

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
SOUTH DAKOTA SUPPLEMENTS ITALICIZED**

WELL

(no.)

CODE 642

DEFINITION

A well constructed or improved to provide water for irrigation, livestock, wildlife, or recreation.

PURPOSE

To facilitate proper use of vegetation on rangeland, pastures, and wildlife areas; to supply the water requirements of livestock and wildlife; to provide an adequate supply of water for conservation irrigation; and to provide for human use in small volumes.

CONDITIONS WHERE PRACTICE APPLIES

All irrigation wells shall be planned and located to serve as a source of water for an irrigation water distribution or conveyance system designed to facilitate the conservation use of the soil and water resources on a farm or group of farms.

Irrigation wells are limited to geological sites where sufficiently large volumes of underground water are available at a rate that will permit practical irrigation of the land on which the water is to be used. Wells may be the only source of water or they may supplement other sources. The land on which the water is to be used must be suitable for the production of locally adapted crops grown under irrigation farming. The water must be of adequate quality to insure that it will not materially reduce the productive capacity of the soil on which it is to be used.

Wells are applicable on rangeland, pastures, cropland, wildlife, and recreation areas where present water facilities are inadequate and the underground water supply is adequate in quantity and quality for the purpose to be served and can be developed at an economical cost.

PLANNING CONSIDERATIONS

Quantity

1. *Effects the cone of depression formed by pumping the well has on adjacent water uses and users.*
2. *Balance of water removed from the aquifer versus its available recharge to estimate the life and utility of the well.*

Quality

1. *Effects of well discharge on surrounding surface and ground water quality.*
2. *Methods and procedures used in the construction, development, operation, and maintenance of the well that could prevent damage to surface or ground water quality.*

Range Planning Requirements. *This practice must facilitate proper range use by improving distribution of grazing over the range, meet the water requirements of livestock with acceptable quality water, and be the most feasible method of development for the needed water supply.*

State Water Laws and Regulations. *South Dakota Water Laws and Regulations apply to ground water and wells. Wells for domestic use and wells at recreation areas are also covered by regulations of the South Dakota Department of Environment and Natural Resources (DENR), Office of Drinking Water. It is the owners and/or operators responsibility to comply with these laws and regulations.*

The construction of the well must be in accordance with State Water Laws. South Dakota law requires the well driller to keep an accurate well construction record. Copies of the records must be

Conservation practice standards are reviewed periodically and updated if needed. The current version of this standard is posted on our website at www.sd.nrcs.usda.gov or may be obtained at your local Natural Resources Conservation Service.

provided to DENR, NRCS and cost-share providers for documentation purposes.

DESIGN CRITERIA

General. The suitability of the well site and the type of well installed shall be based on detailed geologic investigations, including test well drilling, on ground water assessment studies made by local, state, or federal agencies, or on reliable local experience. The design should include ground water conservation measures, provisions for controlling contamination from one aquifer to another in the well, and method for obtaining a maximum supply of sediment-free water.

Chemical analysis indicates that there are areas in the state where the water may be unsafe for livestock from the artesian basin. Inquires should be made about local artesian water chemical characteristics prior to drilling.

Well diameter. The diameter of the well shall be adequate to meet the yield capacity needed from the earth formation and to permit the installation of a pump.

Casing and materials. Wells shall be cased, but the lower sections passing through consolidated strata do not require casing. *All wells must be pressure grouted with bentonite grout or cement grout (see Well Construction standards - State of South Dakota).*

The maximum depth for well casings shall be based on critical collapse pressure as calculated by the Cleideinst Equation in ASTM-F-480, appendix X2. Depth, as used in this standard, applies to the difference in static head between the inside and outside of the casing. This can be determined by measuring the static head or by using the total depth of the well.

Table 1 gives the depth limitations for polyvinyl chloride (PVC), acrylonitrile-butadiene-styrene (ABS), and styrene-rubber (SR) well casing pipes having different standard dimension ratios and module of elasticity.

