Maine Farm-A-Syst

Farmstead Assessment System Worksheet 12

Site Evaluation

Why is the site evaluation important?

How such farmstead practices such as pesticide handling or manure management affect groundwater depends in part on the physical characteristics of your farmstead site: soil type, bedrock characteristics and depth to groundwater. That's why evaluating the soils and geologic characteristics of your farmstead is such an important step in protecting the groundwater you drink.

How do soils affect the potential for groundwater contamination?

Soil characteristics are very important in determining whether a contaminant breaks down to harmless compounds or is leached into groundwater. Because most breakdown occurs in the soil, there is a greater potential for groundwater contamination in areas where contaminants are able to move quickly through the soil.

- Sandy soils have large "pore" spaces between individual particles, and the particles provide relatively little surface area for "sorption," or physical attachment of most contaminants. Large amounts of rainfall can percolate through these soils, and dissolved contaminants can move rapidly down through the soil and into groundwater.

- Clay soils, on the other hand, are made up of extremely small particles that slow the movement of water and dissolved contaminants through the soil. Contaminants also stick tightly to clay surfaces. However, runoff from these soils are a threat to surface waters.

How do subsurface and geologic materials affect the potential for groundwater contamination?

Depth to groundwater is important primarily because it determines not only the depth of material through which a contaminant must travel before reaching an aquifer but also the time during which a contaminant is in contact with dry soil. As a result, where soil and surficial deposits have fairly deep to groundwater table, contaminants are less likely to reach groundwater.

Bedrock geology influences groundwater pollution. Once pollutants reach bedrock fractures no more treatment occurs. Therefore the deeper the soil to bedrock the better potential there is for treatment of contaminants. If a well is drilled into bedrock fractures that are saturated with water, bedrock can serve as an aquifer. Fractures intercepted by wells within the first 200 to 300 feet of the surface generally will supply enough water for private, domestic use. Some highly fractured zones known as faults can yield many thousands of gallons per day, and may be developed for municipal or industrial use. In northern and coastal Maine, there are a few areas where the bedrock is composed of limestone, a

relatively soft carbonate rock. Over time, water can enlarge the fractures in this rock by dissolving the surfaces of the fractures along which it flows. Wells drilled in these areas may also provide enough yield for industrial and municipal use. Where bedrock material contains significant cracks and fractures, the depth and characteristics of soil and surficial geologic deposits largely determine the potential for groundwater contamination.

What is involved in completing this worksheet?

This evaluation has four parts:

Part 1: Evaluating your soil type and depth
Part 2: Evaluating subsurface and geologic materials, along with depth to groundwater
Part 3: Determining your overall site evaluation ranking (combining parts 1 and 2)
Part 4: Doing a farmstead diagram (optional)

Getting the information to complete parts 1 and 2 will require assistance from outside sources, such as your county office, local USDA Natural Resource Conservation Services (NRCS) specialist, Soil and Water Conservation District, or University of Maine Cooperative Extension. How long this takes will vary depending on availability of information in your county. Once you have the information, it should take about an hour to complete the first three parts of Worksheet #12. (The farmstead diagram will take additional time.)

If some of the information you need isn't readily available, the worksheet contains instructions on how to proceed. The more information you can get. The better; but some information is better than no information.

A Word of caution:

As with the results of the other assessment worksheets, use the rankings from this worksheet cautiously. These ranking provide a general indication of vulnerability and are not a precise, exact ranking. Many factors affect whether or not a contaminant will leach into groundwater. There is no guarantee that a "low-risk" site will be uncontaminated--or that groundwater will become contaminated at a "high-risk" site. The type of contaminant involved, how you handle and store potential contaminants such as pesticides and manure), the location and maintenance of your well, and many other factors can affect the potential for groundwater contamination.

Glossary
Site Evaluation

These terms may help you make more accurate assessments when completing Worksheet #13.

Igneous: Rock formed by cooling and solidification of liquid parts of the rock portion of the earth.

