

LIVESTOCK DECISION SUPPORT TOOL FOR THE RURAL MUNICIPALITY OF LORNE



Agriculture and
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Administration

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This report provides the Rural Municipality of Lorne with valuable tools and knowledge that will assist them in making informed decisions regarding sustainable agricultural and rural development, protecting the water and soil resource.

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Abstract

With the recent expansion of the livestock industry in Manitoba, local decision makers and rural municipalities are under pressure to ensure that decisions in regards to livestock operations reflect sustainability in terms of environmental, social and economic issues. A decision support tool was developed for the Rural Municipality of Lorne to assist the council in making decisions regarding the livestock industry in the rural municipality.

A geographical information system (GIS) was used to integrate resource data, locations and size of livestock operations, and provincial laws and regulations regarding livestock development. Analysis of data collected allowed for creation of map based products and other data tabulation to spatially display and examine issues with respect to livestock development such as the availability of land for manure application or implication of recommended buffering on placement of new or expanded facilities.

Currently, there are 227 livestock operations, mainly cattle or hog production, in the Rural Municipality of Lorne producing 27,987 animal units. To support these operations, a minimum of 20,854 acres (8,444 hectares) of land is required for manure application. Using two separate methods, approximately 196,000 to 200,000 acres (79,000 to 81,000 hectares) of land was identified as being currently available for manure application. In addition to provincial setback requirements for manure application, present land use, and soil characteristics such as drainage and texture would place limitations on acres available for manure application. Soil suitability for earthen storage could further reduce potential areas of expansion should this method of manure storage be proposed in any new or expanded development.

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1.0 Introduction and Background

Provincial Industry Trends:

The growth of the livestock industry in Manitoba over the last few years has been dramatic. Due to the removal of the Western Grains Transportation subsidy, Manitoba is the most cost efficient region in North America to feed livestock. Cost efficiency coupled with investment in new hog operations and processing facilities is expected to continue to drive expansion of the livestock industry for several years. In particular, Manitoba's hog industry has seen extensive growth. Provincial hog numbers increased from 2.3 million hogs in 1992 to 3 million hogs in 1995. Currently, production sits at about 5.3 million hogs. Beef cattle numbers are expected to increase from their current status which resides around 554,000. Sheep and goat production has seen a dramatic increase in the last two years and significant growth has also been seen in the poultry industry, particularly the egg sector. Bison production growth rates remain strong around the 20% per year mark. PMU production in Manitoba has stabilized in the last few years. Dairy cattle numbers are expected to decrease, although combining of quotas into larger operational units will intensify production and management issues.

The expansion of many livestock operations is expected to happen rapidly, and in the hog industry the majority of new enterprises will likely be sited, developed and operational within the next two to five years. With expansion, local governments and other decision makers are under pressure to make decisions on livestock operations which must reflect sustainability in terms of environmental, social and economic issues. The resource base data for land use planning, although not complete, is advanced enough to be immediately useful by local governments in their decision making. Social and economic considerations are equally important, but will require additional data and development to be integrated into local decision making.

Rural Municipality of Lorne Livestock Trends:

Livestock production within the Rural Municipality of Lorne has traditionally been involved in dairy, beef, PMU, pork and to a lesser extent poultry production. A significant amount of grain and forage production within the rural municipality (RM) is used in these industries. With an established infrastructure of supporting industries, trained workforce and a strong local knowledge base to build upon, expansion of livestock numbers within the RM has occurred primarily in the poultry and beef sectors. Hog and dairy numbers have stabilized while sheep, goat, bison, and elk numbers have slightly increased since the 1996 census and horse numbers are down slightly.

With the increasing sizes of operations and corresponding changes in technologies used by producers, public concern over the environmental and social impact of livestock operations has also increased. To arrive at decisions that allow for a strong and sustainable livestock industry, while addressing the concerns of the community requires the RM council and staff to effectively acquire, interpret and distribute information.

Geographic Information Systems (GIS) is a relatively new tool that can assist local governments in making sustainable resource development decisions regarding the livestock industry. GIS allows the user to spatially display social, economic, and environmental information and produce hard copy maps. GIS can help local governments and planning districts resolve complicated resource planning issues by displaying information in a comprehensive and easy to understand format.

2.0 Project Description

The objective of this project is to provide the RM of Lorne with a tool for analyzing existing and future livestock scenarios and associated land, water, and social constraints. This was achieved through identification of key resource based issues and data requirements, including the acquisition of current livestock information, application of analytical procedures, and preparation of products and results of the analysis in support of local discussion and decision making. At completion, this project delivered;

- i. a methodology that supports resource based decision making with respect to livestock expansion,
- ii. a demonstrated capability of the Rural Municipality of Lorne to utilize advanced decision support tools,
- iii. reports for project partners that include hard copy (tabular and map form) results of analysis,
- iv. digital products and data for continued analysis by the Rural Municipality of Lorne.

