

## Site Selection for Dairy Housing Systems

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Good site selection is essential for a successful dairy operation. Site selection requires careful planning to ensure that your investments allow you to build towards the future rather than continuing the past. A few essential factors are important to ensure that you have a site suitable for the present and for 20 to 30 years in the future. This publication provides guidelines to make the site-selection process easier.

### Site Description

Start the site-selection process by obtaining a description of all potential sites and locations. A simple map, such as a hand-drawn or tax map, that indicates existing buildings, roads, streams, property lines, utility lines, drainage ways, wells, neighbors, and other important geographic information works well to efficiently and effectively evaluate potential sites (Figure 1).

### Resources for Site Evaluation

Several resources are available for site evaluation, including tax maps, topographic maps, and soil survey maps. Each of these maps provides a different perspective of the site that should be evaluated. An aerial photograph of the existing operation also gives you valuable information, including potential sites within a short distance of the farm.

Consult agricultural professionals to obtain more information regarding site evaluation. People who are not involved with your operation on a daily basis may be able to identify sites that you have not taken into consideration. Consider discussing potential sites with Extension agents, representatives from the local Natural Resources Conservation Service (NRCS) or Soil and Water Conservation District (SWCD) office, design engineers, veterinarians, and loan officers.

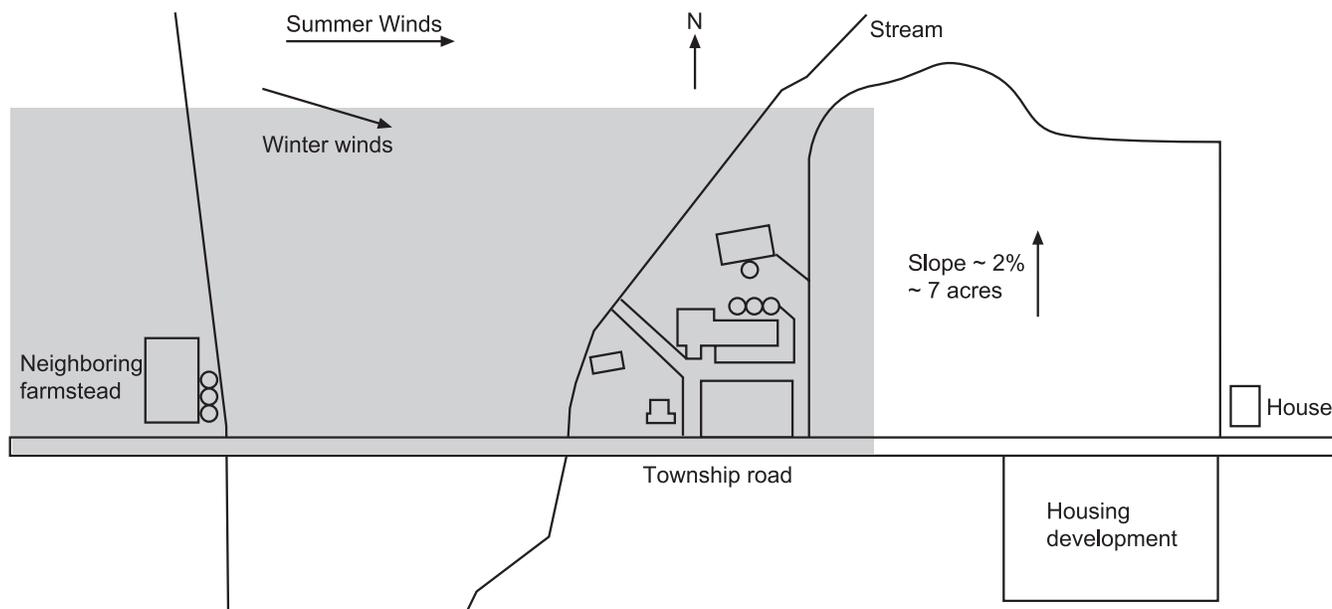


Figure 1. Map of existing facilities, possible sites, and neighboring land. Shaded area is expanded in Figure 3.

## Site Evaluation

Many factors affect the site evaluation process. Therefore, you should not rank sites in order of preference until you have evaluated each site with respect to a list of site factors. Site selection becomes more logical and objective once you have evaluated each site in this manner.

