

Chapter 28

Agriculture – Regulating Livestock Waste to Protect Water Resources

1.0 MAIN POINTS

The Ministry of Agriculture (Ministry) is responsible for reviewing the adequacy of waste storage plans and waste management plans of intensive livestock operations (ILOs). The Ministry is also responsible for inspecting ILOs and enforcing requirements when operators do not sufficiently address risks identified.

According to the *2010 State of the Watershed Report*, the overall health of many Saskatchewan watersheds is stressed by human activity. The report indicates that manure production is one of the potential stressors on Saskatchewan watersheds. The effectiveness of the Ministry's processes to regulate intensive livestock operations is essential to avoid and mitigate the threats posed by livestock waste to our water resources.

Our audit for the period of September 1, 2012 to August 31, 2013 found the Ministry had effective processes to regulate waste generated from ILOs except the Ministry needs to review pre-1996 ILO approvals and confirm sufficient controls are in place. The Ministry also needs to determine the frequency of inspections for ILOs based on risk and then conduct inspections in accordance with its policy.

2.0 INTRODUCTION

The Ministry of Agriculture (Ministry) is responsible for administering the intensive livestock provisions under *The Agricultural Operations Act* (Act) and regulations to ensure intensive livestock operators are storing and managing livestock waste in a manner that protects water resources. Under the Act, a livestock operation is defined as intensive if the space per animal unit where the livestock is confined is less than 370 square metres. One cow, 200 broiler chickens, or six feeder pigs represent one animal unit. **Figures 1** and **2** show the number of cattle, hogs and pigs in Saskatchewan compared to our neighbouring provinces, Alberta and Manitoba.¹ At May 2011, Saskatchewan had about 140 dairy farms, 7,300 beef farms, 65 hog farms, and 115 poultry farms.²

Figure 1 – Provincial Comparisons of Total Cattle

	2013	2006	2001
Manitoba	1,230,000	1,573,097	1,424,427
Saskatchewan	2,890,000	3,363,235	2,899,502
Alberta	5,585,000	6,369,116	6,615,201

Source: Saskatchewan Ministry of Agriculture and Statistics Canada

¹ This includes all cattle, hogs, and pigs raised in the province including those raised in ILOs.

² Per the Ministry of Agriculture's 2011 Census Fact Sheet. Information not readily available for July 2013.



Figure 2—Provincial Comparisons of Total Hogs and Pigs

	2013	2006	2001
Manitoba	2,960,000	2,932,548	2,540,220
Saskatchewan	1,075,000	1,388,886	1,109,797
Alberta	1,420,000	2,052,067	2,027,533

Source: Saskatchewan Ministry of Agriculture and Statistics Canada

The Act requires intensive livestock operators that meet the following criteria to develop and operate according to waste storage plans and waste management plans approved by the Ministry. The Act defines an intensive livestock operation requiring approvals as one that has one of the following:

- › Contains an earthen manure storage unit or lagoon (storages)
- › Involves more than 300 animal units
- › Involves more than 20 animal units confined for more than 10 days out of a month within 300 meters of surface water or 30 metres of domestic water wells

Figure 3 outlines the total number of approvals given by the Ministry over the past three years for ILOs. The Ministry provides approvals for each new or expanding waste storage plan and for each new or altered waste management plan (i.e., there may be more than one approval per ILO). According to the Ministry, at July 2013, there were about 733 Ministry approvals of ILOs operating in the province. At July 2013, the Ministry’s Agriculture Operations area that is responsible for regulating waste from intensive livestock operations had 11 staff.

Figure 3—Number of Ministry Approvals of Intensive Livestock Waste Storage Plans & Waste Management Plans from 2010 to 2013

Year	# of Approvals	Animal Units
2012-13	13	51,092
2011-12	9	11,558
2010-11	6	3,802

Source: Saskatchewan Ministry of Agriculture

3.0 PROTECTING WATER RESOURCES FROM LIVESTOCK WASTE

ILOs can contaminate a source of drinking water (i.e., groundwater or surface water) if manure and disposition of dead animals are not properly managed. ILOs collect and store manure in storage structures. Contamination may occur if these units are inadequately designed or managed, and located in close proximity to water resources. ILOs use stored livestock waste as fertilizer to take advantage of the nutrients in the manure as a valuable fertilizer for crop production. Although soil can filter out bacteria and other microorganisms, they can also enter surface water through run-off.

