

APPENDIX 5-B STANDARDS FOR WATER WELLS

(Statutory Authority: Public Health Law 206(18))

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Section 5-B.1 Application and Definitions.

(a) Applicability

(1) This regulation applies to water wells used for drinking, culinary and/or food processing purposes and is the minimum standard for construction, renovation, development and abandonment of such water wells. Additional requirements may need to be met for certain water wells that serve a public water system as defined in Subpart 5-1 of this Title.

(2) Installation of new and replacement water wells shall meet all of the applicable provisions of this Appendix. Deviations may only be allowed at the discretion of the Department or local health department in accordance with: a waiver issued pursuant to Part 75 of this Title; or a variance issued pursuant to Subpart 5-2 of this Title; or a written approval issued by the Department or local health department prior to December 1, 2005; or a written approval granted by a local health department pursuant to a local sanitary code.

(3) Other state agencies, regional authorities, and local health departments with authority to regulate water wells may establish additional requirements for water wells within their respective jurisdictions.

(b) Definitions - As used in this regulation, the following words and terms shall have the indicated meaning:

(1) Adequate means sufficient to accomplish the purpose for which something is intended, and to such a degree that no unreasonable risk to health or safety is presented. An item installed, maintained, designed and assembled, an activity conducted, or act performed, in accordance with generally accepted standards, principles or practices applicable to a particular trade, business, occupation or profession, is adequate within the meaning of this Appendix.

(2) Air lift test means a method of performing a water well yield test by pumping air through an inductor pipe to force water out of an eductor pipe. The inductor pipe is submerged to a depth generally about 60 percent below the static water level to allow for successful

completion of the test. The drill pipe is utilized as the inductor pipe/air delivery mechanism and the casing and/or borehole as the eductor. The flow rate of water in gallons per minute (gpm) is determined as the water exits the top of the well. The drop of air pressure in the inductor pipe can be used to estimate the drawdown in the well.

(3) API means American Petroleum Institute.

(4) ASTM means American Society for Testing and Materials.

(5) Bailing test means a method of estimating well yield by bailing a known quantity of water from static water level and maintaining a stabilized water level over a measured period of time.

(6) Contaminant includes but is not limited to any physical, chemical, microbiological or radiological substance or matter in water that can be present at levels of public health concern.

(7) Decommissioning means the act of filling, sealing and plugging water wells in accordance with the requirements of Section 5-B.6(a) of this regulation such that the continued existence of the well will neither pose a health or safety hazard nor serve as a conduit for contaminant migration to or within the aquifer.

(8) Department means the New York State Department of Health.

(9) Drive shoe means a beveled cutting edge attachment to the bottom of the first section of permanent steel casing to protect the casing as it is being driven and to provide firm seating in consolidated geologic materials.

(10) gpm means gallons per minute.

(11) Grout means a material that has a low permeability, such as neat cement, bentonite slurry, bentonite chips, bentonite pellets, granular bentonite, or other materials that have equivalent sealing properties.

(12) Hydrofracturing means the procedure of pumping water and/or sand and/or small particles of high-strength plastic into a geologic formation to induce fracture and increase yield.

(13) Local health department means a city, county, or part-county department of health.

(14) NSF means the National Sanitation Foundation International, formerly known as National Sanitation Foundation.

(15) Person means an individual, corporation, company, association, partnership, State agency, or municipality, including a county.

(16) Pitless adapter means an assembly of parts that will permit water from a well to flow through the wall of the well casing, or extension thereof, into a pipe leading to a building or other point of water use, and that shall be constructed and installed in a manner to prevent the entrance of contaminants into the well and the water produced.

(17) Pitless unit means a factory produced assembly that is threaded or welded to the casing below grade which provides access to the well for maintenance and repair and shall be constructed and installed in a manner to prevent the entrance of contaminants into the well and the water produced.

(18) Potable water means water which meets the water quality requirements established in Subpart 5-1 of the State Sanitary Code.

(19) Public water supply well means a water well used or intended for use for a public water system as defined in Subpart 5-1 of the State Sanitary Code.

(20) SDR means “standard dimension ratio” which means the ratio of average outside pipe diameter to minimum pipe wall thickness.

(21) Stabilized water level occurs when water in a well has achieved steady state during a period of constant rate withdrawal of groundwater (i.e. stabilized drawdown).

(22) Static water level is the natural water level in a well not being pumped or in a well fully recovered after pumping, as measured from the top of the well casing or the ground surface.

