Section 7.7 – Agricultural Development

Section 7.7.1 – Agricultural Activities and Resources of the La Salle River Watershed (source: Joint Report from Agriculture and Agri-Food Canada – Prairie Farm Rehabilitation Administration and Manitoba Agriculture, Food and Rural Initiatives)

Table of Contents

Section 7.7 – Agricultural Development

6. Recommendations
7. Appendices

Section 7.7 – Agricultural Development

Preface

Although this document focuses on information about agricultural activities and resources in the watershed, it is important to note that there are many other industries, sectors, and users of the watershed's resources that have an impact, both positively and negatively.

Agriculture is only one component, with other human activities such as industry, recreation and residences contributing to degraded riparian areas. Due to scale and accuracy limitations, this report does not replace the need for site-specific analysis; rather, it serves as a guide for general planning purposes in the La Salle River watershed.

1) Federal-Provincial Agriculture Policy and Departmental Mandates

a) Federal-Provincial Agriculture Policy – Environment Chapter

The environment chapter of the current federal-provincial Agriculture Policy Framework has the following goals:

- Achieving meaningful and measurable improvements in soil, water, air quality and the industry's impact on biodiversity;
- Researching and developing new on-farm beneficial management practices, and
- **Making environmental information available for better land use planning and management (includes integrated watershed management)**.

b) Agriculture and Agri-Food Canada – Prairie Farm Rehabilitation Administration (PFRA) Mandate

PFRA's mission is to provide expertise and services to producers and stakeholders for the sustainable use of agricultural land and water resources. PFRA's focus is agricultural land, agricultural water, and resource analysis and interpretation.

c) Manitoba Agriculture, Food and Rural Initiatives (MAFRI) Mandate

MAFRI's mission is to assist with the compilation of a technical resource package and deliver expertise with the technical information to aid in issue identification, and to assist the proponent in completing the final Integrated Watershed Management Plan.

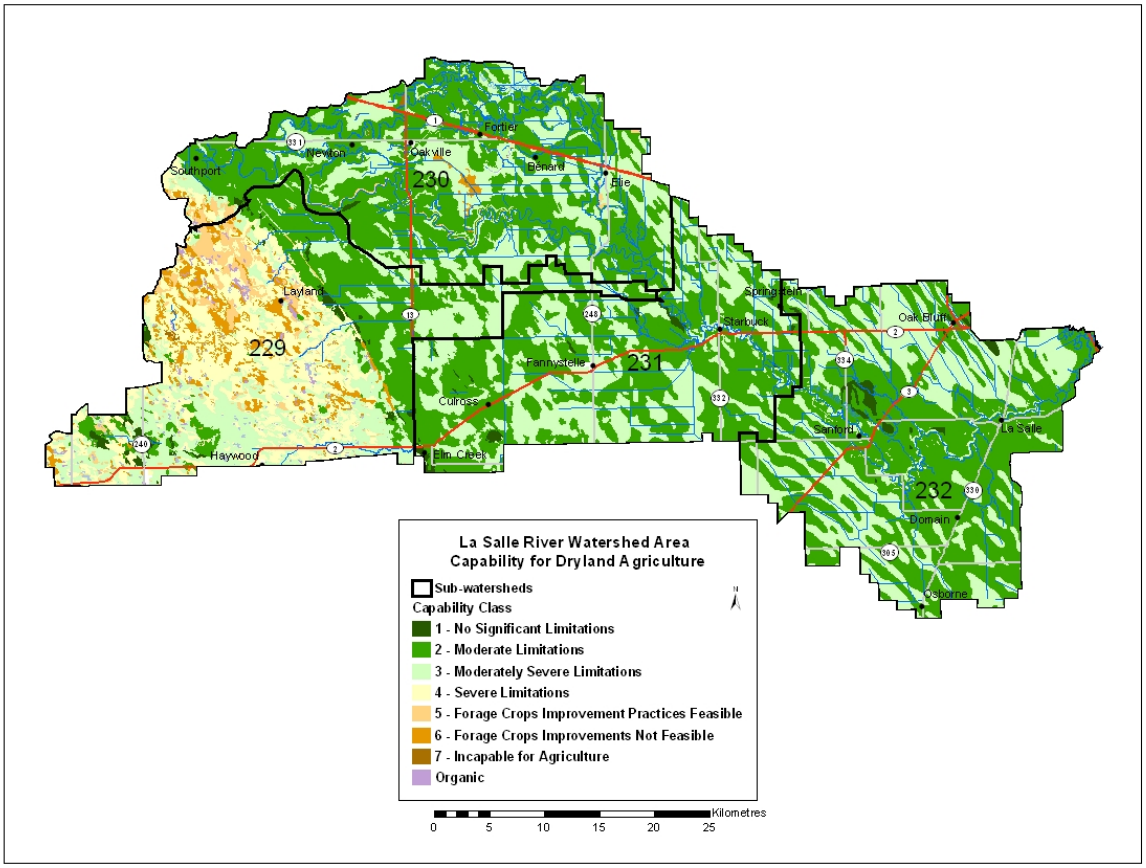
2) General Agriculture Overview of the Watershed

a) Agriculture Capability

Agriculture capability (Figure 1) is a seven-class rating of mineral soils based on the severity of limitations for dryland farming. This system does not rate the soil's productivity, but rather its capability to sustain agricultural crops based on limitations due to soil properties, topography and climate.

Section 7.7 – Agricultural Development

Figure 1 – Capability for Dryland Agriculture



(See also Figure A.1 in appendices for additional agriculture capability information).

Class 1 soils have no limitations, whereas class 7 soils have such severe limitations that they are not suitable for agricultural purposes. The general gradation of agriculture capability classes is as follows:

- Class 1, 2 and 3 soils are capable of sustained production of common field crops, and are thus considered as “prime agricultural lands”.
- Class 4 soils are marginal for sustained arable agriculture and should be in permanent forage production.
- Class 5 soils are suitable only for improved permanent pasture.
- Class 6 soils are suitable only for native pasture use.
- Class 7 soils are incapable of use for arable agriculture or permanent pasture (i.e. it is nearly impossible to drive on class 7 soils, let alone try to farm them).

Agriculture capability subclasses identify the soil properties or landscape conditions that may limit use, such as: adverse climate (C); dense subsoils (D); erosion damage (E); inundation or flooding by streams or lakes (I); lack of soil moisture (M); salinity (N); stones (P); shallow depth to bedrock (R); topography or slopes (T); excess water other than from flooding (W); or two or more minor limitations in combination (X).

In the La Salle River watershed, nearly 50% of the soils are **Class 2** in terms of their agriculture capability, followed by 36% of the soils as **Class 3**. Although not depicted on the map, most of the clay soils found in the eastern 2/3 of the watershed have an excess water (W) limitation due to the slow infiltration of water (i.e. 2W or 3W). The sandy soils in the western 1/3 of the watershed have a lack of soil moisture (M) limitation and, in some cases, a combination of M and W limitations due to their sandy textures and shallow water tables, respectively. These soils are referred to as "wet sands" and usually have an agriculture capability rating of 3MW or 4MW.

b) Land Use and Land Cover

<u>Figure 2 – Land Cover</u>

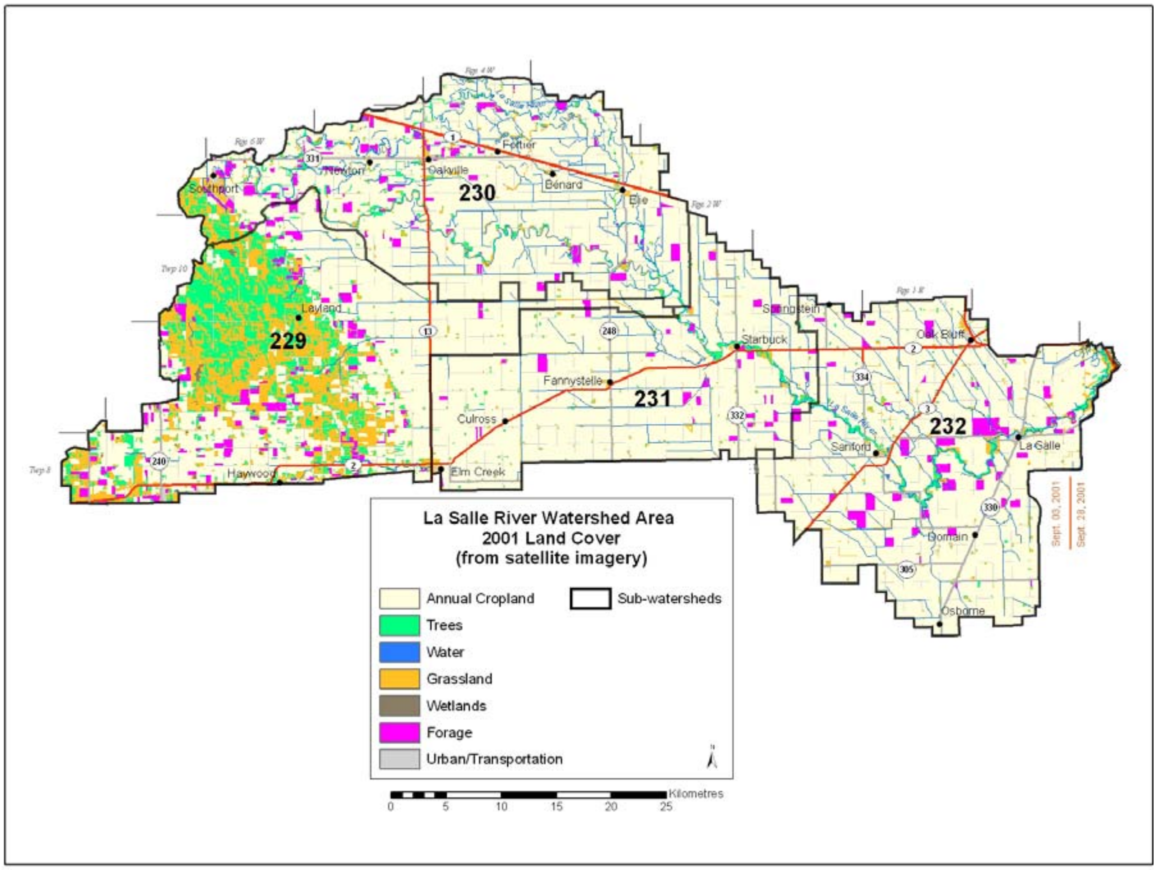


Figure 2 illustrates that the watershed is dominated by agricultural activity. Based on satellite imagery taken in 2001, the watershed's land is covered by 75% annual cropland, 10% grass and pasture, and 4% forages. This translates to almost 90% of the land covered utilized for some form of agriculture with trees, residential uses and transportation infrastructure making up the majority of the remainder of the land cover. However, it is important to note that other land cover classes may be used for agricultural purposes as well. For example, areas with tree cover could be used as pasture land for livestock production. According to this data, wetlands make up only 0.1% of the watershed.

Sub-watershed Comparison

Table 1 - Comparison of 2001 Land Cover by Sub-watershed

Sub-watershed	Crop (%)	Grass (%)	Trees (%)	Forage (%)	Total (%)
229	51	25	16	5	97
230	81	6	4	4	95
231	90	3	1	2	96
232	84	4	2	4	94

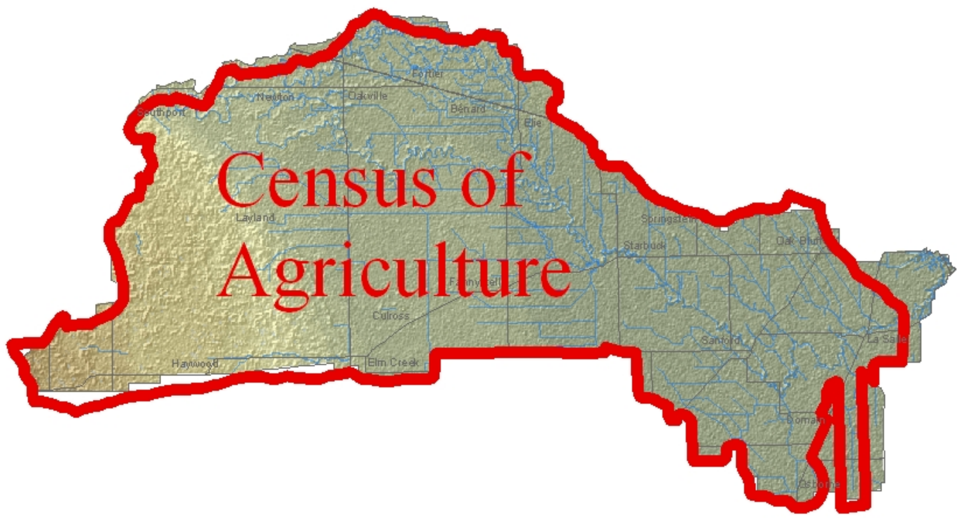
Of the 4 sub-watersheds delineated for the La Salle River watershed (Table 1), three of them are strikingly similar in terms of land cover and are dominated by annual cropland while one (#229), the western most sub-watershed is not. This sub-watershed has significantly greater proportions of its land covered by grass (25%) and trees (16%). This characteristic can be at least partially explained by the inherent soil properties and associated land use that are discussed in more detail in later sections, but can be summarized as having more limitations to crop production and factors generally better suited to livestock production.

c) Agriculture and the Economy

Agriculture plays an important role in the national and local economies. Nationally, the agriculture and agri-food sector accounts for 8.3 % of Canada's Gross Domestic Product (GDP) that includes food service and distribution (4.3%), processing (2.3%) and primary agriculture (1.7%) sub-sectors (source: Statistics Canada 2000),. In Manitoba in 2005, agriculture's direct contribution to the provincial GDP was 3.5% while its indirect contribution was 11%.

Locally, agriculture is an extremely important contributor to the economy in the La Salle River watershed. The Census of Agriculture was applied to the Water Survey of Canada watershed boundary shown in Figure 3. Although it is a slightly different watershed boundary (a coarse national scale watershed), inferences about farming and trends in the watershed should still be valid. According to the Census for 2001, Gross Farm Receipts, or the income from all farm related goods and services, totalled nearly $180,000,000 that year. This highlights the importance of agriculture, arguably the largest contributor to the local economy.

Figure 3 – Water Survey of Canada Watershed Boundary



d) General Agricultural Trends

Table 2 - Farm Number and Size - Census of Agriculture

CENSUS YEAR	Total Farms	Area (ac)	Avg. Farm Size (ac)
1971	963	518,814	539
1976	858	513,952	599
1981	816	513,650	630
1986	777	519,775	669
1991	743	522,869	704
1996	699	531,392	760
2001	627	539,867	861

Table 2 shows trends in the watershed relating to farm numbers and size from 1971 to 2001. During this period, the number of farms has been steadily decreasing in the watershed, but total acres farmed has increased by about 4% . This translates into the remaining farms getting larger with the average farm size growing from about 539 acres in 1971 to about 861 acres in 2001.

3) Agricultural Resources in the Watershed

a) Soil

i) Surface Texture (Figure A.2 in appendices)

Soil texture is the relative proportion of sand, silt and clay. The texture of a soil cannot be altered. In agriculture, soil texture is determined by measuring the size and distribution of particles less than 2 mm in diameter. Sandy soils are referred to as “light” soils because they are easily tilled; clay soils are referred to as “heavy” soils because of their difficult workability.

The map reports on surface texture of soils in the watershed because some soils have a change in texture from the surface layer to the texture found at depth.

In this watershed, about 74% of the area has a **clay** surface texture, with lighter soils (sands and coarse loamy soils) making up about 18% of the watershed, concentrated in the western areas.

Sandy soils (such as Almasippi sands) are more prone to leaching losses of soluble nutrients such as nitrogen fertilizers because water moves quickly through them (at about 2 inches per hour). By contrast, clay soils (such as Red River clays) have extremely slow infiltration rates (less than 0.04 inches per hour), which makes them more prone to water ponding and losses of soluble nutrients via runoff.

ii) Internal Drainage (Figure A.3 in appendices)

Soil drainage refers to the speed and extent of water removal from the soil by runoff (surface drainage) and downward flow through the soil profile (internal drainage). It also refers to the frequency and duration when the soil is not saturated. The drainage classes reported in the watershed map are as follows:

- Rapid – water is removed rapidly in relation to supply – very coarse textured soils in higher landscape positions have rapid internal drainage (about 1% of this watershed).
- Well – water is removed readily in relation to supply, such that there is development of a subsoil horizon which typifies well drained soils (about 5% of this watershed).
- Imperfect – water is removed somewhat slowly in relation to supply to keep the soil wet for a significant part of the growing season, either due to shallow water tables in sandy soils or slow infiltration rates in clay soils (about **61%** of this watershed).
- Poor – water is removed so slowly that the soil remains wet or the water table is near the surface for a large part of the time. These are usually the lower-lying areas where surface drainage improvements have not been made (about 2% of the watershed).
- Poor (Improved) – areas that were originally poorly drained but surface drainage improvements have resulted in soils behaving as if they have imperfect internal drainage characteristics, even though soil properties may still be indicative of poorly-drained conditions. These are usually

clay soils in lower-lying areas where surface drainage enhancements have been made (about 28% of the watershed).

- Very Poor – soils that are so poorly drained that peat material has built up and saturated conditions are prevalent. Very poorly drained soils are organic (peat) soils with no drainage improvements made (about 1% of the watershed).

iii) Irrigation Suitability (Figure A.4 in appendices)

Irrigation suitability is a general suitability rating for irrigated crop production. This classification system considers soil and landscape characteristics such as texture, drainage, depth to water table, salinity, geological uniformity, topography and stoniness and ranks them in terms of their sustained quality due to long term management under irrigation. It does not consider factors such as water application, water availability, water quality or the economics of this type of land use. Irrigation suitability classes are excellent, good, fair and poor.

