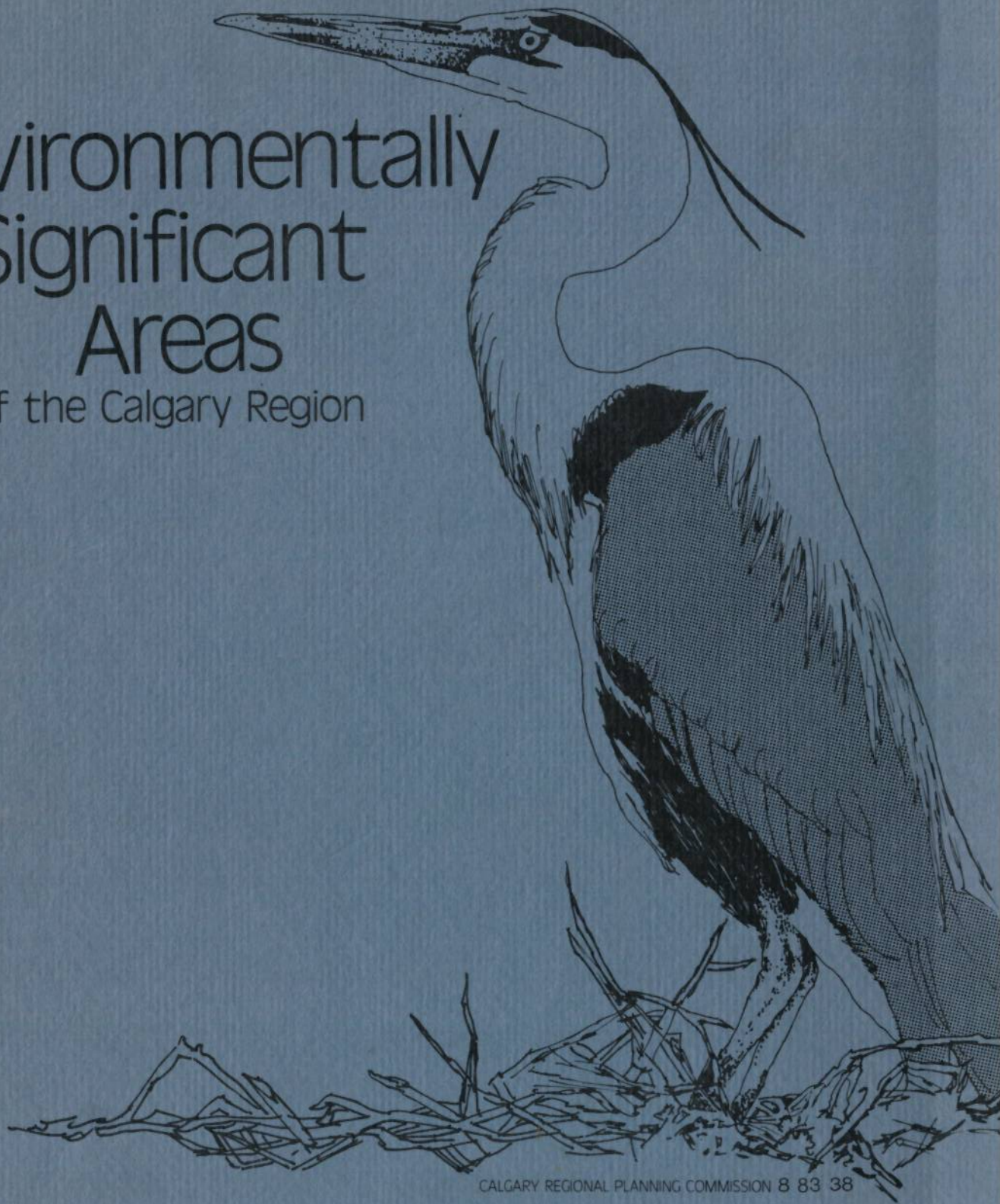


Environmentally
Significant
Areas
of the Calgary Region



ENVIRONMENTALLY SIGNIFICANT AREAS STUDY

Phase Two Report

prepared by

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for
Calgary Regional Planning Commission

This document represents a Background
Technical Report which has not been endorsed
by the Calgary Regional Planning Commission

R.J. Lamoureux & Associates Ltd.
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1.0 INTRODUCTION

R.J. Lamoureux & Associates Ltd. was contracted by the Calgary Regional Planning Commission (CRPC) to undertake a study of Environmentally Significant Areas in the Calgary Region. The broad purpose of the study was to develop an information base that could be used for the development of environmental provisions in the Calgary Regional Plan and for the support of on-going environmental planning efforts within the Region.

A broad definition of Environmentally Significant Areas was used. This definition encompassed not only biophysical (biological and physical) factors, but also paleontological, archaeological and historical ones. Inputs for these additional aspects of the study were provided by Lifeways of Canada Limited.

The study is divided into three phases:

Phase 1 Definition of criteria for identifying Environmentally Significant Areas

Phase 2 Identification of Environmentally Significant Areas and formulation of guidelines for their protection

Phase 3 Analysis of means of incorporating policies for Environmentally Significant Areas into the Regional Plan

This report presents the results of Phase 2 of the study. The Phase 1 results are contained in a report to the Calgary Regional Planning Commission dated April 7, 1983. The results of Phase 3 will be reflected in amendments to the Calgary Regional Plan.

2.0 METHODS

The study was undertaken by a seven-member team comprising a study manager/environmental generalist, an environmental planner, an environmental policy analyst, a surficial geologist, a plant ecologist/ geomorphologist, an archaeologist and an historian. Several specialist advisers were also retained for ad hoc consultations.

The work divided functionally into four areas: biophysical resources, paleontological resources (fossils), archaeological resources and historical resources. The methods for each of these study components are described separately below.

2.1 BIOPHYSICAL RESOURCES

The following four methods of collecting environmental data were used:

- 1) Contacts with knowledgeable persons
- 2) Review of published and unpublished data
- 3) Aerial photo interpretation
- 4) Field reconnaissance.

2.1.1 Contacts with Knowledgeable Persons

A major effort was made to canvas a wide cross-section of individuals with expert knowledge of the Region gained either through professional activities or leisure-time pursuits. These included local naturalists, members of environmental groups, the executive of certain professional associations, government scientists and officials, members of recreation associations, members of fish and wildlife management organizations and university professors. Leaders in municipal

government were also contacted to keep them informed of the nature of the study and to give them the opportunity to identify additional contacts.

A questionnaire package, which contained two maps of the Region at a scale of 1:250,000 for identifying sites (one to be returned; one to be retained by the respondent), questionnaire forms and detailed instructions, was sent to potential respondents. A copy of the questionnaire package is provided in Appendix 1.

The primary purpose of the questionnaire was to obtain data on sites of biophysical importance. However, forms were also provided for respondents to provide incidental data on sites of paleontological, archaeological or historical interest.

A total of 135 questionnaires were sent out. Of these, it was estimated that 95 were sent to persons or groups with a high probability of having detailed knowledge of the region's natural environments.

Twenty-two individuals or groups contributed data to the study as a result of receiving the questionnaire package. Of these, 18 made use of the maps provided, but only six used the questionnaire forms. Seven of the 22 respondents provided data in writing, without using the questionnaire forms, and one respondent provided a combination of written comments and completed forms. As a result of the low response, further personal contact was initiated to increase the level of general input.

It would appear that people with sufficient motivation to make a response were quite willing to use maps as a form of communication, but were reluctant to fill out a detailed questionnaire. This would suggest that future attempts of this nature should incorporate only the maps and a very simple one-page

response form. Follow-up interviews could then be held with those who indicate interest in providing information. During these interviews, a more detailed form could be completed by the interviewer.

Another important conclusion reached from the distribution of the questionnaires is that government officials should be approached only on an individual basis.

It was found that in most cases persons had to be actively sought out to secure their co-operation. A great deal of effort was therefore devoted to interviews with a number of key individuals to obtain data and to encourage them to make formal written submissions.

2.1.2 Published and Unpublished Data

A variety of published and unpublished sources of information were consulted in the course of the study.

Of particular value for the biophysical analysis were the Wildlife Key Area Maps and Fish Resource Maps compiled by the Fish and Wildlife Branch of Alberta Energy and Natural Resources. A number of reports by Alberta Energy and Natural Resources, Alberta Environment, Alberta Recreation and Parks, the Calgary Regional Planning Commission and the City of Calgary Planning Department also provided useful data.

Reports and newsletters issued by groups such as the Calgary Field Naturalists' Society, the Bow River Naturalists and the Alberta Wilderness Association were also reviewed.

A limited number of theses and scholarly publications provided data of relevance to the study. Several standard reference works were also consulted.

2.1.3 Aerial Photo Interpretation

Aerial photos of the Region at a scale of approximately 1:50,000 were evaluated by rapid stereoscopic examination. Only landscape units of potential interest were outlined on the photos; a comprehensive mapping of the region was not attempted. The objective of the photo analysis was to identify those areas that could potentially meet the criteria for environmental significance developed in Phase I of the study.

The airphoto analysis proved to be an invaluable tool both for generating new information and for extrapolating and integrating information originating from other sources.

2.1.4 Field Reconnaissance

A program of field reconnaissance was undertaken to verify sites identified as being of potential biophysical significance. The purpose of this reconnaissance was to confirm the general accuracy of impressions gained from the other sources of site identification. In certain cases the field checks resulted in either an upgrading or downgrading of our initial assessment. Field checks were of a cursory nature and did not involve a formal program of data collection. Site evaluations therefore represent professional judgement based on limited information.

In a few cases, field reconnaissance resulted in the discovery of sites that had not been identified during the office studies. Such occurrences were, however, quite rare.

2.2 PALEONTOLOGICAL RESOURCES

Numerous fossil finds have been made in the Calgary region. Those of regional significance are relatively uncommon. The most important sites are reported in the geological literature which was searched for this study.

2.3 ARCHAEOLOGICAL RESOURCES

A site inventory file is maintained by the Archaeological Survey of Alberta (Alberta Culture). This paper-based file consists of individual site records prepared by archaeologists working in the area. It began with the Glenbow Foundation in 1956, continued with the University of Calgary in 1963, and after passage of the Alberta Historical Resources Act in 1973, became a responsibility of the Archaeological Survey of Alberta. All archaeological work in Alberta is carried out under permit, a requirement of which is the filing of site inventory forms. The data base for the Calgary Region consists of sites which were mainly recorded by student archaeologists working out of the University of Calgary prior to passage of the Act. Regional surveys were undertaken of the site of the proposed Bow-Highwood Reservoir, the Sheep River Valley (Rogers, 1971; Rogers and McIntyre, 1972), the Elbow River Valley east of Pirmez Creek, the Bow River Valley from Calgary to Cochrane and the valley of Jumpingpound Creek. These data provide a relatively complete inventory of those archaeological sites that were visible on the ground or exposed in road and stream cuts. Buried sites were not recorded.

The only other regional study in recent years was undertaken in the Canmore Corridor by Reeves and Malmberg (1977) on behalf of the Calgary Regional Planning Commission. Other archaeological sites recorded are the result of random activity or studies required under the Historical Resources Act. These latter studies have been conducted for highways, powerlines, and pipelines outside of the urban municipalities. The regional data base is extremely variable, and grossly underrepresents areas where river valley oriented inventories have not been carried out. The studies, except for the one in the Canmore Corridor, are all over 10 years in age. Some sites have been radically altered by changing land uses in the intervening time period.

Site files were searched. Those files which appeared to be at least regionally significant were extracted. The abstracted group, originally some 200 sites, were then examined, and those which could be logically grouped as one site complex (for example, a terrace campsite, tipi ring and bison kill -- all geographically associated) were assigned single designations. Sites were tabulated, mapped and compared, and the list further refined. In all, 117 sites were selected, which because of the widely disparate and varying data base, represent only a portion of those of regional significance extant within the Calgary Region.

The information contained on the forms was generally comparable among different observers, as practically all had been completed by Glenbow and University of Calgary personnel. They generally utilized a similar set of criteria in recording and assessing a site's scientific values.

2.4 HISTORICAL RESOURCES

A variety of sources were consulted for the historic site inventory. All municipal offices were contacted by phone to identify the names of citizens involved in local history.

Local history books were consulted. People connected with the various historic book committees were contacted by phone, and as often as time and budget permitted, visited in person. Personal interviews were necessary to update the level of information retrieved from local history books, which were insufficient data sources on their own.

Alberta Culture's Historic Sites Service files in Edmonton were examined, and a discussion held with Brian Melnyk, Inventory Coordinator, as to the Service's methodology in site recording and significance ranking. It was determined that the inventory forms have not yet been ranked by significance or theme, and that they describe a very eclectic collection of structures and sites.

Discussions by phone and in person were also held with Linda LeGeyt of the Calgary office of Historic Sites Services. The Glenbow-Alberta Institute and the Alberta Historical Resources libraries were frequently utilized for their collection of local histories and other related documentary material.

This inventory is preliminary in nature, and does not represent the definitive status of all historic sites in the Calgary Region. Physical examination of all listed sites was impossible, as was visitation of all parts of the region. Thus many significant sites are absent. The inventory does not include historic sites located within towns, or villages, nor those within Calgary city limits. The enumeration and evaluation of these sites was beyond the limits of this present project. Data on some of these sites can be obtained from the Alberta Historic Sites Service, which has carried out inventories in Cochrane, Okotoks and High River.

2.5 GUIDE TO THE SITE NUMBERING SYSTEM

A four to five digit numerical coding system was used to identify sites mapped in the study.

The first number of the code indicates the geographical location of the site, as follows:

1. Improvement District #8
2. M.D. of Rocky View
3. City of Calgary
4. M.D. of Foothills
5. County of Wheatland

The second number of the code indicates the nature of the resource under consideration, as follows:

1. Biological
2. Paleontological (Fossil)
3. Archaeological
4. Historical

The final two to three numbers are simply the sequential site numbers within a given geographical area/resource category.

A few examples are provided below to illustrate the use of the system:

Example A: Site #11124 is the 124th biophysical site in I.D. #8.

Example B: Site #5202 is the second paleontological site in the County of Wheatland.

Example C: Site #4321 is the 21st archaeological site in the M.D. of Foothills.

Example D: Site #2411 is the eleventh historical site in the M.D. of Rocky View.

3.0 REGIONAL OVERVIEW

The Calgary Planning Region comprises some 17,000 square kilometres of diverse landscape in southwestern Alberta. It includes five large political entities: Improvement District #8, the Municipal District of Rocky View, the City of Calgary, the Municipal District of Foothills and the County of Wheatland. In addition, it contains 22 small urban municipalities which are politically independent of the large rural municipalities. For the sake of convenience we have divided the Region into five parts, whose boundaries coincide with those of the five major political units. Each urban municipality is treated as being a part of the rural municipality that surrounds it, although it is recognized that this does not represent the true political situation. Data for each urban centre is included under the appropriate rural municipality for ease of organization.

A brief account of the physical, biological, paleontological, archaeological and historical attributes of the Calgary Region is provided in this section to give the necessary orientation for the more detailed discussions that follow.

3.1 PHYSICAL LANDSCAPE

The Calgary Region can be divided into three broad physiographic units:

- 1) Alberta Plains
- 2) Rocky Mountain Foothills
- 3) Rocky Mountains

The part of the Region within the Alberta Plains is underlain by flat-lying bedrock of Tertiary (1-65 million years old) and Cretaceous (65-136 million years old) age. The younger Tertiary rocks underlie the western part of the unit (including the City of

Calgary), whereas the older Cretaceous sediments underlie the eastern part. In many areas erosion of the more recent and thus higher-lying Tertiary land surface has resulted in the creation of substantial hills, such as Nose Hill in north Calgary and Big Hill east of Cochrane. These large hills are distinguished from foothills by their relatively flat-lying bedrock strata.

The Rocky Mountain Foothills unit consists of folded and faulted Cretaceous sandstones and shales deformed during the formation of the Rocky Mountains. The softer shales have been eroded, leaving a series of resistant sandstone ridges that trend in a northwest-southeast direction.

The Rocky Mountains were formed more than 50 million years ago during a period of very violent crustal deformation in which major folding and thrust faulting of rock strata occurred. Within the Calgary Region huge blocks of Cambrian (500-600 million years old), Devonian (345-407 million years old), and Mississippian (317-345 million years old) sedimentary rock were thrust like layers of shingles over the younger Cretaceous sediments, resulting in the rugged peaks of the Front Ranges. The eastern limit of this overthrusting, known as the McConnell Fault, is dramatically exposed in the sheer rock face of Mt. Laurie west of Calgary.

The ranges of mountains in I.D. #8 consist mainly of limestones and dolomites, although sandstones and shales are locally exposed. The calcareous nature of much of the rock results in very rapid drainage and generally inhospitable conditions for vegetation.

The general pattern of the landscape has been modified by the process of glaciation. The last glacial advance in Alberta occurred more than 31,000 years ago and lasted about 20,000 years. Glaciers originating in the mountains coalesced with a continental ice sheet in the vicinity of the boundary between the foothills and the plains. As the continental glacier retreated it impounded meltwater, creating large pro-glacial lakes. Water from these lakes overflowed into

adjacent drainages eroding major north-south trending valleys. These meltwater channels or coulees are now prominent topographic features of the Region.

Generally speaking the advance and retreat of the glaciers caused only superficial modifications of the pre-glacial landscape. Some softening of the contours of landscape took place where glaciers removed material from topographic highs and filled depressions. Fine sediments were deposited in pro-glacial lakes, creating glacio-lacustrine plains, which may still contain waterbodies to this day. In locations where the glaciers stagnated and melted in place, extensive deposits of glacial debris, or hummocky moraine, were deposited. These areas, which are often dotted with small pothole lakes, are generally unsuitable for cultivation and are typically locations of residual natural landscapes.

The mountain glaciers flowed out to the plains via the Bow River Valley. The advance of these glaciers molded a series of streamlined hills or drumlins in the vicinity of the Stoney Indian Reserve. As the glaciers retreated, there was extensive deposition of sand and gravel in the form of outwash, kames and eskers. Large terraces of glaciofluvial deposits occur within the Bow River Valley throughout the Calgary Region. These deposits are extensively mined for sand and gravel.

The Region lies within the Bow, Red Deer and Oldman River Basins. Drainage systems are generally well-developed, particularly in the mountains, foothills and high plains, where there are few lakes. Lakes are more prevalent in the eastern part of the region, particularly in areas of glacio-lacustrine and hummocky moraine deposits. Lakes in this area are shallow and susceptible to water loss in dry years. Even large lakes may become totally dry.

The Bow River is the largest river in the Region, and its valley is a significant physical feature of the Region. The Highwood and the Sheep are the most important tributaries of the Bow, followed by the Ghost and Elbow Rivers and Jumpingpound Creek.

The Red Deer River drains the northwestern and northeastern parts of the Region. The tributaries of the Red Deer in the northwestern part of the region are small, cold foothills streams whose pattern is largely controlled by the alignment of bedrock features. The tributaries of the Red Deer in the northeastern part of the Region are generally small, intermittent prairie streams. In this part of the Region the only tributaries of any consequence are the Rosebud River and its tributary, Serviceberry Creek, which occupy impressively large valleys at their lower ends.

The Red Deer River forms the eastern boundary of the Region for a few kilometres. This section of the Red Deer River Valley is characterized by badland topography, as is a large section of the river valley both upstream and downstream of this stretch.

The southeast corner of the M.D. of Foothills is drained by the Little Bow River and Mosquito Creek, two relatively insignificant tributaries of the Oldman River.

3.2 VEGETATION

The position of the Region adjacent to high mountain ranges has a profound influence on climate, which in turn has a major effect on the distribution of vegetation.

The Region lies within the rain shadow of the mountains and for the most part possesses a dry continental climate. Annual precipitation typically varies between 40 and 50 cm, about two thirds of which falls in rain. Mountainous areas receive more annual precipitation than this; moreover, more precipitation falls as snow than as rain. The amount of precipitation decreases from west to east, whereas summer temperatures tend to increase significantly. As a result there is a gradual natural transition from forest to parkland to grassland.

The highest peaks of the mountains are above the limit of forest growth. This zone is commonly referred to as the Alpine. The lower Alpine is vegetated by shrub communities of willow and dwarf birch

with islands of stunted and deformed Alpine Fir, Engelmann Spruce, Whitebark Pine and Alpine Larch. The middle Alpine is characterized by relatively continuous heather and snowbed communities, while the upper Alpine has a sparse lichen stonefield type of vegetation.

The Subalpine zone occupies the middle slopes of the major mountain ranges. Here precipitation, in particular snowfall, is much higher than in other parts of the Region. This zone is characterized by a climax vegetation of Engelmann Spruce and Subalpine Fir. However, at lower elevations there are extensive stands of fire-maintained Lodgepole Pine. Natural grasslands are scattered throughout the Subalpine, particularly on steep south-facing slopes.

The warm, dry, winter chinook winds that funnel down the mountain valleys of the Bow and Highwood Rivers have created a unique and relatively restricted environment known as the Montane. Montane environments are characterized by fescue-oat grasslands; open woodlands dominated by Douglas Fir; forests of Douglas Fir, Lodgepole Pine, White Spruce and Trembling Aspen; and open stands of Limber Pine on dry exposed ridges.

Forests dominated by Lodgepole Pine, but also containing Trembling Aspen, Balsam Poplar and White Spruce cover much of the Foothills region.

The outer foothills and high plains is a zone of transition between forest and grassland, known as Parkland. In this environment groves of Trembling Aspen, Balsam Poplar and willow are interspersed within a matrix of fescue grassland. The grove component of Parkland environments north of the Bow River tend to be dominated by Aspen and Balsam Poplar. South of the river, willow becomes a very significant and often the dominant component of the Parkland vegetation, and Balsam Poplar becomes much less significant.

As rainfall diminishes and summer temperatures increase toward the east, the Parkland environment gives way to the Grasslands of the

interior plains. There seems to be considerable disagreement as to the natural subdivisions within this grassland environment. However, grasslands adjacent to the parkland areas have a major component of Northern Fescue whereas the short grass, Blue Grama, becomes a progressively more important component of the vegetation as the climate becomes progressively drier towards the east.

Major river valleys, such as the Bow, the Red Deer and the Rosebud, extend forest elements into the grassland portion of the region. Significant forest development of Balsam Poplar occurs on floodplains and even coniferous species such as White Spruce may colonize cold, damp, north-facing slopes.

The isolated remnant landscape of the Wintering Hills also provides a refugium for forest species within a grassland-dominated environment.

The Region contains a number of rare plant species. Although the scope of the study did not permit identification of sites on the basis of detailed inventories of plants, future sites may be identified on the basis of the occurrence of one or more rare plant species. Known rare and endangered plant species found within the Region are listed in Appendix 2.

3.3 WILDLIFE

The Calgary Region contains a great abundance and diversity of wildlife.

The Region is one of the best areas in North America for large ungulates. A total of six species occur: Bighorn Sheep, Mountain Goat, American Elk, Moose, Mule Deer and White-tailed Deer. Mule Deer and White-tailed Deer are common throughout much of the Region, whereas the other species are confined mainly to the mountains and/or foothills.

Large predators include Grizzly Bear, Black Bear and Coyote.

Beavers and Porcupines are common within the forested and parkland areas. Badgers and Richardson's Ground Squirrels are characteristic of the parkland and grassland areas. The latter are extremely abundant and are of critical importance to both mammalian and avian predators.

The Region has an exceptional diversity of bird life. Some 309 of the 329 birds known to the province have been sighted within an 80-kilometre radius of downtown Calgary. These include 182 nesting species.

The Calgary Region contains exceptionally good habitat for raptorial birds. All of the 18 species known to occur in Alberta have been sighted within the Region; 12 of these definitely nest there.

The eastern part of the Region also contains excellent habitat for breeding and migrating waterbirds. Every species of loon, grebe, swan, goose and duck described in "The Birds of Alberta" (Salt and Salt, 1976), as well as most species of shorebird, have been sighted within the Region.

The Region also has a major colony of threatened Double-crested Cormorants as well as eight colonies of Great Blue Herons.

3.4 FISH

Most of the more important streams of the Region are cold-water streams originating in the mountains and foothills. Depending on their characteristics, these may contain Mountain Whitefish, Rainbow Trout, Brown Trout, Dolly Varden (Bull Trout), Cutthroat Trout or Eastern Brook Trout. Mountain Whitefish are the most abundant species, but Rainbow Trout are the most sought after.

The Bow River, from the Glenmore Trail Bridge in Calgary to the western boundary of the Blackfoot Indian Reserve, is one of the finest

trout streams in North America. The river is particularly well-known for its very large Rainbow Trout, but it also provides excellent angling for Mountain Whitefish and Brown Trout. The Rainbow Trout of the Bow depend on the streams of the Highwood River Basin for spawning, and maintenance of the water quality of these systems is critical for the long-term survival of the Bow River fishery.

The small streams draining the grassland portions of the Region are too warm and intermittent to support a good fishery.

The Region has few lakes important to fish. The Ghost Reservoir on the Bow River and Glenmore Reservoir on the Elbow River are the most important lakes for cold water salmonids. The Ghost and Bearspaw Reservoirs are the only lakes in the Region containing Lake Trout. Eagle Lake, in the eastern part of the Region, supports a fishery for Walleye and Northern Pike, while Namaka Lake, just downstream of Eagle Lake, contains Northern Pike and Lake Whitefish. Chestermere Lake also contains Northern Pike.

3.5 THE FOSSIL RECORD

Fossils in the Calgary Region consist of the remains of plants and animals dating from more than 120,000,000 to less than 10,000 years ago. In the limestone formations of the Front Ranges of the Rocky Mountains, occur shells, corals and other marine fossils of Paleozoic and more recent age. In the Foothills and Plains to the east, are fresh water and marine fossils of Late Cretaceous age (about 60,000,000 years old). Scattered dinosaur fossils occur in some of these beds. No known major dinosaur collecting locals occur within the Region. Rare fossils of small mammals occur in the Paskapoo Formation of the more recent Tertiary Period.

The most recent fossils date to the Ice Age and more recent times. Mammoth, horse, camel and bison, which occur in gravel terrace fills along the river valleys; they date as recently as 10,000 years ago. More recent fossils consist of bone beds, "natural traps" in springs and wetlands where various mammals died.

3.6 PRE-EUROPEAN CONTACT HISTORY

The Calgary Region encompasses the Alberta High Plains, Foothills and Front Ranges of the Rocky Mountains. The mild winter climate made it a favored wintering range for Plains and Mountain Bison. This, in turn, made it an attractive overwintering area for the human inhabitants of the area, in most recent times represented by the Peigan on the plains and the Kootenay in the mountains. Prehistoric sites, some dating back 12,000 years in age, are very common, reflecting the significance of the Region as a wintering locale. Campsites situated on terraces in sheltered stream valleys, as well as on the prairie level, are very common. Some contain stone tipi rings, used to hold down the tipi. Bison kills, including "pounds" where the animals were trapped in a corral, and jumps where they were run off a cliff, occur fairly frequently. The CRPC region has one of the highest densities of bison kill sites in Alberta. Rare ceremonial/religious sites, stone "medicine wheels", cairns, and other features of stone also occur, as do pictographs (Paintings on rockwalls).

Sites are not uniformly distributed over the landscape. Most occur in certain locales, generally where tributary streams join the main valley, for example the Bow-Highwood-Sheep and Bow-Jumpingpound junctions. Highland areas characterized by diverse terrain (e.g. the Wintering Hills) also contain a significantly large number of sites.

The Calgary Region straddles the "Ice Free Corridor" of the Eastern Slopes, a route along which man may first have migrated into the new world some 30,000 or more years ago. Evidence of these Early peoples may someday be found in deeply buried sites covered by later glacial ice or lakes. The first recognized people are those known as "Clovis" who, armed with spears, hunted mammoths and other large animals during the closing centuries of the last Ice Age. Surface finds of their distinctive spear points occur in a number of locales. Following Clovis were a series of spear hunting cultures. One known as Cody existed some 8500-7500 years ago. They were the first highly specialized bison hunters, who occupied the lands during a time when

the climate was drier than today. At that time grasslands were very extensive and bison herds large. A sudden climatic reversal occurred around 8500 years ago. The Cody culture disappeared because of excessive specialization. An older culture present in the mountains replaced them.

Around 7500 years ago the climate again became drier. A new bison hunting culture known as Mummy Cave appeared; this culture was characterized by the use of the throwing spear. The Mummy Cave culture existed in both the plains and mountains until 5000 years ago, when the climate again changed.

The Mummy Cave culture underwent considerable transformation as new peoples, known as McKean, spread out from the Colorado Rockies, occupying the plains, but not the mountains where the older Mummy Cave culture persisted.

Cultures continued to change through time. Around A.D. 100 the bow and arrow appears, associated with a culture known as Avonlea. This group obtained the weapon from people in the interior of B.C. Pottery from the east also appears at this time. The Avonlea, which gave rise to the cultures of the Kootenay and Peigan, produced superb bison hunters and technologists, and some of the best stone work in 8000 years of human settlement. Around 1000 years ago their culture changed to that characterizing the prehistoric Peigan and Kootenay. The other two historic native tribes, the Sarcee and Stony, are recent immigrants into the Calgary Region, arriving in the early 1800's.

3.7 POST-EUROPEAN CONTACT HISTORY

Following is a brief summary of the history of the Calgary Region in post-contact times. It is structured to present only the most important themes and events at this time, to place the historic resource inventory and significance ranking in perspective.

3.7.1 Fur Trade and Exploration

Although not a vitally productive area for the western fur trade, the plains region was to be absorbed into the control of more rapacious commercial enterprises, such as the gold explorations, the Whiskey trade and the Fort Benton merchant interests. This period of Alberta's history witnessed the destruction of many vital native social structures as a result of the whiskey trade and intergroup rivalries, and the near-complete extinction of the once vast bison herds.

Confederation in 1867 and the desire to connect the Crown colonies of the Pacific coast with Upper and Lower Canada necessitated a revised attitude towards the vast Northwest, which had, during earlier scientific expeditions, been described as a dry, infertile area, not suitable for settlement. Its potential for natural resource development to supply the markets of eastern Canada was tremendous. In 1872, the Dominion Land Act was passed, granting free homesteads to heads of households in return for breaking and seeding the land, and erecting buildings within a specified period of time. Immigration policies were also adopted to encourage the large scale influx of foreign settlers to take up blocks of prairie lands.

The transcontinental railway, a major undertaking of the early 1880's, brought a new focus to the undeveloped lands of the Northwest. The railway required settlement and industry to create western markets with transportation needs. Consequently, the Canadian Pacific Railway played an active role in the colonization of southern Alberta.

3.7.2 The Ranching Frontier

In the 25 years before farming became the mainstay of the early Alberta economy, the foothills and short grass plains were the domain of the great ranches, which played a unique and significant role in the development and settlement of the Canadian west.

In 1881, the government passed an order-in-council which made it possible for one man or company to lease up to 100,000 acres at one cent per acre per year. This enabled the foundation of the famed bonanza ranches, many of which were situated within the Calgary Region. The Cochrane Ranche was the first large-scale ranching entity. Other well-known big ranches such as the North West Cattle Company's Bar U Ranch, and the Quorn, Oxley and Walrond ranches were also quickly established. By 1904, the attitude of the Canadian Government toward the west began to change. In seeking to fulfill its vision of a settled, industrialized west, it encouraged the taking up of lands for farming purposes. Farming, fencing and railway branch line construction were in direct conflict with the open range procedures used by the large ranches, and a bitter struggle to preserve cattlemen's interests ensued. The severe winter of 1906-7, in which thousands of head of cattle were lost, can be seen as the death blow to the era of big ranches in Alberta. The open range was abandoned in favour of isolated semi-arid areas, and mixed farming was dropped in favour of cash grain farming (Evans, 1976).

3.7.3 Agriculture, Industrialization and Urbanization

By the conclusion of the large ranch era, the major population centers in southern Alberta had been established, with Calgary a major trade and service center. West of Calgary the foothills remained a ranching area, but north, east and south of

Calgary, lands were quickly taken up by homesteaders for farming purposes, encouraged by the construction of branch lines by the C.P.R. and Canadian Northern Railways. Large colonization companies, such as the Military Colonization Company and the Canadian Coal and Colonization Company were established, and formed such famed ranches as the M.C.C. Ranch and "76" Ranch. An important incentive to attract settlers to the drier short-grass prairies was the promise of irrigation, in which the C.P.R. became extremely active as part of its colonization plans. The Western and Eastern Sections of the CPR's Irrigation Districts were developed in 1910 and 1914 respectively, and eventually turned over to the farmers to operate.

Although many of the workings associated with these early irrigation systems, such as the syphons and headworks, are now gone, some structures such as the Bassano Dam, Bow River Headworks and Brooks Aqueduct still remain.

Settlement and farming were accompanied by the vital resource exploitation industries, such as coal mining, lumbering, quarrying, oil and gas. The Turner Valley oil and gas fields, which lie within the Calgary Region, were of international renown in their time.

For the last eighty years, resource development has been a significant historic theme in the Calgary Region, as has the continued urbanization of the population of the Region. The economic base for the Region was established in 1920, and in many ways has little changed.

3.8 CURRENT LAND USE AND OWNERSHIP

The main land uses in the Calgary Region are agriculture and urban. There are over 1.9 million acres of Canada Land Inventory class 1, 2 and 3 land (Calgary Regional Planning Commission, 1983a). The

largest percentage is in Rocky View with 739,997 acres followed by Wheatland with 710,363 acres, and Foothills with 518,178 acres. The north-central, east and south-central parts of the Region have the greatest amount of land under tillage. The area to the west of this is used predominantly for grazing, forestry, recreation and conservation. Cultivation in the eastern part of the Region is facilitated by an extensive network of irrigation canals.

The main urban centres are located near rivers. Most of the towns in the region are service centres for the predominantly agricultural land use of the region. The City of Calgary exerts a significant influence on both urban and rural land use in the area surrounding it, acting as a work place for people commuting to satellite communities or country residences. There are some 3,500 20-acre lots in the Region, and many more smaller parcels.

Other land uses in the Region are associated with non-renewable resource exploration and development. The extraction of granular material, limestone and shale still occurs. Coal mining and sandstone quarrying were prevalent activities in the past. Petroleum related activities are concentrated in the Turner Valley, Okotoks, Crossfield, Lochend Lake, Jumpingpound Creek, Wildcat Hills and Morley areas.

The majority of the land in the Calgary Region, especially within cultivated areas, is privately owned. In the M.D. of Rocky View north of Highway 1, only 5 sections of land are in provincial Crown ownership. The County of Wheatland contains no provincial Crown land. In the M.D. of Foothills, east of Highway 2, only 10 sections are provincial Crown land.

Most of the region's provincial Crown land is in I.D. #8 (85% Crown land), and in the western part of the M.D. of Foothills bordering the Forest Reserve.

The Stoney, Sarcee, Blackfoot and Eden Valley Indian reserves
comprise a significant portion of the Region.

An interesting aspect of land ownership in the Calgary region is the
size of some of the tracts of privately owned land. These may be as
large as 25 sections.

4.0 CRITERIA FOR ENVIRONMENTALLY SIGNIFICANT AREAS

During Phase 1 of the study, formal criteria were established for identifying sites of biophysical, paleontological, archaeological and historical significance. These are discussed in a report to the Calgary Regional Planning Commission by R.J. Lamoureux and Associates, dated April 7, 1983. During the course of data analysis it was found that some adjustment of these criteria was desirable.

The initial criteria and any subsequent modifications of approach are discussed below according to the four functional components of the study.

4.1 BIOPHYSICAL CRITERIA

Through comparative analysis of a variety of criteria for environmental significance established by international agencies, provincial governments and regional governments, the following list of significance criteria was established for the Calgary Region:

- (1) The area is an excellent representation of one or more ecosystems that characterize the natural zone.
- (2) The area possesses one or more individual features (landforms, geological features, vegetation types, geological or biological processes, water bodies, fish, wildlife, invertebrates) that are excellent representations of features of the natural zone.
- (3) The area contains a remnant ecosystem or an ecosystem that is rare or unusual in the context of the natural zone.
- (4) The area possesses one or more individual features (landforms, geological features, vegetation types, geological or biological processes, water bodies, fish, wildlife, invertebrates) that are rare or unusual in the context of the natural zone.

- (5) The area has a diversity of features that is exceptional for the natural zone.
- (6) The character (e.g. vigour and/or abundance) of one or more important plant or animal species is exceptional for the natural zone.
- (7) The area is critical habitat for a fish or wildlife population of recognized importance in the natural zone.
- (8) The area links habitat critical for the maintenance of a fish or wildlife population of recognized importance in the natural zone; disruption of the links would result in the isolation of pockets of habitat and would thus degrade the overall value of the habitat.
- (9) The area provides water to another ecosystem of recognized importance. Changes in the quantity or quality of water flowing from the area could cause significant changes to the other ecosystem.

The degree of significance (regional, provincial, national, international) would depend upon whether the site was notable within the context of a system of natural zonation appropriate in scale for classifying the environments of the region, the province, the nation or the earth.

Upon analyzing the available data for the Region, we found that three criteria that were initially rejected as primary measures of environmental significance were more important than originally conceived.

It was thought that the size of an area would not be a major determinant in the evaluation of its significance. The protection of large natural areas, if they existed, was thought to be the domain of the provincial government. The data analysis phase, however, revealed the presence of very substantial tracts of semi-natural

environment. In comparing large and small tracts of similar type, it was at least intuitively clear that the large tracts possessed qualities that were not duplicated in a smaller tract. Moreover, it was also clear that the province was unlikely to take steps to conserve many of the regionally significant large tracts of land. It was determined that conservation of these regional significant lands could only be achieved by the action of municipal governments working co-operatively in a regional planning context.

Related to the size of residual natural landscapes was the question of the importance of relative freedom of disturbance. When few areas of semi-natural environment exist, the identification of environmentally significant areas should not be overly influenced by existing levels of disturbance. However, in the case of areas like the Calgary Region, where semi-natural tracts of landscape extend over several thousand square kilometres, the level of existing disturbance does become a factor in differentiating sites.

Although aesthetic factors should not normally be primary determinants in the selection of Environmentally Significant Areas, there is no question that they do influence the choice of sites to some extent. Generally speaking, we have dealt with aesthetics as a reinforcing rather than a primary site selection factor. The only major exception, which we believe to be appropriate, is the identification, as environmentally significant areas, of topographic high points which afford unique 360° perspectives of vast areas of the Region.

4.2 PALEONTOLOGICAL CRITERIA

The criteria for evaluating the significance of archaeological sites were:

- (1) Rarity or uniqueness
- (2) Representativeness
- (3) Preservation or completeness of remains
- (4) Concentration of remains

The significance of a site is also influenced by whether the remains are in primary or secondary context. Sites in primary context are the actual sites where the animal died and are of much greater significance than sites in secondary context, where the animals remains were moved after death and deposited in another locale.

Complete or near complete skeletons of any age (except most of the bison skeletons of the last 10,000 years) are occurrences of provincial significance. Partial remains of rare species are also of provincial significance.

The locale where a fossil was first described (the type section) is of provincial significance, but other good collecting locales for fossils of the same type may be of only regional significance.

4.3 ARCHAEOLOGICAL CRITERIA

The criteria for evaluating the significance of archaeological sites were:

- (1) Scientific value
- (2) Rareness or uniqueness

Scientific values relate to the kind and quality of information (artifacts, butchered bones, and features) a site contains. This information contributes to the understanding of prehistoric Native peoples' patterns of land use and culture. Although a site must be excavated to assess these values, enough can generally be observed from the surface to determine the site's potential. Sites judged to be of scientific significance include relatively small sites which, because of their age, are worth studying. As one goes back in time,

fewer sites are preserved. Consequently, an older site may contain less information than a recent site of the same type (e.g., a small bison kill), but may be of greater significance because there are so few left.

Some kinds of sites, such as pictographs and medicine wheels, are rare because very few were ever made or used. Although they may not contain a great deal of information, or be in a good state of preservation, they are still significant, as representatives of a rare kind.

In cultivated areas most archaeological sites, including once common sites such as tipi rings, have been lost. In such areas the few remaining sites can have great significance.

4.4 HISTORICAL CRITERIA

A number of systems for evaluating historic resource significance are now in use across Canada. In Alberta, different systems are used by the federal (i.e., Parks Canada) and provincial (Historic Sites Service) governments. Moreover, both Calgary and Edmonton have developed evaluation systems for their own uses.

The Historic Sites Service of the Alberta Government determines a site's qualifications for inclusion as a Provincial or Registered Historic Resource. It uses a numerical ranking system which is heavily weighted towards standing urban structures.

The City of Calgary's "A Handbook for Evaluating Calgary's Heritage Resources" is a flexible system which was a result of a review of procedures used in cities across North America. It is also heavily weighted towards urban environments.

The proliferation of evaluation systems on a project-by-project basis is not desirable, but could not be avoided here because the existing systems do not take into account rural or non-standing structures.

An evaluation checklist specific to this study had to be compiled, utilizing information from the City of Calgary, Historic Sites Service and British Columbia's Guidelines for Heritage Resource impact Assessment. This composite system was suitably amended to incorporate the rural landscape and appropriate historic themes.

Significance ranking of sites requires thorough on-site assessments of all potentially significant sites within the Region, coupled with extensive background research on each site to provide relevant historical context. Any identification of important sites in this study represents a preliminary evaluation of potential significance, based on professional judgement.

5.0 BIOPHYSICALLY SIGNIFICANT AREAS

The biophysically significant areas of the region were mapped according to the following seven major themes:

- 1) Significant natural landscapes;
- 2) Key areas for Bighorn Sheep and Mountain Goats;
- 3) Key areas for Elk and Moose;
- 4) Key areas for Mule Deer and White-tailed Deer;
- 5) Key areas for birds;
- 6) Key areas for fish;
- 7) Actual and proposed parks, natural areas, ecological reserves and wilderness areas.

A composite map showing all areas having some known environmental significance was then prepared, and the areas with the highest priority for environmental protection were identified.

The following pages describe the natural environment of the Calgary Planning Region, according to the individual themes described above. A synthesis and distillation of this information is also provided. Each topic is organized according to political jurisdiction to facilitate use of the report on a geographically selective basis.

5.1 SIGNIFICANT NATURAL LANDSCAPES (Map 1)

Significant natural landscapes include landscapes or landscape features that are remnant, rare, unusual, diverse or of an exceptional character, in a Regional context. A landscape could also be considered significant by virtue of its representativeness. That is, it

incorporates the salient characteristics of a major landscape type in the Region.

5.1.1 Significant Natural Landscapes in I.D. #8

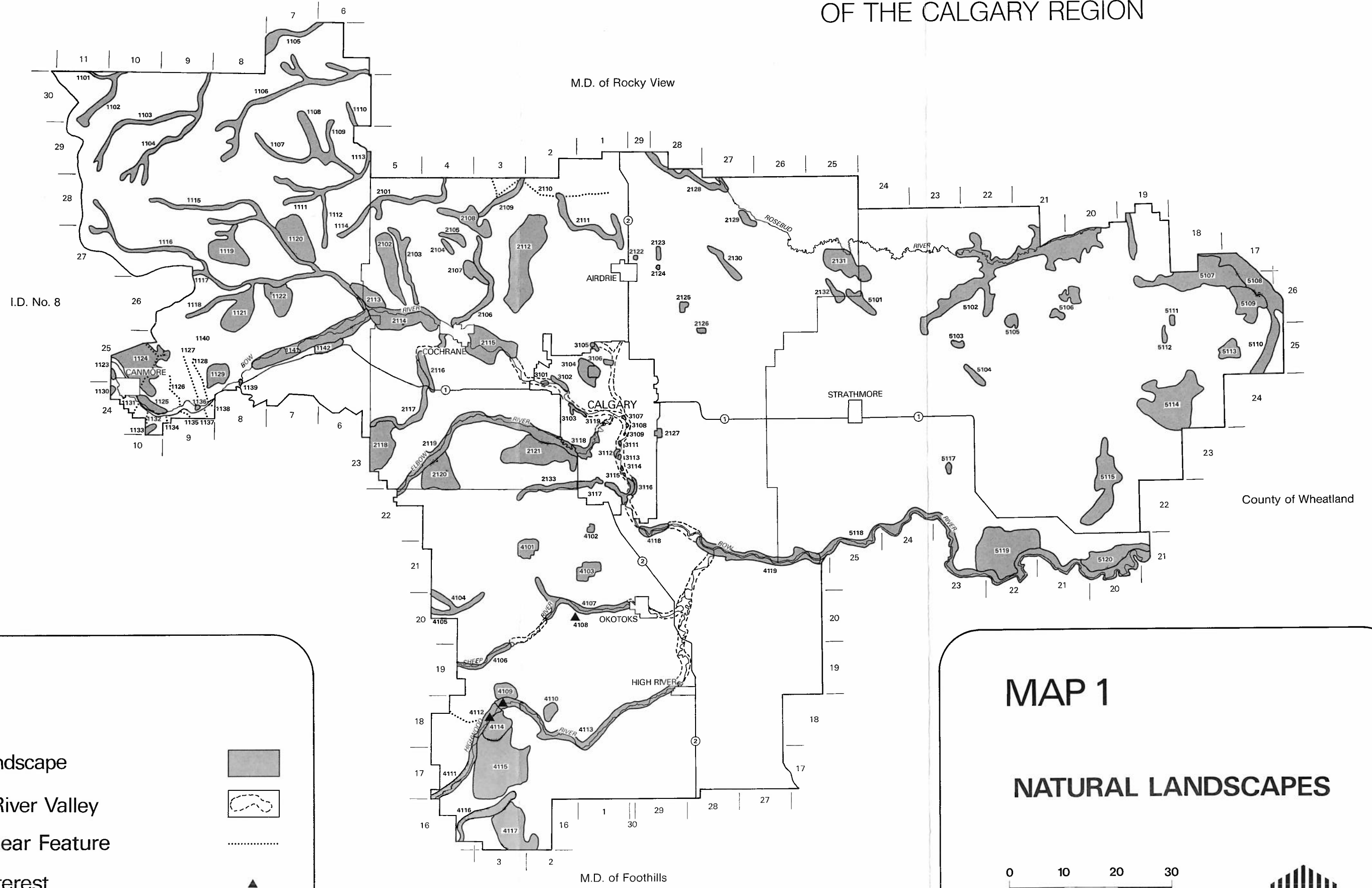
I.D. #8 can be divided into three broad landscape regions:

- 1) An area of forested foothills occupying a major portion of the district;
- 2) An area of mountainous terrain in the western portion of the district;
- 3) The valley of the Bow River.

The foothills portion of the region presents a somewhat repetitive pattern of regular forested hills dissected by a network of small rivers and creeks. The uplands are typically vegetated in nearly pure stands of Lodgepole Pine. The floodplains of the stream valleys typically support a wetland type of vegetation, consisting mainly of willow and sedge. The stream valleys stand out as the major ecologically significant landscapes within this type of environment, as they provide most of the wildlife habitat.

The above pattern is typical of those portions of I.D. #8 draining into the Red Deer River Basin. The more important stream valleys within this portion of I.D. #8 include the Panther River (#1101), Sheep Creek (#1102), North Burnt Timber Creek (#1103), Burnt Timber Creek (#1104), the Red Deer River (#1105), Fallentimber Creek (#1106), Harold Creek (#1107), Grease Creek (#1108), Turnbull Creek (#1109), Silver Creek (#1110), Atkinson Creek (#1111), Salter Creek (#1112), the Little Red Deer River (#1113) and upper Swanson Creek (#1114). Within this system of small streams there is exceptionally good wetland development along Grease Creek (#1108) and along

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION

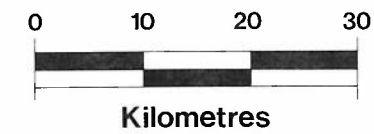


Natural Landscape
Disturbed River Valley
Trail or Linear Feature
Point of Interest



MAP 1

NATURAL LANDSCAPES



The information on this map may be refined by detailed on-site investigations which may result in boundary alterations.