### Essential Site Factors

Potential sites should be eliminated if they cannot provide these four essential factors:

1. **Water:** A year-round supply of potable water is essential for watering animals and sanitation. Water is also needed for fire protection and cooling cows and milk. Between 40 to 50 gallons of fresh water per cow are needed daily for lactating cow consumption and milking center cleaning. Peak water consumption usually occurs shortly after milking. Provide a system that can supply peak and total daily water requirements.
2. **Drainage:** Proper surface and subsurface drainage are required to divert storm water away from animal housing units and to help prevent frost heaving of foundations. Select an elevated building site with a slope of 2 to 6 percent to provide adequate drainage while minimizing erosion.
3. **Required area:** The site should provide an area that is several times larger than the size of the animal housing unit. Assume the operation will double in size and plan accordingly. Make room for feed areas, machine storage, vehicular traffic, and water and electricity upgrades. The site should allow for adequate manure storage. In Virginia, large operations that confine 300 animal units (200 dairy cows) or more are required to provide 120 to 150 days of manure storage capacity. This is in addition to the depth of storm water expected in a 24-hour, 25-year design storm and one foot of freeboard at all times. The site should also provide space for the collection and control of contaminated water from the animal housing units. Allow for adequate separation between buildings to prevent the spread of fire and to enhance natural ventilation.
4. **Off-farm factors:** The site must meet local building codes and pollution requirements. It should also provide adequate setback distances from neighboring residences to avoid nuisance problems such as noise

and odor. A site that is isolated from the residence and sensitive environmental habitats is ideal.

### Other Considerations

You should consider several other site factors when evaluating potential sites. These factors are not as essential as water, drainage, required area, and off-farm factors. However, a potential site should be eliminated if it cannot provide a majority of these other factors:

1. **Access:** The site should provide for the construction of all-weather roads for milk trucks, service personnel, veterinarians, feed delivery, manure handling equipment, and emergency vehicles. Plan for a minimum road width of 12 feet and for adequate turn-around areas. The minimum turning radius is 50 feet for a hay wagon and at least 55 feet for large milk or feed trucks.
2. **Electric power:** Electricity is needed for heating, lighting, pumps, and motors. The site should be located near electric lines and have access to three-phase power if it is available. A minimum 200-amp, 230-volt entrance is recommended and thorough grounding is necessary to reduce stray current problems.
3. **Manure storage and usage:** The seasonal high-water table must be at least one foot below the bottom elevation of the manure storage pit and the pit cannot be built within a 100-year flood plain. The site should also have sufficient land so that manure application does not exceed crop nutrient needs. Consult a certified nutrient management planner to determine if potential sites meet this criterion. The land should not be located further than one mile from the manure storage facilities to minimize hauling costs. Land for manure application should have minimal slope to minimize manure runoff and should not lie adjacent to neighboring residences or public facilities. The Virginia Pollution Abatement (VPA) permit states that no manure application can occur within:
  - 200 feet of an occupied dwelling unless reduced or waived in writing by the occupant;
  - 100 feet of a well or spring;
  - 50 feet of surface water (creek, stream, pond, etc.) or 25 feet if manure is injected;

- 25 feet of a rock outcropping; 50 feet of limestone outcrops;
  - 50 feet from sinkholes; and
  - Waste should not be applied so that it would discharge to sinkholes.
4. **Soil type:** The type of soil can have a significant impact on the cost of constructing a manure storage structure. In most cases, a lagoon must be lined with a clay-type soil, concrete, or a heavy plastic liner. If clay must be transported a long distance, the cost of constructing a clay-lined lagoon can be 25 percent more than if suitable clay is available on the farmstead. A plastic or concrete liner may be comparable in cost to a clay liner if clay must be hauled a long distance. If the proposed building site has sandy soil and extremely shallow fractured bedrock, then an aboveground storage structure may be required. Aboveground storage costs about twice as much as lined lagoons.
  5. **Wind and snow control:** The site should have windbreaks to help deflect winter winds and control snow. Take advantage of trees, existing buildings, and hills for winter wind protection; however, windbreaks should not interfere with summertime ventilation. Consider prevailing wind directions for reducing odor complaints and for controlling snow drifting, insects, noise, and dust.
  6. **Security:** The site should provide security against theft, vandalism, and fire. Visitor access should be limited to control disease and to reduce interference with farm work. When dairy facilities are located on the same site as the manager's residence, the access lane should run near the home. Facilities located away from the manager's residence pose the most problems. Install gates at remote accesses with signs warning about unauthorized entry. Also, make access roads visible from a public road or neighboring residence. More information on farm security is available from *Security for Animal Agriculture: Prevention*, Virginia Cooperative Extension publication 445-001, *Security for Animal Agriculture: Producer Response to Suspicious Animal Diseases and Unauthorized Activity*, Virginia Cooperative Extension publication 445-002, and *Security for Animal Agriculture: Security Checklist*, Virginia Cooperative Extension publication 445-003.
  7. **Safety:** The site should be located away from the residence to reduce the risk of exposing children to injury or death from equipment and animals.

