

Feedlot Site Analysis

Regulations pertaining to open lots

State environmental regulations pertaining to open feedlots in the United States began to appear in the 1960s when cattle feedlots greatly increased in size. Later, the Environmental Protection Agency (EPA) enacted federal regulations for all feedlots over 1,000 animal units (AUs). Table 22-1 gives the AU conversion for various livestock categories. Feedlot operators should contact their state environmental agency to determine the regulations that affect their specific feedlot operation.

Before planning runoff control structures, review the environmental regulations for feedlot runoff. Facilities need to be constructed to comply with both state and EPA regulations. The feedlot size and location determines if runoff has to be controlled and the type of runoff system that can be used. Normally, feedlots greater than 1,000 AUs fall under EPA regulations, which in many states are administered by the state environmental agency. The current EPA regulations require runoff controls based on the 25-year, 24-hour storm event. The rainfall amount from this storm is shown in Figure 22-1. Feedlot runoff from this storm must be contained. Feedlots below 1,000 AUs usually have to meet state regulations, and in many states, state regulations regulate feedlots with 200 to 999 AUs. If a feedlot is causing environmental damage, most states have a general water quality regulation that applies to it, regardless of size.

To obtain feedlot environmental permits, certain regulations, restrictions, and design specifications must be considered in each state. Some of the state regulations involving separation distances that apply to feedlots are as follows:

1. Separation distances may be required from open lots, manure storage areas, and runoff control systems to the property line (minimum of 100 ft recommended if no state regulations).
2. Minimum distances must exist between the lowest elevation of the feeding area or runoff control facilities and the groundwater aquifer or seasonal perched water tables (minimum of 10 ft recommended if no state regulations exist).
3. Minimum distances between the lots and wells, reservoirs, or rural water lines must be preserved (minimum of 100 ft from wells or reservoirs, lots preferably downslope of water sources, and 50 ft from rural water district lines if no state regulations exist).
4. Minimum separation distances must exist between facilities and the nearest habitable structure or public use areas.

Other regulations that affect feedlots are as follows:

1. Runoff control facilities must be able to handle the runoff generated by a certain rainfall amount, for example, a 25-year, 24-hour storm.
2. Sedimentation structure volume and sediment storage allowance are required for feedlot areas.
3. If a containment system is used, the required lagoon storage volumes and the equipment to remove lagoon contents must be specified.
4. Nutrient planning and cropping sequences must occur on land used for manure applications.

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Table 22-1. AU conversions.

Livestock Category	Factor
Beef cattle	1.0
Dairy cattle	1.4
Swine	0.4
Sheep	0.1
Horses	2.0
Turkeys	0.018
Ducks	0.2
Chickens	0.01-0.033

Note: The total number of animal units (AUs) on a site is calculated by multiplying the number of confined animals by the above factors and adding the result for each livestock category.

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Location factors

The type of actual runoff system that meets individual state and EPA regulations depends upon the site, drainage area, proximity of streams or groundwater, number and size of animals fed, and the number of days the lot is used each year. Due to the variability between farms and ranches, it is difficult to state exactly what will work in all situations. However, feedlot operators should not locate feeding pens near streams or running water or in areas such as ravines where cropland or pastures may drain through the pens. Any water draining from adjacent fields through a lot is considered to have the same pollution potential as water falling directly on the lot and must be controlled using either a discharging or nondischarging pollution control system. Therefore, runoff must be diverted, using terraces or channels, from cropland or pastures around the lot, reducing the total amount of runoff to be treated. In some cases, it may be easier to relocate the pens rather than to control the excess adjacent runoff. For new operations, lots should be located on upland rather than bottomland, minimizing the drainage and potential pollution problems.

