17 on Route 4 (Route 2 is EBM's preferred route for the winter haul road from Lake 501 to Ulu). Fish were captured or observed on only 14 (18 percent) streams. Species encountered included Arctic grayling, burbot, lake trout, round whitefish and slimy sculpin. Numerically slimy sculpin were the most abundant, followed by round whitefish, lake trout, burbot and Arctic grayling. Catch per unit effort was very low ranging from 0 to 1.73 fish per minute of electro fishing.

Fish were only encountered in streams where there was adequate overwintering habitat, in the form of deep (ie., greater than 3 metres) lakes, in close proximity to the stream. Use of the streams by fish was generally confined to the transition zone between the stream and a large lake, within 150 metres from the stream mouth. In only one case, the stream crossing identified in RL&L (1996) as Stream 37.0 on Route 1, was a fish found more than 150 metres from the mouth. In this case, the stream is situated between two large lakes and good quality fish habitat could be found over the entire length of the stream.

Overwintering habitat appears to limit the distribution of fish in the study area. As most streams and many of the lakes freeze to the bottom, deep water refugias are critical habitat features. During the winter ice can reach thicknesses of 2.4 to 2.7 metres, therefore lakes must have water depths in excess of 3 metres for fish to overwinter. Ice of this thickness not only prevents self-sustaining populations from becoming established, but also forms barriers to the upstream passage of fish, particularly Arctic grayling, prior to spring breakup.

Fish encountered in streams were either young-of-the-year or rearing juveniles, although several of the burbot captured were probably 3+ years old. Fish appeared to be using the shallow water and multitude of boulders in the lower portions of the streams as rearing areas. Given harsh winter conditions it is unlikely that spawning takes place in these streams, rather, the young-of-the-year and juveniles move into these streams as soon as they are flowing in the spring in order to avoid predation by larger fish (ie., lake trout and burbot) which cannot enter the shallow water of the streams.

2.5 VEGETATION AND HABITAT

The habitat in the area of the Ulu site is upland rocky tundra. The vascular plant community here was examined in July, 1996. Species and structural composition was measured by way of walking line intercept transects as shown on Figure 4. Points were read at one metre intervals along 1,000 metres of transect and recorded on 100 point data forms. Table 2 summarizes these data.

Table 2
Percent Frequency of Plant Species and other Ground Cover in the Vicinity of the Ulu Site, July 1996

Ground Cover	% Frequency	Range*
Lichen	<1	0 - 1
Horsetail (*Equisetum sp.*)	<1	0 - 1
Draba sp.	<1	0 - 2
Mountain Avens (*Dryas integrifolia*)	1.7	0 - 4
Cotton Grass (*Eriophorum sp.*)	1.2	0 - 4
Bearberry (*Arctostaphylos sp.*)	<1	0 - 3
Cranberry (*Vaccinium vitis-idaea*)	2.0	0 - 6
Sedge (*Carex nardina*)	2.5	0 - 14
Blueberry (*Vaccinium uliginosum*)	2.6	0 - 6
Crowberry (*Empetrum nigrum*)	3.3	0 - 5
Willow (*Salix sp.*)	4.7	1 - 11

Table 2 continued

Ground Cover	% Frequency	Range*
Labrador tea (*Ledum sp.*)	5.8	2 - 9
White heather (*Cassiope tetragona*)	6.2	0 - 14
Bare ground	6.5	0 - 17
Dwarf birch (*Betula glandulosa*)	10.6	4 - 24
Rock	51.5	13 - 68

* range in percent in a 100 point sample

The dominant feature of this habitat type is the preponderance of rock. The dominant plant species are dwarf birch, Labrador tea, and heather, all indicators of acidic soil.

The value of an area as wildlife habitats can be evaluated directly and indirectly. The direct method used was faecal pellet counts. Walking line intercept transects over 1,200 metres were also used for these parameters. Caribou pellet groups were encountered with a frequency of one pellet group per 100 metres while arctic hare pellet groups were encountered with a frequency of five per 100 metres. This further underscores the relatively low usage by caribou on an annual basis.

Another wild herbivore habitat evaluation technique is to examine the physical condition of willow on an area. Willow is a preferred browse species in most herbivore habitats throughout the boreal world. A willow shrub community incorporates more nutrients than other tundra plant communities. It is therefore not uncommon to observe very heavily browsed willow shrub on tundra range commonly frequented by large herbivores. The willow around the Ulu site show little effect of browse.

The southern portion of the winter haul road will pass through medium to well drained meadow habitat bordering the flanks of an esker system. Between Contwoyto and Kathawachaga Lakes this habitat type includes a semi continuous cover of dwarf birch.

The middle portion of the winter road, from 501 Lake to the Hood River is over cobble and granular outwash habitat and hosts no continuous plant cover.

The route between the Hood River and the Ulu site is similar to the habitat described by transects conducted at the Ulu site. Habitat disturbance required for upgrading the portage sections of the winter haul road between Lupin and the Ulu site is about 121 hectares.

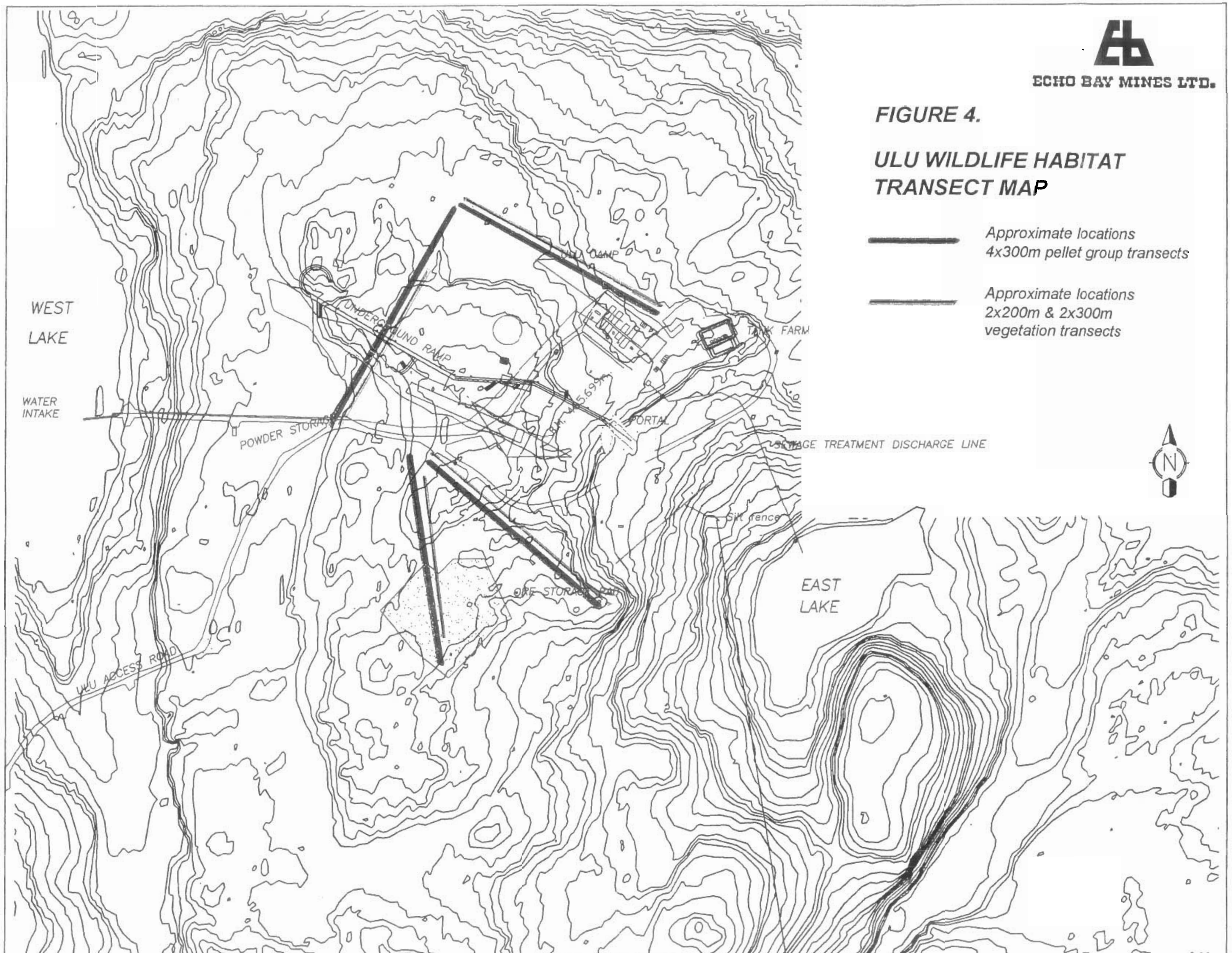

FIGURE 4.

