



## Division of Drinking and Ground Waters

### Nonpotable Well Standard Guidance

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#### I. Purpose:

The purpose of this document is to clarify which Ohio laws and rules cover nonpotable wells (i.e., wells that are used for purposes other than human consumption as defined in rule 3745-81-01 of the Ohio Administrative Code or OAC). This document is intended for use by well installers, to identify and explain the relevant Ohio law and regulations for installing nonpotable wells. It does not replace those laws and regulations, or provide detailed guidance. State and local government agency staff and private ground water consultants may also find this document useful.

#### II. Background:

Much of Ohio is underlain by large quantities of easily accessible, naturally high-quality ground water, which is made available for use by wells. To avoid ground water contamination, it is important that the wells be properly installed and operated. Standards for various types of wells are provided in Ohio law and regulations, but it may not always be clear which regulations apply to which wells.

Potable water wells are designed to provide water for human consumption and are subject to the most stringent regulations. These wells may be part of public water systems (PWSs), which are regulated by Ohio Environmental Protection Agency (Ohio EPA), or private water system wells, which are regulated by the Ohio Department of Health.

Nonpotable water wells are any wells that are excavation dug, drilled, or created by another method to provide ground water for nonpotable use. In Ohio, these wells are typically used for irrigating crops, golf courses and lawns, watering livestock, geothermal heating and cooling water for homes and businesses, and providing wash or coolant water for industries. Monitoring wells are also a type of nonpotable water well, used for ground water research and investigations. Monitoring wells are not addressed in this document but are in OAC rule 3745-9-03 and in Ohio EPA's Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring.

#### III. Applicable Law and Rules:

Ohio EPA is responsible for developing and implementing rules for well siting, construction and abandonment to prevent ground water contamination. This responsibility extends to all water supply wells except those used by private water systems. Ohio EPA has adopted rules covering

the drilling, operation, maintenance and abandonment of wells other than private water system wells. Radial collector wells, monitoring wells and potable wells used by public and private water systems are not addressed in this document.

- A. Nonpotable wells must meet many of the standards found in rules in OAC Chapter 3745-9: Water Well Standards. Not all rules in this Chapter apply to nonpotable wells and some sections of rules only apply to PWS wells. The rules that do apply include:
- 3745-9-01 - Definitions.
  - 3745-9-02 - Scope and Exemptions.
  - 3745-9-04 - Well Siting.
  - 3745-9-05 - Well Construction.
  - 3745-9-06 - Well Construction, Specific Geologic Conditions.
  - 3745-9-07 - Well Grouting for Construction or Closure.
  - 3745-9-10 - Abandoned Well Sealing
- B. The well installer and well owner are responsible for compliance with all applicable well siting, construction and abandonment requirements. (See Ohio Revised Code (ORC) Section 6111.42 and rules adopted in OAC Chapter 3745-9).
- C. Nonpotable well drillers, owners and users must also comply with other sections of the ORC or the OAC. The driller is responsible for compliance with well log filing requirements found in Section 1521.05 of the ORC, which apply to all nonpotable wells. A well log must be filed with the Ohio Department of Natural Resources, Division of Soil and Water Resources. Any well or facility with multiple wells capable of withdrawing 100,000 or more gallons per day must be registered with the Ohio Department of Natural Resources, Division of Soil and Water Resources' Water Withdrawal Facilities Registration Program as required by Section 1521.16 of the ORC.
- D. Local laws and ordinances may also apply.

#### **IV. History**

This guidance document was developed by the Water Well Standards workgroup. The Division of Drinking and Ground Waters first issued this guidance on [\[DATE\]](#).

