NATURAL RESOURCES COMMISSION
Information Bulletin #26
(Technical Update to DNR, Division of Water, Bulletin #3)
23 IR 168

SUBJECT: Recommended Guidelines for the Construction of Wells and the Type and Setting of Pumps for Wells Constructed in 1986, 1987, 1988, 1989, 1990, and 1991

1. INTRODUCTION

The following recommended guidelines apply to water wells constructed after December 31, 1985 and before January 1, 1992, *only.* The subject was considered in *Recommended Guidelines for the Construction of Wells and the Type and Setting of Pumps in the State of Indiana,* DNR Division of Water Bulletin #3, published at 9 IR 1242 (February 1, 1986). This "Technical Update" to DNR, Division of Water, Bulletin #3 contains no substantive changes from 1986. Only cross-references, citations, and similar non-substantive items are updated. In addition, background information contained in the original publication is not repeated here.

The purpose of this technical update is primarily to assist the public in understanding the limited application of the original publication of Bulletin #3, as well as its continued viability for wells constructed in 1986, 1987, 1988, 1989, 1990, and 1991. The substantive operation and effect of Bulletin #3 should continue uninterrupted as if this technical update had not been published.

The recommended guidelines contained in the 1986 publication of Bulletin #3 were issued under IC 13-2-2.5-5 (repealed) which required the Department of Natural Resources to "issue recommended guidelines for the construction of wells and the type and setting of pumps for use in the wells." Those guidelines were affirmed at IC 14-25-4 for "[w]ater wells constructed after December 31, 1985, but before the adoption of rules." See particularly IC 14-25-4-17(1)(B). The rules anticipated by IC 14-25-4 were originally codified at 310 IAC 16.5 and made effective January 1, 1991. 310 IAC 16.5 was repealed and superseded (effectively recodified) by 312 IAC 12 effective March 11, 1999. For water wells and pumps placed after December 31, 1990, 312 IAC 12 (and 310 IAC 16.5 before its repeal) govern.

2. DEFINITIONS

For the purpose of this information bulletin, the following definitions apply:

"**Available drawdown**" means the distance, in feet, between the static water level and the pump setting.
"**Aquifer**" means any underground geologic formation, consolidated or unconsolidated, which has the ability to receive, store, and transmit water in amounts sufficient for the satisfaction of any beneficial use.
"**Bedrock aquifer**" means all consolidated water-bearing formations which have the ability to receive, store, and transmit water in amounts sufficient for the satisfaction of any beneficial use.
"**Casing**" means pipe installed to prevent unwanted solids or liquids from entering the interior of a well.
"**Commission**" means the natural resources commission established by IC 14-10-1-1 (formerly IC 14-3-3-3)
"**Confined, unconsolidated aquifer**" means unconsolidated permeable geologic material containing water that is separated from the atmosphere by relatively impermeable material. Groundwater in confined aquifers exists under pressure.
"**Department**" means the department of natural resources.
"**Director**" means the director of the department.
"**Drawdown**" means the difference between the static water level and the pumping water level in a well.
"**Groundwater**" means all water occurring beneath the surface of the ground regardless of location or form.
"**Nonsignificant ground water withdrawal facility**" means a groundwater withdrawal facility of a person that, in the aggregate, has a withdrawal capacity of less than one hundred thousand (100,000) gallons of groundwater in one (1) day. A withdrawal capability of 100,000 gallons per-day corresponds to a pump capacity of approximately 70 gallons-per-minute.
"**Person**" means an individual, an incorporated or unincorporated organization or association, a trustee or legal representative, the state, a political subdivision of the state, the United States, or an agency of the state, or a

political subdivision of the state, or of the United States, or a group of such persons acting in concert; however, person does not include an operator engaged in coal mining subject to IC 13-4.1 before its repeal.

"**Piezometric surface**" means the level to which water will rise under its hydrostatic head in wells completed in confined aquifers.

"**Pitless adapter**" means a watertight unit designed and constructed for permanent attachment to the well casing. The pitless adapter provides necessary vent, electrical, discharge pipe connections while preventing the entrance of contaminants from surface sources from entering the well. It also permits termination of the well above the ground surface.

"**Potable water**" means water that at the point of use is acceptable for human consumption under prevailing governmental standards.

"**Pumping water level**" means the level of the water surface in a well when water is being discharged by pumping.

