

Chapter NR 112

WELL CONSTRUCTION AND PUMP INSTALLATION

NR 112.01	Purpose (p. 227)	NR 112.16	Samples and reports (p. 265)
NR 112.02	Applicability (p. 227)	NR 112.17	Pump installation and construction (p. 265)
NR 112.03	Definitions (p. 227)	NR 112.18	Well construction equipment (p. 299)
NR 112.04	Approved comparable construction (p. 234)	NR 112.19	Concrete and grout mixtures (p. 299)
NR 112.05	Existing installations (p. 234)	NR 112.20	Well disposal of pollutants (p. 308)
NR 112.06	Contracts for nonconforming installations (p. 234)	NR 112.21	Abandonment of wells (p. 308)
NR 112.07	Well location (p. 234)	NR 112.22	Cooperation with the department (p. 309)
NR 112.08	Drilled type well design and construction (p. 237)	NR 112.23	Standards for existing installations (p. 309)
NR 112.09	Bored type well design and construction (p. 246)	NR 112.24	Severability (p. 312)
NR 112.10	Driven point type well design and construction (p. 247)	NR 112.26	Well and pump installation approvals (p. 312)
NR 112.11	Dug type well design and construction (p. 250)	NR 112.27	Drinking water standards (p. 316)
NR 112.12	Reconstructing dug type wells (p. 253)		
NR 112.13	Springs (p. 254)		
NR 112.14	Surface protection (p. 256)		
NR 112.15	Miscellaneous well construction and pump installation requirements (p. 262)		

History: Chapter NR 112 as it existed on September 30, 1976 was repealed and a new chapter NR 112 was created effective October 1, 1976.

NR 112.01 Purpose. The purpose of this chapter is to establish uniform minimum standards and methods of procuring and protecting an adequate supply of ground water safe and fit for human consumption and for the preparation of food products through adequate construction or reconstruction of wells and reservoirs, installation of pumping equipment, or other methods approved by the department, in conformity with chs. 144 and 162, Stats. This chapter shall govern the location, construction or reconstruction and maintenance of wells and reservoirs, the installation and maintenance of pumping and treatment equipment, and the supervision of well drillers and pumping equipment installers.

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75; am. Register, April, 1978, No. 268, eff. 5-1-78.

NR 112.02 Applicability. The provisions of this chapter shall apply to all new and existing private water supplies, high capacity water systems, school water systems, and public water systems, except those for community water systems serving 15 or more living units.

Note: An approval from the department is required for high capacity water systems, school water systems and sewage treatment plant water systems pursuant to chs. 144 and 162, Wis. Stats., respectively, prior to construction of any well and installation of any pump. See NR 112.26.

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75; am. Register, April, 1978, No. 268, eff. 5-1-78; am. Register, September, 1978, No. 273, eff. 10-1-78.

NR 112.03 Definitions. For the purpose of this chapter the following terms are defined as follows:

Register, June, 1981, No. 306
Environmental Protection

(1) "Absorption pond" means an earth structure constructed for the purpose of slow disposal of treated sewage or other liquid wastes by soil seepage.

(2) "Adequate water supply" means a water supply which has a yield, where obtainable, and the pump capacity to provide the quantity of water which the user has stated is necessary for drinking, culinary, food processing and other purposes for which the water is intended to be used.

(3) "Animal enclosure" means a fenced yard or similar uncovered structure in which an area of 600 square feet or less is provided for each animal unit contained therein and in which animals are enclosed for any part of at least 30 separate days per year.

(4) "Animal lot" means a fenced yard or similar uncovered structure in which the concentration of livestock or poultry is such that a vegetative cover is not maintained.

(5) "Animal shelter" (paved) means a paved covered structure including but not limited to a house or barn in which animals are enclosed for at least any part of 30 separate days per year.

(6) "Animal shelter" (unpaved) means unpaved covered structures including but not limited to houses or barns in which animals are enclosed for at least any part of 30 separate days per year.

(7) "Animal unit" means an equivalent of 1,000 pounds of live animal weight.