Harold Creek (#1107) in the vicinity of its junction with Grease Creek.

The environment of the Ghost River system, which drains into the Bow River, is markedly different from that of the streams draining into the Red Deer River. The Ghost River (#1116), upstream of its confluence with Waiparous Creek (#1115), is a classic braided mountain stream. Its major tributary, Waiparous Creek, is similar in character upstream of the bridge crossing of the Forestry Trunk Road. The South Ghost River also has a braided gravel floodplain, but typically has little surface flow throughout much of the year. It is often referred to as the Dry Fork.

Associated with the Ghost-Waiparous River system are extensive wetland/grassland areas in the vicinities of Meadow Creek (#1119), Salter Ridge (#1120), Brokenleg Lake (#1121) and Kangienos Lake (#1122).

The Meadow Creek area, in conjunction with the adjacent mountain and foothills environments, is a zone of high ecological diversity. It also offers unimpeded views of the mountains, and thus qualifies as an important aesthetic resource.

The Ghost River Valley provides many spectacular scenic vistas, particularly upstream of its confluence with the South Ghost River. Perhaps the most outstanding area is Devil's Gap (#1117), a narrow mountain pass at the head of Lake Minnewanka.

Efforts at collecting data on significant natural landscapes in mountainous areas were concentrated along the Canmore Corridor, east of the Banff National Park gates, where the greatest potential for conflicts between development pressure and preservation of environmental values exists. The landscapes of the mountainous hinterlands were not included within

the scope of the study. These areas are managed by Alberta Energy and Natural Resources and there is a minimal interface between regional planning and the management of these lands.

Major emphasis was given to environmental features along and adjacent to the Bow River Valley. This zone, which includes the previously mentioned Canmore Corridor, is one which has experienced major impact from mineral extraction, transportation and hydro-electric development. The economic future of much of this area is likely to be oriented toward outdoor recreation. Therefore it is important that the natural character of the area be preserved to the greatest possible extent.

The area directly northwest of the Town of Canmore (#1124) is characterized by a dramatic series of glaciofluvial terraces perched upon adjacent mountain slopes. Cougar Creek, the largest stream in this area, drains a valley system which extends well into the Fairholm Range. It has deposited a large alluvial fan on the floodplain of the Bow River. Lesser drainages in the area have deposited a series of smaller alluvial fans at various locations.

Although the alluvial fans have been impacted by development, the terraces (except at Harvie Heights) remain relatively intact. These terraces, in conjunction with the adjacent mountains and the upstream portion of the Cougar Creek Valley form an excellent natural landscape complex.

The north side of the Bow River Valley from Canmore to Seebe is highly disturbed by limestone quarrying operations and related industrial plants. Along this section, however, there are a number of important trailheads for hiking to Grotto Canyon (#1126), Exshaw Creek Canyon (#1127) and Jura Creek Canyon (#1128).

Between the Village of Kananaskis and the boundary of the Stoney Indian Reserve lies the Yamnuska area (#1129). At Mt. Laurie, the main peak in this area, the McConnel Fault is dramatically exposed. Here, limestone strata of the Cambrian and Devonian periods of geological time have been thrust over younger sediments of the Cretaceous period, marking the boundary of the Front Ranges of the Rocky Mountains. The vertical face of this overthrust formation is more than 300 metres thick and provides one of the most popular rock climbing locales in western Canada. Between the mountains and the Bow River, an outwash complex containing a number of glacial landforms, such as kames and eskers occurs. This area is noted for its diversity of flowering plants. It is very similar to Bow Valley Provincial Park on the opposite side of the Bow River. It has been suggested that the boundaries of Bow Valley Provincial Park eventually be expanded to include the Yamnuska area (Yamnuska Natural Area Study Committee, 1974).

The lands on the south side of the Bow River Valley in the Canmore area have been extensively mined for coal, resulting in large zones of disturbed and reclaimed land. Much of this land is currently being or is proposed to be developed for residential use, although some areas have been found unsuitable because of subsidence problems.

Areas of interest on the south side of the Bow River Valley include the Grassi Lakes area (#1130), Wind Ridge (#1133), and the lower portions of the Three Sisters Creek (#1131), Stewart Creek (#1132), West Wind Valley (#1134), McGillivray Creek (#1135), Heart Creek (#1137) and Jewel Pass (#1138) hiking trails.

The Grassi Lakes (#1130) area lies between Spray Lakes Dam and the Rundle Reservoir and is one of the more compact and interesting natural areas in the Region. Although totally surrounded by man-made structures, (a road, dam, penstock and power

transmission line), the uniqueness of this area has been minimally diminished. The Grassi Lakes, with their transparent blue-green waters are a major feature of interest. Moreover, the limestone formations of the area are riddled with intricate solution caverns. Water flows through the area in an unpredictable way as a result of an extensive network of subterranean channels. The stream flowing through the area vanishes into an underground channel, only to reappear with greatly increased flow.

A spectacular waterfall more than 150 metres high, cascades over a limestone escarpment. This is the only waterfall of any significance in the Region.

Because of the physical diversity of the area, there is an interesting variety of vegetation. Mosses are particularly abundant because of the extent of surface saturation.

The site also has considerable historical significance. It is named after Lawrence Grassi, a pioneer trail blazer in the Rockies. Grassi built much of the trail system through the area and many of his original structures still remain. The site also contains Indian pictographs, although their condition has greatly deteriorated in recent years.

Wind Ridge (#1133) is a high alpine meadow lying to the east of Three Sisters Mountain. It is reported by Dr. V. Geist of the University of Calgary, a world-recognized authority on Bighorn Sheep, to be one of the finest winter ranges for Bighorn Sheep in the Canadian Rockies. It is also somewhat of a local landmark. It lies on privately owned land, and there is concern that development of the property could have an unfavourable impact on overwintering sheep.

The Bow Valley Naturalists have expressed concern that private land development south of the Bow River in the Canmore Corridor also might affect established hiking trails (#1131,

1132, 1134, 1135, 1137, 1138). Concerns relate both to the impact of development on the trails and the question of local access to them.

The immediate floodplain environment of the Canmore has been heavily impacted by urbanization and transportation facilities. Consequently, very little of this environment remains in a natural state.

Upstream of Canmore a small area of relatively undisturbed floodplain environment (#1123) remains on the south bank of the river just outside Banff National Park. Immediately downstream of Canmore, the floodplain of the Bow River (#1125) has a unique multi-channelled configuration. The heavily treed islands between these channels have experienced little disturbance other than the construction of a power transmission line. In addition, the channels are recognized as important trout spawning areas (see Section 5.7).

At the east end of Lac des Arcs (#1136) significant deposits of loess (wind-blown silt) lie atop the Pigeon Creek alluvial fan. The area has been highly man-altered by the development of a residential subdivision and a Provincial campground. However, these developments have not extended to the lake shore, and the unique environment can be viewed from the beaches that lie below the loess banks.

Lac des Arcs itself is scientifically interesting. It was created by the coalescing of two alluvial fans on opposite sides of the river, which created a damming effect. It is now almost totally infilled with river sediments and will eventually resemble Vermillion Lake in Banff. Despite its scientific interest, the lake is heavily impacted by the Canada Cement Plant to the north and the Trans-Canada Highway to the south and special designation does not appear warranted.

In the vicinity of Seebe the Bow Valley Naturalists have identified an area where rare orchids can be found (#1139).

The Bow River Valley through the Stoney Indian Reserve (#1141) has not been impacted by transportation infrastructure and mineral extraction to the same extent as the upstream reaches, although Ghost Reservoir downstream of Morley has altered the nature of that stretch of the river.

Aside from its natural qualities, this reach of the Bow River Valley is important to white water canoeists, as it contains the only remaining stretch of white water on the Bow River downstream of Bow Falls in Banff National Park (Jeff Grutz, Calgary Whitewater Club and Alberta Whitewater Association, personal communication). This stretch extends approximately 4 kilometres downstream of the Horseshoe Falls hydro-electric facility.

Immediately south of the Bow River Valley in the Stoney Indian Reserve, there is a field of drumlins (streamlined hills of till molded by glacial action), reputed to be the largest in Alberta. The best impression of these landforms can be obtained immediately north of the Trans-Canada Highway, east of Morley (#1142). Here, the drumlins are covered with grassland vegetation, clearly revealing their distinctive form. This area is a standard stopping point for geological field trips in the Calgary area.

Old Fort Creek (#1140), which flows across the Stoney Indian Reserve to the Bow River, has incised a spectacularly deep and narrow gorge through relatively flat-lying bedrock. The gorge is of scenic and geological interest and may also contain plants with restricted distribution in the Region. Moreover, the creek rises in the Fairholm Range and provides an alternative natural access route for mountain hiking.

5.1.2 Significant Natural Landscapes in the M.D. of Rocky View

The M.D. of Rocky View differs from I.D. #8 in that it is largely devoted to agricultural land use. However, the western part of the district is transitional with the environment of I.D. #8 and there remain substantial areas of natural and semi-natural landscape.

Dogpound Creek (#2101) is a foothills stream, characteristic of the type of Red Deer River tributary found in I.D. #8.

The Wildcat Hills (#2102) are the first large range of true foothills encountered by an observer travelling west on Highway 1A. The hills are of interest because of the great diversity in vegetation occurring over a short distance. At the south end, grassland and open parkland areas occur. Here, individuals of White Spruce and Lodgepole Pine frequently occur in a primarily grassland setting. The grassland and parkland environments give way to closed forests of White Spruce and Lodgepole Pine toward the north end of the hills.

The Wildcat Hills border the east side of Grand Valley (#2103), a feature of impressive scale. The valley environment supports an expansive ranchland area which provides unimpaired views of the Wildcat Hills. Because of the close association of the hills and the valley environment, the two should be considered a unit.

Several miles to the west of Grand Valley there is an isolated landform (#2104) of unknown origin which has remained uncultivated and largely ungrazed. Native wildflowers grow in great profusion on this site. The significance of the site is presently unknown.

Immediately to the northeast of Site #2104 lies a coulee (#2105) containing the uppermost reach of Beaverdam Creek. It

is vegetated by one of the finest stands of Trembling Aspen in the Region.

Bighill Coulee (#2106) extends from Highway 1A in Cochrane to the vicinity of the headwaters of Beaverdam Creek. The coulee is the most deeply incised glacial meltwater channel in the Region. It is also unique in that it contains a spring-fed creek which flows year-round. The continuous supply of water has resulted in significant development of riparian forest vegetation, particularly where the creek flows along the north-facing side of the coulee at the lower end. This area has been heavily colonized by Beaver.

There is an extensive area of natural aspen parkland vegetation to the west of Bighill Coulee (#2107) as well as at the northern end of the coulee, in the vicinity of Beaverdam Creek (#2108). This latter area forms a natural link with the Beaverdam Creek Valley (#2109). Beaverdam Creek Valley possesses unique vegetation consisting of mature individual Willows in a parkland-type setting. The character of the vegetation is probably the result of heavy grazing, which has prevented new shrub growth from invading the grassy areas between individual mature willows.

To the east of Beaverdam Creek is MacPherson Coulee (#2111), another large meltwater channel. This coulee, like Bighill Coulee, is physically impressive in its depth and size. Vegetation varies from open grassland, to forests of mature aspen and willow. A number of man-made lakes add visual interest to the area and provide excellent habitat for water-birds.

An abandoned railway line (#2110), which once connected the communities of Cremona and Crossfield, provides a good habitat link between Beaverdam Creek and MacPherson Coulee. Thus, the possibility exists for establishing a continuously linked

green zone, extending from Cochrane to a point north of Airdrie.

Between the chain of linear environments previously described and the City of Calgary, there is one remaining large area of relatively natural prairie and parkland (#2112). This is an extensive area of hummocky moraine to the north, south and east of Lochend Lake. This area has limited agricultural capability due to the hummocky topography and poor soil conditions. Moreover, country residential development has been confined mainly to the south end. For an area so close to Calgary, it has very few roads, making it an excellent candidate natural area. Numerous ponds and groves of shrubs and trees dot the area, providing good habitat for many species of waterbirds and terrestrial birds. Within this general area 203 of the 329 bird species known to occur in Alberta have been sighted by Mr. Peter Sherrington, a well-known local naturalist. Of these, 61 species are confirmed or probable breeders. The area appears to be particularly good for raptors. Sixteen species, including Peregrine Falcon, Gyrfalcon, Prairie Falcon, Ferruginous Hawk, Golden Eagle and Bald Eagle have been sighted. A Sharp-tailed Grouse lek (dancing ground) occurs in the southern part of the unit.

Between the western boundary of the M.D. of Rocky View and the western boundary of the City of Calgary there are two relatively natural sections of the Bow River Valley. One (#2114) extends from the western boundary of the M.D. of Rocky View to the western boundary of the Town of Cochrane. The majority of the land on the south side of the river is part of the Stoney Indian Reserve. The land to the north of the river is used mainly for ranching. The other relatively natural stretch of the Bow River Valley (#2115) extends from the eastern limits of the Town of Cochrane to the upper part of the Bearspaw Reservoir.

In addition to the above river valley lands, the complex river valley slopes (#2113) at the confluence of the Ghost and Bow Rivers remain in a relatively natural state.

South of the Bow River and west of Highway 22 is an extensive area devoted mainly to ranching. To the north of the Trans-Canada Highway the area is primarily grassland while to the south it is largely forested. To an observer proceeding west along the Trans-Canada Highway, the dominant topographic feature of this area is Copithorne Ridge (#2116) a true foothill supporting grassland vegetation. Limber Pine are reputed to grow on exposed sites on this ridge, but we did not have the opportunity to verify their presence during the reconnaissance program. Jumpingpound Creek (#2117) is the most significant river valley feature of this area. Its banks are relatively natural through most of its length except in the vicinity of a gas plant located near the north end of Copithorne Ridge. The area between Jumpingpound Creek and Bragg Creek, adjacent to the Forest Reserve Boundary (#2118), is an extensive wetland zone which has been identified as being of ecological importance by the Calgary Field Naturalist's Society. Logan Ridge, a forested foothill, has been included within this unit to obtain representation of the full range of foothill environments found in this part of the region. The Jumpingpound Creek Valley, Copithorne Ridge and the Jumpingpound/Bragg Creek Wetland area together form a complex which captures much of the ecological diversity of the Jumpingpound area.

The Elbow River, upstream of Glenmore Reservoir, (#2119) is the only remaining natural link between the City of Calgary and the natural foothill and mountain landscapes of Kananaskis Country (Bow-Crow Forest Reserve) to the west. As such it is a unique and irreplaceable environmental resource. Its importance is further enhanced by the fact that it is the major source of drinking water for the City of Calgary.

Between the Forest Reserve boundary and a point just downstream of the community of Redwood Meadows, the river flows in a well-defined incised channel. Here the banks are well vegetated with White Spruce and Trembling Aspen. The high banks, dense forest cover and minimal flooding problems along the reach have encouraged riverbank residential lot development; significant developments of this type have occurred in the Bragg Creek and Redwood Meadows areas.

The portion of the Elbow River between the Forest Reserve boundary and the bridge at Bragg Creek is a commonly paddled canoe route, and is an ideal location for training novice canoeists (Jeff Grutz, Calgary Whitewater Canoe Club and the Alberta Whitewater Association, personal communication).

Downstream of Redwood Meadows the floodplain of the river tends to be broad, with extensive development of side channels. Vegetation here is more diverse, and includes extensive grassland and shrubland riparian communities as well as riverine forests of White Spruce, Trembling Aspen and Balsam Poplar. Although this part of the river is very close to the City of Calgary, site conditions and potential flooding problems have discouraged the development of residential river lots.

Access difficulties limit recreational use of the riverbanks of the Elbow River along much of its length, and recreational impacts are generally low. A notable exception to this is the Twin Bridges area, where Highway 559 crosses the Elbow River just west of the Calgary City Limits. This area has been impacted by off-road vehicles to the point where its utility for more passive forms of outdoor recreation (e.g. hiking, photography, nature enjoyment) is severely impaired.

The Devonian Foundation granted the City of Calgary a quarter section of land in the Clearwater area, which lies just west

of the Twin Bridges area. The City commissioned a study to develop a master plan for Clearwater Park and the reaches of the Elbow River three kilometres upstream and downstream of it (Leonard Novak Landscape Architect Ltd., 1982). The plan proposed in the report has not yet been implemented and uncontrolled recreational use of the Twin Bridges area continues.

The Sarcee Indian Reserve immediately to the west of the City of Calgary contains large areas of natural landscape. In addition to significant portions of the Elbow River Valley upstream of Calgary, it contains one of the last large parcels of aspen parkland found within the Region. This vegetation type covers much of the area (#2121) occupied by the Camp Sarcee Military Reserve. A major wetland complex (#2120) also occurs within the Reserve Boundaries in the vicinity of the headwaters of Priddis Creek, east of the community of Bragg Creek. A relatively undisturbed section of the Fish Creek Valley (#2133), upstream of Fish Creek Provincial Park and downstream of the community of Priddis, also exists on Reserve Lands.

Natural landscapes are more restricted in occurrence in the portion of the M.D. of Rocky View east of Highway 2, because this area is generally well suited for growing crops. A few small parcels of uncultivated grassland and parkland still remain within a few miles of the limits of the City of Calgary (#2122, 2123, 2124, 2125, 2126, 2127). Portions of the valleys of Carstairs Creek (#2128), Rosebud River (#2129) and Crossfield Creek (#2130) also represent remnants of natural prairie landscapes.

An extensive sand plain dotted with water-filled depressions (#2131) occurs near the eastern boundary of the Region. This relatively infertile area has not been tilled and is used only for grazing cattle. It has a distinctive shrub vegetation which is likely a manifestation of soil and water table conditions. Although we were unable to study the area in any

detail, a cursory visual inspection revealed that it could be of considerable interest from the standpoint of both flora and fauna.

A smaller outlier (#2132) of the landscape type just described is found immediately to the south of it. This area has been more extensively altered by agriculture than the previously-described area and appears to have somewhat less importance as a natural landscape.

5.1.3 Significant Natural Landscapes in the City of Calgary

Eighteen areas of natural landscape were identified within the City of Calgary from accounts by the Calgary Field Naturalists' Society (1981) and a report by the City of Calgary Planning Department (1981). Twelve of these (#3101 to 3103; #3107 to 3109, 3111 to 3116) are remnants of the natural environment of the Bow River Valley. Two (#3105 and #3106) are associated with the valley of Nose Creek and two (#3118 and 3119) with the Valley of the Elbow River. Fish Creek Provincial Park (#3117) maintains much of the valley of Fish Creek and an adjacent portion of the Bow River Valley in a semi-natural state.

Upland natural areas are a rarity in any urban area. The City of Calgary is somewhat unique in having set aside a portion of Nose Hill (#3104) as a natural area representing the prairie grassland environment that was once widespread, but which has now virtually disappeared in many areas of the province.

Natural landscapes within the city limits have been subjected to considerable disturbance. However, such a situation is more or less unavoidable in an urban setting and should not be used as a criterion for accepting or rejecting a site. Because the majority of land within the boundaries of a city has or will be developed for urban uses, any natural remnant

of the original landscape becomes a resource of great value, regardless of the extent of disturbance.

Because the natural landscapes of the City of Calgary are already well documented in the two previously cited reports, and because the level of detail of these reports is considerably greater than can be currently achieved for sites elsewhere in the Calgary Region, only a brief overview of the sites is provided here.

(a) Bow River Valley Sites

The sites along the Bow River vary in size, ecological significance and level of disturbance.

Site #3101, which comprises three small adjacent parcels of land on both banks of the river upstream of and adjacent to Bowness Park, includes an area of river valley escarpment on the right (south) bank, river flats on the left bank, and a small area between Bowness Lagoon and the adjacent escarpment to the south. The first of these sub-areas (which comprises some 26 ha) has experienced little disturbance. It is forested primarily in White Spruce, but toward the top of the escarpment there are magnificent examples of ancient Douglas Fir. The City of Calgary rates these as the finest specimens of Douglas Fir existing within the city limits. The area contains a number of rare species and is of particular interest to ornithologists. The area is also the best of only two sites in the City of Calgary exemplifying the natural vegetation of north-facing escarpments. The Planning Department has rated this site as a Class 1 natural area (City of Calgary Planning Department, 1981).

The river flats on the left bank of the river, which lie adjacent to Al Azhar Temple, comprise approximately 5.5 ha

of low-lying gravel bar, part of which lies within the Bow River floodway. They are rated as a Class 3 natural area by the City.

The portion of site #3101 adjacent to Bowness Lagoon is a marshy area with isolated individuals of Balsam Poplar and White Spruce. It is presently privately owned and entirely within the floodway. The City rates it as a Class 2 natural area.

The Bowmont Flats area (#3102) is a large area of river valley environment extending some four kilometres along the left (north) bank of the Bow opposite Bowness. Its extent is estimated at 158 ha by the Calgary Field Naturalists' Society (1981) at 135 ha by the City of Calgary Planning Department (1981). Ownership of the area is divided between the City and various private interests. Less than half of the area is currently designated as city park.

The Bowmont Flats area is one of the most diverse of the City's natural areas. It contains floodplain elements, south-facing valley slopes and three ravines. Springs in the area rich in dissolved calcium carbonate have resulted in the precipitation of this substance in the form of large blocks of "tufa", imparting great geological interest to the area. Associated with these springs are plant species such as Fragile Fern, Red Elderberry Alkali Buttercup, Bog Violet and Northern Willow-herb.

The site contains grassland, shrubland, aspen woods and Balsam Poplar plant communities. Aquatic habitats are associated with the Bow River and with flooded gravel pits.

The Bowmont Flats area is highly disturbed by gravel excavation and processing, utility corridors and currently uncontrolled recreational uses. A further constraint on the development of Bowmont Flats as a natural area is the option of a possible extension of Sarcee Trail across this area. The City of Calgary rates Bowmont Flats as a Class 2 natural area. Downgrading from a potential Class 1 rating is the result of the disturbed state of the site.

The Edworthy Park area (#3103) which comprises Edworthy Park proper, the area west of the park, the Douglas Fir escarpment and Lowery Gardens is by far the largest natural area in the Bow River Valley (234 ha). The site is extremely diverse; it contains river and pond habitats, grassland, shrub communities, aspen woods, riverine forest and coniferous forest. The latter forest, which covers some one third of the north-facing escarpment, contains excellent examples of mature Douglas Fir. These trees are believed to be at the extreme eastern limit of their range.

The Edworthy Park area has been locally disturbed by railway tracks, gravel pits and ski slopes. There is also a possibility of extending Sarcee Trail over the area, and a right-of-way for this road cuts through the area. Despite these factors, the conservation significance of the area remains high because of its diversity and large size.

The Pearce Estate (#3107) which comprises some 14.5 hectares, is a small river valley green space described by the Calgary Field Naturalists' Society (1981). Most of the site is devoted to a fish hatchery and formal park. However, a narrow strip adjacent to the river was left in natural Balsam Poplar riverine forest.

Inglewood Bird Sanctuary (#3108) is perhaps the most renowned natural area in the Bow River Valley in Calgary. Although only 24 hectares in extent, it has a surprisingly high diversity of plant and animal life. Some 259 species of vascular plants and some 222 bird species have been recorded there. A part of the site is taken up by parking facilities and an historic building, which also serves an educational and interpretive centre. The principal vegetation community of the park is Balsam Poplar riverine forest. Minor areas of willow, grassland and upland shrub also occur. Aquatic habitats include a large lagoon, a small abandoned backwater of the Bow River and the main channel of the Bow River. The Inglewood Bird Sanctuary is rated as a Class 1 natural area by the City of Calgary Planning Department.

The City of Calgary Planning Department has identified a small area (6 hectares) of riverine flatlands on the right (west) bank of the Bow River south of Bonnybrook Bridge (#3109) as being worthy of being included in a system of natural areas. The primary importance of the site is the rich variety of bird life it supports. Because the site is small, isolated and in a heavy industrial sitting it is rated a Class 3 natural area.

The Beaverdam Flats area (#3111) occupies a point bar located inside a tight bend of the Elbow River. The major portion of the area is developed as a City Park, but the Calgary Field Naturalists' Society saw fit to include the area in its inventory of natural areas. Beaverdam Flats lie on the floodplain of the Bow and are vegetated mainly by riverine forests of Balsam Poplar interspersed with open grassland areas. A lagoon occupies an abandoned river channel on the east side of the site. The Calgary River Valleys Plan calls for the development of most of Beaverdam Flats as a conventional City Park. Only the

northern part of the area, which abuts the C.N.R. railway bridge is proposed as a natural area (Class 2 rating). This small area comprises only 6.5 hectares.

The Cominco Natural Area (#3112) includes some 59 hectares of land lying between Deerfoot Trail and the Bow River south of Heritage Drive. The area includes extensive riverine forests, dominated by Balsam Poplar, and shrub lands on the slopes of the west bank of the river. The area is dissected by an abandoned channel of the river as well as by man-made canals associated with an adjacent fertilizer plant. Willow and other wetland communities are found along the margins of these waterbodies. The area is considered by the City of Calgary Planning Department to incorporate one of the best stands of riverine Balsam Poplar forest in the city and is given high marks for general diversity. The Planning Department rates it as a Class 1 natural area.

The Carburn Park area (#3113), which lies directly opposite the Cominco Natural area, is composed mainly of a point bar of the river. It includes some 60 hectares of land by estimate of the Calgary Field Naturalists' Society and some 30 hectares by estimate of the City of Calgary Planning Department. Three islands are associated with the point bar, and an abandoned river channel provides some aquatic habitat away from the main channel of the river. It is vegetated by a mixture of Balsam Poplar forest, willow and grassland communities. Large numbers of waterfowl overwinter in the ice-free river waters of this area. Bald Eagles also overwinter here. The area is also a migratory stopover point for waterfowl and shorebirds. Carburn Park is rated as a Class 2 natural area by the City of Calgary. The area has been significantly disturbed by the removal of vegetation and by the construction of a natural gas pipeline.

The City of Calgary Planning Department proposes to include some 16 hectares of river flats (#3114) on the east bank of the Bow River, opposite the Conmac gravel processing plant as part of its natural area system. Because this area is isolated and surrounded by heavy industry, it is rated as a Class 3 natural area.

In the southern residential section of the City, it is proposed that the river valley escarpment adjacent to Queensland Downs (#3115) and a more extensive area of river valley escarpment and flatlands opposite Fish Creek Park (#3116) be added to the City's natural areas system. The former site has the only stand of White Spruce in the Bow River Valley between Crowchild Bridge and the southern limits of the City, but is rated Class 3 because of its relatively disturbed state; the latter area is rated Class 2.

Fish Creek Provincial Park (#3117) is arguably the showcase natural area system within the City of Calgary. Although there is considerable development of park infrastructure, the size of the park is such (930 hectares) that it has been possible to conserve extensive areas of natural landscape.

The character of Fish Creek Park varies quite dramatically from west to east. The western part of the park is a deeply incised river valley with a narrow floodplain. Very fine stands of White Spruce occupy north facing slopes and drier sites on valley bottoms. Aspen woods are also well developed, and grasslands occur sporadically.

To the east, the park has more of a prairie character. The floodplain is broad, and forests of Balsam Poplar and willow are associated with the immediate stream environment. Grassland vegetation is extensive in this area, particularly on south facing slopes.

Fish Creek Park supports a good diversity of upland birds, but waterbirds are relatively uncommon, except in the vicinity of the Bow River, because of the general absence of standing water. A heron colony, however, is found within the eastern part of the park.

There is a reasonable diversity of mammals in Fish Creek Park. Mule Deer, White-tailed Deer and Beavers are conspicuous elements of the mammalian fauna, existing in sufficient numbers to ensure frequent sightings.

The Glenmore Park/Sandy Beach Park area (#3118) is a large complex of natural and man-made environments which provide a wide array of habitats within the heart of the City. The central element of this system is the Glenmore Reservoir, a man-made lake formed by the damming of the Elbow River. Diverse elements of natural vegetation fringe the reservoir, providing numerous habitat niches. The best such area, known as the Weaselhead, is where the natural river flows into the reservoir. This low area of river-associated wetlands is one of the better wildlife areas within the City. It contains White Spruce, Aspen and Balsam Poplar Communities as well as grasslands created by clearing. Oxbow ponds and sloughs provide habitat for amphibians, waterbirds and muskrats.

Glenmore Reservoir itself is a staging habitat for migratory waterbirds, including Canada Geese and Tundra Swans (formerly called Whistling Swans).

Downstream of Glenmore Dam the steep slopes of the Elbow River Valley provide a variety of natural forest and grassland habitats within a generally urban context.

Although the Glenmore Park/Sandy Beach area does not figure in the City of Calgary's natural areas system, the

ecological significance of this area should not be overlooked.

Downstream of the Glenmore Reservoir in the vicinity of Mission Bridge, a small vegetated island of the Elbow River (#3119 - Elbow Island Park) has been designated for inclusion in the City of Calgary's natural areas system.

In the northern part of the City of Calgary, the premier natural area is Nose Hill (#3104), a vestige of the upland prairie landscape preserved within the urban fabric of the City. Although a portion of the hill was formerly cultivated and other areas have been disturbed by gravel extraction, much of the hill remains in grassland vegetation. Isolated clumps of willow and clones of Trembling Aspen add diversity to the vegetation particularly in areas of natural drainage. A portion of Nose Hill has been acquired by the City of Calgary, but a large part remains in private hands. The significance of Nose Hill as a natural area will increase as the City expands to the north and west, completely encircling the hill.

The City of Calgary Planning Department proposes to establish natural areas in the West Nose Creek area. Site #3105, which occurs on a south-facing escarpment has been identified as a candidate site because it is the only site within the City's river valley where a large area of fescue grassland exists in a natural condition. The site is rated as a Class 2 natural area. The valley of West Nose Creek between 4 Street N.W. and the CPR right-of-way (#3106) has been identified as a Class 3 natural area. This area contains rare prairie flora, the Split Rock glacial erratic and a number of archaeological sites. However, it has been seriously impaired in recent years by the indiscriminate use of motorized vehicles and by the dumping of trash, and is rated a Class 3 natural area.

5.1.4 Significant Natural Landscapes in the M.D. of Foothills

The portion of the M.D. of Foothills north of the Sheep River has been quite intensively developed for agriculture and more recently for country residential subdivision. As a result there are few remaining natural landscapes, particularly in the grassland and parkland parts of this area.

The most diverse parkland environment within this part of the M.D. is found in the Pothole Creek area (#4101). A full spectrum of environments, ranging from wetlands to upland forests can be found here. There is an exceptional diversity of birds, including waterbirds, upland species and raptors. Although the area has been partially subdivided for large-lot country residences, the nature of this development has been compatible with the natural surroundings, and the natural qualities of the landscape have not been significantly impaired. The aesthetic qualities of the site are excellent, which further enhances its value as a natural area.

Other remnant parkland areas of lesser diversity than the Pothole Creek area include a 3/4 section parcel of land near Academy (#4102) and a somewhat larger parcel southwest of DeWinton (#4103). These areas are primarily grassland with some development of aspen groves on slopes. They lack the wetland development which give the Pothole Creek area its special flavour.

The northwest portion of the M.D. lies within the foothills region. This area is naturally forested, but extensive areas have been cleared for pasture. Land uses include both ranching and country residential. The natural qualities of the landscape predominate, but landscape units of distinctive character do not stand out in most cases. Within this area the valleys of Threepoint Creek (#4104) and Ware Creek (#4105) are judged to be the most significant natural landscape

features. These moderately incised streams have well developed riparian vegetation consisting mainly of coniferous species. The well washed streambed gravels are also considered to be critical spawning and rearing habitat for rainbow trout (see Section 10.6).

The Sheep River Valley upstream of Turner Valley (#4106) possesses outstanding natural attributes. From the Forest Reserve boundary to its confluence with Heel Creek, the river is confined within a spectacular gorge which is more than 60 metres deep at certain points. The gorge is bordered by some of the finest White Spruce stands found within the Region. The water flowing through the gorge provide excellent white water canoeing (Jeff Grutz, Calgary Whitewater Club and the Alberta Whitewater Association, personal communication).

At a point just upstream of Heel Creek, the gorge broadens into a deep valley with vegetation transitional between the foothills to the west and the parkland to the east. This valley contains both natural and agricultural landscapes, possesses a diverse vegetation and has excellent scenic qualities.

The section of the river between Turner Valley and Black Diamond is a zone of transition where the narrow floodplain of the deeply incised portion of the stream progressively gives way to a broad multi-channelled floodplain. There is a significant intrusion of urban and industrial land uses in the river valley environment in the vicinity of the two urban centres.

Between Black Diamond and Okotoks (#4107) the river is essentially natural. Here very extensive riverine forests of Balsam Poplar have developed.

From Okotoks to the Highwood River, the Sheep River is again confined to a single channel in a narrow valley. This section of the river valley has been impacted considerably by urban, residential, agricultural and transportation land uses, but still retains significant residual natural landscape values.

The Okotoks Erratic (#4108), which is also known as the Big Rock, lies adjacent to Highway 7 between Black Diamond and Okotoks. This large boulder, which was transported by the action of glaciers from the Rocky Mountains more than a hundred kilometres to the northwest is believed to be the largest glacial feature of its kind in North America, and perhaps in the world. It is a designated site under the Historical Resources Act and is an object of considerable interest to passers-by.

The Highwood River is one of the major natural attractions of the Calgary Region. Its character varies dramatically from the forest reserve boundary to its confluence with the Bow River.

The uppermost reach of the Highwood River (#4111), from the Forest Reserve boundary to a point between Trap Creek and Sullivan Creek, is only moderately incised into a broad plain of glacio-fluvial sediments. The next 12 kilometres of the river (#4112) flows through a spectacular gorge deeply cut into strongly folded Cretaceous sandstones and shales. The nearly vertical bedding of the rock strata and the greater erodability of the shale strata have resulted in very interesting rock formations along the gorge. At two points along the Highwood Pass road, there is direct access to the rim of the gorge, providing passers-by with unexcelled views. Another major point of scenic interest occurs at the junction of Sullivan Creek and the Highwood River where the smaller watercourse has downcut a gorge to the base level of the Highwood River.

Downstream of the gorge section, the Highwood River is a deeply incised prairie stream with grassland vegetation at prairie level and on the south-facing slopes of the river valley. Riverine forests of Balsam Poplar occur on valley bottoms and on north-facing slopes. Riparian Forests are extensive along a stretch of the river extending about 10 km upstream of the Town of High River, where the floodplain of the river is broad.

The river valley is essentially natural above the Town of High River (#4113) and somewhat disturbed by urbanization, agriculture and country residential development downstream of this point.

The Highwood River upstream of Longview (#4111, 4112 and the upper part of #4113) is considered to be the showcase pristine foothills recreation river for whitewater canoeists in the Calgary Region (Jeff Grutz, Calgary Whitewater Club and the Alberta Whitewater Canoe Association, personal communication). It is a river to test the skills of intermediate to expert canoeists, and is not suitable for canoeists of only average skill.

A number of important upland features are closely associated with the Highwood River Valley. These include the prominent uplands in the vicinity of Tongue Creek (#4109), with their well developed willow shrubland vegetation, interesting rock outcrops and stands of limber pine. Also of interest is Longview Hill (#4110). The top of this hill, which is a remnant of the ancient surface of the plains, provides a commanding view of the Highwood River Valley and the surrounding mountains, foothills and plains.

South of the Highwood River, between the Highwood River and Pekisko Creek, lies the most remote portion of the M.D. of

Foothills. In this ranching area can be found the single largest block of natural terrain in the M.D. This area subdivides into two areas, a willow shrubland area (#4114) adjacent to the gorge section of the Highwood River and a very extensive area of foothills grassland (#4115).

The Pekisko Creek Valley (#4116) and adjacent uplands (#4117) together represent a willow shrubland type of environment that now has relatively limited representation in the Region. The area provides excellent habitat for big game animals such as Moose and Elk.

The Bow River Valley straddles the boundary between the eastern parts of the M.D. of Rocky View and the M.D. of Foothills. Between the southern boundary of the City of Calgary and the vicinity of the Bow-Highwood junction, gravel extraction and agriculture have altered the natural landscape. Large-scale gravel operations exist just south of the city limits on the west side of the river as well as on both sides of the river on the broad terraces between Pine Creek and the Bow-Highwood junction. The width of the inactive floodplain in this latter portion of the river valley also permits agriculture to extend down to the river's edge in many places. Nevertheless a small segment of the river valley (#4118) still remains in a relatively natural state.

From the vicinity of the Bow-Highwood Junction to the eastern boundary of the M.D. of Foothills (#4119), the valley slopes are precipitous and the floodplain of the river is narrow. This section of the river valley has seen little physical alteration. Dry grasslands occupy the south facing slopes. Riverine forests of Balsam Poplar colonize the north facing slopes and bottom lands. The only significant agricultural use of this part of the river valley is for cattle grazing.

The junction of the Bow and Highwood Rivers has been an important gathering place since prehistoric times and continues to

fulfill this role today. It is a favorite fishing area for both land-based and water-based fishermen. It is also heavily used as a stopping spot by boaters of all types. Recreational use levels of the area appear to be as high as those found in provincial parks, although no formal facilities exist.

5.1.5 Significant Natural Areas in the County of Wheatland

The County of Wheatland lies entirely within the northern fescue and mixed grassland natural regions of the province. Because the land is largely suitable for growing crops, natural landscapes are relatively uncommon throughout much of the county. However, significant areas of natural landscape still exist where agricultural capability is low.

The sand plain complex described previously as areas #2131 and #2132 in the M.D. of Rocky View is also represented by an area falling mainly within the County of Wheatland (#5101).

The valley of the lower Rosebud River and Serviceberry Creek (#5102) is one of the outstanding assets of the County of Wheatland, and indeed, the Calgary Region. The character of this stream system changes very dramatically over a short distance. At the upper end of the land unit indicated on Map 1, the streams occupy broad glacial melt water channels which suggest, more than anything else, a pastoral landscape. At Redland, where the two valleys merge, the valley takes on a wilder, more rugged aspect.

The valley of the Rosebud River becomes progressively more incised and rugged as it cuts down to meet the base level of the Red Deer River. Grasslands give way to shrublands which in turn give way to a very complex mix of forest, shrubland and grassland. The lower section of the river valley system is unique, having many of the topographic characteristics of the badland terrain of the Red Deer River, but possessing a

much greater diversity of vegetation. Vegetation diversity appeared, by visual inspection, to be as great as in any area in the Region that we were able to field check. Among the notable features of the vegetation were stands of White Spruce of exceptional size and vigour for a grassland location, and a profusion of shrubs, including juniper, sage, saskatoon, buffaloberry, honeysuckle, willow and rose.

South of the Rosebud River Valley lie several small uncultivated areas. In the vicinity of Tudor, an isolated dissected rock upland (#5103) provides a small island of natural habitat in a landscape largely devoted to crop production. To the southeast of this, a saline valley bottom (#5104) of a tributary of Crowfoot Creek provides another natural area that may be of some ecological interest. Other residual natural landscapes include an area with near-surface bedrock along Severn Creek (#5105) and two bedrock uplands (#5106) between the community of Benyon and Deadhorse Lake. The above-described isolated areas of natural landscape were identified from aerial photography. We were unable to reconnoitre them in the field due to time limitations. Therefore their ecological significance is currently an open question.

The northern part of the Wintering Hills (#5107), the Red Deer River Valley (#5108), an area of hummocky moraine adjacent to the Red Deer River Valley (#5109) and Crawling Valley (#5110) form an important complex of natural landscape features in the eastern part of the County of Wheatland.

The gravel capped Wintering Hills (#5107) are remnants of the landscape surface that existed in the Tertiary period of geological time. Major remnants of this land surface are relatively rare in Alberta, the most notable ones being the Porcupine Hills and the Cypress Hills to the south and the Hand Hills to the east. The Wintering Hills rise some 120 m above the surrounding plain. The north slopes of the hills

are vegetated in aspen and Balsam Poplar woodlands, with some Paper Birch. Woodlands grade into fescue grasslands to the south. The southern part of the hills have been converted to agriculture, but natural landscapes predominate in the more rugged northern part of the hills. Here, however, large-scale gravel stripping operations are creating major impacts on the landscape.

The Wintering Hills grade into an extensive area of hummocky moraine (#5109) to the southeast. The more rugged part of this moraine is a large area of fescue grassland directly adjacent to the Red Deer River Valley.

The portion of the Red Deer River Valley within the Region (#5108) possesses badland topography. It is somewhat more subdued and better vegetated than some of the more famous sections of the valley, but it is also less disturbed. A single road, which descends down to the town of Dorothy, provides an excellent panorama of both the badlands and the adjacent hummocky moraine grasslands. Evidence of abandoned coal mine workings and equipment add visual interest to the area.

The Crawling Valley (#5110) is one of the three largest glacial melt-water channels in the Calgary Region. The channel is very regular and almost canal-like over most of its length. This regularity is emphasized by its grassland vegetation and lack of tree species. Some willow grows along a watercourse in the coulee. At the extreme north end of Crawling Valley there is a sudden transition to badland topography where the coulee has eroded down to the level of the Red Deer. The view down this coulee to the Red Deer River is one of the most impressive to be found within the Calgary Region.

As indicated previously, natural landscapes in the more gently rolling southern part of the Wintering Hills have been almost totally replaced by agricultural landscapes. A couple of small uncultivated areas (#5111 and 5112) still remain on two of the more prominent hilltops.

In the uplands between the Red Deer River Valley and the Bow River Valley, several areas of natural grassland on hummocky moraine were found. The smallest of these (#5113) occurs just to the south of Seiu Lake. A much more extensive one, the largest found within the county, is located to the east of Deadhorse Lake (#5114).

An extensive area of natural terrain, consisting of bedrock uplands, colluvial slopes and hummocky moraine, occurs in the vicinity of Crowfoot Creek (#5115). We were unable to undertake a visual inspection of this area and are therefore unable to make an assessment of its significance.

Hammer Hill (#5117), a very small isolated remnant of the ancient prairie surface, provides an unexcelled 360° view of the surrounding landscape.

The Bow River Valley (#5118) is one of the finest natural environment features of the County of Wheatland. From the eastern boundary of the M.D. of Foothills to the western boundary of the Blackfoot Indian Reserve, it gradually changes from a narrow, deeply incised river valley to a valley with extensive terraces and a broad active floodplain. The best development of islands, wetlands and luxuriant riverine forest occurs within this part of the river valley. Within the Blackfoot Reserve, terraces become even more pronounced. The development of islands, wetlands and riverine forest is also significant, but somewhat less spectacular than in the stretch of the valley immediately upstream.

Disturbances of the natural landscape occur within the Bow River Valley throughout the County of Wheatland, although from the perspective of a boater the valley would appear predominantly natural. Upstream of the Blackfoot Reserve they are associated mainly with the Carseland Weir, with gravel extraction and with campground development. On the Blackfoot Reserve they are associated with agricultural and residential land uses on the large terraces adjacent to the river.

The less developed portions of the major terrace features (#5119 and 5120) are potentially of considerable ecological interest, as the terraces have extensive areas of uncultivated grassland vegetation. The natural landscape value of the terraces is limited, however, by very heavy grazing pressure, extensive networks of vehicle trails and widespread dispersal of dwellings.

5.2 KEY AREAS FOR BIGHORN SHEEP AND MOUNTAIN GOATS (Map 2)

Bighorn Sheep and Mountain Goats are found in the Calgary Region only within the western portion of I.D. #8. The primary range of Bighorn Sheep in Canada is along the Front Ranges of the Rocky Mountains. A significant portion of this range lies within the Calgary Region. Mountain Goats are dispersed more widely throughout the mountain ranges of Alberta, British Columbia, the Yukon Territories and the Northwest Territories.

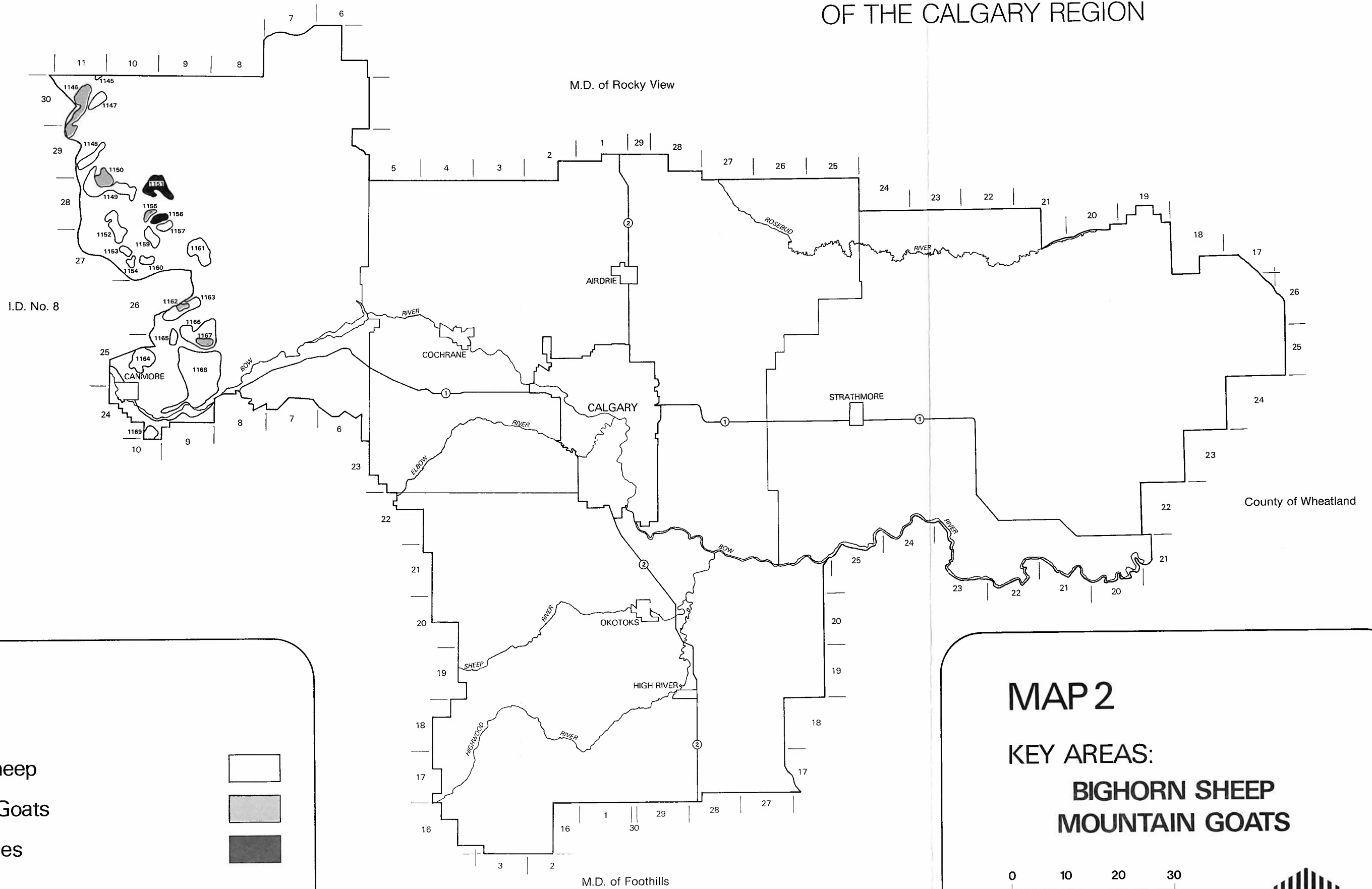
Bighorn Sheep inhabit alpine meadows, grassy mountain slopes, and foothill country in proximity to rugged rocky cliffs and bluffs (Banfield, 1974). They typically summer at fairly high elevations (6,000 to 8,000 feet), but descend to lower elevations (2,500 to 5,000 feet) in locations of light snow cover to overwinter. The Canmore Corridor is an important overwintering area for sheep because of the Chinook winds which blow down the Bow River Valley, reducing or eliminating snow cover.

