Private Rural Water Supplies

H. Simpson, Ph.D.

Factsheet

FACTSHEET 15-047 AGDEX 716/552 DECEMBER 2015
(replaces OMAFRA Factsheet 06-117 of the same name)

All Ontarians can play a role in protecting groundwater quality and quantity. The fourth of four in a series that will help Ontario's farmers and rural residents learn more about groundwater, this Factsheet discusses the different types of private rural water wells that may be found on a rural property or farm.

Other Factsheets in this series include:

- *Understanding Groundwater*
- *Managing the Quantity of Groundwater Supplies*
- *Protecting the Quality of Groundwater Supplies*

Groundwater is a precious resource for rural families and businesses. In some situations, it may be the only water source. Understanding their type of well water supply and the factors and conditions that affect it can help well owners protect and conserve groundwater.

A well is designed to draw water while also keeping contaminants and surface water out. Proper well construction ensures that surface water cannot directly enter the well and will instead infiltrate and pass downward through the soil before it enters the well (Figure 1). A well casing with proper height and a secure lid prevents direct entry of surface water, dust, debris and vermin. Mounded-up soil around the wellhead directs water away from the well casing, and the watertight grout in the space around the well casing prevents surface water from easily moving down along the side of the well casing and into the groundwater.

Surface water can sometimes be contaminated, and the soil will help filter and clean infiltrating water. This is explained in more detail in an information kit from the Ministry of Health and Long-Term Care, *Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well* (ontario.ca/publications).

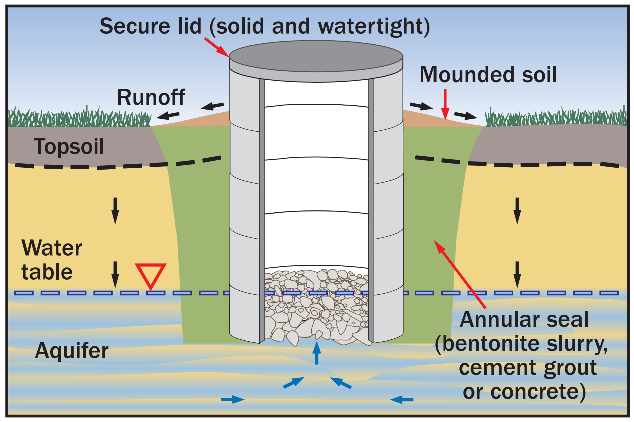

Figure 1. A properly constructed dug or bored well keeps surface water and contaminants from the well.

TYPES OF WELLS

It is important for well owners to know what kind of well they have, including how it was built and its basic operation. This information is summarized in a water well record that was created when the well was built. Contact the MOECC Wells Help Desk to obtain a copy of the water well record that was filed when the well was constructed. If the water well record is not available, there are other ways to determine the type of well. Important information for identifying well type is summarized in Table 1.

Table 1. Visual characteristics of different well types

Casing size	Well type
Small-diameter: 10–20 cm (4–8 in.)	Drilled well (most locations)
Very small-diameter: 2.5–5 cm (1–2 in.)	Sand-point well (if located in a shallow, sandy area) **Note:** Natural gas wells use similar-type casing.
Large-diameter: 60–120 cm (24–48 in.)	Indicates a large-diameter well, often called a bored or dug well

Some wells have no visible casing. In the past, drilled and sand-point wells were sometimes buried or constructed in pits. Also, drilled wells were occasionally constructed in the bottom of large-diameter wells acting as pits. Do not enter any confined space (e.g., well pit, pump houses) unless properly trained and equipped. Confined spaces present asphyxiation hazards, and some wells produce naturally occurring gases that are poisonous and/or explosive.

SMALL-DIAMETER WELLS

Drilled Wells

A drilled well consists of a small-diameter casing ranging in size from 10–20 cm (4–8 in.). Drilled wells obtain water from either overburden or bedrock aquifers. Overburden wells include those constructed into overburden aquifers (the geological materials above bedrock), composed typically of sands and gravels, but also possibly of silts and clays.