3.0 Methodology

3.1 Determine the needs of the Rural Municipality of Lorne

Through discussions with the RM the following general statements about the needs and scope of the project were established. The Rural Municipality of Lorne wanted to have a decision support tool for land use planning capable of spatially illustrating options, issues and factors essential to decisions on livestock development within the parameters set out by provincial guidelines, regulations, acts and laws, and future municipal bylaws. **The product does not replace the need for site specific assessment of each operation but will assist in generalized land use planning for the whole RM.** Data requirements needed to successfully complete the project were discussed and mutually agreed upon and are reported herein.

2.0 Data Collected

Basemap features

The basemap is a digital map that all other information is plotted or corrected to. Essentially, the basemap is the frame upon which the rest of the data is placed. This information includes the position of roads, lakes, rivers, streams, rail lines plus other features. This information is also used in the analysis of environmental setbacks from water bodies, roads and other applicable features. Two separate sources of information were utilized for creating the basemap for the RM of Lorne. These are the National Topographical Survey (NTS) and the ortho-photos with associated quarter section grid. Each source has different levels of information and accuracy.

Ortho-Photo and Quarter Section Fabric

A digital ortho photo is an aerial or satellite photo which accurately represents the surface of the earth at any given location for a specific time. In this case, the original aerial photo has been digitally corrected for many errors that are inherent in the photographic and flight process including the angle of photography, distortion from camera lens, and differences in elevation. The ortho photos for Lorne were taken at 1:60,000 scale. The ortho photo for the RM of Lorne is used as a backdrop in many of the map products.

The quarter section fabric for the RM of Lorne was originally created from a 1:50,000 National Topographic Survey map. Adjustments were then made to the quarter section fabric to match the ortho photo. This fabric allows users to efficiently locate a position in accordance with the Western Canada Land Survey System. The ortho photo and the quarter section fabric were obtained from the Land Information Division, Department of Conservation of the Government of Manitoba

Municipal Zones

Municipal zoning is used by a municipality to control and direct development. The RM of Lorne currently does not have a zoning by-law which sets conditions and/or restrictions on business development including agriculture livestock operations. The RM of Lorne hopes to enter into discussions regarding zoning by-laws with other neighboring RM's (South Norfolk, Victoria) and a few villages (Treherne and Nortre Dame de Lourdes) through the process of developing a municipal planning district. Presently, the R.M. of Lorne relies on existing Provincial livestock regulations, guidelines, and laws to direct livestock development (refer to Table 15).

Location of Residences, Rural Businesses (non primary agriculture), and Abandoned Yards (dwellings)

Residence locations can be used to determine which areas to possibly exclude from livestock expansion or manure application due to close proximity. Using information about residences also allows for an analysis of trends in residential development and their impact upon the livestock industry. Residence locations were determined through analysis of ortho-photos and with the assistance of RM staff.

Conflicts can arise between residential land uses and the livestock industry. As such, the distribution of rural residences can have dramatic impact upon existing, expanding and future livestock operations. Residential development within the RM of Lorne can be split into three main categories: 1) First Nations Reserve, 2) communities/villages, and 3) rural residences.

The Swan Lake First Nations Reserve is located adjacent to the north side of Swan Lake in township 5 range 11 W1 ([Map 1](#) & [lortho](#)). No residential data was collected for the Swan Lake First Nations Reserve.

Eight residential areas are located within the RM. The village of Notre Dame de Lourdes and the hamlet of Bruxelles are both located in Township six. The village of Somerset, the local urban districts of Mariapolis, Swan Lake, and Altamont and the hamlet of St. Alphonse are all located in Township 5. No residential data was collected within residential areas.

All rural residences and abandoned dwellings within the RM were accounted for. Rural businesses (non-primary agriculture) were also accounted for ([Map 1](#) & [lortho](#)). Table 1 illustrates the number of residences, abandoned dwellings, and rural businesses by ward for the RM.

Table 1. Rural Residences, Abandoned Dwellings, and Rural Businesses (non- primary agriculture) in the RM of Lorne

Location	# of Residences	# of Abandoned Dwellings	# of Rural Businesses
Ward 1	66	6	1
Ward 2	64	3	1
Ward 3	72	5	2
Ward 4	82	8	0
Ward 5	77	8	3
Ward 6	75	8	0
Total	436	38	7

Location of Livestock Operations

Knowing the location of existing livestock operations is essential for proper land use planning to occur. This information is extremely useful in determining the direction and scope of future expansion of the livestock industry as well as sustainable management of existing operations and area land and water resources. Livestock locations were determined through the use of ortho-photos and the assistance of RM staff. Information on type of livestock as well as class of operation and size was acquired from producer interviews. **For farms comprised of several types of livestock (ex. Hogs & beef) and/or classes of operation (ex. Beef cows & feeders) each distinctive unit was classified as a single operation.** This information was collated into a single database format for all livestock types. The location of operations that were newer than the ortho photos were approximated with the assistance of municipal staff.

