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HOME•A•SYST
HOMESTEAD ASSESSMENT SYSTEM

EM 8596 • July 1995 **Worksheet**

Assessing the Risk of Groundwater Contamination from Livestock Manure Management

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Why should I be concerned?

Manure in solid and liquid forms is used as a fertilizer and soil amendment on many farms. It can supply some of the nutrient requirements of crops and is a valuable soil conditioner when properly applied. Manure can be a source of nitrogen, phosphorus, salts, and bacteria. These materials can be beneficial to the soil when managed appropriately.

Unlike commercial fertilizers, manure has no guaranteed analysis. The amount of nutrients in manure cannot be changed so that exact nutrient amounts always are applied. Also, applying the plant-limiting nutrient in amounts needed for best crop production may overapply other nutrients.

Overapplication of nutrients can adversely impact surface and groundwater. Of special concern is nitrogen, which converts to nitrate, the plant-available form. Nitrate ions are soluble and are extremely mobile in saturated soils. Both nitrogen and phosphorus can cause problems if carried into surface water bodies such as streams and lakes. These nutrients stimulate growth of aquatic plants and can limit fish survival.

Drinking water with nitrate concentrations above federal drinking water standards of 10 milligrams per liter (mg/l) nitrate nitrogen can cause health problems for infants under 6 months old, including the condition known as methemoglobinemia (blue baby syndrome). Nitrates also can affect adults, but the evidence is less certain, and concentrations need to be much higher to have an impact.

Young livestock also are susceptible to health problems due to high nitrate levels. While livestock may be able to tolerate several times the 10 mg/l nitrate nitrogen concentration specified for household water supplies, concentrations of 20–40 mg/l may prove harmful, especially in combination with high levels of nitrate nitrogen (1,000 mg/l) in the feed.

Fecal bacteria in livestock manure can contaminate drinking or recreational water, causing infectious diseases such as dysentery, typhoid, and hepatitis. Organic materials that lend an undesirable taste or odor to drinking water are not known to be dangerous, but their presence does suggest that other contaminants also are likely to be present.

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How will this worksheet help me protect my drinking water and the surface streams in the area?

- It takes you step by step through your manure handling process.
- It ranks your activities according to how they might affect the groundwater that serves as your drinking water source.
- It provides you with easy-to-understand rankings that will help you analyze the "level of risk" of your manure management practices.
- It helps you determine which of your practices are reasonably safe and effective and which may require modification to better protect the safety and security of your drinking water supply and nearby streams.

How do I complete the worksheet?

Follow the directions at the top of the chart on the next page. It should take you about 15–30 minutes to complete this worksheet and determine your ranking.

Glossary

Manure Management

These terms may help you make more accurate assessments when completing the worksheet. They also may help clarify some of the terms used in the fact sheet.

Continuous cropping: Immediately following the harvesting of one crop by planting the next crop.

Cover crop: Crop used to reduce erosion and/or provide green manure to the main crop (if simultaneously grown) or the subsequent crop if grown during the fallow season.

Evapotranspiration: The combined processes of evaporation of water from the soil and plant surfaces and transpiration of water by the crop.

Limiting nutrient: The nutrient that limits the plant's ability to grow, or nutrients identified as causing adverse environmental impact if introduced into a waterway.

Scavenger crop: Crop used to capture excess soil nutrients. The scavenger crop is subsequently harvested.

Seasonal cropping: Following the harvesting of one crop by a fallow period before planting the next crop.

Worksheet

Livestock Manure Management: Assessing the Surface and Groundwater Contamination Risks