Key areas for Bighorn Sheep, as compiled by the Fish and Wildlife Division of Alberta Energy and Natural Resources, are shown on Map 2. These include the upper Panther River (#1145), Sheep Creek (#1147) and Burnt Timber Creek (#1148) areas; the south facing slopes of Mount Oliver (#1149); and a number of disjunct habitats in the Upper Ghost, Devil's Head and Black Rock Mountain areas (#1151, 1152, 1153, 1154, 1156, 1157, 1159, 1160 and 1161). South of Devils Gap, key areas for sheep have been identified on the south-facing slopes of Saddle Peak (#1163) and in the vicinity of End Mountain (#1165, 1166). Directly adjacent to the Canmore Corridor, key habitats for sheep occur on the south slopes of Mt. Charles Stewart (#1164), in the general vicinity of the Yamnuska area (#1168) and in the Wind Ridge area (#1169). The latter area is considered by Dr. V. Geist, a behavioral ecologist at the University of Calgary and a world-recognized authority on Bighorn Sheep, to be one of the finest sheep ranges in the Rocky Mountains.

Mountain Goats favor the most rugged available mountainous terrain, such as steep grassy talus slopes at the base of cliffs (Banfield, 1974). They occupy more or less the same range winter and summer and do not undertake seasonal migrations to lower elevations, as do Bighorn Sheep. The habits of Mountain Goats tend to insulate them from adverse interactions with man. Consequently, it is unnecessary to develop regional planning provisions to ensure their protection.

Key areas for Mountain Goats are much more restricted in their occurrence than are sheep ranges. The principal ones are on Otuskwan Peak (#1146), Mt. Oliver (#1150), the mountains adjacent to the headwaters of Waiparous Creek (#1151, 1155, 1156), Saddle Peak (#1162) and in the general vicinity of End Mountain (#1167).

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



MAP 2

KEY AREAS:

**BIGHORN SHEEP
MOUNTAIN GOATS**



5.3 KEY AREAS FOR AMERICAN ELK AND MOOSE (Map 3)

The American Elk, or Wapiti, occupies a limited range in Canada. Although its range once extended from Vancouver Island to the Lakehead and a disjunct population even occupied southern Ontario and Quebec, it has become extinct over most of its former range. The foothills and Front Ranges of the Rocky Mountains now constitute the primary range of the species in Canada, although scattered small herds still exist throughout the western provinces. The Calgary Region lies within the heart of the species primary range in Canada.

5.3.1 Key Areas for American Elk

Elk occur in the western parts of I.D. #8 and the M.D. of Foothills in foothill and mountain environments where grasslands or agricultural croplands are found in proximity to relatively large blocks of forest cover (D.A. Westworth, wildlife consultant, personal communication). Elk are primarily grazers, preferring a diet of grasses or forbs. However, they will also browse on winter range.

Elk undertake altitudinal migrations between summer ranges on grassy subalpine and foothills slopes and winter ranges in the protected valleys. Winter herds, which include individuals of every age and both sexes, may exceed a hundred animals (Banfield, 1974). On overstocked winter range, elk may resort to stripping the bark of Trembling Aspen and Balsam Poplar, causing severe scarring and sometimes death of the trees. Elk may also cause damage to ranchers' haystacks and to standing crops of greenfeed during the winter months. In late winter and spring, south and west facing slopes are important to elk because of the lighter snow cover and the earlier greening of the vegetation.

(a) Improvement District #8

Key areas for elk occur in northwestern I.D. #8 on the eastern slopes of the Front Ranges in the vicinity of Dormer Mountain (#1170) and in the high foothills drained by the upper reaches of the Burnt Timber Creek system (#1171). Good winter ranges for elk also exist on the lower slopes of Mt. Rundle (#1178), northwest of Canmore, and in the Wind Ridge area (#1179).

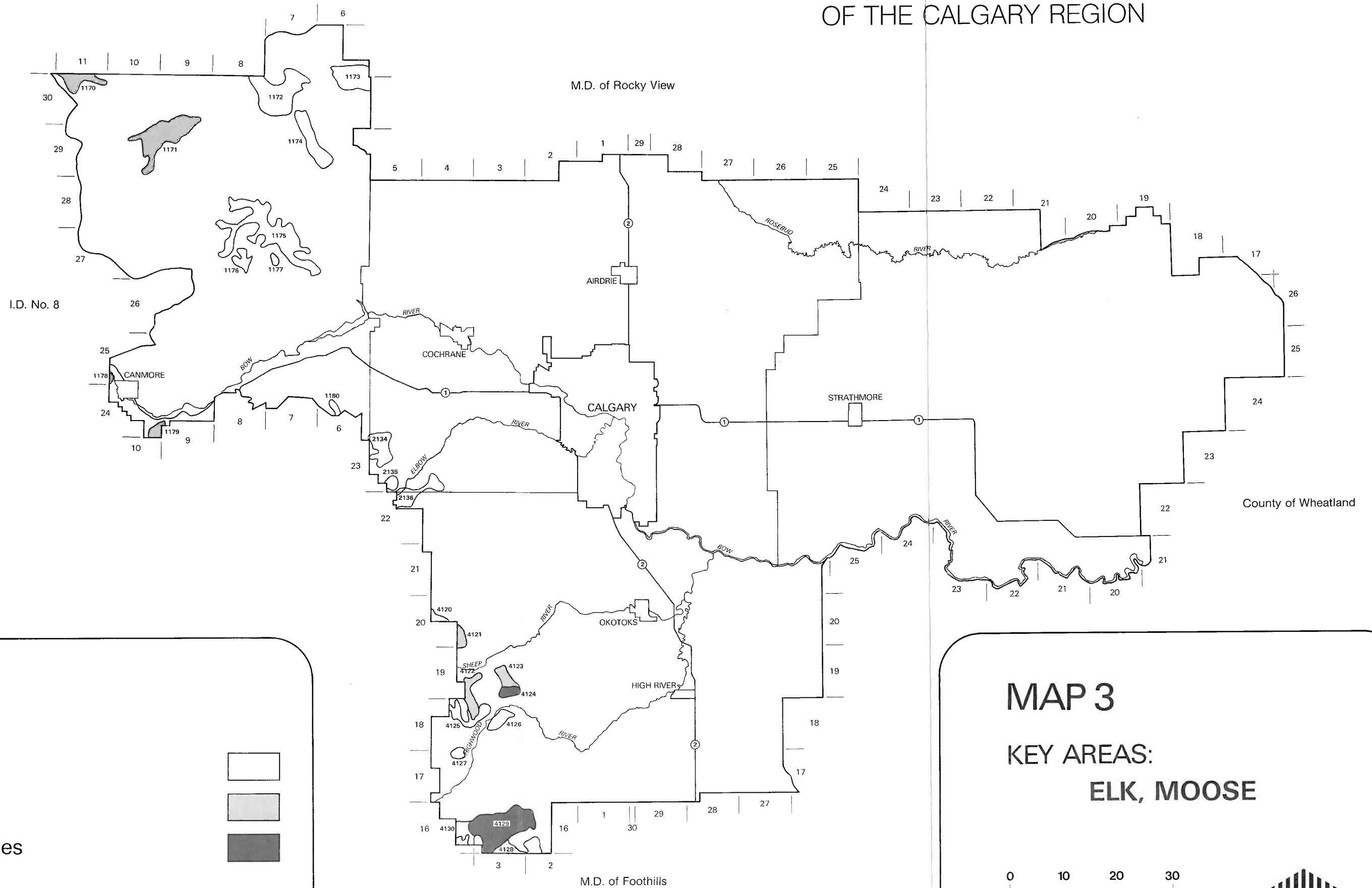
(b) M.D. of Foothills

Prime winter range for elk in the M.D. of Foothills is associated with the high foothills ridges, adjacent to or extending into the Forest Reserve. These include Ware Ridge (#4121) and the Okotoks Mountain/Wiskey Ridge/Jim Ridge area (#4122). Important winter ranges for elk are also found in more open country, including the shrublands of the uplands adjacent to Tongue Creek (#4123) and the shrubland/forest complex south of Pekisko Creek (#4129).

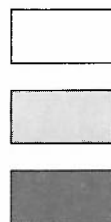
5.3.2 Key Areas for Moose

Moose, unlike the ungulates previously described, prefer a solitary existence. This species is widely distributed and often abundant throughout the forested regions of Canada. They are quite common in the eastern part of I.D. #8, the southwestern part of the M.D. of Rocky view and the western part of the M.D. of Foothills. Moose thrive in areas of early successional vegetation. They are primarily browsers, preferring twigs of young willow, but often utilizing other species such as Red Osier Dogwood, Trembling Aspen, White Birch and Balsam Poplar. Many of the important Moose habitats of the Calgary Region occur within the distinctive shrubland environments of the western part of the M.D. of Foothills. Although atypical of the environments normally associated with Moose, this type of habitat supports some of the highest Moose densities found in North America.

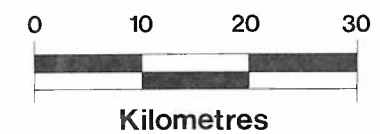
ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



Moose
Elk
Both Species



MAP 3
KEY AREAS:
ELK, MOOSE



The information on this map may be refined by detailed on-site investigations which may result in boundary alterations.

(a) Improvement District #8

In I.D. #8 critical moose habitat is associated with valleys of streams with extensive wetland development or broad willow-covered floodplains. In the northeastern part of the Improvement District, excellent moose habitat occurs in the valley of Fallentimber Creek (#1172, 1173) and Grease Creek (#1174).

The mosaic of forest and shrubland associated with the Waiparous Creek System (#1175, 1177), including the major wetlands along Meadow Creek, provides important moose habitat. Wetlands surrounding Lesseur Creek (#1176) which drains directly into the Ghost River are also prime habitat. These latter wetlands are closely associated with the Meadow Creek wetlands, although they occur on the opposite side of a drainage divide.

Only one small area of critical moose habitat (#1180) has been identified in the portion of I.D. #8 south of the Bow River.

(b) M.D. of Rocky View

A key area for Moose (#2134) occurs along an unnamed tributary of Jumping Pound Creek which rises just northwest of the community of Bragg Creek. Areas of extensive early successional vegetation (#2135, 2136) associated with the Elbow River and upper Priddis Creek drainages also provide excellent moose habitat. All of the key areas of Moose habitat in the District of Rocky view are subject to impacts from human activity in the Bragg Creek area.

(c) M.D. of Foothills

Area #2142 previously described extends into the northwest corner of the M.D. of Foothills. Further south, key moose habitat is associated with the upper reaches of Ware Creek (#4120).

South of the Sheep River the relatively open habitats of North Sullivan Creek and adjacent foothills ridges (#4125) and the Trap Creek Area (#4127) provide excellent habitat for moose, as do the upland willow communities (#4124, 4126) adjacent to the valley of the Highwood river.

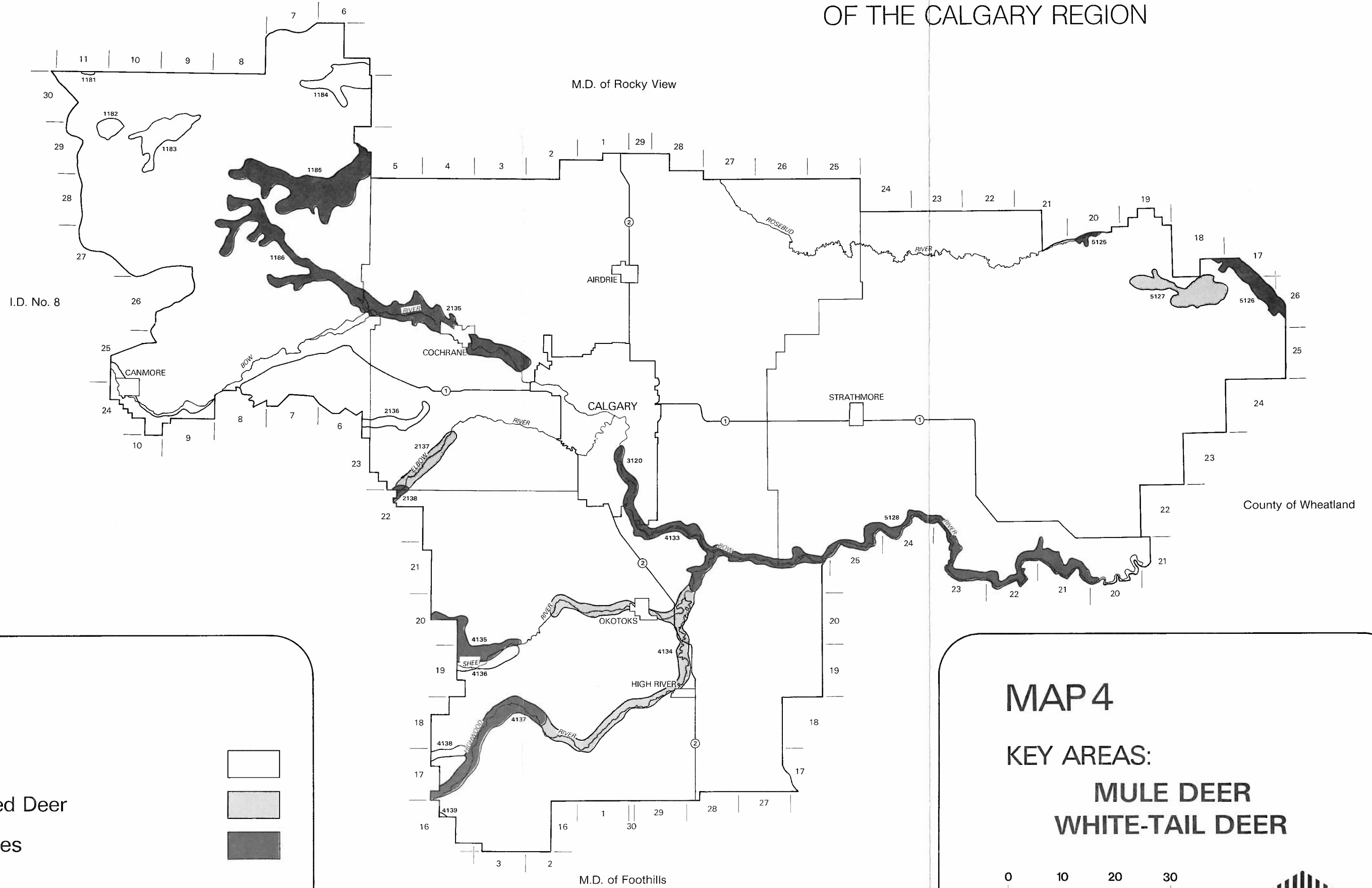
South of Pekisko Creek, extensive areas of willow and other early successional vegetation (#4128, 4129, 4130) provide some of the best moose habitat in the Region. This is the northernmost extension of one of the finest areas of moose habitat in Alberta, which encompasses the eastern slopes of the Livingstone Range and the Porcupine Hills.

5.4 KEY AREAS FOR MULE DEER AND WHITE-TAILED DEER (Map 4)

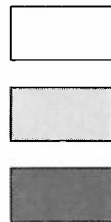
Mule Deer and White-tailed Deer are the most common big game species in the Calgary Region.

Mule Deer are the native deer of the Region. They are typically associated with the foothills environment and with steep broken terrain (river valleys, coulees, draws, erosional remnant hills) on the plains. The type of habitat used by Mule Deer provides escape terrain, natural forage and at least limited cover. Within the Calgary Region the best Mule Deer habitat is found along the valleys of the larger rivers and streams, both in the foothills and the plains. South and west-facing valley slopes are very important for ensuring over winter survival of Mule Deer, as these areas have light to non-existent snow cover in late winter and are the first to become green in the spring.

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION

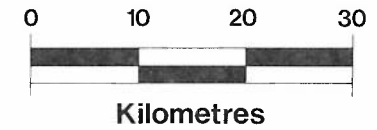


Mule Deer
White-Tailed Deer
Both Species



MAP 4

KEY AREAS:
MULE DEER
WHITE-TAIL DEER



White-tailed Deer have extended their range into the Region because of the expansion of agriculture. They occur typically in parkland or groveland environments, where there is an interspersed of stands of Trembling Aspen or Balsam Poplar within agricultural cropland. In summer they tend to forage in leguminous crops such as clover and alfalfa. In winter they move into river valleys and into wooded upland areas with some coniferous cover (D.A. Westworth, wildlife consultant, personal communication).

(a) Improvement District #8

In the northern part of the District, important Mule Deer ranges occur in the vicinity of the confluence of the Panther River and Dogrib Creek (#1181), in the upper part of the Burnt Timber Creek system (#1182, 1183) and along Fallentimber Creek (#1184) in the vicinity of Boggy Lake.

Key habitats for both Mule Deer and White-tailed Deer occur along the Little Red Deer River (#1185) and within the Ghost River/Waiparous Creek drainage (#1186).

(b) M.D. of Rocky View

The Bow River Valley is a primary area of deer habitat both upstream (#2135) and downstream (#4120) of the City of Calgary. Both Mule Deer and White-tailed Deer are found within this valley.

The valley of upper Jumping Pound Creek (#2136) provides important habitat for Mule Deer, while the valley of the Elbow River upstream of the Highway 22 bridge crossing (#2137) is key habitat for White-tailed Deer.

(c) City of Calgary

Critical habitat for Mule Deer and White-tailed Deer occurs in the Bow River Valley from the southern city limits as far north as Ogden (#3120). Although this section of the river valley is heavily disturbed by gravel extraction and various industrial operations, sufficient natural terrain remains to maintain viable deer populations.

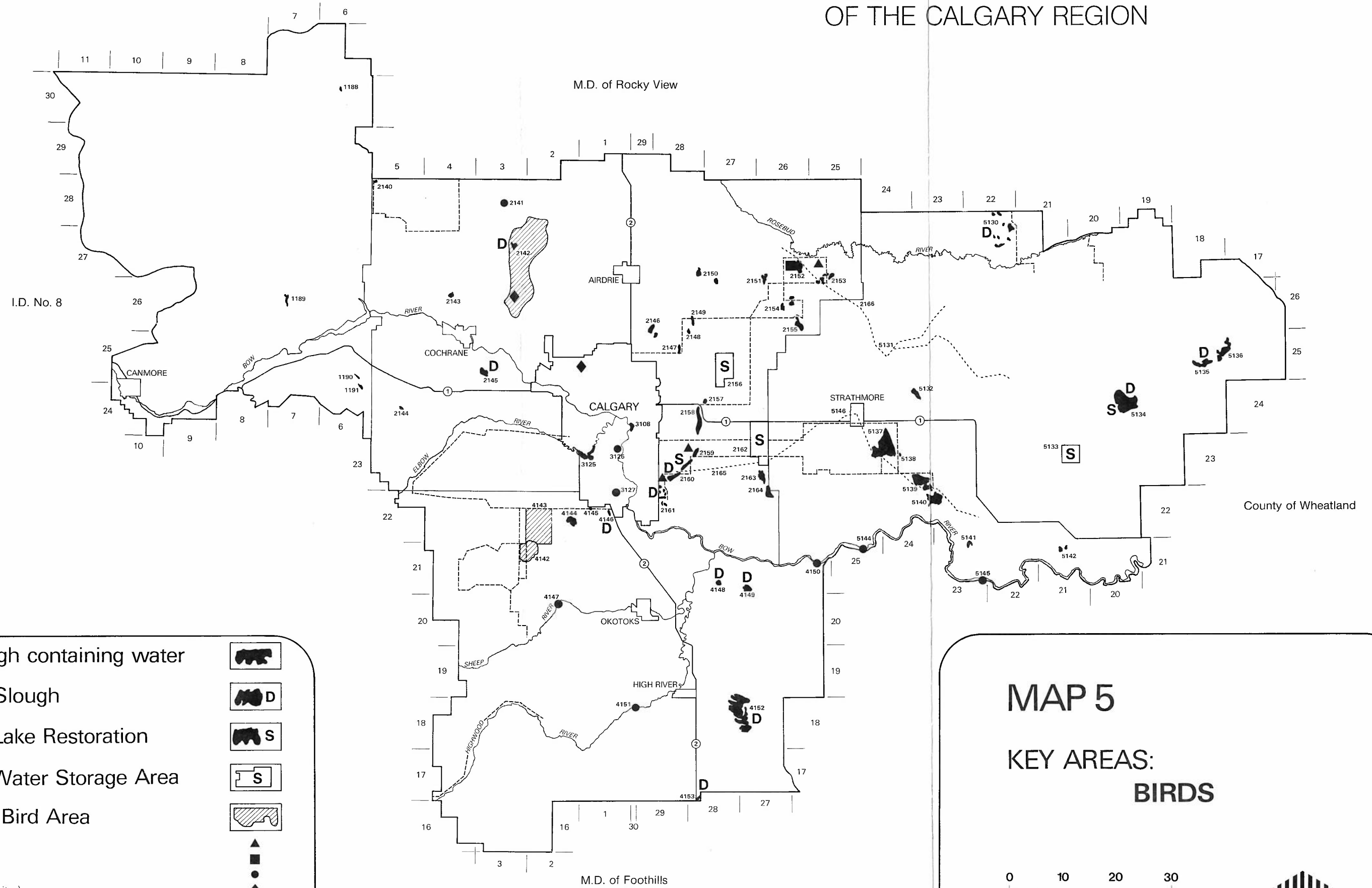
(d) M.D. of Foothills

The Bow River Valley and the first few miles of the Highwood River Valley (#4133) provide excellent habitat for both deer species. The lower Sheep and Highwood Rivers (#4134) are critical habitats for White-tailed Deer. The valley of the Sheep River above Turner Valley (#4136) supports a significant Mule Deer population, while the adjacent Ware Ridge area (#4135) is important for both Mule Deer and White-tailed Deer. The upper Highwood River Valley (#4137) is a key area for both Mule Deer and White-tailed Deer. The valley of Trap Creek (#4138) and the lower slopes of the Livingstone Range (#4139) are important for Mule Deer.

(e) Wheatland County

In Wheatland County the major river valleys of the Bow (#5128), the Red Deer (#5126) and the Rosebud (#5125) are of major importance to both Mule Deer and White-tailed Deer. The only upland area of significance is the Wintering Hills (#5127), whose disjunct aspen woodland vegetation provides critical habitat for White-tailed Deer.

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



Lake/Slough containing water



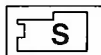
Dry Lake/Slough



Proposed Lake Restoration



Proposed Water Storage Area



Terrestrial Bird Area



(Burrowing Owl Site)



(Cormorant Colony)



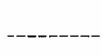
(Heron Colony)



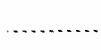
(Sharp-tailed Grouse sites)



Bird Watching Routes

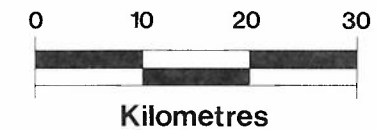


Abandoned Rail Line



MAP 5

KEY AREAS:
BIRDS



The information on this map may be refined by detailed on-site investigations which may result in boundary alterations.

5.5 KEY AREAS FOR BIRDS (Map 5)

Some 309 species of birds, including 182 nesting species, have been recorded within an 80 kilometre radius of downtown Calgary (Calgary Field Naturalists' Society, 1976). The great diversity of species is no doubt due to the exceptional natural diversity of the Calgary Region.

Waterbirds form a very important part of the bird fauna of the Region, particularly to the east of the City of Calgary. The main factor limiting the abundance of waterbirds is the transitory nature of many of the Region's lakes and sloughs. In dry cycles of the climate, such as we are currently experiencing, many lakes in the Region, including some very large ones, may dry up completely. Under these circumstances, lakes which continue to retain water assume an even greater ecological importance.

The construction of irrigation works in the eastern part of the Region has, for the most part, increased waterbird habitat. Similarly the construction of water supply reservoirs and the damming of small intermittent watercourses has generally increased the amount of permanent habitat available to waterbirds. Both natural and man-made waterbird habitats have been included in this inventory of key bird habitat.

Within the Calgary Region there are a number of nesting or potentially nesting bird species that are considered rare, threatened or endangered. These are listed in Part A of Table 5-1, which was derived from an unpublished manuscript of Myres (1978). In addition, there are a number of species, listed in Part B of Table 5-1, whose status is not well known.

Colonially nesting waterbirds are of particular concern because of the great concentration of birds that can occur at a single location and the vulnerability of the birds to disturbance while nesting.

TABLE 5-1 ENDANGERED, THREATENED, RARE, SCARCE OR SPORADIC
BIRD SPECIES WHICH BREED OR COULD BREED IN THE
CALGARY PLANNING REGION

Does Breed, or has Bred	Could Breed, but No Evidence	Could Breed, but Unlikely
A. Endangered, Threatened or Rare		
Western Grebe (T)	White Pelican (E)	Piping Plover (R)
Double-crested Cormorant (R)	Trumpeter Swan (R)	
Peregrine Falcon (E)	Turkey Vulture (R)	
Forster's Tern (R)	Pygmy Owl (R)	
Black-billed Cuckoo (R)	Lewis' Woodpecker (R)	
Burrowing Owl (R)	Great-crested Flycatcher (R)	
Lazuli Bunting (R)		
B. Status not Well Known (rare, scarce, sporadic)		
Black Duck	Virginia Rail	Glossy Ibis
Cinnamon Teal	Yellow Rail	Nashville Warbler
Hooded Merganser	Barred Owl	
Ferruginous Hawk	Alder Flycatcher	
Golden Eagle	Hammond's Flycatcher	
Upland Sandpiper	Purple Martin	
Brown Creeper	White-breasted Nuthatch	
Mockingbird	Rock Wren	
Sprague's Pipit	Sage Thrasher	
Bobolink	Yellow-breasted Chat	
Indigo Bunting	Swamp Sparrow	
Lark Bunting		
Grasshopper Sparrow		
Baird's Sparrow		
Lark Sparrow		
McCown's Longspur		

(E) Endangered
(T) Threatened
(R) Rare

Source: Myres, M.T. 1978. Unpublished Manuscript.

Six species of colonially nesting waterbirds are found within the Calgary Region: Double-crested Cormorant, Western Grebe, Eared Grebe, Great Blue Heron, Ring-billed Gull and California Gull. Three of these species, the Double-crested Cormorant, Western Grebe and Great Blue Heron, have experienced significant population declines in North America, mainly because of human disturbance or the destruction of their nesting sites. Eared Grebes appear to be tolerant of man and Ring-billed Gulls and California Gulls appear to benefit from association with man.

Double-crested Cormorants which normally nest on islands or on cliffs near water are vulnerable to having their nests vandalized by humans or to having their eggs or young attacked by gulls when they are frightened from their nests. Depradation on breeding grounds has reduced the abundance of Cormorants by half over the last 50 years (Salt and Salt, 1979).

Western Grebes build their colonies of floating nests only on large lakes, where they often find themselves in conflict with human recreational activities. The species appears to be unable to adjust to this type of disturbance, and as a result has declined significantly (Salt and Salt, 1974).

Great Blue Herons, which normally nest colonially in trees, have been adversely affected by loss of heronry sites to competing land uses (Salt and Salt, 1974). The status of heron populations in the Calgary Region appears to be good, with approximately 160 pairs of herons distributed over eight heronries. (Adams, 1983; Williams, 1983)

Non-colonial species of particular concern include those whose nesting success depends on the continued existence of native uncultivated grassland. Species such as the Burrowing Owl, Upland Sandpiper and Sprague's Pipit, which were once quite common in the prairie region, are now largely confined to prairie remnants.

The Sharp-tailed Grouse, a species of the aspen parkland, has also retreated before the plough. A peculiarity of this species is the use of ancestral dancing grounds, or "leks", for their mating rituals. Destruction of these dancing grounds may have an adverse effect on breeding success of the species.

In the sections that follow, specific locations of known importance to birds are described. The discussion is strongly biased toward waterbirds and birds occurring near the margins of waterbodies. It has not been possible, with the limited data available, to comprehensively rate areas for upland bird species, whose breeding is normally dispersed over a very large area. Such an undertaking would be massive in scope, requiring careful experimental design, large amounts of data on both habitat characteristics and species abundance, and extensive computer analysis.

The routes commonly used by bird watchers have been shown on the map of Key Areas for Birds (Map 5). These provide some indication of areas of potential importance to upland birds. In addition, data which may be of importance in future assessment of an area, such as locations of observations of Burrowing Owls and locations of Sharp-tailed Grouse dancing grounds, have been marked on the map.

5.5.1 Key Areas for Birds in The Bow River Valley

The Bow River Valley, which transcends all artificial political subdivisions of the Region, is a bird habitat of provincial, national and even international significance. The Canadian Wildlife Service (1979) rates the Bow River Valley in its entirety as a high priority goose production habitat and a medium priority production and staging habitat for colonial nesting migratory birds (Great Blue Heron, Common Tern, Eared Grebe). The Bow River Valley downstream of downtown Calgary is rated as a high priority upland habitat for non-game migratory birds. The same section of river is also used by migrating geese. Exceptional concentrations of Common Mergansers also occur on this part of the Bow River.

5.5.2 Key Areas for Birds in I.D. #8

I.D. #8 has very little importance for waterfowl and has therefore received little study by Alberta Fish and Wildlife, the Canadian Wildlife Service or Ducks Unlimited. Forest species within the district may be of interest to naturalists, but we have been unable to uncover much information that would be of use in such an assessment.

The Bird Study Group of the Calgary Field Naturalists' Society has expressed an interest in four lakes in I.D. #8: Boggy Lake (#1188), Kangienos Lake (#1189), Westover Lake (#1190) and Frederick Lake (#1191). Systematic observations of birds have been made only on Boggy Lake.

A field visit to Boggy Lake revealed that it possessed a floating mat of sedge around its margin. The true shoreline of the lake had a forest vegetation of diverse shrubs, Trembling Aspen, Balsam Poplar, White Spruce and Lodgepole Pine. The ground layer of vegetation, like the shrub layer, appeared to be quite diverse. Birds observed by members of the Calgary Field Naturalists' Society include Sandhill Crane, Common Loon, Bald Eagle, White-winged Scoter, Great Yellow Legs, Raven, Belted Kingfisher, Water Pipit and Red-winged Blackbird.

Kangienos Lake was only observed in passing. It possessed a shoreline bordered by sedge and shrubs with mature Trembling Aspen, White Spruce and Lodgepole Pine on higher ground. The north end of the lake had a grass meadow shoreline.

We were unable to carry out field checks of Westover and Frederick Lakes.

5.5.3 Key Areas for Birds in the M.D. of Rocky View

Permanent lakes are notably scarce in the western portion of the M.D. of Rocky View, and the few lakes that do exist are consequently of considerable ecological significance.

Lost Lake (#2140) is a small foothills lake forming the headwaters of Fricke Creek, a tributary of Dogpound Creek. Its shores are vegetated with mature stands of White Spruce, Trembling Aspen and some Lodgepole Pine. The forest understory, both the shrub layer and the ground layer, appears to be more diverse than in most foothills environments. Moisture-loving plants, such as Sphagnum Moss and a variety of fungi were well represented in the ground layer of vegetation.

Waterbirds were not abundant on the lake. However, the Common Loon, a species not frequently seen in the Region, was present on the lake and probably nested there.

The Calgary Field Naturalists' Society nominated Lost Lake as an Environmentally Significant Area but has not indicated the basis for this judgement.

The Calgary Field Naturalists' Society has described a bird watching route in the general Boggy Lake/Dogpound Creek/Bottrell area. On this route it is possible to observe a number of upland species, such as Gyrfalcon (rare), Sharp-tailed Grouse, Gray Partridge, Spruce Grouse, Pygmy Owl (scarce), Boreal Owl (Scarce), Great Gray Owl (rare), Black-backed Three-toed Woodpecker (scarce), Northern Three-toed Woodpecker (scarce), Mountain Chickadee (scarce), American Dipper, Northern Shrike (scarce), Red Crossbill and White-winged Crossbill (Steeves et al., 1982).

A nesting colony of Great Blue Herons is found in a small grove of trees on the south bank of Beaverdam Creek (#2141).

The current owner of the land has been very conscientious about protecting the colony (P. Sherrington, local naturalist, personal communication). In the event of a change in land ownership, however, the colony could become vulnerable, as the grove of trees is an isolated one and all of the surrounding land is cleared. The visibility of the colony from the road could also be a potential problem. However, the colony is protected to some extent by the presence of creeks which must be crossed to gain access to the heronry.

The hummocky moraine area centred around Lockend Lake (#2142) is perhaps the finest area for birds in the western part of the M.D. of Rocky View. Although Lockend Lake itself is currently a dry lake bed, the surrounding hummocky and largely uncultivated area contains numerous potholes and an excellent interspersed area of wetland and upland parkland and grassland habitats. The area is excellent for a wide range of waterbird species, as well as for many upland birds of the natural grasslands and parklands. Raptors, such as the Red-tailed Hawk and Swainson's Hawk abound. Rare raptors such as Peregrine Falcon, Prairie Falcon and Ferruginous Hawk are also seen fairly frequently. Sharp-tailed Grouse thrive here; a dancing ground occurs in the southern end of the area.

Cochrane Lake (#2143) is still likely to be an important area for migrating waterbirds, although the lakeshore environment on the south side of the lake has been heavily impacted by country residential development. In the past, thousands of birds, including Mallard, American Wigeon, Shoveller, Canvas-back, Lesser Scaup, Goldeneye, Bufflehead and Ruddy Duck, have been observed there during fall migrations (Calgary Bird Club, 1967). The Calgary Field Naturalists' Society has nominated Cochrane Lake as an Environmentally Significant Area, but no update on its current status has been provided.

Glenbow Lake (#2145), which is currently a dry lake bed, was once a stopover point for Tundra Swans. As many as 1700 swans

have been observed there in the past (D. Pharis/P.K. Anderson, University of Calgary, personal communication).

In 1968 the Calgary Bird Club Newsletter (No. 67, April 1968) described Glenbow Lake as a spring migratory stopover for many hundreds of Whistling Swans, Canada Geese and many species of ducks. It also indicated that Glenbow Lake was an excellent place for shorebirds from spring to fall. Problems in maintaining water levels were already apparent, however, at that time.

Norman Lake (#2144) is one of the very few good waterfowl production lakes in the western part of the M.D. of Rocky View. A field reconnaissance of the lake indicated that it is currently a viable waterbird area. Birds observed on or near the lake in the past have included Common Loon, Mallard, American Wigeon, Northern Shoveller, Canvasback, Goldeneye, Ruddy Duck, Red-tailed Hawk, American Kestrel, American Coot, American Bittern, Upland Sandpiper and Greater Yellowlegs.

MacDonald Lake (#2146) and the small slough directly to the west of it are located in a highly disturbed area directly adjacent to a sour gas processing plant operated by Petrogas Processing Ltd. A cursory field visit during the nesting season revealed a good diversity of breeding waterbirds including American Avocet, Willet, Marbled Godwit and Pintail.

The portion of the M.D. of Rocky View east and northeast of the City of Calgary contains a large number of lakes and sloughs which provide important habitats for waterbirds and water associated birds. In addition, uncultivated grasslands bordering these waterbodies often provide scarce habitat for upland species requiring a natural grassland habitat.

Benaman Slough (#2147) is noted by Steeves et al. (1982) as being sometimes excellent for nesting and migrant shorebirds.

An unnamed slough (#2148), about 7 kilometres due west of McDonald Lake, sometimes has flocks of shorebirds including migrating Black-bellied Plover and Golden Plover, which nest in the Arctic.

Twin Lakes (#2149) is a good location for viewing Great Blue Heron, Black-crowned Night Heron, Rucky Duck and Marsh Hawk. Large flocks of shorebirds and the occasional Sandhill Crane can also be seen here.

Two lakes (#2150) 13 to 16 km east of Airdrie, are shown on the Alberta Fish and Wildlife Branch's Wildlife Key Area Maps as being important for waterfowl production.

Texas Irricana Lake (#2151) was identified by Ducks Unlimited as being an excellent lake for waterfowl production. A mid-summer reconnaissance of the lake revealed the presence of large numbers of dabbling and diving ducks, as well as a colony of 50 to 75 pairs of Eared Grebes. A few Canada Geese were also on the lake. The lake is entirely fringed by cattails and appears to provide good cover for breeding birds. Large numbers of Red-winged Blackbirds and Yellow-headed Blackbirds are also present. Gravel excavation directly adjacent to the lake could eventually threaten its long-term viability.

Irricana Reservoir (#2152), also known as Craighdu Reservoir, is a large artificial body of water that has become very important to breeding and migratory birds. It is also the location of the only colony of Double-crested Cormorants in the Region as well as the site of Region's largest colonies of Ring-billed Gulls and California Gulls.

The north side of the Reservoir is cultivated almost to the edge, whereas the remaining shoreline is mainly pasture. The nesting colonies of Double-crested Cormorants, Ring-billed

Gulls and California Gulls are located on an island in the centre of the lake.

The reservoir lies entirely within a very large parcel of land owned by the Hutterite Bretheren. The Hutterites stocked the lake with fish which made it attractive to cormorants, which are fish eaters. Access to the reservoir is limited, affording considerable protection to its valuable wildlife resources.

Members of the Calgary Field Naturalists' Society have observed 103 bird species at Irricana Reservoir. These include 5 species of grebe, White Pelican, Double-crested Cormorant, Great Blue Heron, Black-crowned Night Heron, Snowy Egret, American Bittern, Tundra Swan, Trumpeter Swan, Canada Goose, White-fronted Goose, Snow Goose, 16 species of duck, 5 species of hawk, Sandhill Crane, Sora Rail, American Coot, 19 species of shorebird, 5 species of gull, 2 species of tern, 3 species of owl and 34 miscellaneous upland species.

The Irricana Sloughs (#2153) are a group of small productive waterbodies several kilometres east-southeast of Irricana Reservoir. The qualities of these waterbodies were highly regarded in several independent assessments (Calgary Field Naturalists' Society; Ducks Unlimited; D. Elphinstone, City of Calgary Naturalist). These lakes are noted for unusual ducks, such as Greater Scaup, Barrow's Goldeneye, Cinnamon Teal and Hooded Merganser. These lakes are also used frequently by Great Blue Heron, Black-crowned Night Heron and Double-crested Cormorants. Western Grebes can be found on the large lake adjacent to the railway right-of-way. Tundra Swans and the endangered Trumpeter Swan can be seen in the spring on the most northerly of the lakes. The Upland Sandpiper is also found just north of the lakes. Still further north, Burrowing Owls are sometimes seen.

To the south of Irricana Reservoir is a group of three small sloughs (#2154). The larger of two sloughs located on an east-west road is good for coots, grebes and ducks. It is often the only place to see Ring-necked Ducks in summer. The smaller pond is a cattail marsh good for blackbirds, warblers and wrens. A Great Horned Owl nests in the nearby trees. The general area is also very good for fall-migrating warblers. A slough located on a north-south road is good for nesting and migrating shorebirds. The surrounding upland areas also have excellent populations of Sprague's Pipits, Bairds Sparrows, Savannah Sparrows and Horned Larks.

Bruce Lake (#2155) is one of the most important waterbird lakes in the M.D. of Rocky View. It was nominated as an Environmentally Significant Area by both the Ducks Unlimited and the Calgary Field Naturalists' Society.

Ducks Unlimited identified the lake as an important waterfowl production and migration area. They currently have a project at the south end of the lake.

The Calgary Field Naturalists (Steeves et al., 1982) indicate that all five species of grebe found in Alberta occur in Bruce Lake. The Hooded Merganser, which is relatively rare, can be seen here, and the lake is one of the few where the American Bittern can be seen. Black Crowned Night Heron and Great Blue Heron are common. A large colony of gulls (California or Ring-billed) is found at the south end of the lake and other gulls and terns such as Franklin's Gull, Bonaparte's Gull, Common Tern, Black Tern and the occasional rare Forster's Tern have been seen. Other species seen during our own mid-summer reconnaissance of the lake include Double-crested Cormorant, Pintail, Canvasback, Ruddy Duck, Common Snipe, Marbled Godwit, Willet, Mourning Dove, Eastern Kingbird, Yellow-headed Blackbird, Red-winged Blackbird and Tree Swallow.

The shoreline of Bruce Lake is more varied than those of most of the lakes east of Calgary. The north shore is high in relief, with complex bays and an offshore island. A spit of land divides the northern end of the lake from the southern end, the shores of which are extremely low in relief. Shoreline vegetation varies from emergents to shrubs to open grassland. The diversity of the shoreline may account for the interesting variety of bird life on the lake.

Potential exists for the development of an irrigation reservoir on Canal C of the Western Irrigation District south of the community of Delacour (#2156). Such a reservoir would likely result in an increase in waterbird habitat as well as important recreational benefits.

McElroy Lake (#2157), a small man-made reservoir on Canal C of the Western Irrigation District, is noted by Steves et al. (1982) to be a very productive place in the spring and fall. It is a good place for observing ducks, grebes (all five species found in Alberta), coots and swans. Species observed during a mid-summer reconnaissance of the lake included Horned Grebe, Double-crested Cormorant, Canvasback, Lesser Scaup, Willet, Cliff Swallow and Red-winged Blackbird. The lake is surrounded by farmland pasture and is one of the more unspoiled locations for birdwatching within a short drive of the City of Calgary.

Chestermere Lake (#2158), a large irrigation reservoir on Canal C of the Western Irrigation District, has very intensive lakeside residential development and heavy recreational use by motorized watercraft. Its utility for waterbird production is limited by these factors; however, it is used to some extent as a stopover point for migrating waterbirds.

A complex of sloughs (#2159, 2160, 2161), more or less linearly oriented in a southwest-northeast direction, extends from

the vicinity of Highway 901 south of the community of Shepard to a point north of Highway 560.

The northernmost part of the complex (#2159) is a wetland surrounded by uncultivated prairie pasture. Many species of waterbirds use the central wetlands in wet spring seasons (Steeves et al., 1982). The surrounding grasslands are used by relatively rare species such as Burrowing Owl, Sprague's Pipit, Water Pipit and McCown's Longspur, as well as by more common species such as Chesnut-collared Longspur and Snow Bunting.

The central portion of the slough complex (#2160) is usually dry. Ducks Unlimited has suggested that this area could be developed as an irrigation reservoir and a storm sewer disposal area, which would also be an important waterbird area and recreational resource.

The southern part of the slough complex (#2161) is a favorite bird watching area of the Calgary Field Naturalist's Society. The sloughs are particularly good for large variety of shorebirds, and the adjacent uplands are habitat for Long-billed Curlew, Burrowing Owl and Short-eared Owl. Most of the sloughs in this complex are currently dry.

Weed Lake (#2162), east of Calgary and just north of the Town of Langdon, was drained in the early 1970's, apparently in response to complaints of flooding basements by residents of Langdon. It is a large flat feature with salty soils, supporting no grass. It is regarded as an important area by Ducks Unlimited, who suggest a control gate in the northeast corner and an inlet from Langdon Reservoir to fill the lake. They claim the area has tremendous potential and should never have been drained. When the area contained water, there was a thick marsh vegetation which supported one of the largest breeding Franklin Gull colonies in the area. Pre-drainage bird fauna included at least 10 species of duck, 11 species of

shorebird, Eared Grebe, Great Blue Heron, Sora Rail, Coot, Franklin's Gull, Black Tern, Marsh Hawk, Grey Partridge, Water Pipit and some 13 miscellaneous upland species.

Langdon Reservoir (#2163) and Dalmead Reservoir (#2164) are considered by Ducks Unlimited to be very important waterfowl areas. No specifics were provided by the organization.

Abandoned railway rights-of-way (#2165, 2166) provide access to the Shepard Sloughs and Weed Lake areas in the southeast of the M.D. and to Irricana Reservoir and Irricana Lakes areas in the northeast of the M.D. These rights-of-way extend a considerable distance into the County of Wheatland and their potential use is discussed at length in Section 5.5.5, which deals with key areas for birds in that County.

5.5.4 Key Areas for Birds in the City of Calgary

The Bow River Valley, which was discussed in Section 5.5.1, provides the major bird habitat within the City of Calgary. Most of the City's remaining natural areas are concentrated within this valley. These natural habitats, in conjunction with the adjacent aquatic habitats of the river, continue to provide nesting and staging habitats for a great diversity of waterbirds and upland birds. Much attention has been focussed on Inglewood Bird Sanctuary (#3108) as an area of outstanding importance for birds. This may obscure the fact that the entire Bow River Valley downstream of Inglewood Bird Sanctuary to the southern limits of the City is important to all manner of waterbirds and upland birds.

Glenmore Reservoir (#3125), although highly developed for intensive recreation, is nevertheless an important stopover for migratory waterbirds. Large concentrations of Tundra Swans and Canada Geese can be observed on the reservoir in spring, particularly at the western end in the vicinity of the Weaselhead area.

Two of the eight nesting colonies of Great Blue Herons found within the Region occur within the city limits of Calgary. One is located in the southern industrial part of the city (#3126), in the area bounded by Deerfoot Trail (a major expressway), Heritage Drive (a major arterial road) and the Bow River. The other is found at the eastern part of Fish Creek Provincial Park (#3127).

5.5.5 Key Areas for Birds in the M.D. of Foothills

Several important bird habitats occur in the semi-rural northern portion of the M.D. of Foothills, within a short distance of the City of Calgary.

The Pothole Creek area (#4142), which was previously described in Section 5.1.4, is one of the more diverse bird habitats in the Region. The small ponds scattered through the area support Bufflehead, Barrow's Goldeneye and Ring-necked Duck, and Eared Grebe (Steeves *et al.*, 1982). Our own brief early summer reconnaissance of the area also turned up Lesser Scaup and Ruddy Duck. Although we were unable to undertake surveys for upland birds, habitat conditions appeared very favorable. Raptors also appeared to be plentiful within the general area.

An area of some 12 sections of land (#4143) directly northeast of the Pothole Creek area has been used for a scientific study of raptors by the Biology Department of the University of Alberta. The density of Red-tailed Hawks in this area is the highest ever recorded in North America (Dr. R. Lein, personal communication). It is uncertain whether this density of hawks indicates extraordinary qualities in that particular site or whether it is a reflection of the general excellence of raptor habitat in the uncultivated portions of the M.D. of Foothills.

Lloyd (Red Deer) Lake (#4144) is the only large body of water in the M.D. of Foothills west and north of the Highwood River. As such it assumes regional importance as an aquatic environment. Although not a major waterbird lake, it possesses sufficient wildlife resources to be an area of considerable natural attraction. A field visit in early summer indicated the presence of at least 100 ducks with broods along the southern shore of the lake. A pair of breeding American Avocets and American Coots were also seen. The lake has a diversity of habitats including high shorelines with shrub cover and low shorelines with mudflats. Some country residential development and a public recreation area exists on the lake, but the lake's natural qualities are not significantly impaired. The lake is in a highly aesthetic setting, enhancing its overall value as a natural area.

Radio Tower Slough (#4145) is a small waterbody directly north of the Spruce Meadows equestrian complex. Because of its proximity to a side road, it is an excellent place to view waterbirds at close range. The slough has a good variety of ducks (Steeves et al., 1982). American Coot, Common Snipe, Yellow-headed Blackbird, Red-winged Blackbird and Sora Rail can also be seen here. The site cannot be considered exceptional. However, its preservation is important because it lies just outside the city limits of Calgary. It is therefore one of a very few sloughs that will be accessible to non-motorized residents of the extreme southern part of the City.