The RM of Lorne has a well established livestock industry. A total of 227 different livestock operations were identified ([Map 2 & 2ortho](#)). Beef (42%), hog (31%), and dairy (15%) farms account for the majority (88%) of livestock operations. Horse, poultry, sheep, goat, bison, and elk farms account for the remainder.

Livestock operations within the RM are distributed in a manner similar to residences and total number of operations are distributed fairly equally between the six wards ([Map 3 & 3ortho](#)). The majority of hog operations are located in the central or eastern part of the RM. The majority of dairy and PMU farms are located in the western portion of the RM. Beef operations are also distributed more heavily on the western half of the RM ([Map 4, 5 and 6 & Map 4ortho, 5ortho and 6ortho](#)).

Total animal units for the RM are 27,987 AU. Seventy two percent of all the livestock operations are of the 1 to 200 animal unit range. Operations are classified in animal unit ranges rather than actual units of each operation to protect producer confidentiality, but actual animal units of operations are reflected in the total for the RM. Tables 2, 3, 4, and 5 below show the number, type and size of livestock operations for the R.M. of Lorne. Tables 6, 7, 8, and 9 below show the number and type of livestock operations by ward for the RM. Table 10 highlights the number of reported animal units by ward.

Table 2. Number of Hog Farms by Operation Type and Size for RM of Lorne

Operation Type	Animal Units					Total
	0-100	101-200	201-400	401-800	801-1600	
Sow, Farrow to Finish	8	6	-	4	1	19
Sow, Farrow to Weanling	4	-	-	-	-	4
Weanlings	6	1	-	-	-	7
Grower/Finisher	28	7	4	2	-	41
Total	46	14	4	6	1	71

Table 3. Number of Beef and Dairy Farms by Operation Type and Size for RM of Lorne

Operation Type	Animal Units					Total
	0-100	101-200	201-400	401-800	801-1600	
Beef Cows	77	13	1	-	-	91
Feeder Cattle	3	1	-	-	-	4
Dairy Milk Cows	22	11	1	-	-	34
Total	102	25	2	-	-	129

Table 4. Number of Poultry Farms by Operation Type and Size for RM of Lorne

Operation Type	Animal Units					Total
	0-100	101-200	201-400	401-800	>801	
Broilers	-	1	-	-	-	1
Layers	-	2	-	-	1	3
Pullets	1	-	-	1	-	2
Heavy Toms	1	-	-	-	-	1
Total	2	3	-	1	1	7

Table 5. Number of Horse, Bison, Elk, Goat, and Sheep Farms by Operation Type and Size for RM of Lorne

Operation Type	Animal Units					Total
	0-100	101-200	201-400	401-800	801-1600	
Horses	3	6	2	-	-	11
Bison	1	-	-	-	-	1
Elk	2	-	-	-	-	2
Goats	2	-	-	-	-	2
Sheep	4	-	-	-	-	4
Total	13	6	2	-	-	21

Table 6. Number and Type of Livestock Farms by Ward for RM of Lorne

Location	Beef	Dairy	Hog	Poultry	Horses	Sheep	Goat	Bison	Other	Total
Ward 1	30	11	5	-	5	-	-	-	-	49
Ward 2	18	16	4	-	3	1	1	-	-	43
Ward 3	20	5	12	-	1	2	1	1	-	41
Ward 4	4	-	24	1	-	-	-	-	1	30
Ward 5	10	1	18	2	2	1	-	-	1	35
Ward 6	13	1	8	4	-	-	-	-	-	26
Total	95	34	71	7	11	4	2	1	2	227

Table 7. Number and Type of Hog Operations by Ward for RM of Lorne

Location	Grower/Finisher	Sow, Farrow to Finish	Sow, Farrow to Weanlings	Weanlings	Total
Ward 1	1	2	-	2	5
Ward 2	2	2	-	-	4
Ward 3	8	3	1	-	12
Ward 4	19	5	-	-	24
Ward 5	9	2	2	5	18
Ward 6	2	5	1	-	8
Total	41	19	4	7	71

Table 8. Number and Type of Beef and Dairy Operations by Ward for RM of Lorne

Location	Beef Cows	Feeder Cattle	Dairy Milk Cows	Total
Ward 1	29	1	11	41
Ward 2	16	2	16	34
Ward 3	18	1	5	24
Ward 4	5	-	-	5
Ward 5	10	-	1	11
Ward 6	13	-	1	14
Total	91	4	34	129

Table 9. Number and Type of Poultry Operations by Ward for RM of Lorne

Location	Broilers	Layers	Pullets	Heavy Toms	Total
Ward 1	-	-	-	-	0
Ward 2	-	-	-	-	0
Ward 3	-	-	-	-	0
Ward 4	-	-	-	1	1
Ward 5	1	1	-	-	2
Ward 6	-	2	2	-	4
Total	1	3	2	1	7

Table 10. Reported Animal Units by Ward for RM of Lorne

Ward #	Total Animal Units
1	4,398
2	3,832
3	5,314
4	2,484
5	4,167
6	7,792
Total	27,987

Landuse

The way land is utilized affects decisions about manure application and facility placement. Landuse also has a dramatic impact on the amount of acres available for manure disposal. Native grasslands and improved forage fields can utilize significantly more nutrients found in manure than annual crops and hence application rates can be considerably higher. Rates of manure application can vary even within the improved forage category depending on whether the stand is dominated by a legume such as alfalfa or dominated by grasses. The Farm Practices Guidelines for Livestock Producers outline land base requirements for manure application based on type of landuse.

