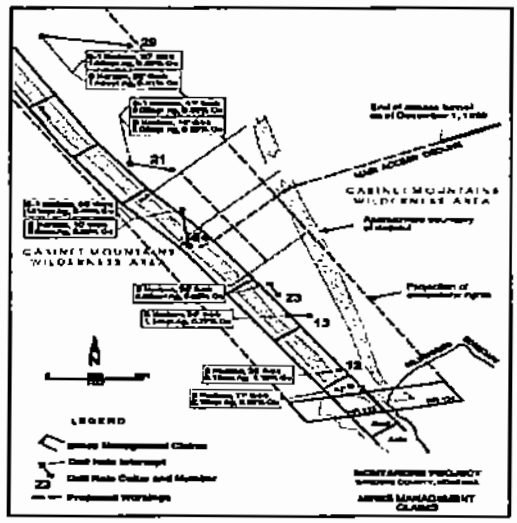
MONTANORE PROJECT

AMENDED APPLICATION

HARD ROCK OPERATING PERMIT

AMENDED PLAN OF OPERATIONS



Appendix C

Wildlife

December 2004

Mines Management, Inc.

WILDLIFE

Wildlife Baseline Report

Montana Project

Lincoln & Sanders Counties, Montana

prepared for:

Noranda Minerals Corp.

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May 1989

WILDLIFE BASELINE REPORT FOR THE MONTANA PROJECT, LINCOLN AND SANDERS COUNTIES, MONTANA

Prepared for:

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May 1989

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SUMMARY

INTRODUCTION

A four-season wildlife baseline study was conducted during 108 field days between May 3, 1988, and April 21, 1989, to meet permitting requirements associated with the Montana Project (MP) proposal in the Cabinet Mountains. The wildlife study plan was reviewed by personnel representing U.S. Forest Service (USFS), Montana Department of State Lands, Montana Department of Fish, Wildlife, and Parks (MDFWP), and the proponent. The finalized study plan, which incorporated reviewers' suggestions, was then endorsed by the Kootenai National Forest.

Major objectives of the MP baseline study were to:

(1) develop a list of wildlife species observed and which potentially occur in the proposed project area;

(2) evaluate the types, distribution, and relative importance of local habitats to various wildlife taxa;

(3) assess the seasonal distribution of important wildlife species (e.g., elk, grizzly bears, eagles, etc.) on and adjacent to the project area;

(4) estimate relative numbers of important wildlife species on and adjacent to the project area; and

(5) document the occurrence of state and federal threatened, endangered, and candidate species and habitat suitability for such species in the project area.

STUDY AREA

The MP wildlife study area is located in northwest Montana, south-southwest of Libby and northeast of Noxon in the Kootenai National Forest. The majority of the study area lies on the east side of the Cabinet Mountains, on the southwest edge of Lincoln County. The Rock Creek portion of the study area, west of the divide, is in the northern tip of Sanders County.

The Cabinet Mountains, straddled by the study area, are characterized by high glaciated peaks along a north-northwest/south-southeast divide, a series of parallel sharp

spur ridges running northeast off the main divide, and topography shaped by glaciation and fluvial processes. Study area elevations range from 3040 ft. along Libby Creek to 7938 ft. at Elephant Peak.

When the wildlife study plan was developed, the proponent was evaluating facilities siting in three alternative areas adjacent to the ore deposit: upper East Fork of Rock Creek, Libby Creek, and Ramsey Creek. Impact assessment required that wildlife data be collected in each of these areas, in adjacent areas where ancillary facilities would be located, and in a surrounding area of potential influence.

The 49.2 square mile MP wildlife study area was stratified into intensive and extensive study areas based on proximity to potential impact areas, the relative distance that different wildlife taxa react to impacts, and the intensity of data required for impact analyses. An intensive study area (potential impact area) (30.8 square miles) encompassed all project-related facilities and activities associated with the development alternatives including mine facilities, mill, tailings disposal areas, road, pipeline and power transmission line corridors, and other ancillary facilities. This intensive study area extended beyond actual disturbance sites to topographic barriers which would contain the obtrusive visual and acoustic impacts emanating from project-related operations. Specific field surveys were conducted in this area because of the relative magnitude of potential impacts. Breeding birds and small mammals were sampled in a 12.1 square mile subset of the intensive study area which included all potential disturbance areas and a 0.25 mile buffer zone. The size and location of this bird and small mammal study area was designed to detect impacts on these communities with the potential development areas. Additionally, occupied habitats beyond this zone were similar enough to those in the sample area to allow valid data extrapolation, if desired. The experimental design of the bird and small mammal study incorporated spatial and temporal controls so that the influence of any combination of development alternatives on these wildlife communities could be assessed by comparison with similar post-development data.

An extensive study area (18.4 square mile buffer) surrounded the intensive development area. Wildlife surveys conducted in this zone were intensive and oriented towards identifying the ecologic setting in which the proposed project area was located. Potential wildlife impacts resulting from the proposed development could not be adequately assessed unless

the relative importance of project area habitats could be placed in perspective with seasonal wildlife use, and importance of, surrounding habitats. The size of the extensive study area varied between wildlife groups, depending on the type and magnitude of anticipated impact and the extent of seasonal wildlife movements.

RESULTS AND DISCUSSION

Habitats

Wildlife habitats in the MP wildlife study area, divided into three sub-study areas, were mapped by existing habitat components (USFS et al. 1988) functional to the entire wildlife community. The study area contained ten terrestrial and one aquatic habitat types. Distribution of these types varied throughout the three sub-study areas in relation to elevation, aspect, slope, substrate, and forest management practices. Forest types dominate the study area except for exposed bedrock areas high along the main divide and its spur ridges and lower elevation clearcuts. In the entire study area (31,481 acres) the mixed conifer type dominates (9,819 acres), followed by spruce-fir (6,469 acres), rock (4,362 acres), shrubfield (4,285 acres), clearcuts (3,256 acres), grassland (1,365 acres), western hemlock (725 acres), riparian (711 acres), lodgepole pine (232 acres), forbfield (152 acres), and aquatic (105 acres).

Species of Special Concern

Forty-three wildlife species identified through federal, state, forest, and/or Montana Natural Heritage Program sources as potentially present in the MP study area have been evaluated as species of special concern to the project. Two federally listed threatened or endangered species, the grizzly bear and bald eagle, are present on or near the MP study area or its transmission line corridors. One federal candidate species, the wolverine, is also present on the study area. Canada lynx, another federal candidate species, has recently been detected on the study area, although not during the present study.

A low number of grizzly bears exist as a stagnant/declining population in the Cabinet Mountains. Results of an ongoing MDFWP study, which began in 1983, indicate that the seasonal ranges of a few grizzlies overlap the MP study area and that the Rock, Libby, and Ramsey Creek drainages are specifically used by these bears. The MP project area is located within the Cabinet-Yaak Grizzly Bear Ecosystem, one of three

ecosystems selected as priorities for grizzly bear recovery after the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1982). Two subadult female grizzlies are scheduled for release into the East Cabinet Mountains in fall 1989 to initiate augmentation of the population (U.S. Fish and Wildlife Service 1987, W. Kasworm, MDFWP, pers. comm.).

While Libby, Ramsey, and the upper elevations in the East Fork of Rock Creek are all important fall bear feeding areas, because of preferred berry concentrations, the east side of the divide, specifically Libby Creek also provides important spring grizzly habitat. In this respect Libby Creek provides better spring habitat than Ramsey Creek because of its larger area, greater number of avalanche chutes supporting feeding areas, its graminoid-sidehill parks, and its riparian areas, which in June support cow parsnip and other succulent forbs (W. Kasworm, MDFWP, pers. comm.).

Bald eagles are non-breeding winter visitors or winter residents on the west side of the Cabinet Mountains, in the vicinity of Rock Creek. They have never been observed in Rock Creek Meadows and it is unlikely that this area is used by them, especially during winter. However, bald eagles are breeders, residents, transients, and winter residents on the east side of the Cabinets and their breeding and wintering numbers are increasing. Although most eagle use occurs along the Kootenai River in winter, they have been observed as far up Libby Creek as the lower bridge during fall whitefish runs and they may use the creek during fall until it freezes. Bald eagles do not inhabit the potential facility or tailings areas, but are present in several transmission line corridors, particularly the lower portion of the Libby-Plant Site corridor where it crosses the Kootenai River.

Six additional federally listed species occur (wolverine, Canada lynx) or have historically occurred (northern Rocky Mountain wolf, woodland caribou, peregrine falcon, Coeur d'Alene salamander) on or near the MP study area. Potential salamander habitat exists along access roads to potential Libby or Ramsey plant sites; however, salamander presence could not be identified in the scope of the present study.

Big Game

Eight big game species, including black and grizzly bears, mountain lion, and five ungulates, inhabit the MP study area. Black bears are abundant and their seasonal use of

the area is oriented toward low elevation, herbaceous meadows in spring and toward summer/fall berry concentrations. Grizzly bears have similar habitat use patterns, but are rare and not legally hunted in the Cabinet Mountains. Both bear species have been the subject of numerous studies in the Cabinets. Mountain lions are also present in the Cabinet Mountains and their numbers are relatively high.

Five species of ungulates utilize habitats in the study area. As in most other mountainous areas of Montana, white-tailed deer are most common in lower elevations of the study area within approximately one-half to one mile of stream bottoms; however, during summer and early fall they often extend their ranges to mid- and upper elevations as well. Mule deer also occur along bottomlands and extend their summer distribution into the alpine. Elk display a spotty distribution in the study area; however, because of their greater intolerance of human activity they are relatively uncommon at lower elevations and occur in less accessible and/or less frequented areas. Like whitetails, moose are most common at lower elevations along streambottoms and around ponds and marshes; however, they too extend their summer and fall distributions to the upper limits of tree-line. Mountain goats summer on alpine and subalpine cliffs and ridges, and most migrate to slightly lower elevations in the winter. They occur primarily along the main divide and out to the tips of the eastern spur ridges. With the exception of mountain goats, most individuals of the other ungulate species summering in the MP study area, migrate to winter ranges out of the study area during "normal" winters. Caribou do not inhabit the Cabinet Mountains and mountain sheep occur further north in the range.

Breeding Birds

Breeding birds were sampled with replication on 4.94 acre plots stratified by major habitat type in June, during the peak of the 1988 breeding season. A total of 1,711 birds, representing 92 breeding species was observed during plot counts. The greatest number of breeding species occurred in riparian habitats (63), followed by spruce-fir habitats (58), shrubfields (57), mixed conifer stands (50), clearcuts (48), and western hemlock stands (37). Breeding species observed on potential impact areas appeared to be representative of the area's avifauna. Only nine additional breeding species were observed in the rest of the MP study area.

Avian species richness differed significantly between and within major habitat types. However, test results also indicated that only the riparian and clearcut bird diversities differed significantly from each other; all other bird richness comparisons between habitats were statistically similar. This appeared to be due to a high degree of variability within habitats and a high degree of similarity between types.

Density of breeding birds did not differ significantly between habitats, but did significantly differ between plots. This former result suggests that the habitat productivity of the six habitats was so similar that it supported numerically similar bird communities.

Small Mammals

Small mammals were trapped in potential development area habitats, on a proportional allocation basis, to document species occurrence and relative abundance. Eleven species of small mammals were captured in the 2,383 available traps established throughout six habitat types between August 17-24. The most species (8) were captured in mixed conifer habitats, followed by spruce-fir (7), riparian and shrubland (6), and hemlock and clearcut (5) habitats. However, there was no statistical difference in species richness between habitat types, in part due to the large variation in richness between individual plots composing each habitat type.

The most individual small mammals of all species were captured in shrubfields (62), followed by spruce-fir (53), mixed conifer (51), clearcut (50), riparian (29), and hemlock (26) habitats, although these relationships were somewhat confused by the number of traps available. Test results indicated that there was no difference in mammal abundance between the six habitats, also due to the wide variation in trap success between plots composing habitats. These results statistically indicate that the six habitats supported numerically similar small mammal communities. Deer mice were the most common small mammal captured in the study area and represented 66% of all mammals captured.

Raptors

Twelve species of raptors were observed in the baseline study area during the study. Eight species, including the sharp-shinned hawk, northern goshawk, red-tailed hawk, American kestrel, great horned owl, barred owl, northern

pygmy owl, and common raven nested, or probably nest, on the MP study area.

Waterfowl and Shorebirds

Habitat for waterfowl and shorebirds is available, but extremely limited in area on the MP study area. On the intensive study area, the best habitats included Rock Creek Meadows, the fen along Libby Creek below its confluence with Howard Creek, and the small pond on the west side of the Little Cherry Creek Loop Road. While some production occurred at all these sites in 1988, it was low. Only two mallard broods and one spotted sandpiper brood were noted in these areas.

Upland Game Birds

Two species of upland game birds were recorded on the study area. Ruffed grouse were common to abundant in riparian habitats, but were detected in all six major types except clearcuts. Blue grouse were common in spruce-fir stands on top of the eastern spur ridges.

Predators

The study area contains an excellent diversity and number of predators. Predators, such as coyotes, bobcats, mountain lions, martens, and wolverine were quantified in the intensive study area via winter track counts.

Herpetofauna

Three reptiles and four amphibians have been recorded in the study area. The only species of any concern is the tailed frog, a state species of special concern that is considered rare and threatened in the state. The frog was noted in five study area streams and was considered locally absent to abundant in the study area. As previously noted, Coeur d'Alene salamanders, a federal candidate species, have historically occurred adjacent to the study area and suitable habitat appears to exist along access roads.

SECTION 1.0

INTRODUCTION

1.0 INTRODUCTION AND PROJECT DESCRIPTION

1.1 INTRODUCTION

The Montana Project (MP) is the proposed development of a silver-copper deposit in the Cabinet Mountains, southwest of Libby and east of Noxon, Montana. Development will consist of mine portals, a processing plant, tailings pond, power transmission line, access roads, and ancillary facilities. At present, three potential plant sites, two tailings sites, and five transmission line corridors are being evaluated.

The ore deposit is located below the Cabinet Mountains Wilderness, managed by the U.S. Forest Service (USFS). Mineral resource development will require the preparation of an Environmental Impact Statement (EIS). In April 1988 Western Resource Development Corporation (WRD) was hired to conduct the environmental baseline studies, including wildlife, fisheries, and aquatic biology, to be used for the EIS analyses.

A draft wildlife study plan was prepared based on:

(1) the Montana Metal Mine Reclamation Act (MMMRA), the Montana Environmental Policy Act (MEPA), the National Environmental Policy Act (NEPA), and guidelines to these Acts;
(2) wildlife guidelines recommended by the Montana Department of State Lands (MDSL) for similar mining projects;
(3) a preliminary review of pertinent, existing resource inventory data for the project area;
(4) accepted baseline study plans for a similar, adjacent underground mine proposed for the area;
(5) an October 1987 site visit with the proponent; and
(6) discussions with state and federal resource and regulatory agency personnel.

This study plan was then reviewed and revised several times by personnel representing the USFS, MDSL, and Montana Department of Fish, Wildlife, and Parks (MDFWP). The finalized wildlife study plan, endorsed by the Kootenai National Forest, was then implemented in 1988/89. This report presents preliminary results of the baseline terrestrial wildlife investigations which will be used for subsequent impact assessment, alternatives analysis, and development of mitigation measures that are part of the EIS process.

Major objectives of the MP baseline study were to:

(1) develop a list of wildlife species observed and which potentially occur in the proposed project area;
(2) evaluate the types, distribution, and relative importance of local habitats to various wildlife taxa;
(3) assess the seasonal distribution of important wildlife species (e.g., elk, grizzly bears, eagles, etc.) on and adjacent to the project area;
(4) estimate relative numbers of important wildlife species on and adjacent to the project area; and
(5) document the occurrence of state and federal threatened, endangered, and candidate species and habitat suitability for such species in the project area. The study will also consider animal species of special concern for Montana and Kootenai National Forest sensitive species.

The finalized (August 15, 1988) wildlife study plan is contained in Appendix 6.1.

1.2 PROJECT DESCRIPTION

This baseline study was initiated by U.S. Borax as part of the licensing requirements for the development and mining of a silver/copper deposit located underneath the Cabinet Mountain Wilderness Area in the Kootenai National Forest, Sanders and Lincoln counties, Montana (see Figure 2.1.1). Whereas the State of Montana, Department of State Lands, and the Kootenai National Forest have primary responsibility for permitting these activities, the two agencies and U.S. Borax developed a Plan of Study that defined the nature and extent of the baseline work. This work was initiated in the spring of 1988 and has been conducted in accordance with the terms of the Plan of Study.

A number of alternative sites were identified for portals, processing plant, tailings disposal and ancillary facilities. The area encompassing and adjacent to these sites then became the focus of the baseline work.

In September 1988 Noranda Minerals Corp. and Montana Reserves formed a venture and purchased the silver/copper deposit from U.S. Borax and continued with project development under the "Montana Project" name. Noranda Minerals Corporation (Noranda) was designated the project manager.

Noranda continued to build from the data and information that had been generated by U.S. Borax and after reviewing the many alternative sites developed the proposed

mining program detailed in the Application for a Hard Rock Operating Permit from the Montana Department of State Lands. The application also serves as a proposed Plan of Operation to the Kootenai National Forest. Basically, the application describes a 20,000 ton per day operation accessed from two (twin) portals in Ramsey Creek, a mill site located adjacent to the Ramsey portals, a portal in Libby Creek, two portals in the Rock Creek drainage for ventilation and emergency access, and a tailing impoundment in the Little Cherry Creek drainage. Access to the Ramsey Creek mine site would be over the existing Bear Creek Road. A new transmission line from Pleasant Valley to the mine site would provide electrical energy for the operation. The total labor force is expected to number approximately 400 people. These positions would be filled by hiring locally as much as possible.

SECTION 2.0

STUDY AREA

2.0 STUDY AREA

2.1 LOCATION

The MP wildlife study area is located in northwest Montana, south-southwest of Libby and northeast of Noxon in the Kootenai National Forest (Figure 2.1.1). The majority of the study area lies on the east side of the Cabinet Mountains, on the southwest edge of Lincoln County. The Rock Creek portion of the study area, west of the divide, is in the northern tip of Sanders County. The entire study area is contained within the approximately 3000 square mile Libby latilong block (block 1), the area between 115-116° W longitude and 48-49° N latitude.

The Cabinet Mountains, straddled by the study area, are characterized by high glaciated peaks along a north-northwest/south-southeast divide, a series of parallel sharp spur ridges running northeast off the main divide, and topography shaped by glaciation and fluvial processes. Study area elevations range from 3040 ft. along Libby Creek to 7938 ft. at Elephant Peak.

2.2 BOUNDARIES AND FACILITY SITES

When the wildlife study plan was developed, the proponent was evaluating facilities siting in three areas adjacent to the ore deposit: upper East Fork of Rock Creek, Libby Creek, and Ramsey Creek (Figure 2.2.1). Impact assessment required that wildlife data be collected in each of these areas, in adjacent areas where ancillary facilities will be located, and in a surrounding area of potential influence. Study area boundaries were delineated with input from the USFS and MDFWP.

Libby Creek on the east side of the Cabinet Mountains has two alternative plant sites named Libby Creek and Upper Libby Creek. The Libby Creek alternative site is at an elevation of 4,200 feet and the Upper Libby Creek site is at an elevation of 4,400 feet. The Upper Libby Creek Valley, which trends northeast, is generally less than 500 feet wide and has steep slopes which rise to surrounding peaks in excess of 7,000 feet. Avalanche chutes are common in the drainage and several extend across the valley bottom. The Libby Creek site is approximately 96 acres in size while the Upper Libby Creek site, which has two small ponds, is about 51 acres.

The 54 acre Ramsey Creek alternative plant site is located in Ramsey Creek, the drainage north of Libby Creek. The elevation of the plant site is about 4,400 feet. Like

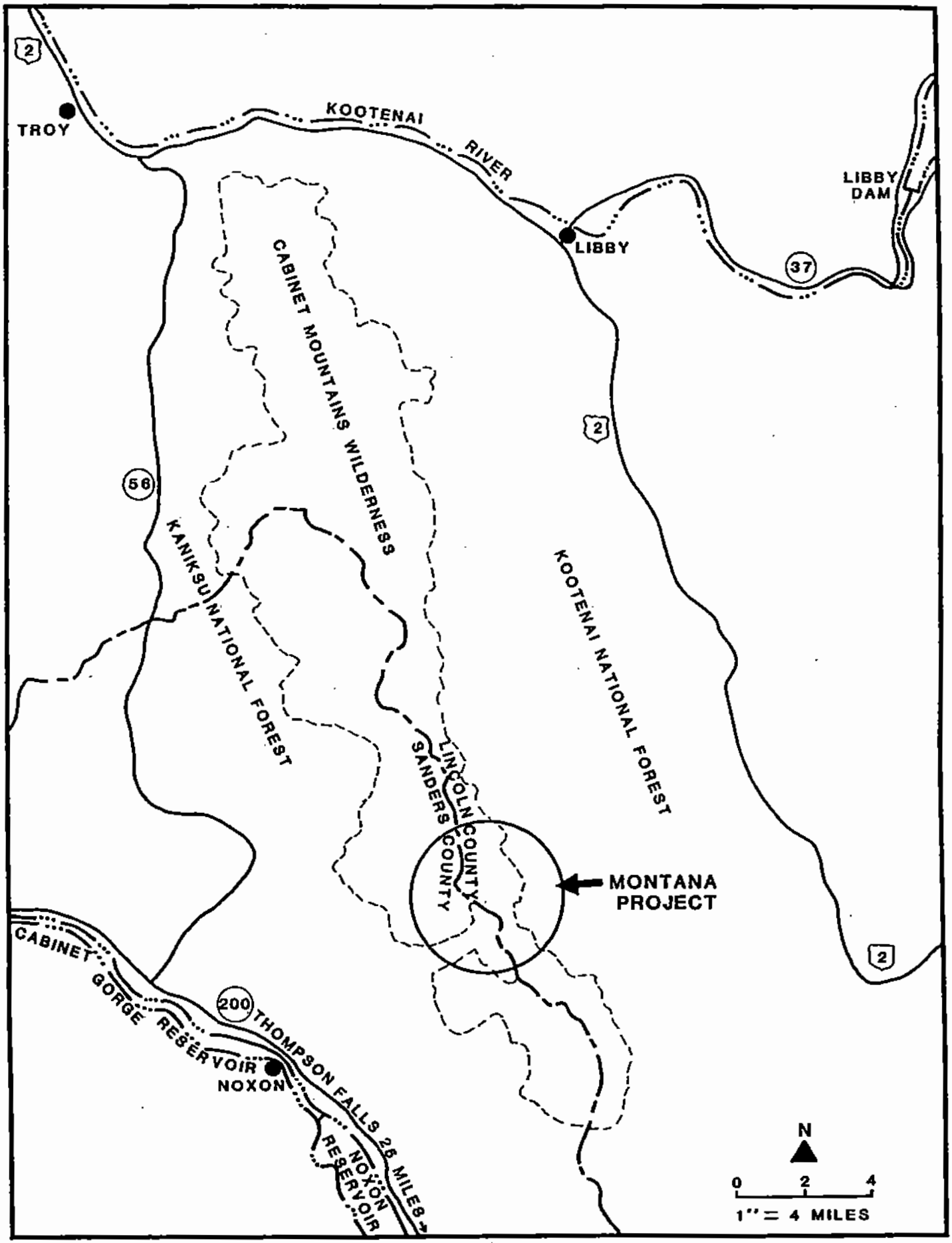


FIGURE 2.1.1. PROJECT LOCATION

NORANDA MINERALS CORP.

LINCOLN & SANDERS COUNTIES, MONTANA

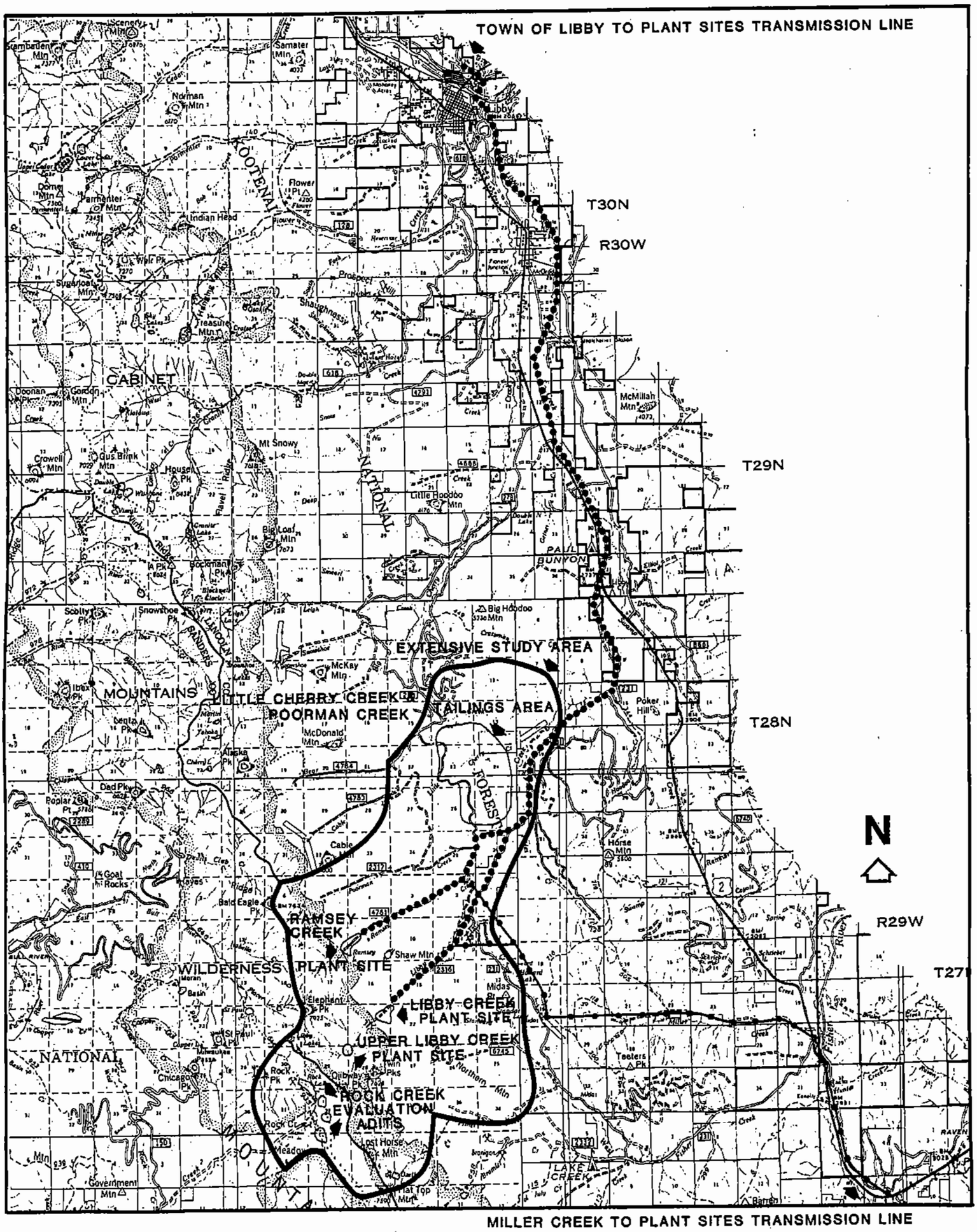


FIGURE 2.2.1
PROJECT ALTERNATIVES LOCATION MAP

NORANDA MINERALS CORP.
MONTANA PROJECT
Lincoln & Sanders Counties, Montana
JAN. 1989 SCALE 1"= 2 MILES

the Upper Libby Creek Valley, the Ramsey Creek Valley is narrow, surrounded by steep slopes, and trends northeast.

The Little Cherry and Poorman Creek tailings areas are located about three and one-half miles northeast of the Libby and Ramsey Creek plant sites. The area in which these sites are located ranges in elevation from 3,400 to 3,800 feet. Little Cherry Creek bisects the northern portion of this area and Poorman Creek is adjacent to the south. The entire site contains numerous small ridges, intermittent drainages, and drains to the northeast. Past continental glacial activity has created a hummocky, poorly drained topography in some areas. A utility corridor will connect the preferred plant site with the preferred tailings alternative.

The town of Libby to plant sites transmission line is about 22 miles in length, considering the terminus at either Libby or Ramsey Creek plant site. The line begins at the Pacific Power and Light substation north of the town of Libby and proceeds south, crossing the Kootenai River, and follows private roads which parallel Libby Creek. Approximately 13 miles south of town the transmission line crosses U.S. Highway 2 and follows the Libby Creek Road to a point just south of the tailings sites. From this point one alternative proceeds up Libby Creek to a plant site and another up Ramsey Creek to a plant site.

The Miller Creek to plant sites transmission line begins at the Bonneville Power Authority transmission line which crosses U.S. Highway 2 southeast of the study area near Pleasant Valley. This transmission line runs north along U.S. Highway 2 for about 4.5 miles to Miller Creek where it turns west and follows the Miller Creek Road. When the road ends, the transmission line continues west crossing a 4,600 foot mountain and then heads northwest past Howard Lake. Alternative branches then proceed up Libby and Ramsey creeks. This line is about 18 miles in length with either the Libby or Ramsey creek alternative.

Three additional transmission line corridor alternatives were added in early April 1989. The Midas Creek route is a variation of the Miller Creek alternative. It leaves the Miller Creek corridor at the mouth of the North Fork of Miller Creek, heads up the North Fork, crosses the top, and runs down Midas Creek to Libby Creek. The West Fisher River route breaks off the Miller Creek corridor just north of Pleasant Valley and follows the Fisher River upstream, eventually connecting with the Miller Creek line near Standard Lake. The Trail Creek alternative leaves the BPA line near the mouth of Iron Meadows Creek, runs up that drainage, down Trail Creek, and connects with the western segment of the West Fisher corridor.

The 49.2 square mile MP wildlife study area was stratified into intensive and extensive study areas (Figure 2.2.2) based on proximity to potential development areas, the relative distance that different wildlife taxa react to impacts, and the intensity of data required for impact analyses. The 30.8 square mile intensive study area encompassed all project-related facilities and activities associated with the development alternatives (including mine facilities, mill, tailings disposal areas, road, pipeline and power transmission line corridors, and other ancillary facilities) and a surrounding buffer zone. The intensive study area's buffer zone extended beyond development areas to topographic barriers which would contain the obtrusive visual and acoustic impacts emanating from project-related operations. Intensive field surveys were conducted in this area because of the relative magnitude of potential impacts. Breeding birds and small mammals were sampled in a 12.1 square mile subset of the intensive study area which included all potential disturbance areas and a 0.25 mile buffer zone. Based on preliminary habitat and physiographic analysis, it was assumed that anticipated impacts to bird and small mammal communities would be nondetectable beyond the buffer zone and occupied habitats beyond this zone were similar enough to those in the sample area to allow valid data extrapolation, if desired.

An extensive study area (18.4 square mile buffer) surrounded the 30.8 square mile intensive impact area. Wildlife surveys conducted in this extensive zone were less intensive and oriented towards identifying the ecologic setting and the relative seasonal wildlife use of habitats surrounding the project area. The size of the extensive study area varied between wildlife groups, depending on the type and magnitude of anticipated impact and the extent of seasonal wildlife movements.

2.3 GEOLOGY

The study area is within the northern Rocky Mountain physiographic province, an area characterized by mountain ranges and intermountain valleys. This area is underlain by Precambrian meta sedimentary rocks of the belt series, clastic rocks generally resistant to weathering (Veseth and Montagne 1980). During the Pleistocene epoch of the Quaternary period continental glaciers covered most of the lower elevations of the Cabinet Mountains and alpine glaciers occurred in the stream valleys. During post-glacial time volcanic ash resulting presumably from the Mount Mazama eruption 6600 years ago covered the landscape (Nimlos 1980). The differential deposition of volcanic ash, combined with redistribution by precipitation, results in soil profiles with variable depths of ash.


LEGEND
Extensive study (49.2 mi^2)
Intensive Study area (30.8mi^2)
Breeding bird and small mammal impact area (12.1 mi^2)
N
NORANDA MINERALS CORP.
Montana Project
Lincoln and Sanders Counties, Montana
Figure 2.2.2
Boundaries of the Montana Project
Wildlife Study Area
JAN. 1989 APPROX. SCALE 1"=4224'
prepared by
Western Resource Development Corporation

2.4 SOILS

The soils of the study area vary in age and degree of development. The young soils associated with recent fluvial and slope processes have little or no development and surface horizons with varying accumulations of organic matter. They may or may not be mantled by ash. These soils generally have a sandy texture, abundant coarse fragments, a pH of 5-6, and are infertile.

Intermediate aged soils have horizons which exhibit alteration of the parent material through soil forming processes. The parent material of these soils has been altered through the accumulation, loss, or translocation of soil constituents and has developed a structure. Weathering of volcanic ash in the surface horizons results in development of these soils. These soils range in age from at least 6600 years (Nimlos 1980) to early Wisconsin. These soils are generally silt loams, infertile, have coarse fragments, and a pH of 5-6.

The tailings area has old soils which are probably related to one of the pre-Wisconsin glacial advances. These soils have thick subsurface horizons with accumulations of silicate clays, and have developed strong structure and distinct horizons and contain coarse fragments with substantial weathering rinds. These infertile soils have a clay to silty clay texture and a pH towards the high end of the 5-6 range.

2.5 CLIMATE

The study area is characterized by a Pacific maritime climate modified by the inland continental location (USFS 1984). The prevailing westerlies carry moist Pacific air masses inland, creating cloudy, warm, wet winters. During summer, dry air masses of the prevailing westerlies create dry and warm days with cool nights. The continental location of the study area results in occasional cold periods in winter and hot intervals in the summer (USFS 1984).

Elevation has a major influence on both temperature and precipitation of the study area. Precipitation at 3,600 feet at the tailings area is approximately 30 inches but may range to 80-90 inches on 7,303 foot Ojibway Peak near Rock Lake (USFS 1984). The majority of the precipitation falls during the November-January period. Most summer precipitation is associated with convectional storms.

The mean annual temperature for Libby is 45°F (USFS 1984). About half the days in July and August have maximum

temperatures of 90°F or warmer. Summer nighttime lows are commonly in the mid 40°F. Temperature inversions are common in this area, which has a growing season of 30-50 days (Montagne et al. 1982). Extremely cold temperatures occur when arctic air masses from Canada move into the region. December and January are the coldest months of the year.

Both temperature and precipitation affect the vegetation pattern. At lower elevations, moisture is the dominant controlling factor influencing the presence of a forest type and at upper elevations temperature is the major factor (Daubenmire 1956).

2.6 VEGETATION

In the late 1970's and early 1980's the U.S. Forest Service mapped forest habitat types in the Kootenai National Forest. This mapping followed the classification of Pfister et al. (1977) as presented in Forest Habitat Types of Montana.

Six climax series with 15 habitat types occur within the extensive study area. Climax series present include:

- Douglas fir (*Pseudotsuga menziesii*)
- Grand fir (*Abies grandis*)
- Western red cedar (*Thuja plicata*)
- Western hemlock (*Tsuga heterophylla*)
- Subalpine fir (*Abies lasiocarpa*)

Each of the climax series are described from publications of Pfister (1974, 1977) and Cooper et al. (1987). See the MP vegetation baseline report (WRDC 1989) for more information.

Fire and logging activities have dramatically affected the presence, distribution, abundance, and dominance of tree species in the study area .

The northern Rocky Mountains is a region of unusually high fire occurrence in forested areas. Fires of varying size and intensity have historically burned the study area, sometimes destroying the entire forest and sometimes only burning the ground litter. These fires have altered the forest environment by fostering the establishment of new seral communities and by selectively eliminating understory species and those trees least adapted to fire. These seral communities are often long-lived as development of the climax community may require upwards to 500 years due to advanced age of climax trees.

Seral trees are generally adapted to fire and disturbances. Western larch, ponderosa pine, and Douglas-fir have fire resistant bark and, along with white pine,

winged/or light seeds for easy travel to disturbed sites. Lodgepole pine has serotinuous cones. Species of *Abies*, *Tsuga*, and *Picea* are likely to be killed by most fires as they have thin bark and are susceptible to rot entering wounds produced by fires.

Timbering practices also result in the creation of seral communities. The logging of small, scattered patches, followed by burning of residual material has created small seral communities of varying ages throughout the study area.

Massive and successive fires often destroy tree seed sources and result in the development of long-persisting shrubland and forb fields. Most shrublands of the study area are due to avalanches and not the past action of fire.

2.7 LAND USE

Major land uses of the study area include timbering, mining, recreation, and agriculture. Timbering began in this region in the late 1800's due to demands created by the railroad and mining industries (USFS 1984). Timbering on the lower elevation of the study area began in the 1960's and continues to present. Mining is also a historic land use. Placer mining for gold occurred in several locations along Libby Creek in the late 1800's and resulted in the development of a few dwellings and ancillary facilities. Silver was mined at the Heidelberg Mine in the Rock Creek drainage in the 1950's. The principal recreation uses of the study area include hunting, fishing, hiking, backpacking, camping, and cross country skiing and snowmobiling in the winter. Livestock grazing is the only agricultural land use. Grazing occurs only at lower elevations and is quite limited.

SECTION 3.0

METHODS

3.0 METHODS

3.1 SPECIES LISTS

Lists of wildlife species which occur or which may occur in the extensive study area were developed from species observed during field surveys and supplemented with habitat-based observations made by local agency biologists, with data from recent, adjacent wildlife studies (e.g., Farmer and Heath 1987), and with general literature sources (U.S. Forest Service 1981, Thompson 1982, Flath 1984, Skaar 1985). See Tables 4.1.1-4.1.4 for scientific names of wildlife mentioned in text. Phylogenetic order and nomenclature follows Stebbins (1985), Hall (1981), and AOU (1983), except for the pygmy shrew which follows Junge and Hoffman (1981).

Wildlife species of special concern were sensitive/ "important" species that occurred or potentially occurred on the MP study area and which could be affected by the proposed development. This group included:

(1) federal threatened, endangered, and candidate species identified by the U.S. Fish and Wildlife Service (FWS);
(2) state threatened and endangered species and species of special concern identified by the Montana Natural Heritage Program (MNHP);
(3) species of high socioeconomic interest identified by the MDFWP; and
(4) Kootenai National Forest sensitive species.

The relative terms pertaining to the abundance of wildlife in the MP study area are used in this report as follows (after Wyoming Game and Fish Department 1977):

Abundant: A species that inhabits much of the preferred habitat within its range; the species or its sign can be seen in numbers on any outing by a skilled observer during the proper season.

Common: A species that inhabits much of the preferred habitat within its range; the species or its sign can usually be seen on any outing during the proper season.

Uncommon: A species that is common only in small areas within its range or a species that is found throughout its range in relatively low densities; usually requires intensive searching to be seen by a skilled observer.

3.2 HABITAT ANALYSIS

Objectives of the habitat analysis were to:

(1) identify habitat types;
(2) identify critical and important habitat types for different wildlife species;
(3) identify the availability of alternative habitats as related to anticipated habitat losses or modifications; and
(4) quantify the distribution of habitat types and their relative importance to different wildlife groups.

"Habitats" and "habitat types" refer to vegetative/physiognomic associations, such as western hemlock, subalpine fir, or shrub land, which are composed of one or more vegetation types and which may be functionally used by wildlife as discrete, homogeneous units.

The Forest Service has mapped land types, habitat types, and habitat components for the entire study area (Madel 1982, USFS 1984, Kasworm 1986, Ottersberg 1988, USFS et al. 1988). This mapping was adequate for the present baseline study and was used for the identification of habitats in the intensive and extensive study areas. Habitats were delineated on 1:24,000 USGS topographic maps.

The habitat component mapping conducted by USFS et al. (1988) for the grizzly bear cumulative effects habitat submodel (Appendix 6.2) was used as the basis for delineating habitats in the MP study area because it was the most detailed mapping of existing habitats available. However, this component mapping focused on units recognized by bears, which do not necessarily extrapolate to the general wildlife community. To develop a habitat map applicable to the entire wildlife community, one or more of the habitat components (USFS et al. 1988, Appendix 6.2) present in the study area were combined into 11 major existing types:

(1) Riparian (R) includes marsh (MA), riparian aspen/cottonwood (WP), riparian streambottom (RB), and wet meadow (WM) components;
(2) Western hemlock/cedar (H) combined all hemlock (WH) stands regardless of successional stage and conifer stocking categories;
(3) Mixed conifer (MC) similarly combined all successional stage and stocking categories;
(4) Clearcut (C) or planning units were all clearcut harvest sites regardless of age and vegetative composition;
(5) Shrubfield (S) contained alder shrubfield/forbfield (AF), buffaloberry shrubfield (FS), chokecherry shrubfield (CS), huckleberry shrubfield (HS), mountain ash shrubfield (NS), serviceberry

shrubfield (SS), mixed shrubfield (HZ), and shrubfield/forbfield (JZ) components;

(6) Spruce-fir (SF) contained all Engelmann spruce and subalpine fir stands regardless of successional stage and stocking categories;

(7) Lodgepole pine (LP) included distinct stands of this type which could be segregated from the MC type;

(8) Grasslands (G) included beargrass sidehill park (XP), although beargrass is a forb, disturbed graminoid (GB), graminoid sidehill park (GP), and natural grassland/dry meadow (GL) components;

(9) Forbfield (F) contained drainage forbfield (DF) and forbfield (F) components;

(10) Rock (RK) was an unaltered category; and

(11) Aquatic (A) represented standing waterbodies.

Where habitat component maps listed a mixture of several components (e.g., HS/XP,SAF1P5b) the dominant structural component was mapped. This mapping was refined in the breeding bird and small mammal impact areas using 1:12,000 color aerial photos, ground truthing, and results of the vegetation study.

Wildlife habitat types in the Libby and Miller Creek alternative transmission line corridors were derived from vegetation types mapped during ground surveys in summer 1988. Habitats were based on major types within 1000' of the corridor's centerline.

Identification of critical and important habitats for different wildlife species was based on observed animal distributions during given time periods, indirect evidence of relative use (e.g., browse utilization, tracks, pellets, etc.), distribution of seasonally important habitats (e.g., low elevation meadows, berry concentrations, etc.), results of quantitative and qualitative surveys, and on habitats of importance as documented by results of local studies (e.g., Farmer and Heath 1987 and Kasworm and Manley 1988) in the scientific literature.

Alternate or adjacent habitat types were qualitatively identified based on results of field investigations only as such habitats may be related to anticipated habitat modifications or losses (e.g., calving habitat, winter range, fall berry concentrations, etc.).

Areas of habitat types within the extensive, intensive, and bird and small mammal study areas were determined by planimetering habitat maps. Relative importance of these habitats to different wildlife groups was based on quantitative and qualitative field survey results and literature review.

3.3 BIG GAME

Big game distribution, relative numbers, and seasonal habitat utilization of the intensive and extensive study areas was evaluated based on results of:

(1) 10 systematic helicopter surveys
(2) vehicle surveys,
(3) ground (pedestrian) surveys, including track counts,
(4) qualitative observations,
(5) literature review, and
(6) discussions with local MDFWP and USFS biologists

"Big game" refers to mule deer, white-tailed deer, elk, moose, mountain goats, bighorn sheep, mountain lion, black bear, and grizzly bear. Caribou are not present in the study area (Flath 1984, Farmer and Heath 1987, Manley 1986).

Ten systematic helicopter surveys were conducted in the intensive and extensive study areas to determine seasonal big game distribution, minimum seasonal numbers, and movement patterns. Flights, in a Soloy-Bell, were conducted on May 20, June 3 and 24, September 9, December 3 and 18, 1988, and January 28, February 26, and April 7 and 20, 1989. An A-Star was used to complete the April 20 flight after the Soloy developed mechanical problems. Twelve helicopter surveys were originally scheduled; however, because of unsuitable survey conditions, typical of the Cabinets in winter, one January and one February flight were unable to be flown or subsequently made up. The scheduling and intensity of the flights were oriented towards identifying parturition areas, raptor nests, late summer bear feeding areas, and big game winter ranges.

Spring and summer flights began approximately one hour after sunrise, under as ideal weather conditions as possible, with the exception of the June 3 survey, which occurred between 1800 and 2042 hours because of unfavorable morning weather. Winter flights generally began midday and proceeded until dusk because of morning fog, bad weather, and/or logistical considerations. Two experienced professional biologists (R. Thompson, WRD and one of the following: A. Bratkovich, FS, W. Kasworm, J. Brown, MDFWP; Joe Elliott, private consultant) accompanied the pilot (R. Gipe, Flathead Helicopters). Intensive and extensive study areas were systematically surveyed with equal intensity focusing on open portions (clearcuts, shrubfields, low density conifer stands, alpine habitats, etc.) of the study area. Three to six contours were flown on each side of a drainage until the area was completely surveyed. Air speed varied with terrain and flight conditions, but was as slow as practical. Altitude ranged from approximately 50-300 feet above the ground. When big game were sighted, the

helicopter occasionally made a low pass by the animal(s) for sex/age identification. Ground and aerial observations were recorded on 1:24,000 topographic maps. Groups, representing one or more animals, were recorded as single dots on maps. Age and sex composition of groups was recorded when possible.

Truck, snowmobile, ski, and pedestrian surveys were conducted along routes strategically located throughout the intensive and extensive study areas (Figure 3.3.1) to collect additional data on big game numbers and distribution. After the ground was snow covered, wildlife tracks were surveyed along roads and trails (transects) to (1) assess seasonal wildlife presence, distribution, and movement patterns; (2) to obtain indices (number of tracks/mile of transect) of wildlife (big game as well as other species) present; and (3) to record other qualitative observations. Areas inaccessible by truck were surveyed on snowmobiles or cross-country skis. Not all transects in the study area were covered during each semi-monthly survey because of excessive snow depths, avalanche hazards, snowstorms, and logistics. Tracking routes were also varied to provide a complete coverage of the MP study area and to repeat key routes in the area. Tracks and their age were identified according to criteria suggested by Halfpenny (1986) and Murie (1975). Mileage was recorded by snowmobile odometer. With the exception of some predators (e.g., mountain lion) and other species of special concern (e.g., big game), only those tracks made within the previous 24 hour period were recorded for track indices.

Additional qualitative ground surveys, covering the intensive study areas most thoroughly, were conducted throughout the one-year study period, during appropriate seasons, to identify wildlife distributions (via tracks, fresh pellets, etc.), locate high use areas (parturition areas, berry concentrations, etc.), make opportunistic sightings, and develop a general understanding of wildlife utilization during that time period. Systematic ground coverage of the intensive study area and portions of the extensive study area was oriented towards areas of seasonal importance to the different wildlife groups during specific time periods.

Spring bear scats were qualitatively examined to obtain some understanding of food habits. Scats were analyzed in the field whenever encountered. Classification of scat composition was to lifeform (e.g., forb, graminoid, insect, etc.) unless more specific identification was possible.

A great deal of background and site-specific literature (see Literature Cited) was available for the project area as a result of prior studies and inventories. Results of these investigations were used in conjunction with data collected

Figure 3.3.1. Location of major winter track transects (red) in the Montana Project wildlife study area. Transect junctions illustrated by red triangles.

during the baseline study to evaluate present wildlife use of the study area. Local MDFWP and USFS biologists were particularly important sources of valuable, unpublished data on wildlife occurrence and use in the area.

3.4 BREEDING BIRDS

Breeding birds were sampled within a 12.1 square mile subset of the 30.8 square mile intensive study area containing all potential development areas (facility sites, exploration portals, waste rock disposal areas, tailings ponds, roads, etc.) and surrounded by a 0.25 mile buffer zone (Figure 2.2.2). Based on preliminary habitat and physiographic analysis it was assumed that anticipated, project-related impacts to bird communities would be nondetectable beyond the buffer zone and that occupied habitats beyond the buffer zone were similar enough to those in the sample area to allow valid data extrapolation, if desired. In May-June 1988, power transmission line corridors had not been identified and were, therefore, not sampled for breeding birds.

The breeding bird study area was stratified by habitat types and mapped on 1:24,000 USGS topographic maps. Habitat boundaries were initially revised from existing USFS grizzly bear habitat component maps (Madel 1982, USFS et al. 1988) to habitats and boundaries which conformed to functional bird habitat. Habitat boundaries were further revised with 1:12,000 color aerial photos and ground-truthing. A digital electronic planimeter was used to determine habitat acreage.

