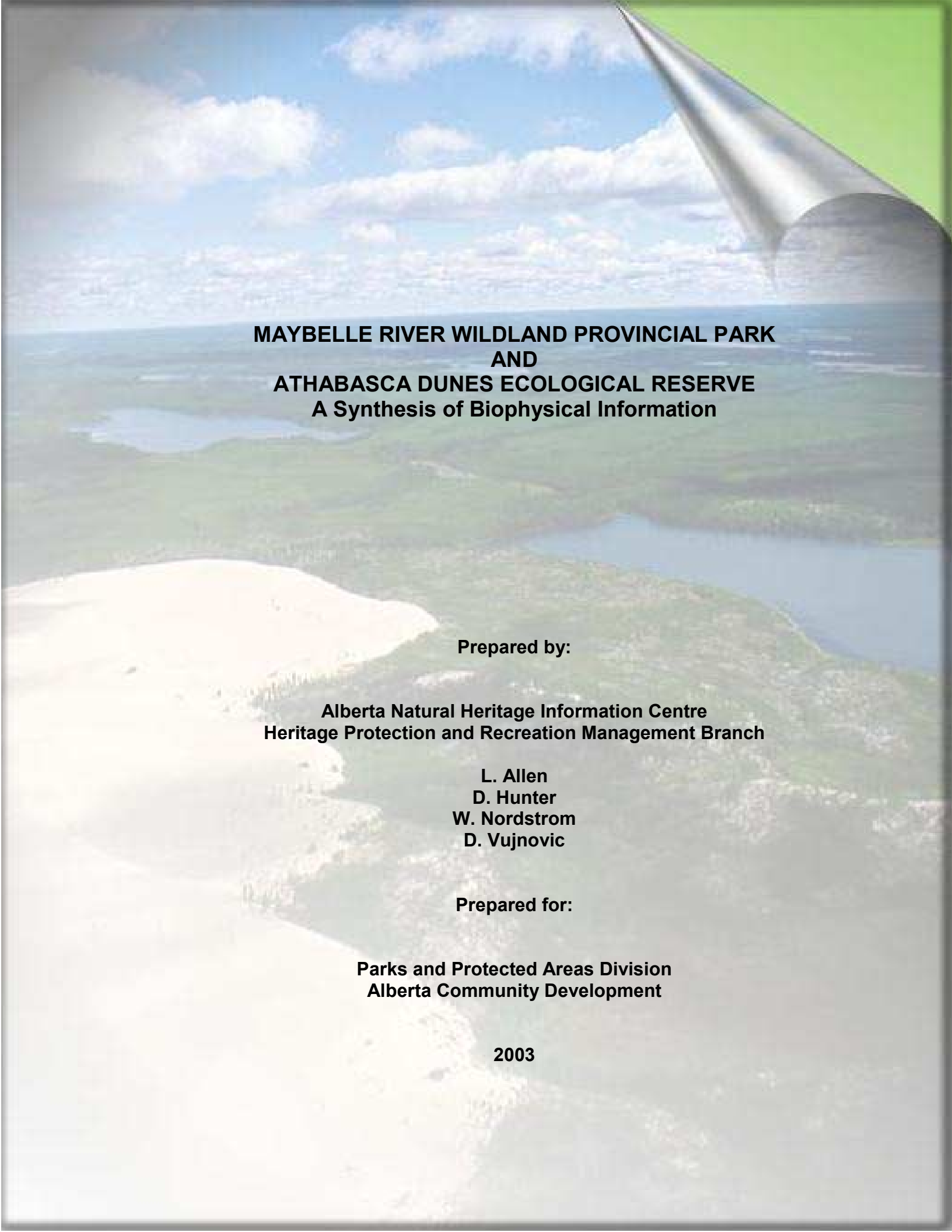

MAYBELLE RIVER WILDLAND PROVINCIAL PARK
AND
ATHABASCA DUNES ECOLOGICAL RESERVE
A Synthesis of Biophysical Information

Prepared by:

Alberta Natural Heritage Information Centre
Heritage Protection and Recreation Management Branch

L. Allen
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Parks and Protected Areas Division
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Front page picture: Aerial view of the eastern edge of the active dunes where they are advancing into the ice contact landscape (photograph by D. Vujnovic).

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1.0 INTRODUCTION

This report represents a synthesis of the available information on the special and representative features of Maybelle River Wildland Provincial Park (153 km^2) and the Athabasca Dunes Ecological Reserve (37 km^2). The ecological reserve is located entirely within the boundaries of the wildland provincial park. For purposes of this report, these two sites will be referred to as the 'study area', unless specifically mentioned otherwise, and will be treated as a single site. This report is largely based on a number of other reports and documents that were prepared as a result of field studies conducted during June and August of 2000. These reports and documents are listed in the Bibliography section of this report and will be available on the website of the Alberta Natural Heritage Information Centre (http://www.cd.gov.ab.ca/preserving/parks/anhic/flashindex.asp) or through the offices of the Parks and Protected Areas Division.

1.1 Location

The study area is located in an area of sand plain, sand dune, peatlands, and kame and kettle terrain in a relatively remote part of northeastern Alberta. The Fort Chipewyan winter road lies along part of the western boundary of the study area (Appendix 6 – 20); Richardson River Dunes Wildland Provincial Park is situated to the southwest. The town of Fort Chipewyan lies about 60 km to the north and the city of Ft. McMurray about 150 km to the south (Figure 1).

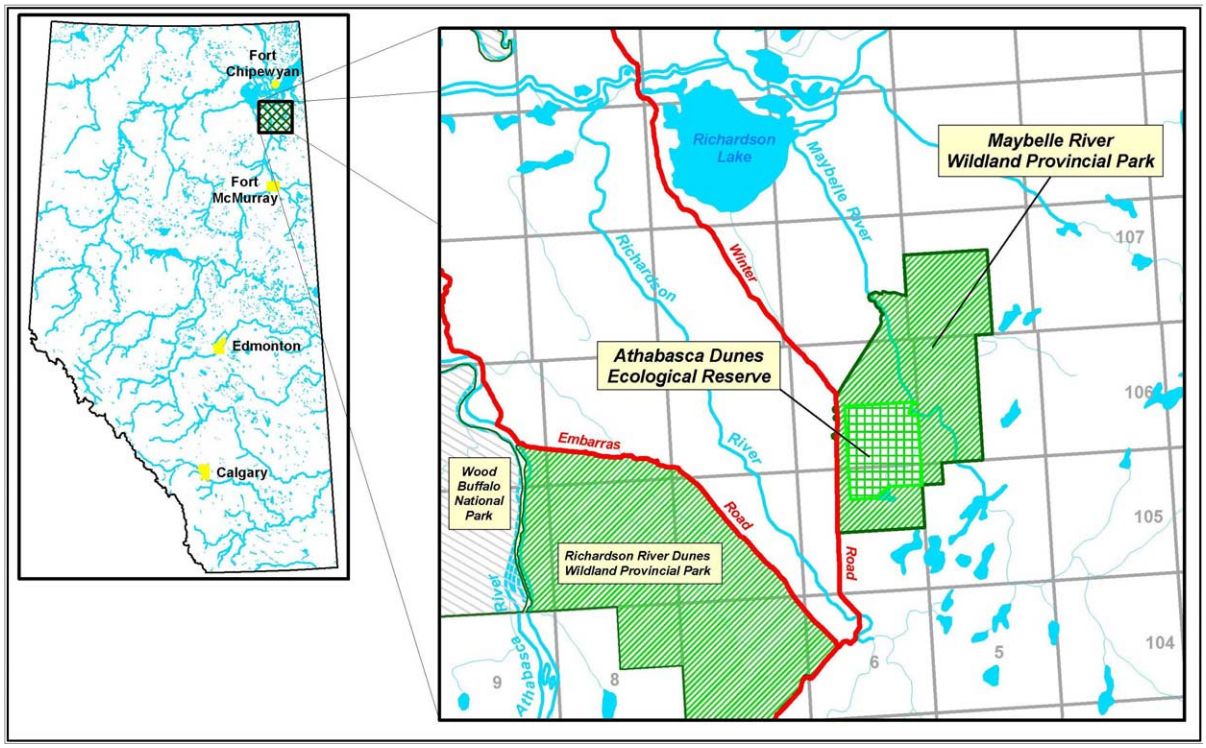


Figure 1. Location of Maybelle River Wildland Provincial Park and Athabasca Dunes Ecological Reserve.

1.2 Surficial Geology

The present-day landscapes of the region originated from the effects of the last glaciation. Glaciers advanced from and retreated to the northeast (Jonker and Rowe 2001). This is reflected in the orientation of the ice-contact features that occur in the region (e.g., drumlinized and fluted outwash). Figure 2 depicts the surficial deposits and/or landforms that are found in the study area. These are described in more detail in the discussion below.

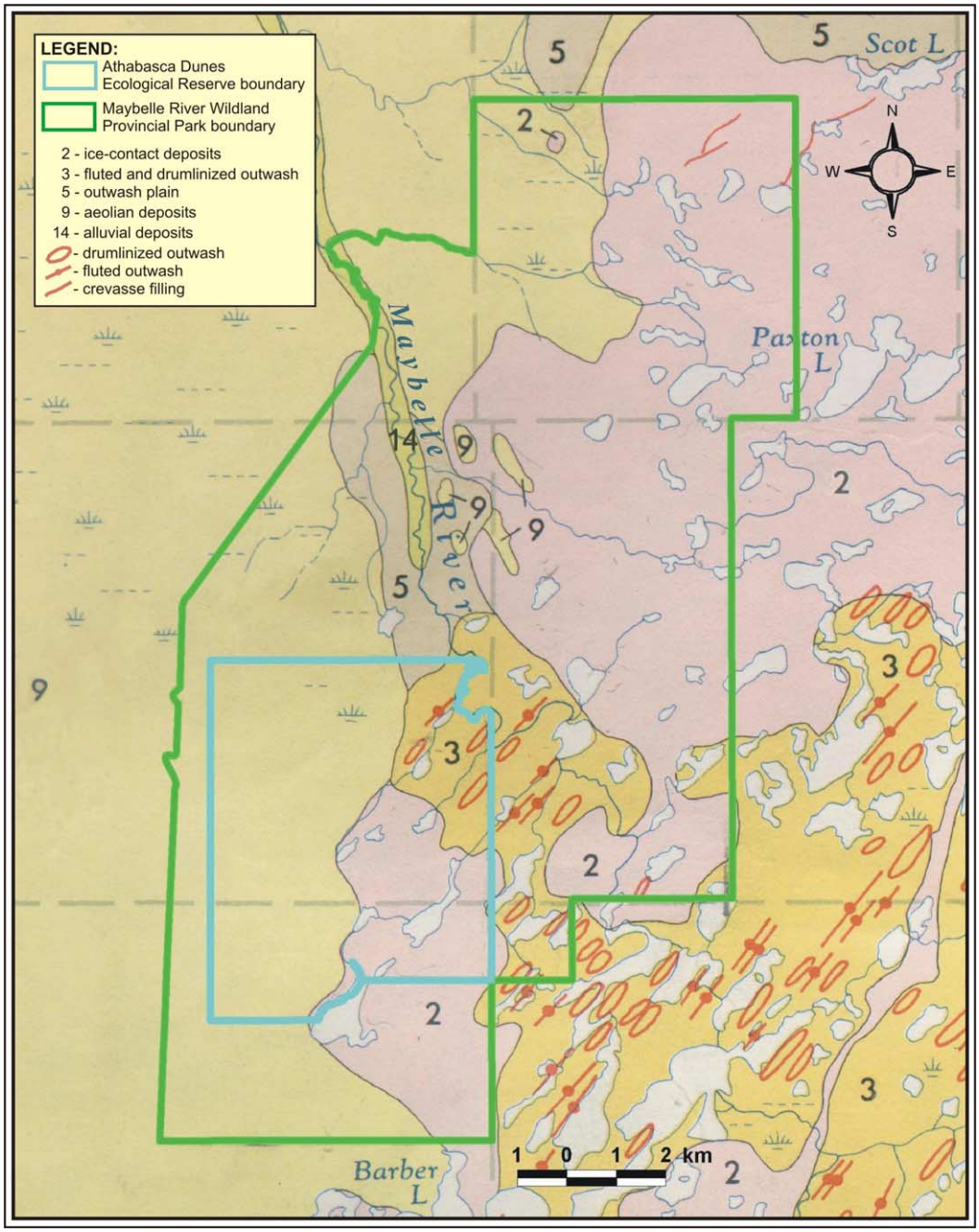


Figure 2. Surficial deposits of the area (from Bayrock 1972)

1.2.1 Glaciofluvial Deposits

Glaciofluvial deposits are commonly made up of sands and gravels. They originate from the action of glacial meltwaters that flow beyond the margin of the ice sheet as well as on, within or beneath it. Glaciofluvial deposits in the study area and adjoining lands can be classified into three categories, as discussed below:

(a) Ice-contact deposits

Sand, gravel and other materials build up within the holes and tunnels of the glacier or in ice-walled trenches or crevasses. They are left behind as 'ice-contact deposits' when the ice melts away (Fairbridge 1968). These deposits are expressed in landforms such as eskers, crevasse fillings, kames, kame complexes, and kettle holes, all of which occur in or near the study area.

Crevasse fillings are relatively short, linear ridges of glaciofluvial sand and gravel, believed to have been formed by meltwater debris penetrating and partly filling a crevasse in the melting ice (Whittow 1984). Most crevasse fillings are composed of gravel (Bayrock 1972). **Eskers** are long, narrow, sinuous ridges of coarse sand and gravel, believed to have formed in stream tunnels beneath or within an ice-sheet. **Kames** are steep-sided ridges or conical hills comprised of gravels and sands deposited by running water in close association with stagnant glacial ice (Fairbridge 1968). Kames form within holes or fissures in the glacier or between the glacier and the land surface. They may appear, after melting of the ice, as a single mound (a kame) or as groups of closely associated mounds (kame complex). **Kettle holes** are enclosed depressions formed when a buried or partially buried body of ice eventually melts and the surface sediments collapse to form a hollow that soon becomes water-filled (Whittow 1984).

A substantial portion of the eastern part of the study area is comprised of a kame complex (Figure 2, number 2). Here there are steep-sided ridges and rounded or conical hills, interspersed with kettle lakes. Kettle lakes are numerous, deep and clear, and surrounded by clean sandy or cobble beaches, often with wooded backshores. Some lakes are interconnected by small streams or separated by only short distances. There are some examples of crevasse fillings southwest of Scot Lake in the north end of the study area (Figure 2).

(b) Fluted and drumlinized outwash

Glacial meltwater deposits beneath flowing ice can be molded into fluted and drumlinized landforms. These landforms usually run parallel to the direction of ice flow. If drumlinized, they take the form of a stream-lined, pear-shaped, elliptical, or dome-shaped hill elongated with the blunt nose facing upstream and the gentler slope tailing off downstream (Fairbridge 1968, Jonker and Rowe 2001). If fluted, they take the form of an elongated ridge or furrow on the landscape, but lacking the characteristic shape of a drumlin (Bates and Jackson 1984). Flutings can be either erosional in origin (the glacier gouges the surface) or depositional (the glacier builds up material) (Jonker and Rowe 2001).

