WATER SMARTS

A Well and Septic System Owner's Guide to Ground Water in the Upper Arkansas Area Chaffee, Custer, Fremont, and Lake Counties, Colorado

By the Upper Arkansas Area COG
In association with the USGS Pueblo Office

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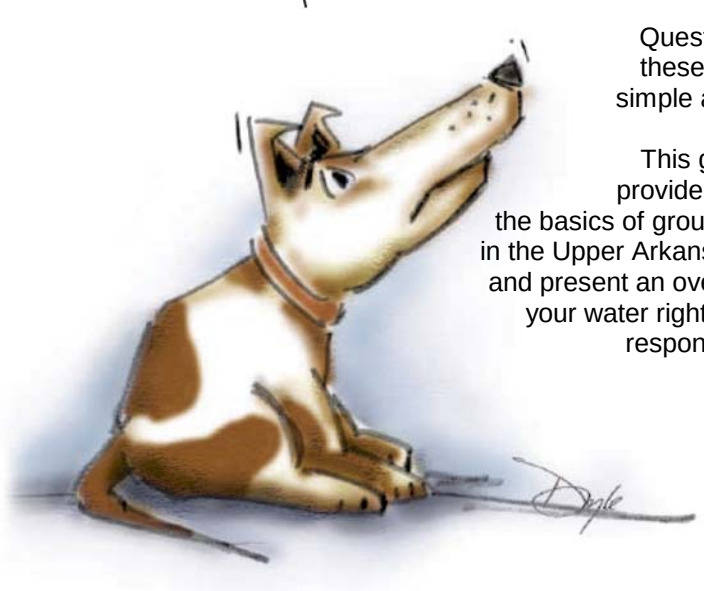
Acknowledgements: This is a revised version of the "Water Smarts" booklet by Jefferson County Planning and Zoning Dept – 2002; illustrations by Doyle Harrison

Will there be enough?

Is it OK to drink?

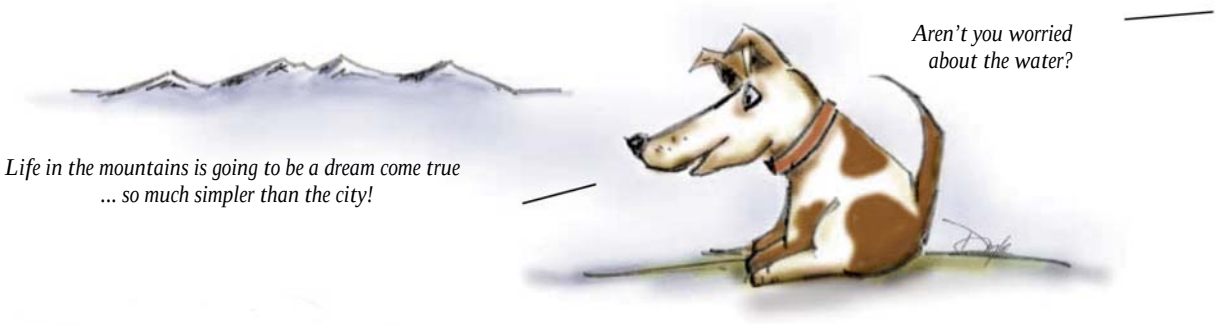
Do I have a right to it?



Questions like these have no simple answers.

This guide will provide you with the basics of ground water in the Upper Arkansas Area and present an overview of your water rights — and responsibilities.

A Drop in the Bucket



This guide focuses on ground-water issues in the Upper Arkansas Area of Colorado, which includes Chaffee, Custer, Fremont, and Lake Counties. Topics discussed include ground-water hydrology, water quality, wells, septic systems, water rights, and lifestyle impacts. Throughout, you will find references to a study referred to as "Upper Arkansas Ground-Water Study". This 3-year study of ground-water conditions in the Upper Arkansas Basin between Buena Vista and Salida, by the U.S. Geological Survey, was begun in 2000 and is being done in cooperation with the Upper Arkansas Water Conservancy District.

Practical advice for the homeowner appears in the form of tips, and questions and answers. A reference section has been provided should you wish to further explore the main topics.

Inside this guide

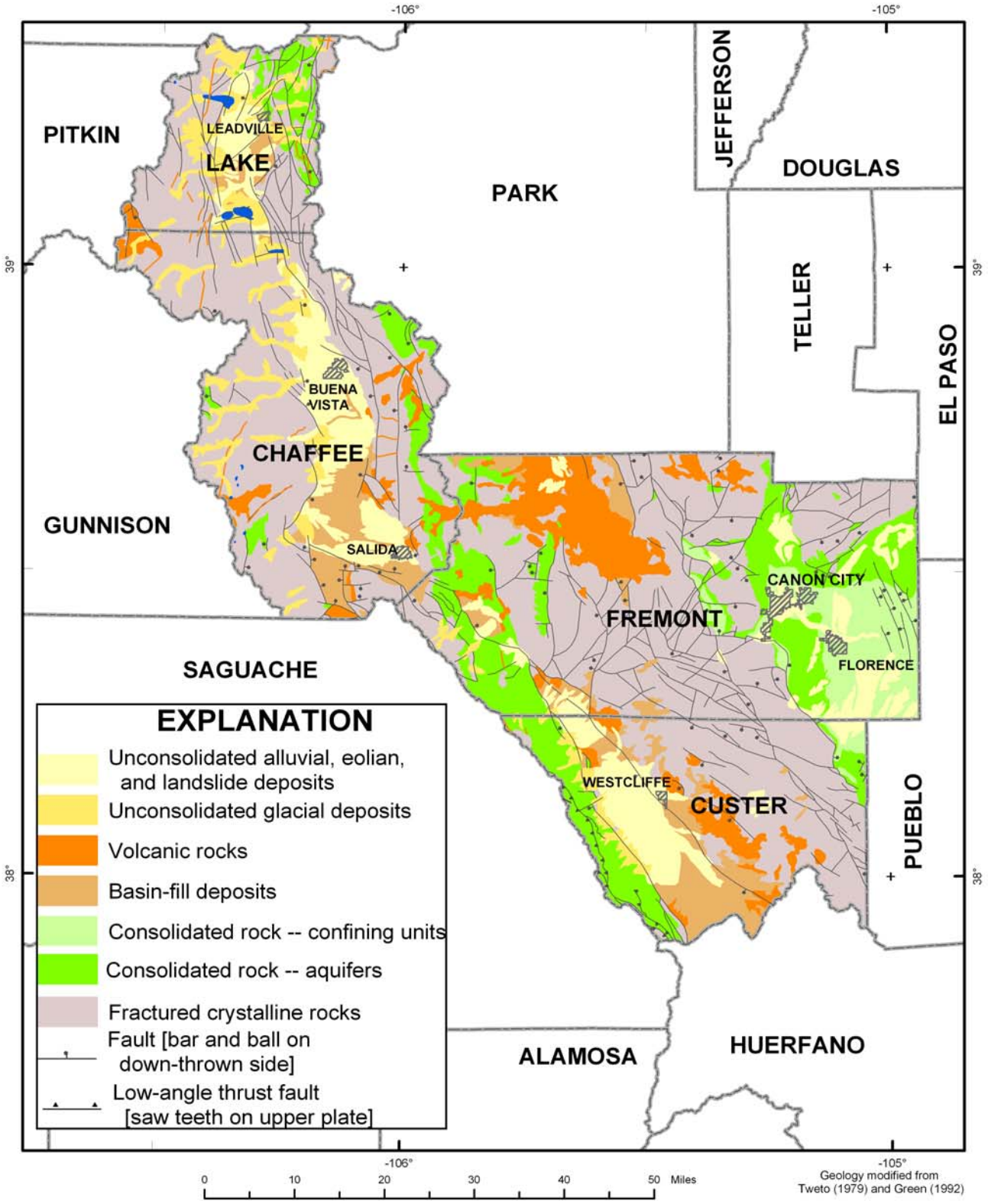
Whether you are new to the Upper Arkansas Area or a long-time resident, water is a common concern. Even long-time residents have questions on this priceless resource. Not surprising, given the complicated nature of ground water.

As precipitation falls to the Earth, it remains on the surface, evaporates, or seeps into the ground. Water beneath the surface that is not held in the soil is called ground water. Rain and snow are the principal sources of recharge to ground water in the Upper Arkansas Area.

Imagine peering beneath the surface of the ground. You might see a layer of soil and loose material, referred to as overburden, on top of thick layers of saturated clay, silt, sand, and gravel. These deposits commonly are referred to as unconsolidated deposits. In turn, the unconsolidated deposits may overlie thick layers of poorly to well consolidated sedimentary rocks, such as limestone, sandstone and shale. In turn these rocks overlie older igneous and metamorphic rocks. In some places, volcanic rocks are also present and may overlie unconsolidated deposits or other rocks. The older igneous and metamorphic rocks (crystalline bedrock) that underlie the area also are exposed in the surrounding mountains.