ULU WILDLIFE HABITAT TRANSECT MAP

2.6 WILDLIFE

The wildlife study undertaken during 1996 concentrated on wildlife activities along the potential winter haul road routes between the Ulu site and Lupin as well as the vicinity of the Ulu site. Figure 5 shows the potential winter haul road routes studied (the preferred route is shown as a solid red line) as well as animal sightings, nest sites, den sites and high density burrow areas.

2.6.1 Birds

The short arctic summer with abundant daylight is an ideal breeding environment for migratory birds. The long daylight hours and abundant food resources, be they insect or vegetable, provide the birds summering in the region "longer working hours" for feeding their young at a season when food is most in demand.

Table 3 lists the birds sited and those that could be present in the vicinity of the Ulu Project. This list is a compilation based on a review of literature and personnel knowledge of professional biologists with experience in the region. Some of the information is based on siting records from the Bathurst Inlet Lodge, located approximately 100 kilometres east of the Ulu Project, on the coast of Bathurst Inlet. Table 3 also indicates whether the species listed are occasional visitors to the area; birds that have strayed from their normal routes.

Observations of birds near the Ulu site and the winter haul road alternative routes were made during the 1996 wildlife survey and during surveys undertaken prior to EBM's purchase of the Ulu lease. Bird sitings were also recorded by personnel working at the Ulu site.

Many of the sitings and observations made during the 1996 wildlife survey were related to predator birds. These birds are the most likely to be affected by the development of industry such as the Ulu site and the winter haul road. Other birds such as water fowl, ptarmigan, gulls, larks and swallows that may frequent the area are much more common and often do not breed in the area, fewer still overwinter in the area.

The predators of the bird world are collectively known as raptors. The areas surveyed supports several species: the golden eagle, the rough-legged hawk, the peregrine falcon and the gyrfalcon. Bald eagles were also observed during the surveys but the tundra is marginal to their breeding range and no nests were observed. As sites occupied by ravens are also used by raptors, these were also recorded.

Figure 5. *Wildlife and Habitat Survey in Relation to Ulu Project Winter Transportation Routes.*

Table 3
Potential Bird Inventory for the Ulu Project

Species	Breed in Vicinity of Ulu Project	Occasional Visitor to Region	Observations Near Ulu Project
Red-throated loon	yes		
Arctic loon	yes		siting at Ulu site, 1990
Yellow-billed loon	yes		
Common loon	no[1]	yes[1]	
Tundra Swan	yes		siting at Ulu site, 1996
White-fronted goose	occasional	yes	
Snow goose	yes		siting at Ulu site, 1990
Canada goose	yes		siting in 1996
Green-winged teal	no[1]	yes[1]	
Pintail	yes		
Canvasback	no	yes[1]	
Oldsquaw	yes		siting at Ulu site, 1990
White winged scoter	occasional[1]	yes[1]	
Black Scoter	no	yes	
Surf Scoter	no	yes	
Red-breasted Merganser	yes[1]		
Common merganser	occasional[1]	yes[1]	
Bald eagle	no[1]	yes[1]	no active nests found in 1996
Golden eagle	occasional		no active nests found in 1996
Gyrfalcon	yes		active nest found in 1996
Peregrine falcon	yes		active nests and siting in 1996
Rough-legged hawk	yes		active nest located in 1996
Willow ptarmigan	yes[1]		1996 at Ulu site
Rock ptarmigan	yes		siting at Ulu site, 1990

Table 3 continued

Species	Breed in Vicinity of Ulu Project	Occasional Visitor to Region	Observations Near Ulu Project
Sandhill crane	occasional	yes	
Lesser golden plover	occasional[1]	yes[1]	siting at Ulu site, 1990
Semipalmated plover	yes		siting at Ulu site, 1990
Lesser yellowlegs	no	yes, rare[1]	
Ruddy turnstone	no	yes, rare	sited at Ulu site, 1990
Sanderling	no	yes, rare	
Semipalmated sandpiper	no[1]	yes, occasional[1]	
Least sandpiper	yes[1]		
White-rumped sandpiper	no	yes, rare[1]	
Baird's sandpiper	yes		
Pectoral sandpiper	rare[1]	yes, rare[1]	
Stilt sandpiper	no	yes, rare[1]	
Common snipe	no	yes, rare[1]	
Red-necked phalarope	yes[1]		
Pomarine jaeger	no[1]	yes[1]	
Parasitic jaeger	no[1]	yes[1]	siting at Ulu site, 1990
Long-tailed jaeger	no[1]	yes[1]	
Herring gull	yes		observed in 1996
Glaucous gull	yes		siting at Ulu site, 1990
Sabine's gull	no	yes[1]	
Arctic tern	yes[1]		
Snowy owl	no	yes[1]	
Short-eared owl	rare[1]	yes, rare[1]	
Common nighthawk	no[1]	yes, rare[1]	
Horned lark	yes		observed in 1996
Cliff Swallow	no[1]	yes, rare[1]	
Bank Swallow	no[1]	yes, rare[1]	

Table 3 continued

Species	Breed in Vicinity of Ulu Project	Occasional Visitor to Region	Observations Near Ulu Project
Raven	yes		observed in 1996
Northern wheatear	rare[1]	yes, rare[1]	
Gray-cheeked thrush	yes		
American robin	yes		siting at Ulu site, 1990
Water pipit	yes		
Northern shrike	rare[1]	yes, rare[1]	
Yellow warbler	yes		
Yellow-rumped warbler	yes[1]	yes[1]	
Blackpoll warbler	yes		
American tree sparrow	yes		
Chipping sparrow	yes		siting at Ulu site, 1990
Savannah sparrow	yes		
White-crowned sparrow	yes		
Harris's sparrow	yes		
Lapland longspur	yes		siting at Ulu site, 1990
Smith's longspur	no	yes[1]	
Snow bunting	yes		siting at Ulu site, 1990
Common redpoll	yes		siting at Ulu site, 1990
Hoary redpoll	*yes*		*siting at Ulu site, 1990*

[1] based on unpublished data from the Bathurst Inlet Lodge species list.

As a group, raptors are seasonally migratory but with significant individual variation. All species set up breeding territories while the land is snowcovered and so are active on the tundra while winter roads are in operation. It is for this reason that it is important that raptor nest sites are documented and alignments adjusted accordingly where this is possible. This is important despite the tolerance that breeding pairs of some of these species have shown for human activities at other locations in their global distribution.

Bald eagle

On July 12 a single bald eagle was seen in the vicinity of 7330957 N and 477395 E (Figure 5). On July 29 two bald eagles were seen in the same general area. A search for a nest was made without locating one. The tundra is marginal to the ordinary range of the bald eagle. Nests are made of sticks and twigs and are used in successive years which makes for a huge structure after repeated usage. The nests are usually built near the top of a tall tree or occasionally on a cliff; neither were evident in the area where these bald eagles were observed.

Golden eagle

The golden eagle ranges over much of the northern hemisphere including most of North America. It may use the same territory and nest site in successive years. Nests are built of sticks and usually are located on a cliff ledge. Birds may stay on their territories most of the year in southern latitudes. In the north they arrive in April with egg laying occurring in late May. Incubation takes 43 days with the nestling period lasting another 77 days before young birds are fledged in September.

Single golden eagles were observed during surveys on July 29 in the vicinity of 7328154 N and 479497 E and on July 31 at 7401773 N and 487487E (Figure 5). Searches throughout the area failed to locate active golden eagle nest sites. The presence of non active stick nests in the area may be suitable for golden eagles which nest regularly near the central Arctic coast.

Rough-legged hawk

Rough-legged hawks have a circumpolar breeding range and overwinter in the open country of north temperate latitudes. Rough-legged hawks prey mainly on microtine rodents so their abundance and breeding success in the region may coincide with the lemming and vole population cycles. They build stick nests on cliffs and may maintain several nest sites within their breeding territory which can be used in successive years. Several inactive stick nests that may have been former rough-legged hawk nests were observed on the 1996 wildlife survey (see Figure 5).

These hawks arrive on their northern breeding territories in early to mid-May and initiate egg laying in early June. The incubation period lasts about 31 days and the young birds take to the wing about 41 days after hatching.

Peregrine

The peregrine enjoys a cosmopolitan distribution. In Canada peregrine populations are separated as to sub species. The birds in the region of the Ulu Project are of the *tundrius* sub species' population. The *tundrius* peregrine is not an endangered species in Canada. Peregrines will occupy the inactive nests of other raptors species or establish a nest on a ledge or pinnacle without any construction or other visible preparation of any sort. The arrival of peregrines on the breeding territory is variable but the mean date in a central Arctic study was mid May and egg laying usually occurred in early June. Incubation takes 32 to 34 days and the nestling period lasts 35 to 40 days.

Six active peregrine nests were located during the 1996 survey at the locations shown on Figure 5.

Gyrfalcon

The gyrfalcon is another circumpolar species, but unlike the peregrine, it is not migratory in that it spends the winter in northern latitudes. The nest, like the peregrine, may be a stick nest built previously by other raptors or ravens, or a scrape on a ledge. Egg laying initiation is variable and may begin between late April through to the third week of May. In a study of 38 sites in the central Arctic between 1983 and 1986, the mean period for egg laying was early May. Incubation takes 34 to 35 days and the young birds fly 46 to 49 days after hatching.

