



**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

**WATER WELL
Code 642
(No.)**



DEFINITION

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

PURPOSE

To provide to access to groundwater supply suitable for livestock watering, fire control wildlife, and other agricultural uses.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies types of agricultural land where the quality and quantity of underground water is appropriate for the intended purpose.

This practice does not apply to wells constructed solely for domestic or public water supply. It does not apply to wells installed solely for monitoring or observation purposes (use Florida NRCS conservation practice standard (CPS) Monitoring Well, Code 353), injection wells, temporary test wells, or piezometers.

This practice does not apply to pumps, surface supply lines, storage facilities, and related appurtenances.

CRITERIA

Evaluate impact to cultural resources, wetlands and Federal and state protected species and avoid or minimize to the extent practicable during planning, design and implementation of this conservation practice in accordance with established National and Florida policy, General Manual (GM) Title 420-Part

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

401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26, National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6, National Cultural Resources Procedures Handbook (NCRPH), National Food Security Act Manual (NFSAM), and the National Environmental Compliance Handbook (NECH).

Laws and Regulations. The investigation, design, and installation of an agricultural water supply well shall comply with all applicable governmental regulations, laws, permits, licenses, and registrations. In particular, federal law requires:

- a proposed well that has a domestic usage component must comply with criteria in ANSI/AWWA American National Standard, A100-06, 2007;
- a proposed irrigation well must comply with criteria in ANSI/ASAE American National Standard, EP400.3, 2007; and
- the well design and installation must follow applicable industry consensus standards.

The landowner is responsible for obtaining all permits and water rights.

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

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

Suitability of Site. Use reliable local experience and all available relevant geologic maps, reports, and well records maintained by state and federal agencies. Review design, construction, and maintenance records of nearby wells to help determine whether groundwater is available in sufficient quantity and of the desired quality for its intended use. If local hydrogeologic data are limited or if conditions are complex and uncertain, use additional expertise to conduct on-site evaluation and to provide professional recommendations regarding the suitability of the site.

Ensure the site is suitable for safe operation of the drilling equipment.

Do not locate wells near overhead and underground utility lines and other safety hazards.

If site conditions allow, locate the well up-gradient from potential sources of surface contamination and away from areas subject to flooding. In determining gradient, consider both pumped and static conditions.

Clear the site of all trees, brush, and obstructions and provide a relatively flat, reasonably dry, working surface for the drill rig and related equipment to ensure a safe and effective working environment.

Well Head Protection. The well shall be located at least 100 feet from potential sources of surface and subsurface pollution and comply with setback distances established in Chapters 40D-3, 62-555, 62-610, 62-640, 62-701, 62-761, 10D-4, and 10D-6, F.A.C.

Divert all surface runoff, precipitation, and drainage away from the wellhead. At the wellhead, compact, mound, and slope earth material away from the wellhead.

Protect the wellhead and associated appurtenances from contamination or damage by wildlife, livestock, farm machinery, vehicle parking, or other harmful human activity.

Grouting and Sealing the Casing. Hard rock formations or physically stable geologic materials may not require casing except for the uppermost 10 feet.

If drilling encounters erodible, friable, or otherwise undesirable material, install watertight grouted casing throughout, with the exception of the intake portions.

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

Provide a watertight seal in the annulus of all well casings. Acceptable sealants include mortar containing expansive hydraulic cement, or bentonite-based grout or bentonite chips and pellets, in accordance with Chapter 62-532 F.A.C.

If one or more zones are encountered that produce water of unacceptable quality, use grout or packers to prevent co-mingling of waters or cross-contamination of aquifers.

Provide a packer, or similar retaining, or a small quantity of sealant between the casing and the less pervious material overlying the aquifer of artesian wells. Provide a similar positive seal to separate water bearing zones where co-mingling of waters is undesirable.

For artesian conditions, seal the confining geologic units directly above and below the aquifer in such a manner as to retain its confining pressure.

When the design requires telescoped screen assemblies, install one or more sand-tight seals between the top of the telescoped screen assembly and casing.