Six major habitat types were identified for sampling: riparian, western hemlock, mixed conifer, clearcut, shrub-field, and spruce-fir. Minor habitats of limited areal coverage or those representing components of major habitats included aquatic (various creeks and Ramsey Lake), graminoid sidehill park, marsh, nonvegetated land/bare ground (roads and clearcut disturbance areas), and rock. Minor types were not surveyed separately. Species associated with these minor types were associated with the major habitats surveyed. Similarly, sampling of ecotones was avoided. Although some species may achieve their maximum densities in ecotones, those species will also be found in the two or more homogeneous habitats forming the ecotone.

The experimental design of the bird study incorporated spatial and temporal control plots enabling the influence of any combination of development alternatives to be assessed by comparison with similar post-development data. Three to five permanent 100 x 200 m (2 ha = 4.94 acres) breeding bird plots (strip transects, Emlen 1971, Eberhardt 1978) were randomly established on a proportional allocation basis in each of the major habitats in May 1988 (see Map 7.1). Habitat units of sufficient acreage were partitioned into one or more cells large enough to accommodate a 2 ha plot.

Cells throughout the project area were consecutively numbered for each habitat type. A random numbers table was used to select the plot locations/type out of all possible sites. Habitat cells selected for sampling had plots oriented medially along the cell's long axis. Plot corners and intermediate points (50 m intervals) along the plot boundary were marked by 1.52 m (5 foot) rebar posts identified with stainless steel adhesive tape and surveyor's flagging. Additional surveyor's flagging was attached to vegetation along boundaries to facilitate identification and observer orientation. Rebar posts, tape, and flagging were left so they could be used for monitoring in subsequent years.

Each of the 26 permanent plots (3-5 plots/type times 6 types) was sampled five times between June 6-28 (Rep. 1: June 6-9; Rep. 2: June 13-14; Rep. 3: June 15-16; Rep. 4: June 20-22; Rep. 5: June 22-24, and 28 [plots SF2 and SF3]), the peak of the 1988 breeding season. R. Thompson and S. Weller traversed the 100 x 200 m plots recording all birds seen or heard within plot boundaries during a 15 minute period. Surveys were conducted between 0.5 hours of sunrise and 0930 hours during favorable weather to minimize variation in bird conspicuousness (Conner and Dickson 1980). A schedule of transect replications for each habitat type was established for investigators to minimize among- and within-habitat variation. Daily and seasonal temporal detectability bias was ameliorated by alternating the daily sampling sequence of habitats and by spacing sampling throughout the breeding season. All birds observed on the study area were recorded; however, only those species observed within transect boundaries during surveys and which demonstrated an affinity to the transect area were included in quantitative measurements. For example, a gull flying high over a conifer plot would not be included. Young-of-the-year were noted, but excluded from quantitative measurements.

Birds demonstrating an affinity towards a plot were considered breeders or transients. Breeders were those birds using habitats in the project area while breeding. However, this does not imply that breeders utilizing a particular project area habitat were necessarily breeding in that habitat, only that they were using that habitat (e.g., for display purposes, maintenance activities, foraging for young, etc.) while breeding in that or a different habitat nearby. For example, a common flicker observed foraging on a grassland plot was considered a breeder even though it may have nested in an adjacent conifer habitat. Transients were migrants not known to breed in nearby habitats.

Species richness (S, number of species present on a plot during each replication) and density (number of birds present on a plot during each replication) values derived

for species in each plot and in all major habitats were used to evaluate avian habitat utilization.

Mean breeding density for individual species within a habitat was derived from the average number of birds per plot replication (n = 5) and then from average values for each of the three to five plots per habitat, where

$$\text{plot mean (n/2 ha)} = \frac{k}{\underset{i=1}{X}} = \sum_{i=1}^{5} n/5$$

$$\text{habitat mean (n/10 ha)} = \sum_{i=1}^{6} \bar{x}/6$$

Species richness and abundance data, collected through the aforementioned experimental design, produced nested analysis of variance (NANOVA) matrices with unequal replication (Sokal and Rohlf 1969, Zar 1974). Differences in breeding bird use among the major habitat types were analyzed by NANOVA. Differences within habitat types were analyzed by single factor analysis of variance (ANOVA), Student-Newman-Keuls (SNK) multiple range tests for unequal sample sizes, and least significant difference (LSD) tests. If a significant F resulted from the ANOVA and all possible comparisons between plots were desired, the SNK test was applied. If only several plot comparisons were intended, the LSD test was used. Tests of significance were at alpha = 0.05 unless stated otherwise.

Data were screened prior to analyses for significant deviations from normality, homoscedasticity, and additivity (Zar 1974). Chi-square goodness of fit tests indicated species richness and density samples were taken from a Poisson distribution ($P < 0.05$). Both data sets were "corrected" with a square root transformation (Bartlett 1936, Zar 1974, Sokal and Rohlf 1981); however, NANOVA test results for comparison of bird richness and density between habitats and among plots were identical whether no transformation, the log transformation, or the square root transformation was employed. This result was attributable to the robustness of analyses of variance tests when data do not deviate appreciably from parametric requirements (Zar 1974).

This experimental design was used to quantify numbers and evaluate relative habitat use of all bird groups on the project area, including nongame birds, galliforms, raptors, and waterbirds. Additional surveys were also conducted specifically for raptors; other bird groups were surveyed opportunistically in conjunction with other fieldwork. Those methodologies are discussed below.

3.5 RAPTORS

Raptor presence, distribution, and relative numbers in the study area were determined:

(1) in conjunction with the 1988 breeding bird surveys;

(2) during systematic helicopter surveys throughout the intensive and extensive study areas and the transmission line corridors, conducted specifically to locate raptor nests;

(3) during winter/spring 1989 surveys for the boreal owl;

(4) in conjunction with other wildlife fieldwork, including big game helicopter surveys; and

(5) from literature review and discussions with local USFS biologists.

Raptor densities and relative abundance in the breeding bird study area were sampled by habitat type in conjunction with the June 1988 breeding bird surveys. In addition, the intensive study area was systematically surveyed by helicopter and ground surveys, during late spring and early summer 1988 and January 1989, to locate active and inactive nests. Helicopter surveys in a Soloy-Bell with a pilot (R. Gipe, Flathead Helicopters) and two experienced, professional biologists (R. Thompson and either A. Bratkovich, USFS, Jerry Brown, MDFWP, or Joe Elliot, private consultant) were conducted on May 20 and June 3 and 24, 1988, and January 28, 1989. Cliffs in the extensive study area were surveyed by helicopter (during the aforementioned flights as well as during some big game surveys) and through spotting scopes. When raptor nests were located, they were mapped and monitored periodically in an attempt to determine nest success and number of young produced.

The centerline of the transmission line corridor alternatives were flown on January 28 and April 7 and 20 to locate raptor nests. Coverage locally extended out to one-quarter mile from centerline to cover promising stands of trees. The April 20 flight included the recently added Midas Creek, West Fisher, and Trail Creek corridor alternatives. Ground surveys were also conducted along segments of lines adjacent to roads searching for raptor nests and holes large enough to support suitable cavities. None of these transmission line surveys were required by the finalized plan of study (Appendix 6.1).

Boreal owl surveys were conducted in suitable, intensive MP study area habitats during the 1989 breeding season. Survey procedure followed that recommended to Forest Service biologists in Regions I and IV by Greg Hayward (University of Idaho). Based on results of prior studies (Hayward et al. 1987, Holt 1987, 1988, P. Sieracki and B. Holder, USFS, pers. comm.) in similar physiographic settings, suitable habitats were characterized as mature to old growth spruce-fir forests above 5,200 feet, and those spruce-fir stands that extended to lower elevations in valley bottoms. In this latter situation, the upper 100 vertical feet of the spruce-fir/hemlock-cedar ecotone may also be inhabited by boreal owls (P. Sieracki, USFS, pers. comm.). However, for safety and logistical considerations, nocturnal surveys were confined to roads and trails (transects) in the Rock, Libby, Ramsey, and Poorman Creek drainages, whose elevations ranged from 3,720 to 4,480 feet. Twenty-three stations were established at 1/4 to 1/2 mile intervals along transects in, or proximal to, spruce-fir or other upper-elevation forested habitats (see Figure 4.5.1); however, because of suboptimal survey conditions, some additional stations were only 200 yards apart. Surveys began at least 1/2 hour after sunset, generally at the highest station in a drainage. Starting points were varied so that stations were monitored at different times of the night. At each station, observers listened for vocalizations for two minutes, played a series of boreal owl calls for one to two minutes, listened for two minutes, played calls for one to two minutes, then listened for two minutes. Calls were broadcast in all directions. Vocalizations of other owls were identified in the field by comparison with tape recorded calls. Travel through the study area was by snowmobile or cross-country skis.

3.6 WATERFOWL AND SHOREBIRDS

Waterfowl and shorebird use of lakes, ponds, and creeks on the intensive study area was quantified in conjunction with the breeding bird plot surveys and opportunistically during other wildlife fieldwork. Opportunistic sightings were primarily of adults, but also included observations of broods, courtship and defensive behavior, and a nest. Waterfowl and shorebird use of the extensive study area was assessed using this latter approach, using results of other studies in the area, and via discussions with local USFS and MDFWP biologists.

Because harlequin ducks are a species of special concern to the project and have been observed in the vicinity (Farmer and Heath 1987, A. Bratkovich and B. Haflich, USFS, pers. comm.), surveys were conducted along suitable steep gradient reaches of Libby, Ramsey, and the East Fork of Rock Creeks in June 1988. Reach boundaries

along the East Fork of Rock Creek extended from the bridge below Rock Creek Meadows to approximately 150 m upstream of the Rock Creek trailhead gate, along Libby Creek from the wilderness boundary to the Howard Lake Road, and along Ramsey Creek from Ramsey Lake to the Libby Road. Surveys consisted of walking along the creeks looking for ducks, their broods, or waterfowl whitewash on rocks.

3.7 SMALL MAMMALS

Small mammals were trapped to document species occurrence and relative abundance. The 12.1 square mile small mammal study area, a subset of the intensive study area, contained all potential impact areas and was circumscribed by a 0.25 mile buffer zone (see Figure 2.2.2). Based on preliminary habitat and physiographic analyses it was assumed that project-related impacts to small mammal communities would be nondetectable beyond the buffer zone and that habitats beyond the zone were similar enough to those in the impact area to allow valid data extrapolation. Trapping was conducted from August 17-24, 1988, on the 100 x 200 m breeding bird plots, proportionally allocated and stratified by major habitat type.

Trapping utilized a combination of Sherman live traps (8 x 9 x 27 cm) and Museum Special and Victor Woodstream (rat) snap traps. Five live and five snap traps (three Museum Specials and two rat traps) were alternated in three parallel transects/plot where distances between traps and transects was approximately 10 m. An extra snap trap was placed in the vicinity of Trap 10 on each transect to account for traps that went off by themselves, traps sprung by animals (red squirrels, snowshoe hares, deer, and bear) without catching them, or other situations where traps were not available to catch small mammals. Number of traps available was recorded each day for each transect. Traps were baited with a mixture of peanut butter, rolled oats, bird seed, and bacon. Trapping was conducted during fair weather typical for August.

The three parallel 90 m (10 traps spaced at 10 m intervals) small mammal transects were initially established at one end of each bird plot, parallel to the plot's long axis. After checking traps on Day 2, traps were collected and transects were moved forward approximately 110 m such that the location of Trap 1 on Day 3 was 20 m ahead of the location of Trap 10 on Day 2. This procedure was a modification of Stoecker's (1984) moving transect method which maximizes trap success and area sampled, and minimizes recaptures. Sampling involved 270-450 trap nights in each of the six major habitats. This trapping procedure, continued for three consecutive 24-hour periods on each plot and trapped a minimum area of approximately 40 x 330 m (1.32

ha = 3.26 acres). Because bird plots measured 100 x 200 m, trappers had the option on Day 3 of continuing their transect forward (and off the bird plot), orienting Day 3's three transects at 90 degrees to those on Days 1 and 2, or locating Day 3's transects parallel and adjacent to those of Day 2. The option selected varied with each plot and the proximity of a different habitat type. The only prerequisite was that Day 3's transects had to sample the same habitat as on Days 1 and 2.

Trapping was conducted by three people working independently. All mammals captured by two of the trappers were retained for identification at the end of the day by the project biologist (the third trapper). Species were identified after Hoffman and Pattie (1968) and Lechleitner (1969). Some skulls were collected as voucher specimens. Identification of the vagrant shrew skull was confirmed by Dr. James C. Halfpenny, Mammalogist, University of Colorado.

Relative small mammal abundance and species richness were evaluated between and within habitats using the data screening, NANOVA, ANOVA, SNK, and LSD analyses described under 3.4 Breeding Birds.

Additional data on small mammal presence and distribution in the study area was collected in conjunction with other fieldwork and from results of other local studies.

3.8 THREATENED, ENDANGERED, AND SENSITIVE SPECIES

No specific threatened or endangered species surveys were conducted during the baseline study because

(1) specific studies covering the proposed project areas have been recently conducted, and

(2) additional data on the species in question would be collected in conjunction with other baseline wildlife surveys.

Three threatened or endangered species occur on or in the vicinity of the project area: grizzly bear, bald eagle, and peregrine falcon. The grizzly bear is a federally threatened species which occurs in low numbers in the Cabinet Mountains. Several recent, intensive studies (Thier 1981, Kasworm 1985, 1986, 1987, Kasworm and Manley 1988, Erickson et al. 1987) have been conducted in the Cabinet Mountains covering the MP's study areas. Those studies have used radiotelemetry to document relative numbers, home range, movements, habitat characteristics and use, and potential impacts to the grizzly population resulting from a

similar, adjacent mining proposal. Use of the MP study area by grizzly bears was assessed using:

(1) results obtained, and management recommendations developed, from those recent studies;

(2) results of interviews and discussions with agency personnel with particular expertise (e.g., W. Kasworm, MDFWP);

(3) results of qualitative and quantitative habitat surveys of proposed impact areas; and

(4) data (sightings, tracks, feces, etc.) obtained in conjunction with other baseline wildlife fieldwork.

Bald eagles are a federally endangered species which breed in the latilong block (block 1) containing the MP study area (Flath 1984, Skaar et al. 1985); however, they are most common in the study area as migrants, transients, or winter residents (Hamer 1976, Kuchera and Ruediger 1978, Flath 1984). Eagle use of the project area was evaluated based on opportunistic field observations made in conjunction with other fieldwork, on results of other recent, local studies, and on literature review.

Peregrine falcons are classified as federally endangered. Historical nesting has been suspected for the latilong block covering the study area (Skaar et al. 1985); however, the lack of recent reported sightings from the region suggests this species may only migrate through the area. No specific surveys were conducted during the baseline study to search for peregrines, although cliffs in the intensive and extensive study areas were surveyed for eyries by helicopter and ground surveys during appropriate time periods in 1988.

Assessment of presence and potential habitat use by species of special concern in Montana (state threatened, endangered, and species of special interest or concern, Flath 1984); Kootenai National Forest threatened, endangered, and sensitive species; and MNHP species of special concern, was determined:

(1) from data collected in conjunction with other wildlife fieldwork;

(2) from recent and historic reports from the area; and

(3) from a species' habitat affinities and the distribution of suitable habitats in the study area.

SECTION 4.0

RESULTS AND DISCUSSION

4.0 RESULTS AND DISCUSSION

4.1 SPECIES LISTS

Lists of mammals, birds, reptiles, and amphibians which occur, or potentially occur, in and around the MP study area were primarily developed from Thompson (1982) and Skaar (1985). These authors divided Montana into 47 "latilong" blocks (geographical units of land one degree latitude and one degree longitude), each approximately 3,000 square miles. Lists of vertebrates present in each latilong block were then derived from a plethora of published and unpublished sources. Wildlife potentially present in the MP study area refers to those species listed by Thompson (1981) or Skaar (1985) which have been observed in the Libby latilong block (block 1), the area between 115-116° W longitude and 48-49° N latitude (Figure 4.1.1). These sources were used as a starting point from which the species lists were refined.

The potential presence of latilong block 1 species in the MP project area is provided (Tables 4.1.1-4.1.4) for general comparison only. Many of the species listed do not occur except by accident in the study area. Latilong block 1 covers an enormous area containing habitats which do not occur or are poorly developed on the high elevation MP study area. For example, latilong block 1, and ASARCO's Rock Creek study area, contain large water bodies, such as portions of Cabinet Gorge Reservoir. Consequently, virtually every species of waterfowl which breeds or migrates through the area was observed in the ASARCO study area (Farmer and Heath 1987) and is listed in the latilong block covering the MP study area. However, waterfowl are uncommon on the MP area because suitable habitat is virtually limited to Howard Lake, Rock Creek Meadows, and the few ponds which occur on site. For more information, Skaar (1985) discusses the merits, shortcomings, and intended use of the latilong system.

Species listed in Tables 4.1.1-4.1.4 indicate not only what species potentially occur in the area, based on latilong studies, but also what species were observed: (1) in the study area during 1988/89 baseline fieldwork; (2) on ASARCO's Rock Creek project (Farmer and Heath 1987) which overlaps part of the MP study area; and (3) in the study area by agency personnel or during previous studies (e.g., MNHP 1987, Kasworm 1988). The 191 species of birds which regularly occur on the Kootenai National Forest (USFS 1981) are also indicated (see Table 4.1.2).

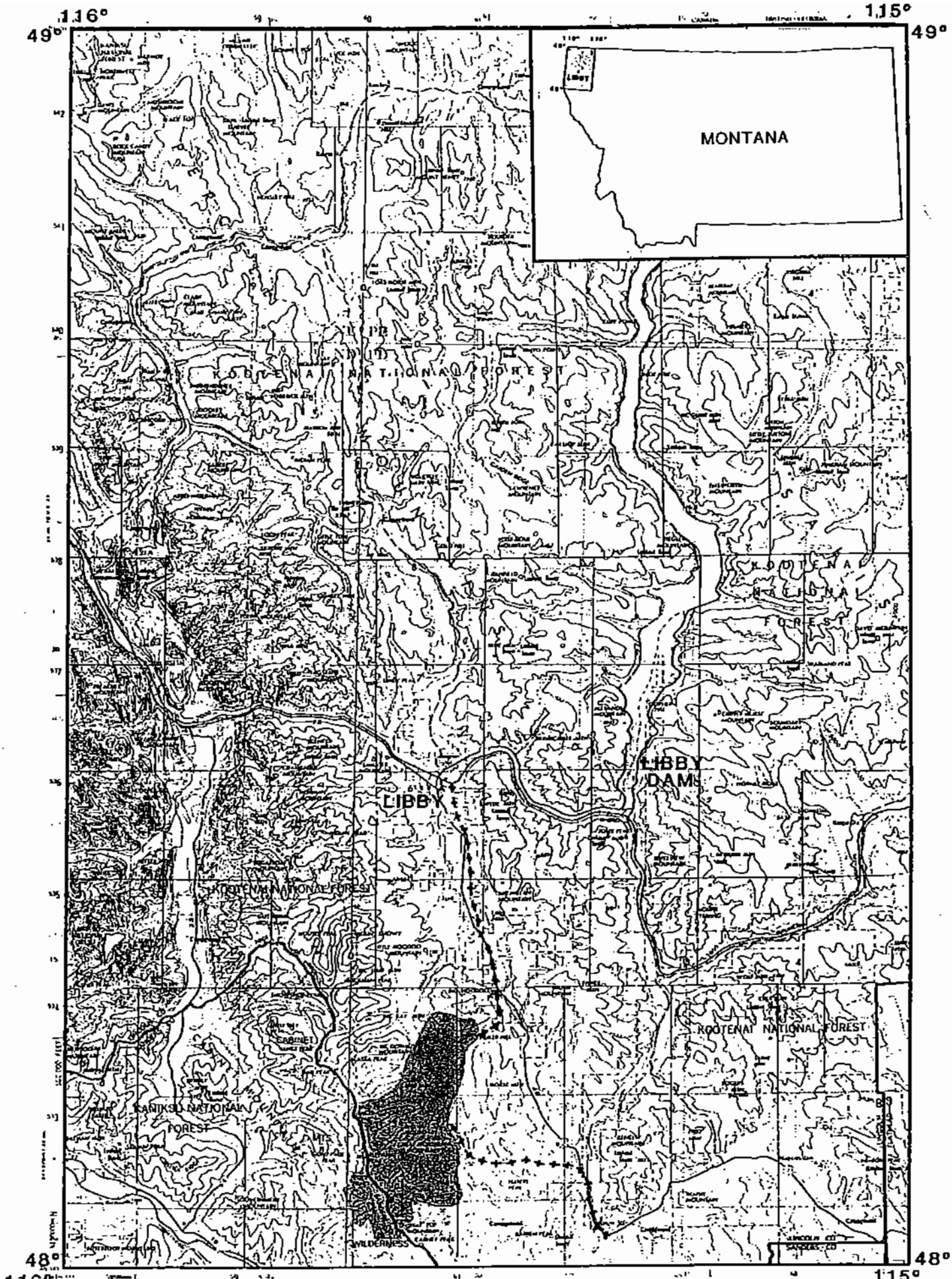


Figure 4.1.1. - Location of the Montana Project wildlife study area and transmission line corridors in the Libby latilong block and Lincoln and Sanders Counties, Montana.

Table 4.1.1 Mammal occurrence on the Montana Project wildlife study area[a]

Common Name	Scientific Name	Occurrence
Masked Shrew	*Sorx cinereus*	c
Vagrant Shrew	*Sorx vagrans*	b
Montane Shrew	*Sorx monticola*	
Water Shrew	*Sorx palustris*	c
Pygmy Shrew	*Sorx hoyi*	
Little Brown Myotis	*Myotis lucifugus*	
Long-legged Myotis	*Myotis volans*	
California Myotis	*Myotis californicus*	
Small-footed Myotis	*Myotis subulatus*	
Townsend's Big-eared Bat	*Plecotus townsendii*	
Pika	*Ochotona princeps*	b,c
Snowshoe Rabbit	*Lepus americanus*	b,c
Yellow-pine Chipmunk	*Eutamias amoenus*	
Red-tailed Chipmunk	*Eutamias ruficaudus*	b,c
Yellow-bellied Marmot	*Marmota flaviventris*	b
Hoary Marmot	*Marmota caligata*	b
Columbian Ground Squirrel	*Spermophilus columbianus*	b,c
Golden-mantled Ground Squirrel	*Spermophilus lateralis*	b,c
Red Squirrel	*Tamiasciurus hudsonicus*	b,c
Northern Flying Squirrel	*Glaucomyps sabrinus*	b
Northern Pocket Gopher	*Thomomys talpoides*	b,c
Beaver	*Castor canadensis*	b,c
Deer Mouse	*Peromyscus maniculatus*	b,c
Bushy-tailed Woodrat	*Neotoma cinerea*	b,c
Northern Bog Lemming	*Synaptomys borealis*	
Gapper's Red Backed Vole	*Clethrionomys gapperi*	b,c
Heather Vole	*Phenacomys intermedius*	c
Meadow Vole	*Microtus pennsylvanicus*	c
Montane Vole	*Microtus montanus*	b
Long-tailed Vole	*Microtus longicaudus*	
Water Vole	*Microtus richardsoni*	
Muskrat	*Ondatra zibethicus*	b,c
Western Jumping Mouse	*Zapus princeps*	b
Porcupine	*Erethizon dorsatum*	b,c
Coyote	*Canis latrans*	b,c
Northern Rocky Mountain Wolf	*Canis lupus irremotus*	
Red Fox	*Vulpes vulpes*	
Black Bear	*Ursus americanus*	b,c
Grizzly Bear	*Ursus arctos*	d
Raccoon	*Procyon lotor*	
Marten	*Martes americana*	b,c
Fisher	*Martes pennanti*	
Ermine	*Mustela erminea*	b,c
Long-tailed Weasel	*Mustela frenata*	b,c
Mink	*Mustela vison*	b
Wolverine	*Gulo luscus*	b,c

Table 4.1.1 Continued.

Common Name	Scientific Name	Occurrence
Badger	*Taxidea taxus*	
Striped Skunk	*Mephitis mephitis*	b,c
River Otter	*Lutra canadensis*	c
Mountain Lion	*Felis concolor*	b,c
Lynx	*Lynx canadensis*	
Bobcat	*Lynx rufus*	b,c
Elk	*Cervus elaphus*	b,c
Mule Deer	*Odocoileus hemionus*	b,c
White-tailed Deer	*Odocoileus virginianus*	b,c
Moose	*Alces alces*	b,c
Caribou	*Rangifer tarandus*	
Mountain Goat	*Oreamnos americanus*	b,c
Mountain Sheep	*Ovis canadensis*	c

[a]Species list from Thompson (1982).
[b]Species observed in Montana Project wildlife study area during this study.
[c]Species observed in ASARCO's Rock Creek wildlife study area (Farmer and Heath 1987).
[d]Species observed in Montana Project study area by W. Kasworm (MDFWP, pers. comm.) during this study.

Table 4.1.2 Bird occurrence on the Montana Project wildlife study area[a]. Phylogenetic order and common and scientific names follow AOU (1983)

Order Common Name	Scientific Name	Occurrence
Order Gaviiformes		
Common Loon	*Gavia immer*	b,d
Order Podicipediformes		
Pied-billed Grebe	*Podilymbus podiceps*	b,d
Horned Grebe	*Podiceps auritus*	b
Red-necked Grebe	*Podiceps grisegena*	
Eared Grebe	*Podiceps nigricollis*	b,d
Western Grebe	*Aechmophorus occidentalis*	b,d
Order Pelecaniformes		
Double-crested Cormorant	*Phalacrocorax auritus*	
Order Ciconiiformes		
American Bittern	*Botaurus lentiginosus*	b
Great Blue Heron	*Ardea herodias*	b,c,d
Order Anseriformes		
Tundra Swan	*Cygnus columbianus*	d
Snow Goose	*Chen caerulescens*	b
Canada Goose	*Branta canadensis*	b,d
Wood Duck	*Aix sponsa*	b,d
Green-winged Teal	*Anas crecca*	b
Mallard	*Anas platyrhynchos*	b,c,d
Northern Pintail	*Anas actua*	b
Blue-winged Teal	*Anas discors*	b,d
Cinnamon Teal	*Anas cyanoptera*	b,d
Northern Shoveler	*Anas clypeata*	b
Gadwall	*Anas strepera*	b
American Wigeon	*Ans americana*	b,d
Canvasback	*Aythya valisineria*	b,d
Redhead	*Aythya americana*	b,d
Ring-necked Duck	*Aythya collaris*	b,d
Lesser Scaup	*Aythya affinis*	b,d
Harlequin Duck	*Histrionicus histrionicus*	b,d
Common Goldeneye	*Bucephala clangula*	b,d
Barrow's Goldeneye	*Bucephala islandica*	b,d
Bufflehead	*Bucephala albeola*	b
Hooded Merganser	*Lophodytes cucullatus*	b,d
Common Merganser	*Mergus merganser*	b,c,d
Ruddy Duck	*Oxyura jamaicensis*	b,c,d

TABLE 4.1.2 Continued.

Order Common Name	Scientific Name	Occurrence
Order Falconiformes		
Turkey Vulture	*Cathartes aura*	b,d
Osprey	*Pandion haliaetus*	b,c,d
Bald Eagle	*Haliaeetus leucocephalus*	b,d
Northern Harrier	*Circus cyaneus*	b,d
Sharp-shinned Hawk	*Accipiter striatus*	b,c,d
Cooper's Hawk	*Accipiter cooperii*	b
Northern Goshawk	*Accipiter gentilis*	b,c,d
Swainson's Hawk	*Buteo swainsoni*	b
Red-tailed Hawk	*Buteo jamaicensis*	b,c,d
Rough-legged Hawk	*Buteo lagopus*	b
Golden Eagle	*Aquila chrysaetos*	b,c,d
American Kestrel	*Falco sparverius*	b,c,d
Merlin	*Falco columbarius*	b
Peregrine Falcon	*Falco peregrinus*	
Prairie Falcon	*Falco mexicanus*	b
Order Galliformes		
Gray Partridge	*Perdix perdix*	
Ring-necked Pheasant	*Phasianus colchicus*	b
Spruce Grouse	*Dendragapus canadensis*	b,d
Blue Grouse	*Dendragapus obscurus*	b,c,d
Ruffed Grouse	*Bonasa umbellusrii*	b,c,d
Sharp-tailed Grouse	*Tympanuchus phasianellus*	
Wild Turkey	*Meleagris gallopavo*	d
Order Gruiformes		
Sora	*Porzana carolina*	b
American Coot	*Fulica americana*	b,d
Sandhill Crane	*Grus canadensis*	
Order Charadriiformes		
Killdeer	*Charadrius vociferus*	b,c,d
American Avocet	*Recurvirostra americana*	
Greater Yellowlegs	*Tringa melanoleuca*	
Lesser Yellowlegs	*Tringa flavipes*	
Solitary Sandpiper	*Tringa solitaria*	b
Willet	*Catoptrophorus semipalmatus*	
Spotted Sandpiper	*Actitus macularia*	b,c,d
Upland Sandpiper	*Bartramia longicauda*	
Long-billed Curlew	*Numenius americans*	
Marbled Godwit	*Limosa fedoa*	
Semipalmated Sandpiper	*Caladris pusilla*	
Western Sandpiper	*Calidris mauri*	b
Least Sandpiper	*Calidris minutilla*	
Baird's Sandpiper	*Calidris bairdii*	
Pectoral Sandpiper	*Calidris melanotos*	
Stilt Sandpiper	*Calidris himantopus*	
Long-billed Dowitcher	*Limnodromus scolopaceus*	b

TABLE 4.1.2 Continued.

Order Common Name	Scientific Name	Occurrence
Common Snipe	*Gallinago gallinago*	b,c,d
Wilson's Phalarope	*Phalaropus tricolor*	b,d
Franklin's Gull	*Larus pipixcan*	
Bonaparte's Gull	*Larus philadelphia*	
Ring-billed Gull	*Larus delawarensis*	b,d
California Gull	*Larus californicus*	b
Herring Gull	*Larus argentatus*	b,d
Caspian Tern	*Sterna caspia*	
Black Tern	*Chlidonias niger*	b
Order Columbiformes		
Rock Dove	*Columba livia*	b
Band-tailed Pigeon	*Columba fasciata*	
Mourning Dove	*Zenaida macroura*	b,d
Order Strigiformes		
Western Screech-owl	*Otus kennicottii*	b
Common Barn-owl	*Tyto alba*	
Great Horned Owl	*Bubo virginianus*	b,c,d
Snowy Owl	*Nyctea scandiaca*	
Northern Hawk-owl	*Surnia ulula*	
Northern Pygmy Owl	*Glaucidium gnoma*	b,c
Burrowing Owl	*Athene cunicularia*	
Barred Owl	*Strix varia*	b,c
Great Gray Owl	*Strix nebulosa*	b,c,d
Long-eared Owl	*Asio otus*	b,d
Short-eared Owl	*Asio flammeus*	
Boreal Owl	*Aegolius funereus*	
Northern Saw-whet Owl	*Aegolius acadicus*	b
Order Caprimulgiformes		
Common Nighthawk	*Chordeiles minor*	b,c,d
Order Apodiformes		
Black Swift	*Cypseloides niger*	b,c
Vaux's Swift	*Chaetura vauxi*	b,c
White-throated Swift	*Aeronautes saxatilis*	b
Black-chinned Hummingbird	*Archilochus alexandri*	b,d
Calliope Hummingbird	*Stellula calliope*	b,c,d
Broad-tailed Hummingbird	*Selasphorus platycercus*	
Rufous Hummingbird	*Selasphorus rufus*	b,c,d
Order Coraciiformes		
Belted Kingfisher	*Ceryle alcyon*	b,c,d
Order Piciformes		
Lewis' Woodpecker	*Melanerpes lewis*	b,d
Red-naped Sapsucker	*Sphyrapicus nuchalis*	b,c,d

TABLE 4.1.2 Continued.

Order Common Name	Scientific Name	Occurrence
Williamson's Sapsucker	*Sphyrapicus thyroidus*	
Downy Woodpecker	*Picoides pubescens*	b,c,d
Hairy Woodpecker	*Picoides villosus*	b,c,d
Three-toed Woodpecker	*Picoides tridactylus*	b,c
Black-backed Woodpecker	*Picoides arcticus*	b,d
Northern Flicker	*Colaptes auratus*	b,c,d
Pileated Woodpecker	*Dryocopus pileatus*	b,c,d
Order Passeriformes		
Olive-sided Flycatcher	*Contopus borealis*	b,c,d
Western Wood-pewee	*Contopus sordidulus*	b,d
Willow Flycatcher	*Empidonax traillii*	b,c
Least Flycatcher	*Empidonax minimus*	c
Hammond's Flycatcher	*Empidonax hammondii*	b,c,d
Dusky Flycatcher	*Empidonax oberholseri*	b,c,d
Western Flycatcher	*Empidonax difficilis*	b,c,d
Say's Phoebe	*Sayornis saya*	c
Ash-throated Flycatcher	*Myiarchus cinerascens*	
Western Kingbird	*Tyrannus verticalis*	b
Eastern Kingbird	*Tyrannus tyrannus*	b,d
Horned Lark	*Eremophila alpestris*	b,d
Tree Swallow	*Tachycineta bicolor*	b,c,d
Violet-green Swallow	*Tachycineta thalassina*	b,c,d
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	b,c
Bank Swallow	*Riparia riparia*	b
Cliff Swallow	*Hirundo pyrrhonota*	b
Barn Swallow	*Hirundo rustica*	b,c
Gray Jay	*Perisoreus canadensis*	b,c,d
Steller's Jay	*Cyanocitta stelleri*	b,c,d
Blue Jay	*Cyanocitta cristata*	
Pinyon Jay	*Gymnorhinus cyanocephalus*	
Clark's Nutcracker	*Nucifraga columbiana*	b,c,d
Black-billed Magpie	*Pica pica*	b,c,d
American Crow	*Corvus brachyrhynchos*	b,c,d
Common Raven	*Corvus corax*	b,c,d
Black-capped Chickadee	*Parus atricapillus*	b,c,d
Mountain Chickadee	*Parus gambeli*	b,c,d
Boreal Chickadee	*Parus hudsonicus*	
Chestnut-back Chickadee	*Parus rufescens*	b,c,d
Red-breasted Nuthatch	*Sitta canadensis*	b,c,d
White-breasted Nuthatch	*Sitta carolinensis*	b,c,d
Pygmy Nuthatch	*Sitta pygmaea*	b,c
Brown Creeper	*Certhia americana*	b,c,d
Rock Wren	*Salpinctes obsoletus*	b
Canyon Wren	*Catherpes mexicanus*	b
House Wren	*Troglodytes aedon*	b,c,d
Winter Wren	*Troglodytes troglodytes*	b,c,d
Marsh Wren	*Cistothorus palustris*	b

TABLE 4.1.2 Continued.

Order Common Name	Scientific Name	Occurrence
American Dipper	*Cinclus mexicanus*	b,c,d
Golden-crowned Kinglet	*Regulus satrapa*	b,c,d
Ruby-crowned Kinglet	*Regulus calendula*	b,c,d
Western Bluebird	*Sialia mexicana*	b,c
Mountain Bluebird	*Sialia currucoides*	b,c
Townsend's Solitaire	*Myadestes townsendii*	b,c,d
Veery	*Catharus fuscescens*	b,c
Swainson's Thrush	*Catharus ustulatus*	b,c
Hermit Thrush	*Catharus guttatus*	b,c,d
American Robin	*Turdus migratorius*	b,c,d
Varied Thrush	*Ixoreus naevius*	b,c,d
Gray Catbird	*Dumetella carolinensis*	b,c
Water Pipit	*Anthus spinoletta*	b
Bohemian Waxwing	*Bombycilla garrulus*	b
Cedar Waxwing	*Bombycilla cedrorum*	b,c,d
Northern Shrike	*Lanius excubitor*	b
Loggerhead Shrike	*Lanius ludovicianus*	b
Starling	*Sturnus vulgaris*	b,d
Solitary Vireo	*Vireo solitarius*	b,c,d
Warbling Vireo	*Vireo gilvus*	b,c,d
Red-eyed Vireo	*Vireo olivaceus*	b,c
Tennessee Warbler	*Vermivora peregrina*	b,c
Orange-crowned Warbler	*Vermivora celata*	b,c
Nashville Warbler	*Vermivora ruficapilla*	b,c
Yellow Warbler	*Dendroica petechia*	b,c
Chestnut-sided Warbler	*Dendroica pensylvanica*	
Yellow-rumped Warbler	*Dendroica coronata*	b,c,d
Townsend's Warbler	*Dendroica townsendi*	b,c,d
Blackburnian Warbler	*Dendroica fusca*	
Palm Warbler	*Dendroica palmarum*	
Blackpoll Warbler	*Dendroica striata*	
American Redstart	*Setophaga ruticilla*	b,c
Northern Waterthrush	*Seiurus noveboracensis*	b,c
MacGillivray's Warbler	*Oporornis tolmiei*	b,c,d
Common Yellowthroat	*Geothlypis trichas*	b,c,d
Wilson's Warbler	*Wilsonia pusilla*	b,c,d
Yellow-breasted Chat	*Icteria virens*	b
Western Tanager	*Piranga ludoviciana*	b,c,d
Black-headed Grosbeak	*Pheucticus melanocephalus*	b,c
Lazuli Bunting	*Passerina amoena*	b,c
Rufous-sided Towhee	*Pipilo erythrophthalmus*	b,c,d
American Tree Sparrow	*Spizella arborea*	b,c
Chipping Sparrow	*Spizella passerina*	b,c,d
Brewer's Sparrow	*Spizella breweri*	b
Vesper Sparrow	*Pooecetes gramineus*	b,c
Lark Sparrow	*Chondestes grammacus*	
Lark Bunting	*Calamospiza melanocorys*	
Savannah Sparrow	*Passerculus sandwichensis*	b,c
Baird's Sparrow	*Ammodramus bairdii*	

TABLE 4.1.2 Continued.

Order Common Name	Scientific Name	Occurrence
Grasshopper Sparrow	*Ammodramus savannarum*	b
Fox Sparrow	*Passerella iliaca*	b,c
Song Sparrow	*Melospiza melodia*	b,c,d
Lincoln's Sparrow	*Melospiza lincolnii*	b,c,d
White-throated Sparrow	*Zonotrichia albicollis*	
White-crowned Sparrow	*Zonotrichia leucophrys*	b,c,d
Harris Sparrow	*Zonotrichia querula*	
Dark-eyed Junco	*Junco hyemalis*	b,c,d
Snow Bunting	*Plectrophenax nivalis*	b,d
Bobolink	*Dolichonyx oryzivorus*	
Red-winged Blackbird	*Agelaius phoeniceus*	b,d
Western Meadowlark	*Sturnella neglecta*	b,c,d
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	b
Rusty Blackbird	*Euphagus carolinus*	
Brewer's Blackbird	*Euphagus cyanocephalus*	b,c,d
Brown-headed Cowbird	*Molothrus ater*	b,c,d
Northern Oriole	*Icterus galbula*	b,c,d
Rosy Finch	*Leucosticte arctoa tephrocotis*	b,d
Pine Grosbeak	*Pinicola enucleator*	b,c,d
House Finch	*Carpodacus mexicanus*	b
Cassin's Finch	*Carpodacus cassinii*	b,c,d
Red Crossbill	*Loxia curvirostra*	b,c,d
White-winged Crossbill	*Loxia leucoptera*	c
Common Redpoll	*Carduelis flammea*	b
Hoary Redpoll	*Carduelis hornemanni*	
Pine Siskin	*Carduelis pinus*	b,c,d
American Goldfinch	*Carduelis tristis*	b,c
Evening Grosbeak	*Coccothraustes vespertinus*	b,d
House Sparrow	*Passer domesticus*	b,d

[a]Species list from Skaar et al. (1985).
[b]Species included in the Kootenai National Forest List (U.S. Forest Service 1981).
[c]Species observed in the Montana Project study area during this study.
[d]Species observed in ASARCO's Rock Creek wildlife study area (Farmer and Heath 1987).

TABLE 4.1.3 Reptile occurrence on the Montana Project study area

Common Name	Scientific Name	Occurrence
Painted Turtle	*Chrysemys picta*	c
Western Skink	*Eumeces skiltonianus*	
Northern Alligator Lizard	*Gerrhonotus coeruleus*	c
Rubber Boa	*Charina bottae*	b,c
Racer	*Coluber constrictor*	
Valley Garter Snake	*Thamnophis sirtalis fitchi*	b,c
Wandering Garter Snake	*Thamnophis elegans vagrans*	b,c
Prairie Rattlesnake	*Crotalus viridis*	

[a]Species list from Thompson (1982).
[b]Species observed in the Montana Project wildlife study area during this study.
[c]Species observed in ASARCO's Rock Creek wildlife study area (Farmer and Heath 1987).

TABLE 4.1.4 Amphibian occurrence on the Montana Project wildlife study area[a]

Common Name	Scientific Name	Occurrence
Long-toed Salamander	*Ambystoma macrodactylum*	b,c
Pacific Giant Salamander	*Dicamptodon ensatus*	
Rough-skinned Newt	*Taricha granulosa*	
Coeur d'Alene Salamander	*Plethodon vandykei*	
Tailed Frog	*Ascaphus truei*	b,c
Boreal Toad	*Bufo boreas*	b
Pacific Tree Frog	*Hyla regilla*	
Red-legged Frog	*Rana aurora*	b
Spotted Frog	*Rana pretiosa*	
Leopard Frog	*Rana pipiens*	c
Bullfrog	*Rana catesbiana*	
Wood Frog	*Rana sylvatica*	

[a]Species list from Thompson (1982).
[b]Species observed in the Montana Project wildlife study area during this study.
[c]Species observed in ASARCO's Rock Creek wildlife study area (Farmer and Heath 1987).

4.2 HABITAT TYPES

The MP wildlife study area, divided into three sub-study areas (Figure 2.2.2), contained 10 terrestrial and one aquatic habitat types (Table 4.2.1, Maps 7.1-7.3). These types represent a combination of one or more existing habitat components (USFS et al. 1988) that are applicable to the overall wildlife community. This mapping does not correspond to potential climax habitat types (Pfister et al. 1977) because:

(1) many diverse existing types (e.g., riparian, clearcut, and mixed conifer) can eventually succeed into one climax type (western hemlock);

(2) mapping provided the basis for stratifying the study area for systematic, habitat based wildlife surveys;

(3) wildlife are responding to existing habitats, not what climax types may be present hundreds or thousands of years from now; and

(4) impact analyses and mitigation will require the present value of wildlife habitats that will be altered or lost to development.

Distribution of these types varied throughout the three sub-study areas in relation to elevation, aspect, slope, substrate, and forest management practices. Forest types dominate the study area except for exposed bedrock areas high along the main divide and its spur ridges. In the entire study area (31,481 acres), the mixed conifer type dominates (9,819 acres), followed by spruce-fir (6,469 acres), rock (4,362 acres), shrubfield (4,285 acres), clearcuts (3,256 acres), grassland (1,365 acres), western hemlock (725 acres), riparian (711 acres), lodgepole pine (232 acres), forbfield (152 acres), and aquatic (105 acres) (Table 4.2.1).

4.3 BIG GAME

Eight big game species, including black and grizzly bears, mountain lion, and five ungulates, inhabit the MP study area. Black bears are common and their seasonal use of the area is oriented toward low elevation, herbaceous meadows in spring and toward summer/fall berry concentrations, generally at higher elevations. Grizzly bears have similar habitat use patterns, but are rare in the Cabinet Mountains (their status is discussed in detail in Section 4.8.9). Both bear species have been the subject of several studies in the Cabinets. Mountain lions are also present in

Table 4.2.1 Areal coverage of existing habitat types on the Montana Project's wildlife study area (after USFS et al. 1988).

Habitat Type	Habitat Area (acres/ha) Potential Development Area[a]	Intensive Study Area[b]	Extensive Study Area[c]	Total
Riparian	589.8/ 238.8	23.7/ 9.6	97.8/ 39.6	711.3/ 288.0
Western Hemlock	358.0/ 145.0	277.3/ 112.3	89.3/ 36.1	724.6/ 293.4
Mixed Conifer	2654.4/1074.7	2438.8/ 987.4	4725.7/1913.2	9818.9/3975.3
Clearcut	1755.1/ 710.5	894.6/ 362.2	605.9/ 245.3	3255.6/1318.0
Shrubfield	904.1/ 366.0	1377.1/ 557.5	2003.9/ 811.3	4285.1/1734.8
Spruce-fir	1194.7/ 483.7	3489.2/1412.6	1785.4/ 722.8	6469.3/2619.1
Rock	124.4/ 50.4	2870.9/1162.3	1366.6/ 553.3	4361.9/1766.0
Grassland	57.9/ 23.5	455.9/ 184.6	850.9/ 344.5	1364.7/ 552.6
Lodgepole Pine	58.9/ 23.8	68.4/ 27.7	104.5/ 42.3	231.8/ 93.8
Forbfield	15.2/ 6.2	45.6/ 18.5	106.4/ 43.1	152.0/ 61.6
Aquatic	15.2/ 6.2	35.1/ 14.2	55.1/ 22.3	105.4/ 42.7
Total				
acres/ha	7712.5/3122.6	11,976.6/4848.9	11,791.5/4773.8	31,480.6/12,745.3
miles^2/km^2	12.1/ 31.2	18.7/ 48.5	18.4/ 47.7	49.2/ 127.5

[a]Bird and small mammal study area.
[b]Excluding bird and small mammal study area.
[c]Excluding bird and small mammal study area and intensive study areas.

the Cabinet Mountains and their number, based on (1) recent harvest data for the two hunting districts which overlap the study area, and (2) field data are relatively high (J. Brown, T. Lempke, MDFWP, pers. comm.).

Five species of ungulates utilize habitats in the study area. As in most other mountainous areas of Montana, white-tailed deer are most common in lower elevations of the study area within approximately one-half to one mile of stream bottoms; however, during summer and early fall they often extend their ranges to mid- and upper elevations as well. Mule deer also occur along bottomlands and extend their summer distribution into the alpine. Elk display a spotty distribution in the study area; however, because of their greater intolerance of human activity they are relatively uncommon at lower elevations and occur in less accessible and/or less frequented areas. Like whitetails, moose are most common at lower elevations along streambottoms and around ponds and marshes; however, they too extend their summer and fall distributions to the upper limits of tree-line. Mountain goats summer on alpine and subalpine cliffs and ridges, and most migrate to slightly lower elevations in the winter. They occur primarily along the main divide and out to the tips of the eastern spur ridges. With the exception of mountain goats, most individuals of the other ungulate species summering in the MP study, migrate to winter ranges out of the study area during "normal" winters. Caribou do not inhabit the Cabinet Mountains and mountain sheep occur further north in the range.

The information presented below on big game habitat use of the MP study area and transmission line corridors, was obtained from a variety of sources specified in Section 3.3. Study area characteristics, study difficulties, and explanations of data presentation are provided in the following paragraphs to assist the reader's interpretation of subsequent big game discussions.

Approximately 69-83% of the non-alpine portion of the MP study area is forested (see Table 4.3.1), which greatly reduces visibility of all wildlife, both from the ground and the air. The percentage varies with the time of year depending on whether the shrubfields have leafed-out. Canopies are dense, often exceeding 100 feet, and typically contain shrubby understories. Extensive canopy coverage, reducing animal observability, coupled with aerial surveys strongly biased toward animals in open habitats, resulted in the detection of only a small proportion of all animals actually present. Observability, expressed as ratio of number of animals observed to number of animals present, was probably highest for mountain goats and lowest for white-tailed deer. Only three white-tails were observed during 22.4 helicopter survey hours over the study area, while close to 200 individuals may have been present during

summer. Moose and black bears were the only species with some empirically based estimate of observability. As a result, numerical estimates of big game present in the study area, when presented, could only be provided in relative terms based on direct and indirect evidence of their presence.

The finalized wildlife study plan (Appendix 6.1) called for 12 helicopter surveys. Only 10 surveys were flown because of chronically unsuitable, winter survey conditions. The two flights that were not completed were winter surveys scheduled for early January and early February, 1989. However, one survey was completed during each of those months (two surveys per month were scheduled) and based on results of those flights (Table 4.3.1) and that most big game species migrated out of the MP during the 1988/89 winter, the cancelled flights do not represent a study deficiency.

