Worksheet #11

Site Evaluation

NEW MEXICO
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Farmstead Assessment System

NM STATE

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Why is the site evaluation important?

How such farmstead practices 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.

What's involved in completing this evaluation?

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 Soil Conservation Service (SCS) or Extension office. How long this takes will vary depending on availability of information in your county. Once you have the information, though, it should take about an hour to complete the first three parts of Worksheet #11. (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.

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 leaches 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.

For glossary, see page W11.15

- 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.

While held securely to soil particles, contaminants are broken down by bacteria and other soil organisms and by chemical reactions with minerals and natural chemicals in the soil. Most of this chemical and biological breakdown takes place in the loose, cultivated surface layers, where the soil tends to be warm, moist, higher in organic matter and well aerated.

Finally, soil organic matter is important in holding contaminants. Soils high in organic matter provide an excellent environment for chemical and biological breakdown of these contaminants—before they reach groundwater.

The natural purification capability of the soil is limited. Under certain conditions, heavy rainfall and chemical spills may exceed the soil's purification capacity, allowing leaching to occur. In such cases, the subsurface geologic material and the distance a contaminant must travel to groundwater are important factors in determining whether a contaminant actually reaches the groundwater.

It is also important to remember that some contaminants will not break down at all, no matter how long they are held in the soil.

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

New Mexico soils were formed in water deposited sediments, weathered and disintegrated bedrock materials, and bedrock. The depth of these surficial deposits ranges from zero to hundreds of feet.

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 the soil. As a result, where soil and surficial deposits are fairly deep, contaminants are less likely to reach groundwater.

Bedrock geology influences groundwater pollution when the water table is below the bedrock surface. Sedimentary rocks have a wide range of permeability—from highly permeable fractured dolomite to nearly impermeable shales and crystalline formations. Movement of pollutants in fractured limestone or dolomite is unpredictable, and pollutants can readily spread over large areas. 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.

A word of caution

As with the results of the previous 10 assessment worksheets, use the rankings from this worksheet cautiously. Many factors affect whether or not a contaminant will leach to 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.

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 county offices of SCS or Extension Service.

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 farmstead, rank each soil individually using this worksheet. Transfer soil mapping unit boundary lines from the soil survey to the farmstead diagram on page 14.

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 county Extension agent or your SCS office for assistance.

Don't skip any parts of the worksheet. If you are not familiar with using soil surveys, you may need help completing Part 1. Ask your county Extension agent or your SCS 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. Soil surveys published before 1965 will not include the soil classification. You'll have to get this information from your county Soil Conservation Service office.

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)	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, fine sandy loam, very fine sandy loam	4
	sand, loamy sand, sandy loam, organic materials (all "O" horizons), and all textural classes with coarse fragment class modifiers (such as "gravelly loam")	1
	Your score(s)	soil #1 soil #2 soil #3

2. Texture of subsoil (B horizon. If there is no B horizon, consider the character of materials within approximately 2 feet below the A horizon.)	clay, sandy clay, silty clay, silt	10	
	sandy clay loam, loam, silt loam, clay loam, silty clay loam	7	
	loamy fine sand, loamy very fine sand fine sandy loam, very fine sandy loam	4	
	sand, loamy sand, sandy loam, organic materials, and all textural classes with coarse fragment modifiers (such as "gravelly loam")	1	
	Your score(s)		soil #1 soil #2 soil #3

		Score
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
4. Depth of soil solum (depth of A and B horizons, minus inches of erosion from surface layer noted in soil survey description)	greater than 60 in.	10
	40-60 in.	8
	30-40 in.	5
	less than 30 in.	1
	Your score(s)	soil #1 soil #2 soil #3
5. Soil drainage class	well drained	10
	well to moderately well drained	7
	moderately well drained	4
	somewhat poorly, poorly, and very poorly drained; somewhat excessively and excessively drained	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 20 inches of the surface, or if bedrock is present in the soil mapping unit 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 survey.

