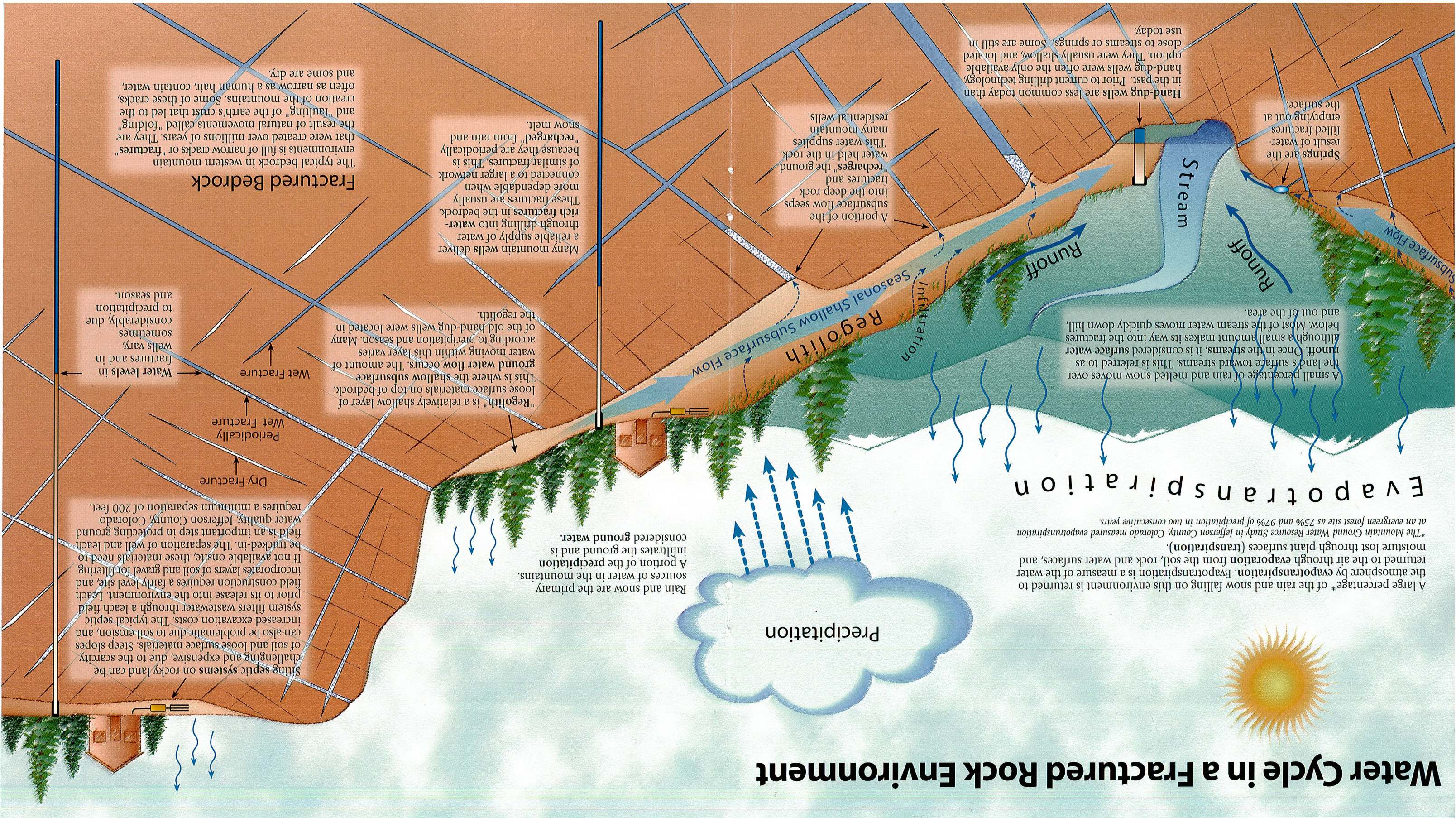


Water Cycle in a Fractured Rock Environment



A large percentage* of the rain and snow falling on this environment is returned to the atmosphere by **evapotranspiration**. Evapotranspiration is a measure of the water moisture lost through plant surfaces (**transpiration**).

*The Mountain Ground Water Resource Study in Jefferson County, Colorado measured evapotranspiration at an evergreen forest site as 75% and 97% of precipitation in two consecutive years.

A small percentage of rain and melted snow moves over the land's surface toward streams. This is referred to as **runoff**. Once in the streams, it is considered **surface water** although a small amount makes its way into the fractures below. Most of the stream water moves quickly down hill, and out of the area.

Springs are the result of water-filled fractures emptying out at the surface.

Hand-dug wells are less common today than in the past. Prior to current drilling technology, hand-dug wells were often the only available option. They were usually shallow, and located close to streams or springs. Some are still in use today.

A portion of the subsurface flow seeps into the deep rock fractures and "recharges" the ground water held in the rock. This water supplies many mountain residential wells.

Many mountain wells deliver a reliable supply of water through drilling into water-rich fractures in the bedrock. These fractures are usually more dependable when connected to a larger network of similar fractures. This is "recharged" from rain and snow melt.

The typical bedrock in western mountain environments is full of narrow cracks or "fractures" that were created over millions of years. They are the result of natural movements called "folding" and "faulting" of the earth's crust that led to the creation of the mountains. Some of these cracks, often as narrow as a human hair, contain water, and some are dry.

Rain and snow are the primary sources of water in the mountains. A portion of the precipitation infiltrates the ground and is considered **ground water**.

"Regolith" is a relatively shallow layer of loose surface materials on top of bedrock. This is where the **shallow subsurface ground water flow** occurs. The amount of water moving within this layer varies according to precipitation and season. Many of the old hand-dug wells were located in the regolith.

Siting septic systems on rocky land can be challenging and expensive, due to the scarcity of soil and loose surface materials. Steep slopes can also be problematic due to soil erosion, and increased excavation costs. The typical septic system filters wastewater through a leach field prior to its release into the environment. Leach field construction requires a fairly level site, and if not available onsite, these materials need to be trucked-in. The separation of well and leach field is an important step in protecting ground water quality. Jefferson County, Colorado requires a minimum separation of 200 feet.

