



For more information refer to the Water Wells That Last video series Part I — Planning and Construction.

For more specific information on pumps, pressure tanks, pipeline sizing, water quality and treatment equipment, contact a water specialist with Alberta Agriculture, Food and Rural Development or your local PFRA office. You could also contact the Alberta Water Well Drilling Association or your local drilling contractors. See Module 11 "Contacts for More Information."

If you are buying new property or building a new home where there is not a well, you should determine water quality and availability first. Where there is a well, you should have it pump tested to establish its performance. You should also have the water tested for quality.

Planning Your Water System

This module helps you assess whether your water source has adequate capacity to meet your needs. Water sources are covered in detail. You will also get an overview of the planning considerations and benefits of a well-designed water system.

A water system includes:

- Water sources
- Pumps
- Pressure tanks and cistern
- Distribution system including pipelines, automatic waterers, hydrants and home plumbing
- Water treatment equipment.

Why Plan?

Often little thought and foresight are given to planning a farm or home water system. On the surface, a water system seems no more than an automatic pump and storage tank that delivers water under pressure to the household. There are other important aspects, such as how much water is available, the pressure, water quality and provisions for watering a garden and fire fighting. When planning your water system, consider all the uses of water in your home and business. Include such things as:

- Livestock watering
- Cleaning barn floors and equipment
- Irrigation of gardens and greenhouses
- Egg and milk production
- Fire protection.

A water system that is well planned and designed costs more initially but saves money in the end. Costly changes to correct errors are reduced and you have a convenient and reliable water supply, provided you monitor and maintain the system (see Module 5 "Monitoring Your Water Well" and Module 6 "Shock Chlorination—Well Maintenance").

Steps to Planning Your Water System

There are several steps to planning your water system:

- Determine water requirements
- Complete an inventory of water sources.

Worksheet

Complete "Average Daily and Annual Water Requirements" worksheet and "Sizing of Water Systems" worksheet. Samples of these worksheets are found at the end of this module. Working copies are found in the back cover pocket. Store these completed worksheets in the back pocket.

Worksheet

Complete "Farm Water Supply Inventory" worksheet. A sample copy is found at the end of this module. Working copies are found in the back cover pocket. Store this completed worksheet in the back pocket for easy reference.

For information on existing water well records and groundwater characteristics, contact the Alberta Environment Groundwater Information Centre at (780) 427-2770.

In some counties, you may also have access to groundwater maps and reports. Contact your local county MD office. See Module 11 "Contacts for More Information."

Determine Water Requirements

The first step to planning is to determine your water requirements. Look beyond your current requirements and consider any changes you may be making in the next few years. For example, is another family moving to the farm? Are you considering diversifying to include a market garden? Use the worksheets "Daily and Annual Water Requirements" and "Sizing of Water Systems" included in the pocket on the back cover to calculate your daily, annual and peak use requirements. Sample copies are at the back of the module.

A well-planned water system should also have a backup or second water source in case of pump or water source failure. Water sources that can easily be connected using underground piping provide the flexibility required in emergencies.

Complete an Inventory of Water Sources

The next step to planning is to complete an inventory of all existing well and surface water sources. Record production rates, storage volumes and any previous problems with water quantity or quality for each water source. Completing an inventory will show if there is adequate water supply to meet your needs year round. Use the worksheet, "Farm Water Supply Inventory," included in the back cover pocket to list all the water sources available to you.

If you have some doubt about the adequacy of your existing water sources, take time to check all the options before choosing to drill a new well. There may be inexpensive ways of increasing well yields or water storage to meet your needs. In some situations a well can comfortably keep up to daily requirements but not peak demands. The addition of a cistern with one-half to one day storage may be all that is required.

Water Source Options

Wells

Water wells are generally the first choice of Albertans wherever there is an adequate supply of good groundwater. In areas of marginal groundwater supply, livestock operations often use a combination of wells and dugouts. The better quality water from the well supplies the household and supplements the livestock's requirements.

For most household situations, wells with a production rate of less than 5 gallons per minute (gpm) for a one hour (peak use) period do not supply enough water so it is usually necessary to create additional water storage using a tank or cistern. Wells that produce at a 5-10 gpm rate usually do not require additional storage.

When a lot of demand is placed on the well at any given time, such as on a farm, it should be capable of providing a minimum of 10 gpm for at least 2 continuous hours. If the flow rate of the well falls short of this amount, a cistern is usually the best option for providing water storage, to overcome the shortage of water. For livestock operations, a well should be capable of providing all of the water requirements in an 8 to 12 hour period.