Examples of fluted and drumlinized outwash landforms occur in the southeastern corner of the study area (Figure 2). The drumlinized landforms trend in a NE-SW direction. They are well shaped and mantled by a layer of large boulders. Flutings are also well developed and grade in places into drumlins (Bayrock 1972). The outwash deposits are very thick and the topography is undulating to rolling.

(c) Outwash plains

Outwash plains develop around the margin of an ice sheet or beyond the snout of a glacier, fed by subglacial streams (Fairbridge 1968). Outwash deposits typically consist of sands and gravels. In regions of low relief the deposits fan out to form almost flat plains (Fairbridge 1968).

Only two small areas of outwash plains occur in the study area (Figure 2, number 5) – one area that borders the Maybelle River for about 6 km in the northwest part of the study area, and another area at the far northern end of the study area. Outwash deposits in the area are generally thin and their characteristic topography is level to gently undulating. They are mostly poorly drained and peatlands have often developed on them. There is a layer up to 20 m deep of outwash sands exposed on the banks of the Maybelle River (Bayrock 1972).

1.2.2 Aeolian Deposits

Wind is one of the major forces that alter landscapes. Wind action erodes, transports, and deposits soil, sand, dust and soluble compounds over long periods of time (Fairbridge 1968). Wind-blown or wind-deposited materials are often referred to as aeolian deposits (Whittow 1984).

Glaciofluvial deposits laid down in the area south of Lake Athabasca during past glacial events have been reworked by strong winds into various types of aeolian features (Jonker and Rowe 2001, Raup and Argus 1982). Within the study area, aeolian landforms occur on the uplands either in the form of sand plains or as dunes.

(a) Sand Plains

A plain is an extensive tract of relatively flat land or gently undulating terrain without prominent hills or depressions (Whittow 1984). When that terrain is covered with a blanket of ‘sheet sands’, it can be termed a ‘sand plain’. Sand plains are typically characterized by muted topography, with the surface dominated by low undulations, hillocks, dry flats and slacks (Jonker and Rowe 2001). The sheet sand deposits occur mainly in the western and south-western part of the study area (Figure 2, number 9) and range in thickness from 0.6 to 3 meters (Bayrock 1972).

(b) Dunes

Dunes are mounds, ridges, or hills of wind-blown sand, either bare or covered with vegetation (Whittow 1984). They can take a variety of shapes, sizes and configurations. The dune field in the study area is comprised of two systems that are distinct in age and orientation (Landals 1978). Dunes in the older, stabilized group were formed by paleowinds that were dominated by southeasterlies. Realigned across this field are semi-active and active dunes being directed by contemporary winds from the northwest. Some of the older ridges, particularly to the north and south of the ecological reserve, are remnants of longitudinal and parabolic paleodunes that are believed to have originated during the warm xerothermic period (10,000 to 6500 years ago), immediately after the last great continental glacier withdrew (Jonker and Rowe 2001).

Contemporary wind action has destroyed, reshaped or distorted most of the paleodunes that once occurred east of the Richardson River. To the north and west of Barber Lake, for example, the paleodunes have been reshaped into other dune forms (e.g., imbricated transverse dunes, distorted parabolic and longitudinal dunes). This is the only place in Alberta where both early and re-worked paleodunes occur together (Landals 1978).

A significant contemporary dune field that is comprised of **active transverse dunes** occurs almost entirely within Athabasca Dunes ER. The term 'transverse dune' is given to an asymmetrical ridge of sand aligned perpendicularly to the formative wind, in this case northwesterly winds (Landals 1978; Whittow 1984). Large areas of active transverse dunes are quite rare features for inland regions. "*The active dunes west of the Maybelle River and the surrounding marshes, lakes and forested hills and plains form a landscape which is incredibly beautiful and duplicated nowhere else in the province*" (Landals 1978, p86).

The transverse dunes occupy a substantial area (~10 km^2). The north-south extent of these dunes is about 8 km and in places they are about 2 km wide. The dunes are freely moving, directed mainly by northwest winds. There are several more-or-less parallel rows of dunes located one behind the other, migrating as a unit in a southeasterly direction. The path of their migration from an original position just east of the Richardson River is marked by two sinuous sand ridges that trail from the northern and southern extremities of the active area.

The active transverse dunes have moved over paleodunes (both longitudinal and parabolic) and sand plains and are now gradually moving into and over kettle lakes (Appendix 6 – 10), peatlands and forested kame hills. Sand from the overridden kames and paleodunes swells the bulk of the active dunes. As the dunes pass, they leave behind flat sandy plains, irregular parabolic ridges and interdune flats often covered with wind-polished and faceted pebbles known as 'desert pavement', 'lag-gravel', or 'residual gravel' (Fairbridge 1968) (Appendix 6 – 12). The term 'gravel pavement' has been used to describe such areas in Alberta and Saskatchewan (Landals 1978; Raup and Argus 1982; Jonker and Rowe 2001). Poles of dead jack pine known as 'buried forests' are also exhumed as the dunes that buried them move eastwards.

1.2.3 Alluvial Deposits

Alluvium is a general term for the sedimentary deposits (sands, clays, silts) made by streams on riverbeds, flood plains, and alluvial fans; especially a deposit laid down during time of flood. The term applies to stream deposits of recent time (Bates and Jackson 1984).

Recent stream sediments are found along the valley of the Maybelle River, primarily at the northern edge of the study area (Figure 2, number 14). The floodplain sediments of the Maybelle are mainly sand (Bayrock 1972).

1.2.4 Organic Deposits

Organic deposits are sediments formed by organisms and their remains (Whittow 1984). These deposits are expressed in a number of 'peatland landform types', including bogs and fens.

In the study area, postglacial accumulations of organic materials mantle many of the surficial deposits described above. In general, these deposits are thin, although locally they may attain a thickness of 6 m or more (Bayrock 1972). Some of the peatlands in the study area are quite large in areal extent; others are small and occur adjacent to kettle lakes and slow-moving streams.

1.3 Hydrology

The Maybelle River drains the study area. This river flows northward and eventually drains into Richardson Lake that in turn drains into Lake Athabasca via the Athabasca River. Several of the kettle lakes, particularly in the southeastern part of the study area, are interconnected with the Maybelle River. At the northern end of the study area, the river flows through a well-defined valley. The east side of the valley is lower in elevation and has gentler slopes than the west side. There are also a number of sandy ridges (oriented in the direction of the prevailing winds) that extend down onto the valley slopes adding to the complexity of the valley topography.

Kettle lakes of varying sizes and shapes dot the central and eastern portion the study area. These lakes are described briefly in the surficial geology section above. Some of the kettle lakes that are in the path of the active transverse dune system are slowly being in-filled with sand.

One large peatland (1026 ha) is located north of the ecological reserve and this drains northward via a short creek (3 km long) into the Maybelle River. Another sizeable peatland borders the river in the vicinity of the northeast corner of the ecological reserve. Other peatlands that lie adjacent to kettle lakes and small streams also eventually drain into the Maybelle River system. The peatlands are primarily fens without permafrost, but discontinuous areas of permafrost occur where there are bog inclusions (Vitt *et al.* 1998).

1.4 Fire History

Fire is the major natural disturbance that occurs in the area. The jack pine woodlands particularly reflect the effect of frequent fires – the even age stands, dense forests of young pine, the lack of organic material in the soil and the degree of sand activity (Landals 1978).

Major fires have occurred in the study area and surrounding areas in 1979, 1980 and 1981 (Figure 3) (Alberta Sustainable Resource Development 2002). The 1981 fire burned throughout the ecological reserve and the southern two-thirds of the wildland park. In 1979 and 1980 the remainder of the park was burned. The burned areas are now regenerating and have relatively dense stands of pine less than 25 years old. As burns tend to be patchy, some mature to old growth forests do remain, but they are neither common nor extensive.

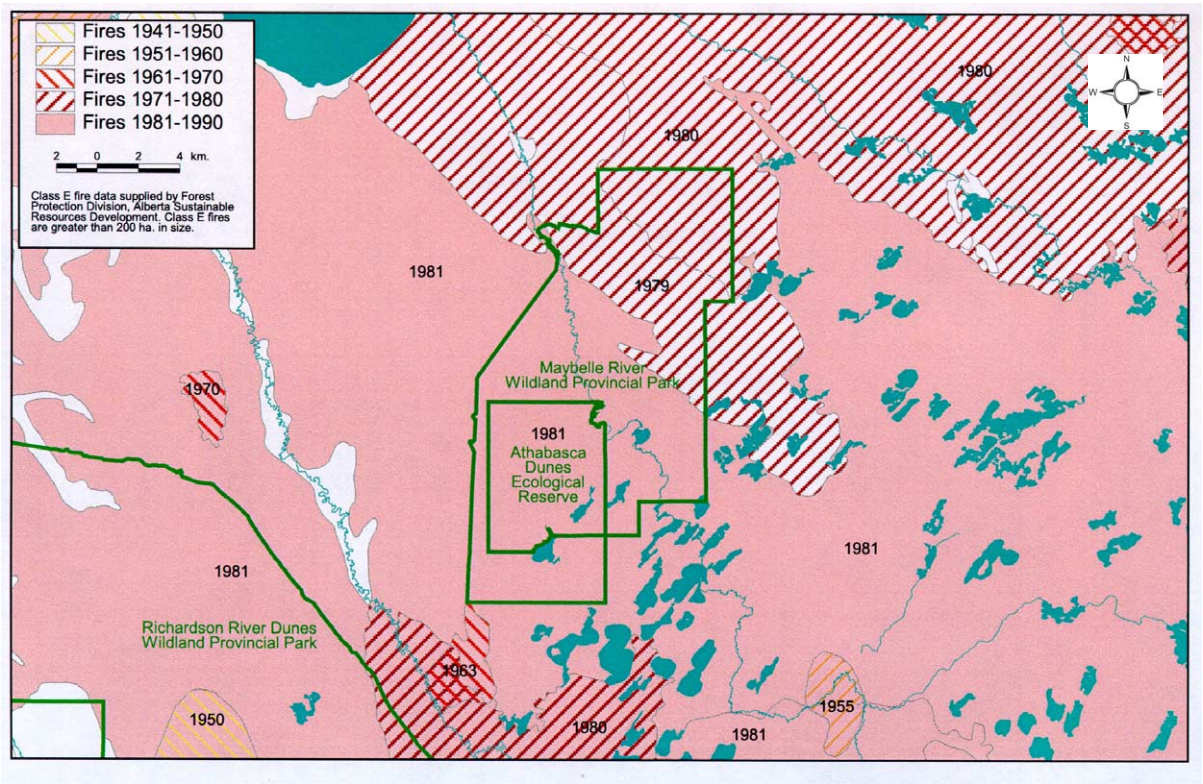


Figure 3. Wildfire occurrences in and adjacent to Maybelle River Wildland Provincial Park and Athabasca Dunes Ecological Reserve.

1.5 Vegetation

A plant community is defined as “a collection of plant species growing together in a particular location that show a definite association or affinity with one another” (Kent and Coker 1992). The mosaic of plant communities in the site makes up the vegetation. Some of the plant communities of the study area have been described (Allen and Johnson 2000, Landals 1978, Meijer 2002), however some areas of the site were difficult to access and have not been documented. The following discussion includes the communities that have been documented as well as some discussion on what additional plant communities might be expected based on observations in the general area.

Active sand creates a harsh habitat, subject to constant disturbances of varying types and intensities. Shifting sand buries plants or excavates the roots. Leaves and stems are subject to abrasion from blowing sand and the sand surface is dry and constantly shifting, making seedling establishment very difficult. For these reasons, the area of active dunes is, in general, unvegetated.

Some sparse yet distinctive plant communities occur in locations where the sand is slightly less active. These include the lee side of dune crests, where communities of one or several of the following species occur occasionally: western wheat grass (*Agropyron smithii*), northern awnless brome (*Bromus inermis* var. *pumpellianus*), narrow reed grass (*Calamagrostis stricta*), creeping red fescue (*Festuca rubra*) and June grass (*Koeleria macrantha*). Rare species, including Indian tansy (*Tanacetum bipinnatum* ssp. *huronense*) and sand chickweed (*Stellaria arenicola*), may be found here. A sparse, linear community dominated by narrow reed grass, including many of the species found on the crest, often occurs right at the base of sand dunes in a zone at the foot of the slip face. This zone is protected by the dune from wind, but subject to sand accumulation off the dune face.

Moist areas in **dune slacks** or in **seepages** at the base of slopes allow for seed germination, and if stable long enough, can develop shrublands of willows or birch saplings or even forest pockets. A complex of dunes and wetlands at the southwest edge of the active dunes has small pockets of jack pine (*Pinus banksiana*), often mixed with paper birch (*Betula papyrifera*) on the dune slopes and water sedge (*Carex aquatilis*) dominated wetlands between the dunes. Small pockets of paper birch / bog cranberry (*Vaccinium vitis-idaea*) occur in slacks that have been protected from sand accumulation.

Probably the most extensive plant communities in the active dune area are those dominated by sand heather (*Hudsonia tomentosa*). They occur in flat areas of **partially stabilized sands** such as dune slacks and at the edges of some of the gravel pavements. They are most extensive along the windward (western) edge of the dune complex. The gravel sites themselves are largely unvegetated, although patches of awned hair-cap moss (*Polytrichum piliferum*) can be found here as well as on some of the sand flats.

At the western edge of the active dune complex, sand heather gives way to a crowberry (*Empetrum nigrum*) community as the sand becomes stabilized. This in turn grades into a young jack pine community with a sparse crowberry understory.

Outside of the active dune area, much of the study area is made up of extensive sand or gravel uplands vegetated by forests dominated by jack pine. These forests are largely young jack pine stands, regenerating after fires (Meijer 2002). There is generally much dead and down material, a dense needle carpet and little understory vegetation. Understory vegetation increases in more mature stands, with typical species including bearberry (*Arctostaphylos uva-ursi*) and common blueberry (*Vaccinium myrtilloides*). Lichens become increasingly significant as stands age, but mature jack pine stands are infrequent. Where found, they tend to have an open canopy with a well-developed lichen understory, primarily made up of green reindeer lichen (*Cladina mitis*), *Cladonia cristatella* and *Cladonia borealis*. On more mesic sites, such as seepage areas at the base of dune ridges, jack pine / green alder (*Alnus crispa*) stands are common.

The landscape east of the active dunes is a **complex of sand and gravel hills and kettle lakes**. Jack pine stands continue to be the main type of woodland but paper birch / common blueberry communities predominate in mesic pockets between hills and ridges and around lakes. Sometimes Alaskan birch (*Betula neoalaskana*) or aspen (*Populus tremuloides*) form a significant component of the tree layer. Steep slopes with a southerly orientation often have graminoid slopes dominated by hay sedge (*Carex siccata*) and provide habitat for rare species such as hot-springs millet (*Panicum acuminatum*). Both deciduous woodlands and graminoid slopes are community types of limited extent in the region.