Almost 73% of the watershed is rated as having **poor** irrigation suitability because the heavy clay soils present higher risks of problems occurring if irrigation is practiced on them, such as increased risk of excess water ponding, runoff of nutrients, and development of salinity. About 16% of the watershed has good irrigation suitability, concentrated in the sandy areas and especially where internal drainage improvements could easily be made.

iv) Salinity (Figure A.5 in appendices)

Soil salinity is a limitation where plant growth is reduced due to the presence of soluble salts in soil which holds water more tightly than the ability of plants to extract water from the soil. As a result, many plants will exhibit symptoms of droughtiness, but the soil is often relatively moist.

For soil salinity to occur, there must be the presence of soluble salts in the subsoil, groundwater or in both, and the presence of wet conditions, either as a shallow water table or frequently saturated conditions that can result in soluble salts moving into the root zone of the soil through the upward movement of water.

Approximately 84% of the watershed is considered **non-saline**, due to a lack of salts present in the bedrock and subsoil, or due to the absence of a shallow water table or shallow bedrock with salts present. What little salinity does occur is only weakly saline, significantly affecting only the most sensitive crops, such as pulse crops and vegetables, and these areas are mostly confined to locations adjacent to watercourses and drainage ditches. Individual aerial photos, soil testing and producer experience would give more detail of the salinity status of specific fields in the watershed.

v) Water Erosion Risk (Figure A.6 in appendices)

Water erosion is the detachment, movement and depletion of soil from the land surface by precipitation leaving the landscape as runoff. Soil erosion by water is often accelerated on agricultural lands by leaving insufficient cover on soils prone to runoff at crucial times (i.e. just prior to or just after spring seeding). A general rule of thumb is to maintain at least 35% cover on soils at all times.

In general, soil erosion by water is more of a concern on clays and loam soils than sands, because the slower infiltration rates on the heavier-textured soils leaves them more prone to runoff and subsequent erosion. Slope length and steepness are other important factors: doubling the length of the slope increases soil losses by 1.5 times; doubling the incline of the slope increases soil losses by 2.5 times.

Approximately 96% of the watershed is at either a **negligible or low** risk of soil erosion by water, even under bare soil conditions. This is largely the result of very flat topography and the presence of sandy soils in the western 1/3 of the watershed. Coupled with management practices that leave enough cover on the soil, the risk of water erosion goes down even further. The greatest risk of water erosion occurs during rapid spring snowmelts and along ditches and watercourses with greater slopes.

vi) Wind Erosion Risk (Figure A.7 in appendices)

Wind erosion is the detachment, movement and depletion of soil from the land surface by wind. Soil erosion by wind is often accelerated on agricultural lands by excessive tillage and by leaving insufficient cover on soils prone to wind erosion (i.e. just prior to or just after spring seeding). A general rule of thumb is to maintain at least 35% cover on soils at all times.

In general, soil erosion by wind is more of a concern on sands than on clays and loams, because sands tend to dry out quickly and what soils clods may form tend to break down easily into single-grained particles, which are highly prone to wind erosion.

About **65%** of the watershed is rated as **moderate** risk for wind erosion, mostly corresponding to the areas with a clay surface texture. Almost **27%** of the watershed is either at **high or severe** risk of wind erosion under bare soil conditions. The sandy surface texture is what makes these soils prone to wind erosion, but under management practices that promote adequate soil cover, such as forages and pasture, the risk of wind erosion is low. Extra care should be taken if some of these sandy soils are planted to low residue annual crops, such as field beans and potatoes. In these cases, shelterbelts and cover crops should be included and the crop rotation should include high residue crops preceding and following low residue crops.

b) Water

Section 7.7 – Agricultural Development

i) Agricultural Water Demand

Water demands in agricultural areas of the watershed include needs for human and livestock consumption, irrigation, crop spraying, washing or processing crops, as well as cleaning of facilities and equipment. As the industry grows, especially irrigated agriculture and the livestock sector, increased demands will be placed on the water resource. According to Census data from 1971 to 2001, irrigated acres have increased from 185 to 2473 during that period. Using an estimate of 5 inches of water applied per irrigated acre per year, the water requirements for irrigation in the watershed have increased from about 77 acre-feet (95,000 cubic meters) per year in 1971 to about 1030 acre-feet (1.27 million cubic meters) per year in 2001.

Table 3 – Estimated Water Requirements

	gallons per day	litres per day
People (one person)	60	227
Beef - Feeder (to 1250 lb)	10	38
Beef Cow with Calf	12	45
Dairy Cow - milking*	30	114
Swine - breeding sows*	20	76
Swine - feeder (to 250 lb)	1.5	6
Swine - weaner (to 50 lb)	0.5	2
Sheep - ewes	2.5	9

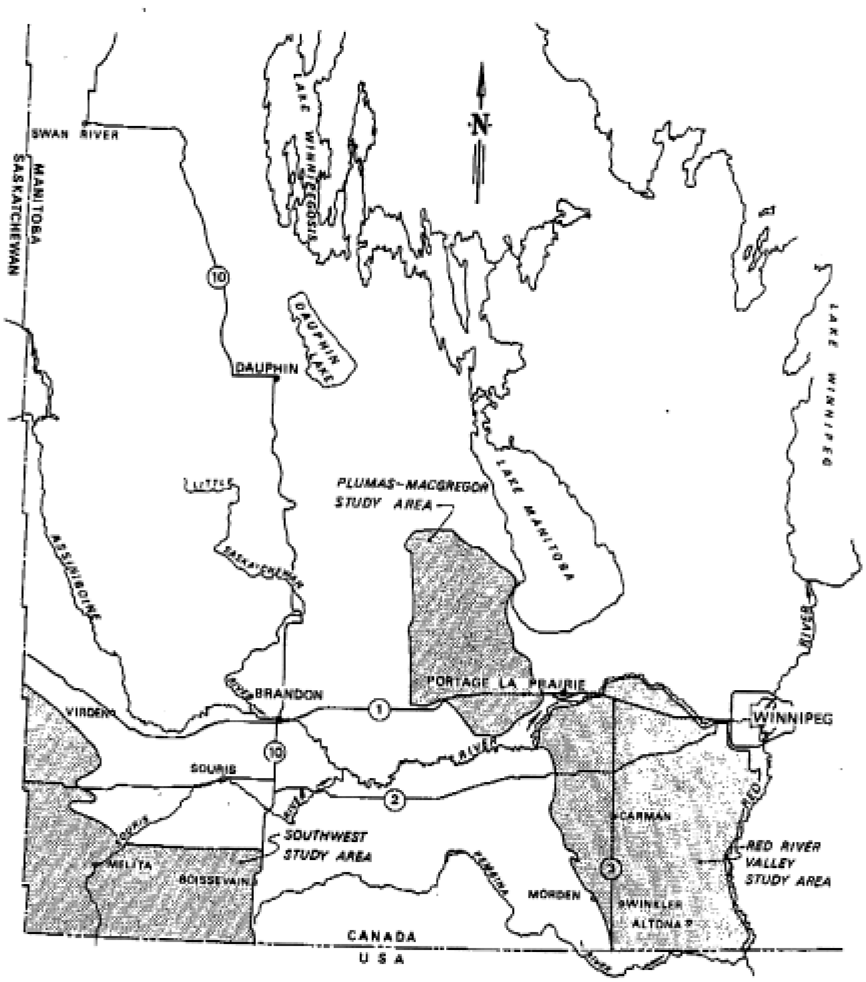
* includes wash water

Livestock numbers have also increased during that time, especially hogs, with numbers more than doubling from around 51,000 pigs in 1971 to over 117,000 in 2001. Using water requirement estimates for the various types of livestock from Table 3 and livestock numbers from the Census of Agriculture, water demand estimates for the industry can be calculated. The total water demand for the hog industry alone in the watershed has grown from about 221 million litres per year in 1971 to about 665 million litres per year in 2001. Estimated water requirements for the main types of livestock present in the watershed (hogs, cattle and sheep) have risen from about 666 million litres per year in 1971 to about 1.25 billion litres per year in 2001.

ii) Water Shortages (Drought) and Water Sourcing

Periods of drought have also had significant impact on the industry by limiting available supplies. Figure 4, taken from Phase II of PFRA's Manitoba Water Sourcing Study, identifies areas in the province that are considered chronic drought areas, or areas that would become water deficient in drought periods. This information was based on previous studies and program data from a variety of agencies as well as knowledge gained from the severe drought of 1988. Figure 5 focuses on what was referred to as the Red River Valley region, which encompasses nearly the entire La Salle River watershed (Figure 6). Figure 5 also outlines areas in the study area with potential to access groundwater sources, note that site specific appraisals are recommended. This information was used to help guide programs and projects in subsequent years to help address the drought sensitivity in this region, including individual farm and community water source projects.

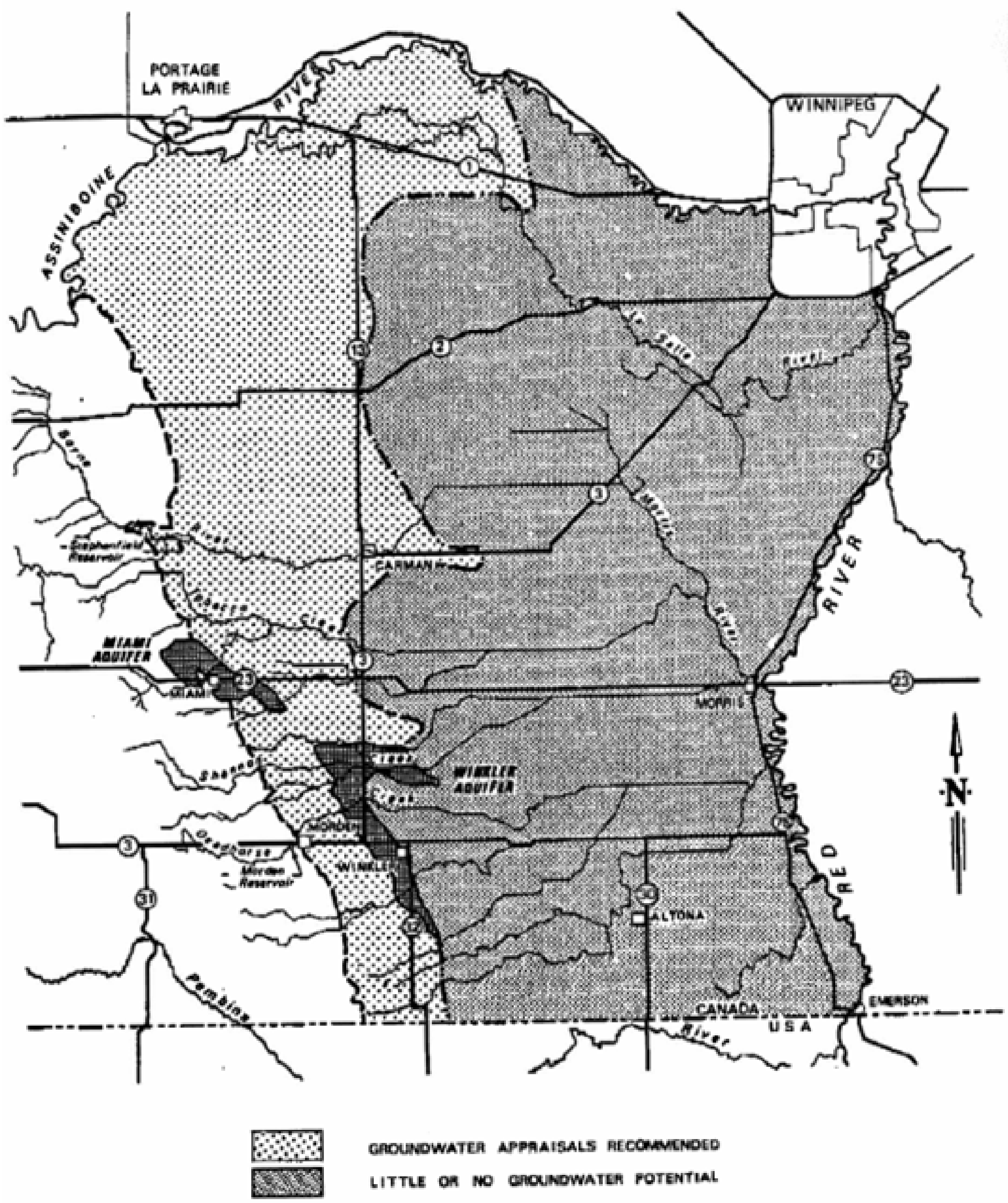
Figure 4 – Chronic Drought Areas for Manitoba



Source: Manitoba Water Sourcing Study Phase II, PFRA, January 1989

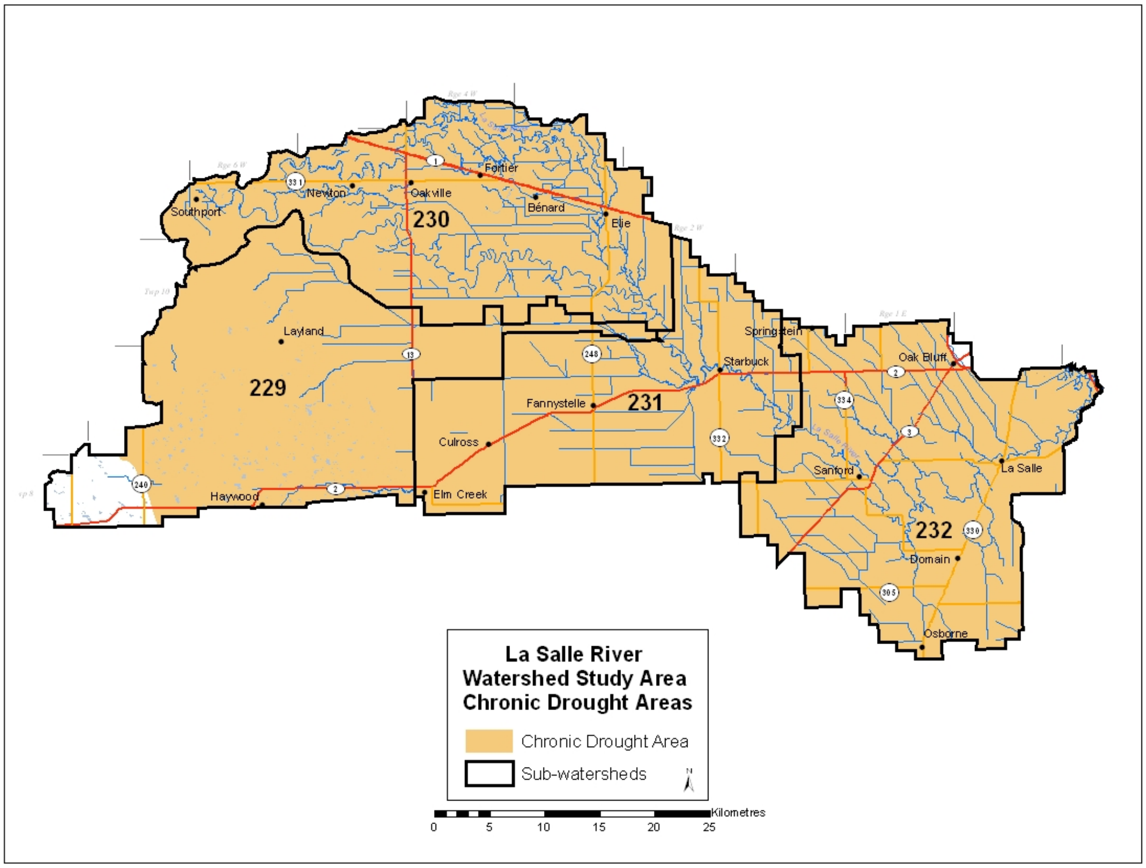
Section 7.7 – Agricultural Development

<u>Figure 5 – Red River Valley Chronic Drought Area</u>



Source: Manitoba Water Sourcing Study Phase II, PFRA, January 1989

<u>Figure 6 – La Salle River Watershed Chronic Drought Area</u>



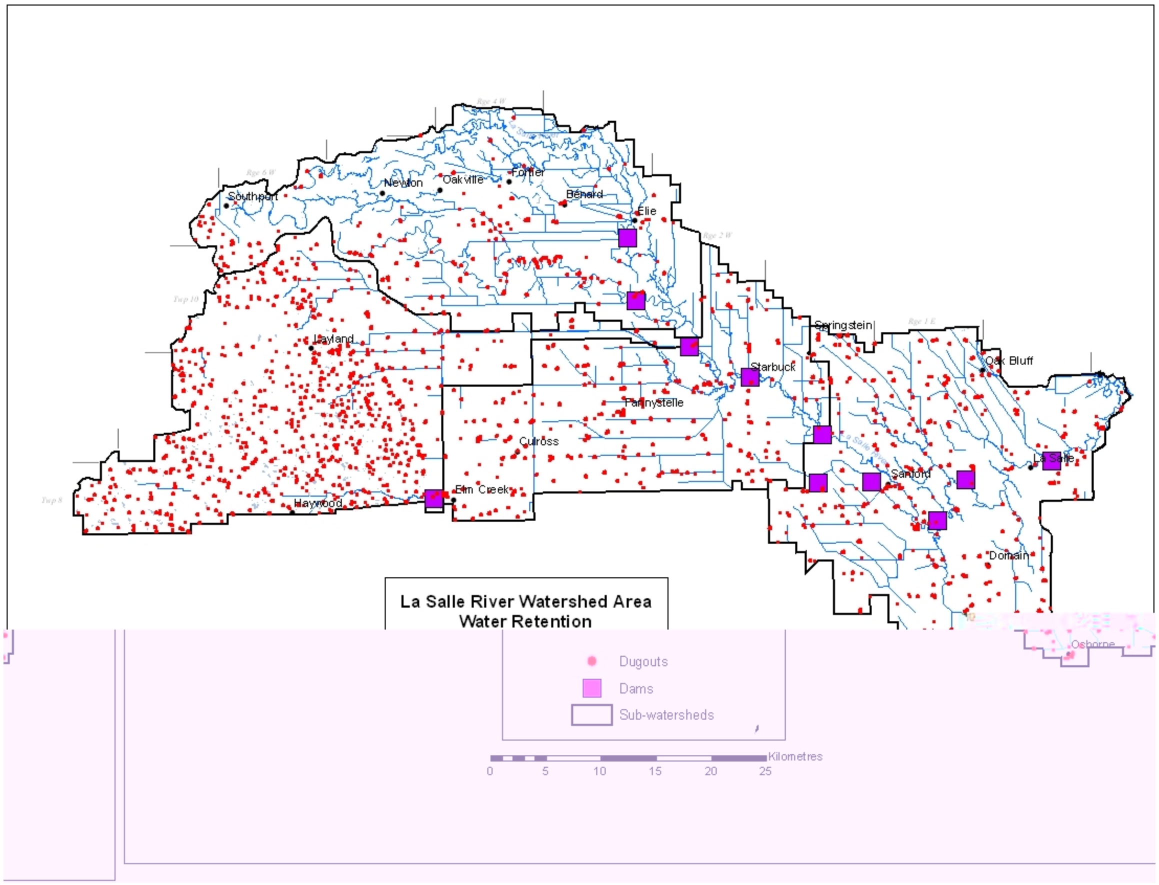
Source: Manitoba Water Sourcing Study Phase II, PFRA, January 1989

iii) Surface Water Sources

Surface water is a very important source of water for producers in the watershed, especially in the western part of the watershed where cattle are more prevalent and dugouts are common (Figure 7). Of concern may be the fact that many of the dugouts in the watershed, particularly in the "wet sands" of the west, are fed by shallow groundwater. These shallow sources are both susceptible to water quality and quantity declines. They are susceptible to drought. They can also be susceptible to contamination by local runoff and potentially affect entire aquifers or portion of because of the interconnection of these surface features with the groundwater.