One active gyrfalcon nest was observed during surveys in the study area (see Figure 5).

Raven

Ravens are not technically considered to be raptors but their nest habitat is similar to that of the raptors in the regions so sites found to be occupied by ravens are generally considered to be part of the overall nest site inventory available to the raptor populations of a given region. Like the hawks and eagles, raven nests are stick structures and over successive years can grow to considerable size.

Ravens are not migratory and so are present in the vicinity of their breeding territory throughout the winter. Egg laying dates vary but the mean date documented Poole and Bromley (1988) on monitoring 12 nests in the central Arctic was mid May. Incubation lasts 20 to 21 days and the young birds are usually flying by mid July.

One active raven nest was observed during the surveys and two groups, presumably family units of recently fledged birds, were observed that were not associated with any obvious nest location.

2.6.2 Mammals

Sixteen species of terrestrial mammals occupy the region of the Ulu Project. Unlike the birds of the region, mammals are not migratory except for caribou, and even some caribou remain on the tundra overwinter. The mammalian fauna here is a full compliment of the natural ecosystem in that no species has been extirpated from the region. All populations are healthy, and although the muskox population here was hunted to near extirpation 100 years ago, it has make a strong recovery and continues to expand the overall territory occupied.

The species inventory that follows was developed by reviewing the range maps for northern mammals in reference compendia and in consultation with biologists familiar with the region. Not all species were actually observed during the 1996 wildlife study for the Ulu Project.

The description of the species' ecology is not intended to be either exhaustive or definitive, but is intended rather to discuss those aspects that are relevant to the development of the Ulu site and the proposed winter haul road.

Masked Shrew

The masked shrew ranges widely across North America with six geographical subspecies recognized in Canada. *S. cinereus ugyunak* is found from the Arctic coast south and east to the NWT/Manitoba border. They are tiny (4 gram) solitary hunters, tolerant of their own kind only during the mating season. They require a habitat that offers ample cover and high humidity, not only for protection but also for foraging among leaves and debris of the ground cover. Their principle foods are insects and other invertebrates but they will also scavenge on the remains of prey of larger predators. Shrews eat their own weight in food daily and pregnant females can eat up to three times their own weight. Life span is short, approximately 23 months. Shrews are beneficial due to the large quantities of insects they consume.

Shrews are not subject to management legislation and are not designated as endangered in any national or international convention.

Arctic Hare

This is the largest of the hare species in North America. It is present in the immediate area of the Ulu site where its faeces are more abundant than those of the caribou as measured on transects over the upland tundra plant community.

Arctic hare are found only in the tundra zone beyond the tree line, frequenting windswept hill sides in winter, and in summer utilizing the meadows of lower areas of glacial till. They are moderately gregarious, usually found alone or in small family group in the southern part of their range, but from northern Baffin Island northward are often found in large bands up to 120. Breeding season is between April and September. Usually one and occasionally two litters of two to eight are produced. Maturity does not occur during the first year. Diet consists of a wide variety of tundra vegetation and will feed on seaweed and meat when available. Arctic hare are an important food source for arctic fox, wolf, and raptors.

Arctic hare are a popular resource for Inuit who use both meat and pelts. The Wildlife Act (NWT) designates Arctic hare as small game. It is not an endangered species.

Arctic Ground Squirrel

This is the only true hibernating mammal in the region of the Ulu Project. It is common through out the region, establishing borrows and colonies on eskers and other well drained habitat. They are a colonial species, active from late April or early May until mid September or early October when they begin a seven month hibernation. The area utilized by a colony is extensively tunnelled and contains many burrows. One litter of between five and ten is born in mid June, and the young are mature by the following spring. Diet consists of leaves, seeds, stems, fruit, flowers and roots of a wide variety of tundra vegetation and will scavenge meat from carcasses when available. Arctic ground squirrels are an important food source for arctic carnivores including weasel, wolf, grizzly bear and raptors.

Traditionally the pelts of Arctic ground squirrels have been used by Inuit to line winter parkas. They are designated small game by the Wildlife Act (NWT). Arctic ground squirrels are not an endangered species.

Voles

Two species of voles are known to inhabit the region that included the Ulu Project: the redback vole and the tundra vole.

The redback vole and the tundra vole are both found throughout the NWT mainland in both forest and tundra. Northern shrub vegetation or open taiga forest is preferred habitat for the redback vole. On tundra, shrubby areas are preferred but if this is not available, rock fields and talus will be used. The tundra vole is an excellent swimmer and prefers damp tundra habitat around lakes, stream banks or sedge and cotton grass marshes. The vole diet consists of leaves, buds, twigs and fruit of shrubs and forbs.

Voles provide an important food source for northern furbearers, birds and even lake trout (tundra vole). They are not subject to management legislations and are not an endangered species.

Lemming

Two species of lemming are known to inhabit the vicinity of the Ulu Project; the brown lemming and the Greenland collared lemming. This small rodent is best known for its cyclic population dynamics.

Usually found in colonies, brown lemmings prefer wet tundra swales covered with grasses and sedges but may also be found on stream banks, lake shores and grassy slopes. In winter they will be found in wet meadows and in the shelter of snowbanks. The greenland collared lemming is somewhat less colonial than the brown lemming, living rather in family groups until the young are sexually mature. Both species of lemming have many of the same habits and are found in common runways during the winter. One to three litters are born to a female each summer. Diet consists of grasses and sedges and to a lesser extent forbs and bark of willow and dwarf birch. Winter nests are balls of dried grass constructed on the ground surface.

Lemmings have great importance as a food source for northern fur bearers. They are not subject to management legislation and are not an endangered species.

Wolf

The welfare of this large carnivore in the NWT is intimately tied to the distribution and abundance of caribou.

The basic social unit of wolf society is the family pack which consists of a dominant male, his mate, their offspring, and other close family members, usually totalling between four and seven in number. They are the dominant predator of large ungulate species and also utilize small game such as hare, grounds squirrels and voles; and will occasionally take ground nesting birds, fish, berries, insects and grass. Litters range in size from 5 to 14 with the average number being seven. Seasonal migration may occur as wolf packs follow migrating caribou herds.

No wolf dens were noted during reconnaissance flights over the potential winter road routes.

Wolves have traditionally been an important fur bearing species in the NWT. They are classed as furbearers and big game animals under the Wildlife Act (NWT). Wolves are not listed as an endangered species in the NWT.

Fox

The Arctic fox and the red fox are not uncommon in the vicinity of the Ulu Project. Typically, the Arctic fox range is the tundra above the tree line and the red fox below the tree line, though it is not unusual to observe the Arctic fox well within the tree line during winters after highs in its population cycle. Red fox has been observed in the area of Reno Lake.

Both species of fox share hunting, breeding and denning characteristics. They are primarily nocturnal hunters with an acute sense of smell. Small mammals form the bulk of their diet but birds, invertebrates and plant material are also utilized. Food is often cached. Litter sizes average 5 to 6 kits born between March and mid June. Summer dens are dug in light sandy soils in river banks, eskers or small hillocks with south facing entrances and tunnels sloping downward to the permafrost. Winter shelters are tunnels in snowbanks.

Fox pelts have been a valuable natural resource for trappers in the Canadian Arctic. Outbreaks of rabies in northern Canada are normally associated with the Arctic fox.

Both the Arctic fox and the red fox are listed as furbearers under the Wildlife Act (NWT). Neither are considered endangered species.

Grizzly Bear

Grizzly bears are the largest carnivore on the tundra and are resident throughout the vicinity of the Ulu Project.

Adult grizzlies are mostly solitary except during the mating season. They shun human contact but may react fiercely when surprised, cornered, wounded or separated from their cubs. Eyesight is poor but senses of smell and hearing are excellent. Grizzlies prefer open areas and are most active during the evening, night and early morning hours, usually napping during the day. Diet is omnivorous including roots, berries, fish, small mammals, and sometimes large mammals. They also scavenge, cleaning up carcasses of winter-killed big game. Mid November to April is spent in a den or natural shelter. Sows breed every second year and cubs remain with their mother for the first two winters. Sexual maturity is reached at an age of six to seven years.

Bear dens were observed in eskers near one of the potential winter road routes. A search for old den sites along the esker complex (potential haul road route) between Kathawachaga Lake and Lake 501 in July, 1996 did not show any dens. Also, a search for fall denning activity in the same area on October 3, 1996 showed no denning activity or tracks in snow cover less than 7 days old.

Grizzly bears are included in the Wildlife Act (NWT). It is not listed as an endangered species in Canada, although they are classified as "vulnerable" by the Committee on the Status of Endangered Wildlife in Canada.

Weasel

Two species of weasels are potential inhabitants in the region of the Ulu Project: the short-tailed weasel and the least weasel. They are found throughout Canada with the possible exception of a few offshore islands. These are agile, quick moving and fierce carnivores. They are mostly nocturnal and prefer to stay under cover. The least weasel is the smallest carnivore, barely exceeding the size of the small rodents on which it preys.