Land use information is derived from Landsat satellite imagery which has a resolution of 30 m². The satellite measures the spectral signatures which can then be correlated to 7 general landuse categories ([Map 7](#)). These categories are Annual Crop Land, Forages, Grasslands, Trees, Water, Wetlands, and Urban and Transportation. Data was acquired from Radar Sat International and classification was performed by Manitoba Remote Sensing Centre.

Annual cropland (67.9%) dominates the landscape, occurring throughout the RM. Areas of grasslands (11.9%) are found throughout the RM, but are more concentrated in the western portion of the RM. Forages fall a similar pattern, covering 3.7% of the landscape. Trees cover 8.2 % of the landscape and with the majority located around Swan Lake and in east of the RM.

Table 11. Land use in the RM of Lorne

Land Use	Acres	Hectares	% of Total
Annual Cropland	162,930	65,963	67.9
Trees	19,756	7,998	8.2
Water	4,475	1,812	1.9
Grassland	28,768	11,647	11.9
Wetlands	7,220	2,923	3
Forage	8,896	3,602	3.7
Urban & Trans.	7,987	3,234	3.4
Total	240,032	97,179	100

Soils

Soils of a municipality are an important natural resource for the community. Information on soils is important for making decisions about agricultural capability, risk of leaching, and suitability for many uses including agriculture, industrial, construction, and recreational. The soils information for the RM of Lorne is available at a scale of 1:50 000, with 1:20 000 detailed soil survey information available for a few smaller parcels within the RM. The soils database contains information about soil texture, drainage, permeability, plus many other characteristics and interpretations. This information plus other soil interpretations can be acquired from the Land Resource Unit of Agricultural and Agri-Food Canada and the Soil Resource Section of Manitoba Department of Agriculture and Food.

Soil Texture (excerpted from descriptions supplied by Agricultural Resource Section of Manitoba Agriculture and Food)

Soil texture strongly influences the soils ability to retain moisture, its general level of fertility and ease or difficulty of cultivation. Water moves easily through coarse textured (sandy) soils so little moisture is retained and they dry out more quickly than fine textured (clay) soils. As well, sandy soils do not retain plant nutrients as well as clay soils and have lower natural fertility. Sandy soils often are characterized by loose or single grained structure, which is very susceptible to wind erosion. Clay soils have a high proportion of very small pore spaces which hold moisture tightly and have higher natural fertility because they are able to retain plant nutrients better. Clay soils transmit water very slowly, therefore these soils are susceptible to excess moisture conditions.

Soil texture also affects decisions about manure application and facility placement. Soil texture plays a major role in the amount of manure which can be applied to the land. Medium to heavy textured soils tend to retain nutrients and water better than coarser textured soils which usually corresponds to more plant biomass production. Because of this, manure application rates according to the Farm Practices Guidelines on medium to heavy textured soils (sand loam to clay) can be higher than for coarser textured soils (loamy sand to sand).

Ninety percent of soils in the RM of Lorne have a Fine Loamy soil texture and are predominately under annual cultivation. Some pockets of coarser textured soils are found in the vicinities of Mariapolis, Notre Dame De Lourdes, and Altamont. Table 12 highlights surface soil texture with landuse overlay for the RM([Map 8](#)).

Table 12. Surface Soil Texture with 1994 Landuse Overlay for the RM of Lorne

Surface Texture	Acres (hectares) of Annual Cropland on	Acres (hectares) of Forage on	Acres (hectares) of Trees on	Acres (hectares) of Grassland on
Eroded Slopes	2,386 (967)	245 (99)	5,318 (2,153)	2,393 (969)
Clayey	1,325 (536)	26 (10)	41 (17)	207 (84)
Fine Loamy	1,54277 (62,460)	8,220 (3,228)	12,051 (4,879)	23,179 (9,384)
Coarse Loamy	84 (34)	60 (24)	63 (25)	79 (32)
Sand	2,351 (952)	166 (67)	776 (314)	589 (238)
Coarse Sands	473 (191)	85 (34)	214 (87)	326 (132)
Organic	1,837 (744)	69 (28)	1,070 (433)	1,657 (671)
Total	16,2733 (65,884)	8,871 (3,590)	19,533 (7,908)	28,430 (11,510)

Soil Drainage (excerpted from descriptions supplied by Agricultural Resource Section of Manitoba Agriculture and Food)

Soil drainage refers to the frequency and duration of periods when the soil is free of saturation. Excessive water content in soil limits the free movement of oxygen and decreases the efficiency of nutrient uptake. Delays in spring tillage and planting are more frequent in depressional or imperfectly to poorly drained areas of a field. Improved surface drainage and underground tile drainage are management considerations that can reduce excessive moisture conditions in soils. The majority of poorly drained soils remain in the native state supporting vegetation associated with wetlands and marsh. Five soil drainage classes are indicated in the soil drainage map ([Map 9](#)).