Section 7.7 – Agricultural Development

Figure 7 – Surface Water Diversions – Dams and Dugouts



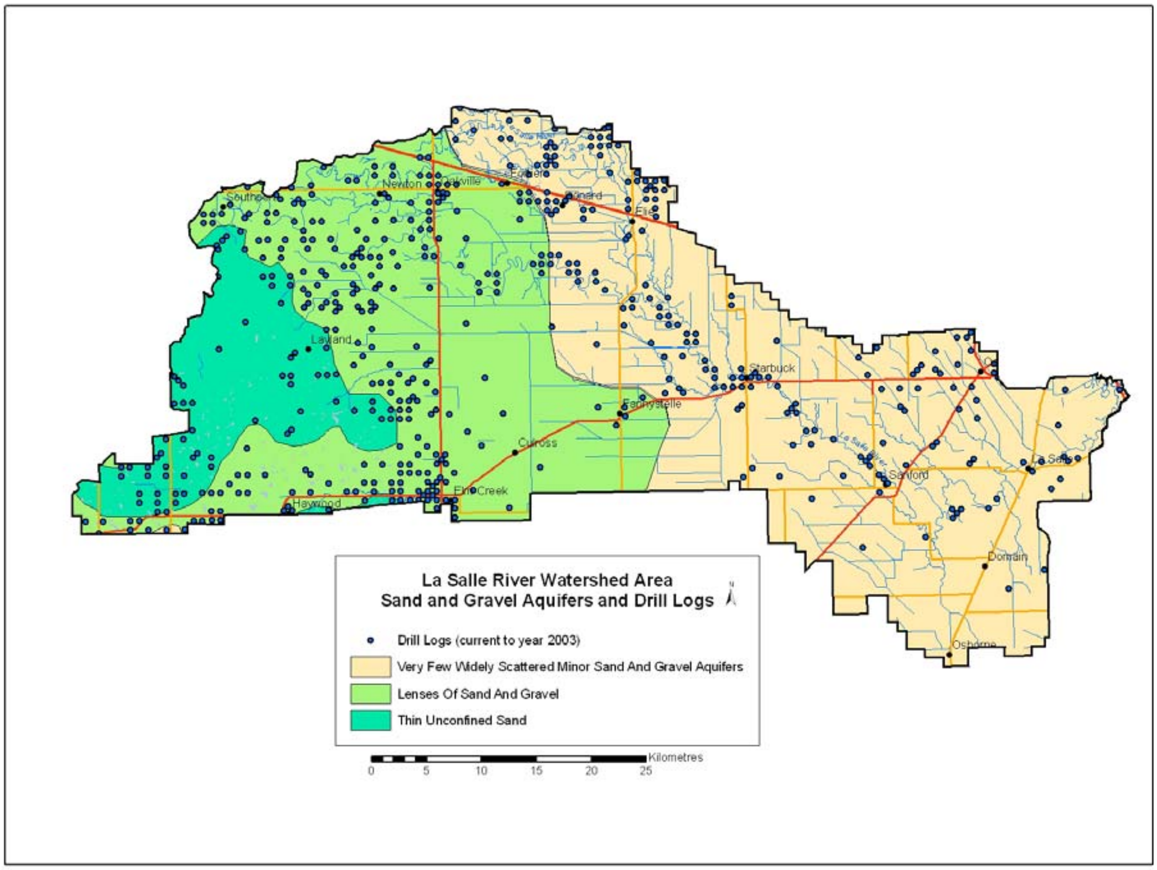
source: Natural Resources Canada - National Topographic System of Canada

iv) Groundwater Sources

Groundwater is a valuable resource to many producers in the watershed, especially in the west and along the banks of the La Salle River. Figure 8 illustrates how there are very few sand and gravel aquifers present in the eastern part of the watershed and other sources of water are commonly required.

Section 7.7 – Agricultural Development

Figure 8 – Groundwater Sources – Sand and Gravel Aquifers and Drill Logs

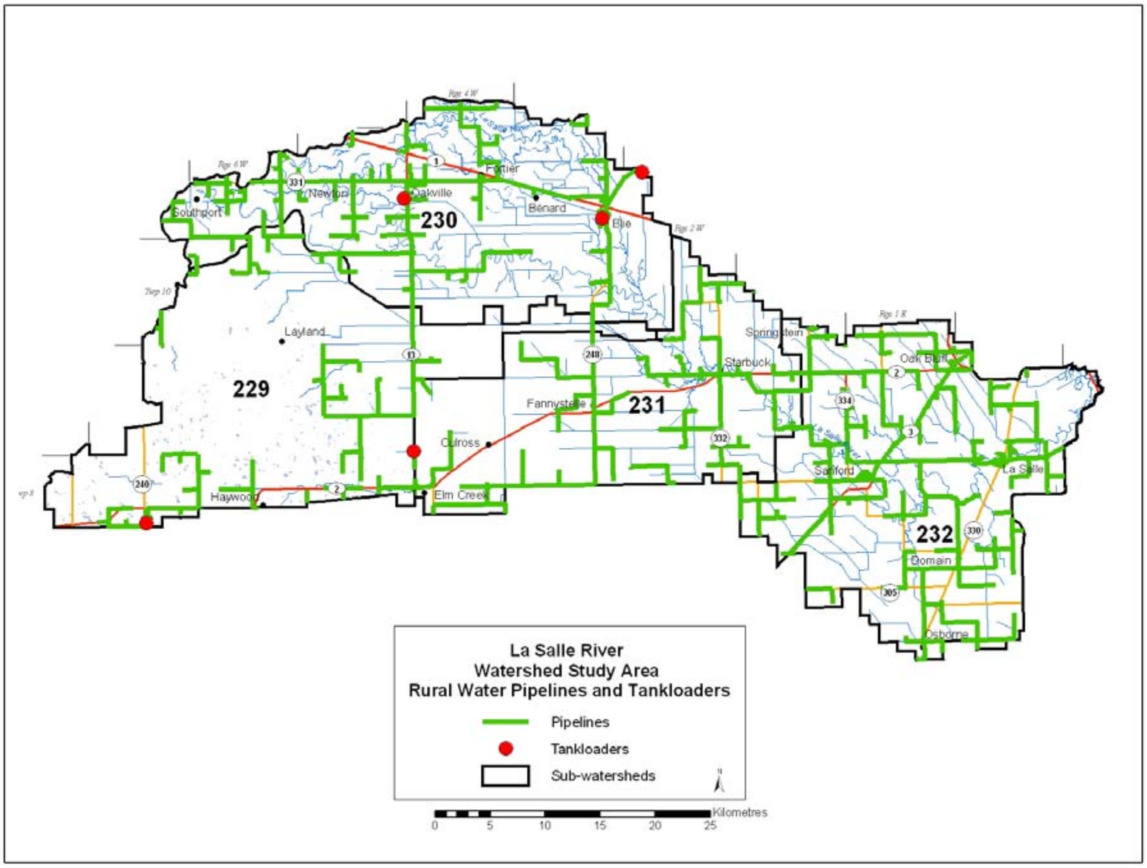


v) Community Sources

Community water supplies represent a dependable source of water for the agriculture industry in the watershed, especially for operations requiring higher quality water such as for spraying and in some cases for livestock operations such as dairy and pigs. Figure 9 shows there is an extensive network of existing infrastructure to help address the water supply needs for much of the watershed.

Section 7.7 – Agricultural Development

Figure 9 – Community Water Sources – Rural Water Pipelines and Tankloaders



4) Watershed Considerations

a) Land Use

The La Salle River watershed is a productive agricultural area. According to the 2001 Census, there were a total of 644 farms utilizing 90% (217,493 ha) of the land in the watershed. For the purpose of this report, farmland includes all land that is owned, rented, leased (including government land) or crop-shared by agricultural operations. Of this land, 5,431 ha (3%) is leased government land. Of the farmland, 172,751 ha (79%) were prepared for seeding in the fall of 2000 or spring 2001.

Land use and management practices of upland areas are important considerations in watershed planning. Crop type (permanent vs. annual, high residue vs. low residue), tillage practices, nutrient management, and conservation practices on the landscape are all activities that can affect water quality within the watershed.

Section 7.7 – Agricultural Development

Table 4 – Cultivated Crop Types (2001 Census)*

Crop Type	Hectares[1]	Percent of Farm Land[1]	Percent of Watershed[1]
Cereals (wheat, barley, oats, buckwheat[2], canary seed)	107,693	49.5%	44.7%
Forages (corn for silage, alfalfa, forage for seed, other tame hay and fodder crops[3])	17,745	8.2%	7.4%
Oilseeds (canola, flaxseed, soybeans, sunflowers)	50,493	23.2%	21.0%
Potatoes[3]	986	0.5%	0.4%
Pulse Crops (dry field peas[2], dry beans[2])	5,035	2.3%	2.1%

1 - Numbers do not include suppressed data
2 - Data is suppressed for one farm reporting
3 - Data is suppressed for two farms reporting

*Source: Summary of Resources and Land Use Issues Related to Riparian Areas in the La Salle River Watershed Study Area, PFRA 2004

i) Nutrient sources

Table 4 – Cropping, Livestock and Nutrient Trends (Census of Agriculture)

	Canola/Mustard (ha)*	Cropland (ha)*	Pigs	Total Cattle	Manure (kg/yr)*	Manure N (kg/yr)*	Manure P (kg/yr)*
1976	1,886	166,870	37,406	23,327	325,948,049	2,010,406	570,124
1981	7,390	175,098	42,742	21,852	303,068,488	1,887,051	534,862
1986	13,754	181,789	60,764	19,535	304,410,660	1,927,311	564,221
1991	20,477	182,172	57,725	21,821	326,624,832	2,033,902	584,470
1996	28,283	179,833	101,164	27,558	442,684,816	2,756,924	807,563
2001	26,793	184,786	117,749	28,408	468,525,146	2,954,965	879,353
% Chg.	**1320%**	**11%**	**215%**	**22%**	**44%**	**47%**	**54%**

*see Table A.1 in appendix for imperial units

Table 4 highlights the most striking trends related to cropping, livestock and nutrient trends in the watershed from 1976 to 2001. The table shows the increase in popularity of canola (shown in the table as Canola/Mustard to accommodate changing terminology), the result of successful breeding programs in the 1970's to reduce acid content that culminated in the origin of the term canola in 1974. Compared to cereals, canola is generally considered to be a higher input crop, commonly requiring relatively high amounts of nutrients and pesticides to achieve desirable yields. Other significant trends highlighted in Table 4 include a steady increase in cropped acres (11% increase from 1976 to 2001) in the watershed, likely corresponding to land clearing and draining for crop production. Significant increases in livestock from 1976 to 2001 are also noted for the watershed. The total number of pigs and cattle in the watershed increased by 215% and 22% respectively over that period. Manure calculations, based on animal unit coefficients for each type of livestock present (Table 5), show significant increases in the watershed.

The total manure produced increased by about 44%. The total nutrient content of manure produced in the watershed was calculated based on the type of livestock and its animal unit coefficient, as nutrient concentrations differ between species and within species with different types of operations. These calculations suggested that the amount of nitrogen in the manure in the watershed increased by 47% and the phosphorous increased by 54% during the 25 year period.

Table 5 – Livestock by Animal Units (2001 Census)*

Livestock	Total Number of Farms[1]	Number of Animals[2]	AU Coefficient[3]	Total AU[2]
Total cattle and calves	219	27,965	--	
Total dairy cows	37	2,862	2	5,724
Total beef cows	175	9,330	1.25	11,663
Total heifers & steers for slaughter and feeding (1 yr and older)	--	3,596	0.631	2,269
Total pigs	47	124,014	--	
Total sows	25	17,216	0.313	5,389
Total nursing and weaner pigs	21	37,439	--	
Total grower and finisher pigs	39	69,006	0.143	9,868
Boars	21	353	0.2	71
Total hens and chickens	39	307,071	--	
Broilers and Roasters	13(4)	48,918	0.005	245
Layers (19 weeks and older)	30	162,103	0.0083	1,345
Pullets (under 19 weeks)	10(4)	34,700	0.0033	115
Turkeys	6(3)	23,440	0.014	328
Total sheep and lambs	10(3)	244	--	
Ewes	10(3)	140	0.2	28
Lambs	6(6)	0	--	0
Total horses and ponies	66	1,989	1	1,989
Bison	0	0	0.8875	0
Elk	2(2)	0	0.52	0
Goats	6(3)	95	0.143	14
				39,046

*Source: Summary of Resources and Land Use Issues Related to Riparian Areas in the La Salle River Watershed Study Area, PFRA 2004

Section 7.7 – Agricultural Development

Figure 10 - Livestock Density – 2001 Census of Agriculture by Sub-watershed

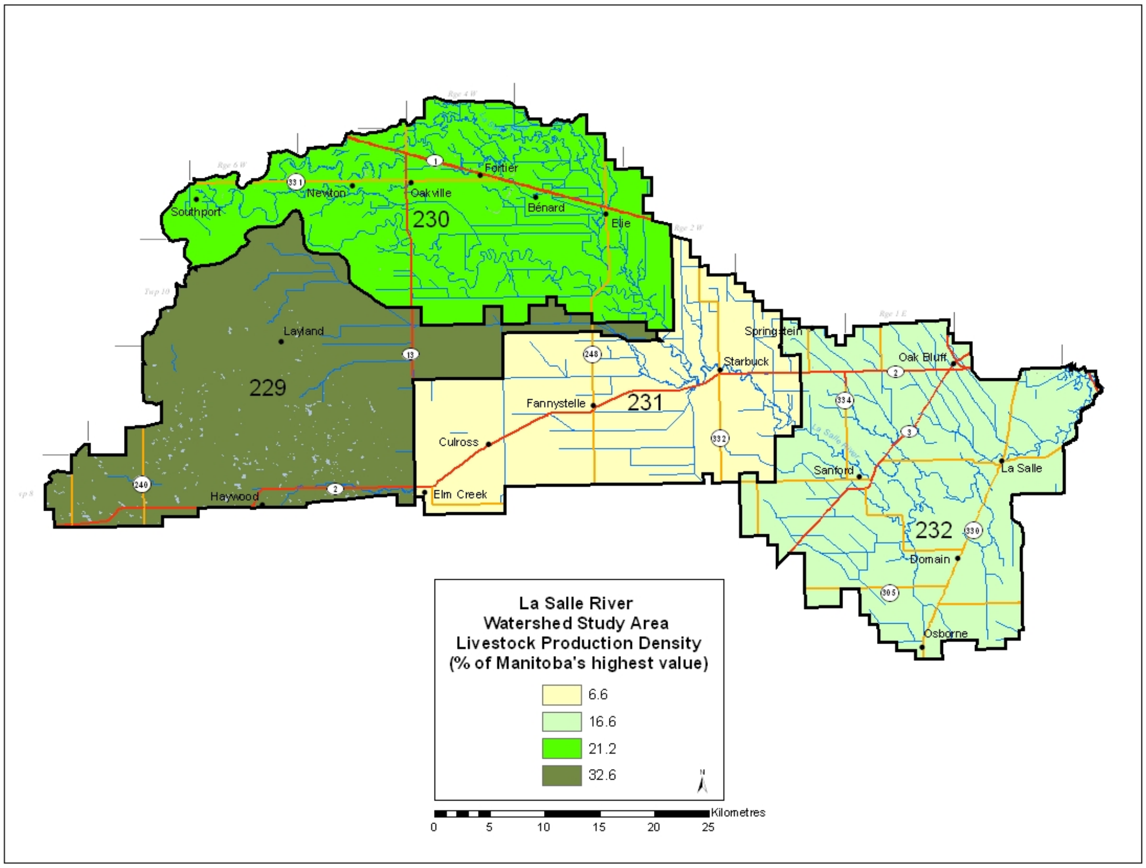


Figure 10 shows livestock density from the 2001 Census by sub-watershed as a percentage of the watershed in Manitoba with the highest livestock density of 0.98 Animal Units/hectare. Comparatively, the La Salle watershed does not have a very high livestock density with the highest sub-watershed (229) having only 32.6% of that value (or 0.32AU/ha). Figure 10 also shows in relative terms how livestock are distributed in the sub-watersheds by comparison, with sub-watershed 231 having only 6.6% of the highest value (or 0.06 AU/ha). Because sub-watershed 229 has the highest number of beef cattle present, riparian pastures are likely more common and riparian pasture management will be important to maintain or improve riparian health.