Kettle lakes tend to be steep sided and deep, with only a narrow emergent vegetation zone surrounded by a narrow beach zone. Aquatic vegetation was noted infrequently, but included floating-leaved species such the common yellow water lily (*Nuphar lutea*) and rare species such as pygmy water-lily (*Nymphaea leibergii*) (S1) and watershield (*Brasenia schreberi*) (S1). Small pockets of emergent vegetation, dominated by hairy-fruited sedge (*Carex lasiocarpa*) were noted in some areas. The beach zone tends to be narrow and is made up of cobbles or sand at or just above the water table. This provides a moist, sparsely vegetated habitat with rare species such as mountain club moss (*Huperzia selago*) and bog club moss (*Lycopodiella inundata*). Some of the small lakes have a 4 to 6 m wide band of floating vegetation instead of the emergent and beach zones. Some lakes that were examined were bordered by a bog rosemary / pitcher plant / peat moss (*Andromeda polifolia / Sarracenia purpurea / Sphagnum angustifolium*) poor fen.

The **peatlands** of the study area were not looked at in great detail, so the following description is preliminary. There are areas of shrubby fens, dominated by shrubs such as leatherleaf (*Chamaedaphne calyculata*), common Labrador tea (*Ledum groenlandicum*) and northern laurel (*Kalmia polifolia*). Shrubby wetlands dominated by bog birch (*Betula pumila*) and/or willows (*Salix* spp.) with an understory of grasses and sedges were noted in the region and may be present in the study area.

There are extensive areas of treed fen, primarily made up of black spruce (*Picea mariana*) with a layer of shrubs, usually leatherleaf and common Labrador tea, with a carpet of peat moss (*Sphagnum* spp.). Some stands have scattered tamarack (*Larix laricina*). Pitcher plant (*Sarracenia purpurea*) is prominent in some of these peatlands. Small areas of open treed bog are also present.

On dryer, level organic areas, a black spruce / common Labrador tea / Schreber's feather moss (*Pleurozium schreberi*) community occurs (Meijer 2002). A review of aerial photographs suggests areas of graminoid wetlands may be present, but none were documented during the 2000 field surveys.

Riverine habitats along the smaller creeks in the study area were not examined in detail, but are likely dominated by willow shrublands. Benches along the Maybelle have closed mixed deciduous stands of Alaskan birch and balsam poplar (*Populus balsamifera*), often with stiff club-moss (*Lycopodium annotinum*) as a significant understory component. Alaskan birch predominates on more mesic sites, with the one site looked at having bluejoint (*Calamagrostis canadensis*) as the main understory species. Lower river terraces may have mature black spruce / Schreber's feather moss stands.

Emergent and wet meadow vegetation such as swamp horsetail (*Equisetum fluviatile*), cattail (*Typha latifolia*) or water sedge communities might be expected adjacent to beaver ponds, but none were looked at in 2000.

1.6 Fauna

1.6.1 Insects and Spiders

Of the insect and spider species collected or observed within the study area or adjacent lands, many represent significant extensions to their known ranges or were the first recorded occurrences for the species in Alberta (Hornung 2001, Schmidt and Pohl 2000, Nordstrom 2002) (Appendix 5). To date, 22 butterfly and 153 moth species have been recorded from the parks and adjacent areas of the region. This is about 37% of the butterfly and 15% of the moth species that are expected to occur here (Schmidt and Pohl 2000). Of the 19 odonate species recorded for the area, five were significant range extensions, these being: *Libellula Julia, Aeshna subarctica, Aeshna canadensis, Calopteryx aequabilis* and *Leucorrhinia glacialis* (Hornung 2001). One phenomenon noted during the field study in June 2000 was the importance of the emergence of Junebugs. They were abundant in sand landscapes and provided a food source for a wide assortment of species including sandhill cranes, nighthawks, bears and foxes.

1.6.2 Fish

The occurrence and distribution of fish in the study area was not assessed during the 2000 survey. A preliminary fisheries survey of the region was conducted in 1968 by Alberta Fish and Wildlife (Landals 1978). That survey concluded that the "area in general has very little sport or commercial fisheries potential" and that lake whitefish (*Coregonus clupeaformis*) and northern pike (*Exox lucius*) are the two main fish species present. Lake whitefish appear to be quite abundant. Walleye (*Stizostedion vitreum*) also occur in the Maybelle River and in some of the lakes connected to the river. The habitat for walleye is not very extensive in the region and there is little suitable spawning habitat, except along the Maybelle. Walleye appear to travel up and down the river (Landals 1978).

1.6.3 Amphibians

The wetlands of the park support good populations of wood frog, boreal chorus frog and Canadian toad (Gammon 2000). Vocalizations of the Canadian toad were regularly heard on many of the lakes and wetlands in the study area.

1.6.4 Birds

Eighty-five bird species were recorded within the study area, however, the region as a whole appears to support low densities of birds (Thomas and Carroll 2001). This is apparently attributable to the extensive stands of young jack pine that occur throughout the area, habitat known to support low densities of birds (Francis and Lumbis 1979). Some species, however, such as the common nighthawk do use open jack pine forests for nesting and foraging and are common inhabitants. The most bird-rich habitats in the study area are riparian areas, marshes, bogs, treed fens, beaver pond complexes and small lakes.

Thomas and Carroll (2001) reported several bird records of significance, including:
- Arctic tern – the first confirmed nesting record for Alberta,
- upland sandpiper – the first confirmed nesting record for the study area,
- surf scoter -- a probable nesting species in the study area,
- sandhill crane – a species on ANHIC's 'watch list'
- hooded merganser, eared grebe – species for which known ranges in Alberta were extended, and horned grebe, sharp-tailed grouse, great gray owl, rusty blackbird, winter wren, mountain bluebird – species considered 'rare' for the study area.

1.6.5 Mammals

Twenty-one species of mammals were recorded within the study area during the 2000 field surveys, but with low densities, attributable to several factors (Vujnovic 2001). An additional eight species are known from the area from fur trapping records and Landals' report (Landals 1978). The riparian habitats that surround lakes, wetlands, streams and rivers in the study area constitute the most important sites for mammalian biodiversity (e.g., ungulates, carnivores, rodents, insectivores). Woodland caribou are known to frequent suitable habitats in the region. It is a provincially threatened species (Dzus 2001) and is ranked S2 by ANHIC. Some of the small mammal species recorded for the area are believed to be uncommon in the study area (e.g., Arctic shrew, northern long-eared bat, hoary bat). Others such as snowshoe hare and red squirrel are common and often abundant residents. Carnivores such as wolves and foxes frequent the study area and its environs. River otter or signs of their presence (tracks, slides) are evident along river, creeks and lakes. Black bears are common inhabitants.

1.7 Environmentally Significant Areas

The study area falls almost entirely within two nationally significant Environmentally Significant Areas (ESAs) (Sweetgrass Consultants Ltd. 1997) (Figure 4). The portion of the study area within the Maybelle River Sand Hills ESA contains a variety of dune forms and is part of the largest single uninterrupted sand dune complex in Canada (David 1977). The Paxton-Larocque Lakes ESA contains classic ice-contact features and when combined with the dune systems to the west (e.g., modified paleodunes, active transverse dunes, sand plains, etc.), this area forms some of the most diverse and unique areas of sandy terrain in Canada (Sweetgrass Consultants Ltd. 1997).

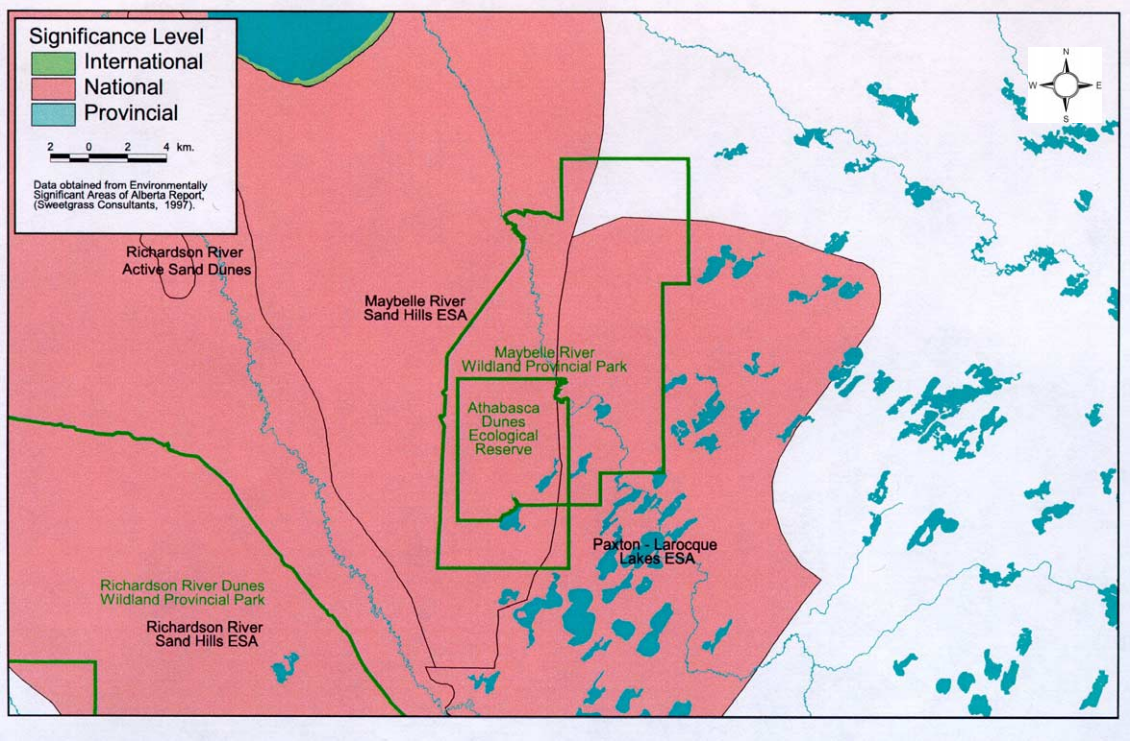


Figure 4. Environmentally Significant Areas within the Study Area.

2.0 METHODS

The goal of this report was to summarize and analyze the known information on the special and representative features of the study area. The existing literature and the results from the field surveys done in the area in 2000 were reviewed and used to identify both representative and special features for the study area. The landscapes were analyzed and divided into polygons, termed landscape units, and a landscape unit base map was generated. The representative and special features were then linked to the particular landscape unit in which they occur. Special features that have been reported for the region and which may occur within the study area were also linked to the landscape unit in which they would most likely be found.

2.1 Representative features

One of the key objectives of Alberta's protected areas system is to protect examples of the representative natural landscapes and features that are found within the province. As a method to evaluate progress towards achieving this objective, the known representative natural features for the province were classified into three levels of 'natural history themes'. The themes that occur within the protected areas system were then documented. This process also enabled gaps in the system to be identified.

For more information on natural history themes, their definitions and applications refer to the following reports:
Alberta Protected Areas System Analysis (Alberta Environmental Protection 1994a)
Natural Regions, Subregions and Natural History Themes of Alberta: A Classification for Protected Areas Management. (Alberta Environmental Protection 1994b)

The Level 2 Natural History Themes identified for the Athabasca Plains Subregion were reviewed and those found in the study area linked to the particular Landscape Unit in which they occur.

2.2 Special features

The information for the study area was reviewed to determine the special features present. These are defined as:

- areas of high biophysical diversity
- areas of species concentrations
- locations of rare elements as defined on the ANHIC tracking and watch lists
- locations of disjunct species or species with significant range extensions.
- locations of features uncommon within the region or within the study area itself

Special features were then ranked according to their level of significance, as defined below:

- **nationally significant** - features that are limited in distribution at a national level or that are the best and only representatives in Canada (Sweetgrass Consultants Ltd. 1997).
- **provincially significant** - features that are of limited distribution in Alberta or are the best examples in Alberta. Included here are the provincially rare elements on the ANHIC tracking lists.
- **regionally significant** – features that are of limited distribution in the Athabasca Plains Subregion or that are the best examples in that subregion. Species believed to be relatively common that occur in the study area as disjunct populations are treated as regionally significant. Further study may find these populations to be of greater than regional significance. Or they may show that the apparent disjunct nature of the population is due to lack of information on intervening areas.
- **locally significant** – features that are of limited distribution in the study area or that are the best examples of a particular feature in that study area.

2.3 Landscape Units

A map of landscape units was created by building on existing Alberta Land Inventory (ALI) polygons and the surficial geology polygons of Bayrock (1972) (see Figure 5). The ALI project (Archibald *et al.* 1979) used 1:50,000 scale aerial photographs to classify the physical landscape into relatively broad homogeneous units based on parent geological material, topography and drainage. The ALI polygons within the study area were evaluated and revised to reflect more recent interpretation of aerial photographs (Jedrzycki 2000) and the results obtained from field surveys.

2.4 Additional special elements

A list was developed of additional special elements that have not been documented in the study area but that have been documented in the region (the area in Alberta east of the Athabasca River, and north of Fort McMurray / Clearwater River). Elements were extracted from the ANHIC database or from published reports. Each element was then evaluated to determine if, from what is known of the required habitat, it could potentially occur within the study area. Through this process, a series of appendices were developed of rare and other notable elements that could occur in the study area and the LUs in which they would most likely occur.

3.0 RESULTS

3.1 Representative features

The study area includes good representation of a number of the landscapes and features of the Athabasca Plain Subregion of the Canadian Shield Natural Region. The natural history themes of the Athabasca Plain Subregion that are found within the study area are presented in Appendix 2. The themes found within a particular Landscape Unit are also listed in the 'Representative Features' section of that Unit.

For some of the Organic Wetland Level 2 themes identified for the Athabasca Dunes Ecological Reserve in *Alberta Protected Areas System Analysis* (Alberta Environmental Protection (AEP) 1994a), the levels of representation have been altered, as follows:

- Bog – some representation (listed as "well represented" in AEP 1994a)
- Graminoid fen – some representation (listed as "well represented" in AEP 1994a)
- Tamarack fen – some representation (no change)
- Shrub fen – well represented (no change)
- Forested – well represented (listed as "some representation" in AEP 1994a)

These changes are based on additional information on the peatland types that are present in the study area (Vitt *et al.* 1998).

3.2 Special features

The study area can be considered a nationally significant site as it falls almost entirely within two nationally significant ESAs (Figure 4).

In addition to the nationally significant features, a number of other special features (with different levels of significance) have been identified within the study area through the fieldwork done in 2000 plus the earlier, detailed work done by Landals (1978). Only a relatively small part of the study area was surveyed, however, so it is quite likely that the special features are more widespread than the surveys documented.