"**Saturated thickness**" means thickness, in feet, of the saturated portion of the aquifer.

"**Significant groundwater withdrawal facility**" means a groundwater withdrawal facility of a person that, in the aggregate from all sources and by all methods, has the capability of withdrawing one hundred thousand (100,000) gallons of groundwater or more in one (1) day. A withdrawal capability of 100,000 gallons-per-day corresponds to a pump capacity of approximately 70 gallons-per-minute.

"**Static water level**" means the level of water in a well which reflects natural non-pumping conditions.

"**Unconfined, unconsolidated aquifer**" means unconsolidated permeable geologic material containing water that is in direct vertical contact with the atmosphere through open spaces in the formation.

"**Water well**" means any excavation, however constructed, used for the purpose of withdrawing groundwater, except agricultural or urban drainage systems, for reasonable beneficial uses.

"**Water well drilling contractor**" means a person who owns or leases water well drilling equipment and who engages in the drilling of water wells, water test wells, water monitoring wells, or geothermal heat pump wells. [Effective January 1, 1998, IC 25-39-2-15 provided that "'water well driller' means a person who operates well drilling or driving equipment or engages in the drilling or driving of wells."]

"**Well seal**" means a device to cap a well or establish a water tight closure of the junction of a well pump or piping with the well casing at the upper terminal of the well, the purpose of which is to prevent contaminated water or other material from entering the well.

"**Yield**" means the quantity of water per unit of time which may be produced from a well once a stabilized pumping level is attained.

3. GENERAL REQUIREMENTS

As required by IC 25-39-1 (since repealed) during its period of effectiveness, every water well, water test, water monitoring or geothermal heat pump well must have been constructed by a water well drilling contractor holding a valid water well drilling contractor's permit granted by the department, and a permit certificate issued by the department for each unit of water well drilling equipment that the contractor operates. [Effective January 1, 1988, IC 25-39 provided that all water well drillers must be licensed by the Department of Natural Resources.]

The contractor was also required to keep accurate records for each well drilled and to report this information to the department's division of water within 30 days after completion of the well.

Every water well was required to be adapted to the geological formation and ground water conditions at the site. Water bearing formations which had undesirable characteristics or were subject to contamination must have been excluded by installing casing or a liner and properly sealing.

Every water well was to have been located to utilize every natural protection available in order to promote sanitary conditions. The finished well casing or pitless adapter was required to extend at least one (1) foot above the ground level or two (2) feet above the maximum flood level, whichever was greater. The water well must also have been as far removed as possible from any source of contamination, but no closer than the minimum distances specified in Section 2.2 of the Indiana State Board of Health Bulletin PWS 2 - *Standards for Construction of Private Water Wells and Water Systems.*

Every water well was required to be located at a maximum practicable distance from existing high-capacity wells in order to minimize the impacts of the high-capacity pumpage.

The water well was required to be constructed and equipped with a pumping system capable of providing a sufficient quantity of water to meet required needs. The well was required to be tested for yield by test pumping for a period of one (1) hour or until a pumping water level had been established. Recommended minimum well yield was five (5) gallons-per-minute with no well yielding less than three (3) gallons-per-minute. Air development of a well was not considered an adequate method of test pumping.

To reduce the possibility of bacterial contamination, new water wells were required to be properly disinfected. Recommended disinfection procedures were available in Sections 7.1 and 7.2 of PWS 2 - *Standards for Construction of Private Water Wells and Water Systems.*

The following method was recognized by the department as establishing reasonable evidence of prior potability. After pumping the well to remove all disinfectant, a water sample was required to be collected in a sterile bottle provided by a certified laboratory for bacterial analysis. The sample was required to contain less than two (2) coliform organisms per 100 milliliters of water. In addition to bacteriological testing, a chemical analysis of the water was recommended. The recommended analysis would include:

Hardness (as $CaCO_3$)	Iron (Fe)
pH	Manganese (Mn)
Specific Conductance (SpC)	Nitrate (NO_3)
Alkalinity	Fluoride (F)
Chloride (C1)	Hydrogen Sulfide (H_2S)

It was stated to be the well owner's responsibility to collect the required samples and obtain the laboratory analyses necessary to establish potability of the water supply. Copies of both the bacteriological and the chemical analysis reports were required to be filed by the well owners with the department's division of water. If a well owner had valid reason to believe the water well was contaminated with manmade chemicals or substances originating from a source not on the owner's property, the county health department or the Indiana Department of Environmental Management's Groundwater Section should have been contacted.