Ground water from the open spaces (pores) between rock particles or from fractures in the bedrock supply the water that you drink every day. The ease with which water flows through these openings depends on the number, size, and interconnection of the pores or fractures. Unconsolidated deposits containing predominantly small-sized sediments, like clay and silt; denser sedimentary rocks, which have been compressed by geologic forces; and bedrock with few interconnected fractures generally do not yield substantial quantities of water to wells. To obtain a reliable source of water, a well must intersect water bearing and connected pores or fractures. The amount of water available to a well is highly variable and depends upon how many water-bearing pores or cracks are contacted by the well.

Because the geology of the Upper Arkansas Area is complex, the occurrence of ground water in the area is also complex. There are six geologic terrains in the area (See Surficial Geology Map) in which ground water may be found (alluvial, glacial, and basin-fill deposits; and, sedimentary, volcanic, and crystalline rocks). This map shows what predominant rock type is present at the surface. Other rock types may underlie the surficial rocks, except that crystalline rocks ultimately underlie all rock types.



GENERALIZED SURFICIAL GEOLOGY IN THE UPPER ARKANSAS AREA OF CHAFFEE, CUSTER, FREMONT, AND LAKE COUNTIES, COLORADO

UPPER ARKANSAS GROUND-WATER STUDY

In 2000, The Upper Arkansas Water Conservancy District and the United States Geological Survey embarked as partners on a three-year study of ground-water resources in the Upper Arkansas Area between Buena Vista and Salida. The purpose of the study was to provide a scientific understanding of the ground-water resources in the Upper Arkansas Area. Reference to this study will be made for illustrations throughout this booklet. In addition, much of the material in this booklet is excerpted from a similar booklet that was prepared by the Jefferson County Zoning and Planning Department. Additional funding for this study was provided by Chaffee County and the Colorado Water Conservation Board.

Unconsolidated alluvial deposits in the Leadville Basin, Buena Vista-Salida Basin, Wet Mountain Valley, and eastern Fremont County primarily are clay, silt, sand, gravel, and boulders that were deposited by streams and rivers. Generally, these deposits are less than 100 feet thick and occur along streams and rivers or as terraces. They are the youngest rock type in the area and may overlie any of the other rock types. They are exposed at the surface in about 6 percent of the area. Where saturated, well yields in these deposits range from 50 to 1,000 gallons per minute. Because these deposits are relatively shallow they are susceptible to contamination from the surface.

Glacial deposits, which are unconsolidated to poorly consolidated, extend along valleys from the surrounding mountains into the Leadville Basin and from the mountains on the west into the Buena Vista-Salida Basin and Wet Mountain Valley. The glacial deposits consist of poorly sorted sand, gravel, cobbles, and boulders, with layers of silt and clay. Thickness of the glacial deposits ranges from about 100 to about 500 feet. They are exposed at the surface in about 3 percent of the area. They may underlie younger alluvial deposits in the Buena Vista-Salida and Leadville Basins and the Wet Mountain Valley. Where saturated, well yields from these deposits range from less than 10 to 1,500 gallons per minute. Because these deposits also are relatively shallow, they also are susceptible to contamination from the surface.

Basin-fill deposits are poorly consolidated rocks that occur in the down-faulted Buena Vista-Salida and Leadville Basins, and Wet Mountain Valley. They consist of sand, gravel, and cobbles, with beds of siltstone, sandstone, and volcanic ash. Thickness is estimated to be as much as 4,000 feet in the Leadville Basin; 4,600 feet in the Buena Vista-Salida Basin; and 6,700 feet in the Wet Mountain Valley. In some areas they underlie alluvial and glacial deposits. They may overlie consolidated rocks or crystalline rocks. These rocks are exposed at the surface in about 5 percent of the area but underlie unconsolidated deposits in the upper basins. Well yields from the basin-fill deposits range from about 10 to 1,200 gallons per minute.

Volcanic rocks occur primarily in northwestern Fremont County, in Custer County near Westcliffe, and locally in the mountains around the Buena Vista-Salida and Leadville Basins. Thickness may be as much as 1,500 feet. Water occurs in pores in the volcanic rocks and interbedded sand and gravel. Well yields generally are less than 10 gallons per minute, but may be as much as 30 gallons per minute in the Wet Mountain Valley.

Consolidated rocks include some strata (shale and shaley limestone), which generally do not yield significant quantities of water to wells. Maximum combined thickness of these rocks is about 5,000 feet. These rocks are exposed at the surface in about 20 percent of the area and generally overlie water-bearing consolidated rocks. Some wells may obtain water from fractures and possibly solution openings in limestone strata. Well yields range from 2 to 100 gallons per minute.

Consolidated rocks also include porous rocks (conglomerate, sandstone, siltstone, limestone, and coal), which commonly yield water to wells. Maximum combined thickness of these rocks is more than about 7,000 feet. They are exposed at the surface in about 15 percent of the area but probably underlie about 35 percent of the area. However, few wells have been completed in some of these formations. Well yields from the consolidated rocks are reported to range from 3 to 1,600 gallons per minute, but generally are from 10 to 500 gallons per minute.

Crystalline rocks consist primarily of igneous rocks (granite, diorite, and

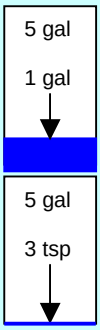
granodiorite) and metamorphic rocks (gneiss). They are exposed at the surface in about 42 percent of the area. Water occurs in fractures in these rocks. Well yields from the crystalline rocks generally are less than 10 gallons per minute. However, greater yields may be obtained where the rocks are highly fractured, particularly along watercourses. Rocks in areas that are faulted likely are more intensely fractured than those in areas that are not faulted. Because ground-water flow through fractures is relatively rapid and soils are generally thin, ground water in fractured crystalline rocks is susceptible to contamination from the surface.

Upper Arkansas Ground-Water Study

There are six generalized rock types in the 3,673-square mile Upper Arkansas Area. Because the number and size of the pores vary between and within these rocks, the water storage and transport abilities are highly variable.

Typical Aquifer Water Holding Capacity

Sand & Gravel
5 gallons of sand & gravel can hold about 16 cups (1 gallon) of water.



Fractured Rock
An equal amount of fractured rock can hold about 3 teaspoons (0.01 gallon) of water.

Water-Holding Capacity

Generally, saturated sand and gravel holds and yields more water to wells per foot than do silt and clay, sedimentary rocks, or fractured bedrock. A five-gallon bucket of sand and gravel can hold about 16 cups of water or about 20 percent of the total volume is drainable pore space. An equal amount of fractured rock may hold and yield about 3 teaspoons of water or about 0.2 percent of the total volume. While clay may contain as much or more water than sand and gravel, water does not drain readily from clay. Yields from sedimentary rocks lie between those of sand and gravel and fractured rocks, depending on the type of rock and the presence of fractures or solution openings.

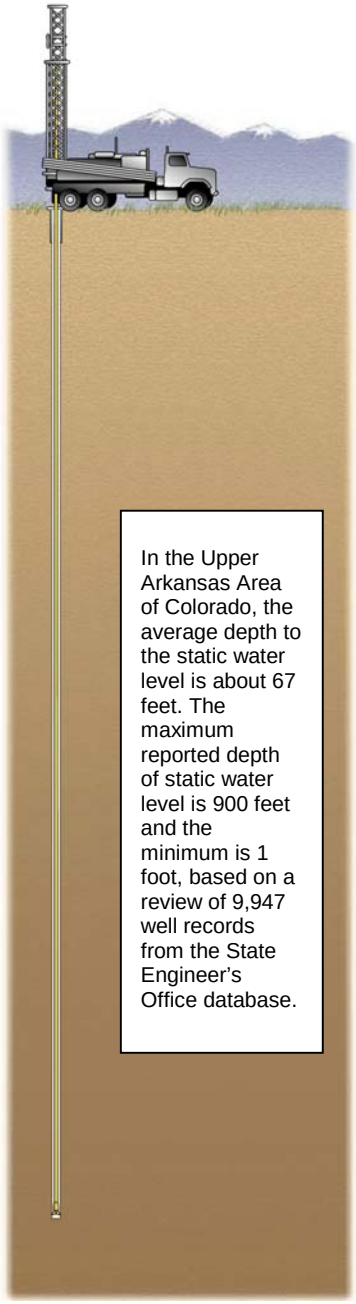
Well Yields

Reported well yields, including domestic, irrigation, public supply, and stock wells, in the area are highly variable, ranging from 0.01 gallon per minute to 4,620 gallons per minute with an average reported well yield of about 17 gallons per minute. Well yields vary primarily as a result of geology and well construction.