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## List of Abbreviations

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BUSTR	Ohio Department of Commerce, Division of State Fire Marshal, Bureau of Underground Storage Tank Regulations
NSF	National Sanitation Foundation
OAC	Ohio Administrative Code
ODNR-DGS	Ohio Department of Natural Resources, Division of Geological Survey
ODNR-DMRM	Ohio Department of Natural Resources, Division of Mineral Resources Management
ODNR-DSWR	Ohio Department of Natural Resources, Division of Soil and Water Resources
OEPA-DDAGW	Ohio Environmental Protection Agency, Division of Drinking and Ground Waters
OEPA-DERR	Ohio Environmental Protection Agency, Division of Environmental Response and Revitalization
ORC	Ohio Revised Code
SCH	Schedule
USGS-OWSC	U.S. Geological Survey, Ohio Water Science Center

## **WELL SITING**

The siting criteria for nonpotable wells can be found in OAC rule 3745-9-04. A nonpotable water supply well must be located:

- As far as possible from a potential or known source of contamination. Potential sources include, but are not limited to, small flow onsite sewage treatment systems, household sewage treatment systems, underground storage tanks and waste management facilities.
- Where surface and subsurface conditions will not allow contaminants to be conducted into the well.
- Where the area can be maintained in a sanitary condition.
- Where access is available for cleaning, treatment, repair and testing, and the well is safe from physical damage.

Nonpotable wells may not be located in a floodway without Ohio EPA approval. Except for a pumphouse, a well may not be located within ten feet of a building foundation.

### **Site review**

Prior to installing a nonpotable well there should be a review of information about the property, surrounding properties and subsurface conditions. The review will help identify local conditions that call for additional precautions during drilling or affect well design, installation or pump performance. These conditions may include:

- Karst and paleokarst;
- Flowing or artesian conditions;
- Coarse sand and gravel deposits;
- Pre-existing ground water contamination;
- Ground water with elevated total dissolved solids;
- Ground water with high chloride concentrations;
- Ground water with moderate or high sulfate concentrations;
- Other ground water conditions that may indicate the need for water treatment prior to discharge;
- Underground mine shafts or rooms; or
- Areas previously used for surface mining.

These conditions may call for changing the drilling method, revising plans for grout selection and placement or affect well location. The well installer or prospective owner should include a review of information available about the local aquifer(s), public records to identify contaminated zones in soil and ground water, past practices and other hazards that may complicate the process of well design, installation and operation.

The pre-design review should also include contacting local government agencies regarding zoning, health and other codes that may affect the siting and installation of nonpotable wells. Local restrictions may include:

- New well siting and construction;
- Disturbances in riparian setback areas and flood plains; and

- Construction based on local conditions, such as slope and soil characteristics.

Coordination with the local health district is necessary to identify the locations of any existing or proposed private water system(s) or sewage treatment system(s) and their proposed replacement areas. If nonpotable wells will be sited near a public water system, close coordination with the Ohio Environmental Protection Agency, Division of Drinking and Ground Waters (OEPA-DDAGW) may be necessary.

Potential sources of information regarding geologic and ground water conditions, siting restrictions and water and waste water infrastructure locations are included in Table 1.

**Table 1 – Sources of information available during a site review.**

*(A list of the abbreviations used in this table can be found on page 5.)*

<b>Area of concern:</b>	<b>Potential sources of information:</b>
<b>Local Geology</b>	
Karst geology	ODNR-DGS, ODNR-DSWR, USGS-OWSC
Coarse sand and gravel deposits	ODNR-DGS, ODNR-DSWR, USGS-OWSC
<b>Local ground water conditions</b>	
Flowing or artesian conditions	ODNR-DSWR, USGS-OWSC
Ground water contamination	OEPA-DDAGW, OEPA-DERR, BUSTR
Other local ground water conditions	ODNR-DGS, ODNR-DSWR, OEPA-DDAGW, USGS-OWSC, Local health districts and departments
<b>Well locations</b>	
Public water system locations	OEPA-DDAGW
Private water system locations	ODNR-DSWR, Local health districts
Oil and Gas Wells	ODNR-DMRM
Other well locations	ODNR-DSRW
<b>Other local conditions</b>	
Active and abandoned underground mines	ODNR-DMRM
Small flow on-lot sewage treatment systems	Local health districts, OEPA-DSW
Local ordinances	Local health districts, zoning boards or commissions and building departments
Mining activity	ODNR-DMRM

## WELL INSTALLATION

The criteria for materials used when installing nonpotable wells can be found in OAC rule 3745-9-05. All materials used in the construction of a well must be free of contaminants. Drilling mud, additives and lubricants must have either standard ANSI/NSF 60 or ANSI/NSF 61 certification. Drilling fluid or additives that contain guar gum, or other such biodegradable organic material, are not to be used. Any water used for drilling must be potable and not obtained directly from surface water. If necessary, the potable water may be treated to meet the drilling mud manufacturer's recommendations.

