NR 112

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Anthony S. Earl
Secretary

BOX 450
MADISON, WISCONSIN 53701

IN REPLY REFER TO: _____

STATE OF WISCONSIN)
) ss
DEPARTMENT OF NATURAL RESOURCES)

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

I, Anthony S. Earl, Secretary of the Department of Natural Resources and custodian of the official records of said Department, do hereby certify that the annexed copy of Natural Resources Board Order No. W-89-76 was duly approved and adopted by this Department on September 16, 1976. I further certify that said copy has been compared by me with the original on file in this Department and that the same is a true copy thereof, and of the whole of such original.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the official seal of the Department at Pyare Square Building in the Village of Shorewood Hills, this 21st day of January, 1977.

Anthony S. Earl, Secretary

(SEAL)

STATE OF WISCONSIN NATURAL RESOURCES BOARD

IN THE MATTER of renumbering sections NR 112.03(55) through (73) and NR 112.07(2)(f) through (m); amending sections NR 112.07(2)(a), (b), (d) & (e), NR 112.08(2) Table 1, NR 112.17(4)(a)4.d., and Figures 13, 14 & 15; and creating sections NR 112.03(55), NR 112.07(2)(f) & (o) of the Wisconsin Administrative Code pertaining to well drilling	W-89-76

ORDER OF THE STATE OF WISCONSIN NATURAL RESOURCES BOARD

RENUMBERING, AMENDING AND CREATING RULES

Pursuant to the authority vested in the State of Wisconsin Natural Resources Board by sections 162.01 and chapter 227, Wisconsin Statutes, the State of Wisconsin Natural Resources Board hereby renumbers, amends and creates rules as follows:

SECTION 1 - Sections NR 112.03 (55) through (73) are renumbered to be sections NR 112.03 (56) through (74).

SECTION 2 - Section NR 112.03 (55) is created to read:

(55) "Sanitary building subdrain" means the horizontal portion of a drainage system within a building which cannot flow by gravity to the building drain.

SECTION 3 - Sections NR 112.07 (2) (a), (b), (d) and (e) are amended to read:

(a) Eight feet between well or reservoir and cast iron or equivalent sanitary or storm building sewer or sanitary or storm building drain or a basement floor drain connected to a cast iron or equivalent sanitary building sewer or sanitary building drain; cast iron or equivalent subdrain; cast iron or equivalent sewage sump; cast iron or equivalent milkhouse floor drain; cast iron or equivalent drain from a conventional silo or glass lined storage facility; cast iron or equivalent sewer conducting manure juices to point of disposal.

(b) Ten feet between well and independent clear water waste drain, rainwater downspout outlet, cistern, hydrant drain, or similar unit; building foundation-drain connected to independent clear water waste drain or other subsoil drain; nonconforming existing or unapproved new well pit, pump pit, pressure-tank pit, pressure-tank access pit or subsurface pumproom; nonconforming reservoir.

(d) Twenty-five feet between well or reservoir and watertight grease basin, septic tank, holding tank, subdrain other than cast iron or equivalent pipe; sewage sump other than cast iron or equivalent material; sanitary building or storm building sewer other than cast iron or equivalent material; sanitary building or storm building drain other than cast iron or equivalent material; floor drain connected to sanitary building sewer or drain of other than cast iron or equivalent pipe material; lake or stream shoreline; below-ground swimming pool.

(e) Twenty-five feet between well or reservoir and watertight barn gutter; animal barn pen with concrete floor; glass-lined storage facility without pit; conventional silo without pit but with concrete floor and proper drain; watertight, milkhouse floor drain other than cast iron or equivalent material; watertight, conventional silo drain or glass-lined storage facility drain other than cast iron or equivalent material; watertight sewer other than cast iron or equivalent material conveying manure juices.

SECTION 4 - Sections NR 112.07 (2) (f) through (m) are renumbered to be sections NR 112.07 (2) (g) through (n).

