NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

WATER WELL

(No.)
Code 642

DEFINITION

A hole drilled, dug, driven, bored, jetted or otherwise constructed to an aquifer for water supply.

PURPOSE

- Provide water for livestock, wildlife, irrigation, and other uses.
- To provide for general water needs of farming/ranching operations.
- Facilitate proper use of vegetation, such as keeping animals on rangeland and pastures and away from streams, and proving water for wildlife.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all land uses where the underground supply of water is sufficient in quantity and quality for the intended purpose.

This practice standard applies only to production wells. Specifically excluded are any types of wells installed solely for monitoring or observation purposes; injection wells; and piezometers. The standard does not apply to pumps installed in wells; above ground installations, such as pumping plants, pipelines, and tanks; temporary test wells; and decommissioning of wells (refer to Florida NRCS conservation practice standard Water Well Decommissioning, Code 351).

CRITERIA

General criteria applicable to all purposes.

Wells shall comply with all Federal, state, and local rules and regulations. Wells shall comply with the requirements of Chapter 40-3 Florida Administrative Code (F.A.C.) and other applicable state and local rules and regulations.

Suitability of Site. Determine the availability of ground water for its intended use at the site by using reliable local experience and reviewing all available relevant geologic maps and reports; well records maintained by state and federal agencies; and design, construction, and maintenance records of nearby wells. An appropriate level of investigation, including test well drilling, is conducted on-site, as needed, prior to well construction to determine site-specific hydrogeologic conditions.

The site shall be suitable for safe operation of the drilling equipment.

Well Head Protection. Wells shall be located at safe distances from potential sources of pollution, including unsealed abandoned wells. The allowable distance shall be based on consideration of site-specific hydrogeologic factors and shall comply with set back distances established in Chapters 40D-3, 62-555, 62-610, 62-640, 62-701, 62-761, 10D-4, and 10D-6, F.A.C.

Surface runoff and drainage that might reach the wellhead from potential areas of contamination, such as those used by livestock shall be diverted.

Wells shall be located a safe distance from both overhead and underground utility lines and other safety hazards.

Borehole. Drilled, jetted, bored, and driven wells shall be sufficiently round, straight, and of adequate diameter, to permit satisfactory

installation of inlet, well casing, filter pack, and annular seal, and passage of tremie pipe (including couplings), if used.

Use of Casing. Install casing to seal out undesirable surface or shallow ground water and to support the side of the hole through unstable earth materials. The intake portion of a well through stable geologic materials may not require casing.

Casing Diameter: Size casing diameter to permit satisfactory installation and efficient operation of the pump. Assure the casing diameter is large enough that uphole velocity is 5 feet per second or less for the designed discharge to protect against excessive head loss.

Materials: Casing and liner pipe shall meet the requirements of Chapter 62-532 F.A.C. Casings may be of steel, iron, stainless steel, copper alloys, plastic, fiberglass, concrete or other material of equivalent strength and durability consistent with the intended use of the water and the maximum anticipated differential head between the inside and outside of the casing.

Steel well casings shall meet or exceed requirements specified in ASTM A 589. Steel pipe manufactured for other purposes may be used if the quality of the pipe meets or exceeds requirements specified in ASTM A 589.

Only steel pipe casings shall be used in driven wells.

To prevent galvanic corrosion, dissimilar metals shall not be joined in direct contact.

Plastic casings made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) shall conform to material, dimensional and quality requirements specified in ASTM F 480.

Plastic pipe manufactured for water or irrigation pipelines may be used if the quality equals or exceeds requirements specified in ASTM F 480.

Filament-wound fiberglass casings (glass-fiber-reinforced-thermosetting-resin pipe, RTRP) may be used if material meets requirements specified in ASTM D 2996. Tests for long-term cyclic pressure strength, long-term static pressure strength, and short-term rupture strength as required in ASTM D 2996 are not needed because the pipe is to be used for well casing. Joints shall meet requirements specified in section 3.8, ASTM F 480.

Fiberglass pressure pipe, (also called reinforced plastic mortar pipe, RPMP, or fiberglass pipe with aggregate) shall meet or exceed requirements specified in ASTM D 3517.

Casing Strength. Well casing wall thickness shall be sufficient to withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development, and use. Required casing strength shall be determined as shown in NEH Part 631, Chapter 33, Investigations for Ground Water Resources Development.

Joint Strength: Joints for well casings shall have adequate strength to carry the load due to the casing length and still be watertight, or shall be mechanically supported during installation to maintain joint integrity. Such mechanically supported casings shall terminate on firm material that can adequately support the casing weight.