(8) "Animal yard" means fenced in dirt or concrete area in which cattle or other livestock or poultry are enclosed and includes animal enclosures, animal lots, and animal shelters defined in NR 112.03 (3), (4) and (5) above.

(9) "Annular space" means the space between 2 concentric cylinders or circular objects, such as the space between an upper enlarged drillhole and initial protective casing pipe or between the initial protective casing pipe and an outer construction pipe or inner liner pipe or between an inner liner pipe and lower drillhole.

(10) "Approval" means the written approval of the department.

(11) "Cistern" means a covered tank in which rainwater from roof drains is stored.

(12) "Clay slurry" means a fluid mixture of native clay formation or commercial clay or clay mineral products and water prepared with only the amount of water necessary to produce fluidity.

(12m) "Community water system" means a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

(13) "Contaminant" means any matter which may render water bacteriologically or chemically impure or turbid so as to make it unfit for human consumption.

(14) "Clear water waste" means cooling water and condensate drainage from refrigeration compressors and air-conditioning equipment,

TABLE I
DRILLED TYPE WELL REQUIREMENTS

1 TYPE	2 NATURE OF WATER BEARING FORMATION (AQUIFER)	3 CRACKS OR FRACTURES OVERLIEING AQUIFER	4 MINIMUM INTERNAL CASING DIAMETER INCHES	UPPER ENLARGED DRILLHOLE				REGULAR DRILLHOLE		9 MINIMUM DRILLHOLE DIAMETER	10 MAXIMUM PROTECTIVE LINER DIAMETER	11 CONSTRUCTION CONDITIONS
				6 MINIMUM DIAMETER	5 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION	9 MINIMUM DRILLHOLE DIAMETER	10 MAXIMUM PROTECTIVE LINER DIAMETER			
1	Sandstone	Limestone to depth of 40' or less with or without unconsolidated overburden over the limestone.	6"	15' into firm sandstone.	Not applicable			8"	2" less than the lower diameter.	The upper enlarged drillhole through casing formations above the rock shall be kept open by temporary well casing with casing cemented by rotary casing or drilling mud and well cemented to formation over the rock in clay or sandstone which will instantly stand open, with rotary drilling the drill cuttings preferably will be removed by mud but use of air will be permitted for sandstone formation. The annular space surrounding the protective well casing shall be permanently filled with cement grout. The well shall be sealed to a depth of 10' below the top of contamination must be sealed off. See Note 2 below. Also see Appendix.	Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the casing pipe diameter shall be assembled with welded joints and sealed in place with cement grout. The casing shall be permanently filled with cement grout. The well shall be sealed to a depth of 10' below the top of contamination must be sealed off. See Note 2 below. Also see Appendix.	
2	Sandstone	Limestone extending to a depth greater than 40' with or without unconsolidated overburden over the limestone.	6"	40' or 10' into sandstone below 30'.	Not applicable			6"	2" less than the lower diameter.	The upper enlarged drillhole diameter need for only 2" greater than the minimum well casing pipe diameter when the well casing pipe is assembled with welded joints and sealed in place by an approved method or other approved method from the bottom of the casing upward.	Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout or other approved method from the bottom of the liner pipe upward.	

NOTE 1: Although the carbonate rocks in this state are primarily dolomites, the term limestone has been given to them in the well construction specifications because it is the common term given to them by the drillers.

NOTE 2: Casing only to the depth indicated in column 5, line p & q, for conditions of column 3, line p & q, is only acceptable as a minimum when it is adequate to seal off the vertical zone of contamination. Greater depth of protective casing is required in areas where well casings show that the vertical zone of contamination extends to a greater depth.

(a) *Well casing pipe.* The protective well casing pipe materials shall be steel pipe having the nominal diameters and the weights as specified in table 2, except that for wells for potable school water systems and high capacity water systems, the minimum wall thickness for 8-inch, 10-inch, and 12-inch diameter pipe shall be 0.322-inch, 0.365-inch, and 0.375-inch, respectively, and for non-potable systems pipe of any diameter used shall have an adequate wall thickness to make the well structurally sound.

