2 STUDY AREA DESCRIPTION

2.1 Location

Strathcona County is located adjacent to the east boundary of the City of Edmonton and encompasses an area of 1,182 square kilometers. It is bounded by the City of Fort Saskatchewan and the Municipal District of Sturgeon on the northeast, the County of Lamont, Elk Island National Park, and the Cooking Lake-Blackfoot Recreation Area on the east, and the County of Leduc on the south. The county is transected by two major east-west arteries, the Yellowhead Highway (Hwy. 16) and the Canadian National Railway (Figure 1).

The study area for this Prioritized Landscape Ecology Assessment Project (PLEAP) incorporates the entire county including *The Lakes Management Plan* area (Strathcona County 1994) - 317 square kilometers comprising the south-eastern part of Strathcona County, and 865 square kilometers comprising the remainder of Strathcona County. The PLEAP is correlated with *The Lakes Management Plan* Study Area (Strathcona County 1994) and *Strathcona County's Land Among the Lakes; An Ecosystem in Transition* (Griffiths 1991). Both reports covered the south-eastern 27% of Strathcona County - *The Lakes Management Plan* Study Area.

2.2 Physiography

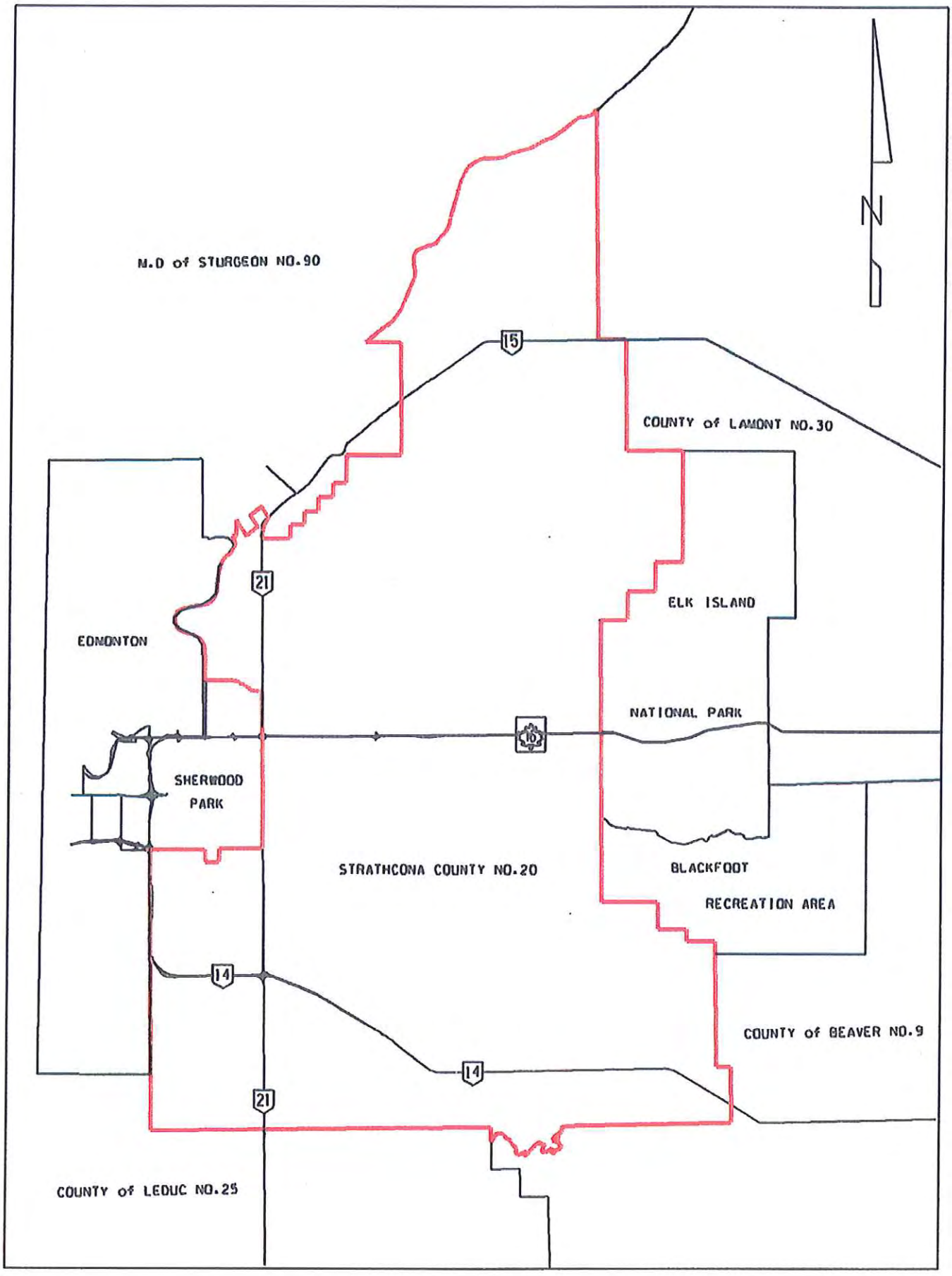
Generally, the study area consists of undulating to rolling strata that was extensively eroded by continental glaciers. Fluvial erosion following deglaciation has been of minor importance in shaping the modern landscape in the area of the County. As a result, this landscape is largely a legacy of the Wisconsin Glaciation which ended 9,000 years ago. Landforms such as hummocky stagnation moraine (till), meltwater channels, eolian sand dunes, and glacial lakebeds are related directly to glacial action and to meltwater from receding glaciers (Achuff 1994). The area's moraine landscape has a complex topography comprised of depressional wetlands and organic deposits (Bentz and Saxena 1994). This is in contrast with glacial lakebeds which are characterized by homogenous areas of minimal relief.

