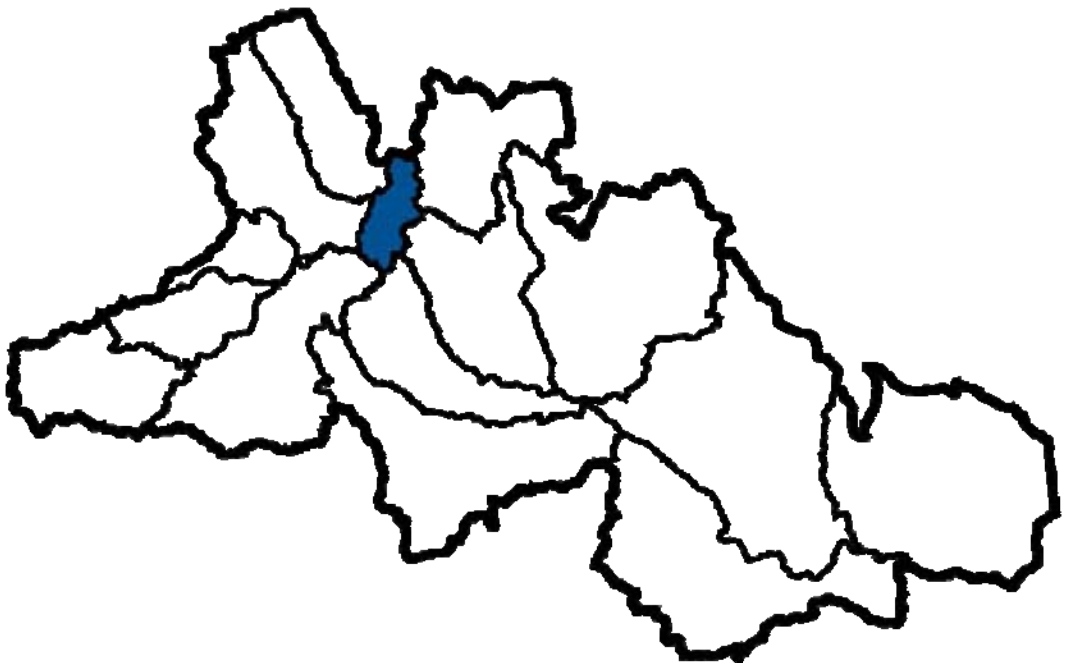
Waskasoo Subwatershed



Red Deer River Watershed Alliance

State of the Watershed

4.7 Waskasoo Creek Subwatershed

4.7.1 Watershed Characteristics

The Waskasoo Creek subwatershed encompasses about 70,031 ha and is located in the Counties of Lacombe and Red Deer. It is the smallest of the 15 subwatersheds of the Red Deer River watershed (Figure 198).

The Waskasoo Creek subwatershed is located east of the City of Red Deer in the Central Parkland Subregion (Figure 199), which is characterized by grassland with groves of aspen (*Populus* spp.) in the south to closed aspen forests in the north. The two major forest types in the Subregion are trembling aspen (*P. tremuloides*) and balsam poplar (*P. balsamifera*) on moister sites in depressions and in the northern part of the Subregion. Both are characterized by a dense, lush, species-rich understory. The grassland vegetation of the 'parks' is dominated by rough fescue (*F. campestris*) (Heritage Community Foundation, 2008).

The Waskasoo Creek subwatershed is characterized by a generally flat topography. The only geologic formation in the subwatershed is the Paskapoo Formation, which consists of sandstone, siltstones/mudstone and minor shale deposits (Alberta Geological Survey, 2006).

The climate of this subregion is continental, with warm summer and cold winters. The mean annual temperature is 2 °C, with a May-September average of 13 °C. The mean annual precipitation is about 350-450 mm, with the May-September precipitation averaging 300 mm (Environment Canada, 2006).

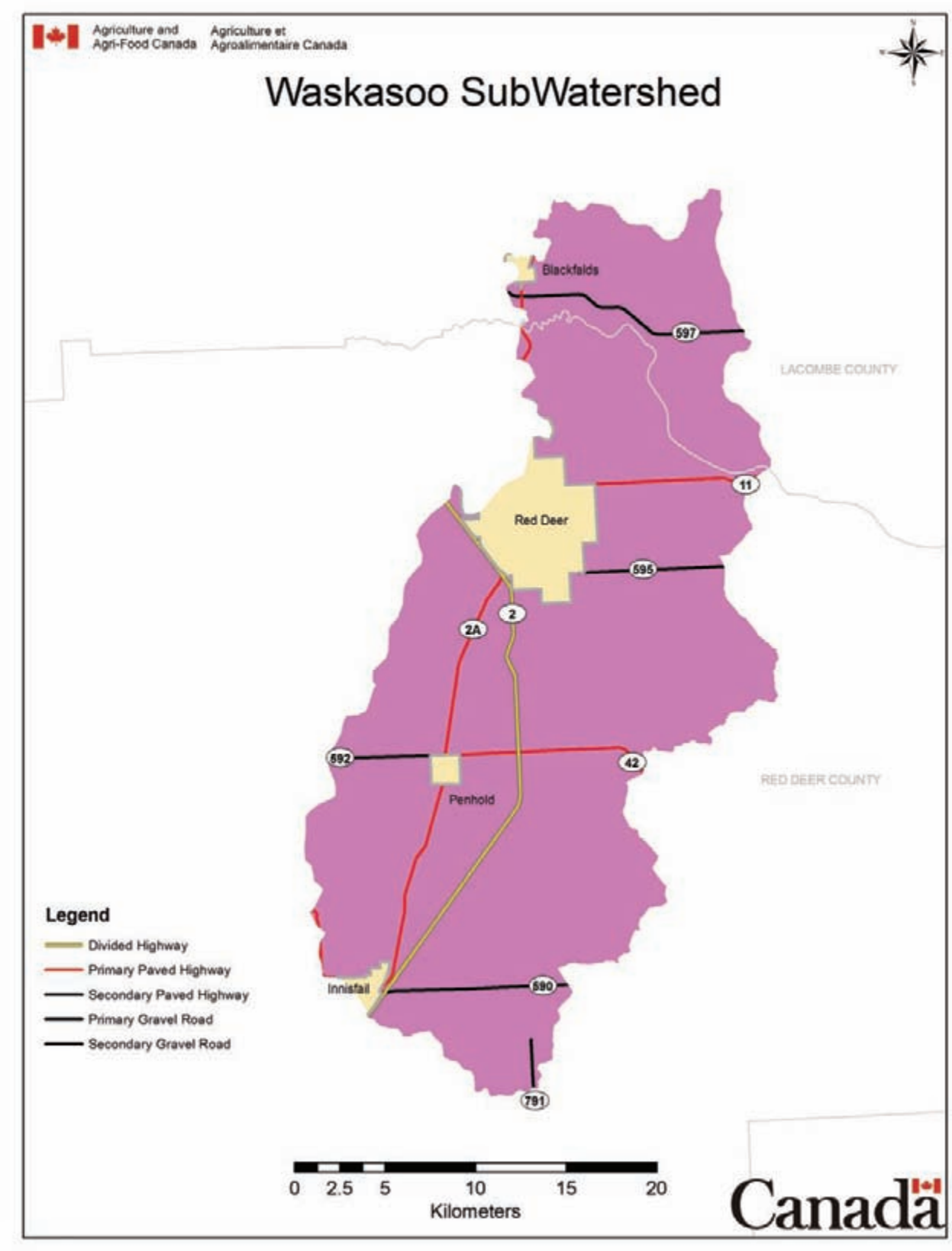


Figure 198. Location of the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

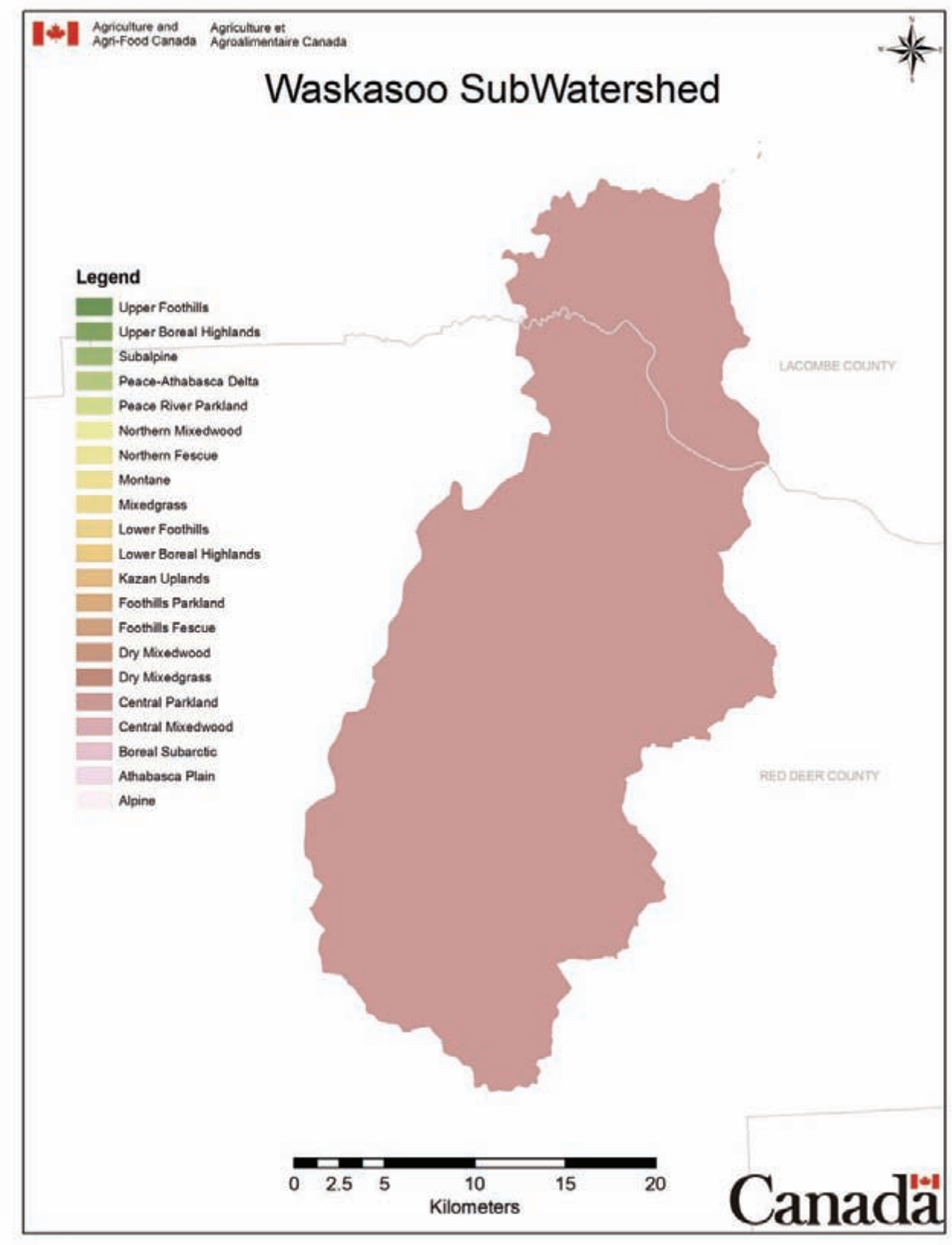


Figure 199. Natural subregions of the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

4.7.2 Land Use Indicators

Changes in land use patterns reflect major development trends, such as forested lands converted to agriculture and agricultural lands developed and lost to urban sprawl. Land use changes and the subsequent changes in management practices impact both the quantity and quality of water within the Red Deer River watershed. Six metrics were used to indicate changes in land use and land use practices in the Red Deer River watershed and its 15 subwatersheds:

- Wetland Loss – Condition Indicator
- Riparian Health – Condition Indicator
- Livestock Manure Production – Risk Indicator
- Urban, Rural and Recreational Developments – Risk Indicator
- Linear Developments – Condition Indicator
- Oil and Gas Activities – Risk Indicator

These six land use change indicators also reflect socioeconomic growth in a region. Hence, while human activities in a region can have negative environmental impacts, it is important to strive for a balance between socioeconomic growth and the sustainable management of natural ecosystems to ensure their long-term health and enjoyment by future generations.

