

## Locating Existing Water, Gas or Oil Wells

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Improperly constructed, maintained or abandoned wells present a safety risk to people, as well as a potential risk to pollute groundwater resources. This factsheet discusses how and where to find old and existing water, gas or oil wells.

### INTRODUCTION

Approximately 2.5 million Ontarians rely on groundwater as their primary source of drinking water, where 1.3 million rely on private wells and 1.2 million rely on municipal groundwater systems. There are many old wells throughout Ontario that were installed prior to the introduction of minimum construction, maintenance or abandonment standards. Wells that fail to meet these standards can pose health risks and increase groundwater contamination by providing a direct pathway for harmful substances from the surface to groundwater. (Figure 1).



**Figure 1.** Unused water well.

Oil was originally discovered in 1858 in Lambton County and led to the rapid development of thousands of oil wells throughout the area (Figure 2). Development of both oil and gas continued south and along an extensive zone north of Lake Erie. There are over 27,000 oil and gas well records, and it is estimated that there are twice as many wells without records. Gas and oil wells pose similar risks and potential for groundwater contamination as water wells because they also provide a direct pathway for harmful substances between leaking oil, natural gas or other contaminants and groundwater. Oil and gas wells may provide direct pathways from the briny waters found with oil and gas deposits to the overlying fresh groundwater used as a water source.



**Figure 2.** Old oil well with wooden storage tank.

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Ontario's [Nutrient Management Act, 2002](#) (NMA), [Ontario Regulation 267/03](#) and associated protocols were developed to reduce agriculture's impact on both surface and groundwater resources. One key strategy of this regulation is to address risks related to nutrient management activities around wells. Applying nutrients and siting new storage facilities require minimum setbacks from various

types of wells. These setbacks apply to any existing well — new or old, used or unused (see box). When preparing a Nutrient Management Plan (NMP) or Nutrient Management Strategy (NMS), every effort must be made to identify all wells (water, oil and gas) regardless of age, type and whether in use or not.

### Land Application Setback Distances from Wells

1. No application of nutrients to land closer than 100 m to a municipal well (including commercial fertilizer).
2. No application of prescribed materials to land closer than 15 m to a drilled well that has a depth of 15 m or more and a watertight casing to a minimum depth of 6 m below ground level.
3. No application of Agricultural Source Material or CM1<sup>a</sup> & CP1<sup>b</sup> Non Agricultural Source Material to land closer than 30 m to a well other than a well as described in #1 & 2 above.
4. No application of Non Agricultural Source Material that is CM2<sup>c</sup> or CP2<sup>d</sup>, i.e., biosolids, to land closer than 90 m to a well other than a well as described in #1 & 2 above.
5. No application of commercial fertilizer or compost (meeting Category AA or A compost in Part II of the Compost Standards) to land closer than 3 m to water well (not a municipal well).
6. The Ontario Regulation 267/03, as amended, defines a well as: any gas well, oil well, unused well, test well and water well.

<sup>a</sup> Content of Metals Category 1, definition found in O. Reg 267/03, s. 1

<sup>b</sup> Content of Pathogens Category 1, definition found in O. Reg 267/03, s. 1

<sup>c</sup> Content of Metals Category 2, definition found in O. Reg 267/03, s. 1

<sup>d</sup> Content of Pathogens Category 2, definition found in O. Reg 267/03, s. 1

### WHO SHOULD BE CONCERNED

Landowners applying nutrients of all types, whether manure, biosolids, commercial fertilizer, etc., need to know about all the wells on their property. Make every effort to locate all wells, including oil, gas, private and municipal water wells, farm wells for irrigation and livestock watering, commercial, industrial, dewatering and monitoring wells, as well as test bore holes. This includes both active and unused wells. Due to the potential risk of contaminating an active aquifer, this must be done prior to spreading any type of material, including nutrients, herbicides and pesticides.

### WHY BE CONCERNED

Wells, especially poorly maintained and improperly plugged (known in [O. Reg. 903 Wells](#) as “abandoned”) wells, are potentially some of the most effective pathways for contaminants to enter the groundwater and affect your drinking, irrigation or livestock water. For example, foreign materials or contaminants dissolved in surface water or sediment can enter a well because of improperly sealed openings, missing or loose well caps, corroded steel casings or poorly sealed casings.

Unlike soil, where contaminants move slowly from surface to groundwater, surface contaminants can enter and immediately affect groundwater.

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## GOOD REPAIR OR PROPERLY PLUGGED

Water well construction and abandonment is regulated under the [Ontario Water Resources Act](#), R.R.O. 1990, [O. Reg. 903 Wells](#). The regulation specifies minimum standards that ensure wells are constructed according to minimum construction standards. The Wells Regulation also places the responsibility for maintenance and abandonment on well owners. It requires that wells no longer in use are plugged and sealed using regulated procedures.

For more information on water well construction, maintenance and plugging, see the Ministry of Environment, Conservation and Parks (MECP) factsheets, [Wells on Your Property](#) and [Water Supply Wells: Requirements](#). Refer also to the OMAFA publication, [Best Management Practices: Water Wells](#).