Karst: Topography formed over limestone or dolomite where there are sinkholes, caverns and lack of surface streams.

Metamorphic: Rock formed by re-crystallization of igneous or sedimentary rock under great pressure and heat, and by means of chemical reactions.

Organic matter: Matter containing compounds of plant or animal origin, measured by organic carbon content.

Permeability: The quality that enables soil to transmit water or air.

Sediment: Waterborne or windborne particles.

Sedimentary: Rock formed from compaction and/or cementation of sediment.

Soil classification: A shorthand system to provide detailed soil descriptions. Includes such groupings as order, suborder, subgroup and family.

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 horizon: a layer of soil, approximately parallel to the surface, that has distinct characteristics, such as color, structure, and texture. Described in shorthand form by letters, such as A, B, and C.

Soil mapping unit: A soil or combination of soils delineated on a map and, where possible, named to show the taxonomic unit or units included.

Soil series: The upper and most weathered part of the soil profile, consisting of the A and B horizons.

Soil solum: The layer of soil which lies above the parent material in which the natural processes of soil formation take place.

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

Till: Unstratified glacial drift deposited by ice and consisting of clay, silt, sand, gravel, and boulders intermingled in any proportion.

Part 1: Evaluating the soil on your farmstead

To complete your soil evaluation, you will need a copy of your county's soil survey report. This report is available at most local USDA/NRCS, Soil and Water Conservation District, or University of Maine Cooperative Extension. You may also get it from the NRCS Web Soil Survey site at http://websoilsurvey.nrcs.usda.gov/app/ .

Step 1: Start by locating your farmstead on the aerial photos in the soil survey, note the soil mapping unit indicated on the photo, and look up information related to that soil in the written sections of the soil survey report.

- If you have more than one soil mapping unit on your farstead, rank each soil individually using this worksheet. Transfer soil mapping unit boundary lines from the soil survey to the farmstead diagram in part 4.

- These rankings describe soil in native, undisturbed conditions. If your farmstead soil has been altered by human activities such as tiling or ditching, contact your local USDA/NRCS, Soil and Water Conservation District, or University of Maine Cooperative Extension.

Don't skip any parts of this worksheet. If you are not familiar with using soil survey you may need help completing Part 1. Ask your NRCS or Soil and Water Conservation District specialist to help you find the following information:

- Location of your farmstead on the map and aerial photographs provided in the soil survey report.

- The soil mapping unit and soil series from the legend provided in the soil survey report.

- The soil series and/or soil mapping unit, including the profile description, as well as any other information in the report regarding depth to bedrock, depth to water, or organic matter content.

- The classification of the soil series, including family, subgroup and order.

Step 2: With this information in hand, you are ready to rank your soil according to seven characteristics. For each of the seven characteristics in the left column, find information about your soils in the soil survey. Then, match your soil description to the description in the middle column to determine your score. (For example, if the soil survey tells you that the texture of your soil is a clay loam, your score for that category would be 8.) Enter your score(s) in the space(s) indicated.

Soil Characteristics

For characteristics 1-6a that follow, consult the soil profile description and text, and the soil mapping unit text in the "Description of the Soils" section of your county soil survey.

		Score
1. Texture of surface (A horizon or topsoil)	Loam, sandy loam, silt loam, sandy clay loam, silt,	9
	Clay, sandy clay, silty clay, clay loam, silty clay loam	8
	Loamy fine sand, loamy very fine sand	4
	Sand, loamy sand, gravel	1
	Your score(s) _____ Soil #1 _____ Soil #2 _____ Soil #3	
2. Texture of subsoil (B horzon- immediately below the topsoil)	Loam, sandy loam, silt loam, sandy clay loam, silt	10
	Clay, sandy clay, silty clay, clay loam, silty clay loam	7
	Loamy fine sand, loamy very fine sand	4
	Sand, loamy sand, gravel	1
	Your score(s) _____ Soil #1 _____ Soil #2 _____ Soil #3	
3. pH-Surface (A horizon)	6.6 or greater (the A horizon description will include one of the following terms: neutral, mildly alkaline, moderately alkaline or strongly alkaline)	6
	Less than 6.6 (the A horizon description will include one of the following terms: slightly acid, moderately acid or strongly acid)	4
	Your score(s) _____ Soil #1 _____ Soil #2 _____ Soil #3	
		Score

