Maine Farm-A-Syst

Farmstead Assessment System Fact Sheet 10

Reducing the Risk of Groundwater Contamination by Improving Milking Center Wastewater Treatment

Wastewater from the dairy milking center includes wastes from the milking parlor (manure, feed solids, and hoof dirt) and milkhouse (bulk tank rinse water and detergent used in cleaning). In Maine, milking center wastewater is commonly disposed of onto vegetated filter areas or in specially designed subsurface disposal systems. In Maine we have moved away from organic beds for treatment of milking center waste water to subsurface system utilizing stone beds or other proprietary devices.

Topics Covered:

No discharge by combining wastes

Treatment before discharge

Discharge methods
- Field application
- Surface flow with slow surface infiltration
- Below-ground absorption field

Source Water Protection/Wellhead Protection Area

Contacts and References

Conventional storage and subsurface treatment systems used for this purpose have the potential to fail by plugging for one of the following reasons:

- Solids flow into the disposal field and plug it because:**
  - Increased volumes of water don't allow adequate retention time in the septic tank.
  - Increased quantities of solids need frequent pumping. When this is not done, the tank's capacity to settle out solids is decreased.
- Conventional tanks are not intended to handle the milk solids and fats, which flow into the disposal field and plug it.
- Sanitizers used in cleaning may reduce decomposition action in the septic tank and or disposal field.

**Note: It is illegal in Maine to discharge milkroom waste into a domestic wastewater treatment system.

From an environmental perspective, delivery of milking center wastewater to a manure storage facility, if available, makes the most sense. This option should be used whenever manure is handled as a liquid.

Discharge options, from most to least desirable, are:

- Addition to non-discharge manure storage or separate storage for land spreading during the growing season.
- Treatment using a designed subsurface waste water disposal system.

- Overland flow in combination with a winter holding pond.
- Year round overland flow.
- Uncontrolled discharge.

No discharge by combining wastes

Combining milking center wastes with manure has the advantage of allowing a common disposal system for both types of waste. A liquid manure storage facility, properly constructed and sized, provides the additional flexibility of storing wastes until they can be applied at the right time to the right sites. (See figure 1a.) This option is limited, however, to farmers who handle their manure in a more liquid form that requires a water tight storage structure. While it adds to transportation and spreading costs, nutrients from dairy wastewater can be used to meet crop requirements, thus reducing fertilizer costs.