## Steps for Evaluation

Use your five-, ten-, and 20-year goals, the area they will require for buildings and systems, and the site factors to work through the four site-evaluation steps as follows:

1. Make a scale drawing of each of the possible sites. Draw existing facilities, slopes, and soil types on the map. Identify the directions to fields, roads, and off-farm influences such as neighbors and sensitive environmental areas (Figure 2).
2. Use the four essential site factors to evaluate the possible sites. This process may eliminate one or more of the possible sites.
3. Use the Site-factors Checklist at the end of this publication to evaluate possible sites with regard to the other remaining site factors.
4. Select a site from the list of potential sites that remain after completing Steps 1 through 3.

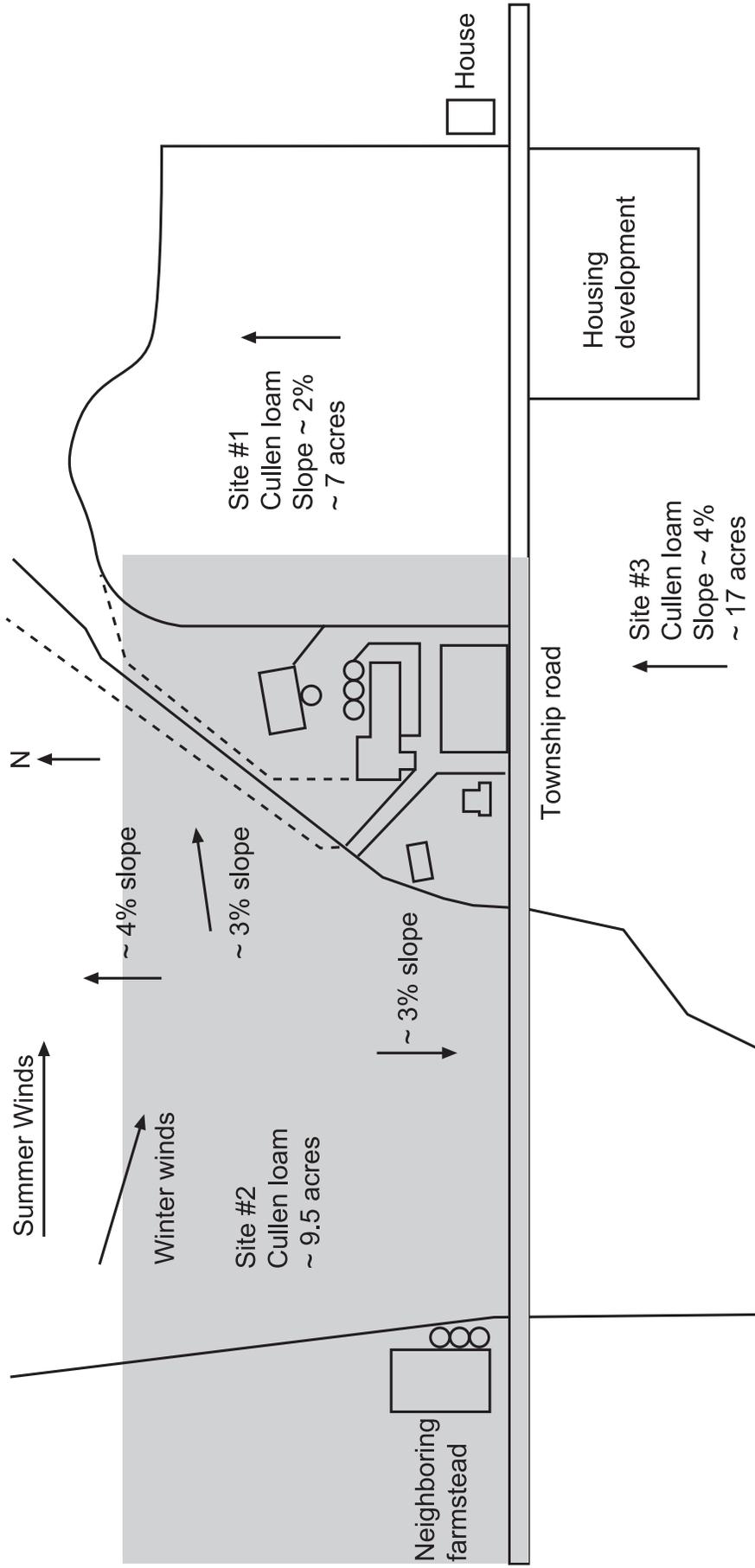
Once you have selected a site, draw the desired facilities on the scale map of the site (Figure 3). This is an iterative process and some changes in the layout may be necessary to fit the facilities into the site. If the facilities do not fit into the site in a desirable layout, select another site. Stake out the buildings on the site after the layout is determined to provide a better idea of how the site will look and function after construction.