4.7.2.1 Wetland Loss

Wetlands serve many functions in the natural landscape including water storage, flood attenuation, wildlife habitat, groundwater recharge and general water quality improvements (e.g., nutrient uptake, degradation of pesticides, sediment retention). Additionally, wetlands provide a cost effective and sustainable alternative to engineered treatment options. The loss of wetlands to development and/or agriculture can be deleterious to surface and groundwater quantity and quality.

Land cover data indicate the presence of 369 ha of wetlands (0.50% of the total subwatershed area) in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008); however, there are no data on the classes, forms and types of wetlands (*sensu* National Wetlands Working Group, 1997) within the subwatershed. Given the presence of lentic (lakes) and lotic (streams and rivers) systems, marshes and shallow open water wetlands are likely present in the subwatershed. In addition, ephemeral, temporary, seasonal and semi-permanent wetlands (*sensu* Stewart and Kantrud, 1971) are likely present in the subwatershed as well.

The Central Parkland Subregion of the Parkland Natural Region comprises the Waskasoo Creek subwatershed. The Prairie Habitat Joint Venture program (a partnership between federal and provincial governments, organizations and conservation groups in Manitoba, Saskatchewan and Alberta) has assessed the loss of wetlands in the Parkland Natural Region (in the Central Parkland Subregion) from 1985-2001 (Watmough and Schmoll, 2007). In Alberta, this Natural Region has lost 7% of its total wetland area and 8% of its total number of wetlands due to anthropogenic disturbances in that 16-year period. There appears to be no change in the rate of wetland loss in the Prairie Parkland Region over the past 50-70 years. Caution must be taken when extrapolating these data to the Waskasoo Creek subwatershed, since the Prairie Habitat Joint Venture program did not assess wetland losses along any transects in this subwatershed (Watmough and Schmoll, 2007).

4.7.2.2 Riparian Health

Riparian areas are an important transition zone between uplands and water. They act as buffer zones, protecting water quality and attenuating floods. Contaminants are adsorbed onto sediments, assimilated by vegetation and transformed by soil microbes into less harmful forms. They have long been proven effective in reducing nutrients, sediments and other anthropogenic pollutants that enter surface waters via overland and subsurface flow.

Riparian health has not been assessed in the Waskasoo Creek subwatershed.

4.7.2.3 Livestock Manure Production

Areas of higher livestock density within a subwatershed, and their associated higher manure production, are expected to have greater impacts on downstream water quality. Streams that drain land with high intensity livestock operations have higher nutrient concentrations, dissolved nutrients, mass loads, fecal bacteria and exports of total dissolved phosphorus than streams with medium or low intensity livestock operations and manure production.

There are 20 feedlots/intensive livestock operations in the Waskasoo Creek subwatershed (Figure 200) (AAFC-PFRA, 2008). Most of these are located throughout the subwatershed and finish cattle/cows and swine. There are also four horse feeders in the subwatershed.

Cattle density ranges from 0.41-0.60 cattle/ha throughout most of the subwatershed but is slightly lower east of the city of Red Deer (0.21-0.40 cattle/ha) (Figure 201) (AAFC-PFRA, 2008). Cattle and all other livestock operations produce 2.6-5.0 tonnes manure/ha in the northern area of the subwatershed (north of the city of Red Deer) and 5.1-7.5 tonnes manure/ha throughout the remainder of the subwatershed (Figure 202) (AAFC-PFRA, 2008). This manure production quantity is considered medium relative to the remainder of the Red Deer River watershed.

Agricultural intensity, expressed as the percent land cover used as croplands, is generally high in the Waskasoo Creek subwatershed, ranging from 60-80%, although agricultural intensity is somewhat lower in the northern and eastern areas (40-60%) (Figure 203) (AAFC-PFRA, 2008).

4.7.2.4 Urban, Rural, Agricultural and Recreational Developments

Urban sprawl, rural and recreational development is the expansion of urban areas, rural subdivisions and recreational areas into surrounding landscape. This expansion can have many negative effects on the environment, including the loss of wetlands, riparian areas, intermittent streams and wildlife habitat, as well as increased surface runoff into neighboring creeks, rivers and lakes.

Communities in the subwatershed include the City of Red Deer, the Towns of Innisfail and Penhold and a number of small settlements, including the Hamlet of Springbrook, formerly Canadian Forces Base Penhold (Government of Canada, 2006). The Gaetz Lake Bird Sanctuary in Red Deer provides walking trails and viewing platforms and is one of a few provincial or federal recreational facilities in the subwatershed.

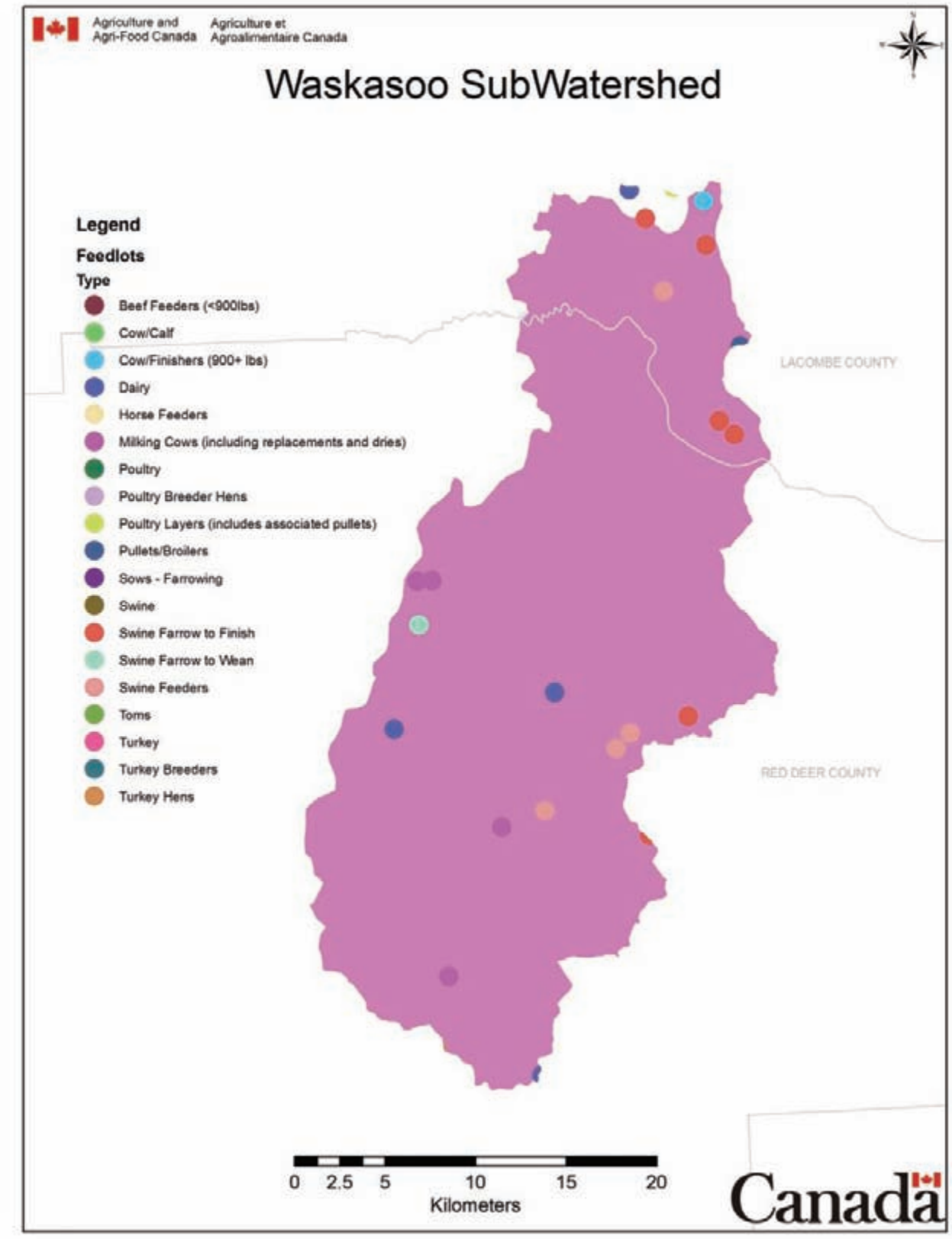


Figure 200. Feedlots and intensive livestock operations in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

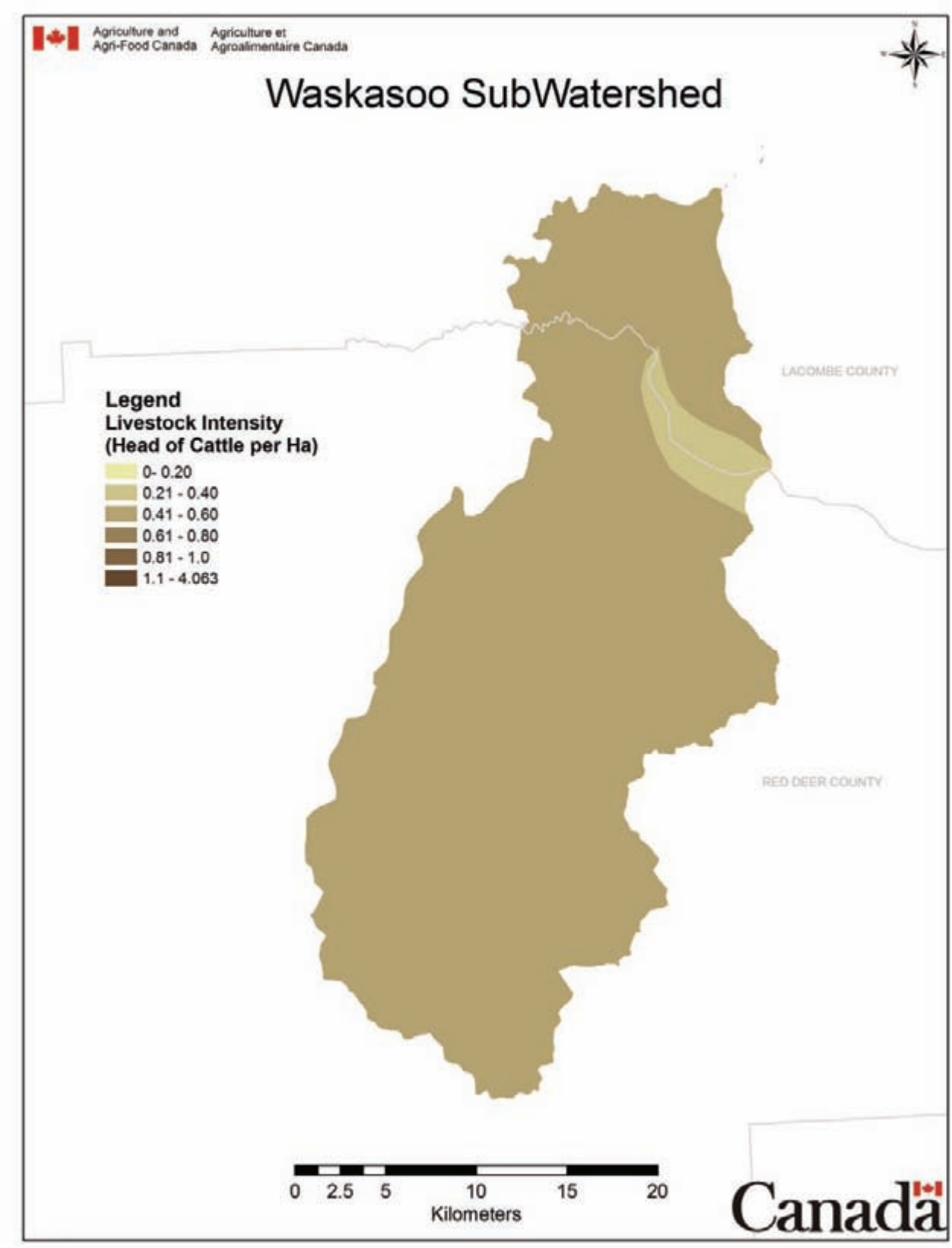


Figure 201. Cattle density (cattle/ha) in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

