Livestock Watering
FACTSHEET

BRITISH COLUMBIA
Ministry of Agriculture and Lands

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PUMPING LIVESTOCK WATER

It's All About the Energy Choices !

This Factsheet outlines some traditional and innovative options for pumping livestock water, especially for remote sites. A chart is given to assist in selecting systems, and a two-page quick reference chart outlines advantages, disadvantages, capacities, relative costs and general comments.

Selecting a System

The following discussion outlines some basic system options and indicates Factsheets that contain more detail. Note that this Factsheet covers many options, not all of which are appropriate for freezing conditions. For those conditions, also see Factsheet #590.307-3, ***Winter Outdoor Livestock Watering*** which discusses specific energy options for frost protection.

Table 1, on the pages 4 and 5, provides a quick reference to compare systems. Table 2, page 6, illustrates a systematic decision process when choosing a summer livestock watering system.

Use these Tables and other system information while also considering the following:

- density, timing, and duration of livestock use may greatly affect decisions
- livestock will respond to water quality, temperature, footing, etc
- no one approach or system works everywhere - site specifics always dictate selection
- the manager/management may be more important than any particular approach
- as to whether the system chosen is the best for a given site, the adage that "If you're not ***monitoring***, you're not ***managing***" prevails
- and finally, there are unfortunately no simple answers to complex situations

Pumping Water

It is often necessary to pump surface water and it is the energy source used that defines many of the innovations available. Energy may be:

- **supplied on-site** by gravity (pipelines, stream-driven pumps, ram pumps, siphons)
- **supplied on-site** by livestock (nose pumps)
- **supplied on-site** by the sun (wind or photovoltaic panels)
- **delivered to the site** (electrical grid or petroleum fuel)

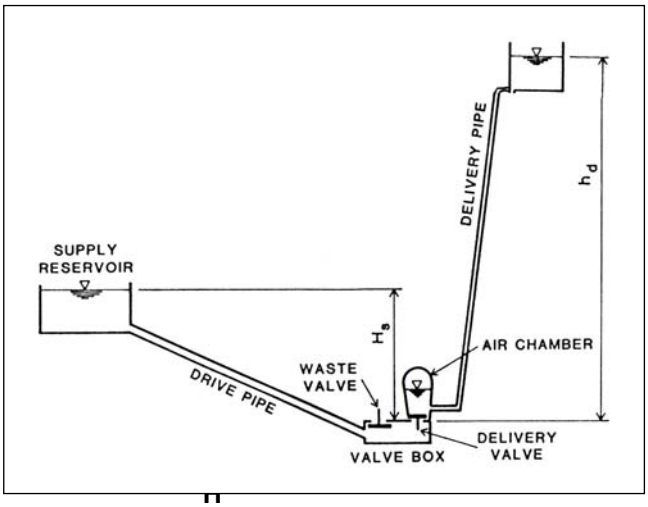
On-Site Energy Sources

Gravity. The terrain of a site can be used to "pump" (pipe) water downhill. See Factsheet #590.304-5, ***Understanding Gravity-Flow Pipelines***. The energy in flowing water can be used to operate an electrical generating turbine, a stream-driven pump, or a hydraulic ram pump. See Factsheet #590.305-5, ***Using Gravity Energy to Pump Livestock Water***.

Stream-Powered Pumps. A simple pump is available that is operated by the energy in flowing water. It is suspended in a creek where the water drives the propeller blades, rotating the pump. Water moves up to a trough set back from the stream. See Factsheet #590.305-8, ***Using Stream Energy to Pump Livestock Water***.

Stream-Powered Pump (*Sling Pump*)

Hydraulic Ram Pump. This is an old concept where a pump uses the "water hammer" effect to force a small amount of drive water up a delivery pipe. The remainder of the water is returned to the source. A modified version of this pumping principle is also available. See Factsheet #590.305-9, ***Using A Hydraulic Ram to Pump Livestock Water***, and also see Factsheet #590.305-10, ***Using A Modified Hydraulic Ram to Pump Livestock Water***.



H ydraulic Ram System

Animal-Driven Pump. For water lifts of less than 20 feet, an animal-driven pump (Nose Pump) is available that will water 20 to 35 animals. The animal uses its nose to push a lever that operates a diaphragm pump to supply water by suction (no lift above the pump). Some training is required. These can pump from shallow wells, dugouts, or other water sources and a winter version is available. See Factsheet #590.305-7, ***Using Livestock Energy to Pump Livestock Water***.

