A Guide For the Private Well Owner

This Guide Contains:

- An Introduction to Well Water
- Well Owner Responsibilities
- Well Construction and Well Maintenance
- Protection of the Well Environment
- Septic Systems and the Environment
- Water Quality Sampling and Testing
- Common Well Water Problems
- Water Quality Treatment
- Resource Guide
- Properly Test Your Water

This guide has been compiled in order to empower consumers. Information is essential to understanding your well and the water it will provide for you, your family, and your home.

<u>This is your water.</u>
You do not need to be an expert. Just informed.

ENVIRONMENTAL WATER SYSTEMS®
Quality Water Filtration Crafted in the USA Since 1987.

Introduction:

This guide is intended to make private well ownership a little easier and is designed to:

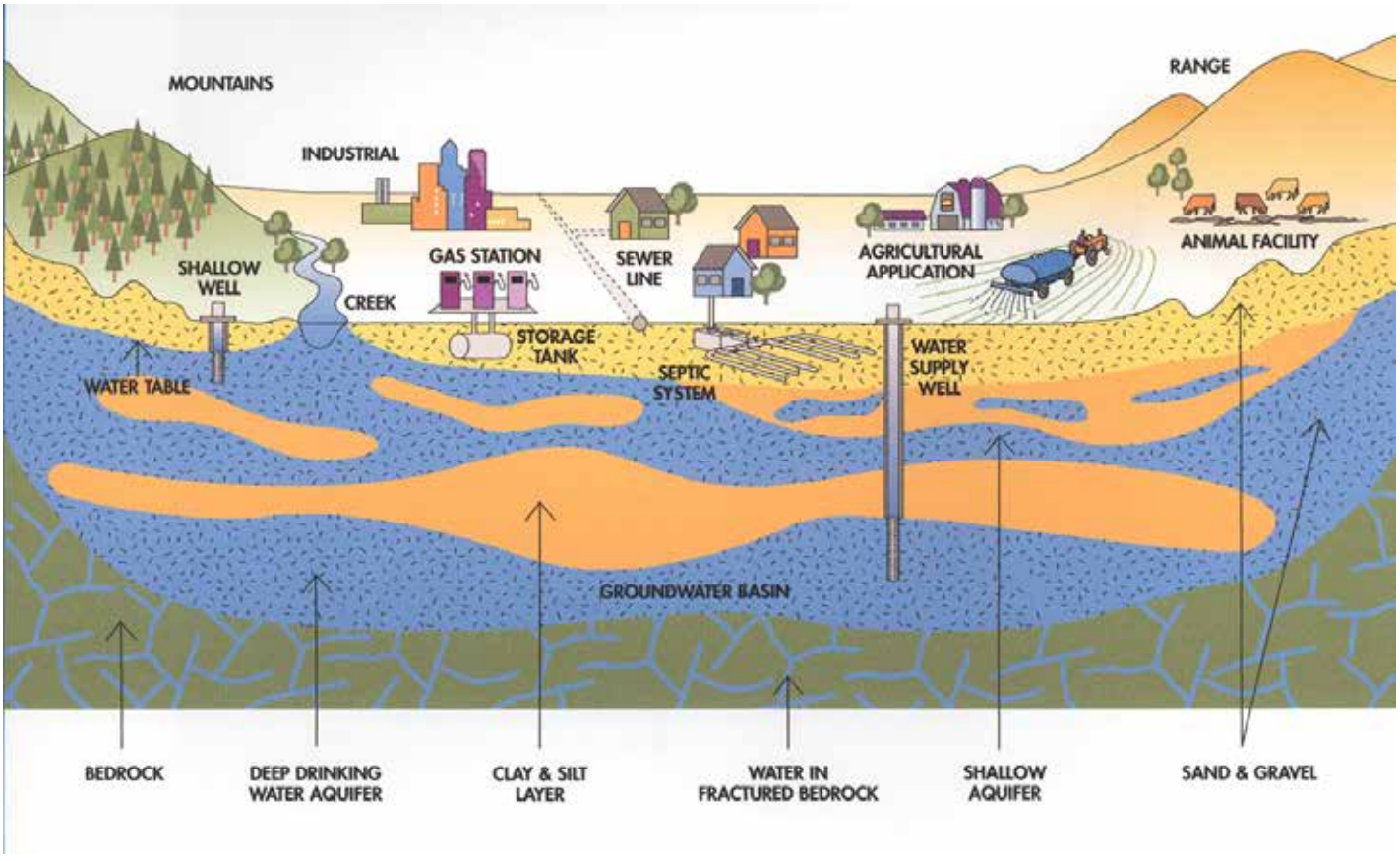
- Introduce well owners to the basics of proper well construction, destruction, and/or maintenance.
- Inform well owners of their responsibilities.
- Alert private well owners to the potential for contamination and the need for independent water-quality testing and if applicable, proper problem solving of water issues.

A percentage of all water used comes from below the ground, where layers of sand and gravel provide a natural storage basin for water in underground aquifers. In addition to being an extraordinary storage facility, the groundwater basin also serves as an inexpensive and efficient treatment and distribution system; as water percolates down, it is naturally purified and spreads out for miles to serve a wide area.

The thousands of water supply wells that draw water from these groundwater basins have traditionally produced very high quality drinking water. In recent years, however, our drinking water aquifers have been threatened by ordinary household chemicals and by-products, toxic chemicals from industrial spills, leaking underground storage tanks, and agricultural applications, as well as biological pathogens from sewers, septic systems and animal facilities. These contaminants can find their way through the natural protective layers of clay and silt and into our drinking water aquifers. The problem can be exasperated by the presence of improperly constructed wells, abandoned wells, or wells located too near to a potential contaminant source like a septic system. These wells can act as vertical pathways, allowing chemicals and pathogens on the surface or in shallow aquifers, to migrate into our deep drinking water aquifers. To help control and prevent the contamination of our groundwater storage basins and to protect public health, we need the cooperation of private well owners.

We have produced this guide to help you protect our groundwater resources and your health.

This guide is meant only as a guide for well owners.
We do not claim that the recommendations made in this document will work in every situation.
Nor do we claim to have covered every possible scenario or contaminant.



Well Owner Responsiblities:

To protect public health and to maintain the high quality of water in drinking water aquifers. Well owners are required to adhere to various state and local laws relating to wells.

In general, well owners are (depending on local, district and/or state regulations) required to:

- Obtain permits before any well construction, destruction, and/or modification.
- Complete any well construction, destruction, or modification according to your district and state well standards.
- Wells must be constructed so that they do not allow poor quality surface water or water from shallow aquifers to migrate into drinking water aquifers. There are specific well construction practices that must be followed to ensure that wells are constructed properly.
- Register all wells. Do not fear local requirements. These requirements, codes and laws are to protect you.
- Obtain well clearance before a well is used for drinking water purposes.
- Properly maintain the well so that it remains in compliance with your district and state well standards. Wells must be maintained so that they do not allow the introduction of surface waters or other materials into them through improperly sealed well casings or gravel fill/sounding tubes. Wells must be secured so that children or animals cannot enter them.
- Properly destroy any wells that are not being used. When no longer in use, wells must be destroyed so that they can never act as vertical conduits or endanger public health. Generally, wells must be completely filled with impervious sealing materials.

According to any code, lack of knowledge is not an excuse.
This is the well providing your water to your home.
You don't need to be an expert - just informed.

