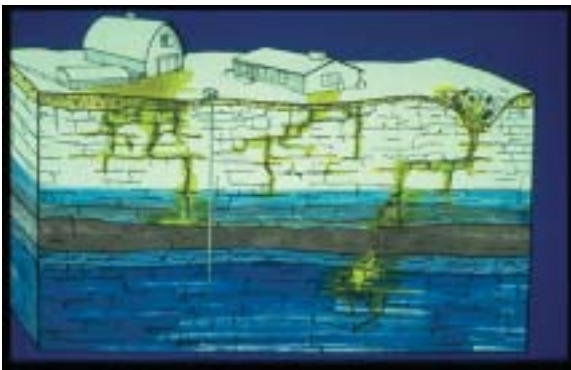


Applying Manure in Sensitive Areas



State requirements and recommended practices to protect water quality

Revised May 2005



Minnesota Pollution Control Agency



Applying Manure in Sensitive Areas



Purpose

This publication describes Minnesota state rule requirements and recommended practices to protect water quality when applying manure in the most common environmentally sensitive areas. All people applying manure, including those who do not need a permit or written manure management plan, are required to follow setbacks and other rules regarding sensitive areas.

Overview

Manure can be a valuable resource or a pollutant. When properly managed and applied, manure supplies nutrients and improves soil properties. But when poorly managed and applied, manure can degrade water quality. Some sites are more vulnerable to contamination of surface or ground water quality, including land near waters or near pathways to water.

Surface water protection. The risk of polluting surface waters increases when manure is applied to high phosphorus soils, steep slopes, or land near lakes, streams, ditches, wetlands, or open tile intakes. Surface runoff can carry phosphorus, microbial pathogens, ammonia, and oxygen-depleting substances. Water quality in sensitive areas can be protected by practices like using immediate incorporation or injection, maintaining setback distances, applying manure less frequently, planting vegetative buffers, and reducing excess nutrient additions.

Ground water protection. Groundwater can be contaminated by microbial pathogens or nutrients from manure. Pathogens can move directly to ground water through cracks in the soil, especially near old wells, mines, quarries, sinkholes, and shallow soils over fractured bedrock. Diverting or filtering runoff before it enters these paths to ground water prevents pollution. Incorporating manure into the soil before runoff occurs also decreases the chances of pollution. Because nitrate leaching through the soil from manure and fertilizer can contaminate ground water, nitrogen must be applied at the proper rate. To further reduce nitrate leaching, manure application should be properly timed, especially in coarse-textured soils and vulnerable lands near public water supply wells.

Rules for applying manure to all land

Several rules apply to all land where manure is applied, regardless of the distance to sensitive areas. For example, state rules limit nitrogen rates on all fields where manure is applied. Estimated plant-available nitrogen from all sources may not exceed expected crop nitrogen needs for non-legumes and expected nitrogen removal for legumes. Manure from all storage areas holding manure from more than 100 animal units must be tested for nutrient content. In addition, for all feedlots where manure management plans are required, manure cannot be applied to bare, harvested fields in June, July, or August unless a cover crop is planted for the remainder of the growing season.

For more information about nitrogen rate limits, manure and soil testing requirements, or manure management plan and record-keeping requirements, see the Minnesota Pollution Control Agency (MPCA) publication *Land Application of Manure—Minimum State Requirements* on-line at www.pca.state.mn.us/hot/feedlot-management.

Storing and stockpiling manure in sensitive areas

State requirements for manure stockpiling or liquid manure storage in sensitive areas are described in Minnesota Rules pts. 7020.2125 and 7020.2100. Information about stockpiling restrictions is at www.pca.state.mn.us/hot/feedlots.html.



Local ordinances

When local ordinances are more restrictive than state rules, the local ordinances must be followed. To find more information about local ordinances that may be more restrictive than state rules, contact your county planning and zoning office.

Recommended practices

Some practices are not required in state and local rules, but are recommended regardless of livestock numbers. For example, sheet, rill and gully erosion should be controlled on all land receiving nutrient applications. Recommended management practices for sensitive areas are noted throughout this publication. The USDA Natural Resources Conservation Service (NRCS) requires many of these management practices as a condition of receiving cost share money for nutrient management. More information about recommended nitrogen practices throughout the state is on-line at www.manure.umn.edu/applied/application.html.