Most water wells are constructed with a well screen that allows groundwater to enter a well while keeping sand and other materials out. A properly constructed overburden well is shown in Figure 2. Well screen openings are sized carefully to allow sediment-free water to flow efficiently into the well and improve the connection between the well and the aquifer. Wells are "developed" during construction by the contractor to ensure that pumped water is sediment-free. The contractor will pump the well for an extended period and agitate water (also called surging) in the well, to remove fine-grained sediments from the area of the aquifer close to the screen.

An unscreened, poorly screened or poorly developed well is usually less efficient to operate and more difficult to maintain than a properly constructed (screened) well, because sediment can enter the well and plug it. A plugged well will require more frequent well maintenance or replacement, have a reduced pump life because of greater use and abrasion of parts, and will generally have increased pumping costs.

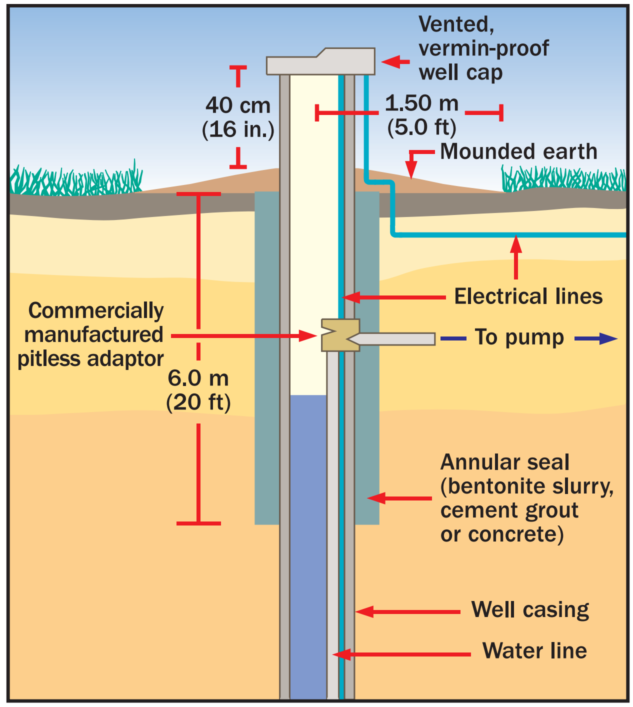

Figure 2. Best management practices for a properly constructed, drilled overburden well.

Bedrock wells are drilled down through the overburden (e.g., soils and sediments) and into the bedrock. The portion of the casing that extends from the ground surface to the top of the bedrock is often cemented around the exterior at the bedrock to ensure a good seal and avoid leakage of water from the overburden into the well. A well screen is usually not used where bedrock is stable but may be installed to stabilize the drill hole if the rock is highly fractured or unstable and likely to cave in. Drilled bedrock wells, like drilled overburden wells, are developed during construction to ensure sediment-free water.

A properly constructed and maintained drilled well should prevent the entry of any foreign substance into the well casing that might impair water quality. When a well is drilled, a bore hole is created into which the well casing is placed. The annular space, which is the space between the casing and the outside of the borehole, should be sealed with a suitable sealant (e.g., bentonite slurry, cement grout or concrete). The casing should be watertight, made from approved materials, and the joints should be welded or properly sealed. This watertight method of construction (using the best management practices shown in Figure 2) makes drilled wells less vulnerable to contamination than other types of wells.

Existing drilled wells that do not meet the specifications in Figure 2 can be upgraded in a number of ways:

- Extend the well casing above finished ground surface by at least 40 cm (16 in.). Where a drilled well is located in a well pit, remove the well pit casing (e.g., concrete tile), extend the casing above the ground surface, backfill and seal.
- Mound soil around the well casing above normal ground level and slope it away from the casing to direct surface water away from the well.
- Cover the top of the casing with a commercially manufactured, vermin-proof well cap.

A complete well maintenance checklist including these and other best management practices is provided on page 66 of *Best Management Practices, Water Wells*, which is available individually or as part of *Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well*. These best management practices either meet or exceed the requirements of the Wells Regulation.

