An Examination of the Environmental Sustainability of the Hog Industry in Manitoba

Manitoba

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Scope of this Report

This report is a compilation of information relevant to livestock operations in general, and more specifically, to hog operations in Manitoba. The paper helps fulfill the remaining recommendations of the Manitoba Clean Environment Commission report on the Maple Leaf Foods Inc. application for expansion, presented to the Minister of Conservation in 2003. The provincial government has acted on all recommendations from the Clean Environment Commission report. The province has taken a broad view of this issue to ensure a sustainable province-wide approach to livestock production and food processing.

The provincial government has undertaken many innovative programs through the ***Livestock Stewardship Initiative***, first announced in March 2000, to ensure the environmental sustainability of the livestock industry and Manitoba's land and water resources, including:

- Manure management plans required to be registered annually by all livestock operations of 300 or more animal units.
- Land use planning is mandatory under the new *Planning Act*.
- The provincial government departments of Conservation, Agriculture, Food and Rural Initiatives, and Intergovernmental Affairs and Trade have increased staff and resources to implement the programs of the ***Livestock Stewardship Initiative***. For example, adding 16 positions to administer Manitoba Conservation's Environmental Livestock Program, including staff to conduct inspections and engineers to review storage facility designs.
- Increased resources have been provided allowing for improved aquifer management and water quality monitoring. Since 2001, 12 new drinking water officers have been hired and over $100 million spent to upgrade drinking water and waste water treatment facilities.
- Technical Review Committee reports and local conditional use approvals are mandatory for proposals to build operations with over 300 animal units.
- Construction of new or expanded livestock operations is prohibited until all provincial approvals are completed.
- Winter manure spreading is banned for all new operations regardless of size, and for all existing operations with over 400 animal units. Existing operations with between 300 and 400 animal units have until 2010 to construct sufficient storage capacity for the winter.
- Millions of dollars have been contributed towards original scientific research to promote effective, efficient hog production while ensuring environmental sustainability.
- New resources for soil testing and mapping are in place, doubling the number of soil survey teams.
- Funding and incentives for odour mitigation and implementation of best management practices are available.
- Initiatives under *The Water Protection Act*, will promote water conservation and protect our valuable surface and ground water resources.
- The Manitoba Phosphorus Expert Committee has completed its work and has provided scientific based recommendations on manure management to help guide future activities.

All of these initiatives have been implemented in partnership with the livestock industry which has embraced these necessary modifications to their practices. In fact, the implementation of the Livestock Stewardship Initiative has come about through the most extensive set of industry consultations ever undertaken in Manitoba. The industry has experienced positive economic growth while implementing these enhanced environmental protection measures.

This paper provides an overview of initiatives to address the sustainability of hog production and processing in Manitoba. While references are made to sustainability in general, including social and economic aspects of sustainability, this paper focuses primarily on environmental sustainability.

1 Introduction

Taking a New Approach

Agriculture is a vital part of Manitoba's economy, and livestock production is playing an increasingly important and dynamic role within agriculture. The pace of change in the livestock sector continues to be dramatic as producers respond to new market forces and economic opportunities. The livestock sector has continued to grow during this century. Shifts in farm policy, market forces, and technology have all combined to create positive opportunities for raising livestock. Livestock operations are larger, more technologically advanced and more vertically linked to other participants. The Manitoba Government has a role to play in ensuring the growth of the livestock sector continues to be viable without compromising our environment or quality of life.

Current Status of the Hog Production Industry in Manitoba

In 2005, there were approximately 8.6 million hogs produced in Manitoba. The breeding herd size is estimated to be 377,200 animals and about five million market weight hogs were raised for slaughter in Canada and the United States. Approximately 3.6 million of these hogs were slaughtered in Manitoba processing plants while 1.38 million live-slaughter hogs and 3.6 million weanlings were exported to the United States in 2005.

Manitoba's livestock industry contributed close to $1.8 billion in farm cash receipts to the provincial economy in 2005. Recent years have seen the industry expand, especially in hog production. The livestock industry provides significant job opportunities and stimulates the growth of related businesses and services throughout rural and urban Manitoba. Further economic investment in state-of-the-art food processing plants could be important in sustaining jobs and economic growth. The province has been working with stakeholders and local communities to strike a balance between economic development and the promotion of value-added industry, and the sustainability of our environment.

Growth in Manitoba's livestock production is dramatic when compared to the production of other agricultural commodities. For example, between 1990 and 2005, the grains and oilseeds share of farm receipts dropped from 45 per cent to 27 per cent while at the same time hog production increased from 13 per cent to 30 per cent. The loss of the Crow benefit and declining world grain prices have combined to take $100 million out of Manitoba's rural economies. Producers see livestock production as a means of keeping their communities alive by generating jobs and growth.

Manitoba has seen a shift from grain, oilseed and other crop exports towards the production of feedcrops for domestic use. Investments in livestock production and value-added processing have greatly increased. Taking advantage of new technology has improved Manitoba's ability to raise hogs and other livestock in a more efficient, effective manner. Producers and livestock processing facilities have taken advantage of the conditions that were created by the loss of the Crow benefit and other factors, to develop a local solution to keep rural Manitobans on their farms.

Listening to Manitobans

All Manitobans have observed these substantial changes in agriculture in the past decade. Before 2000, the substantial growth in the livestock sector and the changing face of agriculture in rural Manitoba did not result in a corresponding change in the regulatory framework for the industry, apart from adoption of the *Livestock Manure and Mortalities Management Regulation* in 1998. While dramatic changes in development of the livestock industry had taken place, there was a sense that changes to maintain environmental protection, ensure good husbandry practices and keep rural communities viable and healthy were needed. This resulted in a comprehensive assessment of the future of livestock production and a new plan to respond to the concerns of

Manitobans and the needs of producers – the ***Livestock Stewardship Initiative.***

With this initiative in 2000, the Government of Manitoba took a bold step towards ensuring the livestock industry in Manitoba would be sustainable now and for future generations. For the first time in the province's history, the livestock industry was brought to the forefront in an attempt to develop the industry with input from all stakeholders. Rather than imposing a livestock production moratorium as other jurisdictions had done, Manitoba created a solution-oriented process based on public feedback and guided by science and research. Manitoba's balanced approach puts in place appropriate measures to allow expansion of the industry while maintaining environmental protection.

In 2000, the independent Livestock Stewardship Panel held broad, public consultations to hear Manitobans' views on the industry and make recommendations to government. This panel made its recommendations to the government based on public concerns ranging from ecosystem protection to ensuring sustainable communities and sustainable agriculture. This process is still underway. It is aimed at attaining a long-term sustainable balance between agricultural production and local value-added processing and ecosystem protection. The public consultation process was pivotal to ensuring Manitoba was protecting the environment and meeting the expectations of the public while determining future steps to take to ensure sustainable growth of the industry.

While the provincial government has been working with the public and stakeholders to understand and address concerns about the hog industry, a 2003 report from the Manitoba Clean Environment Commission (CEC) made a specific recommendation to examine the sustainability of the hog industry.

> Recommendation #11 - *Manitoba Conservation, in cooperation with Manitoba Agriculture and Food, the Prairie Farm Rehabilitation Administration, the Manitoba Pork Council, local and Aboriginal communities, non-government organizations and universities should oversee a study to examine the sustainability of hog production in the Assiniboine River basin, develop sustainability indicators, and report on the study to Manitobans by December 2005 with an interim report due December 2004.*

While assessing the sustainability of hog production in the Assiniboine River basin is clearly important, the province has taken a broad approach rather than focus on one specific geographic region within Manitoba. Expansion of the hog industry and issues surrounding its sustainability are important to all Manitobans. A province-wide approach is needed in order to promote sustainability in the hog sector while ensuring that environmental safeguards are in place.

Protecting Water Quality and Lake Winnipeg's Watershed

With a surface area of 24,000 square kilometres, Lake Winnipeg is one of the largest freshwater lakes in the world and has been recognized by some as Canada's sixth Great Lake. The lake is the receiving body for a huge portion of North America, draining a geographical area nearly 40 times its actual size. The watershed is home to more than six million people and 20 million livestock. Agricultural, industrial and municipal activities in the watershed directly affect the health of Lake Winnipeg.

Excessive concentrations of nitrogen and phosphorus in Lake Winnipeg are causing gradual changes in the lake's water quality and biological communities. Nutrients are directly associated with the production of nuisance growths of algae — affecting fish habitat, recreation, drinking water quality and clogging fishing nets. Some nuisance growths of algae can also produce toxins.

Nutrients are contributed from virtually all of our activities in the watershed. Detailed information on the sources of nutrients can be found in Appendix I.

In February, 2003, the provincial government announced the *Lake Winnipeg Action Plan*, a commitment to reduce nitrogen and phosphorus loads to those that existed prior to the 1970s. The action plan included the formation of a Lake Winnipeg Stewardship Board to help Manitobans identify ways to reduce nitrogen and phosphorus loading to Lake Winnipeg.

The provincial government continues to work with all stakeholders, including agricultural groups, to ensure nutrients entering our waterways are reduced over time. All Manitobans have a role in promoting good land use practices that benefit Manitoba's waterways, including livestock producers. By ensuring that Manitoba's livestock industry is sustainable, we are ensuring the health and long term protection of all our waterways.

This paper presents actions and initiatives underway to act on the recommendations from the CEC, feedback from public forums and information from stakeholders to achieve a balanced approach.

Soil Suitability for Manure Application

Manitoba soils vary in their inherent properties and productivity. Information on soil properties has been collected through reconnaissance (~70 per cent of agro-Manitoba) and detailed soil surveys (~30 per cent of agro-Manitoba). The Canada Land Inventory Rating System for Soil Capability for Agriculture is based on this information and allows relative comparisons of soils.

Over half of Manitoba's agricultural land is considered prime (Classes 1, 2 and 3) with zero to moderate limitations for dry-land crop production (Table 1). Approximately 16 per cent of agro-Manitoba has significant limitations (Class 4) that restrict production and may require special management practices. The Class 4 lands have medium-textured loamy sands, can consist of moderate slope and require proper nutrient management to ensure limited loss of nutrients. About 15 per cent of the land has major limitations (Class 5) and may not be suitable for annual crop production without special management practices. These Class 5 lands have coarse sands or slopes between 15 per cent and 30 per cent, and are prone to nutrient loss to ground or surface water.

Approximately eight per cent of the land has severe limitations (Class 6) that restrict production to perennial crops because improvements are generally not feasible. Only about two per cent of agro-Manitoba is considered unsuitable for agriculture (Class 7). Class 6 and 7 lands generally contain areas with steep slope, exposed surface bedrock, sand dunes, or marshes, swamps, or fens where the application of nutrients could present a risk to the environment, and therefore are not appropriate.

The predominance of productive soils with manageable limitations provides a large land base for agriculture, including livestock production. With proper site-specific management, the required land base exists for environmentally sustainable application of livestock manure.

Much of the land in Manitoba is suitable for crop production and applying manure as a fertilizer. When manure is applied to land surfaces in greater amounts than can be used by growing plants, excess nutrients can leach into ground water or run off into surface water with heavy rainfall, floods and melting snow. Manure must be applied to land at appropriate rates that consider background nutrient concentrations and crop requirements. Much of the land in Manitoba that is suitable for application of manure does not currently have significant livestock populations. However, some regions in Manitoba currently have significant livestock populations and further increases in livestock may be inappropriate if there is not enough land to handle the manure.

Manitoba has approximately 11,650,600 acres of cropland. It is estimated that the combined livestock industries (beef cattle, dairy cattle, chickens, turkeys, hogs) require between 1.017 million (nitrogen requirement-based) and 1.618 million acres (1x crop removal P_2O_5-based) of land for the application of manure as a fertilizer. Our hog industry requires between 474,000 and 742,000 acres of land. Expansion of the hog industry could require between 73,700 and 92,900 additional acres of land to apply manure as a fertilizer. The actual land base requirement will be determined on an individual, on-farm basis and will vary depending on parameters such as soil productivity, crop nutrient requirements and manure handling and application methods. From the hog industry only, enough manure would be produced to fertilize an estimated six per cent of the total agricultural land base in Manitoba.

TABLE 1: Distribution of Agriculture Capability Classes for soil in Agro-Manitoba.

Agriculture Capability Class*	Per cent of Agro-Manitoba
1	2.6
2	26.5
3	23.3
4	16.1
5	15.1
6	8.0
7	1.9
Organic soils	7.0
Unclassified land	3.5
Water	2.2
Total	**100.0**

*Applies to mineral soils only

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What Issues are of Concern to Manitobans?

Through public consultations and recommendations from the Manitoba Clean Environment Commission (CEC), some predominant public concerns with the hog industry were identified and are presented below:

Cumulative Impacts. A number of areas of the province have high density livestock development. The question of the cumulative impact on certain regions is important in any discussion of increased livestock production.

Ground and Surface Water Quality. When phosphorus and nitrogen in manure are applied to land in greater amounts than can be used by growing plants, excess nutrients can leach into ground water or run off into surface water with heavy rainfall, floods and melting snow. Excessive levels of phosphorus and nitrogen in surface and ground water fuel the production of algae and aquatic plants that can change aquatic life habitat, reduce essential levels of oxygen, clog fishing nets, interfere with drinking water treatment facilities and cause taste and odour problems in drinking water.

To protect and preserve the quality of surface and groundwater, it is important that agricultural producers operate responsibly as stewards of the land and water. The risk to water sources can be minimized by:

- locating manure structures, outdoor pens and field manure storage in areas with more impervious materials underneath
- minimizing the duration of manure storage in fields before spreading
- applying manure at proper agronomic rates as fertilizer considering soil residual concentrations of nitrogen and phosphorus, crop requirements, soil texture and sensitivity of underlying aquifers
- applying manure considering local weather conditions and slopes to minimize the risk of run-off

Livestock Manure Management and Storage. By storing manure, farmers can use it as a source of soil nutrients at the appropriate and effective times in the crop production cycle. Public concerns over manure storage have been raised about odour and the potential for manure to degrade ecosystems if managed improperly.

Location. Deciding where to locate hog operations is crucial. The initial planning stage is the most appropriate time for input on laying out the building and manure storage areas and addressing public concerns such as odours.

Managing Livestock Mortality. Livestock deaths occur naturally, accidentally or deliberately. Rendering, composting, burial and incineration are acceptable methods of disposal, provided they are done within regulatory requirements.