To find out more about identifying and protecting sensitive areas, contact your county University of Minnesota Extension Service, USDA NRCS, soil and water conservation district, planning and zoning office, county environmental services office, or the nearest subdistrict office of the Minnesota Pollution Control Agency.

Finding the Information *You* Need

You will probably not need to read this publication from cover to cover. Turn to the pages describing sensitive areas on your farm and find out:

1. How to identify the sensitive area
2. Minimum state requirements for applying manure in the area
3. Recommended management practices that may also be necessary to receive state/federal cost share payments

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Perennial and intermittent streams

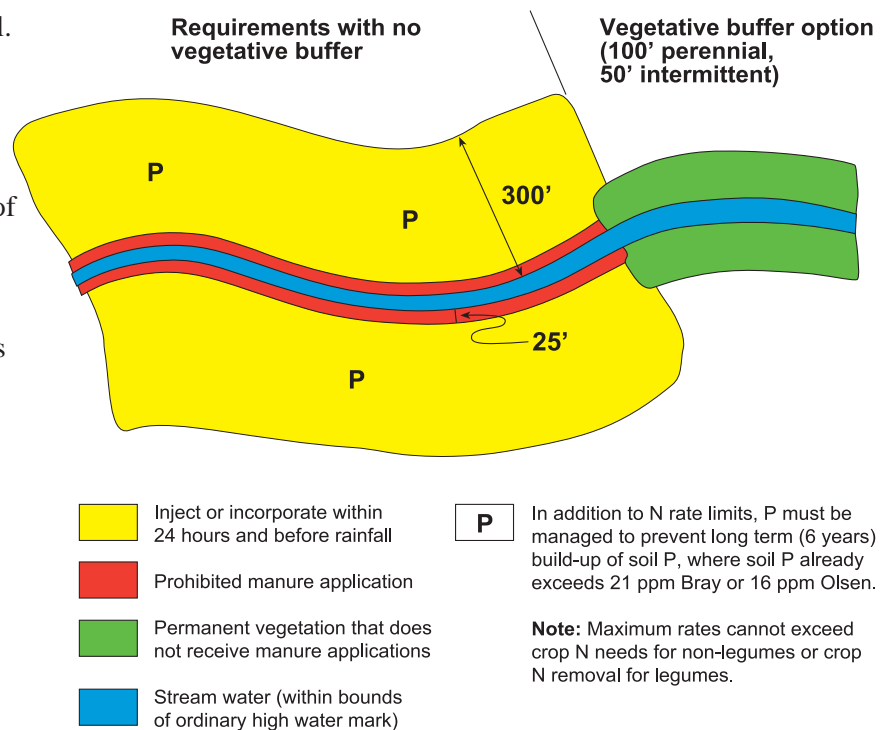
Identifying perennial and intermittent streams

Perennial streams flow continuously. Intermittent streams typically flow after storms or when snow melts, and can flow continuously for extended periods of time. Both are on United States Geological Survey quadrangle maps found at county soil and water conservation district offices or on-line at www.terraserver-usa.com.

Minimum state requirements

- 0 to 25 feet
 - ✓ No manure application is permitted within 25 feet from the ordinary high water level.
- 25 to 300 feet
 - ✓ Inject or incorporate within 24 hours and before rainfall.
 - ✓ Manage phosphorus to prevent long-term build-up of soil P (see page 8: High phosphorus soils).
 - ✓ Do not apply manure to frozen or snow-covered soils in this zone, even if a buffer exists.
 - ✓ Do not apply with irrigation equipment such as a center pivot or traveling gun.
- An interim permit is needed if applying manure from feedlots with more than 300 animal units along streams and intermittent streams where average soil phosphorus levels exceed 75 ppm Bray P1 (or 60 ppm Olsen) or where slopes exceed six percent.

