



Conservation

Construction Requirements for Confined Livestock Areas and Collection Basins

The *Livestock Manure and Mortalities Management Regulation* provides the following definitions:

"confined livestock area" means an outdoor, non-grazing area where livestock are confined by fences or other structures, and includes a feedlot, paddock, corral, exercise yard, holding area and hoop structure;

"collection basin" means a structure
(a) intended to collect runoff water contaminated with manure in an agricultural operation, and
(b) constructed primarily from soil by excavating or forming dikes;

Confined livestock areas most commonly refer to outdoor, open livestock facilities such as beef feedlots or cow-calf operation facilities ("open confined livestock areas"). The amendments to the MR42/98 have included covered structures used for the rearing of livestock that feature a floor design that constitutes an effective water barrier, such as concrete ("Covered Confined Livestock Areas"). Examples include biotech shelters for feeder pig production, broiler houses and dairy loose housings.

Confined livestock areas differ from earthen manure storage structures in that manure at the soil surface is generally solid, with moisture content ranging from 50% to 75%, which departs from the continuously saturated conditions on the floor of earthen manure storage structures. Another point of distinction is that while the floor of confined livestock areas is often dry from mid-summer to late fall, it is also frozen from early winter to late spring. For these reasons, and in spite of research evidence pointing to significant leaching in some areas of confined livestock area pens, the design threshold saturated hydraulic conductivity for confined livestock area floors and collection basins is 1×10^{-6} cm/sec. This design threshold is under revision, pending the availability of new information on the spatial variability of leaching under confined livestock areas.

Collection basins are earthen structures meant for short-term storage of runoff from areas where manure accumulates (e.g. beef feedlot or overwintering facilities for cow-calf operations). The regulation indicates that collection basins must have a capacity of at least 75-mm of runoff over the collection area. The regulation limits the maximum size of the collection basin to 150-mm of runoff, with the intent to have the operator empty the collection basin shortly after a major runoff event. As a result, the maximum hydraulic conductivity for material separating the bottom of a collection basin and the top of an aquifer or bedrock is also 1×10^{-6} cm/sec; this threshold hydraulic conductivity may be decreased in environmentally sensitive areas. Collection basins designed for longer storage duration are considered earthen manure storage structures and are subject to the relevant articles of the regulation and design requirements.

I) Subsoil investigation criteria

1 - Construction requirements are dependent on geotechnical information obtained by the site investigation. Site investigation requires either excavation or drilling of test-holes to a minimum depth of 5-m. However, test-hole depths greater than 5-m may be required to determine the extent of any observed water bearing zones, potential groundwater anomalies or as required to ensure meeting the separation distance from the floor of the confined livestock area and/or collection basin and the uppermost top of an aquifer.

2 - Confined livestock areas with dimensions less than 8 ha (20 acres) must have minimum three (3) test-holes in the immediate area of the confined livestock area plus at least one (1) test-hole located in the area intended for the siting of a collection basin, when a collection basin is included in the contaminated runoff management system. Large collection basins may require additional test-holes.

3 - Confined livestock areas with dimensions greater than 8 ha (20 acres) require additional test-holes at a test-hole density dependent on pen dimensions and area. Test-holes should on a maximum 200-m grid pattern. Additional testing outside of the confined livestock area may be required to delineate potential water bearing zones near the edge of the facility. The table and diagram below can be used for guidance in designing a test-hole sampling grid.

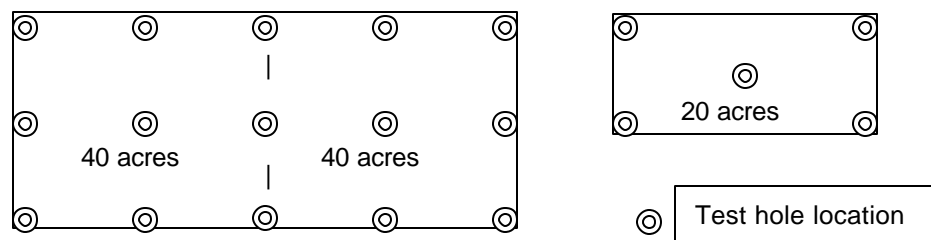


Figure 1. Suggested Test-Hole Grid Patterns for Large Confined Livestock Areas

Table 1. Number of test-hole required for characterisation of a site for constructing a confined livestock area along with laboratory analyses requirements for representative soil formations under the floor of the proposed area or runoff collection basin.

Area (acres)	Number of test-holes for the confined livestock area	Minimum number of sub-samples representative of the soil strata in the profile which are to be sent to a laboratory for detailed analyses
<20	3	3
20	5	4
40	9	6
80	15	8
160	25	12

4 - Post investigation requirements – all soil coring location and test pits must be sealed as follows:

4.a. All soil cores entry holes must be completely sealed with bentonite.

