Fort McKay Environment Services Ltd.

Survey of Wildlife, including Aquatic Mammals, Associated with Riparian Habitat on the Suncor Steepbank Mine Study Area

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SURVEY OF WILDLIFE, INCLUDING AQUATIC MAMMALS, ASSOCIATED WITH RIPARIAN HABITAT ON THE SUNCOR STEEPBANK MINE STUDY AREA

Prepared for

FORT McKAY ENVIRONMENT SERVICES LTD.
Ft. McKay, Alberta

by

CIRC: Crozier Information Resources Consulting Ltd.
Dennis C. Surrendi, M.Sc.
4552 - 99 Street NW
Edmonton, Alberta
Canada T6E 5H5

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Prepared by:

CIRC: Crozier Information Resources Consulting Ltd.
4552 - 99 Street NW
Edmonton, Alberta T6E 5H5

For:

Fort McKay Environment Services Ltd.
P.O. Box 5360
Fort McMurray, Alberta T9H 3G4

ABSTRACT

During the months of November and December 1995, a study was conducted on the Suncor Steepbank Mine Study Area to provide a general overview of the wildlife associated with riparian habitats. Two surveys were conducted during the study: an aerial survey on November 2 and a ground survey during the period November 30-December 1. Both surveys were designed and carried out with the assistance of experienced trappers from Ft. McKay, Alberta. The trappers provided valuable input into the design and implementation of the study through their traditional ecological knowledge. The methodology used for both surveys is discussed. Eighty-two active beaver lodges and 82 active food caches were observed on the study area yielding a density of 0.24/km^2 for both active lodges and food caches. Active beaver lodges were located mainly (76.8 %) on river or stream courses with the remaining active lodges (23.2 %) located on lakes or ponds. Active beaver lodges and food caches were associated mainly with willow/alder shrubland, coniferous dominated mixed woodland, and spruce/tamarack muskeg habitats.

The ground survey yielded 100 observed tracks on three 500 metre transects. In addition to beaver, evidence through snow tracks confirmed that ten other species of wildlife were associating with riparian habitat on the study area. These wildlife species were coyote, fisher, fox, lynx, mink, river otter, weasel, wolf, ruffed grouse and mice or shrews. With the pooling of the ground survey data from both the Suncor Steepbank Mine study area and the Syncrude Canada Ltd. Aurora Mine local study area, an additional five species of wildlife were confirmed. These were "rabbit" (snowshoe hare), moose, deer, ptarmigan, and sharp-tailed grouse. Most of the wildlife snow tracks were associated with deciduous dominated mixed woodland and sedge meadow/emergents habitats.

No muskrat houses or pushups were observed during the study.

When the data from both the Suncor Steepbank Mine study area and Syncrude Canada Ltd. Aurora Mine local study area are pooled, observations from the old ALSANDS site located on the Syncrude Canada Ltd. Aurora Mine local study area reflected a level of wildlife activity ranging from a minimum of 4.3 to a maximum of 30 times that found on all of the other ground survey transect sites from both study areas. Recommendations are presented suggesting that the old ALSANDS site be given further study using the integration of conventional scientific methodology and traditional ecological knowledge to develop insight into reclamation alternatives for mined areas in this region.

Dennis C. Surrendi, M.Sc.
CIRC: Crozier Information Resources Consulting Ltd.
4552 - 99 Street NW
Edmonton, AB T6E 5H5

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1.0 INTRODUCTION

1.1 BACKGROUND

In June 1995, Suncor Inc. Group of Companies initiated action to fulfil its responsibilities for an Environmental Impact Assessment (EIA) of the proposed Suncor Steepbank Mine development. During the summer and fall of 1995, the Ft. McKay First Nations negotiated an agreement with Suncor Inc. to assume a more direct role in the contracting out of certain environmental and social studies that were required in support of the EIA. Toward this end, Ft. McKay Environment Services Ltd. contracted Rhyslyn Resources Ltd. to oversee the completion of these studies. Rhyslyn Resources Ltd. subsequently further contracted the Aquatic Mammal Survey to CIRC: Crozier Information Resources Consulting Ltd. (CIRC).

1.2 OBJECTIVES

The objectives of this study are:

a. To conduct a brief but intensive review of literature from Syncrude, Suncor and any other sources on aquatic mammals in the study area and adjacent areas.

b. To integrate the information obtained in (a) above with information obtained from maps and air photographs of the study area.

c. To conduct interviews with the trappers having traplines directly effected by the proposed Steepbank Mine and to further integrate this information with that obtained in (a) and (b) above.

d. To conduct two surveys of the study area in order to document the status of beaver populations and other wildlife species associated with riparian habitats on the study area.

e. To prepare a report that presents an overview of the general status of beaver and other species of wildlife associated with riparian habitats for which data can be obtained within the time period and budgetary limitations of the project.

1.3 STUDY AREA

The study area is defined as the Suncor Steepbank Mine Study Area. The geographic boundaries of the study area are graphically presented in Figure 1. This study area encompasses 343.1 km^2.

The north and eastern portions of the study area are drained to the northwest into the Athabasca River by the Steepbank River. The west-central portion of the study area is drained in a westerly direction by Legget Creek while the southern portion of the study area drains into the Athabasca River via Wood and McLean Creeks. Shipyard Lake can be found along the ancient flood plain of the Athabasca River on the east side of the Athabasca River between the mouth of the Steepbank River and Legget Creek. The study area included the east bank and flood plain of the Athabasca River. Islands in the Athabasca River were excluded from the study area.