Do not design maximum drawdown below the top of the highest screen or pump intake.

Upon completion, provide a suitably threaded, flanged, or welded cap or compression seal to prevent entry of contaminants into the well.

Casing Materials. Casing and liner pipe shall meet the requirements of Chapter 62-532 F.A.C. Acceptable casing materials include steel, iron, stainless steel, copper alloys, plastic, fiberglass, concrete or other material of equivalent strength and which has sufficient chemical resistance to the groundwater for the design life of the well. To prevent galvanic corrosion, do not join dissimilar metals.

Use only steel pipe casings in driven wells.

Select casing diameter to permit satisfactory installation and efficient operation of a submersible pump, if used.

Select casing material that can withstand all anticipated static and dynamic pressures imposed on the casing during installation, well development, and use throughout the design life of the well. Required casing strength shall be determined as shown in NEH Part 631, Chapter 32, Well Design and Spring Development.

Ensure casing joints have adequate strength to carry the weight of casing throughout its length while maintaining a watertight seal. If needed, mechanically support the casing during installation to maintain joint integrity. Terminate mechanically supported casings on material that can adequately support the casing weight.

Screen and Filter Pack. Procedures for designing well screen shall follow information described in the NEH Part 631, Chapter 32.

Use a screen and filter pack (also called gravel pack) if any of the following conditions exist:

- presence of a poorly graded, fine sand aquifer or heaving or caving sands;
- presence of a highly variable aquifer, such as alternating sand and clay layers;
- presence of a poorly cemented sandstone or other loosely compacted material;
- requirement for maximum yield from a low-yielding aquifer; and

- holes drilled by reverse circulation.

If acceptable filter materials are unavailable, use a commercially manufactured, pre-packed well screen. A pre-packed well screen consists of inner and outer screens that contain the engineered filter material. The material must meet the following quality criteria:

- less than five percent fines (the proportion that passes the number 200 sieve);
- predominantly rounded, dense, siliceous materials;
- no angular particles, such as crushed rock, or flat particles, such as mica;
- no earthy or soft materials, such as clay, shale, silt, gypsum, or anhydrite;
- no organic matter, no other impurities or metallic substances; and
- no material soluble in hydrochloric acid, such as limestone.

Use a pre-packed well screen for horizontal or angled wells.

Position the well screen according to the depth of the water-bearing zone(s) below the ground surface and the thickness of the water-bearing zone penetrated by the drill hole. Install a conventional filter pack from the bottom up and place in a manner that avoids segregation and bridging of particles.

Screen perforation by any method is allowable with the following provisions:

- for uniform size aquifer material, screen openings are smaller than the average diameter of aquifer material;
- for non-uniform aquifer material, screen openings are smaller than 60 percent of the aquifer material;
- screen openings, for filter/gravel pack must exclude at least 85 percent of the filter pack material;
- size the length and open area of the screen to keep entrance velocity or shear stress below the threshold for erosion of filter pack particles and transport into the well; and
- casing must not be functionally weakened or deformed.

For a screened well cased to the bottom of the well, install several extra feet of blank screen or casing at the bottom of the well to accommodate sediment that passes through the well screens and settles to the bottom of the well.

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.

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.

Well Development. Well development shall be performed to repair damage to the formation caused 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.

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. Prior to final chemical disinfection, remove foreign substances, such as, grease, oil, sediment, joint dope, and scum from the well and near the wellhead. Disinfect the well using a chlorine compound at a concentration of no less than 100 mg/L (100 ppm) available chlorine in solution to treat the entire well. 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.

Well Water Testing. If local water quality conditions are unknown or questionable, test the well water using parameters that pertain to well performance or the suitability of the water for its intended usage. Test well water according to Florida NRCS CPS Groundwater Testing, Code 355.

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 be made 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 Florida NRCS CPS, 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 concrete slab 4-inches in thickness installed extending a minimum of 2 feet in all directions from the clean out riser.