Dry Fracture

Periodically Wet Fracture

Wet Fracture

Water levels in fractures and in wells vary, sometimes considerably, due to precipitation and season.

WATER SMARTS

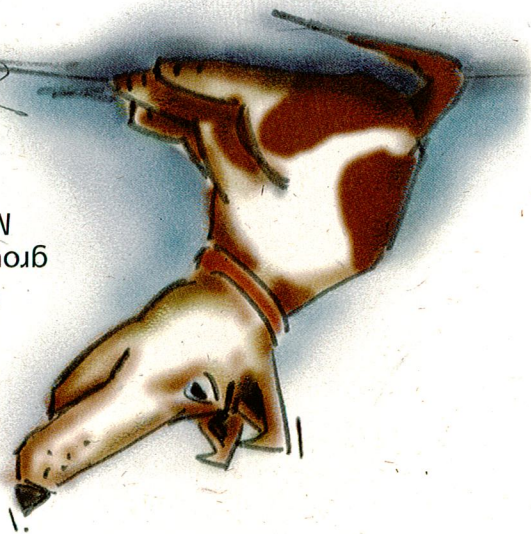
A Homeowner's Guide to Mountain Ground Water

Is it ok to drink?

Will there be enough?

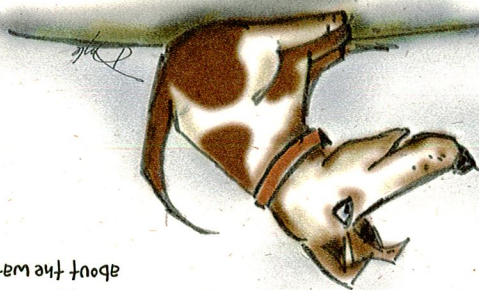
Do I have a right to it?

Questions like these have no simple answers. This guide will provide you with the basics of mountain ground water in the Rocky Mountains, and present an overview of your water rights—and responsibilities.



A Drop in the Bucket

Aren't you worried
about the water?



Life in the mountains is going to be a dream come true
...so much simpler than the city!

Whether you are new to the mountains or a long-time resident, water is a persistent concern. Even seasoned mountain dwellers have questions on this priceless resource. Not surprising, given the complicated nature of ground water in this fragile environment.

As precipitation falls to the Earth, it remains on the surface, evaporates, or seeps into the ground. Water beneath the land surface that is not held in soil is called ground water. Rain and snow are the principle sources of ground water in the Rocky Mountains.

Imagine peering beneath the surface of the ground. You would see a shallow layer of soil and loose material, known as "regolith", on top of a thick bed of hard rock. This "bedrock" is loaded with cracks, or "fractures," that were created over millions of years through natural movement, or the "folding" and "faulting" of the rock. Weathering continues to affect the rock, by increasing the number and size of cracks near the

surface. It is generally believed that due to the surrounding pressure, fewer fractures exist in the deeper areas of fractured rock aquifers.



MOUNTAIN GROUND WATER RESOURCE STUDY

In the summer of 1997, Jefferson County, Colorado and the United States Geological Survey embarked as partners on a four-year study of mountain ground water resources in the suburban foothills west of Denver. Under the guidance of an advisory team consisting of various local, state and federal representatives, the study's purpose was to provide the county with a scientific basis for making land use decisions in the mountains. Reference to this study will be made for illustration throughout this booklet.

Inside this guide

Water Quantity	2
Water Quality	4
Legal Issues	8
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Questions & Answers	15
Definitions	21
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This guide focuses on ground water issues in the fractured bedrock environment typical of the Colorado Rocky Mountains. Topics discussed include ground water hydrology, water quality, wells, septic systems, water rights, and lifestyle impacts. Throughout, you will find references to a case study entitled the "Jefferson County Mountain Ground Water Resource Study". It is a real-world look at the concepts being presented.

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

A kid's education piece has been created in conjunction with this guide. See Resources and back pages for more information.

The Mountain Ground Water Resource
Study identified four generalized rock groups in the 47-square-mile Turkey Creek Watershed. These vary in structure and as a result, water storage and transport abilities. All four groups have extremely low ground water storage capacity compared to the rock and subsurface materials found on the eastern plains.

Typical Aquifer Water Holding Capacity

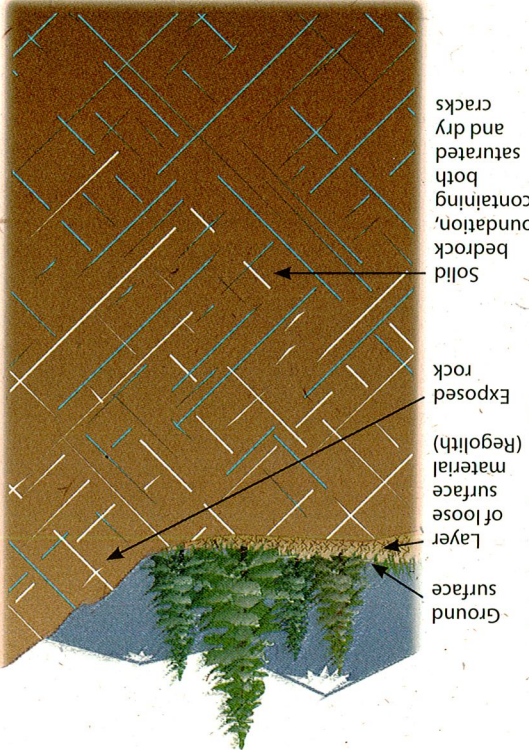
5 gallons of sand & gravel can hold about 16 cups of water
An equal amount of fractured rock can hold about 3 teaspoons of water



Some of these cracks, often as narrow as a human hair, contain the water you drink every day. However, many of the cracks are dry. Also, these fractures must be well connected in order for water to freely pass through them. To access a reliable source of water, a well must intersect water bearing and connected fractures. Because of this, the amount of water available is highly variable. The amount of water a well will produce depends upon how many water-rich cracks are contacted by a well.