Although the La Salle River watershed has relatively low livestock density relative to other watersheds in the province, the trend indicates increasing amounts of livestock, especially pigs and to a lesser extent cattle. Manure represents a valuable fertilizer and proper application can improve soil quality related to the soil's tilth, structure, aeration and water movement, but improper application can result in unwanted odours, increased greenhouse gas release, and increased nutrient loading due to runoff and leaching.

Section 7.7 – Agricultural Development

Figure 11 – Fertilizer Use – 2001 Census of Agriculture by Sub-watershed

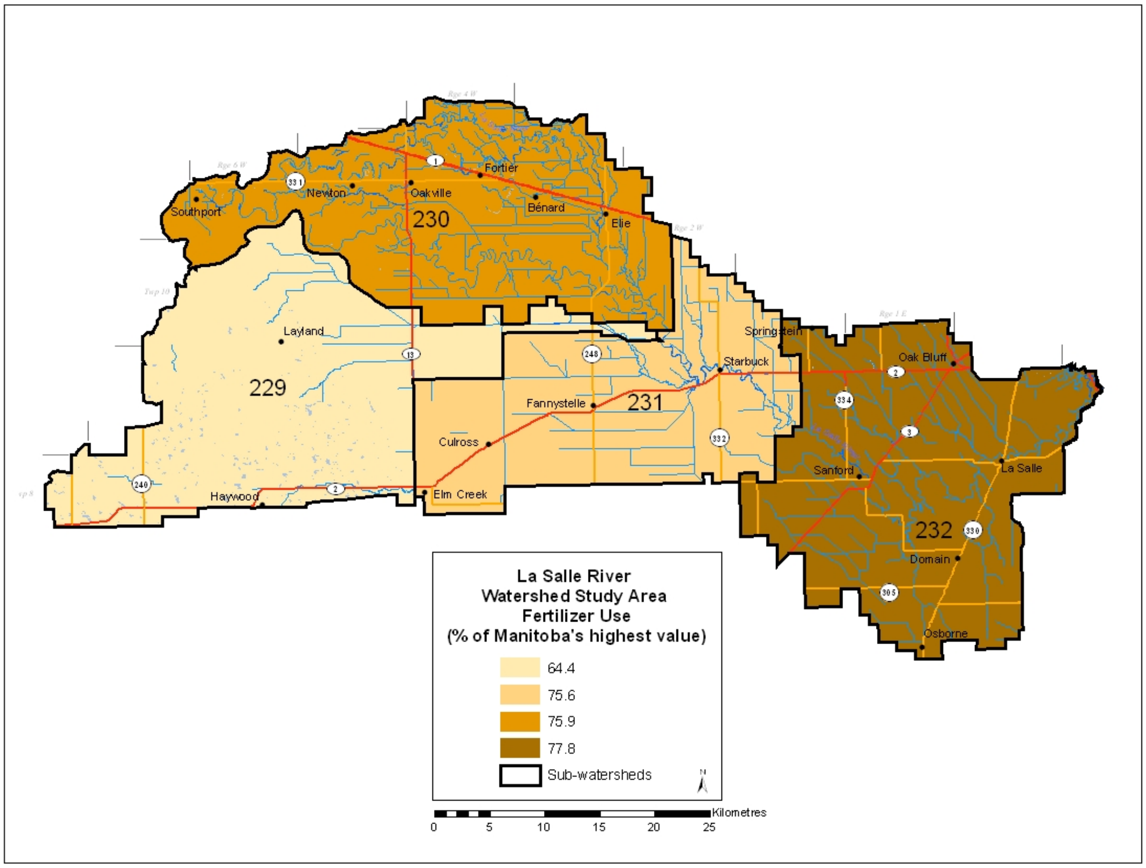


Figure 11 shows fertilizer use from the 2001 Census by sub-watershed as a percentage of the watershed in Manitoba with the highest fertilizer use expressed in terms of $101.23/hectare spent on fertilizer. Comparatively, the La Salle watershed appears to have significant levels of fertilizer use, as would be expected due to the relatively high percentage of productive crop land. The sub-watersheds range from 64.4% to 77.8% of Manitoba's highest value watershed (sub-watershed 229 = $65.23/ha, sub-watershed 232 = $78.76/ha). Sub-watershed 229 has the lowest value for fertilizer use. This is not surprising as it has the lowest percentage of annual cropland, more land used for forage production, and more manure available due to the higher livestock numbers, thereby reducing the demand for and use of commercial fertilizers.

ii) Nutrient Management

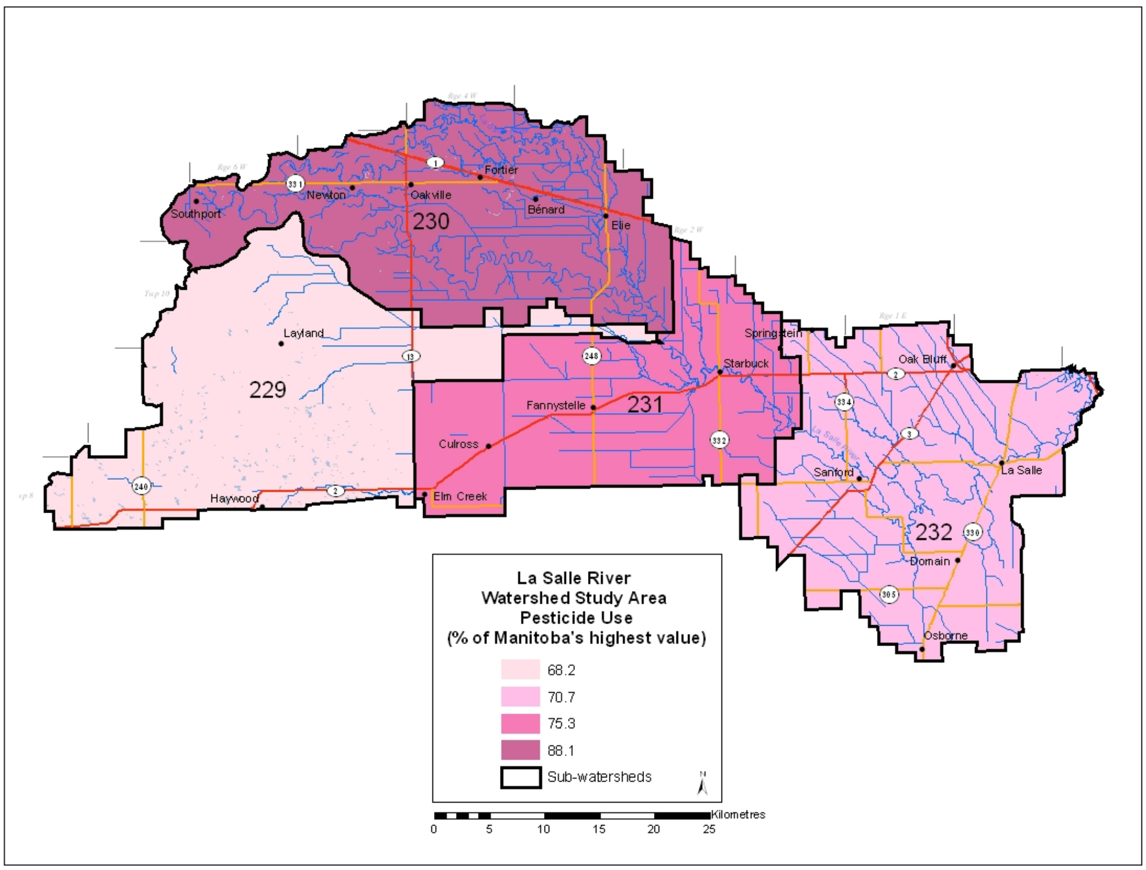
Utilizing nutrients, both in the form of manure and commercial fertilizers, to optimize crop production makes good economic and environmental sense. Avoiding unwanted nutrient loading in waterbodies requires balancing nutrients applied with crop requirements, while taking into account the residual nutrients left in the soil from the previous crop. Using the most appropriate method and timing of application is important to ensure nutrients are available for the crop and reduces amounts lost through runoff or leaching through the soil profile. This is especially true in areas of the La Salle watershed with high runoff potential like the majority of the clay soils in the Red River Valley region, but also true in areas where there are coarse soils and shallow aquifers like the western parts of the watershed where leaching to groundwater could be an issue.

The fate of nutrients in the environment is a complex issue and many factors need to be considered, such as climatic influences, crop yields and utilization, as well as complicated nutrient cycles and transport mechanisms. This is an area where future efforts could be focused to examine nutrient sources and sinks and establish a nutrient budget for the watershed.

The Red River valley Special Management Area (Figure A.8 in appendices) would include the eastern portions of the watershed, which would prohibit winter applications of nutrients and either injection or incorporation within 48 hours of fall applied manure on tilled soils.

iii) Pesticide Usage

Figure 12 – Pesticide Use – 2001 Census of Agriculture by Sub-watershed



Under certain conditions pesticides can enter the environment and have a negative impact on water quality and biodiversity. Using pesticides only when and where necessary, according to label directions and along with integrating non-chemical pest control methods where possible, reduces the potential risks and increases economic viability.

Figure 12 shows pesticide use from the 2001 Census by sub-watershed as a percentage of the watershed in Manitoba with the highest pesticide use expressed in terms of $81.65 per hectare spent on pesticide. Comparatively, the La Salle watershed appears to have significant levels of pesticide use, as would be expected due to the relatively high percentage of productive crop land. The sub-watersheds range from 68.2% to 88.1% of Manitoba's highest value watershed (sub-watershed 229 = $55.69/ha, sub-watershed 230 = $71.93/ha). Sub-watershed 229 has the lowest value for pesticide use as would be expected due to its low percentage of annual cropland and higher amounts of land covered by trees and land used for forage production, typically requiring less pesticide application.

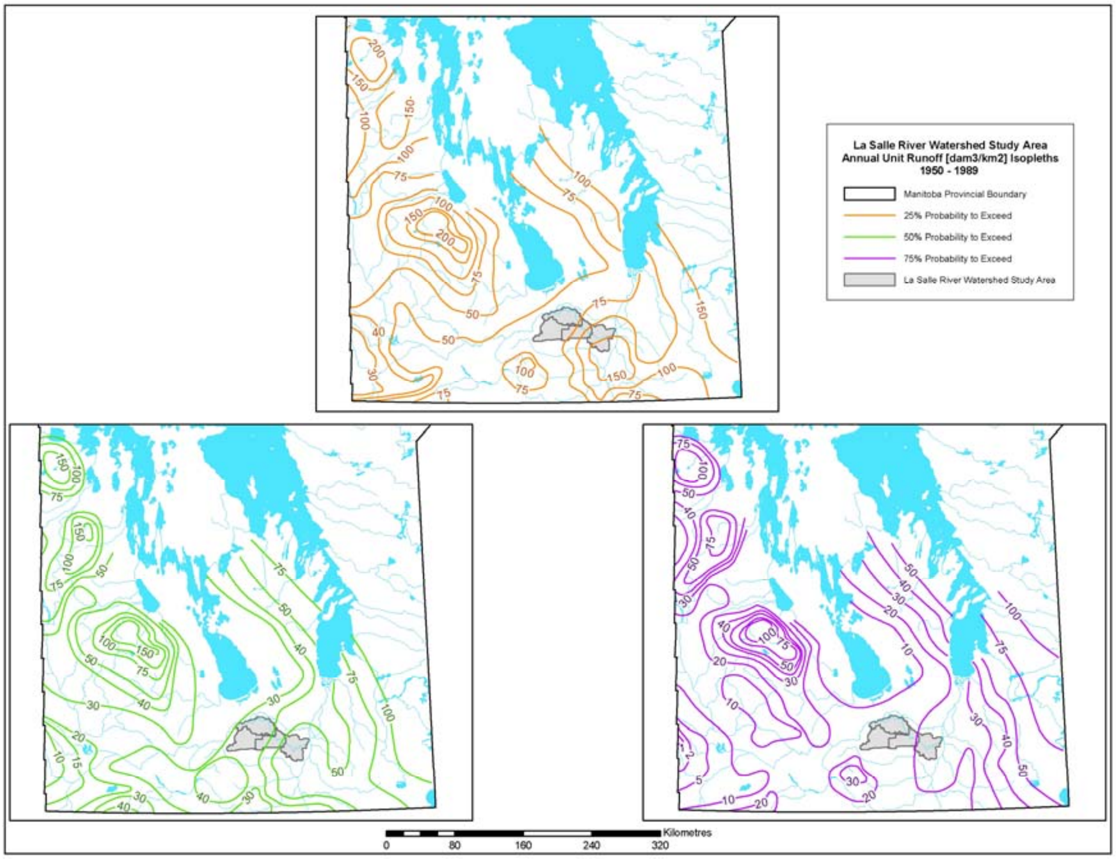
For a comparison of livestock production density, fertilizer use, and pesticide use by Manitoba watersheds for the 2001 Census refer to Figures A.9 A.10 and A.11 in appendices.

b) Climate – runoff

The amount of water runoff has significant bearing on potential erosion as well as nutrient, pathogen and pesticide transport and is also an important consideration for surface water supply options (e.g. dugouts). Soil properties, ground cover, topography and drainage works can significantly influence the amount of runoff in a local area. Figure 13 shows runoff probabilities for the province. The amount of runoff in the La Salle River watershed generally increases as you travel east. Based on these probability isopleths, the easternmost sub-watershed (232) has in any given year, a 25% chance of exceeding 100 dam3/km2 (about 4 acre-inches) runoff and a 50% chance of exceeding 50 dam3/km2 (about 2 acre-inches) runoff. The westernmost watersheds (229 and 230) have only a 25% chance of exceeding 50 dam3/km2 (about 2 acre-inches) runoff and a 50% chance of exceeding just 30 dam3/km2 (about 1.2 acre-inches).