4. Depth of soil solum (depth of A and B horizons)	Greater than 60 in.	10
	40-60 in.	8
	20-40 in.	5
	10-20 in.	3
	Less than 10 in.	1

Your score(s) _____ _____ _____
Soil #1 Soil #2 Soil #3

5. Soil drainage class	Well drained-depth to water table is greater than 60 in.	10
	Well to moderately well drained-depth to water table is 36 to 60 in.	7
	Moderately well drained-water table depth 16 to 36 in.	4
	Somewhat poorly, poorly, and very poorly drained; somewhat excessively and excessively drained. Depth to water table less than 16 in.	1

Your score(s) _____ _____ _____
Soil #1 Soil #2 Soil #3

6. Permeability of subsoil horizon

a. If your soil series description indicates that bedrock is found within 40 inches of the surface, use the following ranking:

Bedrock at 20-40 inches	3
Bedrock within 20 inches	1

(Record score on next page.)

For 6b and 7, consult the table "Classification of Soil Series" in your soil

b. For soils other than those listed in 6a refer to permeability of the c horizon in the published Soil Surveys or the soil interpretation tables on the county's NRCS web page.

Soil Permeability of the C horizon	
0.2-0.6 in/hr	10
0.6-2.0 in/hr	8
2.0-6.0 in/hr	3
6.0-20.0 in/hr	1

Your score(s) _____ _____ _____
Soil #1 Soil #2 Soil #3

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7. Organic matter content of topsoil or 0-6" depth from surface

a. If the soil is less than 20 inches thick, if it is somewhat poorly drained or wetter, or if your soils do not fall into this category use the chemical and physical soil properties to find organic content.

OR

b. If your soil does not fall into the above groups, obtain the organic matter percentage from a soil test report for your farm, the chart of "Soil Properties Significant to Engineering" found in some soil surveys, or your local USDA/NRCS, Soil and Water Conservation District, or University of Maine Cooperative Extension.

Organic matter (%)	
High (4-10%)	10 8
Medium (2-4%)	7
Moderately low (1-2%)	5
Low (0.5-1%)	3
Very low (less than 0.5%)	1

Your score(s) _____ _____ _____
Soil #1 Soil #2 Soil #3

(Lower your score by one level if the soil mapping unit description in the soil survey indicates erosion, unless you take organic matter from soil test results.)

Step 3: Add your seven scores together for each soil you ranked.

TOTALS _____ _____ _____
Soil #1 Soil #2 Soil #3

Step 4: In the box below, find your score in the listed ranges in the left column. Then identify your soil's "potential to protect groundwater" and find the rank number assigned to your score.

Total Score	Soil's Potential To Protect Groundwater	Rank
51+	Best	4
41-50	Good	3
31-40	Marginal	2
0-30	Poor	1

Step 5: Enter rank numbers(s) here:

SOIL #1 RANK	
SOIL #2 RANK	
SOIL #3 RANK	

Step 6: Understand your soils ranking(s).

A soil with more than 50 points (ranking #4) probably is a deep, medium- or fine-textured, well-drained soil which contains 4-10 percent organic matter. Potential contaminants move slowly through the soil, allowing them to become attached to soil particles. Sunlight, air and microorganisms then have the potential to break down the contaminant into harmless compounds. The groundwater contamination risk level is low.

A soil with a score of 30 or less (ranking #1) is probably a coarse, sandy, extremely well-drained soil with less than 1 percent organic matter. Such a soil would enable most contaminants to move rapidly down toward the water table.

Overall, the higher your ranking number, the more likely that your soil conditions will help to reduce the risk of groundwater contamination from farmstead practices.