Screen: Well screens shall be installed in any earth material likely to produce silt or sand. Well screens may be constructed of commercially manufactured screen sections, well points, or field-perforated sections.

The screen shall be constructed with the slot width determined from aquifer samples (Part 631, NEH, Chapter 33). Screen open areas can range from 1 percent for field-perforated screens to 25 percent or more for continuous wire-wrapped screens. To assure good well efficiency, open areas should be designed to approximate aquifer porosity. High open area percentages also make well development more effective.

The length and open area of the screen shall be sized to limit entrance velocity of water into the well in order to maximize water yield, while simultaneously preventing sand from being pumped into the well and preventing screen corrosion and encrustation.

A conservative water well design will have a well screen entrance velocity of about 0.1 foot per second, which has been the common industry standard for many years. The American Water Works Association (AWWA) Standard A-100-06, however, no longer stipulates a maximum screen entrance velocity and cites recent research and testing that indicate that allowable well screen velocities are a function of aquifer characteristics, the overall well design and intended performance and the quality of the groundwater being pumped. For the purpose of this standard, the maximum

recommended entrance velocity shall be less than or equal to 0.7 foot per second.

Depth of the aquifer below ground surface and the thickness of aquifer to be penetrated by the well shall govern the position of the screen in the well.

Maximum drawdown shall not be permitted below the top of the highest screen or pump intake.

Seals (Packers). Telescoped screen assemblies shall be provided with one or more sand-tight seals between the top of the telescoped screen assembly and casing.

Filter Pack. Installation of a filter pack around the well screen shall be considered under the following conditions: presence of a poorly graded, fine sand aquifer; presence of a highly variable aquifer, such as alternating sand and clay layers; presence of a poorly cemented sandstone or similar aquifer; a requirement for maximum yield from a low-yielding aquifer; and holes drilled by reverse circulation.

Pre-packed Well Screens: For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial pre-packed well screen may be substituted for a conventionally installed (by tremie) filter pack.

Installation: Casing shall extend from above the ground surface down through unstable earth materials to an elevation of at least 2 feet into stable material or to the top of the screen.

All wells shall be cased to a sufficient height (minimum of 12 inches) above the ground surface to prevent entry of surface and near-surface water.

Casing for artesian aquifers shall be sealed into overlying, impermeable formations in such a manner as to retain confining pressure.

If a zone is penetrated that is determined or suspected to contain water of quality unsuitable for the intended use, the zone shall be sealed to prevent infiltration of the poor-quality water into the well and the developed portion of the aquifer.

Water well drillers shall adhere to Chapter 62-531 F.A.C for all State licensing requirements and regulations.

Well Development. Well development shall be performed to repair damage done to the formation by the drilling process, and to alter the physical characteristics of the aquifer surrounding the borehole so that water will flow more freely to the well.

The method of well development used shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.

Aquifer Development. For massive, unfractured rock formations unresponsive to well development procedures, the use of aquifer stimulation techniques may be considered to improve well efficiency and specific capacity. Techniques may include dry ice, acidizing, explosives, or hydrofracturing, depending on the composition and structure of the formation.

Grouting and Sealing. The annulus surrounding the permanent well casing at the upper terminus of the well shall be filled with mortar containing expansive hydraulic cement (ASTM C-845), or bentonite-based grout or bentonite chips and pellets, in accordance with Chapter 62-532 F.A.C. The length of the grout seal shall be no less than 10 feet and not less than the minimum specified in state or locally applicable construction codes.

The casing shall be surrounded at the ground surface by a 4-in. thick concrete slab extending at least 2 feet in all directions from the outside of the casing to prevent contamination. The slab shall slope away from well.

A positive seal (grouted in place) or packer shall be provided between the casing and the less pervious material overlying the aquifer of artesian wells, and in all aquifers where co-mingling of waters is undesirable.

Access Port. An access port with a minimum diameter of 0.5 inch shall be installed to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well. Access ports and pressure gages or other openings in the cover shall be sealed or capped to prevent entrance of surface water or foreign material into the well. Removable caps are acceptable as access ports.

Disinfection. Wells shall be disinfected immediately following their construction or repair to neutralize any contamination from equipment, material, or surface drainage introduced during construction. The disinfection process shall comply with all local or state requirements.

Free Flowing Wells. All free flowing wells shall be provided with valves for positive control of the flow of water.

Water Quality Testing. Sampling and testing shall comply with all applicable Federal, state, and local requirements. These requirements vary according to the water quality parameters associated with the intended use(s) of the water.

Additional Criteria for Horizontal Wells

General. A test of the well at 120 percent of the designed continuous discharge rate for 48 hours must produce sediment-free water.

Provisions must be made to prevent less than atmospheric pressure on the well casing and screens.

