

## Assessing the Risk of Groundwater Contamination from Livestock Waste Storage

### Why should I be concerned?

Storing livestock waste allows farmers to spread manure when conditions are right for nutrient use by crops. Accumulating manure in a concentrated area, however, can be risky to the environment and to human and animal health.

Facilities for manure stored in liquid form on the farmstead sometimes leak or burst, releasing large volumes of pollutants. Manure in earthen pits can form a semi-impervious seal of organic matter that does limit leaching potential, but seasonal filling and emptying can cause the seal to break down. Short-term solid manure storage and abandoned storage areas can also be sources of groundwater contamination by nitrates. Manure 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) though this is rare nitrate-nitrogen can pose health problems for infants under 6 months of age, including the condition known as methemoglobinemia (blue baby syndrome). Nitrates can also affect adults, but the evidence is much less certain.

**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.

Fecal bacteria 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 are flowing into groundwater.

**The goal of Farm-A-Syst is to help you protect the groundwater that supplies the drinking water for you, your neighbors, and the public. It is not used for, nor is it related to, any type of enforcement action from any agency.**

### How will this worksheet help me protect my drinking water?

- ◆ It will take you step by step through your drinking water well condition and management practices.
- ◆ It will rank your activities according to how they might affect the groundwater that provides your drinking water supplies.
- ◆ 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 you fill out the worksheets?

Focus on the well that provides drinking water for your home or farm. If you have more than one drinking water well on your farmstead, fill out a worksheet for each one.

- ◆ Use a pencil. You may want to make changes.
- ◆ 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.)
- ◆ Then 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."
- ◆ Directions on overall scoring are explained in the next section "What do you do with the rankings?"
- ◆ Allow between 20-45 minutes to complete the worksheet to figure out your risk ranking for management practices and complete the Farmstead Improvement Action Plan.

## What do you do with the rankings?

Step 1: 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

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 & 2's and list them under "High Risk and Medium-High Risk Practices" in the Farmstead Improvement Action Plan section following the worksheet.

Step 2: Read Fact Sheet # 3, Fertilizer Storage and Handling, and consider how you might modify your farmstead practices to better protect the public and your drinking water. This may help with filling out the Farmstead Improvement action Plan.

Step 3: Fill out the Farmstead Improvement Action Plan (FIAP). Contact your local Soil and Water Conservation District for technical assistance and help with the FIAP if needed.

Step 4: Implement the FIAP- Contact NRCS for possible designs and/or funding for practices. Funding availability depends on the practice installed and the current USDA farm programs.

## **Glossary** **Livestock Waste Storage**

*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 Natural Resources Conservation Service (NRCS) or Soil and Water Conservation District (SWCD) offices. These standards may come from NRCS technical guides, state regulations or land grant university engineering handbooks.

**Filter strip:** A gently sloping grass plot used to filter runoff from the livestock yard 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 yard or storage system.

**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.

**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.

**Soil permeability:** The quality that enables 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.

**Water table depth:** Depth to the upper surface of groundwater. This depth is sometimes indicated in the county soil survey, but this varies from county to county. This information may be available from your well construction report or from hydrogeological reports and groundwater flow maps of your area. Your county Extension educator, NRCS specialist or SWCD specialist may also be able to help you gather this information.

**There are two types of water tables:** (1) the water table typically noted in a well log as an indication of usable water supply; and (2) the seasonal high water table. The seasonal high water table is most important in regard to construction of livestock manure storage facilities, because it may present facility construction problems.



Worksheet # 7

## Livestock Waste Storage: Assessing Drinking Water Contamination Risk

	Low Risk (Rank 4)	Low-Mod Risk (Rank 3)	Mod-High Risk (Rank 2)	High Risk (Rank 1)	Your Rank
<b>Long-Term storage (180 days or more)</b>					
<b>7.1 Steel, glass-lined (liquid-tight design, above ground)</b>  <b>OR</b>	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Leaking tank on slow permeability* soil. Greater than 2 feet to water table and 40 inches to bedrock.	Leaking tank on rapid permeability* soils. Depth to water table is <2 feet or bedrock shallower than 40 inches.	_____
<b>7.2 Concrete stave (liquid-tight design)</b>  <b>OR</b>	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, low permeability* soil. Greater than 2 feet to water table and 40 inches to bedrock.	Concrete cracked high permeability* soil. Water table or fractured bedrock shallower than 3 feet.	_____
<b>7.3 Poured concrete (liquid-tight design)</b>  <b>OR</b>	Designed and installed according to accepted standards and specifications. Properly maintained.	Designed and installed according to accepted engineering standards and specifications. Not maintained.	Concrete cracked, high permeability* soil. Greater than 3 feet to water table and bedrock.	Concrete cracked, high permeability* soil. Water table or fractured bedrock shallower than 3 feet.	_____

\* Slow permeability soils, like clay, allow water to flow through slowly. Rapid permeability soils, like sand and gravel, allow much faster water movement.