TABLE 2
MINIMUM
CASING PIPE AND COUPLING
WEIGHTS AND DIMENSIONS

Size in Inches	Wgt. Lbs. Per Ft.		Pipe			Couplings		
	Threads & Coupling	Plain End	Thickness in Inches	Diameter - Inches		Threads Per Inch	External Diameter Inches	Length in Inches
1	1.70	1.68	.133	1.315	1.049	11-1/2	1.576	2-5/8
1-1/4	2.30	2.27	.140	1.660	1.380	11-1/2	1.900	2-3/4
1-1/2	2.75	2.72	.145	1.900	1.610	11-1/2	2.200	2-3/4
2	3.75	3.65	.154	2.375	2.067	11-1/2	2.750	2-7/8
2-1/2	5.90	5.79	.203	2.875	2.469	8	3.250	2-15/16
3	7.70	7.68	.216	3.500	3.068	8	4.000	4-1/18
3-1/2	9.25	9.11	.226	4.000	3.548	8	4.625	4-3/16
4	11.00	10.79	.237	4.500	4.026	8	5.200	4-5/16
5	15.00	14.62	.258	5.563	5.047	8	6.296	4-1/2
6	19.45	18.97	.280	6.625	6.065	8	7.390	4-11/16
6-5/8 OD	20.00	19.49	.288	6.625	6.049	8 R	7.390	7-1/4
7 OD	23.00	22.63	.317	7.000	6.366	8 R	7.657	7-1/4
8	25.55	24.70	.277	8.625	8.071	8	9.625	5-1/16
10	35.75	34.25	.307	10.750	10.136	8	11.750	5-9/16
12	45.45	43.77	.330	12.750	12.090	8	14.000	5-15/16
14 OD	57.00	54.57	.375	14.000	13.250	8	15.000	6-3/8
16 OD	65.30	62.58	.375	16.000	15.250	8	17.000	6-3/4
18 OD	73.00	70.59	.375	18.000	17.250	8	19.000	7-1/8
20 OD	81.00	78.60	.375	20.000	19.250	8	21.000	7-5/8
22 OD		114.81	.500	22.000	21.000			
24 OD		125.49	.500	24.000	23.000			
26 OD		136.17	.500	26.000	25.000			
28 OD		146.85	.500	28.000	27.000			
30 OD		157.53	.500	30.000	29.000			
32 OD		168.21	.500	32.000	31.000			
34 OD		178.89	.500	34.000	33.000			
36 OD		189.57	.500	36.000	35.000			

R - Round Threads

(b) *Assembly.* Well casing pipe shall be assembled watertight by means of joints welded in accordance with the standard welding procedure specifications of the department of industry, labor and human relations, Ind 53.53 (3), Wis. Adm. Code or by correctly mated, recessed type couplings as used on drill pipe, line pipe or reamed and drifted pipe and having weights and being threaded as indicated in table 2.

(c) *Pipe installation.* Well casing pipe shall be driven or installed so that no injury to the pipe results which may affect the quality of the water supply.

(d) *Pipe specifications.* 1. No used pipe may be installed as the protective well casing in the permanent construction of a well or for other

potable water supply use, except that the well constructor may reuse pipe withdrawn immediately from a newly constructed unsuccessful well or from a new well where the department requests the well constructor to reconstruct or replace it, provided the pipe has suffered no physical damage. The pipe used as the permanent protective well casing either in initial well construction, as a liner subsequent to the initial construction or for other potable water supply purpose shall be new pipe meeting any of the following standards, but further subject to freedom from injurious defects as listed in subd. 4.:

- a. ASTM A-53;
- b. ASTM A-106;
- c. ASTM A-120;
- d. ASTM A-589;
- e. API 5A;
- f. API 5AX;
- g. API 5L;
- h. API 5LX;
- i. AWWA C 200;

j. The standard outlined in subd. 3.

2. Except as provided in subd. 3., each length of pipe 2 inches in diameter or greater shall be legibly marked in conformance with the ASTM, API or AWWA marking specifications for the particular pipe standard showing, where respectively required, the manufacturer's name or trade mark; ASTM or AWWA marking or API monogram; standard; size in inches; weight in pounds per foot; whether seamless or welded and, if welded, type of weld; grade; and length in feet and tenths of feet.