Part 2: Evaluating Subsurface and Geologic Materials on Your Farmstead

This part looks at the subsurface and geologic materials beneath your farmstead's soils. Completing the worksheet will give you a much clearer picture of your site's potential for keeping pollutants out of groundwater.

- For example, the soil evaluation might have indicated a moderate potential for protection of groundwater. However, if the soils are fairly shallow and lie over fractured bedrock, the potential for groundwater contamination at the site is probably higher than indicated by the soil evaluation alone.

This part requires only two items of information: your site's subsurface geologic material and depth to groundwater. Unfortunately, information on subsurface geologic material, as well as depth to water, is often difficult to obtain:

- It is sometimes available from the soil survey report, although this differs from county to county.

- You can also obtain it from your well construction report. If the well installer filled out the report and submitted it correctly, it should be on file with the Maine Geological Survey at 207-287-2801.

- You can find information from other well construction reports in your area, hydrogeological reports and groundwater flow maps. These are generalized maps, though, and may not accurately reflect the depth to groundwater or direction of flow at your farmstead. Check with the Maine Geological Survey at http://maine.gov/doc/nrimc/mgs/mgs.htm or Maine Water Resources Research Institute at http://water.usgs.gov/wrri/institutes.html .

- Published geological reports may show the type of geologic material in your area

Try not to skip any steps in this part. Ask your local USDA/NRCS or Soil and Water Conservation District, or University of Maine Cooperative Extension to help you gather the information and provide assistance in completing Part 2.

If the information for this part is not available, you may skip to Part 3. The instructions will tell you how to proceed without it.

Step 1: Find the information you need-from the soil survey, well construction reports or Geological Survey reports- to identify 1) the geologic materials beneath your farmstead; and 2) depth to groundwater.

Step 2: Match the information on your site's geology to one of the descriptions in the left column below. (You will be choosing **only one description** from the entire table that follows.)

Step 3: When you have chosen the description that best matches your site's geology, read across to the right until you get to the appropriate "depth to groundwater" for your site and circle that score for your farmstead.

For example, you may determine from your well construction report that geologic material beneath your farmstead consists of 30 feet of coarse-textured, unconsolidated material over fractured limestone bedrock, and that depth to groundwater is 15 feet. Looking down the left column to find your category, and then going across to the right, you see that your rank is "1."

Geological Material (more than 5 feet below ground)	Depth to Groundwater (in feet)			
	0-10’	11-30’	31-50’	More than 50’
• Fine-textured materials (more than 45’ of materials)				
Silt, clay or shale	3	3	4	4
• Till (more than 45’ of materials)				
Dense- or fine-textured till (unsorted)	3	3	4	4
Medium- to coarse-textured till (unsorted)	1	2	3	4
• Medium- to fine-textured, unconsolidated materials over fractured bedrock (almost always)				
33-45’ of materials	2	2	3	3
21-32’ of materials	1	1	2	3
6-20’ of materials	1	1	2	2
0-5’ of materials	1	1	1	1
• Sand and gravel (more than 45’ of materials)				
Greater than 12% silt or clay (sorted)	1	1	2	2
Less than 12% silt or clay (sorted)	1	1	1	1

Step 4: Enter your circled number here: SUBSURFACE RANK

There may be other situations that do not fall into the above categories (such as unconsolidated materials over limestone/shale/sandstone sequence). Determining a ranking for such situations requires a judgment call.

Step 5: Understand your subsurface and geology ranking. The table below shows what your rank means.

A ranking of “4” shows that the subsurface material has the best

Rank	Level of Risk of Groundwater Contamination
4	Low
3	Low/moderate
2	High/moderate
1	High

potential to protect groundwater. This material has small pore spaces, groundwater is at least 10 feet from the soil surface, and the risk of groundwater contamination is low.

