

15A NCAC 02C .0107 STANDARDS OF CONSTRUCTION: WATER SUPPLY WELLS

(a) Location.

- (1) A water supply well shall not be located in any area where surface water or runoff will accumulate around the well due to depressions, drainage ways, and other landscapes that will concentrate water around the well.
- (2) The horizontal separation between a water supply well and potential sources of groundwater contamination that exist at the time the well is constructed shall be no less than as follows unless otherwise specified in Subparagraph (a)(3) of this Rule:
 - (A) Single-family dwelling with septic tank and drainfield, including the drainfield repair area 50 feet
 - (B) Single-family dwelling with septic tank and drainfield, including the drainfield repair area in saprolite system as described in 15A NCAC 18A .1956 100 feet
 - (C) All other facilities with septic tank and drainfield, including drainfield repair area 100 feet
 - (D) Other subsurface ground absorption waste disposal system 100 feet
 - (E) Industrial or municipal residuals disposal or wastewater-irrigation sites 100 feet
 - (F) Industrial or municipal sewage or liquid-waste collection or sewer main, constructed to water main standards in the American Water Works Association (AWWA) Standards C600 and/or C900, which can be obtained from AWWA at American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235, at a cost of one hundred and four dollars (\$104.00) 50 feet
 - (G) Water-tight sewer lateral line from a residence or other non-public system to a sewer main or other wastewater disposal system 25 feet
 - (H) Other sewage and liquid-waste collection or transfer facility 100 feet
 - (I) Cesspools and privies 100 feet
 - (J) Animal feedlots, as defined by G.S. 143-215.10B(5), or manure or litter piles 100 feet
 - (K) Fertilizer, pesticide, herbicide, or other chemical storage areas 100 feet
 - (L) Non-hazardous waste storage, treatment, or disposal lagoons 100 feet
 - (M) Sanitary landfills, municipal solid waste landfill facilities, incinerators, construction and demolition (C&D) landfills, and other disposal sites except Land Clearing and Inert Debris landfills 500 feet
 - (N) Land Clearing and Inert Debris (LCID) landfills 100 feet
 - (O) Animal barns 100 feet
 - (P) Building perimeters, including any attached structures that need a building permit, such as garages, patios, or decks, regardless of foundation construction type 25 feet
 - (Q) Surface water bodies that act as sources of groundwater recharge, such as ponds, lakes, and reservoirs 50 feet
 - (R) All other surface water bodies, such as brooks, creeks, streams, rivers, sounds, bays, and tidal estuaries 25 feet
 - (S) Chemical or petroleum fuel underground storage tank systems regulated under 15A NCAC 02N:
 - (i) with secondary containment 50 feet
 - (ii) without secondary containment 100 feet
 - (T) Above ground or underground storage tanks that contain petroleum fuels used for heating equipment, boilers, or furnaces, with the exception of tanks used solely for storage of propane, natural gas, or liquefied petroleum gas 50 feet
 - (U) All other petroleum or chemical storage tank systems 100 feet
 - (V) Gravesites 50 feet
 - (W) Coal ash landfills or impoundments 200 feet
 - (X) All other potential sources of groundwater contamination 50 feet
- (3) For a water supply well as defined in G.S. 87-85(13) on a lot serving a single-family dwelling and intended for domestic use, where lot size or other fixed conditions preclude the separation distances specified in Subparagraph (a)(2) of this Rule, the required horizontal separation distances shall be the maximum possible but shall in no case be less than the following:

- (A) Industrial or municipal sewage or liquid-waste collection or sewer main, constructed to water main standards as stated in the AWWA Standards C600 and/or C900 25 feet
 - (B) Animal barns 50 feet
 - (4) In addition to the separation distances specified in Subparagraph (a)(2) of this Rule, a well or well system with a designed capacity of 100,000 gallons per day (GPD) or greater shall be located a sufficient distance from known or anticipated sources of groundwater contamination so as to prevent a violation of groundwater quality standards specified in 15A NCAC 02L .0202 resulting from the movement of contaminants in response to the operation of the well or well system at the proposed rate and schedule of pumping.
 - (5) Wells drilled for public water supply systems regulated by the Public Water Supply Section of the Division of Water Resources shall meet the requirements of 15A NCAC 18C.
- (b) Source of water.
- (1) The source of water for any water supply well shall not be from a water bearing zone or aquifer that is contaminated;
 - (2) In designated areas described in 15A NCAC 02C .0117 of this Section, the source shall be greater than 43 feet below land surface;
 - (3) In designated areas described in 15A NCAC 02C .0116 of this Section, the source may be less than 20 feet below land surface, but in no case less than 10 feet below land surface;
 - (4) For wells constructed with separation distances less than those specified in Subparagraph (a)(2) of this Rule based on lot size or other fixed conditions as specified in Subparagraph (a)(3) of this Rule, the source shall be greater than 43 feet below land surface except in areas described in Rule .0116 of this Section; and
 - (5) In all other areas the source shall be at least 20 feet below land surface.
- (c) Drilling Fluids. Drilling Fluids shall not contain organic or toxic substances or include water obtained from surface water bodies or water from a non-potable supply and shall be comprised only of:
- (1) The formational material encountered during drilling; or
 - (2) Materials manufactured specifically for the purpose of borehole conditioning or water well construction.
- (d) Casing.
- (1) If steel casing is used:
 - (A) The casing shall be new, seamless, or electric-resistance welded galvanized or black steel pipe. Galvanizing shall be done in accordance with requirements of ASTM A53/A53M-07, which is hereby incorporated by reference, including subsequent amendments and editions and can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C 700, West Conshohocken, PA, 19428-2959 at a cost of eighty dollars and forty cents (\$80.40);
 - (B) The casing, threads and couplings shall meet or exceed the specifications of ASTM A53/A53M-07 or A589/589M-06, which is hereby incorporated by reference, including subsequent amendments and editions, and can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C 700, West Conshohocken, PA, 19428-2959 at a cost of eighty dollars and forty cents (\$80.40), and fifty-two dollars (\$52.00), respectively;
 - (C) The wall thickness for a given diameter shall equal or exceed that specified in Table 1;

TABLE 1: MINIMUM WALL THICKNESS FOR STEEL CASING:

Nominal Diameter (inches)	Wall Thickness (inches)
For 3.5 inch or smaller pipe, Schedule 40 is required	
4	0.142
5	0.156

5.5	0.164
6	0.185
8	0.250
10	0.279
12	0.330
14 and larger	0.375

- (D) Stainless steel casing, threads, and couplings shall conform in specifications to the general requirements in ASTM A530/A530M-04a, which is hereby incorporated by reference, including subsequent amendments and editions and can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C 700, West Conshohocken, PA, 19428-2959 at a cost of forty-six dollars (\$46.00), and also shall conform to the specific requirements in the ASTM standard that best describes the chemical makeup of the stainless steel casing that is intended for use in the construction of the well;
 - (E) Stainless steel casing shall have a minimum wall thickness that is equivalent to standard Schedule number 10S;
 - (F) Steel casing shall be equipped with a drive shoe if the casing is driven in a consolidated rock formation. The drive shoe shall be made of forged, high carbon, tempered seamless steel and shall have a beveled, hardened cutting edge; and
 - (G) Any materials containing lead shall meet NSF 61 standards, which can be obtained from NSF International at a cost of three hundred and twenty-five dollars (\$325.00), or NSF 372 standards, which can be obtained at a cost of fifty-five dollars (\$55.00). Both standards can be obtained from NSF International, P.O. Box 130140, 789 N. Dixboro Road, Ann Arbor, MI 48105.
- (2) If thermoplastic casing is used:
- (A) The casing shall be new and manufactured in compliance with standards of ASTM F480-14, which is hereby incorporated by reference including subsequent amendments and editions, and can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C 700, West Conshohocken, PA, 19428-2959 at a cost of sixty-seven dollars (\$67.00);
 - (B) The casing and joints shall meet or exceed all the specifications of ASTM F480-06b, except that the outside diameters shall not be restricted to those listed in ASTM F480-06b, which is hereby incorporated by reference, including subsequent amendments and editions and can be obtained from ASTM International, 100 Barr Harbor Drive, PO Box C 700, West Conshohocken, PA, 19428-2959 at a cost of eighty dollars and forty cents (\$80.40);
 - (C) The depth of installation for a given Standard Dimension Ratio (SDR) or Schedule number thickness shall not exceed that listed in Table 2 unless the Department is provided written documentation from the manufacturer of the casing stating that the casing may safely be used at the depth at which it is to be installed is provided.

