Watering Systems for Grazing Livestock

Livestock Industry Facilities & Environment

Livestock must have free access to plenty of clean, fresh water at all times to be productive. This holds true for livestock on pasture as well as in the barn. This publication is a short reference with recommendations about how to efficiently provide water to grazing livestock. It is assumed that some form of grazing management is the norm, including rotation of animals among pasture subdivisions, frequently called paddocks, to optimize forage and livestock production from the system.

Location of water tanks

It is preferable to deliver water to animals than to force them to walk long distances to satisfy their thirst. Therefore, the source of water is not always the best location for the water tank. Development of a water system that delivers water to each paddock, as opposed to one or two centralized drinking locations for the entire pasture area, should be a priority for all grazing systems. Individual paddock water devices increase livestock energy efficiency and reduce parasite loads that can occur in areas around centralized water tanks.

Livestock tend to drink individually where water is supplied to paddocks that are 10 acres or less in size. In this situation, small movable tanks or tubs that hold between 25 and 35 gallons connected to a water supply are sufficient. Flow rates of 2 to 6 gallons per minute (gpm) are required to keep the tank full. Usually it is best to locate tanks along fence lines somewhat central to the paddock. Centralization of waterers is more critical for paddocks larger than 10 acres and when grazing high-producing dairy cows. Changing water location along the fence line from time to time will help reduce localized damage to forage if this is a problem.

The installation of water lines to get water to all paddocks can be a major hurdle. If water only can be supplied at locations central to the total grazing area, try to keep maximum travel distances for animals under ¼ mile.

When livestock must walk some distance to a centralized water supply, they tend to move to water and drink socially as a group. In this case, allow adequate tank size or trough length so that 10 percent of the herd or flock can drink at one time. Make sure there is adequate flow or tank reserve to provide enough water for the entire herd to drink within 20 minutes or less. Provide adequate open area so that the entire herd does not have to remain bunched up around the tank or in the lane leading to the tank waiting their turn to drink. Although water will remain a little cooler, it is not advisable to have the tank located under shade because this will encourage animals to rest in an area that will not be as dry or "clean" as the rest of the pasture.

Erosion problems in lanes leading to water, especially in high slope pastures, can have a negative impact on the grazing system.

Allowing livestock direct access to ponds, streams, or springs will result in bank deterioration, water pollution, and poor quality water. Instead, fence off the water source and install drinking fountains or tanks fed by the source.

Quantities and supply rates

Water requirements depend on temperature, stage of production, and water content of the diet. As a rule, animals will consume approximately two times their daily dry matter intake in water. At times, much of the water can be provided in forage; however, water supply should be designed for the worst case scenario—hot, dry weather (see Table 1). See Table 2 for recommended reservoir sizes and delivery rates. When developing a water system, keep in mind possible expansion in the grazing area, or grazing intensity that will increase the number of animals to be watered.

Water quality

Water quality influences how much water livestock drink. They will be more reluctant to drink bad-tasting or contaminated water and, therefore, may allow themselves to become more stressed before drinking. If animals drink less they will consume less dry matter and, as a result, production will be affected.

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Table 1. Daily water consumption by adult animals[1]

Livestock	Average Maintenance	Hot Weather
Beef cattle	8-12	20-25
Milking cow	20-25	30-40
Sheep	2-3	3-4
Swine	6-8	8-12
Beef calf	4-5	9-10
Horse	8-12	20-25

[1]Approximate amounts in gallons per day (gpd)

Table 2. System flow rates[1] and reservoir capacities[2]

A. System flow rates (gpm):
- * minimum flow to waterer
  - — total daily consumption in gallons divided by 240 but not less than ½ gpm per animal drinking at one time
- * minimum continuous flow with storage capacity for one or more day's consumption
  - — maximum daily consumption divided by 1,440

B. Storage recommendations (reservoir capacity)
- * flow rate is less than instantaneous demand
  - — one day's consumption
- * intermittent power sources are used to pump water (i.e. solar, wind, etc.):
  - — two or more day's consumption

C. Waterer space minimums:
- * cup, bowl, or small tub when water is available in each paddock and livestock generally drink one at a time
  - — appropriate for 20-25 animals
- * tank or trough at centralized water supply
  - — room for 10 percent of animals to drink at one time

Note: There are 7½ gallons in one cubic foot of water.