Livestock Pathogens. Animal pathogens are a natural occurrence and tend to stay within livestock populations. Most pathogens carried by animals are harmless to people. To minimize the transfer of pathogens from animals to people, proper food handling, sound manure management practices and good personal hygiene should be followed. The added risk of disease transmission from people to animals must be mitigated through proper bio-security measures.

Information about all these concerns are summarized in the Manitoba Government's *Living with Livestock Production* fact sheet series on the Manitoba Agriculture, Food and Rural Initiatives website.[1]

[1] http://www.gov.mb.ca/agriculture/livestock/publicconcerns/cwa01s00.html

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Responding to Manitobans' Concerns

The provincial government is committed to ensuring that the hog industry is developed and operated in an environmentally sustainable manner by addressing issues such as manure management, increased phosphorus content in soil and water, groundwater quality, livestock mortality management and livestock-pathogens management. The protection of soil and water is paramount to the health of the livestock industry and the health of Manitobans. Initiatives across Manitoba are addressing environmental sustainability of the industry and protection of the province's ecosystems.

Better Land Use Planning. Appropriate land use through effective planning is essential for sustainability. *The Planning Act* and the Provincial Land Use Policy Regulation provide the basis for sustainable land use in Manitoba. Provincial Land Use Policy #2 is intended to foster sustainable development in agriculture. It protects agricultural land use and farm operations and ensures a viable agricultural land base for present and future food production. It also ensures diversification opportunities through sustainable land use planning. A development plan bylaw establishes local policies for land use in a municipality or planning district. The livestock operation policy in a development plan sets out where in a municipality or planning district, livestock operations may be considered. The zoning bylaw sets out the requirements for the location and development of livestock operations. These must meet the minimum regulation standards. Livestock operations involving 300 or more animal units (AUs) are also subject to a technical review committee (TRC) and conditional use approval process.

Effective, Safe Manure Storage. Manure storage issues can be prevented by ensuring safe manure storage facilities are built and maintained to provide storage that does not present a risk to the environment. The locations of permitted manure storage facilities in Manitoba are in Appendix II. Appropriate location of manure storage facilities is essential to protect ground and surface water. See Appendix III for detailed information on the rigorous process for construction, modification or expansion of manure storage facilities in Manitoba.

Effective Livestock Manure Management. Livestock manure management is guided by the requirements of the Livestock Manure and Mortalities Management Regulation. Manitoba Conservation also states manure management plans must be registered annually by all livestock operations of 300 or more animal units. In 2004, the limit was reduced from 400 to 300 animal units based on the recommendation of the Livestock Stewardship Panel.

Reducing excessive nutrients in the soil and water and **preventing groundwater contamination** is critical to all Manitobans. It is anticipated that these issues will be addressed in the amendments to include phosphorus in The Livestock Manure and Mortalities Management Regulation and proposed regulations under *The Water Protection Act*. These will provide strong scientific tools to prevent the over-application of nutrients contained in manure and will protect our valuable water systems, including sources of drinking water.

A Province-Wide Approach

By establishing province-wide initiatives, the province is taking the appropriate steps to ensure environmental sustainability for livestock production in general and specifically hog production in Manitoba. The most current and significant of these are the proposed amendments to The Livestock Manure and Mortalities Management Regulation (LMMMR) explained later in this report. Currently, this regulation under the *Environment Act* limits and controls manure applications in the livestock sector on the basis of nitrogen. Controlling phosphorus as well as nitrogen is critical to reducing algal blooms in water bodies. It is anticipated that the phosphorus based limits in the regulation, will require individual producers to access several times their current total land base for manure spreading.

Many of the sustainability initiatives in place, including the anticipated amendment, are discussed in the following section.

Manitoba's Livestock Stewardship Initiative

To better understand the impact of all livestock production, and to ensure the sustainability of this growing sector, the Manitoba Government formally announced the ***Livestock Stewardship Initiative*** in March, 2000.

As part of this initiative, public consultations were held in 2000 by the Livestock Stewardship Panel consisting of three members of the public familiar with the industry in Manitoba. The result of these consultations was a report, *Finding Common Ground*, where about 40 recommendations were listed for consideration by government. These reflected the input gathered from six public meetings, in which the panel heard more than 225 presentations and received 150 written submissions from Manitobans. The consultations were pivotal to ensuring Manitoba was on the right track in terms of protecting the environment and in determining future steps to take to ensure sustainable growth of the industry. The public consultations provided focus for the Livestock Stewardship Panel and indicated which areas required immediate and future government action. Table 2 provides information on the province's response to the report's 40 recommendations.

Table 2. Livestock Stewardship Panel Recommendations from Finding Common Ground and Government Response Checklist.

STATUS	PANEL RECOMMENDATION
✔	**1.** Government should substantially increase resources on the intensive livestock industry to provide analysis, inspection, monitoring, enforcement and technological assistance. **ACTION: Government has redirected 12 additional positions in Manitoba Conservation, five additional positions in Manitoba Agriculture, Food, and Rural Initiatives (MAFRI) and three additional positions in Manitoba Intergovernmental Affairs and Trade.**
✔	**2.** Enhance government's capability to analyze the impact of new or expanded intensive livestock operations (ILOs) upon both local and larger environments. **ACTION: Increased government resources in Manitoba Conservation, Manitoba Agriculture, Food and Rural Initiatives, and Manitoba Intergovernmental Affairs and Trade have enhanced government's capabilities in these areas.**
✔	**3.** Government makes the policy framework for sustainable livestock expansion public. **ACTION: Through continued consultations, government will ensure the public is made aware of their sustainable livestock policies.**
ON GOING	**4.** The government should accumulate all relevant data concerning livestock operations in a geographic information system (GIS) format. **ACTION: Government has increased the quality and quantity of information on livestock operations by updating the groundwater and associated geological database and conducting a soil sustainability study.**
ON GOING	**5.** Government should take a two-pronged approach to livestock development in Manitoba. **ACTION: Through Manitoba Agricultural Services Corporation, agricultural extension staff and other programs, the government helps producers and will continue to ensure appropriate assistance is provided.**
✔	**6.** New and expanding intensive livestock operations (ILOs) should require formal approval by the host municipality for compliance with land use bylaws and the province, for environmental impact before construction begins. **ACTION: Government improved the approval process by making technical review committee (TRC) reports and local conditional use approval mandatory for proposals over 300 animal units (AU) and prohibited construction of barns until provincial approvals are in place. The municipal and provincial role in reviewing livestock operations and land use has been further clarified in the new planning act.**

STATUS	PANEL RECOMMENDATION
✔	7. New or expanding intensive livestock operations (ILOs) should not be permitted in municipalities that have no land use zoning bylaws. New bylaws must be formally adopted before they're permitted. **ACTION: Government has enhanced incentives for land use planning since 2000. These have resulted in 96 per cent of municipalities having initiated or adopted a development plan and related zoning bylaw. Amendments to the Provincial Land Use Policy Regulation have established minimum separation distance for locating livestock operations across Manitoba. Land use planning has been made mandatory through the new planning act.**
CURRENT PRACTICE	8. The provincial government should designate or appoint an appropriate board or panel empowered to investigate and rule on an appeal of a provincial decision. **ACTION: Through *The Environment Act*, individuals and proponents are able to appeal provincial decisions on permits for livestock manure storage facilities.**
UNDER REVIEW	9. The province should recognize the value of GIS and act promptly to facilitate its use as a planning tool in municipal and provincial governments. **ACTION: An interdepartmental committee is examining geographic information system (GIS) systems to enhance all government services with further potential to co-ordinate provincial and municipal database information for regional planning.**
✔	10. Water quality monitoring must be greatly increased on the impact of livestock production on soil and water. **ACTION: Manitoba Water Stewardship has been created to address all water issues. Additionally, the groundwater and associated geological database has been updated. A requirement for annual sampling of source water from livestock operations with 300 or more animal units.**
✔	11. Additional enforcement effort is required to ensure compliance with current regulations, and penalties for infractions must be increased. **ACTION: Increased government resources in Manitoba Conservation have enhanced government's ability to ensure compliance.**
✔	12. The province should move toward regulating manure application according to phosphorus content of soil. **ACTION: An expert committee was established to examine this issue and its final report has been submitted to government and released to the public. Amendments to regulate manure sources of phosphorus have been proposed and public consultations have been completed. Government is now reviewing the results of the consultation process.**
✔	13. The province should continue to implement the recommendations of the recently released *Drinking Water Advisory Committee Report*. **ACTION: The Office of Drinking Water has been established in the Manitoba Water Stewardship. Government's drinking water strategy provides for 70 per cent of the cost of testing private wells, and 100 per cent for repeat tests of wells with positive results. Drinking water quality continues to remain a priority for government, and government will continue to address these issues.**
UNDER REVIEW	14. The calculation of animal units should be cumulative across species. **ACTION: Before calculating animal units cumulatively across species, government will need to first identify which multi-species livestock operations would be affected, their size, the extent to which they have the capacity to adapt, and methods through which government may mitigate challenges these operations may encounter under new regulations.**

STATUS	PANEL RECOMMENDATION
✔	15. Lower the threshold level to require manure management plans for all new and existing operations of 300 animal units or more, and that winter spreading of manure is prohibited for all new and existing operations above 300 animal units. **ACTION: Government has lowered the threshold for registration of manure management plans to 300 animal units for all operations. Winter spreading is banned for all new operations and for all operations greater than 400 animal units. Existing operations between 300 and 400 animal units in size must comply with the ban by November 10, 2010.**
✔	16. This reduction should be phased in over a reasonable period. **ACTION: Existing operations between 300 and 400 animal units must comply with the ban on winter spreading by November 10, 2010.**
✔	17. Strong research and development emphasis should be placed on the monitoring of pathogens and the mechanisms by which they are transferred from animals to humans. **ACTION: Through existing research and development programs, government will ensure that appropriate and timely research is undertaken.**
UNDER REVIEW	18. Government to review the in-barn environment with a view to: • establishing a monitoring regime and ensuring compliance with existing regulations, especially those affecting the health and safety of workers • assessing the training needs of barn workers • identifying research priorities affecting the health of operators, workers and the nearby public **ACTION: Government is reviewing workplace safety issues as part of its commitment to reduce workplace injuries by 15 per cent.**
UNDER REVIEW	19. All barn workers should be strongly encouraged to wear proper masks. **ACTION: Government is reviewing workplace safety issues as part of its commitment to reduce workplace injuries by 15 per cent.**
✔	20. The industry and government should pay greater attention to familiarizing the public with the in-barn environment and precautions that are taken to raise healthy animals. **ACTION: Government has developed the *Living with Livestock Production* and the *Food Safety on the Farm* fact-sheet series. The Manitoba Pork Council works with the public and industry to mitigate concerns about livestock development.**
✔	21. As a matter of responsibility to Manitobans, government and the industry should make clear why and how the industry uses antibiotics. **ACTION: The government produced and released the fact sheet *Understanding Antimicrobial Resistance* in its *Living with Livestock Production* series.**
✔	22. The provincial government should consider making the public and the agriculture sector aware of the effects of climate change. **ACTION: Government appointed the Manitoba Climate Change Task Force to help Manitoba's strategy on climate change. Through the establishment of the Climate Change Branch in Manitoba Energy, Science and Technology, work is continuing on climate change issues.**
✔	23. Re-assess the training requirements for professionals and technicians in the nutrient management field. **ACTION: Government requires that, other than the livestock operator, only professional agrologists and certified crop advisors who have successfully completed an acceptable nutrient management training course are permitted to prepare and sign manure management plans.**

STATUS	PANEL RECOMMENDATION
✔	24. The provincial government should move towards the formal certification of commercial nutrient applicators. **ACTION: Government is preparing regulations that require formal certification of all commercial manure applicators.**
✔	25. For reasons of odour control, reducing greenhouse gas emissions, and maximizing nutrient capture, intensive livestock operations (ILOs) should be encouraged to implement covered manure storage and injection. **ACTION: Mitigation practices like straw and synthetic cover technologies are promoted and recommended where appropriate by the provincial government and the Farm Practices Protection Board. Additionally, government encourages and participates in the adoption of liquid manure injection.**
✔	26. The Manitoba Cattle Producers Association (MCPA) should take the lead in developing a strategic initiative for riparian management in Manitoba. **ACTION: MCPA chairs the Riparian Health Council, which is designed to improve co-ordination and co-operation among groups that administer riparian stewardship activities. The province provides cost-shared funding for specific projects such as the Riparian Tax Credit.**
NOT IMPLEMENTING AT THIS TIME	27. Industry representatives and government should explore sources of performance bond insurance. **ACTION: To ensure balance and fairness in the industry, government has decided not to implement performance bonds.**
NOT IMPLEMENTING AT THIS TIME	28. Performance bonding should be a condition of approval for new and expanding intensive livestock operations (ILOs). **ACTION: To ensure balance and fairness in the industry, government has decided not to implement performance bonds.**
NOT APPLICABLE	29. The Manitoba Pork Council should co-ordinate the development of a state-of-the-art hog production site and manure handling facility that can test the latest techniques to improve sustainability of the hog industry and improve the in-barn environment. **ACTION: Recommendation directed to the industry, who have responded by supporting the University of Manitoba's development of the National Center for Livestock and the Environment (NCLE) which will address these issues through research.**
✔	30. Government should maintain a pro-active role and sustained leadership in mounting research on environmental stewardship. **ACTION: Through programs like Covering New Ground, Agri-Food Research and Development Initiative, Manitoba Livestock Manure Management Initiative, and the Sustainable Development Innovations Fund, government maintains a pro-active role in environmental stewardship research.**
✔	31. Research should be encouraged into the developing of portable manure nutrient measurement equipment. **ACTION: Rapid field test kits that estimate plant available nitrogen contents in liquid manure are employed by many producers and custom applicators in the province. Provincial extension activities promote understanding and proper use of this equipment.**
✔	32. Research into the application of electromagnetic spectrometry (EMS) to detect leaks in manure storages. **ACTION: Through existing research and development programs, government will ensure that appropriate and timely research is done.**