Burrows of other small mammals such as voles or ground squirrels are commonly taken over and adapted to the weasels' needs. Females are sexually mature within three months and are able to bear young the following spring. Adult male short-tailed weasels are twice the size of females and become sexually mature during their first winter. One litter is born annually in mid April or early May. Least weasel females may have two or more litters in a season. Mice and voles form the largest part of the weasel diet and drastic population fluctuations occur in response to availability of this food source. They also prey upon shrews and ground squirrels.

The short-tailed weasel's white winter pelt is of economic value. Both species of weasel are classed as a furbearers in the Wildlife Act (NWT). They are not endangered species.

Wolverine

In Canada wolverine are found primarily on the tundra of Yukon and the Northwest Territories where their distribution extends to northern Ellesmere Island.

The wolverine is a solitary species. Sexes associate briefly during mating season and family groups of females and their cubs during the first season are the only social groupings. Wolverine are omnivorous, primarily scavengers cleaning up carcasses left by wolves and bears, and also feeding on a wide variety of roots and berries, small game and fish. One litter of between two and five are born in late April or early May.

Wolverine are classed as furbearers and big game animals under the Wildlife Act (NWT). They are not listed as an endangered species in western Canada or the NWT.

Caribou

Perhaps the most conspicuous and widely distributed of the large game animals on the tundra, barren-ground caribou occupy the region of the Ulu Project in varying numbers in all seasons but were not observed during the aerial reconnaissance of potential winter haul road routes in July, August, September and October, 1996. Caribou were sited regularly at the Ulu site in June, 1996.

The caribou that frequent the vicinity of the Ulu Project are members of the Bathurst Caribou Herd, estimated at 350,000 head in 1990; the largest herd in the Northwest Territories. Typically, the herd passes through the area on its spring and fall migration. The herd occupies a range of 250,000 square kilometres which include wintering grounds in the tree line from the Coppermine River to Great Slave Lake, calving grounds in the area surrounding Bathurst Inlet, and the summer range for the herd which extends from the Coppermine River east to the Perry River and includes the lands north of the Back River.

Caribou are covered by the Wildlife Act (NWT). They were designated to be "in danger of becoming extinct" by Order-in-Council under the NWT Act (Canada). No restrictions have been placed on the harvest of caribou from the Bathurst Herd by Inuit for food. Barren-ground caribou are not listed as endangered in any domestic or international wildlife conservation convention.

Muskox

This large tundra ungulate is resident in the region but is still recovering from serious over hunting more than one hundred years ago.

The historic range of muskox include the entire mainland tundra of Canada and most of the arctic islands as well. Over hunting in the 1800's reduced their numbers to the point where all hunting was banned in 1917. Recolonization of former mainland ranges has progressed slowly but steadily to the point where muskox are again hunted under quota. Only two single bulls were observed during reconnaissance flights over the potential winter haul road routes however both single animals and small herds were sited by personnel at the Ulu site.

Muskox are not migratory like the caribou but relatively sedentary, moving more in response to feeding conditions than to innate seasonal triggers. Their diet includes all classes of tundra vegetation from woody willow to the delicate lichen.

Muskox are protected under the Wildlife Act (NWT). They are named in and Order-in-Council pursuant to the NWT Act (Canada) to be a species "in danger of becoming extinct". This designation was deemed necessary for the government to regulate harvest by native hunters taking muskox for food. Muskox are not listed as endangered in any other national or international wildlife conservation convention.

Valued Ecosystem Components

The Valued Ecosystem Components (VEC's) identified in this assessment will be further discussed in Section 4.8: Project/Environment Interactions, Mitigative Measures and Residual Impacts.

The VEC's considered for the Ulu Project are the same as those enumerated by the Regional Environmental Review Committee in 1993 under the title Environmental Evaluation Guidelines for Minnova Inc./Metall Mining Izok Project. They are as follows: terrestrial vegetation (as the key component of wildlife habitat), grizzly bear, caribou, wolverines, wolves, muskoxen, raptors and waterbirds.

2.7 HISTORICAL RESOURCES

Historical resources studies were undertaken to establish the impact of the development of the Ulu site and associated winter haul road on archaeological sites. The investigation was done in two parts: Phase I and Phase II. Phase I consisted of an a archaeological investigation of the Ulu site, local eskers and potential haul road routes north of the Hood River. Phase II consisted of an investigation of several potential route options between Lupin and the Hood River.

The primary goal of the archaeology studies was the identification and demarcation of heritage resources. When archaeological sites were encountered, they were surveyed and extensively flagged for avoidance. As most components of the Ulu Project have a degree of flexibility for their placement, avoidance is deemed to be the optimum form of mitigation for archaeological sites. Echo Bay Mines Ltd. concurred with this strategy, noting that no component within the Ulu site complex has an absolutely predetermined location. The shaft location is the most constrained, but even that could be relocated slightly to avoid heritage resources if any were to be encountered at the preferred location. Mitigative excavation will be considered in cases where avoidance is not feasible and only after consultations between Echo Bay Mines Ltd., the consulting archaeologist, and the Arctic Archaeologist, Prince of Wales Northern Heritage Centre. Curation of artifacts from archaeological sites would be minimal, and restricted to diagnostic specimens and/or organic artifacts which would require immediate conservation to mitigate deterioration.

2.7.1 Phase 1 Investigation

Within the approximately 40 hectare area of the Ulu site is the mine shaft, the camp and an ore storage facility as well as internal roads. The site will be linked to the airstrip and Camp 3 by a road approximately four kilometres long. Camp 3 was a temporary camp established to accommodate airstrip construction and site development. Sands and gravels for construction will be obtained from a borrow location on the east side of the esker lying northwest of Camp 3 which is situated at the northwest end of Reno Lake (Figure 6). In addition, some investigation of potential haul road routes north of the Hood River were undertaken including an investigation of the entire north side of the Hood River between the upper and lower rapids (Figure 7).

The investigation began with low-level helicopter flights across the Ulu development area. This was followed by foot survey throughout the impact zones. In areas where the siting of facilities was constrained by topography and/or resource locations, ie., the Ulu site and road link to Camp 3, the foot survey consisted of parallel traverses. Land topography regulated the distance between traverses, as well as the linearity of the traverse. In most instances, the parallel traverses were fifteen to twenty metres apart. Often, traverses took place in triangular sectors of the area due to the configurations of the bedrock ridges. Shovel testing had been anticipated in locations of soil aggradation. No such locations were encountered.

Where impact zones had not been delineated, ie. potential haul road routes from the Hood River to the Ulu site, foot survey was conducted according to topography. Within each investigation sector heights-of-land were investigated and used as vantage points to scan thesurrounding area for cultural features. Locations which provided good views of possible game trails and those with campsite potential were investigated, again by traverses.

