Livestock and Poultry Environmental Stewardship <LPES> Curriculum

LPES Small Farms Fact Sheets*

Photos courtesy of USDA NRCS.

The ABCs of Livestock Watering Systems

By Ben Bartlett, Michigan State University

Summary

Drinking water is a critical nutritional component and a powerful tool for controlling where animals graze. New kinds of plastic pipe and fittings have increased the options for watering livestock on pasture. Water can be moved in many ways, such as with solar energy, wind, and gravity. However, electric power is often the most reliable and the cheapest option.

MWPS USDA EPA

*Now available online at <www.lpes.org>.

Principles

Everyone knows that farm animals need drinking water to live. In addition, the location and availability of water greatly influences where animals graze, where they rest, and their levels of production. While the impact of water varies according to species and kind of animal, two rules fit almost all grazing animals.

The first rule says that when the source of water is more than 900 feet from the grazing area, the grazing animals will come to drink as a group instead of as individuals. For a reference, a quarter mile or across a square 40 acres is 1,320 feet. This is extremely important when planning tank sizes and flow rates especially with larger herds.

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The second rule is the "law" of least effort, or need by grazing animals to expend as little energy as possible. For example, cattle will drink out of a tank on the creek bank before walking into the mud to drink out of a creek or river. Or, animals will continue to graze the section of a pasture close to the water supply rather than walk farther to more lush growth. Therefore, if you move the water, you will change where the animals spend their time grazing and where they deposit their manure and urine. More watering locations mean manure and urine is more uniformly spread across the pasture.

Livestock Watering Systems

How much water do you need?

Table 1 provides the daily minimums for a watering system. Hot temperatures and dry forage can increase these water needs over fourfold. You need to plan for these rare extremes or have a back-up plan for unusual situations.

Table 1. Water requirements.

Species	Water, in gallons
Dairy cow (also water in barn at milking	20
Beef cow pair	15
Yearling cattle	10
Horse	10
Sheep	2

How far do you need to move water?

Since not much grazing is done during extremely cold weather due to the lack of grazing forage, most pasture grazing water systems do not need to be frost proof. This situation has allowed specially designed plastic water pipe to be used on top of the ground or shallow buried under ground. Moving water takes energy or pressure due to pipe resistance and changes in ground elevation. The larger the diameter of the pipe, the more water that is moved with less resistance but the more expensive the pipe per foot. Table 2 provides an estimated number of gallons of water per minute of flow according to the diameter of the pipe. Pushing water up hills requires more pressure, that is, about 45 pounds per square inch (psi) per 100 feet of elevation. Most water pump systems are set at about 40 to 60 psi, and water pipes often have 100-psi working pressure. This means that 100 foot high hills will max out most pumps, and hills over 200 feet require stronger, or higher, psi pipe.

How fast do you need to move water to your grazing livestock?

The answer depends greatly on the size of the water tank and if the livestock come to drink as individuals or as a group. In a large continuously grazed pasture where farm animals come as a herd or flock, you need a large tank, a high flow rate, or some combination of tank size and flow rate to meet the animals' needs. When livestock are intensively grazed in small pastures and come from short distances as individuals, a slower flow rate and tank size will work.

Table 2. Gallons of water per minute.

Pipe Diameter, in inches	100	200	500	750	1,000	1,500	2,000	3,500	1 mile
	In feet								
½	4	3	2	-	-	1	-	-	-
¾	8	8	5	4	3		2	-	1
1	13	13	8	7	6	5	4	3	2
1¼	23	23	19	15	12	9	8	6	4
1½	30	30	26	22	19	15	12	9	7
2	50	50	50	43	37	29	25	18	15

Courtesy of Kentucky Grazers Supply.

As a rule, when farm animals drink *individually*, you need a (1) tank that allows 2% to 4% of the animals to drink at one time and (2) flow rate that provides total daily needs in four hours or less of pumping using full-flow values to refill the tank (Figure 1). When livestock drink as a *group*, the tank should hold at least ¼ of the daily requirement and allow 5% to 10% of the animals to drink at one time.