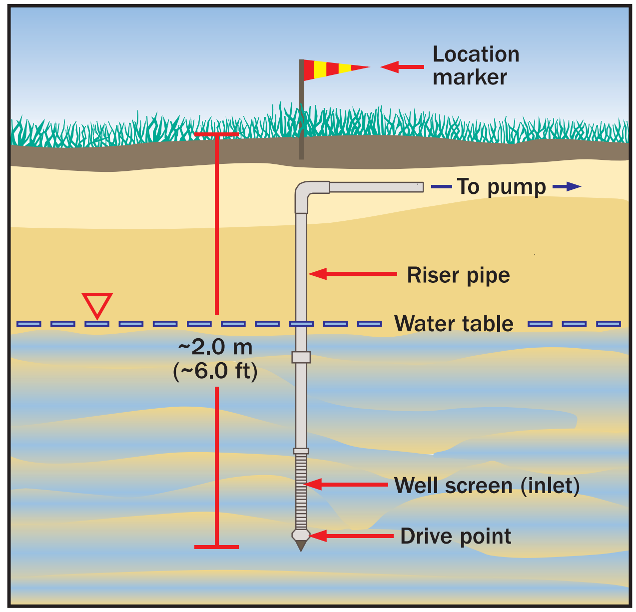

Figure 3. Example of a well point installation.

Well Points

Well points, sand-point or driven-point wells consist of a small-diameter casing ranging in size from 2.5–5 cm (1–2 in.). Well points are constructed in sand and gravel aquifers and are either driven or jetted (inserted using high-pressure water) into the ground. Well points are usually only installed where the aquifer has a shallow water table and contains few or no stones.

Figure 3 shows the construction of a typical well point. Because of the type of construction (driven or jetted into place) and the type of aquifer (unconfined, shallow, sand or gravel), well points are considered highly vulnerable to contamination. Contaminants on the ground surface have only a short distance to travel before reaching the water table and the well inlet. They are also very susceptible to seasonal low water conditions and may not be able provide the required amount of water when needed.