Priddis Slough (#4146), which lies between Macleod Trail and the main north-south Canadian Pacific Railway line in the immediate vicinity of Highway 22X, has been a very popular bird watching area for many years, due to its close proximity to the City of Calgary. It has also been used as an educational resource by the University of Calgary and the Calgary Public School System. Currently, the slough is totally dry. Moreover, a major overpass construction and road widening

project being carried out at the junction of Macleod Trail and Highway 22X is taking up land formerly occupied by the slough. It is not clear whether the slough was deliberately drained to accommodate the highway work or whether it simply dried through natural causes. Moreover, it is not known if water levels can be restored after construction is complete.

The natural attributes of Priddis Slough prior to the current construction activity have been documented by Fisher et al. (1977), Denton and Hallworth (1979) and Steeves et al. (1982). The slough is long and narrow with a shoreline of cattails, sedges and grasses. It is an important area for both migrating and nesting birds. Some 120 species have been recorded there, including shorebirds that are infrequently seen in the area, such as Sanderling, Piping Plover, Ruddy Turnstone, Stilt Sandpiper and Short-billed Dowitcher. In addition to its varied bird life, the site has an excellent diversity of plants. More than 143 species of wildflowers have been recorded there.

Priddis Slough represents a classic example of the conflict between environmental conservation and expansion of transportation infrastructure. It would appear that, in this case, conservation of the natural qualities of this irreplaceable water body was not a major priority in the overall decision making process. It may still be possible, however, to salvage a part of the slough. Perhaps the most important lesson to be learned from the demise of Priddis Slough is that it is important to plan well in advance for the protection of scarce environmental resources on the urban fringe and to have policies in place well before proposals for competing land uses are made.

Three colonies of Great Blue Herons are found within the M.D. of Foothills in the dense Balsam Poplar floodplain forests of the Sheep River (#4147), Bow River (#4150) and Highwood River (#4151).

Four lakes in the portion of the M.D. of Foothills east of Highway 2 are important to waterbirds. All of the lakes were observed during our field checks to be totally dry, a dramatic testimony to the seriousness of the general drying trend that appears to be occurring in the Calgary Region.

Frank Lake (#4152) is the largest (15.7 square kilometres) and traditionally the most important of the four important water-bird lakes in the M.D. of Foothills. It is the only lake in the Calgary Region, and one of only four lakes in the Province of Alberta, rated as a "high priority" duck staging habitat by the Canadian Wildlife Service (1979). It is also one of only four lakes in the Region rated by the same organization as "medium priority" goose staging habitat, and one of only two lakes in the Region rated as "medium priority" production and staging habitat for colonial nesting migratory birds. The current status of the lake is uncertain. A portion of the lake has been permanently drained, and the remaining portion is also dry this year.

Frank Lake's well developed emergent vegetation has provided excellent habitat for a wide variety of bird species. The northern and southeastern parts of the lake have the best habitat characteristics.

Birds observed at Frank Lake have included the Common Loon, 4 species of grebe, Double-crested Cormorant, Great Blue Heron, Black-crowned Night Heron, American Bittern, Tundra Swan, Canada Goose, White-fronted Goose, 16 species of duck, 6 species of raptor (including the endangered Peregrine Falcon), Sandhill Crane, Sora Rail, American Coot, 20 species of shore-bird, California Gull, Ring-billed Gull, Franklin's Gull, Common Tern, Black Tern and 24 miscellaneous upland species.

Nesting species include Black-crowned Night Heron, Canada Goose, Mallard, Pintail, Canvasback, Marsh Hawk, American

Coot, California Gull, Ring-billed Gull, Franklin's Gull, Western Meadowlark and Yellow-headed Blackbird.

Blizzard Lake (#4148) is rated on the Alberta Fish and Wildlife Branch's Wildlife Key Area Maps as an important waterfowl production lake. Third Lake (#4149) located approximately four kilometres to the east of it appears to be very similar in character to Blizzard Lake. No specific information on either of these lakes has been obtained. Both appear to be very susceptible to drying, and both have the appearance, from the luxuriance of vegetation now growing on the former lake bottoms, of having been dry for more than a year.

Silver Lake (#4153) is identified by the Alberta Fish and Wildlife Branch as an important waterfowl production lake and by Ducks Unlimited as an important waterfowl lake and migratory stopover point. Ducks Unlimited indicated that there are excellent waterfowl populations on the lake when water supply is adequate. They indicate that the lake is also noted for its large numbers of Tundra Swans during migration. Mid-summer reconnaissance of the lake indicated that it has been dry for some time. It is currently being used as pasture by cattle.

5.5.6 Key Areas for Birds in the County of Wheatland

The County of Wheatland contains a number of very important areas for birds. A chain of large lakes comprising Eagle Lake (#5137), Namaka Lake (#5138) and Stobart Lake (#5139), is a waterbird area of provincial significance.

Eagle Lake (#5137), located south of the Trans-Canada Highway east of the community of Strathmore, is the largest of the three lakes (12.1 square kilometres). It is surrounded mainly by agricultural land, but has some country residential development along the northwest shore and a small developed recreational area on the east shore. Grazing generally occurs to

the lake edge and has eliminated most shoreline cover. Development of emergents is poor except in the marshy southwest corner of the lake. Ducks Unlimited has expressed interest in maintaining and enhancing waterfowl habitat in this end of the lake. A study of Eagle Lake conducted by the Calgary Regional Planning Commission (1982) recommended the establishment of a waterfowl and wildlife reserve in this area.

The Canadian Wildlife Service (1979) rates Eagle Lake as a "medium priority" goose staging habitat. Adams (1983) also rates the lake as being of value for goose production. The Alberta Fish and Wildlife Branch rates Eagle Lake as an important staging (migration) area on their Wildlife Key Area Map of the area. Steeves et al. (1982) indicate that the whole area at the southwestern end of Eagle Lake is excellent for many kinds of waterbirds and shorebirds, including uncommon Forster's Terns and migrating Sandhill Cranes. Dr. T. Myres (Professor of Biology, University of Alberta, personal communication) has indicated that the lake is important for fish-eating waterbirds such as Common Loon and Common Merganser as well as for non-breeding and migrating White Pelicans.

California and Ring-billed Gulls formerly nested on Eagle Lake, but a 1976 census indicated that they were no longer present.

A small slough (#5138) just east of Eagle Lake is an extremely good habitat for locally-breeding shorebirds. Early summer field reconnaissance revealed the presence of significant numbers of American Avocets, Lesser Yellowlegs, Wilson's Phalaropes and Marbled Godwits. Blue-winged Teal were also present. Dr. T. Myres (personal communication) revealed that dowitcher, Pectoral Sandpiper, Baird's Sandpiper and Grey Plover are found in the same waterbody during fall migrations.

Dr. T. Myres (personal communication) considers Namaka Lake (#5139) to be the most important lake in the Calgary Region for Tundra Swans, Snow Geese, and Canada Geese. In contrast, the Canadian Wildlife Service (1979) does not identify the lake as being important for either goose production or goose staging. Neighboring Eagle and Stobart Lakes are, however, cited as "medium priority" goose staging habitats. Alberta Energy and Natural Resources shows Namaka Lake as an important waterfowl production and staging (migration) area on its Wildlife Key Area Maps.

The two peninsulas which project into Namaka Lake are important for migrating waterfowl (Dr. T. Myres, personal communication) and are also a favored hunting location.

Species recorded at Namaka Lake include Common Loon, Red-necked Grebe, Eared Grebe, Western Grebe, White Pelican, Great Blue Heron, Black-crowned Night Heron, American Bittern, Whistling Swan, Canada Goose, White-fronted Goose, Ross' Goose, 16 species of duck, 4 species of hawk, Osprey, Prairie Falcon, Sandhill Crane, Sora Rail, American Coot, 19 species of shorebird, 3 species of gull, 3 species of tern and 21 miscellaneous upland bird species.

Nesting species include Eared Grebe, Horned Grebe, Western Grebe, Canada Goose, Mallard, Gadwall, Pintail, Green-winged Teal, American Wigeon, Northern Shoveller, Redhead, Canvas-back, Lesser Scaup, Ruddy Duck, American Coot, Killdeer, California Gull, Ring-billed Gull, Franklin's Gull, Common Tern, Black Tern, Yellow-headed Blackbird, Red-winged Blackbird and Savannah Sparrow.

Stobart Lake (#5140), located within the Blackfoot Indian Reserve, is the most natural of the three large waterbodies in southern Wheatland County. It has extensive development of nearshore and offshore emergents (Cattails and Bulrushes) and produces large numbers of waterfowl.

Stobart Lake is rated as a "medium priority" duck staging and goose staging habitat by the Canadian Wildlife Service. It is rated as a key waterfowl production and staging area by Alberta Fish and Wildlife.

Species recorded at Stobart Lake included Common Loon, Horned Grebe, Eared Grebe, Western Grebe, Great Blue Heron, Black-crowned Night Heron, American Bittern, Tundra Swan, Canada Goose, Snow Goose, 14 species of duck, 3 species of hawk, 8 species of shorebird, Sora Rail, American Coot, California Gull, Franklin's Gull, Forster's Tern, Common Tern, Black Tern, and 18 species of miscellaneous upland birds.

Nesting species include Eared Grebe, Western Grebe, Black-crowned Night Heron, American Bittern, Canada Goose, Mallard, Gadwall, Pintail, Green-winged Teal, American Wigeon, Shoveler, Canvasback, Lesser Scaup, Ruddy Duck, American Coot, Willet, California Gull, Franklin's Gull, Horned Lark, Barn Swallow, Yellow-headed Blackbird and Red-winged Blackbird.

Several small lakes peripheral to the main group of important lakes (#5132, 5141, 5142) are shown on the Alberta Fish and Wildlife Branch's Wildlife Key Area Map as being important waterfowl production areas. No specific data on these lakes have been obtained.

Waterbodies of potential importance to birds in the northern and western parts of Wheatland County have been severely impacted by current dry conditions.

An area of sloughs (#5130) northwest of the community of Rosebud, which was briefly alluded to in Steeves et al. (1982) was found to be totally dessicated.

Mattoyekiu Lake (#5135) was similarly dry. This lake is reported by Ducks Unlimited to be excellent for waterfowl production when water conditions are favorable.

Seiu Lake (#5136) did contain water when it was examined during our mid-summer reconnaissance. It had more summer waterfowl than any of the other major lakes in the Calgary Region. At least a thousand ducks were on the lake at the time of our field visit. There was also a large nesting colony of Eared Grebes as well as a number of Canada Geese. The sandy shoreline of the lake was found to be diverse, with a broad edge left uncultivated. Numerous spent shotgun shells attested to the popularity of the area for hunting.

Deadhorse Lake (#5134), with an area of some 12 square kilometres, is virtually the same size as Eagle Lake, the largest lake in the County of Wheatland. However, it has suffered chronic water shortages for a number of years and now serves as pasture for cattle. The lake has been well known in the past for some of the largest concentrations of migrating Snow Geese seen in the Region (G. Freeman, Ducks Unlimited, personal communication). Ducks Unlimited believes that some water could be retained in the lake all season long if the lake were compartmentalized. Thus some of its former productivity could be restored.

There is some potential for developing a water storage reservoir at the junction of Crowfoot Creek and Parflesh Creek (#5133) to catch spring runoff to supplement summer flows to the Eastern Irrigation District (George Freeman, Ducks Unlimited, personal communication). Benefits to waterbirds and other forms of wildlife, as well as recreational benefits, could accrue from such a project.

George Freeman of Ducks Unlimited has suggested that advantage should be taken of abandoned railway rights-of-way to provide corridors of natural habitat and access to the prairie landscape without necessitating trespass on private lands. These rights-of-way provide numerous habitat niches for upland birds as well as access to some of the best prairie wetlands in the

Calgary Region. There is concern that they might eventually be taken over by adjacent farmers, with the resultant loss of a priceless opportunity for conserving upland wildlife habitat and creating an uninterrupted prairie trail system.

Two abandoned railway lines are currently found in the County of Wheatland and the eastern part of the M.D. of Rocky View.

The more northerly line (#2155, 5131) which connects the community of Irricana with the communities of Rockyford and Standard provides excellent visual access to Irricana Reservoir (#2152) and the Irricana Sloughs (#2153). It encompasses a variety of interesting upland country in the County of Wheatland, including areas of aeolian sand deposits (Map 1, #2132, 5101), the valley of Serviceberry Creek (Map 1, #5102), an area of rock uplands near Tudor (Map 1, #5103) and an area of saline flats (Map 1, #5104). It should provide opportunities for viewing birds and other forms of wildlife in a wide variety of habitats.

The more southerly line (#2165, 5146) which connects the community of Shepard with the community of Gleichen, is equally intriguing. It provides excellent access to Eagle Lake, Namaka Lake and Stobart Lake, one of the premier water-bird areas in the Calgary Region. Moreover it provides for the possibility of a ready-made access point to the sloughs near Shepard (#2160) and to Weed Lake (#2162) in the M.D. of Rocky View, in the event that these areas are restored to aquatic habitats in the future.

As indicated in Section 4.5.6 the Bow River Valley throughout the length and breadth of the Calgary Region is an extremely important bird habitat. The section of the Bow River Valley bordering the County of Wheatland is exceptionally good for birds. Its broad floodplain, with its numerous wooded and unwooded islands and point bars, its slow flowing side channels and its stagnant lagoons provide a multitude of

habitats for water-associated birds. Its broad terraces with extensive grassland vegetation may also be significant for upland prairie species.

The forested floodplain of this stretch of the Bow River valley supports two colonies of Great Blue Herons. One is located upstream of the Carseland Weir (#5144) and the other (#5145) is located within the heart of the Blackfoot Indian Reserve.

5.6 KEY AREAS FOR FISH (Map 6)

The Calgary Region is very fortunate in being endowed with some of the best cold-water sports fisheries in North America. Both natural circumstances and the activities of man have affected the evolution of these fisheries.

The native salmonid species of the Calgary Region are the Mountain Whitefish, Cutthroat Trout and Dolly Varden (Bull Trout). Since 1936, species non-native to the region (Rainbow Trout, Brown Trout, Eastern Brook Trout) have been raised at a hatchery located in the City of Calgary and widely released in surrounding streams and lakes. As a result of these releases, as well as changing environmental conditions in the streams of the Region, the current composition of the cold-water fishery is vastly different today from what it was 50 years ago. Although Mountain Whitefish have maintained their status as the most abundant sport fish in virtually every stream in the Region, the Rainbow Trout has largely supplanted the Cutthroat Trout as the major spring spawning trout of the Region. Competition and extensive hybridization between Rainbow Trout and Cutthroat Trout has virtually eliminated many native stocks of the latter species. The supplanting of Cutthroat Trout by Rainbow Trout is dramatically highlighted in a study by McDonald (1975) of spawning rainbow trout from the Bow River downstream of Calgary. Field work undertaken in 1971 to 1973 indicated large numbers of spawning Rainbow Trout in head-water streams of the Highwood/Sheep River system, such as Ware, Threepoint and Sullivan Creeks. In previous studies of the same

streams, conducted by Miller and MacDonald (1950) and Paetz (1957), Cutthroat Trout were the dominant species and Rainbow Trout formed only a minor part of the fish fauna.

The introduction of Brown Trout also seems to have adversely affected native stocks of Cutthroat Trout and Dolly Varden. Paetz and Nelson (1970) believe that Brown Trout are partly responsible for the decline of some native salmonids. They suggest that the Brown Trout's highly territorial behaviour and aggressiveness toward other species of fish is responsible for this decline. However, they also indicate that Brown Trout do not compete for space with Mountain Whitefish.

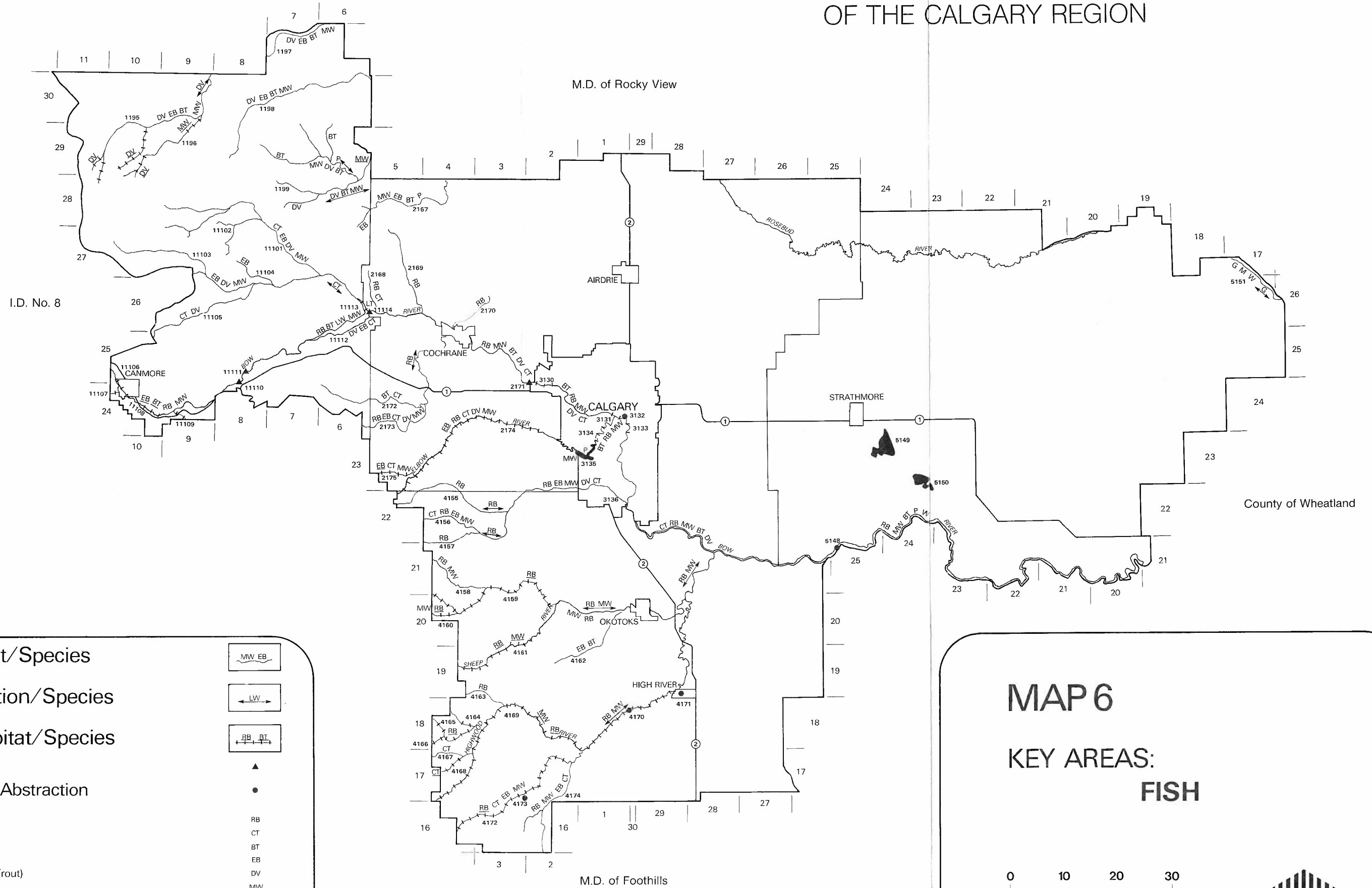
Adult Rainbow Trout and Brown Trout are more tolerant of high water temperatures and low dissolved oxygen levels than are other salmonid species. This may also account for their survival in the face of continuing deterioration of many aquatic habitats. The species are nevertheless sensitive to the effects of degradation of their spawning habitats, as are all salmonids.

There are no natural lakes in the Region suitable for Lake Trout. However, damming of the mainstem Bow River has resulted in the creation of at least two deep water reservoirs (Ghost and Bearspaw Reservoirs) which now contains this species. It is believed that these reservoirs were colonized by fish which escaped from Lake Minnewanka in Banff National Park.

The stream fisheries of the prairie portions of the M.D. of Rocky View and the County of Wheatland are very limited due to high summer water temperatures and unreliable flows. Lake fisheries exist only at a couple of locations within this part of the Region.

Information on the distribution of important fish habitats in the Calgary Region has been obtained from a number of sources. A comprehensive account by Longmore and Stenton (1981) was the most useful for a regional overview. Additional information on species composition in the various streams and lakes within the Region were obtained from the Fish Resource Maps compiled by Alberta Fish & Wildlife and

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



Fish Habitat/Species

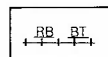
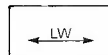
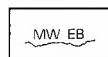
Fish Migration/Species

Critical Habitat/Species

Dam

Weir/Water Abstraction

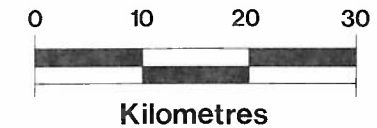
- Rainbow Trout
- Cutthroat Trout
- Brown Trout
- Eastern Brook Trout
- Dolly Varden (Brook Trout)
- Mountain Whitefish
- Lake Whitefish
- Mooneye
- Northern Pike
- Walleye
- Goldeye



- RB
- CT
- BT
- EB
- DV
- MW
- LW
- M
- P
- W
- G

MAP 6

KEY AREAS: FISH



The information on this map may be refined by detailed on-site investigations which may result in boundary alterations.

supplemented with information from commercially prepared maps produced by Brock Hassell (1983). These latter maps appear to be largely based on the Fish & Wildlife Maps, with some updating and correction.

A number of reports (McDonald, 1975; Thompson, 1978; Griffiths, 1979; Stelfox, 1979 a, b; Stelfox, 1980; Stelfox and Konybelt, 1980; Stelfox, 1981; Stelfox and Ladd, 1982) provided detailed information on various aspects of the fisheries of specific streams within the Calgary Region.

5.6.1 Key Fish Habitats in I.D. #8

I.D. #8 encompasses parts of both the Red Deer River and Bow River watersheds.

Fish habitats of the Red Deer River drainage in I.D. #8 include a small segment of the mainstem Red Deer River (#1197), North Burnt Timber Creek (#1195), Burnt Timber Creek (#1196), Fallentimber Creek (#1198), the Little Red Deer River system (#1199) and the upper reaches of the Dogpound Creek system (#2167).

The upper Red Deer River system is characteristic of mountain and foothills streams, with a cold, short growing season, low concentration of dissolved minerals, fluctuating flows, high dissolved oxygen concentrations and unpolluted water. Four species of cold water salmonid, Mountain Whitefish, Dolly Varden, Brown Trout and Eastern Brook Trout, are found within these waters. Mountain Whitefish is the most abundant game species, whereas the other species are more sought after.

Dolly Varden undertake upstream migrations to spawning areas located at the headwaters of North Burnt Timber (#1195) and Burnt Timber (#1196) Creeks and the Little Red Deer River (#1199). Mountain Whitefish spawn on suitable substrate throughout these stream systems (Langmore and Stenton, 1981).

Brown Trout do not appear to be as numerous as the other species. They have been found in the mainstem of the Red Deer (#1198), and in the Little Red Deer River (#1199) and Fallentimber Creek (#1198). The upper reaches of the Little Red Deer River are considered to be excellent for Brown Trout.

The Ghost River drainage system (#11101 to 11105), which forms a sub-basin of the Bow River drainage system, has Cutthroat Trout in addition to Mountain Whitefish, Dolly Varden and Eastern Brook Trout. Brown Trout are not as widely distributed as in the streams of the upper Red Deer River drainage, and are confined mainly to lower Ghost River. Like the streams of the Red Deer River drainage, the streams of the Ghost River drainage are cold mountain and foothills streams of relatively low productivity.

Spawning areas within the Ghost River drainage system are not well known. Cutthroat Trout are believed to migrate from the Ghost Reservoir (#11112) upstream into the system to spawn (Longmore and Stenton, 1981).

The Bow River within I.D. #8 can be broken into two segments:

- 1) The Banff Park boundary to the Kananaskis Dam at Seebe
- 2) The Kananaskis Dam to the Ghost Dam.

In the section of the river between the Park boundary and Kananaskis Dam, Mountain Whitefish are the most abundant species. The fishery for this species between Bow Falls (in Banff National Park) and Seebe is reputed to be the best in Alberta (Calgary Regional Planning Commission, 1977). Brook Trout and Brown Trout are also common, but Rainbow Trout are less numerous and Dolly Varden are very rare (Longmore and Stenton, 1981). Productivity of the river environment is adversely affected by irregular water discharges from hydroelectric plants at Lake Minnewanka and the Spray Lakes.

Spawning of Brown Trout and Brook Trout occurs right in the Town of Canmore (#11106) in Policeman's Creek and Spring Creek. Stelfox (1979 b) found 208 Brook Trout redds and 20 Brown Trout redds in Policeman's Creek. He found 450 Brook Trout redds, but no Brown Trout redds in Spring Creek.

Policeman's Creek is also a valuable resident trout stream, containing an estimated total population of at least 1475 Brook Trout and 130 Brown Trout (Stelfox, 1979 b). Policeman's Creek, and to a lesser extent, Spring Creek, are rearing streams for Mountain Whitefish.

The multiple channels of the Bow River downstream of Canmore (#1108) provide extensive spawning habitat for Eastern Brook Trout and especially for Brown Trout. Stelfox (1979 b) located a total of 125 Eastern Brook Trout redds and a total of 123 Brown Trout redds in this area. The channel directly adjacent to the CPR right-of-way was the most important area for Brown Trout spawning.

Spawning activity also takes place along the lower reaches of Canmore Creek (#1107) and Pigeon Creek (#1109), but is thought to be minor compared to that taking place in the Bow River Channels and in Policeman's and Spring Creeks.

The section of the Bow River between Kananaskis Dam (#1110) and Ghost Dam (#1114) is affected by the fluctuating water release regime of hydro-electric reservoirs. The status of fish populations and the locations of spawning habitats are poorly known. The river portion of this section of the Bow River contains mainly Mountain Whitefish, Rainbow Trout and Brown Trout. The reservoir above Horseshoe Dam (#1111) also contains Dolly Varden (Bull Trout). The large Ghost Reservoir, which occupies approximately the downstream half of this stretch of the Bow River, contains Mountain Whitefish, Rainbow Trout, Brown Trout, Dolly Varden, Eastern Brook Trout and Cutthroat Trout, as well as lake species, such as Lake Trout,

and Lake Whitefish. The reservoir is not, however, a highly productive fishery, although there is considerable recreational fishing on the lake due to its proximity to Calgary.

Lake Trout are known to spawn in the lower reaches of the Ghost Reservoir in the flooded mouth of the Ghost River (#11113). The concentration of Lake Trout in this part of the reservoir results in a sport fishery for this species which would otherwise be difficult to sustain.

5.6.2 Key Fish Habitat in the M.D. of Rocky View

The majority of the M.D. of Rocky View falls within the Bow River watershed. However, the northwest corner, drained by Dogpound Creek is within the Red Deer River basin.

Dogpound Creek (#2167) contains Mountain Whitefish, Eastern Brook Trout, Brown Trout and Northern Pike. It is well known for its very large Brown Trout.

The Bow River between Ghost Dam (#1114) and Bearspaw Dam (#2171) contains Mountain Whitefish, Rainbow Trout, Brown Trout, Dolly Varden and Cutthroat Trout.

Several tributaries of the Bow River along this stretch also have fish populations. On the north side of the River, Spencer Creek (#2168), Grand Valley Creek (#2169) and Bighill Creek (#2170) have populations of Rainbow Trout or Rainbow Trout - Cutthroat Trout hybrids. To the south of the Bow River, the Jumpingpound Creek system is an important fishery. Jumpingpound Creek (#2173) is probably the major spawning stream for Rainbow Trout between Ghost Dam and Bearspaw Dam. It also supports populations of Eastern Brook Trout, Cutthroat Trout, Dolly Varden and Mountain Whitefish. Little Jumpingpound Creek (#2172) is used by Brown Trout and Cutthroat Trout.

The Elbow River above Glenmore Dam (#2174) is an important stream for spawning Brook Trout (Stelfox 1980). High quality spawning substrates occur from the Forest Reserve boundary to the city limits of Calgary, especially within seepage channels of the River, which often appear to have little water. The stream also supports Mountain Whitefish and a few Rainbow Trout, Cutthroat Trout and Dolly Varden.

Bragg Creek (#2175) is the most heavily utilized spawning area for Eastern Brook Trout within the Elbow River drainage. A fall-spawning survey of the stream (Stelfox 1980) revealed the presence of more than 700 redds, about twice as many as in the Elbow River seepage channels. Bragg Creek is also an excellent all round trout stream. Stelfox's (1980) estimate of 517 trout per mile is one of the highest obtained in the Elbow River watershed. Bragg Creek also appears to contain a self-sustaining Mountain Whitefish population, as well as a few Cutthroat Trout.

The only lake fishery of any consequence in the M.D. of Rocky View is on Chestermere Lake, just east of the city limits of Calgary, where non-salmonid sport species such as Northern Pike are taken.

5.6.3 Key Fish Habitat in the City of Calgary

Some of the best trout waters in North America occur in the Bow River downstream of the Bearspaw Reservoir, including parts of the river within the City of Calgary (generally downstream of the Glenmore Trail Bridge). The Bearspaw Reservoir stabilizes the flow of the Bow River, enhancing the productivity of the downstream fishery. Nutrients from treated sewage discharged by the City of Calgary contribute to an abundance of food organisms and consequent high growth rates of fish in this part of the river. However, this nutrient enrichment also creates nuisance growths of algae and rooted aquatics, and has caused occasional fish kills.

From Bearspaw Dam (#2171) to the Western Irrigation District Weir (#3132) east of the downtown area, the Bow River is relatively clean and cold; this stretch of the river still possesses many of the characteristics of a mountain stream. There are no inputs of treated sewage; the only contaminants received by the river are from storm sewer drainage.

Between the Western Irrigation District Weir and the southern city limits, the Bonnybrook and Fish Creek sewage treatment plants discharge significant quantities of treated sewage. Heavy industry, including an oil refinery, also contribute some contaminating substances. Water abstraction at the Western Irrigation District Weir (339 million cubic metres per year) reduces the amount of water available to dilute nutrients and contaminants.

Fish grow very quickly downstream of the Bonnybrook sewage treatment plant as a result of nutrient enrichment of the water, and some excellent sport fishing is available downstream of this plant. A world class fishery for Rainbow Trout is considered to commence at the Glenmore Trail Bridge (J. Eisenhauer, Chairman, Alberta Water Management Coalition, personal communication). Enrichment has also caused aquatic plant growths in this stretch of the river to reach nuisance proportions. Spawning potential is greatly reduced, and side channel rearing areas are almost totally clogged with vegetative growths (Griffiths, 1979).

Palatability of fish caught within the Bow River downstream of the Western Irrigation District Weir has generally been considered poor in the past. However, recent improvement in water treatment to remove a greater proportion of oils and phenols has resulted in a significant reduction in complaints about the taste of fish caught from the river.

The most sought after species in the Bow River in Calgary is Rainbow Trout, although Mountain Whitefish are more frequently

caught. Brown Trout contribute a small but significant proportion of the total catch. Species such as Dolly Varden and Cutthroat Trout are caught only occasionally.

The Glenmore Reservoir (#3135) provides habitat for Rainbow Trout, Brown Trout, Mountain Whitefish and Northern Pike; it experiences considerable angling activity.

The only known mainstem river spawning area for Rainbow Trout downstream of the Bearspaw Reservoir occurs just below Bearspaw Dam in the vicinity of the western city limits (Longmore and Stenton, 1981). Spawning runs for Rainbow Trout also occur within the city on the Elbow River downstream of Glenmore Dam and in Fish Creek.

Most spawning habitats for Brown Trout downstream of Bearspaw Dam occur within the limits of the City of Calgary. Sosiak (1982) has identified mainstem river spawning areas just downstream of Bearspaw Dam (#3130) in Zoo Channel (#3131) and downstream of Inglewood Bird Sanctuary (#3133). Brown Trout also spawn in the Elbow River (#3134) downstream of Glenmore Dam.

A major spawning area for Mountain Whitefish exists just downstream of Bearspaw Dam. Spawning runs of this species support a considerable sport fishery. Elsewhere, spawning locations have not been definitely confirmed, although there is overwhelming evidence of spawning on the Elbow River downstream of Glenmore Dam. Mountain Whitefish are also believed to spawn in a number of unidentified locations within the mainstem Bow River.

5.6.4 Key Fish Habitat in the M.D. of Foothills and the County of Wheatland

The Bow River within the Calgary Planning Region downstream of the City of Calgary is a fishery resource of great significance. An international class sport fishery for Rainbow

Trout, which commences within the City of Calgary, extends as far as the western boundary of the Blackfoot Indian Reserve. A sport fishery of at least regional significance exists within the Reserve.

The Bow River downstream of Calgary also has excellent sport fisheries for Mountain Whitefish and Brown Trout. Species such as Dolly Varden and Cutthroat Trout are present in small numbers in the river, and are only occasionally caught.

The quality of the sport fishery in this part of the Bow River is the result of stable, relatively cold, nutrient-enriched flows. At the Bow River Irrigation District Weir near Carse-land, a substantial percentage of the flow of the Bow River is diverted for irrigation purposes. With reduced flows, the rate of warming of the river increases significantly. The section of the river between the Bow River Irrigation District Weir and the eastern boundary of the Calgary Region is essentially a zone of transition from a cold-water to a warm-water fishery. Just downstream of the Weir, a slight warming of the waters creates near-optimum productivity for cold-water salmonids. However, conditions for cold-water salmonids progressively deteriorate with increasing downstream distance from the Weir, and warm water species become a progressively more significant component of the fish fauna.

The maintenance of Rainbow Trout in the Bow River, both upstream and downstream of the Weir is dependent upon fish being able to successfully migrate to and spawn in streams in the upper Highwood/Sheep River system. For Rainbow Trout downstream of the Weir, the ability to negotiate the fish passage structure provided is critical. These movements are sometimes hampered by profuse aquatic growths, as well as by design deficiencies of the Weir (Longmore and Stenton, 1981). Brown Trout appear to be less dependent upon tributary streams. As indicated in the previous section, important spawning habitats occur on the mainstem Bow River within the City of Calgary.

Brown Trout downstream of the Bow River Irrigation District Weir at Carseland area spawn just downstream of the Weir (Longmore and Stenton, 1981).

The important Rainbow Trout spawning areas on the Highwood/-Sheep River are found on upstream reaches and tributary streams. Critical spawning habitats include Threepoint Creek (#4159), Ware Creek (#4160), the Sheep River above Turner Valley (#4161), North Sullivan Creek (#4164), Sullivan Creek (#4165), South Sullivan Creek (#4166), the Highwood River (#4169) above High River and Pekisko Creek (#4172). The importance of Ware Creek, Sullivan Creek and Pekisko Creek for spawning Rainbow Trout was first established by MacDonald (1975). These findings were confirmed by Stelfox (1981), who also found high redd densities on Threepoint Creek and moderate redd densities on Pekisko Creek. More recent work carried out by Sosiak in 1983, and as yet unpublished, indicates that Pekisko Creek is as important a spawning area as Ware and Threepoint Creeks. This work has also revealed, for the first time, the importance to spawning Rainbow Trout of the Sheep River above Turner Valley and the Highwood River above High River.

The Highwood/Sheep River system is a trout production stream system as well as a spawning system. The system is important for the rearing of young Rainbow Trout. Considerable numbers of large post-spawning Rainbow Trout also remain in the system during the summer months. Resident populations of Rainbow Trout, Cutthroat Trout, Brook Trout and, to some extent, Brown Trout are found in most streams within the Highwood/Sheep drainage.

A small tributary of Trap Creek (#4168), which is isolated from the rest of the Highwood/Sheep River system by a waterfall, contains a stock of native Cutthroat Trout. This may be the only stream in the Calgary Region where native Cutthroat Trout still exist; elsewhere hybridization with Rainbow Trout

is causing the disappearance of Cutthroat Trout as a distinct species.

Mountain Whitefish are very plentiful within the Highwood/- Sheep River system. The species undertake seasonal movements, migrating upstream in the summer to feed and migrating downstream to spawn. Mountain Whitefish spawn in the Highwood River from slightly downstream of the confluence with Pekisko Creek to the confluence with the Bow River (Longmore and Stenton, 1981). They also spawn in the Sheep River from Turner Valley to the confluence with the Highwood River.

There is significant potential for conflict between irrigation water uses and the maintenance of the world class fisheries in this part of the Region. Currently, significant quantities of water are being diverted from the Highwood River to the Little Bow River for irrigation via a channel downstream of the community of High River (#4171). This level of water abstraction, coupled with naturally low summer flows, could result in river temperatures rising above the maximum that can be tolerated by the cold-water species present.

A disused water diversion structure (#4170), which could be rehabilitated to divert water to the Little Bow System via Mosquito Creek, exists upstream of the community of High River on the Highwood River. Irrigation water for local use is also being diverted from Pekisko Creek at location #4173.

Of even greater significance to the Bow River fishery than the previously described diversions is the possibility of future irrigation water storage projects on the mainstem Bow River. One such proposal, which would flood most of the Bow River Valley along the boundary between the M.D. of Rocky View and the M.D. of Foothills, was evaluated by MacDonald (1975), who predicted the virtual elimination of much of the world class fishery we know today. Alternative reservoir sites have been investigated at several other locations, including sites within the Blackfoot Indian Reserve.

Aside from the fisheries of the Bow, Highwood and Sheep River systems, there are virtually no river fisheries of any significance in the M.D. of Foothills or the County of Wheatland.

The Red Deer River (#5151) contains warm water species, such as Goldeye, Mooneye and Walleye, but does not support any significant sport fishery. Lake fisheries are also limited. Eagle Lake (#5149) contains both Northern Pike and Walleye, the latter being the object of an important recreational fishery. Namaka Lake (#5150) provides some angling opportunities for Northern Pike and Lake Whitefish.

5.7 PARKS, WILDERNESS AREAS, NATURAL AREAS AND ECOLOGICAL RESERVES (ACTUAL AND PROPOSED)

A number of mechanisms for the conservation of natural environments are currently available within the Calgary Region. Such mechanisms exist at both the provincial and municipal levels of government.

The Province has the power to designate Wilderness Areas, Ecological Reserves, Natural Areas, Provincial Parks and Historic Sites. Each of these designations carries varying levels of stringency in environmental preservation requirements.

The Wilderness Area designation is reserved for very large tracts of pristine environment. Virtually all activities that would alter the environment from its natural state, including the building of roads, the operation of motorized vehicles, hunting and fishing, are prohibited. These restrictions, in conjunction with the large area of land set aside, afford Wilderness Areas the highest level of protection currently available.

Ecological Reserves are set aside for the purpose of preserving the full range of diversity of Alberta's natural regions. The major reasons for setting these areas are scientific, educational and philosophical. Restrictions enforced within Ecological Reserves are similar to those enforced in Wilderness Areas. However, because

Ecological Reserves, as currently envisioned, are much smaller than wilderness areas, they have the potential of being more heavily impacted by human use. Although the legislation enabling designation of Ecological Reserves is in place, no lands have as yet been designated.

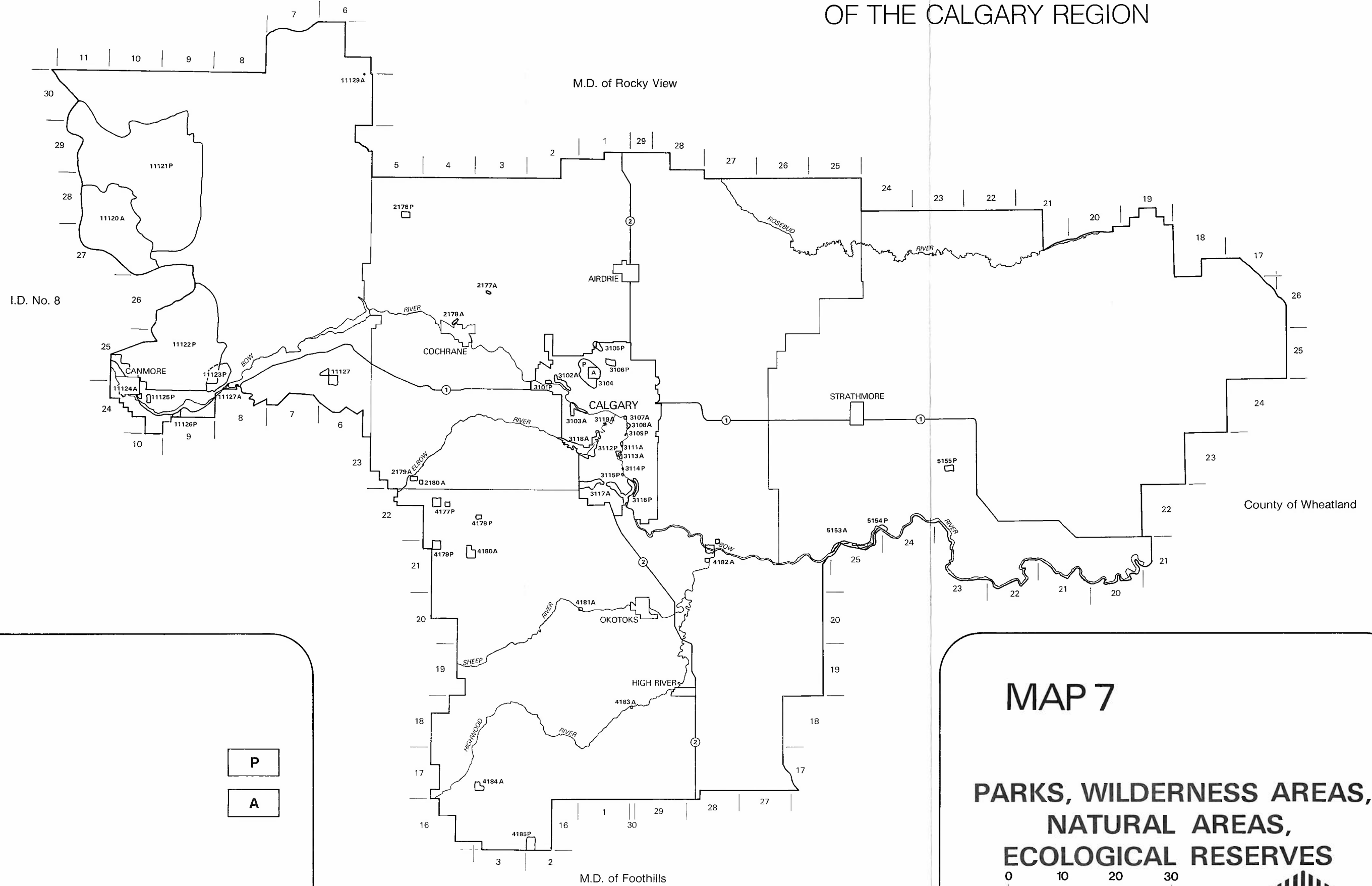
Provincial Parks are multi-use areas which are normally zoned to accommodate a mix of outdoor recreational demands. Portions of a Provincial Park may be very intensively developed with roads, campsites and permanent facilities. A significant natural component is usually retained. Even within the natural component, however, formal infrastructure, such as groomed or surfaced trails, must often be provided because of the very intensive recreational use received by these areas.

Natural Areas are simply parcels of land in a natural or semi-natural state set aside for outdoor recreation or educational instruction. A site need not be ecologically significant to be set aside as a Natural Area. However, the preservation of the province's natural diversity is a secondary criterion in the selection of Natural Areas.

Historic sites are not primary vehicles for the conservation of natural environments. However, certain large sites, such as the Cochrane Ranche, may incorporate lands with important environmental values. In such situations, the establishment of a Historic Site does, in fact, have a considerable environmental conservation effect.

Municipal governments frequently incorporate tracts of relatively natural landscape into their formal system of parks. They may also acquire direct ownership of land of conservation value through a variety of mechanisms including provisions for the ceding of undevelopable land as Environmental Reserve. More recently municipalities, such as the City of Calgary, have been planning a formal system of natural areas to conserve residual natural environments in the city and to provide city residents with opportunities for nature-oriented forms of recreation (hiking, wildlife observation, botanical

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



Proposed

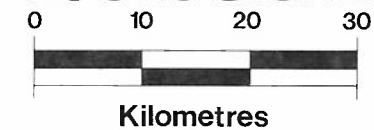
P

Actual

A

MAP 7

**PARKS, WILDERNESS AREAS,
NATURAL AREAS,
ECOLOGICAL RESERVES**



pursuits, photography). A comprehensive plan for a system of natural areas in the city's river valleys has been prepared by the City of Calgary Planning Department (1981). Implementation of the plan has not yet been initiated.

5.7.1 Wilderness Areas, Natural Areas and Ecological Reserves in I.D. #8

The Ghost River Wilderness (#11120) is the only large area with official conservation status within I.D. #8. This area, of about 153 square kilometres includes the valley of the headwaters of the Ghost River, as well as the surrounding mountains, which rise as high as 2900 metres. Below 2100 metres the vegetation consists of subalpine forests of White or Engelmann Spruce, Subalpine Fir and Lodgepole Pine. At higher elevations the closed forests give way to an open transition forest of dwarf trees and ultimately to a treeless alpine tundra vegetation.

The Ghost River Wilderness is a true wilderness area in that there are no roads to accommodate vehicular traffic and no permanent infrastructure. Access to the area is provided by a system of hiking trails.

The Alberta Wilderness Association (no date) has recommended the establishment of two large "Recreational Wildernesses" in I.D. #8. They suggest that these areas be set aside for primitive recreation, which would include such activities as fishing. In such primitive recreation areas, however, no additions would be made to the existing man-made infrastructure to facilitate access or to provide organized camping facilities. Moreover, incompatible land uses, such as forestry, mineral exploration and mineral extraction, would not be permitted.

An area of 360 square kilometres to the northeast of the existing Ghost Wilderness Area (#11121) was proposed as a

"Recreational Wilderness" by the Alberta Wilderness Association. This area, referred to as the Burnt Timber - Waiparous, includes the eastern slopes of the Front Range, the high foothills to the east and the upper valleys of North Burnt Timber, Burnt Timber and Waiparous Creeks. The area has been repeatedly burned in this century and contains extensive tracts of open country and early successional vegetation. The openness of the vegetation provides optimum range conditions for several species of ungulate (Mule Deer, Elk, Moose, Bighorn Sheep) and provides excellent opportunities for enjoying views of the wildlife and vistas of the mountains and foothills.

The second area proposed by the Alberta Wilderness Association as a "Recreational Wilderness" lies directly north of the Canmore Corridor (#11122). This tract of land, referred to South Ghost Wildlands Recreation Area, encompasses some 241 square kilometres. It is a very rugged area of limestone and dolomite mountains (Princes Margaret Mountain, Mt. Charles Stewart, End Mountain, Saddle Peak, Orient Point, Mt. Laurie) incised by the canyons of Grotto Creek, Jura Creek, and Exshaw Creek and by the upper valleys of the South Ghost River and Old Fort Creek. The landscape is dry and sparsely vegetated; streams flow mainly in subsurface channels during most of the year. Good habitat exists for Bighorn Sheep and Mountain Goats, but the area is poor for other large ungulates.

There is no road development, and foot access is mainly via the canyons and river valleys. Despite its proximity to major transportation routes and large centres of population, the area has remained in a remarkably pristine state by virtue of its rugged character.

The Yamnuska Natural Area Study Committee (1974) presented a case for incorporating the Yamnuska Area (#11123) into Bow Valley Provincial Park. Located to the north of the Bow River directly opposite from Bow Valley Provincial Park and only 74

kilometres from the City of Calgary, the Yamnuska is an area of great geological and ecological interest (see Section 5.1.1), and intensive recreational use. It is renowned for excellent rock climbing as well as for more leisurely outdoor recreational pursuits such as hiking and nature observation.

