

Texas Agricultural Extension Service
The Texas A&M University System

Reducing the Risk of Ground Water Contamination by Improving Livestock Holding Pen Management

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1. Do you have a livestock feedyard or livestock holding facility on your property?
2. Are any water wells downslope from or closer than 150 feet to livestock feeding or holding facilities?
3. Is your livestock facility located on a site that has shallow soil or a high water table?
4. Does your livestock facility lack a clean water diversion?
5. Does water run off your livestock facility in an uncontrolled manner?
6. Do you fail to clean manure from your livestock facility in a timely manner (once per week for dairy cattle or once every 1 to 2 months for beef cattle)?
7. Are your livestock holding facilities overstocked?
8. Are there any abandoned livestock feeding or holding facilities on your property?

If these questions create doubt about the safety of your management practices, this publication will provide helpful information.

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Livestock Holding Pen Management

Open lots or holding pens for feeding or holding livestock can be sources of ground water contamination. The potential for livestock feed yards or holding pens to pollute ground water depends on site selection, stocking density and slope. Other good reasons for improving management practices include herd health, ease of maintenance, odor control and fly control.

Livestock yards such as barnyards, holding areas and feedlots contain concentrated livestock wastes. These wastes contain nitrate and bacteria that can contaminate ground water. This is especially true if there is no system to:

- 1) divert clean water flow away from the livestock yard;
- 2) drain water away from the well location; or
- 3) collect polluted runoff from the yard for diversion to a waste retention structure where its effect on surface or ground water is minimal.

Livestock waste can most easily contaminate ground water if the facility or area of animal concentration is located over coarse-textured permeable soils, if the water table is at or near the surface, if fractured bedrock is within a few feet of the surface, or if polluted runoff is discharged to permeable soils and bedrock.

Human health problems caused by fecal bacteria in drinking water include infectious diseases such as dysentery, typhoid and hepatitis. Organic materials, which may give water an undesirable taste and odor, are not known to be dangerous to health, but their presence does suggest that other contaminants are flowing directly into ground water.

This bulletin focuses on managing livestock holding pens and covers the following topics:

- 1) Separation distance from well
- 2) Site characteristics
- 3) Clean water diversion
- 4) Runoff control
- 5) Feedlot cleaning
- 6) Type of yard surface
- 7) Manure storage and utilization

8) Abandoned livestock yards

9) Evaluation table

A glossary in the back of this publication will clarify the terminology used.

Separation Distance From Well

Wells should be located in an elevated area upslope from the livestock feed yard so that runoff will drain away from wells. The Texas water well code requires a minimum separation of 150 feet between existing livestock yards and new wells.

Minimum separation distances regulate new well installations as well as the distance from existing wells to new sources of contamination. Existing wells are required by law to meet separation requirements in effect at the time of well construction.

Site Characteristics

Ground water protection is a major consideration in siting a livestock feed yard or holding pen. Factors to consider include topography, soils and geology. Important soil characteristics include surface and subsoil texture, depth and permeability. A poor site has shallow soil, high water table, or very sandy/gravelly soil with excessive drainage and high permeability.

Clean Water Diversion

One way of reducing water pollution from livestock feed yards is to reduce the amount of clean water entering the open lot. The following structures are always essential:

- ★ waterways, small terraces and roof gutters to direct water away from livestock pens;
- ★ an earthen ridge or diversion terrace constructed across the slope to prevent runoff from entering the feed yard; and
- ★ a catch basin with a pipe outlet installed above the livestock yard if a diversion terrace is not practical.

Runoff Control

An open lot typically has an earthen surface compacted by animal traffic. This surface needs to be shaped to a uniform grade for water drainage, so it remains relatively dry except during and immediately after rainfall.



Manure typically accumulates on the surface, and decaying or decomposing manure is mixed into the soil by animal traffic, sealing the surface and reducing infiltration.