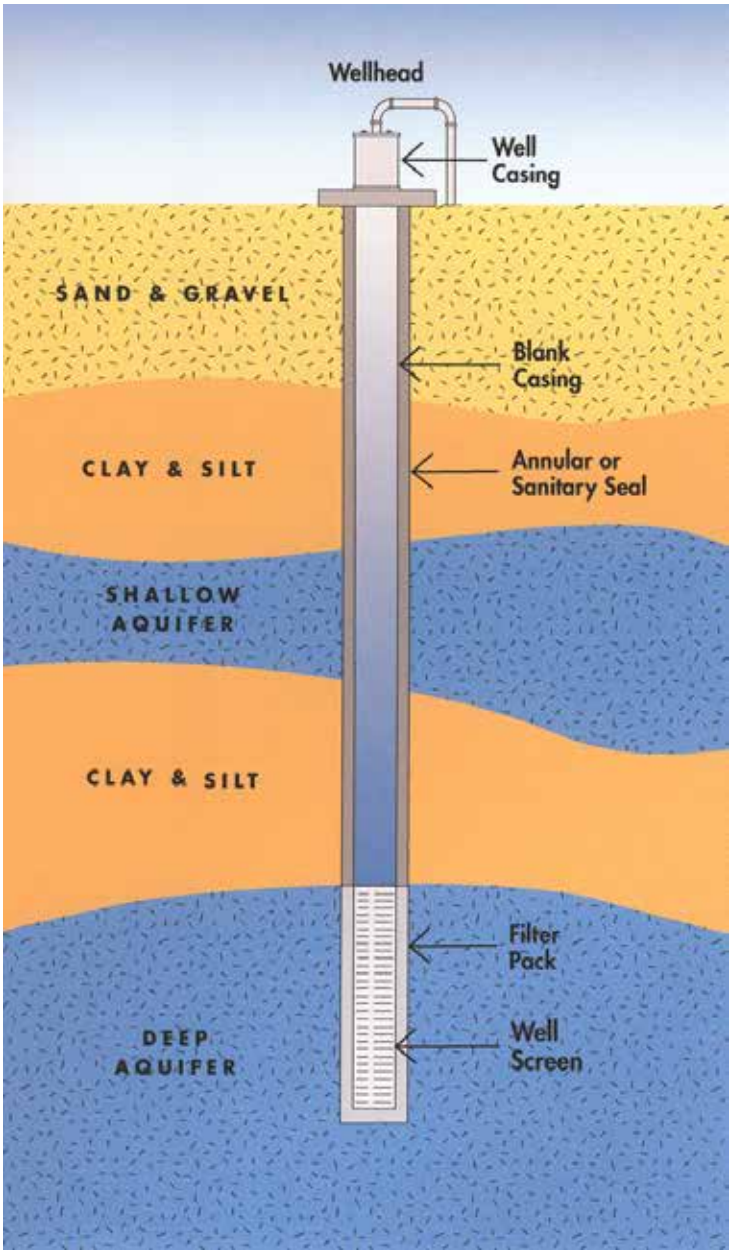
See the following pages for information on:

- **Well construction well maintenance and record-keeping**
- **How to protect your environment and water quality**
- **Independent water sampling and testing**
- **Water quality problems and solutions**
- **Resources**

WELL CONSTRUCTION:
UNDERSTANDING HOW YOUR WELL WORKS AND HOW YOU GET YOUR WATER.

The typical domestic well is constructed by drilling a hole in the ground to a depth of 100 to 300 feet. As the well driller is drilling the hole, the driller notes the type and depth of materials that the bit passes through. This information is recorded on the Driller Log that is submitted to the permitting agency and given to the homeowner. If a Driller Log is not applicable to your local code, insist on one as the homeowner. This information will be of utmost importance for future reference.

The well is constructed once the driller finds layers of sand or gravel that produce enough water to meet the well owner's needs. These water producing layers are called aquifers. To construct the well, the driller installs a length of plastic or steel pipe called the well casing into the hole. The well casing keeps the hole from collapsing and allows pumping equipment to be installed. By regulation, the well casing must have a diameter at least four inches smaller than the diameter of the hole.



Where the hole intersects the best water producing layers, the driller installs the well casing with thick cuts or perforations. This portion of the well is called the well screen. The well screen allows water to pass into the casing but keeps out sand and gravel. Where the hole intersects layers of clay or fine silt (layers that don't typically produce significant quantities of water), the driller installs un-perforated pipe called blank casing.

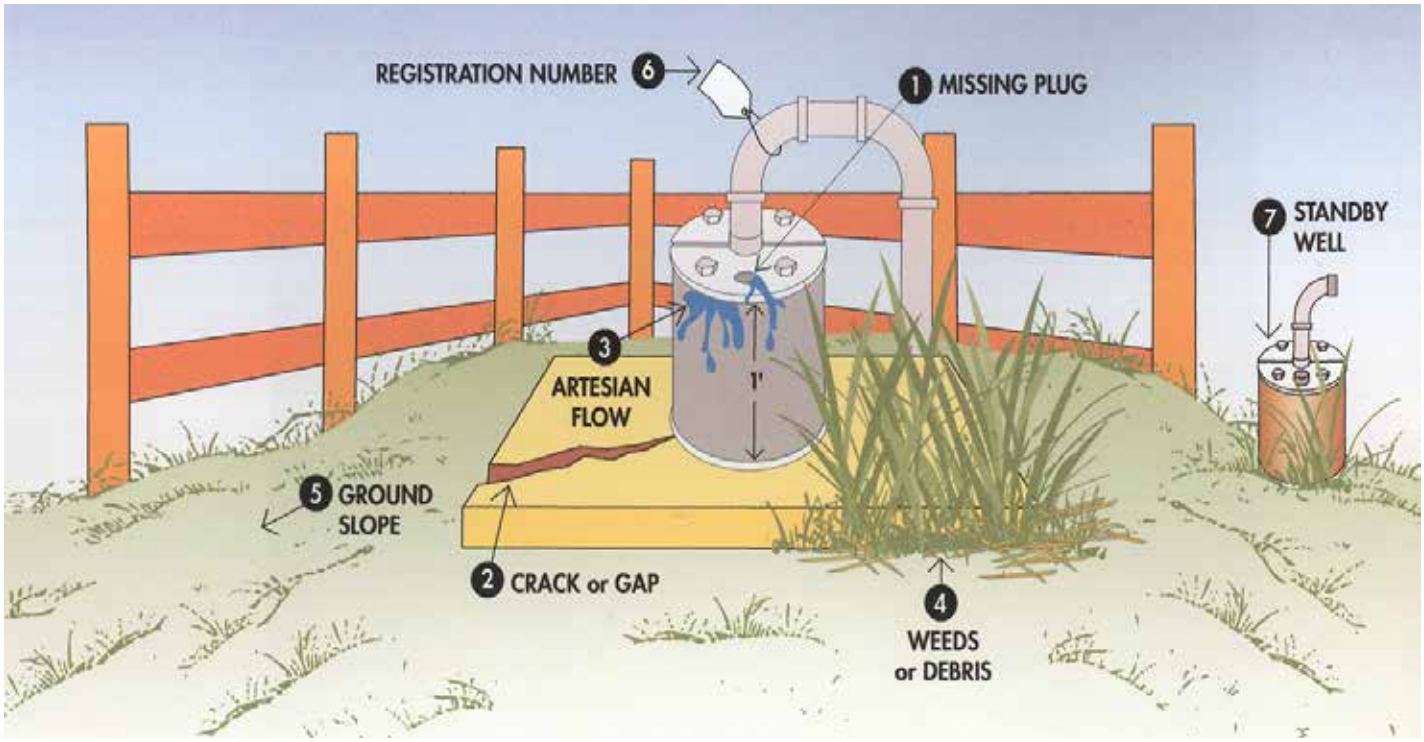
To keep fine sand, silt, and clay from entering the well screen, the driller installs a sand and gravel mix called the filter pack into the space between the casing and the larger diameter hole. To protect the water quality in the deeper, drinking water aquifers from poor quality surface water and shallow aquifer water, the driller also installs a concrete or cement seal (annular or sanitary seal) between the blank casing and the larger diameter hole. Typical well seal depths are 100 or 150 feet.