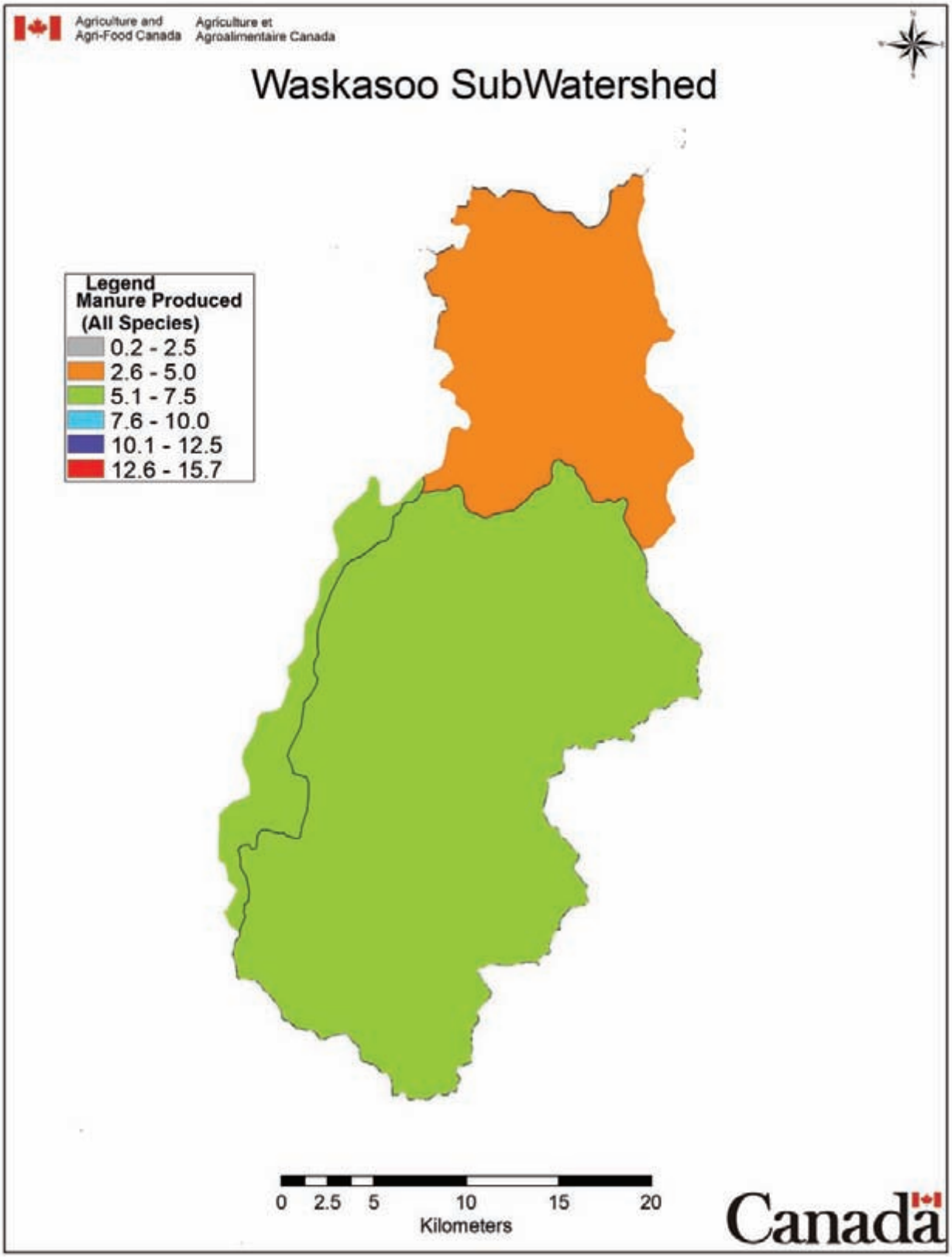


Figure 202. Manure production (tonnes/ha) in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

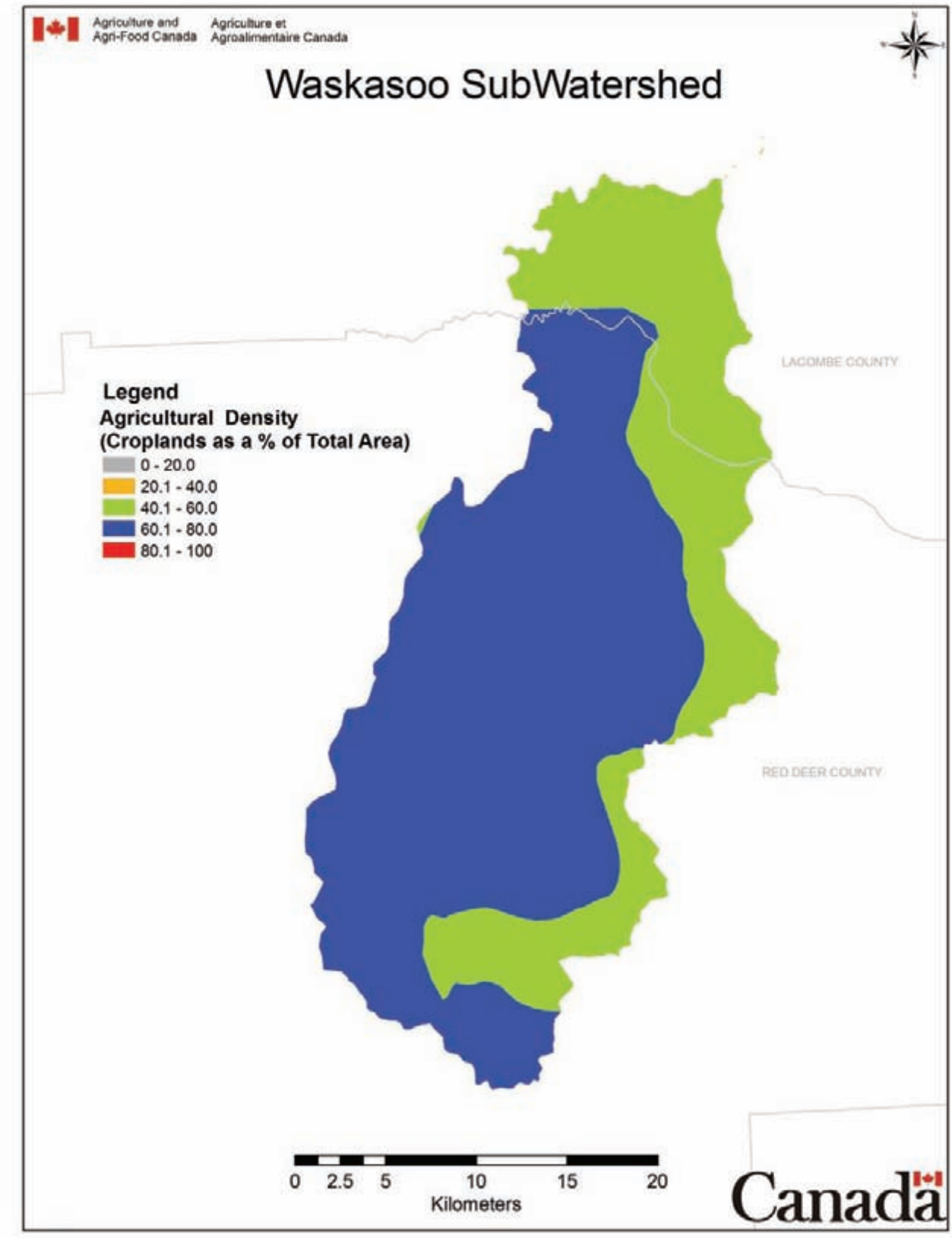


Figure 203. Agricultural intensity (% cropland) in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

4.7.2.5 Linear Developments

Linear developments include seismic lines, pipelines, roads, railways and utility right of ways. Quantifying linear development will help us understand potential changes in water quality and fish and wildlife populations, e.g., wildlife corridors can be interrupted by roads, and watersheds can have their drainage patterns permanently altered by increases in impervious or compacted surfaces.

The most prominent linear developments in the Waskasoo Creek subwatershed are urban and rural roads, which have a total length of 1,388 km and cover 22.21 km^2 of the subwatershed's landbase. Other less prominent linear developments include powerlines and cutlines/trails (Table 86). In total, all linear developments cover an area of 30.9 km^2, or 4.2% of the total area of the subwatershed (Figure 204) (AAFC-PFRA, 2008).

Table 86. Linear developments in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008). The dominant linear development is highlighted.

Linear Development	Length (km)	Width (m)	Area (km^2)	Proportion of total linear disturbances (%)
All roads	1,388	16	22.21	71.8
Cutlines/trails	340	6	2.04	6.6
Pipelines	118	15	1.77	5.7
Powerlines	125	30	3.75	12.1
Railways	77	15	1.16	3.7
Total	**2,048**		**30.92**	

In addition to linear developments, the Waskasoo Creek subwatershed has 135 bridges that cross waterbodies, mostly streams and creeks, or culverts that connect waterbodies. These are primarily associated with Waskasoo Creek and Piper Creek (Figure 205) (AAFC-PFRA, 2008). Along with the Panther River subwatershed, The Waskasoo Creek subwatershed has among the lowest number of pipelines crossing any waterbodies. Most of the crossings are located in the east-central area of the subwatershed (Figure 206) (AAFC-PFRA, 2008).

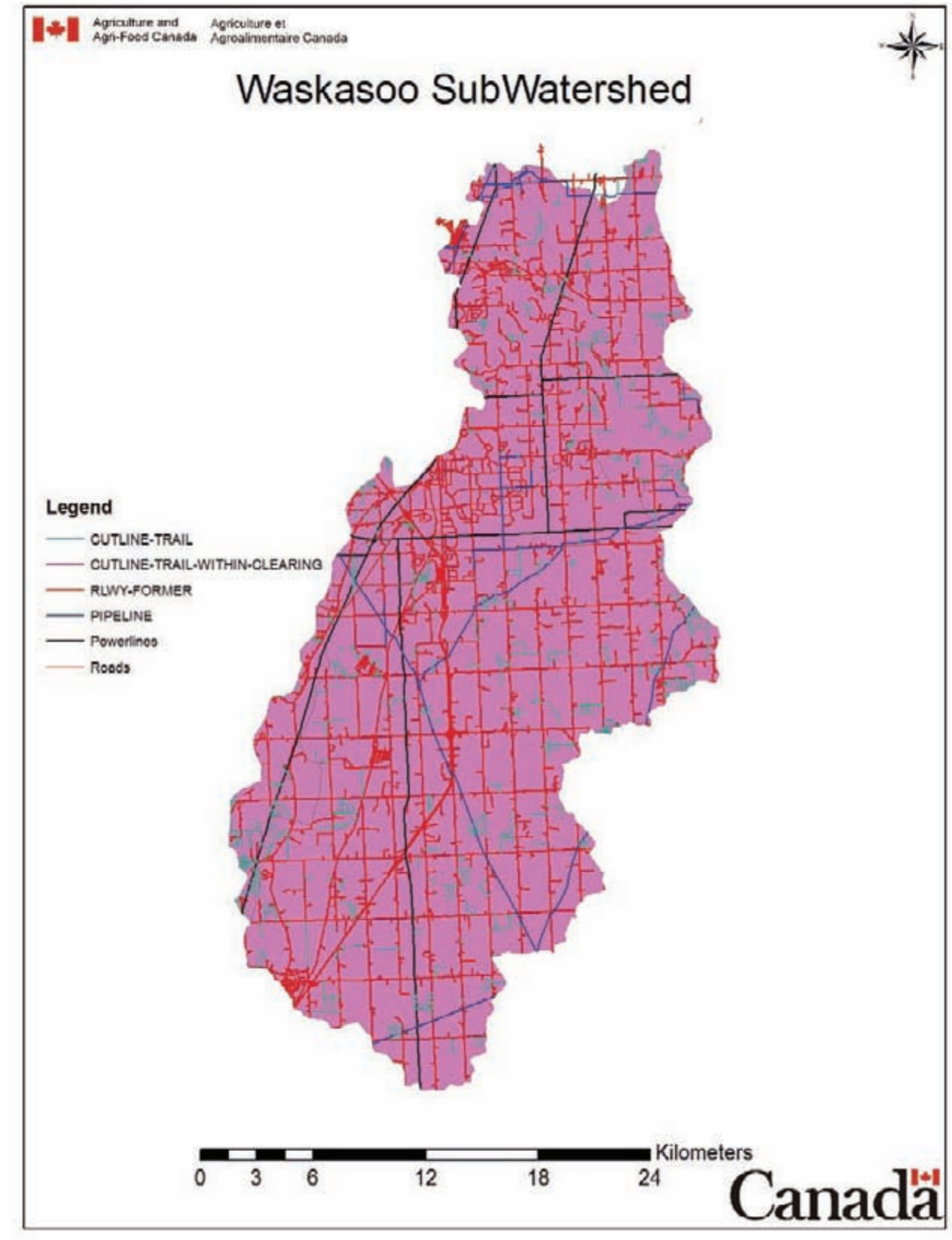


Figure 204. Linear Developments in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