SECTION 5 - Sections NR 112.07 (2) (f) and (o) are created to read:

(f) Twenty-five feet between well or reservoir and a pressurized sewer, other than a street sanitary or storm sewer or similar sanitary or storm sewer piping comprising part of the drainage system on public or private property,

for which the required minimum separating distance between a well or reservoir and such sewers is specified in NR 112.07(2)(h),

(o) For the purpose of paragraphs NR 112.07(2)(a), (d) and (e), the term "equivalent" means, as it pertains to a cast iron sewer, drain or subdrain, approved plastic pipe as listed and limited in Wis. Adm. Code chapter H 62 (State Plumbing Code) for specific uses and as it pertains to a sewage sump, a plastic sump fabricated from a plastic material approved by the division of health, department of health and social services.

SECTION 6 - Section NR 112.08 (2), Table 1 is amended to read:

TABLE I

DRILLED TYPE WELL REQUIREMENTS

1	2	3	4	UPPER DRILLHOLE				9	10	11	
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
	NATURE OF WATER BEARING FORMATION TYPE (AQUIFER)	GEOLOGIC FORMATIONS OVERLYING AQUIFER	MINIMUM NOMINAL CASING DIAMETER INCHES	5 MINIMUM DIAMETER	6 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION	LOWER DRILLHOLE MINIMUM WELL DIAMETER	MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	CONSTRUCTION CONDITIONS	
a.	Sand or gravel	Sand or mixture of sand and gravel.	2"	None required with cable tool drilling but shall be casing diameter plus 4" if one is constructed. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool drilling. To depth of casing setting with rotary drilling.	2"	See Construction Conditions			The depth of protective well casing pipe will be governed by the pumping level. For pumping levels 20' or less the casing shall extend 10' below the pumping level. For pumping levels 20' to 25' the casing shall extend to a depth of 30'. For pumping levels greater than 25' the casing shall extend 5' below the pumping level. When an enlarged upper drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud and the annular space shall be permanently sealed with drilling mud or cement grout. See Note 1 below. Also see Appendix.	a,b,c Protective well casing placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward. An adequate screen shall be provided where necessary. It shall be installed in such manner that removal or replacement can be accomplished without adversely affecting the watertight construction of the well. Approval from the Department is required for a gravel-pack well construction in conformance with Section MR 112.04.
b.	Sand or gravel	Clay or similar material to depth of 30' or more, containing layers of sand or gravel.	2"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	5' into clay below any sand or gravel above the 20' depth with cable tool drilling. To depth of casing placement with rotary drilling.	2"	See Construction Conditions			The protective well casing pipe shall extend 5' below the pumping level. With cable tool drilling the upper enlarged drillhole shall be kept open with temporary well casing and the upper drillhole shall be kept 1/3 filled with clay slurry throughout the driving of the permanent well casing. The balance of the annular space shall be filled with clay slurry or cement grout. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud and the annular space shall be permanently sealed with drilling mud or cement grout. See Note 1 below. Also see Appendix.	
c.	Sand or gravel	Clay or similar material from the ground surface to varying depths.	2"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or a minimum of 20' whichever is the lesser with cable tool drilling. To the depth of casing setting with rotary drilling.	2"	See Construction Conditions			See (a-11) above for minimum casing depth requirements. With cable tool drilling, the upper drillhole shall be kept 1/3 filled with clay slurry throughout the driving of the permanent well casing. The balance of the annular space shall be filled with clay slurry or cement grout. With rotary drilling the upper enlarged drillhole shall be maintained at full diameter with drilling mud and the annular space shall be permanently sealed with drilling mud or cement grout. See Note 1 below. Also see Appendix.	

NOTE 1. Greater depth of casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct an enlarged upper drillhole to a depth of several feet with cable tool equipment by choice under geologic conditions of column 3, line a, to facilitate use of long lengths of pipe.