Alberta's provincial land classification scheme has been developed and refined over the past two decades and has been upheld by the Canadian Council on Ecological Areas (1992) as a national model for protected areas representation analysis. The land

classification currently in use by the Alberta government has recently been revised by Achuff (1992), Alberta Environmental Protection (1994), and Strong and Thompson (1995) and is based on natural or biogeographic features such as

Figure 1: Strathcona County Study Area Location

Figure 1: Study Area



geology, landform, hydrology, soils, climate, and vegetation. This land classification scheme results in fairly broad delineations called Natural Regions, each of which is further sub-divided into Natural Subregions. Six Natural Regions and 20 Natural Subregions have been recognized in Alberta and, recently, Strong and Thompson (1995) further divided the Natural Subregions into Ecodistricts, based on distinctive physiographic and/or geological patterns. The ecodistrict boundaries are based on landscape units developed as part of a national effort by Environment Canada, Agriculture and Agri-Food Canada, and provincial agencies to develop a standard ecological reference base for Canada.

Two Natural Regions are represented in Strathcona County - the Boreal Forest and the Parkland (Figure 2). The Boreal Dry Mixedwood Subregion represents the Boreal Forest Natural Region in the study area. It is comprised of three distinct ecodistricts including a hummocky morainal plain with slope gradients of 3-30 percent (Cooking Lake Upland Ecodistrict), a level outwash and undulating morainal plain (Redwater Plain Ecodistrict), and an incised river valley with terraces and slopes of 16-70 percent (North Saskatchewan River Valley Ecodistrict). The Central Parkland Subregion portion of the study area is comprised of an undulating lacustrine and morainal plain (Leduc Plain Ecodistrict), and an incised river valley with terraces and slopes of 46-70 percent (North Saskatchewan River Valley Ecodistrict). Elevations range from 750 metres in the Cooking Lake Upland, 640 metres on the Leduc Plain, to less than 600 metres in the North Saskatchewan River valley.