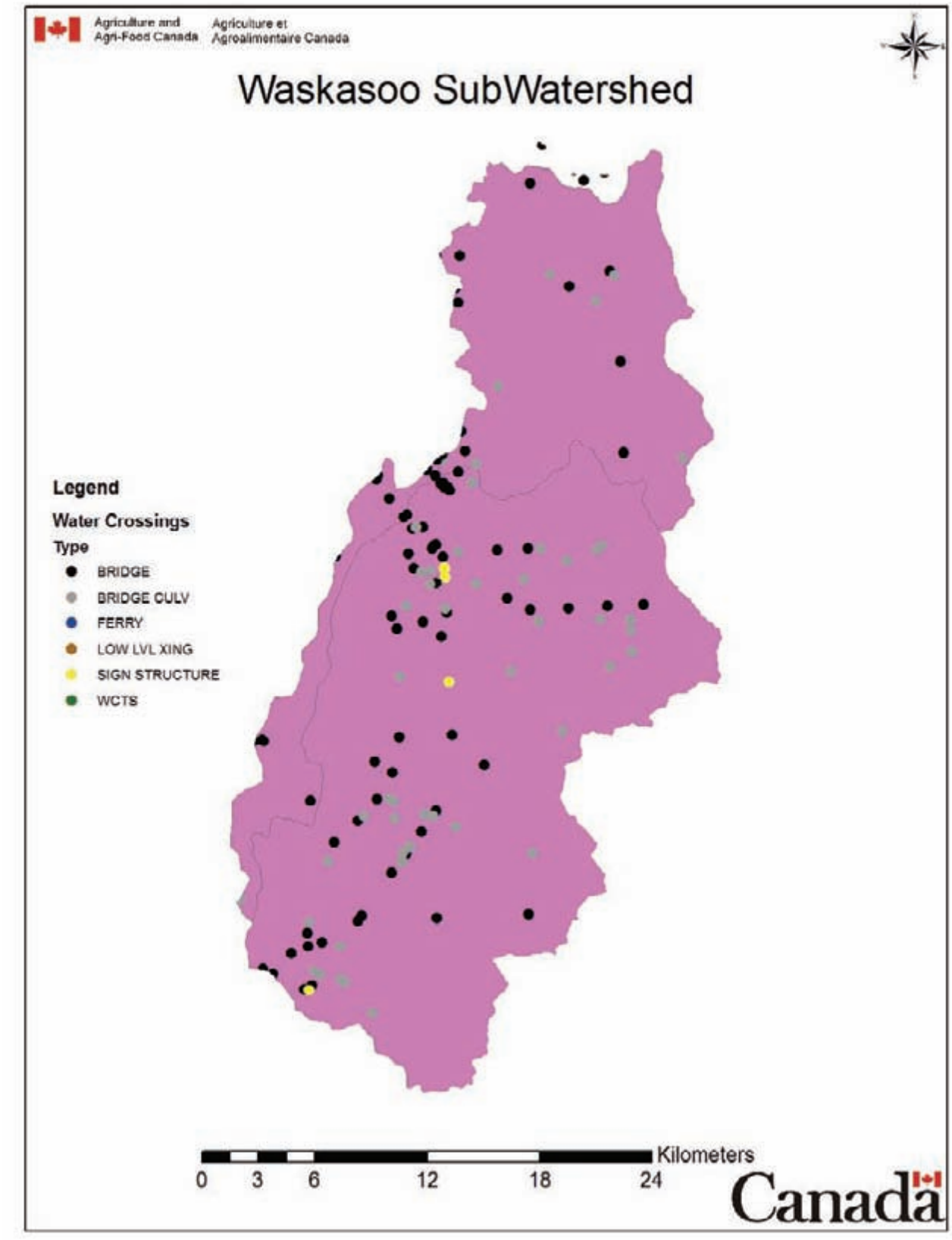


Figure 205. Waterbody crossings in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

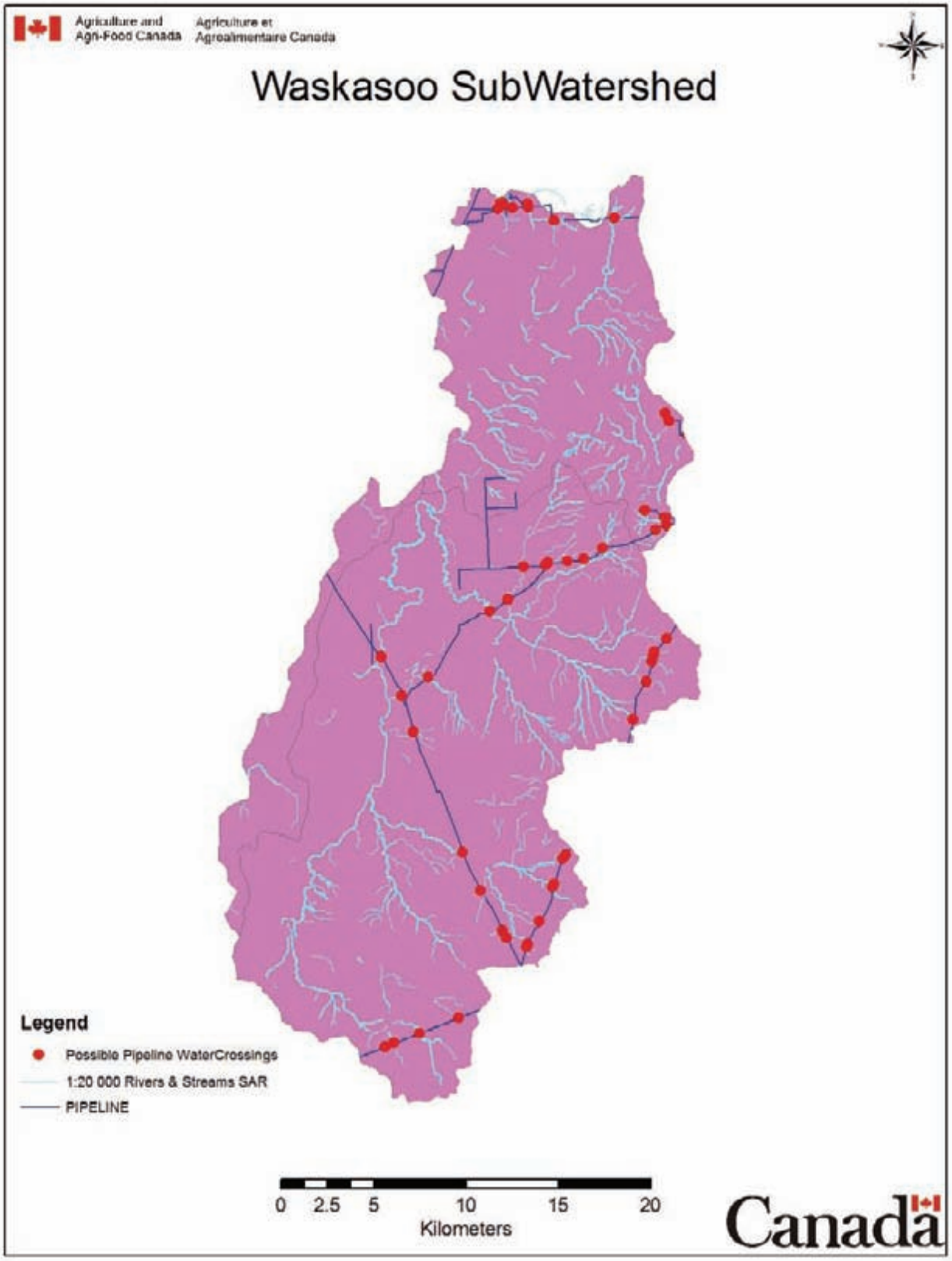


Figure 206. Pipeline crossings over waterbodies in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

4.7.2.6 Oil and Gas Activities

Oil and gas activity is very common throughout the province of Alberta. With oil and gas development there can be a number of associated impacts, including loss of wetlands, habitat fragmentation, increased water use and surface water and groundwater contamination (Alberta Centre for Boreal Studies, 2001).

The Waskasoo Creek subwatershed has an average well density of 1.70 wells/km^2. Wells are distributed throughout the entire subwatershed; however, well density increases up to 5 wells/km^2 near Niobe and in the Piper Creek area. Well densities ranging from 5-10 wells/km^2 occur north-east of Red Deer near Prentiss. Near Labuma and Briggs, oil/gas well densities reach up to 40 well/km^2 (Figure 207). About 50% of all wells are active, with the majority being unspecified wells, followed by oil and gas wells (Table 87) (AAFC-PFRA, 2008).

Table 87. Number of known active and abandoned oil, gas, water and other wells in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

Well type	Quantity
Wells – active *	286
Wells – abandoned *	304
Total	**590**
Gas wells – active	154
Gas wells – abandoned	28
Total	**182**
Oil wells – active	159
Oil wells – abandoned	266
Total	**425**
Water wells – active	23
Water wells – abandoned	36
Total	**59**
Total active wells in subwatershed	**622**
Total abandoned wells in subwatershed	**634**
Total wells in subwatershed	**1,256**

* The purpose of these wells is undefined and may include standing, newly licensed, flowing coalbed methane, testing coalbed methane, carbon dioxide injector or general exploration wells.