The special features that are found within the site are discussed within each of the Landscape Units, organized by level of significance. In addition, a summary of the special elements found within the study area that are currently on the ANHIC tracking and watch lists is presented in Appendix 1. This appendix includes the element occurrence number for those elements that occur in a particular Landscape Unit, and can be used as a link back to the ANHIC database to get more detailed information on a particular occurrence.

3.3 Landscape Units

To facilitate analysis, the study area was divided into five landscape units, each having fairly distinctive landscape features and vegetation. These units are listed below and illustrated in Figure 5.

Landscape Unit 1. ***Active Dune Field***
Landscape Unit 2. ***Sand Plain Complex***
Landscape Unit 3. ***Ice Contact Complex***
Landscape Unit 4. ***Peatland Complex***
Landscape Unit 5. ***Riverine***

Each LU and the representative and special features that are known or expected to occur there are described in the following sections. The special features are listed according to their level of significance (i.e., national, provincial, regional, local). The provincial SRanks (i.e., S1, S2, etc.) are shown beside those species and plant communities tracked by ANHIC. For definitions of SRank and the most up-to-date lists of both tracked and watched elements refer to the web page of ANHIC at http://www.cd.gov/preserving/ parks/anhic/flashindex.asp. The map associated with each LU lists the representative and special features according to their level of significance.

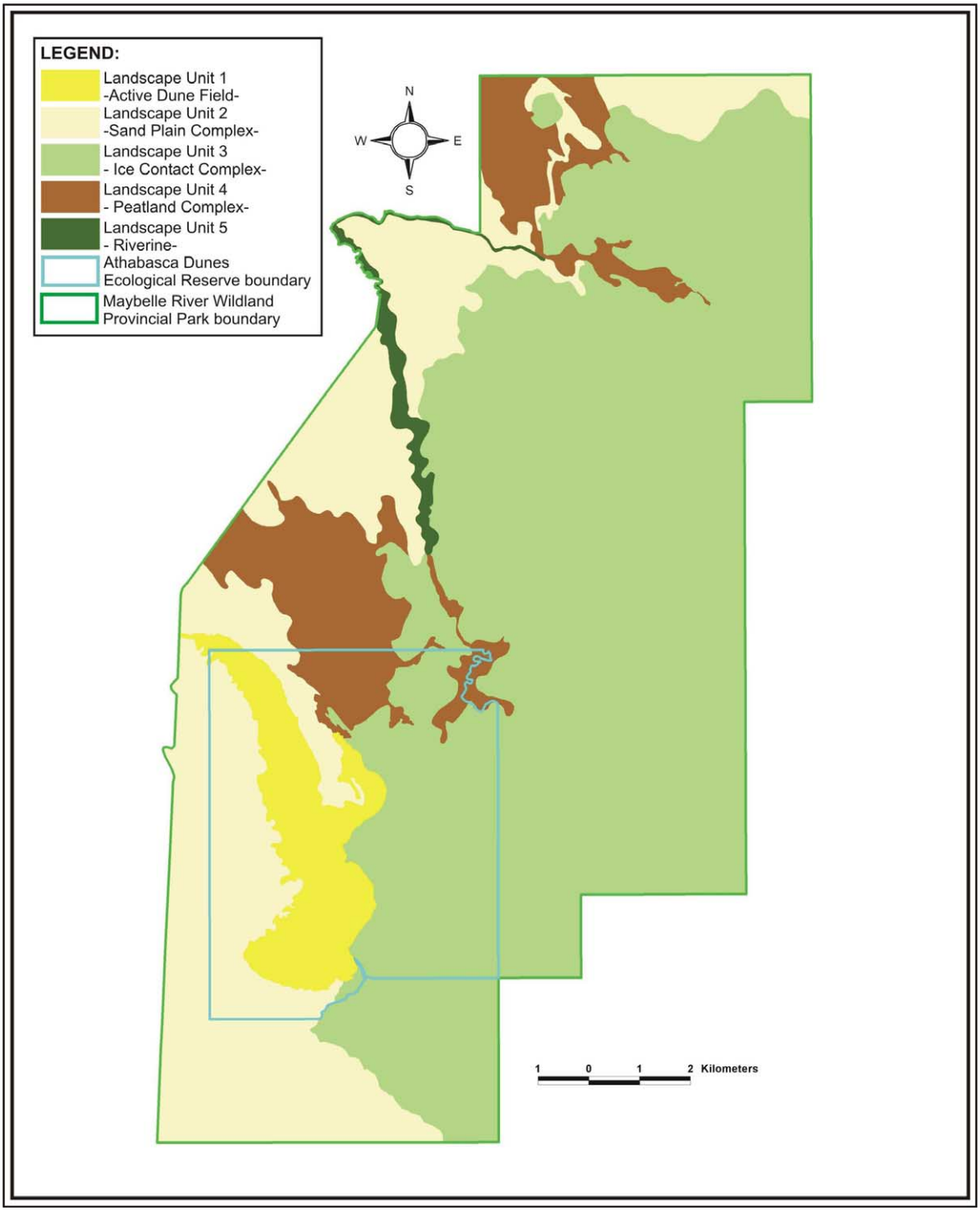


Figure 5. Landscape units of the study area.

3.4 Additional special elements

A list was developed of additional special elements from northeastern Alberta that potentially occur within the study area. Appendix 3 lists additional non-vascular and vascular plant and lichen species, including three liverwort species, 26 mosses, 23 vascular plant species and 12 lichens that have been reported for the region and may occur in the study area. Appendix 4 lists eight additional plant communities. Appendix 5 lists additional vertebrates and invertebrates, including 5 mammal species, 7 birds, 1 reptile, 11 moth and butterfly species, 3 spiders and 4 odonate species that may be expected to occur in the study area. Each species or community has been linked to the LU in which it is most likely to occur.

3.5 Landscape Unit 1. Active Dune Field (Map 1)

Size

- About 992 ha in size.
- Occupies about 5% of the study area.

Description

- An extensive area of active and partially stabilized sand made up predominantly of large, active transverse dunes and extensive sand sheets.
- Rows of roughly parallel dunes are migrating as a unit in a southeasterly direction.
- Sand flats called dune slacks are present where wind has excavated the sand down to a moist layer that is no longer susceptible to wind erosion (Jonker and Rowe 2001).
- There are also areas, called gravel pavement (Appendix 6 – 12), where sand has blown away leaving a surface covered by pebbles.
- There are a series of interdune wetlands in a large depression in the middle of the dune field. Landals (1978) suggested that these were formed as "a large linear lake or marsh has been infilled by the active sand mass".
- Sand sheets are sparsely vegetated areas of low undulations, dry flats and areas of gravel pavement. These are found throughout the dune field.
- There is a complex of dunes and wetlands at the southwestern edge of the active dune field.

Dominant Vegetation

- As discussed in detail in the introductory sections of this document, active sand areas are harsh environments that have only sparse vegetation, if any.
- Gravel pavements are largely unvegetated, although patches of awned hair-cap moss (*Polytrichum piliferum*) can be found here as well as on some of the sand flats.
- Probably the most extensive plant communities in this LU are those dominated by sand heather (*Hudsonia tomentosa*). They occur in flat areas of partially stabilized sands such as dune slacks and at the edges of some of the gravel pavements. They are most extensive on sand sheets along the windward (western) edge of the dune complex.
- The dunes themselves can be divided into six zones as shown in Figure 6 and discussed below.

Zone 1: A long gentle windward slope, subject to much sand movement and generally unvegetated.

Zone 2: A deflation zone on the windward side of the dune crest, also unvegetated.

Zone 3: The lee side of the dune crest. Although often unvegetated, sparse communities of one or several of the following species occur occasionally: western wheat grass (*Agropyron smithii*), northern awnless brome (*Bromus inermis* var. *pumpellianus*), narrow reed grass (*Calamagrostis stricta*), creeping red fescue (*Festuca rubra*), June grass (*Koeleria macrantha*) and Indian tansy (*Tanacetum bipinnatum* ssp*. huronense*).

Zone 4: The slip face – an area of rapid sand accumulation just over the dune crest that is very unstable and generally unvegetated.

Zone 5: A dune slack at the foot of the slip face that is protected by the dune from wind, but subject to sand accumulation off the dune face. A sparse, linear community dominated by narrow reed grass with many of the species found on the crest often occurs right at the base of the dune. If the slack is moist enough, pockets of willows or birch saplings might occur.

Zone 6: The lowest part of the dune slack, outside the area protected from the surface wind is a deflation zone where again little vegetation occurs.

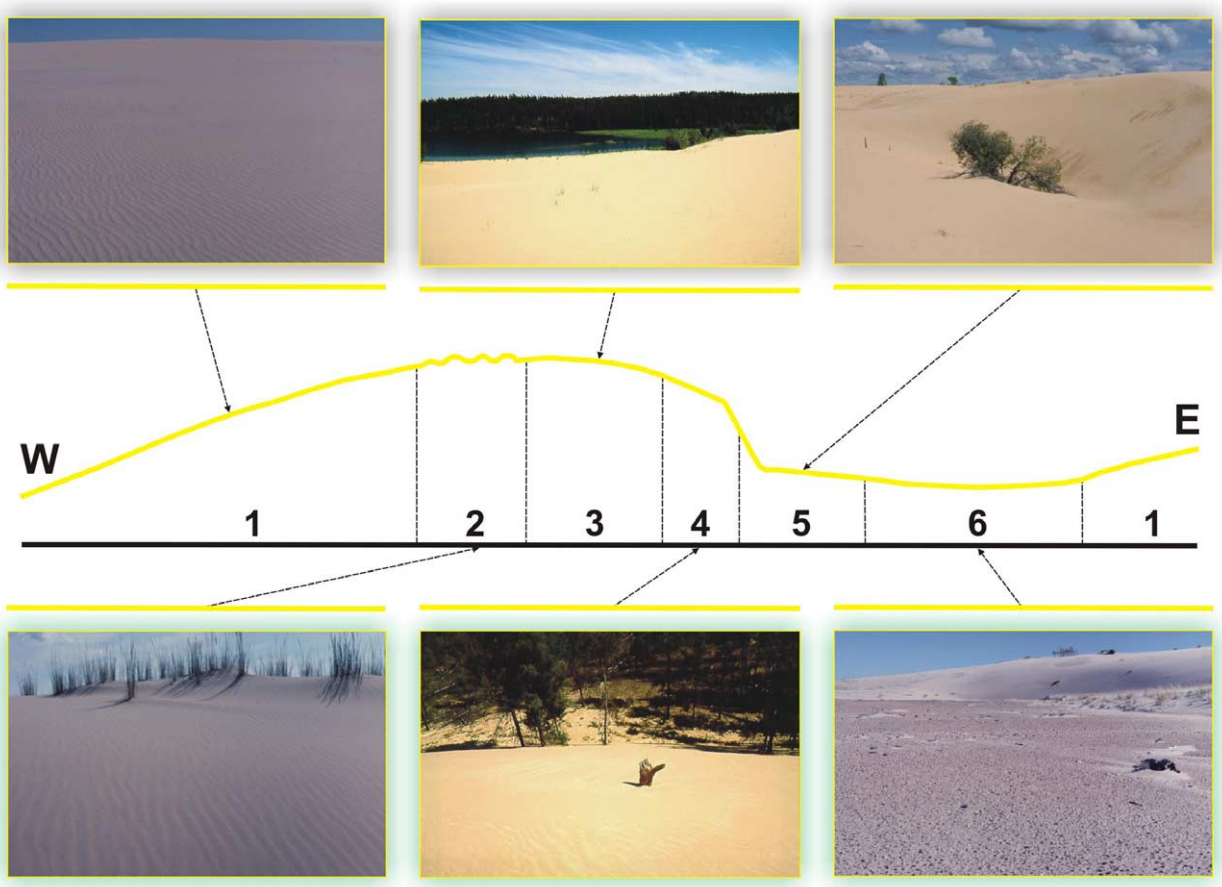


Figure 6. Zones of an active transverse dune along a west-east transect (after Raup and Argus 1982).

- The interdune wetlands provide an unusual habitat of moist sand that has a number of rare species as well as an extensive round-leaved sundew (*Drosera rotundifolia*) population. Willows and seedlings of birch and pine often surround the moist sand areas. Some of the wetlands are deep enough to have standing water in spots.
- The complex of dunes and wetlands at the southwest edge of LU 1 has small pockets of jack pine (*Pinus banksiana*), often mixed with paper birch (*Betula papyrifera*) on the dune slopes and water sedge (*Carex aquatilis*) dominated wetlands between the dunes.
- Small pockets of paper birch / bog cranberry (*Vaccinium vitis-idaea*) occur in slacks that have been protected from sand accumulation.

Representative Features

- Dune Field
  - Active Dune – well represented
  - Stabilized Dune – some representation
- Mineral Wetland
  - Marsh – some representation
  - Wet Dune Slack – well represented

Nationally Significant Features

- Dune complex.
  - LU1, LU2 and LU 4 and adjacent lands have some of the most diverse and unique examples of sandy terrain in Canada (Sweetgrass Consultants Ltd. 1997, p369).
- Transverse dunes (Appendix 6 – 9)
  - Large areas of inland active transverse dunes are quite rare (Landals 1978).

Provincially Significant Features

- Interdune wetlands (Appendix 6 – 10)
  - An unusual wetland feature.
  - Provides habitat for many rare species.

- American starburst lichen (*Imshaugia placorodia*) (S2)
    - Commonly found on jack pine in the area (Johnson 2001).
    - Noted from LU 3.
    - Expected to occur on jack pine in all other LUs.
- Rare lichen (*Stereocaulon condensatum*) (S1)
    - Found on sand in a sparse jack pine stand in LU 1 and on a sand ridge in LU 4.
    - Expected to occur in LU 2 and may also occur in LU 3.
- Large Canada St. John's-wort (*Hypericum majus*) (S2)
    - Areas of open, wet sand in the interdune wetlands.
    - Also found on sandy shores of some of the kettle lakes in LU 3.
- Short-tail rush (*Juncus brevicaudatus*) (S2)
    - Areas of open, wet sand in the interdune wetlands.
    - Also found on sandy shores of some of the kettle lakes in LU 3.
- Bog club moss (*Lycopodiella inundata*) (S1)
    - Areas of open, wet sand in the interdune wetlands.
    - Also found on sandy shores of some of the kettle lakes in LU 3 and in LU 5.
- Tyrrell's willow (*Salix tyrrellii*) (S1)
    - Found both at the edge of the interdune wetlands and scattered throughout the active dunes in the lee of dune crests (zone 3).
    - May also occur in areas of active sand in LU 2.
- Sand-dune chickweed (*Stellaria arenicola*) (S1)
    - Found throughout LU 1, often as part of the sparse plant communities on the lee side of dune crests (zone 3) or at the base of the slip face (zone 5).
    - Also found in LU 2 and may occur in LU 3 in areas of open sand such as blowouts.
- Indian tansy (*Tanacetum bipinnatum* ssp*. huronense*) (S2)
    - Found throughout LU 1, often as part of the sparse plant communities on the lee side of dune crests (zone 3) or at the base of the slip face (zone 5).
    - Also found in LU 2 and may occur in LU 3 in areas of open sand such as blowouts.
- Macloskey's violet (*Viola pallens*) (S1S2)
    - Found in LU 3 and may also occur in the interdune wetlands of LU 1.
- Cutworm moth species (*Euxoa cursoria*) (S?)
    - Collected at the south end of the active dunefield (Schmidt and Pohl 2000).
    - Second record of this species for Alberta.
    - A North American holarctic species more commonly found in the Yukon and the southwestern N.W.T.
- Arctic tern (*Sterna paradisaea*) (S1B) (Appendix 6. – 11)
    - A small nesting colony was discovered in gravel pavement areas of the dune field.
    - First confirmed nesting record for Alberta (Thomas and Carroll 2001).