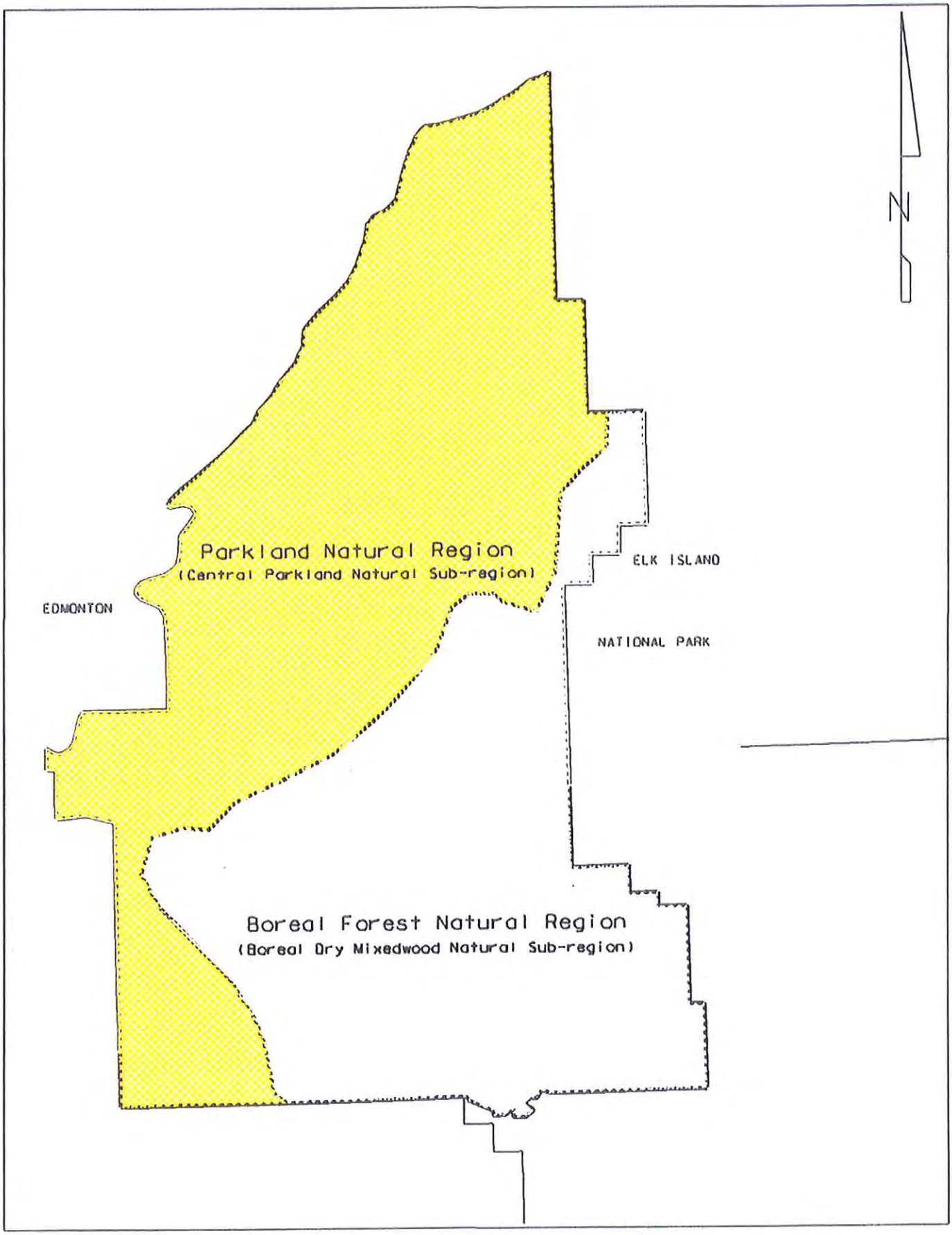
The Cooking Lake Upland Ecodistrict, in the Boreal Dry Mixedwood portion of the study area, has moderate drainage via a convoluted system of sloughs, bogs, and small lakes linked by small watercourses. The soils are predominately Grey Luvisols which have developed either on glacial till or glaciolacustrine material. Grey Solodized Solonetz soils are of secondary importance in the Cooking Lake Upland, being limited to glaciolacustrine deposits (Bowser et al. 1962). The Redwater Plain Ecodistrict, which skirts the northern boundary of the study area, is moderately to well drained, apart from poorly drained organic areas. Eolian landforms on the Redwater Plain have low relief and are interspersed with fens and occasional bogs. Sand dunes are characterized by rapid drainage, while intervening fens and bogs have poor drainage. Soils of these eolian landforms are a mosaic of sandy-textured Brunisols and Regosols. Organic and Gleysolic soils predominate in fens and bogs found within the dune complexes of the study area (Westworth and Knapik 1987).