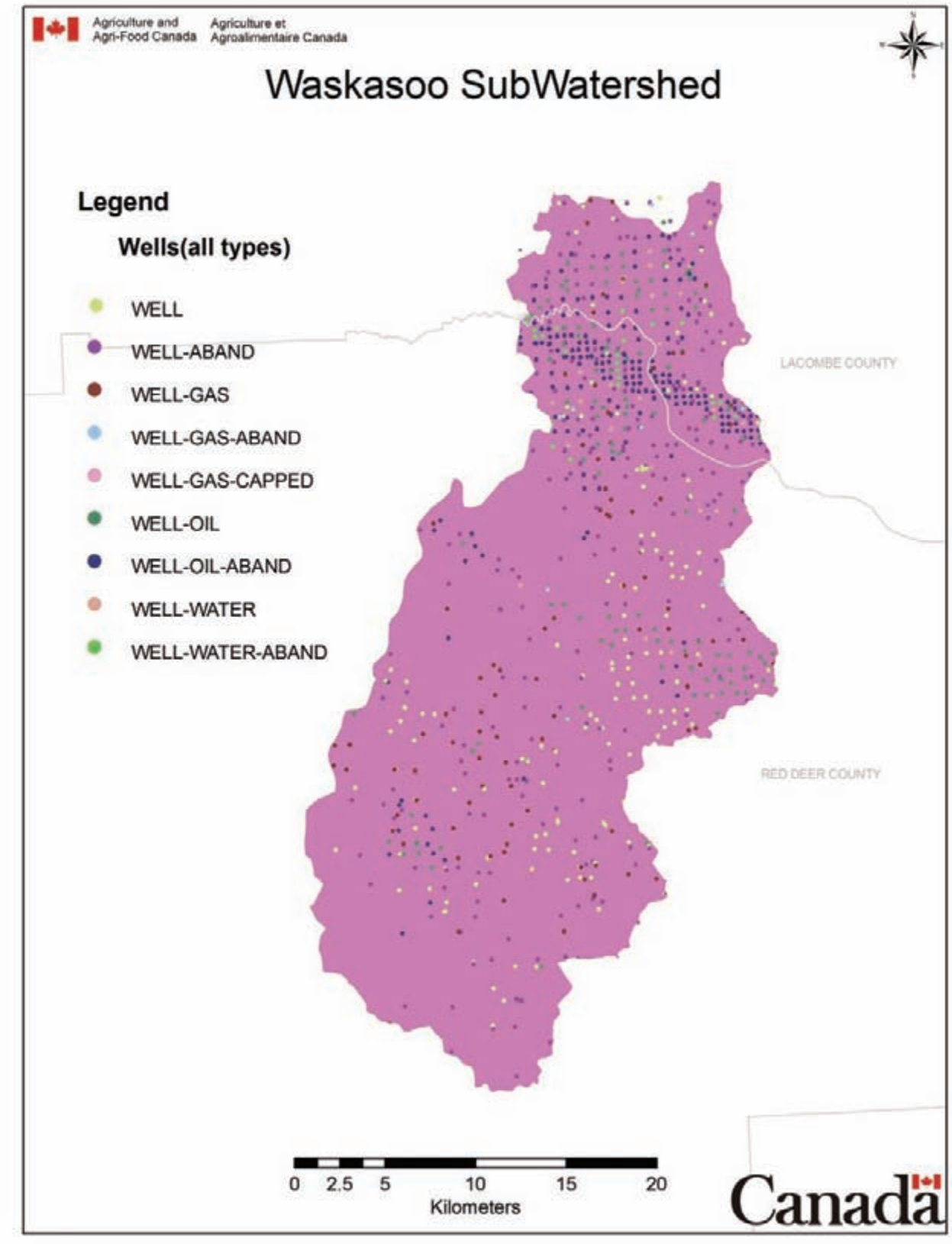


Figure 207. Known active and abandoned oil, gas, water and other wells in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

Coal bed methane (CBM) is natural gas that is found within coal formations. It has received attention recently as an additional source of energy; however, it brings with it potential environmental impacts, some of which are similar to conventional oil and gas exploration and production endeavors. Conversely, some potential impacts it brings with it are new, including an increased intensity in wells, compressors, pipeline infrastructure and completion and production of natural gas from formations above the base of groundwater protection. Some CBM wells are estimated to produce over 65,000 L of waste water per day (Lennon, 2008). In addition, common to oil, gas and unconventional gas (CBM and Shale gas) production is the risk of groundwater contamination through fracturing. Fracturing results from pumping fluids or gases into bedrock formations at high rates and pressures to 'fracture' the bedrock and increase gas or oil production. Fracturing fluids may contain toxic or carcinogenic compounds, which may leach into groundwater sources and pose a threat to human health through contaminated drinking water (Natural Resources Defense Council, 2002).

4.7.3 Water Quality Indicators

Changes in water quality indicate either a deterioration or improvement in the condition of the watershed and demonstrate specific areas that require further attention or protection. Changes in water quality result from changes in land use or land management practices, landscape disturbance and natural events. The major anthropogenic impacts on water quality result from natural resource extraction and processing, wetland drainage, dredging, dam construction, agricultural runoff, industrial wastes, municipal wastes, land erosion, road construction and land development. Five metrics were used to indicate changes in water quality in the Red Deer River watershed and its 15 subwatersheds:

- Nutrients – Condition Indicator
- Bacteria – Condition Indicator
- Parasites – Condition Indicator
- Pesticides – Condition Indicator
- Point Source Inputs

These five water quality indicators reflect socioeconomic growth in a region. Hence, while human activities in a region can have negative impacts on aquatic ecosystems, it is important to strive for a balance between socioeconomic growth and the sustainable management of these aquatic ecosystems to ensure their long-term health and enjoyment by future generations.

4.7.3.1 Nutrients

Nitrogen and phosphorus are essential nutrients for most aquatic plants, whereby excess nutrients can lead to eutrophication, i.e., an excessive amount of aquatic plant and phytoplankton growth. Concomitant with increased plant and phytoplankton growth, oxygen levels may significantly decrease in the water column, which may negatively impact aquatic organisms, including fish. In addition, excessive phytoplankton growth, particularly of cyanobacteria, can lead to the release of toxins into the water column, which may be harmful to aquatic organisms, waterfowl, livestock and humans.

Nutrient concentrations data were not located for any waterbody in the Waskasoo Creek subwatershed.

4.7.3.2 Bacteria

Coliforms are a broad class of bacteria found in human and animal wastes. Total coliforms include *Escherichia coli*, fecal bacteria and other coliforms that occur naturally in warm blooded animals. *E. coli* is one of three bacteria commonly used to measure the direct contamination of water by human or other mammal wastes. Ingestion of or exposure to fecal bacteria can have negative health impacts. Sources of this type of bacteria include agricultural and municipal runoff, wildlife, faulty septic systems and septic fields.

Bacteria data were not located for any waterbody in the Waskasoo Creek subwatershed.

4.7.3.3 Parasites

Waters that are polluted may contain several different disease-causing organisms, commonly called parasites. Enteric parasites, those that live in the intestine of warm blooded animals, can carry or cause a number of infectious diseases. *Cryptosporidium* and *Giardia* spp. are two such parasites. Both occur in almost all environments, including lakes, rivers, reservoirs and groundwater. They come from the feces of rodents, birds, cows, pigs and humans, and the ingestion of these parasites causes gastrointestinal conditions known as cryptosporidiosis and giardiasis.

Parasite data were not located for any waterbody in the Waskasoo Creek subwatershed.

4.7.3.4 Pesticides

Pesticides are a group of chemicals, including herbicides, insecticides, rodenticides and fungicides, used for many purposes, including pest control and aesthetics in urban areas, golf courses and in forestry and agricultural production. Pesticides are a common contaminant of streams and dugouts in the high intensity agricultural areas of Alberta.

Pesticide data were not located for any waterbody in the Waskasoo Creek subwatershed.

4.7.3.5 Point Source Inputs

Point source inputs include effluents from waste water treatment plants (WWTP), stormwater outfalls and industry. Effluent from WWTP's, although regulated, generally has higher concentrations of certain compounds (e.g., nutrients, solids, pharmaceuticals, metals, etc.) than the receiving environment. Similarly, stormwater outfalls contain elevated levels of nutrients, salts and solids compared to the receiving environment, and industrial effluents can contribute elevated levels of a suite of different contaminants, such as metals, solids, hydrocarbons and/or salts, as well as other chemicals used in processing or manufacturing, to aquatic ecosystems.

There are seven upstream oil/gas facilities, one municipal waste management facility, one oil sands/heavy oil processing facility and one chemical manufacturing facility that have released pollutants continuously or sporadically into the air in the Waskasoo Creek subwatershed since 2001. Pollutants from the upstream oil/gas facilities include carbon monoxide (CO), nitrous oxide (N_2O), sulphur dioxide (SO_2) and particulate matter < 2.5 μm in size. The only pollutant from the oilsand/heavy oil processing

facilities is CO, while the chemical plant has released CO, sulphuric acid (H_2SO_4), volatile organic compounds (VOCs), particulate matter < 10 µm in size and various hydrocarbons (e.g., ethylene and biphenyl) (NPRI, 2008). No pollutants were released directly into aquatic ecosystems according to the National Pollution Release Inventory. The City of Red Deer releases tertiary-treated wastewater directly into the Red Deer River.

4.7.4 Water Quantity Indicators

Water quantity is important for the maintenance of aquatic habitat, it has functions related to water quality and it is essential for the treatment and production of sufficient volumes of drinking water to meet current demands. Irrigation, industry and livestock production are highly dependent on a minimum amount of water. Sufficient water quantity is necessary for many recreational activities, and in recent years many cottagers and recreational lake users across Alberta have voiced concerns about the decreasing volumes of water seen across the province. Five metrics were used as water quantity indicators in the Red Deer River watershed and its 15 subwatersheds:

- Volume
- Minimum Flows to Maintain Ecological Integrity – Condition Indicator
- Contributing Areas to the Watershed
- Allocations
- Groundwater Recharge/Discharge

Water discharge rates, allocations and minimum flow rates to maintain ecological integrity can reflect socioeconomic growth in a region. Human activities in a region frequently reduce available water quantities required to maintain healthy aquatic ecosystems. It is important to balance socioeconomic growth and the sustainable management of these aquatic ecosystems to ensure their long-term health and enjoyment by future generations.

4.7.4.1 Volume

Water volume is the amount of water flowing past one point over a given time, or in the case of lakes or other standing waterbodies, the total amount of water present in the waterbody at a given time. This amount varies seasonally and annually with shifts in weather patterns. Water withdrawals for consumptive uses have increased dramatically in recent years and have resulted in some watersheds within the province being closed to new water licenses.

The total length of the water courses in the Waskasoo Creek subwatershed is about 334 km (AAFC-PFRA, 2008). The major streams in the subwatershed are Waskasoo Creek and Piper Creek. Dodd's Lake, Flemming Slough, Kenning Slough, Pakkwaw Lake and Pennington Lake are the largest waterbodies in the subwatershed. In addition, there are numerous small creeks and sloughs in the subwatershed (Figure 208) (Government of Canada, 2006).

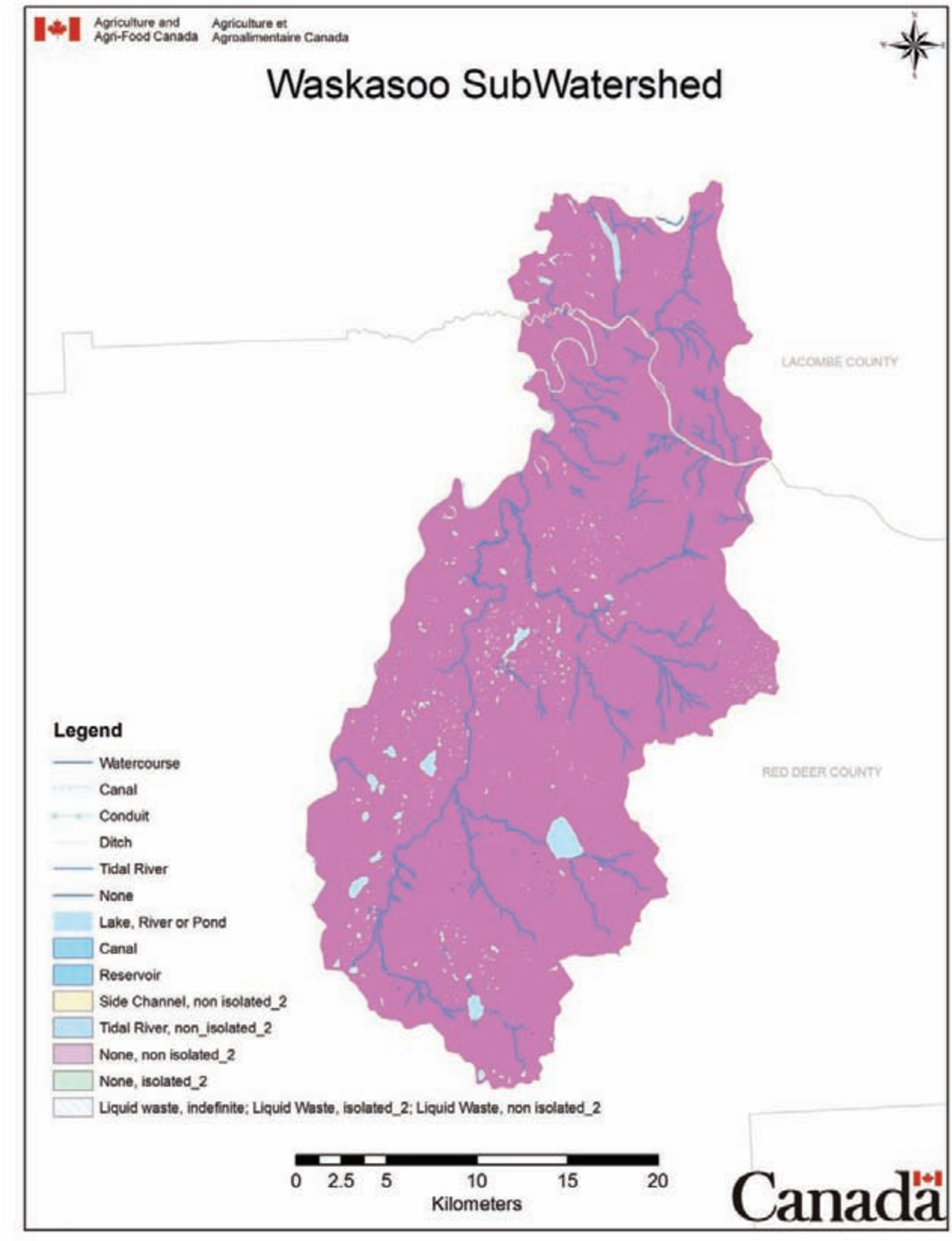


Figure 208. Waterbodies in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

Alberta Environment has been monitoring water discharge rates in Waskasoo Creek (real-time active, 05CC011) (Government of Alberta, 2008c). At this station, discharge rates are usually low but can range from 0.1-5 m^3/sec. Frequently, water discharge from Waskasoo Creek into the Red Deer River ceases altogether in mid-summer and fall. In 2008, water discharge rates were substantially higher than average rates, exceeding 5 m^3/sec on several occasions and 10 m^3/sec once (Figure 209) (Government of Alberta, 2008c).