Although the argument for incorporating Yamnuska into Bow Valley Provincial Park was supported by the Environmental Council of Alberta, no action has been taken to change the disposition of this Crown-owned parcel of land. The area continues to be used very intensively for recreation without any formalization of its status. Permitted uses of Crown land such as grazing and mineral in-traction are also continuing.

Two actual or proposed natural Areas (#11124, 11125) occur to the east of the intersection of Highways 1 and 1A, east of the community of Canmore.

Site #11124 (Alberta Government Site #314) is a small portion of an area of braided river flats described in Section 5.1 (Map 1, #1125). Although it currently has Natural Area status, the site is likely to be dropped as a Natural Area.

Site #11125 (Alberta Government Site #408) contains a portion of the braided river flats described above plus adjacent terraces of the Bow River Valley. The area is minimally disturbed, includes a unique example of the montane forest of the Bow River Valley and also incorporates an important spawning area for Brown Trout (see Section 7.6, and Map 6, #11108). The current government recommendation is to elevate this site to the status of a supplementary Ecological Reserve.

Site #11126 (Alberta Government Site #250) is proposed as a supplementary Ecological Reserve. It contains mature stands of Douglas Fir in association with White Spruce, Lodgepole

Pine, Trembling Aspen and White Birch. A cold sulphur spring runs through the area, imparting unique site conditions.

Site #11127 (Alberta Government Site #286) located to the Northeast of Ole Buck Mountain is a proposed natural area in the foothills (forest) natural region. Its hilly topography is slightly incised by creeks, and there are some boggy depressions. The main tree species are White Spruce, Trembling Aspen and Lodgepole Pine. Eleven distinct vegetation communities have been identified in the area. Site descriptions provided by Alberta Energy and Natural Resources do not reveal whether the site has any outstanding characteristics.

5.7.2 Parks and Natural Areas in the M.D. of Rocky View

The M.D. of Rocky View contains two small Provincial Parks, a major Historic Site and two Natural Areas (one actual; one proposed).

In the northwest corner of the M.D., a natural areas has been proposed in the vicinity of Brooks Hill (#2176; Alberta Government Site #226). This area of moderately rolling terrain in the foothills natural region is forested mainly in Lodgepole Pine and Trembling Aspen, with White Spruce in coulees.

The significance of the site as a natural area for either a recreational or educational purpose is in some doubt pending further comparative evaluations.

Big Hill Springs Provincial Park (#2177) is a small day-use park within Bighill Coulee (Map 2, #2106), which is described in Section 5.1.2. Although the park is small and quite intensively developed, it contains a interesting diversity of habitats, including most of the spring-fed creek that provides lower Bighill Creek with its year round source of water. The

Provincial Government has tried unsuccessfully to purchase the private land adjacent to the park where the actual spring is located.

The Cochrane Ranche Historic Site (#2178) lies at the lower end of Bighill Coulee on the western outskirts of the community of Cochrane. The site has no standing historical structures; the primary purpose of the park appears to be to preserve a portion of the landscape where this famous ranch was established. The site includes the lower portion of Bighill Coulee in which there are a number of interesting natural features (see Section 5.1.2); it has great conservation value in addition to its primary historical value.

Bragg Creek Provincial Park (#2179) is a small day-use park (approximately 1.2 square kilometres) on the south bank of the Elbow River southwest of the Community of Bragg Creek. It comprises a series of terraces of the Elbow River Valley vegetated by a mixed forest of White Spruce and Trembling Aspen. The park, which is bisected by Highway 922, abuts the river for a short distance at two locations. Although the park is not unique, but is simply representative of the environment of the Elbow River Valley upstream of Bragg Creek, it is of considerable recreational importance because of its proximity to the City of Calgary.

Foothills Natural Area (#2180) is a quarter section of land located only a few hundred metres southeast of Bragg Creek Provincial Park. It is a gently rolling area with a few depressions. It is covered by open forest of Lodgepole Pine and Aspen. A fairly rare orchid, Habenaria orbiculata, occurs in the forest understory. The Foothills Natural Area is not a particularly diverse site and does not, in its own right, appear to merit Natural Area status, especially when one considers its close proximity to Bragg Creek Provincial Park. It may eventually be incorporated into the park.

5.7.3 Parks and Natural Areas in the City of Calgary

Major efforts by the Calgary Field Naturalists' Society (1981) and the City of Calgary Planning Department (1981) to identify and describe residual natural areas within the City of Calgary have resulted in a comprehensive inventory of these areas. Descriptions have been provided in Section 5.1.3 and will not be repeated here. Natural areas are located within existing city parks, on city-owned land not dedicated to park use, on provincially owned land and on privately owned land. The City of Calgary has developed a comprehensive plan for the acquisition and dedication of natural areas within the city's river valleys. This plan awaits approval for its implementation.

The City of Calgary's plan generally acknowledges the natural areas identified by the Calgary Field Naturalists' Society. Moreover, the plan adds a number of sites to that organization's list of natural areas (#3101, 3105, 3106, 3109, 3114, 3115, 3116, 3119). Some sites described as natural areas by the Calgary Field Naturalists' Society (the natural portions of the Glenmore Park/Sandy Beach area (#3118) including the Weaselhead and most of the Beaverdam Flats area (#3111)) are not included within the City of Calgary's plan for natural areas. Also, the Planning Department has not normally included as much land within the natural area classification as has the Calgary Field Natralists' Society. Such discrepancies should be expected, given the very different perspectives of the two organizations. In fact, the basic degree of agreement on sites is very good.

Nose Hill Park (#3104) is the only significant natural area in the city located outside of the main river valleys. The maximum potential size of this natural area is well defined by adjacent development which encircles more than three quarters of the site. The actual amount of land assembled to date for this park falls considerably short of the total available area.

Fish Creek Provincial Park (#3117) is now fully developed in terms of land acquisition and infrastructure. Although operated by the Provincial Government, it is a major element of the City of Calgary's system of parks and natural areas.

5.7.4 Natural Areas in the M.D. of Foothills

The M.D. of Foothills has no Provincial Parks. However a number of Natural Areas (both actual and proposed) are found within the M.D.

Area #4177 (Alberta Government Site #343) is proposed as a natural area representing lower foothills forest stands. It contains three forest communities dominated by Trembling Aspen, White Spruce and Lodgepole Pine/Aspen. If expanded to two full sections, the diversity of the site would be significantly increased. The site has significant potential value as an Educational Natural Area, and Provincial Government officials appear to be quite interested in it.

Area #4178 (Alberta Government Site #223) includes a portion of a high, wooded, north-south trending ridge and the adjacent valley of Priddis Creek. Vegetation is characteristic of the main foothills (forested) natural region. The area is vegetated in open mixed forest of White Spruce and Trembling Aspen, open forest of Trembling Aspen and mixed forest of White Spruce, Balsam Poplar and Trembling Aspen. It is judged to have excellent potential as a Recreational Natural Area, as well as some educational potential.

The Whiskey Creek Area (#4179) is considered to be a prime candidate for an Educational Natural Area. The site has most of the topographic diversity and vegetation communities found within a 30 kilometre radius of Calgary. The site would be improved by the addition of W28, N29 and SE29 - 21-4-W5.

The Brown-Lowery Natural Area (#4180) is an officially designated Natural Area. It possesses rolling terrain with two large hills and a few ravines. Mixed forest of Trembling Aspen and White Spruce is the dominant vegetation. Two forest communities dominated by White Spruce and a coniferous forest community of Lodgepole Pine and White Spruce also occur on the site. The Natural Area has a well-developed system of trails and is heavily used by hikers, naturalists and cross-country skiers.

A Natural Area (#4181, Alberta Government Site #368) is officially designated on the floodplain of the Sheep River. This site includes bare gravel floodplain deposits, willow communities and floodplain forest of Balsam Poplar. Abandoned river channels contain some standing water. The area has good potential as a picnic area.

There is also an officially designated Natural Area on the Highwood River (#3183, Alberta Government Site #349). This level to undulating site is largely in seeded hay crop. Shrubs occupy rough coulee land which forms part of the site. Government officials see no special value in the site and recommend its deletion as a Natural Area.

Several islands in the Bow and Highwood Rivers (#4182, Alberta Government Site #350) have been officially designated as a Natural Area. The flat, frequently flooded islands are vegetated in Balsam Poplar, Peachleaf Willow and a variety of grasses and forbs. These islands have recreational potential for boaters, but are not considered high priority sites by Government officials.

A Natural Area has been officially designated in the Emerson Creek Area (#4184, Alberta Government Site #367) just east of the Eden Valley Indian Reserve. This rolling to hilly area has open grassland vegetation on hillsides, forests of White Spruce, Balsam Poplar and Trembling Aspen, and willow/sedge

wetlands with numerous orchid species. Rare Limber Pine occurs on the site. The site is considered to be an excellent Educational Natural Area, exemplifying the montane natural region. However, access is difficult.

A potential natural area (#4185, Alberta Government Site #454) has been identified in southernmost part of the M.D. of Foothills in the Sheppard Creek Area. This area is part of the shrublands that characterize this part of the M.D. No specific inventory of the site has been undertaken.

5.7.5 Parks and Natural Areas in the County of Wheatland

The County of Wheatland contains one Provincial Park and two proposed Natural Areas.

Wyndham - Carseland Provincial Park (#5153) comprises three distinct parcels of land in the Bow River Valley in the vicinity of Carseland Weir. The parcel furthest upstream, which includes the forebay of the weir and a number of forested islands and lagoons, has been dedicated as a wildlife sanctuary, and is indeed an excellent area for such species as Great Blue Heron, Canada Geese and Common Merganser. There is a heronry within this sanctuary. The area downstream of the sanctuary is developed for individual camping and the area furthest downstream for group camping. The level of development is very intensive because of recreational fishing that takes place in the world class sport fishing waters of the adjacent Bow River. These developed areas have little residual value as natural areas.

A reservation is in effect on the extensive system of alluvial flats, islands and river channels (#5154) downstream of Wyndham-Carseland Provincial Park. The river flats and islands are variously vegetated in Balsam Poplar forest, shrub communities and grassland. Sedge and cattail communities occupy abandoned river channels. This alluvial environment

provides important residual habitat for waterfowl and ungulates, and is a key area from the perspective of river-oriented recreation.

The Provincial Government is interested in acquiring Hammer Hill (#5155, Alberta Government Site #404) as a Natural Area. The hill, which rises some 60 metres above the surrounding landscape, is the highest land for many kilometres, and provides an unsurpassed 360 degree panoramic view of the surrounding prairie landscape. The hill also possess some natural attributes of intrinsic interest, such as a strip of bedrock cliffs overlooking a shallow lake used by waterfowl.

5.8 SUMMARY OF ENVIRONMENTAL CONSTRAINTS

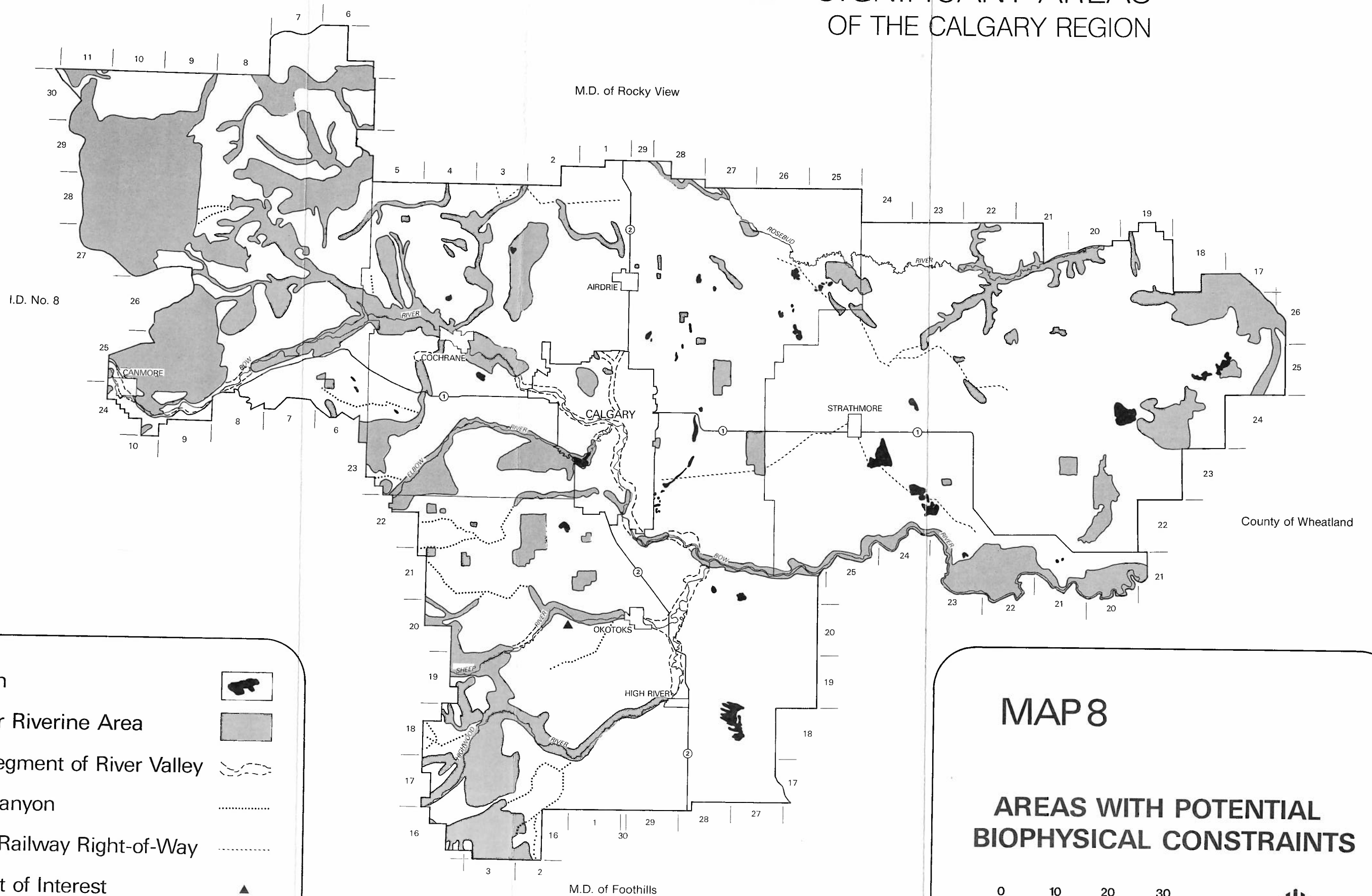
Map 8 was prepared to indicate the locations where some level of environment constraint is known to exist. It shows in composite form all of the areas outlined on Maps 1 to 7. An estimated 5-10 percent of the total area of the Calgary Region is shown to have some level of environmental constraint based on the limited array of factors analyzed.

The purpose of Map 8 is to provide the reader with a quick method of determining whether there are any environmental sensitivities within a given area of interest. The map does not indicate the nature or significance of these sensitivities. To obtain this information, the reader must refer to the individual theme maps and their accompanying text.

5.9 ENVIRONMENTAL PRIORITY AREAS

All of the areas discussed in Sections 5.1 to 5.7 and illustrated on Maps 1 to 7 merit serious consideration in regional and municipal environmental planning. Because of disparities in the nature and quantity of data available for each site, it is difficult to comprehensively rate the relative importance of all the sites that have been identified. Despite these data deficiencies, the regional

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



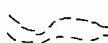
Lake/Slough



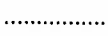
Terrestrial or Riverine Area



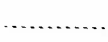
Disturbed Segment of River Valley



Stream or Canyon



Abandoned Railway Right-of-Way



Isolated Point of Interest



MAP 8

AREAS WITH POTENTIAL BIOPHYSICAL CONSTRAINTS

0 10 20 30



Kilometres



importance of a number of sites can be established with a fair degree of certainty. In most cases regional significance is ascertained on the basis of outstanding natural characteristics. However, in urban and near urban environments, sites of lesser intrinsic ecological value may be considered regionally significant by virtue of the scarcity of any type of natural environment in an urban or semi-urban setting.

Sites considered to be clearly of regional significance are illustrated on Map 9, and the rationale for the selection of these areas is explained in the text that follows. The reader is cautioned that this is only an initial prioritization of sites based on very limited data. A number of sites shown on Maps 1 to 7 may not have been elevated to priority site status simply because of lack of data. Moreover, the prioritization of sites is largely a subjective process, based mainly on professional judgement. Therefore, different conclusions on priority sites could be made by different individuals, using the same basic data. Finally, sites of lesser importance should not be ignored simply because better sites exist. A comprehensive approach to environmental planning should take into account the conservation option for sites of lower priority, when this is feasible. Readers are therefore cautioned to make use of the whole data base provided, and not to rely solely on the distillation of information provided in this section.

It should be noted that we have not attempted to provide a comprehensive natural environment inventory of I.D. #8. The analysis has concentrated on areas that relate in some way to the settled portions of the Improvement District, where environmental planning issues exist that are relevant to the mandate of the Calgary Regional Planning Commission.

The text that follows, like the preceding text, is organized according to political jurisdiction to simplify the retrieval of information for a given geographical area of interest. The drawback of this format is that the overall regional context of the discussion can

become obscured. To alleviate this potential problem, a few unifying concepts are presented below, prior to the site by site commentary. The environmental importance of river valleys and coulees cannot be overemphasized. In settled areas these are often the only residual natural environments. Even in relatively natural landscapes these environments often provide critical habitats for many species of birds and mammals. The Bow River Valley forms the backbone of the Calgary Region's system of natural areas. The valleys of major tributaries, such as the Highwood and the Sheep, are also critically important.

In the agricultural areas of the Region, lakes and sloughs are important oases which provide for the needs of a large number of waterbirds and upland birds dependent upon the fringe environments of waterbodies. Rough upland areas, such as hummocky moraines, which have defied cultivation because of their difficult terrain or unsuitable soils, are oases for many upland species of plants and animals which would otherwise be on the verge of extinction.

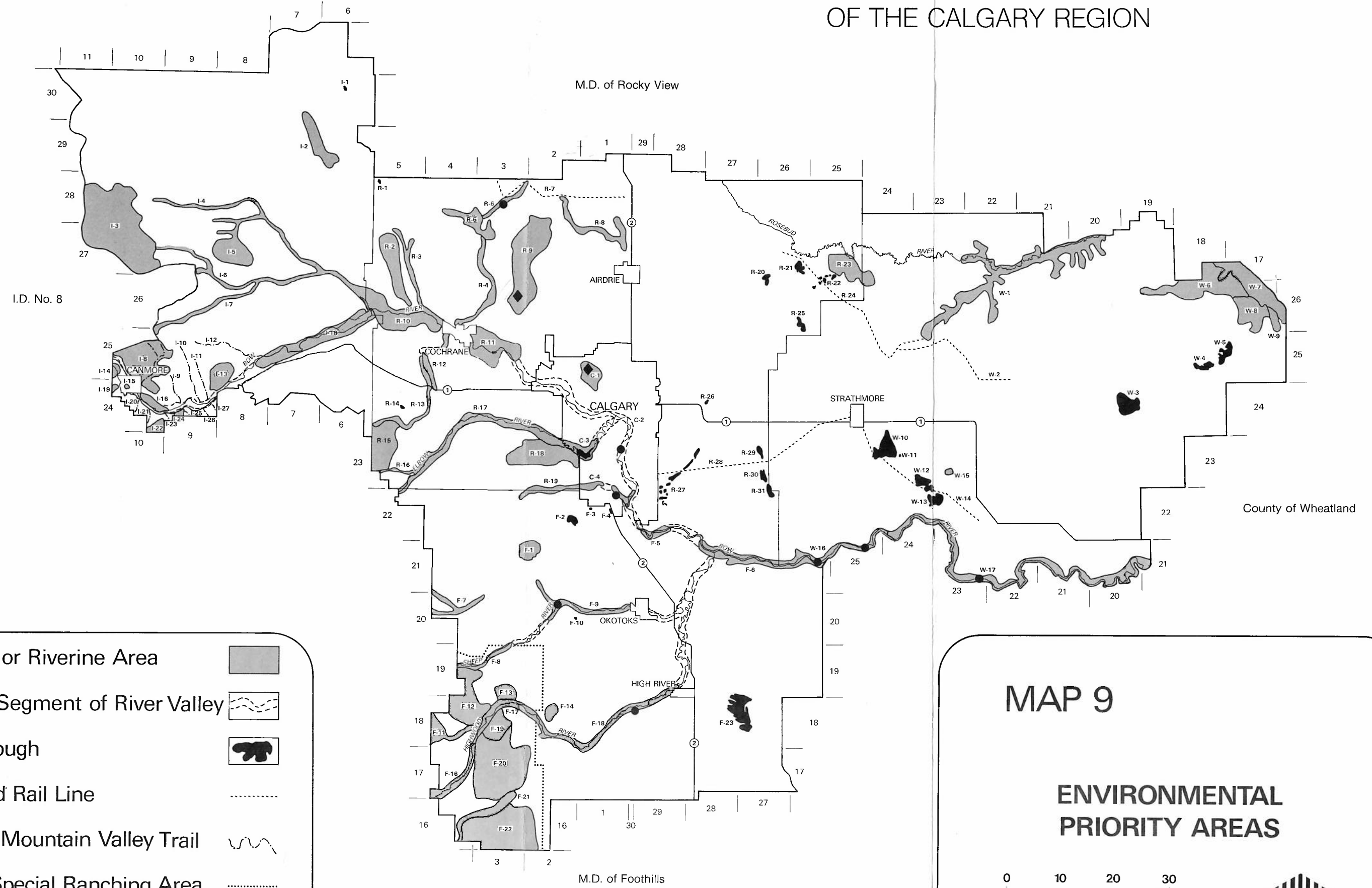
5.9.1 Environmental Priority Areas in I.D. #8








The northern part of I.D. #8 is a large tract of forested foothills interspersed with an extensive network of small watercourses. Within this pattern of terrain, the stream valleys and their associated wetlands stand out as the dominant environmental features.

There are virtually no lakes in this entire region. Hence, Boggy Lake (I-1) stands out as a unique environment. The floating sedge peat shoreline is quite unusual in the Calgary Region. It is one of a very few lakes, if not the only lake, of this type in the Calgary Region. It is also readily accessible to naturalists.

Grease Creek (I-2) has the best developed river valley wetlands in the northern part of I.D. #8. The area is also identified as a key area for Moose (Map 3, #1174).

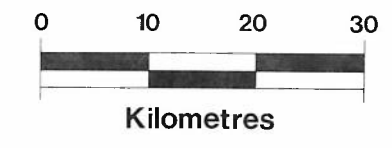
ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



- Terrestrial or Riverine Area 
- Disturbed Segment of River Valley 
- Lake or Slough 
- Abandoned Rail Line 
- Canyon or Mountain Valley Trail 
- Proposed Special Ranching Area 
- Heron Colony 
- Sharp-tailed Grouse sites 

MAP 9

**ENVIRONMENTAL
PRIORITY AREAS**



The information on this map may be refined by detailed on-site investigations which may result in boundary alterations.

The complex of landscapes associated with the Ghost River (I-6), the South Ghost River (I-7), Waiparous Creek (I-4) and the wetlands of the Meadow Creek and Lesseur Creek drainages (I-5) was judged to be the most important environmental feature of the central portion of I.D. #8. This evaluation was based on a number of factors:

- (1) The upper reaches of the Ghost River and Waiparous Creek are the classic examples of braided mountain streams in the Region.
- (2) The valley of Waiparous Creek and the adjacent wetlands are key areas for Moose (Map 3, #175, 176).
- (3) The valleys of the lower Ghost River and lower Waiparous Creek are key areas for Mule Deer and White-tailed Deer.
- (4) The upper reaches of the system provide excellent mountain vistas.
- (5) The Ghost system provides access to the Ghost Wilderness and back country access to Banff National Park (via Devil's Gap to Lake Minnewanka and via South Ghost Pass to the Carrot Creek Trail).

A large and diverse unit of natural terrain (I-8), which incorporates the upper benchlands on the north side of the Bow River opposite Canmore, Mt. Charles Stewart and the upper valley of Cougar Creek, represents the best remaining area of natural landscape in the Canmore area. The benchlands included within this unit are perhaps the most outstanding example of glacio-fluvial terraces on the entire Bow River Valley, and some consideration should be given to the preservation of at least a portion of these significant natural features. The slopes above the terraces possess excellent mature stands of Douglas Fir and the valley of Cougar Creek

provides the most extensive available access to the interior of the rugged Fairholm Range. Hodoos located in the lower fringe of the area lend additional geological interest. The area provides a diversity of recreational opportunity ranging from easy hiking and cross-country skiing across the level and relatively open environment of the terraces to arduous hikes and climbs into the rugged interior country. Scenic views within the unit are excellent due to the relatively open nature of much of the vegetation.

Via Cougar Creek Valley it is possible to gain access to the Carrot Creek Trail in Banff National Park. From there the option exists to enter the Ghost River system via either Lake Minnewanka or the South Ghost Pass. The area is thus an excellent entry point into an extensive system of back country hiking trails.

Currently the lower Cougar Creek area is being developed as a residential subdivision. The General Municipal Plan calls for the eventual use of all of the benchland area for urban expansion of the community of Canmore.

At this time we believe a careful re-evaluation of future development options for the community of Canmore should be undertaken. We believe that there is significant potential for the development of high quality destination-type recreational and accommodation facilities in the Canmore area, along the lines of certain facilities in Banff and Lake Louise. This will require a large, high quality natural site, such as that which exists on the upper benchlands and lower slopes of Unit I-9. It is suggested that development of this area for tract housing may not be the best long-term social and economic use of the site. Failure to capitalize on the possibilities of the site may result in a permanent highway commercial orientation for the community, an economic future well below the full potential that exists.

Grotto Creek (I-9), Exshaw Creek (I-10), Jura Creek (I-11) and Old Fort Creek (I-12) deserve special environmental planning consideration. These creeks which form the major scenic canyons north of the Bow River are protected to a large extent by their steep topography. However, the lower reaches of these creeks are susceptible to extreme forms of impact, such as the quarrying which has occurred for many years along the lower part of Exshaw Creek. A dump, which has been since filled with unsightly coarse blocks of rubble, has defaced the vicinity of the lower Grotto Creek. In the past, the creation of a disturbed area has often resulted in a low level of concern about further disturbances, and the perpetuation of a vicious circle of negative environmental impacts. Future planning initiatives should be directed toward prevention of incremental disturbance and the reclamation of past disturbances.

The geological uniqueness and natural diversity of the Yamnuska area (I-13) warrant special environmental protection measures for the area. Because of the high degree of informal recreational use of the Yamnuska, its inclusion as part of Bow Valley Provincial Park, as suggested by the Bow Valley Naturalists, should be further investigated.

As indicated in the preamble to this section, conservation of the remaining natural environments of the Bow River Valley should be a major priority. Within I.D. #8, conservation options are somewhat limited as a result of urbanization of the river valley and the intensive development of transportation, mineral extraction and hydro-electric power generation facilities.

Upstream of the Stoney Indian Reserve these impacts have been so extensive that only a relatively few natural landscapes remain in the floodplain area. Upstream of Canmore a small remnant of the natural floodplain and adjacent high quality Elk range on the lower slopes of Mt. Rundle (I-14) has been identified as an area deserving conservation. Within Canmore, Policeman Creek and Spring Creek (I-15) remain important spawning and rearing habitats for Eastern Brook Trout, Brown Trout and Mountain Whitefish. No effort should be spared to ensure that these fisheries continue to flourish. Downstream of Canmore, a unique area of braided river flats (I-16) is the largest remaining natural vestige of the floodplain environment upstream of the Stoney Indian Reserve. This area appears to be the most significant trout spawning area between the Banff National Park Boundary and the Kananaskis Dam at Seebe.

The Bow River Valley within the Stoney Indian Reserve (I-18) is a regionally significant environmental resource. The only remaining wild stretch of the river valley occurs within this unit between the Horseshoe Dam and the bridge crossing the river at Seebe. The Ghost Reservoir, although a man-made feature, is fringed by relatively natural and aesthetically pleasing environments. It has become an important angling and recreational boating resource for the Region.

Land use within Unit I-18 is entirely regulated by the government structures of the Stoney Indian Band.

Environmental priority areas south of the Bow River are concentrated in the Canmore Corridor.

The Grassi Lakes area (I-19) possesses singular beauty and diversity. Although located within a hydro-electric power reserve and hence protected from most forms of alteration, the area's small size makes it vulnerable to overuse and misuse.

Hiking trails along Three Sisters Creek (I-20), Stewart Creek (I-21), West Wind Valley (I-23), McGillivray Creek (I-25), Heart Creek (I-26) and Jewel Pass (I-27) originate in I.D. #8 and extend into Kananaskis Country. It is important that future development plans accommodate these trail systems and allow for the preservation of a sufficient amount of the natural environment to maintain their integrity. Current concerns concentrate on the Three Sisters Creek, Stewart Creek and West Wind Valley trails which are partly on privately held land.

Wind Ridge and the Upper West Wind Valley (I-22) are areas of established importance to Bighorn Sheep and Elk. Any future plans to develop the Wind Valley should preserve the critical ranges of these animals and incorporate sufficient development controls to ensure that the animals are not harassed on their winter range.

The Douglas Fir stand on the northwest slopes of Pigeon Mountain (I-24) may receive official designation as an Ecological Reserve, and should be taken into account in environmental planning for the Improvement District.

5.9.2 Environmental Priority Areas in the M.D. of Rocky View

The M.D. of Rocky View has significant environmental resources which will become increasingly more important as the populations of the M.D. and the City of Calgary continue to expand. In many cases these resources are under considerable pressure from competing land uses, particularly country residential development. Environmental land use decisions as to the highest and best use of these resources will have a major effect on the future quality of life in the more densely populated portions of the Calgary Region.

Lost Lake (R-1), in the extreme northwest corner of the M.D., is the only lake within the forested part of the M.D., and deserves special protection. It is possible that the zone of protection should extend for some distance from the lake into the general area of the Foster Hills to protect important habitats for owls, woodpeckers and other upland forest species. However, we currently have insufficient data to locate the boundary of the land unit of concern.

The Wildcat Hills (R-2) are the first major foothills feature seen while travelling west on Highway 1A. They represent a landmark of regional importance and show to great advantage the transition from grassland to forested foothills.

The Grand Valley (R-3), as its name suggests, is a most visually imposing feature of the landscape. The valley is an important ranching area. The ranching country of the Grand Valley and its impressive backdrop of the Wildcat Hills together provide one of the finest vistas in the Region. Preservation of the character of this unique area should be a regional priority.

Bighill Coulee (R-4), the aspen parkland area at its head (R-5), the Valley of Beaverdam Creek (R-6), an abandoned section of railway right-of-way through Madden (R-7) and MacPherson Coulee (R-8) provide a linear system of green space extending from the Bow River Valley to Highway 2. A wide variety of prairie, parkland and wetland environments are represented. Planners should not fail to capitalize upon this unique situation.

The hummocky moraine in the vicinity of Lockend Lake (R-9) appears to be the finest prairie-parkland-wetland complex found within the Calgary Region. The area is excellent for both wetland and upland species of birds. A traditional dancing ground for Sharp-tailed Grouse is located within the

southern part of the unit. Most of this area should be reserved as a natural area to serve the needs of future generations. A detailed biophysical inventory would be needed to identify and prioritize sub-areas of this large unit.

A significant portion of the Bow River Valley in the M.D. of Rocky View west of Calgary is in a remarkably natural state. Excellent natural stretches of the river occur from the Ghost Dam to the western limits of the town of Cochrane (R-10) and from the eastern limits of the town of Cochrane to the upper reaches of the Bearspaw Reservoir (R-11). Planning policies should favor maintaining these portions of the river valley as natural environments.

South of the Bow River and west of Calgary, serious consideration should be given to the preservation of the linear system of natural environments comprising Copithorne Ridge (R-12), Jumpingpound Creek (R-13) and the wetland area to the south of the Jumpingpound Creek (R-15).

Copithorne Ridge (R-12), the first of the true foothills encountered by a traveller going west on the Trans-Canada Highway, is a landmark of regional significance. It is the largest and most accessible of the small number grassland foothills in the area immediately west of Calgary. Limber Pine, a species with very limited distribution, is reported to colonize its exposed ridges. Preservation of Copithorne Ridge as a natural area would be an important step in an overall plan to conserve the ecological diversity of the Calgary Region.

Jumpingpound Creek (R-13) is an environmental resource of regional significance. It is the only good trout stream flowing from the south into the stretch of the Bow River between the Ghost Dam and the City of Calgary (see Section 5.6). The Jumpingpound Creek Valley is also a key area for Mule Deer

(see Section 5.4). The environment of the creek valley also has exceptionally good aesthetic qualities.

The wetlands south of Jumpingpound Creek (R-15) represent some 60 to 70 percent of the high quality moose habitat found within the M.D. of Rocky View (see Section 5.3), and is hence a high priority conservation area. Logan Ridge, a forested foothill, has also been included within this unit in order to encompass the full range of foothills environments found within the western portion of the District of Rocky View.

The diversity of habits represented by the linear complex comprising Units R-12, R-13 and R-15 is exceptional. Terrain ranges from low-lying wetland to exposed ridge tops and vegetation from dry grassland to foothills forest.

Norman Lake (R-14) is one of the few good waterbird lakes in the western part of the M.D. of Rocky View, and thus merits special status.

Bragg Creek (R-16) is undoubtedly the best Eastern Brook Trout system in the M.D. of Rocky View. It is also a potentially important link between the natural environments of the Jumpingpound Creek and Elbow River Drainages. For both of these reasons planning policies should favour the maximum feasible level of conservation of natural riparian vegetation.

The Elbow River Valley (R-17) provides an important natural environment corridor between the semi-wilderness of the Forest Reserve and the City of Calgary. It is an important refuge for a wide variety of wildlife species, including White-tailed Deer and Mule Deer (see Section 5.4). It also provides important spawning habitat for Eastern Brook Trout (see Section 5.6). Although it currently receives only limited recreational use, it will become a resource of critical importance for

recreation as the population of the Region expands. Its importance as the water supply for much of the City of Calgary will also continue into the foreseeable future. It seems clear that the future interests of the Region will be best served by maintaining a virtually uninterrupted natural riparian vegetation zone along the full length of the river. This will preserve the river's function as a wildlife corridor and will facilitate future development of a trail system along the river. It should be noted that portions of the River Valley lie within the Sarcee Indian Reserve, resulting in the need for a co-operative approach in environmental planning matters.

Camp Sarcee (R-18) is one of the last large areas of natural parkland environment in the Calgary Region. The area has considerable conservation and recreation potential. However, any future disposition of the site is a matter between the Sarcee Indian Band and the Federal Government.

The portion of the Fish Creek Valley within the Sarcee Indian Reserve (R-19) is also a potentially valuable natural area with characteristics comparable to those of Fish Creek Provincial Park. The decision on the best use of these lands rests with the Band Council of the Sarcee Indian Reserve.

In examining the priority natural environments in the M.D. of Rocky View south of the Bow River and west of the City of Calgary, it should be noted that they form a continuous linear system linking the Weaselhead area of the City of Calgary's river valley parks system with the Bow River Valley at the community of Cochrane. It would be quite feasible to develop a trail system through these natural environments. This trail system could be linked back, via a trail system through the Bow Valley, to the existing and proposed Bow Valley trail system, to create a circle route.

From the Bow River Valley at Cochrane it is also relatively simple to gain access to the linear system of natural areas stretching from Bighill Coulee to MacPherson Coulee. It is equally simple to gain access to the Ghost River System from this point. Following the Ghost River system, access to the Ghost Wilderness and Banff National Park is possible.

It can be seen that the potential exists to develop an extensive system of trails passing through a tremendous diversity of natural prairie, foothill and mountain landscapes. This system could rank with some of the best in the world.

The portion of the M.D. of Rocky View east of Highway 2 is noted for its agricultural capability. Consequently, much of the area is under cultivation, and semi-natural upland environments are quite rare. The major environmental features of the area are its lakes and sloughs, a number of which are particularly well known for waterbird production and staging (migratory stopover).

In the northeast of the M.D. of Rocky View, Texas Irricana Lake (R-20), Irricana (Craigdu) Reservoir (R-21) and Bruce Lake (R-25) are unquestionably the best of the large lakes. A complex of small sloughs, known collectively as the Irricana Sloughs (R-22) provides breeding and staging habitat for a great diversity of waterbirds, and should be considered as a priority site. An abandoned railway right-of-way (R-24) preserves upland environments in the area and provides excellent visual access to Irricana Reservoir and several of the Irricana Sloughs, without necessitating access through privately owned farmland. A high priority should be placed on securing permanent public access to this right-of-way.

To the northeast of the Irricana Sloughs, a large sand plain (R-23) is the only large, substantially natural area found

within the eastern part of the M.D. of Rocky View. This area appears to be a unique environment warranting preservation.

On the outskirts of Calgary, two areas of waterbird habitat merit special consideration for conservation.

McElroy Slough (R-26), a small irrigation water impoundment, supports a rich diversity of bird life. Although not a major environmental feature on any absolute scale, it is critically important to local naturalists because of its proximity to the City of Calgary. Observations at this site revealed that the pastures adjacent to the lake are important nesting habitats for a number of species seen in the vicinity of the lake. Conservation measures for the site should incorporate the protection of some of these upland habitats.

The complex of sloughs in the vicinity of Shepard (R-27) provides a variety of habitats for waterbirds. The area is very important to local naturalists. Unfortunately these wetlands appear to be vulnerable to drying. A proposal by Ducks Unlimited to maintain water levels by using the area for storage of irrigation water and storm drainage disposal could alleviate the water shortage and turn the area into a consistently productive environmental and recreational resource. Options such as this, in conjunction with environmental protection measures for the area, should be examined.

Weed Lake (R-29) was once an important waterfowl area, but has since been drained. The potential for restoring water levels should be investigated before the lake is written off as a natural area.

Langdon Reservoir (R-31) and Dalmead Reservoir (R-32) appear to be the major waterfowl production lakes in the southwestern part of the Municipal District, and merit environmental priority area status.

5.9.3 Environmental Priority Areas in the City of Calgary

Environmental priority areas within the City of Calgary include Nose Hill (C-1), the Bow River Valley (C-2), the Glenmore Reservoir-Elbow River System (C-3) and the Fish Creek Valley (C-4).

The public acquisition of lands on Nose Hill (C-1) to preserve a large upland prairie remnant in an urban setting is a unique and forward-thinking concept, meriting the support of all citizens in the Calgary Region. Currently only a portion of the available land has been formally acquired. Acquisition of the remaining land is a priority of regional importance. The Nose Hill site contains a dancing ground for Sharp-tailed Grouse. The maintenance of these traditional sites is critical for the breeding success of this species. Recreational users of the park, particularly those with dogs, could cause disruptions which could lead to the abandonment of this site; intensive grazing by horses could also affect Sharp-tailed Grouse habitat in general. Measures may be required to protect this important wildlife resource.

All of the residual environments of the Bow River Valley (C-2), which were discussed in some detail in Section 5.1.3, deserve stringent environmental protection if a high quality system of natural areas is to be established within the city. Moreover, maintenance of much of the important spawning areas in the river is contingent upon maintenance of good water quality between the Bearspaw Dam and the Bonnybrook Sewage Treatment Plant.

Many people are unaware that a world class Rainbow Trout fishery exists within the city limits downstream of the Glenmore Trail Bridge. This is a unique situation for a major urban centre. Although nutrient enrichment from treated sewage discharges has been responsible for significant increases in the abundance of food organisms for trout in this part of the

river, over-enrichment may ultimately result in the demise of the fishery. Protection of this fishery through adequate sewage treatment measures should be a regional and provincial priority.

The importance to Mule Deer and White-tailed Deer of the Bow River Valley downstream of the Glenmore Trail Bridge should also be considered regionally significant. Urban wildlife of this nature is great natural asset which is being increasingly appreciated by urban residents. The Elbow River Valley also supports significant deer population.

The presence of a potentially vulnerable heron colony within the Bow River Valley in the southeast industrial part of the city should be noted. This colony should be closely monitored to determine whether special protective measures are necessary. The area west of Glenmore Reservoir, the Weaselhead, is also recognized as an important area for upland birds.

Although the Glenmore Reservoir-Elbow River (C-3) system is highly urbanized, it provides a number of pockets of residual natural environment spread over a large area of the City of Calgary. Moreover, it is contiguous with natural areas to the south and west. The system also provides recreational fishing opportunities for many urban residents in a highly aesthetic setting. Both the natural and man-made features of the system are enjoyed by exceptionally large numbers of people, and it is expected that the system will play an increasingly important role in maintaining the quality of life of urban residents.

The mix of recreational lands and natural areas within Fish Creek Provincial Park (C-4) is already set by the park design. Although no further planning initiatives may be necessary with regard to the existing park, it is a regionally significant feature which relates to other features discussed in this report, and it is mentioned here for the sake of completeness. It is relevant to note that a heron colony exists within a high use area of the park. To date, measures taken to protect

the colony appear to have been successful. Experience gained with this colony may be transferable to other colonies within the Region.

5.9.4 Environmental Priority Areas in the M.D. of Foothills

The Pothole Creek Area (F-1) is a parkland environment of outstanding natural diversity in the context of the northern part of the M.D. of Foothills; the area is also excellent for a good diversity of waterbirds and upland birds.

Lloyd Lake (F-2) is judged to be a regional significant site because it is the only large lake in the county west of Highway 2. The site also is of moderate importance as a waterbird habitat as well as an area of high visual interest.

Radio Tower Slough (F-3) while not important in an absolute sense, is judged to be regionally significant because of its location on the periphery of a large urban area, where good wetlands are a scarce natural feature.

Priddis slough (F-4) has been an important waterbody to local naturalists and educators for many years. Current impacts due to road widening and overpass construction may be irreversible. However, the possibility of salvaging at least part of the slough should be examined before the area is written off.

The Bow River downstream of Calgary possesses one of North America's finest trout fisheries (see Section 5.6.4). By this measure alone, the river would merit environmental priority status. The value of the river valley environment is further enhanced by its topographic and vegetational diversity, by its importance as a critical habitat for White-tailed Deer and Mule Deer, and its importance to waterbirds.

Between the city limits of Calgary and the junction of the Bow with the Highwood, there is considerable disturbance of the

river valley. One relatively natural stretch of the valley (F-5) remains. It should be protected from further environmental alteration.

From the vicinity of the Bow-Highwood confluence to the eastern boundary of the M.D. of Foothills (F-6), the Bow River Valley is largely in a natural state. World class trout fishing waters continue throughout this section. The valley has excellent populations of White-tailed Deer and Mule Deer. There is also a great diversity of waterbirds and upland birds. A heron colony is found in the eastern part of the unit. Recreational land use is most concentrated at the Bow-Highwood junction where a road on the north bank provides access by foot over private land. This area appears to experience use levels exceeding those of many provincial parks, and some provision of facilities to support this intensity of day use appears warranted.

The unit as a whole is well isolated from existing roads and transportation systems and is well protected by surrounding large land holdings. We would rate it as the most natural stretch of the Bow River found within the Calgary Region, and would recommend the highest possible standard of environmental protection.

The watercourses and stream valley systems of the Highwood/Sheep River drainage are critically important environmental features of the Region. The primary range for White-tailed Deer and Mule Deer away from the Bow River Valley occurs in these major tributary valleys. The system also provides the spawning habitats upon which the famed Rainbow Trout of the Bow River depend; it also supports an important resident sport fishery.

Ware Creek and Threepoint Creek (F-7) and the foothills reaches of the Sheep River (F-8) provide the major spawning habitats for Bow River Rainbow Trout within the Sheep River

system. They should be considered as aquatic resources of critical importance. The foothills portion of the Sheep River (F-8) also provides some of the most spectacular natural river valley and river gorge scenery in the Region. Apart from its aesthetic appeal, this area has a great diversity of vegetation, including mature White Spruce of outstanding size.

The Sheep River between Black Diamond and Okotoks and the lower reaches of Threepoint Creek (F-9) possess outstanding riverine forests of Balsam Poplar on an intricately dissected floodplain. These essentially undisturbed forests provide an oasis effect in a predominantly grassland environment and should be viewed as a regional significant resource. A heron colony is found within this riverine forest environment in the vicinity of the junction of the Sheep River and Threepoint Creek.

Okotoks Rock (F-10), which may be the world's largest glacial erratic, is a geological feature of national and even international significance. It is currently designated under the Historical Resources Act.

The Sullivan Creek System (F-11) has been identified as an environmental priority area because of its critical importance as a spawning area for Bow River Rainbow Trout.

The area of foothill ridges and valleys north of Sullivan Creek (F-12) was identified as being of outstanding environmental value because of its diversity of topography and vegetation, importance to large ungulates (Moose and Elk) and relationship to the Highwood River Valley.

The upland area in the vicinity of Tongue Creek (F-13) was selected as a priority area by virtue of its relatively undisturbed natural shrubland vegetation, interesting E rock outcrops, rare Limber Pine vegetation, importance to Moose and Elk, and generally outstanding aesthetic qualities.

Longview Hill (F-14) commands the best available view of the Highwood River Valley, the mountains, foothills and plains. Steps should be taken to preserve this view for posterity.

The Highwood River rates only second to the Bow among the Region's river resources. It is relatively natural and unpolluted from the Forest Reserve boundary to the community of High River.

Within a short distance the river changes in character from a modest foothills stream (F-16) to a wild river in a dramatic bedrock canyon (F-17) to a large natural prairie river (F-18). Below High River, the stream valley environment is largely agrarian in character.

The Highwood River is a major scenic and recreational resource as well as an important environmental corridor between the Bow River and the Forest Reserve. It provides high quality habitat for deer and other wildlife species throughout its length. A heron colony is found within the floodplain forest upstream of High River. The river supports an important local sport fishery, functions as a migration corridor for Bow River Rainbow Trout that spawn in its tributaries, and provides substantial mainstream spawning areas for Rainbow Trout and Mountain Whitefish. The physical characteristics and natural environmental qualities of the Highwood River make it the premier white water canoeing river in the region.

An outstanding area of isolated shrubland south of the Highwood River (F-19) provides excellent moose habitat and has been selected as a priority area. To the south of this area lies a vast tract of natural grassland (F-20) without permanent roads. This is undoubtedly the closest thing to a native grassland that exists within the Calgary Region and may be one of the finest areas of its type in Alberta.

The Pekisko Creek Valley (F-21) and adjacent uplands (F-22) characterize the willow shrubland environment that is rapidly disappearing from the M.D. of Foothills. The area provides excellent habitat for Moose and Elk. Moreover the natural environment of the area has excellent visual qualities. Pekisko Creek itself is also an important spawning habitat for Bow River Rainbow Trout.

The Pekisko Creek area has figured prominently in the history of ranching in southern Alberta. The area is also of historical interest because the late Prince of Wales (subsequently crowned Edward VIII) once owned a ranch there.

The area between the Forest Reserve boundary and the dotted line on Map 9 encompasses a significant portion of the classic ranching country of southern Alberta. Because of the continued importance of ranching in this area, the significance of the environmental resources protected by this form of land use and the irreplaceable heritage value of this part of the Region, it is recommended that this area be designated as a "Special Ranching Area" within which other incompatible forms of land use are strictly regulated to prevent erosion of the unique character of the area.

East of Highway 2 and south of the Trans-Canada Highway the main area of environmental significance in the M.D. of Foothills is Frank Lake (F-23). In normal years this lake is considered to be the premier waterbird habitat in the Calgary Region. This year, however, the lake, like many other important lakes in the Region, has completely dried. The long-term significance of this phenomenon is not known at this time.