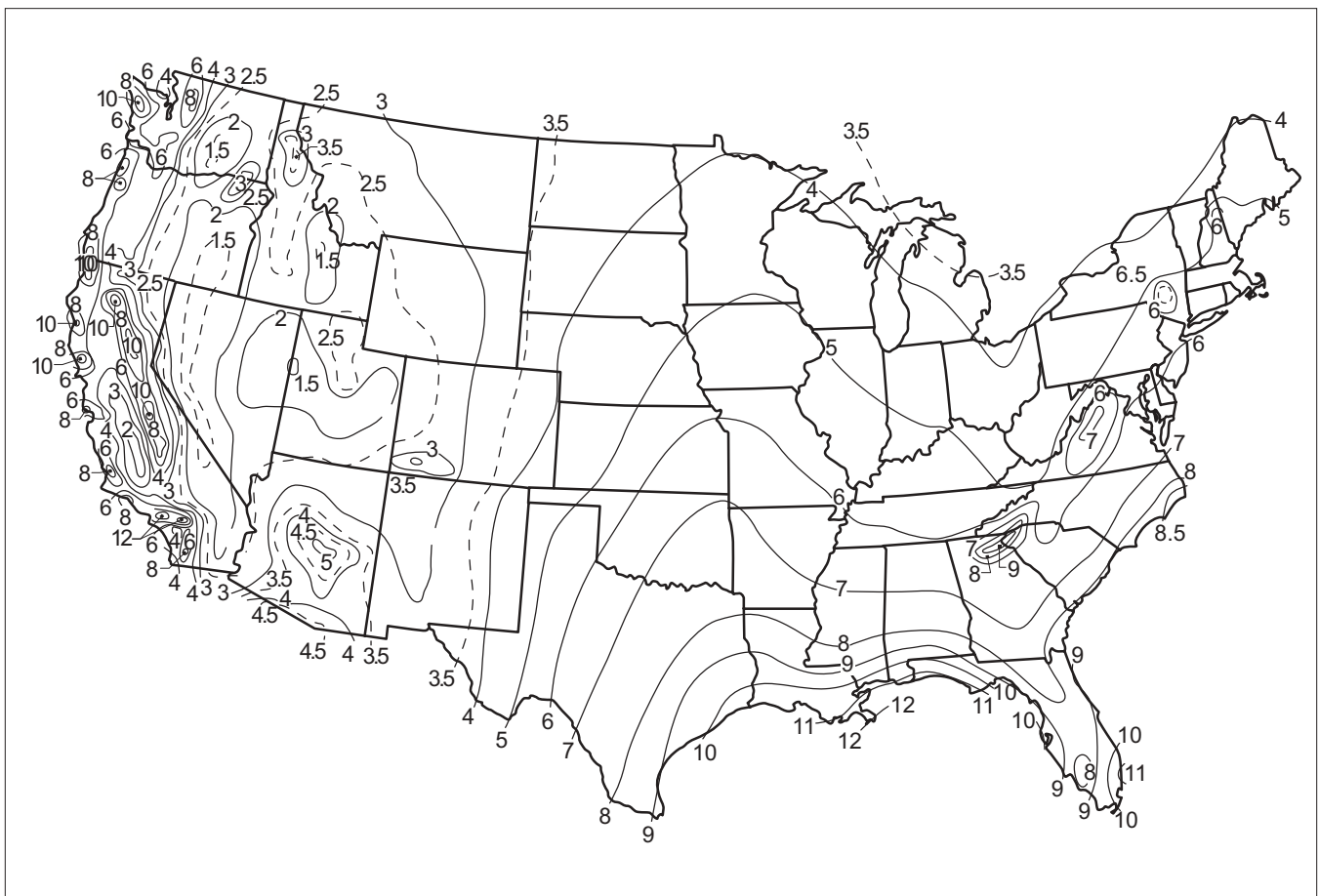


Figure 22-1. 25-year, 24-hour precipitation, inches.

The soil structure at and below the feedlot surface should be investigated. Soils below the surface should have a high clay content to absorb and restrict the movement of ammonia and other materials through the soil profile. Rock layers close to the surface are undesirable. Soil properties should be investigated to a minimum depth of 10 feet below any manure-soil interface. Backhoe trenches and soil borings are used to assess the soil properties below lot and lagoon surfaces.

Initial site planning

Large feedlots can expect both water runoff and air quality problems. Dust and odor problems, however, can be minimized by proper site selection and by appropriate animal density within the pens. To avoid air pollution problems for feedlot workers or neighbors, prevailing winds and habitable structures must be considered. Preliminary site evaluation considers topography, present and future feedlot numbers, and accessibility. A 2% to 5% land slope is recommended, and a soil with 25% or more clay is preferred to sand or fractured rock surfaces. Approximately 1 acre of land is required per 100 AUs for pen space, alleys, and feed roads.

A minimum of 200 feet from the pen to the nearest flowing water channel is recommended. This space allows construction of runoff control structures. Water channels can include road ditches, streams, waterways, or pasture draws. All extraneous runoff needs to be diverted away from the feedlots and roads. For new sites, this is most easily accomplished by siting the feedlot on a ridge or elevating the feed road to construct a diversion channel. Terrain and drainage determine bunk orientation. The preferred bunk orientation is in a north-south direction with east-west sloping lots. During the winter months, feed bunks orientated in an east-west direction can accumulate ice on the bunk's north side. North-sloping lots will not dry as quickly during wet weather, and livestock also may be exposed to more severe winds.