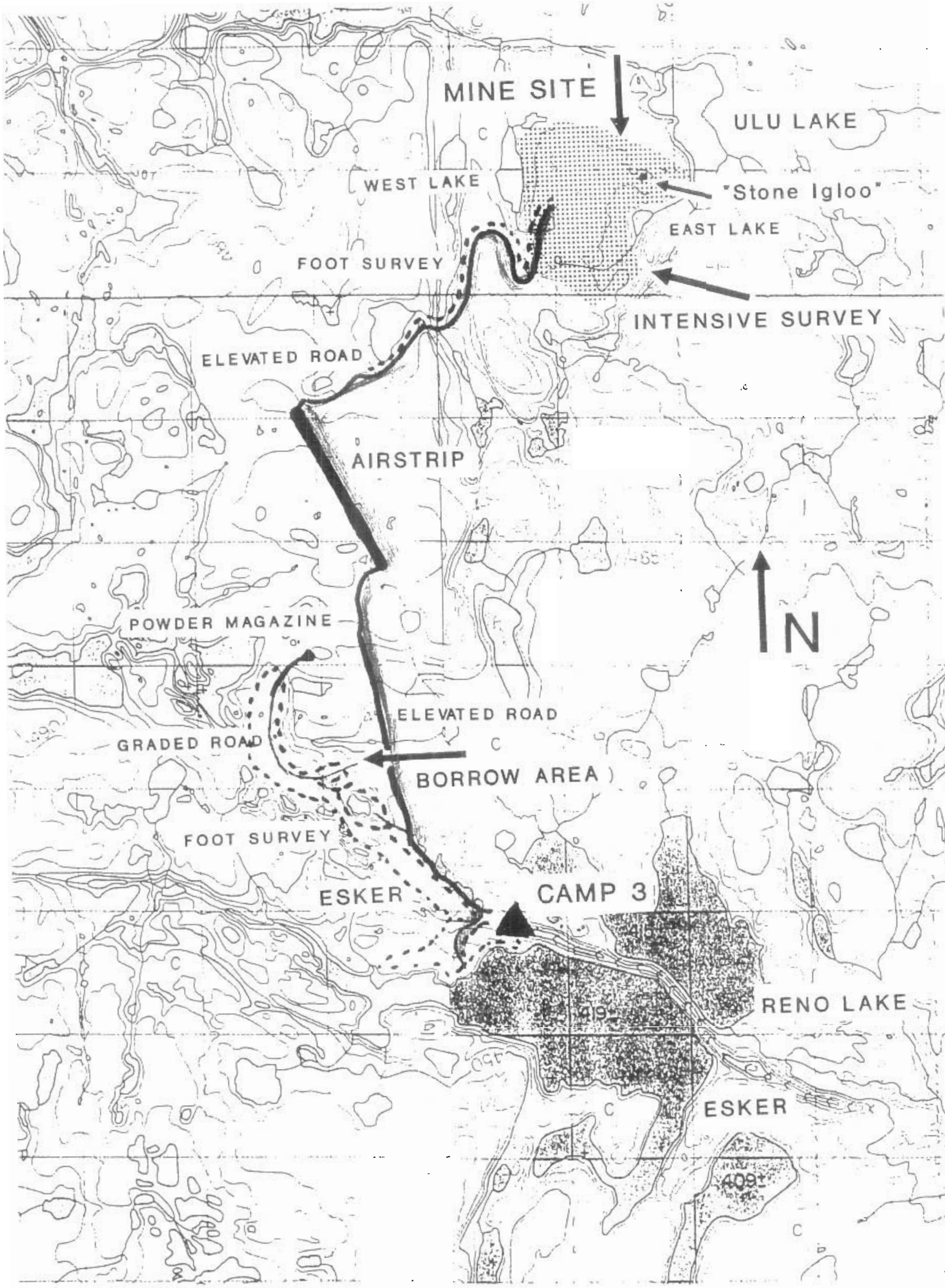

Figure 6: Ulu Site Area (Scale 1:50,000)

ECHO BAY MINES LTD.

Road

•••• Foot Survey

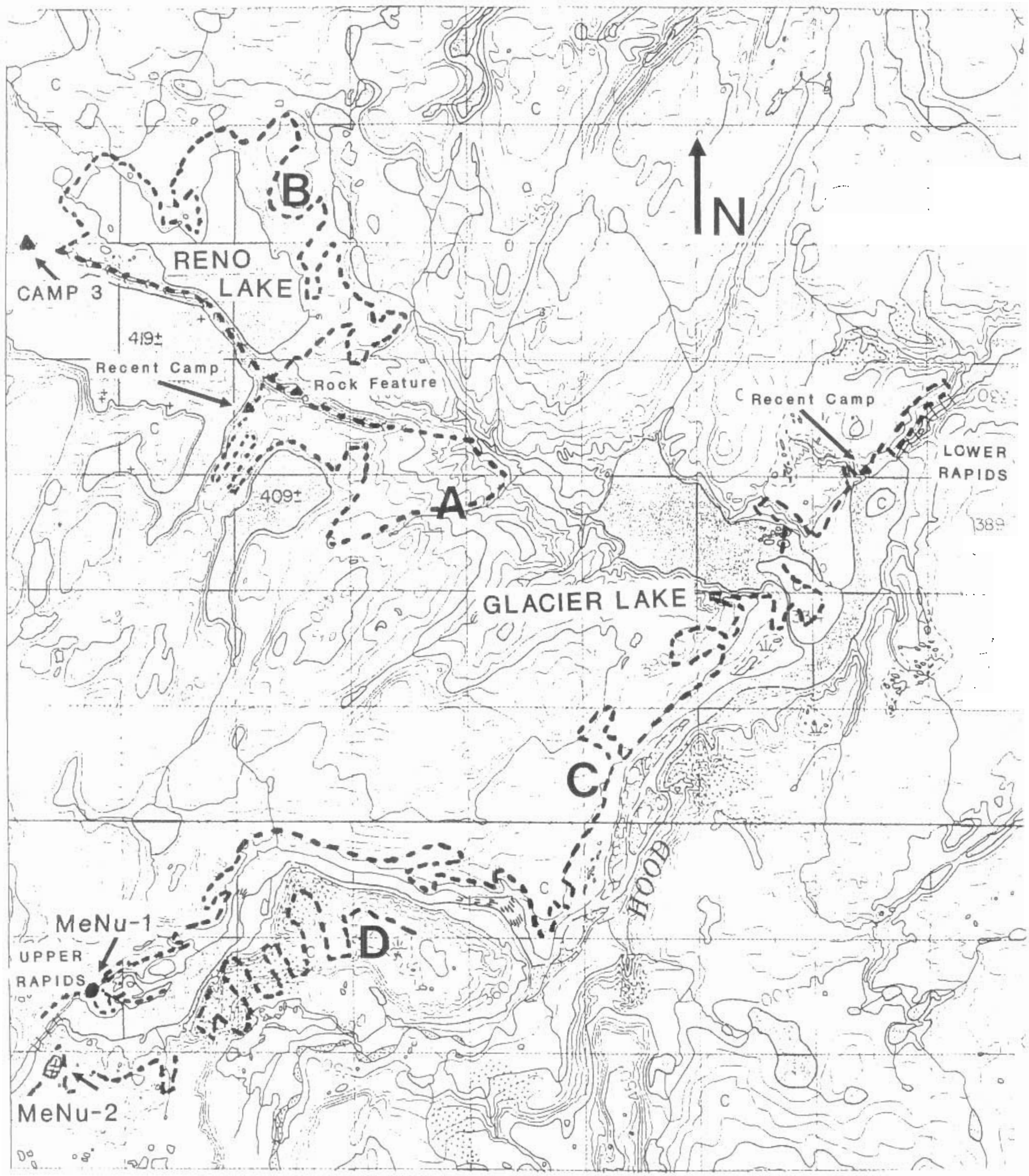

Figure 7: Potential Haul Road Route Investigations (Scale 1:50,000)

ECHO BAY MINES LTD.

•••• Foot Survey

When the foot survey encountered isolated knolls, the investigation pattern consisted of walking spiral traverses around the knoll to the summit. In the case of linear heights-of-land, the traverses consisted of a switchback zigzag pattern up and down each side of the ridge.

Observations

A. Ulu Site Location

The Ulu site location is on a glacially modified bedrock outcrop bounded by a linear lake (West Lake) on the west, a small semi-circular lake (East Lake) on the southeast, Ulu Lake on the north east, and a drainage system to the north. The terrain is rugged, consisting of exposed bedrock, usually modified by frost action into blocky, angular boulders, relocated boulders, and occasional glacial erratics. A small area overlooking West Lake is a swale of soggy sedge tundra, as are large portions of the shores of the lakes. Throughout the area, excluding the exposed bedrock, colonizing vegetation is present.

No archaeological resources were located at the Ulu site. Considerable evidence of geological investigation is present - survey stakes, drilling locations, and flagging tape. The most esoteric discovery is a recently-built stone structure measuring 3.1 metres by 2.1 metres and standing 1.1 metres high. This structure is built of more-or-less tabular rocks and has a narrow opening to the northeast. Associated debris consists of black electrical tape and yellow plastic-coated electrical instrument wire. The structure was built by a field team of geo-physicists and is colloquially known as 'The Stone Igloo' or 'The Physicists Fort'.

The route of the road, under construction at the time of the study, between Ulu and the airstrip was traversed. The route extends south around the base of West Lake, northwest up the ridge, southwest down the ridge to a stream crossing and west up the next ridge to the airstrip (Figure 6). The terrain is rugged with boulder ridges crossing the route at angles. No evidence of cultural activity prior to mineral exploration is present.

The road between the airstrip and Camp 3 had been built using aggregate extracted from the east side of the esker northwest of Camp 3. In addition, a narrow road had been bulldozed to the northern end of the esker for the powder magazine. The edges of the borrow location were examined as were the peripheries of all access roads on the esker. The unmodified western portion of the esker was investigated. No evidence of archaeological resources is present.

B. Potential Haul Road Routes: Hood River to Ulu

Several potential routes are under consideration for the winter haul road. While on site for the archaeological impact assessment of Ulu, foot survey was undertaken in several areas (Figure 7).

Survey A

Survey A examined the esker lying southeast of Camp 3, as well as a sector lying to the west of the esker. The esker has a sharp spine and rises approximately 25 metres above the level of the lakes on either side. A slightly higher knoll occurs at the southeast end of the lakes and has a rock feature at the summit. The rock feature probably originated as a concentration of large cobbles adjacent to a large boulder exposed at the ridge of the esker by erosion. Ground squirrels have placed burrows under the rock and their presence has resulted in lush growth of grass in the immediate vicinity. At some point in the recent past, additional cobbles have been haphazardly piled on the original concentration, producing a roughly circular, low mound. Many of the upper cobbles have lichen on the underside, with the upper surfaces totally bare. The mound is not high enough to be observed unless one is within ten metres, or flying directly overhead at a low altitude. As with the stone structure at the Ulu site, this feature has probably been constructed by field exploration crews.