If the tank cannot be refilled in one hour or less, use a larger tank size (Figure 2). **These are starting points. Each situation will need monitoring to make sure it is working properly**. A herd or flock of thirsty animals

When farm animals drink individually, you need a (1) tank that allows 2%-4% of the animals to drink at one time and (2) full-flow tank float valve that allows rapid refill.

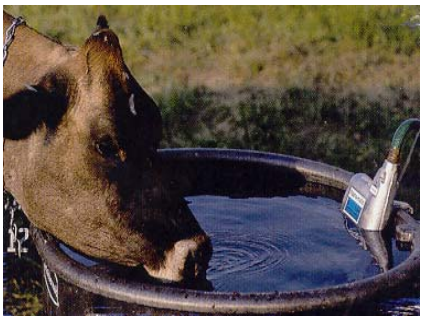

Figure 1. Small tank.

Figure 2. Large tank.

can damage a water system or injure each other. Good management and observation are critical, especially during hot, dry weather.

Estimating pipe and tank needs

Example #1
System: Intensively grazed

Animals: 60 dairy cows

Distance to water in pasture: less than 600 ft

Distance to water source: 1,500 ft from water source to most distant pasture

Daily water consumption: 60 cows x 25 gallons of water = 1,500 gallons/day

Tank refill time: 4 hours = 240 minutes

1,500 gallons divided by 240 minutes = 6.25 gallons water/minute

Pipe size (from Table 2): All 1¼-inch or the first 750 ft is 1¼-inch and the last 750 ft is 1-inch pipe.

Tank size: at least 25 gallons

Example #2
System: Continuously grazed

Animals: 40 beef cows

Distance to water in pasture: over 1,000 ft

Daily water consumption: 40 head x 20 gallons of water/day = 800 gallons of water/day

Tank refill rate: 200 gallons divided by 60 minutes = 3.3 gallons/minute

Pipe size (from Table 2): 3/4 inch

Tank size: 10% of cows to drink = four head at 2 ft/head = 8 ft of tank circumference. 200-gallon tank is 2½ by 7 ft = adequate spacing or 19 ft of drinking space

Example #3
System: Intensively grazed

Animals: 70 stock cattle (one semi-truck load)

Distance to water in pasture: Less than 900 ft

Distance to water source: 5,280 ft (one mile)

Daily water consumption: 70 head x 10 gallons/day = 700 gallons/day

Tank refill rate: 700 gallons divided by 240 minutes requires a flow rate of 3 gallons/minute.

Cost comparison of options if only grazed for 30 days every year

One ¼-inch pipe will provide 4 gallons/minute at one mile, and 1-inch pipe will provide 2 gallons/minute at 1 mile.

5,280 ft of 1 1/4-inch pipe@$0.50/ft plus 10% for fittings plus a small tank, $100 = $3,000

5,280 ft of 1-inch pipe@$0.30/ft plus 10% for fittings plus a large tank, $300 = $2,050

1,100-gallon tank ($425) on your hay wagon plus fittings plus small tank = $550

Pay neighbor $100 to pump water into pasture for a month plus fittings plus small tank = $225

Remember that everyone's situation is a little different, and it is necessary to pencil out the options.

Everyone's situation is a little different, so it is necessary to pencil out the options. Usually, the cost of supplying water to a pasture is cheaper than feeding harvested feed and not using the pasture. In some situations where water needs and performance expectation are low, such as mature beef cows without calves, animals can walk two miles or more to water. In situations where providing water is expensive, this may be the best option, but pasture use will suffer. All factors should be considered.

Water System Components

When putting a water system together, many options are available.

Sources of water

The two main sources are underground (well water) and surface (ponds, rivers, and creeks). Well water with an electric pump is often the most flexible and cheapest way to supply water. Ponds and streams can be used, but environmental issues and the capacity to move water from the source to distant pastures needs to be considered. Most often, a combination of watering options is used. The main set of pastures may be watered by a well and plastic pipe. More distant pastures may access a pond or spring. Other small or infrequently used pastures may have their water hauled in, pumped by a neighbor, or some other creative solution. Remember that water, both surface and ground water, is a valuable resource (Figure 3). Any pollution is not easily or quickly repaired.