The North Saskatchewan River has incised approximately 60 metres into the level Leduc Plain. The valley has consistent physiographic characteristics throughout its length within the Leduc Plain Ecodistrict. Valley slopes range from 16 - 70 percent and

dominant soils are rapidly drained Eutric Brunisols. The Leduc Plain has surficial geological deposits of till and glacio-lacustrine deposits

Figure 2: Natural Regions and Subregions Within Strathcona County

Figure 2: Natural Region and Sub-Region Boundaries of Strathcona County



which form undulating surfaces of 0 - 5 percent slopes. Four creeks, Oldman, Point-aux-Pins, Ross, and Astotin have eroded valleys into this plain and flow either directly or indirectly into the North Saskatchewan River from the Cooking Lake Upland. The Leduc Plain is moderately well drained and soils are Black Chernozems.

Bedrock occurs beneath glacial deposits throughout the study area. Bedrock was formed 70 million years ago (Upper Cretaceous Period) through sediment deposition in both marine and non-marine environments (Green 1970). Deposition of clay occurred in an inland sea covering a large portion of what is now central Alberta. Clay was deposited to depths of 250 metres, producing pressures which caused its metamorphosis into shale and partial metamorphosis into mudstone. Feldspars within igneous rock were uncovered by the mechanical weathering action of ocean waves, and re-incorporated into the clay marine deposits. Because of this, grey feldspars are commonly found in shale bedrock below the study area.

Limestones were formed from the calcium carbonate extracted by the coral reefs growing in the inland sea. These biochemical rocks and detritally-formed shales and mudstones comprise the marine-deposited bedrock of the Bearspaw Formation beneath the study area.

Non-marine rock of the Horseshoe Canyon Formation (15 metres thick below the study area), includes coal, which was formed from the partial decomposition of plants growing in swamps near the coastline of the inland sea, and clayey sandstone formed from clay and sand deposited in coastal river deltas. Iron oxide present within igneous bedrock upstream was eroded by these rivers, and re-deposited around foci within the unconsolidated clay and sand deltaic deposits. The resulting spherical forms are called ironstone concretions. These are present in a clayey sandstone bedrock matrix beneath the study area.

In summary, the bedrock beneath the study area is characterized by rapid transitions between marine (shale and limestone) and non-marine (ironstone and coal) strata (Green 1970). The rapid changes in depositional environment are attributed to short-lived marine transgressions and regressions due to the changes in land levels associated with the formation of the Rocky Mountain foothills and front ranges by orogenic events 45-85 million years ago (Green 1970). Bedrock is overlain by glacial deposits throughout the study area, and so is visible only where post-glacial erosion has removed these deposits such as in the valleys of the North Saskatchewan River and Point-aux-Pins Creek.

2.3 Hydrography

The Strathcona County study area includes seven permanent creeks (Oldman, Irvine, Fulton, Point-aux-Pins, Ross, Hastings, and Astotin), fifteen named lakes (Cooking, Hastings, Ministik, Antler, Wanisan, Trappers, Twin Island, Big Island, Boag, Bennett, Woodenpan, Coleman, McFadden, Halfmoon, and Sisib) and one river, that being the North Saskatchewan River, which forms part of the County's northern boundary (see Figure 3). The entire study area falls within the North Saskatchewan River basin (Mitchell and Prepas 1990).

Mitchell and Prepas (1990) provide a detailed overview of this drainage system and the following is summarized from their description. A large area of the Cooking Lake Upland, a moraine complex of small lakes, sloughs, and bogs, drains northward into the North Saskatchewan River via Point-aux-Pins, Ross, and Astotin creeks. Groundwater inputs into the Cooking Lake Upland through small waterbodies is an important, though unquantified factor contributing to the surface flow of these creeks. Cooking, McFadden, Halfmoon, Bennett, Wanisan, and Antler lakes occupy internal drainage basins within the Cooking Lake Upland during periods of low lake levels. During wet climatic cycles, McFadden, Cooking, Halfmoon, and Antler Lakes do spill over via Cooking Lake Creek into Hastings Lake. The most recent recorded occurrence of water flowing from Cooking Lake was the period from 1952 - 1955. During such periods, water flows east into Beaverhill Lake, then northwestward into the North Saskatchewan River via Beaverhill Creek.