4. WATER WELL CONSTRUCTION CRITERIA

Well Casing. The minimum casing diameter for every new well was to have been at least four (4) inches nominal inside diameter and was to have been at least one (1) inch larger than the maximum outside diameter of the permanent pumping equipment. The casing was required to be steel or thermoplastic material and to be of sufficient thickness and quality to protect the well against structural deficiencies during construction, and against contamination by surface water or other undesirable materials during the expected life of the well. Ferrous casing was required to be new, first class material meeting ASTM Standards A-120 or A-53, or API Standards API-5A or API-5L. Thermoplastic pipe was required to comply with ASTM-F480. Minimum standards for both steel and thermoplastic pipe were set forth in Section 3.2 of PWS 2 - *Standards for Construction of Private Water Wells and Water Systems.* The casing pipe was not to be used as a suction pipe.

Well Screen. Water wells constructed in unconsolidated formations were required to be equipped with a screen having adequate openings to provide maximum water transmittance with respect to the size of the water bearing formation or gravel pack. Recommended screen materials included stainless steel, Everdur bronze, fiberglass, P.V.C., or A.B.S. plastic. Slotted pipe of any type and iron or mild steel screens were not acceptable.

Pitless Adapter. Pitless adapter units were required to be connected to the well casing by a mechanical connection, threading or welding in order to provide a watertight connection. The pitless adapter was required to be commercially manufactured and pressure tested at maximum pumping pressures produced by the water system with no weeping or leakage. The cap, cover, or sanitary seal were required to be self-draining and to overlap the top of the casing extension with a downward flange. The design of the pitless unit was required to be such that the pump tubing or column pipe could not be dropped into the well by misalignment in assembly or reinstalling the integral parts of the adapter. No well pits were allowed.

5. WATER WELL CONSTRUCTION AND PUMP INSTALLATION GUIDELINES

Well Construction in Unconfined, Unconsolidated Aquifers. Wells completed in unconfined, unconsolidated aquifers were required to be at least 30 feet deep and, in order to maximize the development of the source aquifer, the well was required to penetrate at least 50% of the saturated thickness of the source aquifer. If the saturated thickness of the source aquifer was unknown, the department's division of water was required to be consulted to establish a reasonable estimate of the saturated thickness.

Well casing was required to have a minimum of four (4) inches outside diameter and to be at least one (1) inch larger than the maximum outside diameter of the permanent pumping equipment. The well was required to be equipped with at least three (3) feet of properly sized (slot opening) well screen, having an outside diameter of at least three (3) inches.

The pumping apparatus was required to have at least 20 feet of available drawdown.

Example: Well: 35 feet deep
Static Water Level: 10 feet
Minimum Pump Setting Depth: 30 feet
(10 feet + 20 feet = 30 feet)
Available Drawdown: 20 feet
(See Figure 1.)

While shallow well jet pump systems were acceptable for wells completed in unconfined, unconsolidated aquifers, it was recognized they were often limited by their effective lift capabilities. If the requirements of the preceding paragraph could not be met by a shallow well jet pump unit, then a deep well jet or submersible system was required.

Well Construction in Confined, Unconsolidated Aquifers. Wells completed in confined, unconsolidated aquifers were required to be at least 40 feet deep and, in order to maximize the development of the source aquifer, the well was required to penetrate at least 50% of the source aquifer thickness. If the thickness of the source aquifer was unknown, the department's division of water was required to be consulted to establish a reasonable estimate of the aquifer thickness.

Well casing was required to have a minimum of four (4) inches inside diameter and to be at least one (1) inch larger than the maximum outside diameter of the permanent pumping equipment. The well was required to be equipped with at least three (3) feet of properly sized (slot opening) well screen, having an outside diameter of at least three inches.

The pumping apparatus was required to have at least 30 feet of available drawdown.

Example: Well: 45 feet deep
Static Water Level: 10 feet
Minimum Pump Setting Depth: 40 feet
(10 feet + 30 feet = 40 feet)
Available Drawdown: 30 feet
(See Figure 2.)

Deep well jet or submersible pumps were recommended for all installations.

Well Construction in Bedrock Aquifers. Wells completed in bedrock aquifers were required to be at least 60 feet deep and to penetrate a minimum of ten (10) feet of the aquifer being utilized. Greater penetration of the source aquifer was seen as necessary in some areas to obtain a dependable water supply and to have at least 50 feet of available drawdown.