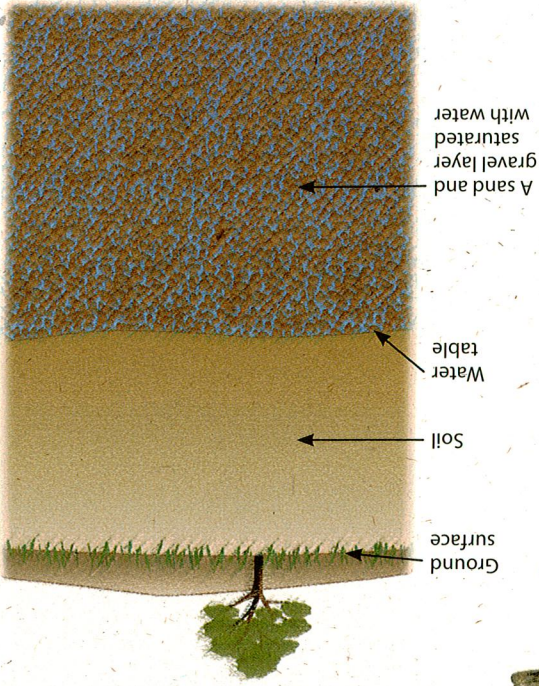
You may also notice that wells are drilled to varying depths. Well depth is, in part, a function of where the well is located. Wells located on top of ridges generally need to be deeper than those located in valley bottoms. Well drillers in Jefferson County, Colorado have found water at depths ranging from one foot to over 1,000 feet below land surface. Based on a review of over 1,100 records in the Colorado State Engineer's Office, the average static water level was 89 feet below the surface in a 47-square-mile basin, in Jefferson County.

Fractured Rock Aquifer



Typical Aquifer Comparison

Sand and Gravel Aquifer



Is It Safe to Drink?

Mountain residents 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 a mountain ground water system makes it vulnerable to contamination.

In the plains, the soils are typically thicker, which allow more filtering. By contrast, parts of the Rocky Mountains have little or no soil or other loose surface material to serve as a filter. As the water moves through cracks in the rock, it may pick up various metals, minerals, dissolved nutrients and other chemicals. At a certain level, these substances can pose health risks.

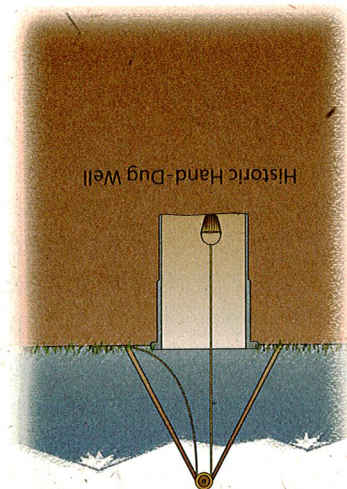
Also contaminants, possibly coming from septic systems, fertilizers, animal waste, and de-icing road salts are less likely to be filtered out before they reach the ground water, and may cause illness.

City residents typically rely on water treatment plants to test and treat drinking water, and public sewage treatment facilities to treat waste.

Mountain dwellers, on the other hand, typically rely on private wells and septic systems. In Colorado, the State Division of Water Resources retains well records. Typically, county health departments retain septic system records, issue permits, and inspect the construction. That means that mountain residents are responsible for testing and treating their water supplies, and periodically inspecting the septic tank and pump-ing it when necessary.

In order to keep septic systems operating properly, and to protect water

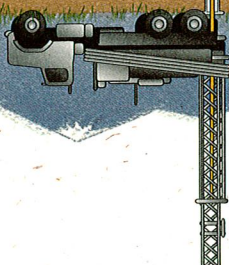
flows to wells, mountain residents must be careful of pollutants that could affect those systems. Excess manure from ani-mals, household chemicals unsuitable for septic systems, or poured directly on the ground, can make their way into the water supply and possibly cause illness. Maintaining your septic system is criti-cal to extend its life, and to provide a healthier environment for your family.



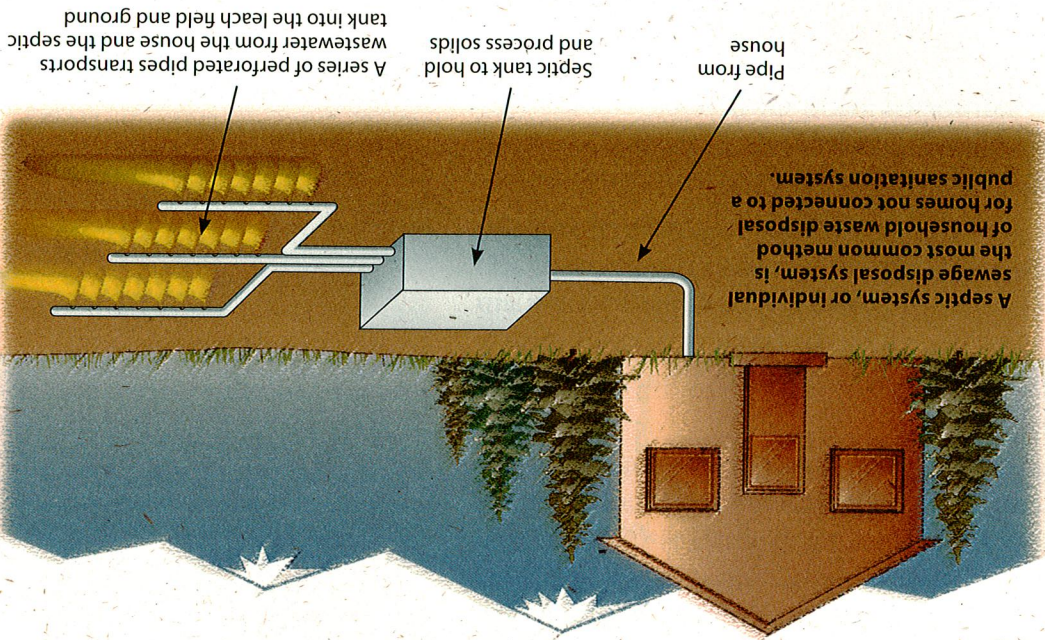
Historic Hand-Dug Well



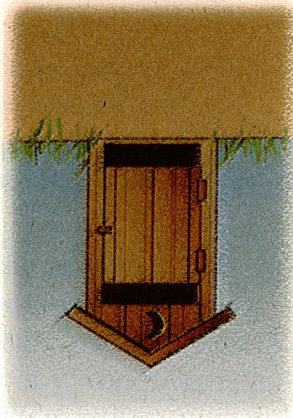
In the Turkey Creek Watershed of the mountains of Jefferson County, Colorado, the average depth of the static water level is 89 feet. The maximum depth of the static wa-ter level is about 520 feet and the minimum is 1 foot, based on a review of over 1,100 well records at the State Engineer's Office.