Regionally Significant Features

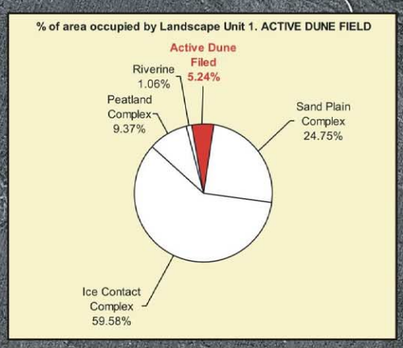
- Plant communities of active sand dunes
    - Very restricted in their distribution due to their specialized habitat needs.
- Carnivore travelling route
    - Edges of the dune field often function as a travelling route for wolves, foxes, bears and other carnivores.

Locally Significant Features

- Junebugs (*Phyllophaga* spp.)
    - Seasonally abundant in sand landscapes.
    - Provide a food source for a wide assortment of species (e.g., sandhill cranes, nighthawks, bears and foxes).
- Sandhill crane (*Grus canadensis*) (S4B)
    - Numerous tracks throughout the dunefield.
    - Most commonly found along edges of active sand, at sand / water interfaces or sand / forest margins.
- Black bear habitat
    - Winter denning area (Landals 1978).
    - Summer feeding area (grazing on the new shoots of sand heather and fruits of crowberries), especially at the dune / forest margins.

Map 1. Maybelle River Study Area - Landscape Unit 1. ACTIVE DUNE FIELD

Representative Features of Landscape Unit 1. Active Dune Field		
Component	**Level 1 Theme**	**Level 2 Theme**
Sandy Upland	Dune Field	Active Dune – well represented
		Stabilized Dune – some representation
Wetland	Mineral	Marsh – some representation
		Wet Dune Slack – well represented



Significant Features of Landscape Unit 1. Active Dune Field				
National	**Provincial**		**Regional**	**Local**
dune complex	interdune wetlands		plant communities of active sand dunes	Junebug (*Phyllophaga* spp.) emergence - seasonally important food source
transverse dunes	rare lichen (*Stereocaulon condensatum*) (S1)	P*	carnivore travelling route	sandhill crane (*Grus canadensis*) (S4B) P
	large Canada St. John's-wort (*Hypericum majus*) (S2)	P		black bear (*Ursus americanus*) (S5) denning / feeding area
	short-tail rush (*Juncus brevicaudatus*) (S2)	P		
	bog club moss (*Lycopodiella inundata*) (S1)	P		
	Tyrrell's willow (*Salix tyrrellii*) (S1)	P		
	sand-dune chickweed (*Stellaria arenicola*) (S1)	P		
	Indian tansy (*Tanacetum bipinnatum* ssp. *huronense*) (S2)	P		
	cutworm moth (*Euxoa cursoria*) (S?)	P		
	Arctic tern (*Sterna paradisaea*) (S1B) nesting colony			
	American starburst lichen (*Imshaugia placorodia*) (S2)	E		
	Macloskey's violet (*Viola pallens*) (S1S2)	E		

P* = present; E* = expected

N

Legend:

Landscape Unit 1. - ACTIVE DUNE FIELD -

Maybelle River Study Area boundary

1 0 1 2 Kilometers

SPACE IMAGING

NATURAL HERITAGE INFORMATION CENTRE ALBERTA

3.6 Landscape Unit 2. Sand Plain Complex (Map 2)

Size
- About 4,684 ha in size
- Occupies about 25% of the total study area.

Description
- Predominantly a level to undulating, sand-dominated landscape.
- Composed of an aeolian blanket or sand sheet, usually over glaciofluvial materials.
- A few vegetated, rolling dunes are present with infrequent blowouts.
- Wetlands are essentially absent, although some small ones do occur.

Dominant Vegetation
- Frequent fires are reflected in the vegetation patterns.
- Much of the sand plain area is covered with closed, young jack pine (*Pinus banksiana*) with sparse understory, regenerating after fires (Meijer 2002). There are considerable quantities of dead and down woody material (Appendix 6 – 17).
- Occasional patches of mature open stands of jack pine with a lichen understory occur in locations that have escaped recent fires.
- Jack pine / green alder (*Alnus crispa*) communities occur in moister locations (e.g. bases of sand ridges).
- Blowouts are generally unvegetated, with areas of sand heather / lichen crust (*Hudsonia tomentosa* / *Placynthiella uliginosa*) beginning the stabilization process.
- Immature stands of jack pine with a sparse understory dominated by crowberry (*Empetrum nigrum*) are common just west of the active dune area, marking the advance of the forest onto the now stabilized sand.
- There is often a zone of a sparse crowberry community between the immature jack pine and the sand heather community discussed in LU 1.

Representative Features
- Dune Field
  - Stabilized Dune – some representation
- Sandy Plain
  - Coniferous forest – well represented
  - Deciduous forest – some representation
  - Recently burned – well represented
  - Erosional Features – well represented

Nationally Significant Features
- Dune complex
  - LU1, LU2 and LU 4and adjacent lands have some of the most diverse and unique examples of sandy terrain in Canada.

Provincially Significant Features
- American starburst lichen (*Imshaugia placorodia*) (S2)
  - Commonly found on jack pine in the study area (Johnson 2001).
  - Noted from LU 3.
  - Expected to occur on jack pine in all other LUs in the study area.
- Lichen (*Stereocaulon condensatum*) (S1)
  - Found on sand in sparse jack pine in LU 1 and on LU 4.
  - Expected to occur in LU 2 and could occur in LU 3 as well.
- Tyrrell's willow (*Salix tyrrellii*) (S1)
  - Found scattered throughout LU 1.
  - May also occur in areas of active sand in LU 2.
- Sand-dune chickweed (*Stellaria arenicola*) (S1)
  - Found throughout LU 1 as well as in LU 2 in active sand areas.
  - May also occur in LU 3.
- Indian tansy (*Tanacetum bipinnatum* ssp. *huronense*) (S2)
  - Found throughout LU 1 as well as in LU 2 in active sand areas.
  - May also occur in LU 3.

- Moth (*Oligia egens*) (S?)
    - An uncommon to rare species of open, wooded sandy areas in the prairie and parkland regions (Schmidt and Pohl 2000).
    - Collected in this LU, well north of its known range.
- Looper moth (*Nepytia canosaria*) (S?)
    - Collected in this LU.
    - The first record of this species for Alberta, previously known to occur only as far west as eastern Saskatchewan (Schmidt and Pohl 2000).

Regionally Significant Features

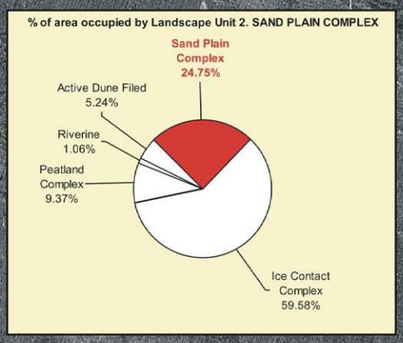
- Stemless lady's-slipper (*Cypripedium acaule*) (S3) (Appendix 6 – 19)
    - A species largely restricted to the Athabasca Plain Natural Subregion in Alberta.
    - Found in this LU and LU 3.
- Moth (*Eufidonia convergaria*) (S?)
    - Collected in this LU.
    - A substantial northward range extension from central Alberta (Schmidt and Pohl 2000).

Locally Significant Features

- Sharp-tailed grouse (*Tympanuchus phasianellus*) (S4)
    - Observed in this LU.
    - A rare species for the study area and 'possible breeder' (Thomas and Carroll 2001).
- Sandhill crane (*Grus canadensis*) (S4B).
    - Important foraging habitat.
- Common nighthawk (*Chordeiles minor*) (S5B)
    - Open jack pine forests provide important nesting and feeding habitat (Landals 1978).
- Mountain bluebird (*Sialia currucoides*) (S5B)
    - Observed in this LU in a jack pine stand near the active dunefield.
    - A rare species for the study area and a 'possible breeder' (Thomas and Carroll 2001).
- Red squirrel habitat
    - Quality habitat available – has ample food source of jack pine cones (Landals 1978).
    - High density of squirrels.
- Black bear habitat (Appendix 6 – 15)
    - Important feeding habitat.

Map 2. Maybelle River Study Area - Landscape Unit 2. SAND PLAIN COMPLEX

Representative Features of Landscape Unit 2. Sand Plain Complex		
Component	**Level 1 Theme**	**Level 2 Theme**
Sandy Upland	Dune Field	Stabilized Dune – some representation
	Sandy Plain	Coniferous Forest – well represented
		Deciduous Forest – some representation
		Recently Burned – well represented
		Erosional Features – well represented



Significant Features of Landscape Unit 2. Sand Plain Complex							
National	**Provincial**		**Regional**		**Local**		
dune complex	sand-dune chickweed (*Stellaria arenicola*) (S1)	P*	stemless lady's-slipper (*Cypripedium acaule*) (S3)	P	sharp-tailed grouse (*Tympanuchus phasianellus*) (S4)	P
	Indian tansy (*Tanacetum bipinnatum* ssp. *huronense*) (S2)	P	moth (*Eufidonia convergaria*) (S?)	P	sandhill crane (*Grus canadensis*) (S4B) foraging area	
	moth (*Oligia egens*) (S?)	P			common nighthawk (*Chordeiles minor*) (S5B) nesting and feeding habitat	
	looper moth (*Nepydia canosaria*) (S?)	P			mountain bluebird (*Sialia currucoides*) (S5B)	P
	American starburst lichen (*Imshaugia placorodia*) (S2)	E			red squirrel (*Tamiasciurus hudsonicus*) (S5) - high density	
	rare lichen (*Stereocaulon condensatum*) (S1)	E			black bear (*Ursus americanus*) (S5) feeding habitat	
	Tyrrell's willow (*Salix tyrrellii*) (S1)	E				

P* = present; E* = expected

N

Legend:

- Landscape Unit 2. - SAND PLAIN COMPLEX -
- Maybelle River Study Area boundary

1 0 1 2 Kilometers

SPACE IMAGING

NATURAL HERITAGE INFORMATION CENTRE ALBERTA

3.7 Landscape Unit 3. Ice Contact Complex (Map 3)

Size
- About 11,273 ha in size.
- Occupies about 60% of the study area.

Description
- Rough topography.
- A complex of ice contact landforms including crevasse fillings, kames and kettle holes.
- A substantial portion of this unit is a kame complex of steep-sided ridges and rounded or conical hills, interspersed with kettle lakes.
- The ridges and hills are comprised of coarse textured materials such as gravels and sands.
- Kettle lakes are numerous, deep and clear; usually surrounded by narrow, clean sandy or cobble beaches and wooded backshores (Appendix 6 – 13).
- Small streams interconnect some of the lakes.

Dominant Vegetation
- Jack pine (*Pinus banksiana*) communities from immature stands with little or no understory to pockets of mature stands with a lichen mat dominate the landscape.
- Paper birch / common blueberry (*Betula papyrifera / Vaccinium myrtilloides*) communities predominate in mesic pockets between hills and ridges and around lakes. Sometimes Alaskan birch (*Betula neoalaskana*) or aspen (*Populus tremuloides*) form a significant component of the tree layer in these communities.
- Steep slopes with a southerly orientation often have graminoid slopes dominated by hay sedge (*Carex siccata*).
- Kettle lakes tend to be steep sided and deep, with only a narrow emergent vegetation zone surrounded by a narrow beach zone.
- Small pockets of emergent vegetation, dominated by hairy-fruited sedge (*Carex lasiocarpa*) or beaked sedge (*Carex rostrata*) are present.
- Some ponds have floating-leaved and submerged aquatic vegetation, but this has not been studied in detail.
- The narrow beach zone is made up of cobbles or sand at or just above the water table. This provides a moist, sparsely vegetated habitat with rare species such as mountain club moss (*Huperzia selago*) and bog club moss (*Lycopodiella inundata*).
- Some of the small lakes have a narrow band of floating poor fen vegetation.
- Vegetation along small streams was not studied, but willows (*Salix* spp.) and sweet gale (*Myrica gale*) would be expected, as well as emergent vegetation such as water sedge (*Carex aquatilis*) along the shoreline.

Representative Features
- Kame Complex
  - Kame moraine– well represented
  - Crevasse fillings – some representation
  - Coniferous forest – well represented
  - Recently burned – well represented
- Mineral Wetland
  - Marsh – some representation
- Organic Wetland
  - Bog – some representation
  - Shrub fen – some representation
- Lake
  - Mesotrophic lake - well represented

Nationally Significant Features
- Ice-contact complex
  - LU3 is part of the Paxton-Larocque Lakes ESA. This ESA is ranked as nationally significant and is recognized for its classic ice contact features.

Provincially Significant Features
- American starburst lichen (*Imshaugia placorodia*) (S2)
  - Commonly found on jack pine in the area (Johnson 2001).
  - Noted in this landscape unit and expected to occur on jack pine in all other LUs.