Section 7.7 – Agricultural Development

Figure 13 – Annual Runoff in Southern Manitoba



c) **Air**

i) **Odour**

Odour is generally a localized issue. Odours associated with livestock operations and manure can be reduced by practices such as appropriate covers for manure storage facilities, consideration for wind speed and direction, and injection or incorporation in the fields as soon as possible.

ii) **Particulates**

Particulates in the air from agricultural activity is usually in the form of dust or smoke. The burning of crop residue creates smoke and tends to be worse in wet years when crops produce more straw and is more difficult to manage. Another concern would be blowing dust in the event of wind erosion occurrences during droughts. The sands and to a lesser extent the clay soils would be prone to blowing dust if inadequate ground cover is in place.

iii) **Greenhouse Gases**

Section 7.7 – Agricultural Development

The most likely greenhouse gas of concern would be nitrous oxide (N2O) emissions if sustained wet periods occur in the clay soils in the watershed after nitrogen fertilization has taken place. While these losses tend to be small and limited in their extent, losses can range from 2-4 lb/ac/day and increase with increasing soil temperature. Nitrous oxide has 310 times the warming potential as carbon dioxide, so it is important to manage nitrogen fertilizers for maximum efficiency.

d) Biodiversity and Wildlife Habitat

<u>Figure 14 - Potential Wildlife Habitat</u>

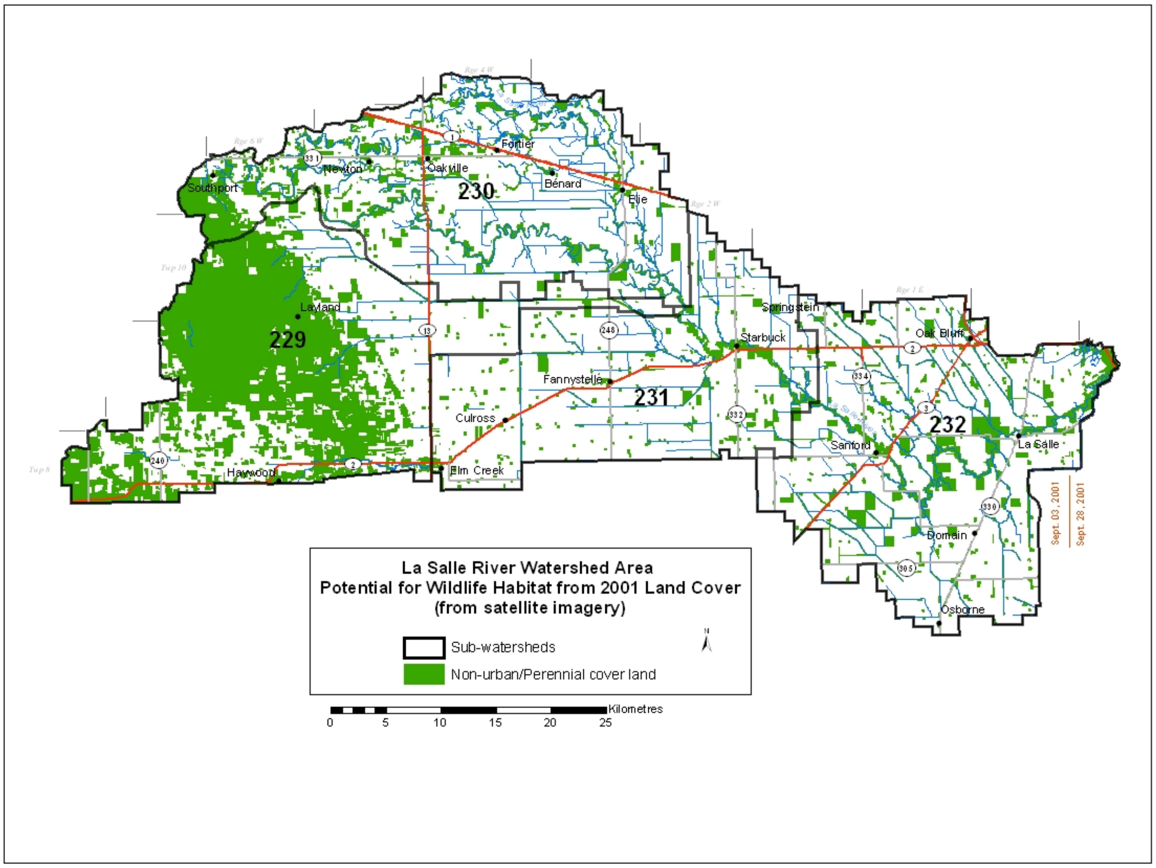
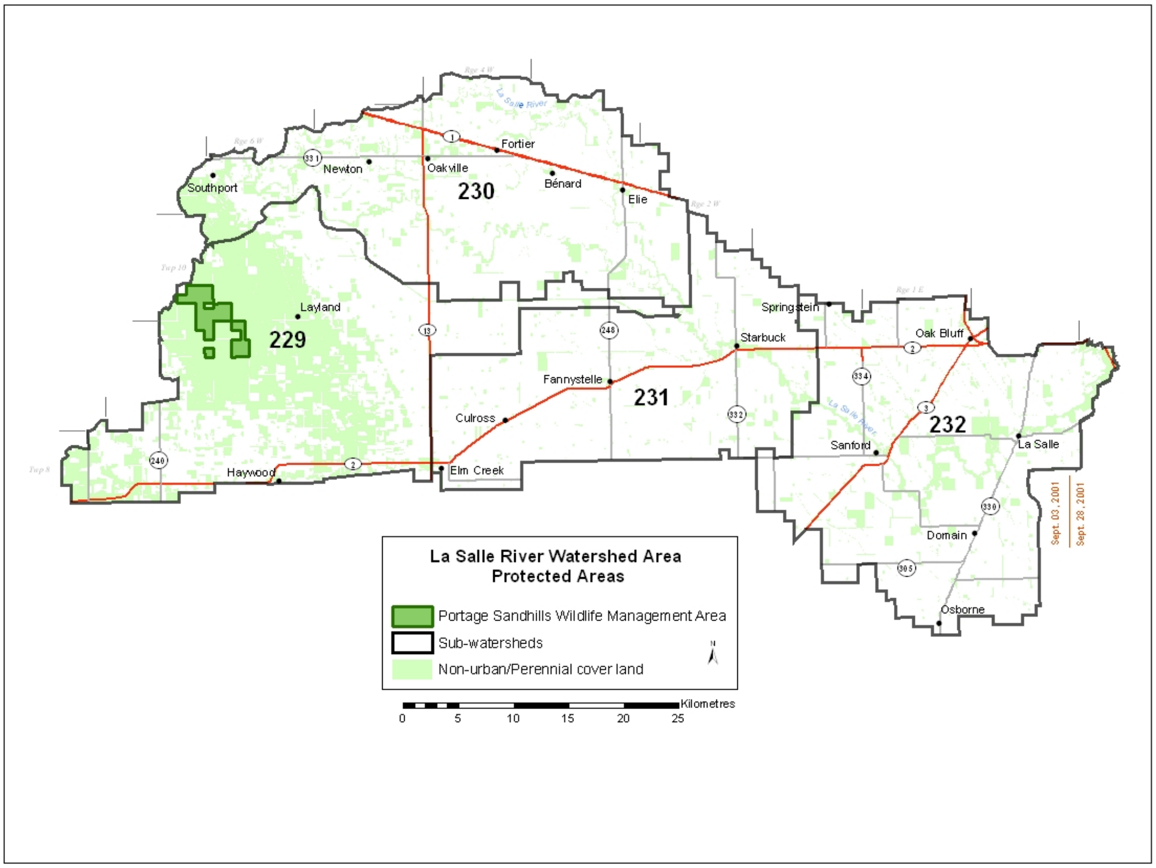


Figure 14 shows areas in the watershed that are **<u>not</u>** in annual crop production or in urban or transportation land use according to satellite data from 2001. These areas of perennial vegetative cover and water bodies are generally considered good habitat for many species of wildlife and occupy about 121 000 acres of the watershed or about 27% of its area.

Section 7.7 – Agricultural Development

Figure 15 – Protected Areas



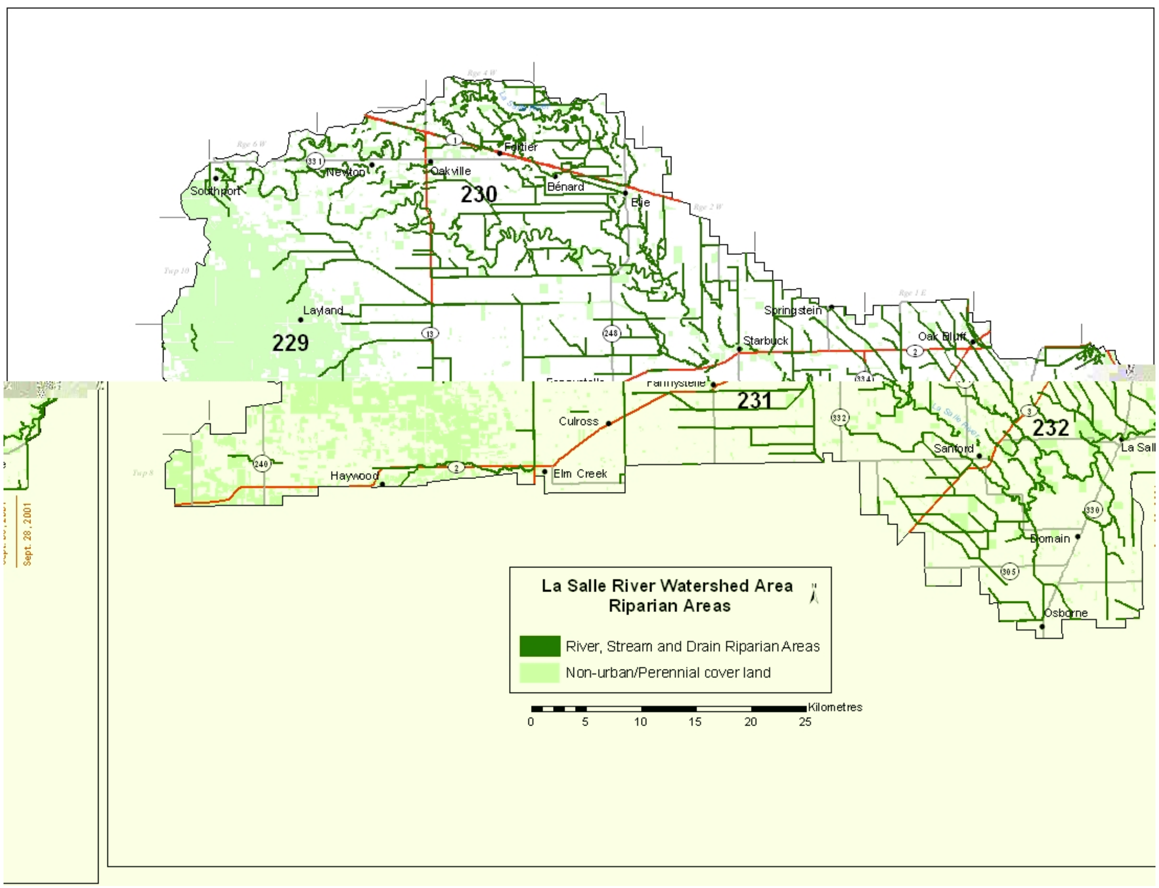
Protected areas in the watershed are restricted to the Portage Sandhills Wildlife Management Area, representing just under 4000 acres of the watershed. Although these areas occupy less than 0.7% of the watershed, they represent some of the largest blocks of contiguous natural lands in the watershed and have significant value in terms of wildlife habitat.

e) <u>Riparian Areas</u>

Figure 16 shows the locations of riparian areas associated with the watershed's many watercourses. Healthy riparian areas not only represent valuable wildlife habitat, but also play a very important role in reducing the impact of agriculture on surface water quality. Riparian areas reduce the amount of contaminants, nutrients, and pathogens reaching surface waters by trapping and filtering sediments and by absorbing excess nutrients. The health of a riparian area determines the extent to which the riparian area can perform its functions. Riparian health is generally determined by onsite assessment and evaluation. Trees are an important part of the riparian area. Tree roots help to stabilize banks and hold the soil in place while canopy cover provides protection from rain drops. Their sparse presence could be an indication of declining riparian health. Another indicator of potential decline in riparian health is the presence of annual crop land in the buffer area. Annual crop land can potentially impact water quality by allowing contaminated run-off to enter surface water.

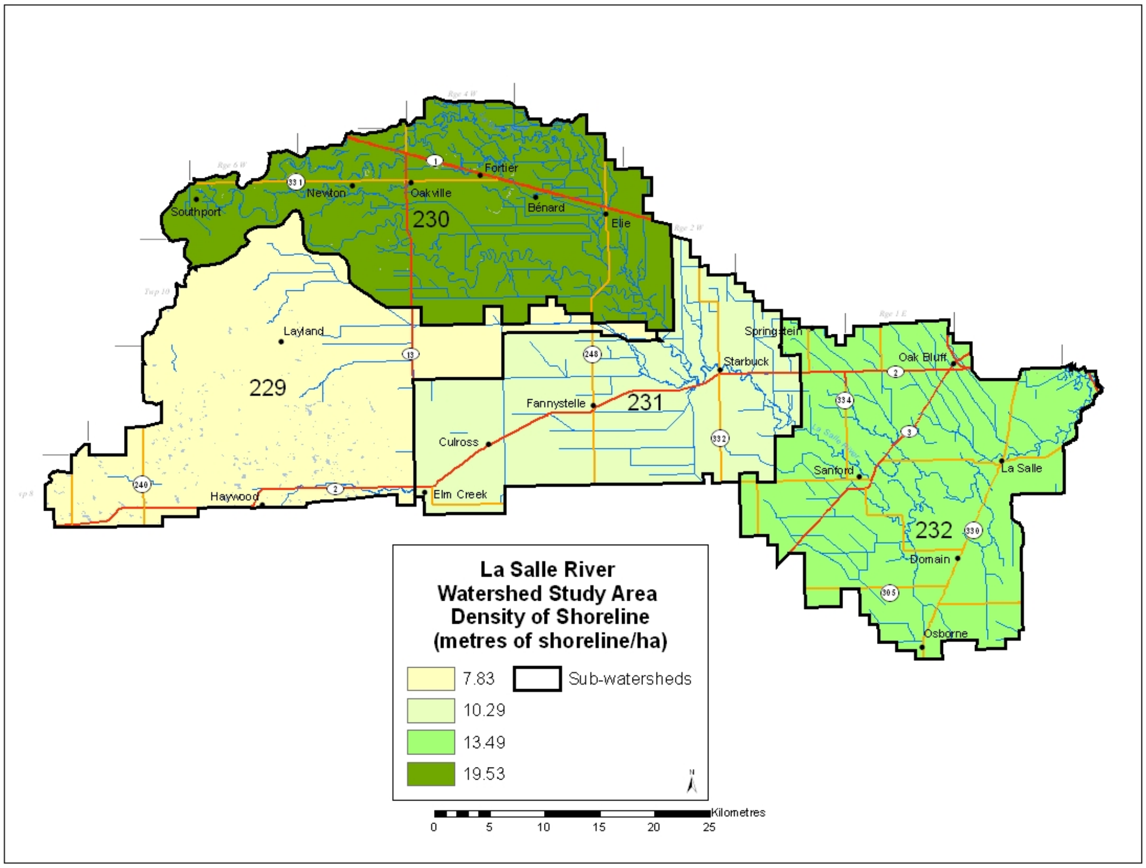
Calculation of shoreline densities (Figure 17) provides information on areas where riparian areas are more concentrated. In the La Salle River watershed, rivers and creeks, including intermittent streams make up the majority of shoreline, although an area with a large amount of wetland shoreline is found in the western part. The 'Oakville' sub-watershed (#230) has the highest shoreline density. A higher shoreline density will indicate a greater concentration of riparian areas. Since riparian areas provide a buffer between upland areas and surface water, management practices (including riparian pasture management, buffer strips, and grassed waterways) become important to maintain this vegetated buffer area surrounding waterbodies and watercourses.

Figure 16 – River, Stream and Drain Riparian Areas



Section 7.7 – Agricultural Development

Figure 17 – Shoreline Density

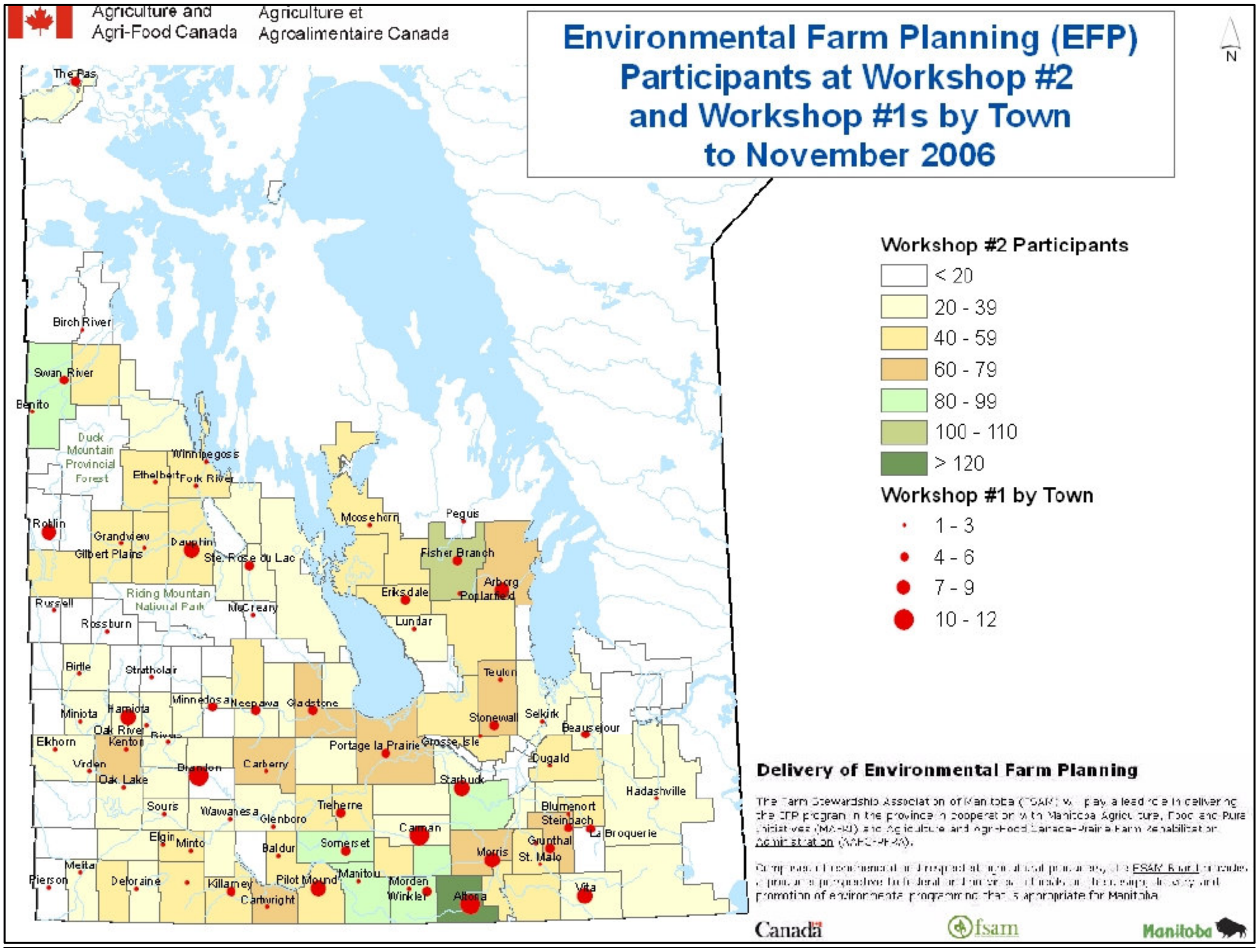


f) Producer Awareness and Beneficial Management Practice Adoption

The Canada–Manitoba Environmental Farm Plan (EFP) Program was initiated in 2005 to help producers identify environmental strengths and weaknesses of their operations and develop an action plan to reduce any identified environmental risks. Figure 18 shows the distribution of workshops held by town and producer participants by rural municipality up to November 2006. The program was well received by La Salle watershed producers. Nine sets of two workshops were held in Starbuck during 2005 and 2006 and nearly 100 producers participated during that period. It is important to note that not all of these producers necessarily farm in the watershed and that producers from the watershed could have attended workshops held elsewhere.