### Casing

Other than when used in a point well, permanent well casing or liners must meet OAC rule 3745-9-05(A). Casing must be new, structurally sound, watertight, straight and free of defects or visible damage. All material must be free of contaminants. Steel or thermoplastic pipe may be used. Casing will need to be sized to allow the well to produce sufficient water and to allow for the installation and maintenance of related pumping equipment. The minimum pipe size allowed for permanent casing is five inches.

All steel pipe or tubing used as permanent well casing or liner must meet requirements of OAC rule 3745-9-05(A)(4)(b). Driven steel casing must be equipped with a drive shoe. Casing joints must be either threaded and coupled, or welded.

All thermoplastic pipe or tubing used as permanent well casing or liner must meet the standards found in OAC rule 3745-9-05(A)(4)(c). Thermoplastic casing may not be installed where potential or known contaminants may degrade or permeate the plastic. Thermoplastic casing may not be driven.

Casing placement must be per OAC rule 3745-9-05. The casing and borehole must be sufficiently straight and vertical to allow the normal installation and operation of the pump and uniform placement of grout. If the casing is not driven and the drilling method requires an oversized borehole, the annular space must be at least 1.5 inches for a well fourteen or less inches in diameter and at least two inches for a well greater than fourteen inches in diameter.

Casing must extend continuously to the top of the aquifer or the non-water bearing consolidated formations above the aquifer.

Casing height above finished grade must be at least twelve inches above finished grade or any concrete apron surface. The finished grade must be sloped to divert surface water runoff away from the well. Where a well house is constructed, the floor surface must be at least six inches above the finished grade and the casing height at least twelve inches above the floor.

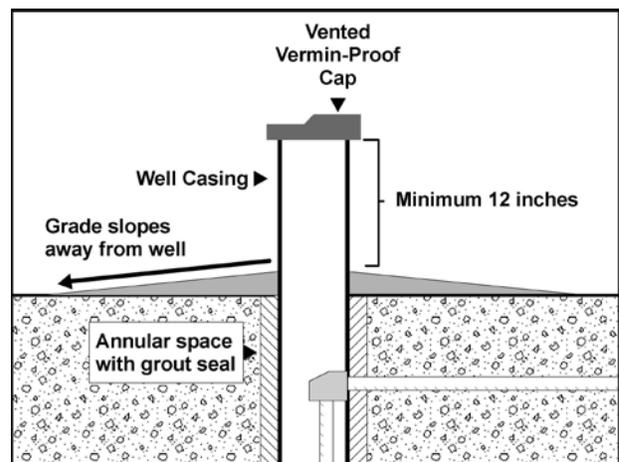


Figure 1 – Proper wellhead construction.

## GROUT SEAL

The grout seal in the annular space outside of the casing prevents surface water and potential contaminants from entering ground water.

### Grout Materials

All grouts must meet OAC rule 3745-9-07. Either cement or bentonite grout must be used.

Bentonite:

1. High solids bentonite grout made with powdered bentonite clay or granular bentonite and coarse grade or pelletized bentonite are acceptable.
2. Must not contain bentonite drilling mud or cuttings.
3. Must be mixed according to the manufacturer's recommendations to achieve at least 20 percent solids.
4. If synthetic organic polymers are added to suppress hydration of the bentonite, the polymers must have an ANSI/NSF 60 certification and must be mixed according to the manufacturer's recommendations.

Cement:

1. Cement grouts that meet standard ASTM C150-00, Standard Specification for Portland Cement, and have standard ANSI/NSF 61 certification, and include:
  - a. Type I, general purpose cement;~~or~~
  - b. Type II, for use in water with moderate sulfate content between one hundred and fifty to fifteen hundred milligrams per liter, and conditions requiring lower heat of hydration;~~or~~
  - c. Type III, for use in conditions requiring high early strength;~~or~~
  - d. Type IV, for use in conditions requiring low heat of hydration; or
  - e. Type V, for use in ground water with a high sulfate content greater than fifteen hundred milligrams per liter.