- Lichen (*Stereocaulon condensatum*) (S1)
  - Found on sand in jack pine stands in LU 1 and LU 4.
  - Expected to occur in LU 2 and LU 3 on sandy sites.
- Watershield (*Brasenia schreberi*) (S1)
  - Floating-leaved aquatic plant found in LU 3 in small lakes between sand ridges.
- Cyperus-like sedge (*Carex pseudocyperus*) (S2)
  - Found at the edge of a kettle lake.
  - May also occur in wetlands in LU 4.
- Beaked sedge (*Carex rostrata*) (S2)
  - Found at the edge of a kettle lake.
  - May also occur in wetlands in LU 4.
- Mountain club-moss (*Huperzia selago*) (S1)
  - Found on the marly shore of one of the kettle lakes in LU3.
  - May also occur in LU 4 and LU 5.
- Large Canada St. John's-wort (*Hypericum majus*) (S2)
  - Found on the moist, sparsely vegetated habitat of some of the kettle lake beaches.
  - Also found in the interdune wetlands of LU 1.
- Short-tail rush (*Juncus brevicaudatus*) (S2)
  - Found on the moist, sparsely vegetated habitat of some of the kettle lake beaches.
  - Also found in the interdune wetlands of LU 1.
- Bog club moss (*Lycopodiella inundata*) (S1)
  - Found on the moist, sparsely vegetated habitat of some of the kettle lake beaches.
  - Also found in the interdune wetlands of LU 1 and in LU 5.
- Pygmy water-lily (*Nymphaea leibergii*) (S1) (Appendix 6 – 6)
  - Floating-leaved aquatic plant found in LU 3 in small lakes between sand ridges.
- Hot-springs millet (*Panicum acuminatum*) (SU)
  - Found on graminoid slopes.
- Blunt-leaved pondweed (*Potamogeton obtusifolius*) (S2)
  - A submerged aquatic species found in shallow water bodies.
  - Was found in the general area in 1975, but records of the exact location are sketchy.
  - Most likely occurs in LU 3, but it may also occur in some of the ponds in LU 4.
- Pitcher-plant (*Sarracenia purpurea*) (S2)
  - A fen and bog species found in LU 4 and around some of the ponds in LU 3.
- Sand-dune chickweed (*Stellaria arenicola*) (S1)
  - Found throughout LU 1 as well as in LU 2 in areas of active sand.
  - May also occur in LU 3 in active sand areas.
- Indian tansy (*Tanacetum bipinnatum* ssp*. huronense*) (S2)
  - Found throughout LU 1 as well as in LU 2 in areas of active sand.
  - May also occur in LU 3 in active sand areas.
- Horned bladderwort (*Utricularia cornuta*) (S1)
  - A species of poor fens and muddy shores.
  - Found in the general area in 1971, but records of the exact location are sketchy.
  - Most likely occurs in LU 4, but it may also occur in some of the ponds in LU 3.
- Macloskey's violet (*Viola pallens*) (S1S2)
  - Found on the shore of kettle lakes.
  - May also occur in the interdune wetlands of LU 1.
- Bog rosemary / pitcher plant / peat moss (*Andromeda polifolia / Sarracenia purpurea / Sphagnum angustifolium*) poor fen (S1S2)
  - A rare plant community found as a 4 to 6 m wide band of floating vegetation around some of the small lakes.
  - Expected to occur around small lakes in LU 4 as well.
- River jewelwing damselfly (*Calopteryx aequabilis*) (S1)
  - Recorded in LU5 and expected to occur in LU3.

Regionally Significant Features

- Stemless lady's-slipper (*Cypripedium acaule*) (S3)
  - A species largely restricted to the Athabasca Plain Natural Subregion in Alberta.
  - Found in this LU and LU 2.
- Deciduous woodlands
  - Found in moist pockets between ridges and around lakes.
  - Regionally uncommon.

- Graminoid slopes (Appendix 6 –5)
    - Regionally uncommon habitats found on steep slopes with a southerly orientation.
- Canada darner (*Aeshna canadensis*) (S4S5)
    - Found in this LU (Hornung 2001) and expected in LU4 and LU5.
    - A significant northwards range extension – the next closest Alberta record being from the Fawcett area north of Westlock (Rice 2000).
- Subarctic darner (*Aeshna subarctica*) (S4S5)
    - Collected in this LU (Hornung 2001).
    - A significant range extension northwards – the next closest record is approximately 700 km to the southwest (Rice 2000).
- Upland sandpiper (*Bartramia longicauda*) (S3B)
    - Two pairs of were observed exhibiting territorial and distraction display behaviour.
    - Confirmed breeder – the northernmost AB breeding record (Thomas and Carroll 2001).

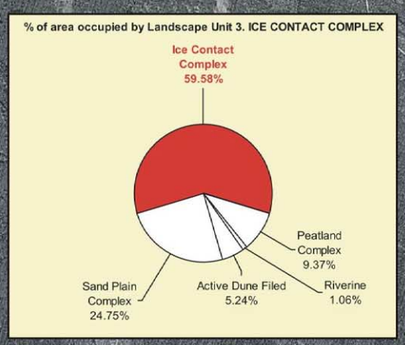
Locally Significant Features

- Old growth jack pine / lichen woodlands
    - Infrequent in the study area due to extensive recent fires.
- Diverse habitats around kettle lakes
    - Support a high diversity of mammal species (e.g., moose, beaver, muskrat, otter, small mammals, etc.).
- Canadian toad *(Bufo hemiophrys)* (S4)
    - Observed in this LU; the wetlands here appear to provide suitable breeding habitat.
    - Also occurs in LU 5 and may occur in LU 4.
- Eared grebe (*Podiceps nigricollis*) (S4B)
    - Observed on a large lake at the south end of this LU.
    - Rare in the study area and a 'possible breeder' (Thomas and Carroll 2001).
- Horned grebe (*Podiceps auritus*) (S3B)
    - Observed on a lake at the eastern margin of the active dunefield.
    - Rare in the study area and a 'possible breeder' (Thomas and Carroll 2001).
- Surf scoter (*Melanitta perspicillata*) (SAB)
    - Observed on a large lake at the south end of this LU.
    - Uncommon to localized in the study area and a 'probable breeder' (Thomas and Carroll 2001).
- Bald eagles (*Haliaeetus leucocephalus*) (S4B)
    - Confirmed nesting in this LU (Thomas and Carroll 2001).
- Common nighthawk (*Chordeiles minor*) (S5B)
    - Observed foraging and feeding in this LU.
- Rusty blackbirds (*Euphagus carolinus*) (S4B)
    - Observed in this LU on a lakeshore snag.
    - Rare in the study area and a 'possible breeder' (Thomas and Carroll 2001).

Map 3. Maybelle River Study Area - Landscape Unit 3. ICE CONTACT COMPLEX

Representative Features of Landscape Unit 3. Ice Contact Complex

Component	Level 1 Theme	Level 2 Theme
Sandy Upland	Kame Complex	Kame Moraine – well represented
		Crevasse Fillings – some representation
		Coniferous Forest – well represented
		Recently Burned – well represented
Wetland	Mineral	Marsh – some representation
	Organic	Bog – some representation
		Shrub fen – some representation
	Lake	Mesotrophic – well represented



Significant Features of Landscape Unit 3. Ice Contact Complex

National	Provincial		Regional		Local	
ice-contact complex	American starburst lichen (*Imshaugia placorodia*) (S2)	P*	stemless lady's-slipper (*Cypripedium acaule*) (S3)	P	old-growth jack pine / lichen woodlands	
	watershield (*Brasenia schreberi*) (S1)	P	deciduous woodlands		diverse habitats around kettle lakes	
	cyperus-like sedge (*Carex pseudocyperus*) (S2)	P	graminoid slopes		Canadian toad (*Bufo hemiophrys*) (S4) breeding area	
	beaked sedge (*Carex rostrata*) (S2)	P	Canada darner (*Aeshna canadensis*) (S4S5)	P	eared grebe (*Podiceps nigricollis*) (S4B)	P
	mountain club-moss (*Huperzia selago*) (S1)	P	subarctic darner (*Aeshna subarctica*) (S4S5)	P	horned grebe (*Podiceps auritus*) (S3B)	P
	large Canada St. John's-wort (*Hypericum majus*) (S2)	P	upland sandpiper (*Bartramia longicauda*) (S3B)	P	surf scoter (*Melanitta perspicillata*) (S4B)	P
	short-tail rush (*Juncus brevicaudatus*) (S2)	P			bald eagle (*Haliaeetus leucocephalus*) (S4B) nesting area	
	bog club moss (*Lycopodiella inundata*) (S1)	P			common nighthawk (*Chordeiles minor*) (S5B) foraging, feeding	
	pygmy water-lily (*Nymphaea leibergii*) (S1)	P			rusty blackbird (*Euphagus carolinus*) (S4B)	P
	hot-springs millet (*Panicum acuminatum*) (SU)	P				
	pitcher-plant (*Sarracenia purpurea*) (S	P				
	Macloskey's violet (*Viola palfens*) (S1S2)	P				
	bog rosemary / pitcher plant / peat moss (*Andromeda polifolia / Sarracenia purpurea / Sphagnum angustifolium*) poor fen (S1S2)	P				
	lichen (*Stereocaulon condensatum*) (S1)	E				
	blunt-leaved pondweed (*Potamogeton obtusifolius*) (S2)	E				
	sand-dune chickweed (*Stellaria arenicola*) (S1)	E				
	Indian tansy (*Tanacetum bipinnatum* ssp. *huronense*) (S2)	E				
	horned bladderwort (*Utricularia cornuta*) (S1)	E				
	River jewelwing damselfly (*Calopteryx aequabilis*) (S1)	E				

P* = present; E* = expected

N

Legend:

Landscape Unit 3. - ICE CONTACT COMPLEX -

Maybelle River Study Area boundary

1 0 1 2 Kilometers

NATURAL HERITAGE INFORMATION CENTRE ALBERTA

SPACE IMAGING

3.8 Landscape Unit 4. Peatland Complex (Map 4)

Size
- About 1,773 ha in size.
- Occupies about 9% of the study area.

Description
- Extensive organic wetlands, dominantly a treed fen complex with inclusions of small bogs.
- Fens are not patterned and without permafrost (Vitt *et al.* 1998).
- Bogs are underlain by permafrost and have collapse scars (Vitt *et al.* 1998).
- Organic deposits occur over aeolian sands and are shallow in some areas.
- Small sand dune ridges are present.

Dominant Vegetation
- Areas of shrubby fens, dominated by shrubs such as leatherleaf (*Chamaedaphne calyculata*), common Labrador tea (*Ledum groenlandicum*) and northern laurel (*Kalmia polifolia*).
- Areas dominated by dwarf birch (*Betula pumila*) or willows (*Salix* spp.) were noted in the region and may be present in the study area.
- Extensive areas of open, treed fen with some wooded bogs:
  - Primarily black spruce (*Picea mariana*) with a layer of shrubs, usually leatherleaf and common Labrador tea, with a carpet of peat moss (*Sphagnum* spp.).
  - Some stands have scattered tamarack (*Larix laricina*) (Appendix 6 – 1).
- On dryer, level organic areas, a black spruce / common Labrador tea / Schreber's feather moss (*Pleurozium schreberi*) community occurs (Meijer 2002).
- Small areas of graminoid wetlands may be present, based on aerial photograph review, but were not documented during the 2000 field surveys.
- Both successional and mature jack pine (*Pinus banksiana*) communities occur on the small dune ridges, as discussed in more detail in LU 2.
- There are some areas of open water, often with a floating-leaved aquatic community of yellow pond lily (*Nuphar lutea*) then edged by peat mosses (Appendix 6 – 7).

Representative Features
- Dune Field
  - Stabilized Dune – some representation
- Organic Wetland:
  - Bog – some representation
  - Graminoid fen – some representation
  - Tamarack fen – some representation
  - Shrub fen – well represented
  - Forested – well represented

Nationally Significant Features
- Dune complex
  - LU1, LU2 and LU 4and adjacent lands have some of the most diverse and unique examples of sandy terrain in Canada.

Provincially Significant Features
- American starburst lichen (*Imshaugia placorodia*) (S2)
  - Commonly found on jack pine in the area.
  - Noted from LU 3.
  - Expected to occur on jack pine in all other LUs in the study area.
- Lichen (*Stereocaulon condensatum*) (S1)
  - Found on one of the small sand ridges in this LU.
  - Also found in LU 1.
  - Expected to occur in LU 2 and could occur in LU 3 as well.
- Rare peat moss (*Sphagnum platyphyllum*) (S1)
  - Found in an unusual wetland complex of a peat moss-dominated poor fen situated between the east face of the dune and a large pond with yellow pond lily and boggy islands.
- Liverwort (*Gymnocolea inflata*) (S1)
  - Found growing on the peat moss in a treed poor fen in this LU (Johnson 2001).

- Cyperus-like sedge (*Carex pseudocyperus*) (S2)
    - Found in LU 3.
    - May also occur as emergent vegetation around wetlands in LU 4.
- Beaked sedge (*Carex rostrata*) (S2)
    - Found in LU 3.
    - May also occur as emergent vegetation around wetlands in LU 4.
- Ground-fir (*Diphasiastrum sitchense*) (S2)
    - Found in an area dominated by peat moss (*Sphagnum fuscum*).
- Mountain club-moss (*Huperzia selago*) (S1)
    - A species of moist substrates in fens bogs and woods.
    - Found on the marly shore of one of the kettle lakes in LU 3.
    - May also occur in LU 4 and LU 5.
- Blunt-leaved pondweed (*Potamogeton obtusifolius*) (S2)
    - A rare submerged aquatic of shallow water bodies.
    - Found in the general area in 1975, but records of the exact location are sketchy.
    - Most likely occurs in LU 3, but it may also occur in some of the ponds in LU 4.
- Pitcher-plant (*Sarracenia purpurea*) (S2) (Appendix 6 – 8)
    - Found in this LU and around some of the ponds in LU 3.
- Horned bladderwort (*Utricularia cornuta*) (S1)
    - A species of poor fens and muddy shores.
    - Found in the area in 1971, but records of the exact location are sketchy.
    - Most likely occurs in this LU and may also occur in some of the ponds in LU 3.
- Bog rosemary / pitcher plant / peat moss (*Andromeda polifolia / Sarracenia purpurea / Sphagnum angustifolium*) poor fen (S1S2)
    - A rare plant community, found in LU 3.
    - Expected to occur around small lakes in LU 4 as well.

Regionally Significant Features

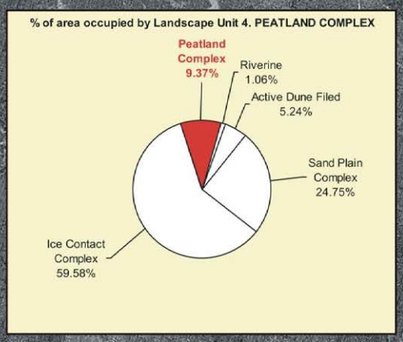
- Northern marble (Euchloe creusa) (S4)
    - Collected in this LU.
    - Species is widespread in the foothills and mountains; boreal populations are localized and apparently not continuous with the mountain populations (Schmidt and Pohl 2000).
- Canada darner (*Aeshna canadensis*) (S4S5)
    - Expected in this LU and LU5 where peaty waterbodies, beaver ponds, and marshes occur.
    - Confirmed in LU 3.

Locally Significant Features

- Bog fritillary (*Boloria eunomia*) (S5)
    - Recorded in this LU.
    - A widespread but localized species in the boreal forest (Schmidt and Pohl 2000).
- Canadian toad (*Bufo hemiophrys*) (S4)
    - Occurs in LU 3 and LU 5; may also occur in LU 4.
- Sandhill crane (*Grus canadensis*) (S4B)
    - A 'possible breeder' in the study area (Thomas and Carroll 2001).
    - May utilize suitable habitats in this LU for nesting purposes.
- Great gray owl (*Strix nebulosa*) (S4)
    - Observed in this LU in an extensive peatland at the north end of the study area.
    - Considered rare for the park.
    - A 'possible breeder' (Thomas and Carroll 2001).
- Arctic shrew (*Sorex arcticus*) (S5)
    - Collected only in this LU.