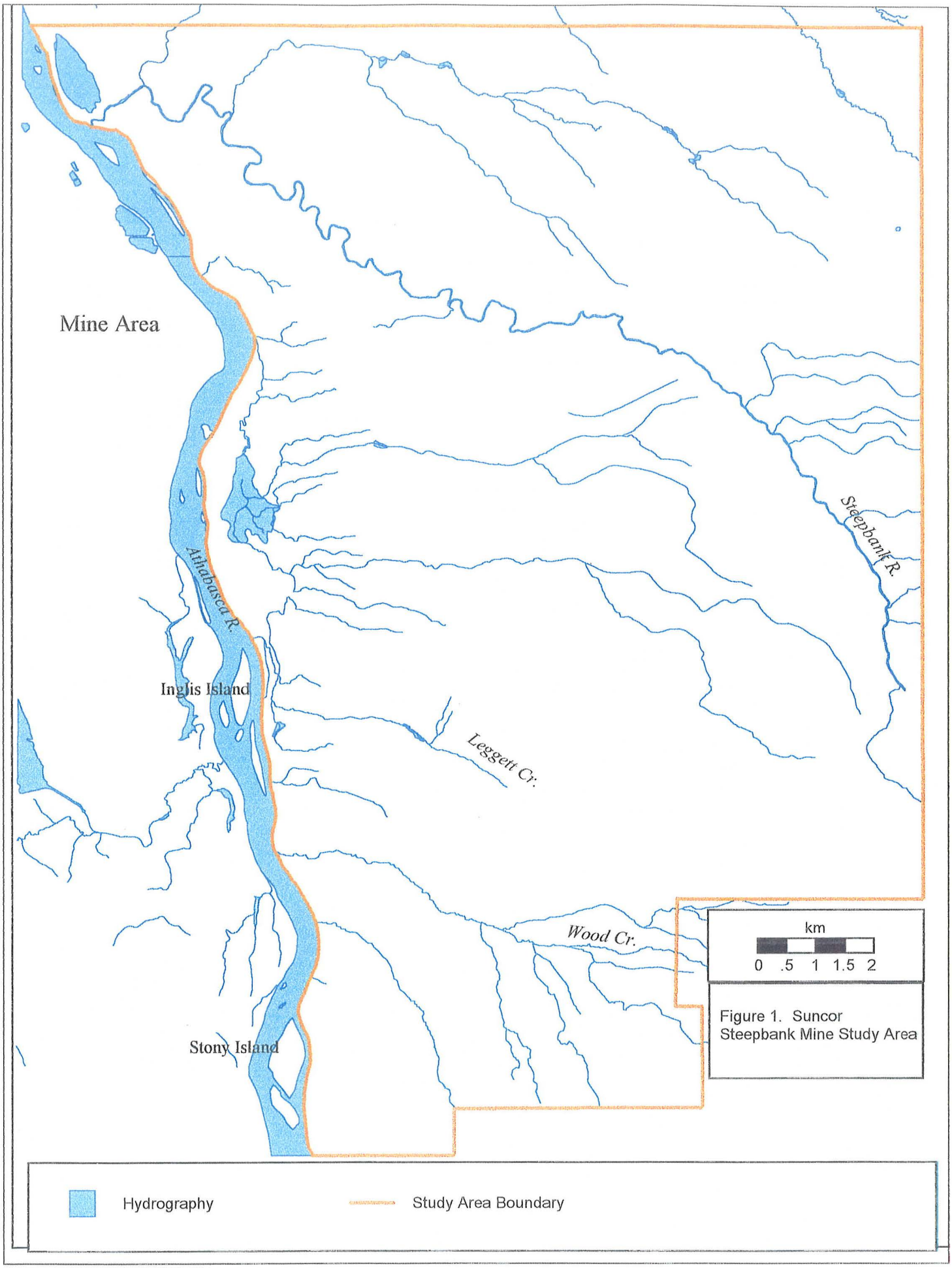
As a result of the exploration for minerals that has occurred on the study area, an extensive network of cut lines and roads can be found in the area. This has resulted in considerable access to the public at large for recreational and subsistence purposes. This area represents a portion of the Traditional Land Use Area of the Ft. McKay First Nations and it is still used by community members for hunting, trapping and gathering.

The study area is comprised of boreal forest in various stages of succession either through natural or human-induced means. This Boreal Mixedwood Ecoregion (Strong and Leggat 1981) is comprised of an upland cover of aspen (*Populus tremuloides*), paper birch (*Betula papyrifera*), balsam poplar (*Populus balsamifera*), white spruce (*Picea glauca*) and jack pine (*Picea banksiana*) forest. The lowland vegetative cover is predominantly black spruce (*Picea mariana*) and tamarack (*Larix laricina*) muskeg.

The climate of the area is typical of a northern temperate region having long cold winters with short warm summers. Prevailing winds in the area are from the north and west northwest (Rudolph et al 1984).

Wildlife and fish species found permanently or seasonally in the study area are typical of those found in a boreal forest region as described by Pruitt (1978).

The study area is underlain by bitumen and is currently under consideration for bitumen extraction and the production of synthetic crude oil by Suncor Inc.


Mine Area
Athabasca R.
Inglis Island
Leggett Cr.
Steepbank R.
Wood Cr.
Stony Island
km
0 .5 1 1.5 2
Figure 1. Suncor
Steepbank Mine Study Area
Hydrography
Study Area Boundary

2.0 METHODS

2.1 BACKGROUND INFORMATION

Rhyslyn Resources Ltd. secured various reports from Suncor Inc. and Syncrude Canada Ltd. concerning previous studies of aquatic mammals either on or adjacent to the study area. These reports were provided to CIRC for review in support of the study objectives. CIRC also conducted its own review of published information pertinent to the study area and the aquatic mammal species involved.

Two trappers, Julian Powder and Willie Boucher, having most of the study area within their collective traplines, were also interviewed to secure traditional ecological knowledge for the area. Fur harvest data for all traplines on the study area were also obtained from Fish and Wildlife Services of Alberta Environmental Protection. Fur sales records for the general region were also obtained from Fish and Wildlife Services.

2.2 AERIAL SURVEY

Based on the information obtained from the preceding sources along with various maps and air photographs of the study area, an aerial survey plan was prepared for the study area that would maximize the cost effective use of a Bell 206 Jet Ranger helicopter supplied co-operatively by Suncor Inc. and Syncrude Canada Ltd. The documentation and data entries to be obtained from the aerial survey were based on the methodology described by Salter and Duncan (1986) with the only alteration to this methodology being that no attempt was made to document aquatic mammal sites per linear kilometre of stream courses or lake shorelines because of the potential for error in securing linear measurements of obscure peripheral drainage channels draining into the more prominent drainages. For purposes of comparison with other studies, the number of active sites documented per square kilometre was used. Muskrat were included in the survey even though aerial surveys have not proven effective in addressing muskrat population estimates in this region (Salter and Duncan 1986).

In addition to the pilot and the author, a paratechnical, Bobby Powder, from the community of Ft. McKay was trained as an observer for the study. In addition, a trapper from the area, Julian Powder, was also included in the aerial survey in order to assist in the provision of traditional ecological knowledge and to act as a third observer. The aerial survey was conducted on November 2, 1995 with a light snow cover and most of the water bodies in the area were partially or completely ice covered. The temperature during the survey ranged between -20^0 C. to -10^0 C. In general, the aerial survey was conducted at speeds less than 100 kilometres per hour and at elevations of less than 100 metres above ground level (AGL). If required, specific site observations were made at less than

10 metres AGL. All stream courses and standing water bodies within the study area were surveyed.

The author used maps and air photographs to navigate the study area, recording the location of all observations on either 1:50,000 maps or 1:40,000 air photos. Each observation was given an identification code comprised of a letter and number, and the nature of the observation was also recorded by the author on a tape recorder for future reference. The second observer, Bobby Powder, manually recorded each observation by letter and number code on a data sheet. The third observer, Julian Powder, assisted in navigation and the identification of active and inactive beaver lodges. The data sheet included the following information:

1. Site identification number;
2. For beaver, the information included whether the site was an active lodge, inactive lodge, food cache or live animal;
3. For muskrat, the information included whether the site was an active house, pushup, bank house, or live animal;
4. The habitat type within a 30 metre radius of the site - a distance considered to be a normal foraging distance for beavers (Hall 1970; Jenkins 1975; and Allen 1983), with the habitat types being categorized as follows:
   - coniferous woodland
   - coniferous dominated mixed woodland
   - deciduous dominated mixed woodland
   - deciduous woodland
   - spruce/tamarack muskeg
   - willow/alder shrubland
   - sedge meadow/emergents
   - open water (including ice covered water)
5. The habitat type within a 200 metre radius adjacent to a site, with the habitat types being categorized similar to item #4 above;
6. The height of the bank nearest the site was recorded as either being less than or greater than 1 metre; and
7. The slope of the bank nearest the site was recorded as being either $<10^0$, between 10^0 and 30^0, or $>30^0$.

Any other pertinent information relevant to each site or evidence of other species of wildlife on or near each site were also noted as and when required.

2.3 GROUND SURVEY

Techniques used for estimating populations of wild furbearers have proven to be difficult to formulate and carry out (Reid et al, 1987). Wildlife managers have historically relied on trends in fur harvest data or fur sales statistics which have inherent biases, or on species specific indices such as active beaver lodges in late fall (Hay 1958) or the use of scent stations by coyotes, (*Canis latrans*) (Linhart and Knowlton 1975). Recent work on river otter (*Lutra canadensis*) using tracks in snow (Reid et al, 1987) has shown that this technique has potential for providing population estimates of this species that can withstand statistical rigour.