Well casing was required to have a minimum of four (4) inches inside diameter and to be at least one (1) inch larger than the maximum outside diameter of the permanent pumping equipment. All casing was required to be installed in accordance with Section 3.2B, 1 and 2 of PWS 2-*Standards for Construction of Private Water Wells and Water Systems*.

The pumping apparatus was required to have at least 50 feet of available drawdown.

Example: Well: 100 feet deep
Static Water Level: 30 feet
Minimum Pump Setting Depth: 80 feet
(30 feet + 50 feet = 80 feet)

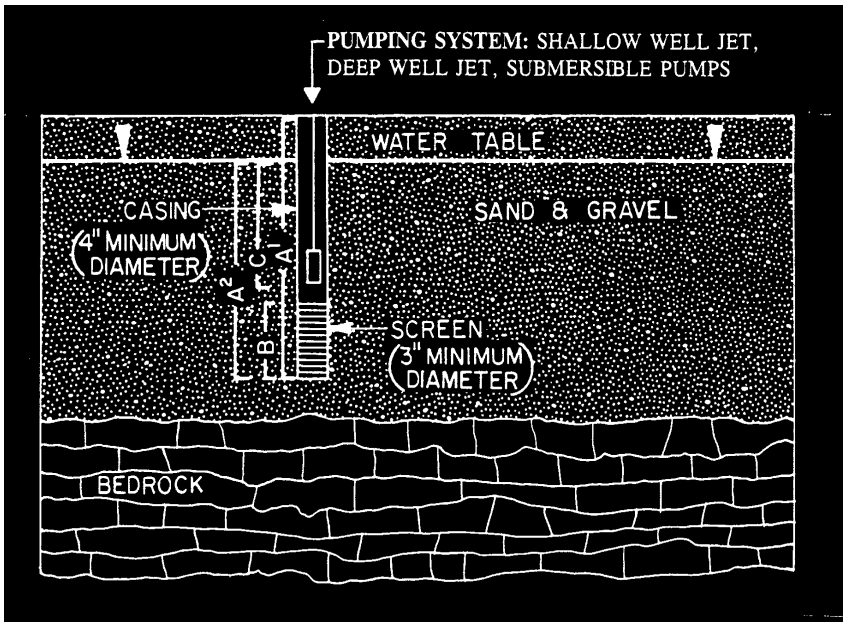
Available Drawdown: 50 feet
(See Figure 3.)

Deep well jet or submersible pumps were recommended for all installations.

6. SPECIAL PROVISIONS

When a written complaint was received from a person that a well in the person's possession had failed to furnish its normal supply of water, or that it supplied water which was no longer potable, representatives of the department sometimes needed to measure the water level in the well to determine if a substantial lowering of the water level had occurred. It was the responsibility of the owner to provide access to the well for such purposes and to provide any reasonable information in the owner's possession that might have been necessary in evaluating the loss of normal supply in the well.

WELL CONSTRUCTION - UNCONFINED, UNCONSOLIDATED AQUIFER



A^1) Well shall be a minimum of 30 feet in depth.

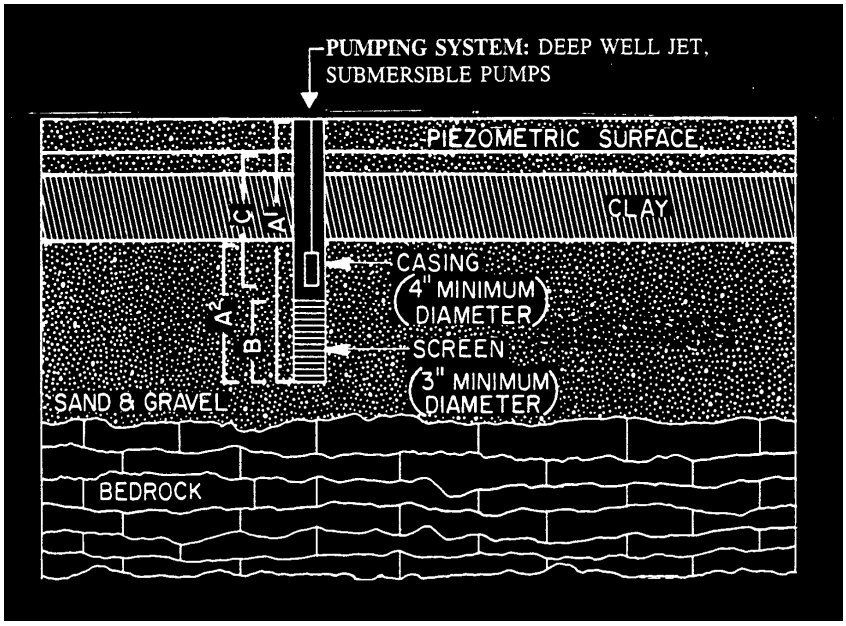
A^2) The well shall penetrate at least 50% of the saturated thickness of the source aquifer.