(23) UL means Underwriters Laboratories.

(24) USDA means the United States Department of Agriculture.

(25) USFDA means the United States Food and Drug Administration.

(26) Water well (well) shall mean any excavation for the purpose of obtaining ground water for drinking, culinary and/or food processing purposes, with installed components (including well casing, screen, grout, adapters, et. al.).

(27) Water well drilling or water well drilling activities shall mean the construction or reconstruction of water wells, the establishment or repair of a connection through the well casing and the repair of water wells including repairs which require the opening of the well casing.

(28) Well casing means watertight, non-porous material used to maintain a well opening and provide access to the interior of the well.

(29) Well development or redevelopment of a water well means actions to remove clay, silt, fine sand and/or organic/inorganic deposits from the aquifer and/or gravel packing to increase porosity and permeability of the aquifer formation and to minimize continued pumping of clay, silt and fine sand while obtaining water without changing the physical construction of the well. Such actions include bailing, jetting, air lifting, pumping, surging, hydrofracturing and/or chemical treatment.

(30) Well renovation means changes or repairs to water well.

(31) Well yield means a sustainable quantity of water per unit of time that may flow from or be pumped continuously from a well and is usually expressed as gallons per minute (gpm).

Section 5-B.2 Water Well Location and Protection.

- (a) A well shall be located so that adequate access to the well for inspection, maintenance, repair, renovation, treatment, and testing is provided.
- (b) A well shall be located where it is not subject to seasonal flooding or surface water contamination, or it shall be constructed in such a manner that seasonal floodwater cannot enter the well.
- (c) A well shall be located upgradient of any potential or known source of contamination unless property boundaries, site topography, location of structures and accessibility require a different location. The minimum horizontal separation distances from potential sources of contamination listed in Table 1 shall be maintained.
- (d) The ground surface immediately surrounding a well casing shall be graded to divert surface water away from the well. Concrete shall not be used for grading purposes.

Section 5-B.3 Water Well Construction.

- (a) Acceptable water well construction methods include well drilling, driving, boring, jetting and excavating into an aquifer to obtain groundwater for a source of water supply. Acceptable water well drilling methods include cable-tool drilling, percussion drilling, air or mud/direct or reverse rotary drilling, sonic drilling, driving water well casing, and boring with earth augers to obtain groundwater.
- (b) All of the following provisions apply to water well construction.
 - (1) Wells shall be constructed according to the requirements of Table 2.
 - (2) A well shall be constructed to maintain existing natural protection against contamination of aquifers and other geologic materials penetrated during well drilling and installation.
 - (3) A well shall be constructed to preclude and prevent entry of all known sources of contamination into the well.
 - (4) A well shall have a minimum casing length extending from one foot above finished grade to nineteen feet below finished grade upon completion of well drilling, with the following exceptions:
 - (i) The required total length of casing may exceed twenty feet depending upon geologic conditions and shall be in accord with the standards for the construction of wells listed in Table 2; and
 - (ii) Where the only viable source of groundwater available is from a shallow aquifer where the well must be completed at a depth less than nineteen feet below grade, the Department or local health department having jurisdiction may allow use of well casing of less than twenty feet total length along with such additional measures as needed, including but not limited to increased separation distances per Table 1, Note 1, to ensure provision of potable water.

- (5) If a well is located in a well house, the floor of the well house shall be at least six inches above grade and the permanent casing shall extend at least six inches above the floor.
- (6) Upon completion of well drilling and until such time as the well is equipped with a pump, the top of the casing shall be secured with a watertight and vermin proof well cap.
- (7) Casing and joints must be of sufficient strength and construction to ensure that integrity, shape, and ability to properly function are maintained during and after installation.
- (8) Steel pipe that is used as permanent well casing shall be new pipe that contains a label or imprint indicating compliance with ASTM specification A53, A106, A500 or A589 or API specification 5L.
- (9) A driven steel permanent casing terminating in bedrock shall be fitted with a drive shoe that is firmly seated in the bedrock.
- (10) PVC pipe that is used as permanent casing shall be new pipe that contains a label or imprint indicating compliance with ASTM specification F 480 and NSF or UL standards and shall be Schedule 80 or SDR 21 or heavier. PVC pipe that is installed at depths of more than 200 feet shall be SDR 17 or heavier.
- (11) Casing pipe that is manufactured from thermoplastic materials other than PVC shall be new pipe that contains a label or imprint indicating compliance with ASTM specification F 480 (i.e., SDR water pipe) and NSF or UL standards for use with drinking water.
- (12) PVC and other thermoplastic materials may be used as casing in bedrock if not driven and if sealed with grout, provided such use complies with other requirements in this Appendix.
- (13) Steel, PVC and other materials used as temporary casing in well construction shall be clean and free of contaminants. PVC and thermoplastic materials other than PVC used as temporary casing shall contain a label or imprint indicating compliance with NSF or UL standards for use with drinking water.
- (14) A well shall be sufficiently straight and vertical to allow normal installation and operation of the pump.
- (15) The upper twenty feet of a water well casing shall not be used as a suction line unless the well casing is protected by a standard weight or heavier outer casing.
- (16) Where bedrock is present within 19 feet of the ground surface, an oversized borehole shall be drilled and the permanent casing in the oversized borehole shall be sealed with grout to a minimum depth of 19 feet below grade, or five feet into the competent bedrock, whichever is deeper.
- (17) Annular space between the well casing and borehole shall be grouted in accordance with Table 2. Where inner and outer well casings are used, the annular space between these casings shall be sealed with grout.