Rule options for non-winter months



Exceptions to state requirements

- Immediate incorporation and phosphorus management are recommended, but not required, if a 100-foot-wide permanent vegetative buffer (non-manured) is planted along perennial streams, or a 50-foot-wide buffer is planted along intermittent streams.
- Requirements for manure application exclude areas of intermittent streams that are maintained as in-field grassed waterways for erosion control.

Recommended voluntary practices

- Phosphorus management and immediate incorporation are recommended on all land that slopes toward streams, even if the land is more than 300 feet from the stream and has vegetative buffers.
- See page 7: Frequently flooded soils.



Lakes and protected wetlands

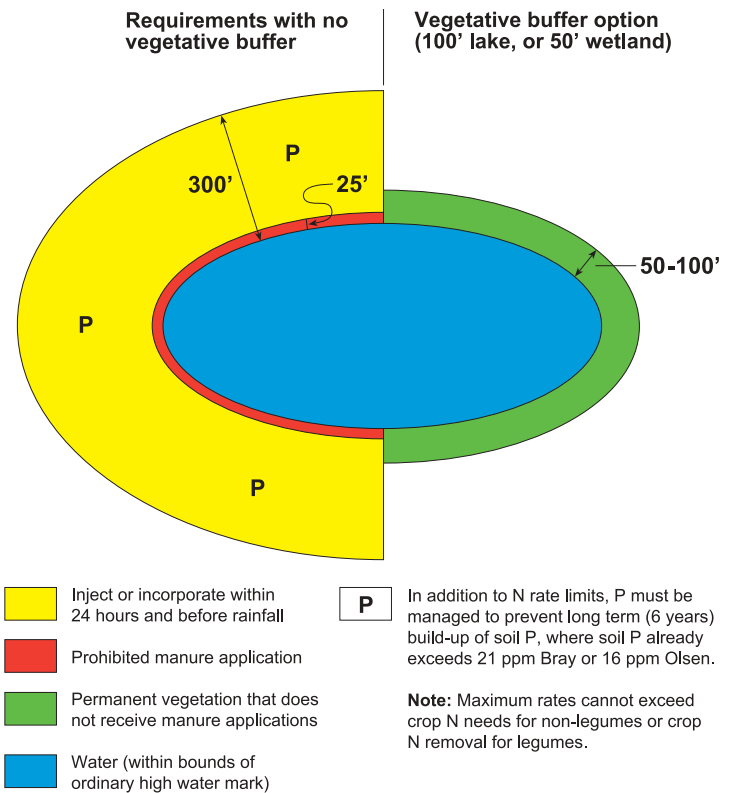
Identifying lakes and protected wetlands

State-required setbacks apply to all protected lakes and wetlands identified on Minnesota Department of Natural Resources protected waters and wetlands maps. Protected wetlands are typically more than ten acres in rural areas. Maps showing protected lakes and protected wetlands are available at local Soil and Water Conservation District offices or on-line at www.dnr.state.mn.us/waters/watermgmt_section/pwi.

Minimum state requirements

- 0 to 25 feet
 - ✓ No manure application is permitted within 25 feet of the ordinary high water level.
- 25 to 300 feet
 - ✓ Inject or incorporate within 24 hours and before rainfall.
 - ✓ Manage phosphorus to prevent long-term build-up of soil P (see page 8: High phosphorus soils).
 - ✓ Do not apply manure to frozen or snow-covered soils in this zone, even if a buffer exists.
 - ✓ Do not apply manure with irrigation equipment such as a center pivot or traveling gun.
- An interim permit is needed if applying manure from feedlots with more than 300 animal units along lakes and protected wetlands where average soil phosphorus levels exceed 75 ppm Bray P1 (or 60 ppm Olsen) or where slopes exceed six percent.

Rule options for non-winter months



Exceptions to state requirements

- Immediate incorporation and phosphorus management are recommended, but not required, if a 50-foot-wide permanent vegetative buffer (non-manured) is planted along the wetland or a 100-foot-wide vegetative buffer is planted along the lake.
- Manure applications are allowed on seasonally saturated soils that are seeded to annual farm crops or crop rotations of perennial grasses or legumes.

