K-STATE Kansas State University

FARM•A•SYST
Farmstead Assessment System

Worksheet 7

Assessing the Risk of Groundwater Contamination from
Animal Waste Management

Why should I be concerned?

Careful handling of wastes from animal production makes it possible to receive some benefit from these wastes. Improperly managed wastes, however, can contribute nutrients and disease causing organisms to both surface water and groundwater.

Nitrate levels in drinking water above federal and state drinking water standards of 10 milligrams per liter (mg/l; equivalent to parts per million for water measure) nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Young livestock are also susceptible to health problems from high nitrate-nitrogen levels. Levels of 20-40 mg/l in the water supply may prove harmful, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Microorganisms in livestock waste can contaminate groundwater, causing such infectious diseases as dysentery, typhoid and hepatitis. Organic materials that lend an undesirable taste and odor to drinking water are not known to be dangerous to health, but their presence does suggest that other contaminants may be flowing into groundwater.

The goal of Farm•A•Syst is to help you protect the groundwater that supplies your drinking water.

How will this worksheet help me protect my drinking water?

- It will take you step by step through your animal waste management practices.
- It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- It will provide you with easy-to-understand rankings that will help you analyze the "risk level" of your animal waste management practices.
- It will help you determine which of your practices are reasonably safe and effective, and which practices might require modification to better protect your drinking water.

How do I complete the worksheet?

Follow the directions at the top of the chart on the page three. It should take you about 15–30 minutes to complete this worksheet and figure out your rank.

Glossary

Animal Waste Management

These terms may help you make more accurate assessments when completing Worksheet 7. They may also help clarify some of the terms used in Fact Sheet 7.

Concrete stave storage: A type of liquid-tight animal waste storage structure. Located on a concrete pad, it consists of concrete panels bound together with cable or bolts and sealed between panels.

Earthen basin or pit: Clay-lined manure storage facility constructed according to specific engineering standards. Not simply an excavation.

Engineering standards: Design and construction standards available at Soil Conservation Service (SCS) or Extension offices, or from the Kansas Department of Health and Environment (KDHE). These standards may come from SCS technical guides, state regulations or land grant university engineering handbooks.

Glass-lined steel storage: A type of liquid-tight, above-ground animal waste storage structure. Located on a concrete pad, it consists of steel panels bolted together and coated inside and outside with glass to provide corrosion protection.

Holding pond: A storage area, usually earthen, where lot runoff, lagoon effluent, and other dilute wastes are stored before final disposal. It is not designed for treatment.

Infiltration: The downward entry of water through the soil surface.

Percolation: The downward movement of water through the soil.

Poured concrete storage: A type of liquid-tight animal waste storage structure. Located on a concrete pad, it consists of poured concrete reinforced with steel.

Runoff control system: A combination of structural, vegetative and management practices that may be used to prevent water pollution resulting from livestock lot runoff. Practices may include diversion of runoff from lots, roof runoff control systems, lot shaping, settling basins, vegetative filters or holding ponds.

Settling basin: Allows separation of liquid and solid wastes by settling out solid wastes for subsequent field application.

Soil drainage class: The conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soils, as opposed to human-altered drainage. Different classes are described by such terms as “excessively drained,” “well-drained,” and “poorly drained.”

Soil permeability: The quality that enables the soil to transmit water or air. Slowly permeable soils have fine-textured materials, like clays, that permit only slow water movement. Moderately or highly permeable soils have coarse-textured materials, like sands, that permit rapid water movement.

Soil texture: The relative proportions of the various soil separates (clay, sand, silt) in a soil. Described by such terms as “sandy loam” and “silty clay.”

Vegetative filter: A gently sloping grass plot used to filter runoff from the livestock lot and some types of solid manure storage systems. Influent waste is distributed uniformly across the high end of the strip and allowed to flow down the slope. Nutrients and suspended material remaining in the runoff water are filtered through the grass, absorbed by the soil and ultimately taken up by plants. Filter strips must be designed and sized to match the characteristics of the livestock lot or waste storage system.