In order to supplement the aerial survey data obtained in this study, a ground survey was also employed to obtain general information on the relative abundance of wildlife associated with riparian habitats using methodology combining some aspects of the techniques developed by Reid et al (1987) with the application of traditional ecological knowledge provided by Aboriginal trappers familiar with the area. While acknowledging that the techniques relating to the use of ground surveys to acquire information on the status of wildlife populations may be wanting with regard to mathematical analysis, by applying the experience and traditional ecological knowledge of local Aboriginal trappers along with known conventional science, a determination of the relative abundance of wildlife associated with riparian habitats in the area can be obtained. Other investigators have used ground surveys to obtain useful information on the relative abundance of wildlife while recognizing that such information has limitations with regard to its use (MacDonald and Mason 1985; Jenkins and Burrows 1980).

Three (3) ground transects were selected on sites considered representative of the general habitat types on the area (Figure 2):

- Site 1 - a portion of the Steepbank River drainage upstream from its mouth having predominant habitat types of coniferous dominated mixed woodland and deciduous dominated mixed woodland both interspersed with willow/alder shrubland;
- Site 2 - a natural lake having associated habitat types of sedge meadow/ emergents and deciduous dominated mixed woodland; and
- Site 3 - a portion of the Legget Creek drainage having associated general habitat types of deciduous dominated mixed woodland and willow/alder shrubland.

The survey team was comprised of three individuals including the author and two experienced trappers from Ft. McKay, Willie Boucher and Julian Powder.

Each ground transect was premeasured at a length of 500 metres; a length considered by Reid et al (1987) to be an optimum length for obtaining a representative sample of river

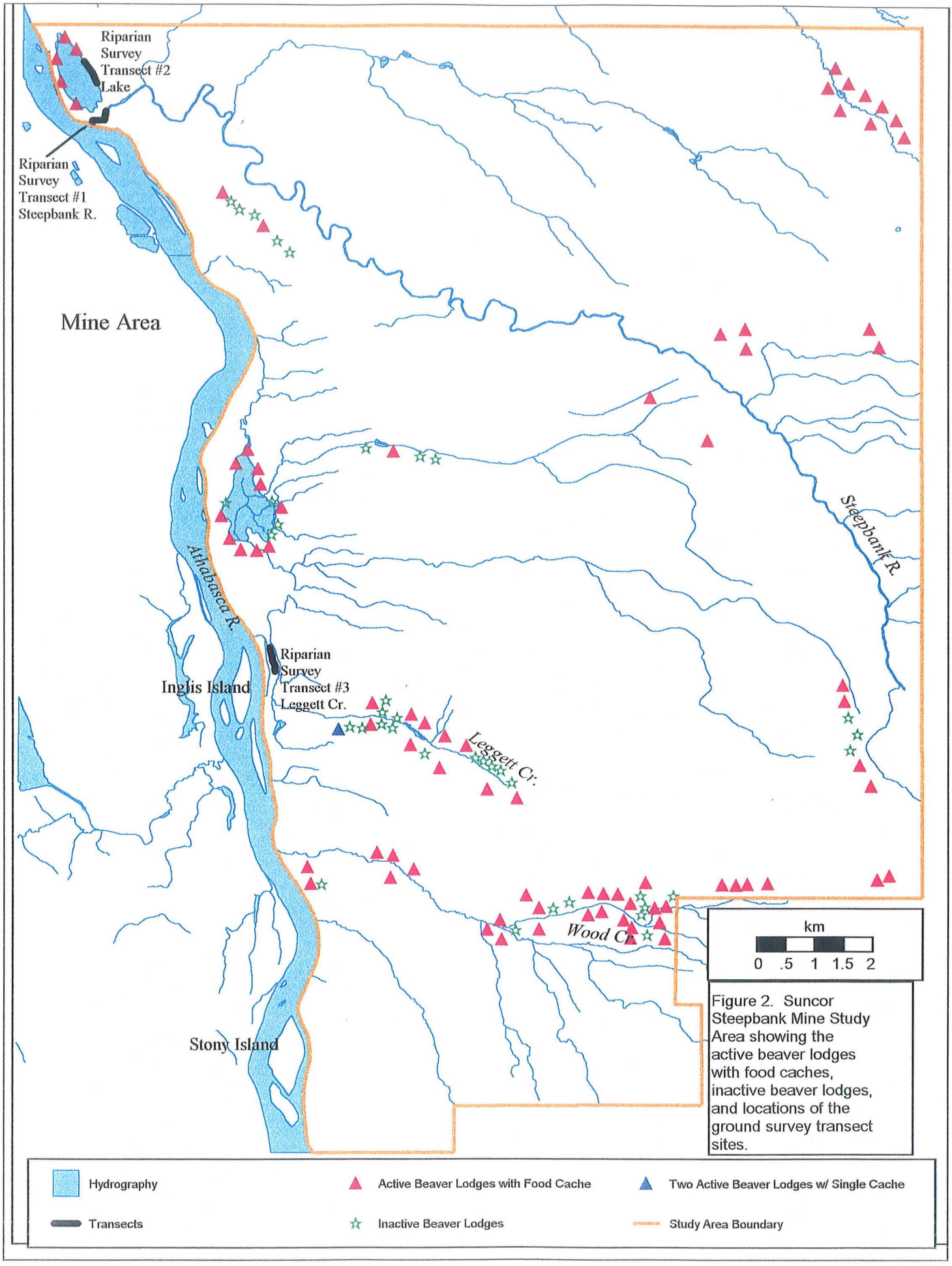


Figure 2. Suncor Steepbank Mine Study Area showing the active beaver lodges with food caches, inactive beaver lodges, and locations of the ground survey transect sites.

otter (*Lutra canadensis*) tracks in snow from a ground transect. The exact line to be followed by the transect was located at the shoreline on lakes, and down the centre of streams less than 10 metres in width. A sample zone 10 metres on either side of the transect line was used yielding a total sample area 500 metres long and 20 metres wide for each site.

Once each ground survey transect had been premeasured, the author, along with at least one of the Aboriginal trappers, walked down the 500 metre transect on both sides of the centre line. All animal tracks that entered the 20 metre wide survey zone were counted only once until they left the zone. If the tracks left the zone a short distance within sight of the observer but returned to the zone, they were not recorded a second time. Based on the experience and traditional ecological knowledge of the trappers, each track was identified by species of animal and the age of the track was determine to be <24 hours old or >24 hours old. Other information such as scats, dead or live animals was also recorded. In instance where a number of similar tracks were observed within a small area, the trappers attempted to determine the number of different animals involved for the record. The predominant habitat type found within 30 metres of each track was recorded in eight (8) categories similar to those used above for the aerial survey. The relationship of each track to water was noted and recorded in one of four (4) categories: on ice; in water; <10 metres from shoreline; and >10 metres from shoreline.

The furbearing species recorded were beaver (*Castor canadensis*), coyote (*Canis latrans*), fisher (*Martes pennanti*), fox (*Vulpes fulva*; all colour phases), lynx (*Lynx canadensis*), marten (*Martes americana*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), "rabbit" (*Lepus americanus*; snowshoe hare), weasel (*Mustela erminea, Mustela rixosa*, and *Mustela frenata*), wolf (*Canus lupus*), and wolverine (*Gulo luscus*).