Fulton and Irvine Creeks drain west to eventually join Blackmud Creek, which then enters the North Saskatchewan River within the City of Edmonton. Astotin Creek meanders in an arc from Astotin Lake in Elk Island National Park to join Beaverhill Creek, a few kilometers south of its confluence with the North Saskatchewan River. Ross Creek drains Trappers Lake, and meanders in a northwesterly direction to the City of Fort Saskatchewan and the North Saskatchewan River.

The above-mentioned creeks, especially Oldman, Point-aux-Pins, and Ross, exhibit ravine development only where a strong erosional gradient is present. The ravine features are most evident on the Leduc Plain close to the deeply incised North Saskatchewan River valley though some ravine development does occur within sand dunes. Wooded sections of these ravines contain significant valley-bottom wetland complexes: combinations of meandering stream channels, beaver (*Castor canadensis*) ponds, and swamps.

Streams characteristically meander across almost level terrain prior to becoming incised

when they approach the North Saskatchewan River. Several creeks, such as Fulton and Irvine, are not incised

Figure 3: Key Hydrological Features of Strathcona County

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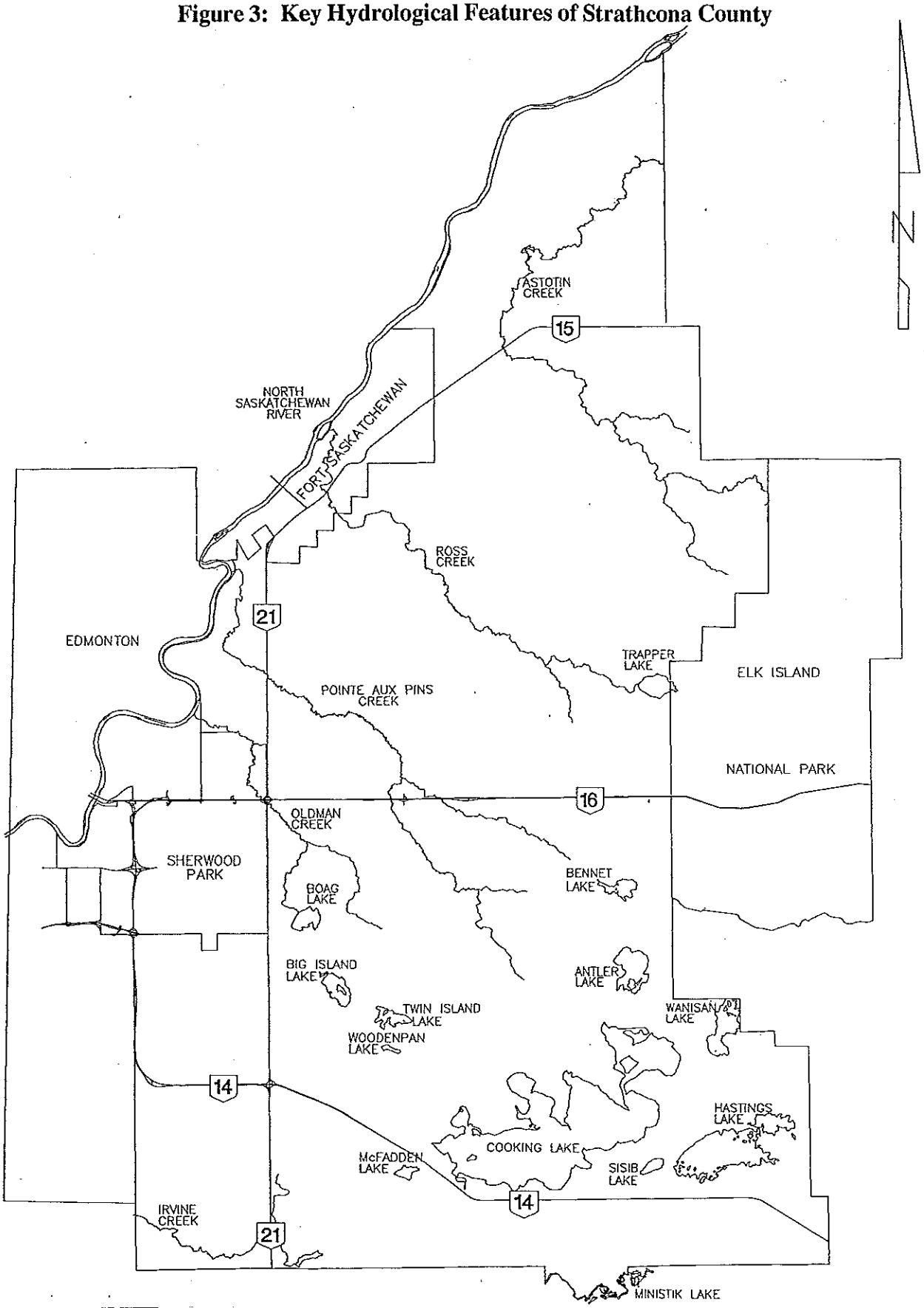