Microorganisms, nitrogen, and phosphorous are the prime contaminants from livestock waste. Some of these contaminants can cause severe illness and disease if ingested or

may have environmental impacts. The following provides an example of potential effects of these contaminants.

- ▶ Excessive amounts of nitrates may have detrimental effects on drinking water. Human consumption can lead to infantile methemoglobinemia or “blue baby syndrome”³, or can cause kidney or spleen problems.

Phosphorous is essential for aquatic and terrestrial plant growth. However, an overabundance of this nutrient can result in excessive algae in water bodies making the habitat unsuitable for many forms of aquatic life. It can also result in excessive vegetation in the water source, causing it to become oxygen depleted. If waste application (i.e., manure spread as fertilizer) rates are high, the soil will accumulate microorganisms, nitrogen, and phosphorous. Through infiltration, organisms or nutrients in the soil that are able to move with the water can contribute to contamination of groundwater sources. Once contaminants are in groundwater, they may eventually reach rivers and lakes.

Drinking water in Saskatchewan comes from lakes and rivers (i.e., surface water) and aquifers (i.e., groundwater). About 73% of municipal or communal waterworks use groundwater to serve 28% of Saskatchewan residents with drinking water, while the remaining 27% of waterworks use surface water to serve about 57% of Saskatchewan residents.⁴

Groundwater can move so slowly that contamination problems can take a long time to appear. For this reason, and because it is expensive to clean up a contaminated aquifer, it is preferable to prevent contamination from happening in the first place.

Prevention strategies include locating ILOs where waste will not contaminate underlying groundwater. Other strategies include ILOs designing storages and managing livestock waste in a manner which protects water resources.

The Ministry is responsible for reviewing the adequacy of waste storage plans and waste management plans of ILOs. The Ministry is also responsible for inspecting ILOs’ waste storage facilities, reviewing their waste management records to assess compliance with approved plans, and enforcing requirements when operators do not comply with requirements.

According to the *2010 State of the Watershed Report*, the overall health of many Saskatchewan watersheds are stressed by human activity. The report indicates that manure production is one of the potential stressors on Saskatchewan watersheds. The effectiveness of the Ministry’s processes to regulate ILOs is essential to avoid and mitigate the potential threats posed by livestock waste to our current and future water resources.

³ “Blue baby syndrome” is thought to be caused by high nitrate contamination in ground water resulting in decreased oxygen carrying capacity of haemoglobin in babies leading to death.

⁴ www.water.ca/wkd-guide-drink-water-1.asp A Guide to Canada’s Drinking Water – Part 1 (22 October 2013).



4.0 AUDIT OBJECTIVE, SCOPE, CRITERIA, AND CONCLUSION

The objective of this audit was to assess whether the Ministry had effective processes to regulate waste generated from intensive livestock operations in a manner that protects water resources (i.e., groundwater and surface water). We examined the Ministry's processes for the twelve-month period from September 1, 2012 to August 31, 2013.

We examined the Ministry's policies, procedures, processes, and database reports. We tested a sample of applications and approvals, interviewed Ministry staff, and attended ILO inspections along with Ministry staff.

To conduct this audit, we followed the standards for assurance engagements published in the *CPA Canada Handbook – Assurance*. To evaluate the Ministry's processes, we used criteria based on our related work, reviews of literature including reports of other auditors, and consultations with management. The Ministry's management agreed with the criteria (see **Figure 4**).