Table 1. — Maximum depth of installation for plastic (SDR-PR) pipe

SDR	Material			
	PVC	ABS	SR	
	Modulus of elasticity (E)			
	400,000	320,000	250,000	300,000
	-----ft-----			
13.5	985	785	615	735
17	475	380	295	355
21	245	200	150	185
26	130	100	80	95
32.5	65	50	40	50

Table 2 gives the dimension and maximum depth of installation for PVC Schedules 40, 80, and 120 pipe constructed of material having a modules of elasticity equal to 400,000 lb/in.². The factors give at the bottom of this table may be used in calculating depth limitations for ABS Schedules 40, 80, and 120 pipe and other PVC classifications.

Table 2. — Dimension and maximum depth of installation for PVC Schedules 40, 80 and 120 pipe constructed of material having a modulus of elasticity equal to 400,000 lb/in.². Factors at the bottom of this table may be used in calculating depth limitations for ABS Schedules 40, 80, and 120 pipe and other PVC classifications.

Nominal dia.	Outside dia.	Schedule 40			Schedule 80			Schedule 120		
		Min. wall thickness	SDR	Max. depth	Min. wall thickness	SDR	Max. depth	Min. wall thickness	SDR	Max. depth
in.	in.	in.		ft.	in.		ft.	in.		ft.
2	2.375	0.154	15.4	650	0.218	10.9	1,960	0.250	9.5	3,070
2 1/2	2.875	.203	14.2	840	.276	10.4	2,260	.300	9.6	2,970
3	3.500	.216	16.2	550	.300	11.7	1,150	.350	10.0	2,580
3 1/2	4.000	.226	17.7	420	.318	12.6	1,220	.393	10.2	2,410
4	4.500	.237	19.0	340	.337	13.4	1,010	.437	10.3	2,330
5	5.563	.258	21.6	230	.375	14.8	740	.500	11.1	1,830
6	6.625	.280	23.7	170	.432	15.3	660	.562	11.8	1,510
8	8.625	.322	26.8	120	.500	17.3	450	.718	12.0	1,430
10	10.750	.365	29.5	90	.593	18.1	390	.843	12.8	1,160
12	12.750	.406	31.4	—	.687	18.6	360	1.00	12.8	1,160

Note: Table 2 PVC Schedule pipe made of material having a modulus of elasticity of 400,000 lb/in.². For PVC pipe having a modulus of elasticity of 360,000, multiply the depths by a factor of 0.9. For a modulus of elasticity of 320,000, use a factor of 0.8. A factor of 0.625 may be used for ABS schedules 40, 80, and 120 pipe having a modulus of elasticity of 250,000 lb/in.².

Figure 2 can be used in determining the maximum depth of plastic and fiberglass casings not covered by Tables 1.