4.b. Where a test pit is dug out with an excavator, the site must be restored by

4.b.1. Backfilling the excavated material into the test pit;

4.b.2. Compacting the material in the upper 1.2-m of soil

4.b.3. Landscaping the surface area of the backfilled test pit to ensure that a depression will not form following backfilling

4.b.4. Seed the affected area with forage grasses.

5 - Laboratories – Only laboratories approved by the regulatory authority shall be used to analyze materials to be used in the construction of confined livestock areas for particle size distribution, Atterberg limits and hydraulic conductivity.

6 - Testing Requirements for Material Characterization – The soil permeability requirement for earthen floors in confined livestock areas and earthen collection basins is 1×10^{-6} cm per second. In order for the material at a site to be approved for use in the construction of a confined livestock area or a collection basin without the need for additional testing, the material at the site must meet the criteria described in Subsections 6.b.1 and 6.b.2.

6.a. All materials to be used in the construction of a collection basin, or the soil under the anticipated floor of a confined livestock area shall be analyzed for particle size distribution following ASTM D2487 and ASTM 422-63, and Atterberg Limits following ASTM D4318 or any other method pre-approved by Manitoba Conservation.

6.b. If the distribution of the particle size classes and the Atterberg limits fall within the ranges given in Subsection 6.b.1 and 6.b.2, the material is considered acceptable for construction of a collection basin or siting of a confined livestock area without the need for additional laboratory testing providing it is installed using the recommended equipment as described in section II, III and IV. The use of materials (as defined above) with the appropriate construction methodologies and equipment are expected to produce in-situ and constructed structures with hydraulic conductivities of 1×10^{-6} cm/s or less.

6.b.1. Acceptable Particle Size Ranges (by weight):

- Percent Fines ≥ 50 %;
- Clay Content ≥ 15 %;
- Sand Content ≤ 45 %; and

where the fines are defined as the soil fraction which passes through a No. 200 (75- μ m) US standard sieve, and clay and sand are defined in the ASTM D2487-00 standard.

6.b.2. Acceptable Atterberg Limits:

- Plasticity Index (PI): $PI \geq 16$ %
- Liquid Limit (LL): $LL \geq 30$ %

6.b.3. Poorly graded materials with high silt content may not be considered acceptable. Such materials do not compact well and are highly erodible.

6.c. If the distribution of the particle size classes and the Atterberg limits **do not** fall within the acceptable ranges given in Subsection 6.b.2.1 and 6.b.2.2, an alternative design acceptable to the director of Manitoba Conservation will be required.

II) Construction requirements for confined livestock areas: Open Confined Livestock Areas

1 - Open confined livestock areas must be located at least 100 m from any watercourse that is flowing outside the property of the livestock operation or any well, inclusive of the wells currently on the operator's property or planned as part of the confined livestock operation proposal, or the property's boundaries.

2 - Confined livestock areas capable of housing 300 animal units or greater must be designed and certified by a professional engineer licensed to practice in Manitoba.

3 - Open confined livestock area designs must include provisions for preventing upland runoff water from entering into the confined livestock area and means for managing runoff water contaminated with manure. One method for managing contaminated runoff is by intercepting runoff in a collection basin and to land apply very shortly after a runoff event. Other methods will require pre-approval by the director.

4 - The minimum separation distance to the uppermost aquifer, as specified throughout this document, applies to facilities after construction such that cuts and fills must be considered.

5 - Operations located on land in which more than 5 m of overburden having an expected hydraulic conductivity of 1×10^{-6} cm per second or less will separate the lowermost point of the area where manure accumulates from the top of the uppermost underlying aquifer or fractured rock are required to construct the pen area at a 2% slope or greater.

6 - Operations located on land in which an aquifer exists when less than 5 m but more than 2 m of overburden separates the lowermost point of the area where manure accumulates from the top of the uppermost underlying aquifer or fractured rock are subject to the following requirements:

6.a. where the overburden has an expected hydraulic conductivity of 1×10^{-7} cm per second or less, the floor of the confined livestock area must be constructed at a 2% or greater slope;

6.b. where the overburden has an expected hydraulic conductivity between 1×10^{-7} cm per second and 1×10^{-6} cm per second, the floor of the confined livestock area must be constructed at a 3% or greater slope.

6.c. In all situations falling under section 6, the confined livestock areas will be subject to the installation of groundwater monitoring wells located and designed in a manner acceptable to Manitoba Conservation.

7 - Operations located on land in which an aquifer exists when less than 2 m of overburden having an expected hydraulic conductivity of 1×10^{-6} cm per second or less will separate the lowermost point of the area where manure accumulates from the top of the uppermost underlying aquifer or fractured rock will require special design criteria to be submitted by a professional engineer. Groundwater monitoring wells located and designed in a manner acceptable to Manitoba Conservation will be required.