in ravines, a fact which has facilitated the widespread ditching, i.e. straightening, of meandering stream channels in the Leduc Plain Ecodistrict (Griffiths 1987). The absence of significant ravine development has also allowed for the extensive clearing of riparian woodland on these sites.

Within the Cooking Lake Upland Ecodistrict, incipiant drainage patterns are widespread in the form of seasonal watercourses which flow into a slough or series of sloughs but which do not contribute surface water to the regional watershed. This type of drainage is most common in areas of hummocky moraine, although it is also present in the more level Leduc Plain Ecodistrict.

2.4 Vegetation

Vegetation patterns in the study area are strongly influenced by climate, parent material texture, drainage, and successional stage (Saxena et al. 1994). The Boreal Dry Mixedwood Natural Subregion, which, in Strathcona County, is represented by the Cooking Lake Upland Ecodistrict and the Redwater Plain Ecodistrict, is a mosaic of deciduous, coniferous, and wetland communities. The Parkland Natural Region, represented in Strathcona County by the Leduc Plain Ecodistrict, is characterized by scattered groves of aspen in the south and closed aspen-dominated forested communities in the north and west (Achuff 1992). The Parkland Natural Region represents the transition between the Grassland and Boreal Forest Natural Regions, while the Boreal Dry Mixedwood Natural Subregion represents a transition zone between the coniferous dominated boreal mixedwood to the north and the aspen parkland to the south. Thus, common community types occur in all three subregions, their distribution being dependent upon latitudinal and topographical differences.

Prior to human settlement of the area, the dominant vegetation type on the Cooking Lake Upland and Leduc Plain Ecodistricts was northern fescue grassland (Pettapiece 1969). The landscape was capable of being expressed as fescue grassland, aspen woodland or even mixedwood forest before settlement; it was maintained as a mosaic of these vegetation types through fire, both natural and anthropogenic, and ungulate grazing (Blyth and Hudson 1992).

Currently, upland native vegetation in Strathcona County is essentially limited to hardwood forests with poplar woodland on hummocky moraine and mixedwood forests on sand dunes and valley slopes. A high proportion of the area has been converted to non-native vegetation, either through country residential development or through agricultural and industrial land-uses. Aspen poplar (*Populus tremuloides*) and balsam

poplar (*Populus balsamifera*) are the dominant tree species of the upland woodland, though white spruce (*Picea glauca*) forms climax stands on sites that have evaded fire and other disturbances (Strong and Legget 1992). Shrub species associated with the aspen communities include low-bush cranberry (*Viburnum edule*), prickly rose (*Rosa acicularis*), beaked hazelnut (*Cornus cornuta*), and red-osier dogwood (*Cornus stolonifera*). The forb communities include such species as pink wintergreen (*Pyrola asarifolia*) and twinflower (*Linnaea borealis*). Paper birch (*Betula papyrifera*) may occasionally occur within these stands and Alaska birch (*Betula neoalaskana*) has been identified in many of these stands (L. Girvan, personal communication).

Mixedwood forests are limited to sites on cooler north-facing slopes of the North Saskatchewan River valley and the Cooking Lake Upland. White spruce, paper birch, aspen poplar, and balsam poplar are the dominant tree species in the mixedwood upland forest. These forests, which generally have a less diverse understory than the aspen woodland (Achuff 1994), are dominated by herbs such as pink wintergreen and low shrubs such as common snowberry (*Symphoricarpos occidentalis*). Common feathermosses associated with this community include step-moss (*Hylocomium splendens*), red-stemmed feathermoss (*Pleurozium schreberi*), and knight's plume (*Ptilium crista-castrensis*) (Achuff 1994).