Worksheet 7

Animal Waste Management: Assessing Drinking Water Contamination Risk

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

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
LOCATION OF ANIMAL LOTS AND WASTE HANDLING FACILITIES					
1. **Distance from drinking water well**	More than 400 feet.	200–400 feet.	100–200 feet.	Less than 100 feet.*	_____
2. **Position in relation to drinking water well**	Downslope from well. No lot runoff reaches well.	At grade with well. No lot runoff reaches well.	Upslope from well. Potential for lot runoff to reach well.	Upslope from well. Lot runoff reaches well.	_____
DESIGN AND MANAGEMENT OF ANIMAL LOTS					
3. **Surface water diversion**	All upslope surface water and roof runoff water diverted from animal lots.	Most upslope surface water and roof runoff water diverted from animal lots.	No surface water diverted. Some roof runoff water collected and redirected.	All surface and roof water runs through animal lots.	_____
4. **Animal lot runoff**	No lot runoff (animals confined to building or on pasture).	All runoff collected from lot. Solids separated for handling. Water directed onto vegetative filter or into holding pond for proper field application.	Most of lot runoff collected. Some solids removed. No vegetative filter. Holding pond with excessive seepage or frequent overflows.	Lot runoff uncontrolled.	_____

*Illegal for new well installation. Existing wells must meet separation requirements in effect at time of construction.

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
DESIGN AND MANAGEMENT OF ANIMAL LOTS (continued)					
5. Animal lot cleaning and scraping	No lot (animals confined to building or on pasture).	Once per production cycle.	Seasonally. At least twice per year.	Rarely. Once per year or less.	_____
6. Abandoned lots or lots not used for extended periods of time.	No abandoned or unused lots on farmstead.	Any permanently abandoned lot dug up and field applied or planted to high-nitrogen-using crop. Manure removed from temporarily unused lot.	Temporarily unused lot not cleaned.	Permanently abandoned lot not cleaned up or not planted to cover crop.	_____
STORAGE OF ANIMAL WASTES (120 days minimum capacity required)					
7. Earthen waste storage pit, pond, or lagoon	Designed, installed and maintained according to accepted engineering standards and apecifications, including specified seepage control measures.	Designed and installed according to accepted engineering standards and specifications, but not maintained according to specifications.	Not designed to engineering standards. Constructed in silt loam, loam, clay loam or silty clay soils. Water table deeper than 20 feet.	Not designed to engineering standards. Constructed in sand or sandy loam soil with no clay layer. Fractured bedrock or water table shallower than 20 feet.	_____
8. Poured concrete or other liquid-tight design	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Concrete cracked, silt loam or loam soils. Water table deeper than 20 feet.	Concrete cracked, sand or sandy loam soils. Water table or fractured bedrock shallower than 20 feet.	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
TEMPORARY STOCKPILING OF ANIMAL WASTES					
9. Stacked in lot or field	Covered concrete slab with curbs, gutters and settling basin. Surface runoff diverted away.	Concrete slab with curbs and gutters. Grass filter strips installed and maintained. Surface runoff diverted away.	Earthen area with silt loam, loam, clay loam or silty clay soils. Water table deeper than 20 feet.	Earthen area with sand or sandy loam soils. Fractured bedrock or water table shallower than 20 feet.	_____
10. Stacked in housing	Building has concrete floor, protected from surface water runoff. Adequate bedding provided to soak up leakage from manure.	Building has concrete or earthen floor on silt loam, loam, clay loam or silty clay soils. Protected from surface water runoff. Adequate bedding provided to soak up leakage from manure.	Building has concrete or earthen floor on silt loam, loam, clay loam or silty clay soils. Subject to surface water runoff. Water table or fractured bedrock deeper than 20 feet.	Building has earthen floor on sand or sandy loam soils snd is subject to surface water runoff. Water table or fractured bedrock shallower than 20 feet.	_____
11. Water-tight structure	Designed and installed according to engineering standards. All liquids retained.	Designed and installed according to engineering standards on silt loam, loam, clay loam or silty clay soils. Water table deeper than 20 feet.	Designed and installed according to engineering standards on sand or sandy loam soils. Water table or fractured bedrock shallower than 20 feet.	Not designed and installed according to engineering standards. Not properly maintained.	_____
MILKING CENTER WASTEWATER TREATMENT					
12. Milking center wastewater	Wastewater delivered directly to liquid manure storage.	_____	Wastewater drains outside to grassed area.	Wastewater drains outside to ditch or area with no vegetation.	_____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
ANIMAL WASTE APPLICATION					
13. Soil testing of waste application site	Yearly	Every two years.	Every three years.	Less frequent than every three years.	____
14. Application rate	Applied at rate equal to or less than plant needs based on soil test.	Low rates of application used but rates not based on soil test results.	High rates of application used with no soil tests performed. Rate may exceed plant needs.	Applied at rate greater than plant needs. Annual application over 250 pound available nitrogen or over 20 dry tons of solid waste per acre.	____
15. Location of waste application areas	All application areas more than 200 feet from surface and groundwater sources.	Most application areas more than 200 feet from surface and groundwater sources.	Several application areas are less than 200 feet from surface or groundwater sources.	Most application areas within 200 feet of surface or groundwater sources.	____
16. Application timing and site conditions	Incorporated into soil, applied to no-till field or applied at site with heavy vegetation. Never applied to frozen or saturated soil.	Incorporated into soil, applied to no-till field or applied at site with heavy vegetation. Try to avoid application on frozen or saturated soil.	Application based on when can get around to it. Sometimes apply to wet or frozen soil.	Applied to frozen, saturated or snow covered soil. Applied to tilled soil with no incorporation and little vegetation.	____
SILAGE STORAGE					
17. Silage storage location	At least 400 feet downslope from well. Water drains to field or pasture.	At least 200 feet downslope or 400 feet upslope from well. Water drains to field or pasture.	At least 100 feet downslope or 200 feet upslope from well. Water pools on soil surface.	Within 100 feet downslope or 200 feet upslope from well. Water pools on soil surface.	____