Figure 4—Audit Criteria

To have effective processes to regulate waste generated from ILOs, the Ministry of Agriculture should:

- 1. Approve construction of livestock waste storage**
 - 1.1 Set and communicate appropriate requirements for construction
 - 1.2 Review and approve livestock waste storage plans prior to commencement of operations
 - 1.3 Ensure operators meet construction requirements
- 2. Monitor waste management at ILOs**
 - 2.1 Set and communicate appropriate requirements for managing waste
 - 2.2 Review and approve waste management plans prior to commencement of operations
 - 2.3 Regularly assess compliance and monitor complaints
 - 2.4 Undertake sufficient environmental impact monitoring
- 3. Address and report non-compliance**
 - 3.1 Require action on non-compliance and serious risks with approved ILOs
 - 3.2 Implement strategies that identify and take action on non-approved ILOs
 - 3.3 Report non-compliance and serious risks to operators, senior management, other government agencies, and the public

We concluded that, for the period from September 1, 2012 to August 31, 2013, the Ministry of Agriculture had effective processes to regulate waste generated from intensive livestock operations except it needs to:

- › **Review pre-1996 intensive livestock operation approvals and confirm sufficient controls are in place**
- › **Determine the frequency of its intensive livestock operation inspections based on risk and then conduct inspections in accordance with its policy**

5.0 KEY FINDINGS AND RECOMMENDATIONS

In this section, we describe our key findings and recommendations related to the audit criteria in **Figure 4**.

5.1 Need to Review Pre-1996 Waste Storage Approvals

Every ILO has some form of waste storage and rainfall runoff containment – whether it is a manure stockpile, earthen manure storage, holding pond, or storage tank. Stored manure is eventually used as fertilizer for crops. The following briefly describes each type of storage.

- › An **earthen manure storage** is a containment structure built primarily of soil. It typically consists of an excavation below grade with low containment dikes above grade. It may include a compacted soil liner, a synthetic liner, or a composite liner. Dairy and hog operations typically use liquid waste systems which pump, flush, or drain liquid waste to large outside earthen manure storages.
- › **Holding ponds** are constructed as a control for rainfall runoff, mainly for cattle operations.
- › **Storage tanks** are generally constructed either above ground or in-ground and are used to collect liquid manure. Storage tanks at ILOs are least commonly used in the province.

The Agricultural Operations Act (1996) sets out the requirements that ILOs must meet to have a waste storage plan approved by the Minister. We also found the Ministry sets out its requirements for construction of waste storage plans in various manuals and technical guidelines. For example, the Ministry has a technical guideline that outlines the engineering requirements for designing earthen manure storages. The Ministry makes these available to ILO operators and consultants through its website and through publications, consultations with industry organizations, and trade shows.

When operators decide to construct or expand an ILO, they must first submit an application to the Ministry for approval of their proposed waste storage plan. Often the waste storage plan has been developed by or in consultation with a professional engineer.

When determining whether approval is necessary, one factor that the Ministry considers is the size of the livestock operation. It also collects key site information in the application such as topographic maps, geologic and groundwater maps, soil surveys and maps, well records and logs, satellite imagery and aerial photos. After Ministry staff conduct a site inspection, they may return the application to the applicant to require additional information before deciding whether to approve the waste storage plan.

For large ILOs, the notice of the application may be advertised in the local community and comments from the public are invited. We found the Ministry also consults with other agencies (e.g., Ministry of Environment, Water Security Agency, Ministry of Government Relations) and obtains their comments on the pending ILO approval. The Ministry confirms that ILO operators address comments (related to water source protection) received by other agencies prior to granting approval.

Ministry staff, who are professional engineers, review each ILO application for completeness and determine the geological risk level associated with the site (i.e., geologically secure, variable, or sensitive). The geological risk associated with the features of the site dictates what the Ministry requires for storage design and controls



(see **Exhibit 7.1**). Once the Ministry has established that the ILO has planned for adequate protection of groundwater and surface water in its proposed plans, it issues an approval to construct/expand the ILO according to the proposed plan.

For the sample of applications and approvals of new or expanded ILOs granted within the audit period that we examined, we found that the Ministry followed its requirements for properly reviewing and approving ILO constructions. We found the Ministry placed special conditions (e.g., ongoing groundwater monitoring at the ILO waste storage site, submission of as-constructed drawings following completion of construction) on some waste storage approvals.

The Ministry maintains a list of approved ILOs. We found that the Ministry's list of approved ILOs does not contain the geological risk rating of each ILO. Rather, the Ministry relies on staff knowledge as well as the paper files of each approved ILO to document geological risk information.