The annular seal extends upward to the ground surface where it is extended out to create a concrete pad with the well casing extending out of the middle of it. These surface features are called the wellhead. At the wellhead, the casing extends at least one foot above the ground surface and is securely capped to prevent anything, including surface water, from entering the well. The concrete pad is sloped away from the casing to protect the well from damage and from surface water contamination.

Remember, this may be a typical well application and yet, your conditions and situation may be different. However, whether or not your well is deeper or much more shallow - proper construction, maintenance and record-keeping will always be required. The information provided in this guide will provide you with the resources to be informed.

WELL MAINTENANCE:
THE SIMPLE THINGS TO LOOK FOR AND THE MAINTENANCE NEEDED.

A poorly maintained well can lead to a variety of problems including poor water quality and reductions in the amount of water your well can produce. To minimize these potential problems, a well maintenance program is an important part of a well owner's responsibilities.



1 Look for openings that insects, rodents, water, or anything else can enter. Cap, seal, or otherwise plug them.

2 Look for cracks in the concrete pad that would allow water, and any contaminants it may be carrying, to follow the well casing down into your drinking water aquifer. Seal cracks, or re-pour a new concrete pad.

3 If water is flowing out the top of the well, call a licensed well contractor to stop the flow. In addition to being a waste of water, if water can leak out, contaminants can seep in.

4 Remove weeds, leaves, and other debris from around your well. These can create great homes for rodents and other pests. Remember, do not use herbicides or any other chemicals near the well.

5 Make sure the ground slopes or drains away from your well and that your well casing extends at least one foot above the ground to ensure that surface water does not collect or flow near the well.

6 Make sure your well registration number (if applicable to your local codes) is still visible on your well. This may be a local legal requirement. Call your local district for information.

7 If you have an inactive well, turn the pump on several times during the year to make sure that everything is functioning properly. Inspect and maintain your inactive well following the same guidelines as for your active well. If you never plan to use the well again, you may be legally required to properly destroy it. Properly destroying the well will prevent it from being an accidental pathway of contamination into your active well, your neighbor's well, or the groundwater.

WELL MAINTENANCE AND THE ALL IMPORTANT RECORD KEEPING

Inspect Your Wellhead

Get in the habit of doing a visual check on your well at least once a year. More often is better.

Maintain Complete Well Records

Effective maintenance programs begin with complete records on the construction, testing, and maintenance of your well. You should work with your contractor to establish inspection and routine maintenance schedules based on the specific characteristics of your well and water supply needs.

Complete well records should include:

- **The Driller Log:**

The document describing the construction of the well: how deep, what depth it draws water from (the perforated interval), piping material, soil types encountered while drilling and the initial start-up date.This important information will help to trouble shoot problems, should they arise. The drilling contractor should provide you with a copy of the Driller Log following completion of the well construction and testing. If not a code requirement, you should request one as the consumer.

- **Pump Test Data:**

The pump test gives information on how much water (GPM - gallons per minute) the well can produce and at what pressure (PSI). This information is also useful to assess well performance as the well ages.

- **Distribution Map:**

Draw a map showing the location of all the buried pipes, the materials and line sizes used, connected to the well. If you share a well with adjacent properties, it is a good idea to have a map of all the plumbing on your neighbors' property as well. This information can be invaluable as the properties change hands and repairs need to be made, or as new wells are added.

- **The Physical Location of the Well:**

Measure the distance to the well from permanent structures (e.g. the centerline of the road or corner of the house).

- **Maintenance Records:**

Record whenever you have any maintenance done, such as replacing the pump or check valves. This is important information to keep track of, regarding the age of various components, what work was done, and who repaired them last.

- **Water Quality Data:**

Keep all your past water quality testing information in one place. By comparing results from one year to the next you will be better able to detect changes which may indicate problems.

- **Disinfection History:** If you disinfect your well, keep track of when, why, and how it was done.

Deteriorating Well Performance

The performance of all wells will deteriorate over time, but proper well construction and maintenance can delay this problem. The typical causes of performance deterioration include one or more of the following: mineral encrustation or biofouling (bacteriological encrustation) of the well screen, physical plugging of the well screen, filter pack, and/or surrounding soils by fine particles, corrosion of the well casing, and pump problems. Many of these problems can be prevented by proper well design and construction, proper pump sizing, proper operation and maintenance, or preventative well maintenance. If not allowed to progress too far, most well performance problems can be corrected. To prevent or correct performance problems, you should work with your Water Well and/or Pump Contractor.

Well Destruction

Any well that is no longer being used for its intended purpose is required by law to be properly destroyed. Because unused, abandoned wells can act as pathways that allow poor quality surface water or shallow groundwater to move into deeper drinking water aquifers, it is very important that they are properly destroyed. This is especially true if other water supply wells are operating in the area. When a well is being used in the vicinity of an abandoned well, the pumping activity in the operating well can actually pull poor quality water down the abandoned well, into the drinking water aquifers, and then into the operating well.

To eliminate these vertical pathways for contaminant migration, abandoned wells must be destroyed by filling the entire well casing with cement based sealing materials. As with all well construction, modification, or destruction, any well destruction work must be completed by a licensed contractor and a permit.

The Protection of Your Well Water Environment

Why should I protect the groundwater?

For most well owners, groundwater is their only source of water and should, therefore, be protected. Groundwater moves very slowly, often only a few feet per year, and because it moves so slowly, once it becomes polluted, it takes years for it to be naturally flushed clean. Manually cleaning pollutants out of groundwater can be extremely costly and difficult. Often, the only solution is to find a new source of water.