STATUS	PANEL RECOMMENDATION
✔	33. A systematic study should be made of the experience of Manitobans living near intensive livestock operations (ILOs), to improving the criteria upon which municipalities base location decisions. **ACTION: The province has reviewed the findings of relevant in-house and external studies on this subject. Based on the best available information, setback distances for livestock operations and manure application from residences continue to be recommended by local governments for proper planning.**
✔	34. The *Farm Practices Guidelines* should strongly stress the uncertainties in general recommendations on setbacks and the need for very careful on-site assessments. **ACTION: *Farm Practices Guidelines* state the importance of application setbacks and site-specific factors such as topography. Revisions of the guidelines are made when changes in legislation and extension warrant them. They require agreement among stakeholders including representatives of the livestock industry and other government departments.**
✔	35. A long-term study should be done on the behaviour and quality of water running off fields in a natural state and those fertilized with livestock manure and/or inorganic fertilizers. **ACTION: Through existing research and development programs, government will ensure that appropriate and timely research is undertaken.**
✔	36. Research should be undertaken on the impact of air quality on animal health and production to indicate the financial benefits of maintaining clean air and fewer odours through nutritional management and different feeding strategies. **ACTION: Through existing research and development programs, government will ensure that appropriate, timely research is undertaken.**
✔	37. Research should be conducted into animal housing in intensive livestock operations (ILOs). **ACTION: Manitoba has premier animal care legislation that is based on national codes. Government will continue to support the efforts of the livestock industry to educate the public about how animals are housed, and research options for animal housing.**
✔	38. The province should initiate a research and development program aimed to identify technology and management practices appropriate for smaller farmers. **ACTION: With its partners, the province has an ongoing program of research and extension activities that focus on technologies appropriate for smaller producers. This included the booklet on low-cost straw-based hoop barns for hogs used throughout Canada and the United States.**
✔	39. The livestock industry and provincial government should re-examine and increase their communication and extension on research and development efforts. **ACTION: The province works with research agencies and industry to exploit opportunities to communicate results to producers to increase awareness and encourage adoption of sound practices.**
✔	40. Government should organize its tasks so competent specialists are on call to consult with both intensive livestock operations (ILOs) and smaller operators. **ACTION: Increased government resources in Manitoba Conservation, Manitoba Agriculture, Food and Rural Initiatives and Manitoba Intergovernmental Affairs and Trade have helped ensure government is able to respond to the needs of industry and the environment.**

Taking Action on the Livestock Stewardship Panel Report

The actions taken on the recommendations in this report demonstrate the willingness of the Manitoba Government to take necessary action to address the issues of most importance to Manitobans.

The many actions stemming from this report were delivered through various provincial government departments in a co-ordinated approach on environmental sustainability. Actions are co-ordinated with stakeholders through policies, guidelines, legislation and other tools.

The Livestock Manure and Mortalities Management Regulation (LMMMR)

The primary purpose of the LMMMR is to ensure environmentally sound storage, management and use of livestock manure. This is accomplished through permits for construction of manure storage facilities, and through nitrogen based restrictions on land application of manure. The regulation was amended on March 30, 2004. Particularly significant changes included new restrictions on manure application, new requirements for monitoring source waters and new requirements for registering manure storage facilities that predated the need for a permit.

New restrictions on manure application replaced the basic soil texture grouping with more standard soil agricultural capability classifications to determine the maximum amount of residual nitrate nitrogen that may be present in soils. This more closely binds fertilization with manure to actual crop productivity and uptake, reducing the potential for environmental degradation. Probably most important was the requirement for the minister of Manitoba Conservation to review, by no later than March 31, 2006, the effectiveness of regulating manure application to land on the basis of nitrate nitrogen in the soil after reviewing any recommendations of the Manitoba Phosphorus Expert Committee.

Manure is recognized as an important crop nutrient source. But like any plant food it must be applied at appropriate rates. Currently, manure application rates in Manitoba are based on crop nitrogen requirements alone. However, the ratio of phosphorus to nitrogen removed by crops is lower than the phosphorus to nitrogen ratio in manure. A build-up of phosphorus in the soil can lead to soil phosphorus saturation and the subsequent transport of phosphorus with water moving over or through the soil.

The Manitoba Phosphorus Expert Committee (MPEC) includes academic researchers, professionals and experts in the field. It was appointed in 2002 to examine the issues surrounding phosphorus and livestock manure and to provide recommendations to government. The committee completed its work and released a report to the minister of Manitoba Conservation in January, 2006. The report includes a number of recommendations for regulating phosphorus from livestock operations in Manitoba. The committee concluded that the focus for regulating phosphorus in Manitoba should be to minimize the risk of phosphorus loss to surface water by reducing excessive phosphorus loading onto land and minimizing the mobilization and delivery of phosphorus to water.

Based on the MPEC recommendations, Manitoba Conservation proposed to amend the LMMMR to include phosphorus. The proposal includes a series of thresholds so the rate of manure application will be incrementally reduced as soil test phosphorus thresholds rise. Also, it was proposed that areas requiring additional management practices to minimize the effects of phosphorus be specially designated. The amendments will provide certainty in the future for livestock industry proponents by more appropriately defining the limits of the land base on a regional and local level, and more clearly defining where the industry can locate and operate in a sustainable manner. Having better information will improve local and provincial government decision making.

Summary of Enforcement Regarding the LMMMR

The following options are used by environment officers when producers fail to comply with the regulation:

- warnings and/or negotiated compliance
- environment officer orders and/or directors orders in the case of emergencies, unsafe conditions and imminent harm to the environment or public health
- offence notices (tickets)
- formal prosecutions

The choice of enforcement options is based upon the following considerations:

- the best option to protect the environment and the public
- the urgency of the situation
- the seriousness of the offence
- the difficulty of correcting the situation

- any previous record of the accused on compliance
- the degree of flagrancy of the offence
- the attitude and cooperativeness of the accused
- the potential deterrent effect of the option chosen

Apart from the standard compliance and enforcement efforts, Manitoba Conservation conducts random audits of manure management plans every year to ensure compliance with the regulation. A summary table of enforcement actions taken during the period 1998/1999 to 2004/2005 is provided in Appendix IV.

The Water Protection Act

The Water Protection Act, which came into force on January 1, 2006, is an innovative piece of legislation that allows for the creation of Water Quality Management Zones, enshrines Water Quality Standards, Objectives and Guidelines in regulation, sets Watershed Planning Authorities, and promotes water conservation. The province is currently working with producers and others to define Water Quality Management Zones for Nutrients under *The Water Protection Act*. When nitrogen and phosphorus are applied to land surfaces in greater amounts than can be used by growing plants, excess nutrients can leach into ground water or run off into surface water with heavy rainfall, floods and melting snow. Water Quality Management Zones for Nutrients are intended to provide scientific tools to prevent the over-application of nutrients contained in fertilizers, animal manure and municipal wastewater sludge to lands.

Extensive public consultations have taken place on the proposed regulation for Water Quality Management Zones for Nutrients, in conjunction with consultations on proposed phosphorus amendments to The Livestock Mortalities and Manure Management Regulation. The proposed nutrient regulation for Water Quality Management Zones advances nutrient management on the landscape beyond the livestock sector to other nutrient sources, including inorganic commercial fertilizers and municipal waste sludge.

The proposed Water Quality Management Zones for Nutrients regulation is just one piece of a comprehensive, balanced nutrient management strategy that involves:

- provincial water quality objectives
- innovative solutions to achieve those objectives, developed through local integrated watershed planning
- information sharing and outreach, that encourages voluntary action based on site-specific conditions
- incentives and adjustment assistance
- development and implementation of new technologies
- research and pilot projects to identify the most effective beneficial management practices
- improved up-front land use planning
- regulations to support the above initiatives

The integrated watershed management planning initiative, launched by Manitoba Water Stewardship, is targeting completion of watershed plans for the approximately 30 watersheds in agro-Manitoba by 2013. Watershed plans are to be compiled by local water planning authorities, with stakeholder input. They must be implemented, monitored and updated regularly (every 10 years) by these authorities. The province will provide financial, planning and technical assistance. The watershed plans will include a report on current knowledge of the environment as well as initiatives to monitor, maintain and improve environmental conditions in the watershed. The intent is to make watershed health assessments using sound, science-based input from several perspectives, including agriculture. Watershed planning initiatives provide an opportunity to assess the environmental sustainability of the hog industry in a local context.

The Planning Act and Provincial Land Use Policies

The Planning Act

On June 16, 2005 the Manitoba Legislature passed Bill 33, *The Planning Act*. It came into force January 1, 2006 and replaced the previous act from 1976.

The new act creates a new framework for land use planning in Manitoba and makes planning mandatory for municipalities and planning districts. Every planning district board or municipal council must prepare and adopt a development plan. In addition, a development plan must now include a livestock operation policy.

The development plan and livestock operation policy are only part of the land use planning framework for livestock operations. *The Planning Act* also includes the following provisions that apply to livestock operations:

- **Zoning bylaw** – The zoning bylaw regulates the use and development of land in the municipality or planning district, and will include requirements for development in each zone.

- **Minimum location and setback requirements** – The separation distances and setback requirements for livestock operations in a zoning bylaw must meet the minimum requirements established in the provincial regulation.
- **A standard review process for larger livestock operations** – The conditional use process applies to all livestock proposals involving 300 or more animal units. This ensures all larger livestock operations are subject to a public hearing and a Technical Review Committee report.
- **Notice requirements** –Enhanced notice requirements ensure potentially affected residents, including those outside the municipality and neighbouring municipalities and planning districts, are notified of applications for large-scale livestock operations. A board or council must notify every owner of property within three kilometres of a proposed large-scale livestock operation.
- **Clarified provincial responsibility for environmental protection and local responsibility for land use regulation** – This sets out what can and cannot be included in local zoning bylaws and the conditions that can be imposed on an approval for a livestock operation.
- **Technical Review Committee (TRC)** – This requires all applications for livestock operations involving 300 or more animal units to be referred to the TRC for a report and recommendations to ensure a proposed operation will not create a risk to health, safety or the environment.
- **Transitional development approval for livestock operations** – This creates a process for dealing with livestock operations where there is no development plan and/or zoning bylaw in place.

Under section 201 of the *The Planning Act*, a board or council has until January 1, 2008 to adopt a development plan that meets the requirements of the act. If an existing development plan does not include a livestock operation policy, the board or council has until January 1, 2008 to amend the development plan to include one.

The Provincial Land Use Policies

The Provincial Land Use Policies guide the province and boards and councils in preparing and reviewing development plans. The policies are adopted as a regulation under *The Planning Act*.

Policy #2 for agriculture, sets out the general requirements for the agricultural policies to be contained in the development plan, and the livestock operation policy in particular. The general intent of the agriculture policy is to foster sustainable development in agriculture. In doing this, the policy seeks to:

1. maintain a viable base of agricultural lands for present and future food production and agricultural diversification
2. protect agricultural operations from encroachment by other land uses that may adversely affect the ability of a producer to efficiently manage, expand or diversify an operation
3. foster land use that is consistent with the principles and guidelines of sustainable development and encourages the sustainable use of the resource base for agricultural production

Policy #2 states that plans shall contain, where appropriate, a livestock operation policy that sets out areas in which applications to develop or expand livestock operations:

(a) may be allowed

(b) may be allowed to a specified maximum number of animal units

(c) will not be allowed

The intent of the livestock operation policy is to ensure that the board or council will determine, in the development plan, where livestock operations will be allowed, restricted in size or prohibited.

Under Provincial Land Use Policy #2, a board or council should take into account several factors when developing a livestock operation policy:

- Soil type - Livestock operations should not be permitted on Class 6, 7 and unimproved organic soils based on detailed soil survey information at a scale of 1:50,000 or better (this does not include grazing).
- Proximity to significant surface water bodies, such as lakes, rivers and wetlands must be considered.
- Flood risk areas and groundwater vulnerability areas are identified by the province.

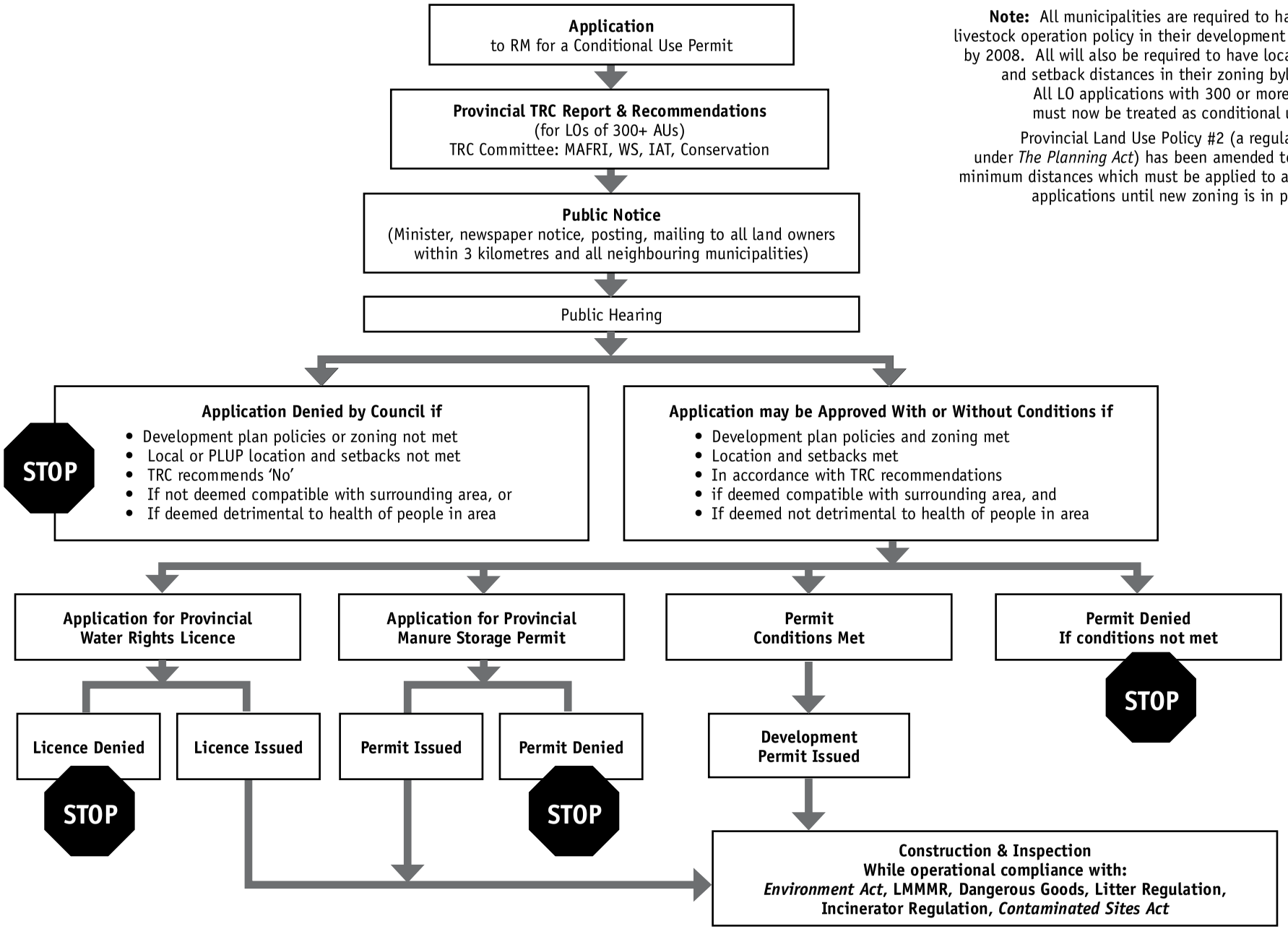
- Proximity to areas is designated in a development plan as urban or settlement centers, rural residential or seasonal residential areas and parks or recreation areas.
- Existing land uses in the area should be considered.