5.9.5 Environmental Priority Areas in the County of Wheatland

The valley of the Lower Rosebud River and lower Serviceberry Creek (W-1) is a unique topographic feature with an exceptional diversity of vegetation and great aesthetic appeal. It is judged to be a feature of regional significance.

A high priority should be placed on ensuring that the abandoned railway right-of-way (W-2) linking the communities of Irricana, Rockyford and Standard is not encroached upon by adjacent land users. This railway right-of-way conserves a cross-section of upland habitats and provides recreational access to prairie environments that would otherwise be inaccessible.

The feasibility and desirability of restoring water levels to at least a part of Deadhorse Lake (W-3) should be investigated to determine whether the once important waterbird habitat can be rejuvenated. If such action proves technically, economically or politically unfeasible, this area should be dropped as a priority site.

Mattoyekiu Lake (W-4) and Seiu Lakes (W-5) are unquestionably the most important lakes for waterbirds in the western part of Wheatland County and should receive stringent protection.

The northern part of the Wintering Hills (W-6), the badlands of the Red Deer River Valley (W-7), a large area of native grassland on hummocky moraine (W-8), and the lower Crawling Valley (W-9) together form a wild prairie landscape of exceptional scale, geological interest and topographic and vegetational diversity, warranting serious consideration for conservation status. Within this complex, the unique tertiary gravel-capped Wintering Hills with their disjunct Trembling Aspen tree communities are threatened by ongoing gravel extraction operations. Some compromise between optimum recovery of

granular resources and conservation of unique environments will be necessary to ensure the protection of at least a part of this unique landscape.

The southwestern part of Eagle Lake (W-10) and all of Namaka Lake (W-12) and Stobart Lake (W-13) are waterbird production and staging areas of regional and even provincial significance. They merit the highest level of protection available. A small lake east of Eagle Lake (W-11) is an exceptionally productive shorebird habitat and merits priority status, despite its miniscule size.

Eagle Lake, in addition to being a significant waterbird habitat, is the only lake in the County of Wheatland with an important sport fishery, based on Walleye.

An abandoned railway right-of-way (W-14) provides superb access to Eagle, Namaka and Stobart Lakes without the necessity for access through private farmland. Conservation of this valuable asset for public use should be a regional priority.

Hammer Hill (W-15) commands a 360° view of a vast area of the surrounding prairie landscape. This priceless view should be permanently protected.

The Bow River Valley from the eastern Boundary of Foothills County to the western boundary of the Blackfoot Indian Reserve (W-16) gradually changes from a narrow, deeply incised feature to an environment of extensive terraces and a broad active flood plain. The broad floodplain in the lower portion of this reach is cut by numerous channels, resulting in a complicated system of bars and islands, with substantial wetland development and luxuriant floodplain forests of willow and Balsam Poplar. This stretch of the river is exceptional for all manner of waterbirds. A Heron Colony is found in the vicinity of Willow Island. The world class trout fishery of the Bow River continues throughout this reach of the river.

Although this section of the river has been extensively disturbed by the construction of a major weir, by roads and campground development, and by gravel operations, the environmental qualities of the river valley are so outstanding that the appeal of the area is scarcely diminished.

Terrace development in the portion of the Bow River Valley within the Blackfoot Indian Reserve (W-17) reaches an immense scale, and the active flood plain is remarkably wide in places. As in the section of the river just upstream, there is extensive development of islands, significant development of riverine balsam poplar forest, and substantial habitat for waterbirds, particularly Canada Geese. Wetland development, however, appears to be less extensive than in Unit W-16.

A slight diminution of natural values takes place in Unit W-17. The world class cold water sport fishery upstream of the Reserve undergoes a gradual downstream transition to the warm water fishery, although trout and Mountain Whitefish can still be caught throughout the Reserve. The broad terraces of the river valley are cultivated in places, criss-crossed with roads and trails, and dotted with dwellings. Thus the river valley environment seems less "natural" than in some of the more confined upstream reaches of the valley.

6.0 SIGNIFICANT PALEONTOLOGICAL (FOSSIL) SITES

Paleontological sites of regional or greater significance are listed in Table 6-1. A brief description of these sites is provided below.

6.1 INVERTEBRATE BEDROCK FOSSILS

Fossil invertebrates occur in a number of formations within the region. Of these, only two sites appear to be of regional significance:

- (1) The Seebe Shale Pits (#1201), from which fossil ammonites of Cretaceous Age have and continue to be recovered.
- (2) Lac Des Arcs, Mississippian bedrock locality (#1202), a standard reference section with interpretive potential.

6.2 VERTEBRATE BEDROCK FOSSILS

Fossil vertebrate sites of regional significance are:

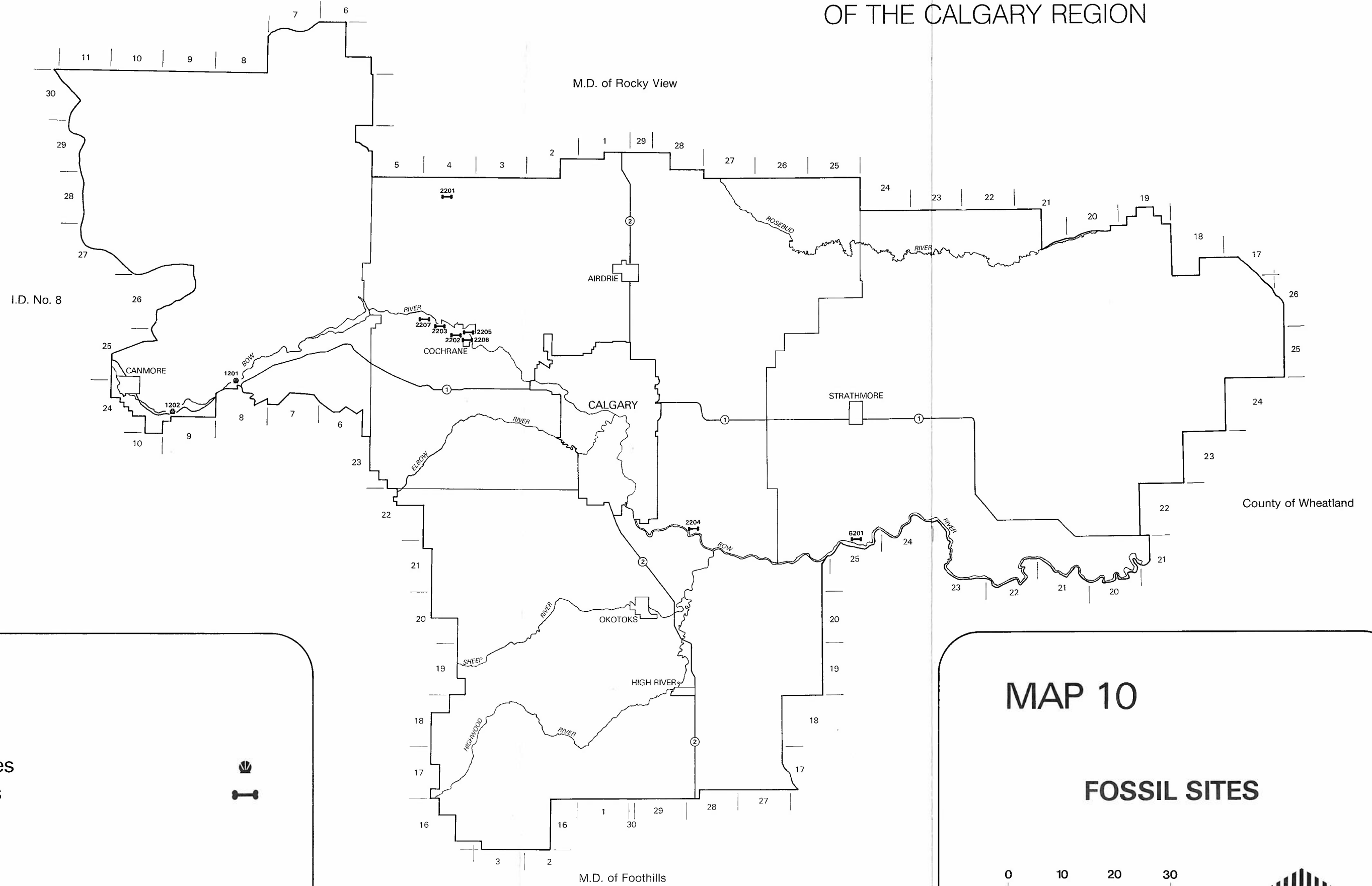
- (1) A locality in the Wintering Hills, in the Cretaceous Edmonton Formation, where the rare carnivorous dinosaur, Dromaeosaurus, was unearthed.
- (2) Two "type section" collecting localities for mammals (#2205, 2206) in the late Tertiary Paskapoo Formation.

6.3 LATE GLACIAL AND POST GLACIAL VERTEBRATES

At five localities, skeletal remains of large mammals dating back less than 10,000 years have been found:

- (1) River gravel terrace deposits at Cochrane, the Griffin and Clarke Pits, the Bonny Castle Pit on the Bow (#2204), and the Carseland Pit (#5201).

ENVIRONMENTALLY SIGNIFICANT AREAS OF THE CALGARY REGION



I.D. No. 8

M.D. of Rocky View

County of Wheatland

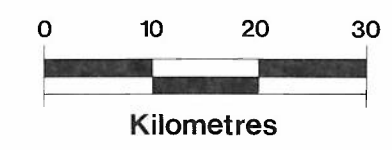
M.D. of Foothills

Invertebrates
Vertebrates



MAP 10

FOSSIL SITES



The information on this map may be refined by detailed on-site investigations which may result in boundary alterations.

- (2) The Hitching Post Ranch (#2201), a "natural trap" deposit of bones (primarily bison) in a spring north of Cochrane, 3,000 years in age.

6.4 PALEONTOLOGICAL PRIORITY AREAS

The Calgary Region contains a limited number of significant fossil sites. Of particular interest are the Paskapoo Sandstone mammals and the Pleistocene mammals which occur in gravel filled terraces. An important locale for both is the Bow and Big Hill Creek area in the vicinity of the town of Cochrane.

TABLE 6-1 PALEONTOLOGICAL SITES

<u>Municipality</u>	<u>Registration No.</u>	<u>Type of Sites</u>	<u>Comments</u>
I.D. #8	1201	Cretaceous invertebrates	shale pit
I.D. #8	1202	Mississippian invertebrates	
Rocky View	2201	Holocene bone bed	natural trap/ spring
Rocky View	2202	Large mammal-Late Glacial gravel terrace	gravel mining
	2203		
Rocky View	2204	Large Mammal-Late Glacial gravel terrace	gravel mining
Rocky View	2205	Paleocene mammals	railway cut
Rocky View	2206	Paleocene mammals	railway cut
Rocky View	2207	Cretaceous dinosaur fossil	rare find
Wheatland	5201	Large mammals-Late Glacial gravels	gravel mining

7.0 SIGNIFICANT ARCHAEOLOGICAL SITES

Significant archaeological sites identified during the study are listed in Tables 7-1 to 7-4. Sites have been classified according to a system of archaeological themes described below. Specific sites of interest are also discussed.

7.1 PREHISTORIC CAMPSITES

Prehistoric campsites are the focal points of Native peoples' activities. Their contents vary depending upon the site location, activities that went on, the number of people who used the site, the season of use, the age of the site, the culture of the occupants and the extent of reoccupation over time.

A campsite may be a very large and repeatedly occupied site. These are generally located in a stream or river bottom. Alternatively it may be a small site, representing a single one time occupation. These are often situated on the prairie overlooking a stream or small slough. A campsite may be an integral part of a bison kill, and may be the location where the carcasses were hauled for processing. The site may contain a wide variety of tools, fire cracked rock from cooking fires, and various cultural features, hearths, storage pits and the like.

Campsites are by far the most common site of potential regional significance in the Calgary Region. Many of the prairie camps in plowed fields represent former tipi ring sites. The majority of campsites of regional significance are in stream valleys. These include major campsites at the junction of Jumpingpound Creek and the Bow River, at and above the Bow-Highwood junction, and up the Sheep as far as Turner Valley. While some camps on small streams may date back as early as 10,000 years, most are less than 5,000 years old. Most of the earlier alluvial fills in the valleys eroded out between 7,000 and 50,000 years ago.

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TABLE 7-1: ARCHAEOLOGICAL SITES

<u>Municipality</u>	<u>Regis- tration No.</u>	<u>Terrace</u>	<u>Camp</u>	<u>Bison Kill</u>	<u>Tipi Ring</u>	<u>Stone Features</u>	<u>Cairn</u>	<u>Effigy</u>	<u>Wheel</u>	<u>Cairn Align- ment</u>	<u>Picto- graphs</u>	<u>Other</u>	<u>Comments</u>
I.D. #8	1301	X											Old site ca. 6800 yrs. eroding (wind)
I.D. #8	1302	X											Test excavated. dates ca. AD 100
I.D. #8	1303	X											Prehistoric Kootenai ca. AD 1500
I.D. #8	1304										X		Grotto Canyon. very bad condition
I.D. #8	1305	X											Potential for early occu- pation
I.D. #8	1306										X		Grassie Lake. very bad condition
I.D. #8	1307	X											Excavated & impacted in construction

TABLE 7-2: ARCHAEOLOGICAL SITES

Municipality	Registration No.	Camp		Bison Kill	Tipi Ring	Cairn	Effigy	Wheel	Cairn Alignment	Pictographs	Other	Comments
		Terrace	Prairie									
Rocky View	2301	X		X								One of few kills on N. side of Bow
Rocky View	2302	X			X							Remnant of former patterns
Rocky View	2303				X							Remnant of former Patterns
Rocky View	2304				X							Remnant of former patterns
Rocky View	2305				X							Remnant of former patterns
Rocky View	2306				X							Remnant of former patterns
Rocky View	2307				X							Remnant of former patterns
Rocky View	2308				X							Remnant of former patterns
Rocky View	2309	X										Spring Head campsite, only one recorded
Rocky View	2310	X			X							Campsite 5000 years ago
Rocky View	2311				X							Remnant of former pattern
Rocky View	2312	X			X							Very large significant site
Rocky View	2313				X	X						Remnant of former patterns
Rocky View	2314				X			X				Only wheel known west of Calgary
Rocky View	2315			X								Twin Bridge, only kill known on Elbow
Rocky View	2316	X										Only campsite of value found on Elbow
Rocky View	2317				X							Remnant of former patterns
Rocky View	2318			X								May be major kill
Rocky View	2319				X							Remnant of former patterns
Rocky View	2320			X						X		Only drive lanes known above Calgary
Rocky View	2321	X		X								May be place name for Jumpingpound Creek
Rocky View	2322				X							One of few left on Beddington
Rocky View	2323				X				X			One of few left on Beddington
Rocky View	2324	X										Balzac site, best camp excavated in area, Prov. Sign.

TABLE 7-2: ARCHAEOLOGICAL SITES (continued)

<u>Municipality</u>	<u>Regis- tration No.</u>	<u>Camp</u>		<u>Bison Kill</u>		<u>Tipi Ring</u>	<u>Cairn</u>			<u>Wheel</u>	<u>Pictographs</u>		<u>Other</u>	<u>Comments</u>
		<u>Terrace</u>	<u>Prairie</u>	<u>Trap</u>	<u>Jump</u>		<u>Cairn</u>	<u>Effigy</u>	<u>Align- ment</u>		<u>graphs</u>			
Rocky View	2325						X	X						Only Effigies in area
Rocky View	2326					X	X	X				X		Major kill in Big Hill
Rocky View	2327				X									Springs
Rocky View	2328				X									May be major jump
Rocky View	2329	X				X								Major campsite dates to 1400 B.C.
Rocky View	2330					X	X	X						Major complex in Cochrane area
Rocky View	2331			X		X	X	X						Buried campsite
Rocky View	2332					X	X							Remnant of former patterns
Rocky View	2333					X	X							Remnant of former patterns
Rocky View	2334					X	X							Remnant of former patterns
Rocky View	2335					X	X							Remnant of former patterns
Rocky View	2336					X	X							Remnant of former patterns
Rocky View	2337					X	X							Remnant of former patterns
Rocky View	2338					X	X	X						Remnant of former patterns
Rocky View	2339					X	X	X						Big Hill-cairn sensitive
Rocky View	2340					X	X	X						
Rocky View	2341												X	Potential significance
Rocky View	2342			X									X	Madden Bison Jump
Rocky View	2343				X									

TABLE 7-3: ARCHAEOLOGICAL SITES

Municipality	Regis- tration No.	Camp		Bison Kill Trap	Tipi Ring	Cairn	Effigy	Wheel	Cairn Align- ment	Picto- graphs	Other	Comments
		Terrace	Prairie									
Foothills	4301			X								Old Woman's - Designated other Jump not
Foothills	4302				X							Most rings gone - plowed
Foothills	4303									X		Mystic Cave
Foothills	4304	X										Excavated dates ca AD100. AD 1200
Foothills	4305		X									High River microblade site
Foothills	4306		X									High River Cody Complex site ca. 7000 B.C.
Foothills	4307			X								Site dates 10,000 yrs. Intact
Foothills	4308			X			X					7000 yrs. old
Foothills	4309							X				Only cairn/effigy recorded in area
Foothills	4310			X			X					Furthest west recorded site on Highwood
Foothills	4311				X				X			Only site of kind recorded on Bow
Foothills	4312	X										Remnant of former pattern
Foothills	4313	X			X							Remnant of former pattern
Foothills	4314				X							Remnant of former pattern
Foothills	4315	X										Remnant of former pattern
Foothills	4316				X							Remnant of former pattern
Foothills	4317				X							Very large cairn - rare
Foothills	4318				X						X	Twin row of circular depressions - unique
Foothills	4319			X	X							Kills uncommon this area of Highwood (preserved)
Foothills	4320				X							Unusually high # of artifacts
Foothills	4321	X										Occupation 7000 yrs.
Foothills	4322	X							X			Large cairn - rare
Foothills	4323	X									X	Large complex of sites on terraces
Foothills	4324	X							X			Burial cairn

TABLE 7-3: ARCHAEOLOGICAL SITES (continued)

Municipality	Registration No.	Camp		Bison Kill	Tipi Ring	Stone Features		Cairn Alignment	Pictographs	Other	Comments
		Terrace	Prairie			Cairn	Effigy				
Foothills	4325				X						Remnant of former pattern
Foothills	4326					X					Large cairn - rare
Foothills	4327				X						Remnant of former pattern
Foothills	4328				X						Remnant of former pattern
Foothills	4329	X		X	X		X				Complex site
Foothills	4330				X						Remnant of former pattern
Foothills	4331				X						Remnant of former pattern
Foothills	4332				X						Remnant of former pattern
Foothills	4333			X				X			Remnant of former pattern
Foothills	4334									X	Drive lanes only ones known
Foothills	4335								X		Big Rock-Prov. Designation
Foothills	4336				X						Remnant of former pattern
Foothills	4337	X		X	X	X					River erosion in kill
Foothills	4338			X	X	X					Large cairn - rare
Foothills	4339					X	X				Large cairn on ridge - rare
Foothills	4340	X									
Foothills	4341			X							
Foothills	4342	X									Site undisturbed
Foothills	4343	X		X	X						Kill furthest west known
Foothills	4344	X		X							EM Jump & campsite - major jump on Bow
Foothills	4345				X		X		X		Part of former pattern. Significant, large wheel, rings
Foothills	4346				X						Remnant of former pattern
Foothills	4347		X				X				High artifact yield
Foothills	4348	X									Excellent stratigraphy
Foothills	4349	X		X	X						
Foothills	4350	X		X	X						Campsite ca. 5000 yrs. old
Foothills	4351				X		X				Gravel extraction

TABLE 7-4: ARCHAEOLOGICAL SITES

<u>Municipality</u>	<u>Regis- tration No.</u>	<u>Terrace</u>	<u>Prairie</u>	<u>Camp</u>	<u>Bison Kill</u>	<u>Trap</u>	<u>Jump</u>	<u>Tipi Ring</u>	<u>Cairn</u>	<u>Effigy</u>	<u>Wheel</u>	<u>Cairn Align- ment</u>	<u>Picto- graphs</u>	<u>Other</u>	<u>Comments</u>
Wheat land	5301							X	X	X	X				To be Designated Prov. Resource
Wheat land	5302							X							Largest ring site recorded on Bow
Wheat land	5303					X									Typical of small kills
Wheat land	5304								X						Rare in plowed lands
Wheat land	5305						X								Gleichen Jump - major site
Wheat land	5306						X								Hammer Hill - major site
Wheat land	5307							X	X						Major jump. intact.
Wheat land	5308							X		X					Crawling Valley. most complex known
Wheat land	5309							X	X	X	X				Wintering Hills. few intact sites
Wheat land	5310							X	X						Excavated date ca 3000 B.C.
Wheat land	5311														One of few left
Wheat land	5312								X						One of few left
Wheat land	5313								X						One of few left
Wheat land	5314								X						One of few left
Wheat land	5315											X			One of few left

7.2 BISON KILLS

Bison kills consist of the remains of a number of animals, which were captured by use of co-operative group hunting, driving and trapping techniques.

The kill may be a single event and include only five or so animals, trapped in a snow drift, pond, or bog. These occur as scattered butchered bones with few, if any, tools left behind. In contrast, large bison kills are characterized by thick bone beds. These may be the result of a single large drive or of repeated drives in the course of one or more years.

The numbers and kinds of stone tools found in a kill vary considerably depending on the intensity, repetitiveness and nature of the kill, and the types of associated activities. Processing and meat stripping may have occurred on site; alternatively, the quarters and sides may have been removed to a nearby processing camp.

Bison kills are divided into a variety of "types" based on the kind of trap employed:

- 1) Jumps - where the animals were jumped over a cliff, usually 8-10 metres high, and maimed or killed in the fall. These sites are often large, complex and repeatedly used. They are of provincial significance.
- 2) Pounds - where the animals were driven into a "corral", constructed below a hill or in a valley, where the animals would not see the entrance until upon it. These sites are often relatively large, and repeatedly used and of either regional or provincial significance.

- 3) Surrounds - where the animals were surrounded by encircling a small herd with a wall of hand-held hides, and killing the animals, as they milled about. This technique was often used on the open plains. Most are single events. They vary in their significance.
- 4) Natural Traps - where the animals were driven into box canyons, snow drifts, steep sided arroyos, springs, seeps, bogs, lakes, rivers, or onto ice in winter. The natural features served as the trap. Some of these sites, particularly where a small number of animals were taken, are difficult to differentiate from ambush/confrontation hunting at water holes and fords. Most of these kills are small single events. They vary in significance depending upon their size, age and preservation. Old sites are rare and provincially significant.

Associated with the kills, particularly the pounds and jumps, are processing campsites, and gathering basins. The processing camps are generally found immediately adjacent to the kill. Here the bison carcasses were taken, and processed into stripped and dried meat, various cuts for immediate consumption, robes, tipi hides, leather, sinew, horn and bone tools, hoof glue, tallow and fat for lamps. A processing camp is characterized by large quantities of butchered bone, fire cracked rock, bone boiling pits, hearths, and a limited variety and number of stone tools. Activities were directed towards processing the animals and their products for use at other times.

Processing camps are associated with the large fall/winter/ spring kills used when the bison were in their wintering and calving range. At other seasons, including midwinter, when large drives were not possible because of the dispersal of the herds, the pattern is one of small drives (e.g., snow drift kills), butchering on site, meat stripping and return of the meat to a midwinter base campsite. This type of campsite is characterized by limited amounts of butchered

bone, a variety of small tools related to maintenance activities (e.g., hide-working tools) as well as hearths and other habitation features.

Large processing and base campsites vary in significance, depending on age, preservation and artifact yield, but are generally of regional significance.

Gathering basins are the areas from which the bison were gathered and driven toward the kill. They may contain drive lanes, marked by lines of stone piles or cairns, through which the bison were driven. Agricultural activities have eliminated most of these sites.

A number of bison kills have been recorded in the Calgary Region. These include five major bison jumps: the Old Woman's Jump (#4301) west of Cayley (A Provincial Historic Resource Site); the FM Jump (#4344) on the FM Ranch, east of DeWinton; the Madden Jump (#2343); the Gleichen Jump (#5305); and Hammer Hill (#5306). The centre of distribution of bison jumps is the Porcupine Hills. Madden is the furthest north of the large buffalo jumps. The jumps within the Calgary Region constitute some of the major ones in the province.

In addition, there are many smaller bison kills and traps, some of which are exposed and preserved and other which lie buried below ground. Many have been lost over the years in the stream valleys, through lateral stream erosion. Consequently, they are now uncommon and are regionally significant sites. A site (#4308) on the Highwood below Longview is over 7000 in age.

7.3 TIPI RING SITES

Tipi ring sites are campsites with stone rings which range from two to eight metres in diameter and which were used to hold down tipis. Hearths often occur within the rings. Various stone features, such as small cairns or "rock piles", are often found outside the rings.

The tipi ring sites within the Calgary Region occur in the Plains and Foothills. They are not found in the forested mountains and foothills valleys. They range in size from the small clusters of three to five rings found in the Wintering Hills overlooking the Red Deer River to sites of over 100 rings in the Bow River Valley south of Highway 22 (e.g., #4305). In the larger and more complex sites, other stone construction (large cairns, medicine wheels, rocklines and effigies) occur.

The smaller sites generally represent a single encampment of a band of related families, while the large ones represent either "tribal gatherings" or repeated use of the same site. The large complex sites are "rare", as most of the land has been put to the plough. They occur in the Bow River Valley, both upstream and downstream of Calgary. Some are of regional if not provincial significance.

7.4 CEREMONIAL STONE FEATURES

A number of stone structures exist, most of which are "ceremonial" constructions, associated with religious activities. Those present in the Calgary Region include cairns, stone mosaics, boulder pavements, effigies and medicine wheels.

7.4.1 Cairns

Large cairns, up to 4 m in diameter and 1 m high, may represent burial sites, constructions associated with religious activities, or "trail shrines". Constructed as early as 5,500 years ago, their original purpose is lost. They were apparently revered as a "holy" place, with offerings left on and in

them as recently as 100 years ago. Large cairns are very rare, as many have been destroyed. Some appear to have been enlarged by farmers removing rock from plowed fields.

7.4.2 Stone Mosaics, Boulder Pavements and Effigies

Geometric or abstract designs, stylized human and animal figures, and symbols have been found constructed from boulders and cobbles. Some tell stories, and were used to record events as recently as the 1870's by the Blackfoot. They are uncommon, and may occur as an isolated site, or part of a larger complex. All are of regional or provincial significance.

7.4.3 Medicine Wheels

Medicine wheels, large stone circles with spokes radiating out to the rim from a central cairn, are rare features, often found on prominent hill tops, or as part of large stone feature sites. They vary considerably in their size and complexity. Some were initially built as early as 5,500 years ago. Four sites were recorded in this inventory, including one in the Bow River Valley west of Carseland (#) and one on the Horse Track Ranch (#5301). This latter site is proposed for designation as a Provincial Historic Resource. All medicine wheel sites are regionally significant.

7.5 ROCK ART SITES

Rock art sites in the CRPC region consist of pictographs (sites characterized by painted designs) located on sandstone outcrops or glacial erratics. The sites are rare. Those recorded include the Big Rock (#4335) at Okotoks, a designated Provincial Historic Resource (designated for its natural not cultural significance).

7.6 CULTURAL PITS

Native peoples in many parts of North America constructed and occupied semi-subterranean houses. These are known as earth lodges on the North American Plains and Pit Houses in the Mountain Plateaux of British Columbia. The former, which are associated with village farmers along the Missouri, are represented by a site on the Blackfoot Indian Reserve, the Cluny Earth Lodge Village. Pit Houses were built by Salmon fishing natives of the Frazer Plateau. A number of these sites were found in Banff National Park. While these kinds of sites have not been recorded in the Calgary Region to date, three sites with excavated pits of prehistoric age, were found. One (#4318) on the Highwood is a double row of pits leading out along a projecting peninsula to a cliff. It may be some sort of bison drive structure. A similar site has never been found anywhere else.

7.7 PRIORITY AREAS

Particularly high densities of prehistoric sites are found in the vicinity of the junction of the Bow and the Highwood rivers in the Bearspaw Reservoir area, and in the vicinity of the junction of the Bow River and Jumpingpound Creek. We believe that the Wintering Hills and Rosebud River Valley are also important areas for prehistoric sites, but there is inadequate survey coverage in these areas to confirm this.

8.0 SIGNIFICANT HISTORIC SITES

In an attempt to deal in a systematic fashion with a burgeoning quantity of data on the Province's historic resources, with the intent to provide for their protection and commemoration, an Alberta Culture Task Force produced the Master Plan, Prehistoric and Historic Resources in 1980. The Plan is organized thematically on an event/date pattern, and attempts to incorporate the major themes of relevance to Alberta History. We have employed the Historic Sites Service structure for the Calgary Region study, since it highlights the significant themes and events occurring in the area. The Historic Sites Services identifies 1925 as a general cut-off date for its inventory. We would extend this date another 15-20 years (i.e., until World War II), should a site represent a unique or first occurrence in a region, even if the represented activity has taken place elsewhere at an earlier date.

Historic sites identified within the Calgary Region are listed in Tables 8-1 to 8-3. The major historical themes are described below, and sites which best illustrate these themes are identified.

8.1 THEME: FUR TRADE

The southern short grass areas of the Northwest in the area that eventually became the Province of Alberta were not directly involved in the fur trade ventures so active in the north. Trade was discouraged by the rapid depletion of the limited fur resources along southern waterways and the hostility of the Blackfoot tribe. This situation resulted in the eventual closure of most forts established in the south.

In 1832, the Hudson's Bay Company established Peigan Post (#1413) on the Bow River, to create a southern terminus with which to compete against James Kipp's successful trading post on the Marias River. Peigan Post was to replace Rocky Mountain House as the focal point of

TABLE 8-1: HISTORIC SITES - IMPROVEMENT DISTRICT #8

Municipality	Regis- tration No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Comments	
		Cairns	Homestead	Farmstead	Ranch	Stopping House	NMP Post	School	Church	Cemetery	Townsite	Agricultural	Coal Mines	Lime Kilns	Sandstone Quarry	Brickyard	Oil/Gas	Other		
I.D. #8	1401																			
I.D. #8	1402										X									Damaged In Hwy 1 Relief Camp
I.D. #8	1403												X							Original Canmore Townsite
I.D. #8	1404																			Place name only, Site
I.D. #8	1405								X											Reclaimed
I.D. #8	1406										X									Olympic Archaeological Site
I.D. #8	1407																			Impact
I.D. #8	1408																			East Gates R. Mountain Park
I.D. #8	1409										X				X					Archaeological Site
I.D. #8	1410																			Razed
I.D. #8	1411																			Archaeological Site
I.D. #8	1412										X									Loder Residence
I.D. #8	1413																			
I.D. #8	1414		X																	Fur Post
I.D. #8	1415									X										McDougal Mission Prov.
I.D. #8	1416																			Desig. Site
I.D. #8	1417		X																	Ranger Station
I.D. #8	1418		X																	Good Condition
I.D. #8	1419								X											Archaeological Site

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TABLE 8-2: HISTORIC SITES - M.D. OF ROCKY VIEW (continued)

<u>Municipality</u>	<u>Site No.</u>	Calns	Homestead	Farmstead	Ranch	Stopping House	NMNP Post	School	Church	Cemetery	Townsite	Agricultural	Coal Mines	Lime Kilns	Sandstone Quarry	Brickyard	Oil/Gas	Other	<u>Comments</u>
Rocky View	2423						X												Archaeological Site
Rocky View	2424					X													Archaeological Site
Rocky View	2425						X												Standing Structures
Rocky View	2426				X														Standing Structures
Rocky View	2427					X													Some Standing
Rocky View	2428			X															Some Standing
Rocky View	2429			X															Some Standing
Rocky View	2430			X															Some Standing
Rocky View	2431			X															Some Standing

trade with the Peigans, but was soon abandoned in 1834 in favour of reopening Rocky Mountain House. This latter was maintained until 1875 when the Hudson Bay Company erected a post on the east side of the Bow River opposite the Northwest Mounted Police's Fort Calgary.

The fur trade is poorly represented by sites in the Calgary region. Most of the related thematic resources are trails, historic viewpoints, portage routes or temporary camp spots. Few physical remains exist.

8.2 THEME: TRANSITION FROM A NOMADIC ECONOMY

8.2.1 Subtheme: Missions

The proselytizing efforts of Roman Catholic, Methodist and Anglican missionaries in the mid to late 19th century wrought profound changes upon the native culture and economy. Much of the pioneering missionary work involved itinerant travel to the widely dispersed native population, although a few small but important missions were established. Within the Calgary Region the Morleyville Mission (#1414), which has been designated as a Provincial Historic Resource, was the first Christian Church and Methodist Indian Mission in southern Alberta. It was established by George McDougall and his son John in 1875, and became a decisive factor in the altering of traditional Stoney living patterns. Related sites include George McDougall's Cabin (#1410), George McDougall's Cairn (#2424) and The Our Lady of Peace Mission (#2424).

8.2.2 Subtheme: The Maintenance of Law and Order

The incorporation of liquor into native lifeways, the ravages of disease, loss of the buffalo and the incursion of the white man onto native lands proved disastrous for Indian culture. In an attempt to deal with these dislocations, the Canadian government initiated the treaty system which concentrated the

native peoples on reserves. Schools were established to train the Indians in sedentary farming practices. Industrial schools were built off the reserves causing a further severing of ties with traditional ways and beliefs. St. Joseph's Industrial School (#4413) built at the junction of the Bow and Highwood, and the Morleyville Orphanage (#1419) are examples of such early institutional buildings.

The administration of treaty signings and the enforcement of law and order was the responsibility of the North-West Mounted Police, who played a major role in the growth and development of the Canadian Northwest. The NWMP were formed in 1873 in response to fears of a potential Indian and Metis uprising across the West. Dissatisfaction among native groups resulted largely from their dealings with the corrupt whiskey traders of that era. The whiskey traders operated from centrally located posts scattered across Southern Alberta. Spitzee (#4414), near High River, and Berry and Shears Post (#4415) on the Highwood are two examples.

The numerous and varied responsibilities of the NWMP were carried out through an efficient hierarchical administrative network of Divisional Headquarters, District Headquarters, Subdistrict Headquarters, local detachments and horseback patrols ("Flying Patrols"). Some of the Divisional outposts in the Calgary Region are Morley (#1414), Priddis, Okotoks, Airdrie (#2425), Stimson (#4408), and Dunbow (#4413).

8.3 THEME: RANCHING

8.3.1 Subtheme: Ranching as the basis of the Southern Alberta Economy

By 1879, the near extinction of the buffalo had reduced the native population to starvation. Thus nucleus breeding herds of cattle were established by the Federal Government at Fort

Macleod and Calgary to provide beef for the Indian Reserves. This new incentive to an ensured market, combined with the stability and security afforded by the presence of the Northwest Mounted Police, who had arrived in Southern Alberta in 1874, resulted in the successful growth and development of ranching in Southern Alberta. The Northwest Mounted Police played a vital role in the Alberta ranching frontier. Many policemen turned rancher upon retiring from the force. Additionally they formed the core social milieu of the Canadian ranching community, which gave it a distinctive Anglo-Canadian character, and differentiated it from that of the American ranching frontier.

The "Bonanza Ranches" were quickly established in the 1880's, aided by the establishment of the "closed lease" form of land tenure, which allowed for huge tracts of grazing land. One man or company was allowed to lease up to 100,000 acres at one cent per acre per year, according to an order-in-council passed by the Federal Government in 1881. The Cochrane Ranch (#2414), the Bar U (#4407), Quorn (#4410), and Rio Alto Ranch (#4404) are some of the large ranches established at this time.

The days of the Bonanza Ranches were short-lived. In 1896, the newly elected Laurier government concelled the closed lease system. By 1904, the Canadian Government sought to fulfill its vision of a settled industrial west, and encouraged the taking up of lands for farming purposes. When the government also began to dispose of the region's water reservations, which had formerly been specially allotted to the ranching industry, the industry began to wane. Extensive railway branch line construction, which segmented the once open ranges, and competition from other countries in the marketing of beef also contributed to the demise of the Bonanza Ranches. Although ranching continued to play an important part in the Alberta economy after 1910, it never

regained the status achieved during the days of the Bonanza Ranches. Some of the smaller ranches established after 1900 are the Bow Valley Ranch (#2422), E.P. Ranch (#4403) and Horse Track Ranch (#2431).

8.4 THEME: SETTLEMENT

With growing realization of the potential of the Northwest, serious attempts were made in the 1880's and 90's to settle the region and incorporate farming as a major activity. The era of rapid railway construction began at this time and flourished at the turn of the century. These developments greatly facilitated the rapid influx of settlers to Alberta. The Canadian Pacific Railway reached Calgary by 1883, and the Calgary-Edmonton line was completed shortly after in 1891. The Grand Trunk Pacific, and the Canadian Northern Railway were also responsible for the encouragement of settlement in the province. The latter was an exceptionally expansion-minded company, and opened up a considerable area for farming in the more arid reaches of south-central Alberta.

Large colonization companies, some of which were connected with the railways, were established. Irrigation companies, such as that associated with the Canadian Pacific Railway, also enticed settlers to the drier, less arable portions of the Province.

The nature of settlement in the late 19th and early 20th centuries, was largely in concentrated blocks along railway lines. Many of the settlers during this period had immigrated to Alberta in large numbers from Northern European and Slavic countries through colonization company promotion, and tended to settle together in groups. This fostered and maintained distinct ethnic communities within the province. The German town of Hussar and the Swedish town of Standard are examples of such communities.

8.5 THEME: RESOURCE DEVELOPMENT

Once again, the railways were the vital catalyst which spurred settlement and development of natural resources. Aided by Branch lines which allowed access to undeveloped regions, settlers quickly took up most available agricultural land by the turn of the century. The exploitation of Alberta's great coal resources, as represented by the Canmore dune workings (#1403) and related sites such as Georgetown (#1405), was also intricately tied up with the expansion of railway networks early in the province's history.

Once methods of dry land farming and irrigation had been introduced, agricultural production increased at a rapid rate. Advances in new technology and agronomy were displayed in the unique experimental farms, which were often established by the railway companies and situated close to main routes of travel, where potential settlers could be influenced. The lumber and clay industries, closely allied with the expansion of settlement, first catered only to local and regional demand before becoming production units of provincial and national importance.

The oil and gas industry became prominent after World War II, and contributed to a second period of economic growth of the province. Turner Valley was one of the most significant locales of petroleum resource development in the province.

8.6 PRIORITY AREAS

Insufficient data exists to permit a comprehensive ranking of sites on a priority basis. Sites exhibiting definite historic integrity and cohesiveness of theme, such as historic groupings within the Canmore Corridor and oil and gas field sites in Turner Valley, should be seriously evaluated. Abandoned sites with no active protection and sites threatened by river erosion and vandalism also deserve special consideration.

9.0 DISCUSSION AND RECOMMENDATIONS

An environmental planning strategy for the Calgary Region should seek to conserve the Region's rich legacy of environmental resources. Because of the extensive nature of these resources, conservation by direct ownership and control would generally not be a feasible means of achieving this goal. The aims of conservation are best served, in most cases, by maintaining current land uses in the areas of concern. In this regard the CRPC and the municipalities should formulate the main environmental planning objectives through appropriate provisions in their Regional Plan, General Municipal Plans, Area Structure Plans, Area Redevelopment Plans and Land Use Bylaws. Other environmental planning objectives can only be achieved by negotiation. Matters of Federal, Provincial or Indian Reserve jurisdiction fall within this category. Moreover, many environmental land use practices on private lands are not regulated by municipalities, and any objectives related to these practices can only be achieved by negotiation with private landowners. Negotiations for the acquisition of private lands will be at the discretion of municipalities only.

The co-ordination of regional, municipal and provincial planning efforts should be a priority; this is especially important in I.D. #8 where many of the important environmental resources fall partly on private and partly on Crown land. Consultation with Indian bands is also necessary, because of the major role of the Reserves in conserving the natural landscapes of the Region.

Biophysically significant areas include those areas which, by virtue of their geological or hydrologic character, flora or fauna, deserve special consideration in the environmental planning process. Within the context of this study, biophysically significant areas include significant natural landscapes, key wildlife areas (mainly for big game and waterbirds) and key fish habitats (mainly for cold water sport species). A variety of other categories are possible, but the current data base could not support a more refined subdivision.

Many of the areas identified can be classified in more than one category. For example, a significant natural landscape can also be an important wildlife or fish habitat. However, the categories used are useful for identifying the types of environmental planning measures needed to protect the biophysical resources of the Region. The discussion that follows attempts to identify the key issues and the appropriate environmental planning approaches to each.

9.1 SIGNIFICANT NATURAL LANDSCAPES

The significance of natural landscapes is largely a function of their rarity. In the settled portions of the Region a major portion of the landscape is devoted to agriculture. Natural landscapes tend to occur only in those areas that are unsuitable for agricultural cropland. In these areas the lands are normally used for grazing and the most inaccessible portions left largely undisturbed.

Many of the grazing lands have not undergone irreversible ecological change from the natural state. They therefore represent the residual natural landscapes of the settled portion of the Region. These residual natural landscapes should be considered as a scarce resource, requiring special planning measures for their protection. Within the category of residual natural landscapes, specific qualities such as rarity, diversity and importance to wildlife may distinguish one area from another, causing a higher priority to be placed on that area.

In the Crown lands of the Region, naturalness or semi-naturalness is the rule rather than the exception. Naturalness, in itself, is therefore not a major criterion in the identification of lands that are significant, except where an exceptionally large area of diverse terrain is in a pristine state, making it suitable for designation as a Wilderness Area. Elsewhere, only those areas with characteristics that stand out as special within a natural landscape context should be designated as significant natural landscapes.

Planning for the conservation of natural landscapes must take into account competitive or potentially damaging uses of the same lands. The major competitive land uses are residential, industrial extractive, transportation and utilities. In addition, a number of other land uses such as intensive agricultural and commercial have some current impact and potential for future impact. Recreational uses of natural landscapes, if improperly controlled, can also lead to significant degradation. These various land uses are discussed briefly below.

9.1.1 Residential Development

Natural landscapes provide the most desirable building sites from an aesthetic standpoint. Unfortunately the cumulative effect of a large number of individual siting decisions based on aesthetics is the undermining of the aesthetic qualities of the natural landscape. Moreover, the subdivision of a natural landscape into a large number of manicured parcels also undermines the ecological functioning of the natural landscape. This process can only be arrested by prohibiting new small-parcel developments on natural landscapes and by prohibiting resubdivision of existing parcels that have already been severed.

High density residential complexes such as condominium developments, which are designed to take advantage of surrounding natural landscapes while minimizing the amount of land used for housing, can in some cases be compatible with goals of environmental conservation. This could be the case if a large tract of natural landscape were incorporated into the development as a permanently protected natural area. Because the impact of this type of development is largely a function of overall environmental design, each such proposal should be evaluated on individual merit. Projects that meet long term environmental planning objectives for natural landscapes in the Region should be given fair consideration.

A sufficient buffer zone should be established adjacent to significant natural landscapes to provide visual isolation of these areas from residential land uses. For example, in designated natural river valleys and coulees, prohibitions against residential subdivision should extend far enough away from the edge of the valley escarpment to prevent views of prominently located residences from affecting the natural environment experience of a user of the protected area. This recommendation is designed to prevent the type of visual intrusion that occurs at Fish Creek Park and the Cochrane Ranche. It will also have the incidental benefit of obviating soil stability problems that can arise when residences are perched near the edge of precipitous river valley slopes.

The degree to which the above recommendation can be implemented depends upon the degree to which the process of urbanization has advanced. In areas such as the City of Calgary, large parts of the river valley already possess an urban landscape and the potential for the protection of views is often restricted to maintaining an intact buffer of streambank vegetation. However, along those stretches of river which still possess relatively undisturbed escarpments, the view of the escarpment from within the river valley should be very carefully protected.

9.1.2 Extractive Industries

Extractive industries such as sand and gravel operations and limestone quarrying frequently create conflicts with the goal of conserving natural landscapes. The best sites are typically found within or adjacent to otherwise natural landscapes such as river valleys, where environmental conservation is also a pressing priority. In such situations, a compromise must be struck between economic necessity and environmental conservation. The guiding principal should be that existing operations should continue to be permitted, except in cases

where the total elimination of a unique landscape is imminent. However, applications for opening new pits and quarries should be entertained only when it can be demonstrated that there is no economically viable alternative. Regional and municipal policies should also encourage the restoration of abandoned pits and quarries in a manner appropriate to the character of the existing landscape. Our field reconnaissance indicated that current practices for filling pits and quarries are in some cases highly detrimental to natural landscapes.

9.1.3 Other Industrial and Agricultural Land Uses

All forms of non-extractive industrial development and intensive forms of agriculture, such as feedlots, poultry farms and nurseries should not be permitted to establish on significant natural landscapes. However, those operations that are already established in these areas should be permitted to remain. Policies that would result in the eventual phasing out of these land uses would be desirable.

9.1.4 Commercial Land Uses

Generally speaking, commercial land uses should not be permitted in areas designated as significant natural landscapes. However, plans and bylaws should allow some flexibility in relation to developments such as guest ranches and destination resorts which have associated with them a large adjacent tract of natural landscape. Such operations can be quite compatible with regional and municipal environmental conservation policies. As in the case of high density residential developments which seek to incorporate and conserve a large component of natural landscape, each such proposal should be considered on its own merit.

Other types of commercial development are clearly incompatible with environmental conservation objections. Highway commercial development, trailer parks, commercial campgrounds and amusement attractions should be prohibited in designated natural landscapes.

9.1.5 Transportation and Utility Corridors

The establishment of transportation and utility corridors and the expansion and modification of existing ones can have a major impact on natural landscapes. Some of these impacts are unavoidable, whereas some could be avoided through the environmental planning process. Regional and municipal policies should be designed to minimize the intrusion of transportation and utility corridors into natural landscapes.

Many decisions on transportation and utility corridors are made by agencies of the Provincial Government. Regional and municipal policies should ensure that these senior levels of government are adequately informed of regional environmental planning concerns.

9.1.6 Buffer Zones

The view problem previously discussed in relation to residential development adjacent to natural landscapes also applies to industries, intensive agricultural developments, commercial developments, transportation corridors and utilities corridors. Regional and municipal policies should provide for adequate visual buffer zones based on line-of-sight considerations to protect significant natural landscapes from visual intrusions. Buffer zones to protect these areas from noise and dust intrusions should also be developed.

9.1.7 Recreational Land Uses

One of the major motivations for conserving natural landscapes is to provide opportunities for present and future generations to experience the diversity of the Region's natural attributes. Natural environments, however, cannot sustain unlimited recreational use. No matter how conscientious the recreational users are in limiting the impact of their activities, their cumulative effects on terrain, vegetation and wildlife can be significant. Compounding this problem are aspects such as the disposal of human waste; which become important issues when large numbers of people use a natural area without formal facilities. These various problems have constituted a major dilemma in environmental conservation since the earliest days of the conservation movement. In short, designation of conservation lands results in recreational use that adversely affects the very qualities that originally influenced the designation. This problem is faced by virtually all of the world's national parks and by most provincial, regional and local parks.

A problem even more disturbing than the unintentional environmental damage caused by well-behaved recreationists, is the often severe impact caused by a small, insensitive minority with no regard for the qualities of the natural environment. These individuals are responsible for the more visible and flagrant abuses, including dumping of trash in natural areas, littering of papers, cans and bottles, use of all-terrain vehicles in sensitive natural environments, damaging fences of private landowners, illegal hunting and vandalism. The unacceptable behaviour of this highly visible minority has frequently posed such a problem to landowners that they have been forced into denying all recreationists access to their land.