The sand dune complexes are characterized by a mosaic of vegetation types due to the large variations in soil moisture over short distances. The dunes support forests of jack pine (*Pinus banksiana*) with an understory of prickly rose, hairy wild rye (*Elymus innovatus*), and reindeer lichen (*Cladina* sp.).

Wetland complexes are often present between the linear dunes. They typically lack open water and are comprised of three community types: the willow (*Salix*) - sedge (*Carex*) community, the scrub birch (*Betula glandulosum*) - sedge fen community, and the black spruce (*Picea mariana*) bog community. Edges of some nutrient-rich fens support tamarack (*Larix lariciana*). Mosses common in fens are *Aulacomium palustre*, *Tomenthypnum nitens*, and *Drepanocladus* (Achuff 1994).

2.5 Fauna

Boreal mixedwood forested ecosystems are profoundly influenced by disturbance processes which affect ecosystem structure, composition, and function at a range of scales. Much of the diversity in mixedwood forests can be attributed to spatial and temporal variation in disturbance frequency, size, and intensity which interact with ecotopic factors such as soil properties and topography to produce a mosaic of forest

conditions. The mosaic nature of boreal forest ecosystems is fundamental in that it provides a wide range of habitats for wildlife in the region. Strong (1992) described the Low Boreal Mixedwood Eco-region, the ecological equivalent of, and precursor to, the Boreal Dry Mixedwood Sub-region, as *"the most productive ecoregion in the Boreal Ecoprovince for wildlife"*, with the most diversity witnessed in tall shrub wetlands bordered by mature mixedwood forests. Such habitats support diverse breeding bird communities and some of the most productive furbearer habitats in the province. Strong's (1992) reference to high quality furbearer habitat in this region applies more to the northern Peace River block of the Dry Boreal Mixedwood Subregion than to the Cooking Lake Upland Boreal Dry Mixedwood. Nonetheless, Strathcona County's portions of the Boreal Dry Mixedwood and Central Parkland Sub-regions, owing mostly to a transitional and ecotonal nature, houses a diverse faunal assemblage which can be expected to include up to 48 mammal, 152 bird, and 8 herpetile species. This species diversity is relatively consistent with that reported for other study areas in close proximity to Strathcona County (Table 1). Appendices A, B, and C provide complete lists of wildlife species which may occupy appropriate habitats within the County.

Table 1: FAUNAL SPECIES DIVERSITY REPORTED FROM AREAS ADJACENT OR OVERLAPPING STRATHCONA COUNTY

STUDY AREA	# OF SPECIES REPORTED			SOURCE
	Mammals	Birds [1]	Herpetiles	
Elk Island National Park	37	227	5	Saxena et al. (1994)
Cooking Lake - Blackfoot Recreation, Wildlife, and Grazing Area	44	222	7	Alberta Recreation and Parks (no date)
Cooking Lake - Beaverhill Lake Area	n/a	126 2	n/a	Zelt and Glasgow (1975)
Central Parkland Natural Subregion	41	138 [3]	5	Saxena et al. (1996a)
Boreal Dry Mixedwood Natural Subregion	46	173 [3]	7	Saxena et al. (1996b)
Fort Saskatchewan and Devon Restricted Development Area	41	211	7	Strong et al. (1985)
Edmonton - Fort Saskatchewan Restricted Development Area	n/a	150+ [3]	6	I.D.Systems Ltd. (1983)

1. Potential residents and migrants, unless otherwise indicated

2. Summer breeding bird survey

3. Potential summer residents only

In a fragmented landscape such as is found in much of Strathcona County, wildlife habitat is largely a function of forest clearings and the amount of edge habitat relative to

interior habitat in mixedwood forest. Closed deciduous forests in the study area form the core interior habitats used by numerous wildlife species, including ungulates, birds, and small mammals. Downing and Karpuk (1992) identified six aspen and balsam poplar vegetation community types in the vicinity of the study area, which provide the life requisites for various wildlife species (Table 2).