Dugouts

In areas where there is a combination of either poor groundwater supply or quality, dugouts may be used exclusively, or in combination with a well, as a water source. If you need to rely solely on a dugout for your water, size the dugout for a two to three year supply. Over this period, the dugout will be filled from runoff or an irrigation canal. When you plan the dugout, be sure to:

- Locate the dugout upstream of any livestock areas
- Fence the dugout
- Install a pumping system with a floating intake
- Aerate.

If you have a well and dugout, use the well water for household use because it is typically of better quality. Dugouts can provide a good quality water source for livestock and irrigation purposes. Check dugout water quality and be aware of risks of algae, etc.

A well that produces as little as 0.5 gpm can meet average household needs for most Alberta families if the water is pumped and stored in a cistern for peak use times.

For more information on using and treating dugout water for household and livestock use, see Module 12 "Other Resources" for a list of publications.

Other Planning Considerations

No matter the water source, do the following to protect your water supply:

- Test the water quality regularly
- Treat the water if necessary
- Monitor the supply and water level
- Maintain the well and water system
- Protect the water source from contamination.

Test Water Quality

All farm water sources should be tested when the supply is first connected and again about every five years. Test the water more often if you notice a significant change in the water quality, if a toxic spill occurs nearby, or if a change occurs in land use or activity. A thorough chemical and bacteriological analysis of water for household use can be done through your local health unit. Water samples for agricultural purposes can be taken to private labs for testing. These labs will supply sample bottles and correct procedures for sampling.

Treat Water

Water quality tests will point out any problems that need to be corrected. The water may have a poor taste, odor or color, or be high in total dissolved solids (TDS). Iron bacteria are a common well water problem in Alberta. Treatments for these and other problems may include chlorination, special filters, water softeners or distillation.

Monitor the Supply

Monitoring your water sources is an important step to ensuring a lasting water supply. It can be compared to checking the oil in a vehicle or doing soil tests. You will have advance notice of changes to the water supply and a chance to make changes before the problem is serious.

Maintain the Well and Water System

Regular maintenance such as shock chlorination is necessary. Well design should allow for this required maintenance.

Protect from Contamination

Both dugouts and wells are susceptible to contamination from various sources. Keys to prevent contamination include proper location, proper design, plugging abandoned wells, fencing, runoff controls and grass cover around dugouts.

Be sure to keep all records of water quality tests for future reference and monitoring.

For more details on specific water treatments see Module 7 "Troubleshooting Water Well Problems" and Module 12 "Other Resources."

See Module 5 "Monitoring Your Water Well" for more information on how to check, record and interpret water level measurements.

For more information on preventing contamination of wells see Module 9 "Plugging Abandoned Wells." Further information on preventing dugout contamination can be found in Module 12 "Other Resources."

Worksheet

Average Daily and Annual Water Requirements

The average daily and annual water requirement numbers can be used for estimating the amount of water used on a farm. The average daily water requirements are based on typical average outside or in-barn temperatures that occur throughout the year. These numbers, however, cannot be used for designing the water supplies and pumping capacity of a farm water system. For example, consider a beef feedlot on a hot summer day. Feeder cattle will drink approximately twice the amounts shown in the table below. For this reason, the water supply and pumping systems need to be designed to meet these peak demands.

Household use:			
People	_____	x 60.0 gpd	= _____ gpd

gpd = gallons per day

Beef:	Animal Size	No. of Animals				
Feeders ¹	550 lb.	_____	x 4.0 gpd	= _____ gpd	feeders on silage	
	900 lb.	_____	x 7.0 gpd	= _____ gpd	feeders on silage	
	1250 lb.	_____	x 10.0 gpd	= _____ gpd	feeders on silage	
Cows with Calves ²	1300 lb.	_____	x 12.0 gpd	= _____ gpd	on pasture or hay	
Dry Cow ²	1300 lb.	_____	x 10.0 gpd	= _____ gpd	on pasture or hay	
Calves ²	250 lb.	_____	x 2.0 gpd	= _____ gpd	on pasture or hay	

¹ For peak demand on hot summer days above 25°C, multiply gpd x 2

² For peak demand on hot summer days above 25°C, multiply gpd x 1.5

Swine:³	Animal Size	No. of Animals			
Farrow-Finish ⁴		_____	x 20.0 gpd	= _____ gpd	
Farrow-Late Wean ⁴	50 lb.	_____	x 6.5 gpd	= _____ gpd	
Farrow-Early Wean ⁴	15 lb.	_____	x 5.5 gpd	= _____ gpd	
Feeder	50-250 lb.	_____	x 1.5 gpd	= _____ gpd	
Weaner	15-50 lb.	_____	x 0.5 gpd	= _____ gpd	

Sub Total _____ gpd

³ Includes wash water for all types of swine operations.