Provincial Land Use Policy #2 also requires a development plan to set out general standards on the location and set-back of livestock operations. The general standards must be expressed with reference to the minimum requirements set out in the appendix to the policy which are based on *The Farm Practices Guidelines*. They include separation distances from residences and designated urban centres or settlement centres, residential areas and parks or recreational areas.

Approval Process for Intensive Livestock Operations (ILOs)

A recommendation that new and expanding intensive livestock operations require formal approval by both the host municipality for compliance with land use bylaws and the province for potential environmental effects before construction begins, has been accepted by government. The approval process has been improved to make Technical Review Committees (TRC) mandatory for proposals over 300 animal units and to prohibit the construction of barns until provincial approvals are in place. Figure 1 demonstrates the process.

Figure 1. NEW Livestock Operation Application Review Process (300+ AU)



Note: All municipalities are required to have a livestock operation policy in their development plan by 2008. All will also be required to have location and setback distances in their zoning bylaws. All LO applications with 300 or more AUs must now be treated as conditional uses.

Provincial Land Use Policy #2 (a regulation under *The Planning Act*) has been amended to set minimum distances which must be applied to all LO applications until new zoning is in place.

The Technical Review Process

Technical Review Committee (TRC) reports and recommendations have been prepared, upon request, for municipalities since 1994. An amendment to *The Planning Act* in 2000 made a TRC report mandatory for livestock operations with 400 or more animal units that are a conditional use under a zoning bylaw. The new planning act of January 1, 2006 requires a TRC report and a conditional use approval on all livestock operation applications involving 300 or more animal units. A TRC will review proposals for smaller livestock operations upon the request of the municipality. This is spelled-out in Figure 2.

The role of the TRC is to provide support to a municipality holding a conditional use hearing on a new or expanding livestock operation by providing preliminary technical information, assessment and recommendations on the proposed development. *The Farm Practices Guidelines for Producers,* developed by a multi-stakeholder committee and published by Manitoba Agriculture, Food and Rural Initiatives are used in the planning review process.

The TRC report is a preliminary report based on information provided by the applicant, existing available technical information, provincial and local regulations and bylaws, and *The Farm Practices Guidelines for Livestock Productions*. The report is intended for the council and public, when considering a livestock operation proposal as a conditional use. The TRC is not a decision-making body.

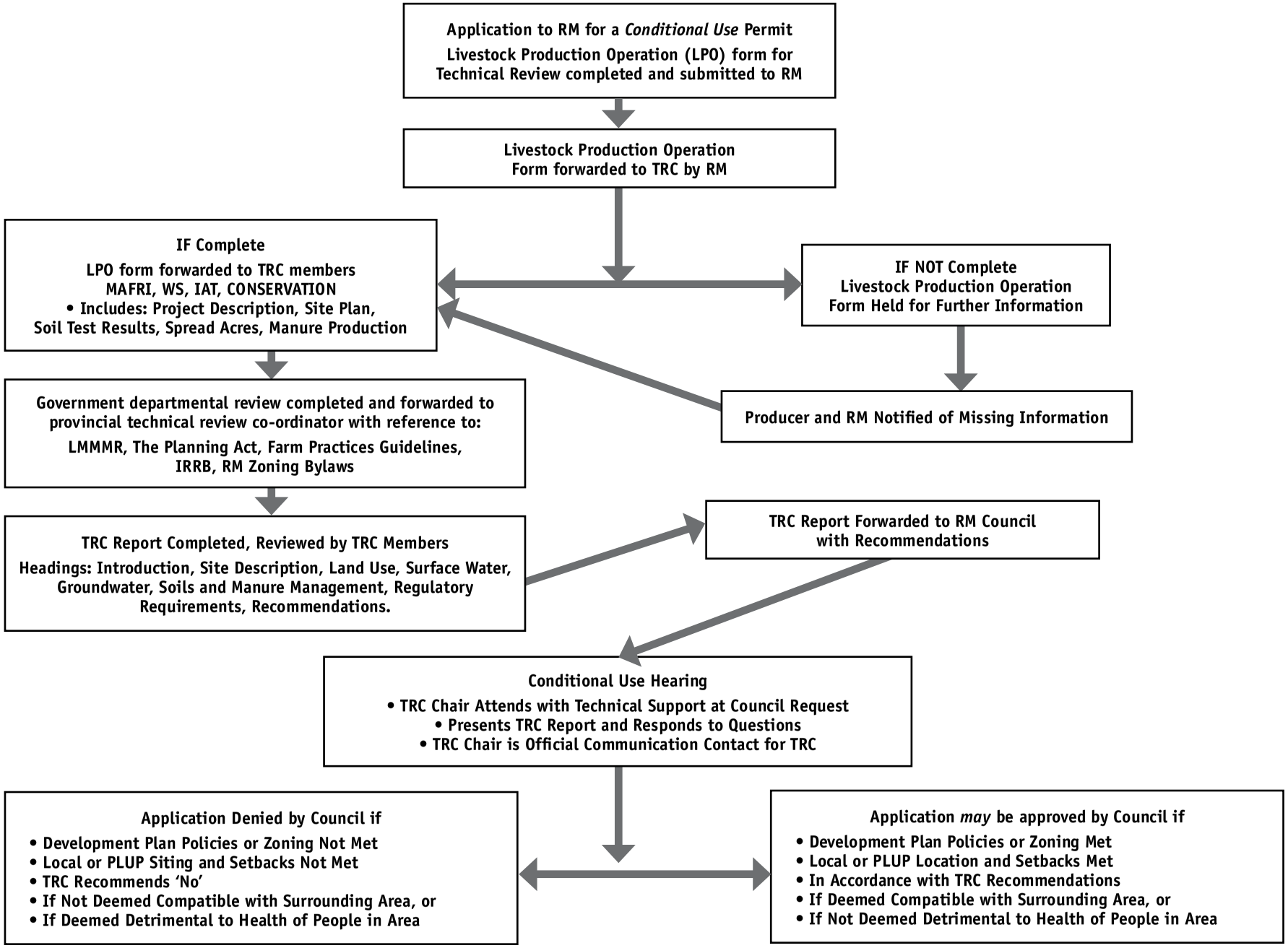
The report provides available technical information, assesses compliance with local land use regulations, compliance with provincial guidelines, land availability for spreading manure, the departments requirements on protection of the environment and water resources, the cumulative impact, potential land use conflicts, odour reduction methods, etc. based on the site-specific characteristics of the proposed location. The two main issues are nuisance odour and the potential environmental impact on the local community.

The TRC is composed of staff from Manitoba Agriculture, Food and Rural Initiatives, Manitoba Intergovernmental Affairs and Trade, Manitoba Conservation, Manitoba Water Stewardship and any other department that may, from time to time, have an interest in an application. The TRC report consists of a compilation of information from each of the participating departments, together with overall conclusions and recommendations.

The municipal council sets a hearing date no sooner than 30 days after receipt of the TRC report and makes it available for public inspection at the municipal office. The process is intended to allow public input at the public hearing. Provincial staff appear at the hearing where the TRC report identifies concerns or issues or where requested by the council.

After the council has dealt with the conditional use application (land use decision), Manitoba Conservation conducts a review and approval process at the provincial level. It looks at the environmental aspects of the proposal that require additional detailed on-site engineering and soil information about storage and application of the manure produced by the operation. This provincial review and approval process only begins after the municipality approves the application.

Figure 2. The Technical Review Process (300+ AU)



The Farm Practices Protection Act and *The Farm Practice Guidelines*

The Farm Practices Protection Act establishes a process for reviewing and mediating nuisance disputes arising from practices of legally established agricultural operations. The act is intended to provide protection from nuisance suits to agricultural operations that conduct their activities in a normal manner. However, the act also provides for changes to practices that are unacceptably disturbing the operations' neighbours. *The Farm Practices Protection Act* works in conjunction with other legislation and requires compliance with *The Environment Act, The Planning Act* and health laws.

The Farm Practice Protection Board established under the act will consider complaints about odour, noise, dust and other disturbances from farm practices. It will not deal with pollution issues, erosion problems, humane treatment of animals or other non-nuisance items. The board may investigate situations, gather evidence, and hold hearings and rule on acceptability of the farm practices. The board can dismiss the complaint if it is about a normal farm practice. If the practice is not normal, the board can require that it be stopped or modified.

The Farm Practice Guidelines describe manure management systems and practices designed to protect the environment, reduce the risk of pollution and minimize the odours experienced by neighbours.

The guidelines contain a wide range of subjects on manure management, including applicable legislation, manure handling and storage, land application, odour control, site selection and mortality management.

Beneficial Management Practices

Beneficial management practices (BMPs) are actions taken by producers and land managers to minimize the negative effects to the environment, while maintaining or improving the quality of water, soil, air and biodiversity. BMPs must be practical in application and should not negatively affect the long-term viability of those in the agricultural industry. They also need to help ensure the sustainability of resources for agricultural production. The effective use of BMPs will benefit both the producer and the whole society.

Manitoba Water Stewardship has developed a BMP Top-Up Incentive Program to encourage Manitoba producers to consider a select number of BMPs that promote water protection practices. This program will be delivered in partnership with the Canada-Manitoba Farm Stewardship Program (CMFSP), administered by Prairie Farm and Rehabilitation Administration (AAFC-PFRA). It will target water quality issues by promoting the adoption of beneficial management practices on the landscape.

The following BMP categories are included in the incentive program.

1. Nutrient Management Planning (BMP #24)
   - consultation services to develop nutrient management plans, planning and decision support tools
2. Improved Manure Storage and Handling (BMP #1)
   - increased storage to meet winter spreading restrictions (including satellite storage)
   - improved features to prevent risks of water contamination (leaks, spills)
   - containment systems for solid manure (includes covers)
   - assessment and monitoring of existing manure storage infrastructure
3. Manure Treatment (BMP #2)
   - de-watering systems, nutrient recovery systems

Manitoba Habitat Heritage Corporation (MHHC)

The Manitoba Habitat Heritage Corporation (MHHC) was established as a Crown corporation by *The Manitoba Habitat Heritage Act* in 1986 to conserve, restore and enhance fish and wildlife habitat. The MHHC conserves habitat by working in partnership with private landowners, farm organizations, corporations, conservation groups and government agencies. MHHC's vision is to ensure a cleaner, greener landscape that benefits all Manitobans. From the beginning, MHHC was structured to generate innovative solutions to conservation challenges that benefit both landowners and wildlife. The MHHC continues to expand its role as a deal-maker and facilitator of conservation partnerships and a delivery agency for farm friendly conservation initiatives.

Riparian Programs

Through *The Conservation Agreements Act*, Manitoba Water Stewardship, in partnership with MHHC, has enabled the use of conservation agreements (riparian easements) for perpetual conservation of sensitive landscapes on private land.

The Manitoba Riparian Health Council's mission is to promote co-ordinated programs and activities that support the sustainable use of riparian and associated lands in agro-Manitoba. The council has developed a vision for

co-operative programs that enhances riparian areas and surface water quality across agro-Manitoba in ways that also support landowner needs. The council has created a network of agencies collaborating to improve the effectiveness of their initiatives.

Improving habitat in riparian zones by managing livestock access not only helps to protect wildlife and plant species, it also improves fish habitat, provides run off and erosion control and improves the quality of surface waters. Helping landowners develop improved grazing and water management systems on their pastures can also contribute to their profits.

Manitoba Agriculture, Food and Rural Initiatives (MAFRI) - Extension Activities

As a follow up from the Clean Environment Commission hearings into the Maple Leaf Foods Inc. plant in Brandon, MAFRI is reviewing its activities to support an expansion in hog production in the province in an environmentally sustainable fashion. Ongoing activities and new departmental initiatives, such as the Pork Industry Task Team, are developing information for producers who want to participate in the expansion of the hog industry in Manitoba. The following information outlines these areas of activity.

The Farm Practices Guidelines for Hog Producers in Manitoba

These guidelines describe manure management systems and practices designed to protect the environment, reduce the risk of pollution and minimize odours.

The objectives are:

- to provide local governments with a basis for evaluating livestock operations
- to help livestock producers optimize the use of manure, prevent pollution and minimize odour
- to provide standards for the Farm Practices Protection Board to determine normal farming practices
- to provide information to the general public and government officials who evaluate livestock operations for potential effects on the surrounding area

The guidelines cover a wide range of subjects on manure management, including applicable legislation, manure handling and storage, land application, odour control, site selection and mortality management.

The Tri-Provincial Manure Application and Use Guidelines – Manitoba Version

The goal of the *Tri-Provincial Manure Application and Use Guidelines* is to provide a set of recommended practices, supported by science-based information, to help ensure the sustainable use of manure as a fertilizer across the Prairie region.

Topics addressed include:

- understanding manure
- soil sampling and analysis
- manure sampling and analysis
- understanding soil and manure test reports
- calculating manure application rates
- manure application equipment
- manure and the protection of water, air and soil
- record keeping

Tools contained in the guidelines include:

- a general unit conversion table and a quick conversion table for manure
- worksheets for calculating manure application rates (solid/liquid, metric/imperial)
- methods for calibrating manure applicators and sample calculations (solid/liquid, metric/imperial)

The Manure Application and Use Guidelines have already been presented and discussed at MAFRI staff training events and industry seminars. Upon request, MAFRI staff continue to use them in extension activities, conveying the principles of sound manure nutrient management to producers and industry professionals.