Section 7.7 – Agricultural Development

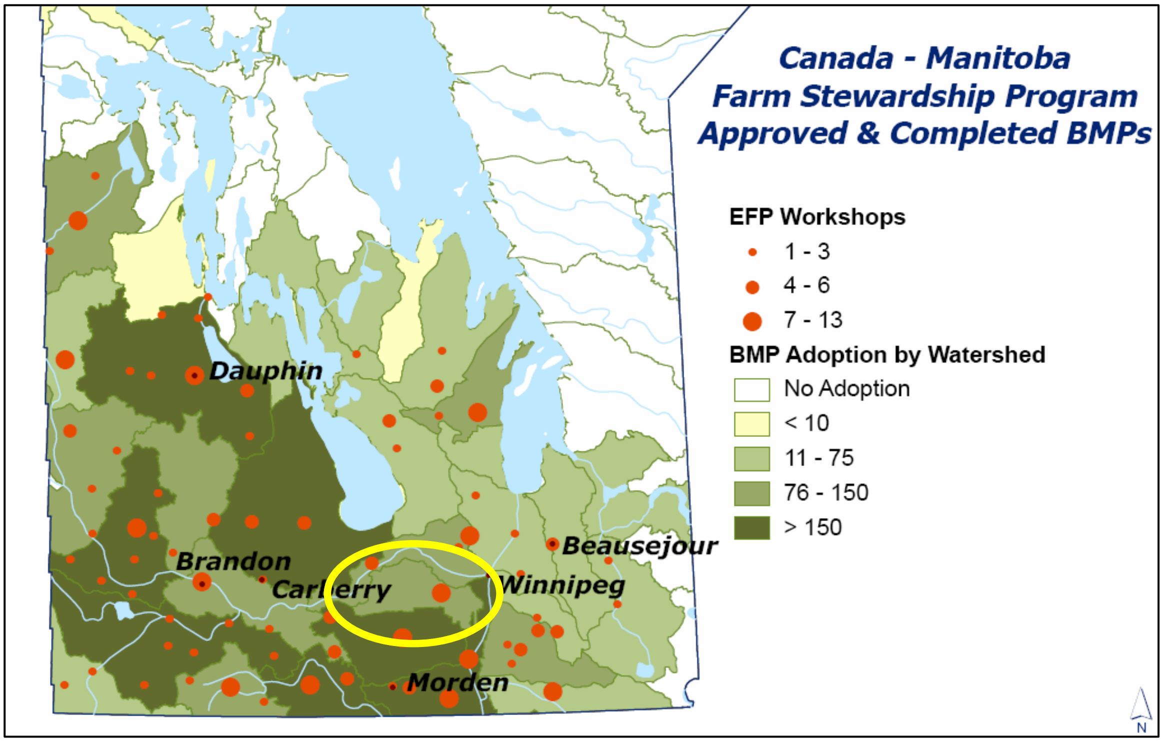
Figure 18 – Producer Participation in Environmental Farm Plans



The Canada-Manitoba Farm Stewardship Program (CMFSP) provides producers in Manitoba who have completed an EFP with financial and technical assistance to develop and implement viable and environmentally sustainable practices. Figure 19 shows program participation levels by Manitoba watersheds. There was a significant amount of Beneficial Management Practice (BMP) projects planned and implemented in the watershed with the assistance of CMFSP. By December 31, 2006, program records indicate about 120 projects were either approved for funding or completed in the watershed.

Section 7.7 – Agricultural Development

Figure 19 – Producer Participation in the Canada-Manitoba Farm Stewardship Program to December 31, 2006



5) Information Gaps

General information is available for agricultural activity and resource use and has been presented in this document, but there is limited knowledge of more site specific land management and the impact it is having on water quality, water quantity, air quality, and biodiversity. Detailed and current information on resource use in the watershed, specifically the impacts they may have on water quality and quantity may also be lacking. Some of these potential gaps and activities to address them may include:

a) Watershed Assessment of Agricultural and Non-Agricultural Impacts
   - sub-watershed monitoring, may require revised sub-watershed delineations based on existing stream and drain network and water quality monitoring program
   - assessment of cropping trends and pesticide usage
   - assessment of point-source contributors to water quality (e.g. municipal and private lagoon discharge, other point and non-point sources, etc.)
   - watershed nutrient budget

b) Watershed Scale Evaluation of Select Beneficial Management Practices (BMPs)
   - buffers – assessment based on high vs. low overland flow areas (focus on areas with significant flow vs. areas where little runoff – may require detailed elevation data to assess)
   - risks to groundwater in Almasippi sands area

    - excess water – sediment and drainage problems – erosion control structures and wetland restoration as potential solutions
    - riparian area management for filtration of sediment and nutrient removal as well as wildlife habitat

c) Watershed Assessment of Water Demands and Availability– especially large users such as RMs, Towns, Irrigators, Livestock Producers, etc..
    - Potential impact of declining water quality (in some cases potentially quantity and allocations) on agriculture

6) Recommendations

Determine the most effective BMPs for addressing the priority issues identified by stakeholders in the watershed (e.g. nutrient loading and riparian health are potential priorities) in the watershed and develop methods to facilitate their adoption. Information gaps (Section 5) will need to be addressed in order to determine the best course of action to achieve results.

Reliable sources of water are a necessity for the agriculture industry. Ensuring the quality and quantity of water needed to meet the demands of an expanding industry is important to the health of the local economy. To this end, a water management strategy could be developed that outlines distinct courses of action to address not only wet years (e.g. improved drainage), but also dry years (e.g. water storage).

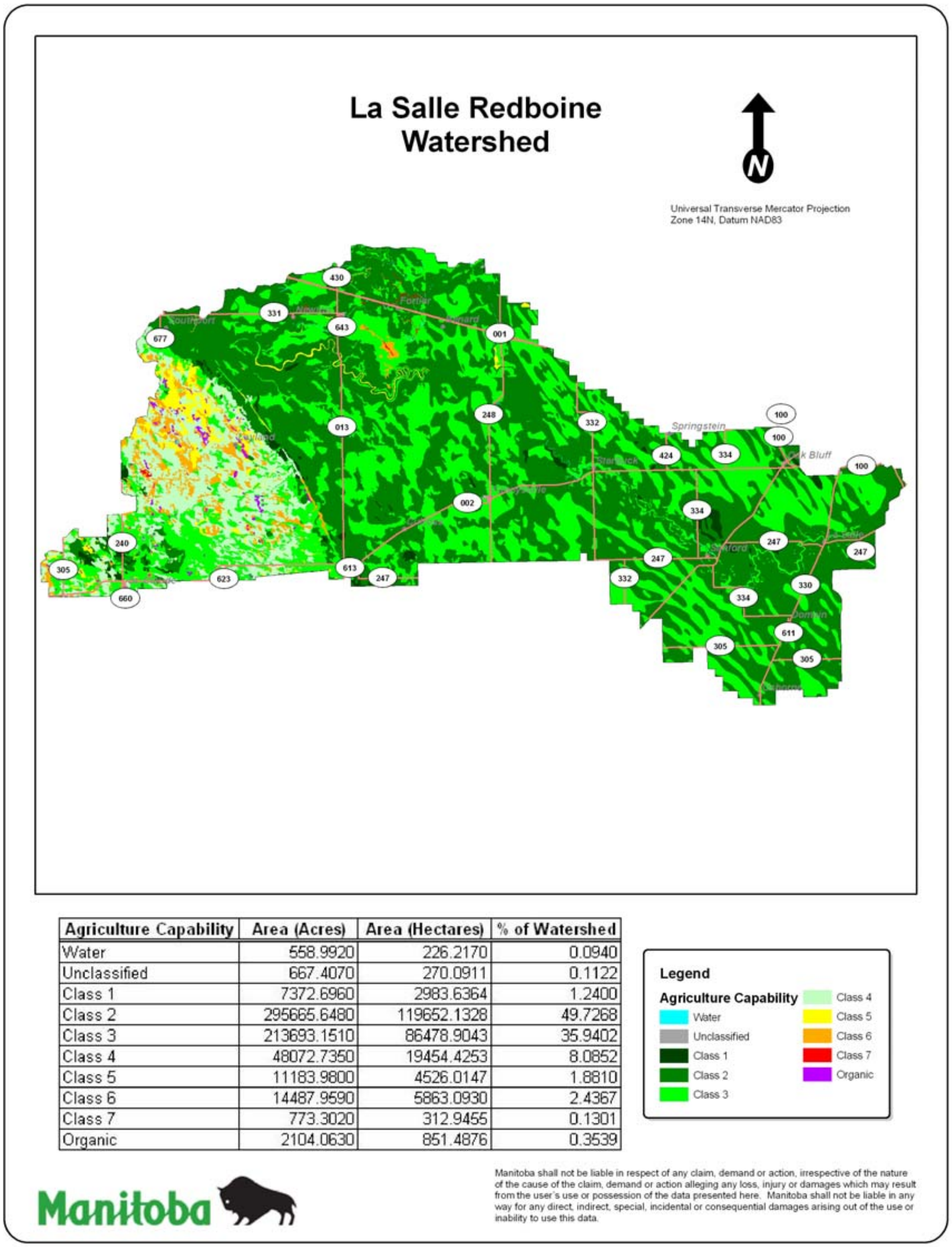
7) Appendices

Soils Maps
Note: map scale

Approximately the western 2/3 of the watershed (RMs of Grey and Portage la Prairie, along with small portions of Cartier and Macdonald) have been mapped at a “detailed” scale of 1:20 000 (i.e. approximately 32 inspection sites per section of land were used to map the soils of the area). The remaining eastern 1/3 of the watershed (largely the majority of Cartier and Macdonald municipalities) has been mapped at a “general” or reconnaissance level of 1:126 720 (i.e. approximately 1-6 inspection sites per section of land).

Detailed soil survey maps identify more of the variation in soil types across smaller landscapes. As a result, detailed soil survey maps are much more accurate and reliable for making decisions at the farm-level. Reconnaissance or general soil surveys give only a broad picture of the dominant soil types and distribution of soils that occur over relatively large areas. The landscape may actually include fairly significant areas of different soils that are not identified on the map. As such, reconnaissance soil surveys are best suited to making general comparisons of soil capabilities and limitations on a regional or national scale.

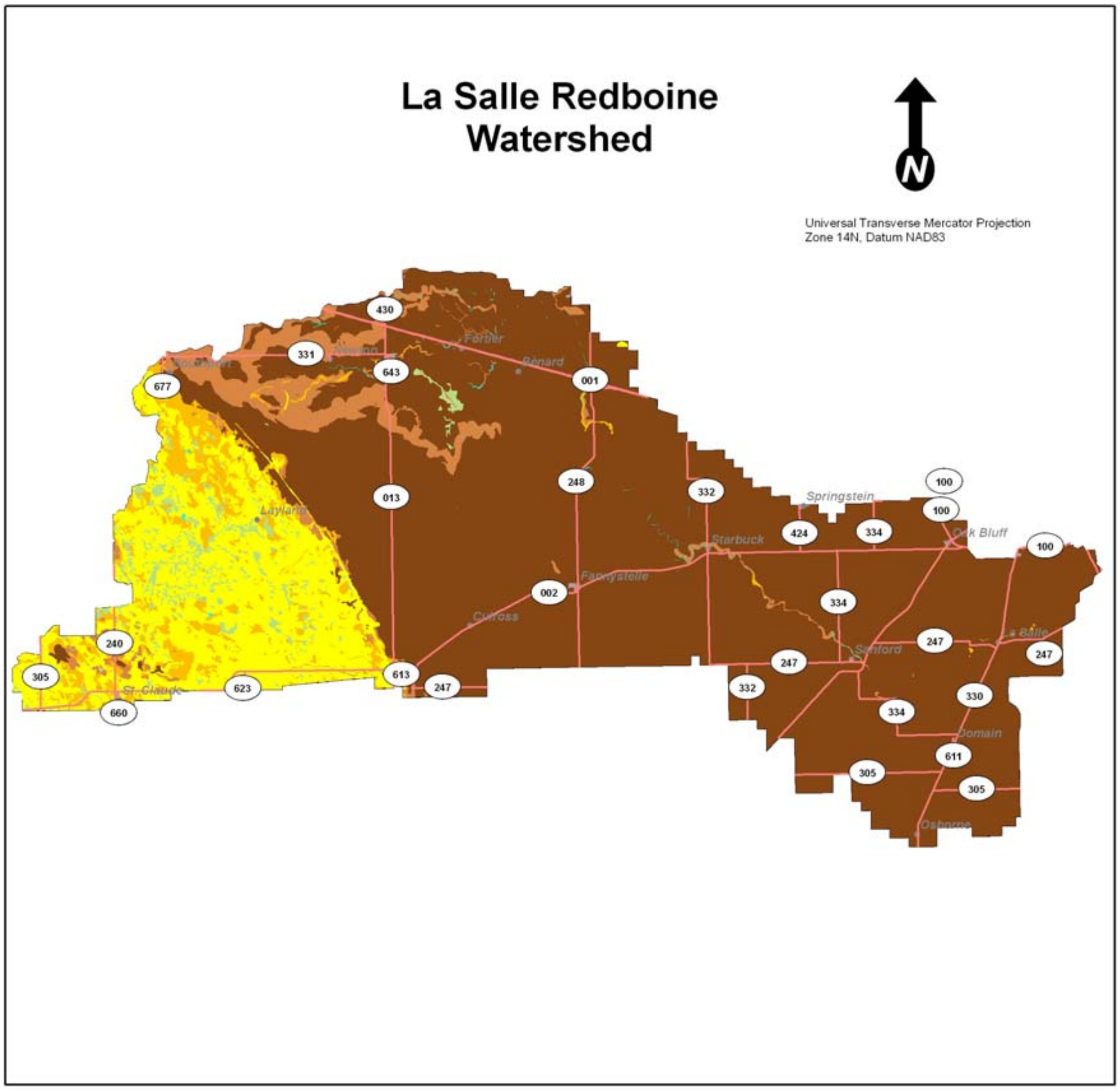
Section 7.7 – Agricultural Development



Agriculture Capability	Area (Acres)	Area (Hectares)	% of Watershed
Water	558.9920	226.2170	0.0940
Unclassified	667.4070	270.0911	0.1122
Class 1	7372.6960	2983.6364	1.2400
Class 2	295665.6480	119652.1328	49.7268
Class 3	213693.1510	86478.9043	35.9402
Class 4	48072.7350	19454.4253	8.0852
Class 5	11183.9800	4526.0147	1.8810
Class 6	14487.9590	5863.0930	2.4367
Class 7	773.3020	312.9455	0.1301
Organic	2104.0630	851.4876	0.3539

Figure A.1. Agriculture Capability of soils in the La Salle River watershed.

Section 7.7 – Agricultural Development



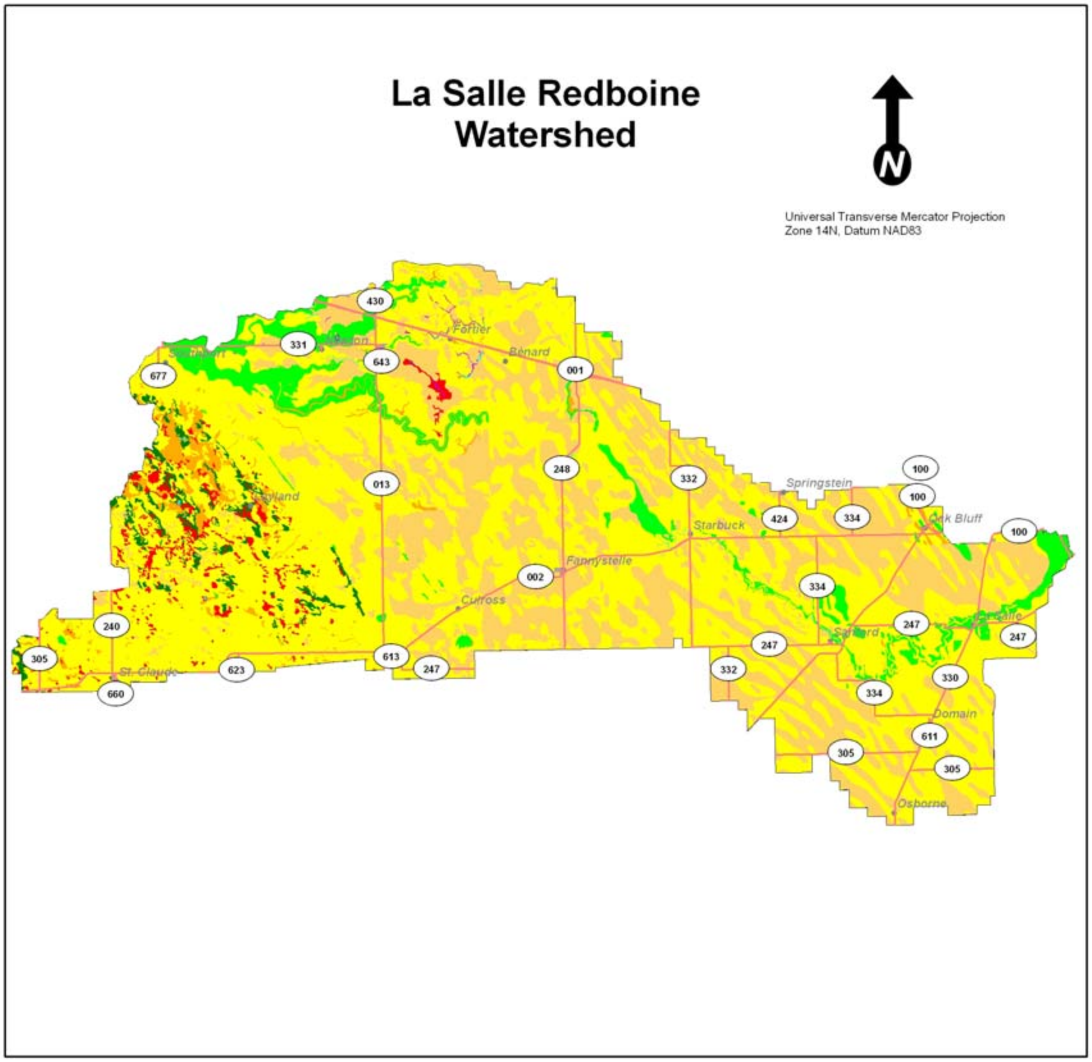
Surface Texture	Area (Acres)	Area (Hectares)	% of Watershed
Water	558.9920	226.2170	0.0940
Unclassified	667.4070	270.0911	0.1122
Clayey	439486.0370	177854.4177	73.9154
Loamy	32306.4650	13074.0161	5.4335
Coarse Loamy	27075.9750	10957.3032	4.5538
Sands	84119.9950	34042.2937	14.1478
Organic	10365.0620	4194.6090	1.7433

Legend

Surface Texture: Water, Unclassified, Clayey, Loamy, Coarse Loamy, Sands, Organic

Manitoba

Figure A.2. Surface Texture of soils in La Salle River watershed.