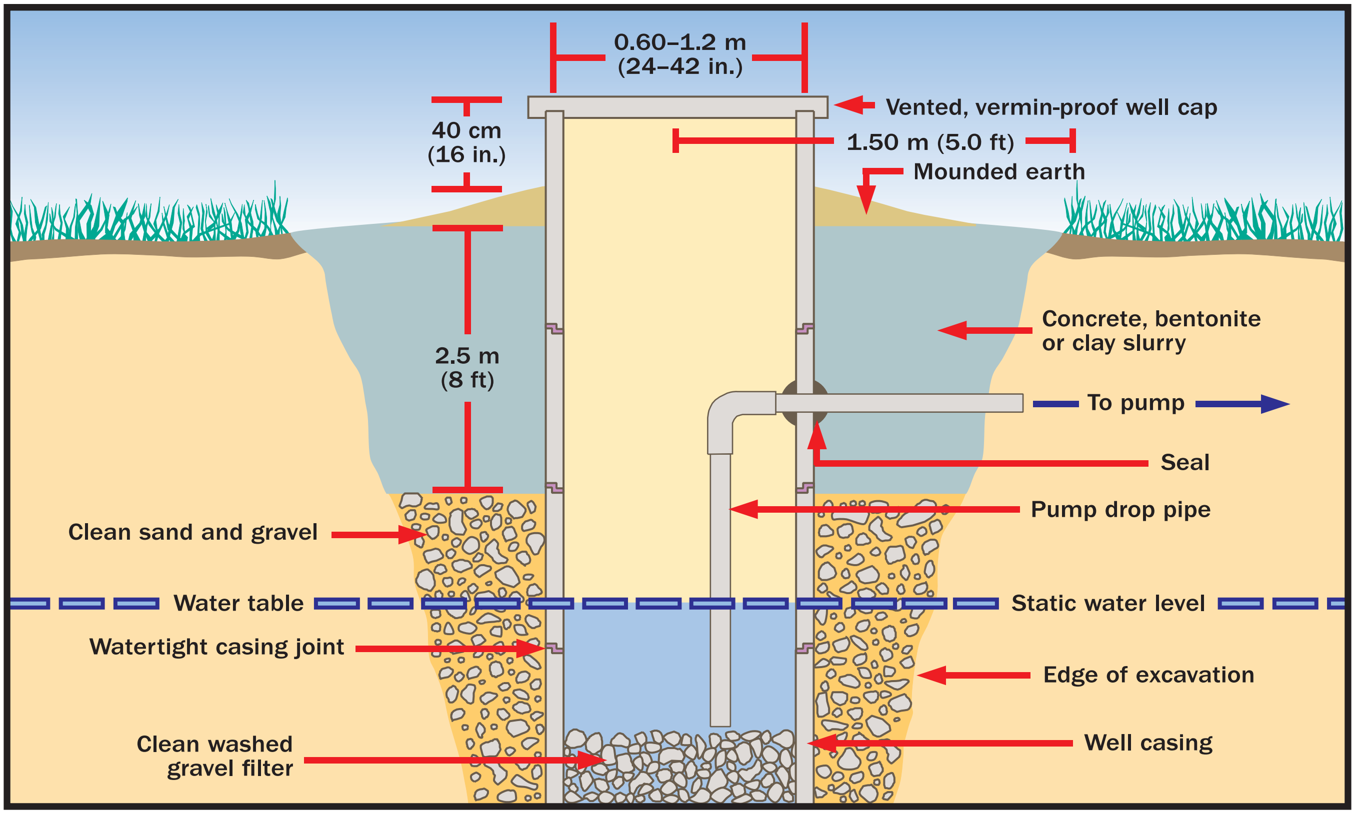

Figure 4. A properly constructed large-diameter well.

LARGE-DIAMETER WELLS

Large-diameter wells are constructed with prefabricated concrete tile or corrugated galvanized steel pipe ranging in diameter from 60–120 cm (24–48 in.) (Figure 4). Older wells may be constructed of brick, stone or even wood cribbing and are very susceptible to undesirable surface-water seepage through the portion of the casing located above the water table.

Dug wells, which were often hand-dug in the past, are now constructed primarily with excavation equipment. They are usually no more than 9 m (30 ft) deep. Bored wells are constructed with the use of a boring machine.

The average depth of bored wells is 15 m (50 ft), but some are 30 m (100 ft) deep. An example of a properly constructed large-diameter well is shown in Figure 4.

Existing large-diameter wells can now be made of metal or approved plastic casing, where the joints are made watertight by welding or sealing with a waterproof material (Figure 4). Large-diameter wells in general are more vulnerable to contamination than drilled wells because of potential leaks in the casing joints and the difficulty of grouting the well's annular space properly.

All large-diameter wells must be capped with a safe cover to prevent unwanted access by water, vermin or other contaminants to the well's interior.

Extremely shallow large-diameter wells (less than 3 m (10 ft) deep) may experience the added problem of low water levels during extended periods of low precipitation. The result can be a reduction in the amount of water that a well can provide, or the well may go dry. More information about managing private wells during times of low precipitation is presented in the OMAFRA Factsheet *Managing the Quantity of Groundwater Supplies.*

HIGHLY VULNERABLE WATER SUPPLIES

The risk of water quality problems with groundwater supplies is directly related to the type of well, its state of repair, its depth and how close it is to potential sources of contamination. The general rule is: the deeper the well, the longer it will take for surface water to enter the well, which lessens the risk of contamination. The risk of contamination also decreases as the distance between the well and potential contamination sources increases.

Water supplies are highly vulnerable to contamination due to a number of factors, including:

- inadequate depth of soil protecting the aquifer
- direct and rapid movement of surface water into the well casing and aquifer due to a defective casing
- a shallow groundwater source easily influenced by surface activities or surface water
- a well that is located in a low area subject to ponding and/or flooding, or near or downslope of a potential contaminant source(s)

More information about groundwater vulnerability is presented in the OMAFRA Factsheet *Protecting the Quality of Groundwater Supplies* and in *Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well*.