Water running off concrete pads and clean water from roofs and upslope areas can cause problems if it washes manure from the open lot surface. Contaminants in runoff water can enter ground or surface water. This risk is greatest with soils having high infiltration and percolation rates. To prevent this problem, runoff controls are essential.

Producers should collect and store runoff from holding pens for later land application. Runoff control systems collect feedlot runoff, settle out manure solids, and direct the remaining runoff water to detention ponds. Figure 1 shows a livestock feedlot runoff control system for an open lot surface. All operations with more than 300 head of beef cattle or 200 head of dairy cattle will need to put in a no-discharge system (holding pond and irrigation system), and all producers are advised to do so regardless of the operation's size.

Feedlot Cleaning

Livestock feedlot surfaces should be cleaned regularly. The amount of manure on a livestock feedlot surface depends on the animal spacing (square feet per head), hours per day animals spend on the open lot, animal size, and type of feed ration. Cleaning and scraping once per week is preferable for dairy cattle, or once every month or two for beef cattle. Concrete surfaces are easier to clean than earthen lots. Earthen yards are usually cleaned when dry, so solids may be removed less frequently. Leave an undisturbed, compacted manure layer (1 to 2 inches thick) over the soil to provide good surface sealing. A tractor-drawn box scraper collects manure while leaving a well-graded, uniform manure surface that sheds water and dries out rapidly. Earthen yards can be cleaned only once or twice per year.

Type of Yard Surface

The area needed per animal to minimize the risk of ground water contamination depends on the type of lot surface. The area needed for a concrete surface is much less than that required for an earthen lot. The concrete area needed is a balance between traffic on the lot and the resting area provided for animals. Too

small an area will make it difficult for animals to move about pens during wet conditions, while too large an area is an extra expense and generates more runoff. For dairy operations, the best protection for ground water is to confine animals to a freestall barn or roofed feeding barn.

A compacted manure layer should be maintained on an earthen open lot surface to retard infiltration and denitrify nitrate. Any adjacent concrete areas should be curbed to keep runoff from flowing off the edges of the concrete onto the earthen area.

If porous soil or fractured bedrock are close to the surface where your livestock yard is located, the surface should be paved.

Manure Storage and Utilization

In addition to the condition of livestock yards, your animal waste management plan should consider storing waste for use as fertilizer. For more information on this subject see B-6030, *Reducing the Risk of Ground Water Contamination by Improving Livestock Manure Storage and Treatment Facilities*, in the TEX*A*Syst publication series.

Using manure as fertilizer on improved pastures removes accumulated nutrients through the cropping system. Animal waste is a valuable fertilizer and soil conditioner. When managed properly, the nutrients in manure can be substituted for commercial fertilizers while saving money and protecting ground and surface water. Matching nutrient applications to crop nutrient needs is critical. Do not over-apply manure to land. Have your soil, manure and effluent tested so you can determine the proper amount to apply.

Abandoned Livestock Yards

In active feedlots or yards, the layer of organic matter and soil at the surface lies over compacted soil, forming a layer through which water moves very slowly. Therefore, leaching of nitrate and bacteria through the surface seal and compacted layers is not likely. However, if this manure/soil layer is removed, leaching may occur.

Abandoned yards can pose a significant ground water contamination risk. As the manure pack breaks up from lack of use, water can leach through to the ground water. If you



