

Practice Specification Water Well (Code 642)

1. SCOPE

The work shall consist of installing and developing water well for livestock. Installation of the pump and riser pipe beyond the well head is addressed in Conservation Practice Standard 533, Pumping Plant.

2. SITE PREPARATION

After receiving the geologic investigation, as required by the standard, clear all trees, brush, and obstacles from the well site prior to setting the drill rig. The area immediately surrounding the well site shall be smoothed and graded to allow for a safe and relatively dry working area.

3. MATERIALS

Perforated Casing. If perforated casing is used, the size of the perforations selected by the contractor shall be approved by the NRCS prior to installation.

Couplings. The strength of all couplings used with well casing shall be greater than or equal to the pipe to which they are attached. Couplings shall be of a material compatible with the casing and recommended for use by the casing manufacturer. If they are made of material susceptible to corrosion, provisions must be made to protect them. Threaded couplings for plastic SDR pipe shall conform to the requirements of ASTM F 480.

Steel Pipe. Steel casings and pipe shall meet or exceed requirements specified in ASTM A 589. The minimum wall thickness for steel water well casings is 3/16 ".

Plastic Pipe. PVC casings shall conform to material, dimensional, and quality requirements in ASTM F 480 and D 1785 or D 2241.

Pipe shall include the following markings spaced at intervals along the pipe, not to exceed five feet:

- Nominal pipe size,
- Type of pipe material,
- Pressure rating in psi at 23 °C (73.4 °F),
- ASTM standard with which the pipe complies,
- Manufacturer's name (or trademark) and code.

The minimum wall thickness for PVC casing shall be as per **Tables 1 or 2** of this specification.

Note: In determining casing thickness, **maximum differential head** can be assumed to be the difference between the highest elevation of the water table and the elevation of the maximum drawdown. If these cannot be determined, use the casing length from the ground surface to the bottom of the casing.

Table 1 Maximum Differential Head in Feet for Plastic Pipe- Modulus of Elasticity of 400,000 psi.

SDR ↓	Maximum Differential Head -Feet-
26	130
21	250
17	480
13.5	950

Table 2 Maximum Differential Head in Feet for Schedules 40, 80, and 120 Plastic Pipe, E = 400,000

Nominal Diameter -inches-	Schedule 40	Schedule 80	Schedule 120
5	230	740	1,830
6	170	660	1,510

Filter Pack and Screen. The filter pack (AKA gravel pack) materials must be clean and predominantly rounded dense, siliceous materials. It should have less than 5 percent angular (such as crushed rock) or flat particles (such as mica), earthy or soft materials (such as clay, shale, or anhydrite), or highly soluble material (such as limestone or gypsum). If rounded materials are unavailable, a prepackaged well screen can be used.

The pack should be 3 to 12 inches thick sand or gravel material with a D30 grain size 4 to 12 times the D30 grain size of the aquifer material. The size and gradation of the filter pack, if required, will be selected after samples of the aquifer have been obtained and analyzed. Alternately, use pea gravel with 100% passing the ½" screen.

The pack shall be placed to prevent segregation and bridging. Installation of a filter pack around the well screen shall be required 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;
- Hole drilled by reverse circulation.

4. INSTALLATION

Drilling. Only clean, potable water shall be used in drilling fluids whether employed alone or in combination with drilling additives.

Whenever there is an interruption of work on the well, such as overnight shutdown, during inclement weather, or periods between testing, et cetera, the well opening shall be covered and secured (by tack welding or other acceptable means) to ensure the public safety, prevent damage to the well, and prevent introduction of unwanted materials into the well. The contractor is responsible for any objectionable material that may fall into the well and any effect it may have on water quality or quantity until completion and acceptance of the work by the land operator and NRCS.

All alloys/materials containing lead, and paints and coatings containing lead or mercury, shall be strictly prohibited from introduction into any new or existing water well.

Joining. To prevent galvanic corrosion, dissimilar metals shall not be joined.

Well Diameter. The diameter of the well shall be adequate to meet the yield capacity of the formation in relation to the nature and extent of the water bearing area and to permit the installation of a pump to deliver the needed amount of water to the projected lift elevation. The nominal diameter of the casing typically should be 2 inches larger than the diameter of the pump. The well diameter shall provide for adequate annular space to permit the placement of the filter pack, if needed.

Alignment: The well alignment must be satisfactory for the successful installation and operation of permanent pumping equipment.

Casing. The casing shall extend from at least 18 inches above the ground surface down to the required depth and be centered in the filter pack.

Filter Pack. Filter pack material shall be carefully placed to prevent segregation and should extend a minimum of 10 feet above the top of the highest screened or perforated section and should extend through the entire length of the water-bearing formation penetrated by the well.

For naturally developed wells in which the screen is placed in direct contact with aquifer materials, the screen slot size should be based on the D40 size of the aquifer materials, so that 60 percent of the material can pass and 40 percent will be retained. The D50 size is acceptable if the water is highly corrosive, or if there is doubt about the reliability of the sample. For wells in which a filter pack is used, the screen slot size should be such that 90 percent or more of the filter material is retained. The length and open area of the screen should be sized to restrict the entrance velocity of water into the well to less than or equal to 0.1 ft./sec.

Pre-packed Well Screens. Commercial pre-packed well screens may be substituted for a conventionally installed filter pack if one of the following conditions applies:

- Heaving or caving sands are present;
- The aquifer is silty or fine-grained;
- The well is horizontal or angled; or
- Appropriate materials are not available for a conventional filter pack.