3. It is permissible to use new weldable steel pipe having nominal diameters of Table 2 for 16 inch pipe or less and tested to a minimum hydrostatic pressure of 1200 p.s.i. and which is otherwise determined to be equivalent to pipe meeting the ASTM A-120 specification in accordance with the following procedures:

a. Each length of such pipe shall be pressure tested and shall be marked or labeled with the test pressure and a code mark acceptable to and registered with the department and the secretary of state, which shall act as certification that the pipe is equivalent to the ASTM A-120 specification.

b. Any entity which proposes to test its pipe in accordance with this subsection shall provide to the department a proposed testing program and procedure which shall be approved by the department prior to the initiation of the testing program.

c. As a part of the surveillance of the testing procedure, at a maximum of 8 unannounced times annually as determined by the department, an independent testing laboratory, contracted for by the entity supplying the pipe and acceptable to the department, shall inspect the testing procedure of the entity and perform hydrostatic tests on at least 10 lengths

of pipe in the entity's stock which has been tested and marked. In addition, the department may require that up to 10 lengths of pipe selected in any year by the department from stock of randomly selected well drillers shall be tested by an independent laboratory in Wisconsin acceptable to the department and contracted for by the entity supplying the pipe. No more than one length of pipe may be selected for testing during any visit. The transportation of the pipe to the laboratory and replacement of the driller's stock and the cost of the testing shall be the responsibility of the entity supplying the pipe. The results of the surveillance inspection and testing by the laboratories shall be reported to the department by the laboratories.

4. All pipe intended for water well construction or other potable water supply use within this state shall be subject to random examination by the department which may require any defective length of pipe or lots having more than 5% of pipe with lengths less than 5 feet to be rejected and returned to the manufacturer or supplier. Defective lengths shall include, but not be limited to:

- a. Pipe with girth welded joints;
- b. Pipe with welded patches;
- c. Pipe not conforming to the marking requirements of subd. 2. or 3.;
- d. Pipe with injurious defects, such as:
 - 1) Cracks;
 - 2) Open welds;
 - 3) Partial or incomplete welds;
 - 4) Open seams;
 - 5) Laminations in pipe wall which exceed 12½% of wall thickness;
 - 6) Slivers which exceed 12½% of wall thickness.

5. The above listed ASTM, API and AWWA references are available for inspection at the offices of the department of natural resources, the secretary of state and the revisor of statutes and may be obtained for personal use from the American Society for Testing and Materials; 1916 Race Street, Philadelphia, Pennsylvania 19103, the American Petroleum Institute, Division of Production, 300 Conigan Tower Building, Dallas, Texas 75201 and from the American Water Works Association, 666 West Quincy, Denver, Colorado 80235.

(e) *Bit sizes.* 1. Cable-tool drilling. Cable tool bits shall have a size no smaller than ¼ inch less than the nominal diameter of the drillhole to be constructed at the beginning of construction of a new rock hole or at the beginning of deepening of any existing rock hole. The bits shall be kept dressed.

2. Rotary drilling. a. Cone bits. Cone bits shall have a minimum size not less than ¼ inch smaller than the nominal diameter of the drillhole to be constructed.

b. Hammer bits. Hammer bits shall have a size no smaller than ¼ inch less than the nominal diameter of the drillhole to be constructed at the

beginning of drilling of a new rock hole or at the beginning of deepening of any existing rock hole.

(f) *Liner pipe for caving zones.* Liner pipe installed during or subsequent to the initial well construction to seal off a caving zone in a well shall be new, unused and non-reclaimed pipe but may have a lesser thickness than shown in table 2 for the nominal diameter of pipe used and may have the largest practical diameter permitting installation in the well.

(g) *Rotary-air drilling.* When constructing wells with combination rotary and cable-tool equipment, the respective drilling methods shall comply with the requirements for rotary-air drilling and for cable-tool drilling.

(h) *Water used in drilling.* Water needed in the construction of drillholes shall be clear water obtained from an uncontaminated source. Such water should be disinfected with chlorine so as to reduce to a minimum the time and effort involved in the required final disinfection of the well. (Note: See NR 112.15 (3) (a).)

