



A Checklist for Feedlot Siting and Environmental Compliance

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One of the most important decisions when planning any livestock facility is site selection. The site for the feedlot operation must not only be suitable for housing, handling and feeding cattle, but also must ensure that surface and ground waters are protected and that the impact from odors is minimized. Whether you are planning a new facility or modifying an existing one, the following checklist may help avoid costly mistakes.

For further information on any of the following areas refer to the Beef Housing and Equipment Handbook (MWPS 6), Livestock Waste Facilities Handbook (MWPS 18), or the NDSU Extension Service.

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Regulatory Requirements

The North Dakota Department of Health is responsible for regulating animal feeding operations. All feeding operations, regardless of size, must abide by the Clean Waters Act, which prohibits discharging pollutants into "waters of the state" or to a position where pollutants are likely to enter those waters. Waters of the state include lakes, rivers, streams, sloughs, gullies, etc. If you are currently feeding or are considering feeding more than 200 animal units (200 mature beef cattle or 300 feeder cattle), you will need to apply for an approval

to operate from the Department of Health. Your application will need to outline what steps you will take to ensure minimum environmental impact. The approval process usually takes up to 45 days (or 60 days for more than 1000 animal units).

Space Requirements

Table 1 (page 2) summarizes the pen and area requirements for cattle in a range of weight classes (from MWPS 18).

Bear in mind that providing more space per head than is necessary makes the task of runoff control more difficult.



Table 1. Sizing pens and barns.

Class of Stock	Feeder Calves	Finisher Cattle	Cows
	400-800 lb	800-1200 lb	1000-1300 lb
Pen			
• unpaved, with mounds (ft ² /head)	150-300	250-500	300-500
• unpaved, no mounds (ft ² /head)	300-600	400-800	500-800
• paved (ft ² /head)	40-50	50-60	60-75
Barn			
• with lot (ft ² /head)	15-20	20-25	20-30
• without lot (ft ² /head)	20-25	30-35	35-50

Slope

Pens should drain freely to prevent boggy conditions in spring, yet not so steep that the surface erodes or the manure washes from the pens. Manure is easier to handle scraped up as a solid than as a sludge or liquid from a storage pond. The optimum slope for pens is between 2% and 6%. Pens should slope away from the feed bunk and roadway. Keep pen length to less than 250 feet to control erosion (the steeper the slope, the shorter the pen should be).

Collection drains should be located outside of the pen and sloped at less than 1%. Below pen drains are usually 0.5% to 0.75% while main drains are 0.2% to 0.5%. Drains designed to separate solids from the runoff stream may require slopes between 0.1% and 0.3%. Alternatively, a settling basin can be constructed.

Soil Type

Soil types should match the requirements of three broad

activities within the feeding operation.

- Pen surfaces and roadways. Locate pens and roadways on a stable, compacted, well drained site. Expansive clays are undesirable.
- Waste collection and control. Silt and clay soils are good for drains and storage ponds as they are relatively impermeable. Silt and clay gravels are also suitable if compacted properly. Using the USDA Unified Soil Classification Series, MH, CL and GC types are usually suitable. CH, ML, GM and SM types are sometimes suitable.
- Manure reuse. Land application of manure and effluent is suited to medium loams to light clays as they provide good drainage and retention of nutrients. Sandy soils offer good drainage but poor nutrient retention so application rates will be lower.

Working with soil types not suited to these activities will add significantly to costs or environmental risk.

Orientation

The preferred orientation for a feeding operation is with the pens facing south or east to offer some protection from the prevailing winds and maximize the sun's drying effect.

Surface Water

Control of surface water is critical. You will need to prevent all site runoff from entering waters of the state. Typically, this requires structures such as sedimentation basins, storage ponds, or grassed filter strips. The choice between different options depends on distance to the water, slope, soil type and vegetation preceding the water and size of operation. Allow at least 2 feet per animal unit as a buffer distance between the operation and any water.

A diversion bank may need to be constructed to prevent clean water from entering the site. Some people will site the pens toward the top of a rise to avoid building a diversion bank, but you will then need to consider wind protection, odor "draining" down slope and visual impacts.

Ground Water

If possible, avoid sites that:

- Are within 2 miles of a glacial drift aquifer (refer to maps from the North Dakota State Water Commission).

- Have usable groundwater within 30 feet of the ground surface.
- Predominantly have sand, sandy loam, loamy sand or gravel soil types.
- Are within 2 miles of a public well.
- Are located within a designated wellhead protection area.

If you cannot avoid these criteria, it may mean extra investigation or monitoring is necessary.

Provide a buffer of at least 250 feet between the holding pens or manure stockpile and your own well.