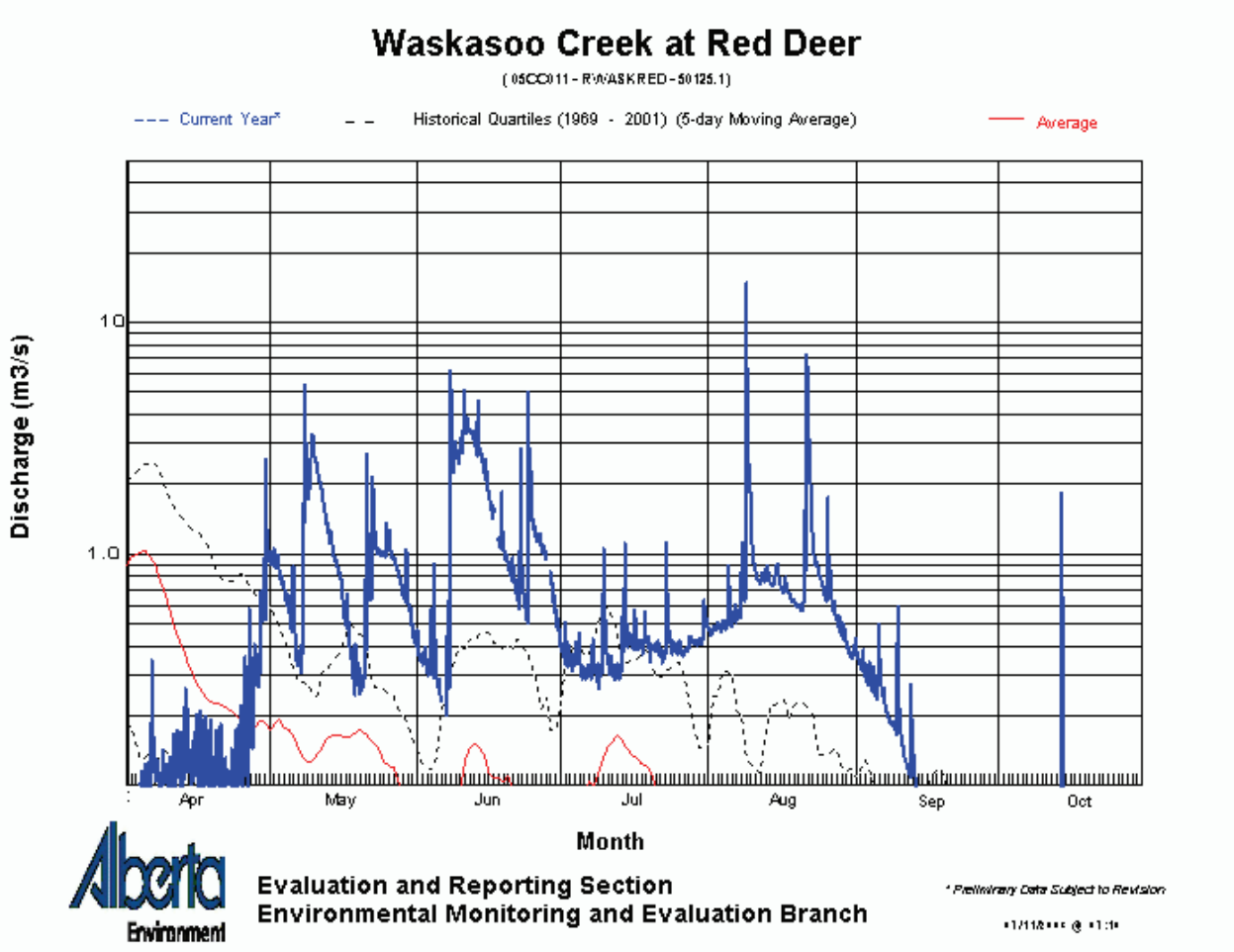


Figure 209. Discharge rates in Waskasoo Creek at Red Deer (Government of Alberta, 2008c). "Current year" indicates water discharge rates in 2008.

There are no major dams located in the Waskasoo Creek subwatershed; however, there are numerous smaller water infrastructures in the subwatershed, e.g., small dams, sluices, weirs and dykes, which control water flow.

4.7.4.2 Minimum Flows to Maintain Ecological Integrity

Minimum flows to maintain ecological integrity are the lowest flows or volumes (lakes) required to sustain native aquatic species and natural ecosystem functions. Minimum flows must be determined before allocation of water can safely take place to preserve the ecological functionality of aquatic ecosystems.

Minimum flow requirements for the maintenance of ecological integrity have not been determined in the Waskasoo Creek subwatershed.

4.7.4.3 Contributing Areas to the Watershed

Contributing areas to the watershed are areas from which runoff flows into the lakes, creeks and rivers of the watershed. These data are used to determine an estimated volume of water contributed to the river on an annual basis.

In the Waskasoo Creek subwatershed, 27,416 ha (or 37.9% of the total area of the subwatershed) of land do not contribute to the drainage of the subwatershed (Figure 21o). These areas are located throughout the subwatershed, e.g., west and east of Waskasoo Creek and east of Red Deer, Innisfail and Ponoka, in areas of low relief and relatively flat topography (Figure 211) (AAFC-PFRA, 2008).

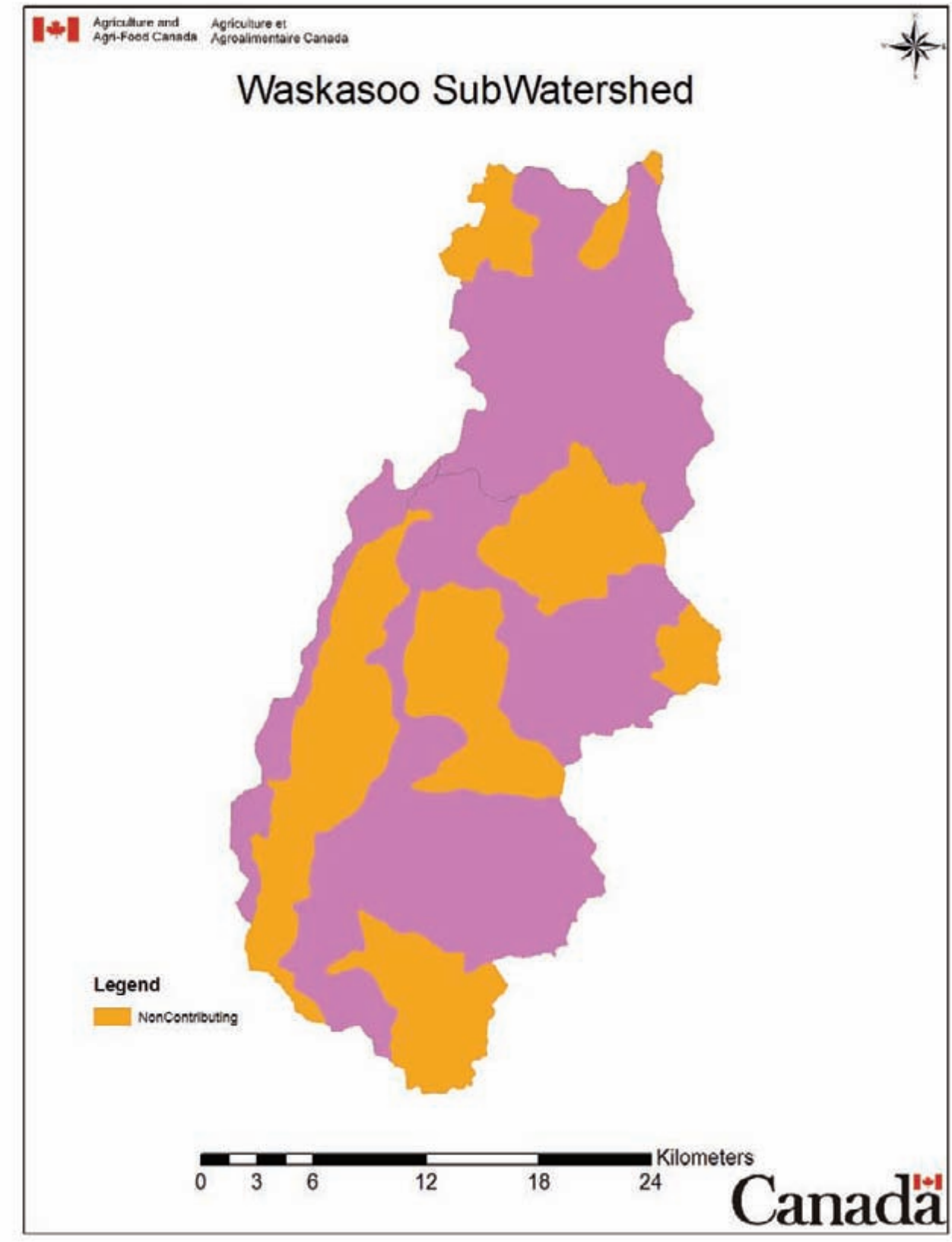


Figure 210. Non-contributing drainage area in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