TABLE 2: Maximum allowable depths (in feet) of Installation of Thermoplastic Water Well Casing. Dimensional standards for PVC pipe are specified in ASTM F 480-14.

Nominal Diameter (inches)	Maximum Depth (in feet) for Schedule 40	Maximum Depth (in feet) for Schedule 80
2	485	1460
3	415	1170
3.5	315	920
4	253	755
5	180	550
6	130	495
8	85	340
10	65	290
12	65	270
14	50	265
16	50	255

	Maximum Depth (in feet) for SDR 21	Maximum Depth (in feet) for SDR 17	Maximum Depth (in feet) for SDR 13.5
All Diameters	185	355	735

- (D) Thermoplastic casing with wall thickness less than that corresponding to SDR 21 or Schedule 40 shall not be used;
 - (E) For wells in which the casing will extend into consolidated rock, thermoplastic casing shall be equipped with a coupling or other device approved by the manufacturer of the casing as sufficient to protect the physical integrity of the thermoplastic casing during the processes of seating and grouting the casing and subsequent drilling operations;
 - (F) Thermoplastic casing shall not be driven by impact, but may be pushed;
 - (G) PVC well casing joints shall meet the requirements of ASTM F 480-14; and
 - (H) Screws or similar mechanical fasteners shall not be used for joining PVC well casing.
- (3) In constructing any well, all water-bearing zones that contain contaminated, saline, or other non-potable water shall be cased and grouted so that contamination of overlying and underlying groundwater zones will not occur.
- (4) Every well shall be cased so that the bottom of the casing extends to the following depths:
- (A) Wells located within the area described in Rule .0117 of this Section shall be cased from land surface to a depth of at least 43 feet.
 - (B) Wells located within the area described in Rule .0116 of this Section shall be cased from land surface to a depth of at least 10 feet.
 - (C) Wells constructed with separation distances less than those specified in Subparagraph (a)(2) of this Rule based on lot size or other fixed conditions as specified in Subparagraph (a)(3) of this Rule shall be cased from land surface to a depth of at least 43 feet except in areas described in Rule .0116 of this Section.