Recommended voluntary practices

- Phosphorus management and immediate incorporation are recommended on all land that slopes toward lakes or wetlands, even if the land is more than 300 feet from the lake or wetland and even if the wetland is not considered a DNR-protected wetland.
- See page 8: High phosphorus soils.



Drainage ditches

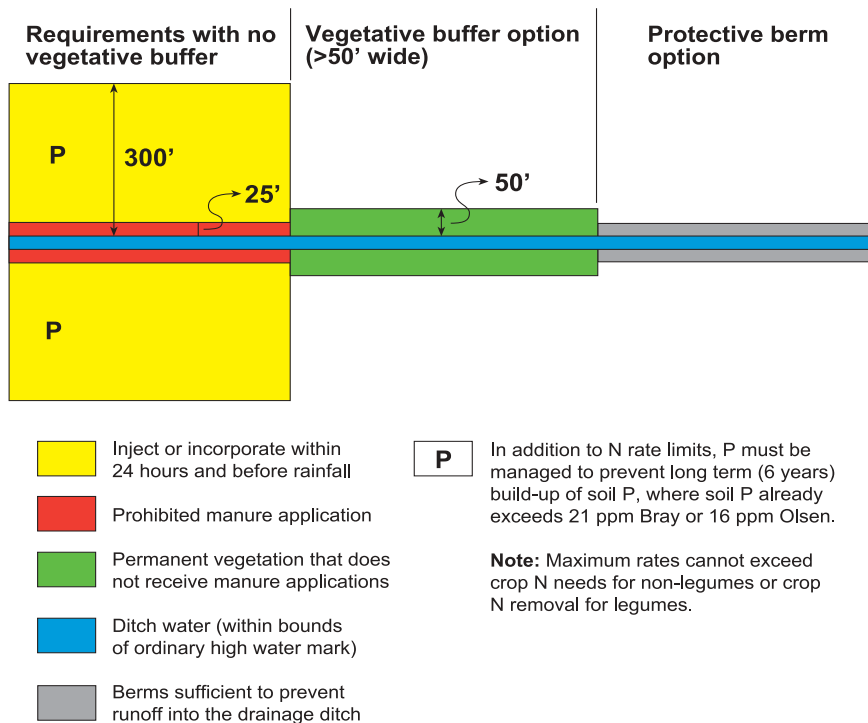
Identifying drainage ditches

These requirements apply to edge-of-the-field drainage ditches shown on United States Geological Survey quadrangle maps and other ditches constructed after the maps were developed. The maps can be found at county Soil and Water Conservation District offices or on-line at www.terraserver-usa.com.

Minimum state requirements

- 0 to 25 feet
 - ✓ No manure application is permitted.
- 25 to 300 feet
 - ✓ Inject or incorporate within 24 hours and before rainfall.
 - ✓ Manage phosphorus to prevent long-term build-up of soil P (see page 8: High phosphorus soils).
 - ✓ Do not apply manure to frozen or snow-covered soils in this zone, even if a buffer exists.
 - ✓ Do not apply manure through irrigation equipment such as a center pivot or traveling gun.
- An interim permit is needed if applying manure from feedlots with more than 300 animal units along drainage ditches where average soil phosphorus levels exceed 75 ppm Bray P1 (or 60 ppm Olsen) or where slopes exceed six percent.

Rule options for non-winter months



Exceptions to state requirements

- These practices are not required if an earthen berm along the drainage ditch prevents runoff into the drainage ditch. If drainage water enters side inlets through the berm, the practices are required.
- Immediate incorporation and phosphorus management are recommended, but not required, if a permanent vegetative buffer (at least 50 feet wide and non-manured) is planted along the ditch.

Recommended voluntary practices

- Phosphorus management and immediate incorporation are recommended on all land that slopes toward drainage ditches, even if the land is more than 300 feet from the ditch and a vegetative buffer is planted.
- See page 8: High phosphorus soils.