B) Well casing shall be a minimum of four (4) inches inside diameter and be at least one (1) inch larger than the maximum outside diameter of the permanent pumping equipment. The well shall be equipped with at least three (3) feet of properly sized (slot opening) well screen, having an outside diameter of three (3) inches or greater.

C) Pumping apparatus shall have a minimum of 20 feet of available drawdown.

FIGURE 1. RECOMMENDED GUIDELINES: WELL CONSTRUCTION IN UNCONFINED, UNCONSOLIDATED AQUIFERS.

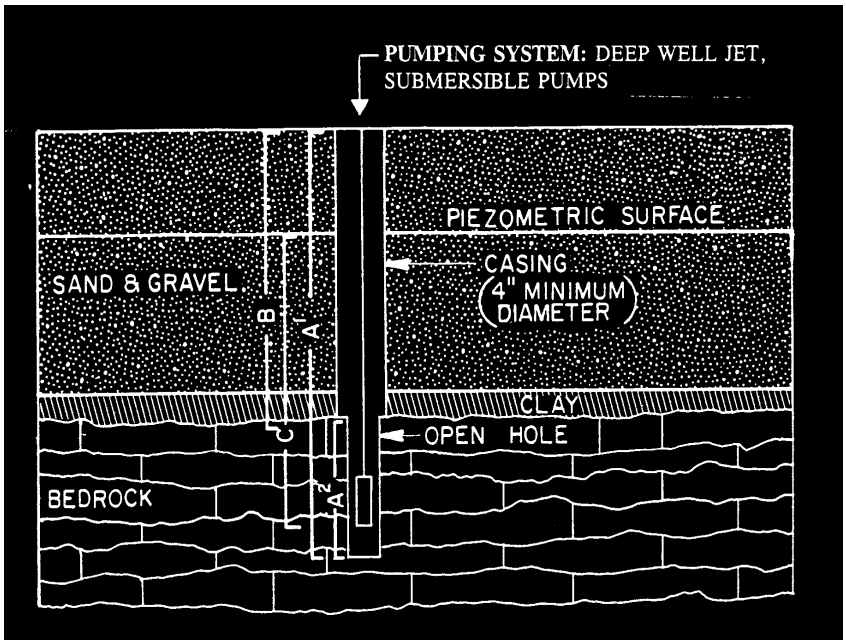
WELL CONSTRUCTION - CONFINED, UNCONSOLIDATED AQUIFER



A[1]) Well shall be a minimum of 40 feet in depth.
A[2]) The well shall penetrate at least 50% of the aquifer thickness.
B) Well casing shall be a minimum of four (4) inches inside diameter and be at least one (1) inch larger than the maximum outside diameter of the permanent pumping equipment. The well shall be equipped with at least three (3) feet of properly sized (slot opening) well screen, having an outside diameter of three (3) inches or greater.
C) Pumping apparatus shall have a minimum of 30 feet of available drawdown.

FIGURE 2. RECOMMENDED GUIDELINES: WELL CONSTRUCTION IN CONFINED, UNCONSOLIDATED AQUIFERS.

WELL CONSTRUCTION - BEDROCK AQUIFER(CONFINED OR UNCONFINED)



A[1]) Well shall be a minimum of 60 feet in depth.
A[2]) A minimum of ten (10) feet of the aquifer shall be penetrated.
B) Well casing shall be a minimum of four (4) inches inside diameter and be installed in accordance with **PWS 2.**
C) Pumping apparatus shall have a minimum of 50 feet of available drawdown.

FIGURE 3. RECOMMENDED GUIDELINES: WELL CONSTRUCTION IN BEDROCK AQUIFERS.