Manure Application Rate Calculator (MARC) Software

The Manure Application Rate Calculator (MARC) is user-friendly manure management planning software. It is designed to facilitate the sustainable management of livestock manure in Manitoba. Although it is available to all producers, it is of particular value to those who are required to submit manure management plans to Manitoba Conservation. Since 1998, livestock operations with 400 or more animal units have been required to submit manure management plans under The Livestock Manure and Mortalities Management Regulation. In March 2004, this requirement was extended to operations with 300 or more animal units.

MARC was first made available by MAFRI in 1998. In 2005 it was updated to a version which:

- contains land, crop, and manure information specific to Manitoba
- provides improved record keeping for crop and livestock producers who use manure as a fertilizer
- gives users more flexibility in the types of manure they apply and the possible methods of application
- automatically fills out and prints manure management plan reports
- helps producers in fulfill regulatory requirements

MARC is being updated again in 2006 to meet the new requirements for phosphorus management recommended by the Phosphorus Expert Committee.

Information CD from the Pork Industry Task Team

The Swine Trade Task Team is developing an information CD for participants who want to enter the grower-finisher hog production industry. The Swine Trade Task Team's "Pig Finishing" is expected to have its public release in fall 2006. This CD was a joint effort between MAFRI and the Manitoba Pork Council. The CD will contain information on the cost of production guidelines for nursery and growing and finishing hogs; an outline of a contract for a grow/finish hog production; an overview of the regulations that producers must follow; financial programs available to producers; and a series of references and resources that producers can access to address questions they may have about growing and finishing hogs.

Straw-Based Hog Production Systems

Producers may want to consider using a straw-based (hoop shelter) housing system for raising growing and finishing hogs (23 kilograms to market weight). Experience suggests that performance is similar to that in conventional barns, however, feed intake increases by about 10 per cent during winter. MAFRI has worked with producers using this production system for about 20 years.

An advantage for these systems compared to conventional housing systems is the capital cost which is about a third of the equivalent size conventional barn.

A current initiative is looking into the use of straw-based systems for raising nursery hogs. Also, for former pregnant mare's urine (PMU) producers looking to enter hog production, straw-based systems are an alternative, since the buildings are already in place and the producers do not need to design and engineer a liquid manure handling/storage system.

The Manitoba Crop Diagnostic School

This two-week event is held annually at the University of Manitoba Carman Research Station in July. More than 400 industry and extension agronomists typically participate in an intensive one-day training program. Participants must inspect demonstration plots and complete exercises meant to teach them the latest information on a variety of agronomic topics, including soil properties and nutrient management. They can then relay this knowledge to their clients, influencing decisions that can improve production success and environmental sustainability.

Challenges associated with manure management - agronomic and environmental, have been demonstrated since 1997. Topics have included manure testing, application methods, soil quality and suitability, equipment calibration, crop suitability, targeting application rates to meet crop requirements and the potential consequences of over-application.

In the past two years of the school, the issue of phosphorus management and its implications for surface water quality have been important soils topics. The influence of cropping systems and fertilization practices on the risk of phosphorus loss from crop land has been illustrated at an excellent demonstration site at the Carman Research Station. This extension activity has conveyed the current understanding of phosphorus movement on the Canadian Prairies, current recommendations for minimizing risk of phosphorus loss and proposed new phosphorus-based regulations for manure and commercial sources of phosphorus to crop land.

Covering New Ground

The Covering New Ground (CNG) program funds Manitoba producer groups and provincial commodity organizations in sustainable agriculture demonstration and technology transfer projects throughout the province. MAFRI staff provide technical assistance to produce economical, practical solutions to environmental challenges in Manitoba.

The goal of the CNG program is to improve the health of agricultural ecosystems supporting the industry. CNG focuses on projects sustainable crop management, livestock and forage management, and integrated pest management projects.

Under the category of livestock and forage management, priority areas have been identified, including nutrient management. Within this priority area, the issue of manure phosphorus management receives special attention. Producers are encouraged to pursue projects that educate the livestock industry on how phosphorus loading, mobilization and delivery can be influenced through beneficial management practices.

4

Chronology of Important Events

There have been significant milestones in the development of the provincial hog industry, including the areas policy and budget initiatives, legislation on regulation, conferences and public consultation. Industry development in Manitoba has become a very public process, and public input is important in determining the industry's future and promoting environmental protection. These events reflect the public's support of public consultations.

March 2000	Province announced its ***Livestock Stewardship Initiative*** (LSI) to ensure the sustainable development of Manitoba's livestock industry. There were three ministers involved – Manitoba Agriculture, Food and Rural Initiatives, Manitoba Intergovernmental Affairs and Trade, and Manitoba Conservation. Announced immediate steps to plan for growth and increase our knowledge base, including inspecting all constructed manure storage facilities; updating groundwater sensitivity maps; and funds and assistance for municipalities to adopt land use plans and join planning districts.
April 2000	Initiated development of a Nutrient Management Strategy for surface waters in southern Manitoba.
June 2000	Province announced proposed amendments to *The Planning Act* including mandatory technical reviews. The changes addressed obvious gaps in the legislation and help promote safe, responsible livestock expansion and clarify the approval process.
June 2000	Consultations by ***Livestock Stewardship Initiative*** (LSI) Panel began. The panel was chaired by Dr. Ed Tyrchniewicz, with Nick Carter and John Whitaker. Meetings were held in six locations around the province. Written submissions were also encouraged.
Dec 2000	***Livestock Stewardship Initiative*** (LSI) Panel Report *Finding Common Ground* was released. Government committed to reduce animal unit limits, but indicated performance bonds would not be implemented. Also agreed to consult on the recommendations a second time.
April 2001	2001 Budget provided an additional $400,000 for on-farm inspections and technical reviews.
April 2001	Added three community planner positions to help municipalities adapt development plans and zoning bylaws to deal with livestock operations.
Nov 2001	Throne Speech – Manitoba's Water Strategy announced. Municipal approval process for livestock operations streamlined and additional funding provided for training and research.

July 2002 Province outlined comprehensive plan:

- Livestock Operations over 300 animal units must submit annual source water tests.
- New studies announced on phosphorus and the cumulative impact of livestock production on the environment.
- Drinking Water legislation to be introduced.
- Office of Drinking Water to be established.
- Subsidized testing for private well owners to be re-introduced.
- Drinking water treatment plant operators to be certified.
- Investment made to upgrade water systems in rural Manitoba.

Jan 2003 Province announced $252,800 for a new land and water management two-year diploma program at Assiniboine Community College.

Province introduced Riparian Tax Credit program in 2001.

Feb 2003 Lake Winnipeg Action Plan announced. The Lake Winnipeg Action Plan is a commitment to reduce nitrogen and phosphorus to Lake Winnipeg by approximately 10%. Action includes:

- Lake Winnipeg Stewardship Board established to help Manitobans identify further actions to reduce nitrogen and phosphorus to pre-1970 levels.
- New measures created to help protect natural growth along rivers to prevent erosion and reduce nutrient run off.
- Program introduced to expand soil testing to ensure proper nutrient application.
- New sewage and septic field regulation introduced.
- Developed shoreline protection project.
- Implementing nutrient removal at major wastewater facilities including the City of Winnipeg.
- Provincial cross-border nutrient management discussions began.

April 2003 Budget highlights included:

- Phosphorus information conference to be conducted by the Manitoba Phosphorus Expert Committee.

Aug 2003 Clean Environment Commission (CEC) recommended significantly limiting nutrient effluent from wastewater treatment facilities. The Manitoba government responded accordingly to improve management of effluent from these facilities.

Nov 2003 Provincial Throne Speech introduced:

- a new department -- Manitoba Water Stewardship — to co-ordinate water management
- *The Water Protection Act*

April 2004 Amendments introduced for Livestock Manure and Mortalities Management Regulation (LMMMR):

- Water sample tests mandatory for operations of 300 or more animal units.
- Threshold for prohibition of winter spreading and mandatory submission of manure management plans lowered to 300 animal units.
- Older manure storage facilities must be registered.
- Commercial applicators must be certified and consultants who prepare manure management plans must be professional agrologists.
- Rates of manure application allowable on environmentally sensitive soils are reduced.

June 2004	Sustainable Development Innovations Fund (SDIF) grant of $18,000 announced to support the work of the Phosphorus Expert Committee.
	Sustainable Development Innovations Fund (SDIF) grant of $25,000 announced to Manitoba Livestock Manure Management Initiative for a two-year research project into a common method to enhance phosphorus use by hogs.
	Sustainable Development Innovations Fund (SDIF) grant of $25,000 announced to Manitoba Livestock Manure Management Initiative for research to develop, test and calibrate a phosphorus index used to estimate the risk of phosphorus loss from Manitoba soils.
	Sustainable Development Innovations Fund (SDIF) grant of $25,000 announced to Manitoba Livestock Manure Management Initiative for research on salmonella bacteria; its survival rate in manure and soil; and ways to minimize potential transfer from hogs to environment and to food.
Oct 2004	MAFRI holds Living with Livestock, Environment and Change Conference.
Mar 2005	The New *Planning Act* was introduced.
Mar 2005	Further enhancement of the Environmental Livestock Program in Manitoba Conservation.
May 2005	Consulted on the Manitoba Phosphorus Expert Committee phosphorus recommendations.
July 2005	Discussion paper released and start of consultation on the proposed nutrient regulation for Water Quality Management Zones under *The Water Protection Act*.
Dec 2005	The Manitoba Livestock Manure and Mortalities Management Regulation was amended to require manure management plans be prepared by professional agrologists or other trained, competent professionals.
Jan 2006	Consultation began on proposed amendments to the LMMMR to include the phosphorus recommendations from the Manitoba Phosphorus Experts Committee.
Feb 2006	Joint consultations began on Livestock Manure and Mortalities Management Regulation and proposed nutrient regulation for Water Quality Management Zones.

5 Areas of Research

Environmental Stewardship

Through programs like Covering New Ground, the Agri-Food Research and Development Initiative, the Manitoba Livestock Manure Management Initiative, and the Sustainable Development Innovations Fund, the provincial government maintains a proactive role in environmental stewardship research.

To plan for a potential increase in the capacity of the hog processing sector in Manitoba, the government is acting to ensure that expansion is sustainable. It is currently estimated that roughly three to six per cent of Manitoba's agricultural land receives applications of hog manure. Any changes or increases in livestock production in Manitoba in response to additional processing are expected to be primarily with the hog industry. The area of agricultural land in Manitoba receiving manure would certainly need to increase to accommodate new hog production. The actual land base requirement will be determined on an individual, on-farm basis. It will vary, depending on such parameters as soil productivity, crop nutrient requirements and manure handling and application methods. Proposed phosphorus amendments to the Livestock Manure and Mortalities Management Regulation will require additional land to spread manure to meet new nutrient limits for sustainability. Manitoba's information base has been developing steadily, as has the research capacity. This allows crop needs to be matched with manure applications and rates. Crops are grown efficiently with minimal input, and by-products from the hog industry are used for beneficial, sustainable purposes.

It is important to note that the new lands receiving animal manure might not require inorganic fertilizer. This will reduce reliance on this costly input to production and increase reliance on a more natural form of plant nutrients.

Through research and a better understanding of the effects of the hog industry in Manitoba, it has become clear certain areas of the province are not suitable for intensive livestock operations, due to a high risk to the environment. There are also areas where the availability of fields to receive animal manure from local operations has been diminished to the point where it is unlikely new livestock operations can be located in those communities or regions.

The province is actively pursuing and collaborating on various research activities to support producer stewardship and the sustainability of hog production. Numerous departments are engaged in research to assure we gain a better understanding of the effects of the industry on Manitoba communities.

1. Soil Sustainability Study

Manitoba Conservation supported this study done by independent consultants, Axys Agronomics in conjunction with Cimarron Engineering Ltd., the University of Manitoba and Wardrop Engineering Inc. in October 2002. The study provided an overview of the ability of land in agro-Manitoba to support intensive livestock operations. This important research was released to the public and stakeholders so all Manitobans are aware of where the most desired areas for hog industry development may be, based on soil science and analysis of testing.

This model has been designed on a regional level. It provides a first estimate of intensively developed areas within the province where there is concern about the current levels of sustainable agricultural industry lands. There are some areas that have little or no additional lands available to receive livestock manure. The identification of these areas will help ensure excess nutrients do not build up, particularly in more environmentally sensitive areas of the province. The model uses a regional approach with both the data and its interpretation. This tool will help us plan sustainably for the future using new information gained at the local and regional level.

Analysis and interpretation was based on the Consolidated Census Subdivision (CCS) political unit, providing interpretation at a regional scale. Model limitations include manure production and nutrient content, nitrogen index issues and phosphorus index issues.

2. Manitoba Livestock Manure Management Initiative (MLMMI)

This initiative encourages the importance of the hog industry and assists its growth without damaging the environment or compromising goodwill among neighbours of producers.

In January, 1998, the Manitoba Livestock Manure Management Initiative was incorporated as a not-for-profit Manitoba corporation without capital shares. It includes a chairman, 11 directors and a secretary-treasurer. The board of directors are volunteers, while the chairman is paid an honorarium. MAFRI pays the salary of the secretary-treasurer and provides office space and services as its contribution. The initiative's mandate is to encourage sustainable development of the livestock industry in an environmentally sound, community friendly way, through research, development and demonstration.

Since its inception, the initiative has funded a total of 48 projects with a combined value of $3,693,125. This amount is broken down as follows:

- initiative funds $1,296,645
- funding by other agencies $969,853
- contribution by project performers $1,426,627

The initiative accepts applications for funding on an ongoing basis. However, there have been six calls for proposals issued. To date, MLMMI has received and considered 173 funding applications.

The list of financial contributors to this initiative is in Appendix V. Further details on this initiative's projects are in Appendix VI.

3. Agri-Food Research and Development Initiative (ARDI) Projects

This initiative supports research and development projects in Manitoba's agriculture and agri-food industry including:

- innovative research that will ultimately benefit the agricultural community and consumers of agri-food in Manitoba
- development of new technologies, production methods and markets, helping Manitoba stay competitive in the global economy

ARDI is funded by Manitoba Agriculture, Food and Rural Initiatives and Agriculture and Agri-Food Canada through the Agriculture Policy Framework agreement. It is managed by a program council, an administrator and program advisors.