Reported well yields for about 10,000 domestic and household wells ranges from less than 1 to 1,500 gallons per minute with an average of about 11 gallons per minute.

Well Depths

The depths to which wells are drilled vary greatly in the area. Well depth is, in part, a function of where the well is located. Wells drilled on hills or ridges generally need to be deeper than those located in valley bottoms. Reported well depths, from records of 11,522 wells in the of the State Engineer's database, range from 2 feet to 3,000 feet below land surface, with an average depth of about 162 feet. Average reported well depths are less in Chaffee and Lake Counties than in Custer and Fremont Counties.



In the Upper Arkansas Area of Colorado, the average depth to the static water level is about 67 feet. The maximum reported depth of static water level is 900 feet and the minimum is 1 foot, based on a review of 9,947 well records from the State Engineer's Office database.

Static Water Level

Based on a review of 9,947 records from the database of the Colorado State Engineer's Office, well drillers in the Upper Arkansas Area have reported the depth of static (non-pumping) water levels at depths ranging from 1 foot to 900 feet below land surface, with an average static water level of about 67 feet below land surface.

The following table summarizes by county the number of records; and the minimum, average, and maximum reported well yield, well depth, and static water level. Data from all types of wells (domestic, household, irrigation, public supply, and other uses) are included in this summary.

Summary of well data from State Engineer's database					
	Chaffee County	Custer County	Fremont County	Lake County	Upper Arkansas Area
Well Depth (feet below surface)					
Number of records	3,875	2,697	3,954	996	11,522
Minimum value	5	3	2	3	2
Average value	115	205	190	116	162
Maximum value	900	1750	3000	655	3000
Water Level (feet below surface)					
Number of records	3,338	2,407	3,303	899	9,947
Minimum value	1	1	1	1	1
Average value	65	65	70	71	67
Maximum value	710	483	900	587	900
Well Yield (gallon per minute)					
Number of records	3,834	2,657	3,576	958	11,025
Minimum value	0.01	0.09	0.01	0.33	0.01
Average value	18	17	17	16	17
Maximum value	1,500	1,203	4,620	815	4,620

Is It Safe to Drink?

Well users often worry about the quality of their water. Some people think of mountain water as the purest on earth, while others argue the effects of high levels of bacteria and other contaminants. One thing is known; the very nature of water movement into sand and gravel aquifers and fractured bedrock aquifers makes them vulnerable to contamination.

Where the soils are thicker, biologic, chemical, and physical processes in the soil may better filter contaminants. By contrast where there is little soil or overburden, contaminants may receive little filtering before they enter the ground-water system. As water moves through the pores or fractures in an aquifer, it may pick up various metals, minerals, dissolved nutrients, and other chemicals. At certain levels, some of these substances can pose health risks. Where soils are thin, potential contaminants from septic systems, fertilizers, animal waste, and de-icing salts are less likely to be filtered out before they reach ground water.

City residents typically rely on water-treatment plants to test and treat drinking water, and public sewage treatment facilities to treat waste. Rural dwellers, on the other hand, typically rely on private wells and individual septic systems. In Colorado, the State Division of Water Resources retains well records. Typically, county health departments issue permits, inspect construction, and retain septic system records. This means that rural residents are responsible for testing and treating their water supplies and periodically inspecting and maintaining their own septic systems.

In order to keep septic systems operating properly and to protect ground water, rural residents must be careful of pollutants that could affect those systems. Excess manure from animals, household chemicals unsuitable for septic systems or that are poured on the ground, can make their way into the water supply and possibly cause illness.

Maintaining your septic system is critical to extend its life and to provide a healthier environment for your family. Septic systems are designed to treat household waste. Although your system should be able to process typical household soaps and cleaners, it will not be able to handle grease, kitchen waste (e.g., eggshells or bones), toxic chemicals (e.g., paint thinner or antifreeze), or personal sanitation items, such as condoms or tampons.

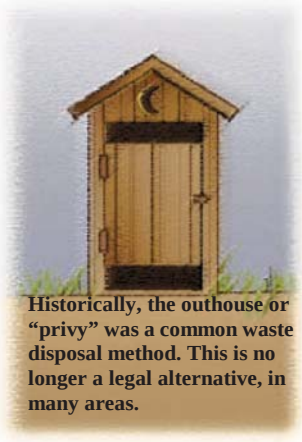
Realize that your septic system is designed to handle a limited flow of water. It will work best if you allow time between showers or loads of laundry, and if you repair leaking faucets and toilets. Also, a septic system enlargement may be required if you put an addition on a house or change a building use. The oldest water-quality law dates back to 1899, and prevents people from dumping trash into streams, rivers, and lakes. In 1972, the U.S. Congress passed the Clean Water Act. This law and subsequent regulations prohibit individuals and industries from dumping material into waters without permits. In 1974, the U.S. congress passed the Safe Drinking Water Act, which allowed the U.S. Environmental Protection Agency (EPA) to establish national standards for public drinking water systems. These regulations, however, do not apply to individual household wells.

Upper Arkansas Ground-Water Study

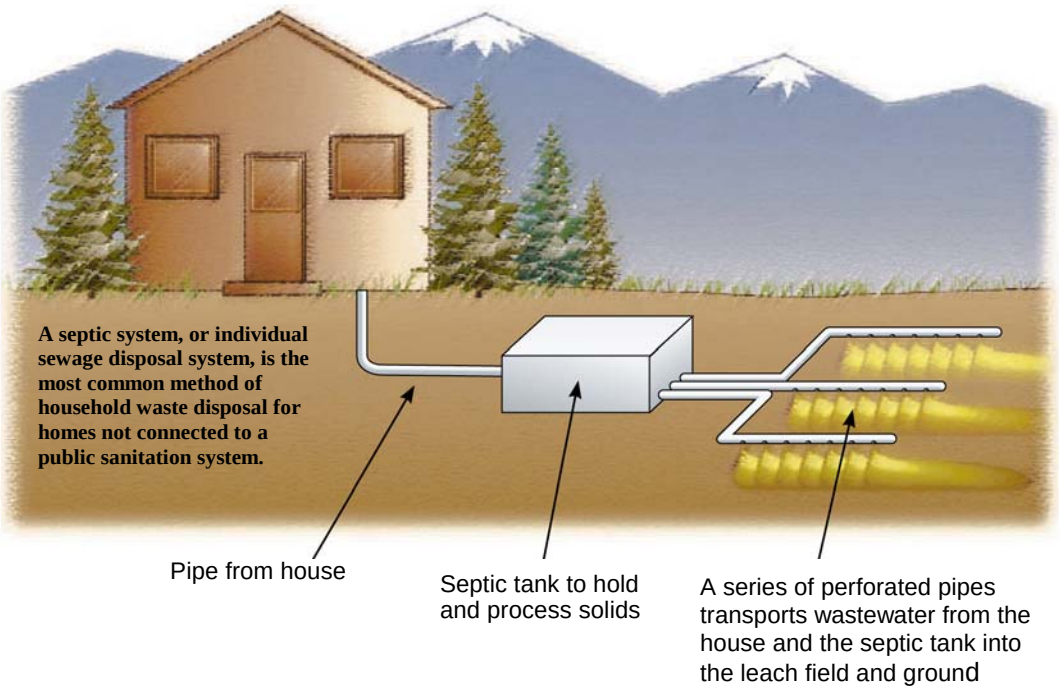
The study included the sampling of selected private wells for water-quality analysis. Results from these samples are being used to access the overall quality of ground water, evaluate whether water quality is being affected by septic systems, and to estimate recharge to the aquifers.

The laboratory analyses of water samples included tests to determine concentrations of various naturally occurring and man-made chemicals, including major ions (calcium, sodium, potassium, chloride, sulfate), alkalinity, nutrients (nitrate, nitrite, phosphate), and tritium.

Tritium is an isotope of hydrogen that can be used to estimate the age of ground water. Ground water that was recharged after the 1950's has more tritium, as a result of nuclear testing, than does water that was recharged prior to the 1950's.



Historically, the outhouse or "privy" was a common waste disposal method. This is no longer a legal alternative, in many areas.



A septic system, or individual sewage disposal system, is the most common method of household waste disposal for homes not connected to a public sanitation system.

