



Best Environmental Management Practices

Farm Animal Production

Land Application of Manure and Environmentally Sensitive Field Characteristics

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Introduction

Selecting an appropriate site to apply manure can directly affect the success of your confined feeding operation. A producer should select a site that can optimize use of manure nutrients and reduce the risk of expensive environmental problems and adverse public relations.

Ensuring that manure application does not degrade water quality should be a primary goal in developing any land application system. Pollutants in manure include pathogens, nutrients (particularly phosphorus and nitrogen), and organic material that can deplete oxygen in surface waters.

Surface waters like rivers, lakes, and streams can be polluted if manure runs off the land surface or reaches tile drains (from open tile intakes or through cracks in dry, fractured soil). The risk is particularly high when manure is applied to land sloping toward a nearby water body or tile intake. Setbacks from surface waters are needed, especially if the slope is steep, if there is little or no plant residue on the surface, or if the ground is frozen or saturated.

Groundwater can be polluted by nitrate and other manure constituents if applications are not managed properly. Risks are higher in karst areas and near shallow wells used for drinking water.

Environmentally Sensitive Areas

Manure should be applied at rates where nutrients can be effectively utilized by the crop to be grown. Fertilizer recommendations consistent with those of Michigan State University and Purdue University and based on soil fertility tests, crop, and expected yield should be followed. This will keep manure nutrient loadings in balance with crop needs. Nevertheless, some areas in a field may be particularly sensitive, requiring additional management practices to avoid polluting surface or groundwater.

1. Public and private water wells

Public water wells are defined as wells for water systems that have at least 15 connections or serve at least 25 people. Examples are wells for towns, mobile home parks, churches, schools, restaurants, etc. Private wells used by a farm or an individual household, or abandoned wells that were not closed properly are usually at a greater risk, particularly if well depths are shallow. See Tables 1 and 2 for setback distances and recommended practices in Indiana and Michigan.

2. Surface water (lakes, ponds, rivers, streams, drainage ditches, etc.)

Perennial streams, which flow continuously, and intermittent streams, which flow only for a short time period after storms, are vulnerable if manure is applied to close. Both can be identified by using U.S. Geological Survey quadrangle maps. (See "Sources of Additional Information.")

3. Sinkholes

Sinkholes are areas in certain landscapes (known as karst) where direct pathways exist from the land surface to groundwater. Manure applied near them can quickly pollute groundwater.

4. Surface drainage inlets – including Water and Sediment Control Basins (WASCOBs)

Open tile intakes allow movement of runoff water into underground tile drains and direct discharge into surface waters. WASCOBs are short earthen dams built across a drainage way that trap sediment and water. A subsurface tile is connected to a riser (vertical) pipe with holes in it to allow the water to drain directly to the tile at a measured rate. Use appropriate setback distances.

5. High P testing soils

When manures are applied to meet all of the nitrogen (N) needs of crops, excess phosphorus (P) will usually be applied. P not used by crops will cause soil P levels to increase. When soil test P levels become too high, mobility of P increases and the risk of nonpoint source pollution of surface waters increases. Therefore, to avoid this risk, manure P loadings should be managed.

In Michigan, the suggested guidance for Bray P1 soil fertility test levels is:

>150 ppm (>300 lb/ac)	do not apply manure
75-150 ppm (150-300 lb/ac)	manure P added should equal crop P removed
<75 ppm (<150 lb/ac)	manure can be applied to supply all crop N needs

Indiana does not yet utilize P guidance, but it may be required as part of an NRCS costshare and in the future with the U.S. EPA rules.

6. Other areas

Setback distances from property lines and public roads may be required or recommended, depending on whether manure is injected or applied to the surface. These are mainly because of odor nuisance concerns rather than water contamination concerns.

Soil should not be too sandy. There should be an adequate vertical separation between the soil surface and underlying bedrock. Where regulations do not specify depth to groundwater, seek guidance from local NRCS offices.

Setbacks from Sensitive Areas

Setback distances from specific areas may be required by state regulations or local ordinances, as in Indiana, or recommended, as with the Right to Farm GAAMPs (Generally Accepted Agricultural and Management Practices) in Michigan. GAAMPs recommend different levels of management depending on size of livestock operation and number of non-farm residences within a half mile of the operation. Protection from nuisance suits can be lost in Michigan if these practices are not followed. Check with your county Extension office, conservation district

office, state water quality agency, or local health department to determine what setback or buffer distances may apply to your farm.

Table 1. Required manure application setbacks for permitted confined feeding operations (CFOs) - Indiana*.