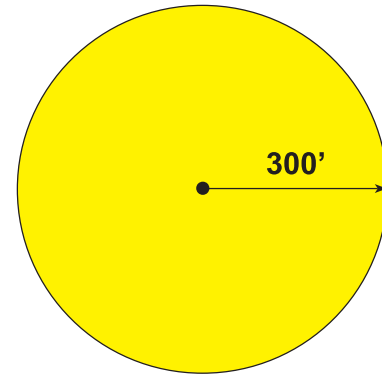
Open tile intakes

Identifying open tile intakes

Open tile intakes include man-made openings in the ground that move unfiltered and untreated runoff waters into underground pipes, which discharge the runoff into ditches or other surface waters.

Minimum state requirements

- Inject or incorporate manure within 24 hours.
- An interim permit is needed if applying manure from feedlots with more than 300 animal units within 300 feet of open tile intakes where average soil phosphorus levels exceed 75 ppm Bray P1 (or 60 ppm Olsen) or where slopes exceed six percent.




Open tile intake

Exceptions to state requirements

- NPDES permit conditions must be followed when they are more restrictive than minimum state requirements.

Recommended practices

- Phosphorus management and immediate incorporation are recommended on all land that slopes toward open tile intakes, even if the land is more than 300 feet from the intake.

 Inject or incorporate within 24 hours and before rainfall

Note: Maximum rates cannot exceed crop N needs for non-legumes or crop N removal for legumes.



Steeply sloping land

Identifying steeply sloping land

Slopes of more than six percent are identified on soil survey maps with the letter C or D after the soil name. Slopes between two and six percent are identified with the letter B after the soil name. Soils with slopes of more than six percent are listed in the table “Sensitive Soil Features for Nutrient Management” available at NRCS offices and on-line at www.mn.nrcs.usda.gov/technical/ecs/nutrient/assessment/assessment.htm.

Minimum state requirements

- An interim feedlot permit is needed if manure from facilities with more than 300 animal units is to be applied regularly to soils within 300 feet of lakes, streams, intermittent streams, DNR-protected wetlands, and open tile intakes *with slopes of more than six percent*.
- NPDES permitted feedlots must follow winter-time slope restrictions of 2% (liquid) and 6% (solid), or as required in the permit.

Recommended voluntary practices

- Avoid applying manure on land where gully erosion is not controlled.
- Control sheet and rill soil losses (< 2-5 tons/acre/year) when manure is applied to steep slopes.
- Avoid winter application to steep slopes if possible. Use contour tillage if winter application is planned. (Required for NPDES permitted feedlots.)



Road ditches

Identifying road ditches

Road ditches are low-lying areas next to roads that could become channels for storm water or melted snow. If a road ditch is identified on United States Geological Survey quadrangle maps as an intermittent stream, follow requirements for intermittent streams on page 3.

Minimum state requirements

- No manure application directly into road ditches, including all land from the lowest point in the channel to the crests of ditch banks.

Recommended voluntary practices

- After storms or when snow melts, a road ditch can become a flowing channel that carries pollutants to waters. Consider using the same protective management practices as for “Perennial and intermittent streams” (page 3) when applying manure near road ditches.

Frequently flooded soils

Identifying frequently flooded soils

Frequently flooded soils (flooded 50-100 times in 100 years) are identified on soil surveys, listed in the table “Sensitive Soil Features for Nutrient Management” available at NRCS offices and on-line at www.mn.nrcs.usda.gov/technical/ecs/nutrient/assessment/assessment.htm.

Minimum state requirements

- No specific state requirements are set for applying manure on frequently flooded soils. Nitrogen rate limits (based on expected yields) pertain to all soils where manure is applied. Nutrient rate requirements are described in the publication *Land Application of Manure: Minimum State Requirements*, which can be found on-line at www.pca.state.mn.us/hot/feedlot-management.

Recommended voluntary practices

- Avoid manure application during peak flooding periods.
- Avoid manure application when the ground is frozen, snow-covered, or actively thawing.
- Immediately incorporate manure when there is risk of flooding.

High water table soils

Identifying high water table soils

Soils with water tables of two feet or less in depth are identified on the table “Sensitive Soil Features for Nutrient Management” available at NRCS county offices (along with soil survey information showing water table depths) and on-line at www.mn.nrcs.usda.gov/technical/ecs/nutrient/assessment/assessment.htm.

Minimum state requirements

- No specific state requirements are set for manure application onto high water table soils.