- (D) Wells located in any other area shall be cased from land surface to a depth of at least 20 feet.
 - (5) The top of the casing shall be terminated at least 12 inches above land surface, regardless of the method of well construction and type of pump to be installed.
 - (6) The casing in wells constructed to obtain water from a consolidated rock formation shall meet the requirements of Subparagraphs (d)(1) through (d)(5) of this Rule and shall:
 - (A) prevent any formational material from entering the well in excess of the levels specified in Paragraph (h) of this Rule; and
 - (B) firmly be seated at least five feet into the rock.
 - (7) The casing in wells constructed to obtain water from an unconsolidated rock formation (such as gravel, sand, or shells) shall extend at least one foot into the top of the water-bearing formation.
 - (8) Upon completion of the well, the well shall be sufficiently free of obstacles including formation material as necessary to allow for the installation and proper operation of pumps and associated equipment.
 - (9) Prior to removing equipment from the site, the top of the casing shall be sealed with a water-tight cap or well seal, as defined in G.S. 87-85(16), to preclude the entrance of contaminants into the well.
- (e) Allowable Grouts.
- (1) One of the following grouts shall be used wherever grout is required by a rule of this Section. Where a particular type of grout is specified by a rule of this Section, no other type of grout shall be used.
 - (A) Neat cement grout shall consist of a mixture of not more than six gallons of clear, potable water to one 94 pound bag of Portland cement. Up to five percent, by weight, of untreated Wyoming sodium bentonite may be used to improve flow and reduce shrinkage. The Wyoming sodium bentonite shall be 200 mesh with a yield rating of 90 barrels per ton. If bentonite is used, additional water may be added at a rate not to exceed 0.6 gallons of water for each pound of untreated Wyoming sodium bentonite.
 - (B) Sand cement grout shall consist of a mixture of not more than two parts sand and one part cement and not more than six gallons of clear, potable water per 94 pound bag of Portland cement.
 - (C) Concrete grout shall consist of a mixture of not more than two parts gravel or rock cuttings to one part cement and not more than six gallons of clear, potable water per 94 pound bag of Portland cement. One hundred percent of the gravel or rock cuttings must be able to pass through a one-half inch mesh screen.
 - (D) Bentonite slurry grout shall consist of a mixture of not more than 24 gallons of clear, potable water to one 50 pound bag of commercial granular Wyoming sodium bentonite. Non-organic, non-toxic substances may be added to bentonite slurry grout mixtures to improve particle distribution and pumpability. Bentonite slurry grout may only be used in accordance with the manufacturer's written instructions.
 - (E) Bentonite chips or pellets shall consist of pre-screened Wyoming sodium bentonite chips or compressed sodium bentonite pellets with largest dimension of at least one-fourth inch but not greater than one-fifth of the width of the annular space into which they are to be placed. Bentonite chips or pellets shall be hydrated in place. Bentonite chips or pellets shall only be used in accordance with the manufacturer's written instructions.
 - (F) Specialty grout shall consist of a mixture of non-organic, non-toxic materials with characteristics of expansion, chemical-resistance, rate or heat of hydration, viscosity, density, or temperature-sensitivity applicable to specific grouting requirements. Specialty grouts shall not be used without prior approval by the Director. A request for approval of a specialty grout shall be submitted to the Director and shall include the following information:
 - (i) a demonstration of non-toxicity, such as American National Standard Institute (ANSI) or National Sanitation Foundation, Inc. (NSF) Standard 60 certification, which is hereby incorporated by reference including subsequent amendments and editions, and can be obtained from NSF International, P.O. Box 130140, 789 North Dixboro Road, Ann Arbor, MI 48105 at a cost of three hundred and twenty-five dollars (\$325.00);