TABLE I
DRILLED TYPE WELL REQUIREMENTS

1	2	3	4	UPPER DRILLHOLE				9	10	11	
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
TYPE	NATURE OF WATER BEARING FORMATION (AQUIFER)	GEOLOGIC FORMATIONS OVERLYING AQUIFER	MINIMUM NOMINAL CASING DIAMETER INCHES	5 MINIMUM DIAMETER	6 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION	LOWER DRILLHOLE MINIMUM WELL DIAMETER	MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	CONSTRUCTION CONDITIONS	
d.	Limestone (See Note 3)	Unconsolidated materials, mainly sand or gravel, to depth of at least 40' to a radius of ½ mile. No record of sink holes, test holes, quarries or abandoned wells in above area.	6"	Casing diameter plus 4" if one is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool drilling. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. When an upper enlarged drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or with temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2' into the limestone. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	d,e Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.
e.	Limestone (See Note 3)	Clay or similar material or such materials with some sand and gravel zones to depth of at least 40' to a radius of ½ mile. No record of sink holes, test holes, quarries or abandoned wells in above area.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth, whichever is the lesser, with cable tool drilling. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. With cable tool drilling, the upper enlarged drillhole shall be kept open by temporary well casing, when necessary and shall be kept 1/3 filled with clay slurry throughout driving of the protective well casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line d. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	d,e,f Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
f.	Limestone (See Note 3)	Unconsolidated materials for depth less than 40' within a radius of ½ mile. No record of sink holes, test holes, quarries or abandoned wells in above area.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	10' into uncreviced rock below 30'.	Not applicable.		6"	2" less than the lower drillhole diameter.	The upper enlarged drillhole through caving formations above the rock shall be kept open by temporary well casing with cable tool drilling and with such casing or drilling mud with rotary drilling. If the formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by drilling mud but use of air will be permitted for such geologic formations. The annular space shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	f The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.

NOTE 1. Casing only to rock under conditions of column 3, lines d & e and to the depth indicated in column 6, line f for condition of column 3, line f, 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 histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct an enlarged upper drillhole with cable tool equipment by choice under geologic conditions of column 3, line d, to facilitate use of longer lengths of pipe.

NOTE 3. 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 drillers.

TABLE I
DRILLED TYPE WELL REQUIREMENTS

1	2	3	4	UPPER DRILLHOLE				9	10	11	
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
TYPE	NATURE OF WATER BEARING FORMATION (AQUIFER)	GEOLOGIC FORMATIONS OVERLYING AQUIFER	MINIMUM NOMINAL CASING DIAMETER INCHES	5 MINIMUM DIAMETER	6 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION	LOWER DRILLHOLE MINIMUM WELL DIAMETER	MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	CONSTRUCTION CONDITIONS	
g.	Shale (See Note 3)	Unconsolidated materials, mainly sand or gravel, to depth of at least 40' to a radius of ½ mile.	6"	Casing diameter plus 4" if one is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool drilling. To shale with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the shale formation. When an upper enlarged drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2' into the shale. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	g,h Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward. g,h,i Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward. i The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.
h.	Shale (See Note 3)	Clay or similar material or such materials with some sand and gravel zones to a depth of at least 40 feet to a radius of ½ mile.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth whichever is the lesser, with cable tool drilling. To shale with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the shale formation. With cable tool drilling, the upper enlarged drillhole shall be kept open with temporary well casing, when necessary, and shall be kept 1/3 filled with clay slurry throughout the driving of the protective casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line g. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	
i.	Shale (See Note 3)	Unconsolidated materials or limestone with or without unconsolidated formations above to a depth of less than 40' within a radius of 1/2 mile. No record of abandoned wells or test holes within the area.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	40 feet	Not applicable	See construction conditions.	6"	2" less than the lower drillhole diameter.	The upper enlarged drillhole through caving formations above the rock shall be kept open by temporary well casing with cable tool drilling and by such casing or drilling mud with rotary drilling. If the unconsolidated formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by mud but use of air will be permitted for such geologic formations. The annular space surrounding the well casing shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	

NOTE 1. Casing only to shale under conditions of column 3, lines g & h and to the depth indicated in column 6, line i, for condition of column 3, line i, is only acceptable as a minimum when adequate to seal off the vertical zone of contamination. Greater depth of protective casing is required in areas where well histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct an enlarged upper drillhole with cable tool drilling equipment by choice under geologic conditions of column 3, line g, to facilitate use of longer lengths of pipe.

