Rural Wellhead Protection Fact Sheet

LOCATING NEW WELLS

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INTRODUCTION

Properly locating a drinking water supply well is one of the simplest ways to help assure a safe water supply. It is the well owner's responsibility to ask well drillers to put domestic wells in appropriate locations. Incorrectly sited domestic water wells can be highly susceptible to contamination. Current land use should be of utmost consideration when siting your well; please refer to the ***Setback Distances*** **Fact Sheet** for additional information. When siting a new well, consider existing contaminant sources and possible expansions into currently undeveloped areas (additions to a house, barn or corral).

LOCATION

The first step in determining the location of a new well should be to find information on water wells in your area. Information can be obtained from various federal, State and local agencies listed in the ***References/Contacts*** section at the end of this **Fact Sheet**. The State Engineer's Office (SEO) has information on permitted wells across the State and can be reached in Cheyenne at (307) 777-7354. By providing the legal description of your property, you can obtain drilling logs of wells in your area that may help identify potential water bearing zones. This information will help in estimating the depth and cost of your well. Drillers familiar with your area are also a valuable source of information. In addition, assistance in determining the occurrence and depth to water bearing zones can be obtained by a professional geologist, well contractor, or the Wyoming Geological Survey, Water Resources Division, in Laramie ((307) 766-2286). The cost of having good professional assistance before drilling a new well may be far less than the cost of additional drilling to replace a poorly designed well.

The distance your well is away from a potential source of contamination is called a setback. These distances provide a margin of security for your well should some accident or spill occur. The suggested setback distances vary depending on the contaminant and local subsurface conditions. Minimum acceptable setback distances are provided in the ***Setback Distances*** **Fact Sheet**.

Whenever possible, wells should be located at high points on your ranch/ farm to prevent surface water runoff from being channeled towards topographic lows and into the wellhead area. New wells should also be located upgradient from any potential sources of contamination. Potential sources of contamination on typical ranches and farms are identified in the ***Contaminant Sources*** **Fact Sheet**. Also, you should site a new well away from your property boundary (toward the center of your lot) so that you have control over the use of land in the area surrounding your well.

Groundwater flow direction is an important consideration when placing a new well. In general, groundwater in water table aquifers flows in the same direction as surface water flow; therefore, topographically high locations may be protected from groundwater contamination. However, groundwater flow directions do not always correspond to surface water flow directions (ground surface topography). This becomes extremely important in water table aquifers near streams, where groundwater flow direction can change due to effects of high water flows in streams during spring runoff. Seasonally high and low stream levels should be considered when evaluating groundwater flow direction in water table aquifers near streams.

HYDROGEOLOGY

The availability and movement of water in the subsurface is controlled by many factors. Some of these factors include: physical characteristics and slope of the water bearing formations, depth to water, recharge area, and ground surface slopes. Obtaining these types of information before drilling will improve the likelihood of drilling and developing a productive well.

Aquifers are water bearing formations composed of unconsolidated (loose) materials, consolidated rock or a combination of both materials. Unconsolidated materials range from loose gravel, sand, silt or clay. Consolidated formations (**Figure 1**) can consist of sandstone, shale, granite, and many other rock types. Most people are aware how water can travel through unconsolidated aquifers such as gravel, but many people don't know that groundwater moves in consolidated aquifers in much the