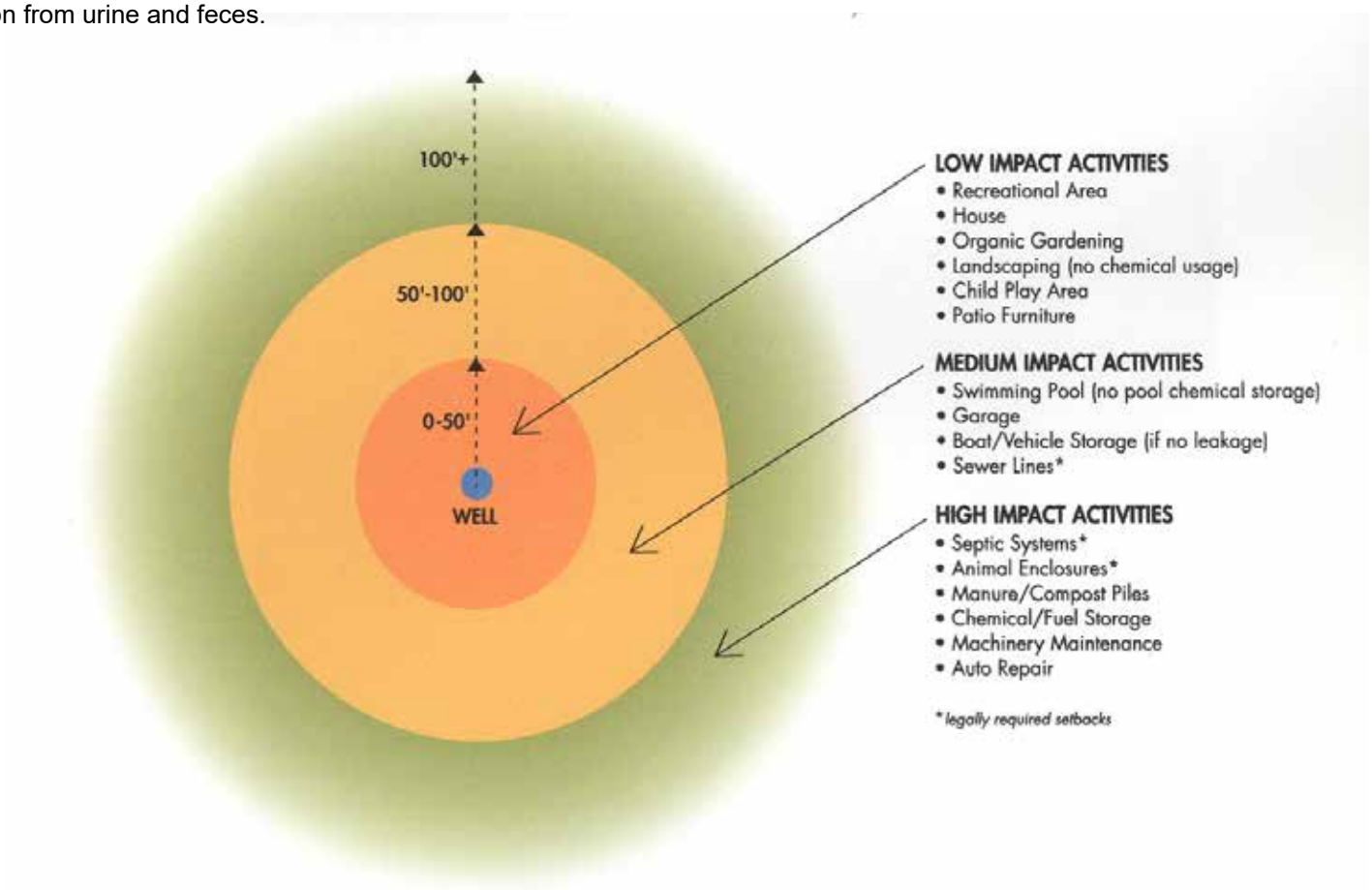
What can I do to protect the quality of my water?

Always keep in mind that you live on top of your drinking water. The layer of earth between you and the water provides some protection from contamination, but it is not perfect. The safest way to protect your water supply is to teach your family, friends, and neighbors: ***If you don't want to drink it, don't put it on, or, in the ground!***

Create a Zone of Protection Around Your Well

Your well is a direct connection between you and your water supply. Contaminants can flow down your well as easily as water flows up it. The farther away from your well you are, the more sand, gravel, and clay there is to filter out contaminants before they reach your water supply. So create a circle at least 50 feet in diameter around your well where you don't store, mix, spray, spill, bury or dump anything that you don't want to drink. Don't forget to look out for your neighbor's well if it is near your property line. Any contamination in your neighbor's well can travel into your well.

Some activities legally require more than a 50-foot zone of protection. For example, septic tanks, leach fields, and animal enclosures need to be at least 100 feet away from any well to ensure that no waste products reach your drinking water. There are many activities that do not have formal, legal setback requirements. Use your common sense. For example, don't tie animals to the well structure--not only do you risk breaking the casing, piping, or electrical connection, you risk contamination from urine and feces.



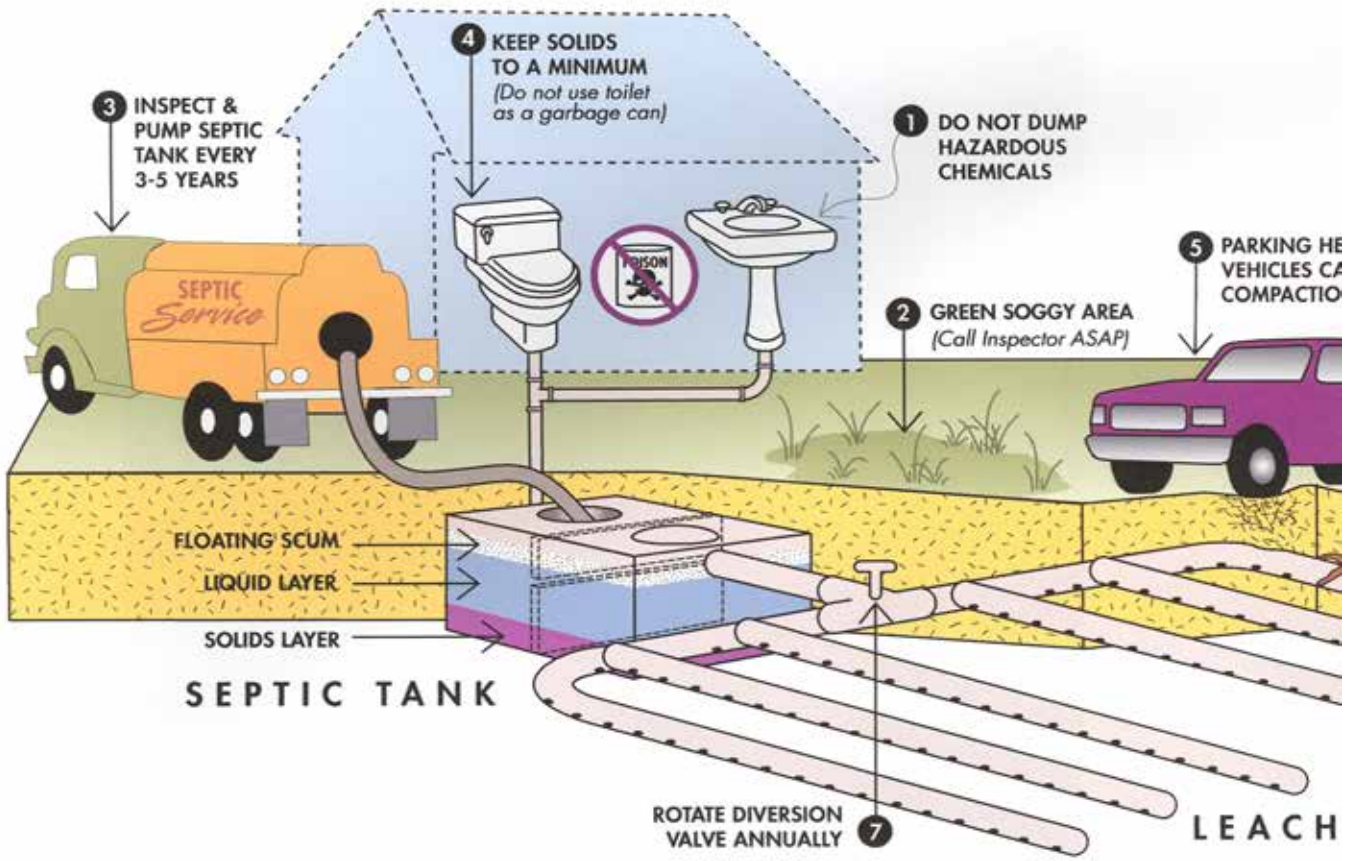
Water Quality Protection and the Maintenance of Your Septic System

A septic system consists of a tank and a leach or drain field. All the solid/liquid waste from inside the home flows into the septic tank. The septic tank is composed of two compartments. The waste is deposited in the first compartment where the solids settle to the bottom and the liquid and scum float above it. Bacteria and other microorganisms break down the solid materials. These microorganisms are important to the process of your septic system.