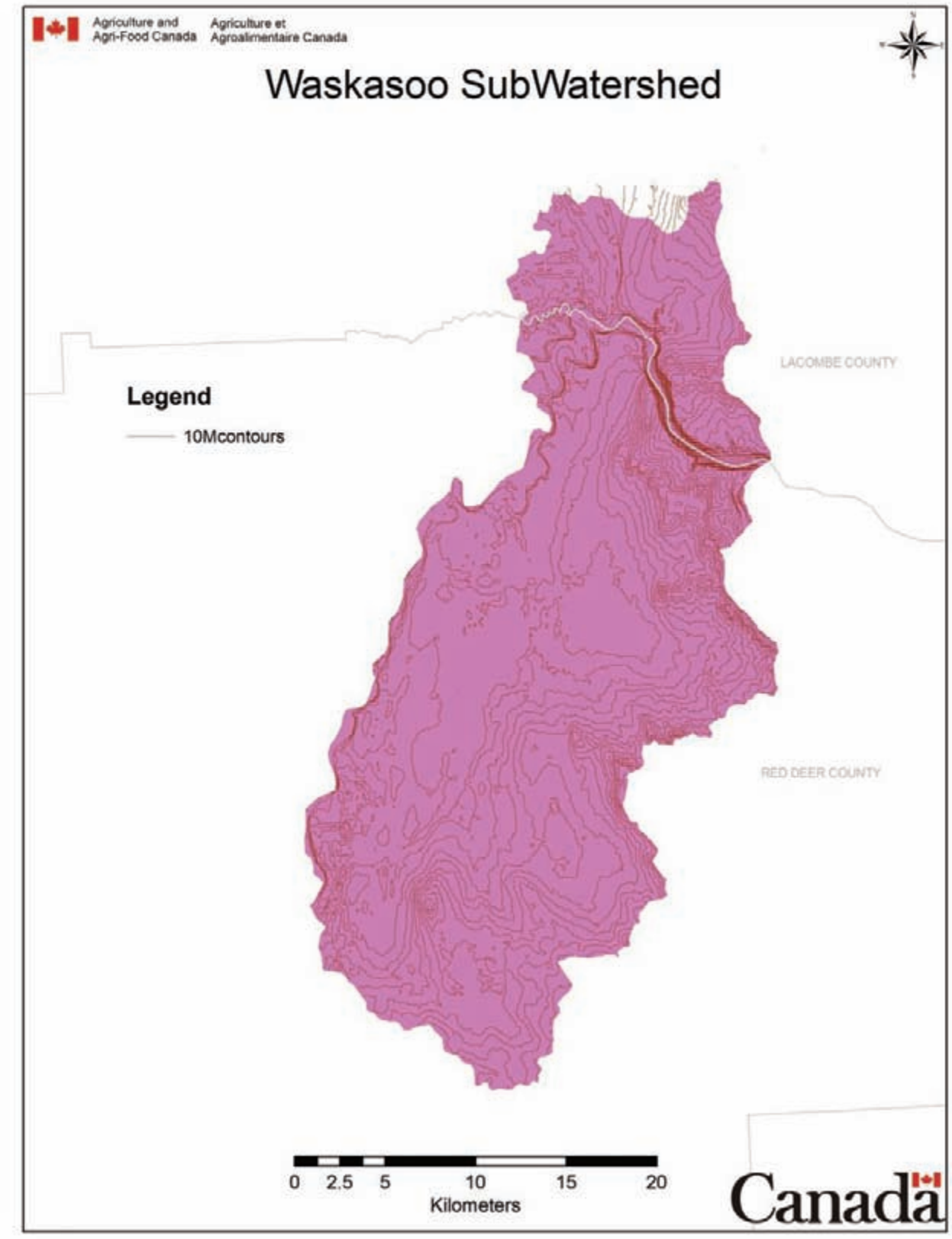


Figure 211. Topography (10-m contour intervals) of the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

4.7.4.4 Allocations

Surface and groundwater water withdrawal permits for the watershed are quantified by user sector along with information on licenses, consumption and return flows. This information will be used along with water flow data to identify areas of potential future constraints on surface water availability, which may have implications for future development.

In the Waskasoo creek subwatershed, 587 surface water licenses and 401 groundwater licenses have been issued for water diversion projects (Figures 212, 213, respectively) (AAFC-PFRA, 2008). They are distributed throughout the entire subwatershed.

About 3.3 million m^3 of surface and groundwater are diverted annually in the Waskasoo Creek subwatershed (Government of Alberta, 2008d). The most prominent use of surface water is for irrigation (70% of total surface water diversions) and for commercial operations (19% of total surface water diversions), while the most prominent users of groundwater are municipalities (71% of total groundwater diversions) and agricultural operations (24% of total groundwater diversions) (Table 88). The majority of water diverted in the entire subwatershed comes from groundwater sources, i.e., the local aquifer (66%) (Government of Alberta, 2008d). Additional groundwater diversion information is provided in HCL (2001a, 2005).

Table 88. Surface and groundwater diversions in the Waskasoo Creek subwatershed (Government of Alberta, 2008d). The highest uses for water have been highlighted. Data reported exclude any water diverted from the Red Deer River mainstem.

Purpose	Surface water (m^3/yr)	Groundwater (m^3/yr)
Agriculture	85,775	528,324
Commercial	215,255	65,664
Dewatering	---	27,140
Disturbance	1,600	---
Habitat enhancement	23,440	---
Industrial	---	545
Irrigation	783,720	---
Management of fish	7,400	2,217
Municipal	---	1,542,228
Other purposes specified by the Director	1,975	2,900
Recreation	---	15,793
Total	**1,119,165**	**2,184,811**
Grand total		**3,303,976**

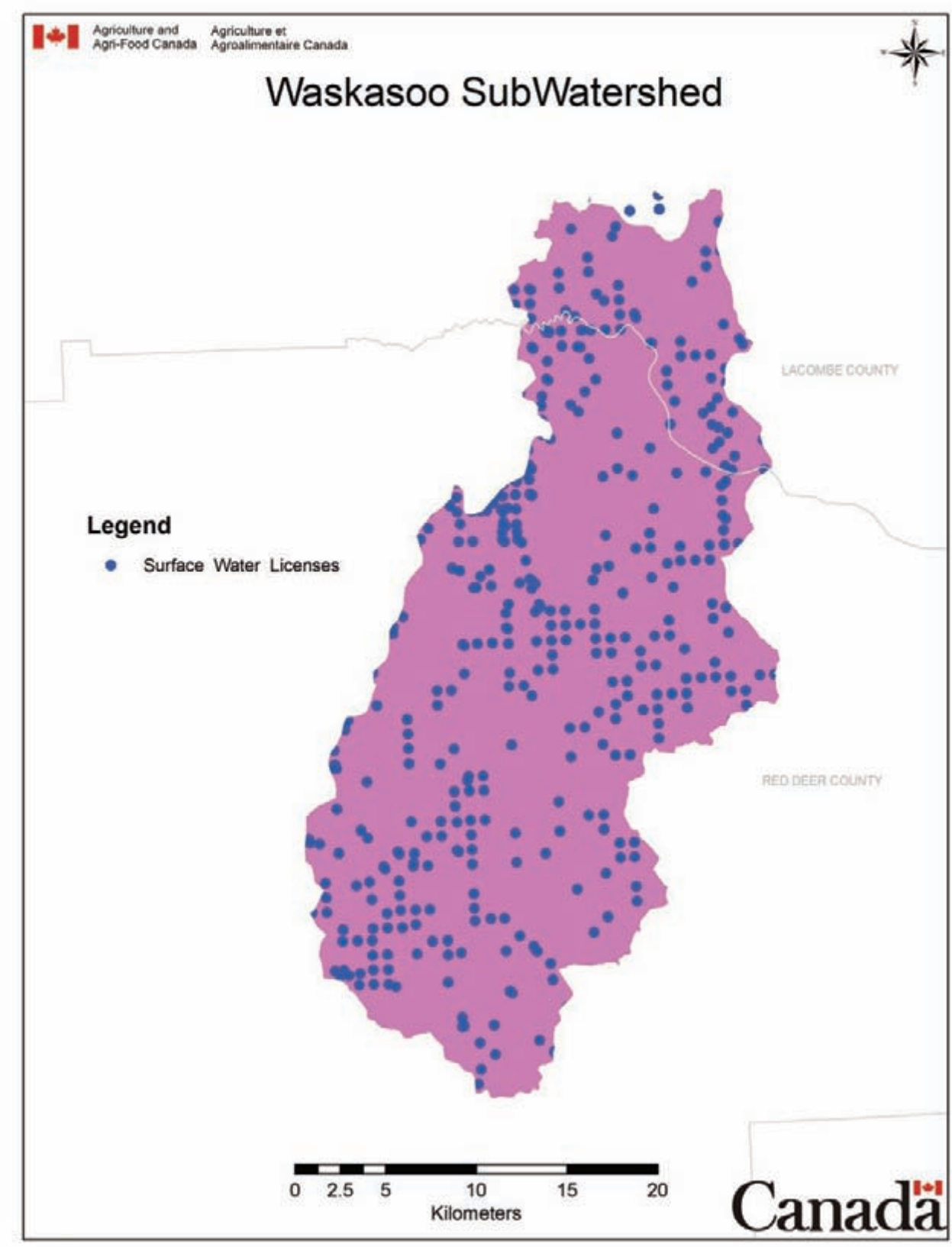


Figure 212. Surface water licenses in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

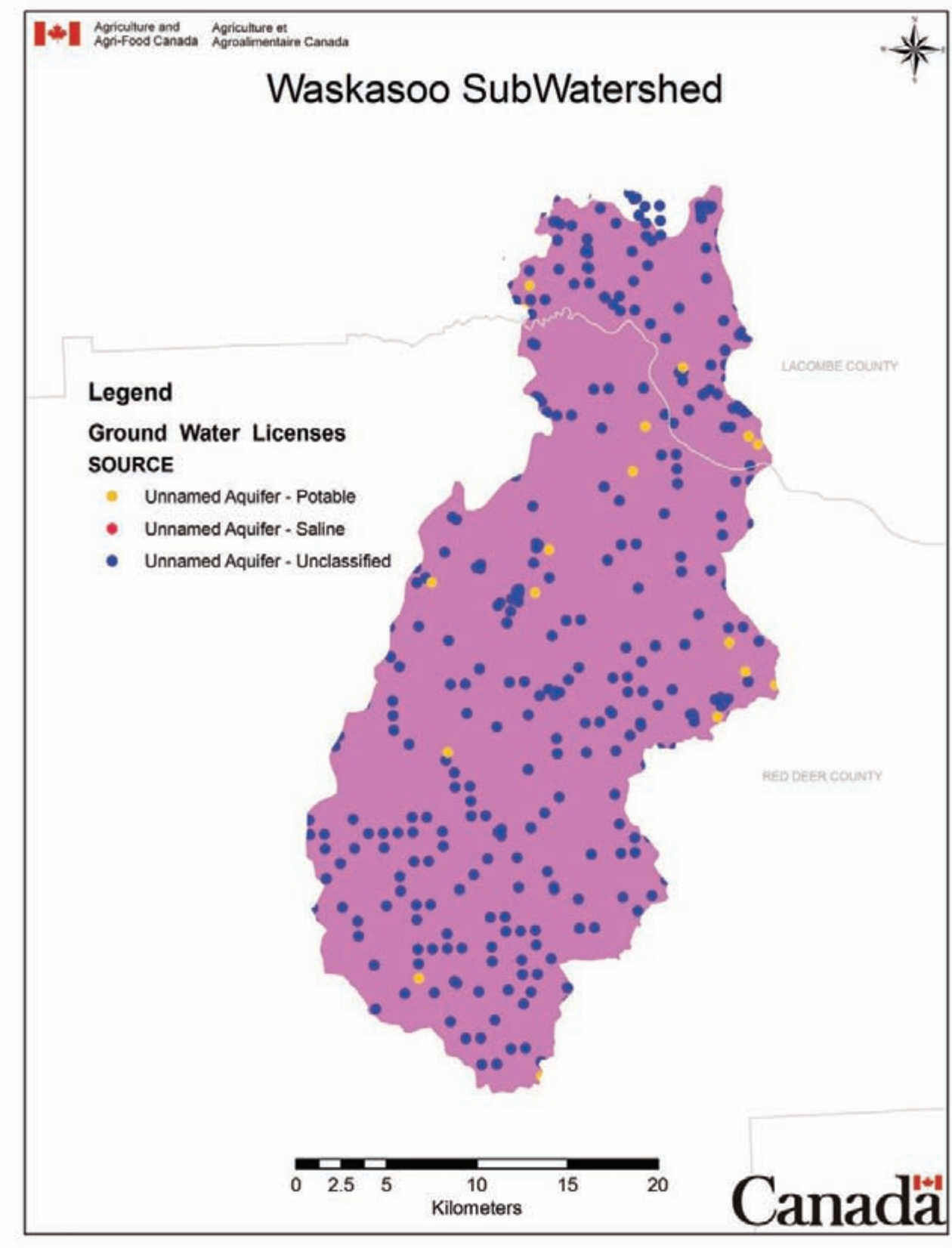


Figure 213. Groundwater licenses in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

4.7.4.5 Groundwater Recharge/Discharge

Areas where groundwater gets recharged or discharges to the surface indicate areas where the groundwater table is close to the surface and the soils are generally more permeable. These areas are at greater risk of becoming negatively impacted from development or agricultural and/or industrial activities. Knowing where groundwater recharges and discharges occur will help to identify areas requiring special protection and limitations to land use.

Freshwater springs are points in the landscape where the aquifer surface meets the ground surface, i.e., freshwater springs are areas of groundwater discharge. The Waskasoo Creek subwatershed has about 15 freshwater springs, most of which are located north and northeast of the City of Red Deer in the vicinity of the Red Deer River.