[1]In gallons per minute (gpm)
[2]In gallons

The U.S. Environmental Protection Agency recommends that livestock water contain less than 5,000 coliform organisms per 100 milliliters. (For human consumption, there should be no coliform organisms.) The recommended "safe" upper limits for nitrates range from 100 to 440 milligrams per liter (mg/l), depending on species and nitrate in feed. Sulfate recommendations for livestock drinking water vary by species and age of livestock. Contact a veterinarian for more specific recommendations.

Clean water tanks, troughs, and reservoirs periodically. Although water temperature is not critical, it will help reduce heat stress if water is a few degrees cooler than air temperature during hot weather.

Central water source with short supply lines

This section describes a centralized water system with one short water line between the source and the tank. In this system, gravity flow works well for ponds when there is room to place a tank below the dam and the area is well drained. Intakes suspended 18-36 inches below the pond surface will withdraw the best quality water. Figure 1 shows one suggested design for a homemade suspended inlet. Delivery rates from a 100-ft. conduit of 1-inch diameter pipe under 6 ft. of head will be approximately 4¾ gpm, and 6¾ gpm with 12 ft. of head. A 1½-inch diameter pipe under 6 ft. of head will deliver approximately 14 gpm, and 20 gpm with 12 ft. of head. Existing ponds should be evaluated for location with respect to the planned grazing area and capacity to supply adequate quantities of water.

New ponds for water supply are eligible for cost-share payments in many Soil and Water Conservation Districts, but only if the primary purpose of the pond is considered to be soil erosion control and water management. Even with cost-share, development expense may exceed the cost of piping water from existing water sources farther from the pasture. Pond locations are strictly limited to topography. Locations of new ponds with respect to the grazing area can significantly affect cost and complexity of the entire grazing system.

Nose-operated pumps work well for cattle but in most cases are too difficult for calves to operate. They have limited applications in cases where it is desirable to provide water in every paddock. These pumps cost about $400 and allow versatility in drawing water short distances from ponds, streams, and shallow wells. Maximum lift is about 24 feet. Each pump can handle between 20 and 25 cows.

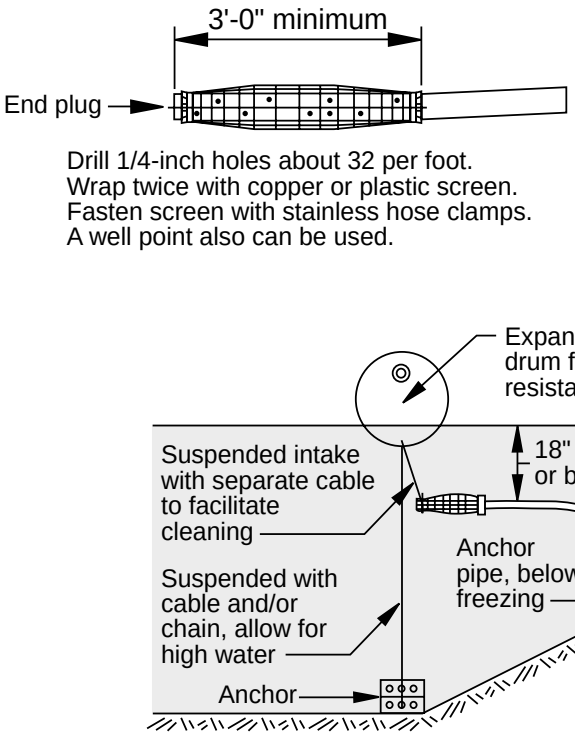

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Figure 1. Homemade suspended intake

Gas- or diesel-powered pumps offer high labor alternatives to pumping water to reservoirs and water tanks. Various levels of automation can be applied. Automatic shut-off is fairly simple to accomplish; however, automatic start is a more complex operation.