Clean Up of Acid Mine Drainage California Gulch/Yak Tunnel

California Gulch, located in Leadville, is the site of historic mining, which left large volumes of mining wastes affecting area soils and the Arkansas River. EPA, the State of Colorado and mining companies are working together to clean up lead in soils and acid mine drainage to make the Arkansas River and soils safe in the 18-plus-mile mining district (www.cdphe.state.co.us/hm/rpcalgulch.asp). In 1986, EPA extended public water supply system lines to residences using private wells. Remediation began in 1988 to minimize the flow of acidic water from the Yak Tunnel. Cleanup consists of a surge pond, water treatment plant, and a ground-water monitoring network. The water treatment plant began operation in spring 1992. EPA has designated additional Operable Units, and environmental sampling has been done to address remediation of Leadville residential areas, surface and ground water, and the affected terrestrial and aquatic environment. "Source area" cleanup activities are also underway at localities in California, Stray Horse, and Oregon Gulches that have been identified as contamination sources to surface and ground water.

Naturally Occurring and Man-Made Ground-Water Contaminants

Water has been called the "universal solvent". As the water from precipitation interacts with the surface and subsurface rock or soil, it dissolves minerals from the rock and soil and may pick up and carry bacteria and man-made pollutants.

"Total coliforms" are a group of related bacteria commonly found in water, soil, and animal intestines. The vast majority of coliform bacteria do not cause disease. If coliform bacteria are found in water, however, fecal coliforms and E. coli may also be present. These bacteria are associated with human and animal waste.

Though most strains of fecal coliforms and E. coli are harmless, one strain produces a powerful toxin that can cause severe illness. More importantly, the presence of fecal coliform or E. coli in drinking water strongly indicates that the water supply has been recently contaminated with animal or septic waste. Consequently, other disease causing bacteria and viruses that are more difficult to detect, may also be present.

Giardia is a microorganism that is more common and problematic in surface water. It is rarely found in individual wells. No amount of Giardia in drinking water is acceptable, and if ingested in any amount may cause severe diarrhea in humans and pets. It may be difficult to diagnose but is relatively easy to treat once identified.

Nitrates and phosphates, which typically are associated with human and animal waste, are the most common contaminants from septic systems. Nitrates may also be leached into the soil from stock enclosures, feedlots, and manure piles.

Many household cleansers contain chemicals that can cause health problems when found in large concentrations in ground water. In addition, some chemicals are not suitable for disposal in septic systems. Consider alternative cleansers that are non-toxic and biodegradable.

Automobiles can cause water pollution. Drips of antifreeze, oil, grease, and gasoline are washed into ground water. Metals, such as copper and zinc, are released as brake linings wear out. Always dispose of used automotive fluids at a recycling center. Commonly, retail automotive supply stores will accept, at no charge, used oil and antifreeze from individual customers.

Abandoned and active mining sites are also potentially significant sources of contaminants to water. Impacts include acid rock drainage, elevated levels of toxic heavy metals, sulfate, cyanide, nitrate, and radioactive elements.

Unlike public water supplies, which are routinely monitored, the responsibility for assuring a safe water supply for private well users rests solely with the homeowner. Regular testing is necessary in determining whether your well water is safe to drink.

Nitrate is a contaminant that was studied in the Upper Arkansas Ground Water Study. It is often linked to human activity and commonly originates from septic systems, stock enclosures, and fertilizer. A study of ground water in the Upper Arkansas River Basin conducted in the 1970-80s (Crouch and others, 1984) reported trace amounts (less than 1 milligram per liter) of nitrate in the majority of ground-water samples from the area. However, concentrations in several samples exceeded background concentrations, indicating potential contamination from the surface. Samples collected for the current study of the Upper Arkansas Basin between Buena Vista and Salida generally were similar in concentrations to those found previously.

Testing the Waters

What to test for is a question best answered after carefully reviewing your water, plumbing, and personal needs.

In most cases, all private wells should be tested annually for bacteria and nitrates. Spring is a good time for this, since it is the time when recharge from melting snow or rain is likely to recharge the ground water. If ground water is free of bacteria in the spring, it is likely to be bacteria-free year-round.

Certain areas have naturally high fluoride levels in ground water. While a certain amount of fluoride is desirable, and is added to some public water systems, elevated levels can pose health problems for children and adults. If fluoride levels are elevated, tests for radioactive components also are recommended. Some areas are known to have high natural radiation levels, due to the presence of uranium and other minerals. Long-term consumption of water with elevated radiation levels may cause significant health problems including cancer and kidney damage. Consider having your water tested for gross alpha and beta radiation, uranium, radium-226, and radon-222. Inside air in your home should also be tested for radon.

If you notice mineral deposits or stains on plumbing fixtures, consider testing for total dissolved solids (TDS), hardness, iron, manganese, copper, and possibly silica. Blue-green staining, metallic taste, or thinning copper pipes with pinholes may indicate that the water is corrosive. Test Langlier index, pH, alkalinity, TDS, hardness, and copper levels before and after flushing water lines.

Water with a musty or swampy odor or taste, sulfur odor, cloudy appearance, or an oily sheen may indicate the presence of bacteria. Other unusual odors or appearance, color, or foaming and sudsing should be discussed with a certified water-quality laboratory. Color and appearance are often aesthetic and not health concerns. Ask the water-testing laboratory to be sure.

Some recurring illness may be due to bacterial or Giardia contamination of drinking water. Giardia is a microorganism that is more common in surface water and that is rarely found in wells. Ingested in any amount, Giardia may cause severe diarrhea for several days in humans or in pets. While sometimes difficult to diagnose, it is easily treated once identified. A trip to the doctor or veterinarian with a stool sample may be required to confirm its presence.

Who's Right?

"first in time, first in right"

Originating in the 1800s, the Colorado water allocation or "water rights" system was established to regulate use of water. The first uses, mining, ranching and farming, required water to be taken out of the stream and applied elsewhere. Because there was not enough water for everyone, the prior appropriation system was adopted. The prior appropriation system is a way to divide water use based on the concept of "first in time, first in right." Historically, the miners, ranchers and farmers were the first to use the water, and therefore the first to claim a "right" to it. Their use established rights that still exist today. These rights, established in the mid to late 1800s are senior water rights as the rights carry old priorities, for example 1862, 1877 etc.. A "priority" is a date associated with a water right. The priority is the date on which the water was first put to use. (A surface water right refers to the amount of water a person can legally remove from a river or reservoir as opposed to ground water which is accessed by wells.) In most streams there are several water rights. Even a particular right may be owned by several people. Thus, knowing who has "priority" is important.

In the Rocky Mountain West, a complex web of laws and regulations govern both water quantity and quality. Understanding the rules—and the agencies that enforce them—can help you avoid arguments and keep you out of court. This booklet provides basics and consultation with a water law attorney is encouraged for in-depth advice.

In the western states, water is limited, and people guard their access to it by obtaining water rights. Colorado has a complex series of laws based on the concept of "first in time, first in right"—or prior appropriations. These laws govern agricultural, commercial, and domestic use, and the water storage and transport handled through reservoirs, diversions, ditches and pipelines.

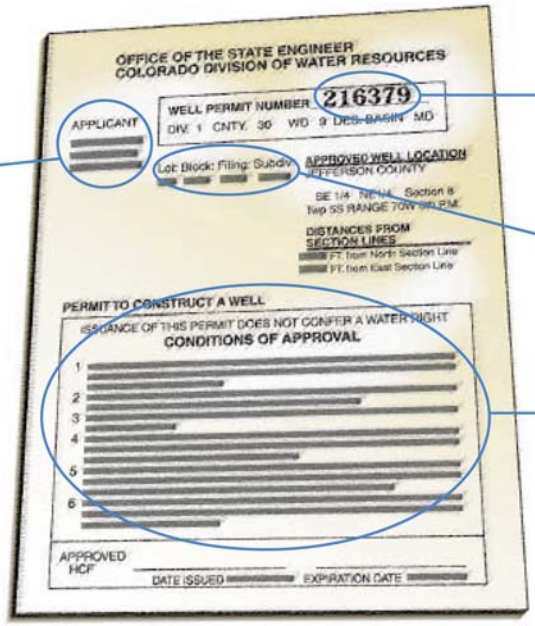
Under Colorado water law, people cannot own water; they can only own the right to use it. Legally, that right can be bought and sold just like a piece of property. If nobody owns the water rights in an area, then the Colorado Constitution guarantees that the water can be used for beneficial purposes such as irrigation, household use or recreation. In many cases, though, more than one person may own the water rights in a given stream or aquifer. Knowing who has priority is important and is based on the concept of "first in time, first in right."

Most Colorado landowners do not get involved with water rights. Those living outside a water district usually obtain a well permit. However, a well permit is not a water right.

Typical Well Permit

At times confusing, this represents the name and address of the person applying for a permit. It does not always match the address of the property where the well is to be located.

When you purchase property with an existing well, the Division of Water Resources requires that you notify them in order to record ownership changes.