⁴ No. of animals = No. of breeding sows.

*** Working copies of this worksheet are found in the pocket on the back cover.**

Dairy:	Animal Type/Size	No. of Animals				
Milking Cow ⁴	Holstein	_____ x 30.0	gpd = _____	gpd		
Dry Cows/Replacement Heifers	Holstein	_____ x 10.0	gpd = _____	gpd		
Calves	to 550 lb.	_____ x 3.0	gpd = _____	gpd		

⁴ Includes 3 gpd/cow for wash water

Poultry:	No. of Birds			
Broilers	_____ x .035	gpd = _____	gpd	
Roasters/Pullets	_____ x .040	gpd = _____	gpd	
Layers	_____ x .055	gpd = _____	gpd	
Breeders	_____ x .070	gpd = _____	gpd	
Turkey Growers	_____ x .130	gpd = _____	gpd	
Turkey Heavies	_____ x .160	gpd = _____	gpd	

Sheep/Goats:				
Ewes/Does	_____ x 2.0	gpd = _____	gpd	
Milking Ewes/Does	_____ x 3.0	gpd = _____	gpd	

Horses, Bisons, Mules	_____ x 10.0	gpd = _____	gpd
Elk, Donkeys	_____ x 5.0	gpd = _____	gpd
Deer, Llamas, Alpacas	_____ x 2.0	gpd = _____	gpd
Ostriches	_____ x 1.0	gpd = _____	gpd

Sub Total _____ gpd
Total Daily Livestock Water Requirements _____ gpd

Annual Water Requirements			
Irrigation of garden and yard in the summer (assume 6 in. application)			
Area in square feet _____ x 3 gal./sq. ft.	= _____	gal.	
Chemical spraying (acres) _____ x _____ gal/acre x _____ no. of applications	= _____	gal.	
Greenhouse	= _____	gal.	
Fire (min. 1200 gal./2 hour period)	= _____	gal.	
Other uses	= _____	gal.	
Total daily livestock water requirements (from above) _____ gpd x 365 days	= _____	gal.	
Total Annual Water Requirements		_____	gal.

* For information on water requirements for field crops, contact an irrigation specialist.

Note: These livestock and poultry water requirement numbers have been compiled with input from Alberta Agriculture, Food and Rural Development staff. If you have questions or comments, please call the Agricultural Water Specialist in Edmonton at (780) 427-2963. Also visit our website: www.agric.gov.ab.ca and use the calculator for determining the size of a dugout.

* Working copies of this worksheet are found in the pocket on the back cover.

Worksheet

Sizing of Water Systems

Water System Fixtures	Peak Use Rates
Automatic cattle waterers (100 head size)	____ X 2 gpm = _____ gpm
Hog nipple waterer	____ X 1 gpm = _____ gpm
Poultry fountain	____ X 1 gpm = _____ gpm
Yard hydrants	____ X 5 gpm = _____ gpm
Household (number of households)	____ X 5-10 gpm = _____ gpm
Fire hydrant	____ X 10 gpm = _____ gpm
Other	____ X ____gpm = _____ gpm

gpm = gallons per minute

Note: The minimum design flow rate of the system must exceed the peak use rate of the fixture that uses the largest amount of water.

Note: If the well is not solely capable of providing enough water for your peak use demand, you will need to install a water storage facility such as a cistern. The well can be operated without overpumping, and the water storage provided by the cistern will ensure water for all your activities.

* Working copies of this worksheet are found in the pocket on the back cover.

Worksheet

Farm Water Supply Inventory

A. Wells

1.	Well Purpose / Location	Date Constructed	Depth (ft.)	Casing Diameter (in.)	Well Production (gpm)
a.					
b.					
c.					

2.	Unused Wells / Location	Date Constructed	Depth (ft.)	Date Plugged	Materials Used
a.					
b.					
c.					

3. Dry Holes

How many dry holes have been drilled on and around the farmstead? _____

How deep were these dry holes? _____

4. Water Quality

What water quality problems limit the usefulness of these wells?

a. _____

b. _____

c. _____

B. Dugouts

1.	Dugout Purpose / Location	Date Constructed	Size (Length, Width, Depth)	Approximate Volume
a.				
b.				
c.				

2. Problems with these dugouts (e.g., seepage, quality, inadequate run off)

a. _____

b. _____

c. _____

C. Other Water Sources and Their Limitations (Hauling, Springs, Rivers, etc.)

* Working copies of this worksheet are found in the pocket on the back cover.