b. For soils other than those listed in 6a, look in the "family" column of the "Classification of Soil Series" table. To determine permeability of the subsoil horizon, use the particle-size class in this column and find the rank for it below. If there is more than one particle-size class (such as "fine silty" over "sandy" or "sandy-skeletal"), choose the underlying material (such as "sandy" or "sandy-skeletal"). If your soil survey was published before 1965, see your SCS specialist for assistance.

moderately low, low to very low (fine, very fine, clayey, clayey-skeletal)	10
moderate (fine loamy, fine silty, coarse silty, loamy-skeletal)	8
high (sandy or sandy-skeletal, coarse loamy)	3
very high (coarse sand, fragmental, sandy; or psammentic suborder)	1

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

7. Organic matter content Ap horizon or 0–6" depth from surface

a. If the "Classification of Soil Series" table classifies your soil series as Histosols, Aquic suborder, or Lithic, Aquollic and Aquic subgroup, use the ranking "1." (These are organic soils, wet soils or soils with less than 20 inches of material over bedrock. See a county specialist if your soil falls into one of these categories.)

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 county SCS office. You can find the soil order for your soil series in the "Classification of Soil Series" table.

Organic matter (%)	**OR** Soil order	
high (4-10%)		10
	Mollisols	8
medium (2-4%)		7
moderately low (1-2%)	Alfisols	5
low (0.5-1%)	Inceptisols, Entisols	3
very low (less than 0.5%)	Aridisols	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 number(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 protecting 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 State Engineer Office (See Contacts and References).

- You can find additional 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 U.S. Geological Survey or the New Mexico Water Resources Research Institute (See Contacts and References).

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

Try not to skip any steps in this part. Ask your county Extension agent or your SCS specialist to help you gather the information and provide assistance in completing Part 2.

If the information for this part is not available, though, you may skip to Part 3 on page 10. 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.)

If your well construction report describes more than two types of geologic material below 5 feet, ask for help in filling out this section from your county Extension or SCS office.

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
•Unweathered or unfractured metamorphic, igneous, limestone or sandstone	2	2	3	4
•Medium- to fine-textured, unconsolidated materials over fractured bedrock				
33–45' of materials	2	2	3	3
21–32' of materials	1	1	2	2
6–20' of materials	1	1	2	2
0–5' of materials	1	1	1	1
•Coarse-textured, unconsolidated materials over fractured bedrock				
33–45' of materials	1	1	2	2
21–32' of materials	1	1	1	2
0–20' 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
•Karst, highly permeable or fractured rock (more than 45' of materials)	1	1	1	1

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 4: Enter your circled number here: SUBSURFACE RANK ☐

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

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

A ranking of "4" shows that the subsurface material has the best 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 pore 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 rankings from the soil evaluation (Part 1, page 7) and the subsurface/geologic evaluation (Part 2, above) to the boxes below:

Soil #1 Rank ☐

Soil #2 Rank ☐

Soil #3 Rank ☐

Subsurface 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.**

Your three site ranking numbers (soils ranking, subsurface ranking and combined ranking) will be used again in Worksheet #12. They will be combined with your risk rankings for specific activities from the 10 assessments (such as pesticide handling) to give you a more accurate assessment of potential groundwater contamination on your farmstead.

If you have more than one soil on your farmstead, you will need to transfer individual soil rankings and combined rankings to Worksheet #12. It will be especially important for you to complete Part 4 of this worksheet if you have more than one soil on your farmstead, so that you can link particular site vulnerability with each farmstead activity.

You may now proceed with Part 4 of this worksheet, or you may go directly to Worksheet #12.

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 drainfields, 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: Begin by looking at the sample diagram on page 13.

Step 2: Then diagram your farmstead on the blank grid provided on page 14. Include all of the following that apply to your farmstead:

- all buildings and other structures (home, barn, machine shed)
- wells and unused wells or windmills
- septic system (tank, dry well, absorption field and/or ditch)
- cowyard/livestock yard
- manure storage (temporary and permanent)
- underground petroleum storage tank
- above-ground 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 landslope, groundwater flow, and the different soil types found around your farmstead. Generally, groundwater follows surface topography and moves downhill towards surface water.

Step 3: 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.

When you've completed the diagram of your farmstead, go on to Worksheet #12.