The Well Permit Number is important because it allows easy access to permit information through the Colorado Division of Water Resources' database. All Colorado well permits are filed by permit number.

The property information does not change over time.

The Conditions of Approval spell out the specific water uses allowed by the permit. The conditions vary from permit to permit regardless of the well type. This is evident at times, when comparing two permits of the same type issued many years apart.

In Colorado, the Division of Water Resources of the Office of the State Engineer retains well records. The Division issues permits after looking at the overall water supply in the basin, estimating well spacing and how much water is available.

A well record usually includes the well driller's log, the pump installer's report, and the well permit. The well driller's log provides well construction details such as the type of rock encountered, the depth to water, and a rough estimate of the amount of water the well produces. The pump installer's report describes the depth to the pump, the type of pump, and the horsepower. The well permit contains information on the allowed water uses. There may not be a well permit for early wells; for example, Colorado did not require permits for wells constructed before May 8, 1972.

A well permit is not a guarantee that a well will find water. Because mountain ground water volumes are highly variable, some residents have installed a storage tank on their property to supplement their well.

The Division of Water Resources is also responsible for enforcing the conditions of approval on a well permit. The local water commissioner is the point of contact for complaints about well usage. Again, the limitations on use of well water are not the same for all wells. If someone thinks that a well is being used illegally, they should contact the water commissioner, who can then do the necessary research to determine how the well in question can be used legally.

Well Drilling Tips

- Contact the Colorado Division of Water Resources to obtain a well permit.
- Consult guidelines in your county's planning and environmental health offices.
- Employ a licensed well driller and pump installer.
- Locate your well at least 200 feet from any septic system and away from corrals, pastures, drainage ways or other potential sources of contamination.
- Do not site wells in an enclosed pasture or a corral.

Tips on Well Maintenance

- Periodically inspect the well head, cap, and seals, and take care of any needed maintenance.
- Conduct an inventory of contaminant sources around the well.
- Remove dangerous chemicals and contaminants from the vicinity of the well, e.g., road salts, fertilizer, and manure.
- Do not use or mix chemicals near the well.
- Dispose of paint thinners, antifreeze and other pollutants properly, rather than dumping them on the ground or pouring them in your septic system.
- Repair in-house water supply system leaks. Fix toilets that run-on after use. This will reduce pump system cycling and prevent uptake of well sediment.
- Test water periodically.

There are several well permit types issued by the Division of Water Resources. Two types of permits are most important to the private homeowner who will be using ground water as a primary water source. They are generally referred to as the domestic well permit and the household-use only permit.

Both permits are for small capacity wells, and each permit has restrictions on the amount and usage of water that can be pumped. Some wells are restricted to water use within the house only, while others allow limited livestock watering and irrigation of lawns and gardens. You should check with the Division of Water Resources to determine the permit limitations for each type of well and the availability of permits in your area.

While there is considerable variation in residential well permits, the most common type issued today is the household-use only permit. This permit gives a property owner the right to look for water (i.e., drill a well) and use the water inside their single-family home. In most cases this type of permit does not allow the use of water outside your house.

In some cases, the zoning of a property may allow the keeping of livestock, but the well permit may not allow the use of water for domestic animals. In that case, you can keep horses or other livestock on your property, but you can not provide them with water from your well. Most likely, your only option would be to “truck in” water for the animals.

Domestic permits are often older residential permits, or those issued for properties larger than 35 acres. Domestic wells can be used for up to three single-family dwellings and may give you the right to use water outside your house, and for your animals. However this does not, in turn, give the owner the right to build three houses.

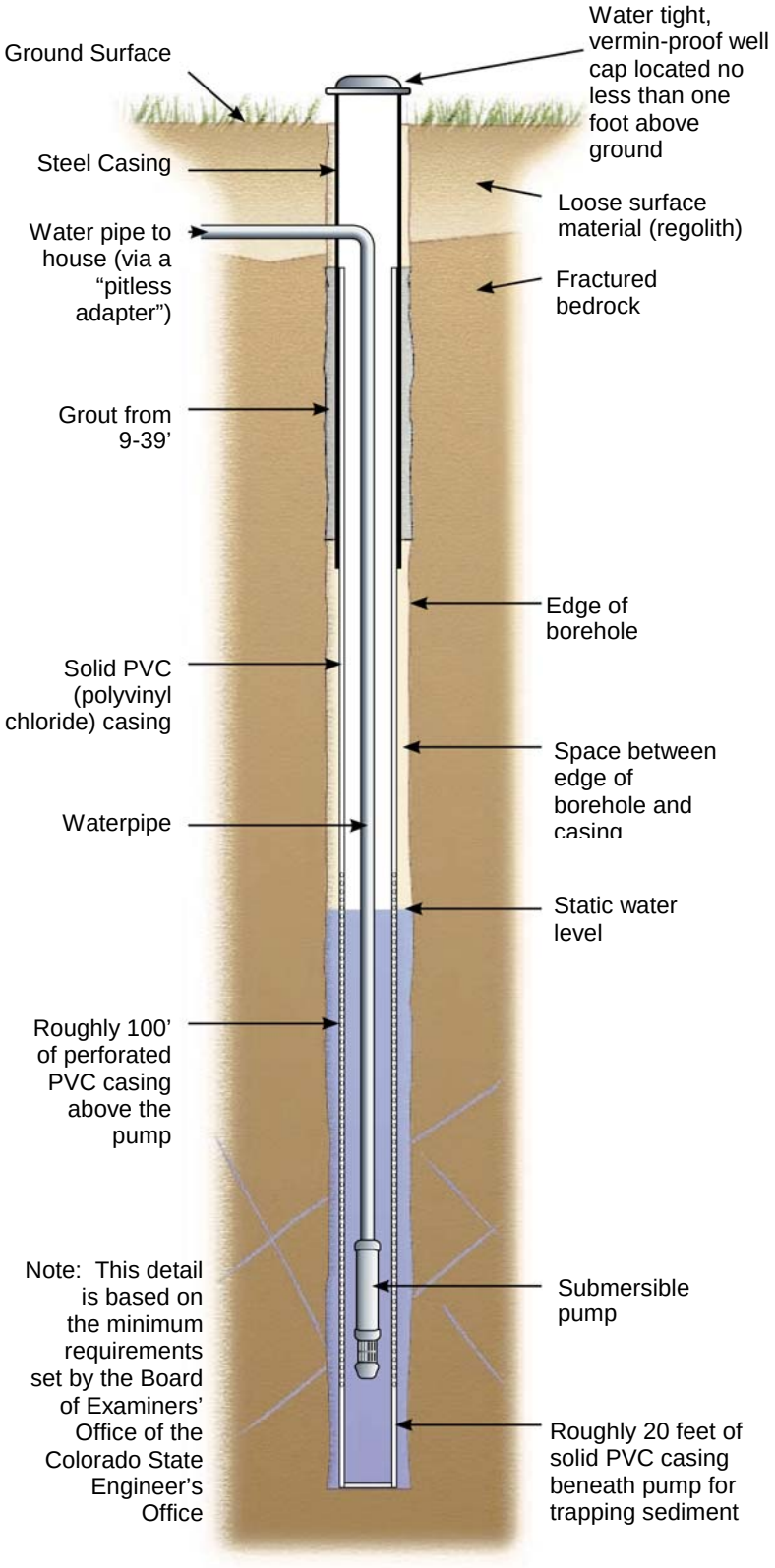
Neither the state nor the local government can guarantee your water supply. However, before approving new subdivisions with wells, some local governments require that a test well be drilled, and that a water supply report be submitted with evidence that there is an adequate water supply for general health and fire protection.

There are a number of state and federal rules that protect water quality, but they apply only to public water supply systems. In Colorado, state laws and part of the Safe Drinking Water Act, are enforced through the Water Quality Control Division of the Department of Public Health and Environment. If your water distribution system services less than 15 homes, water tests are not required. The only way to protect yourself is to periodically have your water tested.

Multiple agencies regulate and monitor various aspects of ground water, yet no agency oversees and integrates all aspects. Each agency has its own focus and jurisdiction as established by enabling laws. It is important therefore, for the homeowner to get involved in monitoring their own well.

Water quality is not addressed in the permit. Water quality testing of a private well is the responsibility of the owner or user. A current test should be requested when purchasing a house with an existing well to demonstrate that the quality meets human consumption criteria or that the water can be treated to meet these standards.

Typical Drilled Mountain Well



Is the View Worth the Price?

A move to the mountains often means more than living a "permanent vacation." One of the attractions and challenges is living a more independent and self-sufficient lifestyle. This is especially true when it comes to water and sanitation.
Sometimes people do not realize the responsibilities of relying on a well and septic system until after they have fallen in love with the lot, bought the house and moved in. There are important questions to ask before ever getting to that point.