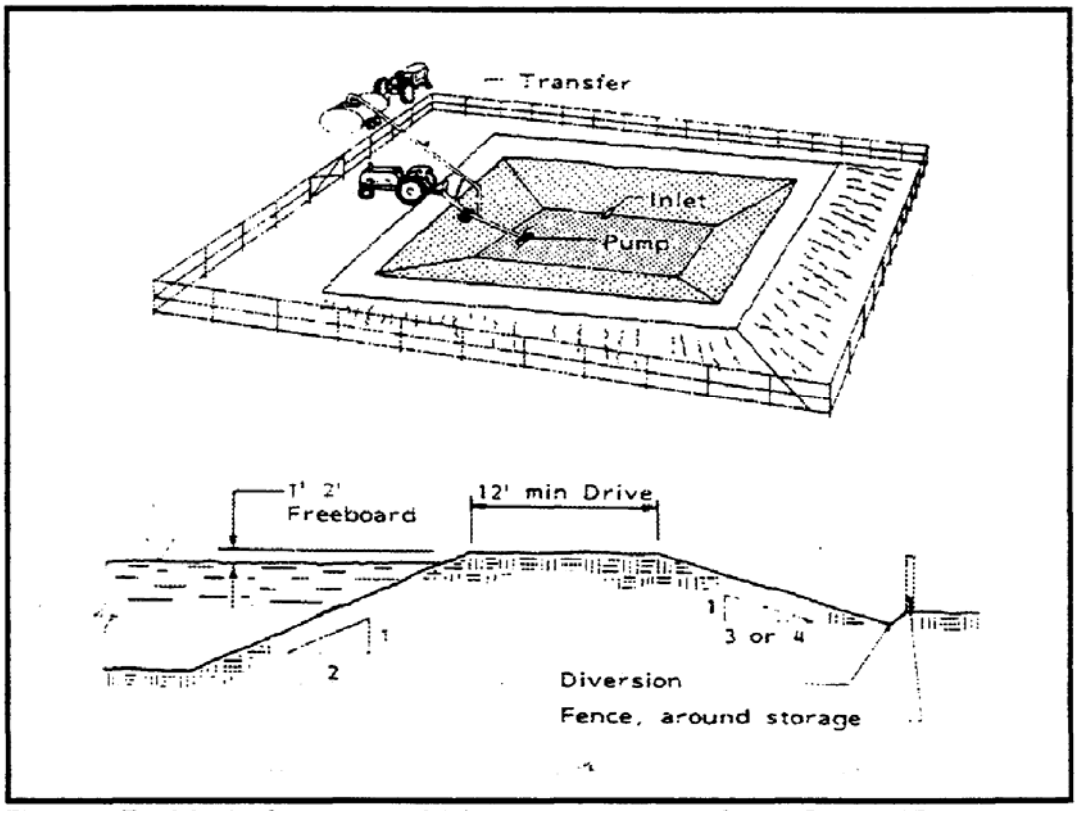


Figure 1a: Earth basins for manure and dairy wastewater storage. *Source: Dairy and Equipment Housing Handbook, MWPS-7, Midwest Plan Service, Ames, Iowa.*

Applying milking center wastes with manure to fields at rates that do not exceed crop needs for nitrogen is least risky for groundwater contamination from both wastes. Care must be taken, however, to keep phosphorus levels from accumulating to levels that will contaminate surface water.

Treatment before discharge

While soil has a large capacity to absorb and degrade wastes, treating wastewater to remove some wastes before it gets into the soil can extend the effective life of a soil application

area. Pretreatment usually consists of a tank that holds the wastewater long enough for heavier particles to settle and lighter solids to float. (See figure 2.)

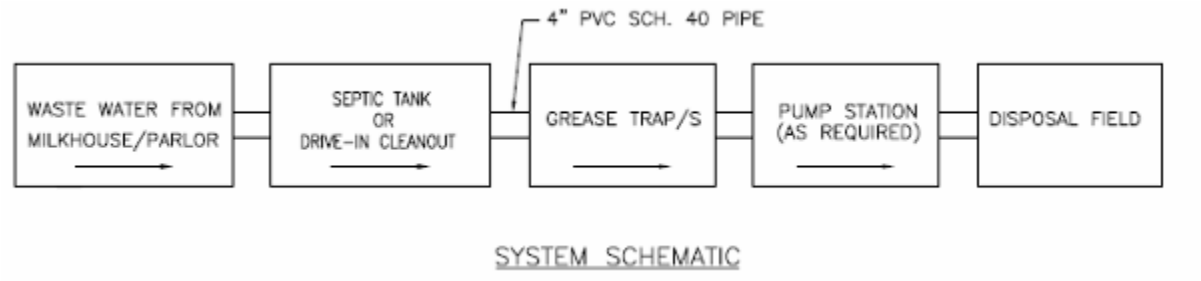


Figure 2: Milkin Center Wastewater Treatment System Schematic. *Source NRCS Drawing Name ME-ENG-MWW1.*

System Notes

1. Septic tanks shall have a minimum 1000 gallon capacity and 24 to 48 hour retention time.
2. Combined grease traps shall have a minimum 1000 gal. capacity.
3. Minimum slope on gravity pipes to disposal field 1%
4. If a pump is used size pipe as recommended by pump manufacturer.
5. Divert surface water away from disposal field.
6. Vehicular or livestock traffic is not allowed on disposal field. The disposal field and fill extension shall be fenced.
7. Septic tanks and grease traps shall be inspected and cleaned regularly, particularly the fat accumulation.
8. Emulsifier soaps shall not be used in conjunction with the milk house waste water treatment system.

