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Water Storage Facilities for Livestock Watering Systems



Many water sources for range livestock are intermittent in nature (surface runoff, renewable-energy pumping systems) or are insufficient to meet peak demands (low-yield wells). However, if the source is capable of meeting total demands over a period of time, it can still be a viable source of water if it is used in conjunction with some sort of storage facility.

What should be considered in selecting or sizing a water storage facility?

The following points should be considered in selecting or sizing a water storage facility:

- The period of time that the storage facility is expected to meet demands
- The total water demand during the time period over which water must be stored
- The potential for materials comprising the storage facility to impart toxic compounds to water
- Potential evaporation losses
- Requirement for portability
- Cost

Water storage to be used in conjunction with a source that cannot meet peak demands, but can supply the total daily water demand over a 24-hour period, should be sized to be the larger of either a two-day supply, or a volume sufficient to meet the peak demand for a period of six hours. For example, if the daily demand is estimated to be 36,000 L, with an estimated peak demand of about 175 L/min., and the source is a well that can only produce water at a rate of about 40 L/min, then the volume of the water storage should be the larger of either:

Two-day supply	36,000 L/day X 2 days = 72,000 L
Six-hour peak flow	175 L/min X 60 min/hr. X 6 hr. = 63,000 L

Water storage for use in conjunction with intermittent water supplies or sources should be sized to meet demand during periods where the source or supply mechanism (solar or wind-powered pump, hauling) may not be available. This depends on the reliability of equipment, personal risk tolerance, and site-specific weather conditions, so general recommendations are difficult to make. However, a storage facility capable of storing a three or four day supply of water is commonly used in such situations.

This fact sheet is limited to water storage facilities such as tanks and lined earthen storage facilities that would store only a limited supply. In general, storing more than about a three to seven day supply of water in a tank will be prohibitively expensive. Storage of volumes of water in excess of these amounts will likely only be feasible in a dugout or a reservoir impounded behind a dam. It is recommended that you seek advice relating to the regulatory requirements for the construction and maintenance of dugouts or other large-scale storage facilities in your region.

Other fact sheets in this series can be consulted for information relating to water demands (Water Requirements for Pastured Livestock, Troughs for Watering Range Livestock).

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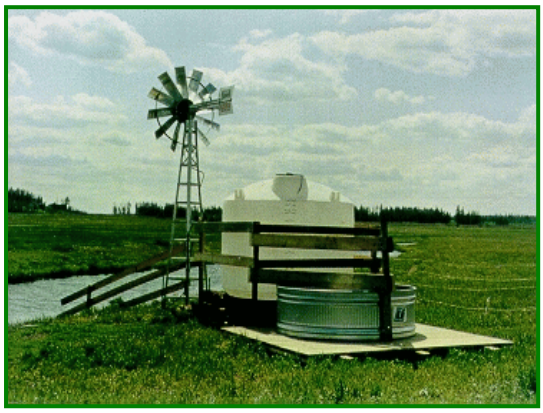
Materials for Constructing Water Storage Facilities

Water storage facilities can be constructed from any material that can be made to hold water, as long as that material will not contribute to degradation of water quality. Wood, concrete, steel, fibreglass, polyethylene and compacted soil are all common materials used in the construction of water-storage facilities for livestock applications. If necessary, synthetic liners (vinyl, polyvinyl chloride, butyl rubber, polyethylene) can be used to waterproof any shape of tank or earthen storage facility.

When using wood, ensure that any preservative treatments applied to the wood are non-toxic. Salvaged materials such as steel and plastic tanks are commonly used, but containers that once held toxic compounds such as pesticides, cleaning products, crude oil or any petroleum products **should not be used under any circumstances**. In almost every case, the cost of *properly* cleaning and coating such materials for re-use as a water storage facility would be prohibitively expensive. As a rule-of-thumb, anything that once held food or food-related products can safely be used as a water trough.