Water is a finite resource, and what you do with it affects everyone. In a sense, everyone lives down stream. The source of water for Colorado, and other western states, is in the mountains. Its protection also needs to begin in the mountains.

Lifestyle choices can help protect and preserve the quality and amount of ground water. Some everyday examples include: eliminating outdoor landscape watering and car washing, periodic septic tank pumping, use of low-flow toilets and low-pressure shower nozzles, in-home water conservation, and xeriscaping.

Rural residential development also puts a strain on mountain water resources. New and existing "individual sewage disposal systems" (ISDS) may degrade local water quality when:
-placed in close proximity to each other
-are not maintained or pumped regularly
-well use influences ground-water movement
-are in soils/geologic conditions with limited carrying capacity

Successful ISDS placement and use is based on the carrying capacity of the land. The land's capacity is not unlimited and must be managed.

Becoming your own water and sewage manager can be one of the unexpected challenges of mountain living. Many new residents do not know much about maintaining their well and septic systems—and may be too intimidated to learn.

Realize that the actions you take every day help determine the quality of your water supply, and that there are some things you can do to help keep your environment healthy.

When a septic system or well is improperly constructed, or a septic system is not regularly maintained, raw sewage can seep into the ground and contaminate the well water. In fact, failing septic systems are the leading cause of water contamination in the mountains. To avoid health problems, have your well water tested periodically, and have your septic system maintained regularly.

Maintain your well. Periodically inspect the well head and seals, and fix them when needed. Remove chemicals or other contaminant sources, such as manure, from around the well head. Mix chemicals far away from wells and dispose of paint thinners and other pollutants properly rather than dumping them on the ground or pouring them into your septic system. Some counties and cities have household hazardous waste drop-off sites for proper disposal of these materials.

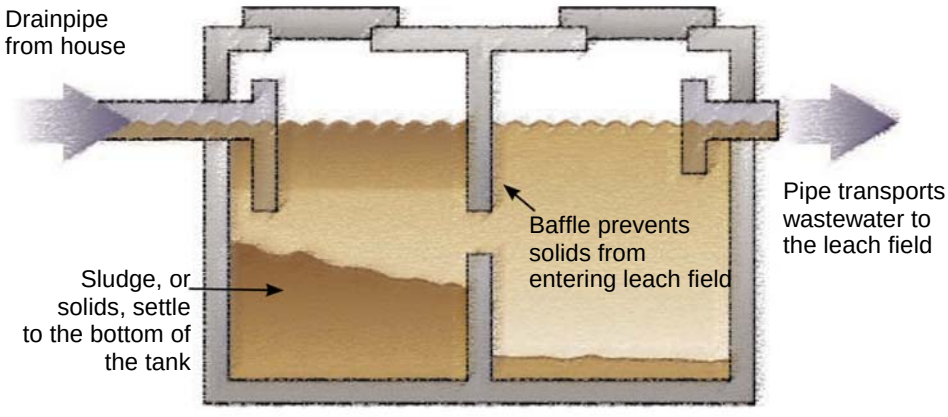
Have your well water tested periodically and ask the laboratory technician if you need a water treatment system. For water quality testing, hire an independent, third party technician to collect a water sample on a random day and have it analyzed by a state-certified laboratory. Always get treatment claims in writing with a guarantee.

Consider that a new septic system can cost between $10,000 and $25,000. Considerable variation exists in available design and installation options. Keep in mind that rocky terrain, steep slope, shallow water table and tight soils may require additional excavation, and the import of proper construction materials. All of these can add to the cost. To safeguard against poor construction or the use of improper materials, it is recommended that an

Tips on Septic Systems

- Obtain a permit to install a septic system from your county health department (in Colorado).
- Have the system designed by an engineer and installed by a qualified contractor, both with experience in fractured rock environments. Consider advanced treatment technologies.
- Locating the system at least 200 feet from any well to avoid contamination is recommended.
- Consult the County Dept. of Health or Environment for system construction and maintenance guidelines.
- Have an existing system (tank and leach field) inspected by a qualified inspector before buying. After buying, have the tank inspected and pumped regularly.
- Be aware that a home addition may require enlarging the system.
- Systems can handle only limited water flow, so allow time between showers and laundry, and repair plumbing.
- Keep these out of drains and toilets: grease, kitchen wastes (bones, eggshells), toxic chemicals (drain cleaner, paint thinner, antifreeze), condoms, and feminine hygiene products.
- Consider using non-toxic and biodegradable products (e.g., phosphate-free detergents and propylene glycol antifreeze).

Typical Septic Tank



Questions to Ask Before Buying

- What are the permitted uses of this well?
- How is the well constructed, and do you have a copy of the well driller's log and pump installer's report?
- May I have a copy of the well and septic permits?
- Is this property in a subdivision, and if so, may I see a copy of the plat?
- What is the average well yield and has this well ever gone dry?
- Have there been any water quality or quantity issues in the past?
- Do you experience colored water during spring run-off?
- Has the well ever been chlorinated, and if so, why and how recently?
- Has a water quality test been performed recently, and if so, did it pass?
- May I see a copy of the water quality tests, including who took the samples and their qualifications?
- Is water treatment equipment present, and if so, why and has it been maintained?
- Do you mind having the well tested for quantity and quality before signing the sales contract?
- How old is the septic system and when was it last inspected?
- Do you have receipts showing that the septic system has been pumped regularly?
- Where are the well head, leach field, and septic tank located, and how far apart are they?

engineer design the system, and a qualified contractor with experience in the local area install it. Remember to plan ahead and become aware of requirements. Colorado is a "buyer beware" state. This means the buyer is solely responsible for becoming informed and aware of existing and possible future conditions of the property and its well and septic system.

If a realtor is aware of any situations involving contaminated or limited supplies of water, he or she should disclose it to a potential buyer. A realtor may not disclose this information or may not be aware of the current or possible future situation. A seller should also disclose this information when selling a home. However, the best way to be sure is to ask questions. Insist on having the well tested for quantity and quality as a condition in your purchase contract.

The Colorado Division of Water Resources requires notification when well ownership (land or house ownership) changes. This happens most often when a property is sold. While making this change does not currently require a fee, it is recommended that you contact the state for specifics.

A permit to drill a water well is tied to a specific location or parcel of land, therefore, the permit rights and allowances stay with the property. Thus, a change in ownership of the well does not affect the conditions or limitations under which the well can be used. If the new owner wishes to change or expand the use of the well beyond those uses granted by the existing permit, he or she would have to apply to the state for a new permit to change the use of the existing well.

"During the 19th and 20th centuries the valley's natural resources were used intensively with little regard for natural limitations and resulting impacts. The typical resource users were mining, ranching and timbering. In time, they became aware of proper resource management and maintenance methods, and the valley's natural resources and people benefited. Today, owners of water wells and sewage disposal systems need to be informed of proper methods of design, management and maintenance for the benefit of their land, their neighborhood and their valley."

Jeff Ollinger
UAACOG Water Quality Planner

Questions and Answers

As more people move to the mountains, questions about water increase. This section attempts to answer some of the more common questions that came up at mountain community meetings in Jefferson County, Colorado.

Quantity & Quality Questions

Why do some wells have water while others don't?

In most cases, wells drilled in rocky, mountainous environments provide a reliable supply of water if and when they intersect water-rich cracks in the rock. Finding cracks or "fractures" that carry good supplies of water can be tricky. Because of this, the amount of available water can vary significantly among wells – even wells located within several hundred feet of each other.

What is the problem with nitrates, and what health effect do they have?

Nitrates are one of the most problematic and widespread of ground water contaminants. The toxicity of nitrates to humans is due to the body's reduction of nitrate to nitrite in saliva, and in the digestive system of infants during their first three months of life. At low doses, the toxicity of nitrite in babies has been demonstrated by "Blue Baby Syndrome," a form of slow suffocation in which reduced oxygen levels literally turn the baby blue. Vomiting, diarrhea and labored breathing are other symptoms of the disease.

Some research has indicated that high levels of nitrates can have cardiovascular effects in adults. Tests on animals have indicated a potential link between high nitrates in drinking water and gastrointestinal cancer. While this association is controversial, it is recommended that you limit your exposure to nitrates. It is important to note that elevated nitrates often indicate the presence of disease-causing bacteria and viruses that are difficult to detect.

How often should I have my drinking water tested, and what should I be testing for?

How often is up to you, depending on the history of your water quality. Unless you have known water quality problems, an annual water test for bacteria and nitrates should suffice. Spring testing is best, due to wet conditions. See page 9 for more on what to test for.

Where do I get my drinking water tested, and how do I know if a company is qualified and reputable?