8 - Construction methods for confined livestock areas where earthmoving is necessary for creating slopes that meet the above design requirements:

8.a. topsoil shall be stripped from the area where any slope is to be constructed before excavation and compaction;

8.b. all excavated material shall be placed in 0.15 m lifts and then compacted;

8.c. compaction is to be carried out with a fully ballasted sheepfoot packer, or other compaction equipment approved by the director, to at least 95% of maximum Standard Proctor dry density, determined by testing in accordance with ASTM Standard D698 at a moisture content between 0.9 and 1.2 optimum, and a maximum hydraulic conductivity no more than 1×10^{-6} cm per second.

III) Construction requirements for confined livestock areas: Covered confined livestock areas

1 - Covered confined livestock areas must be located at least 100 m from any watercourse that is flowing outside the property of the livestock operation or any well, inclusive of the wells currently on the operator's property or planned as part of the confined livestock operation proposal, or the property's boundaries.

2 - Confined livestock areas of 300 animal units or greater must be designed and certified by a professional engineer licensed to practice in Manitoba.

3 - Covered confined livestock area designs must include provisions for preventing upland runoff water from entering into the confined livestock area and means for managing any runoff water contaminated with manure.

4 - The minimum separation distance to the uppermost aquifer, as specified throughout this document, applies to facilities after construction such that cuts and fills must be considered.

5 - Operations located on land in which more than 5 m of overburden having an expected hydraulic conductivity of 1×10^{-6} cm per second or less will separate the lowermost point of the area where manure accumulates from the top of the uppermost underlying aquifer or fractured rock are required to ensure that roof water does not infiltrate the soil under the covered confined livestock area. The operation must provide 3-m wide graded slopes around each confined livestock area housing having a minimum grade of 5% away from the building along with any other means necessary to effectively divert roof water away from the sides of the building. The site layout and landscaping must provide for diversion of uncontaminated roof water to watercourses.

6 - Operations located on land in which an aquifer exists when less than 5 m of overburden having an expected hydraulic conductivity of 1×10^{-6} cm per second or less will separate the lowermost point of the area where manure accumulates from the top of the uppermost underlying aquifer or fractured rock are required:

6.a. to ensure that roof water does not infiltrate the soil under the covered confined livestock area. The operation must provide 3-m graded slopes around each confined livestock area housing having a minimum grade of 5% away from the building along with any other means necessary to effectively divert roof water away from the sides of the building. The site layout and landscaping must provide for diversion of uncontaminated roof water to watercourses, and;

6.b. to provide a suitable floor system under the confined livestock area housing to prevent any leaching of liquids or contaminant from the accumulated manure.

IV) Construction requirements for runoff collection basins

1 - A collection basin is short-term containment structure for water contaminated with manure, which remains by definition, manure. Because of the short-term containment intent, a collection basin does not specifically require a construction permit.

1.a. In the event that a collection basin is proposed as part of the construction of a new or expanded confined livestock area requiring a construction permit (ie. housing 300 or more animal units), the terms for the construction of the collection basin will be included in the permit for the confined livestock area.

2 - A collection basin must have a holding capacity of at least 0.075-m and no greater than 0.150-m of runoff from the collection area plus a 0.3-m freeboard.

2.a. A collection basin constructed larger than 0.150-m of runoff holding capacity will be considered a manure storage facility (long-term storage) and be subjected to the requirements for obtaining a permit to construct a manure storage facility.

3 - When proposed as part of a new or expanded confined livestock area, collections basins must be located 100 m away from watercourses, wells and property boundaries.

3.a. When a collection basin is proposed by an operator or ordered by Manitoba Conservation for an existing confined livestock area, the 100 m setback requirement does not apply.

4 - Collection basins proposed on land in which an aquifer exists when less than 2 m of overburden having an expected hydraulic conductivity of 1×10^{-6} cm per second or less will separate the lowermost point of the collection basin from the top of the uppermost underlying aquifer or fractured rock will require special design criteria to be submitted by a professional engineer. Groundwater monitoring wells located and designed in a manner acceptable to Manitoba Conservation will be required.

5 - Construction methods for dykes and any other compacted area are as follows:

5.a. topsoil shall be stripped from the area where any dyke is to be constructed before excavation and compaction;

5.b. all excavated material shall be placed in 0.15 m lifts and then compacted;

5.c. compaction is to be carried out with a fully ballasted sheepfoot packer, or other compaction equipment approved by the director, to at least 95% of maximum Standard Proctor dry density, determined by testing in accordance with ASTM Standard D698 at a moisture content between 0.9 and 1.2 optimum, and a maximum hydraulic conductivity no more than 1×10^{-6} cm per second;

6 - The slopes (inside and outside) and the floor of the collection basin must be completely seeded to flood resistant grasses within one year of construction. The grass stand must be managed so as to protect the collection basin from erosion at all times.