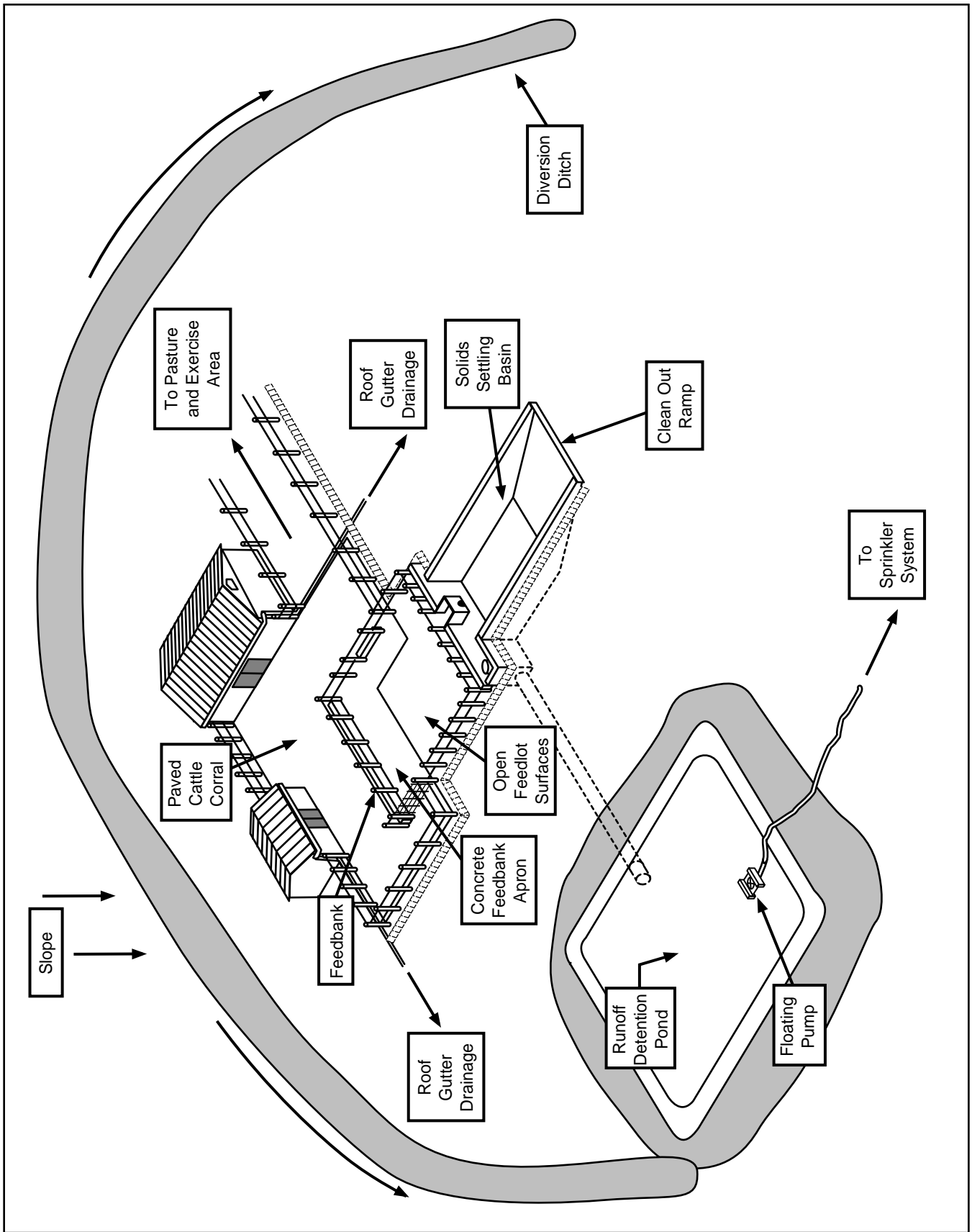


Figure 1. Small livestock yard runoff management system.



have a permanently abandoned feedlot or corral, collect all the manure, spread the manure and soil mixture on fields, and refill the former feedlot surface with other soil material. Then, till and plant the area with a crop that uses lots of nitrogen to make use of the nitrogen released as the manure decomposes. Also remove manure from a feedlot that will not be used for an extended period. Otherwise, cracks developing in the surface may allow leaching of nitrates and salts.

determine the risk that drinking water on a given property will become contaminated as a result of the management practices being used. For each category listed on the left that is appropriate, read across to the right and circle the statement that best describes conditions on your land. Allow 15 to 30 minutes to complete the table, and skip any categories that do not apply. Note any high risk ratings and take appropriate actions to remedy them. Strive for all low or low-moderate risk ratings.