NOTE 3. Wells normally shall not be developed into a shale formation. Such constructions are limited primarily to "Maquoketa" shale where the limestone is missing or very thin but only when the shale is known to be firm enough so that the drillhole will remain open and the water therefrom is not turbid. These wells may occur along the western edge of the Niagara dolomite extending from Door County to the Illinois border, at Blue Mound, at the Platteville Mound and in the Sinsinawa area in Grant County. Shale wells under similar geologic conditions in other areas of the state where overlying rock is missing or thin will also be acceptable.

TABLE I
DRILLED TYPE WELL REQUIREMENTS

1 TYPE	2 NATURE OF WATER BEARING FORMATION (AQUIFER)	3 GEOLOGIC FORMATIONS OVERLYING AQUIFER	4 MINIMUM NOMINAL CASING DIAMETER INCHES	UPPER DRILLHOLE				9 LOWER DRILLHOLE MINIMUM WELL DIAMETER	10 MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	11 CONSTRUCTION CONDITIONS	
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
				5 MINIMUM DIAMETER	6 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION				
j.	Granite or Quartzite (See Note 1)	Unconsolidated materials mainly sand or gravel, to depth of at least 40' to a radius of ½ mile.	6"	Casing diameter plus 4" if one is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. When an enlarged upper drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling equipment, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2' into the granite. The vertical zone of contamination must be sealed off. See Note 3 below. Also see Appendix.	j,k Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward.
k.	Granite or Quartzite (See Note 1)	Clay or similar material or such materials with some sand and gravel zones to a depth of at least 40' to a radius of ½ mile.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth whichever is the lesser with cable tool drilling. To rock with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated into the rock formation. With cable tool drilling the upper enlarged drillhole shall be kept open with temporary well casing, when necessary, and shall be kept 1/3 filled with clay slurry throughout the driving of the protective casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line j. The vertical zone of contamination must be sealed off. See Note 3 below. Also see Appendix.	j,k,l Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
l.	Granite or Quartzite (See Note 1)	Unconsolidated materials for depth less than 40' within a radius of ½ mile.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	40', See construction conditions for exceptions.	Not applicable.		6"	2" less than the lower drillhole diameter.	Normally 40' of pipe is required to seal off the vertical zone of contamination. An attempt shall be made to obtain water below 40' and at least to a depth of 75' even though water in quantity may be encountered during drilling at a depth above 40'. Should an adequate water producing zone not be encountered below 40' and down to a depth of 75' or lower, consideration may be given by the Department to permit production of the water above 40'. Department approval is required for such well. Other construction conditions are the same as for line f. The vertical zone of contamination must be sealed off. See Note 3 below. Also see Appendix.	l The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.

NOTE 1. Crystalline rocks are classed as granite because they are commonly referred to as granite by drillers regardless of their true rock type. This includes trap rock.
NOTE 2. Some drillers construct an enlarged upper drillhole with cable tool equipment by choice under geologic conditions of column 3, line j, to facilitate use of longer lengths of pipe.
NOTE 3. Casing only to rock under conditions of column 3, lines j & k and to the depth indicated in column 6, line l, for condition of column 3, line l, 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 histories show that the vertical zone of contamination extends to a greater depth.