	LOW RISK (rank 4)	LOW-MOD RISK (rank 3)	MOD-HIGH RISK (rank 2)	HIGH RISK (rank 1)	YOUR RANK
SILAGE STORAGE (continued)					
18. Silage storage floor or surface condition	Concrete or asphalt surface. No cracks.	Concrete or asphalt surface with some cracks or compacted clay soil surface.	Surface has some permeable soils (silt loam) and has some cracks.	Surface has permeable soil (sand), not compacted.	____
19. Silage storage cover condition	Cover tight fitting. No leaks.	Cover tight fitting. Minor leaks repaired.	Cover, but many large leaks not repaired.	No cover.	____

TOTAL ____

Use this total to calculate risk ranking on back page of worksheet.

What do I do with these rankings?

Step 1: Begin by determining your overall animal waste management risk rank. 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 rank

*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 rank gives you an idea of how your animal waste management practices **as a whole** might be affecting your drinking water. It should serve only as a **very general guide, not a precise diagnosis.** Because it represents an **average** of many individual rankings, it can mask any **individual** rank (such as 1's or 2's) that should be of concern (see Step 2).

Enter your boxed animal waste managment risk rank on page 1 of Worksheet 9. Later you will compare this risk rank with other farmstead management rankings. Worksheet 8 will help you identify your farmstead's site conditions (soil type, soil depth and bedrock characteristics), and Worksheet 9 will show you how these site conditions affect your risk rankings.

Step 2: Look over your rankings for individual activities:
- **Low-risk** practices (4's)—ideal; should be your goal despite cost and effort
- **Low-to-moderate-risk** practices (3's)—provide reasonable groundwater protection
- **Moderate-to-high-risk** practices (2's)—inadequate protection in many circumstances
- **High-risk** practices (1's)—inadequate; pose a high risk of polluting groundwater

Regardless of your overall risk rank, any individual rankings of "1" require 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.

Find any activities that you identified as 1's and list them under "High-Risk Activities" on pages 6-7 of Worksheet 9.

Step 3: Read Fact Sheet 7, *Improving Animal Waste Management,* if you haven't already. Consider how you might modify your farmstead practices to better protect your drinking water.

FARM•A•SYST
Farmstead Assessment System

The Farmstead Assessment System is a cooperative project of the Cooperative Extension Service, Kansas State University, and the Kansas Department of Health and Environment.

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