The survey continued eastward to a stream valley which feeds into Glacier Lake. This lake apparently is spring-fed throughout the year, resulting in continual accretion of ice - such that it does not totally melt in any given summer. Turning westward, the investigation extended to the height-of-land south of the small lake south of Reno Lake. The survey continued northward, roughly parallelling the esker and investigating the adjacent lake shores. Slight vegetational impact showed the route of a past winter road between the esker and the small lake and a concentration of recent debris was observed on the lake shore immediately south-southwest of the esker. This debris consisted of tin cans, bottles, broken equipment parts, and milled wood fragments.

Survey B

Survey B investigated the area east of Reno Lake, as this was another possible route for the winter haul road. The northeast end of the lake grades into a low, marshy sedge bog, with the approach to the central height-of-land cut by frost-altered bedrock outcrops. The central plateau is relatively flat between knolls and has a well established grass/sedge vegetational community. The investigations continued to the confluence of streams at the start of the main valley leading into Glacier Lake. These valleys are deeply eroded through unconsolidated silts, sands, and gravels. The southern end of this survey route turned west to arrive at the esker at the southeast end of Reno Lake. No evidence of cultural activity was observed.

Survey C

As the location of the crossing of the Hood River had not been determined at the time of this survey, it was decided to investigate the entire north side between the upper and lower rapids (Figure 7). The entire distance was overflown by helicopter prior to the initiation of foot survey at the upper rapids. During the overflights, no landforms stood out as very high potential locations for cultural activities. No cultural features such as tent rings were observed. The north edge of the valley is considerably displaced from the river channel, up to a kilometre in places. A fairly well defined middle terrace, at an elevation of 350 metres above sea level, was chosen as the survey focus, with excursions to the river channel to investigate noteworthy landforms.

The survey of the north side of the Hood River was concentrated on the middle terrace, with occasional forays to the upper plateau or the river bank where features such as fast water or headlands contained some degree of potential for cultural evidence. Most of the area was vegetated with sedge, grass, dwarf birch, decumbent willow, and numerous species of herbs. Promontories and headlands tended to be remnants of till deposition and were more sparsely vegetated, allowing visual inspection of the soil.

A small archaeological site was located on the middle terrace northeast of the upper rapids on the Hood River. This site, MeNu-1, occurs among large glacially-transported bedrock boulders at the edge of the terrace, overlooking the river. The site consists of two small clusters of quartz flakes, the residue from tool manufacture. The first locus covers an area of 15 square metres, the second consisted of a more concentrated scatter of quartz flakes 74 metres north. The flakes surrounded a flat gabbro cobble embedded in the sandy gravel which may have served as an anvil. Both loci would have resulted from a hunter stationed on the edge of the terrace chipping a stone tool while he watched for game. The flakes would derive from quartz pebbles which can be found in the till deposits.

No further evidence of any cultural activity was encountered during the foot survey until reaching the last stream channel entering the Hood River just upstream from the lower rapids. A recent campsite location (or at least the garbage pile resulting from the campsite) was observed on the eastern slope near the channel mouth. The debris consisted of rusted (and possibly burned) tin cans and bottles. Some of the cans still have legible labels - Sunkist and Squirrel Peanut Butter. Others, such as sardine and condensed milk tins, are identifiable by shape.

The foot survey terminated at the lower rapids with investigation of the bank adjacent to the river as well as the upper plateau. The bank is a saturated sedge tundra due to melt run off from the zaboi on the valley wall. The slope to the upper plateau is steep and not easily traversable.

Survey D

The final component of the Phase I field investigation was a foot survey of the south side of the Hood River, beginning at the upper rapids and extending nearly to the river over a height of land (Figure 7). Generally, the area is characterized by a flat upper plateau composed of unconsolidated sands and gravels, steep slopes to the river valley, and extensive erosional stream valleys.

An extensive archaeological site was located on the upper plateau overlooking the upper rapids. The site is designated MeNu-2 (Figure 7). The elevation is 390 metres above sea level, approximately 30 metres above the rapids. The large site covers an area of at least 73 metres by 75 metres. Portions of the site are vegetatively covered with dwarf birch, dryas and grass, precluding visual inspection of the surface. Due to the large number of cultural identifiers observed in non-vegetated areas, no shovel-testing was undertaken.

The site contains three distinct tent rings and numerous concentrations of quartz flakes. Most of the features are on the north edge of the plateau, overlooking the rapids, or the east side of the plateau, overlooking the Hood River Valley. The interior portion of the site was the most heavily vegetated and, therefore, additional flake concentrations probably are present but were not readily observable during the brief survey of the site.

No artifacts were readily observable in the vicinity of the tent rings due to the almost total ground cover. Quartz flake concentrations, as well as isolated flakes, were observed in the numerous blowouts and bare areas, especially at the periphery of the plateau. As the focus of the survey was the identification and demarcation of archaeological sites, only a single artifact was curated from this site. It is a mid-blade section of a projectile point made of white quartzite. The artifact has been bifacially flaked, with expanding, medial, lamellar flake scars on the body. The specimen, lacking the hafting component, is not identifiable to a specific cultural tradition, however, it resembles a projectile point with dates of 100 BC to 500 AD. The degree of lichen encrustation on the tent rings, assuming the projectile point and the rings are contemporaneous, suggest considerable time depth. The site is very tentatively identified as Middle to Late Thaltheilei, circa AD 100 to 1000.

2.7.2 Phase II Investigation

Phase II of the project entailed examination of several route options for the establishment of the winter haul road. These routes begin at Lupin and terminate at the Ulu site.

Investigations consisted of both low-level helicopter flights along the projected route options (Figure 8) and foot survey throughout selected high-potential areas adjacent to, or within, the route right-of-way. Foot survey consisted of parallel traverses by the investigators. Topography regulated the distance between traverses, as well as the linearity of the traverses. In most instances, the parallel traverses were twenty to twenty-five metres apart. Variation occurred on the top of eskers where the archaeologists would each traverse one of the lateral edges, with interior investigations when the width of the esker warranted. Shoreline and river investigations consisted of separated traverses parallelling the water edge.

While the exact impact zones within each route option have not been firmly delineated, all of the corridors were overflown at a low altitude to ensure observation of small-scale structural features, ie tent ring or caches. Major geological features such as rivers, lakes, and eskers adjacent to or lying on the route options were also overflown and usually investigated by foot survey.

The primary goal was the identification and demarcation of heritage resources. As most components have a degree of flexibility for their placement, avoidance is deemed to be the optimum form of mitigation. EBM concurs with this strategy, noting that no portion of the winter road options has an absolutely predetermined location. Mitigative excavation is not deemed to be necessary as avoidance is feasible for all archaeological sites that lie adjacent to any of the winter road options. Curation of artifacts from archaeological sites was minimal. It was restricted to diagnostic specimens lying on the surface, which could be susceptible to inadvertent curation by unauthorized personnel.

Observations

All corridors begin at Lupin and head north with the ultimate terminus at the Ulu site. The 1995 winter haul road followed lake ice to the north end of Contwoyto Lake, along the east side of the Burnside River, east on the ice of Kathawachaga Lake to the east end, north to the Cracroft River (crossing the major esker), and angling north-northwest to the Hood River and to Camp 3. The 1995 northern section, from the esker crossing near the Cracroft River to the Hood River crossing, has been eliminated from current route options. The options considered during this study (Figure 8) are described below. The archaeological team flew over each potential corridor by