The program council is an independent committee with 13 members. Responsibilities include development of ARDI program; development of criteria for project assessment; and prioritization and approval of eligible project proposals. The day-to-day administration is managed by the Manitoba Association of Agricultural Societies (MAAS). MAAS plays an important role in soliciting proposals, developing grant agreements with project leaders. It also administers the disbursement of funds available from governments to successful program applicants. MAAS regularly reports on the status of approved projects. MAFRI provides two program advisors to advise the Manitoba Association of Agricultural Societies and the program council.

See Appendix VII for a list of ARDI projects and funding provided.

4. National Centre for Livestock and the Environment

The centre is located at the University of Manitoba's Glenlea Research Station, a 1200-acre research and teaching facility just south of Winnipeg. The National Centre for Livestock and Environment (NCLE) will provide state-of-the-art facilities and equipment to tackle issues such as odour, water quality, greenhouse gas emissions and fertilizer use, with the goal of developing environmentally sustainable livestock production practices. The long-term systems-based research, expected to span 20 years, will look at animal housing, manure handling, cropping systems, soil, air and water health, animal welfare and food safety.

NCLE is taking a multi-disciplinary approach, bringing together researchers from many universities. Researchers include experts in agricultural and food sciences, engineering and science. The centre also has researches from Agriculture and Agri-Food Canada, Fisheries and Oceans Freshwater Institute and the Canadian Science Centre for Human and Animal Health. The scientists will look at livestock production from every angle to develop the most productive, humane, environmentally friendly practices possible.

NCLE will also investigate the topics of current interest such as the sustainability of the livestock industry in Manitoba. It will devote a significant amount of its resources and research activities toward the sustainability of the hog industry in Manitoba (ex: straw versus conventional hog housing systems).

Research will also be done on the design of intensive animal production and associated manure management on land. Projects will monitor processes on nutrient, gene, pathogen, and water and energy flow in animal production systems.

Nutrient and carbon cycling, greenhouse gasses, microbial populations and pathogen movements through barns, air and water will be monitored on a long-term basis. Research on animal welfare and productivity will also be done.

The federal Canada Foundation for Innovation and Energy Science and Technology's Manitoba Research Innovation Fund each provided $3.5 million toward NCLE.

5. Biodigestor Projects

The Agri-Energy office (MAFRI and Energy, Science and Technology) is working with at least three different types of hog operations across the province to develop anaerobic digestion (AD) as a means of handling the manure in a more sustainable manner.

The benefits of anaerobic digestion include:

- odour control
- nutrient management
- green house gas (GHG) reduction
- pathogen reduction
- reduced surface and groundwater contamination
- energy production/revenues
- diversification

Anaerobic digestion is used successfully in Europe and the U.S. as a manure management tool and a form of energy production. The energy is captured as heat and electricity for use on site and for sale to the power grid. In several U.S. states significant cost-sharing (up to 40 per cent) programs are in place to encourage the practice.

6. Water Stewardship Fund

The Water Stewardship Fund was established under *The Water Protection Act* to provide grants for research, projects and activities that further the purpose of *The Water Protection Act*. It also provides help to implement watershed management plans or water conservation programs. The following are some industry related projects funded in Manitoba.

Forms and Reactivity of Manure Phosphorus from Phytase-Fed Swine in Manitoba
A $25,000 grant was approved for a two-year research project addressing a significant issue in livestock production. It is designed to study the environmental impact of hog production, and it determines if a common method used to enhance phosphorus uptake by hogs has a negative effect on the environment. The proposed research will develop feeding strategies that can be used by swine and poultry producers to reduce the phosphorus content of manure, and reduce the potential for phosphorus export from the soil to surface water.

Livestock Manure Phosphorus Expert Committee
An $18,000 grant was approved to support the Manitoba Phosphorus Expert Committee. The committee addressed concern about the environmental impact and sustainability of the industry, about the potential exports of phosphorus from livestock manure to surface water. The committee was mandated to do scientific analysis of the pathways of phosphorus transport from agricultural fields to surface water bodies. It also estimated the likely extent of phosphorus pollution from livestock production to Manitoba's surface water, and made recommendations on the need and form of regulations or other approaches for managing livestock manure phosphorus.

Manure Nutrients in Sensitive Land
A $24,810 grant was approved for a three-year research project that will help develop best management practices to reduce greenhouse gas emissions and nutrient build-up. The proposed Manure Nutrients in Sensitive Land project will complement and build upon a larger research and demonstration project -- Best Management Practices to Improve Environmental Sustainability and Productivity of Grassland Systems Using Hog Manure. This project is taking place on a commercial pasture near La Broquerie, Manitoba. This portion of the research will investigate nutrient cycling and greenhouse gas emissions from soil from the larger research project.

Manure Nutrients in Sensitive Land, Year 2
A $24,810 grant was approved for the second year of a three-year research project. The project will help development management practices to reduce greenhouse gas emissions and nutrient build-up, as well as transfer to ground and surface water. The proposed Manure Nutrients in Sensitive Land project will complement and build upon a larger research and demonstration project. The project is being done in a commercial pasture near La Broquerie, Manitoba, and is called, Best Management Practices to Improve Environmental Sustainability and Productivity of Grassland Systems Using Hog Manure.

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Appendix I

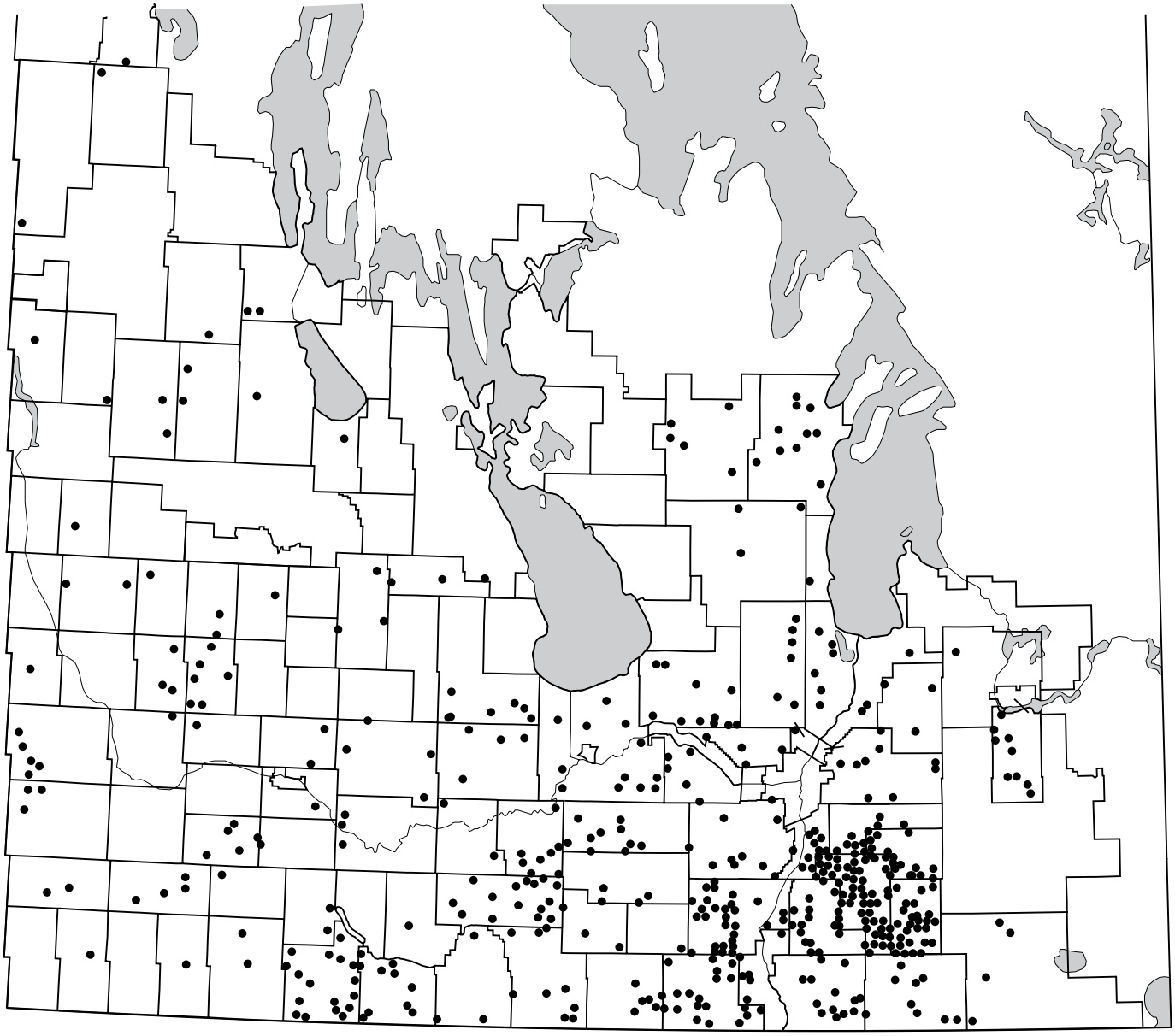
Summary of estimated nutrient loading to Lake Winnipeg (1994 - 2001) (rounded to the nearest 100 tonnes)

Category	Average Total Nitrogen (TN) (t/yr)	%TN	Average Total Phosphorus (TP) (t/yr)	% TP
Overall annual nutrient load to Lake Winnipeg	86,700	100	7,800	100
Upstream jurisdictions	48,900	56	4,100	53
United States (Red River)	19,000	22	2,500	32
United States (Souris River)	1,100	1	200	3
Saskatchewan and Alberta (Assiniboine and Saskatchewan)	8,300	10	400	5
Ontario (East Side)	3,700	4	200	3
Ontario (Winnipeg River)	16,800	19	800	10
Manitoba Sources	37,800	44	3,700	47
Manitoba Point Sources	5,100	6	700	9
City of Winnipeg	3,700	4	400	6
All Others	1,400	2	300	3
Manitoba Watershed Processes	23,200	27	2,500	32
Estimated Natural Background	18,100	21	1,300	17
Present Day Agriculture	5,100	6	1,200	15
Atmospheric Deposition	9,500	11	500	6

Source: Manitoba Water Stewardship.

Appendix II

Location of Permitted Manure Storage Facilities April 2006



Source: Manitoba Conservation

Appendix III

Obtaining a Permit for the Construction/Modification/Expansion of Manure Storage Facilities

1. Contact the office of the rural municipality in which the proposed operation is to be located. Ask about municipal bylaws, conditions, restrictions and permit requirements to ensure your proposal will comply. If the proposed operation is 300 animal units or larger, a technical review will be required and the municipality will have to submit a request to Manitoba Agriculture, Food and Rural Initiatives for it. If the proposed operation is less than 300 animal units, a technical review may or may not be required, depending on the bylaws of the municipality.

2. Contact an engineering firm of your choice and explain your proposal, future expansion plans, etc. All facilities must be designed and the designs must be sealed by a professional engineer.

3. The engineering firm chosen will do an initial site assessment and have test holes drilled at the proposed site. For earthen storages, a minimum of three test holes drilled to a recommended depth of not less than 9.15 metres (30 feet) and collection of soil samples for further analysis will be required. Information from these test holes, including type of soil, depth to water table, estimate of soil permeability, etc., will determine the location and level of protection that will be required for construction/modification/expansion of the manure storage facility.

4. The design of the manure storage facility, including a site plan, capacity for present and future needs, level of protection required, laboratory results of the soil sampling from the initial test holes, and all other pertinent information must be submitted to Manitoba Conservation as part of a Permit Application Form. As well, a map of all lands available for manure spreading that outlines agriculture capability classifications, buffer areas and available spread acreage is required. In addition, a manure management plan is required. Signed agreements with the owners, authorizing manure spreading on lands leased for this purpose, must be attached.

5. Depending on the soil conditions and/or the depth to the water table found at the site, the type of manure storage facility may consist of one of the following:

   A) An **earthen** storage area with a straight cut-and-fill construction may be used when there is adequate **clay** of suitable quality on site.

   B) An earthen storage area with imported clay liner may be used when adequate clay of suitable quality is hauled in from another location, usually in fairly close proximity. A minimum of one metre of compacted clay is required on the floor and inside berms of this storage facility.

   C) earthen base storage area with a **plastic liner**, which may consist of either a PVC (polyvinyl chloride) liner of minimum 30 millimetres thickness or a HDPE (high density poly-ethylene) liner of minimum 60 millimetres thickness may be used.

   D) A **concrete** storage area either pre-cast or poured-in-place facility may be used.

   E) An approved **steel** storage tank may be used.

6. The completed Permit Application Form and supporting information is reviewed by engineering staff at Manitoba Conservation to ensure compliance with all regulatory requirements and accepted construction standards.

7. A permit for the construction, modification or expansion of the manure storage facility will only be issued if the information is complete and the design is acceptable for the site conditions. Before any construction work, a permit must be obtained from Manitoba Conservation under Section 6 of The Livestock Manure and Mortalities Management Regulation.

8. If construction of the manure storage facility requires the installation of either a clay or plastic liner, the installation and sampling of monitoring wells will also be required and will be indicated in the permit. The depth, screened interval and location of these monitoring wells must be approved by Manitoba Conservation before installation. The owner must sample the wells

on a regular basis as specified in the permit and must have the water samples tested for the required indicator parameters. Water analysis reports must be submitted annually to Manitoba Conservation under Section 6.1(2) of the regulation.

9. The owner, operator or contractor must notify, in writing the local Environmental Livestock Program officer of Manitoba Conservation:
   - at least five and not more that 10 days before the start of construction/modification/expansion of the manure storage facility (Section 6(9))
   - of a change in start date (Section 6(11))
   - of the start date for construction/modification/expansion of the manure storage facility if it was suspended more than 10 calendar days (Section 6(10))

10. Regular inspections will be carried out by environment officers and by the design engineer during the construction to ensure compliance with the approved design and with regulatory requirements. Construction must take place between May 1 and October 31.

11. After construction is completed, including the installation of all required appurtenances and monitoring wells, a final inspection will be conducted by the environment officer and by the design engineer.