Animal-Driven Water Pump *(Nose Pump)*

Solar Energy. Energy from the sun can be used as wind (the uneven heating of the earths surface) or directly from sunshine. Unlike most of the previous systems, wind-powered or solar-powered systems can pump surface water or groundwater.

Wind-Powered Pumps. These require **significant and steady** wind to be effective and the wind must be present during the time of year that water needs to be pumped. Water can be directly pumped or a wind generator can charge batteries that power a pump on demand. An accurate assessment of the wind energy potential must be made before development of a site. Interior B.C. is generally poorly suited for wind-driven water pumping but sites have been developed. See Factsheet #590.305-4, ***Using Wind Energy to Pump Livestock Water***.

Wind-Powered Pump

Solar-Powered Pumps. Solar energy can be converted into electricity using photovoltaics. They glass-covered panels face the sun and are either wired directly to a pump or wired to charge batteries. ***Figure 6*** shows a typical photovoltaic water pumping system. See Factsheet #590.305-6, ***Using Solar Energy to Pump Livestock Water***.

Solar-Powered Pump Using Photovoltaic Panels

Off-Site Energy Sources

If no on-site energy sources are available, energy can be brought to the site in the form of utility electricity or petroleum fuel. These sources are usually limited to sites near existing energy grids (electricity) or are only practical for small or short term use systems (petroleum). See Factsheet #590.305-3, ***Powering Livestock Watering Pumps***.