- (18) An artesian well that overflows at land surface shall be constructed, equipped, and operated to provide for controlling the rate of discharges to conserve groundwater and to prevent the loss of artesian head by minimizing uncontrolled continuous waste discharges. Discharges to waste pipe, where installed, shall not be directly connected to a sewer or other source of contamination and shall be equipped with an air gap or backflow prevention device. Discharge pipes shall be properly screened to prevent entry of vermin.
- (19) Wells completed in unconsolidated material or at the unconsolidated-consolidated material interface shall be screened if necessary and sufficiently developed to produce sand-free water and to minimize the entrance of fine materials into the well.
- (20) Lead packers, lead plugs, or lead wool shall not be used as a well component.
- (21) No solder containing more than 0.2 percent lead shall be used in making joints and fittings in any drinking water supply system or any water user's water lines.
- (22) Wells shall be developed by air lift, bailing, surging, jetting, hydrofracturing and/or chemical treatment until sand free. Rock cuttings produced during water well drilling and well development shall be cleaned out of the well. As a final stage, the well may be pumped to waste at a pumping rate which equals or exceeds that of a permanent pump, until the water is clear as reasonably possible considering the groundwater conditions of the area. The permanent pump shall not be used to develop the well without the owner's consent.
- (23) Water that is used for well construction and development purposes or is otherwise introduced into the well, other than water from the well itself, shall be obtained from a public water system or, if necessary, from a non-public drinking water source provided such non-public source is not surface water nor otherwise known or suspected to be contaminated.
- (24) A connection to a water well casing that is made below the ground shall be protected by a pitless adapter or by a pitless unit (threaded or welded joints). A below ground connection shall not be submerged in water during installation. Pitless adapters or pitless units to be used shall contain a label or imprint indicating compliance with the Water Systems Council Pitless Adapter Standard (PAS -97).
- (25) A pitless adapter or pitless unit shall provide adequate clearance within the internal diameter of a water well to permit insertion or withdrawal of water system components from within the well through the top of the well casing and be constructed and installed to exclude dirt or other foreign matter from the interior of the well casing.
- (26) Extensions of existing water well casings to at least 12 inches above grade shall be constructed of the same material as the existing casing.
- (27) Any chemicals or other additives, including disinfectants, used during construction shall be of a specification acceptable for use in water wells and any excess not required for operation of the well shall be cleaned out of the well.

- (28) A water well shall be designed, operated, and maintained in a manner that will preclude cross-connections or any other piping connections which may introduce contaminants into the water supply or aquifer. A physical connection between a water supply that is in compliance with the requirements of these rules and another water supply that is not in compliance with the requirements of these rules is prohibited unless acceptable cross connection control is provided.
- (29) All drilling fluids used for drilling operations shall be of food grade quality or NSF or UL approved or shall be water that complies with paragraph 5-B.3(b)(23) of this Appendix.

Section 5-B.4 Well Yield and Water Flow.