Seasonal definitions of big game use of the study area (e.g., winter: December 16-March 15) are conventional periods of equal duration that generally reflect seasonal use by the overall wildlife community. Unfortunately, there are few individual wildlife species that actually conform to this rigid system. It should be recognized, therefore, that the duration of wildlife habitat use varies between elevations, seasons, years, and species. Where discrepancies occur, they have been noted in the text.

Finally, use of seasonal ranges and movement patterns illustrated or described in the text are based on the best information available. Big game highway crossings are specified where they are known and generalized elsewhere. The lack of radio-collared or marked animals in this and prior studies also resulted in generalized descriptions of migration patterns. Seasonal ranges circumscribed in figures represent the most current data that could be obtained. It should be recognized that these areas vary in size and use between years.

4.3.1 Black Bear

A total of 47 black bears were observed during the baseline study, 18 during spring and 29 in summer (Figure 4.3.1.1). No bears were recorded after September 12 because no field work was conducted between then and December 1, when all or most bears were hibernating. Twenty-four bear sightings were recorded during the systematic helicopter surveys (Table 4.3.1). Spring sightings occurred at low to mid-elevations and all but two were below local snowlines.

A total of 17 spring bear scats were examined to obtain some understanding of what bears were eating. All 17

Table 4.3.1. Results of Montana Project big game helicopter surveys over intensive and extensive study areas.

Species	Number of Big Game Observed on Survey Date										
	May 20	June 3	June 24	Sept. 9	Dec. 3	Dec. 18[b]	Jan 28[b,c]	Feb 26[b,d]	Apr 7[e]	Apr 20	Total
Black bear	1	4	0	19	0	0	0	0	0	0	24
Elk	9	1	13	0	0	0	0	0	0	2	25
Mule deer	14	7	32	19	4	3	0	10	0	0	89
White-tailed deer	0	0	0	3	0	0	0	0	0	0	3
Moose	0	0	0	3	34	23	0	0	1	3	64
Mountain goat	16	4	13	30	3	0	1	3	25	11	106
Survey Time (min.)[a]	144	136	153	172	142	90[b]	109[b]	92	141	163	1,342

[a]Represents actual survey time over study area, excluding transmission line corridors.

[b]Incomplete survey. Could not survey Rock Creek or headwalls and upper elevations of eastern drainages because of dangerous winds.

[c]The scheduled early January flight could not be flown due to unsuitable weather.

[d]The scheduled early February flight could not be flown due to unsuitable weather.

[e]Flight represents a makeup of the scheduled March flight which could not be flown due to unsuitable weather.

Figure 4.3.1.1 Seasonal distribution of black bear observations in the Montana Project study area 1988-89.

- ● Spring March 16-June 15
- ▲ Summer June 16-September 15
- ■ Fall September 16-December 15
- ◆ Winter December 16-March 15

were primarily composed of graminoids, three showed traces (up to approximately 40%) of forbs, one contained ant heads, and one contained snowshoe hare hair and bones. Forbs were probably underestimated because of differential digestibility between graminoids and forbs. By the middle to latter part of June, lush vegetative development and an apparent movement of bears to higher elevations made scats difficult to locate and scat analysis was abandoned.

Summer (June 16-September 15) observations occurred at mid- to upper elevations in the study area as bears followed phenological development and concentrated in berry fields. 1988 was an excellent year for huckleberry production. Based on aerial and ground survey results (Figure 4.3.1.1), the east slope of Great Northern Mountain and the shrubfields in upper Rock Creek were particularly important for bears. Nine and eleven bear observations were recorded in Rock Creek and on Great Northern Mountain during summer, respectively, and of the 19 bears observed during the September 9 helicopter survey, 16 were observed in these two areas.

A great deal of information on black bear ecology on the MP study area is available based on a recent (1983-87) study (Kasworm and Manley 1988) of 26 radio-collared bears. The interested reader is referred to that report for specifics; however, data pertinent to the baseline characterization of bear use of the study area is summarized below.

Mean annual minimum home ranges of male and female black bears in the Cabinet Mountains was 29.7 (range 6.4-87.9) and 6.7 (range 1.5-29.7) square miles, respectively. Radio collar data have indicated that bears captured on one side of the main Cabinet Mountains divide usually remained on that side of the divide (Kasworm and Manley 1988).

Kasworm and Manley (1988) marked bears and obtained a 13.0 to 17.7% likelihood of subsequently observing bears from a helicopter when they were concentrated in fall shrubfields. Brown (1987) obtained similar observability rates of 0.13-0.18 during fall helicopter surveys of Cabinet Mountain shrubfields between 1982 and 1987. Extrapolating these observability rates to the results of the September 9 helicopter survey, when 19 bears were observed, yields a population estimate of 108-146 black bears in the 49.2 square mile MP study area during the fall survey. The corresponding average density estimate for the entire study area was 2.2-3.0 bears/square mile (1.2-0.9 square km/bear). Observed bear density on the September 9 survey was 0.4 bears/square mile (6.7 square km/bear), although local observed bear density on Great Northern Mountain shrubfields was approximately 7 bears/square mile (0.4 square km/bear).

It must be noted, however, that these population and density estimates probably overestimate average annual numbers, and may represent annual peak numbers, because black bears move to the upper elevation shrubfields in the Cabinet Mountains to feed on fall berry crops (Kasworm and Manley 1988). Some unknown proportion of bears, summering at low elevations, moved into berry fields on the MP study area and were counted during the September survey.

Kasworm and Manley (1988) estimated a comparable, though slightly lower, density of 1.1-1.7 bears/square mile (2.3-1.5 square km/bear) in their 403 square mile (1045 square km) Cabinet Mountains study area. They also stated that their density estimates probably reflected only the highest quality habitat in Hunting Districts 103 and 121, and that district-wide estimates probably ranged from 7.5 to 3.5 square km/bear. Comparison of density estimates with those from other ranges in Montana (Jonkel and Cowan 1971, Simmons et al. 1986, Aune and Brannon 1987) indicates the MP study area supports some of the highest fall black bear densities of anywhere in the state. This is at least partially due to the high elevation of the MP study area, the high quality shrubfields it contains, and the excellent berry crop produced in 1988.

Male black bear den entry dates in the Cabinet Mountains (n = 13) ranged from the second week of October to the first week in November (Kasworm and Manley 1988). Females (n = 36) entered dens from the first to third weeks in October. Male den exit dates (n = 10) varied from the second to fourth week of April. Females emerged from the third week of April to the second week of May (n = 24). Only one black bear den was located on the MP study area during the present study. The den was under a Rocky Mountain maple at 4,240 feet on breeding bird shrubfield plot S4 in Ramsey Creek (see Map 7.1). Examination revealed it had not been used during the 1987/88 winter.

Kasworm and Manley (1988) found that black bears used areas within 100 m of open roads less than expected and attributed this avoidance to motorized vehicle use on roads.

Hunting pressure and mortality in the two Hunting Districts that overlap the study area are high. Hunter harvest in these districts are annually some of the highest of hunting districts in Region One (northwest Montana) (Brown et al. 1986, 1987). At present there are efforts to reevaluate bear seasons because hunter harvest frequently exceeds desirable harvest levels (10% of the population) and many of the females taken are killed before they are old enough to reproduce (Kasworm and Manley 1988).

No bears were observed in any of the transmission line corridors during any of the helicopter flights. Ground surveys in these corridors were limited and generally confined to roads. One yearling black bear was observed crossing the Libby Creek Road in the transmission line corridor on June 21, approximately 0.8 miles west of U.S. Highway 2. Ground surveys along the ridge between Howard Lake and Midas Creek, and in the upper portion of the Miller Creek drainage in June and July 1988 located relatively large numbers of bear scats. Wayne Kasworm (MDFWP, pers. comm.) has also suspected high spring bear use in this area. Aside from these observations, little specific information is known about bear use in the transmission line corridors, primarily because only two corridors had been selected by the time the study plan was finalized and the study plan did not indicate that ground or aerial surveys were to be conducted along any of the corridors.

4.3.2 Grizzly Bear

Grizzly bear are a species protected from legal hunting in the Cabinet Mountains. Their use of the MP study area and vicinity is more appropriately discussed in Section 4.8.9 of Threatened, Endangered, and Sensitive Species.

4.3.3 Mountain Lion

The MP study area is contained within MDFWP's Region One and is overlapped by Hunting Districts 121 and 103. Region One contains some of the best lion densities in the state and district 121, which extends west from the Cabinet Mountains divide, produces some of the highest annual lion harvests of any district in Region One. Farmer and Heath (1987) observed one adult lion and two lion tracks on ASARCO's Rock Creek project area. They also reported that local residents consider mountain lions to be common in the area.

Two mountain lion tracks were observed during December 1988 field surveys. The fresh track of a large adult male (Halfpenny 1986, Joslin 1988) was followed on December 19 from where it came south off Cable Mountain (approximately 300 m west of the Poorman Road [LRD #2317] gate, across the Ramsey Creek Road at the gate, and across the Libby Creek Road (Figure 4.3.3.1). The fresh track of a juvenile lion came up out of Bear Creek, followed the lower Bear Creek Road (LRD #6199) for 0.35 miles, then turned north on the south side of Big Hoodoo Mountain on December 20 (Figure 4.3.3.1). Based on limited track observations and predator-prey relationships, lions which summered at higher elevations in the Cabinets, appeared to follow

Figure 4.3.3.1 Location of mountain lion tracks (red arrows) observed in the Montana Project study area, December, 1988.

migrating deer to lower winter concentration areas in December.

4.3.4 White-tailed Deer

A total of 67 white-tailed deer was observed during the wildlife study, 31 during spring and 36 in summer (Figure 4.3.4.1). As in most other mountainous areas of Montana, white-tailed deer were most common in the lower elevations of the study area, within approximately one-half to one mile of stream bottomd from the eastern boundaries of the study area to the headwall toe slopes in the upper drainages. During summer and early fall, they also extend their ranges to mid- and upper elevations on the spur ridges. White-tails were not observed in the Rock Creek portion of the study area, nor were any observed in the entire East Fork of Rock Creek during ASARCO's baseline program (Farmer and Heath 1987).

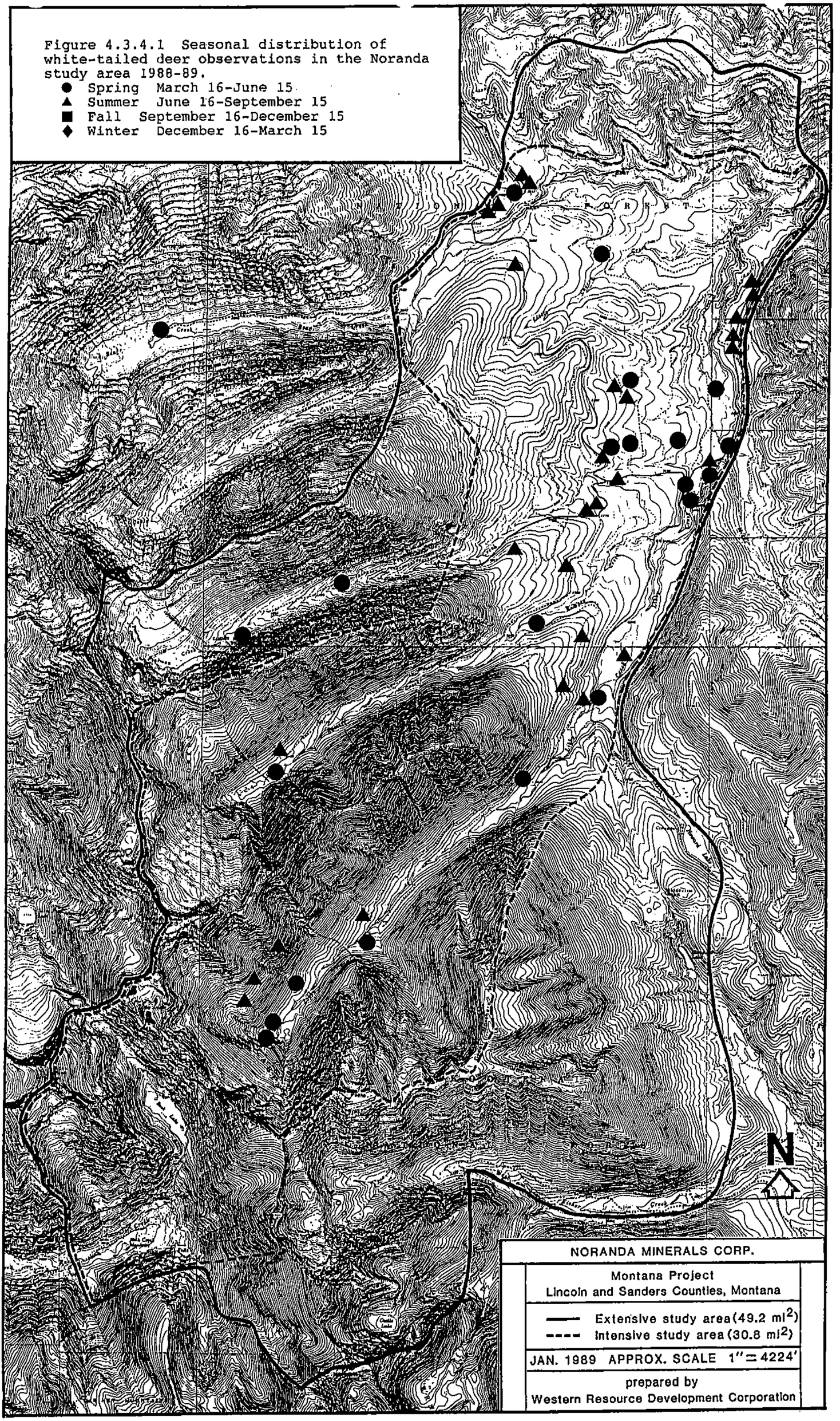
While white-tails were probably the most common ungulate in the MP study area, they were difficult to survey because of their affinity for dense cover. Approximately 69-83% of the non-alpine portion of the study area is forested (see Table 4.3.1). Extensive canopy coverage, coupled with aerial surveys strongly biased toward animals in open habitats and the migration of most whitetails out of the study area in winter resulted in only three white-tailed deer observations during the ten helicopter flights (Table 4.3.1), the lowest observation rate of any big game species in the study area, except the grizzly bear. Other than the relative abundance noted above, it was not possible to accurately enumerate seasonal white-tailed deer numbers in the MP study area.

White-tailed deer migrated east out of the eastern side of the study area in late November and December 1988, slightly preceding movements by elk and moose. While low numbers of deer remained along the lower portions of Libby Creek and adjacent sidehills during winter (not reflected in Figure 4.3.4.1), most moved further east to lower elevations or more snow-free aspects. White-tails were observed crossing U.S. Highway 2 during the fall 1988 and spring 1989 migration periods. Whether these individuals summered in the Cabinet Mountains and the MP study area is unknown without marked animals. These observations could, however, be suggestive of the extent of local movements.

White-tails were occasionally seen in winter along the lower Libby Creek Road (and transmission line corridor) while driving to the MP study area. Although, based on sightings and tracks, this area only appeared to support low numbers of deer, a half-mile wide corridor up

Figure 4.3.4.1 Seasonal distribution of white-tailed deer observations in the Noranda study area 1988-89.

- ● Spring March 16-June 15
- ▲ Summer June 16-September 15
- ■ Fall September 16-December 15
- ◆ Winter December 16-March 15



Libby Creek to the 4 mile marker should be considered winter range.

Some white-tails also winter in the portion of the Libby corridor that is east of U.S. Highway 2 and south of Champion International's operation. White-tailed deer winter range is also present along the Miller Creek transmission line corridor from U.S. Highway 2 west to the North Fork of Miller Creek. The Miller Creek Valley also appears to be a movement corridor for moderate to high numbers of deer in spring and fall. Jerry Brown (MDFWP, pers. comm.) identified the section of the Miller Creek corridor paralleling U.S. Highway 2, from Miller Creek to the Pleasant Valley BPA line, as an important big game highway crossing.

Although few white-tails occur in the East Fork of Rock Creek, large numbers move out of west slope drainages to winter at elevations below 2,500 feet along the Clark Fork and Bull River Valleys and their tributary drainages (Farmer and Heath 1987). Depending on winter severity and snow conditions, many are killed by vehicles or trains along highways 200 and 56.

By late March-early April 1989, much of the snow on exposed, lower study area elevations had melted and deer had moved back into the area. By mid-April snowlines had receded further and white-tails were observed within two miles of the Libby Creek headwalls.

Fawning occurred in the study area during early to mid-late June and although fawns were occasionally observed, the relatively low numbers, dispersed throughout the area suggested there were no specific fawning grounds.

Hunting is a major source of deer mortality in the area and while white-tails were killed in the MP study area during the 1988 season, it is unknown how many were actually killed in the study area. Predation is probably also a high source of deer mortality based on the relatively high mountain lion population on both sides of the Cabinets and the lions' preference for deer. Based on track observations and discussions with local outfitters, lions follow deer (white-tailed and mule deer) out of the upper canyons to winter ranges and they apparently reverse this pattern each spring.

4.3.5 Mule Deer

Mule deer were one of the most common ungulates in the MP study area. One hundred-six were observed during the study, 28 in spring, 59 in summer, 6 in fall, and 13 in winter (Figure 4.3.5.1); however, because most of the study


Figure 4.3.5.1 Seasonal distribution of mule deer observations in the Noranda study area 1988-89.
● Spring March 16-June 15
▲ Summer June 16-September 15
■ Fall September 16-December 15
◆ Winter December 16-March 15
N
NORANDA MINERALS CORP.
Montana Project
Lincoln and Sanders Counties, Montana
Extensive study area (49.2 mi²)
Intensive study area (30.8 mi²)
JAN. 1989 APPROX. SCALE 1" = 4224'
prepared by
Western Resource Development Corporation

area was forested and deer were difficult to observe, they were more common in the area than what these numbers indicate. They were observed throughout the study area in virtually all habitat types, but were most common at moderate to high elevations during summer.

Mule deer began migrating out of the study area in late November and most had left by late December. Movements east of the main divide were generally to lower elevations and/or to the southern slopes of Big Hoodoo and Horse Mountains and Teeters Peak. Extended movements also occurred across U.S. Highway 2 to McMillan, Brush, and Kenelty Mountains (J. Brown, MDFWP, pers. comm., MDFWP, file data). During most winters, movements extend to winter ranges east of Highway 2; during milder winters, more deer remain west of Highway 2 (J. Brown, MDFWP, pers. comm.).

Unfortunately, without marked animals it is unknown what the spcific movement patterns are and whether most study area deer cross Highway 2 during "normal" winters or remain on mountains west of the highway. For example, it is likely that deer summering in West Fisher Creek migrate east to Teeters Mountain and/or down Miller Creek or the West Fisher River to cross Highway 2. Deer from Libby Creek could also move via these corridors, or more likely, move down Libby Creek to Horse Mountain, Big Hoodoo Mountain, and/or the mountains east of Highway 2.

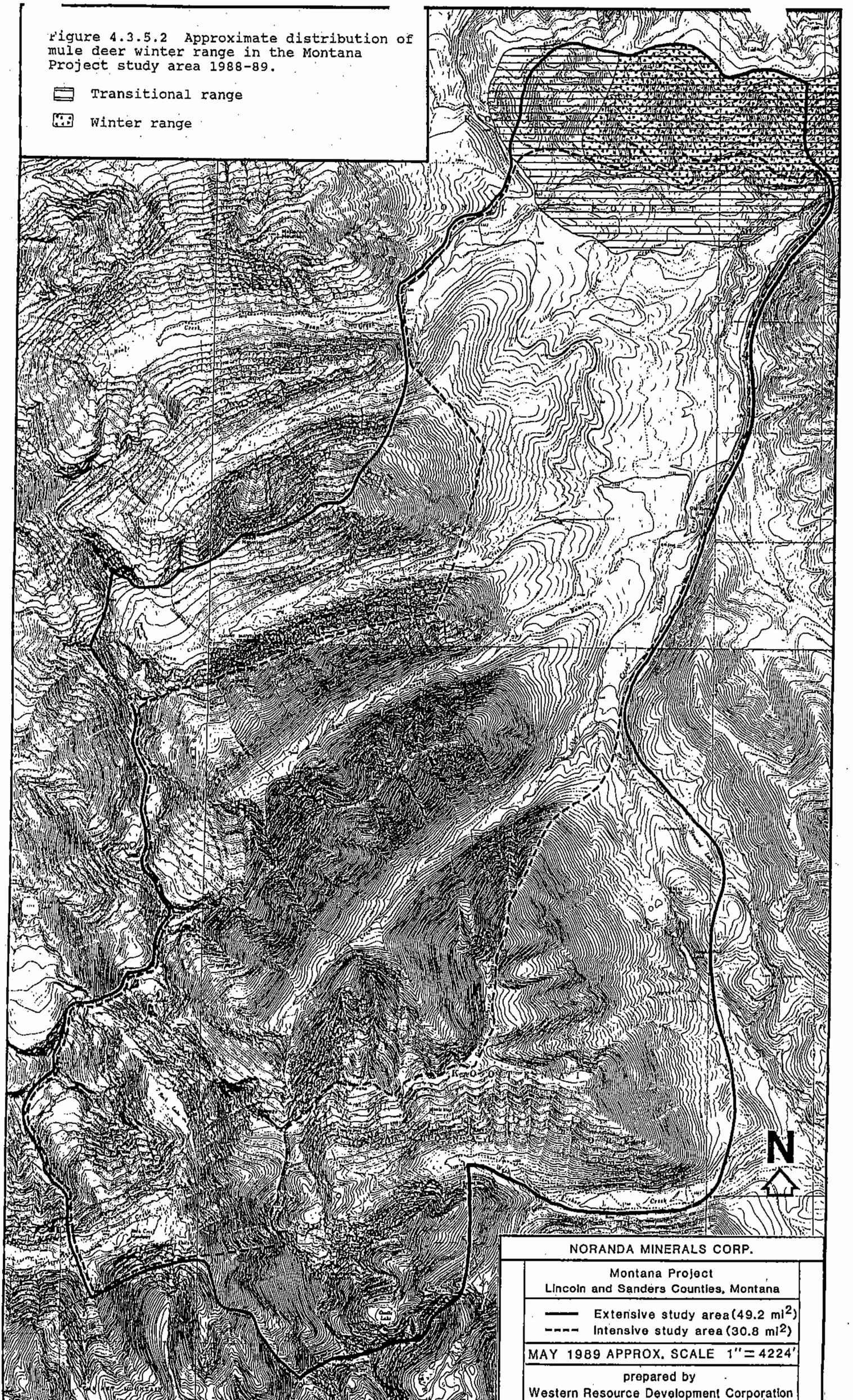
The portion of the MP study area that could be considered mule deer winter range is illustrated in Figure 4.3.5.2, based on observations, track counts, and discussions with local agency biologists. Most of the area delineated is fall transitional range that occurs during migration in early winter (after December 15). Moderate numbers of deer are in the area delineated at that time. True winter range is smaller and confined to the south-facing slopes of Big Hoodoo Mountain, although this may also be somewhat misleading. During the 1988/89 winter more deer use of Big Hoodoo Mountain was observed the further east one went. This use was based primarily on tracks because only three groups of deer, totaling 13 individuals, were observed on the mountain all winter. Undoubtedly more animals were present. However, while this area supports wintering deer, not many individuals were present during the "normal" 1988/89 winter. As mentioned above, winter use of this area probably increases during milder winters.

Mule deer also winter in or adjacent to portions of the Libby Creek transmission line corridor east of the MP study area and, as stated above, areas along McMillan ridge are important winter ranges, especially during harsher winters. Many of the deer wintering east of Highway 2 cross the corridor east of Big and Little Hoodoo Mountains.

Figure 4.3.5.2 Approximate distribution of mule deer winter range in the Montana Project study area 1988-89.

Transitional range

Winter range



The south-facing slopes north of the Miller Creek transmission line corridor are mule deer winter range. Those ridges and the valley bottom are also movement corridors for deer moing to and from winter ranges east of Highway 2.

By late March-early April 1989 mule deer were occupying most of the lower elevations in the study area and had probably reached the headwalls by early May. Fawning peaked in mid-June; however, because no concentrations of deer were noted during this period in 1988, there did not appear to be any areas that could be considered traditional fawning grounds. Fawning appeared to occur in habitats along routes to upper elevation summer ranges. Suitable fawning habitat was widespread because much of the study area is snowfree by June 1, gates are still locked on many area roads, and relatively few recreationists are hiking about at that time.

In summer mule deer occurred throughout the study area, but were most common at mid- to upper elevations. They were observed as high as 6,400 feet on the ridge north of Poorman Creek, but probably extended at least to 6,900 feet. While there was a broad area of habitat overlap, mule deer frequently utilized more open areas in summer and throughout the year than did white-tails.

Fall hunting pressures are moderate in the study area and mule deer are regularly harvested from the project area. Mountain lions are the major predator in the area and their numbers in the Cabinet Mountains are relatively high.

4.3.6 Elk

Only 35 elk were observed during the baseline program: 16 in spring and 19 in summer (Figure 4.3.6.1). Twenty-five of these elk were observed during helicopter surveys (Table 4.3.1). Elk were the least commonly observed ungulate in the MP study area and they may also have been the least abundant.

Elk have a spotty distribution in the MP study area. Movements off summer ranges occur in late November through December, although the timing and length of movements varies with snow depth and accumulation patterns between years. Although few observations of elk use were recorded in the East Fork of Rock Creek, animals summering there generally migrate down the creek and traverse east to the Green Mountain-McKay Creek winter range, while small groups of older bulls winter in less hospitable sites (Farmer and Heath 1987).

East of the main Cabinet Mountains divide, elk migrate out of the MP study area in a general eastward

Figure 4.3.6.1 Seasonal distribution of elk observations in the Noranda study area 1988-89.

- ● Spring March 16-June 15
- ▲ Summer June 16-September 15
- ■ Fall September 16-December 15
- ◆ Winter December 16-March 15

movement. Like mule deer, the distance of fall migrations and the use of specific winter ranges varies between winters. Elk which summer in Libby, Ramsey, and Poorman Creeks are thought to move to the south-facing slopes of Big Hoodoo Mountain during milder winters and to McMillan Ridge, east of U.S. Highway 2, during harsher winters (J. Brown, MDFWP, pers. comm; MDFWP data files). No elk were observed wintering on Big Hoodoo Mountain during the four 1988/89 helicopter surveys. The 1988/89 winter, preceded by three mild winters, was considered "normal," although prolonged, which may have resulted in a reduced or lack of use on Big Hoodoo Mountain. Elk were observed crossing Highway 2 and moving through the Libby airport in fall 1988, although these animals could have summered elsewhere in the Cabinet Mountains.

Elk which summer in West Fisher Creek migrate east to the Teeters and Barren Peaks (north of the Miller Creek and West Fisher River transmission line corridors, respectively) winter ranges during milder winters (J. Brown, MDFWP, pers. comm.). During heavy snowfall winters, elk continue, or later move to, the Hunter Gulch, Brulee Creek, and Sedlak Park winter ranges, east of Highway 2. Elk crossing Highway 2 do so within the segments of the proposed transmission line corridors from the Miller Creek Road, south past the proposed junction with the existing BPA powerline.

By mid-April 1989, at least some elk were migrating back through the MP study area toward their summer ranges. Farmer and Heath (1987) reported migration off the Green Mountain-McKay Creek winter range into all but the highest, snow covered elevations of the Rock Creek study area in early May to mid-June.

Cows break off from these spring movements to calve in late May and early June. The only observations of relatively young calves were made during the June 24 helicopter survey over Big Hoodoo Mountain. Three groups of elk, totaling 13 animals and composed of nine cows and four calves, were observed in and near the upper elevation clearcuts (the only summer observations of elk on Big Hoodoo Mountain in Figure 4.3.6.1). This equates to a cow:calf ratio of 100:44 which is fairly high for a helicopter survey in that type of habitat where calves not standing next to their dams could easily be overlooked.

Based on these observations and those of cows with yearlings in this same area during the May 20, 1988, and April 20, 1989, helicopter surveys, portions of Big Hoodoo Mountain could a represent small, traditional calving ground. Unfortunately, this area was outside the intensive MP study area and, therefore, not subject to ground surveys which could have provided further evidence of calving numbers and distribution. No other young calves or

parturient females were observed during the baseline program to suggest additional calving areas. However, calving habitat in the MP study area does not appear to be limiting, especially in the upper drainages of West Fisher, Libby, Ramsey, and Poorman Creeks. These areas support favorable calving ground characteristics and, normally, experience low human disturbance during the calving period due to locked gates, steep topography, and vegetation that is difficult for humans to move through.

Besides the 13 cows and calves observed on Big Hoodoo Mountain, only two other elk groups, totaling six animals, were observed in the study area during summer. During snowfree periods in the MP study area, tracks were difficult to discern because of unsuitable substrate. Elk tracks and feces were observed in Libby, Ramsey, and West Fisher Creeks; however, it was impossible to estimate numbers from this evidence. It is likely that with increased human use from summer recreationists as well as Noranda consultants, elk were displaced to the least accessible portions of the MP study area.

One elk wallow was located in the study area adjacent to the crescent-shaped lake near the headwalls of West Fisher Creek. Local residents (e.g., D. Ricke, Libby resident, pers. comm.) report this area is the focus of some archery and rifle hunters. Archery hunters may have displaced bulls from the area because a September 9 ground survey indicated that elk had not used the area in the last two to three weeks.

It was uncertain how many elk seasonally utilized the MP study area; however, based on field surveys and discussions with agency biologists, numbers appear to be relatively low. The highest one-day count was the 13 cows and calves observed on Big Hoodoo Mountain on June 24. However, these animals may not have summered on the MP study area, but moved due west or northwest to Big Cherry and Granite Creeks where relatively large groups (30-40 animals) of elk are observed during summer and fall (J. Brown, MDFWP, pers. comm.). Few elk were observed in the study area during summer and fall because of observability, recreationist pressure, and apparently low elk numbers, although more elk were undoubtedly present than were observed. All elk appeared to migrate out of the MP study area during the "normal" 1988/89 winter.

4.3.7 Moose

Ninety-nine moose were observed throughout the MP study area, seasonally distributed as follows: spring, 23; summer, 15; fall, 37; and winter, 24 (Figure 4.3.7.1). Moose were difficult to systematically survey in the study

Figure 4.3.7.1 Seasonal distribution of moose observations in the Noranda study area 1988-89.

- ● Spring March 16-June 15
- ▲ Summer June 16-September 15
- ■ Fall September 16-December 15
- ◆ Winter December 16-March 15

area because of their preference, during most seasons, for relatively dense riparian and forested upland habitats. Consequently, fall and winter tracking surveys (see Tables 4.10.1 and 4.10.2) and sightings obtained by other project personnel (e.g., Dave Anderson, meteorology, pers. comm.) provided important supplementary data. These additional data are not illustrated in Figure 4.3.7.1, but have been incorporated into the text below.

Most moose migrate eastward out of the upper drainages (e.g., Libby, Ramsey, and West Fisher Creeks) to winter ranges along lower elevation drainage bottoms or on south-facing or relatively snowfree mountainsides, such as Big Hoodoo Mountain and Teeters Peak. This movement occurred in late November and throughout most of December 1988. During fall migration, moose concentrated in the 15-20 year old clearcuts within and north of the proposed Little Cherry Creek tailings site. Ground surveys indicated they were feeding on *Pachistima* sp., *Salix* spp., *Ceanothus* sp., and other shrubs.

It was in these areas during December when moose were most visible and effectively surveyed from the air. During the study's ten helicopter surveys, 64 moose were observed and 89% (57) of these were recorded during the December 3 and 18 flights (Table 4.3.1). Fifty-eight percent (33) of 57 moose observed during these two flights were utilizing the clearcuts in or adjacent to the Little Cherry Creek tailings site.

In December 1987 and 1988, Brown (1989) surveyed moose using a capture-recapture procedure involving painted adult moose. His study area north of Libby, in Hunting District 100, contained habitats directly comparable to those in the MP study area (Brown, MDFWP, pers. comm.). Study results indicated that 63-80% of the moose in these areas were overlooked during December helicopter surveys (Brown 1989, pers. comm.). Extrapolating this observability (20% in 1988, 37% in 1989) to the December MP surveys yields estimates of 92-170 and 60-110 moose potentially present in the MP study area (east of the divide) during the December 3 and 18 flights, respectively. There are a number of important underlying assumptions inherent in the capture-recapture procedure which could be discussed in support of, or in opposition to, these estimates. However, eventually we would conclude that the best data available went into the above calculations to procedure the first quantitative estimate of moose numbers in the area. While it is likely that this number of moose may migrate through the MP study area, without marked individuals it is difficult to know how many of these moose utilized summer ranges in the MP study area. While most moose observed near the Little Cherry Creek site probably migrated from upper elevation drainages, many of these animals could have moved from Bear and Cable

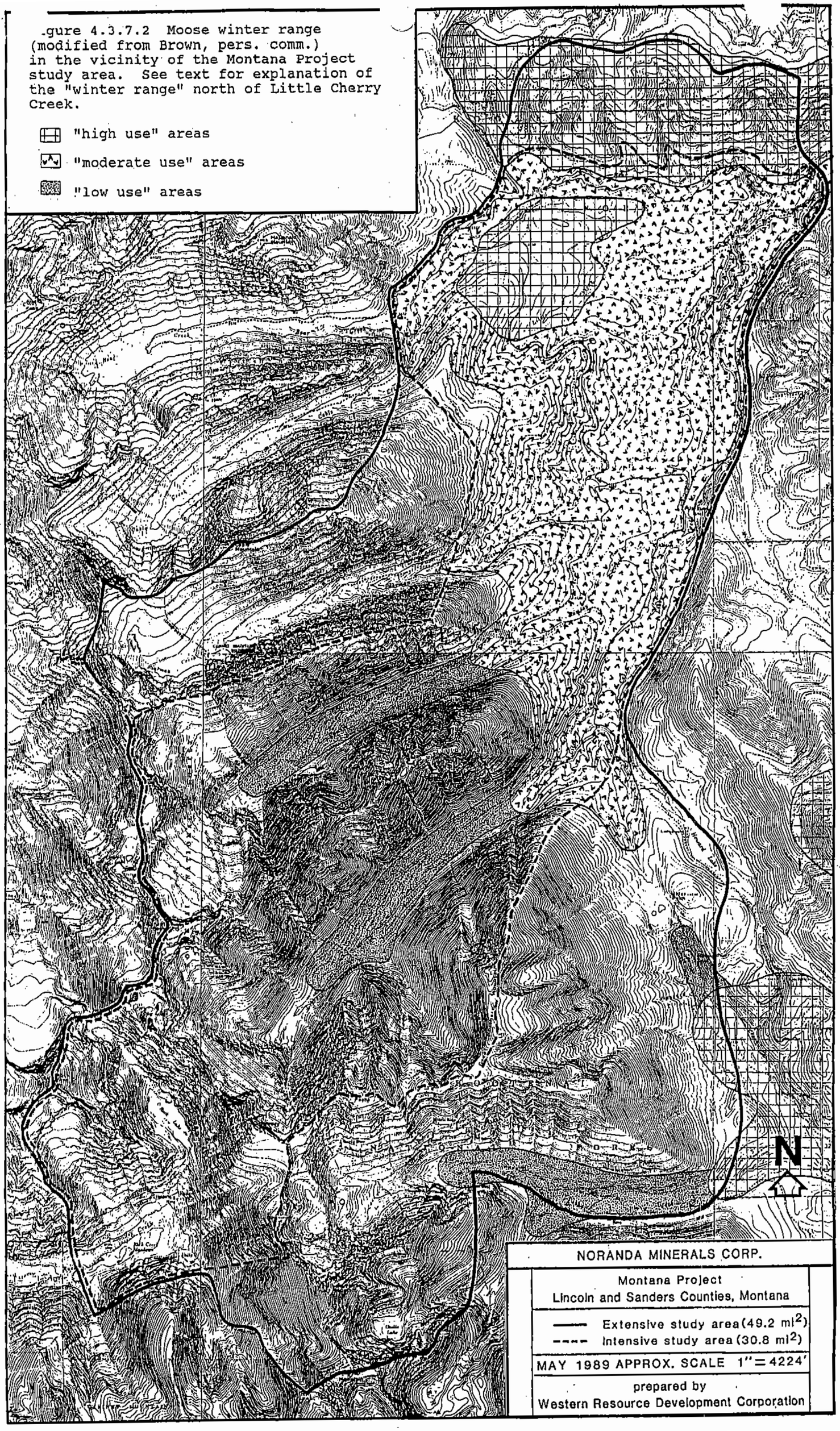
Creeks, outside of the project area. However, regardless of where they came from, the Little Chery Creek tailings site is an important fall transitional range utilized by relatively large numbers of migrating moose.

The majority of moose summering in and migrating through the MP study area appear to leave the study area during winter for wintering areas further east. Nevertheless, there are moderate numbers of moose which remained within study area boundaries over the "normal" 1988/89 winter. Approximate distribution of winter moose ranges in the vicinity of the MP study are illustrated in Figure 4.3.7.2. Some of these boundaries have been modified from "high" and "moderate" use areas delineated by Jerry Brown (MDFWP, pers. comm.) based on results of this study.

The most important winter moose range within the study area is the south side of Big Hoodoo Mountain (Figure 4.3.7.2). While few moose were actually seen on this area during winter surveys, track counts and aerial track observations indicated that moose were present in this area throughout the winter. Moose apparently utilized the older, more densely vegetated clearcuts at night, then returned to adjacent forested areas to bed during the day. This area is also considered a "high use" winter moose range by Jerry Brown (MDFWP, pers. comm.) and was added to the MP study area for that reason (Al Bratkovich, USFS, pers. comm.).

The relatively flat area west of Libby Creek, south of Bear Creek, and east of the Bear Creek Road (Figure 4.3.7.2) was identified by Jerry Brown (MDFWP, pers. comm.) as a "moderate use" moose winter range. Observations recorded during this study confirmed that classification. The clearcuts north of Little Cherry Creek, delineated as a "high use" winter range, actually represent the previously discussed transitional range; however, because of winter range definitions (December 16-March 15) it is included on the winter range map.

Limited winter use occurred in the upper drainages of Ramsey, Libby, and West Fisher Creeks during the 1988/89 winter. Dave Anderson, who monitored the Ramsey Creek weather station via snowmobile each week, regularly observed four to six moose in Ramsey Creek and along the Libby Creek Road during each trip. Moose appeared to move out of Ramsey and Libby Creeks for about a month in late January-February, possibly because of deep, crusty snow, although individuals could have restricted themselves to small, forested areas with relatively unconsolidated snowpacks and gone undetected. No moose or moose tracks were observed in Poorman Creek during any of the winter surveys. Habitats and winter conditions in this drainage were not appreciably different than those in Libby or Ramsey Creeks.



.gure 4.3.7.2 Moose winter range (modified from Brown, pers. comm.) in the vicinity of the Montana Project study area. See text for explanation of the "winter range" north of Little Cherry Creek.

In addition to Big Hoodoo Mountain, the south sides of Teeters Peak and Horse Mountain and the south-facing slopes north of Miller Creek are all important high moose use winter ranges (J. Brown, MDFWP, pers. comm.) that are probably utilized by moose summering in the MP study area. With the exception of the Teeters Peak winter range, which extends onto the MP study area along Standard Creek and the Standard Creek/West Fisher Creek confluence, these winter ranges begin approximately two miles east of the MP study area boundary. Portions of all transmission line corridor alternates pass through some of these moose winter ranges. Moose tracks were observed as far up Rock Creek as the junction of the East and West Fork Roads during the 1988/89 winter.

Spring movements back toward summer ranges were beginning throughout lower study area elevations in late March and early April. Animals are thought to generally retrace their fall routes.

Calving occurs in late May-early June on lower summer range, spring transitional ranges, and what are classified as winter ranges. Because of leaf-out and the use of forested habitats, no moose were observed during the three helicopter surveys bracketing the 1988 parturition period. Young calves and cow and calf tracks were observed in the Libby Creek fen below Howard Creek, near the small ponds above the Little Cherry Loop impoundment site, and near the headwalls of Ramsey Creek; however, these animals could have moved to these areas from their actual calving sites.

Moose summer range extends throughout the study area from the lowest elevations along study area creeks to the mid-elevation sidewalls of the upper drainages. Moose concentrate in riparian bottoms, around ponds with emergent hydrophytes, in 15-20 year old clearcuts with dense shrubby understories, in dry to wet upper elevation *Ceanothus*, *Pachistima*, Rocky Mountain maple, and alder shrubfields, and in forested uplands containing shrubby understories. Although no moose were observed in Rock Creek Meadows, moose tracks indicated that at least a few animals were present.

4.3.8 Mountain Goat

One hundred forty-two mountain goats were observed in the study area during the spring (85), summer (49), fall (3), and winter (5) periods (Figure 4.3.8.1). The number of goats seasonally observed in the study area reflected the schedule and thoroughness of the aerial surveys, since 75% (106 of 142) of the goats observed were detected from the air. Four helicopter surveys were

.gure 4.3.7.2 Moose winter range (modified from Brown, pers. comm.) in the vicinity of the Montana Project study area. See text for explanation of the "winter range" north of Little Cherry Creek.

- "high use" areas
- "moderate use" areas
- "low use" areas

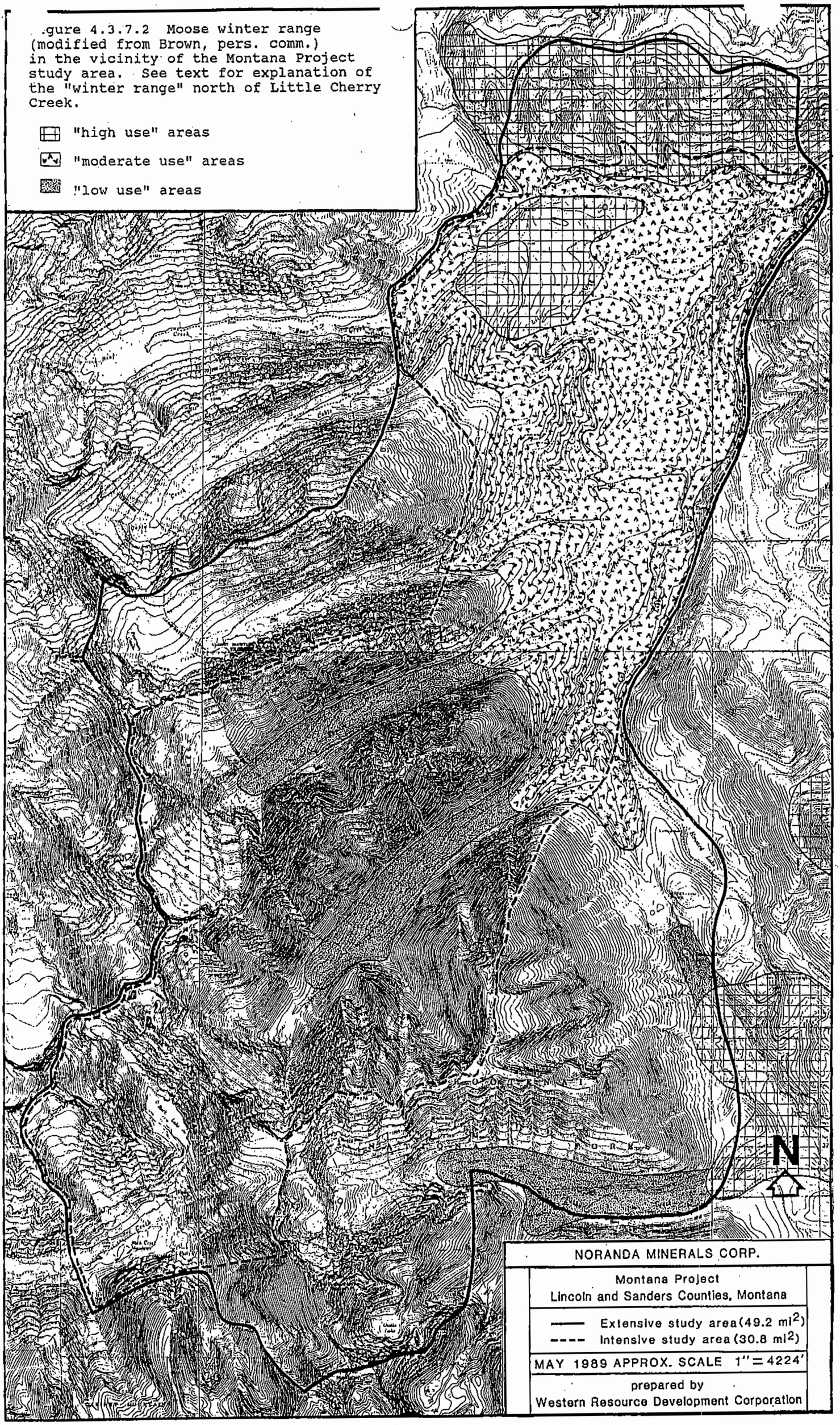


Figure 4.3.8.1 Seasonal distribution of mountain goat observations in the Noranda study area 1988-89.

- ● Spring March 16-June 15
- ▲ Summer June 16-September 15
- ■ Fall September 16-December 15
- ◆ Winter December 16-March 15

conducted during the spring periods, two in summer, one in fall, and three in winter. However, because of dangerous winds none of the winter surveys covered Rock Creek where most goats in the MP study area wintered. Nevertheless, the December 3 and April 17 survey results were more indicative of mountain goat winter range selection and use than the fall and spring seasons, as these flights were defined.

Mountain goats occupied the rocky, upper elevations of the MP study area along the main Cabinet Mountains divide and out onto the spur ridges (Figure 4.3.8.1). Summer range use typically occurred at higher elevations than that during winter; however, there was a broad overlap resulting from local habitat, aspect, and phenological characteristics. On a yearround basis, the concentration of goat activity in the MP study area occurred in and near the headwalls of Rock, Libby, and West Fisher Creeks (Figure 4.3.8.1). Ninety percent of all goats observed during the study were within this area. Goats were also observed elsewhere in Libby Creek and in Ramsey and Poorman Creeks; however, most observations in these areas were of single billies. Based on survey results and study area characteristics, there were probably 40-55 goats that inhabited the MP study area during the 1988/89 baseline survey.

The south-facing slopes of Rock Peak are the primary winter range for goats in the MP study area (Figure 4.3.8.2). About half of the goats wintering in Rock Creek used the cliffs northeast of the first bridge above the trailhead, which was west of the MP study area boundary. Tracks observed during winter snowmobile surveys indicated that goats occasionally came down to the Rock Creek road in winter. Rock Creek was the only area in the MP study area where Joslin (1980) observed wintering goats and she classified the area as "confirmed winter range." Twenty-five goats (including five kids and one yearling) were observed in this area on April 7. Goat tracks followed by helicopter on December 3 out of Libby and West Fisher Creeks lead to this winter range (Figure 4.3.8.2) confirmed a long suspected connection (T. Lempke, MDFWP, pers. comm.) between this winter range and adjacent summer ranges east of the divide. Based on habitat characteristics, Joslin (1980) also classified the south-facing slopes north of West Fisher Creek as "likely winter range" and the northwest-facing slopes southeast of Ozette Lake as "probable winter range." No goats were observed wintering in either area during the present study.

Numerous goat tracks, representing 27-30 individuals, were followed by helicopter on April 20 from the Rock Creek winter range to spring/summer ranges as far as the eastern tips of ridges north of Libby and Ramsey creeks (Figure 4.3.8.2). These latter areas are also winter

Figure 4.3.8.2 Mountain goat winter range and movements in the Montana Project study area.

ranges used by low (4 or less) numbers of goats (primarily single billies) during the 1988/89 winter. These two small areas contain suitable escape terrain, favorable solar orientation, and, visually, retain less snow and shed it faster than adjacent slopes to the west in these drainages. Joslin (1980) classified both these areas and a comparable south-facing slope north of Poorman Creek as "probable winter range."

Few nannies with kids were observed within or close enough to the parturition/seclusion period to identify more than one specific kidding area. Neonates, single nannies, and habitat characteristics suggested that the precipitous slopes northeast of Rock Lake were a kidding ground. A nanny, kid, and two yearlings were observed near the south-facing headwalls of Poorman Creek on June 24; however, the age of the kid, association with two year olds, and habitat characteristics suggested the kid was born elsewhere. By September, kids had been observed in all study area drainages except Ramsey Creek; the lack of sightings there was probably due to sampling effort.