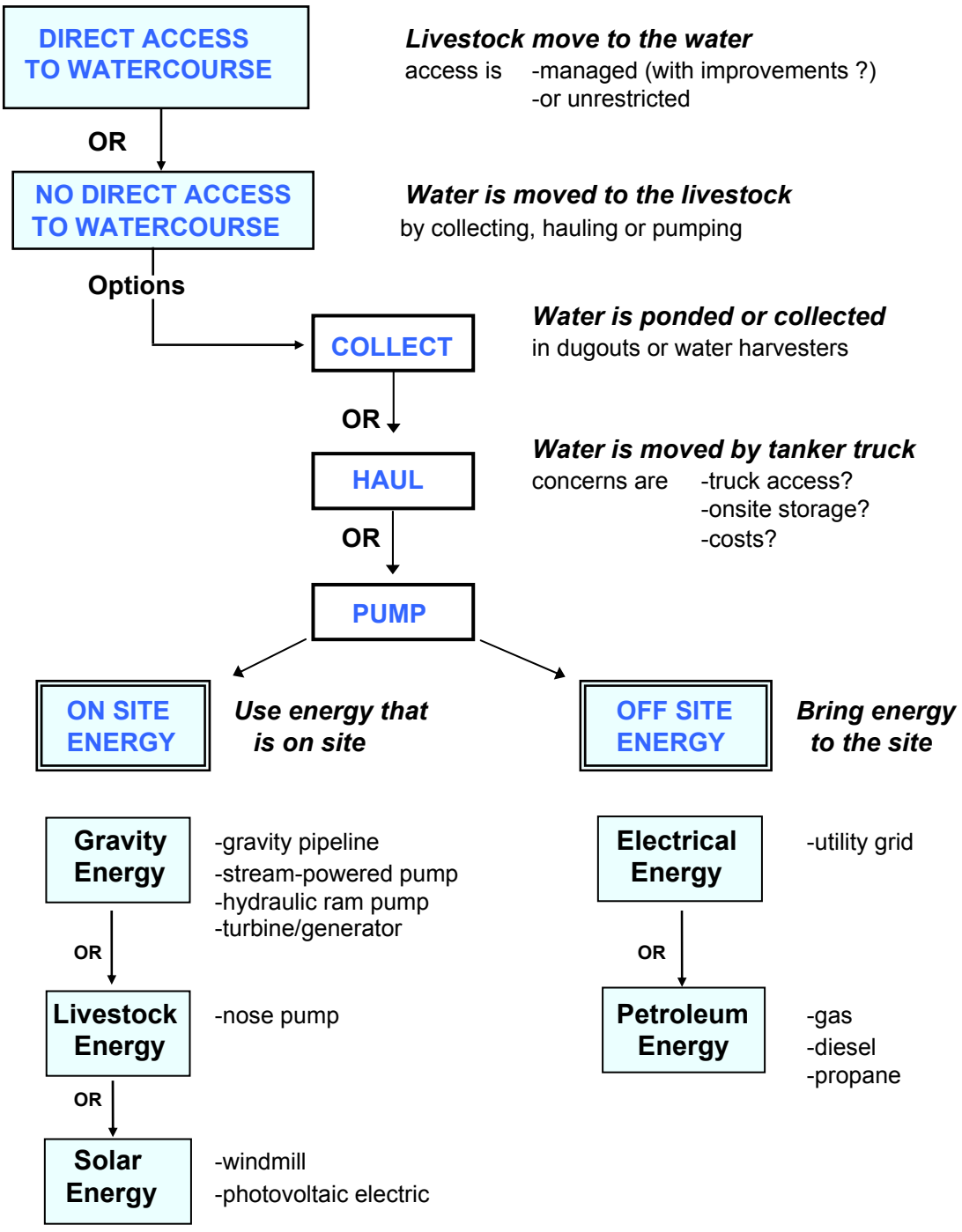
Table 1 — *QUICK REFERENCE TO COMPARE*

WATERING OPTION	ADVANTAGE	DISADVANTAGE
DIRECT ACCESS TO WATERCOURSE		
Uncontrolled access	no costs; suitable for low density use areas	water quality & riparian concerns
Controlled access with ramp	impact area reduced; can be maintained	added costs; may require fencing
Controlled + Improved	impact area reduced; footing/access improved	added costs
WATER COLLECTION - RUNOFF INTO DUGOUT		
Direct access	least cost dugout	water quality affected; added maintenance
Developed access with ramp	improved water quality; less maintenance	added costs
Pumped from dugout to trough	best water quality; distribution possible	added costs; equipment concerns
WATER COLLECTION - STORAGE OF PRECIPITATION		
Water harvesters	collect onsite precipitation (rain & snow)	limited by site precipitation
- metal surface with tank	can supply water exactly where required	only low volumes are practical
- coated ground with tank	can supply water in otherwise dry sites	must have appropriate terrain for collection
WATER HAULING		
Tanker truck; farm/commercial	can supply water where required	high cost for remote sites
WATER STORAGE		
Onsite tank	higher peak flows are possible	adds cost & complexity
GRAVITY SUPPLY		
Ground seep	no surface contamination once developed	may be seasonal, unreliable, hard to assess
Spring	no surface contamination once developed	may be seasonal, unreliable, hard to assess
- with pond storage	storage helps with peak flow demands	possible contamination from open surface
- with troughs in series	distribution extends benefits to larger area	added reliance on water source
- with troughs in parallel	distribution extends benefits to larger area	added reliance on water source
PUMP SYSTEMS - ONSITE ENERGY		
Flowing water	continuous energy with the water; no cost	sites are limited; frost may limit use
- sling pump	simple, easy to install & move	instream concerns (ie. floating debris)
- hydraulic ram pump	pump from 2 -20% of supply flow (10% av.)	semi-permanent installation
- turbine generator/electric	many possible pumping options w/electricity	as above; more costly & complicated
Livestock activated	livestock provide pumping energy	requires livestock training to use
- nose pump	simple; easy to install & move	only water suction (less than 20 ft); no lift
- frostfree nosepump	for freezing conditions	must be mounted on well head; lifts water
Wind powered	low energy costs with large systems	must have wind when water to be pumped
- directly pumped	relatively simple mechanical system	must be located over well
- air compressor pumped	may be located remote from well	usually for smaller water volumes
- generator/electric	may be located remote from well	more complicated system
Sun powered	readily available energy source	most practical for small to medium volume
- photovoltaic panels	simple; easy to install & move	no 'economy of scale' in panel costs
PUMP SYSTEMS - OFFSITE ENERGY		
Electricity	low cost energy once at a site; very adaptable	not readily available at remote areas
- utility supply	can supply high peak loads at no cost penalty	high cost to deliver to remote areas
Petroleum	common motors available to run pumps	fuel not easily supplied to remote areas
- gasoline	low cost motor/pumps available	costly for long term pumping
- diesel	long life motor/pumps available	suited for long term pumping
- propane/natural gas	low cost fuel	requires special delivery to site