The Ministry assesses the environmental risk to water when reviewing the proposed waste storage plan and ensures the waste storage structure is built to mitigate those risks to water associated with the site. Ministry staff complete site inspections during the construction of waste storage structures to determine whether construction occurs in accordance with the approved plans. Staff are expected to be on-site during construction of storage structures and following the completion of construction. For earthen manure storage, Ministry inspections are specifically targeted to observe the final depth of excavation and liner placement during construction. For waste storage where the performance is highly dependent on the proper construction of a liner system, the Ministry requires monitoring and reporting by a professional engineer as a condition of its plan approval.

We observed that the Ministry's documentation showed that staff were on-site during and after construction to ensure the waste storage structures were built according to the approved plan. We also observed an on-site inspection done by the Ministry of an ILO construction and found it met the Ministry's requirements.

The Agricultural Operations Act (Act) became law in 1996. Provisions in the Act allow ILOs that obtained waste storage approval prior to October 1996 (pre-1996) to continue to operate with a previously approved waste storage plan even though waste storage requirements changed under the Act. According to the Ministry's records, there are 407 pre-1996 approvals where ILOs are currently operating and have not had any significant changes requiring a new approval.

We compared a sample of waste storage plans and waste management plans approved pre-1996 to current standards and practices. We found that one out of the five ILOs we sampled would have been constructed differently to minimize environmental risks.

The Ministry does not have a process to revisit approvals issued pre-1996 to determine if any changes are required under the current design standards and/or additional geological information has become available. It does not know how many operating pre-1996 ILOs do not meet current requirements. For example, it does not know how many of these ILOs may need to be upgraded to minimize the negative consequences to water resources. Adequate waste storage is key to protecting groundwater and surface water from possible contamination. The pre-1996 operating ILOs need to be reassessed to ensure sufficient controls are in place to mitigate environmental risk.

1. We recommend that the Ministry of Agriculture confirm that intensive livestock operations, that it approved prior to 1996, have sufficient controls to protect water resources.

5.2 Need to Revisit and Follow ILO Inspection Policy

Livestock waste is a good source of plant nutrients and organic matter that can improve crop productivity and soil quality if managed properly. Proper management requires that the manure be treated as a fertilizer rather than a waste. ILO operators are expected to assess the nutrient composition of the manure and then determine application based on the nutrient requirements of the crop to be grown. Soil testing can help indicate the right rates of nutrients to apply. Manure is usually applied to cropland once every three years, in the fall or the spring. ILOs' waste management plans should include the planned use of manure as fertilizer.

ILOs submit waste management plans to the Ministry along with their applications for new or expanded waste storages. The Ministry reviews and approves these waste management plans in conjunction with the waste storage applications.

The Ministry sets and communicates its requirements for managing waste as it does for waste storage – through the Act, technical guidelines, brochures, presentations, and policy manuals. The Ministry follows generally accepted agricultural practices for management of manure and dead animal disposition. The Act and regulations do not specify minimum and maximum thresholds for application of manure to cropland, or setback distances from watercourses. The legislation requires that the waste management plan ensures the proper protection of water resources. Therefore, the Ministry will assess waste management plans on a case-by-case basis for adequate protection controls.

There are two types of monitoring that may take place at an ILO once operations begin – soil and water monitoring. The Ministry assigns a special soil or water monitoring condition if it considers the location of the ILO to be geologically sensitive (see **Exhibit 7.1**). Of the 733 ILO approvals, the Ministry had 45 approvals with special conditions (e.g., a groundwater monitoring well used for a specified period of time). 24 ILOs have met the special conditions. For the other 21 approvals, the Ministry reviews environmental monitoring reports (i.e., groundwater quality or soil testing results) received from the ILOs on a periodic basis to ensure that ILOs have adequate storage and management safeguards to protect water.

Depending on the risks associated with manure application, the Ministry may require some ILO operators, as a condition of the Ministry-approved waste management plan, to undertake soil sampling related to the application of manure on a regular basis and document the results. The Ministry confirms these soil sampling results when it inspects sites during its review of other manure application information (e.g., manure application volumes). This inspection process ensures that the ILO operators apply manure at rates outlined in the approved waste management plans. Applying manure at a rate that exceeds the acceptable level can result in poor crop production or soil saturation. Soil



saturation can, in turn, have negative consequences on groundwater and surface water in close proximity to the over-applied manure.