Recommended voluntary practices

- To reduce the chance of bacteria moving into ground water, select fields and manure application techniques that maximize the separation between applied manure and the water table. Try to keep at least a 24-inch separation above seasonal high water tables.

High phosphorus soils

Identifying high phosphorus soils

High phosphorus soils can be identified through a soil sampling and testing program. Soil sampling techniques are described on the nutrient management page at www.manure.coafes.umn.edu/applied/soil_testing. Laboratories that analyze for soil phosphorus can be found at www.mda.state.mn.us (go to “MDA A to Z” and click on “S” and “Soil Testing Laboratories”).

Minimum state requirements

- Required phosphorus management practices for manure from all feedlots are summarized in the table below. The phosphorus levels refer to field average.
- Soil phosphorus testing is required by cropland managers when manure is applied from feedlots with 300 or more animal units (including when manure ownership is transferred).

Bray P1 (ppm)*	< 22	22 – 75	76 – 150	> 150
Olsen (ppm)*	< 17	17 – 60	61 – 120	> 120
More than 300 ft from lakes, streams, intermittent streams, protected wetlands, or unbermed drainage ditches	No phosphorus management requirements	No phosphorus management requirements	No phosphorus management requirements unless within 300 ft of tile intakes.	***Permit needed if manure is from feedlot with more than 300 au
Less than 300 ft from lakes, streams, intermittent streams, protected wetlands, or unbermed drainage ditches	No phosphorus management requirements	**Prevent long-term build-up of soil P	**Prevent long-term build-up of soil P ***Permit needed if manure is from feedlot with more than 300 au	**Prevent long-term build-up of soil P ***Permit needed if manure is from feedlot with more than 300 au

*If soil P test results are reported in lb/acre, divide by 2 for approximate levels in ppm (e.g., 200 lb/acre = 100 ppm). If a Mehlich III test is used (instead of Bray P1 or Olsen), then the values in the table columns are roughly <30, 31-90, 91 to 180, and over 180.

** The rate and frequency of manure applications must not allow soil phosphorus build-up over any six-year period. Single-year applications can be based on crop nitrogen needs if excess phosphorus is removed by subsequent crops. Depending on the crop, soil type, and manure nutrient levels, soil P build-up can usually be prevented when applying manure one to three times over a six-year period. Phosphorus build-up is not prohibited if a vegetative buffer is planted along the water (see exceptions).

*** Interim permit applications must include a manure management plan that describes how phosphorus will be managed to prevent pollution from phosphorus transport. Options include reducing frequency/amount of application, changing feed or feed additives to reduce phosphorus in manure, soil conservation practices, and planting crops to remove excess phosphorus. The Minnesota Phosphorus Index or NRCS 590 Standard can be used to demonstrate adequate protection of waters.

Exceptions to state requirements

Phosphorus is allowed to build up to 75 ppm Bray P1 or 60 ppm Olsen on soils within 300 feet of waters if a permanent, non-manured, vegetative buffer is established along the water. The vegetative buffer must be a minimum of 100 feet wide along lakes and streams and 50 feet wide along intermittent streams, wetlands and unbermed drainage ditches.

Recommended voluntary practices

- Begin manure applications on soils with lower phosphorus levels and use all available acres.
- Avoid build-up of soil phosphorus once levels reach the point where additional phosphorus seldom increases crop yield (21 ppm Bray P1 and 16 ppm Olsen).
- Avoid continuous annual manure applications onto soils with phosphorus levels of more than 75 ppm Bray P1 (60 ppm Olsen) regardless of the distance to waters.
- Avoid manure applications to soils with phosphorus levels of more than 150 ppm.
- Increase soil erosion control measures as phosphorus levels increase. For example, control erosion to less than 4 tons per acre per year on fields with phosphorus levels exceeding 21 ppm Bray P1 (16 ppm Olsen).
- Use grain types and feed additives that reduce phosphorus in manure.
- Inject or incorporate manure within 24 hours and prior to rainfall.
- Plant field edge vegetative filter strips.