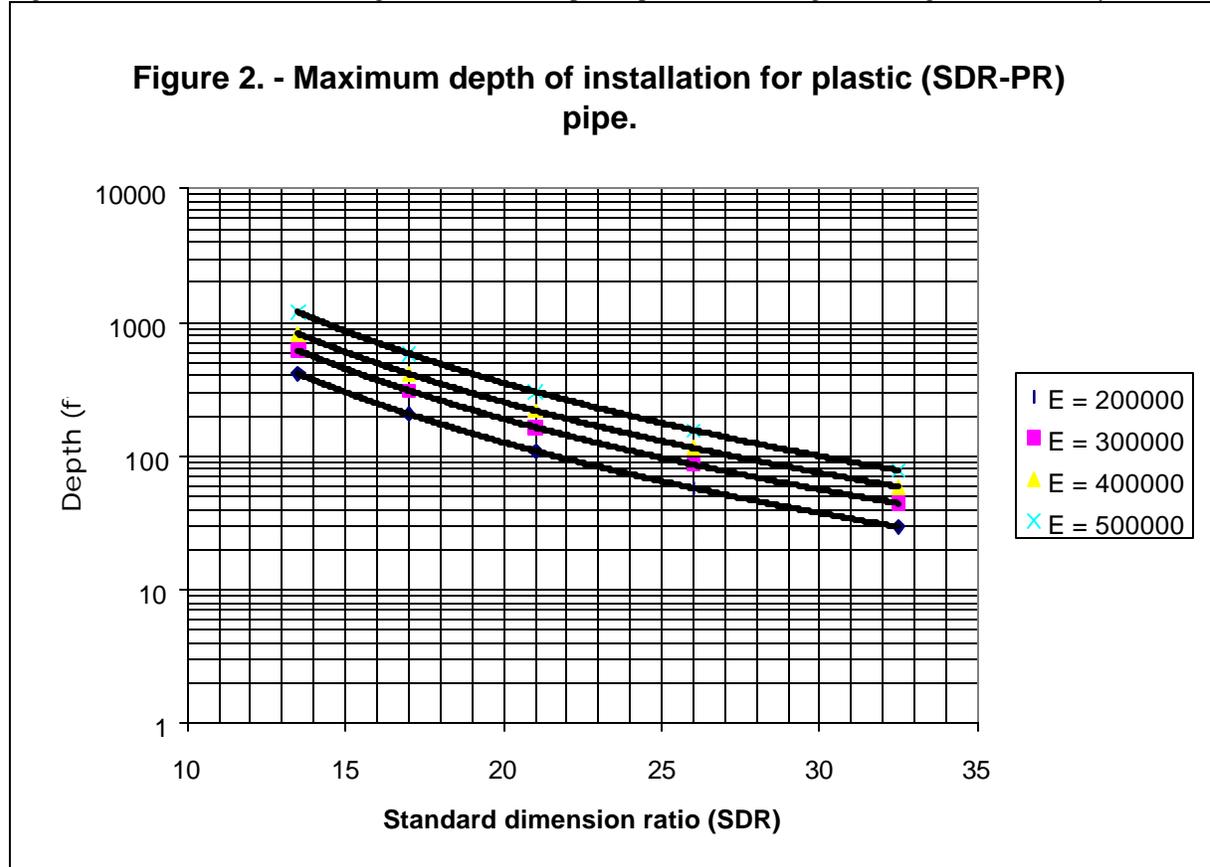


Table 3 gives the dimensions and maximum depth of installation for reinforced plastic mortar (RPM) well casings of various sizes and wall thickness.

Table 3. — Dimension and depth limitations for reinforced plastic well casings

Diameter (in.)	Maximum depth (ft)								
	20	60	100	200	300	400	500	750	1,000
	Minimum wall thickness (in.)								
8	0.17	0.17	0.23	0.23	0.23	0.29	0.29	0.33	0.33
10	.17	.17	.28	.28	.28	.36	.36	.41	.41
12	.18	.19	.34	.34	.34	.43	.43	.46	.46
14	.19	.22	.32	.40	.40	.43	.46	.43	.43
15	.19	.24	.34	.34	.46	.46	.46	.46	.46
16	.20	.25	.36	.36	.46	.46	.46	.46	.46
18	.21	.28	.40	.40	.45	.45	.45	.52	.52
20	.21	.31	.42	.42	.45	.45	.45	.54	.54
21	.21	.33	.48	.48	.48	.48	.48	.57	.57
24	.24	.38	.48	.48	.57	.57	.57	.57	.57
27	.26	.40	.49	.49	.49	.62	.62	.62	.62
30	.29	.44	.49	.49	.49	.68	.68	.68	.68
33	.32	.44	.60	.60	.60	.75	.75	.75	.75
36	.35	.48	.65	.65	.65	.82	.82	.82	.82

Reinforced concrete water well casings shall be limited to wells not greater than 500 ft. in depth.

Non-reinforced concrete well casing shall not be used in wells greater than 90 feet deep or required to withstand any tensile stress.

All steel casings shall be at least Schedule 40 as described in ASTM A-53. Maximum depth of installation shall be 3,800 feet unless a stronger grade of pipe is used.

Casings having a different wall thickness can be used in the same well if the maximum allowable depth for each is maintained.

Screens. All wells constructed to recover water from consolidated aquifers shall be equipped with manufactured screen sections, well points, or field perforated sections meeting the criteria stated below. The screen openings for aquifer material of near uniform size shall be smaller than the average diameter of the aquifer material. The screen or slotted casing section must be protected with a device immediately above the intake section if necessary to prevent well stabilizer materials from entering the intake section area.