The Waskasoo Creek subwatershed lies in Lacombe and Red Deer Counties, for which groundwater assessments have been conducted by HCL (2001a, 2005). The assessment indicated that most of the subwatershed is a groundwater recharge area (i.e., water moves from the surface into groundwater reservoirs) or a transition area (neither groundwater discharge or recharge area). Specific areas of groundwater recharge include small depressions in the landscape and temporary and ephemeral wetlands, which collect rainwater and snow melt and release a proportion of this accumulated water into shallow groundwater and regional aquifers (van der Kamp and Hayashi, 1998; Hayashi et al., 2003). Additional information on aquifers, water quantity and quality of the groundwater associated with each aquifer, hydraulic relationship among aquifers and possible groundwater depletion areas associated with each upper bedrock aquifer is provided in HCL (2001a, 2005).

4.7.5 Biological Indicators

Bioindicators are biological (plant and animal) data from which various aspects of ecosystem health can be determined or inferred. The presence, absence and abundance of such data can be linked to water quality, quantity and ultimately to overall watershed health. Four metrics were used as biological indicators in the Red Deer River watershed and its 15 subwatersheds:

- Wildlife Biodiversity
- Fish
- Land Cover – Condition Indicator
- Species at Risk

Changes in biological populations often reflect socioeconomic growth in a region. Human settlement and the subsequent exploration and extraction of natural resources alters the landscape and with it the habitat of the indigenous flora and fauna. It is important to balance socioeconomic growth with the preservation of natural habitat integrity to ensure the long-term health of natural biological populations.

4.7.5.1 Wildlife Biodiversity

Wildlife inventories to determine the biodiversity within the watershed will indicate changes in environmental conditions (e.g., habitat fragmentation, loss of nesting and breeding sites, nutrient enrichment, etc.). A loss of biodiversity can cause an ecosystem to become less stable and more

vulnerable to environmental change. A change in diversity may also affect nutrient cycling and/or energy flow through the ecosystem.

Wildlife biodiversity assessment data have not been located for the Waskasoo Creek subwatershed.

4.7.5.2 Fish

Inventories of selected fish populations may show increases or declines through introductions or changes in environmental conditions. Indicator species sensitive to environmental pollution may show areas of concern through their absence, while others may show similar with their presence. Invasive species, if present, will indicate areas of concern requiring future monitoring.

Fish population data were not located for any waterbody in the Waskasoo Creek subwatershed.

4.7.5.3 Land Cover

Land cover is the type of vegetation, or lack thereof, covering the landscape. Inventory of vegetation populations may show increases or declines through introductions or changes in environmental conditions. Indicator species that are sensitive to environmental pollution may show areas of concern with their absence, while others may show areas of concern with their presence. Changes in land cover can indicate a change in land use and identify areas that need restoration, are at risk of erosion and/or areas with rare plant species that need protection. Land cover is a separate measurement from land use even though these two terms are sometimes used interchangeably.

The majority of the land base of the Waskasoo Creek subwatershed is covered by annual and perennial croplands/pastures (55% and 24%, respectively). The remaining land cover types generally cover < 5% individually (Figure 214, Table 89) (AAFC-PFRA, 2008).

Table 89. Land cover in the Waskasoo Creek subwatershed (AAFC-PFRA, 2008). The most prominent land cover types are highlighted.

Land cover type	Area (ha)	Proportion of subwatershed area (%)
Waterbodies	1,138	1.54
Exposed land	47	0.06
Developed land	3,848	5.20
Shrubland	308	0.42
Wetland	369	0.50
Grassland	3,343	4.52
Annual cropland	41,037	55.43
Perennial cropland/pastures	17,559	23.72
Coniferous forests	1,543	2.08
Deciduous forests	3,323	4.49
No data	1,515	2.05
Total	**74,031**	

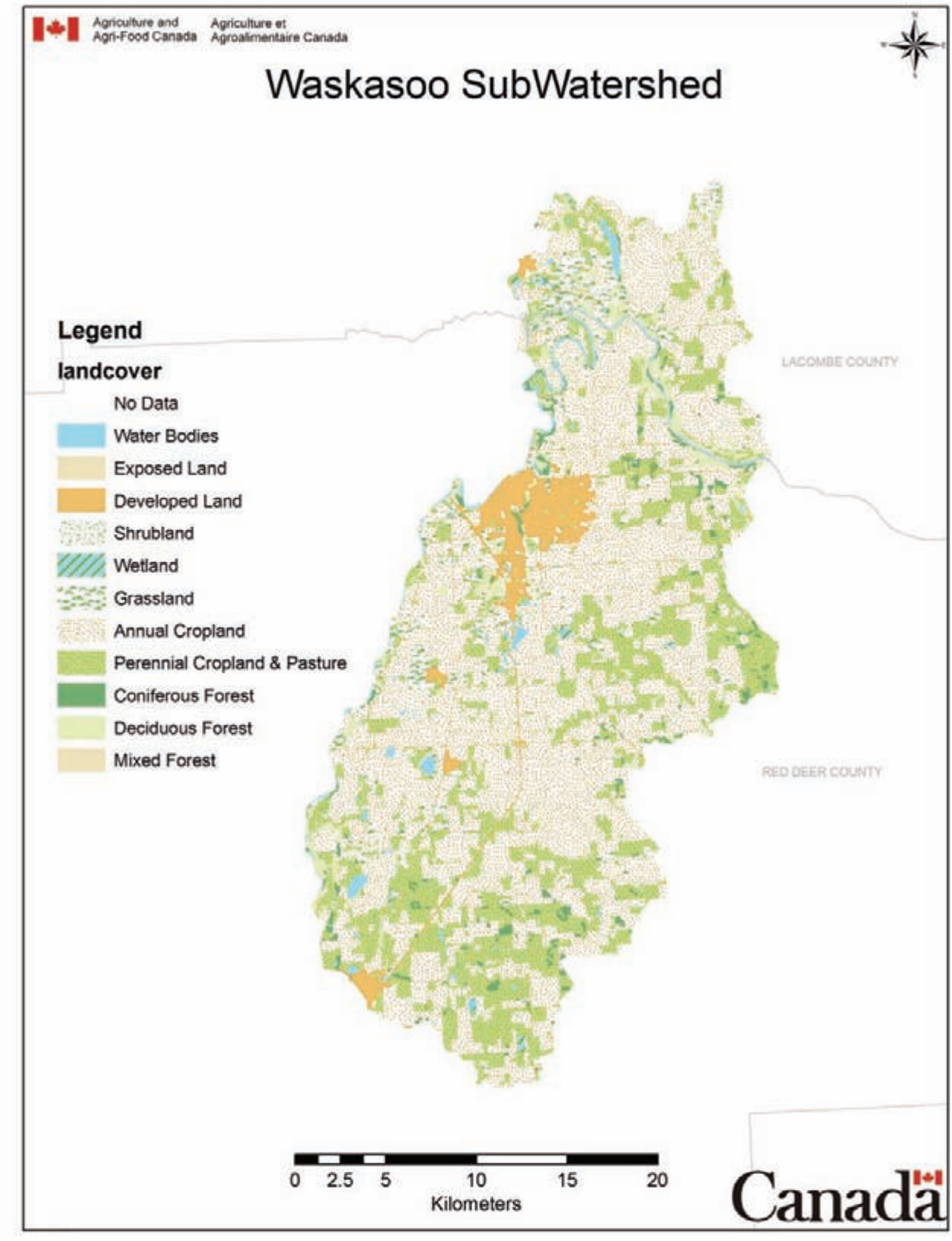


Figure 214. Land cover of the Waskasoo Creek subwatershed (AAFC-PFRA, 2008).

There are no provincially, nationally or internationally designated Ecologically Significant Areas in the subwatershed (Alberta Environmental Protection, 1997).

4.7.5.4 Species at Risk

Identifying species at risk and their habitats will help to determine sensitive areas and level of protection required. The *Species at Risk Act* (*SARA*) was introduced in June 2003 to provide legal protection of wildlife species and conservation of biological diversity. The Act aims to prevent Canadian indigenous species, subspecies and distinct populations from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species and encourage the management of other species to prevent them from becoming at risk. Currently, there are 363 species listed as either endangered (169 species), threatened (110 species) or of special concern (84 species) (Species at Risk, 2008).

"Endangered species" are those species that face imminent extirpation or extinction, while "threatened species" are those that are likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction. "Species of special concern" are those species that warrant special attention to ensure their conservation.

The Waskasoo Creek subwatershed is home to one endangered species (piping plover, *C. melodus circumcinctus*), three threatened species (loggerhead shrike, *L. ludovicianus excubitorides*; peregrine falcon, *F. peregrinus anatum*; Sprague's pipit, *A. spragueii*) and two species of special concern (monarch butterfly, *D. plexippus*; yellow rail, *C. noveboracensis*). Detailed treaties of these species can be found in section 3.1.3.7.

4.7.6 Subwatershed Assessment

The Waskasoo Creek subwatershed is the smallest subwatershed in the Red Deer River watershed. It lies entirely in the Central Parkland Subregion and is characterized by a medium livestock intensity that support about 20 feedlots and high agricultural intensity relative to the Alberta average. Urban centres include the city of Red Deer, the towns of Innisfail and Penhold and several hamlets. Resource exploration and extraction activities have created a complex network of linear disturbances (primarily roads) and 622 active wells, most of which are wells for an unspecified purpose. A total of 988 water licenses have been issued to divert up to 3.30 million m^3 of water annually, with water being used primarily by municipalities and for irrigation purposes. Despite extensive land use practices, no water quality (nutrients, bacteria, parasites, pesticides) or riparian health assessment data were located for any location in the Waskasoo Creek subwatershed. Similarly, no biodiversity or fish population data were located for the subwatershed, despite providing habitat for one endangered species, three threatened species and two species of special concern. The majority of the land base is covered by annual and perennial croplands and pastures.

An Indicator Workshop held in March 2008 identified a total of 20 indicators to be used to assess the overall health of the Red Deer River watershed and its 15 subwatersheds. These indicators included land use, water quality, water quantity and biological indicators. In November 2008, a subset of these indicators was selected to indicate the overall condition of, or risk to, the individual subwatersheds.

There were nine “condition indicators” and three “risk indicators”. The condition indicators were ranked “good”, “fair” or “poor” based on existing guidelines, while risk indicators were ranked “low”, “medium” or “high” relative to the other subwatersheds. The overall subwatershed ranking is based on an “A”-“B”-“C” ranking system with “+” and “-” subrankings. The overall ranking system is based on a subjective evaluation of the combined rankings of the condition and risk indicators.

Based on the available data, the Waskasoo Creek subwatershed receives a rating of “poor” for the condition indicators and a rating of “medium” for the risk indicators (Tables 90, 91). Overall, this subwatershed receives a ranking of “B-”. There are substantial data gaps. Consequently, it is recommended to implement a detailed water quality sampling program, conduct a wetland inventory and regularly monitor riparian health conditions along the major waterbodies in the subwatershed. Of particular concern are (1) the extensive network of linear developments (roads), primarily due to natural resource exploration and extraction activities throughout the subwatershed, (2) the conversion of the landbase from its natural state into annual and perennial croplands and pastures and (3) the loss of wetlands, which likely occurred as a result of agricultural land conversions, drainage, infilling and the disruption of their hydrology following linear developments.

Table 90. Condition and risk indicator summary for the Waskasoo Creek subwatershed. Gray logos indicate data gaps.

Condition Indicators

Risk Indicators


Table 91. Condition and risk assessments of the Waskasoo Creek subwatershed. Indicators with a "poor" or "high" ranking are highlighted.

Indicators		Rating
Condition	Wetland loss	POOR
	Riparian health	---
	Linear developments	POOR
	Nutrients	
	Total phosphorus	---
	Total nitrogen	---
	Bacteria	---
	Parasites	---
	Pesticides	---
	Minimum flows to maintain ecological integrity	---
	Land cover	POOR
Overall		**POOR**
Risk	Livestock manure production	MEDIUM
	Urban, rural, agricultural and recreational developments	MEDIUM
	Oil/gas wells	MEDIUM
Overall		**MEDIUM**