The Ministry has a policy to carry out follow-up inspections (called re-inspections) at least every five years for certain ILOs. It requires ILOs greater than 1,000 animal units, are to be re-inspected every five years. The Ministry does not have documented risk-based decision support for the 1,000 animal units. The policy does not consider other factors such as results of the geological categorization of the site (see **Exhibit 1**), past inspections, or complaints when determining how often to inspect ILOs. We think the Ministry should use a risk-based approach to determine the frequency of inspections to ensure high-risk ILOs are inspected more frequently. ILOs with complaints or that have shown problems in past inspections may pose higher risks of damage to the environment and warrant more frequent inspections.

2. We recommend that the Ministry of Agriculture set a risk-based inspection policy for re-inspections of intensive livestock operations.

The Ministry maintains a list of ILOs requiring re-inspections. The Ministry has about 130 ILOs that it plans to inspect in a five-year period. There are six Ministry staff that carry out re-inspections. At each re-inspection the inspector evaluates the condition of the waste storage structures, reviews records of manure management and dead animal disposal, and documents the results in a checklist. Existing conditions and records are evaluated against the approved plans. We found in 10 out of 30 re-inspections that we sampled, Ministry staff did not complete the re-inspection checklist. In all 30 ILOs tested, Ministry staff sent a letter of summary inspection findings to the ILO operator following the inspection. Also, we noted that the Ministry staff followed up on any discrepancies identified during re-inspections within a reasonable period of time.

We also found that the Ministry did not consistently follow its policy of re-inspections within the five-year timeline. For 5 out of 30 ILOs we sampled, re-inspections were not carried out within the five-year time requirement. We also found nine ILOs, each with more than 1,000 animal units, that have not being re-inspected or contacted within the last five years.

As noted above, the Ministry maintains a list of approved ILOs. The list includes 55 ILOs that are categorized as “status unknown” which means the Ministry is not sure if the ILO is operating. The Ministry should update these 55 ILOs with accurate status information and conduct re-inspections where required.

Untimely re-inspections increase the risk of inadequate water protection going undetected for a longer period of time.

3. We recommend that the Ministry of Agriculture inspect intensive livestock operations in accordance with its policy.

As noted above, the Ministry may require groundwater monitoring be undertaken by the ILO operator as a condition of approval. ILOs build groundwater monitoring wells as part

of the construction of waste storage structures. These wells help identify if anything leaks out of the waste storage system. ILO operators can use either their own staff or hire engineers to sample liquids from the monitoring wells on a regular basis (e.g., annually). ILOs must submit the groundwater sampling results to the Ministry for review. We found that the Ministry is receiving and reviewing groundwater results where required.

The Ministry also works with other agencies and groups to monitor surface water quality at various locations within the province. Since 1998, the Ministry has operated a surface water monitoring program where Ministry staff collect and analyze regular water samples from streams in five selected areas where manure was spread on nearby land. Each of the five areas has approximately six sampling sites. Sampling occurs each spring during the snowmelt runoff period. In general under this program, the Ministry has determined that ILOs have had little impact or no greater impact than commercial fertilizers on surface water quality.

The Ministry published the results of the surface water monitoring program in 2003; it drafted but did not publish an updated report in 2010. Management advised that this was because of staff turnover. We encourage the Ministry to publish the results of its surface water monitoring on a regular basis. The Ministry indicated that it plans to publish a surface quality report in spring 2014.

5.3 Adequately Addressing Non-Compliance

The Ministry has developed a policy to notify ILO operators of non-compliance with the waste storage plans and waste management plans. This policy also notes the escalation steps for enforcement activities when non-compliance continues over a period of time. For example, the Ministry first discusses the issue with the operator, sends a written letter, may issue a Notice of Violation followed by a Minister's Order, and then initiates court action if the issue is not corrected.

In our sample of approved ILOs, Ministry staff have identified minor corrective actions or recommendations for ILOs, and followed these up in a timely manner. The Ministry noted that bringing ILO operators into compliance generally did not require more than a written letter and on-site visits by inspectors to communicate the issue.

As noted above, the Ministry is not required to issue an approval for ILOs that store and manage waste but do not meet the criteria for which approved plans are required under the Act. The Ministry maintains, for future reference, a listing of ILOs that do not meet the criteria and did not require approval under the Act.