The position of the screen in the well shall be governed by the depth of the aquifer below the ground surface and the thickness of the aquifer to be penetrated by the well. If practical, the top elevation of the screen shall be below the lowest

water level expected during pumping and be located opposite the most permeable area in the water-bearing strata.

For optimum production from a well in a non-artesian aquifer, the bottom one-third of the aquifer should be screened (if screen is required). In all cases optimum production and longevity requires that the drawdown should be at least ten feet above the top of the intake section

The screen or perforated casing should have at least the same life as the blind casing. The screen or perforated casing should be made of an equal or less corrosive material than the well casing or pipe to prevent galvanic corrosion.

Filter pack. Sand or gravel packs shall be used in wells constructed in fine materials of relatively uniform grain size to prevent the aquifer material from passing through the well screen or the perforated casing. The pack shall be 3 to 12 in. thick and shall consist of sand or gravel material having a D_{30} grain size 4 to 12 times the D_{30} grain size of the aquifer materials. Provisions shall be made for centering the casing in the filter pack.

Sanitary protection. *Wells will be designed to provide a safe water source for the proposed use of the water. Wells not meeting the requirements for producing water for human consumption should be so labeled at the well head. The label should clearly state the water from the well is unsafe for*

human consumption. When water from the well is to be used for human consumption, requirements of the South Dakota DENR, Office of Drinking Water, Pierre, shall be met. The annular spacing around the casing of a well for human consumption shall be grouted with neat cement. Wells shall be located a safe distance from sources of contamination. If sources are severely limited, a ground water aquifer that might become contaminated if adequately treated. Details

pertaining to local water wells such as depth, type of construction, and vertical zone of influence, together with data on the geological formations, and porosity of subsoil strata, shall be considered in determining the safe allowable distances. The minimum horizontal distance between the water supply and various structures or objects is listed in Table 4.

Table 4

Structure or Object	Minimum Horizontal Distance (ft.)
Sanitary landfill, wastewater stabilization pond, and waste disposal lagoon	1000
Waste water treatment plant, wastewater pumping station, wastewater drainage ditch, chemical warehouse, bulk oil storage facility, fertilizer storage facility	500
Wells supplied by aquifers whose formation to is less than 100 feet deep	
*Pollution Source	150
Wastewater system components or sewer lines	75
Lines that will meet water main standards	30
Wells supplied by aquifers whose formation top is more than 100 feet deep.	
*Pollution source	100
Wastewater system components or sewer lines	50
Lines that will meet water main standards	30
Ordinary high water mark of a public lake	100
Permanent structures	10
Overhead power lines	10

*Definition in Well Construction Standard - State of South Dakota 74:02:03:20. May include such items as cesspool, silo pit, seepage pit, livestock and poultry yards, privy, manure pile, septic tank, and disposal field.

If possible, wells shall be located in ground that is higher than any source of contamination or flooding. Drainage that might reach the source from areas used by livestock shall be diverted. Wells must be readily accessible for maintenance and repair and be located a safe distance from overhead utility lines or other safety hazards. Each well shall be provided with a water tight cover or seal to prevent the entry of contaminated water or other objectionable material. The annular space around the casing shall be at least three in. and shall be filled with cement grout, bentonite grout, or other approved materials to a depth that will seal off surface waters. The annular spacing may be less than three inches in hard rock to facilitate grouting. A positive seal shall be provided between the casing and the impervious material overlying the aquifer of artesian wells.

The casing shall extend at least 12 inches above the surface of the ground or floor of the well house. The surrounding ground shall slope away from the casing at least 1/4 inch per foot for at least 10 feet. If the water is to be used for human consumption, the annular space outside the casing must be filled with a watertight cement grout (as required by the State of South Dakota standards). If a service outlet is provided at the well, a concrete slab four

inches thick and extending at least two feet in all directions shall be provided around the casing.

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

OPERATION AND MAINTENANCE

A well will normally last considerably longer if operated at less than 70 percent of specific capacity. At least annually, the well site should be checked to see if any maintenance is needed, such as, diverting polluted water or repairing a damaged head.

PLANS AND SPECIFICATIONS

Plans and specifications for wells shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purposes.