- (a) The purpose of the water well yield test is to provide evidence that a water well will produce a sustainable flow rate for an extended period of time and to quantify that flow rate. Before being put into use, new and redeveloped wells shall be tested for well yield. The yield test for water well flow rates shall meet the following performance requirements:
 - (1) water well yield tests shall be performed for a period of time adequate to quantify well yield.
 - (2) water level and flow rate observations shall be made and recorded, at a minimum, before the start of the yield test, immediately upon the cessation of water withdrawal, and periodically during drawdown, and recovery periods. Frequency of measurements shall be made as necessary for the test method.
 - (3) water discharged during a yield test shall be discharged in a manner that avoids short circuiting of the water back into the aquifer.
 - (4) for wells that have been subjected to hydrofracturing the yield test shall not commence until redevelopment has been completed and, as a minimum, until the volume of water pumped/discharged into the aquifer has been removed from the well.
 - (5) the well yield determined for new wells shall be recorded on the Well Completion Report form submitted for that well to the New York State Department of Environmental Conservation. Data generated during the yield test shall be provided to the owner of the well, and provided upon request to the State or local agency(ies) having jurisdiction.
- (b) The standard well yield test should include:
 - (1) A minimum four-hour period of stabilized drawdown while pumping at a constant flow rate.
 - (2) During the period of stabilized drawdown the stabilized water level shall not fluctuate more than plus or minus 0.5 foot (i.e., within a vertical tolerance of one foot) for each 100 feet of water in the well (i.e., initial water level to bottom of well) over the duration of constant flow rate of pumping. Water level measurement may be determined by steel tape, calibrated pressure gauge attached to an air line terminating at least five feet above the pump intake, electric sounder, or pressure transducer.

- (3) The recovery period shall include observation of the water level in the well after cessation of pumping from the drawdown level back to at least 90 percent of the initial water level or for a period of 24 hours, whichever occurs first. If the water level does not recover to 90 percent after 24 hours, the tested flow rate may not be sustainable for an extended period of time.
- (c) The well yield test requirements set forth in subdivision 5-B.4(b) may be modified, or an alternative yield test that meets the minimum performance requirements set forth in subdivision 5-B.4(a) may be used as follows:
 - (1) where the local health department having jurisdiction has determined that adequate hydrogeologic information and uniform conditions exist; or
 - (2) when an experienced hydrogeologist or licensed professional engineer directs and certifies the test; or
 - (3) for facilities planned for well water use of less than 500 gallons per day, pumping, bailing or air lift test methods may be used.
 - (4) the well yield of a flowing artesian well may be determined by direct flow measurement if the artesian flow rate equals or exceeds the desired water use rate.

Section 5-B.5 Water Well Pumps: Construction, Installation, Repair and Maintenance.

All of the following provisions apply to water well pumps, construction, installation, repair, and maintenance:

- (a) All water supply system equipment shall be easily accessible for maintenance or repair.
- (b) A pump shall be installed so that there are no unprotected openings into the interior of the pump or the well casing.
- (c) Drop pipe shall be: a continuous unspliced length, except where spliced and adequately joined to accommodate use of a check valve or where spliced and adequately joined to support a depth extension on an existing well pump, of plastic pipe approved for use with drinking water with a minimum working pressure of 160 pounds per square inch containing a label or imprint indicating compliance with NSF or UL; or threaded and coupled schedule 80 or heavier PVC pipe containing a label or imprint indicating compliance with NSF or UL; or threaded and coupled galvanized steel, stainless steel or copper pipe. In addition, drop pipe should be sufficiently sized and installed to accommodate potential working stresses considering well depth, pumping level, pump size, and pump setting.
- (d) A hand pump shall have a closed, downward facing, screened spout and a sealed pump rod packing assembly. A weep hole shall be installed in a hand pump discharge riser pipe below the frost line to protect the riser pipe and pump head from freezing.
- (e) A casing vent shall be provided on all well caps and seals, except for those used on double pipe-packer jet installations. A vent shall be screened, downward facing, and terminate at least 12 inches above grade or six inches above the floor of a well house.

- (f) Vent screening shall be 20 to 30 mesh per inch screen, shall not reduce the vent open area by more than 50 percent, and shall be stainless steel or other non-corrodible material.
- (g) Well caps and seals shall be tightly secured to the well casing, watertight, vermin- proof, and provide venting as noted in this section. Split caps shall not be used.
- (h) Only lubricants with a label indicating compliance as USDA, USFDA, or NSF approved food contact grade formulations shall be used as submersible pump motor and vertical turbine shaft lubricants.
- (i) After a new well has been constructed or an existing well has been repaired or serviced in a manner that requires the opening of the well casing, the well shall be pumped to waste until the pumped water is reasonably clear. After pumping to waste, the well, pumping equipment, and building plumbing shall be disinfected before being put into use.