Seven different kids were observed during the September 9, 1988, survey (30 kids:100 older animals) and five kids were observed on the Rock Creek winter range on April 7, 1989 (25 kids:100 older animals). This indicates relatively good 1988 production for a native goat population and good survivorship over the "normal" 1988/89 winter. However, based on yearlings observed during the study, 1987 production and/or survivorship may have been low. Of the 142 goats observed during the study, only seven were yearlings. The highest ratio observed during any one survey was 33 yearlings:100 older animals (four goats observed; one was a yearling), but ratios from all other surveys in which yearlings were observed (n = 3) ranged from 5 Y:100 OA (16 goats) to 23 Y:100 OA (30 goats).

During summer, goats were most common in the MP study area around Rock Lake and in the south headwalls of Libby Creek. Billies and small family groups were also observed in all other upper elevation study area drainages (Figure 4.3.8.1). The largest number of goats observed during a single flight was 30 on September 9. Thirteen of these goats were in Libby Creek, five in Poorman Creek, two in West Fisher Creek, eight around Ozette Lake, and two in Rock Creek.

4.3.9 Mountain Sheep

No mountain sheep were observed in the study area during baseline fieldwork. The distribution of bighorn sheep in the Cabinet Mountains does not extend as far south

as the MP study area, although some local habitats appear suitable as summer range.

4.4 BREEDING BIRD RICHNESS AND DENSITY

The majority of bird species and individuals which breed in the MP study area migrate into the area in spring and leave the area in early to mid-fall. Numerically, winter bird populations are only a fracton of those present during spring and summer.

A total of 1,711 birds representing 92 breeding species was observed in potential development area habitats during June 1988 plot counts. The greatest number of breeding species occurred in riparian habitats (63), followed by spruce-fir habitats (58), shrubfields (57), mixed conifer stands (50), clearcuts (48), and western hemlock stands (37).

Breeding species observed on potential development areas appeared to be representative of the area's avifauna. Ten additional species (great blue heron, osprey, red-tailed hawk, golden eagle, blue grouse, killdeer, red-naped sapsucker, northern rough-winged swallow, barn swallow, and northern oriole) were observed in the study area during the breeding season, but not during plot counts. Additional undetected species which may breed on the study area are localized or uncommon (e.g., rock wren) and/or are difficult to detect (e.g., small owls) using the present sampling methodology.

Density estimates represent mean values of species present on impact area survey plots during the 1988 breeding season. These estimates may vary over the season and between plots depending on habitat quality, species' habitat affinities, breeding activities, and a number of other factors. Estimates, which are based on sample statistics, are most accurate for common, widespread, territorial species (e.g., American robin) and less accurate for uncommon species with narrow habitat affinities (e.g., black swift) and species difficult to detect (e.g., small owls). The 95% confidence interval, which follows the mean density estimate, simply means that we are 95% confident that, based on sampling variability, the actual value lies within this interval. For example, there is a 95% probability that the 1988 breeding bird density in riparian habitats is between 346 and 1,464 birds/100 ha (905 +558.6) (Table 4.4.1). Unfortunately, there have been no quantitative bird studies conducted on the Forest that these data may be compared to (A. Bratkovich, USFS, pers. comm.). The line transects (Emlen 1971), conducted by Farmer and Heath (1987) on

Table 4.4.1 Mean riparian plot and habitat densities for breeding birds on the Montana Project study area, Lincoln and Sanders Counties, Montana, June 1988. Scientific names are listed in Table 4.1.2.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Mallard	0.4	0	0	0	5 ±13.8
Sharp-shinned Hawk	0.2	0	0	0	3 ± 6.9
Northern Goshawk	0	0	0.2	0	3 ± 6.9
Ruffed Grouse	0	0.2	0.6	0.6	18 ±20.7
Spotted Sandpiper	1.4	0	0	0	18 ±48.2
Common Snipe	0.4	0	0.2	0	8 ±13.2
Rufous Hummingbird	0.6	0.2	0	0	10 ±19.5
Belted Kingfisher	0	0	0	0.2	3 ± 6.9
Northern Flicker	0.6	0.4	0.4	0	18 ±17.3
Olive-sided Flycatcher	0	0.4	0.2	0.6	15 ±17.8
Willow Flycatcher	0.6	0	0.4	0.2	15 ±17.8
Least Flycatcher	0.4	0.2	0.6	0.4	20 ±11.3
Hammond's Flycatcher	0	0	0.2	1.2	18 ±39.6
Dusky Flycatcher	1.0	0	0.2	0.2	18 ±30.6
Say's Phoebe	0	0	0.2	0	3 ± 6.9
Tree Swallow	0	0	0.6	0.2	10 ±19.5
Violet-green Swallow	0.6	0	0	0.6	15 ±23.9
Gray Jay	0	0	0	0.8	10 ±27.6
Steller's Jay	0	0.6	0	0.4	13 ±20.7
Common Raven	0	0	0.2	0	3 ± 6.9
Black-capped Chickadee	0	1.0	1.4	0.2	33 ±45.5
Chestnut-backed Chickadee	0	0.4	0	0.8	15 ±26.4
Red-breasted Nuthatch	0	0	0.2	0	3 ± 6.9
White-breasted Nuthatch	0	0	0.2	0	3 ± 6.9
Pygmy Nuthatch	0	0.4	0	0	5 ±13.8
Golden-crowned Kinglet	0	0.6	0.2	1.8	33 ±55.5
Ruby-crowned Kinglet	0	0.2	0.4	0.2	10 ±11.3
Townsend's Solitaire	0	0	0.2	0.2	5 ± 8.0
Veery	0	0	0	0.4	5 ±13.8
Swainson's Thrush	0.2	1.2	0.8	0.2	30 ±33.8
Hermit Thrush	0	0.2	0.8	0.8	23 ±28.4
American Robin	0.6	0.4	1.6	1.8	55 ±48.4
Varied Thrush	0	0.8	0.2	0.2	15 ±23.9
Gray Catbird	0	0	0.2	0	3 ± 6.9
Solitary Vireo	0.2	0	0.4	0.8	18 ±23.5
Warbling Vireo	0	0	0.2	0.4	8 ±13.2
Red-eyed Vireo	0.2	0	0.2	0	5 ± 8.0
Oranged-crowned Warbler	0.2	0.4	0.8	0.8	28 ±20.7
Nashville Warbler	0.4	0	0.6	0	13 ±20.7
Yellow Warbler	0.6	0	0	1.2	23 ±39.6
Yellow-rumped Warbler	0	0	0.4	0	5 ±13.8

TABLE 4.4.1 Continued.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Townsend's Warbler	0	0.8	0.8	0.8	30 ±27.6
American Redstart	0	0	0.2	0.8	13 ±26.1
Northern Waterthrush	0.2	0	0.2	0.8	15 ±23.9
MacGillivray's Warbler	0.8	0	0.2	1.6	33 ±49.5
Common Yellowthroat	0	0	0.2	0	3 ± 6.9
Wilson's Warbler	0	0	0	0.2	3 ± 6.9
Western Tanager	0	0	0.2	0.4	8 ±13.2
Black-headed Grosbeak	0	0.4	0	0	5 ±13.8
Rufous-sided Towhee	0	0	0.2	0.2	5 ± 8.0
American Tree Sparrow	0	0	1.0	0.2	15 ±32.8
Chipping Sparrow	0	0	1.8	1.2	38 ±62.0
Vesper Sparrow	0	0	0	0.2	3 ± 6.9
Savannah Sparrow	0	0.4	0.8	0.2	18 ±23.5
Fox Sparrow	0.8	0	0	1.4	28 ±46.9
Song Sparrow	1.6	0	1.4	0.2	40 ±56.3
Dark-eyed Junco	0	1.0	1.4	0.8	40 ±40.6
Western Meadowlark	0	0	0	0.2	3 ± 6.9
Brewer's Blackbird	0.2	0	0	0	3 ± 6.9
Brown-headed Cowbird	0	0	0	1.2	15 ±41.3
Pine Grosbeak	0	0	0	0.4	5 ±13.8
Cassin's Finch	0	0	0.2	0	3 ± 6.9
Pine Siskin	0.2	0.2	0.6	1.6	20 ±15.9
Mean Plot Density	12.4	10.4	22.0	27.6	905 ±558.6
Total Birds Observed	62	52	110	138	362[b]
Total Species Observed	23	21	43	43	63[c]

[a]Plots are each 2 hectares (4.94 acres)
[b]Total birds observed during plot counts
[c]Total species observed during plot counts

ASARCO's adjacent Rock Creek study area, did not yield comparative density estimates.

Riparian plots contained more breeding species (63) at higher mean densities (905 ±558.6 birds/100 ha) than plots in other study area habitats (Table 4.4.1). Riparian habitats typically support the most diverse and dense bird communities because of the vegetative diversity and structure associated with flowing or standing water bodies. American robins, song sparrows, dark-eyed juncos, black-capped chickadees, golden-crowned kinglets, and MacGillivray's warblers were the most abundant species and together accounted for 30% of the riparian bird community.

Western hemlock plots contained the lowest number of breeding species (37) of any habitat sampled (Table 4.4.2). Mean bird density in this type was 610 ±180.3 birds/100 ha. The western hemlock/western red cedar association represents the climax successional stage for much of the study area. Although the three study plots were relatively young to decadent hemlock stands, barren to depauperate understories, and, on two plots, the light penetration below the 30-37 m canopies appeared to limit foraging opportunities for a diverse bird community. Golden-crowned kinglets, Townsend's warblers, black-capped and chestnut-backed chickadees, red-breasted nuthatches, and varied thrushes were the most common species representing 52% of the hemlock population. Golden-crowned kinglets and Townsend's warblers alone composed 30% of all birds detected.

Fifty breeding bird species were observed on mixed conifer plots during sampling (Table 4.4.3). Mean bird density in this variable, widespread habitat was 634 ±79.5 birds/100 ha. Townsend's warblers, golden-crowned kinglets, and pine siskins were the most common species, followed by dark-eyed juncos, black-capped chickadees, red-breasted nuthatches, Swainson's thrushes, and American robins. These species represented 57% of all birds observed; the three former species alone accounted for 34% of the bird community.

Clearcuts sampled ranged from relatively sparse stands of less than 1 m-3 m lodgepole pine with isolated, similarly sized larch and grand fir with a shrubby-herbaceous understory (C3), to dense, diverse, 25-30 year old cuts colonized by larch, black cottonwood, western white pine, subalpine fir, western red cedar, grand fir, and Engelman spruce up to 9 m tall. Forty-eight breeding species were observed on the five clearcut plots during the five replications. Mean bird density on these plots was 510 ±184.6 birds/100 ha (Table 4.4.4), the lowest density for the six habitats sampled. This appears to result from the generally low, vegetative structural diversity on these developing cutting units. Dark-eyed juncos, chipping sparrows, and pine siskins were

Table 4.4.2 Mean western hemlock plot and habitat densities for breeding birds on the Montana Project study area, Lincoln and Sanders Counties, Montana, June 1988. Scientific names are listed in Table 4.1.2.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Barred Owl	0.2	0	0	3 ±11.7
Vaux's Swift	0	0.4	0	7 ±23.4
Rufous Hummingbird	0	0.2	0	3 ±11.7
Three-toed Woodpecker	0.2	0.2	0.4	13 ±11.7
Pileated Woodpecker	0	0.4	0.2	10 ±20.3
Olive-sided Flycatcher	0	0.4	0	7 ±23.4
Least Flycatcher	0.6	0	0	10 ±35.1
Western Flycatcher	0	0.2	0	3 ±11.7
Gray Jay	0	0.4	0	7 ±23.4
Black-capped Chickadee	0	1.0	1.6	43 ±82.0
Mountain Chickadee	0.2	0.4	0.4	17 ±11.7
Chestnut-backed Chickadee	0.2	1.6	0	30 ±88.4
Red-breasted Nuthatch	0.4	0.8	0.6	30 ±20.3
Pygmy Nuthatch	0	0.2	0	3 ±11.7
Brown Creeper	0	0	0.2	3 ±11.7
Winter Wren	1.6	0	0	27 ±93.7
Golden-crowned Kinglet	1.4	2.0	3.2	110 ±93.0
Ruby-crowned Kinglet	0.4	0.4	0.4	20 ± 0.0
Swainson's Thrush	0.6	0.6	0.2	23 ±23.4
Hermit Thrush	0.4	0	0.4	13 ±23.4
American Robin	1.0	0.4	0	23 ±51.0
Varied Thrush	0.8	0.6	0.4	30 ±20.3
Nashville Warbler	0.4	0	0	7 ±23.4
Yellow Warbler	0.2	0	0	3 ±11.7
Yellow-rumped Warbler	0	0.4	0	7 ±23.4
Townsend's Warbler	1.0	0.8	2.6	73 ±100.1
Northern Waterthrush	0.4	0	0	7 ±23.4
MacGillivray's Warbler	0.2	0.6	0	13 ±31.0
Western Tanager	0	0.2	0	3 ±11.7
Rufous-sided Towhee	0	0	0.2	3 ±11.7
Chipping Sparrow	0.2	0.2	0	7 ±11.7
Savannah Sparrow	0	0.2	0	3 ±11.7
Dark-eyed Junco	0	0.4	0	7 ±23.4
Brown-headed Cowbird	0	0	0.2	3 ±11.7
Cassin's Finch	0	0	0.2	3 ±11.7
Red Crossbill	0	0.4	0	7 ±23.4

Table 4.4.2 Continued.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Pine Siskin	0.2	0.8	0.4	23 ±31.0
Unidentified	0.2	0	0	3 ±11.7
Mean Plot Density	10.8	14.2	11.6	610 ±180.3
Total Birds Observed	54	71	58	183[b]
Total Species Observed	20	26	16	37[c]

[a]Plots are each 2 hectares (4.94 acres)
[b]Total birds observed during plot counts
[c]Total species observed during plot counts

Table 4.4.3 Mean mixed conifer plot and habitat densities for breeding birds on the Montana Project study area, Lincoln and Sanders Counties, Montana, June 1988. Scientific names are listed in Table 4.1.2.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	5	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Sharp-shinned or Cooper's Hawk	0	0	0	0.2	0	2 ± 5.0
Northern Goshawk	0	0	0.2	0	0	2 ± 5.0
Ruffed Grouse	0	0	0	0	0.4	4 ± 9.9
Black Swift	0.8	0	0	0	0	8 ±19.9
Calliope Hummingbird	0.2	0	0	0	0	2 ± 5.0
Rufous Hummingbird	0	0.2	0.2	0	0	4 ± 6.1
Downy Woodpecker	0	0.2	0	0	0	2 ± 5.0
Hairy Woodpecker	0	0	0	0	0.2	2 ± 5.0
Three-toed Woodpecker	0	0	0.2	0	0	2 ± 5.0
Northern Flicker	0	0	0	0.6	0.4	10 ±15.7
Pileated Woodpecker	0	0	0.2	0	0	2 ± 5.0
Least Flycatcher	0.2	0	0	0	0	2 ± 5.0
Hammond's Flycatcher	0	0	0	0	0.2	2 ± 5.0
Dusky Flycatcher	1.2	0	0	0	0	12 ±29.8
Gray Jay	0	0	0.4	0	0	4 ± 9.9
Steller's Jay	0.6	0	0	0	0	6 ±14.9
Black-capped Chickadee	0.4	0.4	0.6	0.6	0.8	28 ± 9.3
Mountain Chickadee	0	0	0.4	0.2	1.0	16 ±23.0
Chestnut-backed Chickadee	0	0	0.2	0.6	0	8 ±14.5
Red-breasted Nuthatch	0.2	0	0.4	0.8	1.4	28 ±30.8
White-breasted Nuthatch	0	0	0	0.2	0	2 ± 5.0
Pygmy Nuthatch	0	0	0	0.2	0	2 ± 5.0
Brown Creeper	0	0	0.6	0	0.2	8 ±14.5
Winter Wren	0.2	0	0	0.4	0	6 ± 9.9
Golden-crowned Kinglet	0.2	1.8	2.2	1.0	1.6	68 ±43.3
Ruby-crowned Kinglet	0	0.6	0	0	0.4	10 ±15.7
Mountain Bluebird	0	0	0	0.2	0	2 ± 5.0
Swainson's Thrush	0.8	0.4	0.6	0.4	0.6	28 ± 9.3
Hermit Thrush	0.2	0	0.6	0.2	0	10 ±13.6
American Robin	1.2	0.2	0.6	0.4	0.4	28 ±21.4
Varied Thrush	0	1.0	0	0.2	0.6	18 ±24.1
Gray Catbird	0.4	0	0	0	0	4 ± 9.9
Solitary Vireo	0.8	0	0	0	0	8 ±19.9
Warbling Vireo	0.6	0.2	0	0	0	8 ±14.5
Nashville Warbler	0.2	0	0.2	0	0	4 ± 6.1
Yellow-rumped Warbler	0	0.2	0.2	0	0.2	6 ± 6.1
Townsend's Warbler	0.8	0.6	2.6	2.0	2.4	84 ±51.2
MacGillivray's Warbler	0.8	1.4	0.2	0	0	24 ±33.9
Common Yellowthroat	0	0.2	0	0	0	2 ± 5.0
Western Tanager	0.4	0	0	0	0	4 ± 9.9

Table 4.4.3 Continued.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	5	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Black-headed Grosbeak	0.4	0	0	0.2	0.2	8 ± 9.3
American Tree Sparrow	0	0	0	0.2	0	2 ± 5.0
Chipping Sparrow	0	0	0	0	0.2	2 ± 5.0
Savannah Sparrow	0	0.6	0	0	0.2	8 ±14.5
Song Sparrow	0.6	0	0	0	0	6 ±14.9
Dark-eyed Junco	0	0.4	1.6	0	1.4	34 ±42.7
Brown-headed Cowbird	0	0	0.4	0.6	0	10 ±15.7
Cassin's Finch	0.4	0	0.2	1.8	0.2	26 ±40.5
Red Crossbill	0.2	0	0	0	0	2 ± 5.0
Pine Siskin	1.0	2.6	0.2	0.8	1.8	64 ±51.8
Mean Plot Density	12.8	11.0	13.0	11.8	14.8	634 ±79.5
Total Birds Observed	64	55	65	59	74	317[b]
Total Species Observed	24	16	22	21	21	50[c]

[a]Plots are each 2 hectares (4.94 acres)
[b]Total birds observed during plot counts
[c]Total species observed during plot counts

Table 4.4.4 Mean clearcut plot and habitat densities for breeding birds on the Montana Project study area, Lincoln and Sanders Counties, Montana, June 1988. Scientific names are listed in Table 4.1.2.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	5	MEAN HABITAT DENSITY (n/100 ha +95% CI)
American Kestrel	0	0	0	0	0.2	2 ± 5.0
Northern Pygmy Owl	0	0	0.2	0	0	2 ± 5.0
Common Nighthawk	0	0	0	0.2	0	2 ± 5.0
Calliope Hummingbird	0	0	0	0.2	0	2 ± 5.0
Rufous Hummingbird	1.0	0.2	0.4	0.2	0.2	20 ±19.2
Hairy Woodpecker	0	0	0	0.2	0	2 ± 5.0
Northern Flicker	0	0	0.2	0.2	0	4 ± 6.1
Western Wood Peewee	0	0	0.2	0.2	0	4 ± 6.1
Least Flycatcher	0.2	0	0.4	0	0	6 ± 9.9
Hammond's Flycatcher	0	0	0.6	1.0	0	16 ±25.6
Dusky Flycatcher	0.2	0	0	0	0.2	4 ± 6.1
Say's Phoebe	0.2	0	0	0	0	2 ± 5.0
Gray Jay	0	0	0	0.4	0	4 ± 9.9
Steller's Jay	0.2	0	0	0	0	2 ± 5.0
Black-billed Magpie	0	0.4	0	0	0	4 ± 9.9
Common Raven	0	0	0.4	0.6	0	10 ±15.7
Black-capped Chickadee	0	0.4	0.8	0.4	0	16 ±18.6
Mountain Chickadee	0	0	1.0	0.6	0	16 ±25.6
Red-breasted Nuthatch	0	0.2	0	0.2	0	4 ± 6.1
House Wren	0.2	0	0	0.2	0	4 ± 6.1
Winter Wren	0	0.2	0	0	0	2 ± 5.0
Golden-crowned Kinglet	0	0.2	0	0	0	2 ± 5.0
Western Bluebird	0	0	0	0.2	0	2 ± 5.0
Townsend's Solitaire	0	0	0.2	0.4	0	6 ± 9.9
Swainson's Thrush	0	0	0.2	0.2	0	4 ± 6.1
American Robin	0	1.4	0.8	0.6	0	28 ±32.8
Gray Catbird	0	0	0	0.2	0	2 ± 5.0
Cedar Waxwing	0	0	0	0.4	0	4 ± 9.9
Warbling Vireo	0.4	0.4	0	0.6	0	14 ±14.9
Red-eyed Vireo	0	0	0	0.2	0	2 ± 5.0
Tennessee Warbler	0	0	0	0.2	0	2 ± 5.0
Oranged-crowned Warbler	0.4	0	0	0.6	0.6	16 ±16.8
Nashville Warbler	0	0	0	0.4	1.0	14 ±24.3
Yellow Warbler	0	0	0.2	0.4	0	6 ± 9.9
Townsend's Warbler	0	0.4	0.2	0.2	0	8 ± 9.3
American Redstart	0	0	0	0.4	0	4 ± 9.9
MacGillivray's Warbler	0.6	0	0.2	1.0	0.2	20 ±22.2
Wilson's Warbler	0	0	0	0	0.2	2 ± 5.0
Black-headed Grosbeak	0.2	0.2	0.2	0	0	6 ± 6.1
Lazuli Bunting	0.4	0	0	0.2	0	6 ± 9.9
Rufous-sided Towhee	0.2	0	0	0	0	2 ± 5.0

TABLE 4.4.4 Continued.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	5	MEAN HABITAT DENSITY (n/100 ha +95% CI)
American Tree Sparrow	0	0.4	0	0	0	4 ± 9.9
Chipping Sparrow	0.4	1.0	2.2	1.6	2.0	72 ±41.1
Savannah Sparrow	0	0.6	0	0	0	6 ±14.9
Dark-eyed Junco	1.2	1.6	0.6	2.4	1.8	76 ±37.3
Brown-headed Cowbird	0	0	0	0.2	0	2 ± 5.0
Cassin's Finch	0	0	0.2	0	0.4	6 ± 9.9
Pine Siskin	1.8	2.4	0.4	0.2	0.6	54 ±53.6
Unidentified	0	0.2	0	0.6	0.4	12 ±14.5
Mean Plot Density	7.6	10.2	9.6	15.8	7.8	510 ±184.6
Total Birds Observed	38	51	48	79	39	255[b]
Total Species Observed	15	15	20	33	11	48[c]

[a]Plots are each 2 hectares (4.94 acres)
[b]Total birds observed during plot counts
[c]Total species observed during plot counts

the most abundant species on clearcuts and together represented 40% of the bird community.

Fifty-seven bird species were observed on shrubfields during plot counts resulting in a mean habitat density of 653 ±222.6 birds/100 ha (Table 4.4.5). Rufous hummingbirds, MacGillivray's warblers, pine siskins, golden-crowned kinglets, and chipping sparrows were the most common species and comprised 35% of all birds observed.

Spruce-fir habitats contained 58 breeding species and supported a mean habitat density of 666 ±86.9 birds/100 ha (Table 4.4.6). Golden-crowned kinglets were the most common species, followed by pine siskins, Townsend's warblers, Swainson's thrushes, winter wrens, and least flycatchers. Together these species represented 47% of the bird community. Golden-crowned kinglets alone composed 17% of all birds detected.

Table 4.4.7 summarizes breeding bird densities in major impact area habitats by habitat type based on the replicated plot counts. Additional species which were observed in the area, but not during plot counts, are not included. Similarly, species not listed in a particular habitat either do not breed in that habitat, or were not observed in that habitat during sampling. Figure 4.4.1 illustrates the relationship of breeding bird richness and density between habitats.

4.4.1 Avian Use of Habitat Types

Avian species richness on potential development area habitats differed significantly between ($F = 3.11$, $P < 0.025$) and within ($F = 4.02$, $P < 0.0005$) major habitat types (see Table 6.3.2 in Appendix 6.3). Differences in bird use between habitats are related to the different vegetative and physical attributes which characterize a habitat type and to the relative value of that type (habitat quality) in providing various avian life history requirements such as forage, cover, and nesting sites. Differences in use within habitats (i.e., between plots) are related to variation in plot quality within a habitat type. However, SNK test results (see Table 6.3.3 in Appendix 6.3) indicate that only the riparian and clearcut bird diversities differed significantly from each other; all other bird richness comparisons between habitats were statistically similar.

This similarity in bird diversity between habitats is not that surprising after even a cursory habitat analysis. Vegetative composition of understories and overstories, percent cover, and structural diversity was highly variable within and between habitats. Some habitats and bird plots represented distinct habitats while others were ecotones between adjacent types. In some areas

Table 4.4.5 Mean shrubfield plot and habitat densities for breeding birds on the Montana Project study area, Lincoln and Sanders Counties, Montana, June 1988. Scientific names are listed in Table 4.1.2.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Sharp-shinned Hawk	0.2	0	0	0	3 ± 6.9
Northern Goshawk	0	0	0	0.2	3 ± 6.9
Ruffed Grouse	0.2	0	0	0	3 ± 6.9
Vaux's Swift	0	0	1.2	0	15 ±41.3
Rufous Hummingbird	1.2	1.0	1.6	1.6	68 ±20.7
Hairy Woodpecker	0	0	0	0.4	5 ±13.8
Northern Flicker	0	0	0	0.8	10 ±27.6
Pileated Woodpecker	0	0	0.4	0	5 ±13.8
Olive-sided Flycatcher	0	0.8	0.8	0.8	30 ±27.6
Wesern Wood Peewee	0	0	0.2	0	3 ± 6.9
Willow Flycatcher	0	0.2	0	0	3 ± 6.9
Least Flycatcher	0	0.8	0.4	0.4	20 ±22.5
Hammond's Flycatcher	0.2	0	0.2	0.2	8 ± 6.9
Dusky Flycatcher	0	0.2	0	0.2	5 ± 8.0
Western Flycatcher	0	0	0	0.2	3 ± 6.9
Steller's Jay	0.4	0	0	0	5 ±13.8
Black-capped Chickadee	0.4	0	0	0.2	8 ±13.2
Chestnut-backed Chickadee	0.2	0	0.2	0	5 ± 8.0
Red-breasted Nuthatch	0.2	0	0	0	3 ± 6.9
Winter Wren	0	0.2	0	0	3 ± 6.9
Golden-crowned Kinglet	1.6	0	0.8	0.2	33 ±49.5
Ruby-crowned Kinglet	0.2	0	0	0	3 ± 6.9
Townsend's Solitaire	0	0	0	0.2	3 ± 6.9
Swainson's Thrush	0	0.4	0.2	1.0	20 ±29.8
Hermit Thrush	0	0.4	0.2	0	8 ±13.2
American Robin	0.8	0	0.4	0.8	25 ±26.4
Solitary Vireo	0	0	0	0.6	8 ±20.7
Warbling Vireo	0.6	0.2	0.6	0.4	23 ±13.2
Red-eyed Vireo	0.4	0	0	0.2	8 ±13.2
Tennessee Warbler	0	0.2	0	0.6	10 ±19.5
Oranged-crowned Warbler	0.2	0.6	0	0.4	15 ±17.8
Nashville Warbler	0.2	0	0.8	0	13 ±26.1
Yellow Warbler	0.2	0	0.4	0.4	13 ±13.2
Yellow-rumped Warbler	0.2	0.2	0	0.4	10 ±11.3
Townsend's Warbler	0.2	0.8	0.2	0.4	20 ±19.5
American Redstart	0	0	0	0.6	8 ±20.7
Northern Waterthrush	0	0.2	0	0	3 ± 6.9
MacGillivray's Warbler	1.2	0.6	1.8	1.0	58 ±34.4
Common Yellowthroat	0.2	0	0	0	3 ± 6.9
Wilson's Warbler	0.2	0	0	0	3 ± 6.9
Unidentified Warbler	0	0	0.2	0	3 ± 6.9
Western Tanager	0	0	0	0.2	3 ± 6.9
Lazuli Bunting	0	0	0	0.2	3 ± 6.9
Rufous-sided Towhee	0.4	0	0	0	5 ±13.8

Table 4.4.5 Continued.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	MEAN HABITAT DENSITY (n/100 ha +95% CI)
American Tree Sparrow	0.4	0	0.4	0	10 ±15.9
Chipping Sparrow	0	0	1.8	0.8	33 ±58.9
Savannah Sparrow	0.6	0.2	0	0	10 ±19.5
Fox Sparrow	0	0	0.6	0.2	10 ±19.5
Song Sparrow	0	0.2	1.2	0.2	20 ±37.3
Lincoln's Sparrow	0	0.2	0	0	3 ± 6.9
White-crowned Sparrow	0	0	0.2	0	3 ± 6.9
Dark-eyed Junco	0	0.2	0	0	3 ± 6.9
Pine Grosbeak	0	0	0	0.2	3 ± 6.9
Cassin's Finch	0	0	0.4	0	5 ±13.8
Red Crossbill	0	0	0	0.4	5 ±13.8
White-winged Crossbill	0	0	0.2	0.6	10 ±19.5
Pine Siskin	0.4	2.0	0.4	0.2	38 ±57.8
American Goldfinch	0	0	0	0.2	3 ± 6.9
Unidentified	0	0	0.2	0.2	5 ± 8.0
Mean Plot Density	11.0	9.6	16.0	15.6	653 ±222.6
Total Birds Observed	55	48	80	78	261[b]
Total Species Observed	25	20	25	34	57[c]

[a]Plots are each 2 hectares (4.94 acres)
[b]Total birds observed during plot counts
[c]Total species observed during plot counts

Table 4.4.6 Mean spruce-fir plot and habitat densities for breeding birds on the Montana Project study area, Lincoln and Sanders Counties, Montana, June 1988. Scientific names are listed in Table 4.1.2.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	5	MEAN HABITAT DENSITY (n/100 ha +95% CI)
Sharp-shinned Hawk	0.4	0	0	0	0	4 ± 9.9
Ruffed Grouse	0.4	0	0	0	0	4 ± 9.9
Great Horned Owl	0.4	0	0	0	0	4 ± 9.9
Vaux's Swift	0	0	0	0.4	0.2	6 ± 9.9
Calliope Hummingbird	0	0	0	0.2	0	2 ± 5.0
Rufous Hummingbird	0.2	0.2	0.4	0.2	0	10 ± 7.9
Downy Woodpecker	0	0.2	0	0	0	2 ± 5.0
Three-toed Woodpecker	0.2	0	0	0	0.2	4 ± 6.1
Northern Flicker	0.2	0	0.2	0.2	0	6 ± 6.1
Pileated Woodpecker	0	0	0	0.2	0	2 ± 5.0
Olive-sided Flycatcher	0	0.2	0	0.6	0.4	12 ±14.5
Willow Flycatcher	0.4	0	0	0	0	4 ± 9.9
Least Flycatcher	0.4	0.2	0.2	1.2	0.6	26 ±23.0
Hammond's Flycatcher	0.8	0	0	0	0	8 ±19.9
Dusky Flycatcher	0.2	0.4	0.2	0.2	0	10 ± 7.9
Steller's Jay	0.6	0	0	0	0	6 ±14.9
Clark's Nutcracker	0	0	0.6	0	0.2	8 ±14.5
Common Raven	0	0.4	0	0.2	0	6 ± 9.9
Black-capped Chickadee	0.2	0	0.4	0	0	6 ± 9.9
Mountain Chickadee	0	0	0.2	0.4	0.2	8 ± 9.3
Chestnut-backed Chickadee	0	0	0.4	0	0.2	6 ± 9.9
Unidentified Chickadee	0.2	0	0	0	0	2 ± 5.0
Red-breasted Nuthatch	0.2	0.4	0.4	0.2	0.6	18 ± 9.3
White-breasted Nuthatch	0	0.2	0	0	0	2 ± 5.0
Winter Wren	0.6	0.2	0.4	1.0	0.6	28 ±16.5
American Dipper	0.2	0	0	0	0	2 ± 5.0
Golden-crowned Kinglet	3.0	2.4	2.0	1.6	2.6	116 ±30.0
Ruby-crowned Kinglet	0	0.2	0.2	0	0.4	8 ± 9.3
Western Bluebird	0	0.2	0	0	0	2 ± 5.0
Townsend's Solitaire	0	0.2	0	0	0.2	4 ± 6.1
Swainson's Thrush	0.8	0.6	0.8	0.4	0.8	34 ± 9.9
Hermit Thrush	0	0	0	0.2	0.2	4 ± 6.1
American Robin	0.8	0.8	0.2	0.4	0	22 ±19.9
Varied Thrush	0	0.2	0.4	0.6	1.2	24 ±25.6
Gray Catbird	0	0	0	0.2	0	2 ± 5.0
Solitary Vireo	0	0.6	0	0	0	6 ±14.9
Warbling Vireo	0.2	0.8	0	0	0	10 ±19.2
Red-eyed Vireo	0	0.4	0.2	0	0	6 ± 9.9
Tennessee Warbler	0.2	0	0	0	0	2 ± 5.0
Oranged-crowned Warbler	0.2	0	0	0.2	0	4 ± 6.1
Nashville Warbler	0.2	0	0	0	0.2	4 ± 6.1

Table 4.4.6 Continued.

SPECIES	MEAN PLOT DENSITY (n/2 ha)[a] 1	2	3	4	5	MEAN HABITAT Density (n/100 ha +95% CI)
Yellow Warbler	0	0	0	0.4	0.2	6 ± 9.9
Yellow-rumped Warbler	0.2	0	0.6	0	0	8 ±14.5
Townsend's Warbler	0.2	1.6	1.0	0.6	0.8	42 ±28.7
Northern Waterthrush	0.4	0	0	0	0	4 ± 9.9
MacGillivray's Warbler	0.6	0.6	0.4	0.8	0	24 ±16.8
Common Yellowthroat	0.2	0	0	0	0	2 ± 5.0
Wilson's Warbler	0	0	0.2	0	0	2 ± 5.0
Western Tanager	0.4	0	0	0.2	0.2	8 ± 9.3
Black-headed Grosbeak	0	0.2	0	0	0	2 ± 5.0
Chipping Sparrow	0	0	0	0.2	0	2 ± 5.0
Savannah Sparrow	0.4	0	0.2	0	0	6 ± 9.9
Fox Sparrow	0	0.2	0	0	0.2	4 ± 6.1
Song Sparrow	0.6	0	0	0	0	6 ±14.9
Dark-eyed Junco	0.2	0.2	0.4	0.6	0	14 ±12.7
Pine Grosbeak	0	0.2	0	0.2	0	4 ± 6.1
Cassin's Finch	0.2	0.6	0	0	0.6	14 ±16.8
White-winged Crossbill	0	0.4	0	0	0.2	6 ± 9.9
Pine Siskin	0.4	2.4	2.2	0	1.6	66 ±59.6
Unidentified	0	0	0	0.2	0	2 ± 5.0
Mean Plot Density	14.8	15.2	12.2	11.8	12.6	666 ± 86.9
Total Birds Observed	74	76	61	59	63	333[b]
Total Species Observed	33	28	23	26	23	58[c]

[a]Plots are each 2 hectares (4.94 acres).
[b]Total birds observed during plot counts.
[c]Total species observed during plot counts.

TABLE 4.4.7 Summary of June 1988 mean habitat densities for breeding birds in major Montana Project study area habitats, Lincoln and Sanders Counties, Montana. Scientific names are listed in Table 4.1.2.

	Mean Habitat Density (n/100 ha ±95% CI)[a]					
Species	R	H	MC	C	S	SF
Mallard	5±13.8					
Sharp-shinned Hawk	3± 6.9				3± 6.9	
Sharp-shinned or Cooper's Hawk			2± 5.0			4± 9.9
Northern Goshawk	3± 6.9		2± 5.0		3± 6.9	
American Kestrel				2± 5.0		
Ruffed Grouse	18±20.7		4± 9.9		3± 6.9	4± 9.9
Spotted Sandpiper	18±48.2					
Common Snipe	8±13.2					
Great Horned Owl						4± 9.9
Northern Pygmy Owl				2± 5.0		
Barred Owl		3±11.7				
Common Nighthawk				2± 5.0		
Black Swift			8±19.9			
Vaux's Swift		7±23.4			15±41.3	6± 9.9
Calliope Hummingbird			2± 5.0	2± 5.0		2± 5.0
Rufous Hummingbird	10±19.5	3±11.7	4± 6.1	20±19.2	68±20.7	10± 7.9
Belted Kingfisher	3± 6.9					
Downy Woodpecker			2± 5.0			
Hairy Woodpecker			2± 5.0	2± 5.0	5±13.8	
Three-toed Woodpecker		13±11.7	2± 5.0			4± 6.1
Northern Flicker	18±17.3		10±15.7	4± 6.1	10±27.6	6± 6.1
Pileated Woodpecker		10±20.3	2± 5.0		5±13.8	2± 5.0
Olive-sided Flycatcher	15±17.8	7±23.4			30±27.6	12±14.5
Western Wood Peewee				4± 6.1	3± 6.9	
Willow Flycatcher	15±17.8				3± 6.9	4± 9.9
Least Flycatcher	20±11.3	10±35.1	2± 5.0	6± 9.9	20±22.5	26±23.0
Hammond's Flycatcher	18±39.6		2± 5.0	16±25.6	8± 6.9	8±19.9
Dusky Flycatcher	18±30.6		12±29.8	4± 6.1	5± 8.0	10± 7.9
Western Flycatcher		3±11.7			3± 6.9	
Say's Phoebe	3± 6.9			2± 5.0		
Tree Swallow	10±19.5					
Violet-green Swallow	15±23.9					
Gray Jay	10±27.6	7±23.4	4± 9.9	4± 9.9		
Steller's Jay	13±20.7		6±14.9	2± 5.0	5±13.8	6±14.9
Clark's Nutcracker						8±14.5
Black-billed Magpie				4± 9.9		
Common Raven	3± 6.9			10±15.7		6± 9.9
Black-capped Chickadee	33±45.5	43±82.0	28± 9.3	16±18.6	8±13.2	6± 9.9
Mountain Chickadee		17±11.7	16±23.0	16±25.6		8± 9.3
Chestnut-backed Chickadee	15±26.4	30±88.4	8±14.5		5± 8.0	6± 9.9
Unidentified Chickadee						2± 5.0
Red-breasted Nuthatch	3± 6.9	30±20.3	28±30.8	4± 6.1	3± 6.9	18± 9.3

Table 4.4.7 Continued.

Species	Mean Habitat Density (n/100 ha +95% CI)[a] R	H	MC	C	S	SF
White-breasted Nuthatch	3± 6.9		2± 5.0			2± 5.0
Pygmy Nuthatch	5±13.8	3±11.7	2± 5.0			
Brown Creeper		3±11.7	8±14.5			
House Wren				4± 6.1		
Winter Wren		27±93.7	6± 9.9	2± 5.0	3± 6.9	28±16.5
American Dipper						2± 5.0
Golden-crowned Kinglet	33±55.5	110±93.0	68±43.3	2± 5.0	33±49.5	116±30.0
Ruby-crowned Kinglet	10±11.3	20± 0.0	10±15.7		3± 6.9	8± 9.3
Western Bluebird				2± 5.0		2± 5.0
Mountain Bluebird			2± 5.0			
Townsend's Solitaire	5± 8.0			6± 9.9	3± 6.9	4± 6.1
Veery	5±13.8					
Swainson's Thrush	30±33.8	23±23.4	28± 9.3	4± 6.1	20±29.8	34± 9.9
Hermit Thrush	23±28.4	13±23.4	10±13.6		8±13.2	4± 6.1
American Robin	55±48.4	23±51.0	28±21.4	28±32.8	25±26.4	22±19.9
Varied Thrush	15±23.9	30±20.3	18±24.1			24±25.6
Gray Catbird	3± 6.9		4± 9.9	2± 5.0		2± 5.0
Cedar Waxwing				4± 9.9		
Solitary Vireo	18±23.5		8±19.9		8±20.7	6±14.9
Warbling Vireo	8±13.2		8±14.5	14±14.9	23±13.2	10±19.2
Red-eyed Vireo	5± 8.0			2± 5.0	8±13.2	6± 9.9
Tennessee Warbler				2± 5.0	10±19.5	2± 5.0
Orange-crowned Warbler	28±20.7			16±16.8	15±17.8	4± 6.1
Nashville Warbler	13±20.7	7±23.4	4± 6.1	14±24.3	13±26.1	4± 6.1
Yellow Warbler	23±39.6	3±11.7		6± 9.9	13±13.2	6± 9.9
Yellow-rumped Warbler	5±13.8	7±23.4	6± 6.1		10±11.3	8±14.5
Townsend's Warbler	30±27.6	73±100.1	84±51.2	8± 9.3	20±19.5	42±28.7
American Redstart	13±26.1			4± 9.9	8±20.7	
Northern Water-thrush	15±23.9	7±23.4			3± 6.9	4± 9.9
MacGillivray's Warbler	33±49.5	13±31.0	24±33.9	20±22.2	58±34.4	24±16.8
Common Yellowthroat	3± 6.9		2± 5.0		3± 6.9	2± 5.0
Wilson's Warbler	3± 6.9			2± 5.0	3± 6.9	2± 5.0
Unidentified Warbler					3± 6.9	
Western Tanager	8±13.2	3±11.7	4± 9.9		3± 6.9	8± 9.3
Black-headed Grosbeak	5±13.8		8± 9.3	6± 6.1		2± 5.0
Lazuli Bunting				6± 9.9	3± 6.9	
Rufous-sided Towhee	5± 8.0	3±11.7		2± 5.0	5±13.8	
American Tree Sparrow	15±32.8		2± 5.0	4± 9.9	10±15.9	
Chipping Sparrow	38±62.0	7±11.7	2± 5.0	72±41.1	33±58.9	2± 5.0
Vesper Sparrow	3± 6.9					
Savannah Sparrow	18±23.5	3±11.7	8±14.5	6±14.9	10±19.5	6± 9.9
Fox Sparrow	28±46.9				10±19.5	4± 6.1
Song Sparrow	40±56.3		6±14.9		20±37.3	6±14.9
Lincoln's Sparrow					3± 6.9	
White-crowned Sparrow					3± 6.9	
Dark-eyed Junco	40±40.6	7±23.4	34±42.7	76±37.3	3± 6.9	14±12.7
Western Meadowlark	3± 6.9					
Brewer's Blackbird	3± 6.9					

Table 4.4.7 Continued.

Species	Mean Habitat Density (n/100 ha +95% CI)[a]					
	R	H	MC	C	S	SF
Brown-headed Cowbird	15±41.3	3±11.7	10±15.7	2± 5.0		
Pine Grosbeak	5±13.8				3± 6.9	4± 6.1
Cassin's Finch	3± 6.9	3±11.7	26±40.5	6± 9.9	5±13.8	14±16.8
Red Crossbill		7±23.4	2± 5.0		5±13.8	
White-winged Crossbill					10±19.5	6± 9.9
Pine Siskin	20±15.9	23±31.0	64±51.8	54±53.6	38±57.8	66±59.6
American Goldfinch					3± 6.9	
Unidentified		3±11.7		12±14.5	5± 8.0	2± 5.0
Mean Habitat Density	905±558.6	610±180.3	634±79.5	510±184.6	653±222.6	666±86.9
Total Birds Observed	362	183	317	255	261	333
Total Species Observed	63	37	50	48	57	58

[a]Estimates based on three to five 2 ha plots/habitat, each replicated five times.
[b]Habitats are: R, riparian; H, western hemlock; MC, mixed conifer; C, clearcut; S, shrubfield; and SF, spruce-fir.

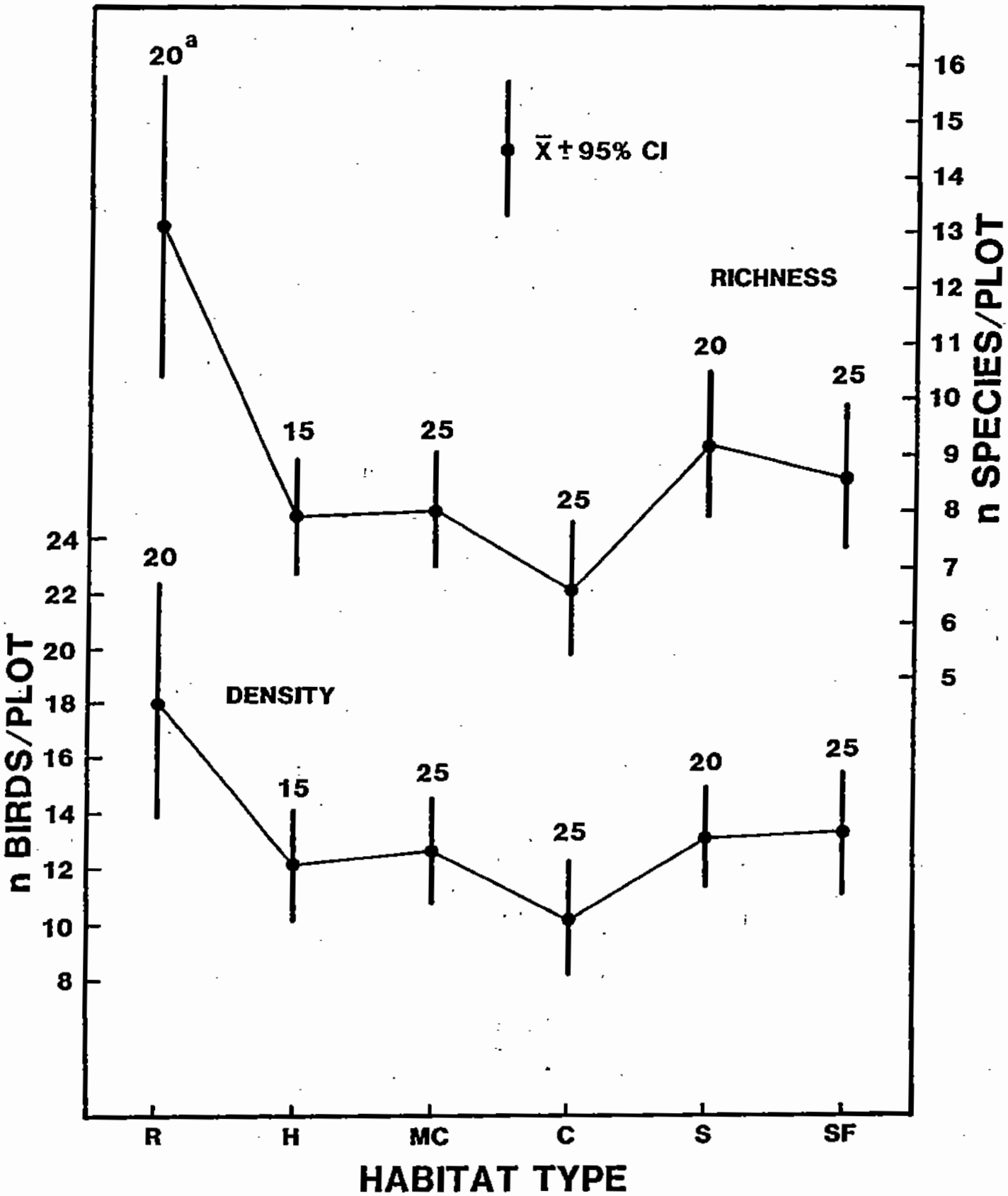


Figure 4.4.1 Breeding bird use of riparian (R), western hemlock (H), mixed conifer (MC), clearcut (C), shrubfield (S), and spruce-fir (SF) habitats on potential Montana Project development areas in the Cabinet Mountains, Montana, June 1988. [a] number of plot counts composing the mean values are given for each habitat.

ecotones were so broad, and clinal variation so nebulous, that it was difficult to nonarbitrarily differentiate types. Virtually all bird plots contained clumps or stands of vegetation characteristic of other habitat types. The result of this high habitat interspersion was increased avian use of adjacent habitats that individual species are not normally associated with, or where individual species are typically uncommon.

Density of breeding birds did not differ significantly ($F = 1.94$, $P > 0.05$) between habitats, but did significantly differ between plots ($F = 2.74$, $P < 0.001$) (see Table 6.3.6 in Appendix 6.3). This former result is somewhat surprising because it suggests that the habitat productivity of these six types is so similar that it supports numerically similar bird communities.