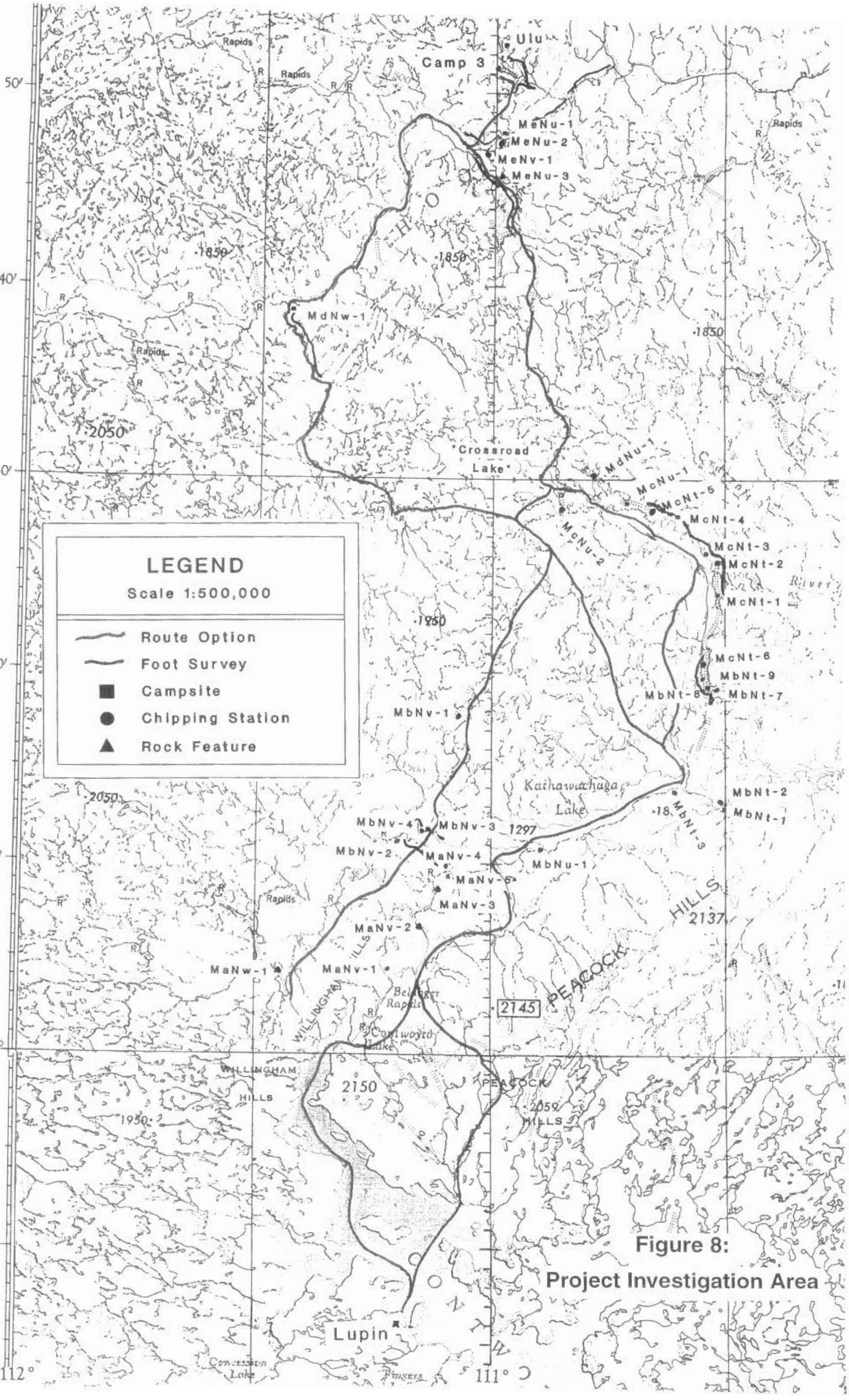

Figure 8:
Project Investigation Area

helicopter. Foot survey was undertaken at areas which held potential for archaeological sites.

Unit Lake Option

The Unit Lake route is a potential corridor which would bypass the Belanger Rapids and join up with the previously used corridor (1995 route). This route would cross Contwoyto Lake in a northeast direction arriving at the stream draining Unit Lake. The route then would angle northwest to meet the 1995 route.

The route, after crossing Unit Lake on the ice, follows a valley in the bedrock and passes over the top of the Peacock Hill before joining the 1995 corridor. The route was flown by helicopter and only two areas were noted which had archaeological potential, albeit relatively low. The bay containing the Unit Lake river has a small esker which appeared to contain no archaeological sites. This locality was not foot surveyed as priorities required investigation of higher potential areas first. The second area is the esker running northeast from the Peacock Hills into the lake when the two routes meet (west of the Belanger Rapids). As the esker could be a source of gravel, it was overflown at a low altitude. No archaeological sites were observed.

Eastern Route from Kathawachaga Lake to Crossroad Lake[1]

This route extends almost due north from Kathawachaga Lake to the medium-sized lake on the west side of the major north/south esker and northwest to Crossroad Lake, still on the west side of the esker. The potential corridor was overflown and consists of relatively level sedge and grass plains. The low relief means that drainage is poor and, as there had been a rainy period prior to the onset of Phase II, much of the ground was saturated and had standing water. As the esker immediately to the east could be a potential source of gravel, it was intensively examined both by helicopter and foot survey. The presence of the large number of sites (Figure 8) on this esker complex made it extremely unlikely that any occupation sites would have occurred in the lower, poorly-drained, resource-poor meadows. Lake/land interfaces within the potential corridor were examined by helicopter and in no instances were there any visible indications of archaeological sites. In most cases, the terrain at the lake shore was not conducive to human utilization, ie., poor visibility, lack of lithic resources, poor drainage.

1 Crossroad Lake is also commonly known as Lake 501.

Central Route Option from Kathawachaga Lake to Crossroad Lake

This route angles north-northwest across the relatively level plains. Occasional bedrock outcrops and boulder till deposits occur among saturated sedge meadows. No esker complexes are within the corridor although it does pass to the northeast of a small section of the discontinuous western esker. Potential for archaeological sites along the entire route ranges between minimal and zero.

Western Route to Crossroad Lake

This route begins near the Lytton mine site west of the Willingham Hills. The Lytton site is already linked with Lupin by an established winter road. The projected route passes to the east of the esker and northeast to the Kathawachaga Lake crossing. The corridor traverses glacial outwash deposits and level upland plains. Kathawachaga Lake will be crossed, on the ice, over the western arm. Foot surveys of the north and south shores were undertaken, resulting in the identification of three archaeological sites (MbNv-2,MbNv-3, and MbNv-4), all of which lie west of the projected corridor.

The next section runs at a north-northeast angle, more or less parallelling the disjunct components of the esker. Most of the area is low marshy meadow interrupted be low relief bedrock outcrops. All portions of the disjunct esker were foot surveyed, with only the southernmost containing a site (MbNv-1). Generally, the potential of the entire route is extremely low and the corridor, located east of the esker segments, would encounter no archaeological sites.

Eastern Route Option from Crossroad Lake to Hood River

This corridor runs slightly northwest. The area immediately north of Crossroad Lake is a glacial outwash plain which was intensively examined be helicopter as it could be a potential location for a midway way station on the route. The route follows a minor river system for most of the distance, passing east of a minor esker complex. The corridor angles away from the minor river to meet the Hood River at the wide section west of the upper rapids. The intermediate section of this route, north of Crossroad Lake to the esker south of the Hood River, is characterized by numerous low relief bedrock outcrops interspersed with small lakes and sedge/grass meadows. Several linear lakes (wide sections of the river) are oriented north/south and would form a major component of the route.

During the helicopter investigation of the area, none of the lakes and/or adjacent terrain appeared to be potential locations for archaeological sites. The northern portion of this route was surveyed on foot, yielding only the identification of a small cairn (MeNu-3) on the bank of the minor river. The terrain, observed during the foot survey, was relatively flat with few opportunities for long-range observation of game animals. The small lakes, being linked with the relatively sterile piscine environment of the Hood River, would not hold any attraction as a food resource location.

Western Route Option from Crossroad Lake to Hood River

This route runs west from Crossroad Lake, over the minor height of land, and then northwestward along a tributary of the Hood River. The terrain of the initial portion of the route is very similar to that of the central Kathawachaga-Crossroad route. It consists of relatively flat sedge/grass plains interspersed with small lakes and marshy areas. When the route turns northward, the corridor traverses several small and medium lakes, eventually turning due north and parallelling the river channel until reaching the Hood River. The haul road would follow the Hood River, on ice, to the north end of this section of the winter road.

Ice conditions at the locations of the series of rapids on the tributary will determine whether or not this portion of the route can be established on the river ice. During helicopter examination of the shores of the tributary at these rapids, the archaeological team found no evidence of archaeological sites. North of the major bend in the tributary, there are no more rapids and it is projected that the route will be on ice. The glacial outwash/esker complex on the east side of the tributary near the confluence of the Hood River was foot surveyed. A small chipping station (MdNw-1) was located.

Inasmuch as the Hood River is relatively wide and the route will be on ice, minimal observation of the shoreline occurred. Overflights were at an elevation which would have allowed the identification of large-scale tent ring campsites such as McNt-2 or MbNt-6. Small, partially-embedded tent rings, like those at MeNu-2, may not have been observed. Occupation sites are possible at some locations along the Hood River, although no impact is probable.

Hood River to Ulu

This section runs from the north shore of the Hood River over the bedrock upland to Reno Lake and joins the existing road facilities between Camp 3 and the Ulu site.

Although no impact is probable on the southern shore of Reno Lake, it had been foot surveyed during Phase I (Quaternary 1996:10-12). The access route onto the north bank of the Hood River was foot surveyed during Phase II. The survey extended from a point two kilometres northwest of the projected corridor to the upper rapids. In the northern portion of the foot survey area, the terrain slopes from the high bedrock valley

valley rim to the water, often with a moderately defined middle terrace. In the southern and eastern part of the area, the terrain was characterized by steep sharply-inclined bedrock slopes. No archaeological sites were present.

The middle section, traversing a moderate swale through the bedrock, each overflown by helicopter several times en route to other localities. This section has no potential for archaeological sites.

Artifacts

The earliest artifact found is an incomplete quartzite projectile point from MbNt-8. This specimen is representative of the Northern Plano Tradition. Artifacts relating to these peoples have been located throughout the Barren Grounds (Gordon[1] 1975:92; 1976;47-49; Wright[1] 1976:86-91). Radiocarbon dates have not produced a viable chronology, although a range of 8000 to 5000 years ago is generally agreed upon by Arctic archaeologists.