Be sure to clean these materials out of the tank at a minimum of every six months, or they will eventually get into the soil absorption area, clogging the spaces between soil particles and causing wastewater to collect on the surface.

A settling tank also provides a place for bacteria to decompose some wastes before they enter the soil absorption area. This process causes a scum to form on top of the water in the tank. Removing the scum layer periodically can keep the system operating more efficiently and allow for annual removal of solids.

Excess solids (manure and feed from the parlor floor) should be removed before the area is washed into a treatment tank. This will extend the period between tank cleanouts.

Discharge methods

Treating wastewater for direct discharge to a stream or lake is generally too expensive for most dairy farms. The soil provides the most cost-effective place for disposal and most options fall into one of three categories:

- subsurface absorption
- slow overland flow with slow surface infiltration
- direct cropland application

Application of wastewater to cropland, at low application rates, poses the least danger to ground and surface waters. The soil can store the dispersed wastes until crops and microorganisms use the nutrients, thus preventing them from entering groundwater or surface water.

Any discharge methods that involve application of wastes to the soil surface should be tied to a soil analysis and a certified nutrient management plan for utilization of these wastes by crops. These applied nutrients should be credited in your fertilizer program. Areas set aside specifically to handle wastewater should be harvested annually.

Field application

Do not saturate areas that can allow rapid percolation to groundwater or runoff to surface water.

Daily wastewater can be applied to croplands and pastures by portable irrigation equipment or a liquid manure spreader. Pipes with sprinklers can also be permanently installed to spray wastewater over certain areas consistently. Determine application rate by: 1) the soil's ability to absorb wastes and 2) the utilization of nutrients by vegetation with periodic removal of the crop produced 3) Information provided in the farm's nutrient management plan. The Maine Soil Testing Service of the University of Maine tests milk house waste water using essentially the same technique as for manure, except it usually is quite dilute and has to be reported in ppm rather than pounds per acre.

Milking center wastewater applied to cropland at low rates poses little danger to groundwater, due to filtering by the soil or plant uptake of potential contaminants. To maximize the efficiency of this system, harvest the crop or other vegetation.

Vegetation removal: After harvesting the vegetation, feed it to livestock if appropriate, or use as bedding. If left on the ground, the nutrients remain available to move toward groundwater. Forests, windbreaks or woodlots may also be suitable for application of wastewater, in which case annual harvest is not needed.

Surface flow with slow surface infiltration

Most vegetative filter areas used in Maine employ a combination of surface flow and slow surface infiltration.

Wastewater can be applied to one end of a gently sloping grass filter strip or terrace though a spreader strip or pipe. By spreading pretreated wastewater over a vegetated soil surface, organic compounds and bacteria can be treated or filtered out as wastes flow in sheet form over the sloped surface and percolate through the soil. . All clean surface runoff should be diverted away from the system. Curtain drains can be installed to divert laterally moving subsurface water.

The slow surface infiltration system works best on well-drained loamy soils with at least three feet to bedrock or groundwater

Harvesting the infiltration area is needed to keep vegetation from decomposing and releasing nutrients that could seep down to the groundwater. (See "Vegetation Removal" in "Field Application" section on page 4.)

With an uncontrolled gravity system, the area remains wet, making mechanical harvesting of vegetation difficult. By controlling the flow with a pump or another dosing system, wastes can be applied and then the area can be allowed to dry out.

Properly operated, a slow infiltration system poses a moderate risk of groundwater contamination by nitrate and other soluble compounds. There is a low risk of contamination by organic matter, pathogenic (disease causing) microorganisms, phosphorous and detergent.