(i) *Drilling delays following grouting.* Following placement of grout in the annular space between a protective well casing pipe and upper enlarged drillhole or between a protective liner pipe and lower drillhole and protective well casing pipe, drilling shall be delayed for a minimum of 24 hours, whether using either cable-tool or rotary equipment.

(3) **FLOWING WELLS.** The construction of flowing wells shall comply with the minimum requirements of NR 112.08 (2) and the following special conditions:

(a) Every practicable effort shall be made to extend the watertight (cased and cement grouted) construction into the upper confining bed of the artesian basin.

(b) When it is impractical to extend the watertight construction in accordance with paragraph (a), an adequate packer shall be set and maintained in the confining bed with a flowpipe extending therefrom to a point at least one foot above the established grade.

(c) The driller shall temporarily install an approved well seal with overflow pipe extending therefrom, if necessary, in which case a control valve shall be installed in the overflow pipe and the flow therefrom either limited or stopped. (Note: See figure 1.)

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75; am. table 1, Register, March, 1977, No. 255, eff. 4-1-77; am. (2) (Intro.) and (a), Register, April, 1978, No. 268, eff. 5-1-78; r. and recr. (2) (d), Register, June, 1981, No. 306, eff. 7-1-81.

NR 112

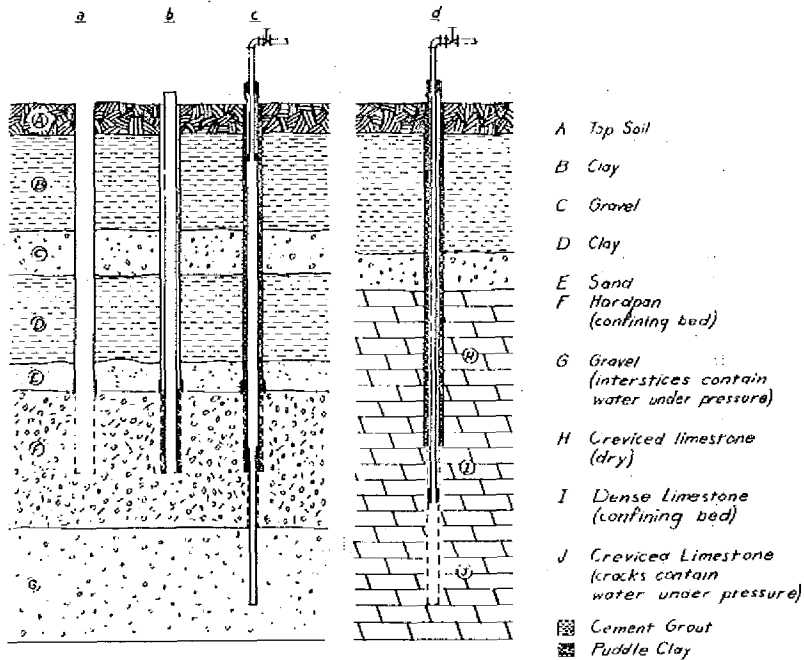


Figure 1. Principle of Construction and Control of Flowing Wells

NR 112.09 Bored type well design and construction. (1) GENERAL. The general construction requirements are the same as NR 112.08 (1).

(2) **SPECIFIC.** Through the vertical zone of contamination the construction of bored type wells shall conform to the specifications for drilled type wells prescribed by NR 112.08 (2). They shall also conform to the following additional requirements:

- (a) The minimum diameter of the casing pipe shall be 6 inches.

basements be located above the ground level or be at least 2 feet above the floor.)

(b) *Pit setting.* A deep well reciprocating, turbine or jet pump and set-length type force pump located in a conforming pit shall be so installed as to permit the sealing of the top of the well with an approved type watertight sanitary well seal with gasket, or an equivalent watertight connection with the pump. Any well vent pipe shall extend to the ceiling of the pit and terminate with a return bend and shall have a screened outlet.