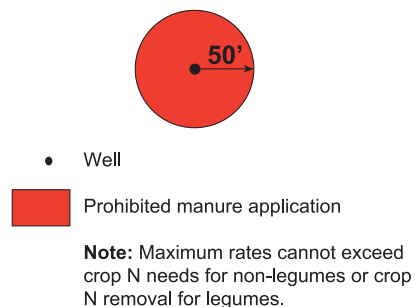
Wells and wellhead protection areas

Identifying wells and wellhead protection areas

Wells include all active wells and inactive wells that have not been sealed in accordance with Minnesota Department of Health (MDH) requirements. Wellhead protection areas include all land supplying water to a public water system, through which potential contaminants are likely to move and reach the well. Drinking Water Supply Management Areas (DWSMAs) encompass the technically defined wellhead protection area and have identifiable landmarks as boundaries. To identify DWSMAs, contact the local public water supplier or the MDH at (800) 818-9318 or on-line at www.health.state.mn.us/divs/eh/water/swp/swa.

Minimum state requirements

- Maintain a 50-foot setback when applying manure.
- Nitrogen rate limits (based on expected yields) pertain to all soils where manure is applied. Nutrient rate requirements are described in the publication *Land Application of Manure: Minimum State Requirements* found on-line at www.pca.state.mn.us/hot/feedlot-management.
- Detailed manure application records must be kept when feedlots with 100 or more animal units apply manure in a DWSMA where the aquifer has been determined to be vulnerable in the local wellhead protection plan.
- An interim permit is needed if manure from facilities with more than 300 animal units is to be applied regularly in a DWSMA where the well and area are designated vulnerable. The permit application must include a manure management plan.



Exceptions to state requirements

- The required set back increases to 100 ft. for agricultural wellheads in fields managed by NPDES permit holders.

Recommended voluntary practices

- Inject or immediately incorporate all manure applied to land where runoff waters may flow toward active wells that are not properly grouted or inactive wells that are not properly sealed.
- Delay manure applications in the fall until average daily soil temperatures at a six-inch depth are below 50 degrees F (to maintain nitrogen in forms that generally do not leach).
- Divert field runoff away from wells, especially old or poorly constructed wells.

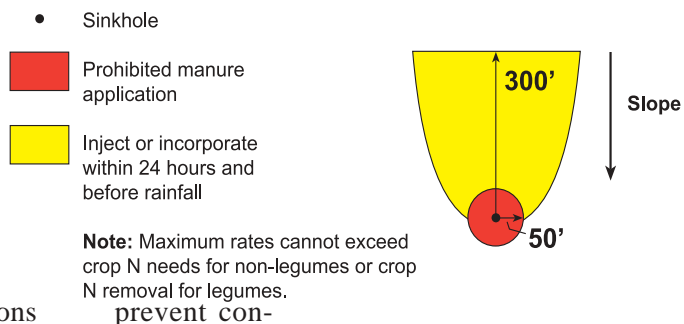
Sinkholes

Identifying sinkholes

Sinkholes are surface depressions caused by a collapse of soil or overlying formation above fractured or cavernous bedrock. For the purposes of manure application restrictions only, sinkholes include easily recognizable depressions in the landscape.

Minimum state requirements

- Maintain a 50-foot setback from the edge (100 ft. for NPDES permitted feedlots).
- Inject or immediately incorporate when applying manure within 50 to 300 feet on the upslope side of a sinkhole.



Exceptions to state requirements

- Incorporation is not required if berms or diversions terminated runoff from entering the sinkhole.

Recommended voluntary practices

- Divert field runoff from sinkholes (where needed to protect water quality), or plant vegetative filter strips on the upslope side of sinkholes.

Coarse-textured soils

Identifying coarse-textured soils

Coarse-textured soils include all soils identified in soil surveys as a sand, loamy sand, loamy coarse sand, fine sand, loamy fine sand, loamy very fine sand, very fine sand, or any soil modified by the word “gravelly.” If a soil is questionable, refer to soil survey manuals found at the county Soil and Water Conservation District office. Additionally, coarse-textured soil mapping units are identified on the table “Sensitive Soil Features for Nutrient Management” available at NRCS county offices and on-line at www.mn.nrcs.usda.gov/technical/ecs/nutrient/assessment/assessment.htm.