In Colorado, the Department of Public Health and Environment (CDPHE) licenses all water quality labs and operators. Check with the state for a list of licensed companies. Reputation is often best gauged by word of mouth. Ask "the locals" who they use and why.

Why does my water sometimes look murky?

This often occurs after it rains, or when the snow melts in the spring. When water in large amounts enters the ground water system, it can dislodge and/or carry sediment and nutrients. Murky water depends in part on well construction, and the depth of the water-bearing fractures that provide water to your well. An in-home water filter or other treatment system may prevent these substances from getting into your drinking

water. This can be difficult and expensive to treat, and it is more a problem of appearance than health.

How does well and septic construction affect water quality?

Well construction can affect water quality in several ways. Wells that are improperly sealed at or below the surface, or older wells with leaking casing can allow surface contamination or shallow contaminated ground water to enter the well. Wells can also be constructed to tap aquifers or parts of aquifers with high quality water while sealing off an aquifer with poorer quality water. Proper well construction may improve overall water quality. Septic system construction and maintenance of the system can prevent untreated or improperly treated sewage from entering the ground water.

What are the "Best Management Practices" for water quality protection?

Best management practices for the protection of a wellhead are preventive in nature. They are based on awareness and common sense. Examples include:

- conducting an inventory of contaminant sources around the well,
- removing dangerous chemicals from the vicinity of the well,
- not using or mixing chemicals near the well,
- inspecting and maintaining the well head, cap and seals, and
- testing water quality periodically.

The following three actions will assist in safeguarding the quality of ground water and well water: 1) maintain your septic system, 2) do not site your well in an enclosed pasture or corral, and 3) do not store or stockpile manure, fertilizers, road salts, or other potential contaminants close to the well head.

How does a laboratory know that a water sample is from a given address?

Laboratories have a "chain of custody" procedure that is designed to keep track of a water sample. Of course, water samples could be switched before they get to the laboratory. If someone knowingly provides a false water sample, though hard to prove, the individual would be liable.

What are the "Best Management Practices" for septic systems?

Faulty septic systems are one of the most common sources of water contamination. Best management practices include regular maintenance of the system (i.e., regular inspection and tank pumping), protecting the system from harmful chemicals and wastes, and avoiding overload.

A septic system is only designed to treat household wastewater. Although typical household soaps and cleaners should not cause a problem, paints, paint thinners, solvents, drain cleaners, pesticides, antifreeze, photographic chemicals, or large quantities of chlorine bleach should never be poured down the drain. Also, the following items should never enter the septic system: bones, eggshells, coffee grounds, cigarette butts, condoms, feminine hygiene products and grease - one of the worst enemies of your septic system. These can interrupt the natural digestion processes in your system, and pollute the ground water.

Unlike a public sewer, your septic system is designed to accept less volume. Space your water use over time to prevent overloading the system. This will help prevent sluggish drains, sewage backups, or waste surfacing on the leach field.

Legal Questions

Can people own water?

Under Colorado water law people do not own water, they only own the right to use it. Legally, that right can be bought and sold just like a piece of property. The Colorado Constitution guarantees that a water right may be obtained to use water for beneficial purposes such as irrigation, household use or recreation if a stream is not "over-appropriated." Over-appropriated means that at times there is more demand associated with a stream than there is water available. In Colorado, most streams are over-appropriated.

Is there any recourse for homeowners when water is not drinkable?

This depends on why it is not drinkable. It can be due to man or nature. If other people have made potable water non-potable, you may be able to sue in civil court. You must have an established record of your water's quality to provide as evidence. Ongoing sampling and monitoring is the best solution for protection. You can't sue Mother Nature, but if the problem is naturally caused, you can treat your water on-site.

If I have a well permit, can I use all the water I want?

In Colorado, you are not allowed an unlimited supply of water. The laws are complex because taking water from a well can affect stream levels, and diverting water from a stream can alter well yields. Your well permit will define limitations on water use.

How do I get a well permit?

In Colorado, the state Division of Water Resources issues well permits. In most cases, if you own a legally platted lot (per the requirements of Senate Bill 35) or a parcel of more than 35 acres, you can get a well permit. The first step is to contact the Office of the State Engineer, Division of Water Resources. (www.water.state.co.us)

What is meant by, "First in time, first in right?"

This refers to Colorado's legal system of allocating water to users. This "water rights" system is based on the premise that those who historically first used the water – "first in time," have the highest priority for current water usage – "first in right." The priority is the date on which the water was first used. Therefore, every water right carries a date. The older the date, the more valuable the right. These oldest water rights are "senior" rights and often date back to the mid- to late-1800s.

Senior water rights users get to use their allotted amount of water first. Junior water rights holders have lower priority since they first used the water after those "senior" to them. Depending on the amount of water available, the junior users may or may not get the full amount of what is allotted to them. A dry year may result in no water for junior holders.

Is it legal to "bleach" a well with known bacterial problems prior to collecting a lab sample?

There are some valid reasons for chlorination, e.g., managing a seasonal bacterial presence. Some people may temporarily disinfect their wells by pouring chlorine bleach down them. This is done to ensure biologically-free drinking water and potability. It is highly suggested to wait 3 to 5 days after flushing the chlorine to resample. This ensures a more representative source-water sample. If

samples repeatedly show a bacterial presence, chlorination may not be the answer.

Because most people do not know how to properly disinfect their wells, there is usually a strong odor of chlorine. If you can smell chlorine, order a new test. You can also run a test for chlorine in the water sample using a basic pool or spa chlorine kit.

Is it true that some small water distribution systems are not subject to the testing requirements of the Safe Drinking Water Act?

If the system serves less than 15 homes, the Safe Drinking Water Act does not require water quality tests. A way to protect yourself is to run your own tests periodically. You may be able to convince others on the system to share the costs of testing. Testing water quality once a year is usually adequate, unless you have reason to believe that contaminants are being introduced to the system. If you believe your water supply is being contaminated by neighboring properties, an established record of your water quality will serve as evidence. Ongoing sampling and monitoring is the best way to protect yourself.

Does obtaining a well permit guarantee I'll have water?

Unfortunately it does not. A well permit gives you permission to look for water. You're not guaranteed to find water where you drill, and the state can't promise the water will continue to flow.

What laws ensure well water quality?

Unlike city residents who rely on local government or a water district to treat and protect water quality, you are responsible for ensuring that your well water is safe to drink. In Colorado, no regulations guarantee the safety of the quality of water from an individual well. The Colorado Water Pollution Control Act of 1966, now the Water Quality Control Act, established water quality standards for both surface and ground water. These standards guide and educate homeowners as to the acceptable levels of potential contaminants in well water, but currently, they are not enforceable for private individual wells.

What are the pros and cons of well adjudication?

Adjudication is a legal process resulting in a court-decreed water right. It defines the water right in terms of date of first use (priority date), type of use, and amount of water that can be used. Any well can be adjudicated, and for some kinds of well use adjudication is a requirement. Exempt wells (typical residential wells) do not have to be adjudicated. It is an option some owners choose for various reasons. The most important reason to adjudicate a well is to have standing before water court if you wish to protest some other case before the court. The biggest potential drawback of adjudicating a well, is that it draws attention to your well permit and uses. An inspection of your property and well permit records is likely, and violations of the permit conditions, or problems with the permit forms may be discovered. This is not a concern if you are using your well in compliance with state law. Whether you choose to adjudicate or not, it is wise to establish and build a record of data and history on your well. Data from regular monitoring of water levels, well yield, and water quality will help you track potential changes to your well. Also, stay informed of surrounding land use activities.

What is a Plan of Augmentation?

With the exception of geothermal wells, every well consumes some portion of the water pumped. This amount, which is lost to the stream system, is call consumptive use.

Before a new well permit can be issued, this consumed amount needs to be identified with a plan in place to return this depleted amount back to the stream system so that existing older water rights are not injured. The process of replacement is a "Plan of Augmentation." This Plan is a Water Court process where the consumptive use is identified using the location, amount and timing of use. Plans must show how this consumptive use is to be replaced to the stream system where it occurred. This is usually accomplished through the release of stored water to match timing of use and amount of depletion that occurs. Some types of domestic wells are exempt from this need for replacement. Contact the Upper Arkansas Water Conservancy District regarding augmentation, wells and planning (See page 25 for more information).

How do we protect ourselves against future wells depleting the already limited ground water supply up here?

In general, new construction can occur on vacant parcels that are legally subdivided and meet zoning and building regulations. If the landowner has applied for property rezoning with the county, anyone opposed can express concerns to the Planning Commission and to the Board of County Commissioners.

If a landowner has a legal parcel, they can usually get a well permit. If they have a well permit, they can drill a well.