Pre-packed well screens shall consist of an inner and outer screen, which are completely filled with uniform, well-rounded, pre-washed grains of silica sand of a specified gradation. The screen slot size shall be based on a sieve analysis of the water-bearing aquifer materials; the slot size shall retain 100 percent of the filter pack's minimum size designation. No minimum annular space is required for a pre-packed well screen if its outside diameter is equal to or less than the casing to which it is attached.

Perforation by any method is allowable with the following provisions:

- Screen openings, for uniform size aquifer material, are smaller than the average diameter of the aquifer material,
- Pipe is not damaged,
- Screen openings, for non-uniform aquifer material, are smaller than 60 percent of the aquifer material,
- Screen openings, for filter/gravel pack will exclude at least 85 percent of the filter pack material,
- Length and open area of the screen can be sized to limit average entrance velocity of water into the well to less than or equal to 0.1 foot per second, and
- The required strength can be maintained.

The position of the screen in the well shall be determined by the depth of the aquifer below the ground surface and the thickness of aquifer to be penetrated by the well. The top of the screen shall be located below the lowest water level expected in the well.

Well screens should be plugged at the bottom.

Grouting and Sealing. In constructing and developing a well, measures shall be taken to preserve the natural barriers to ground water.

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, clay, or other material with similar sealing properties. The length of the grout seal shall be at least 20 feet and not less than the minimum specified in state or locally applicable construction codes.

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. A similar positive seal shall be provided to separate aquifers where co-mingling of waters is undesirable.

A packer or similar retaining device, or a small quantity of sealant that is allowed to set, shall be placed at the bottom of the interval to be sealed before final sealing operations begin to form a foundation for the seal.

On completion, each well shall be provided with a suitable threaded, flanged, or welded cap or compression seal to prevent entry of contaminants into the well.

Foundation and Transition Seals. A transition seal shall be placed in the annular space to separate filter pack and cement-based sealing materials.

The top of the transition seal shall be measured to ensure that no bridging has occurred during placement.

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.

Access Port. Every well shall be constructed with an opening of at least ½ inch in diameter in the casing and at least 18 inches above ground level, to allow a water level measuring line to be inserted between the outside casing and the pump column. A removable cap shall be provided for such openings.

Artesian Aquifers. Refer to: “Well Driller Licensing, Construction, Repair and Plugging of Wells”, NMAC 19.27.4.31, Well Drilling – Artesian Well Requirements, August 2005, published by the New Mexico Office of the State Engineer.

Abandonment of a Dry Hole. See Conservation Practice Standard 351, Well Decommissioning.

5. WELL & AQUIFER DEVELOPMENT

Wells to be completed without a filter pack in unconsolidated granular aquifers shall be developed following guidance provided in ASTM D 5521, Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers. The method shall be selected based on geologic character of the aquifer, type of drilling rig, and type of screen.

For massive, un-fractured rock formations unresponsive to water well development procedures, the use of aquifer stimulation techniques may be considered in order to improve well efficiency and specific capacity. Depending on the composition and structure of the formation, techniques may include dry ice, acid, explosives, or hydro fracturing.

Upon completion of the well and before conducting the yield and drawdown tests, the contractor shall develop the well to remove fines, drill cuttings, drilling fluids, and additives deposited on the borehole face and in adjacent portions of the aquifer during the drilling process. If organic drilling fluids are used, they must be broken down chemically according to the manufacturer’s recommendations before or during development.

After aquifer development is complete, the accumulated sediment shall be removed from the bottom of the well bore by pumping or bailing. The well shall be developed at 120 percent normal anticipated production until it stops producing excessive quantities of solid particles. The permanent pump shall not be used for either of these purposes.

6. DISINFECTION

All water wells shall be disinfected immediately following their construction or repair. Prior to final disinfection, the well shall be cleaned thoroughly to remove all foreign substances, such as grease, soil, sediment, joint dope, and scum. All pump parts shall be thoroughly cleaned before being placed in the well. Surfaces of all components above the static water level as well as the entire pumping system, and all storage tanks, pipes, faucets, valves, and hydrants must be flushed or washed down with a sterilizing solution.

7. CERTIFICATION

The markings indicating the manufacturer, size, and compliance with appropriate specification can be accepted as evidence that the material meets the requirements of this standard and specification. Absent the markings, the supplier must provide written certification that the material complies with the requirements of this standard and specification.

The driller must furnish a signed copy of the “Well Record and Log” (an OSE form) to the owner, who must provide a copy to the certifying technician.

The “Well Record and Log” shall provide an estimated well yield and state the method used to determine the yield. Absent the well yield estimate, the Area Engineer may specify a method to determine the yield.

8. WATER QUALITY TESTING

See with NRCS Conservation Practice Standard 614, Watering Facility.

9. MEASUREMENT & PAYMENT

The amount of well drilling is measured to the nearest foot.

The amount of casing pipe and well screen will be measured to the nearest linear foot. The diameter of these items will be recorded as the nominal diameter in inches.

Measurement and payment for the pump and riser pipe will be per NRCS Conservation Practice Standard 533, Pumping Plant.

10. ITEMS OF WORK AND CONSTRUCTION DETAILS:

Items of work to be prepared in conformance with this specification and the construction details are:

Specific Site Requirements