Big game species that were recorded were moose (*Alces alces*), white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), deer (species not determined), and caribou (*Rangifer spp.*).

Bird species that were recorded were ruffed grouse (*Bonasa umbellus*), spruce grouse (*Canachites canadensis*), willow ptarmigan (*Lagopus lagopus*), and sharp-tailed grouse (*Pedioecetes phasianellus*).

Any other species of wildlife not identified in the preceding list was recorded by species under the heading of "other" wildlife.

The date, time of day, general weather conditions and snow conditions were recorded at each transect site.

An "observed wildlife abundance index" was calculated for each study site transect. This index was determined by dividing the total number of tracks observed within each transect by the 500 metre distance. The purpose of this calculation was to provide a general comparison of the use of each transect study site by animals in the study area.

3.0 RESULTS

3.1 AERIAL SURVEY

3.1.1 Beaver

The distribution of beaver within the study area was predominantly on small tributary stream courses in the upper basins of the major river and stream systems in the study area (Figure 2; Table 1). Of secondary importance were the lakes and ponds in the study area. A total of 82 active beaver lodges and 81 active food caches were recorded for the study area. All active beaver lodges were associated with beaver food caches except that in one instance two active beaver lodges had one food cache between them. Of the 82 active beaver lodges, 63 (76.83%) were associated with stream courses while the remaining 19 (23.17%) were located in conjunction with lakes or ponds. The food caches were distributed in a similar manner as the active lodges with 62 (76.54%) of the 81 food caches being located on stream courses and the remaining 19 (23.46%) associated with lakes or ponds.

Thirty-three (89.19%) of a total of 37 inactive beaver lodges were located on stream courses with the remaining 4 (10.81%) being associated with lakes or ponds.

Of the total active and inactive sites located on the study area, 158 (79.00%) were located in association with stream courses while the remaining 42 (21.00%) were found in conjunction with lakes or ponds.

The overall density of active lodges and food caches for the study area was calculated to be 0.24/km^2 for both. No bank lodges were observed.

Habitat associated in the immediate area (ie. within a 30 metre radius) of active lodges (Table 2) was mainly the willow/alder shrubland complex (41.46%) with coniferous dominated mixed woodland (31.71%) of secondary importance. However, within a 200 metre radius of active lodges coniferous dominated mixed woodland (30.49%), willow/alder shrubland (29.27%), and spruce/tamarack muskeg (24.39%) were found.

Within the immediate area (ie. within a 30 metre radius) of food caches (Table 2), the habitat was mainly willow/alder shrubland (40.74%) with coniferous dominated mixed woodland (32.10%) being of secondary importance. Habitat associated within a 200 metre radius of food caches followed a similar relationship with active lodges in that 30.86 % of the food caches were associated with coniferous dominated mixed woodland, 29.63% were associated with willow/alder shrubland, and 23.46% were associated with spruce/tamarack muskeg.

Table 1.

Number and Density of Active and Inactive Beaver Sites
Observed During the Aerial Survey of the
Suncor Steepbank Mine Study Area in November, 1995

Type of Surface Water	Active Beaver Lodge		Food Cache		Inactive Beaver Lodge		Total	
	No.	%	No.	%	No.	%	No.	%
River or Stream	63	76.83	*62	76.54	33	89.19	158	79.00
Lakes or Ponds	19	23.17	19	23.46	4	10.81	42	21.00
Artificial Channel or Waterbody	0	0	0	0	0	0	0	0
Totals	82	100.00	81	100.00	37	100.00	200	100.00
Number per Km^2 (343.1 km^2)	0.24		0.24		0.11			

* At one site, two beaver lodges had one shared food cache.

Inactive lodges also reflected a strong affiliation within a 30 metre radius (Table 2) to the willow/alder shrubland complex (43.24%) with the second strongest representation being the coniferous dominated mixed woodland (21.62%). Within a 200 metre radius of the inactive sites, the dominant vegetative community was mainly the willow/alder shrubland complex (40.54%) with coniferous dominated mixed woodland (24.32%) being of secondary significance.

When all active and inactive sites area grouped (Table 2), the majority of sites (41.50%) were within 30 metres of willow/alder shrubland and coniferous dominated mixed woodland (30.00%). Within 200 metres of all sites, willow/alder shrubland (31.50%) was only slightly more important than coniferous dominated mixed woodland (29.50%) and spruce/tamarack muskeg (22.50%).

When all active and inactive sites are grouped in accordance with surface water type (Table 3), those sites located on natural stream courses are mainly associated with willow/alder shrubland (37.98%) and coniferous dominated mixed woodland (31.65%) within a 30 metre radius while sites located on lakes or ponds were predominantly associated with a willow/alder shrubland complex (57.14%) at this same distance. Within 200 metres of sites located on natural stream courses, most were located almost equally between coniferous dominated mixed woodland (30.38%) and willow/alder shrubland (29.11%) with a significant number also being associated with the spruce/tamarack muskeg (24.05%) habitat type. The habitat type within 200 metres of sites found on lakes or ponds was predominantly the willow/alder shrubland complex (45.24%) with a large number also being found in conjunction with the coniferous dominated mixed woodland complex (23.81%) and spruce/tamarack muskeg (19.05%).

Banks located adjacent to all active beaver lodges with associated food caches were primarily (90.24%) <1 metre in height while 9.76% had bank heights of >1 metre. The bank heights adjacent to all inactive lodges were <1 metre.

Banks adjacent to 96.34% of all active beaver lodges with associated food caches were $<10^0$ slope while banks adjacent to 3.66% of the remaining active beaver lodges and associated food caches were between 10^0-30^0 slope.

If one assumes that each of the active beaver lodges with associated food caches has an average number of beaver of 6.3 animals (Searing 1979b), then the population on the study area is estimated to be about 517 beaver.

Table 2.

Habitat Types in the Area Surrounding
Active and Inactive Beaver Lodges and Food Caches
Observed During the Aerial Survey of the
Suncor Steepbank Mine Study Area in November, 1995

Habitat Type[1]	Sites															
	Active Lodges				Food Caches				Inactive Sites				Total Sites			
	30 m Radius		200 m Radius		30 m. Radius		200 m. Radius		30 m. Radius		200 m. Radius		30 m. Radius		200 m. Radius	
	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.
Coniferous Woodland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coniferous Dominated Mixed Woodland	31.71	26	30.49	25	32.10	26	30.86	25	21.62	8	24.32	9	30.00	60	29.50	59
Deciduous Dominated Mixed Woodland	3.66	3	15.85	13	3.70	3	16.05	13	2.70	1	18.92	7	3.50	7	16.50	33
Deciduous Woodland	2.44	2	0	0	2.47	2	0	0	13.51	5	0	0	4.50	9	0	0
Spruce/Tamarack Muskeg	19.51	16	24.39	20	19.75	16	23.46	19	10.81	4	16.22	6	18.00	36	22.50	45
Willow/Alder Shrubland	41.46	34	29.27	24	40.74	33	29.63	24	43.24	16	40.54	15	41.50	83	31.50	63
Sedge Meadow/Emergents	1.22	1	0	0	1.24	1	0	0	8.12	3	0	0	2.50	5	0	0
Open Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	100.0	82.00	100.0	82.00	100.0	81.00	100.0	81.00	100.0	37.00	100.0	37.00	100.0	200.0	100.0	200.0

[1]Habitat types follow those used by R.E. Sutter and J.A. Duncan, 1986.