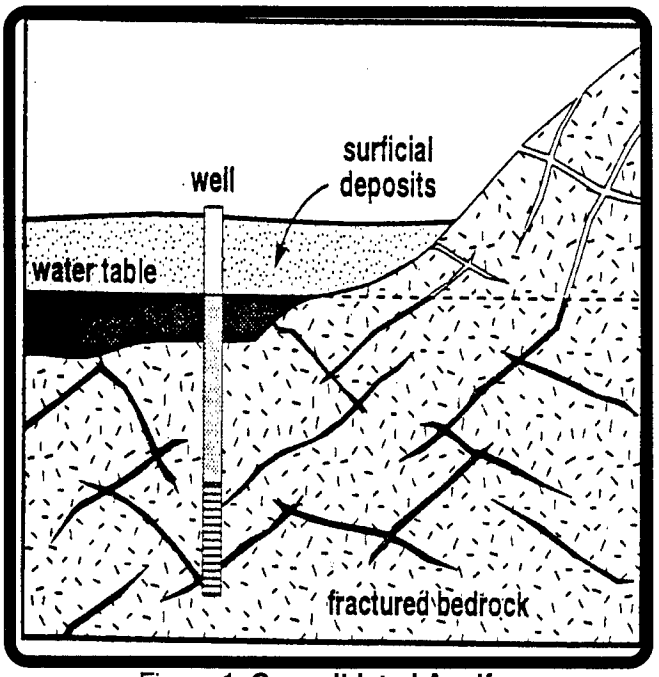

Figure 1. **Consolidated Aquifer**

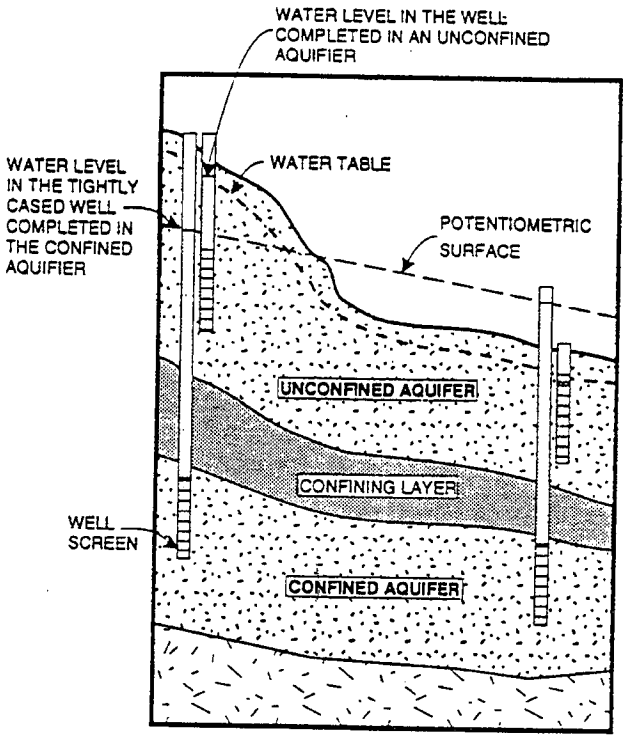

Figure 2. Confined and Unconfined Aquifers

same way. Open spaces, pores or fractures, can transmit water at varying rates. The pore space in consolidated sandstone may transmit adequate amounts of water for your well; however, highly fractured sandstone or limestone may transmit many times that amount of water. The decisions about what formation your well will be completed in can affect how much water your well can supply.

Aquifers can be classified as unconfined or confined **(Figure 2)**. Unconfined aquifers are water table aquifers that are at atmospheric pressure. Confined aquifers are overlain by an impermeable layer, such as clay or shale, that prevents the upward movement of water. The overlying confining layer allows aquifers to develop pressures that result in artisan aquifers. Most confined aquifers are actually semi-confined because the confining layer is not completely impermeable.

SHALLOW WELLS

Many wells in Wyoming are in alluvial valleys, lowlands next to streams and rivers. These shallow wells can be very productive and produce high quality water; however, shallow aquifers are the most vulnerable to pollution from surface activities. The depth to groundwater in many shallow wells is directly influenced by water levels in nearby streams, and can fluctuate several feet in response to seasonal stream changes. Seasonal variations can also cause water quality changes.