A ranking of "1" indicates a material with poor potential to protect groundwater. Its large pore spaces allow contaminants to move downward easily, increasing the risk of groundwater contamination. In highly fractured rock or in very coarse-textured, unconsolidated materials, the depth to groundwater doesn't seem to matter, because some contaminants will flow through the spaces with very little slowdown.

Overall, the higher your ranking number, the more likely that your farmstead's geologic conditions and depth to groundwater will help to reduce the risk of groundwater contamination from farmstead practices.

Part 3: Combining Your Farmstead's Soil and Subsurface/Geologic Rankings

Combining the rankings from parts 1 and 2 will provide you with a good overall ranking of your farmstead site's potential to keep pollutants from moving down to groundwater.

Step 1: Transfer your boxed ranking from the soil evaluation (Part 1, page 7) and the subsurface/geologic evaluation (Part 2, above) to the boxed below:

SOIL #1 RANK		Subsurface Rank	
SOIL #2 RANK			
SOIL #3 RANK			

Step 2: The table below shows the overall level of groundwater contamination risk associated with your farmstead site conditions. Find your two numbers **written in the correct sequence (soils rank-subsurface rank)** and circle the sequence.

Level of Risk			
Low Risk (Rank 4)	Low-Moderate Risk (Rank 3)	High-Moderate Risk (Rank 2)	High Risk (Rank 1)
1-4	1-3	2-2	1-1
2-3	3-2	4-1	1-2
2-4	4-2		2-1
3-3			3-1
3-4			
4-3			
4-4			

Step 3: Look above the sequence you circled to find your risk level and your ranking. (For example, if your numbers are 3-2, your site is in the low-moderate risk column and your ranking is 3.)

Step 4: Enter your combined ranking here. (If you calculated more than one soils ranking, calculate a combined ranking for each soils ranking.)

COMBINED RANKING #1	
COMBINED RANKING #2	
COMBINED RANKING #3	

Step 5: Understand your combined ranking.

In general, a site with a combined ranking of 4 (low groundwater pollution risk) will have a soil with a good capacity to hold and break down contaminants. Its subsurface conditions will also keep contaminants from reaching the water table. Under certain conditions, however, such as spills, poor management and heavy rainfall, contaminants may reach groundwater.

On the other hand, if you carefully manage a site with a combined ranking of 1 (high groundwater pollution risk), you may not affect your drinking water. **Both site characteristics and your management practices are of equal importance.**

Part 4: Learning More About Your Site

Sketching a diagram of your farmstead can provide useful information to help you understand how the physical layout and site characteristics of your farmstead may contribute to-or lessen- the effects of possible contaminants reaching your drinking water.

The diagram can show the location of wells, septic drain fields, manure storage areas, direction of groundwater flow, surface water, buildings, and other activities that may contribute potential contaminants. Along with the soil and subsurface evaluations, the diagram will help point out aspects of your farmstead that may present a hazard to your drinking water.

