

## 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.

#### PURPOSE

- Provide water for livestock, wildlife, irrigation, human, and other agricultural uses
- Facilitate proper use of vegetation, such as keeping animals on rangeland and pastures and away from streams, and providing water for wildlife

#### CONDITION WHERE 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 (ASTM D 5299 and Conservation Practice Standard 351, Water Well Decommissioning).

#### CRITERIA

**Federal, State, and Local Laws.** The investigation, design, or installation of water wells according to this standard shall adhere to all applicable local, State, Tribal, and Federal laws and regulations. All wells shall be constructed by a licensed well driller listed with the Mississippi Department of Environmental Quality (Office of Land and Water Resources). The well driller is required by MDEQ to complete the State Well Report (Form: OLWR-SWR-1A (04/08)).

**Suitability of site.** The availability of ground water for its intended use at the site shall be determined 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.

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

**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 requirements of all applicable state or local, State, Tribal, or Federal regulations or construction codes.

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.

All installed wells shall be protected from freezing, livestock disturbances, mowing, equipment disturbances, etc. by constructing or installing a well house around the well.

Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

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. Casing shall be installed 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 formations may not require casing.

Casing diameter. Casing diameter shall be sized to permit satisfactory installation and efficient operation of the pump, and large enough to assure that uphole velocity is 5 feet per second or less, to protect against excessive head loss.

Materials. 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, using depth and material tables.

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.

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.

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 32, Well Design and Spring 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 screen 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.

Perforation by any method is allowable provided proper slot size and entrance velocity limits can be met. The length and open area of the screen shall be sized to limit entrance velocity of water into the well to less than or equal to 0.1 foot per second (NEH, Part 631, Chapter 32, 32-29).

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.

Prepacked well screens. For heaving or caving sands, silty or fine-grained aquifers, and for horizontal or angled wells, a commercial prepacked 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.

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 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 expansive hydraulic cement (ASTM C 845), shrinkage-compensating concrete, bentonite-based grout, or bentonite chips and pellets, in accordance with State requirements. 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-inch 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 the 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 comingling 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.

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.

Pressure Tank. Unless otherwise approved, construct all wells utilizing a pressure tank of sufficient size to extend the life of the pump.

Power Source. Electrical components and installations shall meet the requirements of the National Electrical Code (NEC) and state and local codes for outdoor installation. Place all electrical wiring in conduit. A qualified state licensed electrician will certify in writing all electrical installations.

## **CONSIDERATIONS**

The potential for adverse interference with existing nearby production wells needs to be evaluated in planning and designing the water well.

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.

## 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. A record of the installation of this practice shall be made and shall include the following information:

- Location of the water well by Global Positioning System, latitude/longitude, township/range, or other georeferencing convention, of such precision that it can be readily re-located
- Date of completion of the water well
- Name of landowner
- Name, title, and address of person responsible for the water well
- Total depth of the water well
- Length of casing and screening
- Inside diameter of well bore or casing
- Type of casing material or schedule (e.g., standard weight steel, or PVC sch-80)
- Static water level measured from ground surface
- Water chemistry before and after disinfection

## 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.

## References

National Engineering Handbook, Part 631, Chapter 32, Well Design and Spring Development

ASTM Specifications: A 589, C 845, D 2996, D 3517, D 5299, and F 480.

NRCS Practice Standard 351, Water Well Decommissioning

Mississippi Department of Environmental Quality, Office of Land and Water Resources, Regulation LW-3 Licensing of Water Well Contractors.

MDEQ, Office of Land and Water Resources website: [www.deq.state.ms.us](http://www.deq.state.ms.us) for current listing of licensed well drillers in MS.

## Natural Resources Conservation Service Construction Specifications

### WATER WELL

#### 1. ALIGNMENT

Drilled vertical wells shall be round, plumb, and aligned to permit satisfactory installation and operation of a pump of the proposed size and type to the greatest anticipated depth of setting.

#### 2. CASINGS

a. Materials. Casings can be made of steel, copper, plastic, fiberglass, asbestos-cement, concrete, or other materials of equivalent strength and durability.