The statistical similarities between bird use of some habitat types does not imply the avifaunas are necessarily the same. Although these habitats may share many of the same species, many of these species have narrow and distinct habitat affinities. The statistical similarities indicate only that these habitats support avifaunas numerically comparable in richness and density.

4.5 RAPTORS

Twelve species of raptors (including the common raven) were observed during the MP wildlife baseline study (Table 4.1.2). Densities of individual birds of prey observed during the breeding bird surveys are recorded by habitat type in Tables 4.4.1-4.4.6 and summarized in Table 4.4.7.

One osprey was observed in the MP study area during the baseline study. On June 22 an osprey was perched in a tall spruce on the north side of Rock Creek Meadows. The bird may have been fishing the beaver ponds on Rock Creek. Rock Creek Meadows, Howard Lake, and portions of Libby Creek are the only potential osprey habitats in the study area. There was no evidence of active nesting around these areas and given their relatively low productivity and isolation (relative to Cabinet Gorge Reservoir and the Clark Fork and Kootenai River), it is unlikely these areas are important fishing areas. However, Al Bratkovich (USFS, pers. comm.) indicated that ospreys from two nests (active 1983-86, inactive in 1987 and 1988 and unobserved during an April 20, 1989, survey) on the West Fisher River, approximately 5-6 miles southeast of Howard Lake, occasionally fished at the Howard Lake. An inactive osprey nest was located along the west bank of Libby Creek, due east of the junction of U.S. Highway 2 and the Farm to Market Road, during April 20, 1989, transmission line corridor surveys. Ospreys were the most commonly observed nesting raptor in ASARCO's Rock Creek

project area (Farmer and Heath 1987) and five active nests were located in their study area along the Clark Fork River in 1985. See Section 4.8.16 for more discussion on osprey use in the vicinity of the MP study area.

Bald eagles are discussed in Section 4.8.15 of this report. The sharp-shinned hawk, northern goshawk, golden eagle, northern pygmy owl, and great grey owl were observed in the study area during baseline studies and are discussed in Section 4.8 of this report.

Red-tailed hawks were frequently observed over and around the clearcuts on the eastern intensive study area and nesting was strongly suspected. A pair of red-tails may have nested in a tall stand of thinned, mixed conifers on the edge of a clearcut between Ramsey and Poorman Creeks. However, repeated ground and aerial surveys were unsuccessful at locating the nest.

American kestrels were relatively common on the study area and were most frequently observed in and around clearcuts. One nest was located in a snag located in a clearcut north of Ramsey Creek. The timing of field surveys did not permit an assessment of nest success.

Great horned owls were common in the MP study area and were observed in spruce-fir, western hemlock, mixed conifer, and clearcut habitats. Two young of the year great horned owls and one adult were observed in hemlock habitat on the Ramsey Creek Road on June 23. Three young of the year owls were observed in clearcut/mixed conifer habitat south of Bear Creek on two separate dates in late June.

One barred owl was observed and was heard vocalizing on western hemlock breeding bird plot H1 on 9 June. A call was also elicited from a barred owl just east of the Libby Creek gate during an April 19 survey for boreal owls. The old-growth forest in which these observations were made is the type of habitat where this species nests in cavities. Barred owls have been expanding their range into the northwestern U.S., including Montana, since the 1960's (Shea 1974, Taylor and Forsman 1977). Skaar (1985) indicates that there is circumstantial evidence that this species breeds in the Libby latilong block. Al Bratkovich (USFS, pers. comm.) indicated that several barred owl nesting territories have been delinated on the Libby Ranger District and that this species should be considered a confirmed breeder.

Boreal owl surveys were conducted at four stations in Rock Creek on February 18 and 27 and at eleven stations in Upper Libby Creek on April 19-20 (Figure 4.5.1). No boreal owls were detected during any survey.

Figure 4.5.1 Locations of boreal owl survey stations (dots) and general distribution of potential boreal owl habitat (spruce-fir stands, shaded) in the Montana Project study area.

Surveys in the Rock, Libby, Ramsey, and Poorman Creek drainages were scheduled for replication twice during the peak of the 1989 calling period, mid-February through March (Holt 1987). Owls calling or responding to a recorded call can only be heard when the wind is relatively calm (i.e., less than about 5 mph, Holt 1988) and when ambient noise is low. In addition, snowfall or rain is thought to inhibit owl calling as well as reducing the distance that owls may be heard. Unfortunately, suitable survey conditions are rare in the upper elevations of the study area. Fifteen nights were spent in the study area during the above calling period and only two surveys could be conducted, both in Rock Creek and both with light snow falling. All surveys in the eastern drainages during this period were cancelled due to heavy snows, high winds, or a combination of the two. While the 1988/89 winter was considered "normal," it persisted longer than usual.

The study period was extended into April in an attempt to complete the surveys. While unsolicited calls usually diminish towards the beginning of April and soliciated calls usually only draw a short response, boreal owls could still be detected in April if they were present. Three more nights were spent in the field when the weather cleared with a passing warm front. In late afternoon on April 7 winds were calm and skies clear in the upper drainages; however, surveys scheduled for that evening were cancelled under advice from Al Bratkovich (USFS) that avalanche potential in the upper drainages was extremely high. These conditions persisted for the next several days.

Finally, in mid-April, conditions were safe and suitable, and an 11-station survey was completed in Libby Creek between 2134 hours on April 19 and 0036 hours on April 20. Unfortunately, the roads (transects) in all study area drainages are located close to the drainage bottoms and the creeks. Runoff was well underway and conditions were so loud that only four stations were effective at transmitting recordings more than 100 yards. One small, unidentified owl was seen flying across the road at 2323 hours at station Li6, but never vocalized. A barred owl gave a few calls at this station from approximately 40 yards away after the second recorded call. No other owls were detected during the survey, which was considered ineffective. After consultation with USFS personnel (A. Bratkovich, B. Summerfield, pers. comm.) the following day, surveys scheduled for Ramsey and Poorman Creeks that night were cancelled because runoff noise levels were similar in those areas and surveys were anticipated to be equally ineffective.

Upper elevation habitats within the MP study area appear to be suitable for boreal owls. The lack of positive survey results, especially under the 1989 survey conditions,

does not negate their presence, nor would negative survey results under ideal survey conditions. If, as other researchers have found, boreal owls are generally confined to mature-old growth, spruce-fir forests above 5,200 feet, then it would be fortunate for an owl to be detected in the MP study area where transect elevations only ranged from 3,720 to 4,480 feet.

Potential boreal owl habitat in the MP study area, delineated as the general distribution of spurce-fir stands, is illustrated in Figure 4.5.1 along with calling station locations. Within the study area, potential habitat is quite restricted in Rock Creek, but widespread east of the divide.

Holt (1987), who successfully surveyed boreal owls in the Lolo National Forest (immediately south of the Kootenai National Forest), found that all owls were associated with mountain tops consisting of gentle rolling slopes, valleys, and meadows. No responses were solicited on steep slopes. If this habitat selection is also characteristic of owls in the Cabinets, then surveys might be attempted along ridgetops of Great Northern Mountain and the divide beween Libby-Ramsey and Ramsey-Poorman Creeks. The only practical approach to surveys in these areas would be helicopter access and camping; however, based on 1989 weather, suitable survey conditions would be rare indeed.

Common ravens are discussed under raptors because they have nesting and food habits similar to some raptors. Ravens are common residents in the Cabinet Mountains. Their stick nests are usually located on cliffs under some type of rocky overhang (Call 1978). Although suitable nest sites appear to exist in the study area, and while they may have nested on the area, no nests were located during the helicopter or ground surveys.

With the exception of the inactive osprey nest observed along Libby Creek during the April 20 flight, no raptor nests were located in any of the transmission line corridors. The two osprey nests identified (A. Bratkovich, USFS, pers. comm.) along the West Fisher River, apparently blew down over the 1988/89 winter. However, while no ospreys appear to be nesting in the corridors during 1989, it is likely these sites will be occupied in the future. Similarly, there are unconfirmed reports of bald eagle nesting along the lower portion of Libby Creek (east of U.S. Highway 2). Furthermore, while only one inactive osprey nest was observed in the corridors, the entire 1000 foot corridor width was not surveyed from the ground and raptor nests present in non-deciduous trees (comprising the major forest type in the corridors) may have gone unobserved during both ground and aerial surveys. Cavities in the boles of large cottonwoods and conifers along the lower

corridors could support nesting raptors, including kestrels and small to large owls.

4.6 WATERFOWL AND SHOREBIRDS

Habitat for waterfowl and shorebirds is suitable, but extremely limited in area on the MP study area. On the intensive study area, the best habitats included Rock Creek Meadows, the fen along Libby Creek below its confluence with Howard Creek, and in the small pond on the west side of the Little Cherry Loop Road. However, while some production occurred at all these sites in 1988, it was low. A mallard nest with nine eggs was located in shrubfield habitat in Rock Creek Meadows on May 5. While mallards were observed in the meadows during most summer surveys no young were ever detected. Two pair of spotted sandpipers and at least one brood (two birds) were observed in Rock Creek Meadows during the 1988 breeding bird surveys. No other species of waterfowl or shorebird was observed in the Rock Creek drainage during the baseline study.

A mallard with four young ducks was observed in the system of beaver ponds along Libby Creek, below Howard Creek, on June 5. Common snipe, spotted sandpipers, and a great blue heron were also observed in this area, and although the two former species probably nested here, no evidence of production was noted. Spotted sandpipers were frequently observed along lower, open areas of Libby and Ramsey Creeks. Killdeer were also noted along sections of Libby Creek with extensive, open gravel and cobble bars that resulted from historic (circa 1880's) placer mining activities.

A mallard hen with at least four 2-3 week old ducklings was observed on the small pond dominated by emergent grasses and forbs west of the Little Cherry Loop Road on June 15. A great blue heron, which was probably hunting red-legged frogs, was flushed from this pond during the June 24 helicopter survey. Waterfowl and shorebird densities in the breeding bird study area are summarized in Table 4.4.7.

In mid-June 1988 the upper reaches of Libby and Ramsey Creeks and the East Fork of Rock Creek, above the gate and below the meadows, were walked in an attempt to locate harlequin ducks. Although none were observed, several recent, large, individual whitewash and fecal deposits characteristic of waterfowl were observed on boulders in Rock Creek and at one site in Libby Creek. All deposits were in the torrential mountain stream habitat that characterizes harlequin duck breeding and nesting areas. No other evidence of harlequin ducks was observed in the vicinity of the study area in conjunction with the wildlife, fisheries, and aquatics field programs.

Adult and young harlequin ducks have recently been observed in Rock Creek. MDFWP personnel accidentally caught adults and young in a smolt trap on lower Rock Creek in summer, 1985 (T. Swant, Noxon, pers. comm.). The ducklings that were captured were so young that they had to have been produced upstream. Specific surveys for these ducks were unsuccessfully conducted in June, July, and August 1985 on Rock Creek and its West Fork by Farmer and Heath (1987). In 1986, MDFWP personnel again observed adults and at least 13 young-of-the-year harlequin ducks on the main stem of Rock Creek and its east and west tributaries on five occasions from early June to August (Farmer and Heath 1987).

In the extensive study area, potential waterbird habitat is, for all practical purposes, restricted to Howard Lake. Howard Lake provides relatively good waterbird habitat; however, because of the fishing and boating activity that occurs on and around the lake, waterbird use is primarily restricted to the spring and fall migratory periods when human access to the lake is restricted or low. Up to 300 geese and a similar number of ducks have been observed at one time on Howard Lake in mid-November (A. Bratkovich, USFS, pers. comm.). This number of migrating waterfowl may remain for one to two weeks at a time. Common goldeneyes, common mergansers, blue-winged teal, mallards, and spotted sandpipers were observed on Howard Lake, mostly in May 1988, but no evidence of production was ever observed. Al Bratkovich (USFS, pers. comm.) stated that mallard broods have been seen on Howard Lake indicating that some nesting occurs.

4.7 SMALL MAMMAL TRAPPING

Small mammals were trapped in potential development area habitats (see Map 7.1) on a proportional allocation basis, to document species occurrence and relative abundance. Sampling methodology is detailed in Section 3.7. All trapping occurred between August 17-24, the time of year when small mammal communities are at or near their annual population peak.

Trapping results are presented in Table 4.7.1. Eleven species of small mammals were captured in the 2,383 traps established throughout 26 plots, representing six habitat types. The most species (8) were captured in mixed conifer habitats, followed by spruce-fir (7), riparian and shrubland (6), and hemlock and clearcut (5) habitats. However, NANOVA results indicated that there was no statistical difference in species richness between habitat types ($F = 0.182$, $P>0.25$, see Table 6.4.2 in Appendix 6.4), in part due to the large variation in species richness between individual plots composing each habitat type (e.g., on mixed conifer plots,

4.6A UPLAND GAME BIRDS

Two species of galliformes were observed in the MP study area, ruffed and blue grouse. Ruffed grouse were the most frequently observed of the two species and were probably more abundant than blue grouse in the study area. Farmer and Heath (1987) considered ruffed grouse to be more common on ASARCO's Rock Creek study area than blue grouse.

Ruffed grouse were common in the MP study area at lower elevations and along valley bottoms extending up to the headwalls of Libby, Ramsey, and Rock Creeks (the only upper elevation drainages where ground surveys were routinely conducted). They were detected on three of four riparian, breeding bird plots (Table 4.4.1), one of five mixed conifer plots (Table 4.4.3), one of four shrubfield plots (Table 4.4.5), and one of five spruce-fir plots (Table 4.4.6). No grouse were observed in clearcut or western hemlock habitats during baseline surveys; however, several of the older, successionally advanced clearcuts provide suitable ruffed grouse habitat. Observed ruffed grouse densities were highest in riparian habitats (18 $\pm$20.7 birds/100 ha) and lower, but similar (3 $\pm$6.9 to 4 $\pm$9.9 birds/100 ha) in shrubfield, mixed conifer, and spruce-fir habitats (Table 4.4.7). Drumming was noted during spring/summer 1988 in all four of the occupied habitats and nests with eggs and/or broods were observed in all but shrubfield habitats. Two nests located on 8 May in upper Libby Creek and 7 June in Rock Creek contained 8 and 7 eggs, respectively. Five broods, ranging in age from several days to several months old, and ranging in size from five to seven (minimum) were observed during the study.

Blue and ruffed grouse appeared to have an almost allopatric distribution in the study area, although this impression may be due to lower sampling frequency in areas occupied by blue grouse. Blue grouse were only detected in the open spruce-fir forests along the ridgeline between Poorman and Ramsey Creek, east of the wilderness boundary and along the ridgelines on Shaw and Great Northern Mountains. It was anticipated that an altitudinal migration would bring blue grouse to lower, more open breeding and brood rearing habitats (Mussehl and Howell 1971, Stauffer and Peterson 1985) spruce-fir zones for the winter; however, they were never observed more than 300 feet below ridgelines during any of the baseline surveys. Booming grouse were observed on the Poorman/Ramsey Creek ridge on 19 May. No nests or broods were ever detected during the study, although reproduction undoubtedly occurred. Blue grouse were considered common, but not abundant, on ASARCO's Rock Creek project area (Farmer and Heath 1987).

Spruce grouse are a game bird that, if present, are uncommon in the MP study area. No evidence of their occur-

rence was detected in the study area during the baseline study. Skaar (1985) considers the species to be a breeding resident in the Libby latilong block. USFS (1981) lists the species as an uncommon confirmed breeder on the Kootenai Forest. The MDFWP considers the species to be present in the vicinity of, if not on, the MP study area (A. Bratkovich, USFS, pers. comm.). Farmer and Heath (1987) only made two observations of spruce grouse on ASARCO's Rock Creek project area, including a brood in upper elevation subalpine fir habitat. Farmer and Heath (1987) considered the species to be uncommon on their study area. In northwestern Montana, spruce grouse inhabit dense mid- to upper-elevation spruce-fir stands from spring through fall and winter in more open, lower elevation forests (Herman 1980). These type of habitats are well developed on the MP study area, east of the divide where, because of their uncommon occurrence at upper elevations, they went undetected.

ADDITIONAL LITERATURE CITED

Mussehl, T. W. and F. W. Howell (Eds.). 1971. Game management in Montana. Montana Fish and Game Dept., Helena.

Stauffer, D. F. and S. R. Peterson. 1985. Ruffed and blue grouse habitat use in southeastern Idaho. J. Wildl. Manage. 49:459-466.

Herman, M. F. 1980. Spruce grouse habitat requirements in western Montana. Ph.D. Thesis, Univ. Montana, Missoula.

Table 4.7.1 Small mammal species richness and relative abundance on plots stratified by habitat type on MP's intensive small mammal study area, Sanders and Lincoln Counties, Montana. Results are based on trapping conducted August 17-24, 1988[a] following a modification of Stoecker's (1984) moving transect method.

	Plots by Habitat Type																																			
	Riparian					Hemlock				Mixed Conifer						Clearcut						Shrubfield					Spruce-fir									
Species[b]	1	2	3	4	Σ	1	2	3	Σ	1	2	3	4	5	Σ	1	2	3	4	5	Σ	1	2	3	4	Σ	1	2	3	4	5	Σ				
Vagrant Shrew	1				1					1					1																					
Snowshoe Hare		1	2		3					1		1		1	3					1	1															
Red-tailed Chipmunk	7	1	1		9					9			1	1	11		2	1	2	1	6	3		1	2	6	1			4		5				
Red Squirrel																														1		1				
Northern flying Squirrel							1	2	3			1			1													1			1	2				
Deer Mouse	1	2		10	13	11		2	13	8	18	1			27	7	4	12	11	7	41	26	1	7	14	48	2	9	9	8	7	35				
Bushy-tailed Woodrat		1			1	6			6	4			2		6		1				1				2	2	1					1				
Gapper's Red-backed Vole						2	1		3			1			1														1	7		8				
Montane Vole																			1		1	1		1	1	3									
Western Jumping Mouse						1			1													1				1				1		1				
Long-tailed Weasel		1			1								1		1							2				2									
Plot Total																																				
Species	3	5	2	1		4	2	2		5	1	4	3	2		1	3	2	3	3		5[c]	1	3	4		3[c]	2	3	4	2				
Individuals	9	6	3	10		20	2	4		23	18	4	4	2		7	7	13	14	9		33[c]	1	9	19		4[c]	10	11	20	8				
Habitat Total																																				
Species					6				5						8						5					6						7			
Individuals					28				26						51						50					62						53			
Number of Trap Nights[d]	92	96	90	93	371	91	93	93	277	90	94	93	87	92	456	93	90	93	91	93	460	82	93	90	93	358	93	94	93	88	93	461				
Trap Success (%)[d]																																				
Plot	9.8	6.3	3.3	10.8		22.0	2.2	4.3		25.6	19.1	4.3	4.6	2.2		7.5	7.7	14.0	15.4	9.7		40.2	1.1	10.0	20.4		4.3	10.6	11.8	22.7	8.6				
Habitat					7.5				9.4						11.2						10.9					17.3						11.5			

[a] Rock Creek plots R1, MC1, S1, and SF1 were trapped August 21-24. All other plots were trapped August 17-20.

[b] Scientific names are phylogenetically listed in Table 4.1.1.

[c] A Swainson's thrush was also captured on this plot.

[d] Numbers reflect actual number of traps available for capture and omit closed, empty traps.

five species were captured on plot MC1 while only one species was captured on plot MC2). This within group or between plot variation accounted for 84% of the variation within the ANOVA model (see Table 6.4.3 in Appendix 6.4). In short, this means that while some habitats supported a larger number of different species than others, there were no statistical differences in the number of small mammal species/habitat type because the number of species on individual plots within the habitat was so variable. This result suggests that these six habitats support statistically similar small mammal diversities.

The most individual small mammals of all species were captured in shrubfields (62), followed by spruce-fir (53), mixed conifer (51), clearcut (50), riparian (29), and hemlock (26) habitats, although these relationships are somewhat confused by the number of traps available. Number of trap nights varied by habitat type from 277 in hemlock forests to 461 in spruce-fir stands (Table 4.7.1). Undoubtedly additional individuals, and possibly species, would have been captured in hemlock forests with a larger number of available traps. This is one shortcoming of sampling using a proportional allocation design.

NANOVA results indicated that there was no difference in mammal abundance between the six habitats ($F = 0.37$, $P>0.25$, see Table 6.4.5 in Appendix 6.4), also due to the wide variation in trap success between plots composing habitats (ANOVA between plot [within groups] variation = 86.6%, see Table 6.4.6 in Appendix 6.4). This is clearly illustrated in a comparison of shrubfield plots S1 and S2; 33 small mammals were captured on transect S1 (Rock Creek), while only one deer mouse was captured on transect S2 (Libby Creek) (Table 4.7.1, Map 7.1). These results statistically indicate that the six habitats supported numerically similar small mammal communities.

Mean trap success for all six habitats was 11.3% and ranged from 7.5% in riparian habitats to 17.3% in shrubfields (Table 4.7.1). Trap success on the 26 individual plots ranged from 1.1% on shrubfield plot S2 (Libby Creek) to 40.2% on S1 (Rock Creek).

Three of five habitats quantitatively sampled for small mammals on ASARCO's Rock Creek Project area (clearcut, hemlock, and spruce-fir; Farmer and Heath 1987) were directly comparable to those on the MP study area. Figure 4.7.1 (Figure 5 of Farmer and Heath 1987) illustrates the locations of ASARCO's comparable small mammal transects. ASARCO's species richness on these habitats was 6, 3, and 2 compared to 5, 5, and 7 for MP habitats, respectively. Number of small mammals captured in ASARCO habitats was 43, 12, and 21 versus 50, 26, and 53, respectively, for MP habitats. Mean trap success was 3.9, 4.7, and 9.8 for

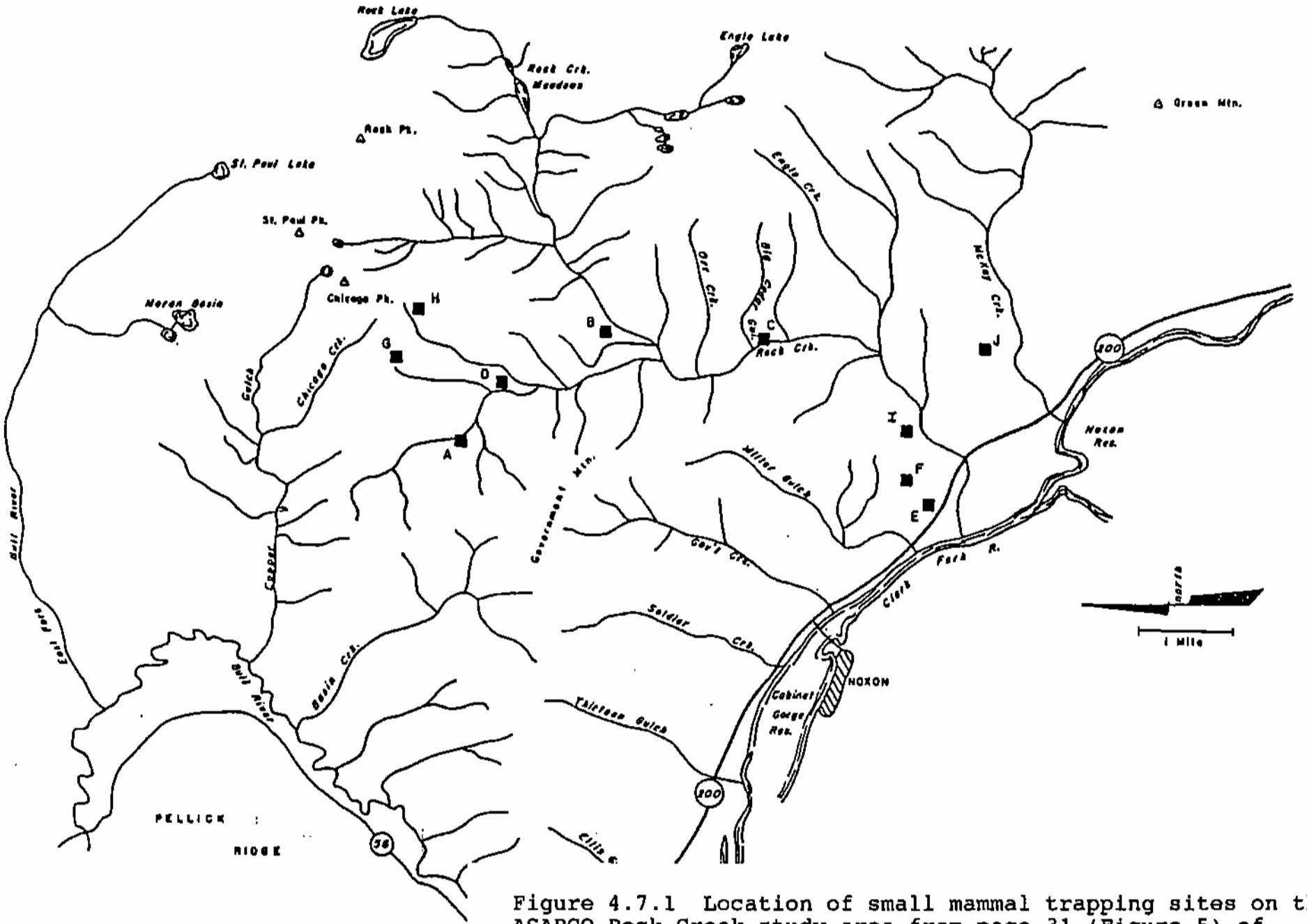


Figure 4.7.1 Location of small mammal trapping sites on the ASARCO Rock Creek study area from page 31 (Figure 5) of Farmer and Heath (1987). Transects A, B, D, F, and G were on clearcuts, transect C was in western hemlock, and transect H was in spruce-fir habitat, habitats comparable to those on the Montana Project area.

ASARCO habitats and 10.9, 9.4, and 11.5 for MP habitats, respectively. With one exception (due to greater trapping intensity in ASARCO clearcuts), MP trapping results produced higher species richness, abundance, and trap success than ASARCO surveys.

Given the similarity of habitats between these overlapping study areas, it is likely that these indices of small mammal presence reflect differences in techniques rather than the substantial differences in diversity and abundance that are portrayed. Both studies utilized similar numbers and types of traps proportionately allocated by habitat type. Montana Project habitats were sampled between August 17-24, within the July-September 1985 time frame of ASARCO sampling. The significant difference in experimental designs appears to be the use of stationary transects by ASARCO representatives versus the use of a moving transect method (Stoecker 1984) by MP contractors. The moving transect avoids the "chumming" or "birdfeeder" effect of a stationary transect by sampling a different area each day. This is important when trapping areas where deer mice, notoriously "trap happy" (White et al. 1982), are the most abundant small mammal in the area. In addition, stationary transects using snap traps typically have waning trap success over the trapping period as local mammals are removed from the population. These two factors probably account for the majority of differences in richness, abundance, and trap success between ASARCO and MP habitats.

Deer mice were the most abundant small mammal in the MP study area (Table 4.7.1). They are virtually ubiquitous throughout the western United States and are probably the most common mammal in Montana. They were captured in all six habitats, on 22 of 26 plots, and represented 66% of all mammals captured. Deer mice were also the most common species on adjacent ASARCO habitats (Farmer and Heath 1987).

Red-tailed chipmunks were the second most common species, and were trapped in all but hemlock habitats. Although chipmunks were not observed in climax hemlock/cedar forests, they were observed in areas where hemlock habitats had been selectively thinned and in more open hemlock ecotones. Chipmunks represented 14% of all mammals captured and were trapped on 15 of the 26 plots.

Although the trapping methodology and equipment were oriented toward small mammals (e.g., mice and voles), bushy-tailed woodrats, snowshoe hares, long-tailed weasels, northern flying squirrels, and a red squirrel were also captured during the study (Table 4.7.1). The abundance of these species in the study area, based on trapping results, is probably underestimated because not all traps used were effective in capturing these species. Most of these species, and individuals including all hares, and the red

squirrel, were captured in the rat traps; none were captured in the Museum Specials, which were frequently found snapped where hares, squirrels, and pack rats were abundant. Red squirrels were ubiquitous in the study area, with the exception of alpine habitats. They were abundant in all forested habitats and present in older clearcuts and shrubfields which contained moderate to large trees. Snowshoe hares were also abundant in the study area, but appeared to be less common in shrubfield habitats. The abundance of northern flying squirrels and bushy-tailed woodrats was difficult to assess aside from trapping results because these mammals are primarily nocturnal. Flying squirrels were only captured in mature conifer forests. Bushy-tailed woodrats represented 6% of all captures and occurred in all habitats sampled.

Gapper's red-backed voles were only captured in hemlock, mixed conifer, and spruce-fir habitats (Table 4.7.1). On the ASARCO study area these voles were only found in spruce-fir and ponderosa pine habitats with mature canopies (Farmer and Heath 1987).

Four montane voles were collected during trapping, three in shrubfields and one in a clearcut. Montane voles were differentiated from the similar meadow vole by upper molar characteristics and from the long-tailed vole by tail length (Hoffman and Pattie 1968, Lechleitner 1969). Thompson (1982) has no record of montane voles from the Libby latilong block, the MNHP did not consider them to be potentially present in the study area, and Burt and Grossenheider (1976) indicated that their distribution in Montana does not extend as far north as the MP study area. However, Hoffman and Pattie (1968, Map 33B, p. 106) indicates the species' northward distribution in Montana extends into, but ends in, the Cabinet Mountains. ASARCO biologists did not capture any montane voles, but captured a meadow vole in a clearcut (Farmer and Heath 1987). It is possible that meadow voles also occur on the MP study area.

Three western jumping mice were captured in hemlock, shrubfield, and spruce-fir habitats (Table 4.7.1). This species probably occurs in other habitats along streams and where grasses and forbs are well developed.

Two vagrant shrews (a federal candidate species, see Table 3.8.1 and Section 4.8.2) were captured in Rock Creek, one in mixed conifer habitat adjacent to a small pond (on MC1), and the other on the riparian plot (R1) in Rock Creek Meadows. Vagrant and masked shrews were differentiated by upper unicuspid characteristics (Hoffman and Pattie 1968, Lechleitner 1969). Identification was confirmed by Dr. James Halfpenny, University of Colorado. Thompson (1982) indicated that there is some uncertainty that this species occurs in the Libby latilong block. ASARCO representatives

captured only masked shrews in hemlock, clearcut, and ponderosa pine habitats. Masked shrews also probably occur on the MP study area.

Four other species of small mammals were observed in the study area in conjunction with other field activities. Pikas were observed in talus slopes and boulderfields in the Ramsey, Libby, and Rock Creek drainages, ranging from 3,300 feet in Rock Creek to the drainage headwalls. Columbian ground squirrels were common in relatively open clearcuts and shrubfields in the intensive study area. None were captured during small mammal trapping because all appeared to be estivating. Northern pocket gopher mounds were common in clearcuts, open shrubfields, riparian meadows, and grasslands where soils were well developed. Golden-mantled ground squirrels were relatively uncommon in the study area, most frequently observed at mid-elevations in open forest ecotones containing rock outcrops.

Two unidentified vole-like rodents were observed in the study area, racing along runways through mixed conifer forest on the bank of Little Cherry Creek and through the boggy riparian meadow below the confluence of Libby and Howard creeks. Traps were set and monitored for several days in this latter area because the observation and habitat were consistent with that of a northern bog lemming. Trapping was unsuccessful and both rodents remain unidentified.

Based on results of ASARCO's Rock Creek wildlife study (Farmer and Heath 1987), habitat similarity, and proximity, it is likely that the masked shrew, water shrew, meadow vole, and mountain phenacomys may also occur in appropriate habitats on the MP study area.

4.8 THREATENED, ENDANGERED, AND SENSITIVE SPECIES

Wildlife species listed as threatened, endangered, sensitive, or of special concern by federal and state agencies were identified by the FWS, Flath (1984), Kootenai National Forest, and a November 1988 MNHP computer search for sensitive species, which covered the MP study area and potential transmission line corridors. The species identified are listed in Table 4.8.1. Individual species accounts, presented below, address the species' status and its known or suspected occurrence on or proximal to the MP project area.

In the discussions below, references are made to wildlife reported from the Libby latilong block (block 1), and from Lincoln and Sanders counties. The Libby latilong block is a 3000 square mile area between 115-116° W longitude and 48-49° N latitude. The MP study area is

Table 4.8.1. Status and presence of wildlife of special concern to the Montana Project study area, Lincoln and Sanders Counties, Montana.

CLASS Species	STATUS Federal[a]	State[b]	Forest[c]	MNHP[d]	Presence[e]
MAMMALS					
Vagrant Shrew				S4	P
Pygmy Shrew		S		S4	
Long-legged Myotis		S			
California Myotis		S		S2	
Townsend's Big-eared Bat		S	S		
Hoary Marmot		S		S4	P
Northern Bog Lemming		S			
Northern Rocky Mountain Wolf	LE	S	E		
Grizzly Bear	LT	S	T	S3	P
Fisher		S			A
Wolverine	C2	S		S4	P
Canada Lynx	C2	S		S4	H
Woodland Caribou	LE	S	S		
BIRDS					
Common Loon			S	S3	
Harlequin Duck			S		
Osprey		S			P
Bald Eagle	LE	S	E		
Cooper's Hawk		S		S4	
Northern Goshawk		S		S4	P
Golden Eagle		S		S4	P
Merlin		S			
Peregrine Falcon	LE	S	E		
Prairie Falcon		S		S4	
Upland Sandpiper		S			
Long-billed Curlew		S			
Northern Pygmy Owl		S		S4	P
Burrowing Owl		S			
Barred Owl		S		S3	P
Great Gray Owl		S		S3	P
Long-eared Owl		S			
Boreal Owl			S		
Northern Saw-whet Owl		S		S4	
Pileated Woodpecker		S			P
Olive-sided Flycatcher		S			P
Western Bluebird		S			P
Bobolink		S			
Brewer's Sparrow		S			
REPTILES					
Northern Alligator Lizard				S3	

Table 4.8.1. Continued.

CLASS Species	STATUS Federal[a]	State[b]	Forest[c]	MNHP[d]	Presence[e]
AMPHIBIANS					
Pacific Giant Salamander		S			
Rough-skinned Newt		S			
Coeur d'Alene Salamander	3C	S	S	S1	
Tailed Frog		S		S3	P
Wood Frog		S			

[a]Federal status of species as defined by the U.S. Fish and Wildlife Service:

- LE - Listed Endangered
- LT - Listed Threatened
- C1 - Notice of review, Category 1 (substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened).
- C2 - Notice of review, Category 2 (current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling).
- 3C - Taxa that have proven to be more abundant or widespread than was previously believed, and/or those that are not subject to any identifiable threat.

[b]State status of species identified as being of "special interest or concern" for Lincoln and/or Sanders Counties and/or the Libby latilong block by Flath (1984).

[c]Kootenai National Forest species status identified as endangered (E), threatened (T), or sensitive (S) on the forest by B. Summerfield (USFS, Libby, pers. comm.).

[d]State status of species identified during a November 1988 Montana Natural Heritage Program computer survey of the Montana Project (MP) study area, including transmission line corridors. Codes are:

- S1 - Critically imperiled in Montana because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state. (Critically endangered in state.)
- S2 - Imperiled in Montana because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state. (Endangered in state.)
- S3 - Rare in Montana (on the order of 20+ occurrence). (Threatened in state.)
- S4 - Apparently secure in Montana.
- S5 - Demonstrably secure in Montana.

Table 4.8.1. Continued.

[e]Presence

P - Presence confirmed in MP study during the present 1988/89 study.

A - Present adjacent to the MP study area during the 1988/89 baseline study.

H - Species has been documented on the MP study area historically (in last 10 years).

located in the southwest corner of that block. Similarly, the portion of the study area lying east of the Cabinet Mountains divide is located on the southwest edge of Lincoln County, while the Rock Creek portion of the study area is in the northern tip of Sanders County.

4.8.1 Vagrant Shrew (*Sorex vagrans*)

Burt and Grossenheider (1976) illustrate the species' distribution in portions of twelve western states from Mexico into British Columbia. It apparently extends through Canada into Alaska (Leichleitner 1969). It is considered common in Colorado (Armstrong 1972) and Wyoming (Long 1965), apparently secure in Montana (MNHP; pers. comm.), and is not considered a state species of concern by Flath (1984). Thompson (1982) indicates that there are no reliable records of vagrant shrews from the Libby latilong block which covers the Noranda study area.

Vagrant shrews inhabit marshes, bogs, wet meadows, and lush vegetation within coniferous forests. In Montana the species breeds from April through August with several litters/year/female, and between two and nine young/litter (Lechleitner 1969).

Two vagrant shrews were captured on August 23/24 in Rock Creek during 1988 small mammal trapping. One was caught in mixed conifer habitat adjacent to a small pond (on MCI) and the other in lush herbaceous vegetation beneath alders in Rock Creek Meadows (plot R1). There was no doubt about the identification of these two specimens. Vagrant and masked shrews were differentiated by the size of the third upper unicuspid (Lechleitner 1969). Identification was confirmed by Dr. James C. Halfpenny, Mammalogist, University of Colorado, Boulder. One skull was prepared and is in the WRD reference collection. Based on small mammal trapping results and relative trap efforts, this species may be more common on the west side of the Cabinet Mountains. Vagrant shrews were not captured during the small mammal trapping associated with ASARCO's Rock Creek baseline study, although four masked shrews were captured (Farmer and Heath 1987).

4.8.2 Pygmy Shrew (*Sorex hoyi*, formerly *Microsorex hoyi*)

The pygmy shrew is a state species of special concern because its status is undetermined and it is considered sensitive to disturbance (Flath 1984). Flath (1984) considers it very rare in the state and suspects its occurrence in Lincoln County. Thompson (1982) also indicates that there is evidence the species occurs in latilong block 1. Pygmy shrews are distributed in a broad band across Canada from the Atlantic Ocean to Alaska (Burt

and Grossenheider 1976); however, the southern limit of their range only reaches the extremes of northwest and northeast Montana (Burt and Grossenheider 1976, Thompson 1982). They may occur in a variety of habitats ranging from wet to dry and wooded to open (Long 1974). Pygmy shrews were not captured during the small mammal trapping associated with the baseline study, nor were they encountered on ASARCO's Rock Creek study area (Farmer and Heath 1987).

4.8.3 Long-legged Myotis (*Myotis volans*)

Flath (1984) suspects this bat occurs in Lincoln County, and therefore considers it a species of special concern for the area. Thompson (1982) indicates this species occurs over approximately one-third of the state, although there he gives no evidence that it has occurred in the Libby latilong block. Nevertheless, Burt and Grossenheider (1976) indicate this species' general range covers the western half of Montana and virtually the entire western United States. Farmer and Heath (1987) did not consider this species to be potentially present in ASARCO's Rock Creek study area.

Bats are nocturnal, elusive, and repugnant to most people, characteristics that do not facilitate species identification or add to distributional records. Despite the lack of data, they may be present in the area. Barbour and Davis (1969) indicate the preferred habitat of this bat as the transitional and Canadian life zones. Typical habitat in the MP study area would include conifer forests and shrub stands. These bats roost by day in buildings, fissures in rocks, and beneath bark on trees, either singly or in small groups. Long-legged myotis feed primarily on moths. They emerge to feed early and forage 3-4 m over ponds, streams, open meadows, and forest openings.

4.8.4 California Myotis (*Myotis californicus*)

The MNHP considers the California myotis as endangered in Montana (Table 4.8.1) and Flath (1984) considers it a species of concern suspected to occur in the Libby latilong block. Burt and Grossenheider (1976) show the species' North American distribution, widespread throughout the southwest and northwest, barely enters western Montana. This is consistent with Thompson (1982) who indicated records of this species in only three of the state's 47 latilong blocks. The California bat has not been documented in the Libby latilong block which overlaps the MP study area (Thompson 1982), although the MNHP survey indicated the species has been reported from Lincoln County. This species was not considered to be potentially present in ASARCO's Rock Creek project area (Farmer and Heath 1987).

The California myotis inhabits lower elevation grasslands, valleys, and canyons through the Upper Transitional Life Zone (Krutzsch 1954). This species uses more artificial structures, such as buildings, mines, and bridges for night roosts than other bats. It also apparently moves without regard for particular diurnal roosts. This bat is entirely insectivorous and forages intermittently throughout the night (Krutzsch 1954).

4.8.5 Townsend's Big-eared Bat (*Plecotus townsendii*)

Townsend's big-eared bat is a sensitive species on the Kootenai National Forest and a state species of special concern (Flath 1984) because of its undetermined status and sensitivity to disturbance. It is known to occur on the Forest and in Sanders County and is suspected to occur in Lincoln County (B. Summerfield, USFS, pers. comm.; Flath 1984). There are no records of its occurrence in latilong block 1 (Thompson 1982) and the MNHP did not list the species as potentially present in the study area. Farmer and Heath (1987) considered this species to be potentially present in ASARCO's Rock Creek study area; however, no individuals were observed.

This bat occurs throughout the western United States extending from southern British Columbia into the eastern U.S., and to southern Mexico (Barbour and Davis 1969, Burt and Grossenheider 1976). Its distribution appears to be determined by the temperatures in roosts such as caves and mines. This species does not make major migrations and appears to be relatively sedentary as most distances traveled from summer foraging grounds to winter hibernation sites are short. This bat is quite sensitive to changes in temperature and humidity within the hibernacular and may arouse to move to a more favorable location. Populations may be primarily limited by high winter mortality due to absence of roosts with stable temperatures. Populations, especially in the nursery, are highly susceptible to disturbance and local declines have been reported (Barbour and Davis 1969, Pearson et al. 1952).

4.8.6 Hoary Marmot (*Marmota caligata*)

Flath (1984) considers the hoary marmot a species of special concern because its status is undetermined. The 1988 MNHP review (Table 4.8.1) considers the species to be apparently secure in Montana. Hoary marmots have been documented in the Libby latilong block (Thompson 1982), are known to occur in Lincoln County, and are suspected to occur in Sanders County (Flath 1984). It was not observed by Farmer and Heath (1987) in ASARCO's Rock Creek study area. Al Bratkovich and Lisa Fairman (USFS biologists, Libby, pers. comm.) observed hoary marmots north of Rock Lake (Sanders County) in September 1988, and Jerry

Brown (MDFWP biologist, pers. comm.) indicated hoary marmots were also present just north of Saint Paul Pass (Sanders County). Hoary marmots occur in alpine and subalpine zones in close proximity to talus slopes, boulder fields/broken rock, and alpine grasslands. This habitat is fairly extensive in upper elevations of the MP study area; however, hoary marmots were not observed in areas other than around Rock Lake during the baseline study.

4.8.7 Northern Bog Lemming (*Synaptomys borealis*)

The northern bog lemming is a state species of special concern which could potentially occur in Lincoln County, but is unknown from Sanders County (Flath 1984). Thompson (1982) shows no record of the species in the Libby latilong block and the 1988 MNHP review did not identify it as potentially present in the study area. Hoffman and Pattie (1968) indicated that it was only known from tributaries to the North Fork of the Flathead River in Glacier National Park (Wright 1950). There its distribution was scarce and local. However, they added that its distribution in Montana may be wider than what was known.

This is a boreal species which reaches the southern limits of its North American distribution in extreme northwestern Montana (Burt and Grossenheider 1976). It occurs in wet alpine and subalpine meadows with lush vegetation, specifically, sedge-alder bogs within or on the edge of dense spruce-fir forest. It was not encountered during the small mammal trapping studies conducted by Farmer and Heath (1987) or during the present study. Suitable habitats appear to exist for this species in the study area, including Rock Creek Meadows, the fen along Libby Creek, just below its confluence with Howard Creek, and around the proposed Ramsey and Upper Libby Creek plant sites.

4.8.8 Northern Rocky Mountain Wolf (*Canis lupus irremotus*)

The Northern Rocky Mountain wolf is a federally endangered species, an endangered species on the Kootenai National Forest, and a state species of special concern (Flath 1984). Thompson (1982) considers the species extinct in most Montana latilongs and the 1988 MNHP survey did not indicate a potential presence in the MP study area. It is unlikely that this species is present in or around the MP study area. No evidence was identified in conjunction with this or the ASARCO wildlife baseline studies (Farmer and Heath 1987) suggesting the species' presence.

4.8.9 Grizzly Bear (*Ursus arctos*)

The grizzly bear is a federal threatened species, a threatened species on the Kootenai National

Forest, a state species of special concern (Flath 1984), and is considered threatened in Montana by the MNHP (Table 4.8.1). A low number of grizzly bears exist as a stagnant/declining population in the Cabinet Mountains and the continued existence of this population is in serious doubt (Kasworm and Manley 1988). Results of a recent MDFWP study (Kasworm 1985, 1986, 1987; Kasworm and Manley 1988), which began in 1983, indicate that the seasonal ranges of a few grizzlies overlap the MP study area and that the East Fork of Rock Creek, Libby, and Ramsey Creek drainages were used by these bears.

The MP study area is located within the 2,612 square mile Cabinet-Yaak Grizzly Bear Ecosystem, one of only six ecosystems south of Canada still supporting grizzlies, and one of three ecosystems designated by the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1982, 1987) for concentrated recovery efforts. The east and west Cabinet Mountains compose about 65% of the Cabinet-Yaak Ecosystem (CYE). Two subadult female grizzlies are scheduled for release in the East Cabinet Mountains (which contain the MP study area) in fall 1989 to initiate augmentation of the population (U.S. Fish and Wildlife Service 1987, W. Kasworm, MDFWP, pers. comm.). This area has been selected because the grizzly population is dangerously low, is believed to be isolated from other populations, and has high quality bear habitat. Isolation from human presence is also higher in the core of the East Cabinets than in other portions of the Cabinet-Yaak Ecosystem (U.S. Fish and Wildlife Service 1987). The addition of augmented bears should numerically and genetically improve the base population, leading to an increase in natural reproduction and long-term population stability and recovery (U.S. Fish and Wildlife Service 1987). It is the consensus of professional biologists that without population augmentation there is a high probability that grizzly bears in the Cabinet Mountains portion of the Cabinet-Yaak Ecosystem would become extinct within the next 20 to 30 years.

The Kootenai National Forest stratified their grizzly bear habitat into three management situations, based on (1) bear population and habitat conditions and management direction, and (2) substratifications (modes), based on habitat conditions, habitat component information, and season of use (USFS 1987b). All proposed MP plant sites and at least portions of the two tailings impoundments are located in Management Situation 1 areas. It is part of the policy of the Kootenai National Forest in Situation 1 areas to "resolve conflicts in favor of grizzly bears and emphasize their welfare in management activities. Activities will be made compatible or they will be foregone" (USFS 1987b). The area around Howard Lake is classified as a Management Situation 3 area. Policy in this area is to

(1) "avoid attracting grizzly bears or creating situations which bring bears into contact with humans" and (2) "actively discourage grizzly presence in these areas" (USFS 1987b).

A number of grizzly bear studies have been conducted in the Cabinet Mountains. Studies began in 1974 after the grizzly bear hunting season was closed in the Cabinet Mountains because of the declining population and after adoption of the Endangered Species Act (1973). Earlier studies (Hamlin and Frisina 1974, Erickson 1976, 1978, Joslin et al. 1976, Moore and Gilbert 1977) focused on habitat surveys and examination of reports of sightings and sign. In 1979 and 1980, Thier (1981) intensively trapped the southern portion of the East Cabinets, including the East Fork of Rock Creek, attempting to capture and radio-collar grizzlies. Twenty-four black bears and one yearling grizzly were captured; however, the grizzly escaped before it could be tranquilized. The yearling's mother was also present, but could not be captured. Additional grizzly sign was observed during the study.

In 1983, Martin (1983) conducted a search for grizzly sign on some of U.S. Borax's claim blocks. The study area was expanded to contain all of Grizzly Bear Management Unit 5, which contains part of the MP study area. His results indicated that at least one grizzly utilized the Libby Creek drainage in 1983, that historical reports from upper Libby Creek were relatively frequent, and that the drainage received frequent grizzly bear use. He also considered grizzly use in the Upper East Fork of Rock Creek to be relatively common, that reliable historical sightings have been reported from this area as recently as 1979, and a sow with two cubs, observed by Al Erickson (1986) in this area in 1983, may have been grizzlies.