LIVESTOCK WATERING SYSTEMS

CAPACITY	RELATIVE COST	COMMENTS
DIRECT ACCESS TO WATERCOURSE (CONT'D)		
watercourse flow	nil	possible pollution; greatest concern of environmental regulations
watercourse flow/ramp size	$500 and up	impact area is reduced but concentrated; improved footing req'd?
watercourse flow/ramp size	$1000 and up	'best' direct access achieved
WATER COLLECTION - RUNOFF INTO DUGOUT (CONT'D)		
dug to match expected runoff	$250 and up	difficult to estimate runoff; expect yearly variations of volume
dug to match expected runoff	$500 and up	improved footing; less earth sluffing; better water usage
size pump to match stock numbers	$1000 and up	pumping requires energy (see Pumping Systems below)
WATER COLLECTION - STORAGE OF PRECIPITATION (CONT'D)		
sized to precipitation/stock numbers	$1500 and up	costly per gallon; usually considered after other watering options
as above	$1500 and up	sloping sheet metal directs water into a storage tank/trough
as above	$1500 and up	sloping ground is treated to shed water to a storage tank/trough
WATER HAULING (CONT'D)		
truck tank size (approx. 5000 USgal)	$/hr or mile trucking	only practical for short hauls or emergencies; need onsite storage
WATER STORAGE (CONT'D)		
size tank to meet stock numbers	$0.20 + per US gal	low cost-per-gal vinyl-lined grain bins or stand alone tanks
GRAVITY SUPPLY (CONT'D)		
wide range possible	$250 and up	local vegetation a good indicator of water flow reliably
wide range possible	$250 and up	as above; also surface flow easier to measure
size pond to meet peak flow needs	$500 and up	allows use of slow flowing seeps/springs; requires pond intake
size troughs as needed	$500 each and up	flow through from trough-to-trough; can't shut-off separately
size troughs as needed	$500 each and up	each is float-controlled; control livestock by shutting off any one
PUMP SYSTEMS - ONSITE ENERGY (CONT'D)		
wide range available	$500 and up	low pumping rates OK as 24 hr pumping = high daily volumes
850-4,000 USgal/day @ 26-83 ft	$700 to 1000	requires 12-16 inch water @ 2 ft/sec; also wind model for ponds
100-20,000 USgal/day @ 4 -400 ft	$500 to 3500	requires 2 to 40 ft fall to pump and pump waste water control
determined by water flow	$1000 and up	more complicated than sling pump; but also greater potential
approx. 35 cows per unit	$500 ea.	for surface water pumping to keep livestock from source
approx. 4 strokes per gal	$500 ea.	usually low water lift sites; can move water laterally 1 mile plus
depends on depth to water	$1100 + installation	ensure good sealing to casing and drainage away from well
cut-in @ 7 - 13 kph; out @ 30 to 50	$500 and up	must have good site wind data; wind on ridges/water in gullies
up to 100 US gal/min & 1000 ft lift	$500 and up	consistent high wind speeds required for full volume & lift
3 to 5 US gal/min	$650 to 800	as above; may use air driven pump or air 'bubbler' foot in well
dependent on wind/generator size	$1000 and up	electricity drives a pump motor; electrical energy may be stored
dependent on panel surface area	approx $8/watt	need full sun 10 am - 4 pm; max. daily output = 6 hr pumping
from 2 US gal/min	$1000 and up	for cloudy days: energy stored as pumped water or in batteries
PUMP SYSTEMS - OFFSITE ENERGY (CONT'D)		
limited mainly by cost	$1500 + /pole (300 ft)	not practical unless utility is close to site
pump sized for stock numbers	$500 and up	systems can be automated easily
as above	$500 and up	difficult to automate engine starting
as above	$500 and up	as above; fuel must be hand delivered to site
as above	$1000 and up	as above; diesel engines are designed for long life
as above	$1000 and up	need site storage; fuel supply not usually available at remote sites

Livestock Watering System Options * : Where's the Energy ?



* Note that these options may not all be viable in freezing conditions. Refer to Factsheet #590.307-3, ***Winter Outdoor Livestock Watering*** for pumping and trough heating options.

Table 2 Livestock Watering System Options

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