Similarly, under the [Oil, Gas and Salt Resources Act, 1990](#), industry standards ensure that oil and gas wells are developed and decommissioned under strict guidelines. Earlier, many gas and oil wells had inferior or improper linings, with the earliest wells being lined with wood. Assume that any unused wells found on the property have not been properly sealed or permanently plugged.

## LOCATING OLD WELLS

### What to Look for

- **Dug water wells** were often constructed prior to the development of boring and drilling methods. These wells were frequently hand dug, typically less than 9 m deep. Later, backhoes did the excavating. These wells target shallow groundwater supplies. Because of the large width, shallow depth and unsealed, generally non-watertight casing, these wells can pose a considerably higher risk of contamination than drilled wells. Look for a wide (60–120 cm across) circular or rectangular opening with walls that may extend above the ground and are lined with stacked fieldstone, brick or other masonry materials.
- **Bored water wells** are augured and target relatively shallow groundwater, generally less than 15 m but can be up to 30 m in depth. Older wells were often lined with clay tiles. The susceptibility to contamination is similar to that of dug wells

because of their similar design characteristics and poorly sealed casing joints. Look for a larger diameter (60–120 cm) cement tile, PVC or corrugated galvanized casing protruding a few centimetres above the ground.

- **Drilled water and oil wells** can be constructed to depths deep below ground into any subsurface material, including bedrock. Wells have been drilled to a depth of 185 m or more but are commonly 15–60 m in depth. Newer drilled wells, following more stringent, modern rules and regulations are less likely to be contaminated or be conduits for contamination. Wells may be constructed out of several materials, such as steel, plastic (PVC) or concrete. Older oil and gas wells generally have uncemented steel liners, whereas newer wells have steel casings that are cemented full length. Very old oil wells may have wooden liners. Look for a steel, PVC, copper or fibreglass casing (10–20 cm) with welded or threaded joints that extend above the ground (10–60 cm).
- **Jetted, water well points and driven wells** are usually small-diameter wells, either driven or jetted using high-pressure water, into the ground. These wells source shallow groundwater aquifers in sand or gravel that are more easily contaminated. Look for small diameter (2–5 cm) tubing that extends above the ground and is often connected to a pump.

## WHERE TO SEARCH

Start by searching documents that may identify the location of wells. Look for:

- [water well records](#) (MECP)
- [oil and gas well records](#) ([Ontario Oil, Gas & Salt Resources Library](#))
- interactive maps with petroleum well records ([Ontario Geohub](#))
- building permits, old land deeds, property surveys and land transfer documents (municipal and township offices)
- old fire insurance plans

If there was a house or a livestock barn on the property, there is a good chance a water well was used and may still be present.

Consider aerial photography as a source of information on the area's past land use and changes over time to identify potential locations of unused wells. They can help identify old barns, homes, windmills and other important structures that may be associated with an old well where there may no longer be any visible evidence remaining of past development. Stereoscopic aerial photography provides a three-dimensional image so small buildings, windmills or similar structures are easily identified from surrounding textures that may not be available with regular aerial photography. Long time neighbours or drillers may also help in identifying past farmsteads where unused wells could be found (Figure 3). Occasionally, dug wells were located in low-lying areas (i.e., edge of wetland, away from the farmstead).



**Figure 3.** Abandoned farmstead.

### How to Search for Potential Well Sites

After reviewing records or maps, conduct a systematic land search for potential well sites.

- Draw a sketch of the property, identifying potential sites where water is commonly used: residences, dwellings, barns, livestock feeding sites and fields with irrigation or past irrigation permits.
- Carefully walk the entire property, looking for any areas not identified on the sketch where water may have been used or clues that indicate water may have historically been used there (windmills, old foundations, outbuildings, silos or feeding pens). This is best done during early spring or late fall when vegetation is dead and there is no snow on the ground.

- In areas where water may have been used, watch for evidence of unplugged wells:
  - any metal or wooden debris that may have been used to construct wells, such as pipes sticking out of the ground (Figure 4)
  - pipe or casing material or covers that may conceal a well
  - abnormal depressions in the ground
  - old hand pumps, drill bits or other material used to drill the well
  - piles of rocks, clay tiles, steel casings
  - electrical switch boxes and pump motors to run pumps
  - rings of concrete, bricks, wood and cement pits
  - buried piping that has surfaced that may have been connected to a well at one point in time

**Caution:** Take care in moving any material that may be covering an old well as the ground nearby or the old well top may be unstable and collapse!

Pipes sticking out of the ground are extremely suspect. Abnormal depressions in the ground, especially those supporting permanent open seepage and aquatic vegetation, could indicate old collapsed dug or bored wells or well pits, all of which can have quite large well diameters. Further supportive evidence would include the discovery of cribbing or support material that lined the well (i.e., cobble, fieldstone, wood, brick, etc.).