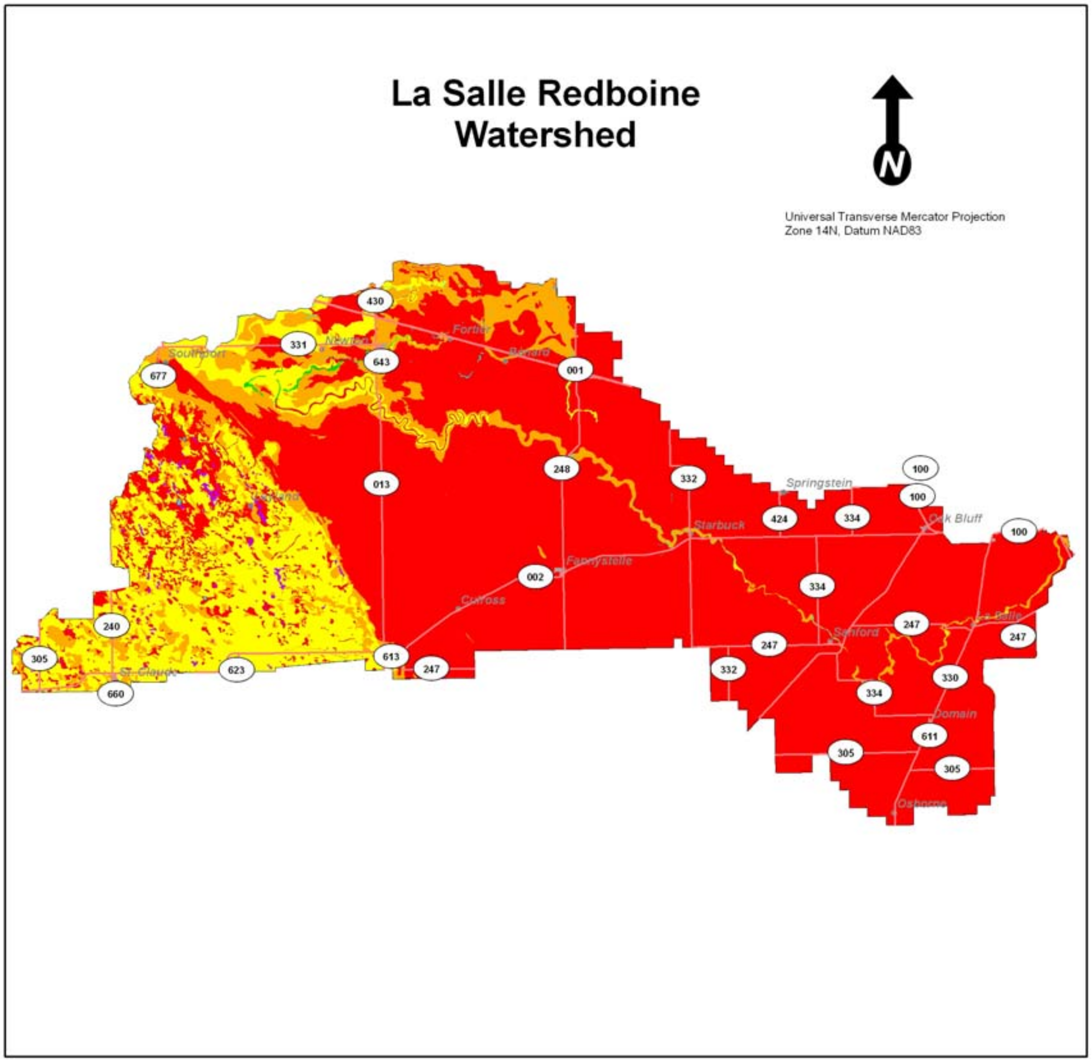
Soil Drainage	Area (Acres)	Area (Hectares)	% of Watershed
Water	558.9920	226.2170	0.0940
Marsh	618.0000	250.0968	0.1039
Unclassified	667.4070	270.0911	0.1122
Rapid	7789.3220	3152.2397	1.3101
Well	32332.8490	13084.6934	5.4379
Imperfect	363599.2060	147143.9810	61.1523
Poor (Improved)	166934.9150	67556.4400	28.0761
Poor	13255.2980	5364.2508	2.2294
Very Poor	8823.9440	3570.9381	1.4841

Legend

Soil Drainage
- Water
- Marsh
- Unclassified
- Rapid
- Well
- Imperfect
- Poor (Improved)
- Poor
- Very Poor

Manitoba

Figure A.3. Internal drainage of soils in the La Salle River watershed.

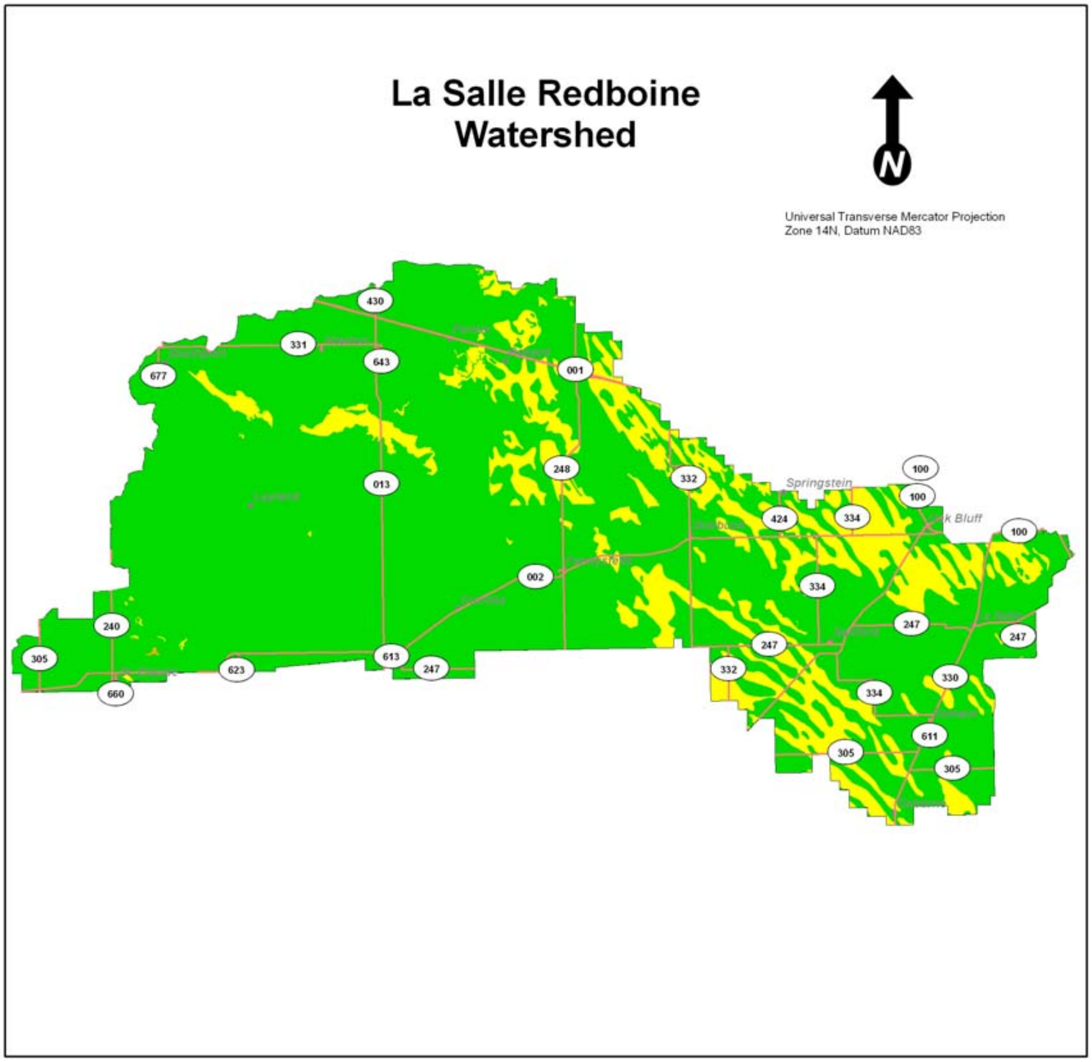


Irrigation Suitability	Area (Acres)	Area (Hectares)	% of Watershed
Water	558.9920	226.2170	0.0940
Unclassified	667.4070	270.0911	0.1122
Excellent	709.0810	286.9561	0.1193
Good	97315.0390	39382.1604	16.3670
Fair	61845.5250	25028.0985	10.4015
Poor	431379.8260	174573.9371	72.5520
Organic	2104.0630	851.4876	0.3539

Legend
Irrigation Suitability
Water
Unclassified
Excellent
Good
Fair
Poor
Organic

Manitoba

Figure A.4. Irrigation suitability of soils in the La Salle River watershed.



Soil Salinity	Area (Acres)	Area (Hectares)	% of Watershed
Non Saline (< 4 dS/m)	499898.9580	202302.7596	84.0760
Weakly Saline (4-8 dS/m)	94592.4890	38280.3790	15.9091
Moderately (8-15 dS/m)	88.4860	35.8092	0.0149

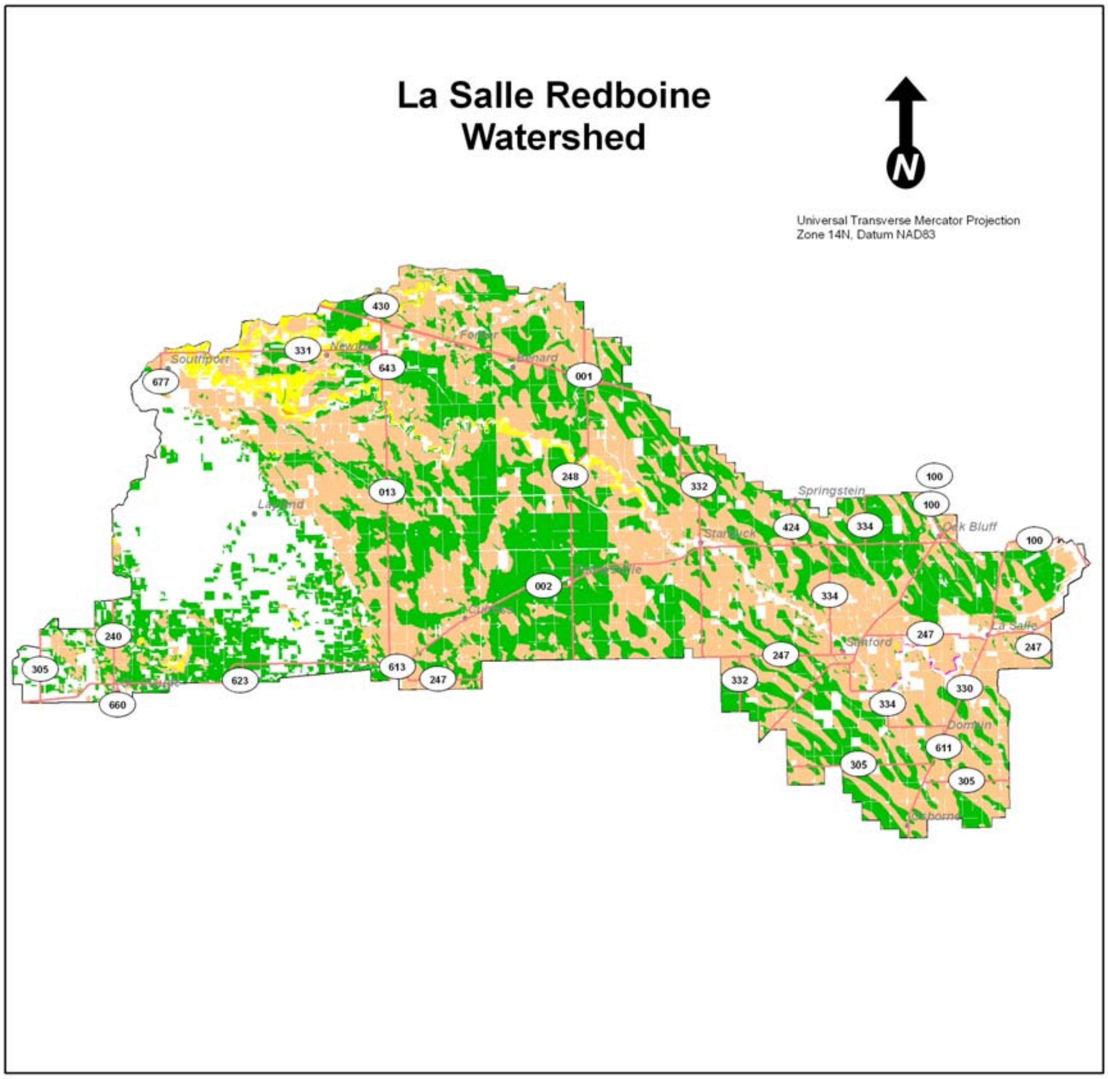
Legend

Soil Salinity

- Non Saline (< 4 dS/m)
- Weakly Saline (4-8 dS/m)
- Moderately Saline (8-15 dS/m)

Manitoba

Figure A.5. Degree and extent of soil salinity in La Salle River watershed.



Cropland with Risk of Water Erosion (Bare Soil)	Area (Acres)	Area (Hectares)	% of Watershed
Negligible Risk	200839.0610	81277.0173	33.2123
Low Risk	235856.3560	95448.0719	39.0030
Moderate Risk	14424.9760	5837.6046	2.3854
High Risk	205.4070	83.1256	0.0340
Severe Risk	193.3070	78.2289	0.0320

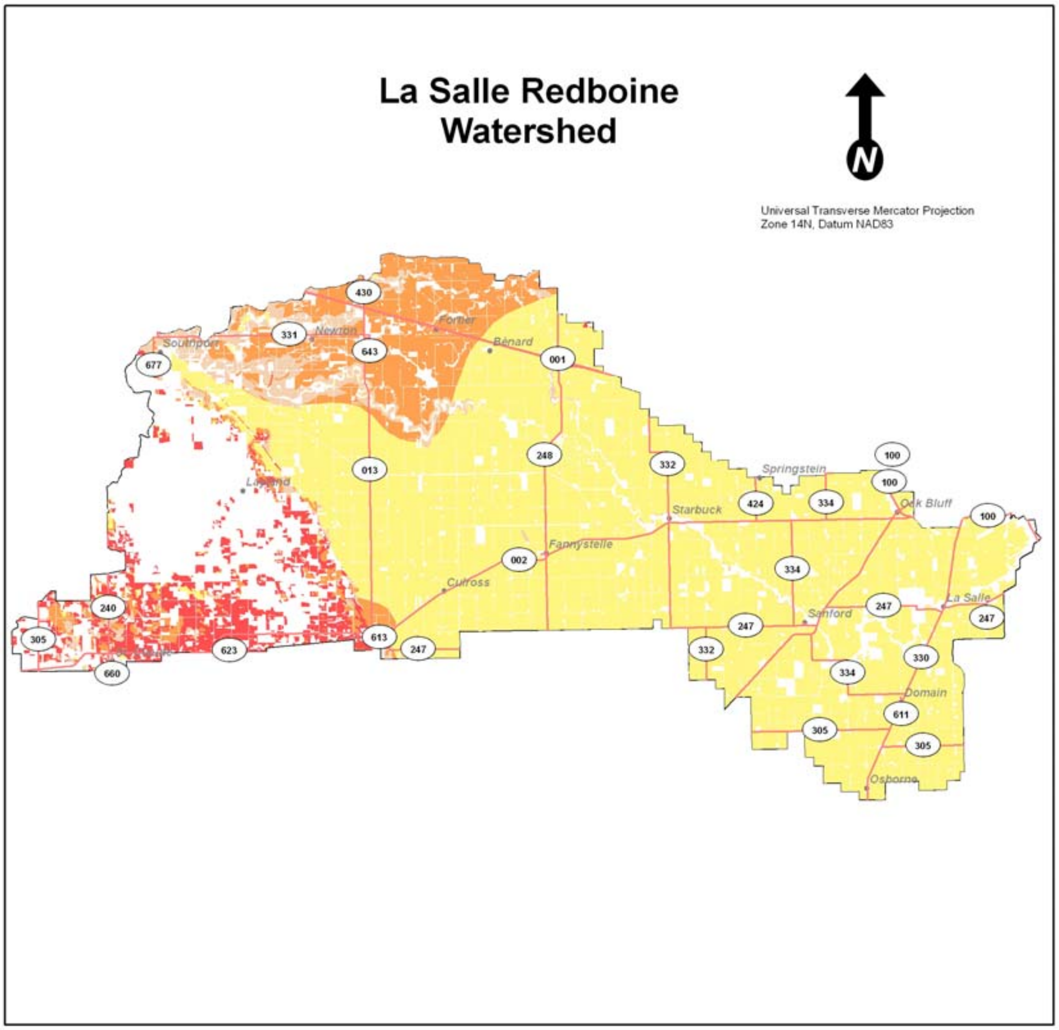
Legend

Cropland with Risk of Water Erosion (Bare Soil)

- Negligible Risk
- Low Risk
- Moderate Risk
- High Risk
- Severe Risk

Manitoba

Figure A.6. Risk of soil erosion by water in the La Salle River watershed.