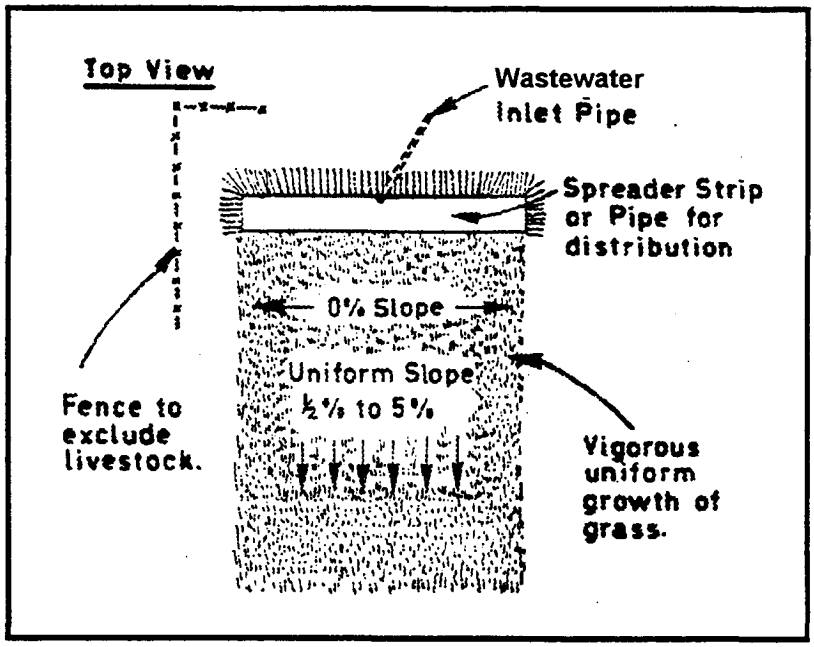


Figure 3: Surface flow (overland). *Source: Dairy Manure Management Handling Milk Center Wastes, Northeast Dairy Practices Council 27.B. October 1977.*

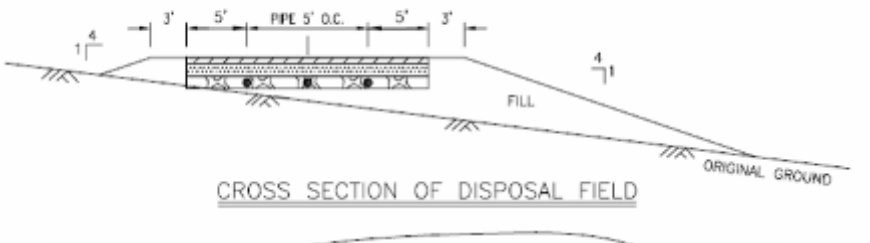
However, there is a significant risk to surface water when this system alone is employed. Frozen or snow covered ground fails to allow wastewater to infiltrate, and without growing plants and microorganisms, nutrients will not be used. If wastewater is stored over the winter months and released throughout the growing season, this method will be more effective for year-round use.

Below-ground absorption field

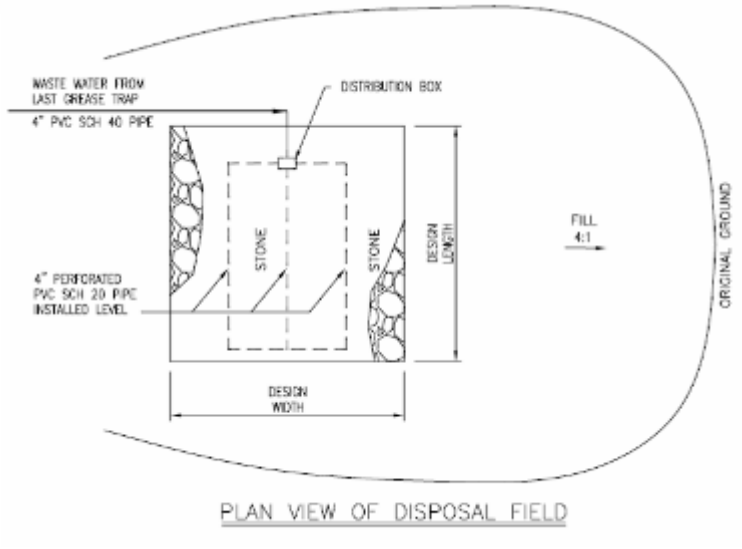
While below-ground absorption has been recommended in the past, experience has shown that these systems have the potential to fail if not maintained and operated properly. Failure to remove solids from the wastewater, or releasing large quantities of milk into the system can cause the soil to become clogged and allow wastes to back up through the drains. The wastewater may collect on the surface until it evaporates or flows into a field or watercourse. Surface discharge could violate both dairy sanitation regulations and surface water quality standards.