The Kootenai National Forest compiled and plotted reliable historical grizzly bear records in the CYE up to 1982 (KNF Draft Grizzly Bear Record Map, 1983). This map shows two areas where grizzly records are concentrated in the vicinity of Grizzly Bear Management Unit 5, which generally agree with Erickson's (1978) two proposed population centers. One area with a high density of grizzly records is the upper West Fisher Creek drainages and the adjacent upper Libby, Swamp, McKay, and East Fork of Rock Creek drainages along the southern end of Bear Unit 5. Another area with frequent grizzly use records is located in the North, Middle, and South Forks of the Bull River drainage and the upper drainages of Big Cherry Creek. According to this map, prior to 1983, 24 reliable records of grizzly use were reported from Bear Unit 5. Of the nine from the west slope drainages, six were from the head of the East Fork of Rock Creek. Of the 15 grizzly records reported from the east slope drainages, one each was from Cable and

Ramsey Creeks, two were from Poorman and Bear Creeks, and nine were from Libby Creek.

More recently, some grizzly studies in the Cabinet Mountains have focused on mapping grizzly bear habitat components for the Cumulative Effects Model (Christensen 1982, Madel 1982, Ottersberg 1988, USFS et al. 1988). This model is used to evaluate the impacts of management activities on grizzly bears and their habitats. Present USFS grizzly bear habitat management is based on the Cumulative Effects Analysis Process (Christensen 1982) and the Kootenai Forest Plan (USFS 1987). Development effects associated with ASARCO's proposed Rock Creek Mine are currently being evaluated by the model and it is likely that MP alternatives will also be evaluated by the model as part of the EIS process.

Jerry Brown, MDFWP biologist, has flown annual late summer shrubfield surveys over the Cabinet Mountains from 1982-1987 to classify black and grizzly bears (Brown 1983, 1984, 1985, 1986, 1987). These helicopter surveys were concentrated over upper elevation shrubfields where bears are attracted to fruit-bearing shrubs. Although 783 black bears were recorded during the six years of surveys, only one grizzly was observed and that bear was previously radio-collared as part of Kasworm and Manley's (1988) study.

As part of the baseline work for ASARCO's Rock Creek Mine proposal, Erickson et al. (1986) conducted field studies to evaluate the project's impact on the grizzly population. During 42 helicopter surveys, totaling 63.4 hours, they observed a female grizzly with two cubs in Upper Libby Creek, a single grizzly at Ozette Lake, a probable female grizzly with two cubs on Lost Horse Mountain, and 164 black bears.

Farmer and Heath (1987) conducted the wildlife baseline study for the ASARCO proposal and expended over 1,230 man hours in the field. A portion of their study area included the East Fork of Rock Creek. They did not observe any grizzly bears or observe any grizzly evidence in conjunction with that study, although 15 black bears were observed.

Similarly, during the present MP wildlife baseline study, whose scope and methods are delineated elsewhere in this report, no evidence of grizzlies was observed. Forty-seven black bears were observed during seven systematic helicopter (12 are scheduled) and additional ground surveys. Seventeen spring 1988 bear scats analyzed were all from black bears, and all tracks and bear hair located during the study were those of black bears. Nonetheless, Kasworm's old, radio-collared sow grizzly (#678) utilized portions of the Ramsey, Libby, and the East

Fork of Rock Creek drainages during 1988 (Kasworm, MDFWP, pers. comm.).

The study which has most thoroughly evaluated grizzly (and black) bear habitat utilization in the Cabinet Mountains has been a cooperative project conducted from 1983 to 1987 (with ongoing monitoring) by the MDFWP (Kasworm 1985, 1986, 1987, Kasworm and Manley 1988). During the study's extensive trapping effort three grizzly bears were captured six times and 185 black bears were captured 277 times. All the grizzly bears and 26 black bears were radio collared and monitored. Average minimum home range of the old sow grizzly (33.5 years old as of June 1988, #678) over five years was 112 square miles (annual range 76-169 square miles, 5 year range 438 square miles). Minimum home range of the 12.5 year old male (on May 1985, #680) over 1984 (494 square miles) and 1985 (580 square miles) averaged 537 square miles, with a two-year composite range of 771 square miles. Male grizzly #680 captured in June 1984 in upper Libby Creek was shot twice with a .30 caliber rifle on 21 November 1984 by a hunter who mistook the bear's tracks for those of a black bear. The hunter pursued the bear and when it came at him at close range, he shot it in self-defense. Fortunately, the bear survived and hibernated. After initial capture and radio-collaring, adult male grizzly #14 (27.5 years old, 19 June 1985) was only monitored for three months before it was killed by bow hunters in late September. Minimum home range size during that period was 236 square miles. The composite home ranges of all three of these bears overlapped the Libby, Ramsey, and upper East Fork of Rock Creek drainages, and captures/relocations were recorded in each of these drainages (Kasworm, MDFWP, pers. comm.).

Grizzly and black bears exhibited similar food habits and habitat utilization patterns (Kasworm and Manley 1988). Differences were attributable to grizzly bear avoidance of areas within approximately 550 yards of open roads. Little avoidance of trails, which included closed roads, was noted. Graminoids dominated grizzly diets in May and June. Forb use, dominated by *Heracleum*, increased in June and composed most of the July diet. In August-September there was a drastic shift to shrubs (*Vaccinium* spp.), which composed 80 to 95% of their diets. Habitat use patterns reflected this shift from spring and early summer grass-forb areas to areas where berry-producing shrubs were concentrated. In terms of gaining sufficient resources to survive denning and post-emergence the following spring (Sizemore 1980), as well as maximizing reproductive success (Jonkel and Cowan 1971, Rogers 1976), availability and access to berry producing habitats can be critical to grizzly and black bears. Kasworm and Manley (1988) found that October diets shifted completely back to grasses and sedges.

Relative comparison of the three drainages proposed for MP plant site development indicates that while Libby, Ramsey, and the upper elevations in the East Fork of Rock Creek can all be important fall grizzly feeding areas because of berry concentrations, the east side of the divide, specifically Libby Creek, also provides important spring grizzly habitat. In this respect, Libby Creek provides better spring habitat than Ramsey Creek because of its larger area, greater number of avalanche chutes supporting preferred foraging habitat, its graminoid-sidehill parks, and its riparian areas, which in June and July support *Heracleum* and other succulent forbs (W. Kasworm, MDFWP, pers. comm.).

Observations and evidence obtained during Kasworm and Manley's (1988) study indicated at least seven grizzly bears were present in the study area. However, it is doubtful that the Cabinet Mountains grizzly population exceeds 15 bears, which equates to approximately 1 bear/113 square miles (U.S. Fish and Wildlife Service 1987, Kasworm and Manley 1988). The decline of grizzlies in the CYE over the last several decades has been due primarily to man-caused mortality (legal hunting, illegal kills, and self-defense shootings (W. Kasworm, MDFWP, pers. comm.). As of fall 1988, 58 grizzly bears are known to have been killed in the CYE since 1950 (Kasworm 1988, pers. comm.). Additional, unreported kills have probably occurred. The fact that two of Kasworm and Manley's (1988) three radio-collared bears were shot within one year of capture illustrates the pressure of human-induced mortality on the population. Low natural reproduction, limited immigration, and habitat changes have also contributed to decline of this population.

Recovery goals for the CYE were established by delineating an area that appeared capable of supporting grizzly bears based on habitat, present land uses, and historic or current grizzly observations. The occupied habitat delineated for the CYE in the Recovery Plan totaled 1,818 square miles. The recovered population goal for the CYE is 70 bears. This equates to one bear per 26 square miles, which is equivalent to densities of bears in other ecosystems having similar habitat features (U.S. Fish and Wildlife Service 1982). While MDFWP's EIS (Dood et al. 1986) on grizzly bear management stated a goal of having 90-120 bears within the Montana portion of the CYE in order to have a huntable population, 70-90 bears, or the equivalent biological parameters as stated in the Grizzly Bear Recovery Plan, would be adequate to consider the population recovered (U.S. Fish and Wildlife Service 1987). Forty to 60 of these bears would live in the Cabinet Mountains portion of the CYE.

4.8.10 Fisher (*Martes pennati*)

Fishers are state species of special concern in Lincoln and Sanders counties (Flath 1984); however, they were not present in the area before recent introductions (J. Brown, MDFWP, pers. comm.). Fishers are native to the deciduous and mixed coniferous forests of northwestern Montana, but were eliminated in the Rocky Mountains south of the Canadian border by intensive trapping during the 1920's and 30's (Hoffman and Pattie 1968, USFS 1987). They are classified as furbearers and protected in most areas by closed seasons under Montana law. Several 1959 Montana releases have resulted in viable populations and legal trapping seasons in some parts of the state (Weckwerth and Wright 1968).

Fishers travel over large areas and naturally occur in low numbers. They are opportunistic feeders well known for their ability to kill and eat porcupines. Other predominant foods include snowshoe hares, small rodents, and carrion, especially deer and moose. When available, they will also consume birds and their eggs, insects, reptiles, and amphibians (Strickland et al. 1982).

In a cooperative project between the MDFWP, University of Montana, and the Kootenai National Forest, 12 fishers were released in the East Fork of the Bull River, approximately three miles west of the MP wildlife study area, in late December 1988. This was the first year of a two year release program whose purpose in reintroducing fishers to the Cabinet Mountains includes returning a species to its former habitat, maintaining species diversity, conserving native wildlife populations, and providing an aesthetic and potential economic resource to local and regional areas (Rathbun 1988). Released fishers have been radio collared and are being monitored to assess movements, habitat use, and reproduction (USFS 1987). Some will eventually move into or through the MP study area.

4.8.11 Wolverine (*Gulo luscus*)

The wolverine is a federal candidate species (C2) that may be proposed for listing if and when substantial biological information to support such a ruling is obtained. Wolverines are apparently secure in Montana (MNHP, Table 4.8.1), but are considered state species of special concern (Flath 1984). This species is present in the Libby latilong block and Lincoln County (Thompson 1982, Flath 1984) and was present on ASARCO's Rock Creek project area (Farmer and Heath 1987), which is overlapped by the MP study area. Wolverines have been increasing their numbers and distribution in northwestern Montana since about 1940 (Newby and Wright 1955, Newby and McDougal 1964, Hornocker and Hash 1974).

Al Bratkovich (USFS, pers. comm.) photographed a wolverine track near the headwalls of Big Cherry Creek, approximately three miles northwest of the MP study area boundary, in September, 1985. On January 29, 1989, as part of the MP baseline study, a fresh wolverine trail was followed out of the West Fork of Rock Creek, where it crossed the West Fork Road, approximately 1.4 miles north of the East Fork/West Fork Road junction, and up the East Fork as far as 0.25 miles southeast of the Lower Heidelberg Mine.

4.8.12 Canada Lynx (*Felis lynx canadensis*)

The Canada lynx is a federal candidate species (C2) that may be proposed for listing if and when substantial biological information to support such a ruling is obtained. Lynx populations, cyclic as they are, are apparently secure in Montana (MNHP, Table 4.8.1). They are classified as furbearers and are still trapped in Montana under a restricted harvest (up to two lynx may be taken per trapper per year). MDFWP harvest data indicate that lynx numbers in Region One (which contains hunting districts overlapping the MP study area) are among the highest in the state. Lynx are known to occur in Lincoln and Sanders counties; however, because of insufficient data their status is undetermined (Flath 1984). Wayne Kasworm (MDFWP, pers. comm.) indicated that during one of his aerial grizzly relocation surveys he located a radio-collared lynx in the East Fork of the Bull River that had been collared in 1985 around Thompson Falls. Jerry Brown (MDFWP, pers. comm.) indicated that lynx occur in the area, but are scarce. He was also unaware of any being caught and suggested that the upper elevation lodgepole pine habitat that lynx prefer in the area is difficult for trappers to access. Robert Cluzen (pers. comm.), a long-time Noxon resident and trapper, observed a set of lynx tracks in Orr Creek, a tributary of Rock Creek, in the mid-1970's. Lynx or their sign were not identified by Farmer and Heath (1987) during baseline wildlife surveys for ASARCO's Rock Creek project.

Lynx dependency on snowshoe hares is well established (Kieth 1963, Brand et al. 1976); however, small mammals, birds, and, rarely, larger mammals are also taken (Burt and Grossenheider 1976, McCord and Cordoza 1982). In western Montana, as in other parts of their range, they are generally confined to dense, high-elevation coniferous forests (Hoffman and Pattie 1968), particularly those supporting high snowshoe hare densities.

4.8.13 Woodland Caribou (*Rangifer tarandus caribou*)

The woodland caribou is a federally listed endangered species that has disappeared from its former range in the continental United States, except for a

stagnant, remnant population in the Selkirk Mountains, numbering approximately 30 animals.

Woodland caribou originally occupied a finger of boreal forest and alpine habitats which projected south from Canada only as far as extreme northeastern Washington, northern Idaho, and extreme northwestern Montana (Miller 1982). Their decline in this and other areas south of Canada has been attributed to logging, mining, and road building in climax spruce-fir forests, fire suppression, climatic change, overhunting, competition with white-tailed deer, and parasitical meningeal worms carried by deer (Smith et al. 1964, Anderson 1971, Miller 1982, Manley 1986).

While caribou are a Kootenai National Forest endangered species, Evans (1964) considered the Montana population to be extinct except for casual, wandering individuals from Canada. Flath (1984) also considered caribou to be extinct in Montana and noted that the last reliable sighting occurred in 1982. While recreationists report caribou sightings in the Yaak (B. Summerfield, A. Bratkovich, USFS, J. Brown, MDFWP, pers. comm.), these are probably wandering individuals (Evans 1964) and do not represent a viable population. Caribou are not present in the Cabinet Mountains (Farmer and Heath 1987, B. Summerfield, A. Bratkovich, USFS, pers. comm.); however, in the 1950's one was mistaken for an elk and shot in the East Cabinets and 2-3 were reported by a Forest Service trail crew near Wanless Lake in 1962 (Manley 1986). There have been no reports of caribou in the East Cabinets since the Wanless Lake Report (Manley 1986).

4.8.14 Common Loon (*Gavia immer*)

The common loon is a Kootenai Forest sensitive species and is considered rare in Montana by the MNHP (Table 4.8.1). Montana's 1985 population was estimated at a minimum of 105 birds (Skaar 1986). In northwest Montana, its breeding range is restricted to low elevation glacial lakes where it occasionally overwinters (MNHP, pers. comm., Skaar et al. 1985). Although it is considered a breeder in the Libby latilong block (Skaar 1985), which overlaps the MP study area, it generally does not nest on lakes less than 20 acres or over 5000 feet in elevation (Skaar, as cited by MNHP). As such, there are no suitable lakes for breeding in the study area or adjacent to any of the transmission line corridor alternatives. The only lake in the MP study area potentially suitable as habitat for the common loon is Howard Lake. Although this lake does not meet the minimum size criterion specified above, even if it did, the lack of islands or suitable emergent wetlands in secluded coves would eliminate this lake as potential nesting habitat. Howard Lake could provide a migratory stopover area during late April or late October migration; however, loons are

sensitive to human disturbance and the level of human activity around the lake associated with camping and fishing would not only eliminate any breeding, but limit the lake's value as a stopover area for all but brief intervals when people are not present.

Loons were not observed on the MP wildlife study area during the present baseline program. They were detected by Farmer and Heath (1987) on ASARCO's Rock Creek project area, probably on Cabinet Gorge Reservoir. Dick McCallum (Noxon resident) indicated in January 1989 that he had observed two pair of loons on Cabinet Gorge Reservoir during late spring, summer, and early fall of the "last several years."

4.8.15 Harlequin Duck (*Histrionicus histrionicus*)

Harlequin ducks are sensitive species on the Kootenai National Forest and are considered rare in Montana (Flath 1984, Table 4.8.1). Skaar et al. (1985) lists them as breeders in the Libby latilong block.

In the western part of their range, harlequin ducks nest from Alaska, south through the Rocky Mountains of Montana, as far south as Wyoming's Bighorn Mountains (Bellrose 1980). They usually nest along rocky shores adjacent to turbulent mountain streams. In late summer/early fall they migrate to the Pacific coast and winter from the Aleutian Islands south to central California.

Adult and young harlequin ducks have recently been observed in Rock Creek. MDFWP personnel accidentally caught adults and young in a smolt trap on lower Rock Creek in summer 1985 (T. Swant, Noxon, pers. comm.). The ducklings that were captured were so young that they had to have been produced upstream. Specific surveys for these ducks were unsuccessfully conducted in June, July, and August 1985 on Rock Creek and its West Fork by Farmer and Heath (1987). In 1986, MDFWP personnel again observed adults and at least 13 young-of-the-year harlequin ducks on the main stem of Rock Creek and its east and west tributaries on five occasions from early June to August (Farmer and Heath 1987). Farmer and Heath (1987) also reported that harlequin ducks were observed in 1985 on Elk Creek near the town of Heron. In summer 1988, MP wildlife personnel (Thompson) observed two males just above Kootenai Falls.

In mid-June 1988 the upper reaches of Libby and Ramsey Creeks and the East Fork of Rock Creek, above the gate and below the meadows, were walked in an attempt to locate harlequin ducks. Although none were observed, several recent, large, individual whitewash and fecal

deposits characteristic of waterfowl were observed on boulders in Rock Creek and at one site in Libby Creek. All deposits were in the torrential mountain stream habitat that characterizes harlequin duck breeding and nesting areas. No other evidence of harlequin ducks was observed in the vicinity of the study area in conjunction with the wildlife, fisheries, and aquatics field programs.

4.8.16 Osprey (*Pandion haliaetus*)

Flath (1984) and Skaar et al. (1985) considered the osprey to be a common breeder in the Libby latilong block. It is listed as a state sensitive species because it is listed in the appendices to the Convention on International Trade in Endangered Species (CITES) (Flath 1984).

Ospreys are primarily piscivorous (fish eaters) and in northwest Montana they are associated with large rivers, reservoirs, and lakes. Ospreys nest in live or dead trees or on man-made structures adjacent to, or in the vicinity of, these waterbodies. Kuchera and Ruediger (1978) located 47 osprey nests on the Kootenai National Forest in 1977; 21 active and 26 inactive. They concluded that osprey nesting habitat was characterized by: (1) availability of fish, (2) presence of a suitable nest site, (3) proximity (less than 0.3 mile) to water, (4) nest structure had to be taller than adjacent vegetation, (5) nests were often near inlets of streams on large bodies of water, and (6) there were no roads between the nest and open water.

No active, inactive, or historic osprey nests have been identified in the MP study area or adjacent to the two eastern transmission line corridor alternatives. It is possible, however, that nesting could occur adjacent to Howard Lake, Rock Creek Meadows, or lower portions of Libby Creek. Four osprey nests have been located within the project's area of influence. Al Bratkovich (USFS, pers. comm.) indicated that two osprey nests were located along the West Fisher River, approximately 5-6 miles southeast of Howard Lake and close to the West Fisher transmission line corridor alternative. Both nests were active from 1983-86 and inactive in 1987 and 1988. However, during an April 20, 1989, helicopter survey of the West Fisher transmission line corridor to locate the nests, neither could be located and it is likely that they blew down during the 1988/89 winter. Nevertheless, habitats in this area are still suitable for nesting and it is likely that nesting will again occur in this area. A previously unknown osprey nest was located along the west shore of Libby Creek, due east of the junction of U.S. Highway 2 and the Farm to Market Road, during April 20 transmission line corridor surveys. This nest appeared to be inactive. On the west side of the project area, an osprey nest, inactive in 1988, was located

on a transmission line tower near the mouth of Rock Creek. This nest blew down during the 1988/89 winter. This site is adjacent to the Rock Creek access road. An active (1989) osprey nest was located approximately 300 m west of the U.S. Highway 200/Rock Creek Road junction along Highway 200 and Cabinet Gorge Reservoir.

Although ospreys are common along Cabinet Gorge Reservoir and the Clark Fork, Bull, and Kootenai Rivers, they are relatively uncommon in the MP study area because of its high elevation and general lack of suitable fishing habitat. Only one osprey was observed in the MP study area during the baseline study. On June 22 an osprey was perched in a tall spruce on the north side of Rock Creek Meadows. The bird may have been fishing the beaver ponds on Rock Creek. Al Bratkovich (USFS, pers. comm.) has noted that ospreys from the West Fisher River nests were occasionally seen fishing at Howard Lake. Rock Creek Meadows, Howard Lake, and lower portions of Libby Creek are the only potential osprey habitats in the study area. Use of these areas probably varies between years depending on their proximity to active nests. However, given their relatively low productivity (relative to Cabinet Gorge Reservoir and the Clark Fork and Kootenai Rivers), it is unlikely these areas could individually support a nest. While Howard Lake could be the exception to this, it is uncertain to what extent human presence on and around the lake would have on regular osprey fishing and use of an active nest. Ospreys were the most commonly observed nesting raptor in ASARCO's Rock Creek project area (Farmer and Heath 1987) and five active nests were located in their study area long the Clark Fork River in 1985.

4.8.17 Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are listed as federal endangered species, endangered species on the Kootenai Forest, and state species of special concern (Table 4.8.1). They are primarily piscivorous, feeding on salmonids, suckers, and whitefish, but also prey on waterfowl and small mammals. Carrion, especially road-killed white-tailed deer, is also important winter food. Important year round habitat include wetlands, major water bodies, spawning streams, ungulate winter ranges, and open water areas (BLM 1986). Bald eagles usually nest in tall trees (selection for ponderosa pine, Douglas-fir, and cottonwood) or on cliffs near water. The same nest may be used in successive years, or they may annually alternate between two nest sites. All nests are within 1 mile of a water body with an adequate food supply (MNHP).

Bald eagles occupy suitable northwestern Montana habitats year round, although they are most common during fall (November) or spring (April) migration.

Typically, eagles begin arriving in September, and in most winters remain throughout the winter along the Kootenai River (open year round) or remain along the Clark Fork River and Cabinet Gorge Reservoir until early to mid-February when the river and reservoir have frozen over, fish are unavailable, and waterfowl have left (B. Haflick, B. Summerfield, A. Bratkovich, USFS, pers. comm.). During years when the Clark Fork River and reservoir have frozen over, eagles are locally absent from mid-February to late March as they move upstream to Thompson Falls or down river to Lake Pend Oreille. Eagles return during thaws and their numbers peak during April migration. Cabinet Gorge Reservoir has been open each of the last three years (T. Hightower, Noxon resident, pers. comm.) and during such years, low numbers 2-4 eagles are present.

Bald eagles wintering along the Kootenai River and surrounding areas have increased in recent years. The FS conducts annual surveys along the Kootenai from Libby Dam to Kootenai Falls (23-28 river miles). Peak daily numbers in November 1979-1981, ranging from 12-15, have increased to 91 and 166 in November 1987 and 1988, respectively (Table 4.8.17.1, A. Bratkovich, USFS, pers. comm.). This increase is probably partially attributable to a decline in the Flathead Lake kokanee salmon population and an increase in the Lake Koocanusa kokanee population (A. Bratkovich, USFS, pers. comm.). In 1985, approximately 500 bald eagles were wintering on McDonald Creek, a tributary of Flathead Lake. In 1987, following the kokanee decline, only 30 eagles were observed. One of the eagles, radiocollared at McDonald Creek, was observed on the Kootenai River.

Libby Creek, a tributary of the Kootenai River, has been surveyed by FS personnel (1982 to 1988) from the confluence, up the creek 8 miles. Peak daily counts have recorded up to 8 eagles in this reach during fall before the creek freezes. Bald eagles have also been seen as far upstream as the lower Libby bridge (approximately 1.5 miles upstream from U.S. Highway 2) during fall whitefish runs (A. Bratkovich, USFS, pers. comm.).

Nesting has been increasing in recent years on or adjacent to the Kootenai Forest (B. Summerfield, USFS, pers. comm.). In 1988, three nests along the river, one on Lake Koocanusa and one on Bull Lake, all fledged young. Although bald eagles nest along the Clark Fork River (BLM 1986) neither Hamer (1976) nor Kuchera and Ruediger (1978) reported any nests on the Cabinet Ranger District. Bruce Haflich, Cabinet Ranger District biologist (Dec. 1988, pers. comm.) was unaware of any bald eagle nests on the District (other than the Bull Lake nest) and Hamer (1976) speculated that the District lacked suitable nesting snags and adequate seclusion for bald eagle nesting.

Table 4.8.17.1 Peak fall bald eagle counts on the Kootenai Rier from Libby Dam to the Kootenai Falls area (approximately 28 river miles), Lincoln County, Montana. Unpublished data from Al Bratkovich, Libby Ranger District Biologist, USFS.

Date	Total	Adults	Immatures	River Miles	Eagles/Mile
11/20/79	15	15	0	23	0.7
11/19/80	13	9	4	23	0.6
11/19/81	12	11	1	23	0.5
12/01/82	35	33	2	23	1.5
11/23/83	35	30	5	23	1.5
11/28/84	55	33	22	23	2.4
11/06/85	20	13	7	23	0.9
11/19/86	59	49	10	23	2.6
11/21/87	91	56	35	28	3.3
11/17/88	166	83	83	28	5.9

No bald eagle nests occur, or are likely to occur, on the MP wildlife study area. This is primarily due to the lack of large waterbodies on the relatively high elevations of the study area. This inadequate hunting habitat also accounts for the lack of any bald eagle observations made during the study, although it would not be surprising to observe bald eagles flying around Big Hoodoo Mountain or other big game transitional and winter ranges in search of carrion.

Bald eagles do utilize portions of the proposed transmission line corridors adjacent to Libby Creek, the Kootenai River, Swamp Creek, and the Fisher River as hunting habitat (for fish, waterfowl, and road-killed deer) and as flight corridors. Most use probably occurs during fall and spring migration and before these smaller streams freeze in winter.

4.8.18 Cooper's Hawk (*Accipiter cooperii*)

The Cooper's hawk is a state species of special concern because of its inclusion under CITES and because it faces adverse modification of primary essential habitat (Flath 1984). The MNHP considers the species apparently secure in Montana (Table 4.8.1) although Flath (1984) lists its status as undetermined. Skaar et al. (1985) indicated the species breeds in the Libby latilong block and overwinters. Farmer and Heath (1987) did not observe the species on ASARCO's Rock Creek project area; however, local birders reported it in the Noxon-Herron area in 1985.

Fleeting glimpses of accipiters, which could only be identified as sharp-shinned or Cooper's hawks, were observed in mixed conifer and spruce-fir habitats during the June 1988 breeding bird surveys (Table 4.4.7). Cooper's hawks have similar habitat affinities with sharp-shinned hawks and goshawks, which were observed in riparian, hemlock, mixed conifer, shrubfield, and spruce-fir habitats during the study.

4.8.19 Northern Goshawk (*Accipiter gentilis*)

Flath (1984) considers the northern goshawk to be a common breeding species in the Libby latilong block, but lists it as a species of special concern because of its inclusion in CITES and because its primary essential habitat faces adverse modification. The MNHP lists the goshawk as apparently secure in Montana. Farmer and Heath (1987) considered the species to be common on ASARCO's Rock Creek study area project.

Goshawks nest in open understory coniferous forest and aspen habitat on relatively gentle slopes. They either construct their own nests or take over those of

Cooper's hawks or great horned owls. They may use their nests repeatedly over successive years.

Al Bratkovich (USFS, pers. comm.) reported a goshawk nest in Douglas-fir habitat along Bear Creek (in the northeastern portion of the MP study area) that was active several years ago. No goshawk nests were found during the MP baseline study; however, nesting was suspected. The best evidence came from a female goshawk who screamed and stooped at the project biologist twice on June 21, 1988, on breeding bird plot MC3 (mixed conifer habitat). Goshawks often direct this type of behavior towards an intruder close to a nest site, especially when chicks would be in the nest. However, initial and subsequent surveys did not locate a nest. Densities of goshawks in MP study area habitats are listed in Table 4.4.7.

4.8.20 Golden Eagle (*Aquila chrysaetos*)

Flath (1984) and Skaar et al. (1985) consider golden eagles to be common breeding species in the Libby latilong block. Although they are apparently secure in Montana (MNHP), they are considered state species of concern because of their inclusion in CITES and the Bald Eagle Protection Act (1969).

Golden eagles nest in the Cabinet Mountains; however, there have been no nests located in the MP study area and none identified as part of the baseline program. Hamer (1976) did not locate any nests or observations of golden eagles in the Cabinet Ranger District.

Farmer and Heath (1987) concluded that ASARCO's Rock Creek project area did not contain nesting habitat attractive to golden eagles. On the MP study area, some upper elevation cliffs in the East Fork of Rock Creek (some south-facing cliffs on the south side of Rock Peak and the west-facing cliffs east of Rock Lake) appeared suitable as golden eagle nesting habitat (and an adult golden eagle was observed perched at 6,900 ft. on the former site on June 24). However, no nests were observed in either area during ground or aerial raptor surveys, or in conjunction with other fieldwork.

Only two golden eagles were observed in the MP study area. The first observation is described above. The second involved an immature hunting the south-facing clearcuts on Big Hoodoo Mountain, probably for big game carrion, on December 18, 1988. Other golden eagles were observed in the Kootenai and Clark Fork Valleys during the study, most on carcasses of road-killed, white-tailed deer. No golden eagles were observed during the breeding bird survey.

4.8.21 Merlin (*Falco columbarius*)

The FS (USFS 1981) lists the merlin as a confirmed breeder on the Kootenai Forest; Skaar et al. (1985) considered it a possible breeder. USFS (1981) considers the species to be uncommon and Flath (1984) gave its status as undetermined. It is considered a state species of concern because of its inclusion in CITES.

Call (1978) indicates the species inhabits open prairie-parkland, isolated groves of trees with open prairie surroundings, mixed woods, and wooded areas along prairie river bodies and islands. Although merlins may be uncommon nesters elsewhere on the Kootenai Forest, they may only inhabit the MP study area as migrants, because suitable habitat appears to be lacking. Jerry Brown (MDFWP, pers. comm.) recalled observing a merlin on or near St. Paul Pass. The species was not observed on ASARCO's Rock Creek study area (Farmer and Heath 1987) nor on the MP area during the present study.

4.8.22 Peregrine Falcon (*Falco peregrinus anatum*)

The peregrine falcon is a federal endangered species, an endangered species on the Kootenai National Forest, and a state species of special concern (Flath 1984). This species was not listed by the MNHP as potentially present in the MP study area (Table 4.8.1). Skaar et al. (1985) indicate that there is only circumstantial evidence of peregrines breeding in the Libby latilong block and notes that most breeding records for the state are old. The peregrine is not included in the Kootenai National Forest bird list except in a footnote category for rare birds out of their normal range (USFS 1981). This species probably only occurs in the area as a rare migrant.

No historic eyries are known from the Cabinet Mountains. Portions of the MP study area support apparently suitable prey populations in settings which would make them vulnerable to peregrine attack and there are several cliffs that have been tentatively identified during this study as potential nesting sites; however, these sites have not been rigorously evaluated for hack site suitability because that was considered beyond the scope of this project. Two of the more suitable potential nesting sites are the cliffs east of Rock Lake and the cliff on the west side of the large drainage ("Good Creek") on the south side of Upper Libby Creek. Both sites are sheer cliffs of suitable height, aspect, and ledges that are in or close to habitats supporting moderate to high densities of preferred prey species. The problem with both sites, however, is that the cliffs accumulate heavy snows which, in 1989 (a "normal" winter) did not begin sliding off the cliffs until mid-

(Rock Creek) to late April (Libby Creek). By the time these cliffs were sufficiently snowfree, the delayed nesting phenology could make these suites unsuitable. Other sites in the study area, such as some of the smaller, south-facing cliffs of Rock Peak, could potentially support peregrine nesting if there were more birds in the area. Peregrines are increasing their numbers in other areas of the Rocky Mountains (Craig 1986). No peregrine falcons were observed during the ASARCO Rock Creek (Farmer and Heath 1987) or MP wildlife baseline studies.

4.8.23 Prairie Falcon (*Falco mexicanus*)

Although apparently secure in Montana (MNHP, Table 4.8.1), prairie falcons are considered species of special concern by Flath (1984). The FS (1981) reported the species as a breeder on the Kootenai Forest, although Skaar et al. (1985) list only circumstantial evidence that this species breeds in the Libby latilong block. Flath (1984) considers the prairie falcon a migrant or non-breeder in the Libby latilong block. Prairie falcons were not observed on ASARCO's Rock Creek project area during the 1985 baseline study (Farmer and Heath 1987). No prairie falcons were observed during the breeding bird plot counts, during helicopter surveys of study area cliffs, or in conjunction with other environmental field activities. Suitable cliff nesting habitat is lacking in the MP study area.

4.8.24 Upland Sandpiper (*Bartramia longicauda*)

The upland sandpiper is a nonbreeding transient in the Libby latilong block (Skaar et al. 1985) that is considered by Flath (1984) to be a species of state concern because (1) available data are inadequate to assess its status and (2) the species is particularly vulnerable to disturbance or habitat loss due to natural or man-caused factors. Robbins et al. (1983) and Terres (1980) consider this species local and uncommon throughout its distribution. Unlike other sandpipers, this species is seldom seen near water. It is an upland species of prairies, hayfields, meadows, pastures, and alfalfa fields (Terres 1980). These type of habitats do not occur in the MP study area, although small, isolated pastures are locally crossed by the transmission line corridors near U.S. Highway 2. The species was not observed on ASARCO's Rock Creek project area (Farmer and Heath 1987).

4.8.25 Long-billed Curlew (*Numenius americanus*)

The long-billed curlew is a breeder in the Libby latilong block (Flath 1984, Skaar et al. 1985) that is considered by Flath (1984) a state species of special concern because (1) available data are inadequate to assess its status, (2) the species is particularly vulnerable to

disturbance or habitat loss due to natural or man-caused factors, and (3) it occurs at population levels less than one-half of its former level or its range is less than one-half of its former range. It inhabits dry prairies, open grasslands, meadows, and pastures (Terres 1980, Allen 1980). Outside the breeding season it is also found in marshes, mudflats, and beaches (Robbins et al. 1983). These habitats are absent or localized and poorly developed in the MP study area and transmission line corridors. The species was not observed on ASARCO's Rock Creek project area (Farmer and Heath 1987).

4.8.26 Northern Pygmy Owl (*Glaucidium gnoma*)

Flath (1984) lists the northern pygmy owl as a state species of special concern because (1) its status is undetermined, (2) it is included under CITES, and (3) it is sensitive to habitat loss or disturbance. The MNHP considers the species apparently secure in Montana (Table 4.8.1). Flath (1984) and Skaar et al. (1985) consider the species a likely breeder in the Libby latilong block; USFS (1981) considers the species a confirmed breeder. The species was not observed on ASARCO's Rock Creek project area (Farmer and Heath 1987).

Pygmy owls nest in cavities at mid to upper elevations of dense mature or old-growth coniferous forest (Scott et al. 1977). They are probably nonmigratory, but may seek lower elevations in winter (Call 1978). Suitable nesting habitat and cavity availability appear to be widespread in the MP study area. One pygmy owl was observed in clearcut bird plot C3 on June 23, 1988 (see map 7.1).

4.8.27 Burrowing Owl (*Athene cunicularia*)

Burrowing owls are possible breeders in the Libby latilong block (Flath 1984, Skaar et al. 1985). They are state species of special concern because their status is undetermined, they are vulnerable to disturbance, and they face adverse modification of its primary essential habitat (Flath 1984). Burrowing owls typically inhabit prairies and open grasslands. As their name implies, they nest in burrows, most frequently those excavated by prairie dogs. Zarn (1974) reported that burrow availability is the chief limiting factor controlling burrowing owl numbers and that they primarily depend on active burrowing mammal colonies for nest sites. The only burrowing mammals present in the MP study area which create large enough burrows, are colonial, and occur at potentially suitable elevations are Columbian ground squirrels; however, the habitats in which these burrows occur are of questionable compatibility for burrowing owls. The owl was not observed during ASARCO's Rock Creek baseline program (Farmer and Heath 1987).

4.8.28 Barred Owl (*Strix varia*)

Flath (1984) and Skaar et al. (1985) consider barred owls to be possible breeders in the Libby latilong block; the USFS (1981) considers them confirmed breeders on the Kootenai Forest. This species is of special concern to the state because (1) its status is undetermined in the latilong block, (2) it's included under CITES, (3) it is faced with destruction or modification of its primary essential habitat, mature and old-growth forests, and (4) it is sensitive to this habitat loss (Flath 1984). They are considered rare in Montana by the MNHP (Table 4.8.1).

This owl is typically associated with deep, deciduous, southern swamps (Terres 1980) and less commonly in eastern deciduous woods (Nicholls and Warner 1972); however, its range projects northwest in Alberta and British Columbia (Terres 1980, Robbins et al. 1983). Since the 1960's, barred owls have been expanding their range into the northwestern U.S. (Taylor and Forsman 1977), including northwestern Montana (Shea 1974).

One barred owl was observed and was heard vocalizing on western hemlock breeding bird plot H1 on June 9, 1988. A barred owl was also heard vocalizing near the Libby Creek gate during a boreal owl survey on April 19, 1989. The old-growth, drainage bottom forests in which these observations were made are the type of habitats where the species nests in cavities. This species was not observed by Farmer and Heath (1987) on the Rock Creek study area (ASARCO), although it has been recorded by birders in the Noxon-Heron area. Al Bratkovich (USFS, pers. comm.) considers the species to be a confirmed breeder on the Libby Ranger District.

4.8.29 Great Gray Owl (*Strix nebulosa*)

Great gray owls are state species of special concern because (1) their status is undetermined in the Libby latilong block, (2) they're protected under CITES, (3) they are faced with destruction or modification of their habitat, and (4) they are particularly sensitive to this habitat loss (Flath 1984). The MNHP classifies them as rare in Montana (Table 4.8.1). They are considered circumstantial breeders in the Libby latilong block by Flath (1984) and Skaar et al. (1985). The USFS (1981) has confirmed breeding on the Kootenai Forest.

This owl inhabits deciduous forests or mixed deciduous/coniferous forests. It frequently uses old goshawk, red-tailed hawk, or raven nests (Call 1978). One great gray owl was observed in Engle Creek in February 1985 as part of ASARCO's Rock Creek study (Farmer and Heath 1987). Several additional suspected great gray owl

vocalizations heard during mid to late winter and the lack of evidence during other seasons indicated that they were only present during winter (Farmer and Heath 1987).

There was only one observation of a great gray owl during the MP baseline study. This bird was observed in mixed conifer habitat on breeding bird plot MCI in the East Fork of Rock Creek in September 1988.

4.8.30 Long-eared Owl (*Asio otus*)

The long-eared owl is a state species of concern because (1) its status in the Libby latilong block is undetermined, (2) it is protected under CITES, (3) it is sensitive to disturbance or habitat loss (Flath 1984). There is only circumstantial evidence that it breeds in the Libby latilong block and there is no evidence that it overwinters (Skaar et al. 1985), although USFS (1981) has confirmed breeding on the Kootenai Forest. Long-eared owls typically inhabit dense stands of coniferous trees or tall, dense shrubs (Call 1978). It usually uses old hawk, squirrel, raven, or magpie nests as its nesting site and rarely constructs its own nest (Call 1978).

Farmer and Heath (1987) recorded a single long-eared owl in western hemlock habitat along the West Fork of Rock Creek. No observations of this species were made during the present MP baseline study.

4.8.31 Boreal Owl (*Aegolius funereus*)

Boreal owls are a sensitive species on the Kootenai National Forest (Table 4.8.1). They have no special state status, although they are protected under the provisions of CITES. Skaar et al. (1985) only have questionable records for the Libby latilong block, although USFS (1981) has confirmed breeding on the Kootenai Forest. This owl was not detected by Farmer and Heath (1987) on ASARCO's Rock Creek project area.

In northwestern Montana, boreal owls are confined to mature-old growth spruce-fir forests above 5,000 feet (P. Sieracki, USFS, Bonner's Ferry Ranger District, Idaho, pers. comm.). They may occur at lower elevations where spruce-fir habitat extends into drainage bottoms as well as the upper 100 feet of the cedar-hemlock/spruce-fir ecotone. See Section 4.5 of this report for additional discussion of this owl.

4.8.32 Northern Saw-whet Owl (*Aegolius acadicus*)

Saw-whet owls are state species of special concern because (1) their status in the Libby latilong block is undetermined, (2) they are protected under CITES, and (3)

their habitat faces adverse modification (Flath 1984). However, they are apparently secure in Montana (MNHP, Table 4.8.1). They are breeding residents in the Libby latilong block (USFS 1981, Skaar et al. 1985), inhabiting mature and old-growth forests. They nest in cavities at low to mid elevations (Call 1978) and, like many small owls, they are difficult to detect without specific designed surveys.

Saw-whet owls were not detected on ASARCO's Rock Creek study area (Farmer and Heath 1987). They have not been detected on the MP study area.

4.8.33 Pileated Woodpecker (*Dryocopus pileatus*)

Pileated woodpeckers are state species of special concern because their essential habitat faces imminent loss, destruction, or adverse modification and the large cavities they excavate provide essential ecological values to a wide variety of secondary cavity-nesting birds and mammals. It is a common year round resident in the Libby latilong block, but Flath (1984) and Skaar et al. (1985) indicate there is only circumstantial evidence of breeding in the latilong block. USFS (1981) indicates breeding has been confirmed on the forest.

Pileated woodpeckers were common the ASARCO (Rock Creek, Farmer and Heath 1987) and MP study areas. During the 1988 breeding season, they were observed in all forested habitats except riparian and were the second mostcommon woodpecker on the study area. Only northern flickers were more abundant (Table 4.4.7). Although no active nests were located, territorial behavior suggested active nests were present in several study area locations. Furthermore, nest holes (differentiated from excavations) characteristic of pileated woodpeckers were common in large snags throughout the study area. While unattended nest holes may constitute "hard evidence" of past breeding, it only represents circumstantial evidence of breeding in 1988.

4.8.34 Olive-sided Flycatcher (*Contopus borealis*)

The olive-sided flycatcher is a state species of special concern because its status is undetermined in the Libby latilong block and its habitat faces destruction and adverse modification (Flath 1984). Skaar et al. (1985) indicate that there is only circumstantial evidence of breeding in the latilong block, although USFS (1981) indicate breeding has been confirmed on the Kootenai Forest.

This flycatcher inhabits open, mid to high elevation coniferous forests where it sallies from exposed perches to catch flying insects (Torres 1980). This species was common on ASARCO's adjacent Rock Creek study area (Farmer and Heath 1987) and was one of the most common

flycatchers on the MP wildlife area (Table 4.4.7). Only circumstantial evidence of nesting was observed during the 1988 breeding season, although it was strongly suspected.

4.8.35 Western Bluebird (*Sialia mexicana*)

The western bluebird is a state species of special concern because it is rare, its habitat faces destruction or adverse modification, and it is particularly vulnerable to this habitat loss (Flath 1984). It is a rare breeder in the Libby latilong block and on the Kootenai Forest (USFS 1981, Skaar et al. 1985). Its dramatic numerical decline during the 1960's may have been due to the loss of snag cavities near open clearings (Jackman and Scott 1975, Farmer and Heath 1987). Western bluebirds were not observed on ASARCO's Rock Creek study area (Farmer and Heath 1987); however, they were observed in clearcut, spruce-fir, and riparian habitats during the 1988 MP breeding bird survey.

4.8.36 Bobolink (*Dolichonyx oryzivorus*)

Bobolinks are a state species of special concern because their status is undetermined in the Libby latilong block and they are confronted by loss, destruction, or adverse modification of their habitat (Flath 1984). Skaar et al. (1985) indicate there is circumstantial evidence that they breed in the Libby latilong block; the USFS (1981) considers them rare or outside of their normal range, but indicate they have nested on the Kootenai Forest in recent years.

Bobolinks occur in small, scattered populations usually associated with naturally occurring moist areas or irrigated hay meadows. They were not detected during ASARCO's Rock Creek baseline study (Farmer and Heath 1987) or during the present MP study. There is no suitable habitat on the MP study area and only local, marginally suitable habitat along the transmission line corridors.

4.8.37 Brewer's Sparrow (*Spizella breweri*)

Brewer's sparrows are confirmed breeders in the Libby latilong block (Skaar et al. 1985) and on the Kootenai Forest (USFS 1981); however, because their status is undetermined and they faced loss or adverse modification of their essential habitat they are considered state species of special concern (Flath 1984). Brewer's sparrows are associated with shortgrass prairies and sagebrush communities. It was not observed during ASARCO's Rock Creek baseline study or during the MP baseline study because suitable habitats were absent or extremely limited (Farmer and Heath 1987). There is limited habitat available along

U.S. Highway 2 that is crossed by proposed transmission line corridors.

4.8.38 Northern Alligator Lizard *Gerrhonotus coeruleus)*

The northern alligator lizard is a species of concern in the MP area because it was identified by the MNHP as potentially in the study area and a rare species in Montana (Table 4.8.1). The species is confined to western Montana, northern Idaho, north and western Washington, and the southern extreme of British Columbia (Stebbins 1985). It inhabits woodland and forest, under bark, inside rotten logs, and under rocks and other objects on the ground. One lizard was observed in Douglas-fir habitat during ASARCO's Rock Creek baseline study (Farmer and Heath 1987). Despite searches through suitable habitat, the species was not detected during the MP baseline study.

4.8.39 Pacific Giant Salamander (*Dicamptodon ensatus)*

The Pacific giant salamander is considered a state species of special concern for the MP only because its occurrence is suspected in Sanders County, where it is considered rare and on the periphery of its distribution (Flath 1984). The MP study area only overlaps the extreme northwestern tip of Sanders County. This large salamander's primary distribution extends along the western portions of northern California, Oregon, Washington, and extreme southwest British Columbia; however, there are also two relatively small, isolated distributions in Idaho, one of which extends into northwest Montana (Stebbins 1985). The species' Montana distribution is based on a single observation in 1979 near the town of Salese, approximately 45 miles south of the MP study area (Thompson 1982). It inhabits damp forests in or near clear, cold streams or seepages and around the rocky shores of mountain lakes. They have been found under logs, bark, rocks, and other objects near streams, or crawling exposed in damp woods (Stebbins 1985). It was not observed during ASARCO's Rock Creek baseline program (Farmer and Heath 1987) or during the MP baseline study, although suitable habitat appears to be available.

4.8.40 Rough-skinned Newt (*Taricha granulosa*)

The rough-skinned newt is rare and on the periphery of its distribution in Sanders County, but is known from the county base and one record from near Thompson Falls in 1979 (Thompson 1982). Its main distribution extends along the Pacific coast from Alaska to central California; however, an isolated population, probably the result of introductions (Nussbaum et al. 1983) occurs in Idaho and based on the 1979 record, Montana (Stebbins 1985).

Although the damp forests, ponds, and cold streams it inhabits are present in the MP study area, it was not detected during the 1988 baseline study, or on ASARCO's Rock Creek study area (Farmer and Heath 1987).

4.8.41 Coeur d'Alene Salamander (*Plethodon vandykei idahoensis*)

The Coeur d'Alene salamander is listed as a federal candidate species (3C, Table 4.8.1) that has proven to be more abundant and widespread than was previously believed. It is also considered a Kootenai National Forest sensitive species, a state species of concern (Flath 1984), and critically endangered in the state by the MNHP. However, a recent MNHP (1987) report describes 18 newly discovered and 13 historically known Coeur d'Alene salamander localities in northwest Montana. Over 600 Coeur d'Alene salamanders were collected in September 1988 from historic sites along U.S. Highway 2 between Troy and Libby to avoid mortality from highway widening (B. Summerfield, USFS, pers. comm.). The salamanders are being held at Western Washington State University facilities and will be returned to undisturbed portions of their former habitat when construction activities conclude. At present, it is unlikely that, based on this large population, the species will be delisted to a less critical status because their known distribution is still extremely localized and restricted. Farmer and Heath (1987) did not locate any Coeur d'Alene salamanders during their baseline study on ASARCO's Rock Creek project area.

Coeur d'Alene salamanders have been found below 5,000 ft in western Montana, north of 46° N latitude and west of 114° W longitude (Stebbins 1985, MNHP 1987). This species is the only plethodontid in the northern Rocky Mountain region, and because it lacks lungs, it is closely associated with damp microhabitats so it can respire through its moist skin (Feder 1983). It is associated with seepages, waterfall sprayzones, and along small, cascading creeks with dense overstory canopies (MNHP 1987, Groves 1988). Fractured bedrock and colluvium interstices provide diurnal and hibernacula microhabitats (MNHP 1987).

The closest site to the MP study area where these salamanders have been found is at Big Hoodoo Mountain (MNHP 1987). This historic site lies adjacent to the Bear Creek Road, one of two potential access roads to mine facilities on the east side of the Cabinets, approximately 2.5 miles north of the study area boundary. The northwest side of Big Hoodoo Mountain is the type location for the Coeur d'Alene salamander in Montana (Teberg 1964). Teberg collected one salamander from this site in 1962. Subsequent surveys at the historic site and along two adjacent tributaries of Big Cherry Creek, as recent as 1987, failed

to locate any additional salamanders (MNHP 1988). Recent clearcutting above these sites may have adversely affected salamander habitat.