Although the Ministry does not actively look for ILOs that may fit the criteria under the Act and have not obtained its approval, it is made aware of potentially unapproved ILOs through a variety of ways. For example, it receives complaints, farmer inquiries, and referrals from rural municipalities, other government agencies, and lending institutions about livestock operations. Other Ministry programs, such as the Growing Forward program or Intensive Livestock Operation Environmental Rehabilitation Program, may also identify unapproved ILOs. In these cases, the Ministry notifies the livestock operator and works with them to determine if they require an approval under the Act. Ministry staff keep an open file on that livestock operation until a decision has been made (i.e., it has been approved or it determined the operation does not require an approval under



the Act). If an operator is not cooperative with the Ministry, the Ministry will commence enforcement action.

Senior management is kept informed of individual ILO issues as they move along the enforcement process through reports and briefing notes. Non-compliance issues are not made publicly available. The Ministry provides ILO operators with summary finding letters after re-inspections.

6.0 SELECTED REFERENCES

Office of the Auditor General of Alberta. (2004). *Confined Feeding Operations*. Author: Edmonton.

Office of the Auditor General Manitoba. (2007). *Audit of the Department of Conservation's Management of the Environmental Livestock Program*. Winnipeg: Author.

Saskatchewan Watershed Authority. (2010). *State of the Watershed Report*. Regina: Author.

Saskatchewan Agriculture, Food and Rural Revitalization. (2003). *2003 Surface Water Quality Monitoring Report for Intensive Livestock Operations*. Regina: Author.

7.0 EXHIBIT

Exhibit 7.1 – Minimum design standards, construction criteria and monitoring plan required for varying geographical categories

Category	Geologic & Hydrogeologic Setting	Minimum Design Standards	Minimum Construction Criteria	Monitoring Plan
Geologically Secure	<p>The floor of the manure storage must be separated from a usable groundwater resource by a uniform aquitard at least 10 metres thick.</p> <p>The Darcy flux⁵ divided by matrix porosity through this minimum aquitard shall not exceed 0.15 cubic metres per square metre per year.</p>	Engineering calculations are required to confirm the minimum criteria.	<p>Over excavate any isolated sand lenses encountered and replace with compacted clayey material.</p> <p>Scarify the sub grade to a depth of 15-20 cm and recompact.</p> <p>Provide suitable erosion protection for inlets and agitation.</p>	Usually not required due to soundness of the site, but may be required at the discretion of the regulatory agency.

⁵ The Darcy flux is defined as the flow per unit cross sectional area of the porous medium.

Category	Geologic & Hydrogeologic Setting	Minimum Design Standards	Minimum Construction Criteria	Monitoring Plan
Geologically Variable	The manure storage will be located in a surficial geologic formation with non-uniform conditions. An aquitard with uniform conditions exists between the surficial geologic formation and any usable groundwater resource.	Control of lateral flow is required. Compacted clay or synthetic liners are suitable design options. Calculations and design drawings prepared by a registered professional engineer must support the design.	Construction is completed according to plans approved by a registered professional engineer. Quality control inspection during construction by a registered professional engineer is required. As constructed engineering reports may be required by the approving authority.	Monitoring facilities may be required. Install wells according to standard engineering practice. The regulator may require a monitoring and reporting plan.
Geologically Sensitive	Complex geology with inter bedded clay and sand or gravel strata and there is insufficient or no aquitard separating the floor of the manure storage from a usable groundwater resource.	Engineered steel or concrete storage structures are suitable alternatives. Earthen manure storage options are limited and require advanced design including synthetic or composite liners, collection systems and extensive monitoring. Calculations and design drawings prepared by a registered professional engineer must support the design. Advanced seepage analysis (such as computer modelling) may be required.	Construction is completed according to plans approved by a registered professional engineer. Quality control and inspection during construction by a registered professional engineer is required. As constructed engineering reports, including construction monitoring reports may be required by the approving authority.	Submit a ground water monitoring plan for approval (timing, locations and frequency, reporting and measured analytical parameters) that will address design and site specific criteria.

Source: Saskatchewan Ministry of Agriculture's Site Characterization Manual