Map 4. Maybelle River Study Area - Landscape Unit 4. PEATLAND COMPLEX

Representative Features of Landscape Unit 4. Peatland Complex		
Component	**Level 1 Theme**	**Level 2 Theme**
Sandy Upland	Dune Field	Stabilized Dune – some representation
Wetland	Organic	Bog - some representation
		Graminoid Fen - some representation
		Tamarack Fen - some representation
		Shrub Fen – well represented
		Forested – well represented



Significant Features of Landscape Unit 4. Peatland Complex							
National	**Provincial**		**Regional**		**Local**		
dune complex	lichen (*Stereocaulon condensatum*) (S1)	P*	northern marble (*Euchloe creusa*) (S4)	P	bog fritillary (*Boloria eunomia*) (S5)	P
	peat moss (*Sphagnum platyphyllum*) (S1)	P	Canada darner (*Aeshna canadensis*) (S4S5)	E	great gray owl (*Strix nebulosa*) (S4)	P
	liverwort (*Gymnocolea inflata*) (S1)	P			Arctic shrew (*Sorex arcticus*) (S5)	P
	ground-fir (*Diphasiastrum sitchense*) (S2)	P			Canadian toad (*Bufo hemiophrys*) (S4)	E
	pitcher-plant (*Sarracenia purpurea*) (S2)	P			sandhill crane (*Grus Canadensis*) (S4B)	E
	American starburst lichen (*Imshaugia placorodia*) (S2)	E				
	cyperus-like sedge (*Carex pseudocyperus*) (S2)	E				
	beaked sedge (*Carex rostrata*) (S2)	E				
	mountain club-moss (*Huperzia selago*) (S1)	E				
	blunt-leaved pondweed (*Potamogeton obtusifolius*) (S2)	E				
	horned bladderwort (*Utricularia cornuta*) (S1)	E				
	bog rosemary / pitcher plant / peat moss (*Andromeda polifolia / Sarracenia purpurea / Sphagnum angustifolium*) poor fen (S1S2)	E				

P* = present; E* = expected

Legend:

- Landscape Unit 4. - PEATLAND COMPLEX -
- Maybelle River Study Area boundary

1 0 1 2 Kilometers

N

SPACE IMAGING

NATURAL HERITAGE INFORMATION CENTRE ALBERTA

3.9 Landscape Unit 5. Riverine (Map 5)

Size
- About 201 ha in size.
- Occupies about 1% of the study area.

Description
- Narrow zones vegetation adjacent to streams and on slopes of the Maybelle River valley.
- Includes small oxbow lakes usually occupied by beaver and muskrats.
- West side of the river valley is steep and with numerous sandy ridges, east side is lower and more sloped.
- Short, fast-flowing spring-fed creeks are present in the valley.

Dominant Vegetation
- Benches along the Maybelle River have closed mixed deciduous stands of Alaskan birch (*Betula neoalaskana*) and balsam poplar (*Populus balsamifera*), often with stiff club-moss (*Lycopodium annotinum*) as a significant understory component (Appendix 6 – 4).
- Alaskan birch predominates on more mesic sites, with the one site looked at having bluejoint (*Calamagrostis canadensis*) as the main understory species (Allen and Johnson 2000).
- Some lower river terraces have mature black spruce / Schreber's feather moss stands (*Picea mariana / Pleurozium schreberi*) (Appendix 6 –3).
- Willow (*Salix* spp.) and alder (*Alnus tenuifolia*) shrublands are likely the main plant communities along creeks, but were not looked at in the 2000 study.
- Emergent and wet meadow vegetation such as swamp horsetail (*Equisetum fluviatile*), cattail (*Typha latifolia*) or water sedge (*Carex aquatilis*) communities might be expected adjacent to oxbow lakes, but again these were not looked at in 2000.

Representative Features
- Floor / Stream
  - River – well represented
  - Bog stream – some representation
- Mineral Wetland
  - Marsh – some representation

Nationally Significant Features
  - Significant landscape
  - Part of the Maybelle River Sand Hills nationally significant ESA.

Provincially Significant Features
- American starburst lichen (*Imshaugia placorodia*) (S2)
  - Commonly found on jack pine in the study area.
  - Noted from LU 3.
  - Expected to occur on jack pine in all other LUs in the study area.
- Mountain club-moss (*Huperzia selago*) (S1)
  - A species of moist substrates in fens, bogs and woods.
  - Found on the marly shore of one of the kettle lakes in LU 3.
  - May also occur in LU 4 and LU 5.
- Bog club moss (*Lycopodiella inundata*) (S1)
  - Found this LU as well as LU 1 and LU 3.
- River jewelwing damselfly (*Calopteryx aequabilis*) (S1)
  - Recorded in this LU along the Maybelle River and expected in LU3.
  - These records represent a substantial extension to its known range.

Regionally Significant Features
- Springs
  - Regionally uncommon.
- Canada darner (*Aeshna canadensis*) (S4S5)
  - Expected in this LU and LU4.
  - Confirmed in LU 3.

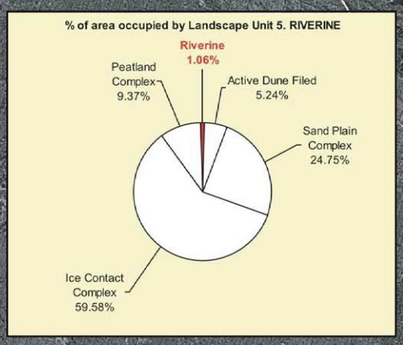
- Hooded mergansers (*Lophodytes cucullatus*) (S2B)
    - Observed on the Maybelle River.
    - Rare in the study area; no evidence of breeding (Thomas and Carroll 2001).
    - Only confirmed breeding records are considered provincially significant.

Locally Significant Features

- Mature to old-growth forests
    - Main LU they are found with in the study area.
- Distinctive plant communities
    - Communities along the Maybelle River are unique to this LU.
- High diversity of habitats
    - Important habitats for mammal species (e.g., porcupine, shrews, beaver, muskrat, otter, black bear, moose, etc.).
- Canadian toad (*Bufo hemiophrys*) (S4)
    - Confirmed in this LU.
    - Also occurs in LU 3 and may occur in LU 4.
- Winter wren (*Troglodytes troglodytes*) (S4B)
    - Recorded in deciduous forest bordering the Maybelle River.
    - Rare in the study area and a 'possible breeder' (Thomas and Carroll 2001).
- Hermit thrush (*Catharus guttatus*) (S5B)
    - Active nest found in this LU.
    - Uncommon in the study area (Thomas and Carroll 2001).

Map 5. Maybelle River Study Area - Landscape Unit 5. RIVERINE

Representative Features of Landscape Unit 5. Riverine		
Component	**Level 1 Theme**	**Level 2 Theme**
Valley / Ridge	Floor / Stream	River - well represented
		Bog Stream – some representation
Wetland	Mineral	Marsh - some representation



Significant Features of Landscape Unit 5. Riverine							
National	**Provincial**		**Regional**		**Local**		
significant landscape	bog club moss (*Lycopodiella inundata*) (S1)	P*	springs		mature to old-growth forests		
part of the Maybelle River Sand Hills nationally significant ESA	river jewelwing (*Calopteryx aequabilis*) (S1)	P	hooded mergansers (*Lophodytes cucullatus*) (S2B)	P	distinctive plant communities		
	American starburst lichen (*Imshaugia placorodia*) (S2)	E	Canada darner (*Aeshna canadensis*) (S4S5)	E	high diversity of habitats		
	mountain club-moss (*Huperzia selago*) (S1)	E			Canadian toad (*Bufo hemiophrys*) (S4)	P	
					winter wren (*Troglodytes troglodytes*) (S4B)	P	
					hermit thrush (*Catharus guttatus*) (S5B)	P	

P* = present; E* = expected

N

Legend:

- Landscape Unit 5. - RIVERINE -
- Maybelle River Study Area boundary

1 0 1 2 Kilometers

SPACE IMAGING

NATURAL HERITAGE INFORMATION CENTRE ALBERTA

4.0 DATA GAPS AND RESEARCH NEEDS

Few field surveys have been done in the general area. The most comprehensive survey was a 1978 study focusing on the preservation and recreation values of the sand dunes and surrounding area (Landals 1978). The field surveys conducted by staff of Parks and Protected Areas and volunteers in the study area during June and August of 2000 were quite limited. This was in part because three large wildland provincial parks (Marguerite River, Maybelle River and Richardson River Dunes) were targeted for survey at the same time, thus allowing very little time per site. Available helicopter time was limited, and the helicopter time schedule was unreliable during the field survey. ATVs (quads) were used to travel the winter road and other access trails near the study area, but access to the interior of the site was by foot. Walking through the site proved to be difficult as much of it (with the exception of the active dune area) is covered by dense stands of regenerating jack pine blocked with deadfall.

Given the limited field time that researchers spent in the study area and the difficult access, data gaps exist for which further field research and inventory is recommended. In particular, there is a lack of information about the plant and animal species, and the plant communities of the Ice Contact Complex, Peatland Complex and Riverine Landscape Units.

Further general research is needed in the study area on:

- The distribution and abundance of fish species.
- The distribution and abundance of species within each LU as well as among LUs.
- The type and distribution of plant communities.

A number of special elements are known to occur in the study area, but additional studies are needed to better document their distribution. In addition, there are a number of species and plant communities of note that are known to occur in the region in habitats similar to those present in the study area (Appendices 3, 4 and 5). Their presence and distribution in the study area should be determined.

5.0 CONCLUSION

The entire study area can be considered **nationally significant** as it lies almost entirely within two nationally significant ESA's. The site also includes a number of provincially, regionally and locally significant features, as well as features representative of the Athabasca Plain Natural Subregion. There are many additional species and plant communities of conservation concern that are known to occur in the region and for which appropriate habitat seems to be present in the study area (Appendices 3, 4 and 5). More study is needed to verify and document the suite of special features of the study area. As more studies are conducted, information should be deposited in the Alberta Natural Heritage Information Centre (ANHIC). To ensure the use of the most current information, ANHIC should be consulted for any updates to the information provided in this report as well as for details concerning specific element occurrences.

6.0 ACKNOWLEDGEMENTS

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Appendix 1. Tracking and watch list elements found within the study area.

This appendix summarizes the special elements found within the study area that are currently on the ANHIC tracking and watch lists. When an element occurs in a particular LU, the element occurrence (EO) number(s) for that record is supplied. For some historical EOs, the location information is so general that the exact location is unknown. In such cases, EO numbers are listed for the LU in which they are most likely to occur, followed by a "?". The EO number provides a link back to the ANHIC database.

E = element is expected to occur in the LU.
P = element is confirmed in the LU but so widely distributed that EO records were not done.
W = watch list element confirmed for the LU (EOs are not generally done for watch list elements).

Scientific name	Common Name	Element Code	S Rank	Landscape Unit*				
				1	2	3	4	5
Vascular Plants								
Brasenia schreberi	Watershield	PDCAB01010	S1			001 002		
Carex pseudocyperus	Cyperus-like sedge	PMCYP03B70	S2			003	E	
Carex rostrata	beaked sedge	PMCYP03BP0	S2			031	E	
Cypripedium acaule	stemless lady's-slipper	PMORC0Q010	S3		005	W		
Diphasiastrum sitchense	ground-fir	PPLYC01100	S2				009	
Huperzia selago	mountain club-moss	PPLYC02070	S1			005	E	E
Hypericum majus	large Canada St. John's-wort	PDCLU03120	S2	004		014		
Juncus brevicaudatus	short-tail rush	PMJUN010G0	S2	011 012		009		
Lycopodiella inundata	bog club moss	PPLYC03060	S1	001		003		002
Nymphaea leibergii	pygmy water-lily	PDNYM050J0	S1			008		
Potamogeton obtusifolius	blunt-leaved pondweed	PMPOT030R0	S2			011?	E	
Panicum acuminatum	hot-springs millet	PMPOA24020	SU			003 005 006 009		
Salix tyrrellii	Tyrrell's willow	PDSAL022B6	S1	001 002 005 006	E			
Sarracenia purpurea	pitcher-plant	PDSAR02070	S2			016 017	018	
Stellaria arenicola	sand-dune chickweed	PDCAR0X0N4	S1	001 002 007 008 009	005	E		
Tanacetum bipinnatum ssp. *Huronense*	Indian tansy	PDAST92012	S2	004 006 007 008 009 010 011 012	002	E		
Utricularia cornuta	horned bladderwort	PDLNT02030	S1			E	002?	
Viola pallens	Macloskey's violet	PDVIO04142	S1S2	E		014		
Mosses and Liverworts								
Gymnocolea inflata		NBHEP1D020	S1				001	
Sphagnum platyphyllum	peat moss	NBMUS6Z0X0	S1				001	

Appendix 1. Cont'd.

Scientific name	Common Name	Element Code	S Rank	Landscape Unit*				
				1	2	3	4	5
Lichens								
Imshaugia placorodia	American starburst	NLT0012560	S2	E	E	008	E	E
Stereocaulon condensatum		NLTES10620	S1	001 004	E	E	005	
Plant Communities								
Andromeda polifolia / Sarracenia purpurea / Sphagnum angustifolium poor fen	bog rosemary / pitcher plant / peat moss	CEAB000120	S1S2			003	E	
Birds								
Sterna paradisaea	Arctic tern	ABNNM08080	S1	001				
Bartramia longicauda	upland sandpiper	ABNNF06010	S3B			W		
Amphibians								
Bufo hemiophrys	Canadian toad	AAABB01080	S4			P	E	P
Odonates								
Calopteryx aequabilis	river jewelwing	IIODO65010	S1			E		005
Aeshna canadensis	Canada darner	IIODO14020	S4S5			W	E	E

* Landscape Unit 1. *Active Dune Field*
Landscape Unit 2. *Sand Plain Complex*
Landscape Unit 3. *Ice Contact Complex*
Landscape Unit 4. *Peatland Complex*
Landscape Unit 5. *Riverine*

Appendix 2. Level 1 and Level 2 Natural History Themes within the study area and the main landscape units in which they occur. (W = well represented; S = some representation).

Component	Level 1 Theme	Level 2 Theme	LU 1*	LU 2	LU 3	LU 4	LU 5
Sandy Upland	Dune Field	Active dune	W				
		Stabilized dune	S	S		S	
	Sandy Plain	Coniferous forest		W			
		Deciduous forest		S			
		Recently burned		W			
		Erosional features		W			
	Kame Complex	Kame moraine			W		
		Crevasse fillings			S		
		Coniferous forest			W		
		Recently burned			W		
Valley / Ridge	Floor / Stream	River					W
		Bog stream					S
Wetland	Mineral	Marsh	S		S		S
		Wet dune slack	W				
	Organic	Bog			S	S	
		Graminoid fen				S	
		Tamarack fen				S	
		Shrub fen			S	W	
		Forested				W	
	Lake	Mesotrophic			W		

*Landscape Unit 1. *Active Dune Field*
Landscape Unit 2. *Sand Plain Complex*
Landscape Unit 3. *Ice Contact Complex*
Landscape Unit 4. *Peatland Complex*
Landscape Unit 5. *Riverine*

Appendix 3. Additional non-vascular and vascular plant and lichen species on the tracking lists that may occur within the study area and the landscape units in which they are most likely to be found.