Table 2: WILDLIFE HABITATS IN THE BOREAL DRY MIXEDWOOD NATURAL SUBREGION

Species or species group	Valuable Habitat Components
ungulates	✍ hiding cover in all aspen stands ✍ thermal cover in aspen / rose - lowbush cranberry communities, with highest occurrence of spruce ✍ winter forage (ericaceous shrubs, willows, low-bush cranberry, red-osier dogwood) in most aspen communities
black bear (*Ursus americanus*)	✍ high forb diversity and productivity in aspen / rose / forb / reed grass communities
ruffed grouse (*Bonasa umbellus*)	✍ all older aspen stands with deadfall for roosting and drumming and aspen buds, rose bushes and other forage
sharp-tailed grouse (*Tympanuchus phasianellus*)	✍ aspen forests adjacent to shrubby openings, providing interspersed hiding cover and foraging areas
cavity nesters (ducks, owls, and songbirds)	✍ mature to old aspen forests with snags >10 cm diameter, likely associated with aspen / rose-low bush cranberry communities
songbirds	✍ good vegetation stratification and heterogeneous shrub layer most likely in aspen / beaked hazelnut stands
lynx (*Lynx canadensis*) and other furbearers	✍ good prey base (hare and rodent) is associated with aspen / beaked hazelnut communities for hare browse and granivore forage ✍ aspen stands with coniferous interspersion provide thermal, hiding cover and den sites

The Parkland Natural Region in Alberta is a transition zone between the southern grasslands and the northern boreal forests. Wildlife assemblages in the Parkland Natural Region have both boreal forest and dry mixedgrass affinities. As a result of this, it is difficult to pinpoint faunal species endemic to the Parkland Natural Region. There is a trend, however, towards increasing use of woodland and heterogeneous habitats by fauna with boreal affinities northward across the Parkland Natural Region transition zone. Common species of the Boreal Forest Natural Region (beaver, moose (*Alces alces*), and pilieated woodpecker (*Dryocopus pileatus*)), have convergent geographic ranges in the Parkland Natural Region with species typical of grassland aspen groves - olive-sided flycatcher (*Contopus borealis*) and least chipmunk (*Tamias minimus*). Strathcona County is located in this region of convergent geographic ranges.

The boreal mixedwood forest comprising the Boreal Dry Mixedwood Subregion heterogeneous both at a landscape scale, and stand scale. The resultant wildlife habitat is diverse, providing young, seral deciduous communities, mature deciduous communities, old deciduous and mixedwood communities, and, where suitable conditions persist for long periods, coniferous communities dominated by climax species such as white spruce. Younger and mature stands are characterized by diverse understories and dense canopies while older stands are characterized by structural habitat features such as woody debris and snags. Obviously, the potential wildlife use of such forest mosaics is high.

Of all wildlife species groups that utilize wetland habitats in the vicinity of central and east-central Alberta, waterfowl are the most significant. The three prairie provinces produce 60 percent of the waterfowl on the continent and waterfowl production in Alberta accounts for 40 percent of this total. Alberta, which includes a portion of the Northern Great Plains, is one of the major production areas for North American waterfowl. These birds contribute significantly to populations that use the Central and Pacific flyways, and, to a lesser extent, the Mississippi and Atlantic flyways. Large concentrations of northern breeding ducks, geese, and swans stage on Alberta lakes during spring and fall migration, with a significant proportion of these birds utilizing habitats within Strathcona County.

2.6 Land Uses

Strathcona County supports several types of land uses including residential, country residential, agricultural, rural, and industrial development. Population density within the county ranges from 500 persons per square kilometer in Sherwood Park, through 51-100 persons per square kilometer in country residential zones, to less than 50 persons per square kilometer in rural land use areas. Rural land-use consists primarily of grain farming and mixed farming operations. Grain farming is the predominant land-use in the Leduc Plain Ecodistrict, while on the Cooking Lake Upland Ecodistrict, mixed farming is more common. Country residential development and industrial development are not typically located on prime agricultural land, but rather on marginal land. Country residential subdivision development is concentrated on the The Cooking Lake Upland Ecodistrict where it is interspersed with mixed farming land. Industrial development in the form of oil and gas extraction is concentrated on a sand dune complex on the northern edge of the Leduc Plain. Two oil refineries are also located in this sand dune complex. The other significant industrial land-use in the study area, gravel extraction, is restricted to the terraces along the North Saskatchewan River. Public utility land-uses (recreation centres and schools, golf courses), and conservation lands occupy a small proportion of the study area.