Tanks

While various materials can be used, the shape and size of the tank will affect material choice. Circular tanks are inherently stronger than flat-sided tanks for a given amount of material used in their construction. Also, for a given volume of water, a shallow tank will have a larger surface area than a deeper tank, meaning that it will be more difficult to cover. Costs for fabricated tanks vary significantly depending on the material used in their construction and the size of the tank. Typical costs for tanks are about $0.25-$0.40/L for polyethylene, $0.40-$0.60/L for fibreglass, and $0.25-$0.40/L for concrete. These costs are for the tank or tank materials only, and do not include delivery, handling and installation charges. The requirement for site construction and/or heavy equipment in the case of concrete can sometimes make this option prohibitively expensive.



Polyethylene Storage Tank

A relatively low-cost water storage facility can be created using corrugated, galvanized steel grain bins lined with a 20 mil vinyl liner. The bin roof controls evaporation and prevents contamination. Because the load distribution from water will differ from the loading for which the bin was designed (grain), the bin will have to be strengthened or partially buried. The manufacturer of the bin should be contacted for advice in converting grain bins for water storage.

Raised earthen storage with woven polyethylene liner

Photo Source: Pasture Water Systems for Livestock, Alberta Agriculture, Food and Rural Development, Agdex/400/400_716-3

Formulae for calculating the volume that can be stored in circular or rectangular tanks can be found on the last page of this fact sheet.

Elevated Earthen Reservoirs

For storing larger volumes of water, the most economical alternative is likely to be a raised earthen reservoir. Unless the storage facility can be constructed entirely of carefully compacted highly-plastic clay material, it will require a liner to prevent leakage. The unit cost of this type of storage facility can be expected to range from about $0.015-$0.03/L.

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Locating a Water Storage Facility

Water storage facilities for livestock applications are generally located as close to the source of water as possible, and are elevated above the surrounding terrain to allow water to be distributed to watering troughs by gravity.

Polyethylene tank mounted on a truck with attached trough

Water stored in steel grain bin rings above trough in field

The Bigger Picture

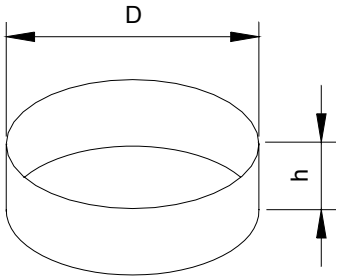
Water storage facilities are only one part of a livestock watering system that can protect source water quality and provide enhanced livestock health and productivity. For additional information on water storage options or components comprising them, as well as additional information on total livestock water systems, contact your local AAFC-PFRA office.

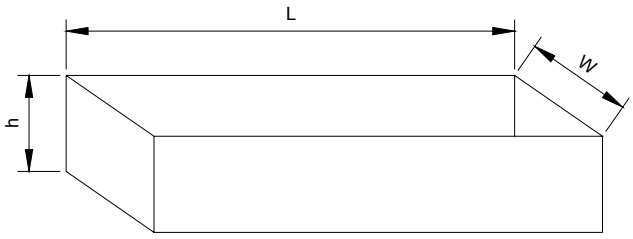
Sources of information for this Fact Sheet included: Pasture Water Systems for Livestock, Alberta Agriculture, Food and Rural Development, Agdex 400/716-3, BC Livestock Watering Manual, BC Ministry of Agriculture and Fisheries - Soils and Engineering Branch, 1990.

UNIT CONVERSIONS

1 US gallon = 3.785 litres	1 cubic metre (m^3) = 1,000 litres	1 metre (m) = 3.28 feet
1 Imperial Gallon = 4.546 litres	1 kilometre = 1,000 m = 0.62 miles	PI (π) = 3.14159

USEFUL FORMULAE





Circular Tank
Volume (litres) = 250 π D^2h
Perimeter (m) = πD

Rectangular Tank
Volume (Litres) = 1,000 LWh
Perimeter (m) = 2(L+W)

where D, L, W and h are measured in metres

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