Although the CRPC and the municipalities have limited authority to exert direct control over many of the problems mentioned above, we believe that they can nevertheless play an important role in the solution of these problems. Potential avenues of action include:

- 1) Providing a local forum for landowners and recreationists to discuss their respective concerns and work toward mutually acceptable resolutions.
- 2) Co-ordinating the monitoring of recreational use of natural landscapes.
- 3) Developing regional and municipal environmental policies/-liaising with provincial decision makers.
- 4) Identifying law enforcement issues related to recreational use of natural landscape.
- 5) Taking direct action, where appropriate.

Elaboration on these points is provided below.

1) Forum for Landowners and Recreationists

The CRPC and the municipalities should act as the organizational focus for establishing local forums, involving individual landowners, surface rights associations, Indian bands and outdoor recreation associations, for the discussion of recreational land use issues of mutual concern. Such a forum could give rise to resolutions of recreational land use conflicts that satisfy all parties.

For example, canoe clubs wishing to gain access to a certain stretch of a recreational river might negotiate for this privilege with a landowner or group of landowners. The landowners might be sympathetic to permit

canoe access, but may wish to limit broad-scale recreational activities on their land. A possible resolution of this situation might be an agreement to permit access to canoeists only if they can prove membership in a club recognized by the landowner. The clubs involved would agree to police their own membership and address any landowners' complaints that might arise out of the agreement.

Along slightly different lines, a club wishing to gain access to certain private lands might agree to carry out a periodic cleanup of litter left behind by the public in return for the privilege of access.

Numerous other types of arrangements are possible. The above two examples are provided only as a stimulus to further thinking regarding such constructive privately negotiated arrangements.

2) Co-ordination of Site Monitoring

It would be difficult and costly for either the CRPC or the municipalities to set up a formal system for monitoring the condition of the significant natural landscapes in the Region, given the extensive nature of these resources. The only potentially effective approach to monitoring is to secure the co-operation of the two main groups with an interest in the land: the landowners and the actual or potential recreational users. We believe that it would be relatively easy to establish both types of monitoring systems.

Landowners could be initially notified by letter that a reporting and monitoring system was being set up to document the extent of public use of private lands and the nature of any related problems. This would be followed up by personal contacts with selected landowners to give planners a more immediate feel for the situation.

Associations of recreationists and naturalists should be requested to provide periodic reports (including verbal reports) on current environmental conditions in the areas they visit. The CRPC and the municipalities should also attempt to secure their co-operation in monitoring sites in which their interests are more peripheral.

The CRPC should maintain environmental monitoring files on each environmentally significant area that figures in the long term planning of the Region. These files, in addition to being used by regional planners, should be made available on request to all member municipalities. Moreover, whenever a situation arises that requires the attention of a member municipality, the CRPC should ensure that the municipality is automatically informed.

3) Policy Development/Liaison with Provincial Decision Makers

The CRPC and its member municipalities should develop environmental planning policies that reflect local and regional perspectives. These policies should be forcefully communicated to Provincial government agencies whose decisions affect the environment of the Region. In addition, the CRPC and the municipalities should develop and convey to the Provincial government specific recommendations on pending decisions that affect the environment of the Region. Involvement in environmental issues should start at the earliest possible stage in the decision making process to ensure meaningful and effective participation in the process.

The CRPC and the municipalities should not limit their activities to reacting to Provincial government initiatives. They should also actively put forward, for consideration, environmental policy initiatives and concrete environmental protection and enhancement proposals.

4) Liaison with Law Enforcement Authorities

The environmental planning activities of the CRPC and the municipalities will bring to light situations where stricter enforcement of existing laws is necessary to protect the environment, and in many cases, the rights of landowners. In such matters planners should bring these issues to the attention of law enforcement authorities.

5) Direct Action

Although the CRPC and the municipalities have limited authority to directly regulate recreational land use, there are certain situations where direct action might be appropriate. For example, the acquisition of a small strip of land by a municipality might provide public access to an environmental feature and prevent problems of trespassing on adjacent lands. A municipality might also choose to erect signs to regulate public use and access of sensitive environments.

Municipalities should also consider reserving funds for maintaining environmentally significant areas on private lands in cases where landowners permit public access. Such funds could be used for the maintenance of gates and fences that direct or control public access, maintenance of pathways, and the removal of incidental litter. This approach would remove the financial burden of permitting access from the landowner and would likely lead to more amicable relations between landowners and the general public. Moreover, it would limit the environmental degradation that occurs in areas of unregulated public access (e.g. Twin Bridges area on the Elbow River, Bow-Highwood River junction).

Although the above suggestions involve some costs to municipalities, these are minimal in comparison to the most modest program of land acquisition of environmentally significant areas.

9.2 SIGNIFICANT WILDLIFE HABITATS

If the protection standards suggested for significant natural landscapes were applied to all identified areas of importance to wildlife, a very high degree of protection of wildlife resources would be achieved. However, because of the very large areas of land involved, such an approach would not always be feasible. Some compromises between wildlife protection and other land use demands are inevitable. Even in such cases the potential exists to preserve some specific elements of the landscape that provide suitable habitat for wildlife. All potential changes in land use that could affect wildlife habitat should be discussed with the staff of the Fish and Wildlife Division of Alberta Energy and Natural Resources. Some of the major wildlife issues of relevance to the Region are discussed briefly below.

9.2.1 Big Game Species

Because Bighorn Sheep occupy a restricted range in North America, provisions for their protection should be stringent. In the Calgary Region, the major human interactions with Bighorn Sheep populations take place along the Canmore Corridor. Development planning should ensure not only the protection of important ranges, but also the protection of animals from disturbance while on these ranges.

No specific recommendations have been made for the protection of Mountain Goats because of the inaccessibility of their habitats and the unlikelihood of their being impacted by development activities.

Elk habitats deserve special consideration because of the restricted North American range of the species. In the Calgary Region potential pressures on elk range exist within the Canmore Corridor and in the northeastern part of the M.D. of Foothills. The best method of conserving elk habitat is to maintain ranching or other non-intensive land uses. An issue of importance to the long-term viability of elk populations is the control of wildfires, which is permitting tree species to invade the grassy areas favoured by elk. Another significant issue is the economic impact of crop depredation by elk.

The Moose habitat of the Region, particularly in the M.D. of Foothills is being significantly impaired by range improvement programs, which annually remove large amounts of willow to improve cattle production. This issue, which involves trade-offs between agricultural production and wildlife conservation, has no simple resolution. In the M.D. of Rocky View country residential development is encroaching into prime Moose habitat. In this case, land use bylaws could ensure the conservation of at least parts of these areas, which are only marginal for the type of development.

To conserve the Mule Deer populations of the Region, municipal and regional policies should encourage the preservation of natural river valleys, coulees and draws. Where areas of important Mule Deer habitat have already been subdivided into country residential lots, further subdivision into smaller lots should be discouraged.

Policies described above for the protection of Mule Deer habitats will also have a favorable impact on White-tailed Deer populations. In addition, policies to encourage the retention of remnant groves of trees in areas of cropland should be developed.

All big game species, with the possible exception of Mountain Goats are vulnerable to harassment by dogs and by people on all terrain vehicles. In certain cases selective controls may become necessary.

9.2.2 Waterbirds

The Calgary Planning Region, and particularly the eastern portion of the Region, possesses a number of lakes and wetlands which have considerable capability for waterbird production. Many lakes are also important staging areas for spring and fall migrants. The attractiveness of the Region to waterbirds varies greatly from year to year, however, depending on precipitation and water levels. Saturation of the ground before freeze-up and accumulation of adequate snow cover are most likely the important factors affecting lake levels the following year. During dry years, such as we are currently experiencing, many of the important lakes and sloughs of the Region lose all of their water. During such periods, lakes which continue to hold water assume an even greater importance.

Because of the scarcity of surface water in the Region, man-made lakes and reservoirs are important habitats for waterbirds. Indeed, some of the most important lakes in the Region, such as the Irricana Reservoir, are man-made.

Regional and municipal environmental planning policies should address the following:

- 1) The protection of water levels in existing natural water bodies;
- 2) The operation of existing man-made lakes to ensure protection of waterbird resources;
- 3) The protection of currently dry lake beds from encroachment by non-compatible land uses;
- 4) Allowance for potential new water storage projects in the planning process;
- 5) Protection of shoreline vegetation.

These are discussed briefly below.

1) Water Level Protection

Generally speaking, the very dramatic lack of water in the lakes and sloughs of the Region has been due mainly to recent climatic trends rather than to land drainage practices. However, we are aware of at least one instance (at Weed Lake) where deliberate land drainage measures have resulted in the loss of an important waterbird resource. Currently, the widening of Highway 22X and the construction of overpass structures at its junction with Highway 2 appears to be causing drainage alteration which may bring about the total elimination of the Priddis Slough, a regionally significant waterbird area on the urban fringe of the City of Calgary. It is therefore important to address water level protection as part of an overall Regional environmental protection strategy.

There is at least circumstantial evidence that the practice of damming small creeks to create small artificial lakes may be adversely affecting water levels in lakes receiving the drainage. We do not, however, have sufficient information to make a reliable evaluation of this process.

Under the Planning Act (Government of Alberta, 1980), municipalities are empowered to set provisions in their Land Use Bylaw to regulate the excavation and filling of land and the building of water control structures. It is important that municipalities adopt specific provisions in their Land Use Bylaw that deal with excavations for drainage of sloughs and wetlands and the placing of fill in such depressional areas. Such activities should be prohibited on sloughs, lakes and wetlands designated as significant in the Regional Plan. On other lakes, sloughs and wetlands, the landowner should be required to demonstrate conclusively that the waterbody or wetlands in

question have virtually no utility to waterbirds. Regional and Municipal environmental policies should also ensure that the damming of small streams by landowners be subjected to an environmental approvals process to ensure that such actions do not result in a reduction in the water available to an important downstream wetland resource.

2) Existing Man-Made Lakes

Regional and municipal environmental planning policies should ensure that important waterbird resources that have developed on man-made reservoirs are not subsequently jeopardized by changes in operating regime. An example of an important resource of this nature would be the large colony of Cormorants that nests on an island in Irricana Reservoir. This colony would be endangered if water levels were increased or decreased significantly.

3) Protection of Dry Lake Beds

A number of lakes that have, in the past, been extremely important to waterbirds (Frank Lake, Matoyekiu Lake, Deadhorse Lake, Blizzard Lake, Third Lake, Silver Lake, Shepherd Sloughs, Glenbow Lake, Lochend Lake) have lost their water under the dry climatic regime that has prevailed over the past few years. These dry lake beds should not be written off as being of no further value to waterbirds. Rather, regional and municipal environmental policies should ensure the protection of these dry lake beds until such time as wetter conditions again prevail. Regional and municipal planners should also maintain ongoing liaison with Ducks Unlimited, the Fish and Wildlife Branch, and Alberta Environment to determine whether active measures are feasible to maintain water in these basins on a more sustained basis.

4) Water Storage Projects

Ducks Unlimited has indicated interest in water storage projects in a number of areas (Shepard Slough, Weed Lake, Langdon Reservoir, Deadhorse Lake, Parflesh Creek). These projects would have the potential to greatly expand water-bird production within the Calgary Planning Region. Regional and municipal environmental planning strategies should ensure that these potential uses be fully taken into account when considering proposals for competing land uses in these areas. Regional and municipal planners should maintain ongoing liaison with Ducks Unlimited to ensure continuing awareness of their current thinking.

5) Protection of Shoreline Vegetation

Many waterbirds are dependent upon the existence of suitable shoreline vegetation including shoreline emergents and shrubs for successful reproduction. In addition, terrestrial birds, such as Red-winged Blackbirds and Yellow-headed Blackbirds, use the vegetation along the margins of waterbodies as breeding habitat. Land use practices such as cultivation to the edge of the waterbody and lot development on the shores of lakes destroy shoreline vegetation and hence reduce the utility of the waterbody to birds.

Regional and municipal environmental policies should encourage the maintenance of a margin of shoreline vegetation. Small-lot subdivision around the larger lakes of the Region should be discouraged. When small-lot subdivision is permitted along a lake margin, it should occupy no more than 20 percent of the perimeter of the lake. In these cases only the steeper shores of the waterbody should be developed, and provision should be made in the subdivision plan for an undisturbed strip of land at least 30 metres wide along the shoreline.

9.3 KEY FISH HABITATS

The main environmental planning considerations with regard to the protection of fish populations and their habitat in the Region are:

- 1) Maintenance of water quality and quantity;
- 2) Maintenance of fish migration routes;
- 3) Protection of spawning habitat.

9.3.1 Maintenance of Water Quality and Quantity

The quality and quantity of the Region's water resources are affected by a number of factors including:

- 1) Sewage disposal practices;
- 2) Storm sewer drainage;
- 3) Snow disposal practices;
- 4) Runoff from agricultural land;
- 5) Runoff from feedlots;
- 6) Water abstraction;
- 7) Stream regulation and water storage.

1) Sewage Disposal Practices

The major sewage disposal issues are related to the discharge of treated effluent into watercourses by the cities and towns of the Region. Pollution problems associated with septic tanks do not appear to be a major issue, probably because of the general dispersion of residences using such facilities.

Although most urban municipalities provide secondary sewage treatment, nutrient loading of streams and rivers remains a significant environmental problem in the Region because of seasonably low flows in most rivers. In many cases tertiary treatment of wastewater or storage of treated effluent for release during periods of high flow will be required to preserve water quality.

The Provincial government has the primary responsibility for establishing sewage treatment standards for municipalities. However, because the effects of wastewater treatment practices extend beyond the border of an urban municipality and even beyond the borders of the Calgary Planning Region, waste water treatment standards are a significant regional concern. We therefore recommend that the CRPC develop policies for a regional approach to wastewater treatment and that it make its views known at the municipal and provincial levels.

The CRPC should also investigate the possibility of establishing guidelines for sewage treatment in developments adjacent to lakes and small watercourses to ensure that seepage from septic tanks does not result in excessive enrichment of the waterbody in question. Such guidelines could take the form of both technical requirements and limitations on the allowable number of residences, based on the assimilation capacity of the specific water body.

2) Storm Sewer Drainage

Storm sewers are a major source of contamination of water bodies. They carry residues of fertilizers, herbicides and pesticides used on individual residential properties, as well as salt, sand and silt from street runoff. In addition, rubber particles from tires and industrial toxins broadcast into the urban environment ultimately

find their way into storm sewer drainage. Unfortunately, it is difficult to treat storm sewer drainage because of the very high volumes of water involved. Therefore, some residual impact of storm sewer drainage must be accepted as the price of urbanization. However, the CRPC and the municipalities should take steps to reduce, to the extent feasible, the quantities of contaminants that enter streams through storm sewers.

The use of fertilizers, herbicides and pesticides by individuals is very difficult to regulate. The only practical approach is through public education, which under the best of circumstances, can be expected to achieve only a limited degree of success.

Municipalities do have control over the amount of sand and salt that they use on icy roads. Careful monitoring of the spreading of sand and salt could perhaps lead to reductions in the amount used. Such a program would likely be self-financing, as it would result in savings in material purchase and subsequent spring cleanup.

Another possible method of reducing the impact of storm drainage is to use natural depressions as storm drainage disposal areas. This would have the added benefit of alleviating the chronic water shortage problem being experienced in many of the Region's lakes and sloughs.

3) Snow Disposal

The disposal of snow on the streambanks of rivers causes an elevation in the levels of suspended sediments, salt and heavy metals entering the watercourse. These effects are detrimental to fish habitat, particularly in small streams. However, the consequences do not appear to be as severe as those associated with storm sewer drainage.

Snow dumps are also detrimental to streambank vegetation and can be a hazard to small children playing in the area. As such, it is important to pay careful attention to their placement.

It is recommended that the CRPC adopt policies to encourage municipalities to locate snow dumps away from small watercourses. Moreover, efforts should be made to secure alternative sites in areas draining into natural depressions. This recommendation, which is consistent with the one made for storm sewer drainage, would alleviate chronic water shortages in some of our more important lakes and sloughs.

4) Runoff from Cropland

Runoff from cropland is a major source of nutrient enrichment in the Region's streams and rivers. This runoff also carries pesticides and herbicide residue into watercourses. There is little that the CRPC or the municipalities can do to directly address this problem. However, regional planners should maintain an awareness of the issue and should document any site-specific problem areas that come to their attention in order that they can effectively liaise with the Provincial government.

5) Runoff from Feedlots

Feedlots draining directly into watercourses can have a significant effect on water quality, particularly during periods of low flow. In small streams they can be the main source of water pollution. Municipalities have the power to regulate feedlot operations and should exercise control both in granting new permits for feedlots and in ensuring the environmental acceptability of existing operations. New operations directly adjacent to watercourses should be discouraged, and existing operations should be monitored to ensure compliance with acceptable standards.

6) Water Abstraction

Water quality problems in the Region are exacerbated by the abstraction of significant quantities of water for irrigation. Water from the Bow River is diverted for irrigation at the Western Irrigation District Weir in the City of Calgary and at the Carseland Weir. Water is also diverted from the Highwood River system near High River. There also appears to be a relatively small scale diversion of water from Pekisko Creek.

Reduced flows resulting from water abstraction result in a reduced ability of streams to assimilate waste, higher water temperatures, significant growths of aquatic vegetation and reduced dissolved oxygen levels. There is a very real danger of reaching the point at which the stream can no longer support desired fish species.

Although the granting of water abstraction permits is a Provincial responsibility, it has potentially significant regional environmental repercussions. The CRPC should therefore take an active role in discussing water abstraction issues with Provincial government authorities.

7) Water Regulation and Storage Structures

The creation of an impoundment in a river system has a major effect on fisheries within and downstream of the impoundment. In the area of impoundment, productivity of the fishery and the relative status of individual fish species changes dramatically from pre-impoundment conditions. Productivity per unit area generally decreases. However, since the reservoir may be several times larger in area than the pre-impoundment stretch of river, the total biomass of fish may increase.

Downstream effects of an impoundment structure vary depending upon the purpose of the structure. A structure designed primarily for hydro-electric power generation usually has an adverse effect on downstream productivity, because of unstable flows. A structure used primarily to stabilize flows can have the opposite effect, causing a significant increase in productivity.

Aquatic environments in the Calgary Region, particularly the Bow River, have been significantly affected by in-stream water regulation and storage structures. Moreover, the potential exists for additional developments.

The hydro-electric installations upstream of the Bearspaw Dam have probably caused some reduction in the value of the upstream fishery. However, because these structures were installed many years ago, their effects were never documented.

The effect of the Bearspaw Dam in stabilizing downstream water flows appears to be positive and is probably a major contributing factor, in conjunction with nutrient enrichment, to the world-class trout fishery that exists between Bearspaw Dam and the Carseland Weir (Griffiths, 1975).

In the future, the CRPC may be faced with proposals to impound the Bow River at a point 4 kilometres downstream of the Highwood-Bow River confluence. This would be for the purpose of storing irrigation water (see McDonald, 1975). This would result in a reservoir extending upstream along the Bow River to Fish Creek and upstream on the Highwood River to the first highway bridge. An established world-class sports fishery would be affected, as would substantial natural landscape values.

The operation modes of existing reservoirs on the Bow River are set by long years of precedent, and it would be pointless to re-examine their operation from an environmental standpoint. However, it is obvious that any new impoundment proposals are of major regional significance. Although neither the CRPC nor its member municipalities have the authority to directly affect decisions on new river impoundment options, it is important that they formulate clear positions on such issues and communicate these positions to the responsible Provincial government agencies.

9.3.2 Maintenance of Fish Migration Routes

Many fish populations in the Calgary Region migrate upstream and downstream to spawn or feed. The viability of these populations is dependent upon the fish being able to move freely to the various habitats utilized. In order for this free movement to occur, an adequate flow of water of appropriate quality must be maintained in the stream through which the migration takes place. In addition, the stream must be free of barriers that could block migration.

As indicated in the previous section, the Bow River, upstream of Calgary, has been modified by the erection of a number of dams. These have broken the fishery into a number of segments defined by the placement of the dams.

Downstream of the dams, two weirs have been constructed, but these do not prevent fish from moving upstream. Thus fish can migrate up the Bow River as far as Bearspaw Dam and up the tributaries of the Bow River including the Highwood River, the Sheep River, Fish Creek and the lower Elbow River.

Any proposal to impound the mainstem Bow River or its important tributaries would have a major effect on the regional fishery. For example, past proposals to store irrigation water on the mainstem Bow River by means of an impoundment located downstream of the Highwood-Bow River junction would not only create a large reservoir inundating some of the best Rainbow Trout fishing waters in North America, but would also present a formidable obstacle to spawning migrations of trout in the remaining downstream stretch. These trout migrate to the upper reaches of the Highwood-Sheep River system. Although it might be feasible to provide a fish passage structure, it should be recognized that such structures have not always been successful on high dams.

The potential impact of any in-stream barrier, no matter how insignificant a stream may appear, always requires careful consideration. Fish often migrate long distances to spawn in a small headwater stream. A weir, an improperly designed road crossing, or a man-made channel constriction in an insignificant-looking spawning stream could create a physical obstruction or velocity barrier to migrating fish. Such a situation could have major repercussions for an important downstream fishery.

In-stream construction is regulated by a permitting process of Alberta Environment. Municipalities also regulate such structures through the granting of development permits. It is important that Regional policies encourage these efforts to ensure protection of the resource. Municipal inspectors should also be specifically trained to identify potential problem situations in the field.

9.3.3 Protection of Spawning Habitat

The aspects discussed under Section 9.3.1 (Maintenance of Water Quality) are especially critical in important spawning

habitat for cold-water Salmonid species. High dissolved oxygen levels must be maintained. This is especially critical for fall-spawning fish that are dependent upon low, under-ice flows.

Spawning habitats must also be protected from significant inputs of silt which can cause the suffocation of developing eggs. In this regard, land use and construction practices adjacent to spawning streams should be carefully regulated.

The best way to protect spawning streams is to maintain a buffer zone of natural vegetation along the streambanks. Breaks in this buffer zone by trails, roads and unvegetated areas should be minimized. Permits for construction in the buffer zone should be granted only when the proponent can provide a detailed account of the measures undertaken to protect and restore the stream both during and after the construction phase.

Sanitary and storm sewer outfalls should not be located in spawning streams, nor should snow dumps be established. Similarly, muddy water from excavations should not be pumped into these streams.

Only necessary excavation should be permitted in spawning streams and select material, low in fines, should be used for backfilling. Except for backfilling excavations, the deposition of material on the bed or banks of spawning streams should be prohibited.

Free-ranging cattle can affect the quality of spawning habitat by damaging streambanks. The only way of dealing with this problem is to fence off the affected stream. This has been done by the Fish and Wildlife Branch on Ware Creek, a critical Rainbow Trout spawning stream, under their "Buck for Wildlife" program. It is unlikely that the practice will be rapidly

expanded to other spawning streams because of the cost involved. The role of the CRPC and the municipalities in such situations is purely consultative. However, if monitoring programs indicate the development of a worsening problem, the CRPC should make every effort to bring the matter to the attention of the Fish and Wildlife Branch and discuss possible solutions.

Recreational all-terrain vehicles can cause severe habitat degradation in spawning streams. The policies of the CRPC and the municipalities should include provisions for preventing such recreational land use in and adjacent to these streams.

9.4 OTHER POTENTIAL AREAS OF BIOLOGICAL IMPORTANCE

Data from published and unpublished sources have permitted a fairly reasonable overview of the more obvious environmental characteristics of the Region. This study has concentrated upon delineation of natural landscapes and the identification of habitats of species of interest to hunters, naturalists, fishermen and casual observers of nature. Given the size of the study area and the resources available for environmental inventory, it was not feasible to attempt to identify optimum habitats for the literally hundreds of species of mammals, birds, amphibians and reptiles that utilize the various habitats in the region. Similarly, even cursory consideration of the invertebrate fauna of the Region were beyond the scope of the study.

Rare, endangered or threatened species of flora and fauna were considered, but only limited data came to light in the course of the study. The Bow Valley Naturalists suggested a site near Seebe as an important area for orchid species. References to Burrowing Owl nesting sites were gleaned from a field guide published by the Calgary Field Naturalists. Prairie Falcons are known to nest on cliffs along the Bow River Valley, but specific nesting sites have yet to be identified.

It is believed that the habitat requirements of most species of flora and fauna present within the Calgary Region will be met if environment planning policies are directed toward the conservation of the natural landscapes and wildlife habitats described in this report, as these various areas encompass most of the diversity found within the Region. Nevertheless, it is recommended that Regional planners maintain close contacts with local naturalists to ensure that new knowledge is incorporated into the environmental planning process. This is particularly important with regard to knowledge of rare or unique species of flora or fauna.

9.5 SIGNIFICANT PALEONTOLOGICAL SITES

Significant paleontological sites occur only in certain geological formations and deposits, some of which are utilized for building materials and granular resources. The finds however are very scattered, and generally occur only as a result of the development of these resources. While direct impacts cannot generally be mitigated prior to development occurring, development permits issued to pit and quarry operators should require the immediate disclosure of discovered fossil remains, so that these materials can be excavated with proper scientific controls.

9.6 SIGNIFICANT ARCHAEOLOGICAL SITES

The Calgary Region contains a significant set of prehistoric sites, of interest to both the scientific community and general public. Policies and guidelines should be developed to maximize the conservation of these sites, for eventual scientific study and public interpretation.

Prehistoric sites vary considerably in value, and only those of outstanding value merit avoidance and preservation when in conflict with planned development. Current mitigative strategies for archaeological sites typically involve archaeological documentation and salvage of important sites prior to their being destroyed.

Regional and municipal policies should encourage the conservation of important archaeological sites through planning. This will require detailed inventories well in advance to proposed development, as well as the establishment of mechanisms for conserving sites. Possible conservation methods include the incorporation of sites into natural areas, parks, recreation areas and environmental and municipal reserves.

A conservation strategy for archaeological sites is particularly important within river valleys, the primary locales of prehistoric settlement. Many sites of archaeological importance are also choice building sites or locations of important granular resources; there is consequently a significant potential for impact on these sites.

Although farming practices and the activities of the oil and gas industry create the most widespread impacts on archaeological sites within the Calgary Region, municipalities currently have little power to control these impacts.

9.7 SIGNIFICANT HISTORIC SITES

The data base for historic sites is the weakest of the four components of the study; consequently, only the most general of recommendations can be made at this time. A major improvement of the data base would be required before meaningful steps can be taken to conserve the Region's historic sites.

Once an adequate data base is assembled, sites should be classified into categories such as:

- 1) Sites meriting preservation
- 2) Sites meriting study, but not preservation
- 3) Sites meriting interpretive signage.

As in the case of archaeological sites, impacts on valuable sites should be avoided through early inventory and planning. For standing

structures, the preservation option requires upkeep and maintenance, which usually necessitates an economic use for the structure. Municipalities should therefore incorporate into their General Municipal Plans, Area Structure Plans, Area Redevelopment Plans and Land-Use Bylaws, provisions that provide for the possibility of economically viable uses for historic resources.

Regional and Municipal planners should also carry out an active program of contacting owners of historic sites to inform them of the types of assistance that can be obtained under the existing Alberta Historical Resources Program.

Finally, it is possible to control the use of historical sites through land use designation provisions in Land Use Bylaws. A special category could be established for historic sites. Alternatively, historic sites could be designated as Direct Control areas. These approaches, however, should be balanced with economic incentives to ensure that owners of historic sites are not victimized. It is probably preferable to risk the loss of some sites by adopting a flexible and humane approach than to risk the loss of the whole program as a result of political backlash against excessive rigidity.

10.0 DATA GAPS

10.1 BIOPHYSICAL SITES

The major deficiency of the biophysical component of the study is the general lack of detailed environmental data on sites of potential concern. Although a few sites are quite well documented, the information available on the majority of sites is at best sketchy. Definitive judgements on the relative significance of sites and detailed environmental planning for specific sites will require more detailed environmental inventories.

Only a few sites of rare, endangered or threatened flora and fauna have been identified in the study. We are reasonably certain that a number of such sites exist, but they can only be identified on the ground by well trained people. A comprehensive program to identify such sites is far beyond the scope of the present study.

Generally speaking it has not been possible to identify areas of exceptional productivity for dispersed breeding birds. Because of the number of species and habitats involved, such a task would be an incredibly complex and labour-intensive project in such a large area.

In a similar vein, many groups of animals, including small mammals, amphibians, reptiles and invertebrates have not been considered at all in this evaluation. Although it is believed that application of the broader criteria used in this study generally identifies a sufficient cross-section of environments to provide for the requirements of these species, there may be situations where the approach should be more selective.

The treatment of aquatic habitats was strongly biased toward cold-water salmonids. A number of important physical and biological phenomena unrelated to sport fisheries may be deserving of special consideration. However, the identification of such phenomena

requires very detailed information that cannot be obtained in this type of regional survey.

Data on significant natural landscapes north of Waiparous Creek in I.D. #8 are not of the same quality as in other areas. This is not believed to be a serious deficiency, as the Calgary Regional Planning Commission plays a very limited planning role in this area.

10.2 PALEONTOLOGICAL SITES

The majority of fossil sites are localized occurrences. The presence or absence and exposure of fossiliferous bedrock depends on many factors within a fossiliferous geological deposit. Although more bedrock fossil locales of regional significance most certainly exist, generally they are in very isolated and rugged terrain, in contexts which are unavailable to public interpretation or appreciation, or in areas that are unlikely to be affected by development. Consequently, the data gaps that do exist do not appear to be of a nature requiring immediate action.

10.3 ARCHAEOLOGICAL SITES

The archaeological data base for the region is extremely variable, and heavily biased toward river valleys. Past "regional" studies have focussed on some of the major river valleys, particularly those of the Bow, Highwood and Sheep Rivers. Other drainage systems (e.g., the Rosebud River), reported to contain large numbers of sites, have not been examined nor have areas such as the Wintering Hills. Historical Resources Impact Assessments in the latter areas indicate a very high density of archaeological sites, of which only a few would qualify as being regionally significant.

The data upon which this assessment is based is in most cases more than 10 years old. In the intervening time, many of the sites may have been destroyed. It was not possible to undertake field checks under the terms of reference of the study. Therefore the current status of many of the sites reported herein is uncertain.

10.4 HISTORIC SITES

The historic sites comprising this inventory represent a wide and varied collection in terms of type, representativeness, condition and status of assessment data. This extreme range of variables, combined with biased weighting in those areas which have undergone previous study and assessment, creates distinct knowledge gaps in terms of historic site identification and evaluation. For example, the data sources employed at this level of inventory could not always provide:

- 1) detailed locational data (local histories seldom provide legal descriptions; local informants are not usually aware of them);
- 2) information on present site status, (i.e., is structure still standing? What condition is it in? Is site an archaeological feature? If so, what condition is it in?).

When basic information was lacking, potential significance beyond the stated inferred historical value could not always be determined.

Certain regions have been previously studied, either through impact assessments of proposed developments, research investigations, local history inventories or tourism-related interpretive evaluations. Canmore Corridor, Turner Valley, and the Springbank locale are examples of such investigated regions. Data from these areas facilitate identification of sites, although sufficient information to establish site status and significance may not always be provided.

The most notable data gaps exist in regard to ranches and isolated historic sites, particularly in the eastern portions of the Calgary Region. Sites with locations no more accurate than township and range could not be mapped, and are not listed. Further research should be undertaken to clarify locational data, and update inventory data, as some sites may now be destroyed.

11.0 FUTURE RESEARCH

11.1 BIOPHYSICAL SITES

- 1) Future research efforts should concentrate on the development of detailed environmental descriptions of sites identified as priority sites. The type of information required and the level of detail provided should be similar to that suggested in the Biophysical Resources Site Report form included in Appendix 2. A map of each site showing the main features of terrain and vegetation at a scale of at least 1:50,000, should also be prepared.
- 2) The data acquisition program should take place over an extended period of time and should concentrate on areas where the most significant development pressures exist. The co-operation of groups, such as the Calgary Field Naturalists' Society and the Bow River Naturalists should be sought for conducting the necessary field work. The possibility of integrating the long-term data acquisition program with student research projects at the University of Calgary should also be investigated. The Calgary Regional Planning Commission should provide some material support to defray the expense associated with these voluntary efforts.
- 3) The Calgary Regional Planning Commission should investigate with the Calgary Field Naturalists' Society the possibility of using data being compiled to produce a bird atlas of the Calgary area for the identification of upland bird habitats of particular importance to dispersed-breeding birds.
- 4) The Calgary Regional Planning Commission should seek the co-operation of naturalists' groups and other interested parties in the identification of sites of rare, endangered or threatened species of flora and fauna in the Calgary Region.

- 5) The Calgary Regional Planning commission should seek the co-operation of naturalists' groups and other interested parties in the identification of biophysical resources that have not been specifically addressed within the framework of the present study.
- 6) The Calgary Regional Planning Commission should maintain and update files on significant biophysical sites on an ongoing basis.

11.2 FOSSIL SITES

- 1) A considerably body of unpublished literature exists on the bedrock geology and paleontology within the western part of the Calgary Region. These will contain other fossil locations and should be searched.
- 2) Geologists, both within and outside of the oil and gas industry, have detailed knowledge of fossil locales in the western part of the Region. A general circulation should be made through their professional association enquiring of such sites.

11.3 ARCHAEOLOGICAL SITES

11.3.1 Updating of Existing Data

- 1) The land use information on the sites listed herein should be updated to reflect current status. This can be accomplished by aerial photo interpretation, and fixed-wing reconnaissance.
- 2) Certain sites, particularly the large stone cairns, and tipi rings, should be revisited to visually reassess their scientific significance.

11.3.2 Filling Knowledge Gaps

- 1) The areal gaps in the Bow River Basin Inventory data should be filled to complete the data base. These infill surveys should include:
 - the Bow River Valley downstream to the Gleichen Reserve, from the former Bow-Highwood Dam site;
 - the Highwood River Valley from the mouth of the Sheep River to the Forestry Reserve;
 - the Elbow River Valley from Calgary to the Forestry Reserve;
 - the Bow River Valley from Cochrane to the Stoney Indian Reserve.

- 2) A statistically designed sampling program should be developed and tested to provide an indication of the numbers, kinds and values of archaeological sites in areas of Calgary Region that have not been subjected to any systematic study.

11.4 HISTORIC SITES

- 1) Clarification of locational data for historic sites tentatively identified during the inventory but not included on the map should be a priority of further inventory and assessment work. Stage 2 inventory activities would also be advisable. These would involve further informant interviews and field visitation to potential historic sites. Historic sites within the small urban municipalities should also be inventoried.

- 2) Evaluation of site significance and determination of present status and physical condition would require on-site field reconnaissance. This was beyond the scope of the present inventory, but could be beneficially undertaken in regional overview studies, rather than on a project by project basis.

- 3) The inventorying of historic sites, and indeed all historical resources, should be an on-going process, as new site identifications will continue to be made.

12.0 SITE MONITORING

Because of the extensive nature of the Calgary Region and the relatively large number of Environmentally Significant Areas it contains, CRPC staff will not be able to monitor the current status of all potential sites within the Region. It may be possible to field check certain key sites on a regular but infrequent basis, as well as to undertake random field checks of other sites. The primary focus of monitoring efforts, however, should be on sitting up a network of volunteer monitors. Literally thousands of individuals (naturalists', hikers, skiers, canoeists, fishermen and hunters, amateur archaeologists and historians) visit Environmentally Significant Areas within the Calgary Region in the course of a year. These people have a vested interest in maintaining the quality of the environment and would therefore be eager to notify decision-makers of any adverse changes. Moreover, many of these individuals are members of organizations. By working with these organizations, it should be possible for the CRPC to indirectly monitor the status of most of the Environmentally Significant Areas in the Region.

13.0 PROGRAM IMPLEMENTATION

The Calgary Regional Planning Commission's major functions are to set the overall planning framework for the Region, to provide requested planning services for member municipalities and to act as the Subdivision Approving Authority for some of the member municipalities. The Commission also functions as a forum for planning matters of mutual concern to its member municipalities.

Although many important areas of environmental planning fall within the mandate of the CRPC, many others, such as transportation, water resources and wildlife management, are primarily Provincial responsibilities. In these areas the Calgary Regional Planning Commission can make its views known to the appropriate Provincial agency, but cannot actually implement measures.

It is the responsibility of all levels of government to ensure that the public has the opportunity to make its views known to decision makers. Because the CRPC is an organization that is readily accessible to local people, it can serve as an important conduit for local input into environmental decisions taken at the Municipal and Provincial levels. It can also provide a local forum for the resolution of environmental issues involving private groups (e.g., landowners and recreationists).

We thus envision three distinct aspects of the environmental planning function in the Calgary Region:

- 1) Direct action in areas where the CRPC's planning mandate is clear;
- 2) Communicating the Region's position in environmental planning matters under Provincial jurisdiction;
- 3) Channelling public input into the environmental planning process.

13.1 DIRECT ACTION

The CRPC is the most appropriate agency to set overall guidelines for environmental planning in the Region. Once the guidelines are in

place, however, it is the responsibility of the municipalities to determine how they should be implemented.

The key to an effective planning process is a data base of high quality. The assembly, interpretation and dissemination of environmental data should be the primary function of the CRPC environmental planning program. This will ensure consistency of approach within the member municipalities and will permit sufficient concentration of expertise to launch an effective program.

It is critical that data flow freely, both from the municipalities to the CRPC and from the CRPC to the municipalities.

13.2 ADVISING PROVINCIAL GOVERNMENTS

The CRPC should take a very active stance in dealing with the Provincial Government on environmental planning matters. The key to effectiveness in this role is a thorough understanding of the environmental planning issues faced by the Region. Planners discussing Regional environmental issues must have a better grasp of these issues than their Provincial counterparts if they are to be effective spokesmen for the Region.

13.3 CHANNELLING PUBLIC INPUT

In environmental planning matters, public input is critical for the development of both the data base and the planning approaches. Channelling public input into the planning process should be a major Regional priority. It is therefore recommended that the system of contacts developed in the course of the study be maintained and expanded. It is also recommended that the CRPC take steps to create a formal Environmental Advisory Committee, which would include members representing the full range of environmental interests in the Region. Committee members would be drawn from surface rights associations, naturalists' associations, hunters and fishermen's associations, environmental associations, recreation associations, municipal

councils, archaeological and historical societies, and educational institutions; prominent unaffiliated individuals with significant environmental expertise would also be approached.

13.4 ORGANIZATIONAL REQUIREMENTS

The implementation of the program will involve a significant commitment of human resources. At the minimum, one full-time environmental planner should be assigned to environment planning functions. Excellent analytical capabilities and superior negotiating skills will be required for the position.

Other planners currently engaged by the CRPC should be given the opportunity to work on environmental planning tasks to increase the general level of environmental expertise within the entire CRPC organization. By this mechanism planners will become accustomed to considering environmental factors in all of their planning decisions, and the overall impact of the environmental planning program will be greatly enhanced.

14.0 REFERENCES

- Adams, G.O. 1983. Migratory bird habitat priorities for the prairies. Draft copy. Canadian Wildlife Service. Edmonton, Alberta.
- Alberta Conservation and Utilization Committee. 1976. Assessing river shorelands. Report by Task Force on Shorelands. Edmonton, Alberta. June, 1976. 103 pp. Map.
- Alberta Energy and Natural Resources. 1979. Canmore corridor integrated land management plan. May, 1979. Edmonton, Alberta. 29 pp.
- Alberta Energy and Natural Resources. 1977. A policy for resource management of the Eastern Slopes. Edmonton, Alberta.
- Alberta Energy and Natural Resources. 1982. Fish resource maps. Open file map series at scale of 1:50,000. Fish and Wildlife Division. Edmonton, Alberta.
- Alberta Energy and Natural Resources. 1981. Wildlife key area maps. Open file map series at scale of 1:250,000. Fish and Wildlife Division. Edmonton, Alberta.
- Alberta Department of the Environment. 1973. Priddis Lake Study. Report by the Planning Division. Edmonton, Alberta. March, 1973. 13 pp. Maps.
- Alberta Environment. 1976a. Regional rivers perspective - Calgary region - inventory. Report by the Planning Division. Edmonton, Alberta. November, 1976. Map.
- Alberta Environment. 1976b. Bio-ecological review committee. Edmonton, Alberta. January, 1976.
- Alberta Lands and Forests, Alberta Environment and Environment Canada. 1973a. The foothills resource allocation study. Phase 1. Red Deer drainage district. August, 1973. 42 pp. Maps.
- Alberta Lands and Forests, Alberta Environment and Environment Canada. 1973b. The foothills resource allocation study. Phase 1. Ghost drainage district. August, 1973.
- Alberta Lands and Forests. 1974. Wildlife management systems on private lands in Alberta. Prepared by Fish and Wildlife Division and published by the Alberta Land Use Forum. Technical Report No. 2A. Edmonton, Alberta. 14 pp.
- Alberta Wilderness Association. no date. Wildlands for recreation. Calgary, Alberta.
- Anderson, H.G. 1979. Ecological land classification and evaluation - Highwood-Sheep. Report by Alberta Energy and Natural Resources, Resources Evaluation Branch. ENR Report No. 93. Edmonton, Alberta. 63 pp. Maps.

- Banfield, A.W.F. 1974. The mammals of Canada. National Museum of Natural Sciences, National Museums of Canada. University of Toronto Press. 438 pp.
- Benfield, R.W., B. Butkovic and B. Hope. 1976. Regional lakes perspective - the Calgary region - inventory. Report by Alberta Environment, Environmental Planning Division. Edmonton, Alberta. March, 1976.
- Blogorodow, P., S. Bundt, T. Cameron, M. Evan, B. Rogers and T. Walls. 1976. Big Hill Springs Provincial Park mini master plan. Report by Alberta Recreation and Parks, Planning and Design Branch. Edmonton, Alberta. 44 pp. Map.
- Brechtel, S. 1978. Legislative protection for the White Pelican and Double-crested Cormorant in Alberta. Alberta Naturalist 8(1). March, 1978.
- Brock, Hassell. 1983. Rocky Mountain fishing and hiking maps. Calgary, Alberta.
- Brockman, F.C. 1968. Trees of North America - a field guide to the major native and introduced species north of Mexico. Golden Press, New York. 280 pp.
- Calgary Field Naturalists' Society. 1976. Check-list of the birds of the Calgary region. Calgary, Alberta
- Calgary Field Naturalists' Society. 1981. Calgary's natural areas. Report prepared by the Natural Areas Committee. Calgary, Alberta. 585 pp.
- Calgary Regional Planning Commission. 1976. Eastern region study. Calgary, Alberta. July, 1976. 132 pp.
- Calgary Regional Planning Commission. 1977a. Calgary Region growth study. Physical characteristics. Summary and technical bulletins. Report A.4. Calgary, Alberta.
- Calgary Regional Planning Commission. 1977b. Canmore Corridor study - inventory and prospect - cultural landscape. Volume 1, Part 1. Calgary, Alberta. 35 pp.
- Calgary Regional Planning Commission. 1977c. Canmore Corridor study - inventory and prospect - physical landscape. Volume 1, Part 2. Calgary, Alberta. 73 pp.
- Calgary Regional Planning Commission. 1977d. Canmore Corridor study - inventory and prospect - user preferences. Volume 1, Part 4. Calgary, Alberta. 76 pp.
- Calgary Regional Planning Commission. 1977e. Canmore Corridor study - river shorelands pilot study. Volume 2. Calgary, Alberta. 110 pp.

- Calgary Regional Planning Commission. 1978a. Town of Canmore and Improvement District No. 8 General Municipal Plan. Volume 1 of the General Municipal Plan Study. Calgary, Alberta. 108 pp.
- Calgary Regional Planning Commission. 1978b. Town of Canmore and Improvement District No. 8. Technical background: Improvement District No. 8. Volume 2 of the General Municipal Plan Study. Calgary, Alberta. 112 pp.
- Calgary Regional Planning Commission. 1978c. Town of Canmore & Improvement District No. 8. Technical background: Town of Canmore. Volume 3 of the General Municipal Plan Study.
- Calgary Regional Planning Commission. 1982. Eagle Lake feasibility study. Report prepared by Rural Planning Services for County of Wheatland No. 16. October, 1982. 64 pp.
- Calgary Regional Planning Commission. 1983a. The disappearance of our agricultural land: Alberta's choice. Calgary, Alberta. May, 1983. 36 pp.
- Calgary Regional Planning Commission. 1983b. Calgary Regional Plan with changes recommended by the Chairman's Task Force on the Regional Plan.
- Canada Department of Agriculture. 1966. Ninety-nine range forage plants of the Canadian Prairies. Publication 964. Ottawa, Ontario. 102 pp.
- Canadian Wildlife Service. 1979. Migratory bird habitat priorities - Prairie Provinces. Western and Northern Region, Habitat Management Section. June, 1979. 104 pp.
- Canadian Wildlife Service. 1981. Wildlife habitat - a handbook for Canada's prairies and parklands. Environment Canada. Edmonton, Alberta.
- City of Calgary. no date. A handbook for evaluating Calgary's heritage resources.
- City of Calgary Planning Department. 1981. Calgary river valleys plan - the plan and policies. 4 volumes (main-report and three supporting volumes). Calgary, Alberta. September, 1981.
- Cochrane, P., D. McCallum, H. Measure and R. Ollerenshaw. 1980. Canmore benchlands study. Report by University of Calgary, Faculty of Environmental Design for the Town of Canmore. Calgary, Alberta. Fall, 1980. 121 pp. Maps.
- Committee on the Status of Endangered Wildlife in Canada. 1978. Double-crested Cormorant. Status Report on Endangered Wildlife in Canada. Canadian Nature Federation. Ottawa.
- Committee on the Status of Endangered Wildlife in Canada. 1982. List of species with designated status as of April, 1982.

- Cormack, R.G.H. 1977. Wild flowers of Alberta. Hurtig Publishers. Edmonton, Alberta. 415 pp.
- Denton, D. and B. Hallworth. 1980. Report on the Priddis Slough area. Prepared by the Calgary Field Naturalists' Society for the City of Calgary Planning Department. 8 pp.
- Ebel, G.R.A. and D.A.E. Spaulding. 1974. A preliminary list of Alberta's vulnerable birds - Part I (loons, ducks). Alberta Naturalist, Volume 4, Number 4. December, 1974.
- Ebel, G.R.A. and D.A.E. Spaulding. 1975. A preliminary list of Alberta's vulnerable birds - Part II (hawks-fringillids). Alberta Naturalist, Volume 5, Number 5. December, 1975.
- Eisenhauer, J. and B. Kolar. 1982. Rivers on borrowed time - eight great Alberta waterways, and what we must do to save them. Alberta Wilderness Association. Calgary, Alberta. 29 pp.
- Environmental Conservation Authority. no date. The Bow River watershed basin - an information paper. Environmental Conservation Authority. Edmonton, Alberta. 44 pp.
- Esau, A.A. 1974. Land ownership rights - law and land: an overview. Prepared under the auspices of the Institute of Law Research and Reform. Alberta Land Use Forum. Technical Report No. 9. 195 pp.
- Evans, S.M. 1976. The passing of a frontier: ranching in the Canadian West 1882-1912. Ph.D Thesis, Department of Geography, University of Alberta. Edmonton, Alberta.
- Fisher, A. 1977. The birds, mammals and native vegetation of the South Environmental Study Area. Report by Calgary Field Naturalists' Society. Calgary, Alberta.
- Fisher, R.M. 1979. Census of two Great Blue Heron colonies in the Calgary Area with a discussion of methods for future monitoring. Alberta Naturalist 9(1). March, 1979.
- Government of Alberta. 1973. Report of the Task Force on the Subdivision of Land Adjacent to Water Bodies. Interdepartmental Report. Edmonton, Alberta. 20 pp.
- Griffiths, W.E. 1979. Sports fisheries within the City of Calgary. Report by Alberta Energy and Natural Resources, Fish and Wildlife Division. Calgary, Alberta. November, 1979. 12 pp.
- Hallworth, B. and D. Denton. 1979. Priddis Slough brief. Presented to the City of Calgary Planning Department on behalf of the Natural Areas Group of the Calgary Field Naturalists' Society. March, 1979.
- Hardy, W.G. (Editor). 1967. Alberta - a natural history. M.G. Hurtig, Publishers. Edmonton, Alberta. 343 pp.