As the liquid separates from the solids, it overflows into the second compartment where more separation and decomposition occur before it flows into the leach/drain field. The leach/drain field is a network of perforated pipes within a trench of washed drain rock buried about two to three feet deep. The liquid waste flows out of the perforated pipe and into the soil where more pollutants are removed. By the time the wastewater reaches the groundwater, few impurities should remain.

If you have a septic system, keep in mind that whatever goes down the drain may find its way into your drinking water. The required 100-foot setback between your well and your septic system provides relatively good protection against bacteria and viruses when it is working properly. However, this setback was not designed to protect against things like photographic processing chemicals, hazardous art supplies, hazardous household cleaners, paint and paint cleaners, automotive wastes, pesticides, by-products from soaps, detergents, shampoos and conditioners, and other hazardous chemicals that may not break down and filter out as easily.

Either from you, your neighbor, or any groundwater - these are the volatile organic contaminants (VOC's) that are generally odorless, colorless and/or tasteless; difficult and expensive to test for - but relatively easy to reduce and safeguard from. See below and the next page for some of the things to be aware of, and look out for.



Inspect Your Wellhead On a Regular Basis

It is very important to keep any foreign materials, including surface water, out of your well. Therefore, it is important that your well is free from opening and that your concrete well pad is structurally sound. Your well should be inspected annually to be sure that there are no openings in the wellhead or cracks in the well pad. Any openings or cracks should be secured or sealed. Refer to pages 4, 5 and 6 in this Guide for more information on how to complete an inspection.

Protect The Well Structure

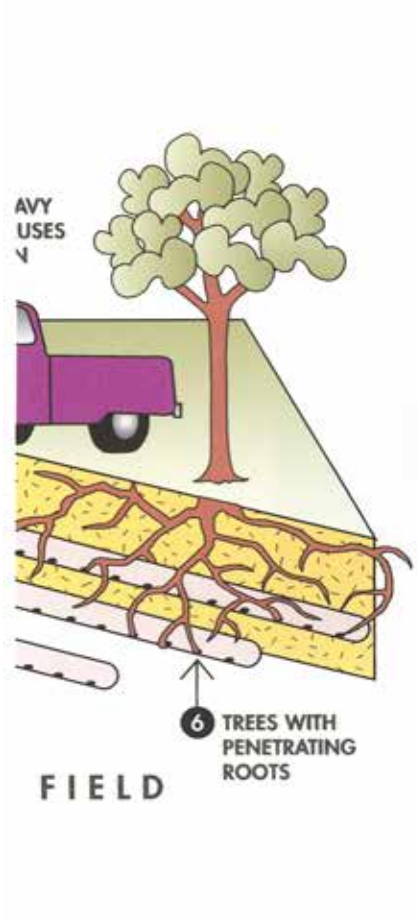
Many well repairs can be very costly, so it pays to protect your well from any physical damage.

- The safest way to protect your well from being damaged or lost is to build a small structure or fence around it. Keep in mind that you will need easy access to the well for maintenance and repairs. If you don't have a structure around your well, then clearly mark it so when vegetation grows up, it doesn't become buried and lost.
- Lock the well enclosure to minimize the chance of vandalism.

A Word About The Brine Discharge From Softeners - Some Restrictions May Apply To Their Use.

- Brine discharge may be a problem for your septic application. The brine discharge kills the microorganisms necessary for the septic process to function. Some states or local agencies have already banned the use of softeners and their brine discharge to septic and even to municipal supplies due to the problems created with wastewater treatment and ground water contamination. Some restrictions require softeners to have metered valves to prevent excessive brine discharge, hot-side only applications, or salt-exchange tanks and services.
- Local water dealers and other organizations do not inform consumers of these issues and believe these rules are unenforceable, however the consumer is ultimately responsible. These restrictions apply to both sodium and potassium chloride, since both are salts.
- Softeners may also provide warranty issues with pools and spas, certain other products and finishes.
- Softened water should not be used for drinking, cooking, pets or plants and is usually bypassed or "looped away" from the cold side of the kitchen sink. Reverse Osmosis, which also has its' drawbacks, may be sold to remove the salt from the water that the softener put in at the kitchen sink, yet may be misapplied for your local water conditions.

Septic System Health, Hazards and Maintenance



1 Do not dump hazardous chemicals down the drain. If your drain is plugged try using boiling water or a drain snake instead of chemical drain cleaners. Use less toxic cleaning supplies whenever possible. Take all hazardous chemicals to a hazardous waste drop-off for disposal.

2 If you notice a sewage smell, a continuously wet area in your yard, lush vegetation around the septic tank or leach field, or liquid waste backing up through your drains, then something is not working properly. Call a licensed septic tank inspector immediately.

3 Have your septic tank inspected and pumped every three to five years (more often if you have a garbage disposal). If the solid waste in the tank builds up too high, it can flow into the leach lines, plug them, and cause your system to fail.

4 Keep the solids in your system to a minimum. Do not use your toilet as a garbage can. Food wastes, feminine hygiene products, and other household solids are better placed in the garbage.

5 Do not park or drive heavy equipment over your leach lines. This may compact the soil around the lines and prevent adequate percolation of the liquid waste, causing your system to fail.

6 Do not plant trees near your leach line. Tree roots often seek out the moist environment inside your leach lines and plug them, causing your system to fail.

7 If you have a dual leach field system, change the diversion valve setting once a year.

8 Be cautious of septic tank additives, yeast, bacteria, enzymes, or other products to enhance the system. None of these products have been proven to be beneficial and some can cause permanent damage.

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Quality Water Filtration Crafted in the USA Since 1987.

Water Quality and What You Need To Know

As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and can pick up substances resulting from the presence of animals and human activity.