- (ii) the results of an independent laboratory that demonstrate the finished product has a permeability of less than 1×10^{-6} centimeters per second and, if the product is used in areas of brackish or saline groundwater, the grout will not degrade over the lifetime of the well;
 - (iii) a general procedure for mixing and emplacing the grout;
 - (iv) the types of wells the request would apply to; and
 - (v) any other additional information the Department needs to ensure compliance with G.S. 87-84 as requested by the Department.
 - (2) With the exception of bentonite chips or pellets, the liquid and solid components of all grout mixtures shall be blended prior to emplacement below land surface.
 - (3) No fly ash, other coal combustion byproducts, or other wastes shall be used in any grout.
- (f) Grout emplacement.
- (1) Casing shall be grouted to a minimum depth of twenty feet below land surface except that in those areas designated in Rule .0116 of this Section, grout shall extend to a depth of two feet above the screen or, for open end wells, to the bottom of the casing, but in no case less than 10 feet.
 - (2) In addition to the grouting required by Subparagraph (f)(1) of this Rule, the casing shall be grouted as necessary to seal off all aquifers or zones that contain contaminated, saline, or other non-potable water so that contamination of overlying and underlying aquifers or zones shall not occur.
 - (3) Bentonite slurry grout may be used in that portion of the borehole that is at least three feet below land surface. That portion of the borehole from land surface to at least three feet below land surface shall be filled with a concrete or cement-type grout or bentonite chips or pellets that are hydrated in place.
 - (4) Grout shall be placed around the casing by one of the following methods:
 - (A) Pressure. Grout shall be pumped or forced under pressure through the bottom of the casing until it fills the annular space around the casing and overflows at the surface;
 - (B) Pumping. Grout shall be pumped into place through a hose or pipe extended to the bottom of the annular space that can be raised as the grout is applied. The grout hose or pipe shall remain submerged in grout during the entire application; or
 - (C) Other. Grout may be emplaced in the annular space by gravity flow to ensure complete filling of the space. Gravity flow shall not be used if water or any visible obstruction is present in the annular space within the applicable minimum grout depth specified in Subparagraph (f)(1) of this Rule at the time of grouting, with the exception that bentonite chips or pellets may be used if water is present and if designed for that purpose.
 - (5) If a rule of this Section requires grouting of the casing to a depth greater than 20 feet below land surface, the pumping or pressure method shall be used to grout that portion of the borehole deeper than 20 feet below land surface, with the exception of bentonite chips and pellets used in accordance with Part (f)(4)(C) of this Rule.
 - (6) If an outer casing is installed, it shall be grouted by either the pumping or pressure method.
 - (7) Bentonite chips or pellets shall be used in compliance with all manufacturer's instructions including pre-screening the material to eliminate fine-grained particles, installation rates, hydration methods, tamping, and other measures to prevent bridging.
 - (8) Bentonite grout shall not be used to seal zones of water with a chloride concentration of 1,500 milligrams per liter or greater. For wells installed on the barrier island from the Virginia state line south to Ocracoke Inlet, chloride concentrations shall be documented and reported as required by 15A NCAC 02C .0114(1)(E).
 - (9) The well shall be grouted within seven days after the casing is set. If the well penetrates any water-bearing zone that contains saline water, the well shall be grouted within one day after the casing is set.
 - (10) No additives that will accelerate the process of hydration shall be used in grout for thermoplastic well casing.
 - (11) If grouting is required by the provisions of this Section, the grout shall extend outward in all directions from the casing wall to a minimum thickness equal to either one-third of the diameter of the outside dimension of the casing or two inches, whichever is greater.
 - (12) In no case shall a well be required to have an annular grout seal thickness greater than four inches.

- (13) For wells constructed in locations where flowing artesian conditions are encountered the well shall be grouted to protect the artesian aquifer, prevent erosion of overlying material, and confine the flow within the casing.

(g) Well Screens.

- (1) The well, if constructed to obtain water from an unconsolidated rock formation, shall be equipped with a screen that will prevent the entrance of formation material into the well after the well has been developed and completed.
- (2) The well screen shall be of a design to permit the optimum development of the aquifer with minimum head loss consistent with the intended use of the well. The openings shall be designed to prevent clogging and shall be free of rough edges, irregularities, or other defects that may accelerate or contribute to corrosion or clogging.
- (3) Multi-screen wells shall not connect aquifers or zones that have differences in water quality or potentiometric surfaces that would result in contamination of any aquifer or zone.

(h) Gravel and Sand-Packed Wells.

- (1) In constructing a gravel-or sand-packed well:
 - (A) The packing material shall be composed of quartz, granite, or similar mineral or rock material and shall be of uniform size, water-washed, and free from clay, silt, and toxic materials.
 - (B) The size of the packing material shall be determined from a grain size analysis of the formation material and shall be of a size sufficient to prohibit the entrance of formation material into the well in concentrations above those permitted by Paragraph (i) of this Rule.
 - (C) The packing material shall be placed in the annular space around the screens and casing by a fluid circulation method to ensure accurate placement and avoid bridging.
 - (D) The packing material shall be disinfected.
- (2) The packing material shall not connect aquifers or zones that have differences in water quality that would result in contamination of any aquifer or zone.

(i) All water supply wells shall be developed by the well contractor. Development shall include removal of formation materials, mud, drilling fluids, and additives, such that the water contains no more than:

- (1) Five milliliters per liter of settleable solids; and
- (2) Ten NTUs of turbidity as suspended solids.

Development does not require efforts to reduce or eliminate the presence of dissolved constituents that are indigenous to the ground water quality in that area.