Diurnal searches through appropriate habitats on the MP study area, conducted in conjunction with other fieldwork, did not locate any Coeur d'Alene salamanders; however, suitable habitat for this species does exist in potential development areas and along the Bear and Libby Creek access roads.

4.8.42 Tailed Frog (*Ascaphus truei*)

The MNHP considers tailed frogs to be rare and threatened in the state (Table 4.8.1). Flath (1984) considers the frogs to be species of special concern because their essential habitat faces disturbance and adverse modification. Logging practices which increase water temperatures and siltation may have an adverse effect on tailed frog populations.

Tailed frogs have an extremely low reproductive potential. They may not breed until 7-8 years old, their tadpoles do not leave the nest until the following October-November (year 8-9) or later, and it is not until the tadpole's fourth year (year 12-13) that they metamorphose into adults (Daugherty 1979).

No specific surveys were conducted for this species as part of the baseline program, although studies conducted in conjunction with fisheries electroshocking were effective in quantifying tailed frogs in measured reaches of project area streams. In the MP study area, tailed frogs were locally absent to abundant in shallow, slow to moderate velocity, 1-15% gradient streams, with mean widths of approximately 0.5-12 m. Streams supporting these frogs included Libby, Ramsey, Poorman, Little Cherry, and the East Fork of Rock Creek (Table 4.8.42.1). Habitats through which these streams flowed included riparian, mixed conifer, and hemlock/cedar with 70-100% canopy coverage. Substrates ranged from silt to boulders; however, most observations occurred on or over cobble.

Tailed frogs were not observed in Rock Creek Meadows or in Rock Lake. However, they were common in a 500 ft. reach (EFRC) on the lower East Fork of Rock Creek that was electroshocked on September 11. Six adults and one tadpole were caught or observed during about 1.5 hours of the first pass. One pair was observed in amplexus. No red-legged frogs were observed in this reach. Habitat suitability suggests that tailed frogs could also be present in the East Fork of Rock Creek above the meadows/below the lake. Farmer and Heath (1987) considered this species to be

Table 4.8.42.1 Summary of tailed frogs observed in Montana Project streams during the 1988 wildlife, fisheries, and aquatic biology baseline programs, Lincoln and Sanders Counties, Montana.

Drainage	Date	Tailed Frogs Observed	
		Adults	Tadpoles
Little Cherry Creek			
500 ft. fishery reach LC-1	Aug. 24	7	
500 ft. fishery reach LC-2	Aug. 23	3	3
Poorman Creek			
1000 ft. fishery reach P-1	Aug. 25	11	7
500 ft. fishery reach P-2	Aug. 26	11	
Ramsey Creek			
1000 ft. fishery reach RM-2	Aug. 31	3	
Libby Creek			
Aquatic Biol. Section Li-7	Aug. 2		1
Aquatic Biol. Section Li-11			2
Midas Creek			
Near Libby Creek	May 20		1
East Fork of Rock Creek			
500 ft. fishery reach EFRC	Sept. 11	6	1

common in Rock Creek, the West and East Forks of Rock Creek, and several local tributaries.

Three male tailed frogs and three tadpoles were collected from a 500 ft. Little Cherry Creek reach (LC-2) on August 23. This reach also contained an estimated 60-70 red-legged frogs and two 2.2 cm long boreal toads. Seven adult tailed frogs, including two recently metamorphosed males, were observed in the lower 500 ft. LC-1 reach on August 24. The substrate of this latter reach was covered with sediment from a recent clearcut upstream.

Eleven adults and seven tadpoles were captured or observed in the first pass down the 1000 ft. lower Poorman reach (P-1) sampled on August 25. Tailed frogs were more numerous in this reach than red-legged frogs. The upper 500 ft. Poorman reach (P-2), sampled August 26, contained six tailed frogs and two red-legged frogs the first pass, and five tailed frogs the second pass. Frogs collected in the first pass were held until after the second pass, then redistributed at their collection points.

Three adult tailed frogs were observed in the 1000 foot, 5.5-7.0% gradient section of Ramsey Creek (RM-2) on August 31. This reach, located just below the proposed plant site, flowed through a mature spruce-fir forest with a large number of mature western hemlocks and western red cedars. No tailed frog adults or tadpoles were observed in either of the other two Ramsey Creek electroshocking or aquatics reaches.

One tailed frog tadpole was collected August 2 in Libby Creek, below Howard Creek (aquatics section Li-7) and two tadpoles were observed August 3 in upper Libby Creek (aquatics section Li-11). No adults were observed elsewhere in Libby Creek, although they were undoubtedly present. One tailed frog was observed in a small tributary of Midas Creek, just above Libby Creek, on May 20.

4.8.43 Wood Frog (*Rana sylvatica*)

The wood frog is a state species of special concern because its occurrence is suspected in Lincoln County as a disjunct population on the periphery of its widespread distribution across North America (Flath 1984, Stebbins 1985). In the colder parts of its range, including Montana, it inhabits open grassy areas bordered by willow and aspen thickets, and in alpine ponds. Spruce or other forest trees are often present nearby (Stebbins 1985). This species was not detected in ASARCO's Rock Creek project area (Farmer and Heath 1987). While suitable habitat exists in the MP study area, it was not detected during the baseline study.

4.9 HERPETOFAUNA

Three species of reptiles were recorded on the MP study area during the baseline study (see Table 4.1.3). Valley and wandering garter snakes (subspecies of common and western terrestrial garter snakes, respectively) were common to abundant in valley bottoms and along toe slopes throughout the study area. Although they occurred in all major project area habitats, they were most frequently observed in shrubfields along upper Libby and Ramsey Creeks, and around Rock Creek Meadows. Both species were observed with approximately equal frequency. Farmer and Heath (1987) reported both species from ASARCO's Rock Creek project area, but indicated that common garter snakes were captured more frequently.

Rubber boas also probably occur in similar habitats throughout the study area; however, they were far less common than garter snakes and only three were observed during the study (one in mixed conifer and two in shrubfields), all around Rock Creek Meadows.

Four amphibians were recorded in the study area during the baseline program (see Table 4.1.4). Red-legged frogs were abundant in virtually all creeks, ponds, lakes, marshes, and temporary standing waters on the project area. They were not observed in the East Fork of Rock Creek or in Rock Lake, but they were abundant in Rock Creek Meadows.

Tailed frogs were locally absent to abundant in the Noranda study area and in some areas outnumbered red-legged frogs. Tailed frogs are threatened in the state and are a state species of special concern. Their status and distribution in the study area are discussed in detail in Section 4.8.40.

Three boreal toads (a subspecies of the western toad) were observed during the baseline study. A large (S-V length = 10.2 cm) adult was captured in spruce-fir habitat (on bird plot SF5) on June 23. Two young 2.2 cm boreal toads were captured on the shore of Little Cherry Creek on August 23 below a mixed conifer forest.

Long-toed salamanders were undoubtedly more abundant in the study area than the level suggested by incidental baseline study results. Only one adult was observed during the study. It was located beneath a mossy rock, just outside the spray zone of a waterfall at 4800 ft, approximately 100 yards west and 380 vertical feet above Ramsey Lake. The identification of this salamander was confirmed by D. Genter (MNHP, pers. comm.) using photos, because (1) the habitat was similar to that characteristically used by Coeur d'Alene salamanders and (2) the two

salamanders are similar in appearance. Seven long-toed salamander larvae were observed in a large water-filled depression next to the Little Cherry Creek Loop Road on June 14. This depression also contained several age classes of adult red-legged frogs and approximately 20 red-legged frog tadpoles, one of which was being eaten by one of three, large dragonfly larvae. On June 15, one of the salamander larvae was being eaten by a dragonfly larvae; the other dragonfly larvae were pursuing the remaining frog and salamander larvae. By June 21 there were only two salamander larvae and no tadpoles left in the depression. The other larvae were presumably eaten. The site was not visited until July 31, at which time the depression was completely dried up.

Although no Coeur d'Alene salamanders were located during the baseline study, they have occurred in the vicinity of the study area (Teberg 1964, MNHP 1987) and suitable habitat is common in the study area. This species, a federal candidate and state endangered species, is discussed in detail in Section 4.8.39.

4.10 OTHER MAMMALS

During the portion of the baseline study that the ground was not snow covered, it was difficult to inventory and assess the relative abundance of species considered in this section; primarily predators. The majority of the study area is forested, limiting opportunities for direct observations, and few areas provide suitable substrata for accepting distinct tracks. As a result, predator data collected during this period was limited to serendipitous observations, identification of scats and tracks, and the assessment of potential presence based on habitats present, literature review, and interviews with agency personnel, trappers, and local residents.

Beginning in December 1988, when most of the study area was snow covered, tracking surveys were initiated throughout the study area (see Figure 3.3.1). Objectives and procedures are described in METHODS. Tracking surveys covered 141.4 initial miles (where counts were made) and 120.8 miles of repetitive mileage for a total of 262.2 miles (Table 4.10.1).

Results of winter track surveys, expressed as the number of tracks made during the previous 24-hour period/mile of transect, are contained in Table 4.10.2 by transect and survey date. Results provide an index of species present and relative abundance in the study area; however, they must be interpreted with caution. First, on any individual transect, numerical differences for a given species between surveys are not necessarily due to changes

Table 4.10.1 Mileage covered during winter tracking surveys in the Montana Project Wildlife study area.[a]

Survey Date	Mileage		
	Initial Tracking	Repetitive Tracking	Total
Dec. 2, 1988	4.7	4.7	9.4
Dec. 4, 1988	5.5	4.1	9.6
Dec. 19, 1988	16.6	17.6	34.2
Dec. 20, 1988	12.9	14.2	27.1
Dec. 21, 1988	3.7	3.9	7.6
Jan. 14, 1989	11.5	11.1	22.6
Jan. 27, 1989	24.9	15.7	40.6
Jan. 29, 1989	9.6	14.4	24.0
Feb. 16, 1989	6.9	6.9	13.8
Feb. 18, 1989	9.5	9.5	19.0
Feb. 27, 1989	9.5	9.5	19.0
Mar. 14, 1989	26.1	9.2	35.3
Total	141.4	120.8	262.2

[a]Some transects are located within and outside the MP extensive wildlife study area.

Table 4.10.2 Results of winter track surveys along Montana Project area transects. Data are number of fresh tracks made within the previous 24-hour period/mile of transect. Scientific names are listed in Tables 4.1.1 and 4.1.2.

Transect[a] / Species	Survey Date					
	Dec. 4	Dec. 19[g]	Jan. 14[f]	Jan. 27[g]	Feb. 16[h]	Mar. 14[k]
UPPER LIBBY CREEK[a]						
Red Squirrel	13.2	3.3		4.6		
Snowshoe Hare	13.8	3.7		2.4		
Porcupine	0.5			0.3		
Coyote		0.2		b		
Weasel spp.	0.8	1.2				
Pine Marten	0.5					
Deer spp.						
Moose	3.8	0.6				
Grouse spp.	0.3					
LOWER LIBBY CREEK[a]						
Red Squirrel	7.8	1.5		2.6		
Snowshoe Hare	8.9	3.7		7.0		
Porcupine						
Coyote	b	0.7		0.6		
Weasel spp.	3.3	0.7		0.6		
Pine Marten				0.2		
Mountain Lion		0.7				
Deer spp.	1.1	1.1				
Moose	4.4			b		
Grouse spp.				b		
LIBBY ACCESS ROAD[a]						
Red Squirrel			1.3	2.5		
Snowshoe Hare			0.6	10.0	0.6	
Coyote				3.1	1.2	
Weasel spp.					0.6	
Deer spp.			1.9	1.9	1.8	
Moose			b		0.6	
Grouse spp.				b		

Table 4.10.2 Continued.

Transect[a] / Species	Survey Date: Dec. 2	Dec. 19[g]	Jan. 27[g]	Mar. 14[k]
UPPER RAMSEY CREEK[a]				
Red Squirrel	10.6	2.6	1.1	
Snowshoe Hare	11.6	1.0	1.1	
Porcupine	0.3			
Coyote	0.3		b	
Weasel spp.	1.0	0.6	0.3	
Pine Marten	1.0	0.3	0.3	
Deer spp.	1.3			
Moose	2.3			
Grouse spp.			0.3	
LOWER RAMSEY CREEK[a]				
Red Squirrel	4.4	3.1	3.3	
Snowshoe Hare	17.7	6.3	9.0	
Porcupine				
Coyote	3.1		1.0	
Weasel spp.		1.3	1.0	
Pine Marten				
Mountain Lion		0.6		
Elk	0.6			
Deer spp.	31.3			
Moose	1.3	1.3	b	
Grouse spp.		0.6	1.9	

Table 4.10.2 Continued.

Transect[a] / Species	Survey Date: Dec. 19[c]	Dec. 20[d]	Jan. 14[f]	Jan. 27[g]	Feb. 16[h]	Mar. 14[k]
POORMAN CREEK[a]						
Red Squirrel	4.2					
Snowshoe Hare	2.3					
Porcupine						
Coyote	0.3					
Weasel spp.						
Pine Marten	0.3					
Mountain Lion	0.3					
Deer spp.						
Moose	0.6					
Grouse spp.						
BEAR CREEK ROAD[a]						
Red Squirrel	3.3	1.3	0.2	1.5	1.3	
Snowshoe Hare	5.5	1.1	0.2	3.5	2.5	
Porcupine			b			
Coyote		0.7		0.6		
Weasel spp.		0.3			1.3	
Pine Marten						
Mountain Lion	1.1					
Bobcat		0.2				
Deer spp.	4.4				1.3	
Moose		1.0	b			
Grouse spp.				1.0		

Table 4.10.2 Continued.

Transect[a] / Species	Survey Date: Dec. 20[d]	Jan. 14[f]	Jan. 27[g]	Feb. 16[h]	Mar. 14[k]
LOWER BEAR CREEK[a]					
Red Squirrel					
Snowshoe Hare					
Coyote	a				
Mountain Lion	0.6				
Weasel spp.					
Bobcat	a				
Deer spp.					
Moose					
LITTLE CHERRY LOOP ROAD[a]					
Red Squirrel	3.8	0.2	3.6		
Snowshoe Hare	0.8	b	6.9	1.4	
Coyote			1.5	0.9	
Weasel spp.	0.2		1.3	0.2	
Bobcat	0.2				
Deer spp.		b		0.2	
Moose	1.2	0.4		2.3	

Table 4.10.2 Continued.

Transect[a] / Species	Survey Date: Dec. 21[g]	Jan. 29	Feb. 18[i]	Feb. 27[i]
UPPER EAST FORK ROCK CREEK[a]				
Red Squirrel	1.9	11.2	1.4	4.5
Snowshoe Hare		6.2	1.0	1.9
Coyote		1.4	0.5	0.5
Weasel spp.	0.3	1.7	0.5	0.5
Pine Marten			0.7	
Wolverine		0.2		
Bobcat				0.2
Moose	0.3			
Grouse spp.	0.3			0.2
LOWER EAST FORK ROCK CREEK[a]				
Red Squirrel		7.0	0.6	2.8
Snowshoe Hare		12.4	1.3	2.5
Coyote		2.6	0.8	1.3
Domestic Dog				0.6
Weasel spp.		0.9		0.6
Pine Marten				
Deer spp.		0.2	0.6	b
Moose		0.2	0.6	b
Grouse spp.			0.6	

Table 4.10.2 Continued.

[a]Transect boundaries, mapped in Figure 3.3.1, refer to Libby Ranger District (LRD) and Cabinet Ranger District (CRD) Road Access Maps valid through August 31, 1989, are as follows:

Upper Libby Creek - LRD road 2316 from road 6210 to wilderness boundary and road 6702.

Lower Libby Creek - LRD road 231 from road 278 to road 2316, road 231 to road 6210, and road 6210.

Libby Access Road - LRD road 231 from road 4778 to road 278.

Upper Ramsey Creek - LRD road 4781.

Lower Ramsey Creek - LRD road 6201 and that portion of road 2317 from road 278 to road 6201.

Poorman Creek - LRD road 217.

Bear Creek Road - LRD road 278 from 231 to 6199, including some spur roads.

Lower Bear Creek - LRD roads 6199 and 6209. Outside of intensive study area only surveyed for predators.

Little Cherry Loop Road - LRD road 6212, including some spur roads.

Upper East Fork Rock Creek - CRD road 150A from West Fork Road (150) junction to the lower Heidelberg mine and beyond.

Lower East Fork Rock Creek - CRD road 150 from lower Miller Gulch residence to East Fork Road (150A).

[b]Track greater than 24 hours old.

[c]Because of preceding snowfall, tracks observed on Dec. 19 were no more than 9 hours old.

[d]Snowed lightly during survey; tracks observed on Dec. 20 were less than 8 hours old.

[e]Because of preceding snowfall, tracks observed on Dec. 21 were less than 4 hours old.

[f]Snowed lightly to moderately during survey; tracks observed on Jan. 14 were less than 5 hours old.

[g]Most transects on Jan. 27 track count were affected by high winds.

[h]Because of preceding snowfall, tracks observed on Feb. 16 were less than 6 hours old.

[i]Because of preceding snowfall, tracks observed on Feb. 18 were less than approximately 4 to 6 hours old.

[j]Snowed lightly during first portion of survey; tracks observed on Feb. 27 were less than 6 to 14 hours old.

[k]Survey ineffective because of substrate and weather conditions.

in that species' abundance. A number of surveys were conducted when snow was still falling or before it had stopped snowing for 24 hours. Counts enumerated during these surveys (such as on December 21) clearly underestimated the number of species and their abundance on the transect and could not be quantitatively compared to surveys covering a complete 24-hour accumulation of tracks. Unfortunately, these less than 24-hour counts could not validly be "corrected" by equating them to a full 24-hour period because wildlife are not active 24 hours a day or during the same periods of the 24-hour cycle. Second, caution should be used comparing species indices between transects because habitats and tracking conditions (e.g., wind blowing tracks on high elevation transects while wind is calm at low elevations) may differ. Third, numbers of some wide-ranging predators (especially coyotes) may be overestimated because of their habit of following roads, leaving the road for several hundred yards, then returning. Attempts were made in the field to reduce this potential bias.

Two observations of bobcats were recorded during the study. On August 20 an adult bobcat crossed the upper Libby Road from a 15-25 year old clearcut into riparian habitat approximately 0.5 miles east of small mammal plot R2 (Map 7.1). On August 23 a female and three or four kittens were observed crossing the Bear Creek Road into mixed coniferhabitat on the north side of Big Hoodoo Mountain (outside the study area).

Coyotes were considered to be common in the study area, although they were infrequently observed. Scat and tracks indicated that they were widespread and ranged throughout all study area habitats.

One mink was observed hunting along Libby Creek below the upper Libby Creek bridge on August 19. Mink are probably common along all streams and lakes in the study area; however, they are primarily nocturnal and infrequently observed.

4.11 HUMAN ACTIVITY

Human activity within the MP extensive wildlife study area (excluding the transmission line corridors) was recorded incidental to the wildlife, fisheries, and aquatics baseline programs. For comparative purposes, human activity was differentiated into recreational and non-recreational categories, and subdivided into various activities after Farmer and Heath (1987). Some observations were recorded in two categories (e.g., fishermen who were also camping).

Table 4.11.1 presents the classification of 434 human activity observations recorded during the study. However, it should be noted that these data are strongly biased primarily because the field programs were designed to assess wildlife, not human, use of the study area. Virtually all fieldwork was conducted off roads (and even trails) in relatively inaccessible and otherwise unattractive areas for recreational and most non-recreational activities; while virtually all other human activities recorded were associated with roads. Also, field activities were not evenly stratified by area, season, or time of year. As a result many activities (e.g., hunting and berry-picking) were clearly underestimated because they did not spatially or temporally coincide with the field programs (fieldwork actually avoided some hunting seasons). Indeed, the only activity accurately assessed using this approach was the number of man-days spent in the area by field biologists under contract to the MP and associated agency personnel. Consequently, little reliance should be placed on these data as an index of recreational and non-recreational use of the study area.

With the aforementioned bias in mind, Table 4.11.1 suggests that mining related activities (MP baseline surveys) on the extensive study area represented 71% of all activity recorded and all recreational activities composed only 15%. If unbiased data were available, it is likely that over the course of the wildlife baseline program, mining related activities would still dominate all others; however, this is atypical of most years and due solely to the MP's proposal. By excluding all mine related activities in Table 4.11.1, recreational and non-recreational activities would compose 36% and 64% of all activities, respectively.

Results of the MP recreation report (Fletcher Associates 1988) are summarized below to provide a broader, less biased analysis of human activity. The Cabinet Ranger District (CRD) on the west side of the Cabinet Mountains is approximately 500,000 acres. District-wide recreational use is summarized in Table 4.11.2. District vehicle counts, conducted from June through November 1987, indicated 1,162 vehicles used the Rock Creek drainage (East and West Forks) accounting for 3,486 Recreation Visitor Days (RVD), the second lowest (4% of the total) of eight monitored drainages in the District. The two major areas of vehicle use, the Vermillion and South Fork of the Bull River drainages, accounted for 61% of the RVD. Estimated 1987 hiker use on the Rock Lake trail was 630 people. This trail is an access route to the Cabinet Mountains Wilderness and also provides fishing access to Rock Creek Meadows, Rock Lake, and St. Paul Lake. Fishing lakes are some of the most popular recreational destinations in the Cabinet Mountains.

Table 4.11.1 Classification of human activity observed on the MP's extensive wildlife study area incidental to the 1988/89 wildlife, fisheries, and aquatics field studies.

Category	Activity	Number	Percent			
			Category		Total	
			With[a]	Without[a]	With[a]	Without[a]
Non-recreational	Mining related					
	(W, F, Aq. field studies[a])	(255)	(69)		(59)	
	(Other[b])	(51)	(14)	44	(12)	28
	Total	306	83		71	
	Government (FS, MDFWP, MDSL, etc.)[c]	21	6	18	5	12
	Firewood Cutting (non-commercial)	16	4	14	4	9
	Logging (commercial)	9	2	8	2	5
	Residents	5	2	4	1	3
	Berry-picking	2	1	2	<1	1
	Other/Unknown	5	2	4	1	3
	Cutting Christmas Trees	6	2	5	1	3
	Subtotal	370	102[d]	99[d]	85	64
Recreational	Fishing	9	14		2	5
	Hunting	18	28		4	10
	Hiking	7	11		2	4
	Camping	4	6		1	2
	Horseback Riding	3	5		1	2
	Sledding	12	19		3	7
	Skiing	5	8		1	3
	Snowmobiling	6	9		1	3
	Subtotal	64	100		15	36
	Total	434			100[d]	100

[a]Includes only personnel associated with wildlife, fisheries, and aquatic field programs and visiting agency personnel.
[b]Includes all mining companies, exploration, and environmental studies exclusive of a.
[c]Includes government personnel not associated with the MP baseline studies.
[d]Does not sum to 100% due to rounding error.

The Libby Ranger District (LRD) on the east side of the Cabinet Mountains has a total area of 350,000 acres. Recreational use for this District is summarized in Table 4.11.3. Unlike the CRD which has 21 permitted outfitters, the LRD does not permit outfitters. Based on Table 4.11.2 and 4.11.3, the LRD has over 4.5 times less hunting days and over 27 times less fishing days than the CRD. Recreational use on the LRD, like the CRD, is highest in the summer. Recreational use of the upper drainages (e.g., West Fisher, Libby, Ramsey, Poorman, Cable, and Bear creeks) appears to be limited to relatively light hunting levels, because there are limited fishing opportunities and vehicle access into these areas is restricted by locked gates outside of winter.

SECTION 5.0

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5.0 LITERATURE CITED

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APPENDIX 6.1

FINAL WILDLIFE PLAN OF STUDY

ENDORSED BY AGENCIES

WESTERN RESOURCE DEVELOPMENT CORP.

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August 15, 1988

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Re: Plans of Study

Dear Ken:

We have reviewed the Plans of Study Section 5 (Wildlife and Aquatic Biology), Section 6 (Vegetation), and Section 8 (Soils) as provided in your letter of July 11, 1988. Since development of the Plans of Study numerous changes have occurred. The U.S. Forest Service and the Montana Department of Fish, Wildlife, and Parks have modified details of the wildlife and aquatic biology. Field conditions of the area have resulted in minor changes to all Plans of Study.

These changes have been incorporated into the Plans of Study and they have been retyped. The enclosed document now represents what the agencies would like implemented.

Please call if you have questions.

Sincerely,

David

David L. Johnson
Ecologist

DLJ:ei
Enclosures

cc:
Gary Fletcher

Section 5

WILDLIFE AND AQUATIC BIOLOGY

A detailed plan of study for baseline wildlife and aquatic inventories is presented in the following sections. The plan represents present understanding of state and federal requirements for mine development. Specifically, the plans are based upon the Montana Environmental Policy Act (MEPA), National Environmental Policy Act (NEPA), Montana Metal Mine Reclamation Act (MMMRA), guidelines to these acts, interactions with Kootenai National Forest and Montana Department of State Lands (MDSL), and MDSL guidelines for metal mines.

Section 5.1 provides information on the fisheries and aquatic biology plans, while Section 5.2 discusses the wildlife inventory.

5.1 FISHERIES AND AQUATIC BIOLOGY

Outlined below are the fisheries and aquatic biology programs.

5.1.1 Fisheries

A detailed fisheries study plan is presently being developed between the Montana Department of Fish, Wildlife, and Parks (MDFWP) and U.S. Borax. Fisheries sampling is scheduled to begin in mid-August 1988.

5.1.2 Aquatic Biology

The objective of aquatic sampling is to assemble a database for periphyton, benthic macroinvertebrates, and physical habitat in streams within and adjacent to (and upstream and downstream of) the potential development areas. Streams included in the study area are Upper Rock Creek, on the west side of the Cabinet Mountains, and Ramsey, Libby, Poorman, Little Cherry, and Bear creeks on the east side.

Each stream will be divided into classification reaches according to Forest Service accepted methods. Classification will be based on stream channel type (i.e., morphology, flow regime, etc.). Three sampling stations will correspond to each of the designated stream type classification reaches on each stream. A survey of the project area was conducted on May 4 and 5, 1988, with biologists for the U.S. Forest Service, Montana Water Quality Bureau, and U.S. Borax to more accurately identify stream types prior to establishing exact locations of study sites. The number of sites to be investigated are as indicated in the table on the following page.

AQUATIC SAMPLING SUMMARY

		Hab. Anal.	Macro Inverts	Characterize only
Libby Creek				
L.1	1. 1/2 mi reach below Hoodoo & above Crazyman Cks (Cum. effects)	X	X	
L.2	2. Reach above to below Bear Ck			X
L.3	3. Canyon reach to above Little Cherry Ck (exp stn for dam)	X	X	
L.4	4. Braided reach below Little Cherry Inpoundmt. (exp stn for LCL impound)	X	X	
L.5	5. Old Town reach (above Poorman -> Ramsey) (cumm effects for Ramsey & Libby)	X	X	
L.6	6. characterize bedrock section within a dif reach but no sampling			X
L.7	7. Ramsey to upstream braided section (exp stn for Libby)			X
L.8	8. Braided section (exp for Libby & Howard Cks)	X	X	
L.9	9. Howard Ck confl. up to 3720' elev.			X
L.10	10. Gentle Libby Ck (exp for mine facilities)	X	X	
L.11	11. Upper Libby Ck (control for mine facilities)	X	X	
Ramsey Creek				
Ra1	1. Confl. w Libby upstream 1/2 mi			X
Ra2	2. Gentle reach (exp 2 for mine facilities)	X	X	
Ra3	3. Steeper upper reach (exp 1 for mine facilities)	X	X	
Ra4	4. Swampy, meandering upper reach (control for mine facilities)	X	X	
Poorman Creek				
Po1	1. One reach above Libby Ck w 2 macro stns: one above Bear Ck Rd & impound (control) one as close to Libby as possible (exp)	X	2X	
Little Cherry Creek				
LC1	1. One reach: one stn above dam (LC100); one stn below dam (LC600) macro stn(s) ? - one below; one above if flow in August	X	1-2X	
Bear Creek				
Be1	1. Steep, lower reach (macro sample exp for dam leaching)	X	X	
Be2	2. Long, upper section to just above Bear Ck Rd bridge (control above bridge)	X	X	
Be3	3. Reach above bridge to confl w Cable Ck (Control for road & dam)	X	X	
Rock Creek				
Ro1	1. Upper reach - Rock Lk down to meadows	X	X	
Ro2	2. Swamp/meadows	X	X	
Ro3	3. Steep gradient			X
Ro4	4. Section above West Fork	X	X	
Totals		18	20(180)	6
Proposed (samples)		18	18(162)	0
Periphyton Totals (1 sample/stn/3 times/yr)			60	
Periphyton Proposed			18	

Existing macroinvertebrate, macrophyte, periphyton, riparian vegetation, fisheries, and hydrologic data are available for seven stations along Rock Creek and its tributaries as a result of investigations associated with the ASARCO proposed Rock Creek mine development. Sampling sites within Rock Creek reaches for the U.S. Borax baseline study will correspond as closely as possible to some of these stations so that these existing data will be directly comparable.

In other streams, coordination will occur between aquatic biologic, hydrologic, and water quality specialists to maximize multidisciplinary sampling from the same stations.

Major tasks of the aquatic data collection program are discussed below.

Task 1. Physical Habitat Evaluation. Physical habitat for all streams will be evaluated once during August 1988. Some specified habitat parameters will be measured during both high- and low-flow conditions as required by the analysis. Habitat evaluation will follow the Forest Service General Aquatic Wildlife System (GAWS) Prescriptive Planning Level (Level 3) methodology for evaluating aquatic ecosystems. Physical parameters to be measured will include, but are not limited to:

1. Riparian vegetation
2. Streambank stability
3. Gradient
4. Channel stability
5. Substrate composition
6. Pool and riffle area
7. Pool quality and quantity relative to adult trout habitat
8. Average width
9. Stream depth
10. Stream flow
11. Current velocity
12. Temperature
13. Spawning areas and fry habitat
14. Stream structure and diversity

All physical parameters will be measured at each of the designated study sites. Level 3 GAWS methodology specifies measurement of parameters across five transects at each study site; three study sites are located in representative portions of each classification reach; all environmental consultants will conduct creel surveys as opportunities are available.

Task 2. Benthic Macroinvertebrates and Periphyton. Macroinvertebrate community parameters will be measured on the following creeks: Upper Rock Creek (East Fork), Ramsey

Creek, Libby Creek, Poorman Creek, Little Cherry Creek, and Bear Creek.

Portions of Rock Creek other than reaches within the upper part will not be sampled for macroinvertebrates because adequate, recent data are available and will be utilized. Methods will follow those outlined by the Forest Service (Mangum 1987). Sampling will occur two times during 1988 (summer low flow and fall) and once in 1989 (pre-runoff) with specific periods to be decided. Aquatic and water quality sampling will be coordinated. Three square foot Hess samples will be collected from each of the channel classification reaches (excluding those in previously sampled reaches of Rock Creek). The Standardized Traveling kick method (Kinney et al. 1978) will be used to sample macroinvertebrates in Rock Creek. The specific sampling methods will be determined at the first site visit with the discipline coordinator. Methods will be documented so they can be duplicated in the future. Macroinvertebrates will be identified at the species level, wherever possible. Collections will be analyzed for the following measures:

1. Taxa identifications and counts
2. Taxa richness
3. Community density
4. Community biomass
5. Shannon diversity
6. Equitability

Other biotic or community indices may be calculated, as appropriate, to assess the macroinvertebrate community health.

A reference collection of all macroinvertebrate taxa identified will be maintained for future use. Sampling and sample sorting methods and taxonomic references will be recorded. A quality assurance/quality control program will be developed and implemented to assure accurate taxonomic identifications and thorough sample sorting (i.e., some samples will be sent out for verification by an independent biologist). A biotic condition index (BCI - Mangum 1987) will be calculated.

Qualitative periphyton sampling will be conducted to provide species lists and an approximate relative abundance of algae in the study area streams. Periphyton will be sampled at the same locations and on the same dates as the macroinvertebrates. A composite periphyton sample will consist of scraping the film of attached algae from natural substrates at each site.

At each site, substrates will be sampled in proportion to their occurrence, and microscopic algae will be sampled in proportion to the percentage of substrate it covers.

Scraping from each site will be combined, transferred to labeled vials, and preserved in Lugol's solution. Aquatic macrophyton will be identified, and the locations noted as they are encountered.

Taxa of uncertain identity will be pressed in the field and later identified using appropriate taxonomic keys.

QA/QC procedures will include sending 5% of the samples out to an independent consultant for review and verification.

Task 3. Literature Review and Evaluation. Existing literature and available agency data related to physical habitat and macroinvertebrates in the area will be reviewed and evaluated prior to field work for background data, applicability to the sampling program, and for fine-tuning proposed methodology.

Task 4. Report. A stream analysis report will be prepared integrating results from the physical habitat, macroinvertebrate studies, literature review, and pertinent study results from other associated disciplines (e.g., water quality). Report contents will include background, purpose, methods, detailed analyses, results, conclusions, recommendations, and appendices. It is assumed, at present, that fisheries data collected by the MDFWP will be supplied to a fisheries specialist for report preparation.

The final report shall be suitable for inclusion in U.S. Borax's permit application as a technical appendix.

The company will review the findings with the agencies and depending on the findings, the company's schedule for development and the need to characterize the potentially affected benthic macroinvertebrate community, the company will negotiate a sampling/monitoring program with the agencies.

5.2 WILDLIFE

This wildlife study plan has been designed to assemble a database on local wildlife resources which is adequate for subsequent impact analysis and the development of mitigation measures for U.S. Borax's proposed mine development in the Cabinet Mountains. This study plan was developed based on:

(1) Montana Metal Mine Reclamation Act (MMMRA), Montana Environmental Policy Act (MEPA), National Environmental Policy Act (NEPA), and guidelines to these Acts;

(2) Wildlife guidelines recommended by the Montana Department of State Lands (MDSL) for similar mining projects;

(3) Preliminary review of pertinent, existing resource inventory data for the project area;

(4) Accepted baseline study plans for a similar, adjacent underground mine proposed for the area;

(5) An October 1987 site visit; and

(6) Discussions with state and federal resource and regulatory agency personnel.

This plan is intended for review, revision, and endorsement by regulatory and resource agencies.

Major objectives of the study plan are to:

(1) Develop a list of wildlife species observed and which potentially occur in the proposed project area;

(2) Evaluate the types, distribution, and relative importance of local habitats to various wildlife taxa;

(3) Assess the seasonal distribution of important wildlife species on and adjacent to the project area;

(4) Estimate relative numbers of important (i.e., elk and mountain lions) wildlife species on and adjacent to the project area; and

(5) Document the occurrence of federal and state threatened, endangered, and candidate species and habitat suitability for such species in the project area. The review will include Animal Species of Special Concern for the State of Montana and Kootenai National Forest Sensitive Species.

Field data collection for this plan of study will be conducted over one calendar year such that surveys will be made during spring, summer, and fall, and one complete winter. U.S. Borax will review the baseline data with the agencies. The findings, planned development scheduling, and the need for monitoring will be discussed and negotiated. Field data will be supplemented with results of the ASARCO baseline study (whose study area is overlapped by a portion of this study area) and other local studies to incorporate interannual differences in wildlife utilization. A thorough

literature review, data analysis, and report preparation will be conducted prior to and following field surveys.

The study area circumscribing the area in which field investigations are implemented will be stratified into intensive and extensive study areas. The intensive study area (potential impact area) encompasses all project-related facilities and activities associated with the development alternatives including mine facilities, mill, tailings disposal areas; road, pipeline and power transmission line corridors, and other ancillary facilities. Field surveys will be concentrated in these areas because of the relative magnitude of potential impacts.

The extensive study area (buffer) will surround the impact area. Wildlife surveys conducted in this zone will be less intensive and oriented towards identifying the ecologic setting in which the proposed project area is located. Potential wildlife impacts resulting from a proposed development can not be adequately assessed unless the relative importance of project area habitats can be placed in perspective with seasonal wildlife use, and importance of, surrounding habitats. The size of the extensive study area will vary between wildlife groups, depending on the type and magnitude of anticipated impact and the extent of seasonal wildlife movements.

The exact delineation of both study zones will be finalized for individual wildlife groups following final refinement of conceptual development alternatives and interactions with resource and regulatory agency personnel. Presently proposed areas are shown on Figure 5-1.

The methodology for each of the major tasks of the wildlife study are discussed below.

5.2.1 Literature Review

A thorough literature review will be conducted prior to the advent of field work to identify the extent and quality of existing, useful wildlife information that can:

(1) Be used by itself to meet study objectives,

(2) Function as additional information on use of the study area in prior years, and/or

(3) Be used to supplement field inventories,

Much of this information is available from the MDFWP, the Forest Service, and their local wildlife specialists, and includes harvest data, population estimates, locations of seasonal ranges (e.g., winter range, parturition areas, migration corridors), and raptor nest sites. Further,

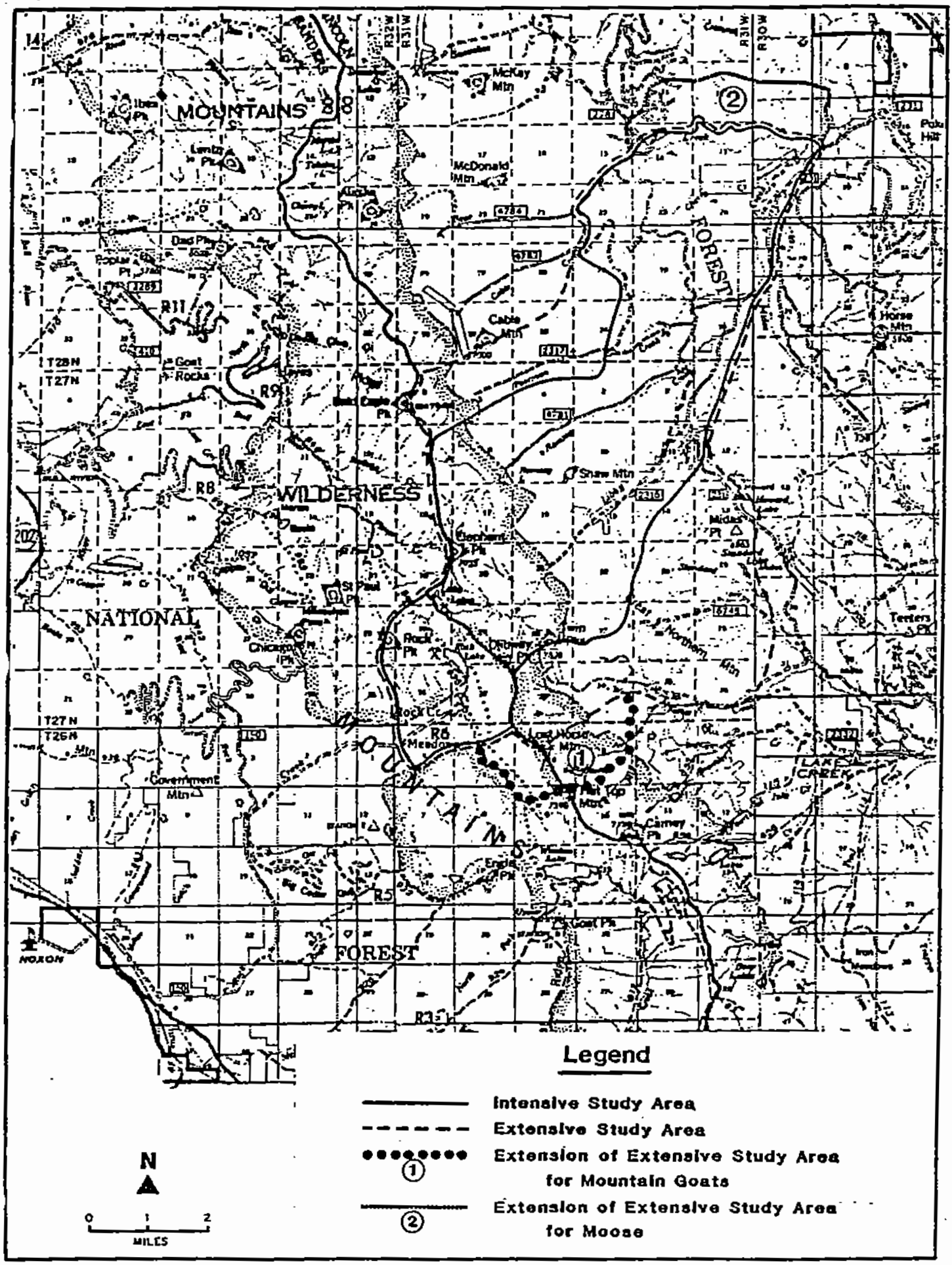

Figure 5-1

WILDLIFE BASELINE DATA COLLECTION AREAS

results of the recent ASARCO wildlife baseline study (Westech 1987), whose study area overlaps all of U.S. Borax's proposed western development area, provides a comprehensive analysis of information directly applicable to this study. Other studies, such as Joslin (1980), Kasworm (1986), and Erickson et al. (1987) can also be used, by themselves or in part, to meet study objectives.

5.2.2 Species List

A list of wildlife species which occur or which may occur in the study area will be developed from observations made during field surveys and supplemented with general literature sources (e.g., Skaar 1980, Flath 1984, Thompson 1982) based on habitat availability. Knowledge of local agency biologists should also be used when developing a species list.

5.2.3 Habitat Analysis

Objectives of the habitat analysis will be to:

(1) Identify habitat types. "Habitat types" and "habitat" refer to major habitat types such as western hemlock, subalpine fir or shrub land, which can be one or more vegetation type functioning as one homogeneous unit;

(2) Identify critical and important habitat types for different wildlife species;

(3) Identify the availability of alternative habitats as related to anticipated habitat losses or modifications; and

(4) Quantify the distribution of habitat types and their relative importance to different wildlife groups.

The Forest Service has mapped land types, habitat types, and habitat components for the entire study area (Madel 1982, USFS 1984, Kasworm 1986). This mapping is adequate for the present baseline study and will be used for the identification of habitats in the extensive study area. Habitats will be delineated on 1:24,000 USGS topographic maps. Forest Service mapping will also be used to identify the distribution of habitats in the intensive study area at a 1:24,000 scale on topographic maps; however, this mapping may be refined using results of the vegetation study.

Identification of critical and important habitats for different wildlife species will be based on observed animal distributions during given time periods, indirect evidence of relative use (e.g., browse utilization, tracks, pellets,

etc.), distribution of seasonally important habitats (e.g., low elevation meadows, berry concentrations, etc.), results of quantitative and qualitative surveys, and on habitats of importance as documented in scientific literature.

Alternate or adjacent habitat types will be qualitatively identified based on results of field investigations only as such habitats may be related to anticipated habitat modifications or losses (e.g., calving habitat, winter range, fall berry concentrations, etc.).

Distribution of habitat types within the intensive study area will be determined by planimetering habitat maps. Relative importance of these habitats to different wildlife groups will be based on quantitative and qualitative field survey results and literature review. Acreage of wildlife habitats to be disturbed by the proposed project will be presented in tabular form in the final report.

5.2.4 Big Game

Big game distribution, relative numbers, and seasonal habitat utilization of the intensive and extensive study areas will be evaluated based on results of:

(1) systematic aerial surveys,
(2) vehicle surveys,
(3) ground surveys,
(4) qualitative observations,
(5) literature review, and
(6) discussions with local MDFWP and Forest Service biologists.

Survey routes should be coordinated with local agency biologists to determine where they would be most useful.

"Big game" refers to mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*), elk (*Cervus elaphus*), moose (*Alces alces*), mountain goats (*Oreamnos americanus*), bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), black bear (*Ursus americanus*), and grizzly bear (*Ursus arctos*). Caribou (*Rangifer tarandus*) are not present in the study area (Flath 1984, Westech 1987).

A systematic aerial survey will be conducted for one year in the intensive and extensive areas to determine seasonal big game distribution, minimum population estimates, and movement patterns. Flights will begin at sunrise, under as ideal weather conditions as possible. The schedule for helicopter flights will be as follows:

2 flights per month December thru February
1 flight per month March and April
3 flights between May 15 and June 30
1 flight during September
12

The flights will focus on winter range for moose and mountain goats and spring kidding areas. One to two experienced observers will accompany the pilot. Observations will be recorded on 1:24,000 topographic maps. Age and sex composition of groups will be recorded when possible. Distributions of individual species will be summarized by season in final report figures which include observations made during aerial and ground surveys.

Truck and snowmobile surveys will be conducted along routes strategically located throughout the intensive and extensive study areas to collect additional data on big game distribution. After the ground is snow covered, vehicle or snowmobiles will be used to survey tracks along roads (transects) to assess seasonal presence, distribution, movement patterns, to obtain indices (number of trails/km of transect) of wildlife (big game as well as other species) present, and record other qualitative observations. Areas inaccessible to snowmobiles will be surveyed on cross-country skis. Additional ground surveys, covering the intensive study areas most thoroughly, will be conducted monthly to identify wildlife distributions (via tracks, fresh pellets, etc.), locate high use areas (parturition areas, berry concentrations, etc.), make opportunistic sightings, and develop a general understanding of wildlife utilization during that time period. Specific routes may be used; however, monthly systematic coverage of the intensive study area and portions of the extensive study area will be oriented toward areas of seasonal importance to the different wildlife groups during that specific time period.

Relative big game abundance will be evaluated between and within habitats using the NANOVA, ANOVA, SNK, and LSD analyses described below under Breeding Birds. A chi-square analysis will be used to evaluate big game habitat utilization relative to habitat availability in the impact area. Quantitative vegetation data (collected by the vegetation specialist) will be used to support and clarify habitat utilization patterns.

Defecations from other wildlife species (e.g., bears, coyotes, etc.) can also be quantified in conjunction with these surveys; however, low sample sizes may prohibit similar analyses. Nevertheless, such results can be used as an index of abundance and habitat use, directly comparable to relative big game indices.

A great deal of background and site-specific literature is available for the project area as a result of prior studies and inventories. Results of many of these investigations will be used to supplement data collected during the baseline study to evaluate present wildlife use of the study area. Local MDFWP and Forest Service biologists will be

particularly important sources of valuable, unpublished data on wildlife occurrence and use in the area.

5.2.5 Small Mammals

Small mammals will be trapped in the intensive breeding bird study area to document species occurrence and relative abundance. Trapping will be conducted on the proportionally allocated 100 x 200 m breeding bird plots, stratified by major habitat type, in July-August 1988 and utilize a combination of Sherman live traps (8 x 9 x 27 cm) and Museum Specials and/or Victor Woodstream (rat) snap traps. Pitfall traps will not be used because of their low trapping effectiveness. Five live and five snap traps will be attempted in parallel transects where distances between traps and transects will be approximately 10 m. Traps will be baited with a mixture of peanut butter, rolled oats, and bacon/Bacos. Trapping will be conducted on three consecutive days during fair weather.

The three parallel 90 m (10 traps spaced at 10 m intervals) small mammal transects will initially be established at one end of each bird plot, parallel to the plot's long axis. After checking traps on Day 2, transects will be moved forward approximately 110 m such that the location of Trap 1 on Day 3 is 20 m ahead of the location of Trap 10 on Day 2. This procedure is a modification of Stoecker's (1984) moving transect method which maximizes trap success and area sampled, and minimizes recaptures. Sampling will involve 270-450 trap nights in each major habitat. Relative small mammal abundance and species richness will be evaluated between and within habitats using the NANOVA, ANOVA, SNK, and LSD analyses described under Breeding Birds.

Additional data on small mammal presence and distribution in the study area will be collected in conjunction with other fieldwork and from results of other local studies.

5.2.6 Breeding Birds

For breeding bird (and small mammal) sampling, the intensive study area was further reduced in area to include only the potential impact areas (facility sites, portals, waste rock disposal areas, tailings ponds, roads, etc.) and a one-quarter mile buffer zone surrounding these areas. The decision to utilize this approach was made after preliminary qualitative sampling indicated that (1) anticipated, project-related impacts to breeding bird communities would be nondetectable beyond the buffer zone and that (2) occupied habitats beyond these areas were similar to those being sampled, thus permitting data extrapolation to unsampled areas.