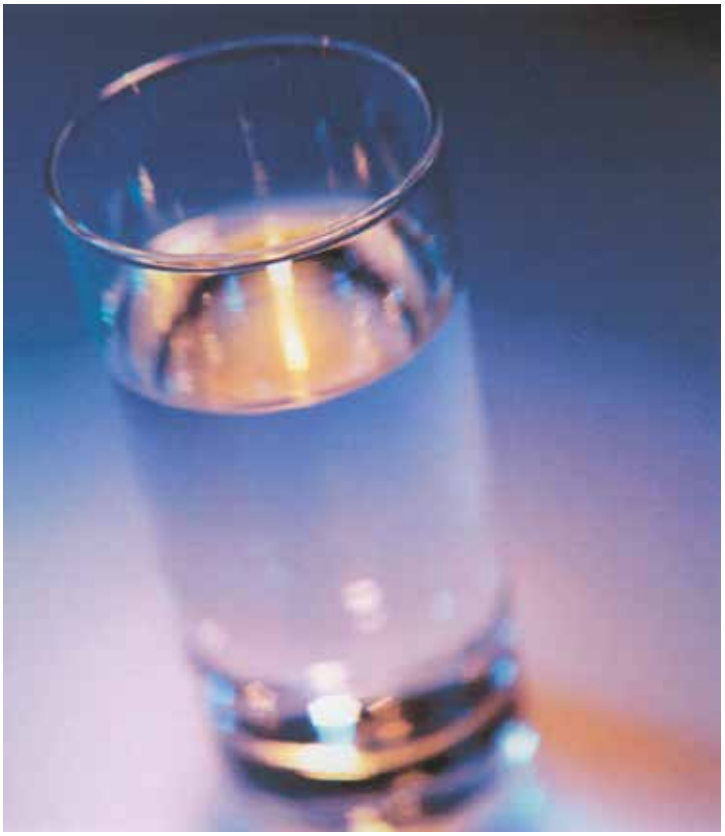
Contaminants that may be present include:

- Microbial contaminants, such as viruses and bacteria, that may come from sewage treatment plants, septic systems, agricultural livestock operations, and wildlife.
- Inorganic contaminants, such as salts and metals, that can be naturally-occurring or result from urban stormwater runoff, industrial or domestic wastewater discharges, animal facility waste generation, mining, or farming.
- Pesticides and herbicides, that may come from a variety of sources such as agriculture, urban stormwater runoff, and residential uses.
- Organic chemical contaminants, including synthetic and volatile organic chemicals, that are by-products of industrial processes and petroleum production, and can also come from gas stations, urban stormwater runoff, agricultural application, and septic systems.
- Radioactive contaminants that in our area are typically naturally occurring.

Drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants and does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the USEPA's Safe Drinking Water Hotline (1-800-426-4791) or by contacting your local municipal water district.

Some people may be more vulnerable to contaminants in drinking water than the general population. Immuno-compromised persons with cancer undergoing chemotherapy, persons who have undergone organ transplants, people with HIV/AIDS, diabetes, lupus, or other immune system disorders, some elderly, and infants, can be particularly at risk from infections. These people should seek advice from their health care providers about their drinking water supply, and is a standard statement among all municipal water districts.

Be aware your health care provider may be not relate water conditions and your health, and more then likely, are not informed on water issues and may make incorrect water treatment recommendations (it's just not their expertise). For example; most dermatologists do not connect our chlorinated water supplies and problems with dry or sensitive skin.



Bacteriological quality of drinking water is determined by analyzing for coliform bacteria. These bacteria occur naturally in the intestinal tracts of humans and animals and in the soil. Although coliform bacteria normally do not cause illness, they should not be present in drinking water. The presence of these bacteria in the drinking water indicates that the water may be contaminated with other organisms that can cause disease. Disease symptoms may typically include diarrhea, cramps, nausea, and any associated headaches and fatigue. Bacteria levels can fluctuate seasonally with wet and dry periods.

Nitrate is a naturally occurring compound, but high amounts of nitrate in groundwater are typically due to human activity such as fertilizer applications, septic systems, and animal enclosures. Nitrate in drinking water at levels above 45 milligrams per liter (mg/L) NO_3 or 10 mg/L NO_3-N is a health risk for infants of less than six months of age, pregnant women and people with specific enzyme deficiencies. Nitrate concentrations in groundwater may rise quickly for short periods of time because of rainfall or agricultural activity. If you are caring for an infant or are pregnant, you should seek advice about your drinking water from your health care provider.

Water Quality Sampling and Testing

Why should I test my water?

People must recognize that drinking water contamination is a serious problem. It is a problem that is constantly being addressed by government officials, public interest groups, and the scientific community. Since this is a complex and multi-faceted problem, it will take years of research and testing before resolution may be found.

While we wait for the numerous sources of contamination to be cleaned up, we must live with these unsatisfactory conditions. We can live with contaminated water supplies if we address the following questions:

- **What form of contamination, if any, is present in my water?**
- **What is the source of contamination?**
- **Does this contamination pose a health hazard to me?**
- **How can the contaminant(s) be removed from my drinking water supply?**
- **What is contamination?**

Pure water (H2O) consists of 11.1888% hydrogen and 88.812% oxygen by weight. Although the term “pure water” is used commonly, it is virtually a non-existent liquid due to its aggressive nature. Water is often referred to as a “universal solvent” because of its ability to dissolve almost anything it comes in contact with. The superior solvent action of water allows it to be easily contaminated by water soluble materials. For example, well water typically contains minerals such as calcium, magnesium, iron, and manganese due to its contact with rock formations containing these minerals. Water also dissolves metals from pipes and plumbing fixtures which may contain lead, copper, iron, etc. Gases and dusts from the atmosphere and ay other water soluble compounds may also be dissolved by water as they come in contact with it. Water is considered to be “contaminated” when it contains harmful or objectionable substances which may be dissolved, suspended, or biological.

Where did this problem originate and why now?

Water pollution and contamination are issues that have been attracting more and more attention since the beginning of America’s industrial revolution. The Industrial Revolution prompted a rise in the manufacturing of goods. This increased manufacturing lead to the creation of new synthetic materials. The U.S. chemical industry produced 11 trillion pounds of synthetic organic chemicals between 1945 and 1991, most of which has ended up in our environment: soil, air, and/or water.

In mankind’s efforts to improve the quality of life, many different chemicals have been developed. Some of the numerous uses include: food preservation; sprays for personal hygiene; pet care; and cleaning homes and automobiles. Over a thousand new chemicals are created each year to meet demands in the marketplace.

In the past, these chemicals were developed and released into the environment with little thought given to the potential dangers they might present. Environmental activists have forced industry and government agencies to become more conscious of waste disposal and its impact on the environment. Traditionally, hazardous waste has been disposed of via deep-well injection, surface impoundments, and landfills. Current regulations for deep-well injections do not require long-term monitoring of the sites, which allows waste to contaminate the soil and water long after monitoring periods have passed. According to the U.S. Environmental Protection Agency (EPA), approximately 70% of surface impounds (pits, ponds, and lagoons) that are used for hazardous waste disposal do not have liners and as many as 90% may threaten ground water. The Office of Technology Assessment has determined that eventually even the best designed and secured landfills will leak hazardous waste into nearby surface and groundwater. Past hazardous waste management practices have allowed thousands of chemical compounds to find their way into many drinking water supplies.

When is a contaminant considered harmful?

In 1974, Congress passed the Safe Drinking Water Act, which authorized the EPA to establish safety levels for certain contaminants in public water supplies. These safety levels are referred to as Maximum Contaminant Levels (MCL’s), which are the maximum allowable amounts of the regulated compounds in drinking water.

The EPA has divided the standards for drinking water into primary and secondary standards. Primary drinking water standards regulate contaminants that are health related. Secondary standards, may or, may not be health related and indicate aesthetic issues such as taste, odor, color, and appearance.