Table 3. Habitat Types in the Area Surrounding Active and Inactive Beaver Lodges and Food Caches Observed During the Aerial Survey of the Suncor Steepbank Mine Study Area in November, 1995

Surface Water Type	Habitat Type[1]	Sites									
		Active Lodge		Food Cache		Inactive Sites		Total Sites			
		30 m. Radius	200 m. Radius	30 m. Radius	200 m. Radius	30 m. Radius	200 m. Radius	30 m. Radius		200 m. Radius	
								No.	%	No.	%
River or Stream	Coniferous Woodland	0	0	0	0	0	0	0	0	0	0
	Coniferous Dominated Mixed Woodland	22	20	20	19	8	9	50	31.65	48	30.38
	Deciduous Dominated Mixed Woodland	2	10	2	10	1	6	5	3.16	26	16.46
	Deciduous Woodland	2	0	2	0	5	0	9	5.70	0	0
	Spruce/Tamarack Muskeg	12	16	13	16	4	6	29	18.35	38	24.05
	Willow/Alder Shrubland	24	17	24	17	12	12	60	37.98	46	29.11
	Sedge Meadow/Emergents	1	0	1	0	3	0	5	3.16	0	0
	Open Water	0	0	0	0	0	0	0	0	0	0
	Sub-Total	63.00	63.00	62.00	62.00	33.00	33.00	158.00	100.00	158.00	100.00
Lakes or Ponds (Natural)	Coniferous Woodland	0	0	0	0	0	0	0	0	0	0
	Coniferous Dominated Mixed Woodland	5	5	5	5	0	0	10	23.81	10	23.81
	Deciduous Dominated Mixed Woodland	0	2	0	2	0	1	0	0	5	11.90
	Deciduous Woodland	0	0	0	0	0	0	0	0	0	0
	Spruce/Tamarack Muskeg	4	4	4	4	0	0	8	19.05	8	19.05
	Willow/Alder Shrubland	10	8	10	8	4	3	24	57.14	19	45.24
	Sedge Meadow/Emergents	0	0	0	0	0	0	0	0	0	0
	Open Water	0	0	0	0	0	0	0	0	0	0
	Sub-Total	19.00	19.00	19.00	19.00	4.00	4.00	42.00	100.00	42.00	100.00
	TOTAL	82.00	82.00	81.00	81.00	37.00	37.00	200.00		200.00	

1.Habitat types follow those used by R.E. Salter and J.A. Duncan, 1986

3.1.2 Muskrat

No observations of muskrat houses or muskrat pushups were made during the aerial survey.

3.2 GROUND SURVEY

3.2.1 Suncor Steepbank Mine Study Area

The ground survey was conducted during the period November 30 - December 1, 1995. Weather conditions for both days were cold with temperatures ranging between - 23^0 C and - 27^0 C. About four centimetres of fresh snow fell during the night preceding each day in the field but no snow fell during the daylight hours. Skies were clear during both days with light winds out of the southwest. Accumulations of about 30 centimetres of snow were present on the study area inclusive of the recent snow falls experienced on the two days of the ground survey.

A total of 100 tracks of various ages were observed on the three study sites during the two day period (Table 4) with 23 on Site 1, 42 on Site 2, and 35 on Site 3. Animal tracks <24 hours old comprised 8.7% (n = 2) of those observed on Site 1; 35.7% (n = 15) of those observed on Site 2; and 57.1% (n = 20) of those observed on Site 3. Of the total tracks observed, 37% (n = 37) were <24 hours old.

The species distribution of observed wildlife tracks is also presented in Table 4. On Site 1, the ground transect on the Steepbank River upstream from its mouth, lynx tracks were observed in 26.1% (n = 6) of the observations with fox tracks second in abundance (21.7%; n = 5) along with progressively lesser numbers of fisher (17.4%; n = 4), mink (13.0%; n = 3), wolf (8.7%; n = 2), ruffed grouse (8.7%; n = 2), and weasel (4.4%; n = 1).

Site 2, located on a lake north of the mouth of the Steepbank River, had the largest number of fox tracks among all of the ground transects with 35.7% (n = 15) followed by weasel (23.8%; n = 10), river otter (16.7%; n = 7), mink (7.1%; n = 3), wolf (7.1%; n = 3), coyote (4.8%; n = 2), and fisher (4.8%; n = 2). Site 2 had the largest number of observations of river otter tracks among all of the ground transects and Site 2 was also the only transect in the study where coyote tracks were recorded. At Site 3 on Legget Creek, the highest number of observed mink tracks were recorded (25.7%; n = 9) among all of the study sites with weasel and fisher tracks respectively being observed in similar numbers (20.0%; n = 7) followed by progressively lesser numbers of fox (14.3%; n = 5), lynx (8.6%; n = 3), and river otter (8.6%; n = 3). Site 3 was the only ground transect

Table 4.
Summary of Observed Snow Tracks on Three Ground Transects
Located on the Suncor Steepbank Mine Study Area
During the Period November 29-December 01, 1995

Ground Survey Transects

Species	Site 1		Site 2		Site 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%
Beaver	0	0	0	0	0	0	0	0
Coyote	0	0	2	4.8	0	0	2	2.0
Fisher	4	17.4	2	4.8	7	20.0	13	13.0
Fox	5	21.7	15	35.7	5	14.3	25	25.0
Lynx	6	26.1	0	0	3	8.6	9	9.0
Marten	0	0	0	0	0	0	0	0
Mink	3	13.0	3	7.1	9	25.7	15	15.0
Muskrat	0	0	0	0	0	0	0	0
Otter	0	0	7	16.7	3	8.6	10	10.0
Rabbit *	0	0	0	0	0	0	0	0
Weasel	1	4.4	10	23.8	7	20.0	18	18.0
Wolf	2	8.7	3	7.1	0	0	5	5.0
Wolverine	0	0	0	0	0	0	0	0
Moose	0	0	0	0	0	0	0	0
Deer	0	0	0	0	0	0	0	0
Caribou	0	0	0	0	0	0	0	0
White-tailed Deer	0	0	0	0	0	0	0	0
Mule Deer	0	0	0	0	0	0	0	0
Ruffed Grouse	2	8.7	0	0	0	0	2	2.0
Spruce Grouse	0	0	0	0	0	0	0	0
Ptarmigan	0	0	0	0	0	0	0	0
Sharptailed Grouse	0	0	0	0	0	0	0	0
Mice/Shrews	0	0	0	0	1	2.8	1	1.0
TOTAL	23	100.0	42	100.0	35	100.0	100	100.0
Tracks < 24 hrs **	2	8.7	15	35.7	20	57.1	37	37.0

* Snowshoe hare

** Number and percentage of snow tracks less than 24 hours old

where the track of either a mouse or a shrew (2.8%; n = 1) was observed among all study sites. None of the ground transects on the Suncor Steepbank Mine study area had any rabbit (snowshoe hare) tracks observed.

It is interesting to note that there was no sign of muskrat houses or pushups on any of the ground transects even though Site 2 appeared to have emergent vegetation that had previously accommodated a muskrat population according to the two trappers involved in the ground survey.

When the data are grouped for the three Sites (Table 4), fox was the most abundant (25.0%; n = 25) followed by weasel (18.0%; n = 18), mink (15.0%; n = 15), fisher (13.0%; n = 13), river otter (10.0%; n = 10), wolf (5.0%; n = 5), coyote (2.0%; n = 2), ruffed grouse (2.0%; n = 2), and a single mouse or shrew (1.0%; n = 1).