The breeding bird study area was stratified by major habitat types and mapped on 1:24,000 USGS topographic maps. Minor types were not surveyed separately. Species associated with these major types were associated with the major habitats surveyed. Similarly, although some species may achieve their maximum densities in ecotones, those species will also occur in two or more homogeneous habitats forming the ecotone.

Three to five 100 x 200 m (2 ha = 4.94 acres) breeding bird plots (strip transects, Emlen 1971, Eberhardt 1978) were randomly established in each of the major habitats in early June 1988. Number of plots per habitat was roughly proportional to total habitat area within the sampling area. Habitat units of sufficient acreage were partitioned into one or more cells large enough to accommodate a 2 ha plot. Cells throughout the project area were consecutively numbered for each habitat type. A random numbers table was used to select the plot locations/type out of all possible sites. Habitat cells selected for sampling had plots oriented medially along the cell's long axis. Plot corners and intermediate points (50 m intervals) along the plot boundary were marked by 1.22 m (4 foot) rebar posts identified with stainless steel adhesive tape and surveyor's flagging. Additional surveyor's flagging was attached to vegetation along boundaries to facilitate identification and observer orientation. Rebar posts, tape, and flagging were left after sampling so the same plots can be used for future monitoring.

Each of the bird plots (3-5 plots/habitat type times 6 types) was sampled five times during the peak of the 1988 breeding season. Observers traversed the 100 x 200 m plots recording all birds seen or heard within plot boundaries during a 15 minute period. Surveys were conducted between 0.5 hours of sunrise and 0930 hours during favorable weather to minimize variation in bird conspicuousness (Conner and Dickson 1980). A schedule of transect replications for each habitat type was established for investigators to minimize among- and within-habitat variation. Daily and seasonal temporal detectability bias was ameliorated by alternating the daily sampling sequence of habitats and by evenly spacing sampling throughout the breeding season. All birds observed on the study area were recorded; however, only those species observed within transect boundaries during surveys and which demonstrated an affinity to the transect area were included in quantitative measurements. For example, a gull flying high over a conifer plot was not included. Young-of-the-year were noted, but not included in quantitative measurements.

Birds demonstrating an affinity towards a plot were considered breeders or transients. Breeders were those birds using habitats in the project area while breeding.

However, this does not imply that breeders utilizing a particular project area habitat were necessarily breeding in that habitat, only that they were using that habitat (e.g., for display purposes, maintenance activities, foraging for young, etc.) while breeding in that or a different habitat nearby. For example, a common flicker observed foraging on a grassland plot was considered a breeder even though it may have been nesting in an adjacent conifer habitat. Transients were late migrants.

Species richness (S) (number of species present on a plot during each replication) and density (number of birds present on a plot during each replication) values derived for species in each plot and in all major habitats were used to evaluate avian habitat utilization.

Mean breeding density for individual species within a habitat will be derived from the average number of birds per plot replication (n = 5) and then from average values for each of the five plots per habitat, where

$$\text{plot mean (n/2 ha)} = \frac{\underset{i=1}{\overset{k}{\text{x}}}}{} = \sum_{i=1}^{5} n/5$$

$$\text{habitat mean (n/10 ha)} = \sum_{i=1}^{5} x/5$$

Species richness and abundance data, collected through the aforementioned experimental design, will produce nested analysis of variance (NANOVA) matrices with equal replication (Sokal and Rohlf 1969, Zar 1974). Differences in breeding bird use among the major habitat types will be analyzed by NANOVA. Differences within habitat types will be analyzed by single factor analysis of variance (ANOVA), Student-Newman-Keuls (SNK) multiple range tests, and least significant difference (LSD) tests. If a significant F results from the ANOVA and all possible comparisons between plots were desired, the SNK test will be applied. If only several plot comparisons are intended, the LSD test will be used. Tests of significance will be at alpha = 0.05 unless stated otherwise. Data will be screened for normality prior to testing.

This experimental design will be used to quantify numbers and evaluate relative habitat use of all bird groups on the project area, including nongame birds, galliforms, raptors, and waterbirds. Additional surveys will also be conducted specifically for the two latter groups. Those methodologies are discussed below.

5.2.7 Raptors

Raptor presence, distribution, and relative numbers in the study area will be determined in conjunction with the

(1) 1988 breeding bird surveys;

(2) During systematic helicopter surveys throughout the intensive and extensive study areas, conducted specifically to locate raptor nests; and

(3) In conjunction with other wildlife fieldwork.

Breeding bird results will present raptor densities in the intensive study area by habitat type. The intensive study area will be systematically surveyed by helicopter and ground surveys during spring and early summer 1988 to locate active and inactive nests. Cliffs in the extensive study area will be surveyed by helicopter and through spotting scopes. When raptor nests are located, they will be mapped and monitored periodically until young have fledged in an attempt to determine nest success and number of young produced. Distribution of raptors in the study area will be illustrated in the final report by individual species. Special attention will be placed on surveying for the Boreal owl in late winter and early spring. The northern goshawk will also be of special interest.

5.2.8 Waterfowl

Waterfowl use of ponds and creeks on the intensive study area will be quantified in conjunction with the breeding bird plot surveys and opportunistically during other wildlife fieldwork. Waterfowl use of the extensive study area will be assessed using this latter approach, using results of other studies in the area, and from literature review. Surveys will address the harlequin duck and common loon, both sensitive species for the Kootenai National Forest.

5.2.9 Threatened and Endangered Species

No specific surveys for threatened and endangered species are proposed for the baseline study because

(1) Specific studies covering the proposed project areas have been recently conducted, and

(2) Additional data on the species in question will be conducted in conjunction with other baseline wildlife surveys.

Three threatened or endangered species occur on or in the vicinity of the project area: grizzly bear, bald eagle

(*Haliaeetus leucocephalus*), and peregrine falcon (*Falco peregrinus*). The grizzly bear is a federally threatened species which occurs in low numbers in the Cabinet Mountains. Two recent, intensive studies (Kasworm 1984a, b, 1986, Erickson et al. 1987) have been conducted in the Cabinet Mountains covering the proposed study areas. Some of these studies have been sponsored by U.S. Borax. Those studies have documented relative numbers, home range, and movements, via radiotelemetry, habitat characteristics, and use, and potential impacts to the grizzly population resulting from a similar, adjacent mining proposal. Potential impacts of the proposed mine development to the grizzly bear population will be assessed using

(1) Results obtained and management recommendations developed from those recent studies,

(2) From results of qualitative and quantitative habitat surveys of proposed impact areas, and

(3) From data (sightings, tracks, feces, etc.) obtained in conjunction with other baseline wildlife fieldwork.

Bald eagles are a federally endangered species which breeds in latilong block 1 (Flath 1984); however, they are most common in the study area as migrants, transients, or winter residents (Homer 1976, Kuchera and Ruediger 1978, Flath 1984). Eagle use of the project area will be evaluated based on opportunistic field observations made in conjunction with other fieldwork, on results of other recent, local studies, and on literature review.

Peregrine falcons are a species classified as federally endangered. Historical nesting has been suspected for the latilong blocks covering the study area; however, the lack of recent reported sightings from the region suggests this species may only migrate through the area. No specific surveys are proposed for the baseline study to search for peregrines.

Assessment of presence and potential habitat use by species of special concern in Montana (state threatened and endangered species, Flath 1984) is discussed below under Other Wildlife Groups.

5.2.10 Herpetofauna

Presence and relative number of reptiles and amphibians in the intensive study area will be determined in conjunction with other wildlife fieldwork. Surveys will be conducted through suitable spring habitats surveying ponds, streams, and searching beneath rocks and logs for species such as the Coeur d'Alene salamander (*Plethodon vandykei*) and the tailed

frog (*Ascaphus truei*); however, no systematic searches are proposed.

5.2.11 Human Activity

Relative levels of present and past human use of the study area, including logging, mining, and seasonal recreation, will be determined from data collected by field biologists, data obtained from local Forest Service and MDFWP personnel, and from data collected by socioeconomists as part of the baseline survey. The influence this human activity has and has had on wildlife distributions in the study area will be subjectively evaluated.

5.2.12 Other Wildlife Groups

Presence and level of use of the proposed impact areas and the surrounding area by predators and furbearers (e.g., beaver, coyote, fisher, wolverine, mountain lion, lynx, bobcat, northern goshawk, etc.) and other wildlife species (e.g., pygmy shrew, hoary marmot, blue grouse, western bluebird, etc.) of special concern (Flath 1984) not specifically discussed in this study plan will be determined in conjunction with other wildlife fieldwork. These data, as well as recent and historic records from the area, will be summarized by species in the final report. The Kootenai National Forest Sensitive Species list will be included and addressed. The Nature Conservancy and Montana Heritage Program will be contacted for ecological information.

5.3 TECHNICAL REPORT

The final report shall be suitable for inclusion in U.S. Borax's permit application as a technical appendix.

LITERATURE CITED

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5

FLETCHER
ASSOCIATES

17740 East Hinsdale Avenue
Aurora, Colorado 80016
(303) 693-2516

November 15, 1988

Jim Rathbun
Forest Supervisor
Kootenai National Forest
506 U.S. Highway 2 West
Libby, MT 59923

Kit Walther, Chief
Hard Rock Bureau
Montana Dept. of State Lands
1625 Eleventh Avenue
Helena, MT 59620

Re: Montana Mining Venture

Gentlemen:

Enclosed are the modified sections of the Plan of Study for:

1. Section 5 - Wildlife and Aquatic Biology
2. Statement of Work - Fisheries, Section 5.1.1
3. Section 6 - Vegetation

The Wildlife, Aquatic Biology, and Fisheries sections were prepared, modified, and completed in the field after consultations with the following agency personnel:

1. U.S. Forest Service - Al Bratkovich
   Doug Perkinson
2. Water Quality Bureau - Gary Ingman
3. Fish, Wildlife & Parks - Terry Hightower
   Joe Huston
   Jim Vashro

Also enclosed are the "marked up" sections of Wildlife, Aquatic Biology, and Vegetation, enabling you to see the changes, as well as have clean copies of the finals.

Briefly, the changes were:

1. completed fish study
2. increased number of reaches and techniques for aquatic biology, and
3. reduction of area for birds and small mammals.

If you have any questions, please contact me.

Sincerely,

Gary J. Fletcher
GJF:af
Enclosures
cc: Joe Scheuering (w/o enclosures)
Brent Bailey (w/o enclosures)

United States Department of Agriculture | Forest Service | Kootenai NF | 506 US Highway 2 West Libby, MT 59923

Reply to: 2810

Date: January 9, 1989

Joe Scheuering
Noranda Minerals Corp.
P.O. Box 7176
Reno, NV 89510

Re: Plan of Study (POS) - Wildlife, Vegetation and Soils

Dear Joe,

Per letter of November 15 from Gary Fletcher, the agencies accept your proposed modifications/additions to the following sections:

a. Section 5, Wildlife and Aquatic Biology,
b. Section 6, Vegetation,
c. Section 8, Soils.

The agencies request that the proposed modifications be reflected as an addendum to the POS. The addendum should be revised Sections 5, 6 and 8 with appropriate signature page and cover.

If you have any questions, please contact either Kit or me.

Sincerely,

Ron Erickson

Ron Erickson
FS Project Coordinator

cc: Kit Walther, DSL
Brent Bailey
Gary Fletcher

APPENDIX 6.2

USFS HABITAT COMPONENT LIST

APPENDIX 6.2

Table 6.2.1. Grizzly bear habitat components mapped in the Cabinet-Yaak Ecosystem (USFS et al. 1988) that were used as the basis for habitat mapping on the Montana Project wildlife study area.

Component	Map Label
Alder shrubfield/forbfield	AF
Aquatic	AQ
Aspen (Upland)	PN
Beargrass sidehill park	XP
Buffaloberry shrubfield	FS
Chokecherry shrubfield	CS
Drainage forbfield	DF
Forbfield	FF
Graminoid (disturbed)	GB
Graminoid sidehill park	GP
Huckleberry shrubfield	HS
Marsh	MA
Mountain ash shrubfield	NS
Natural grassland/dry meadow	GL
Nonvegetated land/bare ground	NL
Riparian aspen/cottonwood	WP
Riparian streambottom	RB
Rock	RK
Serviceberry shrubfield	SS
Shrubfield (mixed)	HZ
Shrubfield/forbfield	JZ
Unmapped	NU
VASCSO-XERTE shrub/forbfield	XV
Wet Meadow	WM
Warm/Dry-Seed/Sap-Closed	1W1
Warm/Dry-Seed/Sap-Medium	1M1
Warm/Dry-Seed/Sap-Open	1P1
Warm/Dry-Pole-Closed	2W1
Warm/Dry-Pole-Medium	2M1
Warm/Dry-Pole-Open	2P1
Warm/Dry-Intermediate-Closed	3W1
Warm/Dry-Intermediate-Medium	3M1
Warm/Dry-Intermediate-Open	3P1
Warm/Dry-Mature-Closed	4W1
Warm/Dry-Mature-Medium	4M1
Warm/Dry-Mature-Open	4P1
Warm/Moist-Seed/Sap-Closed	1W2
Warm/Moist-Seed/Sap-Medium	1M2

APPENDIX 6.3

RAW BREEDING BIRD DATA AND STATISTICAL TEST RESULTS

Table 6.3.1. Raw data for breeding bird species richness sampled in major habitats on potential Montana Project development areas, Cabinet Mountains, Montana, June 1988.

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD SPECIES RICHNESS - RIPARIAN

R1.S88	R2.S88	R3.S88	R4.S88
6.00	8.00	11.00	28.00
8.00	10.00	11.00	15.00
10.00	10.00	16.00	18.00
14.00	9.00	19.00	18.00
9.00	4.00	19.00	19.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD SPECIES RICHNESS - HEMLOCK

H1.S88	H2.S88	H3.S88
7.00	8.00	7.00
8.00	12.00	5.00
9.00	7.00	6.00
7.00	9.00	7.00
8.00	11.00	7.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD SPECIES RICHNESS - MIXED CONIFER

MC1.S88	MC2.S88	MC3.S88	MC4.S88	MC5.S88
6.00	8.00	5.00	4.00	11.00
9.00	8.00	9.00	11.00	11.00
9.00	9.00	6.00	4.00	6.00
14.00	5.00	9.00	10.00	7.00
8.00	5.00	10.00	6.00	10.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD SPECIES RICHNESS - CLEARCUT

C1.S88	C2.S88	C3.S88	C4.S88	C5.S88
6.00	10.00	6.00	12.00	4.00
4.00	3.00	5.00	11.00	3.00
5.00	5.00	7.00	12.00	5.00
7.00	6.00	7.00	12.00	5.00
4.00	9.00	7.00	6.00	4.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD SPECIES RICHNESS - SHRUBFIELD

S1.S88	S2.S88	S3.S88	S4.S88
8.00	3.00	15.00	10.00
5.00	7.00	8.00	11.00
9.00	8.00	10.00	11.00
12.00	10.00	9.00	12.00
9.00	6.00	9.00	12.00

Table 6.3.1. Continued.

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD SPECIES RICHNESS - SPRUCE-FIR

SF1.S88	SF2.S88	SF3.S88	SF4.S88	SF5.S88
10.00	9.00	8.00	16.00	12.00
8.00	14.00	4.00	7.00	5.00
11.00	8.00	6.00	7.00	7.00
12.00	3.00	10.00	6.00	6.00
11.00	10.00	11.00	5.00	9.00

Table 6.3.2. Results of two-level NANOVA test examining differences in transformed breeding bird richness between and within Montana Project development area habitats. Transformed species richness statistics are provided below for habitats (group 1 = riparian, group 2 = hemlock, group 3 = mixed conifer, group 4 = clearcut, group 5 = shrubfield, and group 6 = spruce-fir) and plots (subgroups).

07-20-1988

TWO-LEVEL NESTED ANALYSIS OF VARIANCE NANOVA2. R.W.THOMPSON

CABINET MOUNTAINS - BIRD RICHNESS

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	11.77332	5	2.354663	3.11004	19.71734 %
AMONG SUBGROUPS	15.14233	20	.7571167	4.022394	30.24606 %
WITHIN GROUPS (ERROR)	19.57544	104	.1882254		50.0366 %
TOTAL	46.49109	129			

SQUARE ROOT TRANSFORMATION

GROUP BREAKDOWNS

GROUP NO.	MEAN	+/- SE	n	CVM(%)
GROUP 1 (R)	3.608252	.1747953	20	4.844321
GROUP 2 (H)	2.877596	7.842622E-02	15	2.725408
GROUP 3 (MC)	2.882995	8.858608E-02	25	3.07271
GROUP 4 (C)	2.617033	.1022948	25	3.908809
GROUP 5 (S)	3.081323	.1039859	20	3.374714
GROUP 6 (SF)	2.971734	.1058291	25	3.56119

SUBGROUP BREAKDOWNS

FILE	MEAN	+/- SE	n	CVM(%)
R1.S88	3.11909	.206929	5	6.634274
R2.S88	2.919949	.208506	5	7.140743
R3.S88	3.935222	.2313163	5	5.878101
R4.S88	4.45875	.2342814	5	5.254419
H1.S88	2.878077	6.456252E-02	5	2.243252
H2.S88	3.132599	.1473296	5	4.703111
H3.S88	2.622111	7.831398E-02	5	2.986676
MC1.S88	3.087457	.2046992	5	6.630027
MC2.S88	2.720715	.1562927	5	5.744545
MC1.S88	3.087457	.2046992	5	6.630027
MC2.S88	2.720715	.1562927	5	5.744545
MC3.S88	2.8599	.1739038	5	6.080765
MC4.S88	2.684737	.2702712	5	10.06695
MC5.S88	3.062165	.175462	5	5.729997
C1.S88	2.375194	.1208849	5	5.089473
C2.S88	2.617625	.2490189	5	9.513161
C3.S88	2.622111	7.831398E-02	5	2.986676
C4.S88	3.309455	.1920335	5	5.802572
C5.S88	2.160777	8.809546E-02	5	4.077027
S1.S88	2.992126	.1918203	5	6.410837
S2.S88	2.66296	.2283896	5	8.576531
S3.S88	3.251453	.1789237	5	5.502886
S4.S88	3.418754	.0550525	5	1.610309
SF1.S88	3.294742	.105681	5	3.207566
SF2.S88	2.983354	.3160697	5	10.59444
SF3.S88	2.843568	.2313658	5	8.13646
SF4.S88	2.886793	.3026663	5	10.48452
SF5.S88	2.850215	.2099273	5	7.365317

Table 6.3.3. SNK and LSD test results for transformed 1988 avian breeding richness in Montana Project habitats.

07-20-1988

********** STUDENT-NEUMAN-KEULS (SNK) TEST RESULTS **********

CABINET MOUNTAINS - BIRD RICHNESS - SQ. RT. TRANS.

	RANKED MEANS	UNRANKED MEANS	FILENAME
1 (R)	2.63569	3.635407	CMR.S88
2 (H)	2.884728	2.884728	CMH.S88
3 (MC)	2.910977	2.910977	CMMC.S88
4 (C)	3.012525	2.63569	CMC.S88
5 (S)	3.102521	3.102521	CMS.S88
6 (SF)	3.635407	3.012525	CMSF.S88

CALCULATED Q VALUE FOR COMPARISON:	6 vs 1	Q' =	5.452723
CALCULATED Q VALUE FOR COMPARISON:	6 vs 2	Q' =	3.596156
CALCULATED Q VALUE FOR COMPARISON:	6 vs 3	Q' =	3.951232
CALCULATED Q VALUE FOR COMPARISON:	6 vs 4	Q' =	3.397364
CALCULATED Q VALUE FOR COMPARISON:	6 vs 5	Q' =	2.757349
CALCULATED Q VALUE FOR COMPARISON:	5 vs 1	Q' =	2.546222
CALCULATED Q VALUE FOR COMPARISON:	5 vs 2	Q' =	1.043348
CALCULATED Q VALUE FOR COMPARISON:	5 vs 3	Q' =	1.044731
CALCULATED Q VALUE FOR COMPARISON:	5 vs 4	Q' =	.4908627
CALCULATED Q VALUE FOR COMPARISON:	4 vs 1	Q' =	2.180037
CALCULATED Q VALUE FOR COMPARISON:	4 vs 2	Q' =	.6402728
CALCULATED Q VALUE FOR COMPARISON:	4 vs 3	Q' =	.587466
CALCULATED Q VALUE FOR COMPARISON:	3 vs 1	Q' =	1.592571
CALCULATED Q VALUE FOR COMPARISON:	3 vs 2	Q' =	.1315124
CALCULATED Q VALUE FOR COMPARISON:	2 vs 1	Q' =	1.247695

NUMBER OF MEANS COMPARED = 6 ERROR DF = 20

SEE ZAR'S CRITICAL Q DISTRIBUTION, p.457.
NUMBER OF MEANS (6) IS THE COLUMN STARTING POINT.
THE ERROR DF (20) IS THE ROW.
COMPARE EACH OF THE ABOVE Q's (TOP DOWN) WITH ZAR's TABLE (RIGHT-LEFT).

IF Q ABOVE IS > CRITICAL Q, REJECT Ho.

Table 6.3.4. Results of untransformed and square root transformed ANOVA tests for avian richness in Montana Project habitats.

07-20-1988

SINGLE FACTOR ANALYSIS OF VARIANCE ANOVA. R. W. THOMPSON

CABINET MOUNTAINS - BIRD RICHNESS - NO TRANS.

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	104.8134	5	20.96267	3.153549	33.33027 %
WITHIN GROUPS	132.9465	20	6.647327		66.66973 %
TOTAL	237.7599	25			

NO TRANSFORMATION

07-20-1988

SINGLE FACTOR ANALYSIS OF VARIANCE ANOVA. R. W. THOMPSON

CABINET MOUNTAINS - BIRD RICHNESS - SQ. RT. TRANS.

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	2.394699	5	.4789399	3.205797	33.86506 %
WITHIN GROUPS	2.987961	20	.1493981		66.13493 %
TOTAL	5.38266	25			

SQUARE ROOT TRANSFORMATION

Table 6.3.5. Raw data for breeding bird density sampled in major Montana Project habitats, Cabinet Mountains, Montana, June 1988.

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD DENSITY - RIPARIAN

R1.D88	R2.D88	R3.D88	R4.D88
10.00	13.00	19.00	40.00
8.00	13.00	12.00	20.00
13.00	12.00	19.00	24.00
14.00	10.00	33.00	29.00
17.00	4.00	27.00	25.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD DENSITY - HEMLOCK

H1.D88	H2.D88	H3.D88
11.00	11.00	10.00
10.00	17.00	13.00
13.00	9.00	7.00
10.00	13.00	17.00
10.00	21.00	11.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD DENSITY - MIXED CONIFER

MC1.D88	MC2.D88	MC3.D88	MC4.D88	MC5.D88
9.00	15.00	6.00	6.00	16.00
13.00	11.00	18.00	18.00	19.00
13.00	16.00	7.00	5.00	10.00
19.00	5.00	17.00	15.00	12.00
10.00	8.00	17.00	15.00	17.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD DENSITY - CLEARCUT

C1.D88	C2.D88	C3.D88	C4.D88	C5.D88
9.00	13.00	8.00	24.00	11.00
4.00	4.00	7.00	15.00	4.00
14.00	8.00	10.00	18.00	8.00
7.00	8.00	12.00	14.00	10.00
4.00	18.00	11.00	8.00	6.00

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD DENSITY - SHRUBFIELD

S1.D88	S2.D88	S3.D88	S4.D88
10.00	8.00	21.00	13.00
7.00	10.00	15.00	16.00
12.00	13.00	12.00	15.00
13.00	11.00	17.00	14.00
13.00	6.00	15.00	20.00

Table 6.3.5. Continued.

RAW DATA PRINTOUT 07-20-1988 R.W.THOMPSON

BIRD DENSITY - SPRUCE-FIR

SF1.D88	SF2.D88	SF3.D88	SF4.D88	SF5.D88
15.00	17.00	10.00	22.00	17.00
11.00	25.00	4.00	10.00	9.00
17.00	14.00	10.00	11.00	15.00
12.00	4.00	15.00	9.00	8.00
19.00	16.00	22.00	7.00	14.00

Table 6.3.6. Results of two-level NANOVA test and habitat (group) and plot (subgroup) statistics for transformed breeding bird density sampled in potential Montana Project development areas, Cabinet Mountains, Montana, June 1988.

07-20-1988

TWO-LEVEL NESTED ANALYSIS OF VARIANCE NANOVA2. R.W.THOMPSON

CABINET MOUNTAINS - BIRD DENSITY

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	11.31165	5	2.262329	1.937737	8.122448 %
AMONG SUBGROUPS	23.35022	20	1.167511	2.735228	23.67083 %
WITHIN GROUPS (ERROR)	44.3916	104	.4268424		68.20671 %
TOTAL	79.05347	129			

SQUARE ROOT TRANSFORMATION

GROUP BREAKDOWNS

GROUP NO.	MEAN	+/- SE	n	CVM(%)
GROUP 1 (R)	4.189438	.2349252	20	5.607559
GROUP 2 (H)	3.532128	.1265127	15	3.581769
GROUP 3 (MC)	3.568027	.136806	25	3.834219
GROUP 4 (C)	3.189972	.1477726	25	4.632409
GROUP 5 (S)	3.643612	.1201085	20	3.296415
GROUP 6 (SF)	3.643652	.1505275	25	4.131228

SUBGROUP BREAKDOWNS

FILE	MEAN	+/- SE	n	CVM(%)
R1.D88	3.564254	.2214137	5	6.212063
R2.D88	3.249139	.292873	5	9.013866
R3.D88	4.679852	.3869722	5	8.268899
R4.D88	5.264509	.31022	5	5.892667
H1.D88	3.357302	8.444414E-02	5	2.515238
H2.D88	3.793543	.2779524	5	7.326987
H3.D88	3.445537	.2388912	5	6.933353
MC1.D88	3.617386	.2315833	5	6.401953
MC2.D88	3.330174	.3201323	5	9.61308
MC3.D88	3.591178	.3884088	5	10.81564
MC4.D88	3.413978	.4014834	5	11.75999
MC5.D88	3.887421	.2167722	5	5.576249
C1.D88	2.77427	.3175802	5	11.44734
C2.D88	3.185534	.3716092	5	11.66552
C3.D88	3.164232	.1480193	5	4.677891
C4.D88	3.982255	.3322816	5	8.344055
C5.D88	2.843568	.2313654	5	8.136445
S1.D88	3.372597	.1771921	5	5.253878
S2.D88	3.154151	.1945062	5	6.166672
S3.D88	4.045931	.1805875	5	4.463436
S4.D88	4.001767	.1465078	5	3.661078
SF1.D88	3.892577	.1922554	5	4.939026
SF2.D88	3.844856	.4788225	5	12.45359
SF3.D88	3.456496	.4337723	5	12.54948
SF4.D88	3.439154	.3435907	5	9.990559
SF5.D88	3.585175	.2482559	5	6.924515

Table 6.3.7. Results of untransformed and square root transformed ANOVA tests for avian breeding density in Cabinet Mountains habitats.

07-20-1988

SINGLE FACTOR ANALYSIS OF VARIANCE ANOVA. R. W. THOMPSON

CABINET MOUNTAINS - BIRD DENSITY - NO TRANS.

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	145.5142	5	29.10283	1.958953	18.20804 %
WITHIN GROUPS	297.1265	20	14.85632		81.79196 %
TOTAL	442.6407	25			

NO TRANSFORMATION

07-20-1988

SINGLE FACTOR ANALYSIS OF VARIANCE ANOVA. R. W. THOMPSON

CABINET MOUNTAINS - BIRD DENSITY - SQ. RT. TRANS.

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	2.24115	5	.44823	1.930065	17.75693 %
WITHIN GROUPS	4.644715	20	.2322357		82.24308 %
TOTAL	6.885865	25			

SQUARE ROOT TRANSFORMATION

APPENDIX 6.4

SMALL MAMMAL TRAPPING DATA

AND STATISTICAL TEST RESULTS

Table 6.4.1. Raw small mammal richness data for major habitats on potential Montana Project development areas, Cabinet Mountains, Montana, August 1988.

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL RICHNESS - RIPARIAN PLOTS

R1.S88	R2.S88	R3.S88	R4.S88
1.00	1.00	0.00	1.00
2.00	2.00	0.00	1.00
2.00	3.00	2.00	1.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL RICHNESS - HEMLOCK PLOTS

H1.S88	H2.S88	H3.S88
3.00	2.00	0.00
2.00	0.00	1.00
2.00	0.00	2.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL RICHNESS - MIXED CONIFER PLOTS

MC1.S88	MC2.S88	MC3.S88	MC4.S88	MC5.S88
4.00	1.00	0.00	2.00	1.00
2.00	1.00	4.00	1.00	1.00
4.00	1.00	0.00	0.00	0.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL RICHNESS - CLEARCUT PLOTS

C1.S88	C2.S88	C3.S88	C4.S88	C5.S88
1.00	2.00	1.00	2.00	2.00
1.00	2.00	2.00	2.00	2.00
1.00	2.00	1.00	2.00	1.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL RICHNESS - SHRUBFIELD PLOTS

S1.S88	S2.S88	S3.S88	S4.S88
2.00	1.00	1.00	3.00
4.00	0.00	1.00	3.00
2.00	0.00	2.00	2.00

Table 6.4.1. Continued.

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL RICHNESS - SPRUCE-FIR PLOTS

SF1.S88	SF2.S88	SF3.S88	SF4.S88	SF5.S88
1.00	1.00	2.00	4.00	2.00
2.00	2.00	1.00	2.00	1.00
1.00	1.00	2.00	2.00	1.00

Table 6.4.2. Results of two-level NANOVA test examining differences in transformed small mammal richness data between and within Montana Project development area habitats. Habitat (group) and plot (subgroup) statistics are provided below.

11-02-1988

TWO-LEVEL NESTED ANALYSIS OF VARIANCE NANOVA2. R.W.THOMPSON

CABINET MOUNTAINS, MT - SMALL MAMMAL RICHNESS - SIX HABITATS

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	1.801285	5	.360257	.1820248	9.847124 %
AMONG SUBGROUPS	39.58328	20	1.979164	2.708327	32.71025 %
WITHIN GROUPS (ERROR)	38.00005	52	.7307701		57.44262 %
TOTAL	79.38461	77			

NO TRANSFORMATION

GROUP BREAKDOWNS

GROUP NO.	MEAN	+/- SE	n	CVM(%)
GROUP 1	1.333333	.2562354	12	19.21765
GROUP 2	1.333333	.372678	9	27.95085
GROUP 3	1.466667	.3762809	15	25.65552
GROUP 4	1.6	.1309307	15	8.18317
GROUP 5	1.75	.3508648	12	20.04941
GROUP 6	1.666667	.2108185	15	12.64911

SUBGROUP BREAKDOWNS

FILE	MEAN	+/- SE	n	CVM(%)
R1.S88	1.666667	.3333334	3	20
R2.S88	2	.5773503	3	28.86751
R3.S88	.6666667	.6666667	3	100
R4.S88	1	0	3	0
H1.S88	2.333333	.3333332	3	14.28571
H2.S88	.6666667	.6666667	3	100
H3.S88	1	.5773503	3	57.73503
MC1.S88	3.333333	.6666668	3	20
MC2.S88	1	0	3	0 VM(%)
MC3.S88	1.333333	1.333333	3	100
MC4.S88	1	.5773503	3	57.73503
MC5.S88	.6666667	.3333334	3	50
C1.S88	1	0	3	0 .86751
C2.S88	2	0	3	0 0
C3.S88	1.333333	.3333333	3	25
C4.S88	2	0	3	0 .28571
C5.S88	1.666667	.3333334	3	20
S1.S88	2.666667	.6666666	3	25 73503
S2.S88	.3333334	.3333334	3	100
S3.S88	1.333333	.3333333	3	25
S4.S88	2.666667	.3333332	3	12.49999
SF1.S88	1.333333	.3333333	3	25
SF2.S88	1.333333	.3333333	3	25
SF3.S88	1.666667	.3333334	3	20
SF4.S88	2.666667	.6666666	3	25
SF5.S88	1.333333	.3333333	3	25

Table 6.4.3. Results of ANOVA test using transformed small mammal richness data for Montana Project habitats.

11-02-1988

SINGLE FACTOR ANALYSIS OF VARIANCE. ANOVA. R. W. THOMPSON

SMALL MAMMAL SPECIES RICHNESS - PLOT SUMS

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	.1125259	5	2.250519E-02	.1559215	16.38424 %
WITHIN GROUPS	2.886734	20	.1443367		83.61576 %
TOTAL	2.99926	25			

SQUARE ROOT TRANSFORMATION

Table 6.4.4. Raw small mammal abundance data for major habitats on potential Noranda impact areas, Cabinet Mountains, Montana, August 1988.

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL ABUNDANCE - RIPARIAN PLOTS

R1.D88	R2.D88	R3.D88	R4.D88
2.00	1.00	0.00	2.00
2.00	2.00	0.00	4.00
5.00	3.00	3.00	4.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL ABUNDANCE - HEMLOCK PLOTS

H1.D88	H2.D88	H3.D88
11.00	2.00	0.00
4.00	0.00	1.00
5.00	0.00	3.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL ABUNDANCE - MIXED CONIFER PLOTS

MC1.D88	MC2.D88	MC3.D88	MC4.D88	MC5.D88
10.00	5.00	0.00	3.00	1.00
5.00	4.00	4.00	1.00	1.00
8.00	9.00	0.00	0.00	0.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL ABUNDANCE - CLEARCUT PLOTS

C1.D88	C2.D88	C3.D88	C4.D88	C5.D88
2.00	3.00	4.00	4.00	3.00
2.00	2.00	5.00	2.00	5.00
3.00	2.00	4.00	8.00	1.00

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL ABUNDANCE - SHRUBFIELD PLOTS

S1.D88	S2.D88	S3.D88	S4.D88
7.00	1.00	1.00	6.00
11.00	0.00	5.00	4.00
15.00	0.00	3.00	9.00

Table 6.4.4. Continued.

RAW DATA PRINTOUT 11-02-1988 R.W.THOMPSON

SMALL MAMMAL ABUNDANCE - SPRUCE-FIR PLOTS

SF1.D88	SF2.D88	SF3.D88	SF4.D88	SF5.D88
1.00	4.00	2.00	7.00	4.00
2.00	3.00	4.00	5.00	2.00
1.00	3.00	5.00	8.00	2.00

Table 6.4.5. Results of two-level NANOVA test examining differences in transformed small mammal abundance data between and within Montana Project development area habitats. Habitat (group) and plot (subgroup) statistics are provided below.

11-02-1988

TWO-LEVEL NESTED ANALYSIS OF VARIANCE NANOVA2. R.W.THOMPSON

CABINET MOUNTAINS, MT - SMALL MAMMAL RELATIVE ABUNDANCE - SIX HABITATS

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	2.589996	5	.5179993	.3705475	10.01266 %
AMONG SUBGROUPS	27.95859	20	1.397929	6.384506	57.78961 %
WITHIN GROUPS (ERROR)	11.38574	52	.2189566		32.19773 %
TOTAL	41.93433	77			

SQUARE ROOT TRANSFORMATION

GROUP BREAKDOWNS

GROUP NO.	MEAN	+/- SE	n	CVM(%)
GROUP 1 (R)	1.607752	.1502932	12	9.348036
GROUP 2 (H)	1.628414	.3035532	9	18.64103
GROUP 3 (MC)	1.76964	.2342731	15	13.23846
GROUP 4 (C)	1.914185	.1099441	15	5.743649
GROUP 5 (S)	2.158297	.3027784	12	14.02858
GROUP 6 (SF)	1.948278	.1302599	15	6.685901

SUBGROUP BREAKDOWNS

FILE	MEAN	+/- SE	n	CVM(%)
R1.D88	1.835828	.2546897	3	13.87329
R2.D88	1.558904	.1868393	3	11.9853
R3.D88	1.095014	.3879073	3	35.42487
R4.D88	1.94126	.1800604	3	9.275441
H1.D88	2.619231	.3913401	3	14.94103
H2.D88	.9984508	.291344	3	29.1796
H3.D88	1.26756	.336619	3	26.55645
MC1.D88	2.833685	.2616277	3	9.232772
MC2.D88	2.516245	.2902686	3	11.53579
MC3.D88	1.178511	.4714045	3	40
MC4.D88	1.26756	.3366191	3	26.55646
MC5.D88	1.052199	.172546	3	16.39861
C1.D88	1.677702	9.656371E-02	3	5.755713
C2.D88	1.677702	9.656208E-02	3	5.755615
C3.D88	2.195949	.074632	3	3.398621
C4.D88	2.205979	.3875083	3	17.56628
C5.D88	1.813594	.3247133	3	17.90441
S1.D88	3.355594	.3464022	3	10.32313
S2.D88	.8796528	.172546	3	19.61524
S3.D88	1.813594	.3247133	3	17.90441
S4.D88	2.584346	.2779317	3	10.75443
SF1.D88	1.343543	.1187976	3	8.842114
SF2.D88	1.954326	8.349847E-02	3	4.272495
SF3.D88	2.015889	.2267799	3	11.24962
SF4.D88	2.666432	.1685318	3	6.320498
SF5.D88	1.761199	.1800609	3	10.22376

Table 6.4.6. Results of ANOVA test using transformed small mammal abundance data for Montana Project habitats.

10-27-1988

SINGLE FACTOR ANALYSIS OF VARIANCE ANOVA. R. W. THOMPSON

SMALL MAMMAL RELATIVE ABUNDANCE

SOURCE OF VARIATION	SS	DF	MS	F	VARIANCE COMPONENTS
AMONG GROUPS	2.392578	5	.4785157	.317275	13.68072 %
WITHIN GROUPS	30.16409	20	1.508205		86.31928 %
TOTAL	32.55667	25			

SQUARE ROOT TRANSFORMATION

LEGEND

R	RIPARIAN
H	WESTERN HEMLOCK/CEDAR
MC	MIXED CONIFER
C	CLEARCUT
S	SHRUBFIELD
SF	SPRUCE-FIR
G	GRASSLAND
F	FORBFIELD
LP	LODGEPOLE PINE
RK	ROCK
A	AQUATIC

Habitats represent major existing types as modified from USDA Forest Service et al. (1988)

EXTENSIVE STUDY AREA (49.2 mi^2)

INTENSIVE STUDY AREA (30.8 mi^2)

BREEDING BIRD & SMALL MAMMAL IMPACT AREA (12.1 mi^2)

Breeding bird and small mammal trapping plots

habitat code SF1 plot number

KOOTENAI NATIONAL FOREST

CABINET MOUNTAINS WILDERNESS

NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln & Sanders Counties, Montana

MAP 7.1.

HABITAT TYPES IN THE MONTANA PROJECT WILDLIFE STUDY AREA

N | JAN. 1989 | SCALE 1"= 2000'

prepared by
Western Resource Development Corporation

NORANDA MINERALS CORP.

MONTANA PROJECT
Sanders & Lincoln Counties, Montana

MILLER CREEK TO PLANT SITES
ALTERNATIVE TRANSMISSION LINE

MAP 7.2
WILDLIFE HABITAT TYPES

N | JAN. 1989 | SCALE 1" = 2000'

prepared by
Western Resource Development Corporation

LEGEND

- CF Coniferous Forest
- CC Clearcut
- R Riparian
- SH Shrubland
- TS Talus Slope
- W Wetlands
- D Disturbed
- wa Water

LEGEND

- CF Coniferous Forest
- CC Clearcut
- R Riparian
- SH Shrubland
- W Wetlands
- A Agricultural
- D Disturbed
- I Industrial
- Re Residential
- TS Talus Slope
- wa Water

NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln County, Montana

TOWN OF LIBBY TO PLANT SITES
ALTERNATIVE TRANSMISSION LINE

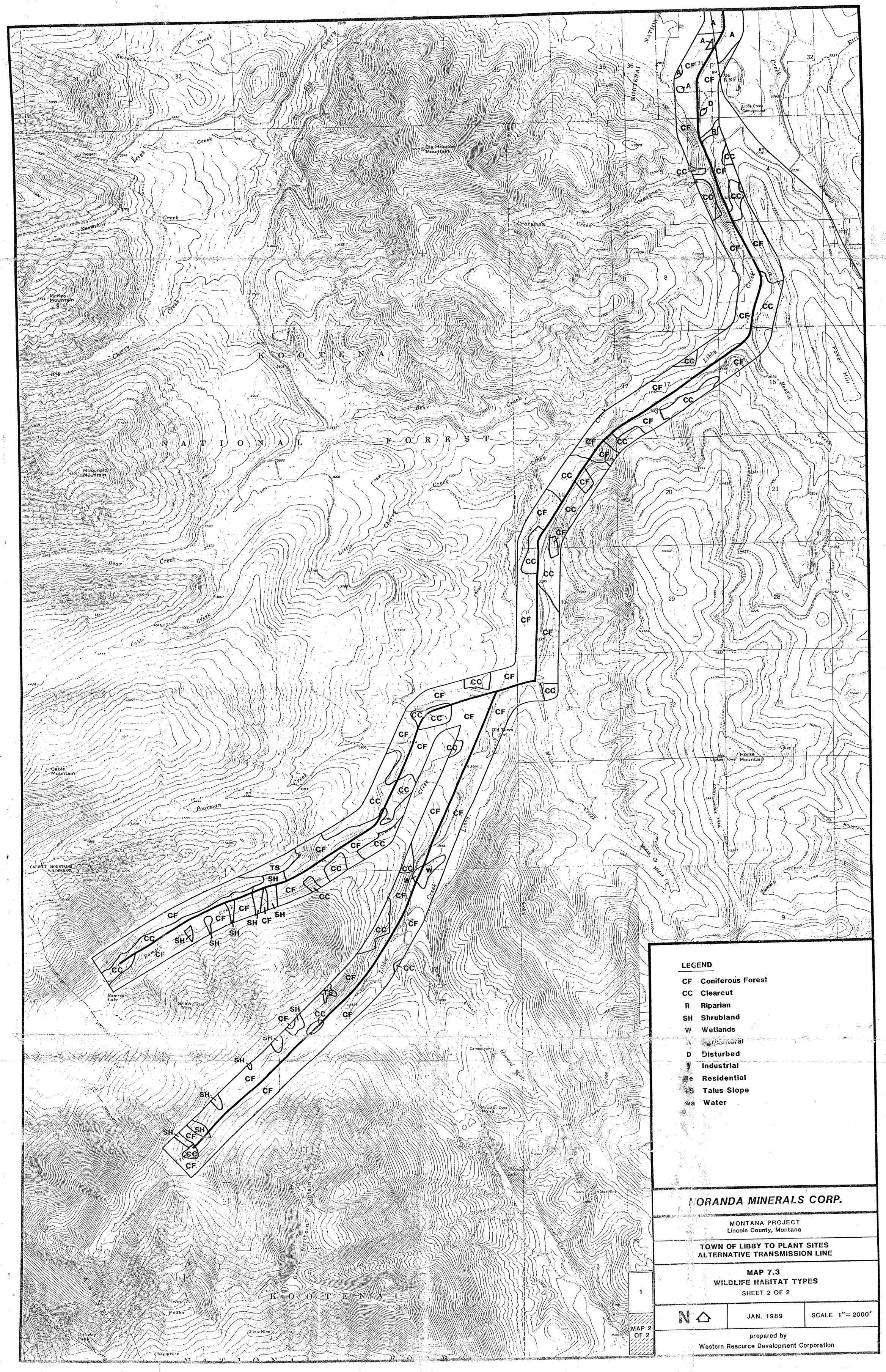
MAP 7.3
WILDLIFE HABITAT TYPES
SHEET 1 OF 2

N | JAN. 1989 | SCALE 1"= 2000'

prepared by
Western Resource Development Corporation

MAP 1 OF 2

2



LEGEND

- CF Coniferous Forest
- CC Clearcut
- R Riparian
- SH Shrubland
- W Wetlands
- A Agricultural
- D Disturbed
- I Industrial
- Re Residential
- TS Talus Slope
- wa Water

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MONTANA PROJECT
Lincoln County, Montana

TOWN OF LIBBY TO PLANT SITES ALTERNATIVE TRANSMISSION LINE

MAP 7.3
WILDLIFE HABITAT TYPES
SHEET 2 OF 2

N | JAN. 1989 | SCALE 1"= 2000'

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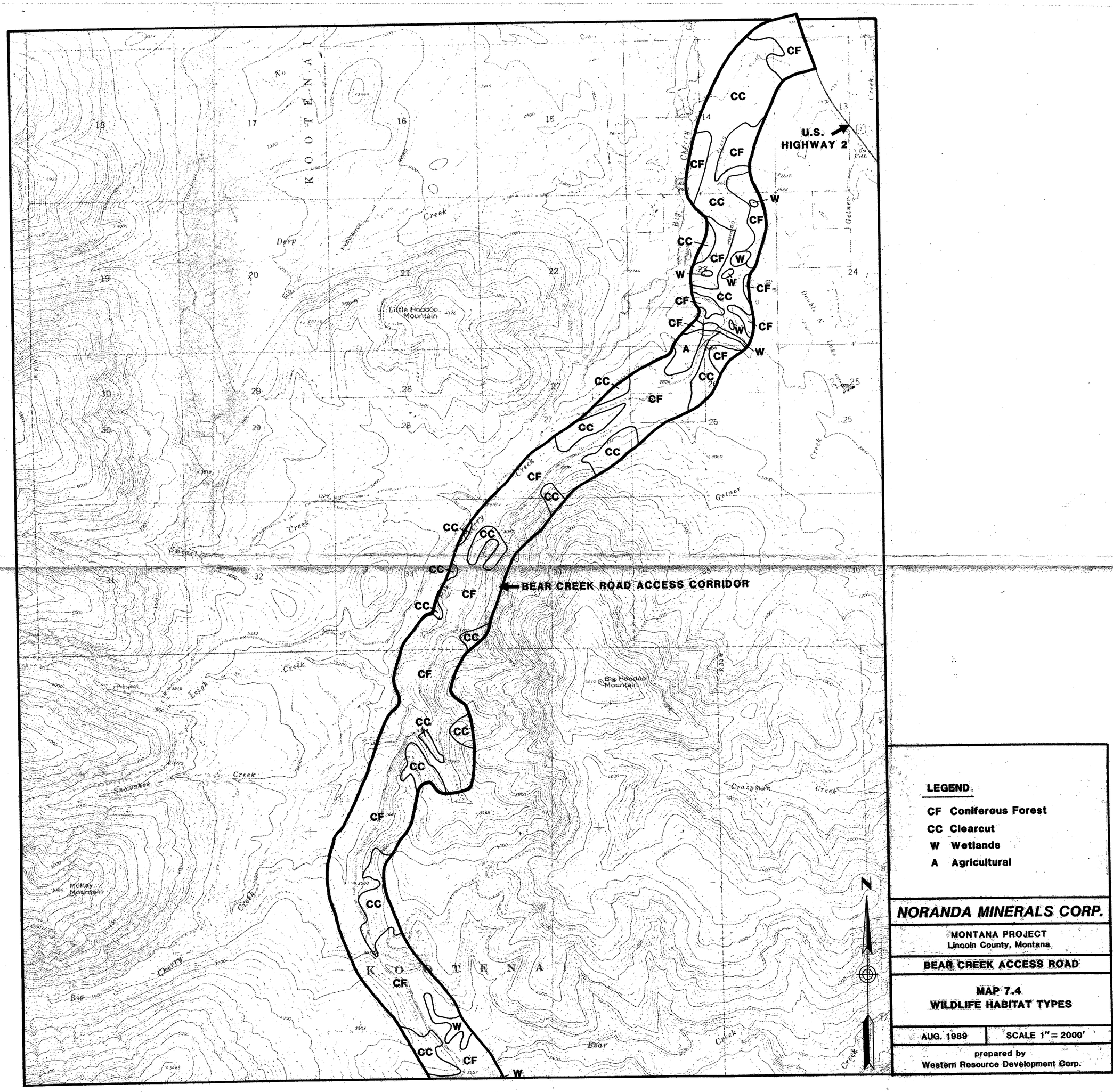
Western Resource Development Corporation



LEGEND

- CF Coniferous Forest
- CC Clearcut
- W Wetlands
- A Agricultural

NORANDA MINERALS CORP.

MONTANA PROJECT
Lincoln County, Montana

BEAR CREEK ACCESS ROAD

MAP 7.4
WILDLIFE HABITAT TYPES

AUG. 1989 | SCALE 1"= 2000'

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