Contemporary Rig-Drilled Well



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



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 any leaking faucets or 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 it prevents people from dumping trash into streams, rivers and lakes. Water quality protection took a giant step forward in 1972, when the U.S. Congress passed the Clean Water Act. This law and subsequent regulations prohibit people and industries from dumping materials 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 wells.

The Mountain Ground Water

Resource Study included the periodic sampling of private wells for water quality analysis. The laboratory tests included an examination of various nutrients, metals, bacteria and other substances. Several of these, including radon, minerals, and bacteria, occur naturally in the area, and only become health risks when concentrations are high. Radon is a natural component in many ground water supplies in Jefferson County due to the presence of uranium and other mineral deposits. Long term consumption of water containing radon may result in cancer and kidney damage, if uranium is present.

MGWRS

Heard there's nitrates
in that there water!

Did you say
nitrates?



Naturally Occurring and Man-Made Ground Water Contaminants

Water has been called the "universal solvent". As the water from precipitation interacts with surface and subsurface rock and soil, it dissolves minerals from the rock and soil and may pick up and carry with it 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 is 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 either fecal coliforms, or *E. coli* in drinking water strongly suggests that the drinking water supply has been recently contaminated with sewage or animal waste. Therefore, other disease-causing bacteria and viruses that are more difficult to detect, may also be present.

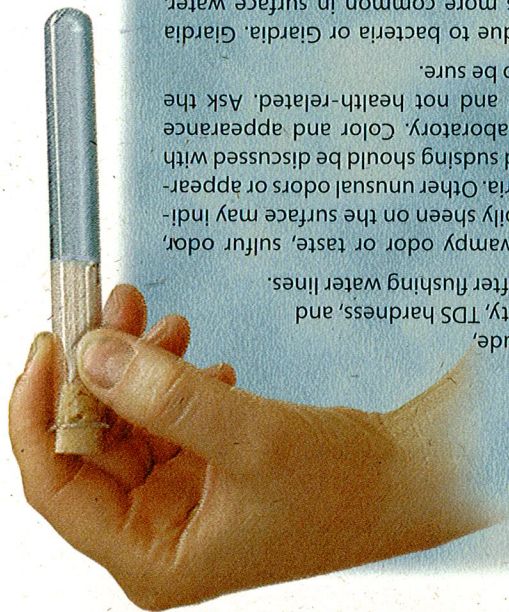
Giardia is a microorganism that is more common and problematic in surface water. It is rarely found in individual wells. No amount of Giardia is acceptable, and if ingested in any amount it may cause severe diarrhea for several days in humans, or in dogs. It is difficult to diagnose, but easy to treat once identified.

Nitrates and phosphates, which are typically associated with human or animal waste, are the most common contaminants from septic systems. Nitrates also come from horse enclosures, animal feedlots, and fertilizer stockpiles.

Multi-million dollar federal clean up in Aspen Park - Conifer, Colorado.



In the spring of 1994, the U.S. Environmental Protection Agency (EPA) learned that a privately owned drinking water well in Aspen Park - Conifer, Colorado was contaminated with low levels of chlorinated solvents, including carbon tetrachloride. In October 1994, EPA tested 115 residential and business wells in the vicinity. The laboratory analysis revealed concentrations of carbon tetrachloride from barely detectable to 99,000 parts per billion (ppb). The highest concentrations far exceeded the EPA's maximum contaminant level for public drinking water supplies (5 ppb). The EPA immediately provided bottled water as needed, and installed water treatment systems in 33 homes to remove all traces of carbon tetrachloride from the affected wells. The EPA also built and continues to operate a large treatment system that pumps contaminated ground water, removes the solvents, and injects the treated water back into the ground. The source of the contamination is still unknown. Although ground water remains contaminated, concentrations are lower, and residents are not drinking contaminated water. Carbon tetrachloride is a solvent that was used as a degreaser and cleaner. It can cause liver problems or cancer.



Testing the Waters

What to test for, is a question best answered through a careful look at your water, plumbing, and personal needs.

In most cases, all private wells should be tested annually for bacteria and nitrates. Spring tends to be the best time for this, since it is usually a time when the ground is most wet. If ground water is free of bacteria (coliforms) in the spring, it is likely to be bacteria-free year-round.

Certain mountain areas have naturally high fluoride levels. While a certain amount of fluoride is desired, and added to public water systems, elevated levels can pose health problems for kids and adults.

If fluoride levels are elevated, a test for radioactive components is recommended. Some areas are known to have high natural radiation levels in ground water due to the presence of uranium or other minerals. Long-term consumption of water with elevated radiation levels may result in significant health problems including cancer and kidney damage, if uranium is involved. Consider testing for gross alpha/beta, uranium, radium-226, and radon-222. An additional test is recommended for radon in the air.

If you notice depositing, staining or buildup on faucets or fixtures, consider testing for total dissolved solids (TDS), hardness, iron, manganese, copper and possibly silica.

Blue-green staining, metallic taste, or thinning pipes with pinholes may require tests for "corrosivity," or the aggressiveness of water. These might include, Langelier 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 on the surface 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 issues are often aesthetic and not health-related. Ask the water-testing laboratory to be sure.

Recurring illness may be due to bacteria or Giardia. Giardia is a microorganism that is more common in surface water, and rarely found in individual wells. Ingested in any amount, Giardia may cause severe diarrhea for several days in humans, or in dogs. While difficult to diagnose, it is easily treated once identified. A trip to the doctor or vet with a stool sample may be required to confirm its presence.

Many household cleansers contain chemicals that can cause health problems when found in high concentrations in ground water. Also, some of these products are not suitable for disposal in your septic system. Consider looking for non-toxic and biodegradable products.

Road salts, both in open stockpiles and as applied to roads to control ice, contain sodium chloride and/or magnesium chloride. Both can cause widespread pollution in surface and ground water.