Wells shall not adversely impact wetlands.

Casing and Materials.

Vertical Pump Risers. The vertical pump risers shall of materials with sufficient strength and durability for the depth installed. Each vertical pump riser shall be provided with a watertight cover or seal to prevent the entry of contaminated water or other objectionable materials. The annular space around the riser shall be filled with cement grout or other suitable material to a depth that will seal off surface waters.

Clean Out Risers. The clean out risers shall meet or exceed the materials for NRCS conservation practice standard, Subsurface Drain, Code 606 or for pump risers as described above. The horizontal well shall be installed with a non-perforated riser at its terminal end to allow access to the well for clean out, if needed. The minimum diameter of the clean out riser pipe shall be 6 inches or equal to the diameter of the horizontal screen, whichever is larger. The clean out riser shall extend 1 foot above ground, capped, and a 4-inch thick concrete slab installed extending a minimum 2 feet in all directions from the clean out riser.

Screens. All horizontal screens (perforated piping) shall be in conformance with NRCS conservation practice standard, Subsurface Drain, Code 606 or AASHTO M252 and must have adequate strength to support the planned depth of cover and other external loads. The perforations shall have an area for the length of screen to maintain the entrance velocity of water less than 0.10 ft/s.

Joints. All in-line pipe joints shall be connected with a coupling made of compatible material which shall be manufactured to properly conform to the corrugations of the receiving pipe. A water tight adapter will be used when connecting to the vertical pump risers and above ground clean out riser.

Filter. All perforated pipe shall be encased with a filter that conforms to NRCS conservation practice, Subsurface Drain Standard, Code 606.

Installation. Placement and bedding of horizontal screens (perforated pipe) shall be installed in conformance to NRCS Standard and Specifications for Subsurface Drain, Code 606.

Testing. After installation of the horizontal well, three shallow wells shall be installed to the same depth as the horizontal screen and located near the pump. The wells should be located 3 feet, 45 feet, and 90 feet perpendicular to the horizontal screens. If more than one horizontal screen is installed, three shallow monitor wells must be installed for each horizontal screen.

A 48-hour pump test must be conducted to test the yield of the horizontal well and to determine the zone of influence of the well system. Provisions shall be made to prevent undesirable off site discharge of water during the testing of the horizontal well.

Water levels must be recorded prior to pumping starts to determine static water levels. Once pumping starts, water levels in each monitor well must be recorded at 5 minutes, 10 minutes, 30 minuets, and at each hour during pumping for the duration of the pump test. All water level measurements shall be referenced to below land surface.

Certification and Guarantee. The manufacturer shall certify and furnish supporting data that the pipe meets the requirements specified in this standard when requested by the owner or individual certifying the practice. The installing contractor shall certify that the installation compiles with the requirements of this standard and shall furnish a written guarantee that protects the owner against defective workmanship and materials for not less than one year. The certification shall identify the manufacturer and markings of the pipe used and the continuous discharge rate of the test.

Basis of Acceptance. The acceptability of the well shall be determined by inspections to check compliance with the provision of this standard with respect to design, materials, material markings, testing, and minimum installation requirements.

The contractor will furnish a sketch showing the location and extent of pump, horizontal screens, etc.

CONSIDERATIONS

The potential for adverse interference with existing nearby production wells needs to be evaluated in planning.

The potential for ground water overdraft and the long term safe yield of the aquifer needs to be considered in planning.

If practicable, wells should be located in higher ground and up gradient from sources of contamination or flooding.

Potential effects of installation and operation of the well on cultural, historical, archeological, or scientific resources at or near the site need to be considered in planning.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared for specific field sites in accordance with this standard and shall describe the requirements for applying the practice to achieve its intended uses.

OPERATION AND MAINTENANCE

A plan for maintenance of a well shall be prepared. The well construction records shall be kept on file with the maintenance plan by the owner/operator. As a minimum, the plan shall include a statement of identified problems, corrective action taken, date, and specific capacity (yield per unit drawdown) of well before and after corrective action was taken.

Horizontal well shall be operated such that adverse impacts to wetlands will be avoided. Monitoring of the water table in the shallow wells shall be required in order to determine maximum length of pumping.

REFERENCES

ASHTO M252
ASTM Specifications:
A 589, C 845, D 2996, D 3517, D 5521, D5299
F 480
Chapters 40D-3, 62-555, 62-610, 62-640, 62-701, 62-761, 10D-4, and 10D-6, F.A.C.
National Engineering Handbook, Part 631,
Chapter 31, Investigations for Ground Water Resources Development
Chapter 32, well Design and Spring Development
NRCS Conservation Practice Standard,
Subsurface Drain, Code 606