When drilling a well near streams or rivers during periods of high water levels, seasonal water table changes must be taken into account. The screened interval must be deep and long enough to allow for seasonal fluctuations. The well screen should be placed deep enough in the target water-bearing zone to avoid having the well go dry or avoid insufficient water yields during low water table conditions. For example, shallow wells next to agricultural lands can show drastic water table rises during irrigation periods. Well screen depth should be designed to prevent the impacts from agricultural practices such as the application of fertilizers or pesticides during irrigation periods. The well design should include casing and sealing material (bentonite or concrete grout) to prevent surface water and shallow groundwater from seeping down alongside the outside of the well casing and contaminating deeper groundwater supplies. A well located next to an irrigation ditch, sub-irrigated land, or a subsurface tile drain system may have a high potential for contamination from agriculture applications of pesticides and herbicides. Additional information on these topics are presented in the ***Contaminant Sources*** and ***Well Construction*** **Fact Sheets**.

DEEP WELLS

Deep wells are more costly to drill than shallow wells and present additional difficulties in assessing the subsurface aquifer conditions and the chances of encountering adequate water quantities. Costs for deep wells increase due to increased drilling difficulty,

additional labor and material costs, and increased pump size requirements. The drilling method chosen can significantly increase or decrease the time to reach the desired depth of the well. Care must be taken during well construction to prevent water from undesirable shallow aquifers from entering the deep well. Poor quality water from aquifers shallower or deeper than the target aquifer can reduce the overall water quality of the well. Properly casing and completing the well can prevent this from occurring. It is recommended that guidance be obtained from a professional geologist, well contractor, or the Wyoming Geological Survey, Water Resources Division, in Laramie ((307) 766-2286) on the construction design of deep wells.

WELL CONSTRUCTION METHODS

Drilled water wells have distinct advantages over other installation methods such as dug wells or driven well points, due to the quality of the finished well. Many drilling methods can be used; each has particular advantages and disadvantages depending on the depth of the well, formations to be penetrated, cost, speed, and other factors. Almost all drilling methods use water, air or some kind of drilling fluid to remove the rock fragments from the borehole. Care must be used if drilling fluids must be used to ensure that the drilling fluid used will not contaminate your aquifer or present a problem with development of the finished well.

References/Contacts

Additional Reading:

Freeze, Allan R. and Cherry John A., Groundwater, Prentice-Hall, Inc., NJ, 1979.

Bouwer, H., Groundwater Hydrology, McGraw-Hill, 1978.

USEPA Seminar Publication-Wellhead Protection: A Guide for Small Communities, US Government Printing Office, EPA/625/R-93/002, February 1993.

Driscoll, Fletcher G., Groundwater and Wells, 2nd. Edition, Johnson Division, St. Paul, MN, 1987.

Contacts

Wyoming Dept. of Environmental Quality, Water Quality Division, 122 W. 25th St. 4W, Cheyenne, WY 82002, (307)777-7781.

Wyoming State Engineers Office, 122 W. 25th St. Herschler Bldg., 4E, Cheyenne, WY 82002, (307)777-7354.

Geological Survey of Wyoming, P.O. Box 3008, University Station, Laramie, WY 82071-3008, (307)766-2286.

U.S. Geological Survey, Water Resources Division, 2617 E. Lincolnway, Cheyenne, WY 82007, (307)772-2153.

U.S. Environmental Protection Agency, Region VIII, 999 18th St., Suite 500, Denver, CO 80202-2466, 1-800-227-8917.

University of Wyoming Water Resources Center, P.O. Box 3067, University Station, Laramie, WY 82071-3067, (307)766-2143.

Drinking Water Quality Standards

U.S. Environmental Protection Agency's Safe Drinking Water Hotline. Call toll free 1-800-426-4791 from 8:30 A.M. to 5:00 P.M. Eastern Time.

Water Quality Testing: Laboratories/Information

County Health Departments or County Extension Agents.

Wyoming Department of Agricultural, Analytical Services, 1174 Snowy Range Road, Laramie, WY 82070, (307)742-2984.