The tracks of seven different species of wildlife were observed on each of the study Sites (Table 5).

Table 6 presents the general habitat type within 30 metres of all observed animal tracks on the study sites. Of the eight habitat type categories, four were sampled in the ground survey transect sites. The habitat types not sampled in the ground survey transects were coniferous woodland, deciduous woodland, spruce/tamarack muskeg, and open water (or ice covered water). Animal tracks observed on Site 1 were associated with deciduous dominated mixed woodland (43.5%; n = 10), coniferous dominated mixed woodland (34.8%; n = 8) and willow/alder shrubland (21.7%; n = 5). Tracks observed on Site 2 were predominantly in sedge meadow/emergents (90.5%; n = 38) and to a lesser degree in willow/alder shrubland (7.1%; n = 3) and coniferous dominated mixed woodland (2.4%; n = 1). All of the observed tracks on Site 3 were found in association with deciduous dominated mixed woodland (100.0%; n = 35). When the habitat data from all three ground survey transects are grouped, most of the observed tracks were associated with deciduous dominated mixed woodland (45.0%; n = 45) followed by sedge meadow/emergents (38.0%; n = 38), coniferous dominated mixed woodland (9.0%; n = 9), and willow/alder shrubland (8.0%; n = 8).

An "observed wildlife abundance index" was calculated for each of the study Sites and the results are presented in Table 7. The highest index value was obtained for Site 2 with an index of 0.084 followed by Site 3 having an index of 0.070 and Site 1 with an index of 0.046. These calculations indicate that Site 2 had 1.8 time more wildlife activity than Site 1 and Site 2 had about 1.2 time more wildlife activity than Site 3.

Table 5.

Diversity of Wildlife Species on Ground Transects
as Determined from Observed Snow Tracks on
Suncor Steepbank Mine Study Area During the
Period November 30-December 01, 1995

Ground Transect	Species of Wildlife	Number of Species
Site 1	F, Fx, L, Mi, We, W, RG	7
Site 2	C, F, Fx, Mi, Ot, We, W	7
Site 3	F, Fx, L, Mi, Ot, We, M/S	7

Species Key:

Species Abbreviations:

Fur:

B - Beaver
C - Coyote
F - Fisher
Fx - Fox (all colors)
L - Lynx
Mi - Mink
M - Marten
Mu - Muskrat
Ot - Otter
R - Rabbit (Snowshoe hare)
We - Weasel
W - Wolf
Wlv - Wolverine

Big Game:

M* - Moose
D - Deer
C* - Caribou
WD - Whitetail Deer
MD - Mule Deer

Birds:

RG - Ruffed Grouse
SG - Spruce Grouse
Pt - Ptarmigan (willow)
StG - Sharp-tailed Grouse

Other:

M/S - Mice or shrews (species unknown)

Table 6.

General Habitat Types Within 30 Metres of Observed Snow Tracks
on Ground Transects Located on the Suncor Steepbank Mine Study Area
During the Period November 30-December 01, 1995

Ground Transect	Habitat Types *																	
	CW		CDMW		DDMW		DW		S/T		W/A		SM/E		OW		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Site 1	0	0	8	34.8	10	43.5	0	0	0	0	5	21.7	0	0	0	0	23	
Site 2	0	0	1	2.4	0	0	0	0	0	0	3	7.1	38	90.5	0	0	42	
Site 3	0	0	0	0	35	100.0	0	0	0	0	0	0	0	0	0	0	35	
TOTAL	0	0	9	9.0	45	45.0	0	0	0	0	8	8.0	38	38.0	0	0	100	100.0

* Habitat Types:

CW - Coniferous Woodland
CDMW - Coniferous Dominated Mixed Woodland
DDMW - Deciduous Dominated Mixed Woodland
DW - Deciduous Woodland
S/T - Spruce/Tamarack Muskeg
W/A - Willow/Alder Shrubland
SM/E - Sedge Meadow/Emergents
OW - Open Water (or ice-covered water)

Table 7.

Observed Wildlife Abundance Indices for
Ground Transects on the Suncor Steepbank Mine Study Area
Conducted During the Period November 30-December 01, 1995

Ground Transect	Total No. of Snow Tracks Observed	**Divided by**	Length of Ground Transect	**Equals**	Observed Wildlife Abundance Index
Site 1	23	÷	500 metres	=	0.046
Site 2	42	÷	500 metres	=	0.084
Site 3	35	÷	500 metres	=	0.070

$\bar{x}$ = 0.067

3.2.2 Combined Observations From the Suncor Steepbank Mine Study Area and the Syncrude Canada Ltd. Aurora Mine Local Study Area

Permission was obtained from Suncor Inc. and Syncrude Canada Ltd. through Ft. McKay Environment Services Ltd. to pool the ground transect data from a total of seven (7) study transects on both study areas.

When these data are combined (Table 8), a total of 348 tracks of various ages were observed on the seven study Sites during the period November 29 - December 1, 1995 inclusive. Of the 348 tracks observed, 243 (69.8%) were <24 hours old. The predominant species observed over the combined study transects was rabbit (snowshoe hare) with 40.2% (n = 140) followed by decreasing numbers of weasel (19.7%; n = 65), fisher (9.8%; n = 34), fox (8.9%; n = 31), mink (5.2%; n = 18), river otter (2.9%; n = 10), lynx (2.6%; n = 9), wolf (2.6%; n = 9), sharp-tailed grouse (2.2%; n = 8), moose (1.7%; n = 6), deer (1.1%; n = 4), willow ptarmigan (1.1%; n = 4), beaver (0.9%; n = 3), ruffed grouse (0.9%; n = 3), coyote (0.6%; n = 2), marten (0.3%; n = 1), and a mouse or shrew (0.3%; n = 1).

The diversity of species tracks on the ground transects varied from a high of 10 (Table 9) for Site 2 located on the Syncrude Canada Ltd. Aurora Mine local study area down to only 3 species' tracks being observed on Site 3 on the same study area. Site 1 on the Aurora Mine study area had 8 species' tracks observed; Sites 1, 2 and 3 on the Suncor Steepbank Mine study area and Site 4 on the Syncrude Canada Ltd. Aurora Mine local study area each respectively had 7 species' tracks observed. Lynx, coyote, river otter, and mice or shrew tracks were only observed on ground transect sites located on the Suncor Steepbank Mine study area.

Table 10 presents the general habitat types within 30 metres of all observed animal tracks for the combined data from the ground transects conducted on both the Suncor Steepbank Mine study area and the Syncrude Canada Ltd. Aurora Mine local study area. Of the eight habitat type categories, six were sampled in the ground survey transect sites. Only pure coniferous woodland and pure deciduous woodland habitats were not sampled during the ground survey. Wildlife snow tracks observed during the ground survey were found in the largest numbers (61.0%; n = 213) in association with the willow/alder shrubland habitat type with a decreasing number of snow tracks being found in association with deciduous dominated mixed woodland (18.0%; n = 64), sedge meadow/emergents (15.0%; n = 53), coniferous dominated mixed woodland (3.0%; n = 9), spruce/tamarack muskeg (2.0%; n = 6), and on open water or ice covered water (1.0%; n = 3).

An "observed wildlife abundance index" was calculated for each of the seven (7) study Sites on the two study areas and the results are presented in Table 11. Based on these calculations it is clear that the ground transect on Site 2 of the Syncrude Canada Ltd.