TABLE I
DRILLED TYPE WELL REQUIREMENTS

1	2	3	4	UPPER DRILLHOLE				9	10	11	
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
TYPE	NATURE OF WATER BEARING FORMATION (AQUIFER)	GEOLOGIC FORMATIONS OVERLYING AQUIFER	MINIMUM NOMINAL CASING DIAMETER INCHES	5 MINIMUM DIAMETER	6 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION	LOWER DRILLHOLE MINIMUM WELL DIAMETER	MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	CONSTRUCTION CONDITIONS	
m.	Sandstone	Unconsolidated materials mainly sand and gravel to a depth of 25' or more.	6"	Casing diameter plus 4" if one is constructed with cable tool drilling. See construction conditions. Casing diameter plus 2" with rotary drilling.	None required with cable tool. Into firm sandstone with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. When an upper enlarged drillhole is constructed with cable tool equipment, the annular space shall be filled with clay slurry or cement grout placed in an approved manner. See Note 2 below. With rotary drilling, the upper enlarged drillhole shall be maintained at full diameter with drilling mud or with temporary well casing and the annular space shall be permanently sealed with drilling mud or cement grout, except that only cement grout shall be used when the upper enlarged drillhole is constructed more than 2' into the sandstone. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	m,n Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, as is only permissible with rotary-air drilling, shall be assembled with welded joints and sealed in place with drilling mud or cement grout placed in the annular space by a suitable pump from the bottom of the casing upward. m,n,o Protective liner pipe shall be assembled with welded joints, placed concentrically within the drillhole and sealed in place with cement grout placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
n.	Sandstone	Clay or similar material or such material with some sand and gravel zones to depth of 25' or more.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	To the bottom of the clay or to the 20' depth whichever is the lesser, with cable tool drilling. Into firm sandstone with rotary drilling.	6" with cable tool drilling. Not applicable with rotary drilling.	See construction conditions.	6"	2" less than the lower drillhole diameter.	The protective well casing pipe shall be firmly seated in the rock formation. With cable tool drilling, the upper enlarged drillhole shall be kept open by temporary well casing, when necessary and shall be kept 1/3 filled with clay slurry throughout the driving of the protective casing. The balance of the annular space shall be filled with clay slurry or cement grout applied in an approved manner. Construction conditions for drilling with rotary equipment are the same as above for line m. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	
o.	Sandstone	Any material except limestone to a depth of less than 25'.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	Into firm sandstone or to the 30' depth whichever is greater.	Not applicable.		6"	2" less than the lower drillhole diameter.	The upper enlarged drillhole through caving formations above the rock shall be kept open by temporary well casing with cable tool drilling and by such casing or drilling mud with rotary drilling. If the formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by mud but use of air will be permitted for such geologic formations. The annular space surrounding the protective well casing shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 1 below. Also see Appendix.	o The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing upward.

NOTE 1. Casing only to the depth indicated in column 6, lines m, n & o, for conditions of column 3, lines m, n & o, 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 histories show that the vertical zone of contamination extends to a greater depth.

NOTE 2. Some drillers construct enlarged upper drillholes to a depth of several feet with cable tool equipment by choice under geologic conditions of column 3, line m, to facilitate use of longer lengths of pipe.

TABLE I
DRILLED TYPE WELL REQUIREMENTS

1	2	3	4	UPPER DRILLHOLE				9	10	11	
				UPPER ENLARGED DRILLHOLE		REGULAR DRILLHOLE					
TYPE	NATURE OF WATER BEARING FORMATION (AQUIFER)	GEOLOGIC FORMATIONS OVERLYING AQUIFER	MINIMUM NOMINAL CASING DIAMETER INCHES	5 MINIMUM DIAMETER	6 MINIMUM DEPTH	7 MINIMUM DIAMETER	8 BOTTOM ELEVATION	LOWER DRILLHOLE MINIMUM WELL DIAMETER	MAXIMUM NOMINAL PROTECTIVE LINER DIAMETER	CONSTRUCTION CONDITIONS	
p.	Sandstone	Limestone to depth of 40' or less with or without unconsolidated overburden over the limestone.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	15' into firm sandstone.	Not applicable.		6"	2" less than the lower drillhole diameter.	The upper enlarged drillhole through caving formations above the rock shall be kept open by temporary well casing with cable tool drilling and by such casing or drilling mud with rotary drilling. If the formation over the rock is clay or material which will similarly stand open, with rotary drilling the drill cuttings preferably shall be removed by mud but use of air will be permitted for such geologic formation. The annular space surrounding the protective well casing shall be permanently filled with cement grout. The vertical zone of contamination must be sealed off. See Note 2 below. Also see Appendix.	pq Protective well casing pipe placed in an upper enlarged drillhole only 2" greater in diameter than the nominal well casing pipe diameter, shall be assembled with welded joints and sealed in place with cement grout placed in the annular space by a suitable pump 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 placed by a suitable pump or other approved method from the bottom of the liner pipe upward.
q.	Sandstone	limestone extending to a depth greater than 40' with or without unconsolidated overburden over the limestone.	6"	Casing diameter plus 4" with cable tool drilling. Casing diameter plus 2" with rotary drilling. See construction conditions.	40' or 10' into uncreviced rock below 30'.	Not applicable.		6"	2" less than the lower drillhole diameter.	The upper enlarged drillhole diameter need be only 2" greater than the nominal well casing pipe diameter when the well casing pipe is assembled with welded joints and the cement grout is placed in the annular space by a suitable pump or other approved pressure method from the bottom of the casing 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 6, lines p & q, for conditions of column 3, lines 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 histories show that the vertical zone of contamination extends to a greater depth.