- Hydrogeological Consultants Ltd. 1975. Hydrological and geological resource inventory - Bragg Creek Provincial Park. Report prepared for Alberta Recreation, Parks and Wildlife. 60 pp.
- Lamoureux, R.J. and Associates Ltd. 1983. Environmentally significant areas study. Phase one report. Report prepared for Calgary Regional Planning Commission. April, 1983. 22 pp.
- La Roi, G.H., T.A. Babb, C.E. Perley and P.R. Mortimer. 1979. Canadian national directory of IBP areas, 1968-1979. University of Alberta Printing Services. Edmonton, Alberta.
- Leonard Novak Landscape Architect Ltd. 1982. Clearwater Park master plan - draft report. Prepared for City of Calgary Parks and Recreation Department. May, 1982. 110 pp.
- Lombard North Group. 1979. Fish Creek Provincial Park general plan. Volume 1. Inventory and analysis. Report to Alberta Recreation, Parks and Wildlife. Edmonton, Alberta. April, 1976.
- Longmore, L.A. and C.E. Stenton. 1981. The fish and fisheries of the South Saskatchewan River Basin - their status and environmental requirements. Report prepared by Alberta Energy and Natural Resources, Fish and Wildlife Division for Alberta Environment, Planning Division. Edmonton, Alberta. March 31, 1981. 335 pp.
- Markham, B.J. and S.H. Brechtel. 1978. Status and management of three colonial waterbird species in Alberta. Alberta Recreation, Parks and Wildlife, Fish and Wildlife Division. Edmonton, Alberta.
- McCrossan, R.G. and R.P. Glaister (Editors). 1969. Geological history of Western Canada. Alberta Society of Petroleum Geologists. Calgary, Alberta. 232 pp.
- McDonald, D.G. 1975. Rainbow trout and Canada Goose reproduction relative to existing and predicted post-impoundment conditions in the Bow River Basin, Alberta. M.Sc. Thesis. University of Calgary. 255 pp.
- McGregor, C.A. 1979. Ecological land classification and evaluation - Ghost River study area. Report by Alberta Energy and Natural Resources, Resource Inventory and Appraisal Branch. ENR Report No. 116. Edmonton, Alberta. April, 1979. 64 pp. Maps.
- McNicholl, M.K. 1982. Alberta bird species at risk. Alberta Naturalist 12(2). June, 1982.
- Miller, M.J. and W.H. MacDonald. 1950. Preliminary biological surveys of Alberta's watersheds. 1947-1949.
- Moss, E.H. 1959. Flora of Alberta. University of Toronto Press. 546 pp. plus supplement.
- Myres, T. 1978. Unpublished manuscript.

- Nelson, S.J. 1970. The face of time - the geological history of Western Canada. Alberta Society of Petroleum Geologists. Calgary, Alberta. 133 pp.
- Paetz, M.J. 1957. A report on the trout populations in six streams of the South Saskatchewan drainage. Report by Alberta Department of Lands and Forests, Fisheries Branch. Edmonton, Alberta. 58 pp.
- Paetz, M.J. and J.S. Nelson. 1970. The fishes of Alberta. Queen's Printer, Edmonton. 282 pp.
- Pinel, H. and C. Wallis. 1972. A botanical investigation in the Drumheller area, Alberta. Blue Jay 30(3): 169-194.
- Public Advisory Committee on the Environment. 1974. Recommendations and resolutions 1974. Edmonton, Alberta.
- Red Deer Regional Planning Commission. 1978. The Little Red Deer River - toward a land use and management plan. Red Deer, Alberta, May, 1978. 154 pp. Oversize volume.
- Reeves, B.O.K. and D. Malmborg. 1977. Historic and prehistoric archaeological inventory, Canmore Corridor. Report by Lifeways of Canada Limited to Calgary Regional Planning Commission. Calgary, Alberta. On file, Archaeological Survey of Alberta. Edmonton, Alberta.
- Robbins, C.S., B. Bruun and H.S. Zim. 1966. Birds of North America - a guide to field identification. Golden Press. 1966. 340 pp.
- Rogers, J. 1971. Archaeological investigations in the Calgary area, preliminary report. Manuscript on file, Department of Archaeology, University of Calgary. Calgary, Alberta.
- Rogers, J. and M. McIntyre. 1972. Bow-Highwood survey, preliminary report. Manuscript on file, Department of Archaeology, University of Calgary. Calgary, Alberta.
- Rothfels, M. 1981. Co-existence of the Red-tailed and Swainson's Hawk in southern Alberta. M.Sc. Thesis, Biology Department, University of Calgary. Calgary, Alberta.
- Sadler, T.S. and M.T. Myres. 1976. Alberta birds, 1961-1970, with particular reference to migration. Provincial Museum of Alberta Natural History, Occasional Paper No. 1. Edmonton, Alberta. April, 1976. 314 pp.
- Salt, W.R. and J.R. Salt. 1979. The birds of Alberta. Hurtig Publishers. Edmonton, Alberta. 498 pp.
- Schneeberger, A. 1978. Calgary plan environmental study. Report to City of Calgary Planning Department. August, 1978. 27 pp.

- Sherrington, P. (editor). 1975. Calgary's natural areas - a popular guide. Calgary Field Naturalists' Society. Calgary, Alberta. 184 pp.
- Smith, W. 1967. An account of the Oct. 21st field trip. Calgary Bird Club Bulletin No. 62. November, 1967.
- Spaulding, D.A.E. 1980. A nature guide to Alberta. Provincial Museum of Alberta Publication No. 5. Hurtig Publishers and Alberta Culture. Edmonton, Alberta. 368 pp.
- Steeves, J.B., B. Burrows, M.T. Myres and A.N. Wiseley (editors). 1982. A bird-finding routes guide and bird-sighting probability chart for the Calgary region of Southern Alberta. Calgary Field Naturalists' Society, Bird Study Group. Calgary, Alberta. June, 1982. 45 pp.
- Stelfox, J.D. 1979a. Policeman's Creek and Spring Creek fall spawning study. Report by Alberta Energy and Natural Resources, Fish and Wildlife Division. Calgary, Alberta. December, 1979. 34 pp. Maps. Colour Slides.
- Stelfox, J.D. 1979b. Bow River spawning channels fall spawning survey. Report by Alberta Energy and Natural Resources, Fish and Wildlife Division. Calgary, Alberta. 10 pp.
- Stelfox, J.D. 1980. Kananaskis Country fall spawning survey. Report by Alberta Energy and Natural Resources, Fish and Wildlife Division. Calgary, Alberta. January, 1980. 54 pp. Map.
- Stelfox, J.D. and R.D. Konynenbelt. 1980. An inventory of fish populations and fish habitat in the Elbow River and Fish Creek watersheds. Report by Alberta Energy and Natural Resources. Fish and Wildlife Division. Calgary, Alberta. November, 1980. 123 pp.
- Stelfox, J.D. 1981. Rainbow trout spawning in Pekisko Creek and the Sheep River watershed. Report by Alberta Energy and Natural Resources, Fish and Wildlife Division. Calgary, Alberta. 38 pp.
- Stelfox, J.D. and C.G. Ladd. 1982. An inventory of fish populations and fish habitat in streams and beaverponds of the Highwood watershed. Report by Alberta Energy and Natural Resources, Fish and Wildlife Division. Calgary, Alberta. 328 pp. Map.
- Stephenson, H.G. (Mining Consultants) Ltd. 1976a. Reclamation of the Walker Strip Mine at Georgetown, near Canmore. Report to Alberta Department of the Environment. Canmore, Alberta. July, 1976.
- Stephenson, H.G. (Mining Consultants) Ltd. 1976b. Reclamation of the Canmore Creek No. 3 Strip Mine at Canmore, Alberta. Canmore, Alberta. August, 1976.
- Stilwell, W.G. 1973. Survey of potential land uses: Lower Rosebud Valley in I.D. 7. Report by Calgary Regional Planning Commission. Calgary, Alberta. January, 1973. 9 pp.

- Strong, W.L. 1979. Ecological land classification and evaluation - Livingstone-Porcupine. Report by Alberta Energy and Natural Resources, Resources Evaluation Branch. ENR Report No. 94. Edmonton, Alberta. 89 pp. Maps.
- Strong, W.L. and K.R. Leggat. 1981. Ecoregions of Alberta. Report by Alberta Energy and Natural Resources, Resource Evaluation and Planning Division. Edmonton, Alberta. 64 pp. Map.
- Tees, R. 1973. A proposal for the expansion of existing services coupled to a comprehensive long term development plan to protect the mountain parks and the integrity of the Bow Valley. Canmore citizen's brief. June, 1973.
- Thompson, G.E. 1971. The limnology and fishery management of Eagle Lake, Alberta. Report by Department of Lands and Forests, Fish and Wildlife Division. 41 pp.
- Thompson, G.E. 1978. Canmore Corridor fisheries management plan. Report by Alberta Department of Recreation, Parks and Wildlife, Fish and Wildlife Division. Calgary, Alberta. June, 1978. 28 pp.
- Thompson, P.S. 1981. Urbanization of agricultural land. Report by Environmental Council of Alberta. Edmonton, Alberta. 77 pp.
- Underwood, McLellan & Associates Limited. 1969. Stoney Indian Reserves Alberta - land use study and recommendations. May, 1969. Report to Stoney Indian Bands. Calgary, Alberta. May, 1969. 197 pp. Maps.
- Van Waas, N. 1976. Biophysical analysis and evaluation of capability - Canmore Corridor. Prepared for Eastern Slopes Interdepartmental Planning Committee by Alberta Energy and Natural Resources, Resource Evaluation Branch. Edmonton, Alberta. December, 1976. 65 pp.
- Vermeer, K. 1973. Great Blue Heron and Double-crested Cormorant colonies in the Prairie Provinces. Canadian Field-Naturalist 87:427-432.
- Wallis, C. 1977a. Red Deer River resource evaluation. Resource Assessment and Management Section, Parks Planning and Design Branch, Alberta Recreation, Parks & Wildlife. Edmonton, Alberta. 216 pp. Maps.
- Wallis, C. 1977b. Preliminary lists of the rare flora and fauna of Alberta. Calgary, Alberta.
- Wallis, C. 1980. Montane, foothills, parkland and southwest rivers natural landscapes survey. 1978-79. Report prepared for Alberta Recreation and Parks, Alberta Parks Division, Resource Assessment and Management Section. Edmonton, Alberta. January, 1980. 95 pp.
- Wallis, C. 1983. Untitled manuscript prepared for Alberta Recreation and Parks.

- Wedgewood, J.A. 1978. The status of the Burrowing Owl in Canada. Prepared for the Committee on the Status of Endangered Wildlife in Canada. Environment Canada, Canadian Wildlife Service. Ottawa.
- Weseloh, D.V., S. Brechtel and R.D. Burns. 1977. Recent population changes in Double-crested Cormorants and California and Ring-billed Gulls in Alberta, Canada, with a note on White Pelicans. In: Proceedings of Colonial Waterbird Group (CWG) 1977 Conference. Sponsored by CWG, Department of Biological Sciences, Northern Illinois University and the Kishwaukee Audubon Society.
- Yamnuska Natural Area Study Committee. 1974. Yamnuska - introductory study of a natural area with proposals for its protection and use. Joint report of Calgary Field Naturalists' Society and the Bow River Naturalists. 46 pp.

APPENDIX 1 QUESTIONNAIRE PACKAGE

This appendix reproduces the questionnaire and accompanying covering letter sent by R.J. Lamoureux & Associates Ltd. to potential respondents.

April 28, 1983

TO WHOM IT MAY CONCERN:

RE: Calgary Regional Planning Commission's
Environmentally Significant Area Study

The Calgary Regional Planning Commission has engaged R.J. Lamoureux & Associates Ltd., in conjunction with Environmental Project Consulting and Lifeways of Canada Limited, to undertake a study of Environmentally Significant Areas (ESA's) within its area of jurisdiction. This area, which is shown on the enclosed map, comprises the City of Calgary; the Municipal Districts of Rocky View, Foothills and Wheatland; and the recently redefined Improvement District #8.

The objectives of the study are to identify and map regionally significant ESA's and to formulate guidelines for their management. The results of the study will ultimately be reflected in future amendments to the Calgary Regional Plan.

Currently, there are international, national and provincial systems for conserving representative and unique natural and cultural environments. These systems, however, have little impact on the immediate environment in which we live. The efforts being expended by the Calgary Regional Planning Commission are designed to address this very important deficiency.

Data on Environmentally Significant Areas are being collected by contacting people with special knowledge of the Region, by researching existing documents and by air photo interpretation. We believe that a significant proportion of the information will come from key contacts. This package of documents has consequently been sent to you to enable you or your organization to participate in this important study.

This mailing comprises the following items:

- 1) A background paper explaining the concept of Environmentally Significant Areas.
- 2) Two copies of a 1:250,000 scale topographic map of the Calgary Region.
- 3) A set of blank forms for reporting information on sites of physical and/or biological interest.
- 4) A set of blank forms for reporting information on sites of paleontological, archaeological or historical interest.
- 5) Instructions for filling out items (4) and (5).
- 6) A list of persons to whom this package of documents has been sent.

We would ask you to mark the locations (and where feasible, the outlines) of areas of interest to you on one of the maps provided. (The second map is provided as your working copy.) We would also ask you to fill out one or both sets of forms for each site identified on the map. After executing the above tasks, we request that you return the completed documents to this office. We will then set up a meeting to discuss your findings face-to-face.

Could you also examine our tentative list of key contacts and telephone our office as soon as possible to advise us of the names, addresses and telephone numbers of additional persons who should receive this mailing. We will ensure that they receive it.

Because a large number of people will be contributing to this study, the logistics of handling data and arranging for meetings could become quite complex. To ensure that you have the maximum possible impact on the study, it is important that you submit your material with the least possible delay. A response within two weeks of receipt of the package would be ideal.

We regret that it is impractical for us to send you multiple copies of the site report forms. We would therefore recommend that you retain the enclosed blank forms as masters for running off additional copies. If the enclosed forms have insufficient space for what you have to say, you may want to retype them with altered spacing. If you do this, we would request that you maintain the same headings as on the original forms.

Regardless of how sketchy your information on a site may be, we would ask you to identify it on the map and fill out the appropriate site report form. This principle should apply even if most of the site report form is left blank. Also, it is not essential that you use scientific jargon in filling out the site report forms.

If you have any further questions, don't hesitate to call me at my office (253-4787) or at my home (259-3269).

Yours sincerely,

Raymond Lamoureux

BACKGROUND INFORMATION

(Calgary Region ESA Study)

The study addresses sites with important physical and/or biological values and those with significant paleontological, archaeological and historical values. The former are referred to as biophysical resources and the latter as historical resources. They are described separately below.

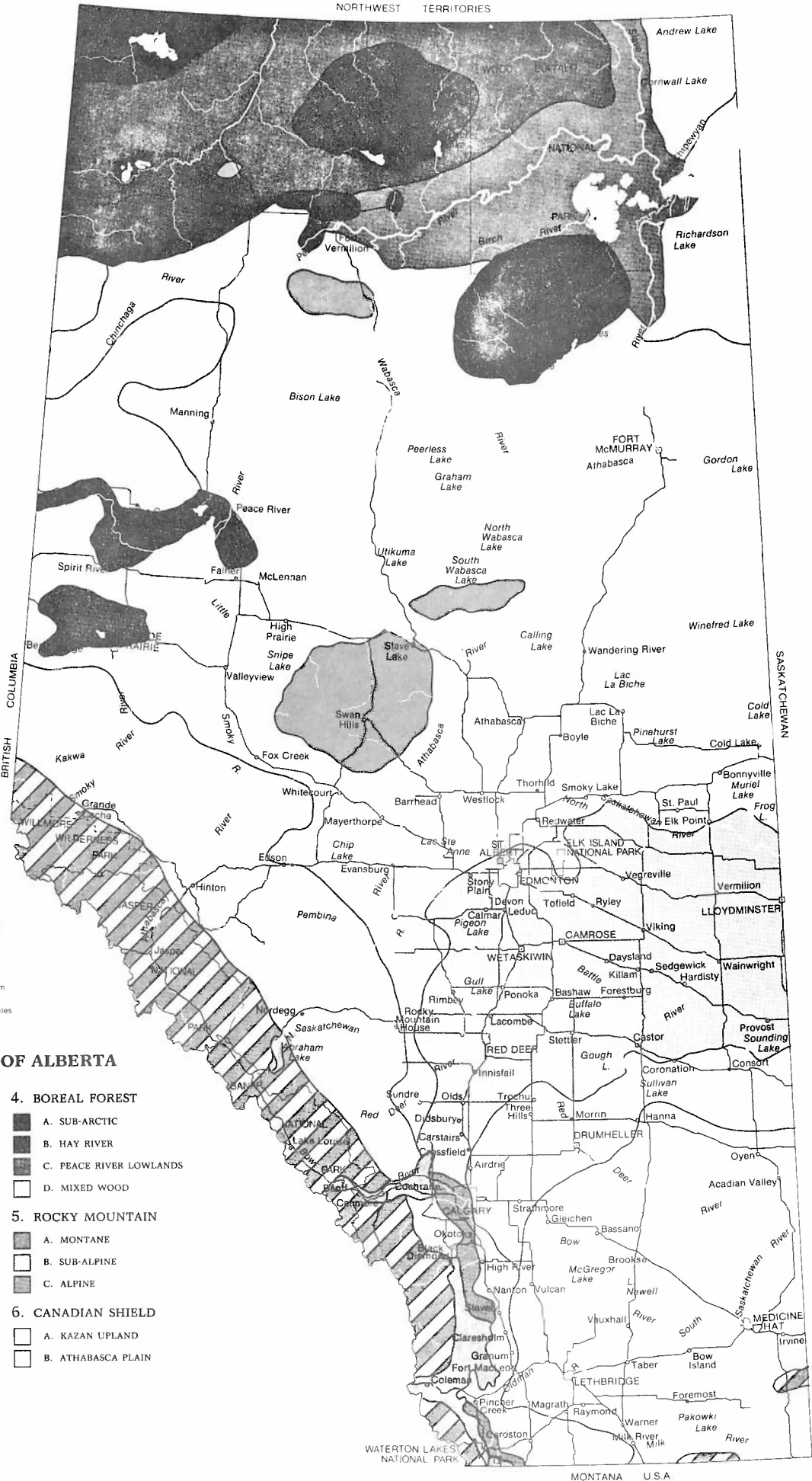
BIOPHYSICAL RESOURCES

The Calgary Region is very large and encompasses an area with dramatic gradients in topography and climate. As a result, the Region is one of the more ecologically diverse areas in North America. Because of this great diversity, it is appropriate to identify the recognizable natural zones within the Calgary Region and to use these subdivisions, rather than strictly artificial political boundaries, as a framework for assessing regional significance.

We have adopted the natural region classification system that was devised by Alberta Recreation and Parks and Alberta Energy and Natural Resources in support of their Wilderness Areas, Ecological Reserves and Natural Regions Program. A map dividing Alberta into 17 natural zones according to this classification system is attached.

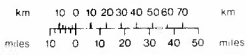
Within the Calgary Region at least nine natural zones can be identified. Brief descriptions condensed from unpublished information provided by C. Wallis of Cottonwood Consultants Ltd. are given below:

- 1) Mixed Grassland: This is largely a broad, flat to gently rolling plain of deep glacial till deposits. Vegetation consists of a mixture of short and mid-grasses. Mid-grasses include spear grass, western wheat grass, June grass, northern wheat grass and porcupine grass. The main short grass is blue grama.
- 2) Northern Fescue Grassland: This is largely a broad, flat to gently rolling plain of deep glacial deposits. Most of this area is converted to agricultural cropland. The native grassland vegetation, which is dominated by rough fescue, occurs mainly on strongly hummocky moraine.
- 3) Foothills Grassland: This is a narrow band of grassland in the zone of transition between the plains and the foothills. Principal grass species are rough and Idaho fescues and Parry's and intermediate oat grasses. Rare little bluestem grasslands occur on coarser outwash deposits. Forbs (non-grass herbaceous plants) are more prevalent than in the Northern Fescue Grassland.
- 4) Central Parkland: This is a zone of transition between the grasslands and the northern Boreal Forest. The Central Parkland zone is typically vegetated by groves of aspen interspersed with rough fescue grassland.
- 5) Foothills Parkland: This is a zone of transition between the grasslands and the forests of the Eastern Slopes. Aspen or willow is interspersed with grassland vegetation that is characteristic of the Foothills Grassland zone.



Alberta

RECREATION AND PARKS



NATURAL REGIONS OF ALBERTA

1. GRASSLAND

- A. MIXED
- B. NORTHERN FESCUE
- C. FOOTHILLS

2. PARKLAND

- A. CENTRAL
- B. FOOTHILLS
- C. PEACE RIVER

3. FOOTHILLS

- A. MAIN
- B. NORTHERN OUTLIERS

4. BOREAL FOREST

- A. SUB-ARCTIC
- B. HAY RIVER
- C. PEACE RIVER LOWLANDS
- D. MIXED WOOD

5. ROCKY MOUNTAIN

- A. MONTANE
- B. SUB-ALPINE
- C. ALPINE

6. CANADIAN SHIELD

- A. KAZAN UPLAND
- B. ATHABASCA PLAIN

- 6) Main Foothills: This is an area of folded and thrust-faulted sedimentary rock overlain by thin till deposits. It is lower in elevation than the Rocky Mountains but higher than the Boreal Forest. The characteristic vegetation is lodgepole pine. Balsam poplar dominates along stream channels.
- 7) Rocky Mountain Montane: This environment is found in the warmer parts of the Rocky Mountain Region. In the Calgary Region it is associated mainly with the east-west trending valley of the Bow River which channels warm air during the winter. This zone is characterized by fescue-oat grasslands; open woodlands dominated by Douglas fir and limber pine; and more closed forests of Douglas fir.
- 8) Rocky Mountain Sub-Alpine: This environment occurs at attitudes between the Alpine and the Montane or Foothills zones. It is characterized by a climax vegetation of Engelmann spruce and subalpine fir. However, at lower elevations there are extensive areas of fire-maintained lodgepole pine.
- 9) Rocky Mountain Alpine: This environment occurs above the treeline. At the lower elevations it is characterized by lush herb growth, willow, dwarf birch and stunted, ground-hugging coniferous trees. The middle Alpine is characterized by heather and snowbed communities and the upper Alpine is very sparsely vegetated. Lichens dominate in stonefields.

In addition to the above, we propose to use the category "urban" to identify those areas within the Region whose natural character has been almost totally transformed by human activity. In these areas the significance of remaining green space would be evaluated within an urban context rather than within the context of a natural zone.

A natural area or feature will be considered to be regionally significant if it is notable within the context of the zone in which it is found. Thus mixed grassland areas will be evaluated in the context of other mixed grassland areas, subalpine areas in the context of other subalpine areas, and urban areas in the context of the general urban environment.

In this manner we will attempt to avoid the biasing of environmental significance to selected types of environments.

A site which fulfills at least one of the following criteria will be considered to be regionally significant:

- 1) The area is an excellent representation of one or more ecosystems that characterize the natural zone.
- 2) The area possesses one or more individual features (landforms, geological features, vegetation types, geological or biological processes, water bodies, fish, wildlife, invertebrates) that are excellent representations of features of the natural zone.
- 3) The area contains a remnant ecosystem or an ecosystem that is rare or unusual in the context of the natural zone.

- 4) The area possesses one or more individual features (landforms, geological features, vegetation types, geological or biological processes, water bodies, fish, wildlife, invertebrates) that are rare or unusual in the context of the natural zone.
- 5) The area has a diversity of features that is exceptional for the natural zone.
- 6) The character (e.g. vigour and/or abundance) of one or more important plant or animal species is exceptional for the natural zone.
- 7) The area is critical habitat for a fish or wildlife population of recognized importance in the natural zone.
- 8) The area links habitat critical for the maintenance of a fish or wildlife population of recognized importance in the natural zone; disruption of the links would result in the isolation of pockets of habitat and would thus degrade the overall value of the habitat.
- 9) The area provides water to another ecosystem of recognized importance. Changes in the quantity or quality of water flowing from the area could cause significant changes to the other ecosystem.

A similar set of criteria, considered within a natural regions' framework of progressively greater geographical scope, will be used to identify any sites of provincial, national or international significance.

Development of significance criteria is an ongoing process. During the course of the study additional general criteria may be developed or the suggested general criteria modified. Moreover, it is intended that specific criteria related to each general criteria will be developed to assist future investigators in identifying additional sites for designation as Environmentally Significant Areas.

At this point in the study we have deliberately avoided any attempt to develop criteria related to recreational, educational, scientific and aesthetic attributes of sites. These attributes are, however, intrinsic to the more fundamental criteria that were selected. It is felt that it is preferable at this time to avoid an explicit and comprehensive treatment of such considerations, as this would inject elements of such complexity as to cause a general loss of study focus.

HISTORICAL RESOURCES

The Calgary Region has a rich heritage of paleontological, archaeological and historical resources. The more outstanding examples of these resources receive protection under the Historical Resources Act. However, provincial records of such resources vary in their comprehensiveness, depending on the specific location within the province. Therefore it is very likely that some historical resources of provincial significance are neither documented nor protected. In addition to the above, there may be a number of historical resource features which, though not significant within the context of the province, are nevertheless regionally significant. We are particularly interested in collecting new

information on either of the above types of sites. For the reader's orientation, discussions of the types of features that might be of interest are provided under the headings, Paleontological Resources, Archaeological Resources and Historical Resources.

Paleontological (Fossil) Resources

Fossil finds vary considerably in their value and significance, depending on such factors as rarity, representativeness, completeness, state of preservation, and concentration of remains at a locale. Another important consideration is whether they are in "primary context" (i.e., at the location where the animal originally died and was preserved) or in "secondary context" (i.e., redeposited in other sediments at another locale remote from the place of death). Fossils in primary context are generally of much greater significance than those in secondary context, all other factors being equal.

Within the Calgary Region, potential sites of regional or greater significance include:

- locations where there are significant concentrations of plants or invertebrates in primary context
- all sites where there are marine vertebrate or dinosaur remains in either primary or secondary context
- all sites where there are primitive mammal remains in either primary or secondary context
- all sites where there are recent (extinct) mammal remains in primary or secondary context.

Archaeological Resources

Human occupation of the Calgary Region dates back some 12,000 years; more than 2,000 identified archaeological sites, some of regional or greater significance, are recorded within the archives of the Archaeological Survey of Alberta. There may also be a number of sites of regional or greater significance that are not presently documented in the central archives.

Archaeological sites likely to be of regional or greater significance include:

- major campsites
- workshops
- quarries
- sites of unusual animal kills
- bison jumps (rare)
- bison pounds
- gathering basins (rare)
- natural traps for bison
- some tipi rings and cairns
- stone lines
- drive lines
- mosaics (boulder pavements)
- effigies (boulder outline figures)
- medicine wheels (rare)

- ceremonial stone circles (rare)
- stone arcs (rare)
- rib stones (rare)
- petroglyph boulders (rare)
- petroglyphs (rare)
- earth burial mounds (extremely rare)
- earth lodges (extremely rare)
- pit houses (extremely rare)
- pits
- trails
- isolated human burials
- graveyards (extremely rare)

Historical Resources

Historic sites are those sites which are associated with European exploration and settlement of the Region, including sites of Native peoples dating from the establishment of the reserve system. Significance is assessed on the basis of a site's historical, archaeological or community importance.

Historical importance refers to the association of the structure with persons, events, social and economic developments, a distinctive period, or a group of other structures considered historical.

Architectural importance refers to a structure's uniqueness of design; representativeness of a common type (now rare); association with an architectural school, style or important architect; particular construction technology; interior details; condition; and integrity.

Community importance refers to the role the structure played within the rural or urban community, its landmark status, streetscape characteristics and character.

The Historic Sites Service of Alberta has developed a Thematic Master Plan for the protection and development of historic resources. This flexible system can be adopted for use in the Calgary Region. The following themes are appropriate to the Calgary Region.

1. Fur Trade (1790-1875)
2. Transition from Nomadic Economy (1840's to 1880's)
 - Mission Period
 - Metis Settlement
 - Exploration
3. Maintenance of Law and Order
 - American Traders
 - Northwest Mounted Police
 - Indian Treaty No. 7
4. Ranching (1870's to 1910)
 - Bonanza Ranches (larger than 25,000 acres)
 - Small Stock Operations (smaller than 25,000 acres)

5. Settlement (1883 to 1930's)
 - Coming of the Railway (1883-1896)
 - Era of Expansion (1896-1915)
 - Completion of Settlement (1915-1930's)
6. Resource Development (1880's to 1950's)
 - Agricultural Developments
 - Lumbering, Clay Products and Construction
 - Coal Mining
 - Oil and Gas

A wide variety of sites could be of at least regional significance under one or the other of the above themes. These include:

- trading post sites
- Northwest Mounted Police posts
- Indian Reserve schools
- homesteads, farmsteads, cabins
- public structures and facilities such as schools, post offices, court houses, hospitals, police and fire stations, municipal and provincial offices, public and private utilities
- religious institutions
- unique or representative residences
- unique or representative business premises
- transportation-related structures, such as abandoned rail lines, railway stations, elevators, yards, water towers, trestles, trails, roads, highways, bridges, abandoned World War II airfields
- historic settlements (both occupied and abandoned)
- historic commercial centres
- agricultural developments, such as defunct irrigation systems, experimental farms and stations, flour and feed mills
- Resource extraction/processing sites, such as logging camps; lumber mills; lime, cement and brick works; sandstone quarries; underground and surface coal mines; coke ovens; early sites and facilities associated with the oil and gas industry.

BIOPHYSICAL RESOURCES SITE REPORT

1. Name of Site: _____ File No: _____

2. Natural Region _____ & Section _____

3. Map Ref: _____ 4. Elev: Min. ___ m Max. ___ m 5. Area: _____ hectares

6. UTM Grid Ref: _____ 7. Lat. & Long: _____

8. Legals: Sections _____ T _____ R _____ W of _____ Meridian

Sections _____ T _____ R _____ W of _____ Meridian

Sections _____ T _____ R _____ W of _____ Meridian

Sections _____ T _____ R _____ W of _____ Meridian

9. Reported by: Name _____ Date _____

Address _____

Home Tel. _____ Office Tel. _____

10. Ownership: Private ___ Provincial ___ Federal ___ Indian Reserve ___

11. Owner: Name _____ Tel. _____

Address _____

12. General Site Description: _____

13. Reasons for Significance: _____

14. Satisfies Criteria No.: 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___ 9 ___

15. Estimated Significance: Reg. ___ Prov. ___ National ___ Internat. ___

16. Main Land Use(s): _____

17. Current Recreational/Educational/Scientific Uses: _____

18. Potential Recreational/Educational/Scientific Uses: _____

19. Topography: _____

20. Geology/Geomorphology/Soils: _____

21. Water Bodies: _____

22. Vegetation: _____

23. Fish: _____

31. Site Map (1:50,000 scale):

HISTORICAL RESOURCES SITE REPORT
(Paleontological, Archaeological and Historical Sites)

1. Name of Site: _____ File No: _____
2. Type of Site: Paleontological _____ Archaeological _____ Historical _____
3. Map Ref: _____ 4. Elev: _____ m 5. Area: _____ hectares
6. UTM Grid Ref: _____ 7. Lat. & Long: _____
8. Legals: _____ 1/4 _____ 1/4 of Section _____ T _____ R _____ W of _____ Meridian
9. Reported by: Name _____ Date _____
Address _____
Home Tel. _____ Office Tel. _____
10. Ownership: Private _____ Provincial _____ Federal _____ Indian Reserve _____
11. Owner: Name _____ Tel. _____
Address _____
12. Site Description: _____

13. Reasons for Significance: _____

14. Estimated Significance: Reg. _____ Prov. _____ National _____ Internat. _____

15. Main Land Use(s): _____

16. Current Recreational/Educational/Scientific Uses: _____

17. Potential Recreation/Education/Scientific Uses: _____

18. Site Condition: _____

19. Access: _____

20. Conflicts: _____

21. Recommendations: _____

22. Comments: _____

23. Site Map (1:50,000 scale):

GUIDE FOR COMPLETING BIOPHYSICAL RESOURCES SITE REPORT FORM

Instructions for filling out the form are given according to the heading numbers shown on the form.

1. If you wish to name the site for easy reference, you may do so; otherwise we may name it.
2. This refers to the Natural Regions and the Sections of Natural Regions shown on the enclosed coloured map and described in the Study Background paper. If you are unsure of this information, leave spaces blank and we will fill them out.
3. Give the number(s) of the 1:50,000 scale National Topographic Series map(s) covering the proposed site. If you don't have access to these maps, refer to the appropriate 1:250,000 scale map(s). The enclosed map is a composite of Maps 82-I, 82-J, 82-O and 82-P of this latter series.
4. Indicate the maximum and minimum elevation of the site. Data should preferably be taken from a 1:50,000 scale topographic map, but data from a 1:250,000 scale map is also acceptable. Convert elevations from feet to metres by dividing by 3.28.
5. Give the approximate area of the proposed site in hectares. Convert from acres by dividing by 2.47.
6. Give the UTM (Universal Transverse Mercator) grid position of the approximate centre of the proposed site. If possible, read position from a 1:50,000 scale topographic map. Positions read from 1:250,000 scale topographic maps are also acceptable.
7. If you have difficulty using the UTM grid system, report the position of the approximate centre of the proposed site as latitude and longitude. Use a 1:50,000 scale map, if possible. Otherwise you can take the position off the enclosed 1:250,000 scale map.
8. Indicate by legal description the sections within which the proposed site is found. Eg: Sections 7, 8 and 9, T(Township) 32, R(Range) 7, W of the 5th Meridian.
9. This information is required so that we can make follow-up contacts with you.
10. Check off the appropriate ownership category if you have this information. If a site lies within more than one category of land, check off more than one item.
11. If you know who is the owner of the land, supply this information; otherwise leave space blank.
12. Give a very brief thumbnail sketch of the site stressing those attributes that lead you to the assessment that the site has significant environmental values.

13. Indicate the specific reasons you think the site is significant. If possible, structure your arguments in relation to the nine significance criteria described in the enclosed Study Background paper.
14. Check off the numbers of the significance criteria that the site fulfills.
15. Check off whether you think the site is of regional, provincial, national or international significance.
16. Describe main current land uses on the site (e.g.: agricultural cropland, grazing land, industrial, gravel extraction, residential, parkland).
17. Indicate any current recreational, educational or scientific uses of the site (e.g.: general sightseeing, photography, hiking, climbing, skiing, hunting, fishing, nature study, field trips, ecological research, geological research). Indicate intensity of such land uses (sporadic, occasional, frequent, very frequent).
18. Indicate any recreational, educational or scientific uses that you could envision for the site.
19. Give a brief description of the topography of the site.
20. Give a general description of surficial materials and landforms. Indicate any features notable within the context of the Calgary Region, the province or the nation.
21. Indicate the types of water bodies present on the site and briefly indicate any relevant details of their physical and biological characteristics. Indicate any features notable within the context of the Calgary Region, the province or the nation.
22. List the main vegetation types, starting with the most common and progressing to the less common. Indicate any features notable within the context of the Calgary Region, the province or the nation. If feasible, use the system used in the following example:

aspen-balsam poplar/Saskatoon-red osier dogwood/rough fescue-spear grass

This would mean that the tree layer is dominated by aspen and has a lesser component of balsam poplar; the shrub layer is dominated by Saskatoon and has a lesser component of red osier dogwood; and the ground cover is dominated by rough fescue and has a lesser component of spear grass.

If you have insufficient information to describe the vegetation in the above format, use a simple narrative format.

Because the report is directed toward a general audience, we would prefer common, rather than scientific, names in the vegetation description.
23. List, by their common names, the species of fish present in waterbodies on the site. Indicate any aspects of this fauna notable within the context of the Calgary Region, the province, or the nation.

24. List by their common names, important species of mammals and birds known to make use of the site. Indicate any aspects of this fauna notable within the context of the Calgary Region, the province or the nation.
25. List any information on amphibians, reptiles or invertebrates that may be relevant to the site assessment. Indicate any aspects of this fauna notable within the context of the Calgary Region, the province or the nation.
26. Describe the impact of man on the site.
27. Indicate the nature and location of road and foot access to site. Indicate whether the site is accessible by water. If there is a significant walk to the site, indicate its distance and difficulty.
28. Indicate present or probable future land use activities that may impair the environmental significance of the site. Indicate whether site is under any immediate threat.
29. Give your views as to the degree of protection that the site merits. Suggest management guidelines for agricultural, industrial, residential, recreational, educational or scientific use of the site.
30. Make any additional comments that do not readily fit into the above categories or which elaborate upon or emphasize points made above.
31. Make an 8 1/2 X 11 xerox copy of the portion of the 1:50,000 scale topographic map covering the proposed site. (Or make a tracing showing map coordinates or main landmarks.) On this map, show the approximate outline of the site and indicate the main access route to the site.

GUIDE FOR COMPLETING HISTORICAL RESOURCES SITE REPORT FORM

Instructions for filling out the form are given according to the heading numbers shown on the form.

1. If you wish to name the site for easy reference, you may do so; otherwise we may name it.
2. Check off the appropriate site category.
3. Give the number of the 1:50,000 scale National Topographic Series map covering the site location.
4. Indicate the approximate elevation (in metres) of the site as shown on the 1:50,000 National Topographic Series Map. (Convert feet to metres by dividing by 3.28)
5. Give the approximate area of the site in hectares (acres divided by 2.47).
6. Give the UTM (Universal Transverse Mercator) grid position of the site, taken from the appropriate 1:50,000 scale topographic map. If the site is large, give the location of the approximate centre of the site.
7. If you have difficulty using the UTM system, read the latitude and longitude of the site from the appropriate 1:50,000 scale topographic map.
8. Give the legal description of the site, if you have the information readily available. Provision has been made for identifying the site location down to a 40 acre parcel (1/4 of a 1/4 section). However, you need not go to this level of precision unless your data justifies it.
9. This information is required so that we can make follow-up contacts with you.
10. Check off the appropriate ownership category if you have this information. If a site lies within more than one category of land, check off more than one item.
11. If you know who is the owner of the land, supply this information; otherwise leave space blank.
12. Describe features of the site. Use the Study Background paper for orientation.
13. Give your reasons for believing that the site is significant and deserving of protection.
14. Check off whether you think the site is of regional, provincial, national or international significance.
15. Describe main current land uses (e.g.: agricultural cropland, grazing land, industrial, gravel extraction, residential, parkland).

16. Indicate any current recreational, educational or scientific uses of the site (e.g.: passive recreation; activities of amateur paleontologists, archaeologist or historians; field trips; scientific research). Indicate intensity of such land uses (sporadic, occasional, frequent, very frequent).
17. Indicate any recreational, educational or scientific uses that you could envision for the site.
18. Indicate the state of preservation of the historic resources and the degree to which humans have disturbed the historical resources.
19. Indicate the nature and location of road and foot access to site. Indicate whether site is accessible by water. If there is a significant walk to the site, indicate distance and difficulty of terrain.
20. Indicate present or probable future land uses that may impair the site. Indicate whether site is under an immediate threat.
21. Give your views as to how the site should be protected and/or restored. Suggest management guidelines for agricultural, industrial, residential, recreational, educational or scientific use of the site.
22. Make any additional comments that do not readily fit into the above categories or which elaborate upon or emphasize points made above.
23. Make an 8 1/2 X 11 xerox copy of the portion of the 1:50,000 scale topographic map covering the site of interest. (Or make a tracing showing map co-ordinates or main landmarks.) On this map, show the site location (or outline, if known or relevant) and indicate the main access route to the site.

LIST OF PERSONS OR ORGANIZATIONS RECEIVING MAILING

(Calgary Region ESA Study)

ARCHAEOLOGICAL/HISTORICAL SOCIETIES

- Ms. Elise Corbet - Historical Society of Alberta
 Ms. Louise Travis - Archaeological Society of Alberta

ENVIRONMENTAL ASSOCIATIONS

- Mr. Tom Beck - Chairman, Canadian Environmental Advisory Committee
 Ms. Cheryl Bradley - President, Alberta Wilderness Association
 Mr. John Eisenhauer - President, Alberta Water Management Coalition
 Ms. Martha Kostach - Environment Council of Alberta
 Ms. Rosemary Nation - National and Provincial Parks Association
 Mr. T.J. O'Keefe - Canadian Wildlife Federation
 Mr. Lionel Jackson - Sierra Club (Alberta)
 Mr. Andy Russell - Canadian Wildlife Federation
 Mr. Cliff Wallis - Alberta Wilderness Association

LOCAL GOVERNMENT

- Chairman and Council - Improvement District No. 8
- Reeve and Council - M.D. of Foothills
 - M.D. of Rocky View
 - County of Wheatland
- Mayor and Council - Town of Airdrie
 - Village of Beiseker
 - Town of Black Diamond
 - Village of Blackie
 - City of Calgary
 - Town of Canmore
 - Village of Cayley
 - Summer Village of Chestermere Lake
 - Village of Cluny
 - Town of Cochrane
 - Town of Crossfield
 - Summer Village of Ghost Lake
 - Town of Gleichen
 - Town of High River
 - Village of Hussar
 - Village of Irricana
 - Village of Longview
 - Town of Okotoks
 - Village of Rockyford
 - Village of Standard
 - Town of Strathmore
 - Town of Turner Valley

NATURALISTS' ASSOCIATIONS

- Ms. Dorothy Broadbett - Red Deer River Naturalists
 Ms. Margaret van Knoll - Calgary Field Naturalists' Society
 Mr. Mike McIvor - Bow Valley Naturalists

NATURALISTS' ASSOCIATIONS (continued)

Mr. James Posey - President, Calgary Field Naturalists' Society
 Ms. Mary-Helen Posey - President, Federation of Alberta Naturalists
 Mr. Alan Wiseley - Federation of Alberta Naturalists

PRIVATE CITIZENS

Dr. Charles D. Bird - Mirror, Alberta
 Mr. David Elphinstone - Calgary, Alberta
 Mr. Thomas S. Saddler - Camrose, Alberta
 Mr. Peter Sherrington - Cochrane, Alberta

PROFESSIONAL ASSOCIATIONS

Mr. Neil Chymko - Canadian Society of Environmental Biologists
 Ms. Joy Finlay - Alberta Teachers' Association
 Dr. Ronald Wallace - Alberta Society of Professional Biologists

PROVINCIAL/FEDERAL GOVERNMENT

Dr. Peter Acuff - Northern Forest Research Institute
 Mr. Harold Carr - Alberta Energy and Natural Resources
 Mr. Dave Christiansen - Alberta Energy and Natural Resources
 Mr. Kenneth Crutchfield - Alberta Energy and Natural Resources
 Ms. Barbara Danielson - Alberta Energy and Natural Resources
 Mr. Gary Erickson - Alberta Energy and Natural Resources
 Mr. William Glasgow - Alberta Energy and Natural Resources
 Mr. Jack Glenn - Alberta Environment
 Ms. Diane Griffin - Alberta Energy and Natural Resources
 Mr. William Griffiths - Alberta Energy and Natural Resources
 Dr. Lionel Jackson - Geological Survey of Canada
 Mr. Mel Kraft - Alberta Energy and Natural Resources
 Mr. Archie Landals - Alberta Recreation and Parks
 Mr. Keith Leggat - Alberta Energy and Natural Resources
 Mr. Douglas Lowe - Alberta Energy and Natural Resources
 Mr. Brent Markham - Alberta Energy and Natural Resources
 Mr. David McCallum - Alberta Energy and Natural Resources
 Mr. Lee McKibben - Alberta Environment
 Mr. David Perraton - Alberta Recreation and Natural Resources
 Mr. Thomas Smith - Alberta Energy and Natural Resources
 Mr. Harry Stelfox - Alberta Energy and Natural Resources
 Mr. Bruce Stubbs - Alberta Energy and Natural Resources
 Mr. Gerald Thompson - Alberta Energy and Natural Resources
 Mr. Eric Vuori - Alberta Energy and Natural Resources
 Mr. Harold Weaver - Alberta Energy and Natural Resources

RECREATION ASSOCIATIONS

Mr. Herb Benson - Bearspaw Canoe Club
 Mr. C.D. Campbell - The National Trail Association of Canada
 Mr. Jeff Grutz - Calgary White Water Club
 Mr. Charles Lee - Alberta Canoe Association
 Ms. Dianne Pachal - Great Divide Trail Association
 Mr. Brian Prior - President, Great Divide Trail Association
 Mr. Richard Voelmle - Bow Waters Canoe Club

RESOURCE MANAGEMENT ASSOCIATIONS

Mr. B. Foran - Okotoks and District Fish and Game Association
 Mr. George Freeman - Area Supervisor, Ducks Unlimited
 Mr. R. Ippolito - Sarcee Fish and Game Association
 Mr. G. Primrose - Crossfield-Carstairs Fish and Game Association
 Mr. D. Skinner - Calgary Fish and Game Association

UNIVERSITIES

Dr. Paul K. Anderson - University of Calgary
 Dr. Lawrence D. Cordes - University of Calgary
 Dr. Ronald W. Davies - University of Calgary
 Dr. William A. Fuller - University of Alberta
 Dr. Valerius Geist - University of Calgary
 Ms. Beryll Hallworth - University of Calgary
 Dr. Lou Hamill - University of Calgary
 Dr. Stuart Harris - University of Calgary
 Dr. Len Hills - University of Calgary
 Dr. Edward A. Johnson - University of Calgary
 Dr. George H. La Roi - University of Alberta
 Dr. A. Legge - University of Calgary
 Dr. M. Ross Lein - University of Calgary
 Dr. Art Limbird - University of Calgary
 Dr. Timothy Myres - University of Calgary
 Dr. Joseph S. Nelson - University of Alberta
 Dr. G. Osborne - University of Calgary
 Dr. Dennis Parkinson - University of Calgary
 Dr. Richard Pharis - University of Calgary
 Dr. Gordon Pritchard - University of Calgary
 Dr. Richard Revel - University of Calgary
 Dr. Grant Ross - University of Calgary
 Ms. Helen Ross - University of Calgary
 Dr. Daryll Smith - University of Calgary
 Dr. Dixon Thompson - University of Calgary
 Dr. M. Wilson - University of Calgary

APPENDIX 2 RARE AND ENGANGERED PLANT SPECIES

Polypodiaceae

Pellaea atropurpurea

Graminae

Andropogon scopartusSphenpholis obtusataTrisetum cernuumCorispermum orientale

Rosaceae

Potentilla fonitima

Violaceae

Viola peddtifida

Boraginaceae

Onosmodium occidentaleAnacharis longivaginat

Graminae

Alopecurus geniculatus

Alopecurus occidentalis

Oryzopsis micrantha

Chenopodium premontii

Suckleya suckleyana

Amaranthus californicus

Heliotropium curassivicum

Veronica catenata

Madia glomenata

Yucca glauca

Endolepis suckleyi

Rorippa sinuata

Ambrosia psilostachya