Section 5-B.6 Water Well Capping and Abandonment.

- (a) All water well capping, abandonment and decommissioning shall be in accord with requirements in Appendix 5-A of this title.

Section 5-B.7 Separability.

If any provisions of this Appendix are held invalid, such invalidity shall not affect other provisions which can be given effect without the invalid provisions.

**Table 1
Required Minimum Separation Distances to Protect Water Wells from Contamination**

Contaminant Source	Distance (Feet)¹
Chemical storage sites not protected from the elements (e.g., salt and sand/salt storage) ²	300
Landfill waste disposal area, or hazardous or radiological waste disposal area ²	300
Land surface application or subsurface injection of effluent or digested sludge from a Municipal or public wastewater treatment facility	200
Land surface application or subsurface injection of septage waste	200
Land surface spreading or subsurface injection of liquid or solid manure ³	200
Storage Areas for Manure piles ⁴	200
Barnyard, silo, barn gutters and animal pens ^{5,6}	100
Cesspools (i.e. pits with no septic tank pretreatment)	200
Wastewater treatment absorption systems located in coarse gravel or in the Direct path of drainage to a well	200
Fertilizer and/or pesticide mixing and/or clean up areas	150
Seepage pit (following septic tank) ⁵	150
Underground single walled chemical or petroleum storage vessels	150
Absorption field or bed ⁵	100
Contained chemical storage sites protected from the elements (e.g. salt and sand/salt storage within covered structures) ⁷	100
Septic system components (non-watertight) ⁵	100
Intermittent sand filter without a watertight liner ⁵	100
Sanitary Privy pit ⁵	100
Surface wastewater recharge absorption system constructed to discharge storm water from parking lots, roadways or driveways ⁵	100
Cemeteries	100
Sanitary privy with a watertight vault	50
Septic tank, aerobic unit, watertight effluent line to distribution box	50
Sanitary sewer or combined sewer	50
Surface water recharge absorption system with no automotive -related Wastes (e.g., clear-water basin, clear-water dry well)	50
Stream, lake, watercourse, drainage ditch, or wetland	25
All known sources of contamination otherwise not shown above	100

Notes for Table 1:

¹ The listed water well separation distances from contaminant sources shall be increased by 50% whenever aquifer water enters the water well at less than 50 feet below grade. If a 50% increase in separation distances can not be achieved, then the greatest possible increase in separation distance shall be provided with such additional measures as needed to prevent contamination. See also Note 6 to Table 2.

² Water wells shall not be located in a direct line of flow from these items, nor in any contaminant plume created by these items, except with such additional measures (e.g., sentinel groundwater monitoring, hydraulic containment, source water treatment) as needed to prevent contamination.

³ Based upon on-site evaluations of agricultural properties done per agricultural environmental management (AEM) or comprehensive nutrient management plan (CNMP) programs by a certified nutrient management planner or soil and water conservation district (SWCD) official, water wells may be located a minimum of 100 feet from areas subject to land spreading of manure.

⁴ Water wells may be located 100 feet from temporary (30 days or less) manure piles/staging areas that are controlled to preclude contamination of surface or groundwater or 100 feet from otherwise managed manure piles that are controlled pursuant to regulation in a manner that prevents contamination of surface or groundwater.

⁵ When these contamination sources are located in coarse gravel or are located upgradient and in the direct path of drainage to a water well, the water well shall be located at least 200 feet away from the closest part of these sources.

⁶ Animal pen does not include small pet shelters or kennels housing 3 or fewer adult pets.

⁷ Chemical storage sites as used in this entry do not include properly maintained storage areas of chemicals used for water treatment nor areas of household quantities of commonly used domestic chemical.

Table 2. Standards for Well Casing, Grouting, Diameter, and Screens

Water-bearing Formation	Overlying Material	Minimum Casing Length or Depth ¹	Oversize Drillhole For Grout, Diameter ¹	Casing and Grout Placement ¹	Well Diameter		
					Cased Portion	Uncased Portion	Well Screen Diameter ² (where applicable)
1. Sand or gravel	Unconsolidated caving material; sand or sand and gravel	19' minimum; but 5' below pumping level ³	None required	Grouting not required.	2" minimum	Does not apply	2" minimum
2. Sand or gravel	Clay, hardpan, till, silt, or similar material to depth of more than 15'	5' below pumping level ³	Casing size plus 2" if pressure placement of grout is used, Casing size plus 4" if gravity placement of grout is used. ^{4,5,6}	Upper drillhole shall be kept at least one-third filled with clay slurry while driving permanent casing; after casing is in the permanent position, annular space shall be filled with grout ⁵	2" minimum	Does not apply	2" minimum
3. Sand or gravel	Clay, hardpan, till, silt, or similar material containing layers of sand or gravel within 15' of ground surface.	5' below pumping level ⁴	Casing size plus 2" if pressure placement of grout is used, Casing size plus 4" if gravity placement of grout is used. ^{4,5,6}	Annular space around casing shall be filled with grout.	2" minimum	Does not apply	2" minimum