SECTION 7 - Section NR 112.17 (4) (a) 4. d. is amended to read:

d. Unless an approved-type above-ground discharge unit is installed as illustrated in figures 14 and 15, or the discharge pipe is installed above grade and drains back above grade into the well between pumping cycles, the pump discharge line and accessory equipment installed above grade shall be protected against freezing by insulation of structure and piping and installation of dependable heating facilities, preferably a thermostatically controlled type.

SECTION 8 - Figures 13, 14 and 15 are amended to read:

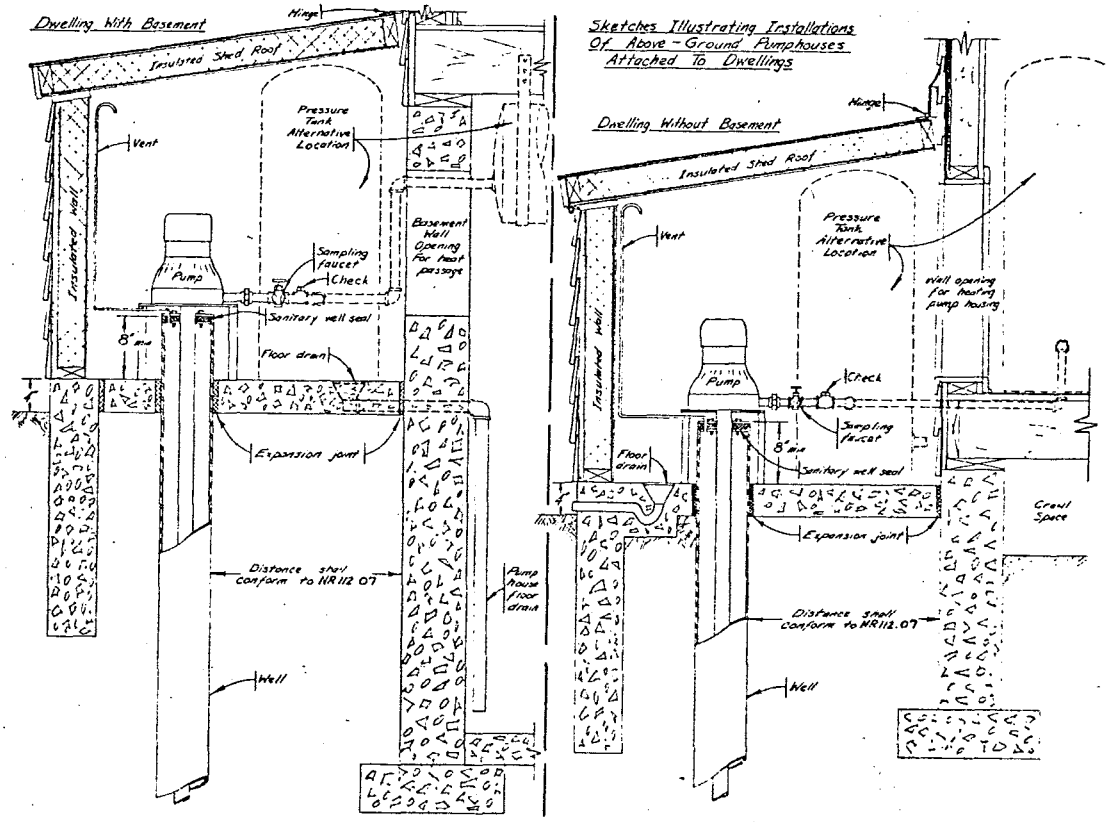

Figure 13. Insulated Pumphouse Adjoining a Dwelling.