Highly vulnerable water supplies include:

- extremely shallow- or large-diameter wells (i.e., less than 3 m (10 ft) below ground surface)
- below-grade wells, including well pits, that are constructed where the top of the well casing is below ground level, such as:
  - buried wells (including those constructed beneath a structure)
  - well pits (drilled wells constructed in excavations below the frost line), drilled wells in well pits that are below grade and subject to flooding
- drilled wells constructed in old large-diameter wells
- cisterns (reservoirs used to collect and store water)
- springs and spring boxes constructed around a spring to collect water for more efficient pumping — spring water is highly vulnerable to contamination from natural and human sources where it flows close to the ground surface.
- surface-water trench systems, also known as "shore wells"

Do not use highly vulnerable water supplies for drinking because of the limited opportunity for water to be purified naturally, unless:

- it is the only water supply available and attempts to develop an alternative water supply have not been successful
- it is located as far as possible from any potential source of contamination
- it has been regularly tested and found to be safe for consumption
- it has treatment for potable use, where required

Testing and treatment options are discussed in *Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well.*

UNUSED WELLS

Unused or improperly abandoned wells are a significant potential source of groundwater contamination.

In Ontario, unused or improperly abandoned wells must either be upgraded to meet regulatory requirements or be properly abandoned (plugged and sealed to protect the aquifer from the direct entry of surface water and contaminants). When considering upgrading, replacing or abandoning a well, consult a licensed well technician who also holds a valid well contractor licence or works for the holder of a valid well contractor licence. Properly abandoning a well also prevents the movement of water and contaminants between aquifers, or between an aquifer and the ground surface, and eliminates a safety hazard to humans and animals.

ADDITIONAL RESOURCES

The information kit entitled *Keeping Your Well Water Safe to Drink: An Information Kit to Help You Care for Your Well* (ontario.ca/publications), published by the Ministry of Health and Long-Term Care, provides in-depth guidance on how to maintain private water supplies. It also shows how and when to have water tested, and the acceptable levels of dissolved materials and indicator bacteria counts in drinking water.

Information on different actions that can be taken to protect the quality of groundwater and your drinking water supply is provided in the *Canada-Ontario Environmental Farm Plan* workbook and associated Infosheets (ontario.ca/be5v).

OMAFRA. *Best Management Practices, Water Wells.* 2003. ontario.ca/omafra.

MOECC. *Green Tips: Managing Your Water Well in Times of Shortage.* PIBS 3784e. ontario.ca/document/managing-your-water-well-times-water-shortage.

MOECC. *Wells Regulation – Siting a New Well.* PIBS 7939e. ontario.ca/document/wells-regulation-siting-new-well-technical-bulletin.

MOECC. *Well Repairs and Other Alterations.* PIBS 79383. ontario.ca/document/wells-regulation-well-repairs-and-other-alterations-technical-bulletin.

MOECC. *Wells Regulation – Well Abandonment: How to Plug and Seal a Well.* PIBS 7940e. ontario.ca/document/wells-regulation-well-abandonment-how-plug-and-seal-well-technical-bulletin.

This Factsheet was updated by Dr. Hugh Simpson, Program Analyst, OMAFRA, Guelph; Jim Myslik, JPM Consulting, Marden; Dr. Brewster Conant, Department of Earth Sciences, University of Waterloo. It was reviewed by Tim Brook, Water Management Engineer, OMAFRA, Elora; Rebecca Shortt, Water Quality Engineer, OMAFRA, Simcoe: and H.J. Smith, Environmental Management Specialist, OMAFRA.

This Factsheet is consistent with, but does not reflect the full detail, of the Wells Regulation. For assistance with the Regulation, seek advice from the Ontario Ministry of the Environment and Climate Change (MOECC) through the Wells Help Desk. Call 1-888-396-9355 or e-mail wellshelpdesk@ontario.ca.

Order these publications through ServiceOntario:

- Online at ontario.ca/publications
- By phone through the ServiceOntario Contact Centre Monday to Friday, 8:30 AM to 5:00 PM
  - 416-326-5300
  - 416-325-3408 (TTY)
  - 1-800-668-9938 Toll-free across Canada
  - 1-800-268-7095 TTY Toll-free across Ontario

Published by the Ontario Ministry of Agriculture, Food
and Rural Affairs

ISSN 1198-712X
Également disponible en français (Fiche technique 15-048)

Agricultural Information Contact Centre:
1-877-424-1300
1-855-696-2811 (TTY)
E-mail: ag.info.omafra@ontario.ca

ontario.ca/omafra