The original list of inorganic and organic contaminants with established MCL’s has grown from 18 in 1975 to 94 in 1999, additional contaminants are constantly being considered for future regulations.

How small is one contaminant?

Very small! The standard units for measuring contaminants include milligrams per liter (mg/l), parts per million (ppm), and parts per billion (ppb). The maximum contaminant levels are written in mg/l. The units mg/l and ppm are interchangeable. To give you an idea of how small these measurements are, one part per billion is equivalent to one second in 32 years. 16 parts per million (or mg/l) equals 1,600 parts per billion. Very small quantities of toxic contaminants usually do not cause immediate health problems, but if consumed over a long period of time they can cause serious and possibly irreversible health complications.

Water Quality Sampling and Testing

What is the risk to us?

Unfortunately, chemicals are being introduced into the environment faster than we can calculate their risks and benefits. There are currently an excess of 70,000 chemicals in commercial use. According to the National Academy of Sciences only 10% of these have been tested for toxicity.

The effects of some toxic substances on human life have been understood for some time. For instance, arsenic studies have indicated that arsenic is a potent carcinogen (India). The effects of mercury poisoning became apparent in the early 1950's in Japan where eating mercury-contaminated fish crippled and killed thousands of people. There have been significant numbers of studies conducted, which have determined that even small amounts of lead can have adverse health consequences, especially in infants and small children. According to the EPA almost 1 in 5 Americans drink tap water containing excess levels of lead (including 7 million children).

THE THREAT IS REAL

According to the National Water-Quality Assessment Program, an on-going study by the U.S. Geological Survey, about fifty percent (50%) of wells sampled contained one or more pesticides and more than fifty percent of streams sampled contained five or more pesticides.

According to studies conducted by the Environmental Working Group, between 1994 and 1995 (the most recent federal data available) over 45 million Americans were supplied drinking water that violated federal health standards for fecal matter, parasites, disease-causing microbes, radiation, toxic chemicals, lead, and other pollutants.

There are approximately 1.4 million underground storage tanks containing petroleum products or other hazardous chemicals in the United States. The EPA estimates about 20% of these are leaking, which breaks down to 280,000 tanks.

According to another study conducted by the Environmental Working Group in 1999, Atrazine, a toxic weed killer, was found in the drinking water of 796 towns throughout the Midwest.

Many contaminants are colorless, tasteless, and odorless, which leads people to believe they have safe drinking water. This may not be a safe assumption. Analysis by a qualified laboratory is the only way to accurately determine the presence or absence of true contaminants. National Testing Laboratories, Ltd. offers comprehensive analyses to ensure water is free of various types of contamination.

COMPLIANCE TESTING vs. INFORMATIONAL TESTING

What do you really need?

When choosing a test package for water analysis, consider your needs and how you will use the data. Is the testing strictly for your own information? Is a regulatory agency requiring that testing be performed? Will the results be used to configure a water treatment system? Addressing these questions will help determine the most suitable test and if the testing should be compliance or informational.

When is a compliance test needed?

Compliance testing is required when testing must meet local, state, or federal regulations, or when results are to be used in a court of law. Compliance testing is most often performed for public water supplies and bottled water producers. Once it has been established that a compliance test is required, the laboratory selected must be certified by the state(s) in which results will be submitted to a regulatory agency. A laboratory does not need to be certified for all regulated contaminants to be considered certified; therefore, a list of required contaminants should be submitted to the laboratory prior to analysis for verification of certification for each contaminant. Additionally, some states certify laboratories for specific parameters based on the methods used to run the samples. This must also be reviewed if the regulatory agency specifies that the samples are to be run by a particular method.

When can an information test be used?

An accurate informational test is an excellent choice if the above criteria for compliance testing does not apply. Since informational testing is not regulated, a laboratory is free to use any analytical method suitable for the tests required. Informational testing is often acceptable for applications such as: monitoring home water quality, water treatment diagnosis, monitoring drinking or process water quality in businesses, preliminary testing for new water sources, real estate transactions, and new well drilling/development.

How accurate is an informational test?

A competent laboratory with experienced analysts can provide an informational test with a high level of accuracy. Informational tests are performed by the same analysts, using the same laboratory equipment that is used to meet the high standards required for compliance testing. Certain variations in methodology can reduce costs without reducing accuracy. These tests are designed to give an overall picture of water quality. They include a number of contaminants that are regulated by the EPA under the Safe Drinking Water Act.

Water Quality Sampling and Testing

This is a process that begins here!

The following pages of this guide pertain to the proper testing of your water, common problems and the proper treatment of water issues based on the application. This information should be provided to any consumer and/or contractor dealing with a well water application. Well water can be wonderful or miserable, with many variables in-between however, you do not know what you have until you properly test the water.

Testing by an independent lab.

Have the well water sampled and tested by an independent lab. Testing should be based on consumption and quality of water and then the aesthetics. This process better informs the consumer and provides for the correct solution and care of the water to the home or facility, now and for many years to come.

Beware of the door-to-door salesperson!

A door-to-door saleperson will perform a basic test to sell the limited product that he has available. Usually a softener based on the evidence of naturally found calcium and magnesium minerals. These minerals, also known as the hardness minerals are found in all your spring waters and bottled water manufacturers add them back into the water to provide flavor and taste. Be aware that testing your water is far more complex than a simple sales tactic and should be taken more seriously. Softeners, although having certain benefits with regards to problems associated with hardness, do not provide any benefits (and can be a detriment) regarding the actual drinking quality of your water. Information on softeners is included in this guide along with other treatment options available, based actual water issues and/or consumer preference.

What Should I Test My Water For?

There are dozens of tests that can be performed on drinking water and no one analysis can assure that your water is “safe to drink.” We have tried to compile the most commonly performed tests and their recommended testing frequencies. The tables in this guide should be used for general guidance only. Observe and be aware of the environment, local water conditions and issues not usually tested for; (ie: silica, particulates such as silt or sand, tannins).

Mandatory Health Related - Primary Standards

- **Coliform bacteria** must be absent to provide the basis of healthy, potable water. No water treatment system should be on an application that does not provide water that is microbiologically safe. If present, the occasional or residual disinfection of the water supply must provide a negative or absent result.
- **Nitrate** is a commonly found contaminant, and a test is recommended as a window to other potential issues.
- **Electrical conductivity (EC)** is a measure of all the dissolved ions in your water. By itself, EC does not tell you if your water is safe to drink. However, since the electrical conductivity test is the cheapest and easiest, it can be used as an indicator of changing conditions that may require further testing.
- **Inorganic Contaminants or the Metals** are recommended in order to establish a baseline understanding of the water quality in your well and as a mechanism to indicate water quality changes. High levels are significant problems.
- **Radioactivity** should be part of the testing package as an indicator of water problems and health issues not associated with other categories.
- **Organic Chemicals or the Volatile Organic Contaminants (VOC’s)**. A test for total trihalomethanes (THM’s) is an indicator of the presence of this category which is a modern world water problem. Whether or not, the test shows a presence or “non-detected” (N/D), this and other VOC’s are in virtually all our water in trace amounts, too low for equipment to detect unless it reaches a maximum contamination level (MCL). A test is important to indicate any significant issues.