Cropland with Risk of Wind Erosion (Bare Soil)	Area (Acres)	Area (Hectares)	% of Watershed
Low Risk	22816.3840	9233.5008	3.7731
Moderate Risk	341591.3650	138237.6872	56.4882
High Risk	56157.0130	22726.0300	9.2866
Severe Risk	28921.5050	11704.1658	4.7827

Legend

Cropland with Risk of Wind Erosion (Bare Soil)

- Low Risk
- Moderate Risk
- High Risk
- Severe Risk

Manitoba

Figure A.7. Risk of soil erosion by wind in the La Salle River watershed.

Section 7.7 – Agricultural Development

Table A.1 – Cropping, livestock and nutrient trends – Converted to Imperial Units (Census of Agriculture)

	Canola/Mustard (ac)	Cropland (ac)	Pigs	Total Cattle	Manure (t/yr)	Manure N (t/yr)	Manure P (t/yr)
1976	4,661	412,329	37,406	23,327	320,798	1,979	561
1981	18,261	432,662	42,742	21,852	298,280	1,857	526
1986	33,986	449,196	60,764	19,535	299,601	1,897	555
1991	50,598	450,141	57,725	21,821	321,464	2,002	575
1996	69,886	444,362	101,164	27,558	435,690	2,713	795
2001	66,204	456,600	117,749	28,408	461,122	2,908	865
% Chg.	**1320%**	**11%**	**215%**	**22%**	**44%**	**47%**	**54%**

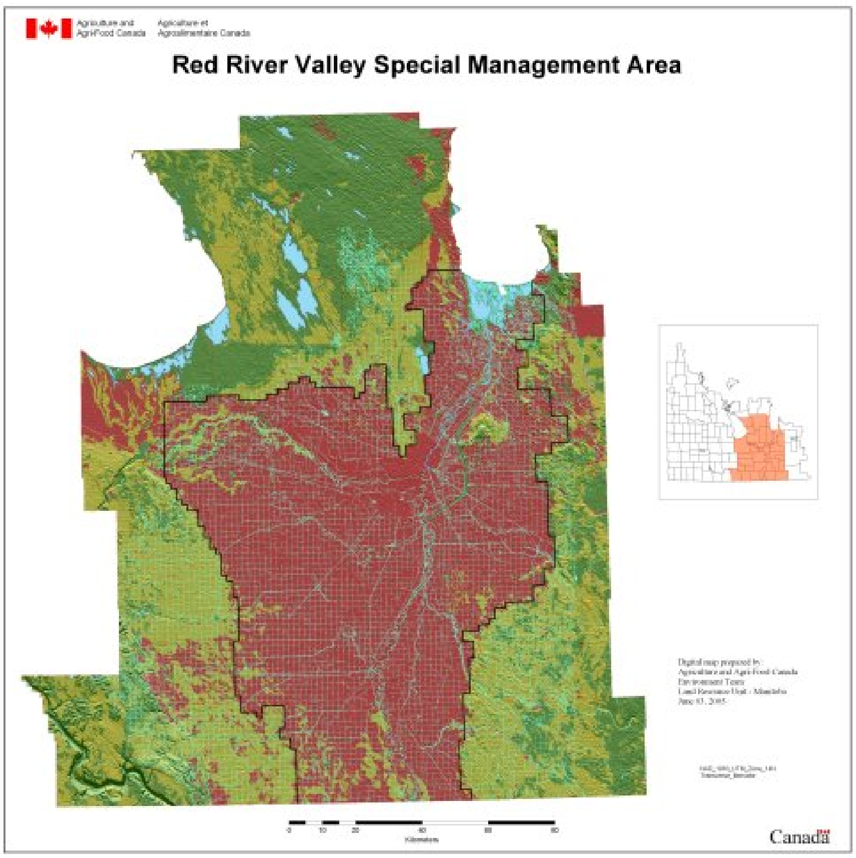
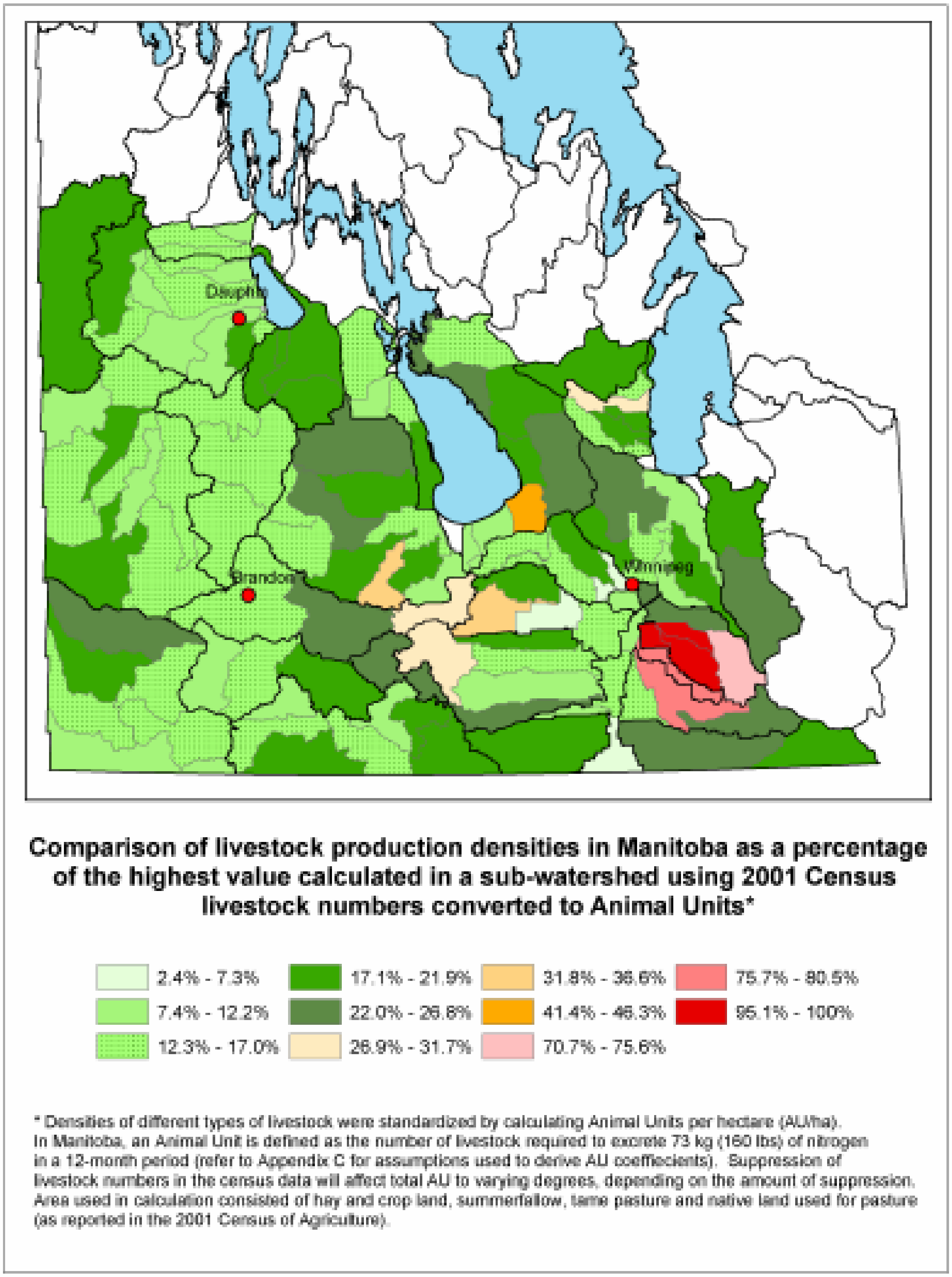


Figure A.8 Red River Valley Special Management Area

Section 7.7 – Agricultural Development

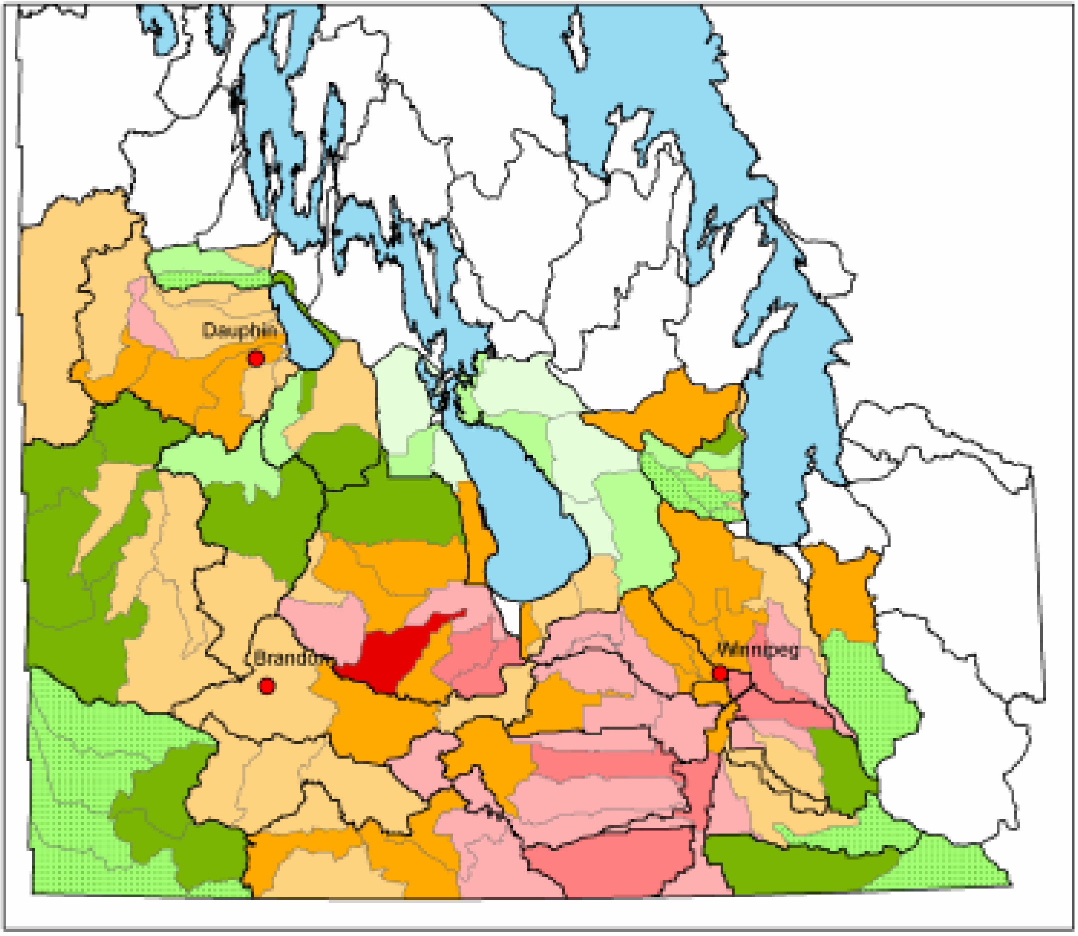
Figure A.9 Livestock production density by Manitoba watershed



*Source: Summary of Resources and Land Use Issues Related to Riparian Areas in the La Salle River Watershed Study Area, PFRA 2004

Section 7.7 – Agricultural Development

Figure A.10 Fertilizer use by Manitoba watershed



Comparison of commercial fertilizer use in sub-watersheds in Manitoba, calculated as a percentage of the highest value in a sub-watershed (as reported in the 2001 Census of Agriculture).*

8.4% - 18.6%
18.7% - 28.8%
28.9% - 38.9%
39.0% - 49.1%
49.2% - 59.3%
59.4% - 69.5%
69.6% - 79.6%
79.7% - 89.8%
89.9% - 100%

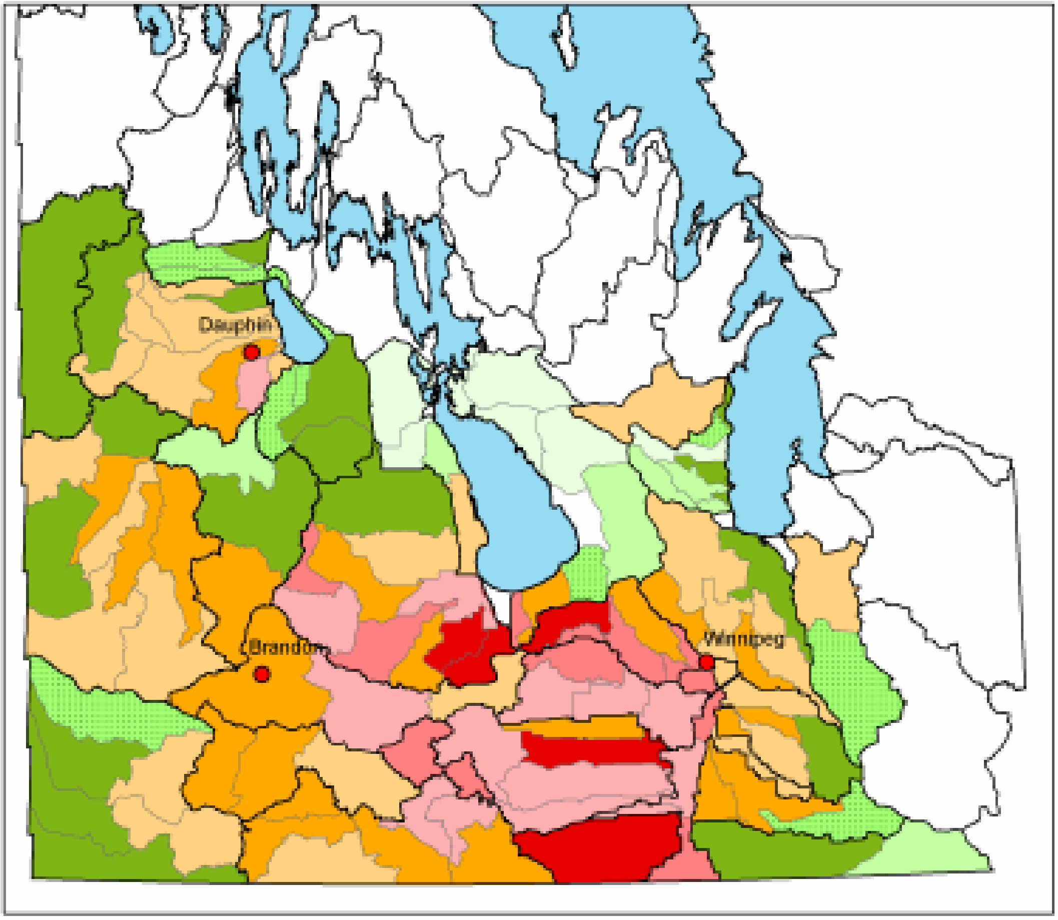
* Level of fertilizer use is calculated as dollars spent on fertilizers per hectare in the year 2000, as reported by farms in the 2001 Census of Agriculture. Land area was calculated as the number of hectares used for crop and hay production and summerfallow (as reported by farms for the 2001 Census).

---

*Source: Summary of Resources and Land Use Issues Related to Riparian Areas in the La Salle River Watershed Study Area, PFRA 2004

Section 7.7 – Agricultural Development

Figure A.11 Pesticide use by Manitoba watershed



Comparison of pesticide use in sub-watersheds in Manitoba, calculated as a percentage of the highest value in a sub-watershed (as reported in the 2001 Census of Agriculture).*

2.4% - 13.2%	35.0% - 45.8%	67.6% - 78.3%
13.3% - 24.1%	45.9% - 56.6%	78.4% - 89.2%
24.2% - 34.9%	56.7% - 67.5%	89.3% - 100%

* Level of pesticide use (herbicides, insecticides and fungicides) is calculated as dollars spent on fertilizers per hectare in the year 2000, as reported by farms in the 2001 Census of Agriculture. Land area was calculated as the number of hectares used for crop and hay production and summerfallow (as reported by farms for the 2001 Census).

*Source: Summary of Resources and Land Use Issues Related to Riparian Areas in the La Salle River Watershed Study Area, PFRA 2004