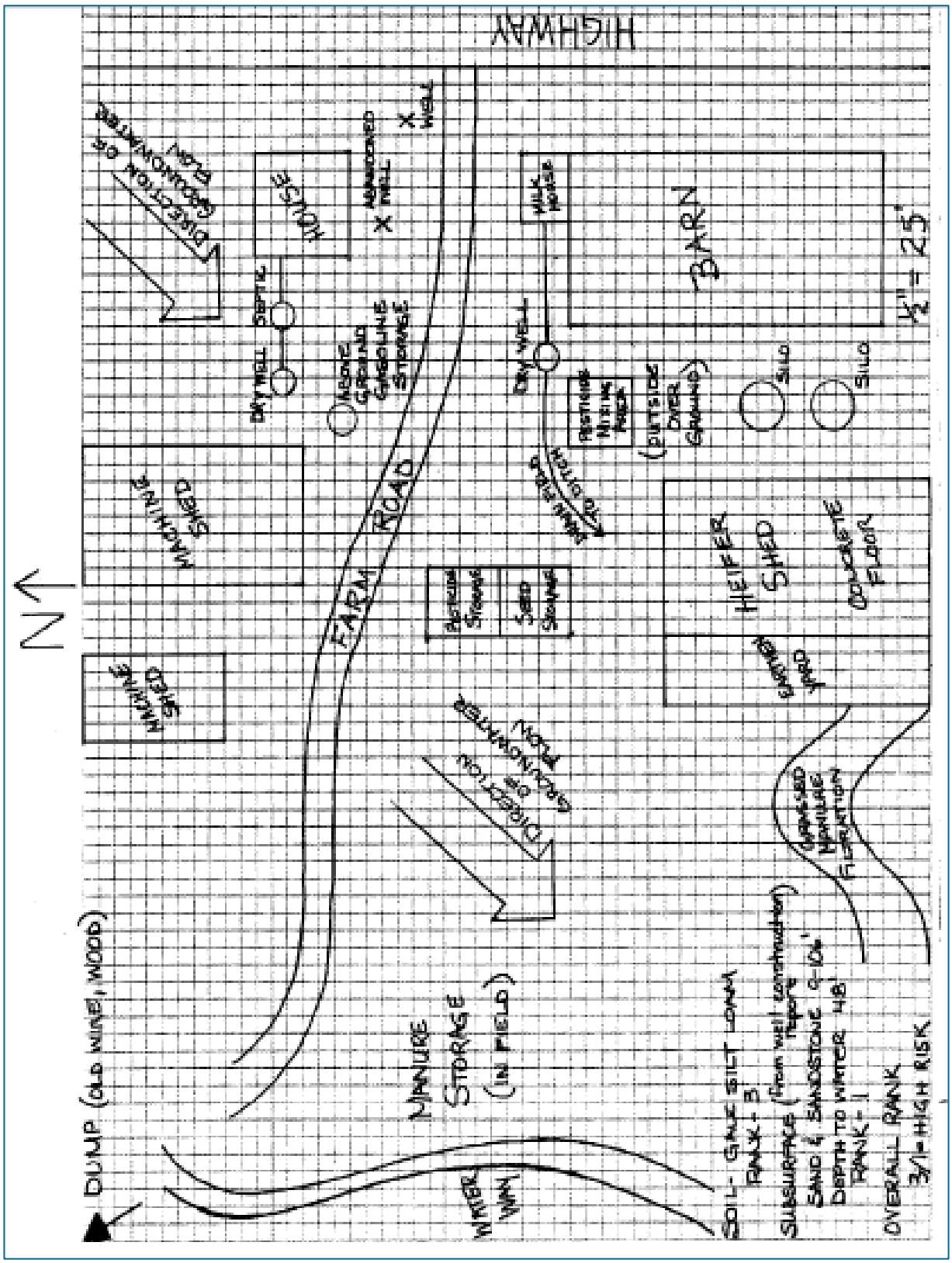
Step 1: Diagram your farmstead on the blank grid provided at the end of this section. Include all of the following that apply to your farmstead:

- All buildings and other structures (home, barn, machine shed)
- Wells and unused wells
- Septic system (tank, dry well, absorption field and/or ditch)
- Cow yard/ livestock yard
- Manure storage (temporary and permanent)
- Underground petroleum storage tank
- Above-fround petroleum storage tank
- Pesticide and fertilizer storage, handling and mixing areas
- Silage storage
- Milkhouse waste disposal system (tank, field and/or ditch)
- Farm dumps
- Vehicle maintenance areas
- Liquid disposal areas
- Tiles, surface intakes and open ditches

You can use the same diagram to indicate surface water (ponds and streams), direction of land slope, groundwater flow, ant the different soil types found around your farmstead. Generally, groundwater follows surface topography and moves downhill towards surface water.

Step 2: Use your diagram to note which activities or structures on your farmstead have a greater likelihood of allowing contaminants to reach groundwater. This information should help prepare you to make better decisions about your farmstead activities and structures and how they might be affecting your drinking water.

Sample Site Sketch



Site Sketch