Steel, copper, asbestos-cement, reinforced plastic mortar, plastic, or fiberglass pipe casings can be used in drilled wells. Only steel pipe casings shall be used in driven wells. If the water is to be used for human consumption, plastic casings for transporting potable water supplies must be approved by the National Sanitation Foundation. Used steel pipe can be used for well casings if it is of good quality and has a wall thickness equal to or greater than that of Schedule 40 pipe.

Plastic casings shall be made of acrylonitrile-butadiene-styrene (ABS), polyvinyl chloride (PVC), or styrene-rubber (SR) and shall conform to the requirements specified in ASTM-F-480. Plastic pipe manufactured for water or irrigation pipelines can be used if the quality of the pipe equals or exceeds that specified in ASTM-F-480.

Fiberglass casings can be used if tests indicate that:

(1) The material meets the 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.

(2) The joints meet the requirements specified in Section 3.B, ASTM-F-480.

(3) The modulus of elasticity is certified for use in determining maximum depth.

Asbestos-cement casings shall equal or exceed the requirements specified in ASTM-C-296 (pressure pipe), ASTM-C-668 (transmission pipe) or NRCS 430-BB (irrigation pipe). The minimum crushing strength shall be 1,500 lb/ft.

Concrete casings shall be reinforced and shall meet or exceed the requirements specified in ASTM-C-76. The minimum 28-day compressive strength shall be 4,000 psi.

Reinforced plastic mortar casings shall equal or exceed the requirements specified in ASTM-D-3517.

Steel well casings shall equal or exceed the requirements specified in ASTM-A-589. Steel pipe manufactured for other purposes can be used if the quality of the pipe equals or exceeds that specified in ASTM-A-589.

b. Joints. 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.

c. Gravel pack. If gravel packing is used, it shall have the gradation and thickness specified in the design and shall be carefully placed to prevent segregation and bridging. Gravel pack material shall extend a minimum of 10 feet above the

top of the perforated or screened section and shall extend through the length of the water-bearing formation.

- d. Installation. In consolidated formations, the casing shall extend from the ground surface through the overburden material to an elevation of at least 2 feet into the consolidated material.

In unconsolidated formations, the casing shall extend from the ground to the screen.

For artesian aquifers, the casing shall be seated into the overlying impermeable formations to retain the artesian pressure.

If a water-bearing formation known to contain or suspected of containing poor-quality water is penetrated, the formation shall be sealed to prevent infiltration of poor-quality water into the well and the developed aquifer.

### **3. DEVELOPING**

The well shall be developed until it stops producing detrimental quantities of solid particles when the continuous discharge rate is approximately 20 percent greater than the anticipated normal production rate.

### **4. PROTECTION**

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

If the well water is for human consumption, the annular space outside the casing must be filled with a watertight cement grout or clay having similar sealing properties from the surface to a minimum of 10 feet below the ground surface. The casing shall be surrounded at the ground surface by a 4-inch concrete slab extending at least 2 feet in all directions. A sanitary well seal shall be installed at the top of the well casing to prevent the entry of contaminated water or other objectionable materials.

All installed wells shall be protected from freezing, livestock disturbances, mowing, equipment disturbances, etc. by constructing or installing a well house around the well.

**5. WORKMANSHIP**

The well casing pipe, couplings, and screens shall be homogeneous throughout and shall be free of visible cracks, holes, foreign materials, or other injurious defects. The well casing pipe, couplings, and screens shall be as uniform in color, density, and other physical properties as is commercially possible.

**6. MARKINGS**

The well casings pipe shall be marked according to the ASTM specification for the material used.

**7. CERTIFICATION**

All wells shall be constructed by a licensed well driller in the state of MS who is listed with the MS Department of Environmental Quality (Office of Land and Water Resources).

Electrical components and installations shall meet the requirements of the National Electrical Code (NEC) and be installed by a qualified MS state licensed electrician.

Markings on material identifying the manufacturer and indicating compliance with appropriate specifications can be accepted as evidence that the material meets the requirements of this standard. If the material does not bear these markings, the manufacturer can certify that it complies with the requirements of this standard. The state conservation engineer, however, can request tests supporting this certification.

**8. CONSTRUCTION DETAILS**

---

---

---

---

---

---

---