Odor

Minimizing the impact of odor on neighboring residents is a combination of:

- Recognizing the prevailing wind direction. In North Dakota, this is usually from the north west or south east (or north/south in the Red River Valley).
- Using topography to your advantage. Odor tends to “drain” down slope in the evening in summer.
- Reduce visual impact. Visual confirmation of dust is more likely to result in odor complaints. Windbreaks will also help break up odor plumes and provide stock protection.

- Providing a buffer distance to the neighbors. It is difficult to specify a particular buffer distance without taking into account the previous factors. Be aware that odors from some larger facilities have been detected 4 to 5 miles distant. Anyone planning a facility within 1 to 2 miles of neighboring dwellings will have to provide more detailed information on how they plan to minimize odor.

Zoning

Confirm with your county government that the site is zoned appropriately.

Winter Protection

Windbreaks provide shelter for stock and control snow drifts, reducing time spent removing snow from roads and bunks. Twelve foot high slat fences handle snow efficiently but are more costly than trees. Three rows of 20 foot high trees with a density of 50-60% will handle as much snow at less cost and improve visual amenity. Allow 150 feet between the windward row and the pens and extend the rows 100 feet past the ends. Give thought to where the drainage from the melting snow will go. It should be clean water and may be diverted.

Mounding

Mounds can be used to improve drainage within pens on flat sites. In new facilities, soil for the mounds can come from the lot itself or from soil removed to make debris basins or holding ponds. On sites with less than a 2% slope away from bunks, soil may have to be hauled in to provide adequate mounds. Mounds can be built in existing lots from a mixture of manure and soil, but clay is preferred.

Typical mounds have short, relatively steep slopes on the mound itself, with less slope in the valley. It is important that good drainage out of the pen be maintained, otherwise water and manure will accumulate within the pen, creating a bog. Having the pen fence on the crest of the mound results in manure working away from the fence, eliminating manure buildup under it which would become a fly breeding area during the summer months.

Future Changes, Expansion, Change in Markets

The operation will change over time, for example expanding in numbers or concentrating on different markets. Will you have a site with enough space available to accommodate those changes?

Volume/Composition of Waste

If you have an existing operation, you should have samples tested to determine the manure's nutrient content. In the absence of your own data, several references provide typical manure volume and composition analyses. Be aware that the nutrient content will vary significantly from site to site. Table 2 is from the USDA-SCS Agricultural Waste Management Field Handbook.

Manure Management

While scraping pens, try to maintain the manure interface layer and leave a level pen surface. A box scraper is better than a dozer or tractor mounted blade for pen maintenance. As manure spreading occurs less frequently than pen cleaning, you may need a stockpile area. If it is outside the pen ensure that any runoff is directed to the storage pond. Stockpiling can reduce the volume of manure to be spread by as much as 40%. Composting will result in a product with reduced odor but will require turning of the stockpile to maintain aeration.

Table 2. Beef waste characterization.

	Feedlot Manure	Lagoon Effluent	Lagoon Sludge
Weight	17.50 lb/day/1000#	n.a.	n.a.
Total solids	55.00 % (wet basis)	0.30 % (wet basis)	17.20 % (wet basis)
Nitrogen	0.21 lb/day/1000#	1.67 lb/1000 gal	51.70 lb/1000 gal
Phosphorus	0.14 lb/day/1000#	n.a.	17.50 lb/1000 gal
Potassium	0.03 lb/day/1000#	7.50 lb/1000 gal	14.20 lb/1000 gal

Units of lb/day/1000# are pounds per day per 1000 pounds of live weight.

Runoff Management

Runoff from the pens and stockpile will carry manure off site unless contained. Typically this will require a storage pond with a capacity designed to hold:

- Any runoff produced when it is not suitable to distribute that water on pasture or cropland (Department of Health require 180 days).
- The runoff from a 24 hour, 1 in 25 year storm.
- Any sludge that may accumulate and otherwise reduce pond capacity.

The pond may empty by evaporation over the summer but the liquid is of suitable quality for distribution by irrigation.

Reuse

The nutrients in the solid and liquid should be reapplied to pasture or cropland (this is not yet legislation but may one day

become so). Develop a manure application plan that considers:

- Existing soil fertility levels.
- Nutrient content of the manure to be applied. Testing at the time of application accounts for most losses, use that data for next years calculation.
- The crop's nutrient requirement after selecting a suitable yield goal.
- Calculation of the manure application rate so that no nutrient is applied in excess of the crop requirements.
- Calibration of the spreader.
- Crediting the nutrients applied against the usual inorganic fertilizer application.

Additional Resources

Mid West Plan Service, (1987). Beef Housing and Equipment Handbook. MWPS-6, 4th Edition.

Mid West Plan Service, (1985). Livestock Waste Facilities Handbook. MWPS-18, 2nd Edition.

USDA-SCS, (1992). Agricultural Waste Management Field Handbook.