Table 8. Summary of Observed Snow Tracks on Seven Ground Transects Located on the Syncrude Canada Ltd. Aurora Mine Local Study Area and the Suncor Steepbank Mine Study Area During the Period November 29-December 01, 1995

Species	Syncrude Aurora Mine Local Study Area								Suncor Steepbank Mine Study Area							
	Site 1		Site 2		Site 3		Site 4		Site 1		Site 2		Site 3		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Beaver	1	3.0	2	1.1	0	0	0	0	0	0	0	0	0	0	3	0.9
Coyote	0	0	0	0	0	0	0	0	0	0	2	4.8	0	0	2	0.6
Fisher	5	15.2	11	6.1	2	33.3	3	10.3	4	17.4	2	4.8	7	20.0	34	9.8
Fox	1	3.0	2	1.1	0	0	3	10.3	5	21.7	15	35.7	5	14.3	31	8.9
Lynx	0	0	0	0	0	0	0	0	6	26.1	0	0	3	8.6	9	2.6
Marten	0	0	0	0	0	0	1	3.5	0	0	0	0	0	0	1	0.3
Mink	2	6.1	0	0	0	0	1	3.5	3	13.0	3	7.1	9	25.7	18	5.2
Muskrat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Otter	0	0	0	0	0	0	0	0	0	0	7	16.7	3	8.6	10	2.9
Rabbit*	3	9.1	130	72.2	2	33.3	5	17.2	0	0	0	0	0	0	140	40.2
Weasel	17	51.5	13	7.2	2	33.3	15	51.7	1	4.4	10	23.8	7	20.0	65	18.7
Wolf	0	0	4	2.2	0	0	0	0	2	8.7	3	7.1	0	0	9	2.6
Wolverine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moose	0	0	6	3.3	0	0	0	0	0	0	0	0	0	0	6	1.7
Deer	3	9.1	1	0.6	0	0	0	0	0	0	0	0	0	0	4	1.1
Caribou	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White-tailed Deer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mule Deer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ruffed Grouse	0	0	0	0	0	0	1	3.5	2	8.7	0	0	0	0	3	0.9
Spruce Grouse	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ptarmigan	0	0	4	2.2	0	0	0	0	0	0	0	0	0	0	4	1.1
Sharp-tail Grouse	1	3.0	7	4.0	0	0	0	0	0	0	0	0	0	0	8	2.2
Mice/Shrews	0	0	0	0	0	0	0	0	0	0	0	0	1	2.8	1	0.3
Total	33	100.0	180	100.0	6	100.0	29	100.0	23	100.0	42	100.0	35	100.0	348	100.0
Tracks <24 hrs.**	21	63.6	170	94.4	0	0	15	51.7	2	8.7	15	35.7	20	57.1	243	69.8

* Snowshoe Hare

** Number and percentage of snow tracks less than 24 hours old

Table 9.

Diversity of Species Observed from Snow Tracks On Each Ground Transect Conducted on the Syncrude Canada Ltd. Aurora Mine Local Study Area and the Suncor Steepbank Mine Study Area During the Period November 29-December 01, 1995

Study Site	Species	No. of Species
Syncrude		
Site 1	B, F, Fx, Mi, R, We, D, StG	8
Site 2	B, F, Fx, R, We, W, M*, D, Pt, StG	10
Site 3	F, R, We	3
Site 4	F, Fx, M, Mi, R, We, RG	7
Suncor		
Site 1	F, Fx, L, Mi, We, W, RG	7
Site 2	C, F, Fx, Mi, Ot, We, W	7
Site 3	F, Fx, L, Mi, Ot, We, M/S	7

Species Key:

Species Abbreviations:

Fur:

B - Beaver
C - Coyote
F - Fisher
Fx - Fox (all colors)
L - Lynx
Mi - Mink
M - Marten
Mu - Muskrat
Ot - Otter
R - Rabbit (Snowshoe hare)
We - Weasel
W - Wolf
Wlv - Wolverine

Big Game:

M* - Moose
D - Deer
C* - Caribou
WD - Whitetail Deer
MD - Mule Deer

Birds:

RG - Ruffed Grouse
SG - Spruce Grouse
Pt - Ptarmigan (willow)
StG - Sharptailed Grouse

Other:

M/S - Mice or shrews (species unknown)

Table 10.

General Habitat Type Associated with Observed Wildlife Tracks in Snow
on Ground Transects Located on the Syncrude Canada Ltd. Aurora Mine Local Study Area
and the Suncor Steepbank Mine Study Area During the Period November 29-December 01, 1995

Ground Transect	Habitat Types																
	CW		CDMW		DDMW		DW		S/T		W/A		SM/E		OW		Total
Syncrude	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Site 1	0	0	0	0	0	0	0	0	0	0	25	76.0	8	24.0	0	0	
Site 2	0	0	0	0	0	0	0	0	0	0	180	100.0	0	0	0	0	
Site 3	0	0	0	0	0	0	0	0	6	100.0	0	0	0	0	0	0	
Site 4	0	0	0	0	19	66.0	0	0	0	0	0	0	7	24.0	3	10.0	
Suncor																	
Site 1	0	0	8	34.8	10	43.5	0	0	0	0	5	21.7	0	0	0	0	
Site 2	0	0	1	2.4	0	0	0	0	0	0	3	7.1	38	90.5	0	0	
Site 3	0	0	0	0	35	100.0	0	0	0	0	0	0	0	0	0	0	
Total No.	0	0	9	3.0	64	18.0	0	0	6	2.0	213	61.0	53	15.0	3	1.0	348

* Habitat Types:

CW - Coniferous Woodland
CDMW - Coniferous Dominated Mixed Woodland
DDMW - Deciduous Dominated Mixed Woodland
DW - Deciduous Woodland
S/T - Spruce/Tamarack Muskeg
W/A - Willow/Alder Shrubland
SM/E - Sedge Meadow/Emergents
OW - Open Water (or ice-covered water)

Table 11.

Observed Wildlife Abundance Indices for Ground Transects on the Syncrude Canada Ltd. Aurora Mine Local Study Area and the Suncor Steepbank Mine Study Area Based on Observations Obtained During the Period November 29-December 01, 1995

Ground Transect	Total No. of Snow Tracks Observed	**Divided by**	Length of Ground Transect	**Equals**	Observed Wildlife Abundance Index
Syncrude					
Site 1	33	÷	500 metres	=	0.066
Site 2	180	÷	500 metres	=	0.360
Site 3	6	÷	500 metres	=	0.012
Site 4	29	÷	500 metres	=	0.058
Suncor					
Site 1	23	÷	500 metres	=	0.046
Site 2	42	÷	500 meters	=	0.084
Site 3	35	÷	500 meters	=	0.070

$\bar{x}$ = 0.10 *
$\bar{x}$ = 0.06 **

* Includes Site 2 on Syncrude Canada Ltd. Aurora Mine Local Study Area
** Excludes Site 2 on Syncrude Canada Ltd. Aurora Mine Local Study Area

Aurora Mine local study area had the highest index value of 0.360 with the remainder of the sites on both study areas having decreasing indices down to the lowest which was recorded from the ground transect on Site 3 of the Syncrude Canada Ltd. Aurora Mine local study area where an index of 0.012 occurred. These results indicate that Site 2, which was the ground transect located on the old ALSANDS project site within the Syncrude Canada Ltd. Aurora Mine local study area, had a level of wildlife activity 4.3 times that of Site 2 on the Suncor Steepbank Mine study area, 5.1 times that of Site 3 on the Suncor study area, 5.5 times that of Site 1 on the Syncrude study area, 6.2 times that of Site 4 on the Syncrude study area, 7.8 times that of Site 1 on the Suncor study area, and 30 times that found on Site 3 of the Syncrude study area.