12. After final inspection, the engineering firm must submit a written certification and an engineering report to the owner and to Manitoba Conservation indicating that the construction is in compliance with the requirements of The Livestock Manure and Mortalities Management Regulation and that the approved design plan was properly followed. The manure storage facility must not be put into operation until the operator has received a letter from Manitoba Conservation indicating acceptance of the engineer's letter of certification (Section 6.7).

13. Continued maintenance and proper operation of the manure storage facility is expected and is the responsibility of the owner/operator (Section 4).

14. Periodic inspections of all permitted manure storage facilities are conducted by Manitoba Conservation environment officers.

15. Additional information may be obtained from the local Environmental Livestock Program officer at Manitoba Conservation.

16. All agricultural operations that have 300 or more animal units must submit annually for registration of a manure management plan.

17. All existing agricultural operations that store manure in a facility for more than 30 days must register that facility (tank, earthen manure storage, molehill or under-barn storage) with Manitoba Conservation.

Note: this is not an exhaustive list of the requirements for a permit. Operations are assessed individually and the required information is site-specific.

Source: Manitoba Conservation

Appendix IV

Livestock Manure and Mortalities Management Regulation
Summary of Enforcement Activities 1998/99 to 2004/05

Fiscal Year	Prosecutions	Warnings	Orders
1998-99	12	32	7
1999-00	9	35	10
2000-01	16	49	22
2001-02	16	53	34
2002-03	15	59	21
2003-04	19	54	57
2004-05	16	63	45
TOTALS	**103**	**345**	**196**

Source: Manitoba Conservation

Appendix V

Financial Contributions to MLMMI

Year	Contributor	Amount
1998	Agri-Food Research and Development Initiative (ARDI)	$31,873
	Manitoba Rural Adaptation Council (MRAC)	$43,000
	Prairie Farm Rehabilitation Administration (PFRA)	$30,000
	Triple S Hog Manure Management Initiative	$47,000
	Hog Environmental Management Strategy (HEMS)	$63,150
	Sustainable Development Innovations Fund (SDIF)	$40,000
	Prov. of MB. Sust. Development Coord. Unit	$100,000
	Manitoba Pork	$300,000
	Landmark Feeds	$20,000
	Feed-Rite	$15,000
	Continental Lime	$11,000
	Puratone	$10,000
	Rhone Poulenc	$5,000
	IMC Agrico	$5,000
	Pfizer	$5,000
	Bio Agri Mix	$5,000
	Spectrum Feeds	$5,000
	Pharmacia & UpJohn	$4,000
	Royal Bank	$2,000
	Max Pro Feeds	$2,000
	Pro-Ag Products	$1,000
	Walinga Inc.	$500
	Tartan Feed	$1,000
	Agri-Fed Products	$1,000
	Van Walters & Rogers	$1,500
1999	Agri-Food Research and Development Initiative (ARDI)	$120,070
	Manitoba Rural Adaptation Council (MRAC)	$7,000
	PDK Products	$1,660
	Manitoba Zero Till	$1,030
	Max Pro Feeds	$2,000
	Pharmacia & UpJohn	$4,000
	Continental Lime	$1,000
	Van Walters & Rogers	$1,500
	Landmark Feeds	$20,000
	Pfizer	$5,000
	Canadian Pork Council	$47,186
	Tartan Feed	$1,000

Year	Contributor	Amount
1999	Agri-Feed	$1,000
	Bio Agri Mix	$5,000
	Walinga	$500
	Pro-Ag Products	$500
	IMC Agrico	$5,000
	Manitoba Pork	$150,000
	Puratone	$10,000
2000	Agri-Food Research and Development Initiative (ARDI)	$56,000
	Canadian Pork Council	$12,480
	Max Pro Feeds	$2,000
	Spectrum Feeds	$5,000
	Walinga	$500
	Tartan Feeds	$1,000
	Van Walters & Rogers	$1,500
	Continental Lime	$1,000
	Bio Agri Mix	$5,000
	Pharmacia & UpJohn	$4,000
	Landmark Feeds	$20,000
	Steinbach Hatcheries	$500
	Pfizer	$5,000
	Manitoba Pork	$152,000
	Agri-Feed	$1,000
	Feed-Rite	$15,000
	Puratone	$10,000
2001	Agri-Food Research and Development Initiative (ARDI)	$106,760
	Manitoba Pork	$207,500
	Agri-Feed	$1,000
	Spectrum Feeds	$5,000
	Graymont (Continental Lime)	$1,000
	Pro-Ag	$500
	Pfizer	$5,000
	Walinga	$500
	Landmark Feeds	$15,000
	Feed-Rite (Cotswold)	$7,500

Year	Contributor	Amount
2002	Manitoba Rural Adaptation Council (MRAC)	$150,000
	Sustainable Development Innovations Fund (SDIF)	$50,000
	Manitoba Pork	$221,700
	Landmark Feeds	$20,000
	Pfizer	$5,000
	Feed Rite (Cotswold)	$7,500
	Spectrum Feeds	$5,000
	Pro-Ag	$500
	Graymont (Continental Lime)	$1,000
	Agri Feed	$500
	Hytek Ltd.	$1,000
	Premium Pork	$1,500
2003	Manitoba Rural Adaptation Council (MRAC)	$150,000
	Sustainable Development Innovations Fund (SDIF)	$75,000
	Manitoba Pork	$190,000
	Landmark Feeds	$10,000
	Pifzer	$5,000
	Spectrum Feeds	$5,000
	Feed Rite (Cotswold)	$2,500
	KPA Pigs	$2,500
	Hytek Ltd.	$1,000
	Graymont (Continental)	$1,000
	Agri Feed	$500
	Pro-Ag	$500
2004	Manitoba Rural Adaptation Council (MRAC)	$40,860
	Manitoba Pork	$190,000
	Pfizer	$5,000
	Graymont (Continental)	$1,000
	Hytek Ltd.	$1,000

Source: Manitoba Agriculture, Food and Rural Iniatives

Appendix VI

Manitoba Livestock Manure Management Initiative Inc.
Completed Projects

Project No. & Title: MLMMI 98-01-04
Determination of the Areal Extent of Odour Plume from Large Hog Facilities in Manitoba
Amount Funded: $35,500

Project No. & Title: MLMMI 98-01-08
Demonstration of Liquid Hog Manure as a Fertility Source on Grassland
Amount Funded: $44,000

Project No. & Title: MLMMI 98-01-09
Testing the Use of Hog Manure on Zero Tillage Acreage
Amount Funded: $5,200

Project No. & Title: MLMMI 98-01-15
Study of the Rapid Analysis of Available N & P in Hog Manure Amended Soils by Near Infrared Spectroscopy
Amount Funded: $25,700

Project No. & Title: MLMMI 98-01-18
Developing and Establishing Test Protocols for the Objective Sensory Analysis of Mal-odours from Livestock Sources
Amount Funded: $38,000

Project No. & Title: MLMMI 98-01-19
Novel Technology for Hog Manure Odour Control/Remediation. Use of Crystal Engineering, Synthetic Clays, Synthetic Zeolites, Clathrates
Amount Funded: $35,300

Project No. & Title: MLMMI 98-01-23
Development of a Treatment Technology using Lime, Lime-clay Combination and Plant Derived Phytochemicals for Eliminating Odour from Hog Operations
Amount Funded: $45,000

Project No. & Title: MLMMI 98-01-26
Purchase of a Dynamic-Dilution Olfactometer for Odour Measurement
Amount Funded: 41,000

Project No. & Title: MLMMI 98-01-31
Demonstration of the Performance of a Three-Stage Waste Treatment Technology. Odour Treatment through Solids Separation with Aerobic and Anaerobic Digestion
Amount Funded: $100,000

Project No. & Title: MLMMI 98-01-32
Development of a Negative Air Pressure Cover System for Swine Manure Earthen Storages in Manitoba
Amount Funded: $53,000

Project No. & Title: MLMMI 99-01-17
Evaluation of the Addition of Commercial Fertilizer to Swine Manure on Transportation Cost, Yield Performance and Nutrient Accumulation
Amount Funded: $34,950

Project No. & Title: MLMMI 99-01-19
Investigation of Seepage from Earthen Animal Manure Storages
Amount Funded: $35,985

Project No. & Title: MLMMI 99-01-25
Feasibility study on the Rapid Compositional Analysis of Hog Manure by Near Infrared Spectroscopy
Amount Funded: $12,885

Project No. & Title: MLMMI 99-01-27
Measurement of Odour Emissions from Hog Operations in Manitoba
Amount Funded: $30,000

Project No. & Title: MLMMI 99-01-28
Study of water Consumption and Waste Production during Different Growth Stages in Hog Operations
Amount Funded: $54,662

Project No. & Title: MLMMI 99-01-30
Soil Landscape Modeling for Setting Phosphorus Application Limits
Amount Funded: $26,150

Project No. & Title: MLMMI 99-01-33
Purchase of a Jerome Meter for the Measurement of Hydrogen Sulfide from Livestock Operations
Amount Funded: $20,713

Project No. & Title: MLMMI 99-01-34
Economic Feasibility Study to Determine the Cost and Market Effectiveness of SEI Technology for Eliminating Odours from Hog Manure
Amount Funded: $15,000

Project No. & Title: MLMMI 99-02-03
Develop a Decision Support System for Land Application of Manure Affecting the Groundwater Quality in Manitoba
Amount Funded: $29,250

Project No. & Title: MLMMI 99-02-06
Earthen Manure Storage Covers: Their Role in Nutrient Conservation and Manure Stabilization
Amount Funded: $37,680

Project No. & Title: MLMMI 00-01-01
Segregation of Wash/Spillage Water from Defecated Manure: A Means of Reduction of Odour and Ammonia Emission within the Barn Environment
Amount Funded: $43,800

Project No. & Title: MLMMI 00-01-05
South Tobacco Creek Manured Watershed Runoff Study
Amount Funded $18,000

Project No. & Title: MLMMI 00-02-03
Study on the Effectiveness Two Field-Portable Near-Infrared Instruments Measurement of Metals & Minor Elements in Hog Manure
Amount Funded: $31,050

Project No. & Title: MLMMI 00-02-08
Tracing the Source of E. coli Fecal Contamination of Water Using rep-PCR
Amount Funded: $6,060

Project No. & Title: MLMMI 00-02-11
Comparison of Odour Measurements Using Olfactometry and N_ButanolScale
Amount Funded: $50,200

Project No. & Title: MLMMI 00-02-12
Construction of a Facility for Lab-Scale Testing of Stored Livestock Manure
Amount Funded: $21,200

Project No. & Title: MLMMI 00-02-16
Soil Sampling of Manured and Non- Manured Fields
Amount Funded: $55,710

Project No. & Title: MLMMI 01-01-03
Innovative Design for Manure Storage Facilities
Amount Funded: $27,000

Project No. & Title: MLMMI 01-01-04
Nutrient Model for Setting Phosphorus Application Limits – Year 2 – Validation
Amount Funded: $57,200

Project No. & Title: MLMMI 01-01-07
Manure Exposure, Odour and Crop Response Following Injection
Amount Funded: $86,320

Project No. & Title: MLMMI 01-01-08
Measurement & Simulation of Nitrate, Phosphorus and Carbon Leaching from Manure & Fertilizer
Amount Funded: $60,000

Project No. & Title: MLMMI 01-01-11
Design and Testing of an Enclosed Biofilter
Amount Funded: $70,000

Project No. & Title: MLMMI 01-01-14
Ingredient Processing & Enzyme Supplementation for Minimizing Nutrient Excretion and Manure Volume
Amount Funded: $29,295

Project No. & Title: MLMMI 01-01-15
Hog Manure on Forage Crops
Amount Funded: $75,000

Project No. & Title: MLMMI 01-01-19
Pilot Scale Study of Hog Manure Treatment Technology
Amount Funded: $80,000

Project No. & Title: MLMMI 02-01-07Soil Sampling Manured and Non-Manured Fields in Grass Forage Production
Amount Funded: $28,400

Project No. & Title: MLMMI 02-01-11
Odour Generating Bacteria in Swine Manure & Composted Swine Manure Identification by Molecular Techniques
Amount Funded: $6,676

Project No. & Title: MLMMI 02-HERS-01
Phosphorus Study
Amount Funded: $120,000

Project No. & Title: MLMMI 02-HERS-03
Odour Production, Evaluation and Control
Amount Funded: $54,500

Project No. & Title: MLMMI 02-HERS-04
Regional Nutrient Balances
Amount Funded: $81,000

Project No. & Title: MLMMI 02-HERS-05
Pathogenic Organisms
Amount Funded: $44,546

Project No. & Title: MLMMI 03-01-04
Efficiency of Buffer Strips in the Manitoba Landscape as a Best Management Practice
Amount Funded: $66,356

Project No. & Title: MLMMI 03-01-06
Fluctuations in Manure Nutrient Concentration during Storage Pump-out
Amount Funded: $4,800

Project No. & Title: MLMMI 03-01-15
Determination of Phosphorus Sorption – Desorption Characteristics of Manitoba Soils
Amount Funded: $80,000

Project No. & Title: MLMMI 03-HERS-01
Odour & Greenhouse Gas Emissions from Hog Operations
Amount Funded: $129,630

Project No. & Title: MLMMI 03-HERS-02
Reducing Salmonella Transfer from Manure to the Environment
Amount Funded: $74,780

Project No. & Title: MLMMI 03-01-02
Best Management Practices to Improve Environmental Sustainability and
Productivity of Grassland Systems Using Hog Manure
Amount Funded: $80,000

Project No. & Title: MLMMI 03-01-20
Forms & Reactivity of Manure Phosphorus from Phytase Fed Swine in Manitoba Soils
Amount Funded: $85,000

Project No. & Title: MLMMI 04-01-01
Land Requirement for Manure from Hogs Fed Phytase-Amended Rations
Amount Funded: $69,720

Project No. & Title – MLMMI 04-01-04
Gasification of High – Solid – Content Livestock Manure as an Energy Source
Amount Funded: $12,000

Project No. & Title – MLMMI 04-01-09
Degree of Phosphorus Saturation in Manitoba Soils
Amount Funded: $70,000

Project No. & Title – MLMMI 05-01-01
Solid Cattle Manure as a Nutrient Source in Annual and Forage Cropping Systems
Amount Funded: $0

Project No. & Title – MLMMI 05-01-02
Economic Assessment of the New Environment Regulations for the Pig Industry in Manitoba
Amount Funded: $50,000