Automobiles can cause water pollution. Drips of oil, grease, and gasoline are washed into the ground water. Even automobile brakes, as they wear out, release copper and zinc.

Abandoned and active hard-rock mining sites are also potentially significant sources of contamination. Impacts include acid rock drainage, elevated levels of toxic heavy metals, sulfate, cyanide, nitrate and radioactivity.

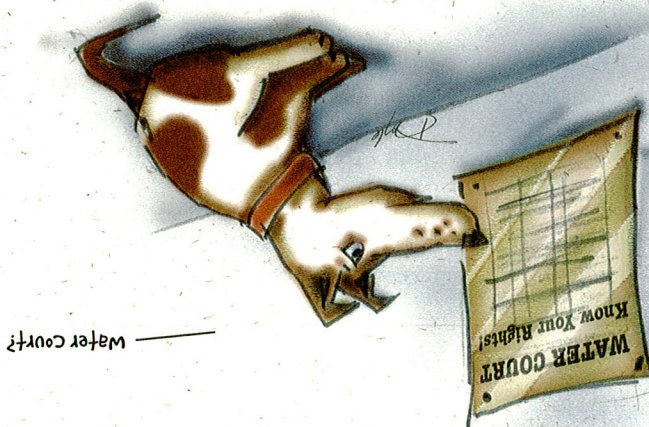
Unlike public water supplies, which are regularly monitored, the responsibility for assuring a safe supply of private well water rests solely with the homeowner. Regular testing is necessary in determining if the well water is safe to drink.

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Nitrate is a contaminant that

was studied in the Mountain Ground Water Resource Study. It is often linked to human activity and commonly originates in septic systems, horse enclosures, animal feedlots and fertilizer stockpiles. A 1975 Jefferson County study found trace amounts of nitrate in the ground water. The current study found many wells averaging 2 milligrams per liter. Although 2 milligrams per liter is considered a small, safe amount, it was a notable find. In 25 years, nitrate levels have gone from nothing to 2 milligrams per liter. Only 2 to 3 percent of the precipitation found its way back to the aquifer. It would be interesting to find out the nitrate level of this 2 or 3 percent of recharged water.

Who's Right?



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 will provide you with the basics, but for particularly tough issues, you may want to consult with an attorney specializing in water law.

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.

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 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.

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.

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.

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.

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, determining how much water is available.

Typical Well Permit

OFFICE OF THE STATE ENGINEER
COLORADO DIVISION OF WATER RESOURCES

WELL PERMIT NUMBER 216379

APPLICANT [Redacted]

EXPIRATION DATE [Redacted]

PERMIT TO CONSTRUCT A WELL

ISSUANCE OF THIS PERMIT DOES NOT CONFER A WATER RIGHT

CONDITIONS OF APPROVAL

NO.	DESCRIPTION
1	[Redacted]
2	[Redacted]
3	[Redacted]
4	[Redacted]
5	[Redacted]
6	[Redacted]

SE 1/4 NE 1/4, Section 8
Twp 55 Range 70N R14E
JEFERSON COUNTY

APPROVED WELL LOCATION

Lot Block Piling Supply

DIRT RANGES FROM
SECTION LINES
[Redacted] FT. from North Section Line
[Redacted] FT. from East Section Line

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.

Well Drilling Tips

- Contact the Colorado Division of Water Resources to obtain a well permit.
- Consult the guidelines in the Jefferson County Department of Health and Environment pamphlet "Individual Water Wells - a Guide to Proper Construction" to learn about recommended construction. (health.jeffco.us)
- Employ a licensed well driller and pump installer.
- Locate your well at least 200 feet from any septic system and away from corals, pastures, drainage ways or other potential sources of contamination.
- Do not site wells in an enclosed pasture or a coral.

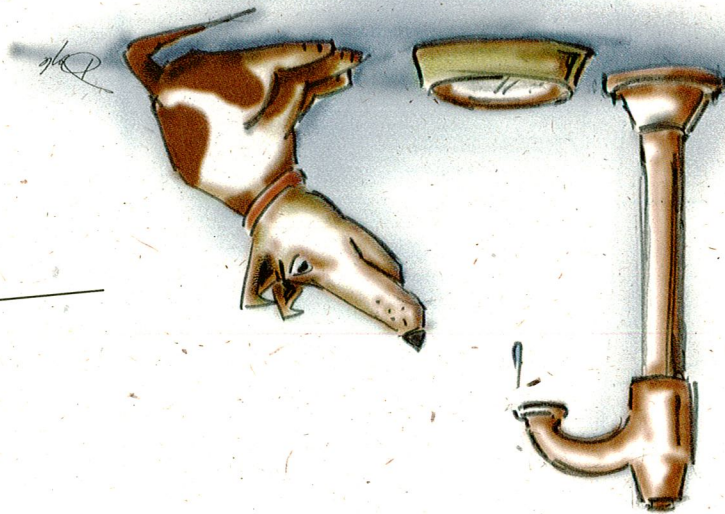
There are several well permit types issued by the Division of Water Resources. Two types of permits are most important to the private homeowner who will be using ground water as a primary water source. They are generally referred to as the domestic well permit and the household-use only permit.

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.

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.
- Test water periodically.



No more water?
Are you crazy?

May not be any more
water down there.