4.0 DISCUSSION

Based on the aerial survey, the observed densities of beaver on the study area (0.24 active lodges and food caches/km^2) are within the range of those found in other studies that have taken place in northern Alberta (Table 12).

The primary habitat requirements of beaver include a reliable source of water for year-round occupation in close proximity to a supply of food and building materials preferably in the form of deciduous woods or shrublands (Slough and Sadleir 1977; Todd 1978). Observations obtained in this study show that active lodges and food caches were mainly associated with stream courses and, to a lesser degree, with ponds or small lakes on the study area. Those active sites associated with stream courses were mainly associated with willow/alder shrubland and coniferous dominant mixed woodland within a 30 metre radius of the sites. Within a 200 metre radius of the active sites on stream courses, three habitat types: coniferous dominant mixed woodland; willow/alder shrubland; and spruce/tamarack muskeg, were of comparable ranking.

The results obtained from this study are generally consistent with the results of other studies conducted in northern Alberta. Novakowski (1967), Searing (1979a and 1979b), Green (1983), Skinner (1984), and Salter and Duncan (1986) found that active beaver colonies were associated with habitats dominated by willow, aspen, balsam poplar, paper birch or other deciduous vegetation. Coniferous plant species appear not to be preferred by beaver for either food or construction material (Novakowski 1967; Skinner 1984). In this study, no active beaver sites were observed in association with pure stands of coniferous woodland habitat. Willow shrubland has been identified as the most stable habitat type preferred by beaver due to the fact that this vegetative community is considered to be climax in riparian ecosystems and it is quick to regenerate following browsing (Slough and Sadleir 1977).

In addition to the preceding, all of the active sites associated with stream courses were found in the upper tributary drainages of the major rivers and creeks of the study area. No active beaver sites were located in the lower reaches of the major drainages on the study area characterized by steep gradients and with the water courses at the bottom of steep defiles. Retzer et al. (1956) reported that 96.0% of all active beaver colonies recorded in Colorado were in valleys with stream gradients less than 12%, and no active beaver colonies were found in streams, or portions of streams, having a gradient of 15% or more. Observations in this study support Retzer's findings although no quantitative measurements of stream gradient were made.

Those active sites found in conjunction with small lakes or ponds were predominantly associated with willow/alder shrubland and, to a lesser degree, with coniferous dominated mixed woodland within a 30 metre and 200 metre radius of these sites.

Table 12.

Comparison of Active Beaver Lodge and Food Cache Densities on the Suncor Steepbank Mine Study Area With Other Areas of Northern Alberta

Year	Location	Density	Reference
1964	Wood Buffalo National Park	0.43 active lodges per km of stream	Novakowski, 1967
1975	Syncrude Project Area	0.38 food caches per km^2	Penner, 1976
1978	AOSERP Study Area	0.32 active lodges per km of stream 0.14 active lodges per km lakeshore	Searing, 1979(a)
1978	AOSERP Study Area	0.40 active lodges per km of stream	Gilbert, 1978
1978	Syncrude Project Area	0.32 food caches per km^2 0.26 active lodges per km^2	Westworth, 1978
1978	Cold Lake	0.93 active lodges per km of stream 0.40 active lodges per km of lakeshore	Searing, 1979(b)
1979	Syncrude Project Area	0.29 food caches per km^2 0.23 active lodges per km^2	Westworth, 1979
1981	Syncrude Project Area	0.39 food caches per km^2	Pauls, 1982
1982	Elk Island National Park	0.94 food caches per km^2	Skinner, 1984
1983	Syncrude Project Area	0.34 food caches per km^2	Murray & Pauls, 1983
1984	Syncrude Project Area	0.43 food caches per km^2	Pauls, 1984
1995	this study	0.24 active lodges and food caches per km^2	Surrendi, 1995 (CIRC)

Of the total number of inactive lodges observed (n=37), most (n=33) were found on stream courses. Most of the inactive sites located on the study area were found mainly within 30 metres and 200 metres of willow/alder shrubland and, to a lesser degree, coniferous dominated mixed woodland.

It is acknowledged that further refinements are needed in the methodology of using traditional ecological knowledge in conjunction with ground surveys of animal tracks and other signs in snow conditions as a tool in the determination of wildlife populations. That said, however, the information obtained in this study from the ground surveys combined with the traditional ecological knowledge of the two experienced trappers is considered of significant importance in providing useful information on the current relative status of wildlife populations associated with riparian habitats on the study area, particularly when the data that was obtained is viewed in conjunction with the observations from the aerial survey as well as other studies of this region.

In addition to active beaver lodges and food caches documented in the aerial survey, data obtained from the ground survey transects conducted on both the Suncor Steepbank Mine study area and the Syncrude Canada Ltd. Aurora Mine local study area provide evidence of an additional 15 species of wildlife associated with riparian habitats. These other wildlife species included fisher, fox, weasel, mink, "rabbit" (snowshoe hare), wolf, coyote, lynx, river otter, mice or shrews, moose, deer (species unknown), ptarmigan, sharp-tailed grouse, and ruffed grouse.

Of particular significance was the absence of any sign of muskrat on both the Suncor Steepbank Mine study area and the Syncrude Canada Ltd. Aurora Mine local study area, even though each study area had at least one ground survey transect site on lakes having substantial emergent vegetation and some history of muskrat activity according to the trappers involved in the ground survey. No muskrat houses or pushups were observed on any of the seven ground transect sites.

When the habitat association data are pooled for both the Aurora and Steepbank study areas (Table 10), the willow/alder shrubland complex is prominent with 61.0 % (n = 213) of the observed tracks being located in association with this habitat type. This emphasis on the willow/alder shrubland habitat stems, in part, from the significant showing of this habitat type in Site 2 of the Syncrude Canada Ltd. Aurora Mine local study area. On this Site, all of the animal tracks (100.0%; n = 180) were found in this habitat type. The fact that the Syncrude Canada Ltd. Aurora Mine local study area excluded the Muskeg River while the Suncor Steepbank Mine study area included two ground survey transects within riverine environments on the Steepbank River and Legget Creek, probably accounts for the more diversified habitat encountered in association with tracks from the Suncor Steepbank Mine study area. Another factor that should be born in mind between the two study areas is the fact that the Steepbank study area has no comparable environmental

alteration equivalent to the ALSANDS project site located on the Syncrude Canada Ltd. Aurora Mine local study area.

Of particular significance in the findings of this study was the importance to wildlife of the human altered habitat on the old ALSANDS project site. This site covering 14.05 km^2 was cleared of vegetation in 1980 and drained with artificial channels in 1981 in preparation for test mining operations. This site was not altered with wildlife benefits in mind nor was the site reclaimed other than by natural means. Yet, from the data obtained through both the ground survey transect on this site and aerial surveys on the study area, the willow/alder shrubland complex that has revegetated this area supports an abundance and diversity of wildlife unmatched by any of the other habitat types examined in this study either on the remainder of the Syncrude Canada Ltd. Aurora Mine local study area or on the Suncor Steepbank Mine study area.

Serious consideration should be given to a more detailed examination of the ecological response to the previous channelization and deforestation activities on the old ALSANDS site in order to develop further insight into future reclamation alternatives for mined areas in this region. Any future detailed examination of the ALSANDS site should be approached through the integration of traditional ecological knowledge and conventional scientific methodology.

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