Rapidly drained - water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow can occur on steep slopes during heavy rainfall. Soils have low water storage capacity and are usually coarse in texture.

Well-drained - excess water is removed from the soil, flowing downward readily into underlying pervious material or laterally as subsurface flow.

Imperfectly drained - water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. The source of moisture includes precipitation and/or groundwater.

Poorly drained - water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time when the soil is not frozen. The main water source is subsurface flow and/or groundwater in addition to precipitation.

Very poorly drained - water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time that the soil is not frozen. Excess water is present in the soil throughout most of the year.

Well drained soils predominate in the RM of Lorne (65.2%) and occur throughout the RM. Areas of rapid soil drainage correspond with eroded slope areas along valleys and also east of the area between Altamont and Notre Dame De Lourdes towards the Manitoba Escarpment. Imperfectly

drained soils predominate in a line running from northwest to southeast between Swan Lake and Somerset and also in the very northwest corner of the RM.

Although soil drainage is not specifically mentioned in the Farm Practices Guidelines for Livestock Producers, it does play a role in siting of facilities and application of manure. Poor soil drainage can create inherent problems with trafficability around facilities and in fields during manure application. It also has a direct relationship to the amount of potential field runoff or internal leaching for a soil. Significant improvements to soil drainage can sometimes be achieved but usually at a significant cost. Avoiding problem areas is the best measure if possible.

Table 13. Soil Drainage Class for the RM of Lorne

Class	Acres	Hectares	% of RM
Water	6,928	2,805	2.9
Rapid	16,260	6,583	6.7
Well	15,7198	63,643	65.2
Imperfect	35,820	14,502	14.9
Poor	17,705	7,168	7.3
Very Poor	7,240	2,931	3
Total	241,151	97,632	100

Soil Suitability for Sewage Lagoons (excerpted from descriptions supplied by Agricultural Resource Section of Manitoba Agriculture and Food)

Factors affecting the ability of undisturbed soils to impound sewage and prevent seepage are considered in evaluating soils for their suitability for lagoon areas. This evaluation considers soil both as a vessel for the impounded area and as material for the enclosing embankment. As the impounded liquids could be potential sources of contamination of nearby water supplies, the risk of flooding due to landscape position of the lagoon must also be considered.

The degree of soil suitability is based on the following factors:

- depth to water table
- flooding
- soil permeability
- slope
- organic matter
- coarse fragments, size and amount
- depth to bedrock
- thickness of slowly permeable layer
- subgrade Unified Soil Class

Sewage lagoons, commonly used by rural communities, were considered to be equivalent to the earthen manure storage used by many intensive livestock operations. This interpretation outlines soil factors that should be considered when building a new manure storage facility. A significant portion

(93%) of the RM of Lorne can be characterized as having moderate to very significant limitations for construction of earthen manure storage facilities due primarily to one or more parameters such as slope, soil permeability, and subgrade materials ([Map 10](#)). **This classification is meant as a generalized assessment and can not be used for specific site assessments.**

Table 14. Soil Suitability Limitations for Earthen Manure Storage in the RM of Lorne

Classes	Acres	Hectares	Percent of RM
Very Significant	67,568	27,355	28
Significant	23,403	9,475	10
Moderate	143,236	57,990	59
Negligible	0	0	0
Water	6,935	2,809	3

4.0 Analysis and Discussion

4.1 Setbacks for Livestock Operations

An important tool used in municipal planning for livestock operations are setbacks. Setbacks are used to maintain appropriate distances between livestock operations and residences in order to prevent potential nuisance complaints or conflicts. The RM of Lorne does not have zoning bylaws and therefore relies on the Provincial Farm Practice Guidelines for Livestock Producers and the Livestock Manure and Mortalities Management Regulation under the Environment Act to establish appropriate setback distances.

Under the Livestock Manure and Mortalities Management Regulation, most livestock and all manure storage facilities must be placed 100 m from water features such as streams, lakes, wells, dugouts...etc to comply with the regulation. However, at the time of this study water well locations were accurate only to the quarter section and were not used in the analysis of setback distances.