(c) *Hand type pumps.* Hand type pumps may be continued in service provided that the pump base flange rests upon a casing flange and the flanges are separated by a gasket. The casing flange must be placed at least 6 inches above the ground or a concrete pump platform. If water is pumped from a hand pump to a reservoir, the piping attachment to the pump shall be made with permanent pipe fittings. Whenever a reservoir exists, the discharge pipe from the pump shall enter the reservoir in a watertight manner through that portion of the structure extending above the ground grade unless a subsurface reservoir supply line is connected to the well by an approved type pitless adapter for a submersible or deep well reciprocating pump and the supply line can be maintained under a positive head of at least 5 feet. The supply pipe in such case shall terminate at or no more than a few inches above the bottom of the reservoir and a float control switch or low and high water level electrical pump-control rods shall exist. Any check valve shall exist only in the portion of the pump discharge pipe located within the well.

(d) *Reservoirs.* 1. The roof of any existing reservoir shall be crack-free, reinforced, poured concrete having a thickness of at least 5 inches. The floor of the reservoir normally shall be crack-free poured concrete at least 4 inches thick. The walls of the reservoir shall be crack-free, reinforced, poured concrete at least 5 inches thick or equivalent construction. A 3-inch thick reinforced concrete facing on substantial masonry walls may be accepted as equivalent wall construction. Exception to this requirement will be made where masonry with mortared joints has been used in the construction of the walls, or roof or both and the masonry is crack-free.

2. The manhole curbing shall extend at least 12 inches above the ground grade unless the reservoir roof terminates above the ground grade, in which case the curbing shall terminate at least 6 inches above the reservoir roof. The manhole shall be provided with a tight-fitting, overlapping cover with a minimum of 3-inch wide skirted sides. The manhole cover shall preferably be constructed of welded sheet steel but one constructed of concrete will be acceptable. The manhole cover shall be fitted snugly over the manhole curbing so as to prevent entrance of insects and vermin into the reservoir.

3. Any reservoir overflow pipe shall be located just under the roof of the reservoir and entirely above the ground grade and terminate with a down-turned pipe with a screened outlet at a point at least 12 inches above the ground grade. If an existing overflow pipe is totally buried between the reservoir and its outlet, it shall be eliminated by properly sealing the pipe with concrete back to the reservoir.

NR 112

4. The reservoir location shall be equivalent to that required for an existing well.

(3) **INSPECTIONS.** Inspections of existing installations will be made for problem water supplies and also those requiring certification when staff are available to provide such service.

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75.

NR 112.24 Severability. Should any section, paragraph, phrase, sentence, clause or word of this chapter be declared invalid or unconstitutional for any reason, the remainder of this chapter shall not be affected thereby.

History: Cr. Register, June, 1975, No. 234, eff. 10-1-75.

NR 112.25 Effective date. **History:** Cr. Register, June, 1975, No. 234, eff. 10-1-75; r. Register, June, 1981, No. 306, eff. 7-1-81.

NR 112.26 Well and pump installation approvals. (1) **HIGH CAPACITY WELL APPROVALS.** (a) No wells shall be constructed, reconstructed, rehabilitated, installed or operated to withdraw water from underground sources for any purpose where the operating capacity, either singly or in the aggregate with that of other wells on the property will be in excess of 70 gallons per minute, unless the owner, lessee, or any other person having a possessory interest obtains a written approval from the department. In any case involving an application by a person other than the owner of the subject property the owner shall join in the application.

(b) If the department finds that a proposed high capacity well will reduce the availability of groundwater to any public utility as defined by s. 196.01, Stats., it may deny approval or grant a limited approval under which it imposes such conditions as to locations, depth, pumping capacity or rate of flow and ultimate use so that the water supply of any public utility will not be impaired.

(c) Any well constructed pursuant to this subsection shall be constructed in accordance with NR 112.08.

(d) Approval applications shall provide the following basic information:

1. Description of property, including any contiguous property owned or leased by the applicant.
2. Property owner, giving names of partners, if a partnership, and officials if a corporation.
3. Proposed well owner, giving name of lessee if lessee is to construct well.
4. Proposed well operator, giving name of lessee if lessee is to operate well.
5. Existing well locations on property.
6. Description of designs of existing wells and pump installations on same and contiguous property owned or leased by the applicant.