Project No. & Title – MLMMI 05-01-05
Can Valuable Bioactive Compounds be Obtained from Composed Swine Manure
Amount Funded: $3,683.29

Source: Manitoba Agriculture, Food and Rural Iniatives

Appendix VII

ARDI Funding to the Pork Industry - April 1998 to April, 2006

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
HOG FEEDING														
98.017	Dept. of Animal Science, University of Manitoba	Development of a New Generation of Exogenous Enzymes for Swine and Poultry	$163,600.00	$0.00	$53,000.00	$58,000.00	$52,600.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Feb/03
98.046	Dept. of Animal Science, University of Manitoba	Enhancement of the Performance of Early Weaned Pigs Using Chicken Egg-Yolk Antibodies	$110,500.00	$36,000.00	$36,000.00	$38,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Dec/01
98.117	Dept. of Animal Science, University of Manitoba	Processing of Pulses and Cereal Grains with Infra-Red Heat for Early Weaned Pigs	$50,000.00	$25,000.00	$25,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Oct/01
98.123	Dept. of Animal Science, University of Manitoba	Dietary Effects of Flax Seeds and Vitamin E in the Diet of Pregnant and Lactating Sows on Sow and Litter Performance	$128,700.00	$50,250.00	$39,100.00	$39,350.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Feb/03
98.185	Dept. of Animal Science, University of Manitoba	Inedible Technical Albumen &Whole Egg "By Products" as High Quality Protein /Energy/ Maternal Antibody/ Bactericide Supplements in Animal Nutrition	$41,800.00	$20,900.00	$20,900.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/01
00.362	Dept. of Animal Science, University of Manitoba	Sustainable Pork Production in Manitoba: The Role of Feed Peas	$30,000.00	$0.00	$0.00	$15,000.00	$15,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Aug/03

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
00.383	Dept. of Animal Science, University of Manitoba	Removal of Deoxynivalenol from Barley Intended for End-Use as Swine Feed	$20,000.00	$0.00	$0.00	$0.00	$20,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/03
00.411	Dept. of Animal Science, University of Manitoba	Enhancing Use of Nutrients from Feedstuffs for Profitable Pork Production and Environmental Sustainability	$52,060.00	$0.00	$0.00	$26,030.00	$26,030.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/04
00.456	Dept. of Food Science, University of Manitoba	Evaluation of Exogenous Enzyme Supplements in Poultry and Swine Diets with Respect to Growth of Select Bacteria	$34,000.00	$0.00	$0.00	$0.00	$17,000.00	$17,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/04
01.520	Dept. of Food Science, University of Manitoba	Effect of Infrared Processing and Enzyme Supplementation on the Nutritive Value of Peas for Swine	$16,000.00	$0.00	$0.00	$0.00	$0.00	$8,000.00	$8,000.00	$0.00	$0.00	$0.00	$0.00	Completed Feb/04
04.635	Dept. of Animal Science, University of Manitoba	Effect of Microbial Phytase on Amino Acid Utilization in Pigs and Broilers Fed Western Canadian-Type Diets	$66,714.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$33,357.00	$33,357.00	$0.00	$0.00	In-Progress
05.660	Dept. of Animal Science, University of Manitoba	Dietary Nitrogen Utilization and Gut Health Benefits Associated With the Use of Low-Protein Amino Acid Supplemented Diets in Pork Production	$101,805.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$33,935.00	$33,935.00	$33,935.00	In-Progress
12	Sub-Totals		$815,179.00	$132,150.00	$174,000.00	$176,880.00	$130,630.00	$25,000.00	$8,000.00	$33,357.00	$67,292.00	$33,935.00	$33,935.00	

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
HOG GRADING														
98.118	Swine Research and Development Consortium	Development of Superior Hog Quality Assurance and Carcass Grading Strategies Through Use of Real-Time Ultrasound and Nutritional Intervention	$405,308.00	$196,686.00	$109,577.00	$99,045.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Nov/02
04.625	Manitoba Pork Council	Evaluation of Real-Time Ultrasound as a Means of Quantifying Intramuscular (Marbling) Fat in Pork Loins	$120,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$55,000.00	$55,000.00	$10,000.00	$0.00	In-Progress
2	Sub-Totals		$525,308.00	$196,686.00	$109,577.00	$99,045.00	$0.00	$0.00	$0.00	$55,000.00	$55,000.00	$10,000.00	$0.00	
HOG HEALTH														
98.074	Manitoba Pork Est.	Risk Factors Associated with Post-Weaning Multisystemic Wasting Syndrome of Swine (PMWS)	$25,000.00	$25,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed May/00
00.363	Dept. of Animal Science, University of Manitoba	Water Quality Impacts on the Economics of Nursery Pig Production	$50,000.00	$0.00	$0.00	$50,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Feb/04
00.412	Dept. of Animal Science, University of Manitoba	Modified Lysozyme as a Potential Alternative to Antibiotics in Animal Nutrition	$74,000.00	$0.00	$0.00	$37,000.00	$37,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/04
04.550	Zyme Fast Inc.	Production, Use of and Evaluation of Efficacy of a Natural Growth Promotant for Animal Feed Using a Biotechnological Approach	$149,976.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$49,992.00	$49,992.00	$49,992.00	$0.00	In-Progress

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
04.569	Dept. of Animal Science, University of Manitoba	Transportation of Early Weaned Piglets: Water Consumption Following Weaning, Implications for Production and Medication	$22,550.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$22,550.00	$0.00	$0.00	$0.00	In-Progress
04.572	Dept. of Animal Science, University of Manitoba	The Potential of the Probiotic VSL#3 and Raw Potato Starch as Antimicrobial Agents in Nursery Pig Diets	$126,060.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$42,020.00	$42,020.00	$42,020.00	$0.00	In-Progress
04.634	Dept. of Animal Science, University of Manitoba	Conjugated Linoleic Acid (CLA): Impact on Sow and Litter Immune Status and Sow Reproductive Performance	$65,197.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$40,216.00	$24,981.00	$0.00	$0.00	In-Progress
05.657	Dept. of Animal Science, University of Manitoba	Transportation of Early Weaned Piglets: Modifying Density/Bedding to Improve Win. Transport; & Util. of Electrolytes to Encourage Early Feed/Water Consump.	$93,800.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$48,500.00	$45,300.00	$0.00	In-Progress
05.729	Nutratech Inc.	Development of a Passive Immuno-therapeutic Strategy for Controlling Clostridium difficile Associated Diarrhoea in Neonatal Pigs and Use of it as a Model for Evaluating Efficacy of Avian Antibody Therapy in Other Livestock and Humans	$25,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$25,000.00	$0.00	$0.00	In-Progress
9	Sub-Totals		$631,583.00	$25,000.00	$0.00	$87,000.00	$37,000.00	$0.00	$0.00	$154,778.00	$190,493.00	$137,312.00	$0.00	

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
HOG MANURE MNGT PROJECTS														
98.012	Dept. of Biosystems Engineering, University of Manitoba	Development of High Efficiency Liquid Manure Injector	$42,000.00	$17,500.00	$24,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jun/01
98.065	DGH Engineering Ltd.	Survey and Measurement of Odour Emissions and Nuisances from Hog Operations	$60,000.00	$30,000.00	$30,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jun/02
98.087	Dept. of Biosystems Engineering, University of Manitoba	In Barn Evaluation of Manure Pit Additives for Odour Reduction	$23,000.00	$23,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Oct/99
98.102	Brandon Research Centre, AAFC	Evaluation of the Use of Swine Manure in Irrigated Potato Production Systems	$36,000.00	$18,000.00	$18,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Feb/01
98.121	ISIS Canada	Innovative Design for Manure Storage Tanks	$110,000.00	$0.00	$40,000.00	$40,000.00	$30,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jul/02
98.124	Dept. of Soil Science, University of Manitoba	Long-term Effects of Hog Manure on Soil Quality and Productivity	$26,000.00	$10,000.00	$16,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed May/01
98.137	Dept. of Biosystems Engineering, University of Manitoba	Dynamic-Dilution Olfactometer for Odour Measurement	$14,000.00	$14,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Nov/00
98.142	Manitoba Forage Council	Demonstration, Odour & Yield Measurement of Shallow Injection and Surface Application Methods of Liquid Hog Manure as a Fertility Source on Grassland	$17,873.00	$17,873.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Oct/01

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
98.223	Agricultural Management (AGMGT) Ltd.	Evaluation of the Addition of Commercial Fertilizer to Swine Manure on Transportation Cost, Yield Performance and Nutrient Accumulation	$17,475.00	$17,475.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jan/01
98.224	Ascion Industries Ltd.	Demo of Odour/Pathogen Control in Hog Waste using Electron Beam Treatment and Eval. of Electron-Treated Hog Manure as Fertilizer	$22,500.00	$0.00	$22,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jan/01
98.225	Ag Waste Management Corporation	Automated Animal Manure Nutrient Monitor	$43,583.28	$0.00	$43,583.28	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	In-Progress
98.248	Elite Swine Inc.	Measurement of Odour Emissions from Hog Operations in Manitoba	$15,000.00	$0.00	$15,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Complete Jan/01
98.251	DGH Engineering	Water Consumption and Waste Production in Hog Operations	$27,331.00	$0.00	$27,331.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Nov/01
99.269	Dept. of Civil & Geological Eng., University of Manitoba	Investigation of Seepage from Earthen Animal Storages	$17,993.00	$0.00	$17,993.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Dec/00
99.270	Dept. of Biosystems Engineering, University of Manitoba	Purchase of a Jerome Meter for the Measurement of Hydrogen Sulfide from Livestock Operations	$10,356.00	$0.00	$10,356.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jan/00
99.310	DGH Engineering Ltd.	Earthen Manure Storage Covers: Their Role in Nutrient Conservation and Manure Stabilization	$18,840.00	$0.00	$18,840.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jan/01

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
99.340	DGH Engineering Ltd.	Segregation of Wash/Spill Water from Defecated Manure: A Means of Reduction of Odour and Ammonia Emission within the Barn Environment	$21,900.00	$0.00	$0.00	$21,900.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/02
99.341	Deerwood Soil and Water Management Association	South Tobacco Creek Manured Watershed Runoff Study	$9,000.00	$0.00	$0.00	$9,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/02
00.377	Dept. of Soil Science, University of Manitoba	Effect of Biosolids & Manures on Solubil-ity, Phytoavailability and Movement of Phosphorus	$56,000.00	$0.00	$0.00	$28,000.00	$28,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Nov/03
00.395	University of Manitoba and University of Alberta	Comparison of Odour Measurements Using Olfactometry and n-Butanol Scale	$25,100.00	$0.00	$0.00	$25,100.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Feb/02
00.434	Dept. of Biosystems Engineering, University of Manitoba	Electronic Nose (Sensor-Based Odour Analysis System) for Odour Identification and Measurement	$25,000.00	$0.00	$0.00	$25,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Jun/03
00.436	Dept. of Biosystems Engineering, University of Manitoba	Manitoba Hog Barn Biofiltration Study	$35,000.00	$0.00	$0.00	$0.00	$35,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Oct/04
00.458	Dept. of Soil Science, University of Manitoba	Effect of Hog Manure Applications on Weed Control Management	$53,647.00	$0.00	$0.00	$23,650.00	$29,997.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed April/04
01.474	Dept. of Biosystems Engineering, University of Manitoba	Manure Exposure, Odour and Crop Response Following Injection	$43,160.00	$0.00	$0.00	$0.00	$21,895.00	$21,265.00	$0.00	$0.00	$0.00	$0.00	$0.00	File Closed

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
04.557	Dept. of Biosystems Engineering, University of Manitoba	Evaluation of a Non-Pressurized Headspace Horizontal-Airflow Biofilter	$27,500.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$16,500.00	$11,000.00	$0.00	$0.00	In-Progress
05.740	Home Farms Technologies Incorporated	Design Improvement of Liquid-Solid Separation System	$64,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$64,000.00	$0.00	$0.00	In-Progress
26	Sub-Totals		$862,258.28	$147,848.00	$284,103.28	$172,650.00	$144,892.00	$21,265.00	$0.00	$16,500.00	$75,000.00	$0.00	$0.00	
OTHER HOG PROJECTS														
98.041	L.R. Rigaux and Associates	Development of a Canadian Weanling Price Guide	$13,000.00	$13,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Oct/01
98.149	Dept. of Biosystems Engineering, University of Manitoba	Performance Evaluation of Heat Mats in Swine Farrowing Facilities	$32,120.00	$32,120.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Dec/99
98.163	Dept. of Animal Science, University of Manitoba	Influence of Light Source on Physi-ological Responses, Puberty Onset and Embryo Survival in Gilts	$31,240.00	$16,665.00	$14,575.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	In-Progress
98.164	Dept. of Animal Science, University of Manitoba	Transportation of Early Weaned Piglets	$36,015.00	$15,000.00	$21,015.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Oct/02
98.238	Northern Bioidentifica-tion Service Ltd.	Development of Genetic Markers for Swine Improvement	$48,950.00	$0.00	$48,950.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Aug/00

Project #	Applicant	Project Name	Total Approved Funding	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	Project Status
99.292	Canada Pork International	Pork Industry Development	$30,000.00	$0.00	$30,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/01
99.300	Dept. of Animal Science, University of Manitoba	Photoperiod, Time Weaning and Reproductive Performance of Sows	$42,290.00	$0.00	$23,070.00	$19,220.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Mar/04
99.303	Dept. of Biosystems Engineering, University of Manitoba	The Effect of Heat Lamp Usage on Performance of Piglets Shortly After Birth	$35,244.00	$0.00	$24,002.00	$11,242.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed May/03
00.364	Dept. of Animal Science, University of Manitoba	Transportation of Early Weaned Pigs	$50,000.00	$0.00	$0.00	$25,000.00	$25,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	Completed Aug/04
05.723	Dept. of Animal Science, University of Manitoba	Sow Longevity: Modelling as a Method of Economic Analysis	$125,000.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$62,500.00	$62,500.00	In-Progress
10	**Sub-Totals**		**$443,859.00**	**$76,785.00**	**$161,612.00**	**$55,462.00**	**$25,000.00**	**$0.00**	**$0.00**	**$0.00**	**$0.00**	**$62,500.00**	**$62,500.00**	
62		**TOTAL**	**$3,278,187.28**											

Source: Manitoba Agriculture, Food and Rural Iniatives

Manitoba Conservation
2006