Site planning also includes the location of the working facilities. Most cattle operations are better suited to move livestock out of the lower side of the pens rather than onto the feed road. Using the feed road for cattle movement may save fence construction, but it can interfere with truck traffic and create animal and worker stress during handling. Normally, 1/8 to 1/2 acre of land is needed for siting the working facilities. Additional space may be needed for sick or receiving pens. Trucks and stock trailers must have easy access to the working facilities. Rather than backing trucks and trailers down a road, a circular turning area is preferred. Allowing a semi-truck to enter and circle back out to the entrance road requires a turning area of 130 to 150 feet in diameter. Similar space is required for many fifth-wheel stock trailers pulled by farm trucks. When locating access roads to the feedlot, consider road visibility to oncoming traffic.

Pen space

Table 22-2 provides the recommended earthen and paved feedlot pen space for livestock in 25- to 35-inch average rainfall areas. In other areas (those areas not in this rainfall range), pen space can be adjusted by multiplying the table value by the average rainfall and then dividing by 30. Generally, most producers find 300 square feet per AU to be adequate pen space in 25- to 35-inch rainfall areas.

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Pen arrangement

Feedlot pens are arranged using a single or double row design, that is, pens can be located on one or both sides of the feed road. A single row arrangement typically has feed bunks located on one side of the road and a diversion channel on the other side to carry away extraneous drainage. Often, a single row arrangement (Figure 22-2a) may follow a terrace around a hillside. Only one runoff control structure is required for this arrangement, a definite advantage.

A double row arrangement requires locating the pens along a ridge with lot construction on both sides of the feed road (Figure 22-2b). With this arrangement, the runoff must be contained from both sides of the ridge, using either two structures or two channels to bring the runoff back to a common lagoon. However, the cost of the feed road is distributed between two pens rather than one. In large operations where snow and rainfall runoff are drained between the feed roads, a wider feed road may be required, reducing the cost savings.

Feed roads

In single pen row arrangements, most feed roads are 12 to 16 feet wide. The feed road is sloped away from the feed bunks and pens into a diversion channel. Feed road width in double pen row arrangements can vary from 16 to 30 feet. The wider road is required if snow or rain runoff from the road is drained or stored in a center channel of the feed road. The center channel normally drains away from the pens and to one end of the feed road. If the feed road water drains toward the pens, then the feed road should be crowned in the center. To build an all-weather road, adequate roadbed preparation (elevation, slope, and drainage) is required before adding 8 to 12 inches of

Table 22-2. Feedlot square footage allowed per animal for 25- to 35-inch rainfall areas.

Type of Animal, lbs	Earthen Lot, square ft	Paved Lot, square ft
Beef		
Cow-calf	500	75
Calf (600)	250	50
(600-1,400)	350	60
Dairy		
Calf (250)	200	30
(250-400)	300	35
(400-600)	400	40
(600-800)	500	45
(800-1,000)	600	50
Sheep		
Rams (180-300)	40	16
Ewes (150-200)	40	16
Ewes with lambs	50	20
Feeder lambs (3-130)	30	10
Swine		
Nursery pigs (30-75)	75	8
Finishing pig (75-275)	150	15
Gestating sow	200	20
Boar	200	40

gravel. In most states, the drainage from the feed road does not have to be controlled, so if possible, the road drainage can be diverted away from the pen runoff collection system.

Livestock waterers

Livestock waterers can be located in fence lines or the middle of the pen. It is advisable to have a 10-foot concrete apron around the waterer and a 10- to 20-foot concrete apron from the feeding apron to the waterer. This is not feasible if the waterer is located at the back of the pen. To prevent mud holes and ice from forming around the waterer, open tanks or automatic waterers that constantly release water to prevent freezing require additional drainage systems for the overflow water. Preferably, animals can travel from the

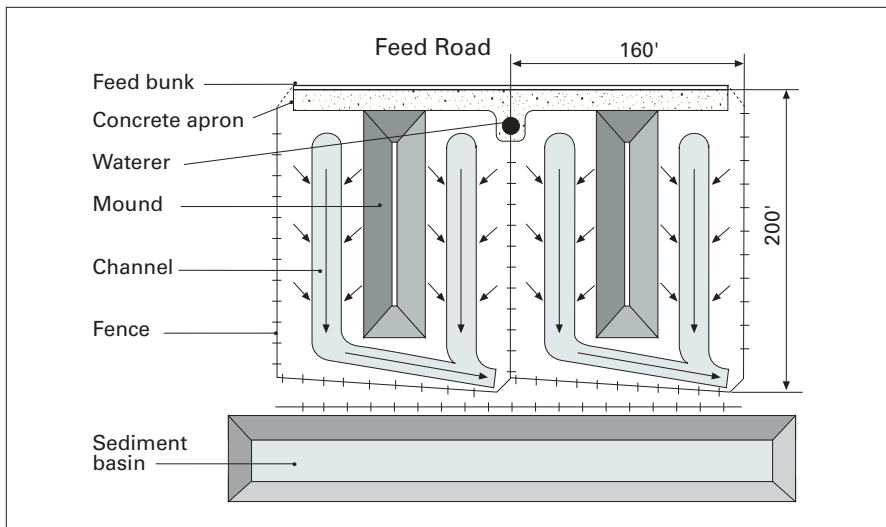


Figure 22-2a. Single-row feedlot design.