### Grout Placement

Grout placement must be per OAC rule 3745-9-07. The annular space must be completely filled from the bottom of the annular space, or from the top of the filter pack or formation stabilizer, upward to the ground surface. Grout must be placed by pressure grouting unless other measures are required for specific geologic conditions (see Special Conditions on page 11), when dry grouting using a cable tool drilling rig or in the circumstances discussed below.

If a pitless adapter or pitless unit will be installed and well construction is not completed when

casing is set, compacted clean clay may be temporarily used from the expected point of attachment to the ground surface.

### **Dry Driven Grout**

The primary reason for grouting a driven well casing is the same as for other types of well construction. The driving of the casing into the ground creates a “micro” annular space between the casing and the geologic material. By placing an impervious layer of material in the annulus (i.e., space between the casing and borehole), the probability of surface water intruding the aquifer is minimized. When the annulus is properly sealed, water is restricted from flowing from one aquifer to another. Proper grouting techniques result in the best well construction possible. This guidance document, and others pertaining to well construction, will help you learn how to protect everyone’s ground water. The methods used to grout and drive well casing may vary, but the following procedures cover the basic technique.

Initially, a 3-foot-deep borehole should be drilled approximately four to five inches wider than the drill pipe being used. Next, the casing is placed into the borehole and the annulus is filled with a dry grouting material. As drilling continues, the well casing is then driven into the ground approximately 12 feet while grouting material is continually placed around the drill pipe at the surface. The grouting material simply moves down the annulus along the casing. As additional well casing is driven, each coupling drags and pulls the grout down along the exterior of the casing filling the annulus.

Water used for drilling operations may spill onto the area where the dry grout is being placed. This makes the grout swell creating a temporary seal at the surface. This is corrected by shoveling off the thin top layer of the moistened grout and exposing the underlying dry grout. If the grout hangs up (bridges) during driving operations, and no longer moves down the annulus, it is necessary to pull the well casing back two or three feet. By pulling the well casing back, the bridging of the grout is eliminated, and drilling and driving procedures may continue.

### **Grout Placement for Temporary Casing**

When a temporary casing is required, grout placement must be per OAC rule 3745-9-07. The annular space between a permanent casing and a temporary casing must be filled with grout during temporary casing removal. Where temporary casing removal is not possible or practical, temporary casing must be withdrawn at least five feet to insure grout contact with the formation at the base of the permanent casing. Coarse grade bentonite may be poured into the annular space between a permanent casing and temporary casing during temporary casing removal.

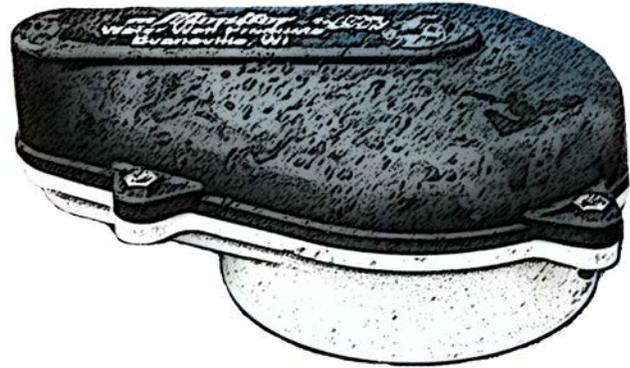
## **OTHER EQUIPMENT**

### **Well Caps**

OAC rule 3745-9-05 requires that a completed well have a cap or seal to prevent the entrance of water, dirt, animals, insects or other foreign matter. The top of the casing at its finished height must be cut so that the upper casing surface will fit flush with the cap and provide a tight seal. The cap or seal must fit securely to the top of the casing, be secured with screws or other appropriate connections, and vented to equalize the pressure in the well with the atmosphere. Electrical conduit connections on the cap or seal must be threaded and sealed to prevent the

entrance of insects and water.

