Livestock Watering FACTSHEET

BRITISH COLUMBIA
Ministry of Agriculture and Lands

Order No. 590.304-4
January 2006

LIVESTOCK WATER SYSTEM DESIGN #4

Design Worksheet

Use this worksheet to do a systematic approach to livestock watering system design.

1. Water Quantity

a) Daily Water Requirements (refer to *Factsheet #590.301-1*, Table 1)

Beef Cattle	_____	x	see table	USgpd	=	_____	USgpd
Bison	_____	x	12	USgpd	=	_____	USgpd
Dairy cows	_____	x	see table	USgpd	=	_____	USgpd
Fallow Deer	_____	x	2.5	USgpd	=	_____	USgpd
Horses	_____	x	12	USgpd	=	_____	USgpd
Swine	_____	x	4	USgpd	=	_____	USgpd
Sheep	_____	x	2	USgpd	=	_____	USgpd
Chickens	_____	x	see table	USgpd	=	_____	USgpd
Turkeys	_____	x	see table	USgpd	=	_____	USgpd
			Total Daily Requirement		=	_____	USgpd

b) Peak Flow Rates (refer to *Factsheet #590.304-1*)

From Daily Requirements

Minimum Peak Flow Rate = $\frac{\text{\_\_\_\_\_ USgpd}}{240}$ = minimum peak flow rate = _____USgpm

OR,

From Fixture Flow Rates

Automatic waterers	_____	x	2	USgpm	=	_____	USgpm
Poultry fountain	_____	x	1	USgpm	=	_____	USgpm
Dairy hose	_____	x	5	USgpm	=	_____	USgpm
Sanitation hose	_____	x	10	USgpm	=	_____	USgpm
Outdoor hydrant	_____	x	5	USgpm	=	_____	USgpm
Household	_____	x	10	USgpm	=	_____	USgpm
Fire hydrant	_____	x	10	USgpm	=	_____	USgpm
			Total Peak Flow Rates from Fixtures		=	_____	USgpm

2. Water Supply

c) Wells (refer to *Factsheet #590.303-2*; for drilled wells, also refer to well log for info)

Type of well (dug, driven, drilled, etc)	_____	
Depth of well	_____	ft
Diameter of well	_____	in
Capacity of well (tested flow rate)	_____	USgpm

d) Springs (for measuring flow, refer to *Factsheet #502.100-5*)

Type of spring (concentrated, seepage, etc.)	_____	
Flow capacity (free flowing)	_____	USgpm

e) Flowing Surface Water (for measuring flow, refer to *Factsheet #502.100-5*)

Type of supply (ditch, creek, river, etc.)	_____	
Maximum capacity at low flows	_____	USgpm
Licenced capacity	_____	USgpm

f) Intermittent Storages

Daily Water Requirement: from 1(a)	_____	USgpd
Minimum Flow Rate = $\frac{\text{gpd}}{60 \text{ min/hr} \times 24 \text{ hrs/day}}$ =	_____	USgpm
Actual Supply Flow Rate from source	_____	USgpm
Peak Flow Rate required: from 1(b)	_____	USgpm

If the water source flow is less than the peak flow requirements, then the minimum intermittent storage required is twice the daily requirement.

Intermittent Storage = 2 x _____ USgpd = _____ USgallons (minimum)

Note: Storage will assist the daily water supply, but on a daily basis, the Supply Flow Rate from the source *must be greater* than the Minimum Peak Flow Rate required. If not, additional source(s) are required.

g) Dugout Storages

Capacity = Daily Water Requirement x Number of Days for period of use x 1.1 (for losses)

Capacity = _____ USgpd x _____ days of use x 1.1

= _____ USgallons required for period of use

Dugout size (refer to *Factsheet #590.303-3*)

Capacity	_____	USgallons
Length	_____	feet
Width	_____	feet
Depth	_____	feet
Side Slopes	_____ : _____	ratio of run : rise

h) Water Harvesters (refer to *Factsheet #590.303-4*)

Water Requirement = Daily Water Requirement x Number of Days for period of use
= _____ USgpd x _____ days of use
= _____ USgallons required for period of use

Average Annual Precipitation at the site = _____ inch annually

Catchment area = 1.8 x $\frac{\text{USgal Required}}{\text{Inches Annual Precipitation}}$
= _____ square feet Catchment Area

i) Tank Storage Size (refer to *Factsheet #590.304-7*)

Storage Requirement _____ USgallons

Round Tank

Tank diameter _____ ft
Tank depth _____ ft

Rectangle Tank

Tank length _____ ft
Tank width _____ ft
Tank depth _____ ft

3. Distribution System

For simplicity, set the water source at 0 feet elevation. Elevations below the source are considered negative and pressure is gained. Elevations above the source are positive and pressure is lost (to be supplied by pumping).

j) Elevations

Water source	**0** ft	x	0.433	=	**0**	psi
Storage elevation	_____ ft	x	0.433	=	_____	psi
Waterer A elevation	_____ ft	x	0.433	=	_____	psi
Waterer B elevation	_____ ft	x	0.433	=	_____	psi
Waterer C elevation	_____ ft	x	0.433	=	_____	psi
Max elevation difference	_____ ft	x	0.433	=	_____	psi

k) Friction Losses

Pipe section	Comments	Max flow (USgpm)	Length (ft)	Pipe size/type	Friction loss (psi/100 ft)	Friction loss (psi)

Where is friction loss the worst case? _____

Total friction loss in the worst case is _____ psi

l) Total Pressure Head Required

Pressure due to elevation differences	=	_____	psi
Pressure required at highest outlet	=	_____	psi
Friction loss (worst case)	=	_____	psi
Miscellaneous losses (allow minimum 3 psi)	=	_____	psi
Total Pressure Head Required	=	_____	psi
Check to ensure the pipe selected is sufficient for the total pressure head.		_____	pipe OK

4. Pump Specification

Total head required _____ psi x 2.31 ft/psi	=	_____	ft
Maximum peak flow required	=	_____	USgpm
Minimum pump efficiency (from dealer)	=	_____	%
Pump model (from dealer)		_____	

The horsepower required can be calculated as follows:

$$\text{H.P.} = \frac{\text{total head (ft)} \times \text{maximum flow (USgpm)}}{3960 \times \text{pump efficiency}}$$

$$= \frac{\text{\_\_\_\_\_ ft} \times \text{\_\_\_\_\_ USgpm}}{3960 \times}$$

= _____ h.p.

Select the nearest size motor _____ h.p

5. System Check

Check to ensure pressures and flows are sufficient – are there any problem areas?

6. Schematic Livestock Water System Layout

Include water source, elevations, distances and demand flows.

RESOURCE MANAGEMENT BRANCH
Ministry of Agriculture and Lands
1767 Angus Campbell Road
Abbotsford, BC V3G 2M3 Phone: (604) 556-3100

WRITTEN BY
Lance Brown
Engineering Technologist
Kamloops Office