Landowners can adjudicate their wells, granting them legal standing in water court should they wish to protest some other case before the court. Well adjudication does not guarantee water availability.

It is wise to establish and build a record of data and history on your well. Collect data from regular monitoring of water levels, well yield, and water quality to track potential changes to your well. Also, stay informed of surrounding land use activities.

What well documents or information should I get from the sellers?

The state's Division of Water Resources retains well records. Before purchasing, obtain a copy of the well record and review it carefully. A well record will include the well driller's log with construction details, the pump installer's report with pump depth and type, and the well permit showing allowed water uses(s).

Lifestyle Questions

What are the hidden costs of wells and septic systems?

Preventive maintenance costs are minor compared to the cost of replacing an entire septic system, or drilling a new well. Usage and age take their toll on various parts of wells and septic systems. Well pumps and pressure tanks may need to be replaced. A continually declining well yield may indicate the need to drill a new well. Also, you may need an in-home water treatment system. Be aware that companies may try to convince homeowners that expensive treatment equipment or septic additives are necessary, when they may not be. Have your water tested first, and always require written guarantees on any treatment claims. Regular maintenance will prolong the life of a septic system. Some experts argue that even a well-maintained standard septic system will eventually fail. When that happens, the installation of a new leach field, or new system would be required.

Are there ways to conserve ground water?

Yes. In-home water conservation measures include low-flow shower heads and toilets and watering plants with water used for boiling eggs or cooking vegetables.

Outside, landscape design using native trees, shrubs and grass mixes is recommended because additional watering is not necessary. Consult your local nursery and landscape professionals.

Are there different types of septic systems? If so, how do they vary in quality, maintenance, and cost?

There are several types of septic systems available. Contact an installer for descriptions of types and uses. With the proper construction and maintenance, a standard septic system can be an effective treatment option. The quality of the materials used in the construction determines its effectiveness. The entire septic system, including leach fields, should be inspected before you purchase any home. Sometimes septic installation companies and/or previous owners cut costs by using alternate materials.

In some cases, water quality or other site factors determine the need for an alternative system. The most common is the advanced, nitrogen-reducing septic system. This system requires a smaller leaching field because nitrate levels are reduced internally before wastewater leaves the septic tank. This system performs well, but costs more, and requires a maintenance contract.

For information on a specific septic system, some counties keep “as built” drawings of existing systems. These are drafted by the county inspector when he checks the installation of the septic system to ensure that the system was installed in accordance with county regulations.

What are the different types of wells and what are the differences in efficiency, quality, maintenance, and costs?

Some wells may be used in-house only and do not allow outside watering. Others may allow in-house use and limited watering of domestic animals and up to one acre of grass and/or garden. Some may allow water for livestock. In Colorado, it is best to contact the Division of Water Resources of the Office of the State Engineer for specifics. The efficiency of a well is dependent on well construction, pumping equipment installed, depth to water, and aquifer characteristics. Typically, a small capacity well will employ either a jet-type pump or a submersible pump. Consult with a licensed pump installer to determine the type of pumping equipment best suited for your area and conditions. The cost of well construction, pump installation and maintenance, water quality testing and treatment vary considerably. It is best to contact these professionals directly. Well drillers, pump installers, and water quality laboratories are licensed by the State of Colorado and must comply with established standards.

Definitions

The following definitions describe the meanings of terms, which are used in this booklet and with which the reader may not be familiar.

Acid-mine drainage
Acidic water forms through the chemical reaction of water with rock containing sulfide minerals (such as pyrite) forming sulfuric acid. The acid leaches heavy metals from the mineralized rock and keeps the metals dissolved in water. This acid rock drainage can adversely impact aquatic life and human health if it mixes with water supplies.

Aquifer
A geologic formation, part of a formation, or group of formations, that will yield usable quantities to a well or a spring.

Confining unit (bed)
A geologic formation, part of a formation, or group of formations, whose hydraulic conductivity may range from nearly zero to some value distinctly lower than that of the aquifer that it confines.

Corrosivity
Refers to the aggressiveness of water. This is in part a function of how acidic the water is. The EPA defines "corrosive" as, " A chemical agent that reacts with the surface of a material causing it to deteriorate or wear away."

Fault
A fracture or a zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture.

Fracture
A crack or break in a rock formation due to structural stresses. Fractures are often the result of the natural process at work when the mountains were formed (i.e., folding and faulting). Fractures may or may not hold ground water.

Ground water
The water found beneath the Earth's surface at pressure equal to or greater than atmospheric pressure.
Unconfined ground water has a water table.
Confined ground water is under pressure significantly greater than atmospheric, and its upper limit is the bottom of a bed of distinctly lower hydraulic conductivity than that of the material in which confined water occurs.

Hydraulic conductivity
The property of a porous medium, which allows water to flow through it. It is analogous to electrical conductivity.

Igneous rocks
Said of a rock or mineral that solidified from molten or partly molten material. These include intrusive igneous rocks, such as granite, and extrusive rocks, such as volcanic rocks.

Metamorphic rocks
Any rock derived from pre-existing rocks by mineralogical, chemical, and/or structural changes, in response to marked changes in temperature, pressure, and chemical environment, generally at depth in the Earth's crust.

Overburden
The loose soil, silt, sand, gravel, and other unconsolidated material overlying bedrock, either transported or formed in place (*regolith*).

Sedimentary rocks
A rock resulting from the consolidation of loose sediment that has accumulated in layers, consisting of mechanically formed fragments of pre-existing rock transported from its source and deposited in water or from air or ice, or formed by precipitation from solution, or consisting of the remains or secretions of plants and animals.

Unconsolidated material
A sediment that is loosely arranged or unstratified, or whose particles are not cemented together.

Water table
That surface in an unconfined water body at which the pressure is atmospheric.

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Green, G.N., 1992, The digital geologic map of Colorado in ARC/INFO format: U.S. Geological Survey Open-File Report 92-0507

Londquist, C.J., and Livingston, R.K., 1978, Water-resources appraisal of the Wet Mountain Valley, in parts of Custer and Fremont Counties, Colorado: U.S. Geological Survey Water-Resources Investigations Report 78-1, 56 p.

Tweto, Ogden, 1979, Geologic map of Colorado: U.S. Geological Survey, State Geologic Map, scale 1:500,000.

The publications referenced in this report may be purchased from:

USGS Information Services (Map and Book Sales)
Box 25286
Denver Federal Center
Denver, CO 80225
Telephone: (303) 202-4700
Fax: (303) 202-4693
Hours: Monday through Friday 8:00 AM to 4:00 PM (Mountain Time)

USGS Information Services (Open-File Report Sales)
BOX 25286
Denver Federal Center
Denver, CO 80225
Telephone: (303) 202-4700
Fax: (303) 202-4188
Hours: Monday through Friday 8:00 AM to 4:00 PM (Mountain Time)

Some publications of the U.S. Geological Survey can be accessed online at: http://infotrek.er.usgs.gov/pubs/

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For More Information

This resource list may prove helpful should you wish to further research a topic.

Chaffee County Planning & Zoning Department
Phone: (719) 530-5565
Web site: www.chaffeecounty.org

Colorado Department of Natural Resources, Water Resources Division
Phone: (303) 866-3581
Ground Water Information Desk:
(303) 866-3587
Records Section:
(303) 866-3447
Web site: www.water.state.co.us

Colorado Department of Public Health and Environment
Phone: (303) .692-2035
Web site: www.cdphe.state.co.us

Custer County Planning and Zoning
Phone: (719) 783-2669
Web site: www.custercountygov.com

Fremont County Planning and Zoning
Phone: (719) 276-7360
Website: (Under construction)

Lake County Building Inspector
Phone: (719) 486-2875

National Ground Water Association
Phone: (800) 551-7379
Web sites: www.ngwa.org or
www.wellowner.org
[This site contains valuable tips on selecting a driller, ground water, wells, water-quality, and related subjects.]

United States Environmental Protection Agency Region VIII
Region VIII serves Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming, and 27 Tribal Nations.

Phone: (303) 312-6312 or (800) 227-8917 (Region VIII states only)
Safe Drinking Water Hotline: (800) 426-4791
Web sites: www.epa.gov

United States Geological Survey (USGS) Water Resources Division.
The Pueblo Subdistrict of the Colorado Office of the USGS was a technical partner for the Upper Arkansas Ground-Water Study.

Phone: (719) 544-7155
Web sites: www.usgs.gov or
co.water.usgs.gov

Upper Arkansas Area Council of Governments
Phone: (719) 275-8350
Web sites: www.uaacog.org or
www.uaacog.com

UAACOG Water Quality Planning
Phone: (719) 395-2602

Upper Arkansas Water Conservancy District
Phone: (719) 539-5425
Web site: www.uawcd.com