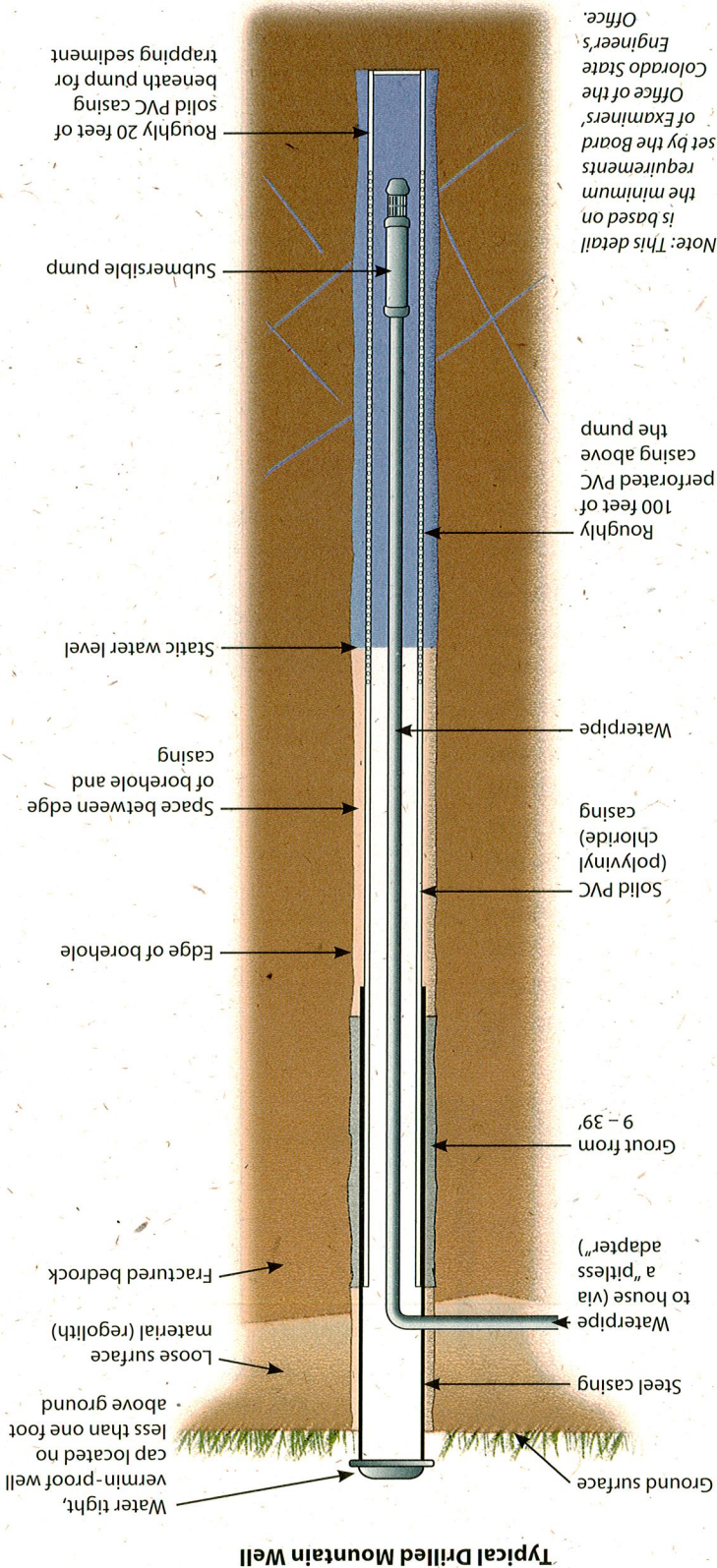
Domestic permits are often older residential permits, or those issued for properties larger than 35 acres. Domestic wells can be used for up to three single-family dwellings and may give you the right to use water outside your house, and for your animals. However this does not, in turn, give the owner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



Is the View Worth the Price?



Yupi-
Septic tank
needs pumpin.

What's that
going to cost?

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 every day 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.

The rapid development of new houses also puts a strain on mountain water resources. Property rights in conjunction with zoning and subdivision regulations, often entitle landowners to build on their property. Some existing homeowners may fear that construction of even one new home with a well will deplete their own water supply. However, recent studies, such as that conducted in Jefferson County, Colorado, are beginning to estimate the amount of ground water in subsurface storage. With this estimate and an estimate of water usage by existing development, local governments can get a better understanding of the "carrying capacity" of small drainage basins.

The ground water modeling done as part of the Mountain Ground Water Resource Study estimated that a large percentage of the water flowing in streams in the area quickly left the watershed and was not available for ground water recharge. It also revealed that on average, 75% and 97% of the precipitation that fell on a typical evergreen forest, in two consecutive years, evaporated into the atmosphere and was not available for surface or ground water. Additionally, on average, the amount of water that percolated into the ground water system in the Turkey Creek Basin was almost the same as the amount of water that was currently being withdrawn by individual wells.

MGWRS

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 are 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.

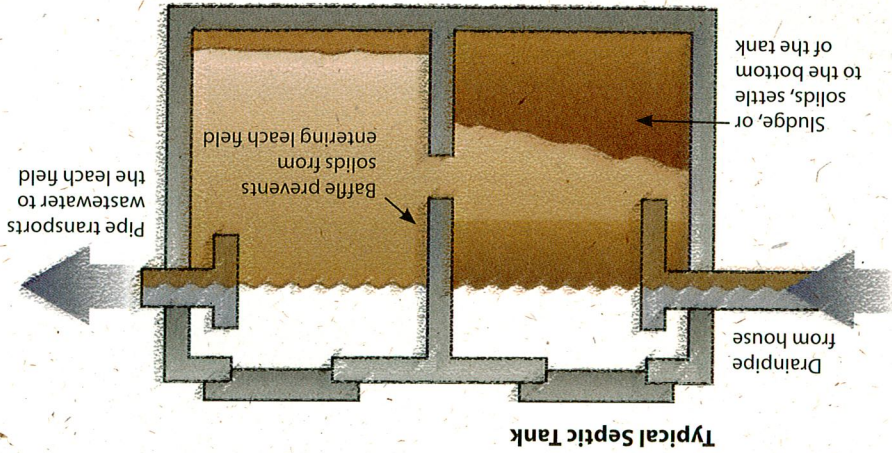
When a septic system or well is improperly constructed, or a septic system is not regularly maintained, raw sewage can seep into the ground and contaminate the well water. In fact, failing septic systems are the leading cause of water contamination in the mountains. To avoid health problems, have your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

er construction materials. Both of these can add to the cost. To safeguard against poor construction or the use of improper materials, it is recommended that an engineer design the system, and a qualified contractor with experience in fractured rock environments install it. Remember to always get contractor claims in writing prior to beginning the work.



Typical Septic Tank

Tips on Septic Systems

- Obtain a permit to construct 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.
- Locate the system at least 200 feet from any well to avoid contamination, and locate leach fields so that they drain away from your well.
- Consult the Jefferson County Dept. of Health and Environment for system construction and maintenance guidelines. Also see health.jeffco.us.
- 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 wastewater 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).

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 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 construct 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. 