Within the last 10 years, an experimental system called an organic matter bed has been used to treat milking center wastewater in Maine. Maine has since gone away from organic beds for treatment of milking center waste water. A subsurface stone bed is now being used. The organic beds were failing probably due to solids getting into the beds. Also even distribution of the wastewater over the bed was problematic as it only entered one end and probably deep infiltrated before it reached the far end. Refer to the images below of a milking center wastewater treatment system single disposal field and a terraced disposal field.

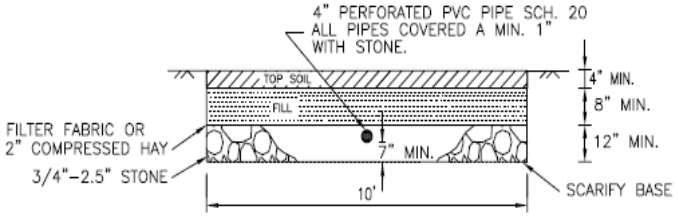
MILKING CENTER WASTEWATER
TREATMENT SYSTEM
SINGLE DISPOSAL FIELD



CROSS SECTION OF DISPOSAL FIELD

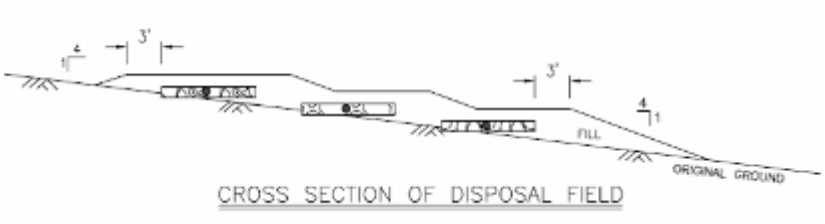


PLAN VIEW OF DISPOSAL FIELD

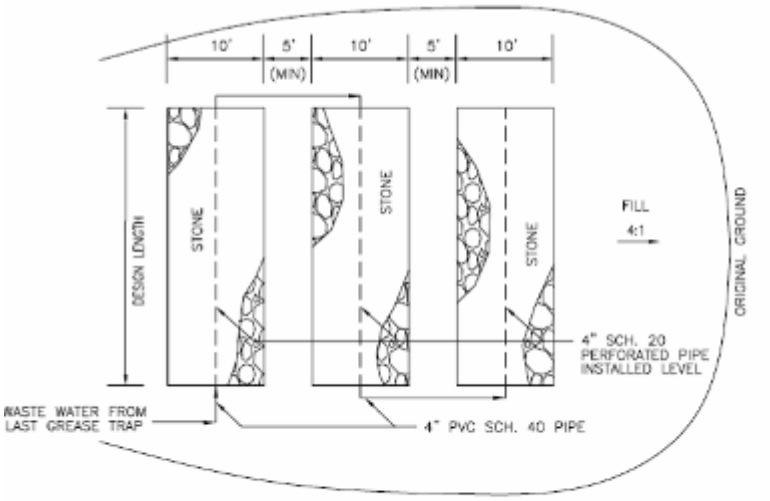


DETAIL OF DISPOSAL FIELD

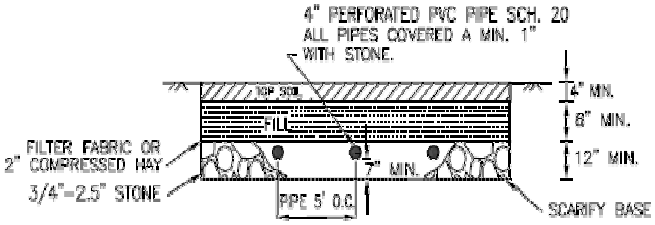
MILKING CENTER WASTEWATER
TREATMENT SYSTEM
TERRACED DISPOSAL FIELD



CROSS SECTION OF DISPOSAL FIELD



PLAN VIEW OF DISPOSAL FIELD



DETAIL OF DISPOSAL FIELD

Above Figures: Milking Center Watewater Treatement System Single Disposal File and Terraced Disposal filed. *Source NRCS Drawing Names ME-ENG-MWW2 & ME-ENG-MWW3*

Source Water Protection / Wellhead Protection Area

Almost half of Maine's population depends on groundwater for its drinking water supply from either private or public wells. We are lucky to have some of the best water supplies in the world, and it is our job to keep them safe. Being aware of potential problems on your property that might pollute drinking water sources is important. You may not even know that there is a potential threat. Taking the time to read and fill out the applicable Farm-A-Syst sections is a great first step. From there you will sit down with a district employee or someone trained in Farm-A-Syst to discuss some possible solutions such as best management practices (BMP) that can be applied. BMPs are a method, measure, or practice that, when correctly installed or performed, will prevent, reduce, or minimize water pollution. In this case, the focus is on drinking water supplies and the areas that provide them with water.

There are some laws that pertain to areas within a source water protection zone that don't apply to other landowners. Be sure to check with your local water district and municipality for local ordinances or if you are unsure if you live in a source water protection area.