## Summary

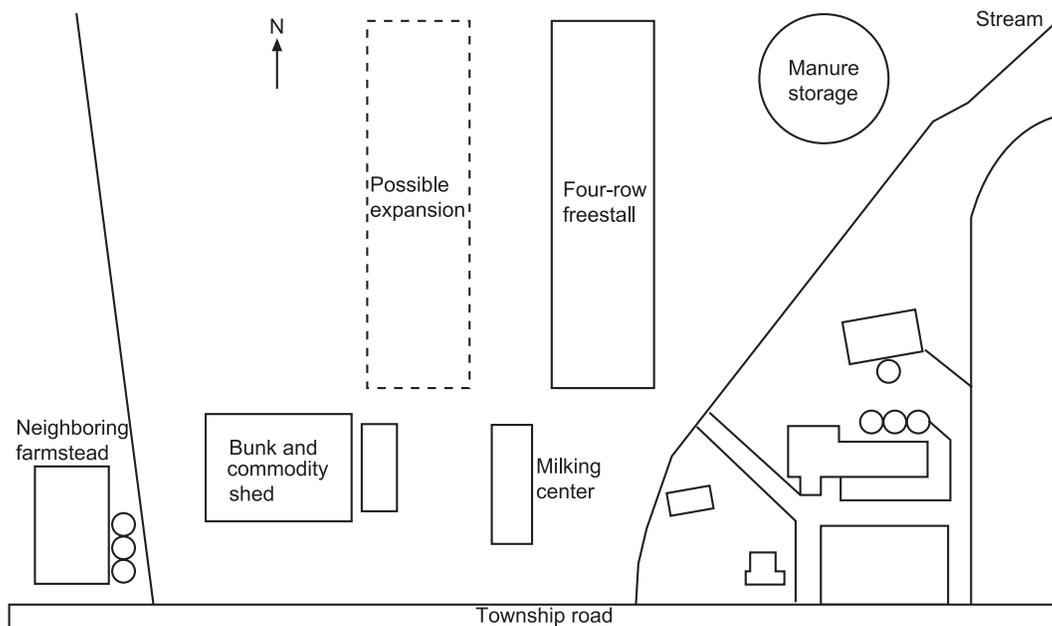
Site selection is a time consuming process. However, the selected site will affect the future of your dairy. Therefore, spending extra time to select a site that will accommodate your long-term goals for your operation will save both time and money in the future. Site evaluation is best done using a team approach to find as many potential sites as possible. Use the list of essential site factors to eliminate potential sites. Other remaining site factors should be used to reduce the number of potential sites even further. Remember, it is far easier to correct mistakes made with pencil and paper than with concrete and rebar.

## Acknowledgements

The author would like to express her appreciation for the review and comments made by Associate Professor and Extension Engineer Lori S. Marsh and Professor and Extension Engineer Robert "Bobby" Grisso of the



**Figure 2.** Map of existing facilities, possible sites, and neighboring land. Using the Site-factors Checklist on page 5, Site 2 is the best site for new facilities because it is elevated with a 2 to 6 percent slope for good drainage and has the required area for animal housing, manure storage, and other facilities. The site also has an appropriate setback distance from the housing development, access to all-weather roads, and good prevailing winds for ventilation.



**Figure 3.** Map of proposed layout of new facilities, with additional expansion, in relation to existing facilities.

Department of Biological Systems Engineering, Virginia Tech, and Dairy Science Extension Agents Alan Grove, Rockingham County, and Susan Puffenbarger, Franklin County.

## For Additional Information

### On Dairy Expansion

“Dairy Expansion: Financial Planning for Success” (\$10.00), NRAES-166

“Environmental Factors to Consider When Expanding Dairies” (\$9.00), NRAES-95

### On Dairy Housing

“Dairy Freestall Housing and Equipment” (\$25.00), MWPS-7

### On Dairy Modernization

“Dairy Modernization Planning Guide” (\$20.00), MWPS-DMPG

### On Farm Security

*Security for Animal Agriculture: Prevention*, Virginia Cooperative Extension publication 445-001, <http://pubs.ext.vt.edu/445-001/>

*Security for Animal Agriculture: Producer Response to Suspicious Animal Diseases and Unauthorized Activity*, Virginia Cooperative Extension publication 445-002, <http://pubs.ext.vt.edu/445-002/>

*Security for Animal Agriculture: Security Checklist*, Virginia Cooperative Extension publication 445-003, <http://pubs.ext.vt.edu/445-003/>

### On Virginia Cooperative Extension

[www.ext.vt.edu](http://www.ext.vt.edu)

To order MWPS or NRAES publications, contact your local Virginia Cooperative Extension office.