The Farm Practices Guidelines for Livestock Producers (Table 15) dictate that as the size of operations increase so does the size of the setback between it and neighboring residences or designated areas (ex. towns/villages). Setback distance from designated areas or zones are greater than from individual residences and the setback distance from earthen manure storage is greater than that for non-earthen storage or from livestock holding facilities. Separation distances apply to new and expanding operations. As a rule, existing operations or facilities are considered in compliance if the operation was established before the new guidelines or regulations.

Table 15. Recommended Criteria for Siting Livestock Operations

Animal Units (AU)	Maximum Number of Residences within One Mile	Minimum Distance							
		From Single Residence				From Designated Residential or Recreational Area			
		To Earthen Storage		To Buildings		To Earthen Storage		To Buildings	
m	ft	m	ft	m	ft	m	ft		
10-100	18	200	656	100	328	800	2640	530	1760
101-200	16	300	984	150	492	1200	3960	800	2640
201-400	14	400	1311	200	656	1600	5280	1070	3520
401-800	12	500	1639	250	820	2000	6600	1330	4400
801-1600	10	600	1967	300	984	2400	7920	1600	5280
1601-3200	8	700	2297	350	1148	2800	9186	1870	6135
3201-6400	6	800	2640	400	1311	3200	10560	2130	6988
6401-12800	4	900	2953	450	1479	3600	11871	2400	7920
12801 & greater	2	1000	3278	500	1639	4000	13200	2670	8760

Setbacks for Livestock Operations in the RM of Lorne:

Combining recommended and regulated setbacks limits the number of new or expanded operations that can potentially exist within a region. Using the location of map features such as rural residences and rural businesses, setback distances from earthen storage facilities were digitally created from the center of a residence or business. The effect of the buffers for a range of operation sizes from 10 to 400 and from 401 to 3,200 are displayed on [Map 11](#) and [Map 12](#). Buffering rural residences and businesses to new or expanded livestock buildings or non-earthen storage facilities would reduce setbacks by one half to that displayed in [Maps 11](#) and [12](#) for earthen manure storage, as setback distances from these facilities are smaller. Proposed livestock facilities within buffered zones may be considered in some instances, but would likely require consultation and/or approval from neighboring residences, a technical review team, Manitoba Conservation, and/or other parties. In RM's with zoning by-laws, conditional use permits are often issued as a means of setting out the terms and conditions in which livestock facilities can be located. Conditional use permits usually incorporate livestock guidelines, regulations, and other social, economic, resource, and farm management considerations into siting of new facilities, especially in more sensitive areas.

Setbacks for New Residences in the RM of Lorne:

If information on the size of livestock operations exists then the appropriate setback can be placed around individual operations. This would allow the RM to direct development of residences to areas where conflict with existing livestock operations could be minimized. For the RM of Lorne, a buffer was created around each livestock operation based upon its size in order to adequately space any new residences from that facility ([Map 13](#)). Total combined animal units for a farm were not used in the analysis. Rather, each distinctive livestock type (ex. hogs & beef) and or class (ex. beef cows & feeders) on farms comprised of several types of livestock and/or classes of operation were classified as a single operation.

In addition to highlighting areas where operations can establish, the ability to spatially display setback distances of various sizes allows an RM council or other local decision makers to review proposed bylaws to ensure that they provide a balanced approach to livestock development. This information can then be easily presented to their constituents which promotes a higher level of public input into development of the livestock industry within the RM. The same analysis also becomes useful for rural communities and residents trying to attract or making the case for livestock development and/or infrastructure opportunities.

The maps and tables about setback distances represent an approximation of the areas where livestock operation can be placed according to the above mentioned guidelines and/or regulations. Other bylaws, regulations, environmental concerns can only be addressed at a level of detail not available for this study. **This report does not replace the need for site specific analysis but rather can act as a generalized guide for overall municipal planning purposes.**

4.2 Manure Application

To be sustainable, livestock operations need a minimum acreage of agricultural land upon which manure can be applied. In order to properly understand the implications for the RM of Lorne given their current status of livestock operations, a two pronged approach was used. First the total land base “required” for manure application was calculated based on reported livestock units. Then an analysis of amount of land “available” for manure application in the RM was done.

Land Base Required for Manure Application in the RM of Lorne:

Total land base required for manure application was calculated based on reported animal units for the RM. This was done using the methodology set out in the Farm Practices Guidelines for Livestock Producers. The calculation is as follows:

$$\begin{aligned} & \text{Total Animal Units} \\ & \times \text{Storage \& Application Factor} \\ & \times \text{Soil \& Crop Nitrogen Utilization Factor} \\ & \times \text{Days in Feeding Location} \\ & = \text{Land Base Required} \end{aligned}$$

Using the equation above, livestock operations were grouped by type as required to produce the following calculations:

Hogs & Poultry -	$A.U. \times 0.57 \times 1.6 \times 365 / 365 = \text{acres required}$
Dairy -	$A.U. \times 0.71 \times 1.6 \times 241 / 365 = \text{acres required}$
Beef, Bison, Horses, Sheep, Goats, Elk -	$A.U. \times 0.67 \times 1.6 \times 150 / 365 = \text{acres required}$
	Sum = Total acres required for RM

Assumptions used:

1. Earthen storage used for all hog & poultry operations.
2. Manure pack used for all beef, bison, horse, sheep, goat, & elk operations.
3. Dairy scrape used for all dairy operations.
4. Dairy cattle confined 25% more (i.e. 91 days) than beef.
5. Beef confined from Dec. 1 to April 30 (5 months or 150 days).
6. All manure is applied in the fall by broadcast and incorporated within 48 hours.
7. All manure is applied on annual crop land of medium to heavy texture (90% of soils have loam texture - Table 12).