	Low Risk (Rank 4)	Low-Mod Risk (Rank 3)	Mod-High Risk (Rank 2)	High Risk (Rank 1)	Your Rank
<b>7.4 Earthen waste storage pit (below ground)</b>	_____	Designed and installed according to accepted engineering standards and specifications. Properly maintained.	Not designed to engineering standards. Constructed in low permeability* soil. Greater than 2 feet to water table and 40 inches to bedrock. Earthen lining eroding.	Not designed to engineering standards. Constructed in rapid permeability* soil. Depth to water table is <2 feet or bedrock shallower than 40 inches. More than 10 years old.	_____
<b>Short-Term Storage (usually 30-90 days; in some cases, up to 180 days)</b>					
<b>7.5 Stacked in field (on soil base)</b>	_____	_____	Stacked on high ground on low permeability* soil. Greater than 3 feet to water table and bedrock.	Stacked on high ground on high permeability soil. Water table or bedrock shallower than 3 feet.	_____
<b>7.6 Stacked in yard</b>	Covered concrete yard with curbs, gutters and settling basin.	Concrete yard with curbs and gutters. Grass filter strips installed and maintained.	Earthen yard on low permeability* soil. Greater than 2 feet to water table and 40 inches to bedrock.	Earthen yard on rapid permeability* soil. Depth to water table is < 2 feet or bedrock shallower than 40 inches.	_____
<b>7.7 Watertight structure designed to accepted engineering standards and specifications</b>	Designed and installed according to engineering standards on low permeability* soil. Greater than 2 feet water table 40 inches to bedrock.	Designed and installed according to engineering standards on slow permeability* soil. Depth to water table is <2 feet or bedrock shallower than 40 inches.	Designed and installed according to engineering standards on low permeability* soil. Water table or fractured bedrock shallower than 3 feet.	Designed and installed according to engineering standards. Not properly maintained.	_____

\* Low permeability soils, like clay, allow water to flow through slowly. High permeability soils, like sand and gravel, allow much faster water movement.

	Low Risk (Rank 4)	Low-Mod Risk (Rank 3)	Mod-High Risk (Rank 2)	High Risk (Rank 1)	Your Rank
<b>7.8 Stacked in open housing</b>	Building has concrete floor, protected from surface water runoff. Adequate bedding provided.	Building has earthen or concrete floor on low permeability* soils, protected from surface water runoff. Greater than 2 feet to water table and 40 inches to bedrock.	Building has earthen or concrete floor on low permeability* soil, subject to surface water runoff. Depth to water table is < 2 feet or bedrock shallower than 40 inches.	Building has earthen floor on high permeability* soil, subject to surface water runoff. Water table or bedrock shallower than 3 feet.	_____

### Location

<b>7.9 Location of livestock waste storage in relation to drinking water well</b>	Manure stack, earthen waste storage pit and manure storage structure (liquid tight) more than 100 feet downslope from well.	Manure stack, earthen waste storage pit and manure storage structure (liquid tight) less than 300 feet upslope from well.	Manure stack, earthen waste storage pit and manure storage structure (liquid tight) less than 300 feet upslope from well.	Manure stack, earthen waste storage pit and manure storage structure (liquid tight) less than 300 feet upslope from well.	_____
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Worksheet Section #	List High Risk and Med-High Risk practice(s)	Alternative Low Risk practice (Include potential sources of technical and financial assistance.)	Action Plan	
			Planned completion date	Indicate date when completed

I understand that this farmstead assessment (Farm-A-Syst) and corresponding Farmstead Improvement Action Plan were developed on the basis that I have disclosed, to the best of my knowledge, all information pertaining to my farmstead operations.

**Farmstead address:**

Street \_\_\_\_\_

City \_\_\_\_\_ ME, Zip code \_\_\_\_\_

Watershed name: \_\_\_\_\_

\_\_\_ Aerial map with farmstead boundaries is attached

**Producer's signature** \_\_\_\_\_

Date \_\_\_\_/\_\_\_\_/\_\_\_\_

**Farm-A-Syst conducted by:**

Name \_\_\_\_\_

Title \_\_\_\_\_ Date \_\_\_\_/\_\_\_\_/\_\_\_\_

## Acknowledgments

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Revision Editors of Farm-A-Syst Worksheet #7: Megan Wooster, AVSWCD; Susan Gammon, AVSWCD; Andrews Tolman, State of Maine CDC Drinking Water Program; Chris Jones, Natural Resources Conservation Service; David Wilkinson, Natural Resources Conservation Service; Dan Baumert, Natural Resources Conservation Service; Mark F. Hedrich, Department of Agriculture; Susan Breau-Kelley, Maine Rural Water Association. 2008.

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