Feature	Injection or Single-Pan Incorporation	Liquid Incorporation to 12" Depth or Dry-Pan Incorporation to 6" Depth	Liquid Surface Application with 12" or 6" Crop Residue	Liquid Surface Application with 6" or 3" Crop Residue
Public water wells & intake structures	500'	500'	500'	500'
Private wells	50'	50'	100'	200'
Surface waters	25'	50'	100'	200'
Sinkholes	25'	50'	100'	200'
Drainage inlets - including WASCOBs	5'	50'	100'	200'
Property lines	0	10'	50'	50'
Public roads	0	10'	50'	50'

*Using CFOs can apply to frozen ground with >2% slope if crop residue or crop cover. Never permitted CFOs must avoid applications on frozen ground if >180 days storage unless established in confined feeding approval from state.

Table 2. Recommended manure application guidelines in Michigan.

Application Condition	Recommended practice
Within 150' of surface waters or areas subject to flooding	<ul style="list-style-type: none"> Inject or surface apply and incorporate within 48 hours. Use conservation practices to protect against runoff & erosion.
Grassed waterways	Avoid
Saturated soils	Avoid
Sloping ground greater than 6%	Inject or surface apply with incorporation within 48 hours.
Frozen and snow-covered soils	<ul style="list-style-type: none"> Least desirable, avoid if possible. Solid manure should only be applied to areas where slopes are 6% or less. Liquid manures should only be applied to soils where slopes are 3% or less. Soil and water conservation practices should be in place to control runoff and erosion.

Recommended Application Practices

If not specified by federal, state, or local regulations, the following are reasonable and generally accepted management practices for manure application. These are called Best Management Practices in Indiana or GAAMPs in Michigan.

Odor

Odor management is critical for livestock producers to demonstrate that they can be a "good neighbor." The following can be helpful in achieving this goal:

- Avoid spreading where the wind blows towards populated areas.
- Avoid spreading on weekends/holidays when people are likely to be engaged in nearby outdoor and recreational activities.
- Spread in the morning when air begins to warm and is rising, rather than in late afternoon.
- Incorporate manure into soil during, or as soon as possible after, application.

Land Application

BMPs in Indiana and GAAMPs in Michigan recommend converting a portion of fields receiving manure into buffer strips to protect surface waters. Recommended or required setback distances for manure application may vary, depending on whether buffer (filter) strips are used. Where regulations do not specify, seek guidance from NRCS or Extension specialists with expertise in soil and water conservation practices.

Manure should not be applied to saturated soils or during rainfall events. When applied to conservation-tilled crops or grassland, the manure can be broadcast, provided the application follows recommended or required practices to avoid surface runoff and erosion.

Manure application to frozen or snow-covered soils should be avoided if possible. In Michigan, follow the guidance in Table 2 and the GAAMPs. In Indiana, existing CFOs can apply on frozen ground only if:

- It is necessary to prevent storage overflow.
- The land is not subject to flooding.
- Land slope is less than 2% or erosion-control BMPs are installed.

Where application of manure is necessary in the fall rather than spring or summer, use the following practices to minimize potential loss of $\text{NO}_3\text{-N}$ by leaching:

- Apply to medium- or fine- rather than to coarse-textured soils.
- Delay applications until soil temperatures fall below 50°F.
- Establish cover crops before or after manure application to help remove $\text{NO}_3\text{-N}$ by plant uptake.

Sources of Additional Information*

Resources for additional information on environmentally sensitive areas and potential land application sites include:

- U.S. Geological Survey maps showing "blue line" streams where regulations may require setbacks. These are available at USDA-NRCS offices, or on the Web at <<http://terraserver.homeadvisor.msn.com>> (type in nearest town and state, click "go", then select "topo map") or <<http://www.topozone.com>>

• Aerial photos can be obtained in hard copy or digitally over the Web. County tax assessor maps are often the most recent, highest resolution source of hard copy aerial photographs. County Soil surveys may have aerial photos that identify types and physical properties of soils. Digital orthophotos (photos that have the properties of a map) are also available from many NRCS offices. You may be able to obtain high quality photos at <<http://terraserver.homeadvisor.msn.com>> (described above) or by entering your address at <<http://www.mapquest.com>> and clicking the "aerial photos" tab. For Indiana, these are also available on CD-ROM (Contact Media Distribution at 1-888-EXT-INFO or <<http://www.agriculture.purdue.edu/agcomm/campus/other/mdc/order.html>>) or at <<http://pasture.ccn.purdue.edu/~caagis>>.

- Michigan's Right to Farm GAAMPs on Manure Management and Utilization
<http://www.michigan.gov/mda>
- Purdue Animal Manure Solutions (PAMS)
<http://www.agriculture.purdue.edu/PAMS>
- NRCS Field Office Technical Guide Standard 393 - Filter Strips

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* References to specific Web sites do not constitute an endorsement by Purdue University or Michigan State University.

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