Based on this method of analysis, the total land base required by ward for manure application is presented in Table 16. Changes in method of manure storage, method of manure application, soil texture, crop type, and days in confinement can reduce or increase land base requirements. This type of analysis can be done to facilitate the decision making process on operation placement and/or management of any existing or proposed livestock enterprise.

Table 16. Total Land Base Required by Ward for Manure Application based on Reported Animal Units for the R.M. of Lorne.

Ward	Acres of Land Base Required (hectares)	
1	2,329	(943)
2	2,543	(1,030)
3	3,844	(1,556)
4	2,154	(872)
5	3,218	(1,303)
6	6,766	(2,739)
Total	20,854	(8,443)

Land Base Available for Manure Application in the RM of Lorne:

Information on how land is utilized allows the decision maker to see areas where potential for growth of the livestock industry exists, or areas where growth restrictions should be considered. To understand how many acres are potentially available for manure application in the RM, two methods of analysis were used. One method was to simply display the amount of land available as reported by livestock producers within the RM. The other method involves analysis of two separate databases (soil survey and land use).

METHOD 1: Data on amount of available land for manure application was collected from livestock producers in the R.M. of Lorne by councillors. Recommended setbacks from designated residential or recreational areas and individual residences were likely not considered. In addition setbacks from water features and property lines were also not likely considered by producers during reporting of available land base. Total land base available for manure application as reported by livestock producers is 196,245 acres (79,451 hectares) (Table 17).

Table 17. Total Land Base Available for Manure Application as Reported on a Ward Basis by Livestock Producers from RM of Lorne.

Ward	Acres of Land Base Reported Available (hectares)	
1	22,430	(9,081)
2	22,365	(9,055)
3	18,860	(7,636)
4	26,530	(10,741)
5	58,760	(23,789)
6	47,300	(19,150)
Total	196,245	(79,452)

METHOD 2: The analysis of two available databases, Soil Survey and 1994 Landsat Landuse, also provides an understanding of how much land is potentially available for manure application. Essentially manure application would be limited to those areas which are annual cropland, forages, and grasses (Map 7). Areas that are classified as treed, water, wetlands, and urban and transportation are unavailable for manure application and are removed from further analysis. Organic soils (Map 8) whose use for manure application is not well known were also removed from analysis. In the case of RM of Lorne this would mean that approximately 200,594 acres (81,212 hectares) are suitable for manure application (Table 18).

Table 18. Total Land Base Available by Ward for Manure Application based on 1994 LandSat Imagery for the RM of Lorne.

Ward	Acres of Annual Crop Land (hectares)	Acres of Forage (hectares)	Areas of Grassland (hectares)	Total Acres (hectares)
1	23,890 (9,672)	3,739 (1,514)	5,753 (2,329)	33,382 (13,515)
2	20,847 (8,440)	3,019 (1,222)	6,107 (2,472)	29,973 (12,135)
3	28,915 (11,706)	1,091 (442)	4,393 (1,780)	34,399 (13,927)
4	32,175 (13,026)	142 (57)	4,122 (1,669)	36,439 (14,753)
5	31,985 (12,949)	294 (119)	3,361 (1,361)	35,640 (14,429)
6	25,118 (10,169)	611 (247)	5,032 (2,037)	30,761 (14,429)
Total	162,930 (65,962)	8,896 (3,602)	28,768 (11,648)	200,594 (81,213)

However, setbacks from designated residential or recreational areas and individual residences must be removed from this value. In addition setbacks from water features vary depending on the percent slope of the land surrounding a water feature (see Farm Practices Guidelines for Livestock Producers) and therefore must be removed from the total area available for manure application too. Since accurate slope information does not exist, pin pointing exact acres available was impossible.

Calculation of the percent reduction in acres available for manure application was performed. A 9.5% (19,060 acres/7,717 ha) reduction in acres available from the available 200,594 acres (81,212 ha) indicated previous would occur due to setback distance requirements if the following assumptions were made.

1. All manure surface applied and incorporated within two days from residences and designated residential areas (property line setbacks not factored in).
2. All manure surface applied and incorporated within 48 hours from water sources. Assumes all land receiving application has less than 4% slope. Property line setbacks not equated. Setbacks from wells not equated.