Figure 3. Riparian area fenced as separate pasture.

Water delivery systems

The three ways to water livestock are as follows: (1) providing access to surface water (Figure 4); (2) gravity flow; or (3) pumping water. If you use surface water, such as creeks, rivers, and ponds, access ramps to water should have a maximum slope of 6:1. They should also be constructed of a non-slip, firm, non-eroding surface and a minimum of 10 feet wide. Your Natural Resource Conservation Service office can offer technical design support and cost share.

Occasionally, the source of water is at higher elevations than the grazing areas. In this case, gravity can be the force that moves the water. However, the pipe needs to be larger in

Figure 4. Access ramp to small stream.

diameter due to lower operating pressures, and valves need to be able to handle water containing possible foreign matter. Pumping is the most common way to move water, and electric-powered pumps are by far the most common choice. What are the options if electric power is not available?

Pumping is the most common way to move water, and electric-powered pumps are by far the most common choice.

There are many options. Every system has its strong points and its weak points. For example, solar pumps require adequate sunlight and work well when the average farm animal water consumption is high. A sling pump driven by flowing water will not work as effectively when stream flow is low due to hot dry weather or just when livestock will have their peak water needs. But, the sling pump will work 24 hours a day. Unlike a solar pump, it will not need a battery backup for night-time or cloudy days.

Other options include nose pumps that cattle can operate (Figure 5); wind-powered pumps (both old and new versions of the classic windmill); water-powered ram pumps; 12-volt battery pumps; power takeoff driven pumps, and gasoline- or diesel-powered electric generators or pumps.

Figure 5. Nose pump.

Special items and considerations

The plastic pipe used for above ground water systems originated in drip irrigation systems. It is not your basic hardware store black plastic pipe (Figure 6). This pipe is tougher and is worth the small increase in cost. This pipe does not need to be buried below the frost line. It is often placed on top of the ground. It does not need to be covered in high traffic areas. In other areas, the grass cover will prevent the water from becoming too hot. If you use cost share funds, check the requirements for underground burial.

Figure 6. Full-flow coupler with plastic pipe.

To permit maximum recharge of water tanks, a full-flow valve should be used (Figure 7). These valves can supply ¾ inch, 1 inch, or even greater water flow.

Figure 7. Full-flow valve.

The typical tank float has only a 1/8-inch opening. Such a small opening can be the bottleneck in what would be an excellently designed system.

Water is both a nutritional necessity for your farm animals and a tool that you can use to manage your grazing animals. More watering locations may also enhance the wildlife in your pastures. In addition to increasing the number of wildlife species on your farm or ranch, it may also increase your eligibility for cost-share funding. After people improve their pasture-watering capacity, their most common remark is, “Why didn’t I do this sooner!”

Points to Remember

- Farm animals need adequate clean water to ensure high production and good health.
- The location of water strongly influences where livestock graze and where their manure and urine are deposited.
- New equipment and new ideas have made moving water to grazing livestock much easier and less costly.
- Many watering system options are available. You may use different systems for different times of the year and/or different pastures.

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For More Information

Educational Resources
http://www.lpes.org/–To view the Livestock and Poultry Environmental Stewardship (LPES) curriculum resources

http://www.reeusda.gov/1700/statepartners/usa.htm/–To obtain state Cooperative Extension contacts

Small Farm Resources
1-800-583-3071–USDA-CSREES Small Farm hotline

877-947-7827 or cecommerce.uwex.edu–To purchase the CD, *Pastures for Horses, A Guide to Rotational Grazing*, 2003, from the University of Wisconsin Extension

1-800-292-0969 or muextension.missouri.edu–To purchase the *1996 Missouri Grazing Manual* from the University of Missouri Extension Publications

906-439-5880–To purchase *Watering Systems for Grazing Livestock*, 1998, from Ben Bartlett, Michigan State University Extension

http://www.attra.org–National Sustainable Agricultural Information Service

Local NRCS Office and Cooperative Extension Office

State-Specific Resources
The local contact for your land-grant university Cooperative Extension program is listed in the phone book under "Cooperative Extension" or "*(county name)* County Cooperative Extension.

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