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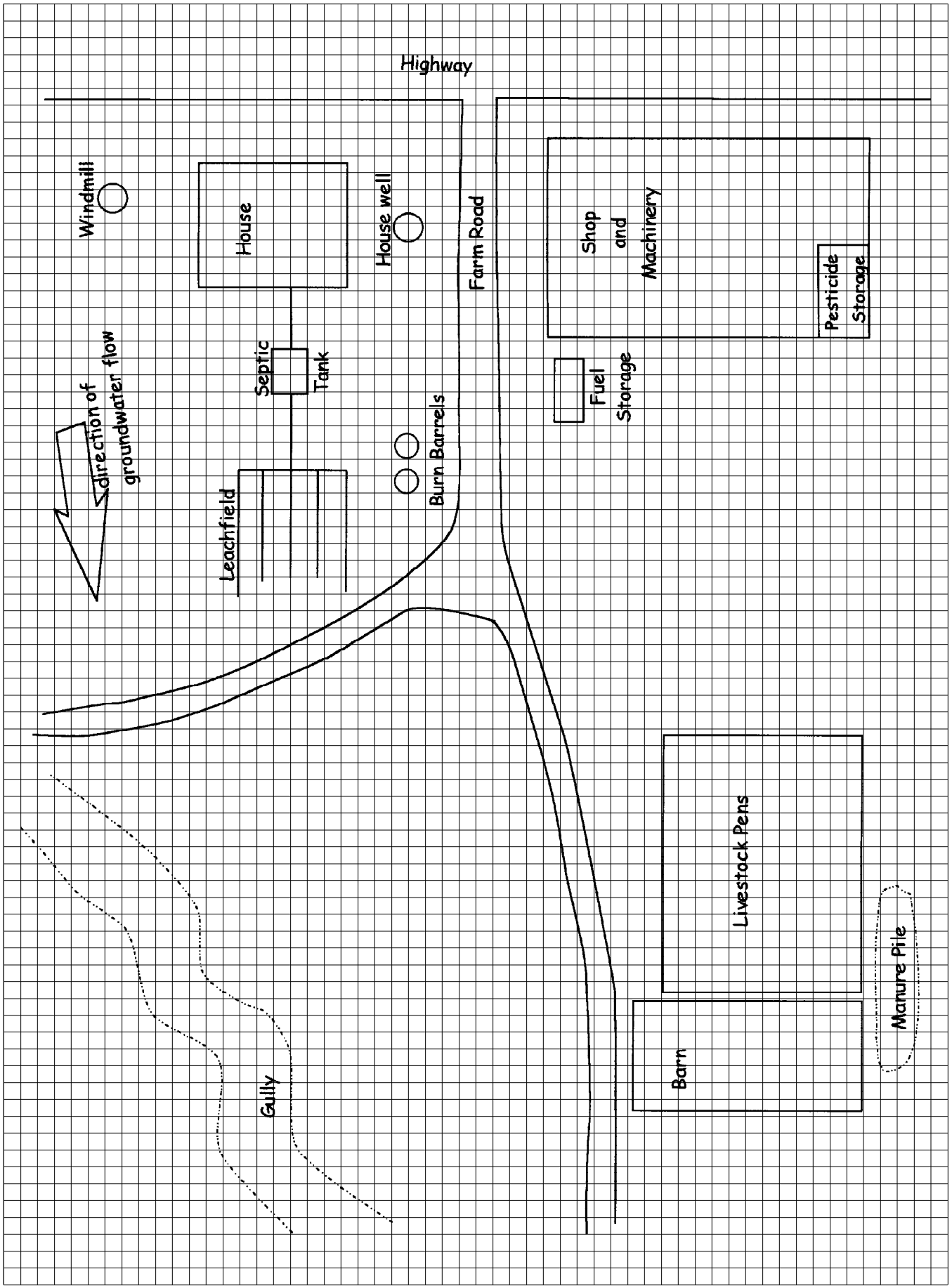
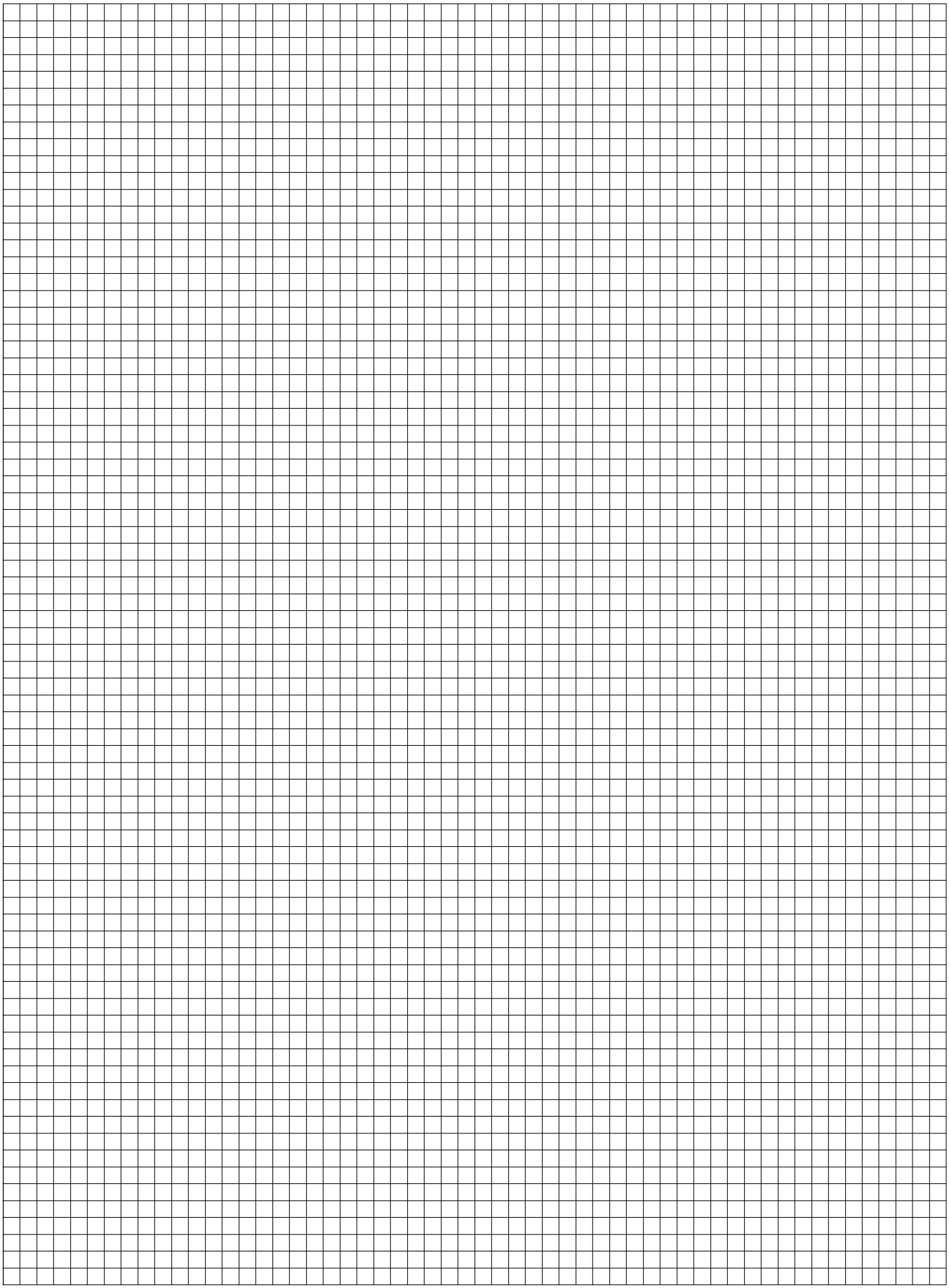
SAMPLE FARMSTEAD DIAGRAM



YOUR FARMSTEAD DIAGRAM



Glossary

Site Evaluation

These definitions may help clarify some of the terms used in Worksheet #11.

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 recrystalization 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.

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 basic unit of soil classification, consisting of soils that are essentially alike in all major profile characteristics.

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

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*.

Subsoil: The *B* horizon, roughly the part of the solum below the depth of plowing.