Minimum state requirements

- At NPDES permitted feedlots, fall application onto fields with more than 1/3 coarse-textured soils must be delayed until soil temperatures in the upper six inches are less than 50° F.
- Nitrogen rate limits (based on expected yields) pertain to all soils where manure is applied.

Recommended voluntary practices

- Avoid fall applications to coarse-textured soils whenever possible. If fall application is necessary, wait until average daily soil temperatures at a six-inch depth are below 50 degrees F.

Shallow soils over bedrock

Identifying shallow soils over bedrock

Areas with bedrock less than or equal to 40 inches deep are identified in the table “Sensitive Soil Features for Nutrient Management” available at NRCS county offices and on-line at www.mn.nrcs.usda.gov/technical/ecs/assessment/assessment.htm. Metal rods or soil probes can also verify whether fractured bedrock is within two feet of the ground surface.

Minimum state requirements

- No specific state requirements are set for manure application onto shallow soils over fractured bedrock.

Recommended voluntary practices

- To reduce the chance of bacteria moving into ground water, select fields and manure application techniques that maximize the separation between applied manure and fractured bedrock. Try to keep at least a 24-inch soil separation above bedrock.
- Avoid fall applications to areas with shallow soils over bedrock if possible. If fall application is necessary, wait until average daily soil temperatures at a six-inch depth are below 50 degrees F.

Mines and quarries

Identifying mines and quarries

Mines and quarries include human excavations to remove stone, gravel, sand, iron, or other minerals.

Minimum state requirements

- Maintain a 50-foot setback for manure application from the edge of the mine or quarry.

Recommended voluntary practices

- Within 300 feet upslope of the mine or quarry, inject or incorporate manure within 24 hours of rainfall or runoff.
- Divert runoff waters from entering the mine or quarry.
- Plant vegetative buffers around mines or quarries.

MINIMUM STATE REQUIREMENTS FOR MANURE APPLICATION IN SENSITIVE AREAS

Sensitive Areas	Winter Setbacks	Non-Winter Setbacks			Other Requirements
		A: Surface Application	B: Incorp. + P mgmt	C: Incorp. NO P mgmt	
Streams/inter. streams	300'	*300'	25'	*300'	
Lakes and wetlands	300'	*300'	25'	*300'	
Drainage ditches	300'	*300'	25'	*300'	
Open tile intakes	**300'	**300'	0'	0'	
Steeply sloping land	—	—	—	—	Permit may be needed
Road ditches	—	—	—	—	No application into ditch
Frequently flooded soils	—	—	—	—	Consider in mgmt. plan
High phosphorus soils	—	—	—	—	Permit may be needed No P build-up at some sites
High water table soils	—	—	—	—	Consider in mgmt. plan
Wells/wellhead protection	50'	50'	50'	50'	Permit may be needed
Sinkholes (without berms or diversions)	50' down 300' up	50' down 300' up	50'	50'	
Coarse-textured soils	—	—	—	—	Consider in mgmt. plan
Shallow soils over bedrock	—	—	—	—	Consider in mgmt. plan
Mines and quarries	50'	50'	50'	50'	

A = Surface application with NO incorporation within 24 hours

B = Injection or incorporation within 24 hours AND phosphorus management***

C = Injection or incorporation within 24 hours with NO phosphorus management***

— = No specific requirements.

*Setbacks can be reduced from 300' to either 100' (lakes and perennial streams) or 50' (wetlands, drainage ditches, and intermittent streams) if permanent vegetative buffers that are at least 100 and 50 feet wide are planted along the waters.

The 300' open tile intake setback for non-incorporated surface application of **solid manure is exempted until 2005.

***Phosphorus management means that the application rate and frequency over six-year periods will not result in soil P build-up where soil P already exceeds 21 ppm Bray P1 or 16 ppm Olsen.

This publication was developed by the Minnesota Pollution Control Agency and the USDA Natural Resources Conservation Service with the assistance of the University of Minnesota Extension Service.

Photographs provided by the Minnesota Pollution Control Agency, the USDA Natural Resources Conservation Service, and the University of Minnesota Extension Service

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