All caps and seals must include a vent. The vent must be self-draining, screened with a non-corroding material of fifteen to thirty mesh, and pointed downward at or above the top of the casing, pitless adapter or pitless unit. The vent must terminate at least twelve inches above the ground surface, well house floor or concrete apron surface. Deep well single pipe packer jet installations, point wells, or flowing wells where the flow rate is greater than the pumping rate of the permanent pump are not required to have a vented well cap or seal. A point well may have a watertight well cap that does not vent.



**Figure 2** – An example of a vermin-proof well cap with a rubber gasket.

Prior to completion and to prevent contaminants from entering the well, a temporary watertight well cap or seal must be provided until the pumping equipment is installed.

### **Well Houses**

A well house or pumphouse is a building designed and constructed solely to house pumping and water system equipment. OAC rule 3745-9-05(A)(13) establishes the minimum requirements for a well house. A well house must be constructed above ground surface.

As noted in the Casing Placement section, if a well house is constructed, the floor surface must be at least six inches above the finished grade and the casing height must also be at least twelve inches above the well house floor.

### **Pitless Adapters**

A pitless adapter or pitless unit may be installed when piping from the casing is below ground surface. OAC rule 3745-9-05 requires that the pitless adapter or pitless unit and installation procedures in above and below ground surface installations must adequately prevent the entrance of surface water, dirt, animals, insects or other foreign matter. OAC rule 3745-9-05(A)(8) and (A)(9) describe the minimum requirements for a pitless adapter or pitless unit connection to casing.

### **Well Pumps**

OAC rule 3745-9-05(A)(14) establishes the minimum requirements for well pumps. A pump must be constructed so that there are no unprotected openings into the interior of the pump or well casing. Submersible pump motors with mercury seals are prohibited. Above-ground pumps and line shaft pumps must be attached in accordance with one of the following:

- to the casing;
- to the suction or discharge line by a watertight connection; or
- have a base plate attached to the casing by a threaded or welded connection, that has bolted flanges with rubber gaskets twelve inches or greater above ground surface, or an extension of the casing at least 0.5 inch into the base of a pump mounted on and sealed

to a concrete pedestal.

Below ground water service pipe must be maintained under system pressure at all times. Check valves are not to be installed between a pitless adapter or pitless unit and the pressure tank.

## **SPECIAL CONDITIONS**

Wells completed in certain geologic settings must satisfy additional construction requirements as outlined below and found in OAC rule 3745-9-06. Special conditions are applicable to wells completed in: consolidated formations within 25 feet of the surface; where multiple aquifers are present; confined aquifers; cavernous formations or mines; when brine is encountered; and weathered bedrock.

## **WELL MAINTENANCE**

OAC rule 3745-9-05(A)(16) establishes the minimum standards for well maintenance. The well must be altered, modified, or repaired if any of the following occur:

- The pump, or any part of a well, malfunctions;
- The pump, or any part of a well, is defective;
- The top of the casing is buried below ground surface; or
- There is a potential or actual risk of contamination of ground water.

Maintenance on, modifications to or alterations to a well must be performed so that the casing and top of well are protected against contamination or inadvertent damage.

## **WELL COMPLETION**

Disinfection is not required prior to putting a nonpotable well into use.

## **ABANDONED WELL SEALING**

Nonpotable wells must be sealed in accordance with OAC rule 3745-9-07 and rule 3745-9-10 when taken out of service. Technical Guidance For Sealing Unused Wells (State of Ohio, [Placeholder for date]) is to be used for guidance.

The finished grade must ensure that surface water runoff drains away from the sealed well.

All obstructions must be removed from the abandoned well. This includes the pump and related equipment, drop pipe, pitless adapter, suction line, trash or other debris.

## **DEFINITIONS (as defined in OAC rule 3745-9-01)**

"Conductor pipe--gravity" means allowing cement grout to flow by gravity through a funnel or hopper connected to a conductor pipe.

"Conductor pipe--pumped" means pressure grouting with a conductor pipe that is lowered to the bottom of the annular space with grout pumped from the bottom up in a continuous operation. The end of the conductor pipe remains submerged and full of grout at all times.