The next earliest culture represented is the Arctic Small Tool Tradition, which extended from the Alaskan coastline to northern Greenland to Labrador. This coastal-based tradition began approximately 4000 years ago and lasted until approximately AD. 1000. Within this tradition, several temporal and regional variants are recognized:

- Pre-Dorset (up to 1000 BC);
- Independence I (a High Arctic manifestation similar to early Dorset circa 100 to 500 BC);
- Independence II (a High Arctic manifestation similar to early Dorset circa 1100 to 500 BC); and
- Dorset (the widespread cultural pattern that lasted until AD. 1000 when the people were displaced/assimilated by the peoples of the Thule whaling culture) (McGhee[1] 1976: Volume 2:109-115).

A complete projectile point, MeNu-2/2, from a site on the Hood River is representative of the Dorset Phase, more probably the latter portion of the time range of that culture. An incomplete projectile point, MeNu-2/1, representing a different culture, an inland, forest-base hunting culture designated as Thaltheilei, was also recovered from the same site, MeNu2 (Phase I investigation). This incomplete projectile point is identified as representative of Middle to Late Thaltheilei, representing a temporal period from AD. 100 to 1000. It must be noted that not all Dorset artifacts have the finely-detailed

[1] see Ulu Mine Project Archaeological Impact Assessment: Phase II, Quaternary Consultants Limited, September 1996 for reference information.

flaking represented by MeNu-2/2 and that the incomplete projectile point, MeNu-2/1, could also be Dorset. The tent rings at MeNu-2 are the same style that is present at McNt-9 (two rings), McNt-6 (two rings), and MeNv-1 (two rings). If the correlation is accurate, four sites would be representative of the populations using the area one to two thousand years ago.

The bifaces from MeNv-1 are not identifiable to a specific cultural phase or a time period. The lithic material and the type of flaking in the black chert biface, MeNv-1/1, suggest that this artifact has considerable time depth, perhaps relating to either of the two cultural occupations at the nearby MeNu-2 sire. The type of flaking appears more related to the Dorset projectile point (MeNu-2/2) than the incomplete projectile point (MeNu-2/1). Due to the character of vein quartz, culturally diagnostic flaking techniques are not often identifiable and the quartz biface (MwNv-1/2) could be a tool which was made by any one from the earliest inhabitants (the Northern Plano People) to relatively recent Inuit hunters prior to the introduction of iron knives. Similarly, the many chipping stations contained no tools which would have permitted the identification of the occupants.

Most of the larger sites contain some artifacts which can be identified as dating to after AD. 1900, ie., MbNt-9, McNt-2, McNt-5, and McNt-6. However, based upon the variation of tent ring styles, the occupation that deposited the historic artifacts may only be the latest of a long series of occupations. The reasons for which the campsite locations were chosen would be equally valid whether the occupying group is engaged in pre-Fur Trade subsistence hunting, ancillary Fur Trade hunting for food supplies, or as a settlement-based group moving inland for a short period to harvest caribou.

On a speculative basis, the presence of square tent rings could represent a latter period within the Fur Trade period, when canvas tents were used rather than traditional tents of caribou hide. This, of course, is assuming that the square tent rings are not residual from activities of early Euro-Canadian prospectors. Three of the square tent rings at MeNv-1 appear to have an outline that suggests the presence of a "Bill Mason"-style tent.

Most of the tent styles are represented at several locations. However, one specific style is only present at McNt-5. This massive style of construction is unlike any other type in the investigation area and would represent an occupation by a distinct group of people. This distinction may be cultural or temporal and, as yet, information is insufficient to ascribe any identification to the builders of these different tent rings.

2.8 Land Use

Historical land use studies have shown intermittent utilization of the vicinity of the Ulu Project by peoples based at Kugluktuk, Omingmaktok, and Cambridge Bay. Prior to the establishment of trading posts at coastal communities (Period I as defined in the Inuit Land Use and Occupancy Project[1]), inland use was primarily a summer activity undertaken to obtain supplies of caribou. Peoples from the Coppermine region (Kogloktomiut and Asiakmiut) would move inland down the Coppermine and Asiak Rivers as far as the south end of Contwoyto Lake. The caribou hunting was supplemented with muskoxen and fish. Both groups wintered on the ice of Coronation Gulf (Farquharson[1] 1976:34-36). Peoples from the southern part of the Bathurst Inlet region (Kilusiktomiut) and the Contwoyto Lake people did not usually winter on the sea ice. The Kilusiktomiut sometimes stayed inland all winter while the Contwoyto Lake people only visited the coast when their caribou supply was exhausted or for trading purposes (Farquharson[1] 1976:50).

The introduction of trading posts had major societal ramifications. The "change from subsistence hunting to a combined hunting-and-trapping economy radically changed the peoples way of life. Many more stayed inland all winter to hunt and trap" (Farquharson[1] 1976:50). This intensified use of inland resources was practised by people from the Coppermine area, the Bathurst Inlet area, as well as the autochthonous Contwoyto Lake people. The resources sought were directly related to the fur trade, ie. fox and later wolf and wolverine. An intensive network of trap lines existed around Contwoyto and Kathawachaga Lakes (Freeman[1] 1976: Volume 3, Map 31, and Map 36). In addition to the trapping, subsistence activities, which focused upon caribou, fish, and waterfowl, were extensive (Freeman[1] 1976: Volume 3, Map 25, Map 31, and Map 37). Caribou were harvested during spring and fall migrations, with the latter providing meat for winter food supplies. Birds were usually trapped during the summer moult and muskoxen were hunted at various times throughout the year. Net fishing occurred throughout the year, with jigging through the ice during the winter. This period, delineated as Period II in the Inuit Land Use and Occupancy Project[1], came to an end with the building of the DEW line.

After the construction of the DEW line, people tended to concentrate more in the coastal settlements, reducing inland activities until the introduction of the snowmobile. Even through many people settled into the communities of Coppermine, Bathurst Inlet, and Cambridge Bay, "some continued to live at Contwoyto Lake the year round, and many others live in Coppermine only during the winter and spend the rest of the year

[1] see Ulu Mine Project Archaeological Impact Assessment: Phase II, Quaternary Consultants Ltd., September 1996 for reference information.

in the Contwoyto Lake area" (Farquharson[1] 1976:41). The major change in the Contwoyto Lake area had been the adoption of a more sedentary way of life with the construction of more permanent base camps from which to operate. These base camps at Concession Lake, Pellatt Lake, and Nose Lake, consisting of wood and canvas structures, were ephemeral albeit more established than the previously short-term hunting and/or fishing camps during Period II. The extent of trap line in the Contwoyto/Kathawachaga area had diminished during Period III (Freeman[1] 1976: Volume 3, Map 26, Map 33, and Map 38). Concomitantly, the intensity of game resource harvesting had also diminished (Freeman[1] 1976: Volume 3, Map 27, Map 35, and Map 39).

The period covered by the studies for the "Inuit Land Use and Occupancy project" ended in 1974. The two decades since that date have seen more reliance on wage economy and a subsequent reduction of trap line/subsistence economy.

Most of the studies of land use in the Contwoyto Lake area emphasize that the lake and its immediate environs, including Kathawachaga Lake and the upper Burnside River, are the most intensively utilized. "However, the area northeast of Kathawachaga Lake...was basically unused (by the Coppermine people) nor was it used by the Tree River people or the Bathurst Inlet people"(Farquharson[1] 1976:41). A more specific reference stated that "the area north-northeast of Contwoyto Lake, on the upper reaches of the James and Hood River, was seldom used, although caribou hunting was said to be good there"(Farquharson[1] 1976:52).

The most extensive trapping period (Period II) indicates only two trap lines north or northeast of Kathawachaga Lake although several exist on the east side of the upper Burnside River. One trap line extends diagonally from the western arm of Kathawachaga Lake to the major north/south esker. The tent ring at MbNv-1 may be related to this activity as may some components of the occupation sites on the major esker.

In view of the lack of documented utilization of the area north of Kathawachaga Lake, the tent ring campsites on the major esker may be earlier than the land use data obtained by the researchers of the Inuit Land Use and Occupancy Project[1]. A second alternative is that data regarding subsistence/utilization activity of the Contwoyto Lake people is under-represented on the utilization maps (Freeman[1] 1976: Volume 3). The major campsite locations (e.g., MbNt-9, McNt-2, McNt-5, and McNt-6 as discussed in Section 2.7 Historical Resources) indicate more than one period of occupation with the

1 see Ulu Mine Project Archaeological Impact Assessment: Phase II, Quaternary Consultants Ltd., September 1996 for reference information.

latest ones extending into the Period II time frame. It is probable that these campsite locations were important foci in the seasonal round, particularly as it related to the interception of the spring and fall migrations of the Bathurst caribou herd.