Evaluation Table

The following table can be used to help agricultural producers and rural homeowners

Livestock Waste Storage: Assessing Drinking Water Contamination Risk				
	Low Risk	Low-Moderate Risk	Moderate-High Risk	High Risk
Location of Livestock Waste Storage Facility				
Distance from drinking water well	More than 200 feet.	100 to 200 feet.	50 to 100 feet.	Less than 50 feet.
Site Characteristics				
Soil depth and permeability	Well-drained medium- or fine-textured soils (loam, silt loam, clay loams, clays) more than 40 inches deep with low permeability (silt and clay).	Well-drained or moderately well-drained medium- or fine-textured soils (loam, silt loam, clay loams, clays) 30 to 40 inches deep with moderate permeability (loamy).	Moderately well-drained coarse-textured soils (sands, sandy loam), shallow (20 to 30 inches) and/or with high permeability (sandy).	Excessively well-drained coarse-textured soils (sands, sandy loam) or gravel, and/or somewhat poorly drained to poorly drained soils, very shallow (less than 20 inches) and/or with very high permeability (coarse sand).
Design and Management of Facilities				
Surface water diversion	All upslope and roof water diverted.	Most upslope surface and roof water diverted.	No surface water diverted. Some roof water collected and redirected.	All water (surface and roof water) runs through the yard.
Lot runoff control system	No yard runoff produced (either barn or roofed area).	All runoff collected from open lots and routed through settling basins. Solids separated. Water directed into a waste storage structure.	Most of lot runoff collected. Some solids removed.	Lot runoff uncontrolled.
Yard cleaning and scraping practice	No yard. Animals confined in house. Old manure, if present, removed and disposed of properly.	Yard cleaned once or twice per year; undisturbed manure pan maintained.	Yard cleaned once or twice per year without maintaining manure pan for seal.	Rarely.



Livestock Waste Storage: Assessing Drinking Water Contamination Risk				
	Low Risk	Low-Moderate Risk	Moderate-High Risk	High Risk
Concentration of Animals on Yard (square feet per head (sf/hd))				
Dairy cows	No yard. Confined to barn or roofed area.	75 sf/hd or more on fenced, curbed concrete pad and/or 400 sf/hd on graded earthen surface.	50 sf/hd or more on concrete and/or 200-300 sf/hd on earthen surface.	Some concrete (fewer than 50 sf/hd) and earth (fewer than 100 sf/hd).
Dairy replacements	No yard. Confined to barn or roofed area.	More than 40 sf/hd on fenced, curbed concrete pad and/or 150-200 sf/hd on earthen yard.	More than 20 sf/hd on concrete and/or more than 75 sf/hd on earthen surface.	Fewer than 75 sf/hd on earth.
Beef feeders	No yard. Confined to barn with slotted floor.	Barn and/or paved lot with more than 50 sf/hd. Earthen lot with mound with more than 300 sf/hd, or without mound with more than 500 sf/hd.	No shelter and paved lot with 40 to 50 sf/hd. Earthen lot with mound with more than 150 sf/hd, or without mound with more than 250 sf/hd.	Paved with fewer than 30 sf/hd, or earthen with fewer than 150 sf/hd.
Beef cows/heifers	Barn or roofed lot.	Barn with paved lot with more than 60 sf/hd. Earthen lot with mound with more than 400 sf/hd. Earthen without mound with more than 600 sf/hd.	Paved lot with more than 30 sf/hd. Earthen mound with more than 200 sf/hd. Earthen without mound with more than 300 sf/hd.	Earthen without mound with fewer than 200 sf/hd.
Sheep/ewes	No yard. Confined to barn or roofed yard.	Barn and paved lot with more than 20 sf/hd. Earthen with more than 25 sf/hd.	Barn and paved lot with fewer than 15 sf/hd. Earthen with fewer than 25 sf/hd.	Earthen with fewer than 10 sf/hd.
Feeder lambs	No yard. Confined to barn.	Barn and paved lot with more than 10 sf/hd. Earthen with more than 25 sf/hd.	Barn and paved lot with more than 5 sf/hd. Earthen with more than 10 sf/hd.	Earthen with fewer than 10 sf/hd.
Hogs/sows	No yard. Confined to barn.	Shed and paved lot with more than 30 sf/hd.	Shed and earthen lot with fewer than 15 sf/hd.	Earthen with fewer than 10 sf/hd.
Pigs: growing/finishing	No yard. Confined to barn.	Shed and paved lot with more than 15 sf/hd.	Shed and earthen lot with more than 15 sf/hd.	Shed and earthen lot with fewer than 10 sf/hd.
Horses	No yard. Confined to barn or on pasture.	Earthen exercise lot with more than 2,500 sf/hd. No pasture.	Earthen lot with more than 1,500 sf/hd. No pasture.	Earthen lot with fewer than 1,000 sf/hd. No pasture.
Chickens: Broilers	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 2 sf/hd or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 2 sf/hd or more on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.