### Publication Modified from

MidWest Plan Service (MWPS). 2000. Chapter 2: Total dairy facilities. *In Dairy Freestall and Housing Equipment*. 7th ed. MWPS-7. Ames, Iowa: MWPS.

Tyson, J.T., and R.E. Graves. 1995. Site Evaluation for Dairy Housing Systems. H 72. Penn State Cooperative Extension, The Pennsylvania State University, University Park, Pa.

Reviewed by Bobby Grisso, Extension specialist, Biological Systems Engineering

# SITE-FACTORS CHECKLIST

**SITE NAME:** \_\_\_\_\_

**SITE LOCATION:** \_\_\_\_\_

SITE FACTOR	YES	NO	SITE FACTOR	YES	NO
<b>WATER</b>			<b>ACCESS</b>		
quality	<input type="checkbox"/>	<input type="checkbox"/>	all-weather roads	<input type="checkbox"/>	<input type="checkbox"/>
quantity	<input type="checkbox"/>	<input type="checkbox"/>	minimum road width turn-around areas	<input type="checkbox"/>	<input type="checkbox"/>
<b>DRAINAGE</b>			<b>ELECTRIC POWER</b>		
Surface	<input type="checkbox"/>	<input type="checkbox"/>	close to electric lines	<input type="checkbox"/>	<input type="checkbox"/>
subsurface	<input type="checkbox"/>	<input type="checkbox"/>	3-phase power access	<input type="checkbox"/>	<input type="checkbox"/>
elevated site	<input type="checkbox"/>	<input type="checkbox"/>			
slope 2 - 6%	<input type="checkbox"/>	<input type="checkbox"/>			
<b>REQUIRED AREA</b>			<b>MANURE STORAGE AND USAGE</b>		
animal housing units	<input type="checkbox"/>	<input type="checkbox"/>	minimum depth to water table	<input type="checkbox"/>	<input type="checkbox"/>
milking center	<input type="checkbox"/>	<input type="checkbox"/>	distance from flood plain	<input type="checkbox"/>	<input type="checkbox"/>
cow traffic	<input type="checkbox"/>	<input type="checkbox"/>	sufficient land for application	<input type="checkbox"/>	<input type="checkbox"/>
bunker silos	<input type="checkbox"/>	<input type="checkbox"/>	cropland within one mile	<input type="checkbox"/>	<input type="checkbox"/>
commodity sheds	<input type="checkbox"/>	<input type="checkbox"/>			
grain bins	<input type="checkbox"/>	<input type="checkbox"/>	<b>WIND AND SNOW CONTROL</b>		
machine storage	<input type="checkbox"/>	<input type="checkbox"/>	wind breaks	<input type="checkbox"/>	<input type="checkbox"/>
vehicular traffic	<input type="checkbox"/>	<input type="checkbox"/>	prevailing winds for ventilation	<input type="checkbox"/>	<input type="checkbox"/>
parking	<input type="checkbox"/>	<input type="checkbox"/>	<b>SECURITY</b>		
utility upgrades	<input type="checkbox"/>	<input type="checkbox"/>	limited access	<input type="checkbox"/>	<input type="checkbox"/>
Young-stock housing	<input type="checkbox"/>	<input type="checkbox"/>	near manager's residence	<input type="checkbox"/>	<input type="checkbox"/>
manure storage	<input type="checkbox"/>	<input type="checkbox"/>	access road visible to public	<input type="checkbox"/>	<input type="checkbox"/>
building separation	<input type="checkbox"/>	<input type="checkbox"/>			
<b>OFF-FARM FACTORS</b>			<b>SAFETY</b>		
building codes	<input type="checkbox"/>	<input type="checkbox"/>	limited access to children	<input type="checkbox"/>	<input type="checkbox"/>
pollution requirements	<input type="checkbox"/>	<input type="checkbox"/>			
setback distances	<input type="checkbox"/>	<input type="checkbox"/>			
isolated from surroundings	<input type="checkbox"/>	<input type="checkbox"/>			