1. Use a pencil. You may want to make changes.
2. For each category listed on the left that is appropriate to your manure management practice, read across to the right and circle the statement that **best** describes conditions on your operation. (Skip and leave blank any categories that don't apply.)
3. Next, look above the description you circled to find the "rank number" (4, 3, 2, or 1). Enter that number in the blank under "your rank."
4. Directions on overall scoring appear at the end of the worksheet.
5. Allow about 15 to 30 minutes to complete the worksheet and figure out your risk ranking for manure management.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Manure production and cropland available	All manure transported off the farm.	Sufficient cropable land available for manure distribution.	Inadequate cropland for manure distribution; no manure transported off farm; no commercial fertilizer applied.	Inadequate cropland for manure distribution; no manure transported off farm; some commercial fertilizer applied.	____
Capacity of farmsite to receive additional nutrients	Farmsite and watershed have no identified limiting nutrients.	Watershed has identified limiting nutrient.	Farmsite has elevated content of an environmentally limiting nutrient.	Farmsite and watershed have excessive amounts of environmentally limiting nutrients.	____
Evaluation of site for land application					
Depth to water table being used as water source	More than 100 feet.	50–100 feet.	20–50 feet.	Less than 20 feet.	____
Application site soil texture	Well-drained medium- or fine-textured soils (loam, silt-loam, clay-loam, or clay).	Well-drained or moderately well-drained medium- or fine-textured soils.	Moderately well-drained coarse textured soils (sands or sandy loam).	Excessively well-drained coarse-textured soils (sands, sandy loam, or gravels).	____
Application site surface slope	Less than 1 percent.	1–5 percent.	5–10 percent.	Greater than 10 percent.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Evaluation of site for land application (continued)					
Application site soil depth to impermeable layer or groundwater	More than 40 inches.	30–40 inches.	20–30 inches.	Less than 20 inches.	____
Application site surface cover and shaping	Dense vegetation cover, good erosion control.	Moderate vegetation, limited erosion control.	Moderate vegetation, limited water-retention capacity.	Minimal vegetation cover, no other water-retention provisions.	____
Distance and slope to well and soil type	More than 100 feet and uphill to well. Fine- to medium-textured soil.	More than 50 feet and uphill or level grade to well. Fine- to medium-textured soil.	More than 50 feet and downhill to well. Medium- to coarse-textured soil.	Less than 50 feet and downhill to well. Medium- to coarse-textured soil.	____
Distance and slope to surface water	More than 50 feet of vegetated filter strip with a slight slope or at grade.	20–50 feet of vegetated filter strip with a slight slope or at grade.	Less than 20 feet of vegetated filter strip or steeply sloped strip.	No buffer or filter strip available.	____
Storage site					
Dry manure (cover)	Covered on impermeable surface, rainfall diverted.	Covered on clay or other low permeability soil. Rainfall diverted.	Partially covered on slightly permeable soil, runoff collected.	No cover on permeable soil.	____
Dry manure (runoff)	No runoff, rainfall on adjacent area diverted.	No runoff, most rainfall diverted.	Runoff collected.	Runoff not collected.	____
Liquid or slurry	Concrete or other impermeable lined/walled. Side wall and bottom integrity maintained.	Earthen structure, low permeability soil liner. Side wall and bottom integrity maintained.	Earthen structure, low permeability soil liner. Obvious cracks and holes for leakage or discharge.	Permeable earthen structure with evidence or the possibility of leakage or discharge.	____
Storage volume	More than 180 days.	90–180 days.	30–90 days.	Less than 30 days.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Water application (irrigation plus rainfall plus liquid manure)	Total amount approximately equal to evapotranspiration and plant needs.	Frequent applications during dry season with total no more than 120 percent of plant use.	Infrequent application with total no more than 125 percent of plant use.	Heavy application with runoff or deep percolation (intermittently saturated soil).	____
Nutrient application and credits					
Frequency of manure analysis	Sample and use results prior to each land application.	Sample and use results once each year.	Use handbook values for nutrient content.	No nutrient analyses being used.	____
Frequency of soil testing	Before each crop from each field; results indicate all applied nutrients are needed.	Annual testing; results indicate some nutrients are needed.	Testing less frequent than annually. At least one major nutrient needed.	No soil tests, or results indicate that manure will be excess nutrient.	____
Frequency of irrigation water nutrient analysis	Annual.	Every 3 years.	Every 5 years.	Rarely done.	____
Other nutrient sources—fertilizer, sludge, compost, or residue	All tested; nutrients credited.	Use published values and take credit for organic and commercial products.	Take credit for only commercial fertilizer.	No nutrient management plan for these products.	____
Method to determine total nutrient application rates	Use previous crop yields and nutrient status prior to nutrient application.	Use regional nutrient yield values for crops of interest.	Use textbook values for nutrient requirements.	Plant nutrient requirements are not considered.	____
Water-holding capacity of soil	Medium to high capacity to hold water.	Low to medium capacity to hold water.	Low capacity or saturated soil.	Saturated soil with standing water present.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
Method to determine manure application rates	Calculate for specific fields considering plant nutrient needs, soil tests, and anticipated yield.	Use regionally recommended application rates.	Apply manure to achieve adequate supply of limiting nutrient.	Use land for manure disposal without considering plant needs or other sources.	____
Timing of application					
Nature of cropping system	Year-round or continuous cropping.	Seasonal cropping with scavenger or cover crops.	Shallow-rooted row crops followed by fallow land.	Fallow or unmanaged land.	____
Frequency of nutrient application (includes manure and other nutrients)	Multiple applications of nutrients during the growing season.	Single application of nutrients timed to meet plant requirements.	Nutrients applied independently of plant needs.	Single or multiple nutrient applications that exceed crop use.	____
Distribution of manure solids on land	Uniform application, equipment calibrated annually.	Uniform application, equipment calibrated every 2 years.	Nonuniform; equipment calibrated every 2 years.	Nonuniform; equipment not calibrated.	____
Incorporation of manure into the soil	Knifing or injecting into the soil as the means of application.	Surface application followed by incorporation within 24 hours.	Surface application with no mechanical incorporation. Soil has high water-holding capacity.	Surface application with no mechanical incorporation. Soil is saturated or has low capacity to hold water.	____

TOTAL ☐

Use this total to calculate risk ranking on page 7.

What do I do with these rankings?

Step 1: Begin by determining your overall manure application risk ranking. Total the rankings for the categories you completed and divide by the number of categories you ranked:

_____ divided by _____ equals [ ]*

total of rankings | # of categories ranked | risk ranking

*Carry your answer out to one decimal place.

3.6-4 = low risk 2.6-3.5 = low to moderate risk 1.6-2.5 = moderate to high risk 1-1.5 = high risk

This ranking gives you an idea of how your manure application practices, **as a whole,** might affect your drinking water. This ranking should serve only as a **very general guide**, **not a precise diagnosis.** Because it represents an **average** of many individual rankings, it can mask individual rankings (such as 1's or 2's) that should be of concern.

Step 2: Look over your rankings for individual activities:

- **Low risk** practices (4's): ideal; should be your goal
- **Low to moderate risk** practices (3's): provide reasonable water quality protection
- **Moderate to high risk** practices (2's): provide inadequate protection in many circumstances
- **High risk** practices (1's): inadequate; pose a high risk of polluting your water supply or that of a neighbor. You may be held responsible.

Regardless of your overall risk ranking, any individual ranking of "1" requires immediate attention. Some concerns you can take care of right away; others could be major or costly projects requiring planning and prioritizing before you take action.

Step 3: Read *Fact Sheet: Improving Livestock Yards Management*, and consider how you might modify your farmstead practices to better protect your local water supply.

Information derived from Home•A•Syst worksheets is intended only to provide general information and recommendations to homeowners regarding their own home practices. It is not the intent of this educational program to keep records of individual results.

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