Table 2. Standards for Well Casing, Grouting, Diameter, and Screens (Continued)

Water-bearing Formation	Overlying Material	Minimum Casing Length or Depth ¹	Oversize Drillhole For Grout, Diameter ¹	Casing and Grout Placement ¹	Well Diameter		
					Cased Portion	Uncased Portion	Well Screen Diameter ² (where applicable)
4. Creviced, shattered or otherwise fractured shale, limestone, igneous, metamorphic or similar rock types or sandstone	Unconsolidated caving material, chiefly sand or sand and gravel to a depth of 19' or more.	Through caving overburden	None required	Casing shall be firmly seated in rock. Grouting not required.	6" minimum	6" preferred	Does not apply
5. Creviced, shattered or otherwise fractured shale, limestone, igneous, metamorphic or similar rock types or sandstone	Clay, hardpan, till, shale, or similar material to a depth of 19' or more	Through overburden	Casing size plus 2" if pressure placement of grout is used, Casing size plus 4" if gravity placement of grout is used. ^{4, 5, 6}	Casing shall be firmly seated in rock. Annular space around casing shall be grouted.	6" minimum	6" preferred	Does not apply
6. Creviced, shattered or otherwise fractured shale, limestone, igneous, metamorphic or similar rock types or sandstone	Unconsolidated materials to a depth of less than 19'	19' minimum	Casing size plus 2" if pressure placement of grout is used, Casing size plus 4" if gravity placement of grout is used. ^{4, 6}	Casing shall be firmly seated in rock. Annular space around casing shall be grouted.	6" minimum	6" preferred	Does not apply

Notes for Table 2:

¹ In the case of a flowing artesian well, attempts should be made to install and seal the well in a manner that protects the artesian aquifer, prevents erosion of overlying geologic materials, and confines the flow to within the well casing, giving due consideration to practicality, cost, and safety.

² These diameters shall also be applicable in circumstances where the use of perforated casing is deemed practicable. Well points commonly designated on the trade as 1 1/4" pipe shall be considered as being 2" nominal diameter well screens for purposes of these regulations.

³ As used in this table, the term "pumping level" shall refer to the lowest elevation of the water in a well during pumping, determined to the best knowledge of the water well contractor taking into consideration usual seasonal fluctuations and drawdown.

⁴ Pressure placement includes methods of grout placement using pumps and tremie tubes or using grout displacement through the casing, or otherwise from the bottom up around the casing, with one or more drillable plugs. When pressure placement is used with a borehole diameter of only 2" greater than the casing diameter, casing shall be assembled without couplings unless installed per the "Casing and Grout Placement" technique described on Line "2" of this Table. Gravity placement includes any method that relies on gravity to draw grout, either dry or as a slurry, down into the annular space between the casing and borehole or between an inner casing and outer casing.

⁵ For wells constructed by cable tool, hollow rod, jetting, or other drilling method where the permanent casing is driven, and where neither temporary casing nor an oversize borehole are used, dry driven grout methods using granular bentonite may be used. These methods use continuous feeding of granular bentonite into a starter hole or continuous mounding around the casing as the casing is driven. Collar flared joints or weld beads extending beyond the outside diameter of the permanent casing shall be used with sufficient spacing to ensure that the grout seal is continuous and extends downward into the saturated zone (i.e., beneath the water table).

⁶ The oversized borehole for grout placement should be as deep as necessary, based upon local hydrogeologic conditions and potential contaminant sources, to prevent contamination from entering the well. Grout should be placed along the full length of casing, particularly where the presence of non-caving unconsolidated materials, coarse gravel, or creviced, shattered, or fractured rock may result in pathways of contamination to a well water system. Where this is not feasible because of practicality, cost or safety, grout shall be placed at least to a minimum depth of 19 feet. See also Note 1 to Table 1.