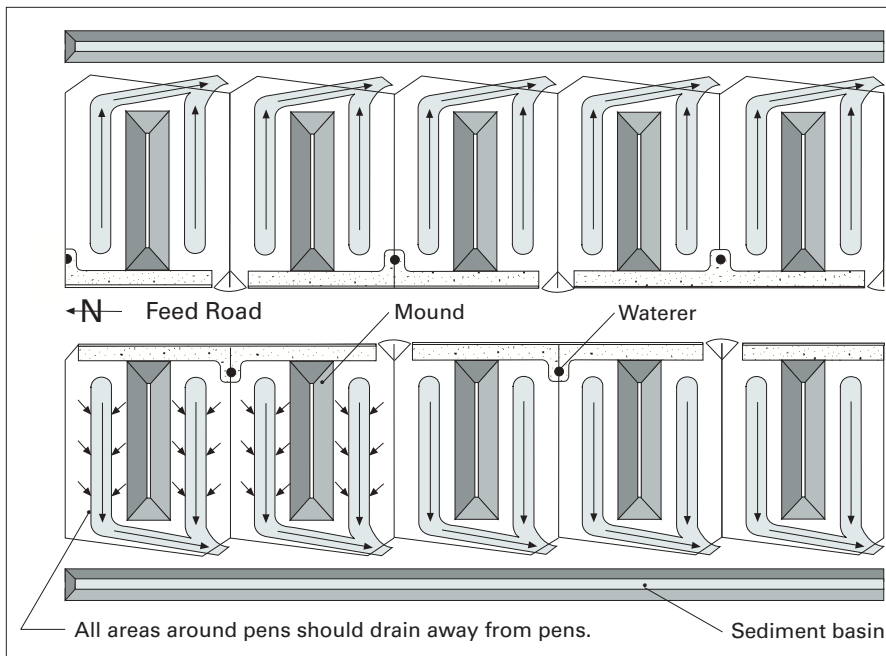


Figure 22-2b. Double-row feedlot design.

Mounds are places for animals to rest and get away from the mud...

feeding area to the waterer without having to cross a drainage area.

Mounds

Mounds are places for animals to rest and get away from the mud; they are not places to stack manure. Proper mound construction requires 20 to 40 square feet of mound space per AU on each side of the mound. The entire pen of animals should be able to rest on one side of the mound without laying on each other. Animals should also be able to step off of a mound and onto the feeding apron without having to move through mud. Mound height ranges from 4 to 6 feet. The top of the mound is usually less than 5 feet wide and the side slopes are at a 5:1 or 4:1 ratio (Figure 22-3). Animals use mounds oriented east-west as a windbreak by laying on the south side. Mounds should be constructed to encourage animals to lay on the sides rather than on the top. If they rest on the top, animals often create areas where rainwater and urine accumulate rather than drain off the sides. Finally, mounds should not impede natural pen drainage and should be constructed so that pen shaping and leveling equipment can travel over and maintain the shape of the mound.

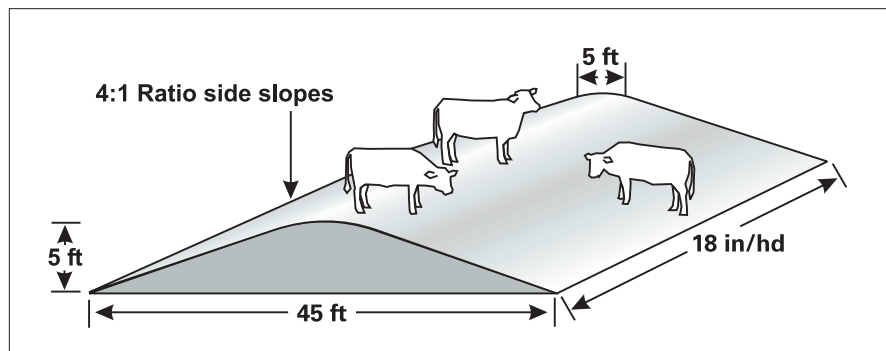


Figure 22-3. Cross section of a feedlot mound.