Scientific name	Common name	S Rank	Habitat in NE Alberta (from occurrence records when available)	Landscape Units*				
				1	2	3	4	5
Liverworts								
Calypogeia muelleriana	liverwort	S?	Black spruce muskeg				✔	
Lophozia guttulata	liverwort	S2	Treed fen.				✔	
Scapania irrigua	liverwort	S2	Black spruce fen				✔	
Mosses								
Anomodon minor		S1	Mixed wood area			✔		✔
Brachythecium nelsonii		S2	Found on moist soil in a partly shaded location at the edge of a sedge fen				✔	
Brachythecium rutabulum		S2?	In black spruce stand				✔	✔
Bryoria simplicior	old man's beard	S2S3	commonly found on jack pine in NE AB	✔	✔	✔	✔	
Bryum cyclophyllum		S1S2	In moist black spruce stand				✔	✔
Bryum pallens		S2	In white spruce – balsam fir stand.					✔
Campylium polygamum		S3	balsam poplar forest on bottomlands					✔
Drepanocladus sendtneri	brown moss	S2	Subhydric, poorly drained, depressions in fens				✔	
Entodon schleicheri		S1	Riparian sites					✔
Hygroamblystegium noterophilum		SU	In moist white spruce stand					✔
Hygroamblystegium tenax		S2	Moist soil, riparian woodlands					✔
Hypnum callichroum		S1	Riparian spruce forest					✔
Neckera pennata		S2	Riverine forests.					✔
Pohlia sphagnicola		S2	Fens and willow swamps				✔	✔
Racomitrium microcarpon		S1?	Variable species of rock, tree bases or rotting wood					✔
Rhodobryum ontariense		S2	River banks and mesic forests					✔
Schistidium agassizii	elf bloom moss	S1	White spruce stands					✔
Sphagnum compactum	neat bog moss	S1S2	Poor fen				✔	
Sphagnum fallax	peat moss	S2	Poor fen				✔	
Sphagnum fimbriatum	fringed bog moss	S2S3	Black spruce stands				✔	
Sphagnum lindbergii	Lindberg's bog moss	S2S3	Poor fen				✔	
Splachnum ampullaceum	flagon fruited splachnum	S2	Animal (usually moose) dung in fens and bogs				✔	
Splachnum luteum	yellow collar moss	S2	Animal (usually moose) dung in fens and bogs				✔	
Splachnum rubrum	red collar moss	S2	Animal (usually moose) dung in fens and bogs				✔	
Splachnum sphaericum	globe-fruited splachnum	S2	Animal (usually moose) dung in fens and bogs				✔	
Splachnum vasculosum	large-fruited splachnum	S2	Animal (usually moose) dung in fens and bogs				✔	

Appendix 3. Cont'd.

Scientific name	Common name	S Rank	Habitat in NE Alberta (from occurrence records when available)	Landscape Units*				
				1	2	3	4	5
Vascular Plants								
Artemisia tilesii	Herriot's sagewort	S2	Eroded banks			✔		
Astragalus bodinii	Bodin's milk vetch	S1	Grassy river slopes			✔		
Carex capitata	capitate sedge	S2	Moist pockets, usually in peatlands				✔	
Carex houghtoniana	sand sedge	S2	Sandy sites, often in pine woods	✔	✔	✔	✔	
Carex oligosperma	few-fruited sedge	S1S2	Sedge meadow on sandy substrate				✔	
Carex retrorsa	turned sedge	S2S3	Wet ground along rivers and streams and in fens				✔	✔
Carex umbellata	umbellate sedge	S1	Open pine woods, rock	✔	✔	✔		
Drosera linearis	slender-leaved sundew	S2	Fens				✔	
Dryopteris cristata	crested shield fern	S1	Moist woods and thickets					✔
Dryopteris filix-mas	male fern	S1	Moist woods and thickets					✔
Eupatorium maculatum	spotted Joe-pye weed	S1S2	Moist river bank					✔
Isoetes echinospora	northern quillwort	S1	Aquatic plant of nutrient-poor ponds and lakes			✔	✔	
Juncus filiformis	thread rush	S2S3	Lake and river shorelines, wet soil in open areas			✔	✔	
Lobelia dortmanna	water lobelia	S1	Emergent aquatic, shallows of sandy lakes and ponds			✔	✔	
Malaxis monophylla	white adder's-mouth	S2	Mesic woodlands, shrublands and fens				✔	✔
Pinguicula villosa	small butterwort	S1	*Sphagnum* hummocks in peatlands				✔	
Polygala paucifolia	fringed milkwort	S1	Moist coniferous or mixed woods			✔		✔
Potamogeton foliosus	leafy pondweed	S2	Shallow lakes or ponds			✔	✔	
Potamogeton natans	floating-leaf pondweed	S2	Still or slow-moving shallow water			✔	✔	✔
Potamogeton praelongus	white-stem pondweed	S2	Deep clear water of lakes or ponds			✔	✔	
Potentilla multifida	branched cinquefoil	S1	Dry open ground, often on disturbed sandy sites	✔	✔	✔		
Sagittaria latifolia	broad-leaved arrowhead	S1	Shallow water of ponds and lakes			✔	✔	
Spiranthes lacera	northern slender ladies'-tresses	S1	Jack pine – lichen forest, often with common blueberry	✔	✔	✔	✔	

Appendix 3. Cont'd.

Scientific name	Common name	S Rank	Habitat in NE Alberta (from occurrence records when available)	Landscape Units*				
				1	2	3	4	5
Lichens								
Arthonia patellulata		S3?	Bark of aspen			✔		✔
Bacidia bagliettoana		S2	Bark of aspen			✔		✔
Bryoria nadvornikiana		S2	Found on black spruce in peatlands. General habitat is boreal woodlands on conifers and birch (Brodo *et al.* 2001).				✔	✔
Bryoria simplicior	old man's beard lichen	S2S3	often found on jack pine in NE AB	✔	✔	✔	✔	
Cladonia bacilliformis		S2S3	Rotting wood in old growth white spruce forest					✔
Cladonia macrophylla		S2	A ground lichen of exposed soil	✔	✔	✔	✔	
Cladonia ramulosa		S1	Eroded banks			✔		✔
Cyphelium tigillare		S2	Conifer wood or bark. Black spruce peatland in NE AB				✔	
Pannaria conoplea		S?	on bark of decaying log, on exposed hillside			✔		✔
Phaeophyscia constipata		S3	Soil and moss in dry habitats (Brodo *et al.* 2001)	✔	✔	✔		
Phaeophyscia endococcina		S2?	On sandy soil	✔	✔	✔	✔	
Rinodina exigua		S1	Riverine spruce-fir woodlands, most Alberta specimens collected on spruce bark					✔

* Landscape Unit 1. *Active Dune Field*
Landscape Unit 2. *Sand Plain Complex*
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Landscape Unit 5. *Riverine*

Appendix 4. Additional plant communities on the tracking list that may occur within the study area and the landscape units in which they are most likely to be found.

Scientific name	Common name	S Rank	Habitat in NE Alberta	Landscape Units*				
				1	2	3	4	5
Carex oligosperma/ Sphagnum subsecundum poor fen	few-seeded sedge / twisted bog moss poor fen	S1S2	Centre of channel drainage on sand, water table very near surface				✔	
Carex pseudocyperus – Calla palustris wetland	Cyperus-like sedge – water arum wetland	S1S2	Edge of beaver ponds and oxbows					✔
Chamaedaphne calyculata - Kalmia polifolia / Cladina mitis shrubland	leatherleaf – northern laurel / green reindeer lichen shrubland	S1S2	Edge of channel drainage on sand, water table very near surface				✔	
Isoetes echinospora	northern quillwort submerged aquatic	S1	Sandy shorelines			✔	✔	
Picea glauca / Cetraria islandica	white spruce / lichen	S1	Open stands on sandy knolls	✔	✔	✔		
Populus balsamifera / Rhamnus alnifolia / Equisetum arvense	balsam poplar / alder-leaved buckthorn / common horsetail	S1	Riparian stands					✔
Populus balsamifera / Viburnum opulus / Matteuccia struthiopteris	balsam poplar / high-bush cranberry / ostrich fern	S1S2	River terraces					✔
Salix athabascensis string shrubland	Athabasca willow string shrubland	SP	Patterned fen				✔	

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Appendix 5. Additional vertebrates and invertebrates of note that may occur within the study area and the landscape units in which they are most likely to be found. Some of the noted species are on ANHICs tracking / watch lists; others are new records for Alberta or the region, are may-be-at-risk / at-risk species, or are otherwise noteworthy.

Scientific name	Common name	S Rank	Comments	Landscape Unit*				
				1	2	3	4	5
Mammals								
Sorex hoyi	pygmy shrew	S3	Prefers bogs, treed fens, riparian areas.			✔	✔	✔
Myotis septentrionalis	northern long-eared bat	S2S3	Restricted to the boreal forest in western Canada. Prefers tall mature trees, alive or dead for roosting.		✔	✔		✔
Lasiurus cinereus	hoary bat	S2B	Migratory. Appears to prefer conifer forests for roosting. Occurs throughout the boreal forests of AB.		✔	✔		✔
Gulo gulo	wolverine	S3	A 'may be at risk' species. Wide-ranging.		✔	✔	✔	✔
Rangifer tarandus	woodland caribou	S2	An at-risk species in AB. Designated as 'threatened' under the Wildlife Act. Utilizes treed peatlands and uplands.		✔	✔	✔	✔
Birds								
Coturnicops noveboracensis	yellow rail	S2B	Prefers grass -sedge fens.				✔	
Limnodromus griseus	*short-billed dowitcher*	S2B	Breeding habitat is peatland, and edges of lakes.			✔	✔	
Lagopus lagopus	*willow ptarmigan*	S1B	Winter migrant. Could be found in treed areas near rivers and streams.			✔		✔
Asio flammeus	short-eared owl	S3B	Could be found in marshy areas, open peatlands, meadows.			✔	✔	
Chlidonias niger	black tern	S3B	Prefers shallow lakes, marshes, ponds			✔		
Empidonax flaviventris	yellow-bellied flycatcher	S3B	Prefers bogs, forest edges, shrubby riparian areas.			✔	✔	✔
Picoides arcticus	black-backed woodpecker	S2S3	A 'sensitive' species. Prefers burned or mature coniferous stands		✔	✔		✔
Reptiles								
Thamnophis sirtalis	red-sided garter snake	S3	A 'sensitive' species. Hibernacula are tracked.		✔	✔		✔
Moths and Butterflies								
Oeneis chryxus caryi	Cary's Arctic	S1S2	Prefers open jack pine forests.		✔	✔		
Oeneis jutta ridingiana	Jutta Arctic	S4	Uncommon and localized in spruce bogs; widespread throughout the boreal forest.				✔	
Euchloe creusa	northern marble	S4	Few known boreal forest populations; may be restricted to mature closed canopy pine forests.		✔	✔		
Erebia mancinus	Taiga alpine	S5	Uncommon and localized, but widespread across the boreal forest. Prefers black spruce-*Sphagnum* bogs.				✔	

Appendix 5. Cont'd.

Scientific name	Common name	S Rank	Comments	Landscape Unit*				
				1				
Crambidia impura	an Arctiid Moth	S?	Unknown from AB prior to 2000. Found in dry open habitats; larvae feed on lichens.		✔	✔		
Eupithecia russeliata	A Geometrid moth	S?	Unknown from AB prior to 2000. Found in peatlands (larvae feed on *Kalmia).*				✔	
Abagrostis brunneipennis	A Noctuid Moth	S?	Known from less than 5 localities in AB but may be widespread across the southern boreal forest where *Vaccinium* occurs.		✔	✔	✔	
Drasteria adumbrata	shadowy arches (a Noctuid moth)	S?	Known from only one other location in AB (Wainwright), this being a historical record (~50 years ago). A species of open jack pine forests.		✔	✔		
Hemipachnobia monochromatea	A Noctuid moth	S?	Known from only one other location in AB. Found in peatlands.				✔	
Lapara bombycoides	northern pine sphinx (a Sphingid moth)	S?	Known from only 3 localities in AB. Found in jack pine forests, jack pine being the larval host plant.		✔	✔		
Sphinx poecila	larch sphinx (a Sphingid moth)	S?	A relatively rare species of boreal wetlands. Occurs in peatlands that have larch.				✔	
Spiders								
Schizocosa minnesotensis	wolf spider	S?	A newly discovered disjunct population for NE Alberta. Found in vegetated sandy areas and dune habitats.	✔	✔	✔		
Habronattus captiosus	jumping spider	S?	A newly discovered disjunct population for NE Alberta. Occurs in habitats with sparse vegetation.	✔	✔	✔		
Dictyna arundinacea	meshweb weaver	S?	Unknown from AB prior to 2000. Found in vegetated areas.		✔	✔	✔	✔
Odonates								
Leucorrhinia glacialis	crimson-ringed whiteface	S1S3	Expected in boggy lake habitats and marshy areas.			✔	✔	
Libellula julia	chalk-fronted skimmer	S3S4	Expected in bog ponds and large swampy areas.			✔	✔	
Ophiogomphus colubrinus	boreal snaketail	S3	Expected in stream and lake habitats.			✔		✔
Sympetrum costiferum	saffron-winged meadowhawk	S3	Expected in pond and lake habitats.			✔		

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Landscape Unit 5. *Riverine*

Appendix 6.

Photo Album of Maybelle River Wildland Provincial Park and
Athabasca Dunes Ecological Reserve

Photo Album Captions.

1. Open black spruce fen in LU4
2. Hair-cap moss, common in many habitats in the study area
3. River alder on the banks of the Maybelle River and black spruce stands behind
4. Closed mixed deciduous stands on the benches along the Maybelle River (LU5)
5. Kettle lake with south-facing graminoid slopes behind (LU3)
6. Pygmy water lily (LU3)
7. Pond with islands (possibly permafrost) at east edge of the active dune face (LU4)
8. Pitcher plant (LU4)
9. Extensive area of transverse dunes (LU1)
10. Aerial shot of east face of the active dunes (LU1) with interdune wetlands
11. Arctic tern defending nest and eggs
12. Gravel pavement
13. Diverse habitats edging a kettle lake (LU3)
14. Northern long-eared bat (LU3) – a potential species for the study area
15. Black bear feeding in crowberry and sand heather community at western edge of active sand (LU2)
16. Tiger beetle in sand habitat
17. Extensive young jack pine stands in LU2 with fallen trees, remnants from earlier fires in the area
18. Information sign at access point to the ecological reserve
19. Patch of stemless ladies-slipper
20. Winter road where it forms the western boundary of the study area

Photo Album of Maybelle River Wildland Provincial Park and Athabasca Dunes Ecological Reserve