Livestock Waste Storage: Assessing Drinking Water Contamination Risk				
	Low Risk	Low-Moderate Risk	Moderate-High Risk	High Risk
Concentration of Animals on Yard (square feet per head (sf/hd) (continued)				
Chickens: Layers	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 4 sf/hd or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 4 sf/hd or more on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.
Turkeys	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 8 sf/hd or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 8 sf/hd or more on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.
Ducks	No lot. In building with watering system in good working order. Runoff protected.	No lot. In building with watering system in good working order. Inadequate runoff protection.	Earthen lot of 4 sf/hd or more, on medium-textured soils (silt loam, loam). Water table deeper than 20 feet.	Earthen lot of 4 sf/hd or more on coarse-textured soils (sands, sandy loam). Water table shallower than 20 feet.

Glossary

Filter strip: A gently sloping grass strip planted between the livestock yard and drainage ways to streams and managed to filter runoff from the livestock yard. Influent waste is distributed uniformly across the high end of the strip and allowed to flow through the strip. Nutrients and suspended material remaining in the runoff water are filtered through the grass, absorbed by the soil and ultimately taken up by the plants. Filter strips must be designed and sized to match the characteristics of the livestock yard. A typical practice is to make the filter strip area about equal to the livestock yard area.

Infiltration: The entry of water through the soil surface.

Percolation: The downward movement of water through the soil.

Runoff control system: A combination of management practices that can be used together to prevent water pollution from livestock yard runoff. Practices may include

diverting runoff from the yard or roofs, using roof runoff systems, shaping yards, using settling basins, and planting filter strips or buffer areas.

Soil drainage class: A description of the frequency and duration of periods of saturation or partial saturation that exist in soils, as opposed to human-altered drainage. Different classes are described by such terms as “excessively drained,” “well-drained,” and “poorly drained.”

Soil permeability: The quality that enables a soil to transmit water or air. Slowly permeable soils may have fine-textured materials, such as clays, that permit only slow water movement. Moderately or highly permeable soils commonly have coarse-textured materials, such as sands, that permit rapid water movement.

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



Contacts and References

For additional information contact your local county Extension agent, or:

- ★ The Texas Natural Resource Conservation Commission at (512) 239-1000,
- ★ Texas Agricultural Extension Service Agricultural Engineering unit (409) 845-7451,

- ★ Texas Agricultural Extension Service Water Quality unit (409) 845-0887,
- ★ Texas State Soil and Water Conservation Board, (817) 773-2250.

Internet address: TEX*A*Syst bulletins and links to other water quality sites are contained in a homepage located on the World Wide Web at: <http://waterhome.tamu.edu>.

TEX*A*Syst is a series of publications to help rural residents assess the risk of ground water pollution, and to describe Best Management Practices (BMPs) that can help protect ground water. The TEX*A*Syst documents were developed from the national Farm*A*Syst ground water protection program. The TEX*A*Syst system is designed to help the user learn more about the environment, existing environmental policies and regulations, and recommended management practices. Thus, the user can voluntarily reduce the pollution risks associated with water wells.

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