"Drive shoe" means a hardened steel collar with a beveled cutting edge that is attached to the lower end of a casing by threading or welding to protect the casing as it is driven.

"Floodway" means the channel of a river or stream, and those portions of the floodplain adjoining the channel required to carry the flood discharge.

"Granular bentonite" means bentonite that has been processed to coarse granular particles ranging in size from thirty-three to ninety-three thousandths of an inch.

"Grout" means a slurry of cement, bentonite, clay, or other impervious material that is used to seal a well, test hole, dry hole, or annular space. Grout specifications for sealing are in rule 3745-9-07 of the Administrative Code.

"Grout shoe--continuous injection" means pressure grouting by using a grout shoe with a check valve installed in the bottom of the permanent well casing and connected by a conductor pipe to the surface through which grout is pumped until the entire annular space is filled with grout. The conductor pipe is removed, the permanent casing set at the bottom of the borehole, and the grout allowed to set until cured.

"Monitoring well" means an excavation by digging, boring, drilling, driving, or other method that is done or used to extract samples of ground water or for the purpose of determining the quality, quantity, or level of ground water.

"Packer" means a rubber or inflatable device used to temporarily or permanently seal off a portion of the borehole, annular space or well casing.

"Pelletized bentonite" means bentonite that has been processed into pellets or tablets that have a diameter of one fourth to one half inch.

"Pitless adapter" means an assembly of parts which will permit water to pass through the casing or extension thereof; provides access to the well and to the parts of the water system within the well; and provides for the transportation of the water and the protection of the well and water therein from surface or near surface contaminants.

"Pitless unit" means an assembly which extends the upper end of casing to above grade and prevents the entrance of contaminants into the well, to conduct water from the well, to protect water from freezing or extremes of temperature and to allow access to the well and components of the pumping equipment.

"Point well" means a well with casing with an integral screen and drive point that is installed by driving or jetting.

"Pressure grouting" means any of the following methods of placing a grout slurry into a well or the annular space of a well: conductor pipe-pumped; grout shoe-continuous injection; well seal with conductor pipe-pumped; grout displacement method.

"Shale basket" means a conical shaped rubber packer that is attached to the bottom of the casing to seal the annular space and prevent grout from entering the open borehole or screened area of the well.

"Standard dimension ratio (SDR)" means the ratio of average outside pipe diameter to minimum pipe wall thickness.

"Static water level" means the level of the water when measured from the established ground surface to the water surface in a well that is neither being pumped nor under the influence of pumping.

"Thermoplastic" means polyvinyl chloride (PVC) or acrylonitrile butadiene styrene (ABS).

"Well" means any excavation by digging, boring, drilling, driving, or other method for the purpose of removing ground water from an aquifer, except a private water system well or a monitoring well.

"Well cap" or "cap" means a device used to enclose the atmospheric termination of the well casing, and a device that covers and encloses the upper termination of a pitless unit or the well casing and provides protection to the top, exposed portion of the well casing by being tamper resistant, forming a protective cover from the elements, and being resistant to the entry of vermin or contaminants.

"Well house" or "pumphouse" means a building designed and constructed solely to house pumping and water system equipment.

"Well screen" or "screen" means an intake structure with uniform openings designed to retain the aquifer formation, prevent collapse of the borehole adjacent to the screen, and accommodate a yield adequate for the intended use of the well.

"Well seal with conductor pipe--pumped" means pressure grouting by setting the permanent casing just above the bottom of the borehole and filling the casing and annular space with water, drilling mud or a bentonite slurry. Conductor pipe is then set inside the casing to the bottom of the borehole either through a watertight well seal or packer. Grout is pumped into the annular space displacing all other fluids in the annular space and the permanent casing set in place.

"Well vent" or "vent" means a screened opening in a well seal or cap to allow atmospheric pressure to be maintained in the well.

## Ohio EPA Districts and District Offices

**Northwest District Office**  
347 N. Dunbridge Road  
Bowling Green, OH 43402  
(419) 352-8461

**Central District Office**  
P.O. Box 1049  
50 West Town Street, Suite 700  
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**Northeast District Office**  
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**Southwest District Office**  
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