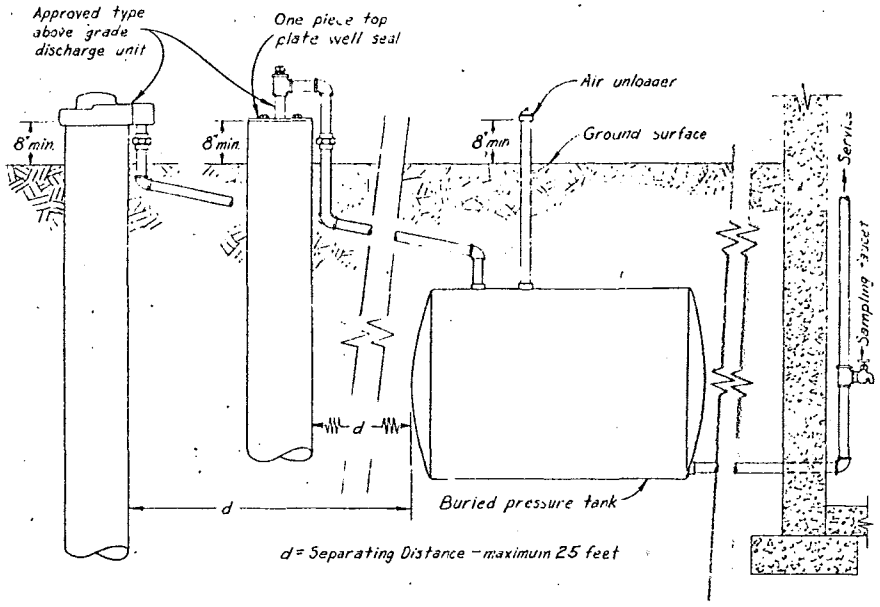

Figure 14. Pump Installations using Submersible Pumps and Approved Above-Ground Discharge Unit.

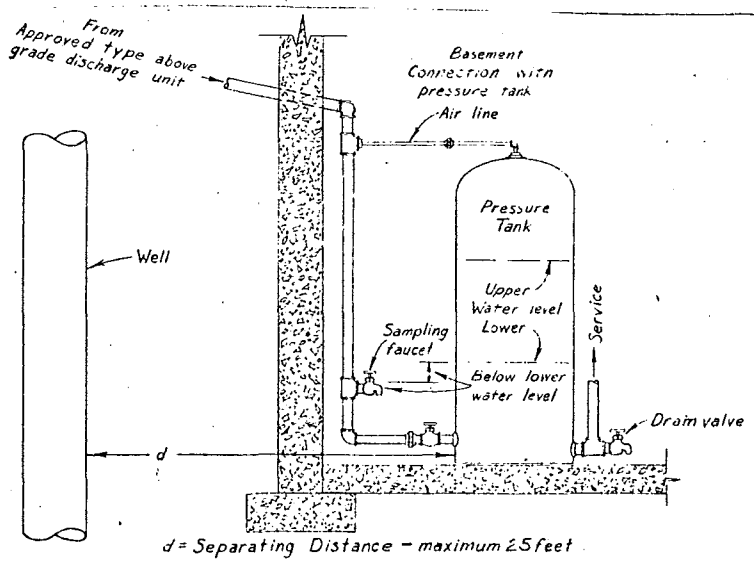

Figure 15. Alternative Pressure Tank Location with Submersible Pump Installation and Approved Above-Ground Discharge Unit.

The foregoing rules were approved and adopted by the State of Wisconsin Natural Resources Board on September 16, 1976.

The rules contained herein shall take effect upon publication.

Dated at Madison, Wisconsin 21 January 1977

STATE OF WISCONSIN DEPARTMENT OF NATURAL RESOURCES

By Anthony D. Earl
Anthony S. Earl, Secretary

(SEAL)