"The air is crisp, there are elk and deer browsing, and spring snow runoff courses through the meadow. Mountain living has an appeal that is hard to resist; it also has unique conditions that require special preparation."

Mountain Living Checklist, Jefferson County, Colorado

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?

Note: You should always visit your local planning and zoning department before purchasing the property.

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 cause vascular and 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 7 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 contamination of 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. Maintain your septic system, do not site your well in an enclosed pasture or corral, and do not store or stockpile manure, fertilizers, road salts, or other potential contaminants close to the well head.

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

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.

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 worse 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 truck-in water, or 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.

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.

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, or is defined as a public water supply, 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 recourse do I have if rock blasting for my neighbor's leach field causes damage to my house? Does County Health allow this?

Blasters are licensed and carry liability insurance for just this reason. The Jefferson County Department of Health and Environment does not have a role in regulating blasting. Consult regulations for your county to see if they apply.

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.

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, watering plants with water used for boiling eggs or cooking vegetables.

What can you do if a County Board of Health grants variances for septic permits on lots smaller than one acre?

Protect your own water supply by testing and if necessary, chemically treating your water. Get involved, and contact the Health Department to see if they are willing to inspect and red-flag malfunctioning septic systems. Finally, voice your concerns about variances to the County Board of Health.

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).

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 describe how terms are being used in this booklet. Many are from the U.S. Environmental Protection Agency's "Terms of Environment" (epa.gov/OCEP/aterms/intro.htm). These do not constitute the Agency's official use of terms for regulatory purposes.

Acid Rock Drainage

Acidic water forms through the chemical reaction of surface water and shallow ground water with rock containing sulfide minerals (such as pyrite) forming sulfuric acid. The acid leaches heavy metals from mineralized rock and keeps the metals dissolved in water. Metals are then dispersed in the water draining from the mineralized areas. This acid drainage can adversely impact aquatic and human health when it contacts surface water and ground water.

Adjudication

The judicial process through which the existence of a water right is confirmed by court decree. It includes, but is not limited to, confirmation of the initial date of use, the annual amount of water used and the pumping rate of the well.

Administration

The supervision and control of water diversions in order of their priority. The Colorado State Engineer's Office is responsible for all water rights administration.

Aquifer

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

Augmentation Plan

In a water rights system, this is a way for junior water rights holders to obtain water supplies through terms and conditions approved by a water court that protect senior water rights from the depletions caused by the new diversions. These plans can be very complex, and it is suggested that an engineer and/or attorney be consulted to properly consider all hydrologic and water right factors.

Best Management Practice (BMP)

Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources.

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."

Evapotranspiration

The loss of water from the soil both by evaporation and by transpiration from the plants growing in the soil.

Exempt Well

Small residential and livestock wells that are considered to be exempt from administration. "Exempt from administration" means that even though the water right has a junior priority, it will not be shut off when the senior rights are not able to divert all the water to which they are entitled. To obtain this type of exemption, strict criteria must be met as set forth by the legislature.

Fracture

A crack or break in a rock formation due to structural stresses. Fractures are often the result of the natural processes at work when the mountains were being formed many years ago (i.e., folding, faulting). They may or may not hold or move ground water.

Ground Water

The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs. Because ground water is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants or leaking underground storage tanks.

Hardrock Mining

Usually involves digging tunnels and adits (horizontal entrances into hillsides) to reach lodes of mineral-rich ore.

Hard Water

Alkaline water containing dissolved salts that interfere with some industrial processes and prevent soap from sudsing.

Heavy Metals

Metallic elements with high atomic weights; (e.g., mercury, chromium, cadmium, arsenic, and lead); can damage living things at low concentrations and tend to accumulate in the food chain.

Historic Use of Water

The documented diversion and consumptive use of water over a period of years. A water right user who wishes to change the type or location of use must ensure the change will not injure other water users. This is accomplished by limiting the change to the amount of water that was actually, historically consumed.

Individual Sewage Disposal Systems (ISDS)

Commonly referred to as a septic system. See Septic System definition.

Leach Field

The part of the septic system or ISDS that receives the wastewater minus the solids, from a waste stream. This is also referred to as an absorption field.

Livestock

Domestic animals of types customarily raised or kept on farms or ranches for profit or other productive purposes (Jefferson County Zoning Resolution, orig. 11-15-65). Examples include pigs, sheep, lambs, and poultry.

Nitrate

A compound containing nitrogen that can exist in the atmosphere or as a dissolved gas in water and which can have harmful effects on humans and animals. Nitrates in water can cause severe illness in infants and domestic animals. A plant nutrient and inorganic fertilizer, nitrate is found in septic systems, animal feed lots, agricultural fertilizers, manure, industrial wastewaters, sanitary landfills, and garbage dumps.

Non-Point Source Pollution

Water pollution coming from any number of diffuse sources, but not coming from a single defined point such as the end of a pipe. Pollutants are generally carried off the land by storm water. Common sources are septic systems, mining, agricultural and household use of fertilizers, pesticides and herbicides, construction, forestry, nutrients, and land disposal.

Nutrients

A category of water quality contaminants including nitrates and phosphates. They are essential for healthy plant and animal populations; however, elevated concentrations can degrade water quality and pose risks to human and animal health.

Pitless Adapter

A device designed for attachment to a well casing that will permit water service pipes to pass through the wall of a casing but prevent entrance of contaminants into the well or water supply.

Precious Metals

Mined metals, such as gold, silver, platinum, palladium, iridium, osmium, rhodium and ruthenium.

Regolith

A relatively shallow layer of loose surface material that is on top of bedrock. This is the upper part of the Earth's surface that has been altered by weathering processes. It includes both soil and weathered bedrock.

Septic System

An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a system of tile lines or a pit for disposal of the liquid effluent (sludge) that remains after decomposition of the solids by bacteria in the tank and must be pumped out periodically.

Transpiration

The giving off of moisture through the surface of leaves and other parts of plants.

Water Court

A special division of some district courts that hear matters related to water. Special district judges, called the Water Judges are assigned to these courts. There are seven water courts in Colorado, one in each major river basin.

Water Right

A right to use, in accordance with its priority, a certain amount of water.

Watershed

The land area that drains into a common waterway, such as a stream, river, lake, wetland, or even the ocean. Its boundary is delineated by a line that connects the highest points from which the overland flow drains to a common point.