(j) Well Head Completion.

- (1) Access Port. Every water supply well shall be equipped with a usable access port or air line, except for the following: a multi-pipe deep well with jet pump or adapter mounted on the well casing or well head; and wells with casing two inches or less in diameter if a suction pipe is connected to a suction lift pump. The access port shall be at least one half inch inside the diameter opening so that the position of the water level can be determined. The port shall be installed and maintained in such manner as to prevent entrance of water or foreign material.
- (2) Well Contractor Identification Plate.
 - (A) An identification plate, showing the well contractor and certification number and the information specified in Part (j)(2)(E) of this Rule, shall be installed on the well within 72 hours after completion of the drilling.
 - (B) The identification plate shall be constructed of a durable weatherproof, rustproof metal or other material approved by the Department as equivalent.
 - (C) The identification plate shall be permanently attached to either the aboveground portion of the well casing, surface grout pad, or enclosure floor around the casing where it is visible and in a manner that does not obscure the information on the identification plate.
 - (D) The identification plate shall not be removed.
 - (E) The identification plate shall be stamped to show the following:
 - (i) the total depth of well;
 - (ii) the casing depth (feet) and inside diameter (inches);
 - (iii) the screened intervals of screened wells;
 - (iv) the packing interval of gravel-packed or sand-packed wells;

- (v) the yield, in gallons per minute (gpm) or specific capacity in gallons per minute per foot of drawdown (gpm/ft. of drawdown);
 - (vi) the static water level and the date it was measured;
 - (vii) the date the well was completed.
- (3) Pump Installation Information Plate.
- (A) An information plate, showing the well contractor and certification number of the person installing the pump and the information specified in Part (j)(3)(D) of this Rule, shall be permanently attached to either the aboveground portion of the well casing, the surface grout pad, or the enclosure floor, if present, where it is visible and in a manner that does not obscure the information on the identification plate, within 72 hours after completion of the pump installation;
 - (B) The information plate shall be constructed of a durable, waterproof, rustproof metal or other material approved by the Department;
 - (C) The information plate shall not be removed; and
 - (D) The information plate shall be stamped or engraved to show the following:
 - (i) the date the pump was installed;
 - (ii) the depth of the pump intake; and
 - (iii) the horsepower rating of the pump.
- (4) Controlled flow. Every artesian flowing well shall be constructed, equipped, and operated to prevent the uncontrolled discharge of groundwater. Flow discharge control shall be provided to conserve the groundwater resource and prevent or reduce the loss of artesian hydraulic head. Flow control may consist of valved pipe connections, watertight pump connections, receiving tank, flowing well pitless adapter, packer, or other methods approved by the Department to prevent the loss of artesian hydraulic head and stop the flow of water as referenced in G.S. 87-88(d). Well owners shall be responsible for the operation and maintenance of the valve.
- (5) Pitless adapters or pitless units shall be allowed as a method of well head completion under the following conditions:
- (A) Design, installation, and performance standards are those specified in PAS-97(04), which is hereby incorporated by reference including subsequent amendments and editions and can be obtained from the Water System Council National Programs Office, 1101 30th Street, N.W., Suite 500, Washington, DC 20007 at no cost;
 - (B) The pitless device is compatible with the well casing;
 - (C) The top of the pitless unit extends at least 12 inches above land surface;
 - (D) The excavation surrounding the casing and pitless device is filled with grout from the top of the casing grout to the land surface; and
 - (E) The pitless device has an access port.
- (6) All openings for piping, wiring, and vents shall enter into the well at least 12 inches above land surface, except where pitless adapters or pitless units are used, and shall be sealed to preclude the entrance of contaminants into the well. The final land surface grade adjacent to the well head shall be such that surface water is diverted away from the well.

*History Note: Authority G.S. 87-87; 87-88; S.L. 2018-65;
 Eff. February 1, 1976;
 Amended Eff. May 14, 2001; December 1, 1992; March 1, 1985; September 1, 1984; April 20, 1978;
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