Screens. All horizontal screens (perforated piping) shall be in conformance with Florida NRCS CPS, 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 Florida NRCS CPS, Subsurface Drain, Code 606.

Installation. Placement and bedding of horizontal screens (perforated pipe) shall be installed in conformance to Florida 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 minutes, 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 complies 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

Consider evaluating the potential for adverse interference with existing nearby production wells when planning and designing the water well.

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

Well Performance Testing. After completion of well construction and the water level is stable, conduct a pump test to determine specific capacity and dynamic water level. Record the length of test and pumping rate.

PLANS AND SPECIFICATIONS

Develop plans and specifications that clearly describe requirements for applying the practice to achieve its intended purpose(s). If not already specified in the documentation required by the appropriate Florida regulatory authority, record the following information in the installation record.

- location of water well by Global Positioning System (GPS) coordinates or in a sufficiently detailed narrative description to readily locate the well;

- name of well owner;
- type of casing material or schedule, and whether new or used;
- wellhead protection;
- well diameter;
- height of casing extending above ground surface;
- depth and method of surface sealing;
- static water level measured from top edge of casing or from ground surface;
- water well capacity;
- notification of whether aquifer is artesian or non-artesian. If well is flowing artesian, provide flow rate and pressure;
- well development method(s) used;
- results of pump test including length of test, stability of water level, pumping rate, and specific capacity after water level had stabilized, if needed;
- well driller's log;
- if water quality was tested, record the parameters and test results, date of sampling, name of person who took sample, and name of laboratory that conducted tests; and
- location of utilities and notification requirements.

OPERATION AND MAINTENANCE

Prepare a plan for operation and maintenance of the water well. The owner is responsible for keeping and maintaining well construction records with the maintenance plan. The owner must ensure periodic inspection of the well for proper functioning and water quality.

Ensure no agricultural chemicals, such as fertilizers and pesticides, are stored or mixed or containers rinsed within a radius of 100 feet of the wellhead.

The inspection must include conditions that affect well performance as designed for the proposed water use. As a minimum, these conditions include the following:

- declines in discharge, static level, maximum pumping level, and pressure (for artesian wells) that are outside acceptable limits for the well design;
- appearance of sediment that may damage the well, pump, or appurtenances;
- changes in water quality including odor, color, taste, and chemistry; and
- presence of algae or iron bacteria.

For screen wells that have blank casing installed at the bottom, periodically bail or flush the well to remove excessive, accumulated sediment.

In the maintenance record, include statements describing identified problems, corrective action taken and date, and specific capacity of well before and after corrective action. The owner must remedy unacceptable conditions in a timely manner.

In the event the well becomes unserviceable, it may be decommissioned according to Florida NRCS CPS Well Decommissioning, Code 351.

REFERENCES

ANSI/ASAE American National Standard *EP400.3, 2007, Designing and Constructing Irrigation Wells.*

ANSI/AWWA American National Standard, *A100-06, 2007, Standard for Water Wells.*

AASHTO M252

Chapters 40D-3, 62-555, 62-610, 62-640, 62-532. 62-701, 62-761, 10D-4, and 10D-6, F.A.C.

Florida NRCS CPS

Groundwater Testing, Code 355

Monitoring Well, Code 353

Subsurface Drain, Code 606

Well Decommissioning, Code 351

General Manual (GM) Title 420-Part 401; Title 450-Part 401, Title 190-Parts 410.22 and 410.26,

National Planning Procedures Handbook (NPPH) Florida Supplements to Parts 600.1 and 600.6

National Cultural Resources Procedures Handbook (NCRPH),

National Food Security Act Manual (NFSAM)

National Environmental Compliance Handbook (NECH).

NEH Part 631, Chapter 32, Well Design and Spring Development

USDA, NRCS, Conservation Engineering Division, Agricultural Waste Management Field Handbook 651.01, Laws, Regulations, Policy, and Water Quality Criteria.

USDA, NRCS, Conservation Engineering Division, National Engineering Handbook, Part 631, Geology, 631.32, Water Well Design.