Results of this analysis indicated that 0.88 % (1,779 acres/720 ha) would be due to residence setbacks, 2.2 % (4,311 acres/1,745 ha) due to residential area setbacks, and 6.5 % (12,970 acres/5,251 ha) due to water source setbacks. Some overlap in buffer area calculation for residences, communities, and water sources would occur. Method and timing of manure

application would greatly influence available land base required as would manure application on annual cropland verses forage/grasslands (see Farm Practices Guidelines for Livestock Producers).

The above analysis for amount of land base “required” verses the amount of land base “available” for manure application clearly indicates there is ample room for livestock expansion in the R.M. of Lorne from a manure application perspective. Regardless of the method of analysis used to calculate land base available for manure application, acreage calculations in Tables 17 and 18 are greater than those calculated in Table 16. Depending on the size of any new or expanded livestock operation, setbacks could have more of a bearing on available space for livestock expansion in the RM than land required for manure application.

4.3 Data Maintenance

Information is a time sensitive resource. As the time from original collection increases so does the chance for significant changes to occur. These changes can have significant impact upon the validity of conclusions derived from the data. The rate at which data changes is related to the specific type and scale of data collected. Social information about the location of roads, gas lines, residences, livestock locations, livestock numbers, municipal bylaws and other factors can change significantly within a year. Frequent updates of this information should occur. Natural resource information is typically not as dynamic as social information. The location of streams, lake, elevation, soil properties, climate and other properties often change at a more gradual rate than social information. However it should be noted that new data is being acquired constantly and a periodic review should occur. When reviewing improved data one should always remember to consider the present use of the data and if new information is truly needed. For example, new more detailed information about the location of streams may have been created. But if the level of detail required is low then acquiring new data sets may not be justified. Any updates to data should occur only through discussion between the user (RM staff and council) and a knowledgeable professional who is well versed in the data, it’s uses and limitation.

The RM of Lorne assumes ownership and management of all hard copy and digital data collected for completion of this report. Release of any detailed information contained within the data set will be at the discretion of the RM of Lorne and their rate payers.

5.0 Summary and Conclusions

With the growth of the livestock industry in Manitoba and the increase in concern for the environment, municipal councillors are under pressure to make informed decisions that address environmental, social and economical issues. By having information such as land resources, location of residences and livestock operations, and infrastructure available in a useable form, through the use of GIS, councillors will be able to make wise decision regarding the livestock industry in their municipality.

Livestock production in the RM of Lorne is quite diverse with production varying from beef and dairy cattle to hogs to horse, goats and elk production. Beef cattle operations are the most common in the RM, with hog production second. Currently there are 227 livestock operations in the RM of Lorne, producing 27,987 animal units.

Based on current animal units, 20,854 acres (8,443 hectares) of land, at a minimum, is required for manure disposal. With 196,000 to 200,000 acres (79,000 to 81,000 hectares) of land available for manure application, there is considerable room for increased livestock production. The acres of land available for manure application would be reduced by some 19,000 acres (7,690 hectares) when setback distances required under provincial regulation are accounted for. Soil characteristics such as drainage and texture as well as present land use would have implications on manure management plans and acres available for application. Livestock expansion may further be reduced depending on method of manure storage as 38% of the rural municipality has significant to very significant soil suitability limitations for earthen manure storage facilities. Detailed site assessments would have to be done in order to determine nature and degree of limitation for locating livestock facilities.

This report does not replace the need for site specific assessment for new or expanding livestock operations but will assist in generalized land use planning for the whole RM. GIS map products generated under this initiative provide an additional tool for all parties involved with livestock expansion in the RM of Lorne to help steer development in the best direction possible at the onset of any new proposal. This should translate into potential time and cost savings for project proponents and the RM. In addition public confidence should remain higher. From here proponents of livestock development projects and local decision makers can enter into more detailed assessment protocols.

5.1 Future Steps

As livestock expansion occurs, the RM will likely develop their own bylaws. GIS can be used to analyze and visually display the impact of proposed bylaws on the RM. Ultimately councillors can determine which bylaws are most appropriate for their RM or planning district.

Manure spread for some facilities will be targeted outside of the RM, reducing how much manure is applied within an RM. Knowing this information, the amount of land available for additional manure application from potential livestock expansion can be calculated. In the event of the development of planning district this information can be extended to the district as a whole to

assist with the sustainable expansion of livestock.

As the RM gains familiarity with the use a GIS, they may wish to incorporate more of their day to day operations into such a system. For example, internal management of infrastructure works such as location of and/or repairs and maintenance on culverts, bridges, roads, drainage ditches, signs and other infrastructure. Also tax role and assessment can be included in a GIS environment. The improved ability to bring information together in an easily understood format, such as maps, will assists councillors in their decision making, but will also facilitate public input into decisions. Improved decision making that will arise from this and similar projects will allow the RM council and staff to better serve the people of the RM of Lorne.

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7.0 Data Sources

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