It is the landowner's responsibility to know local and state laws pertaining to their land, although it is hard to navigate sites and wade through the legal jargon of written laws.

If you are living or operating in a source water protection area (the surface and subsurface areas surrounding a drinking water supply for a public water system where activities can contaminate the supply) or wellhead protection area (an area

used to protect groundwater, a form of source water) you should pay extra special attention. We have tried to find pertinent information pertaining to this section. You can find links to these laws along with helpful information in the following Contact & Reference section as well as in appendices A: Law and Regulations & B: Resources.

CONTACTS AND REFERENCES

Who to call about…

Plans and recommendations for fertilizer mixing and loading pads

Your county Extension office. Check your phone book for numbers.

Fertilizer spills

The Maine Department of Environmental Protection,	1-800-452-4664
The Maine Department of Agriculture	207-287-3871

Proper disposal of soil contaminated by a fertilizer spill

Call the Maine Department of Environmental Protection	1-800-452-4664
The Maine Department of Agriculture	207-287-3871

Health Effects

The Maine Bureau of Health	207-287-3201

What to read about…

Publications are available from sources listed at the end of the reference section. (Refer to number in parentheses after each publication.)

Groundwater and nitrates in groundwater

Health Effects of Drinking Water Contaminants. University of Maine Cooperative Extension Water Quality Fact Sheet #2. (1)

Best Management Practices for Groundwater protection. 2004. Maine Department of human Services Drinking Water program.
This manual is intended for the use of local officials, public water suppliers and landowners in Maine. It is intended to encourage educated decisions, informed practice, and directed planning in regard to groundwater protection, particularly in the vicinity of public drinking water supply wells.
http://www.maine.gov/dhhs/eng/water/forms/Sections/BMPv2%200A.htm

Health effects

Nitrate: Health Effects in Drinking Water. University of Maine Cooperative Extension Water Quality Fact Sheet #22, Publication # 7107. (1)

Fertilizer handling and management

Manual of Best Management Practices for Maine Agriculture. 2007. Maine Department of Agriculture, Food & Rural Resources Division of Animal Health & Industry. (1)
Nitrogen Fertilizer Choices: Maine Soil Nitrate Test For Corn. TJMCE Publication #7097. (1)
The Maine Nitrogen Soil Test for Corn: Key to Economical, Environmentally Sound