Wind and solar power technology also offer alternative energy sources for pumping water for livestock. These systems generally cost anywhere between $1,500 and $4,000 to install, depending on quantity of water to be pumped, lift required, and sophistication of equipment. If a tank or reservoir is used to store at least a two-day water supply, storage batteries are not needed to provide electrical energy to pump water on demand. Systems without automatic controls should be closely matched to need because excess water pumped will overflow the storage structure. Controlled overflow is needed to avoid erosion and wet ground around the tank.

Other pumping devices that do not require external power sources are water or hydraulic rams, water wheels, and sling pumps. Costs range between $500 and $1,000, but they are appropriate only in unique locations and situations. For example, sling pumps require flowing streams at least 12-18 inches deep. Water rams are driven by the force of falling water and work only where water can be piped from the source to lower ground, where the ram works on a hydraulic principle and forces a portion of the water to higher elevations. Hydraulic rams waste large portions of water. They seldom pump more than 20 percent of the water required for operation and frequently less than 10 percent. Therefore, provisions for draining tailwater away from the ram must be provided when using this pumping device.

Long-term grazing systems should not be developed on the basis of hauling water to livestock in water wagons, although this might be considered as a temporary solution or in emergency situations. The cost of hauling water one mile is about $0.01 per gallon.

Distribution systems for individual paddocks

In most cases, pumping water through a system of pipes and valves is required to provide water for all paddocks or pasture subdivisions. Such a distribution system also requires a pump that can develop sufficient pressure to push water through several hundred feet of

piping and perhaps several elbows, junctions, and valves, to a tank that may be at an elevation many feet above the water supply, at a rate sufficient to satisfy the thirst of the animals. Due to relatively low flow rates (about 2-6 gpm), a ¼-horsepower electric pump often is sufficient.

Pipes less than 1-inch diameter are seldom recommended, and 1½-inch diameter pipe should be considered for distances more than ¼ mile. Refer to Figure 2 as a guide for plastic pipe selection to keep pressure losses in the line within reasonable, low levels.

Flexible white or black plastic pipe is available in 100-ft. coils. Common sizes range from ¾- to 2-inch diameters. Always use pressure-rated piping, and select UV-stabilized pipe for above-ground use. One-inch black plastic pipe costs approximately 25 cents per foot, and 1½-inch pipe is about 50 cents per foot. For above-ground use, white pipe will stay slightly cooler than black, but it costs approximately twice as much as black pipe. If water lines are placed in the fence row, they will be less susceptible to livestock damage and will be quickly shaded by vegetation.

Buried lines are protected from animal damage and will stay cooler than above-ground lines. The cost of trenched-in plastic water line is approximately $1.00 to $1.50 per foot. Some supply companies have developed new, more durable above-ground piping systems and quick coupler hydrants that reduce but do not eliminate the potential for winter freeze and rupture. UV-stable, polyethylene portable tanks (30-35 gallons) with float valves and quick coupling devices cost approximately $150.

A poorly designed or installed piping system can result in an inadequate water supply to animals, even though the source is adequate. When paddocks are developed, evaluate the layout for watering locations to minimize costs. Water supply equipment dealers may be able to provide additional assistance in water system design.

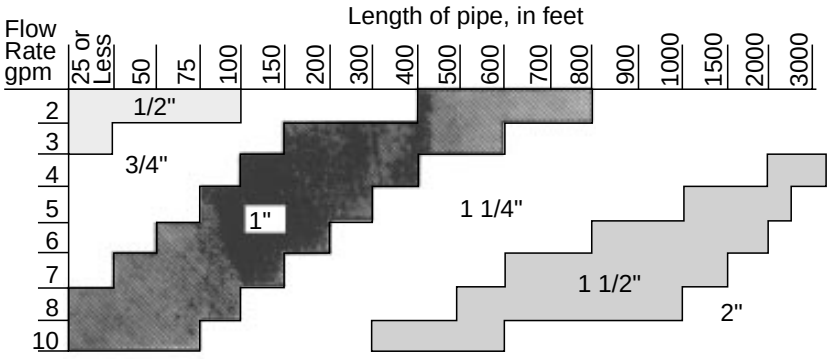

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Figure 2. Recommended sizes for outdoor uses—Schedule 40 thermoplastic pipe

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