Well head

The portion of a drilled water well that is at or above the surface of the land.

Xeriscape

A method of landscaping that promotes water conservation. It is based on seven principles: planning and design, limiting turf areas, selecting and zoning plants appropriately, improving the soil, using mulches, irrigating efficiently, and doing appropriate maintenance. The term was coined by the Denver Water Department in 1981 in response to a prolonged drought.



For More Information

This resource list may prove helpful should you wish to further research a topic. Many listed agencies serve the Rocky Mountain region, and other western states. State specific references are for Colorado, and county- specific are for Jefferson County, Colorado.

American Ground Water Trust
 Publishes consumer awareness information on various ground water related topics.
 Phone: (603) 228-5444
 Web site: www.agwt.org

National Drinking Water Clearinghouse
 Offers technical assistance and information about drinking water treatment, management, distribution, infrastructure, safe Drinking Water Act regulations, and water conservation for small, rural communities.
 Phone: (800) 624-8301 or (304) 293-4191
 Web site: www.ndwc.wvu.edu

National Ground Water Association
 Phone: (800) 551-7379
 Web site: www.ngwa.org

United States Environmental Protection Agency (USEPA) Region VIII
 Region Eight serves Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming, and 27 Tribal Nations. This Agency is responsible for protecting human health and the natural environment.
 Phone: (303) 312-6312 or (800) 227-8917
 Safe Drinking Water Hotline (800) 426-4791
 Web site: www.epa.gov

USEPA National Small Flows Clearinghouse
 Managed by the University of West Virginia, this clearinghouse provides information and technical assistance to small communities and homeowners in search of solutions to their wastewater treatment problems.
 Phone: (800) 624-8301 or (304) 293-4191
 Web site: www.nsfcwvu.edu

United States Geological Survey (USGS) Water Resource Division
 The Colorado Office of the USGS Water Resource Division was the technical partner for the Jefferson County, Colorado Mountain Ground Water Resource Study.
 Phone: (303) 236-4882
 Web site: www.usgs.gov or water.usgs.gov

Colorado Board of Health
 Responsible for developing and implementing public health laws to protect the public. One of the Board's public health issues is the regulation of septic systems.
 Phone: (303) 866-6328
 Web site: www.cdph.state.co.us (See Boards and Commissions)

Colorado Department of Public Health and Environment (CDPHE)
 The Colorado Water Quality Control Division of the CDPHE regulates the discharge of pollutants into the state's surface and ground waters and enforces the Primary Drinking Water Regulations.
 Phone: Main (303) 692-2000 or WQCD (303) 692-3500
 Web site: www.cdph.state.co.us (See Divisions and Programs, then Environment)

Colorado Division of Water Resources, Office of the State Engineer
 This office focuses on the distribution of water in accordance with statutes, decrees and interstate compacts. The staff also issues permits for ground water wells (domestic or public use and commercial uses).
 Phone: (303) 866-3581
 Web site: www.water.state.co.us

Colorado Rural Water Association
 Located in Pueblo West, Colorado, the CRWA has created Best Management Practices for Wellhead Protection.
 Phone: (719) 545-6748
 Web site: www.crwana.net

Colorado State University (CSU) Cooperative Extension
 The CSU extension service has fifty-three statewide locations and provides information to residents on agricultural, and home economics topics, including water resource management. Best Management Practice information is available for wellhead protection.
 Phone: (970) 491-6281 (Main Office-Ft. Collins) or (303) 271-6620 (Jefferson County)
 Web site: www.ext.colostate.edu

Colorado Water Quality Control Commission
 The Water Quality Control Commission is responsible for developing specific state and enforces water quality classifications and standards for Colorado's surface and ground waters.
 Phone: (303) 692-3469
 Web site: www.cdph.state.co.us (See Boards and Commissions)

Colorado Water Well Contractors Association
 Information on water well contractors and suppliers.
 Web site: www.cwwca.org

Jefferson County Department of Health and Environment
 This department is responsible for issuing septic system permits. Web site has information on the household hazardous waste drop-off center.
 Phone: (303) 271-5755
 Web site: health.jeffco.us

Jefferson County Planning and Zoning Department
 This department is involved with water quantity and quality issues through zoning, platting and comprehensive planning. The Long-Range Section managed the Jefferson County Mountain Ground Water Resource Study (MGWRS) from its inception through final technical report and recommendations to the Board of County Commissioners.
 Phone: (303) 271-8700
 Web site: planning.jeffco.us (See "Projects" for MGWRS)

Rooney Road Recycling Center
 Household hazardous waste drop-off center for Jefferson County residents.
 Phone: (303) 316-6262
 Web site: health.jeffco.us



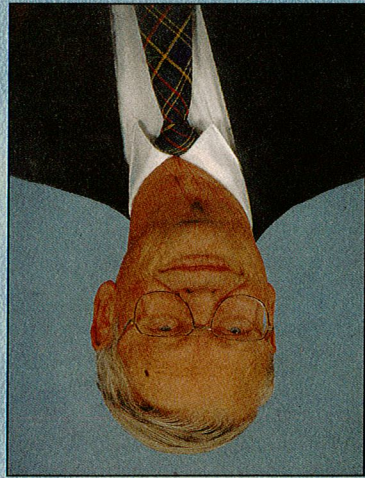
*Remember that as a mountain dweller, the future of your water supply depends on you.
The everyday decisions you make can help protect it, and to preserve
the quality of life you moved to the mountains to attain.*

This publication is being dedicated to the memory of Elwood Bell. Elwood served as an invaluable resource in the creation of this guide. Until his sudden passing on November 7, 2001, he was an active member of the design team. Having recently retired, he volunteered his time and expertise to the project.

His professional role as a sanitary engineer and environmental geologist brought him in touch with water quality issues in Colorado and other western mountain states. This evolved into a personal interest in and commitment to the topic of septic systems and their impact on water quality in mountain environments.

Elwood was a model railroad enthusiast who authored many articles on narrow gauge railroads in Colorado. He was a Jefferson County, Colorado resident and loved the Rocky Mountains.

His personal warmth and dry sense of humor were ever present. He was a joy to work with and will be missed by many.



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