Nitrogen Fertilizer Use. UMCE Publication #7098. (1)
Best Management Practices for Maine Agricultural Producers: Protecting Ground Water from Nutrients and Pesticides. 1989. UMCE Publication #. (1)

Publications available from…

1. Your county Extension office. There may be charges for the publications, postage and sales tax.
2. Your county NRCS office.
3. Maine Board of Pesticides Control, Station #28, Augusta, ME 04333-0028.
4. Midwest Plan Service Secretary Agricultural Engineering Department, 460 Henry Mall, University of Wisconsin, Madison, Wisconsin 53706 (608) 262-3310

Websites:

This link will take you to the Natural Resources Conservation Service (NRCS) Conservation Practice Standards. Here you can find technical guides that are the primary scientific references for NRCS. They contain technical information about the conservation of soil, water, air, and related plant and animal resources.
http://efotg.nrcs.usda.gov/treemenuFS.aspx

Below is a link to "Manual of Best Management Practices for Maine Agriculture" put out by the Maine Department of Agriculture, Food & Rural Resources Division of Animal Health & Industry. January 2007. This resource has links to all the different BMPs that apply to a farm.
http://mainegov-images.informe.org/agriculture/narr/documents/BMPManual2007.pdf
This manual doesn't have any of the actual BMPs written out. It is literally a guide that will lead you to other links. To make things a little easier you will find direct links to BMPs suggested by the manual that pertain to this specific section.

- **Agricultural Waste Management Field Handbook,** Part 651. NRCS, http://www.wsi.nrcs.usda.gov/products/W2Q/AWM/handbk.html

- **Treatment of Milkhouse Effluent.** New Brunswick, Canada, Dept. of Agriculture, Fisheries and Aquaculture, http://www.gnb.ca/0173/10/0173010004-e.asp

- **Environmental Factors to Consider When Expanding Dairies**. NRAES – 95, http://www.nraes.org/nra_order.taf?_function=detail&pr_id=81&_UserReference=BD89344C04A748F147BDB550

Manual of Best Management Practices for Maine Agriculture. 2007. Maine Department of Agriculture, Food & Rural Resources Division of Animal Health & Industry
http://www.maine.gov/agriculture/narr/documents/

Nitrogen Fertilizer Choices: Maine Soil Nitrate Test For Corn.
http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item_number=7097&store=413&design=413

University of Maine Cooperative Extension: "Nitrate: Health effects in drinking water".
http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item_number=7107&store=413&design=413

The Maine Nitrogen Soil Test for Corn: Key to Economical, Environmentally Sound Nitrogen Fertilizer Use. UMCE Publication #7098.

http://extensionpubs.umext.maine.edu/ePOS/form=robots/item.html&item_number=7098&store=413&design=413

Chapter 317: Nutrient Management Loan Program
This rule establishes the procedures, standards and fees applicable to Borrowers applying for loans from the Authority's program of direct loans for the finance of construction of livestock manure and milk room waste containment and handling facilities as set forth in the Nutrient Management Act 7 MRSA §4201 et seq., and Chapter 565 of the Rules of the Department of Agriculture, Food and Rural Resources, from a portion of the Clean Water Revolving Loan Fund, provided by the United States Environmental Protection Agency through the Maine Municipal Bond Bank and the Maine Department of Environmental Protection.
http://www.maine.gov/sos/cec/rules/90/94/457/457c317.doc

Best management Practices for Groundwater Protection
http://www.maine.gov/dhhs/eng/water/forms/Sections/BMPv2%200A.htm

See "Appendix A: Laws and Regulations" and "Appendix B: Resources" for additional links.

Acknowledgments

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Original Fact Sheet #10 Adapted by Lisa Krall, Natural Resources Conservation Service 1995