**Figure 4.** Surfaced well pipes.

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## FINDING OIL AND GAS WELLS

Use a similar systematic approach to identify unused oil and gas wells. Only landowners in Lambton, Kent, Essex, Elgin, Oxford, Norfolk, Haldimand, Brant, Welland and Niagara need to find oil and gas wells on their property. To a lesser extent, Huron, Middlesex, Perth, Wentworth, Halton, Wellington, Grey and Bruce counties also had some development of varying degrees.

Oil and gas fields are typically developed as a cluster of wells and are joined by infrastructure to efficiently remove and store product from the deposit on the same site. Signs of past producing sites and unused oil and gas wells include:

- pipes joining wells to holding tanks, oil spills (early oil production)
- partially exposed steel casing, that may range in diameter from 12–25 cm
- storage tanks sunken and above ground, wooden and metal construction
- pumping systems (jack pumps)
- well access trails or roads, cement or stone drilling pads
- old drilling equipment, bits, cable, steel rods and metal casings (Figure 5)
- electrical boxes, utility poles and remnants of electrical, motors or engines required to power pumps



**Figure 5.** Unused oil or gas well and remnants.

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These wells could be located anywhere on the property. Long-established neighbours or local community members are invaluable sources of information, as well as historic aerial photos. Look for changes in vegetation development or sites (Figure 6) and access trails disturbed by previous oil and gas activity. Soils at these locations may be compacted so vegetation is stunted and sparse. Many old oil pumps and storage tanks often leaked oil on site. Sites absent of vegetation or with tar-like deposits are good indicators. Old oil and gas wells may also leak methane, or salty or sulphurous waters that kill vegetation.

As a best management practice, identify on a sketch or map all suspect sites, blast holes, cisterns and exploration boreholes for mineral, geothermal, geological or geophysical purposes. Mark all confirmed or highly suspect well locations on maps.



**Figure 6.** Old oil well site. Note the lack of vegetation.

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## **OTHER RESOURCES TO IDENTIFY OLD, UNUSED WELLS**

One difficulty in locating some wells is that over time:

- they may have back-filled (improperly plugged)
- the casing may have been cut off below the ground surface or
- the wellhead may be buried, leaving no visible evidence at the surface

In these situations, wells can often be located using non-invasive geophysical survey methods. Geologists use these surveys to locate metallic minerals and oil and gas deposits buried beneath the earth's surface. Geophysical surveys allow interpretation of various formations, objects and processes in the ground without costly excavation. Three surveys considered practical for locating well-type structures are: electromagnetic, magnetic and ground penetrating radar.

Steel casings can be detected using an electromagnetic (EM) instrument (buried metal detector) or a magnetometer (which measures the strength of the earth's naturally occurring magnetic field). Magnetic surveys are more susceptible to interference from metal objects such as vehicles and metal-clad buildings than EM surveys. To find buried wells with little metal, a ground penetrating radar (GPR) survey may be used. Due to cost considerations, a GPR survey is most effective when focused on a few key areas of a site.

## **REPORTING PREVIOUSLY UNKNOWN WELL LOCATIONS**

Report any well discovered that has no previous record either within the MECP (for water wells) or the Ministry of Natural Resources (MNR) for oil and gas wells. This will provide valuable information to future generations of land users and developers. There may be multiple old wells on a single property; do not stop looking after the first one is located!

For water well plugging requirements, refer to MECP's factsheet, [Wells on Your Property, Water Supply Wells: Requirements and Best Practices](#) and the [Best Management Practices: Water Wells](#).

There are very specific requirements to abandon a well, including who is qualified to do the work. Any person or business hired to plug and seal any water well must be licensed by the MECP and report each well plugging to the ministry. Additional information is found in MECP's report, [Water Supply Wells: Requirements and Best Practices](#).

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## WELL QUICK REFERENCE CHECKLIST

### High Potential for a Well

- farm properties that include multiple farmsteads, abandoned land or structures and uncultivated sites
- farm located in a former or current oil/gas producing area
- areas of different or stunted vegetation, compacted trails/sites, oil residue, abandoned drilling pads

### Unused Well Investigation

- searched for records of oil, gas and water well locations (MNR and MECP)
- searched for old irrigation permits, building permits, site surveys and plans
- investigated ground of abandoned fields, old farmsteads, former livestock feeding sites and fence lines
- checked around debris piles, old foundations and partially buried pipes, stone, brick, wood, clay tiles and well casings
- examined farm infrastructure, including:
  - windmill sites
  - holding tanks
  - farm structures
  - out buildings
  - outdoor electrical boxes
  - abandoned utility poles
  - abandoned well pumps, hand pumps and motors
- used other aids including aerial photos or geophysical surveys
- investigated deep pits or unusual depressions with seepage and aquatic vegetation, stunted, dead or no vegetation areas

## RESOURCES

- [Water Management in Agriculture](#)
- [Oil, Gas and Salt Resources of Ontario, Provincial Operating Standards](#)
- [National Air Photo Library](#)

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