Non-Health Related - Secondary Standards

- **Iron and Manganese**. Even though not contaminants within normal ranges, the red/pink (iron) or black/brown (manganese) are aesthetic problems and a nuisance for other water treatment systems, as well as, for plumbing and fixtures. Test as part of the test package because a small amount, whether visibly present or not, can effect other treatment solutions
- **Total Dissolved Solids (TDS)**. Even though not a contaminant within normal ranges this item is hotly debated by people trying to sell product improperly. TDS is part of most spring, mineral or bottled waters.

Non-Health Related - Additional Constituents Analyzed, No Standards Set

- **pH, Alkalinity and Hardness (calcium and magnesium)**. These items create a balance of water and are familiar to people who take care of pools and spas. Like anything else, there are acceptable ranges and problems if these items are too low or too high.

•**pH** is great between 7.2-7.6 and acceptable between 6.8-8.2. pH lower then 6.8 can be corrosive or acidic to pipes and fixtures, while above 8.2 may appear chalky and basic.
•**Alkalinity** also has acceptable ranges between 60 and 240, lower is acidic, higher is basic.
•**Hardness** is the common reference to the naturally found calcium and magnesium minerals in the water. Not a health issue if ingested, the only issue is aesthetics in the home and use of certain household appliances. Too low the water can be leaching and corrosive, too high is a build-up issue. Softening, the replacement of these minerals with a salt, is a tradeoff - not a solution, greatly misapplied, oversold, and has many other issues. *Water treatment is not based on this item alone*.

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Water Testing - What?, How Often?, Interpretation and Treatment Options

Recommended Test		Interpreting Your Results	
PRIMARY STANDARDS - Mandatory Health-Related Standards			
Test	**Recommended Frequency**	**If the Lab Report Shows:**	**Then you may want to consider one or more of the following options:**
MICRO-BIOLOGICAL; Total Coliform Bacteria General test to determine the health of your water	**Twice per year:** Wet season Dry season some local agencies may perform this test for free	Present (absent is the only acceptable result)	•Eliminate the cause, disinfect the well and retest. •Results should always be absent. Problems with any micro-biological issues will affect all other water treatment options. See information in this guide for problems/corrective actions. •Find an alternative water supply •Install a treatment system such as chlorination or ozonation to treat all the water •Consider a drinking water system that can safeguard for cryptosparidium and giardia, and bacterial, viral, e-coli and other microorganisms. (DWS-UV, RO3-UV or RO4-UV)
Nitrate (NO_3)	**Annually**	≥ 45 mg/l NO_3 or ≥ 10 mg/l NO_3-N	•Find an alternative water supply. •Install the correct reverse osmosis system for drinking uses.
Electrical Conductance (EC)	**Annually**	≥ 1600 µmhos/cm or significantly different from previous year result	•Conduct further testing for nitrates and other inorganics to determine cause for a high EC or any change in this EC value from year to year.
INORGANICS:			**Problems with one or more Inorganic Compounds**
Aluminum (Al) Arsenic (As) Barium (Ba) Cadmium (Cd) Chromium (Cr) Chloride (Cl) Copper (Cu) Fluoride (F) Lead (Pb) Mercury (Hg) Selenium (Se) Silver (Ag) Sulfate (SO_4) Zinc (Zn)	**Every 5 - 10 years** or test: If EC changes significantly, or If taste, color, odor or surrounding land use change.	Al ≥ 0.2 mg/l As ≥ 0.05 mg/l Ba ≥ 1.0 mg/l Cd ≥ 0.005 mg/l Cr ≥ 0.05 mg/l Cl ≥ 500 mg/l Cu ≥ 1.0 mg/l F ≥ 2.0 mg/l Pb ≥ 0.015 mg/l Hg ≥ 0.002 mg/l Se ≥ 0.05 mg/l Ag ≥ 0.1 mg/l SO_4 ≥ 500 mg/l Zn ≥ 5.0 mg/l	•Find an alternative water supply. •An appropriate treatment system is dependent on your overall water chemistry and what needs to be removed or reduced. •An effective removal system for this classification of contaminants is a properly specified reverse osmosis system (RO3 or RO4). These systems should be specified properly for chlorinated or non-chlorinated water. Heavier particulate water or excessive levels of total dissolved solids would require an upgrade to the RU500T35 series and may require a booster pump (RU500T35w/BP) to provide the 40 psi needed for the reverse osmosis unit to function properly. All units available with ultraviolet (UV) options for the safeguard of bacterial, viral, e-coli and other microorganisms. If a reverse osmosis system is not applicable, then a drinking water system (DWS, DWS-UV) or whole home (CWL/EWS) appliance would be applicable for removal of VOC's without the disadvantages of a reverse osmosis system.

KEY TO UNDERSTANDING THIS CHART:
≥ is greater than or equal to.
mg/l is milligrams per liter and 1mg/l = 1 part per million(ppm).
1 gm/l = 1000 micrograms per liter (µg/l) and 1 µg/l = 1 part per billion.
nss = no standards set. Test for aesthetics or non-health related effects such as undesirable taste, odor, or potential plumbing problems and/or water balance.

RESOURCES FOR INDEPENDENT LABORATORY TESTING:
■ **See ewswater.com and in Well Water Section find the Well Test Referral**

Look in your local Yellow Pages for "analytical services, labs, laboratories, environmental services" or any heading that will direct yout to an independent lab. The three listed above are not an endorsement and can be used as a basis of information.
A simple test by a salesperson is not complete, nor independent. ***This is your water - and your responsibility. Be informed***

Recommended Test		Interpreting Your Results	
PRIMARY STANDARDS - Mandatory Health-Related Standards			
Test	**Recommended Frequency**	**If the Lab Report Shows:**	**Then you may want to consider one or more of the following options:**
RADIOACTIVITY: Gross Alpha Activity Gross Beta Activity Trittum Strontium Radium Uranium	**Every 5 - 10 years**	 15 pCi/l 50 pCi/l 20,000 pCi/l 8 pCi/l 5 pCi/l 15 pCi/l	•Find an alternative water supply. •An appropriate treatment system is dependent on your overall water chemistry and what needs to be removed or reduced. •An effective removal system for this classification of contaminants is a properly specified reverse osmosis system. These systems should be specified properly for water of a very particulate nature.
Radon		present	•An effective removal system for this classification of contaminants is a properly specified drinking water system incorporating granular activated carbon.
ORGANIC (VOC's) CHEMICALS Total Trihalomethanes (THM's) General test to determine issues with this category of over 200 tested items	**Every 5 - 10 years**	Testing is only sensitive enough to indicate when a problem exists at the maximum level acceptable - however - VOC's are in all our water in trace amounts.	•An effective removal system for this classification of contaminants is a properly specified drinking water system incorporating granular activated carbon. DWS for taste and odor, chlorine and VOC's and the safeguard against lead and cysts (cryptosparidium and giadia) or to the DWS-UV with ultraviolet (UV) disinfection for the additional safeguard against bacterial, viral, e-coli and other microorganisms. •Whether or not any problems or issues exist in the water, a carbon based drinking water system for a sink and/or a CWL/EWS Whole Home Appliance is a good compliment as a safeguard to our modern chemicals and their by-products in our water supplies without the disadvantages of other systems

Recommended Test		Interpreting Your Results	
SECONDARY STANDARDS - Non-Health Related, Aesthetic Standards			
Test	**Recommended Frequency**	**If the Lab Report Shows:**	**Then you may want to consider one or more of the following options:**
Iron (Fe) Manganese (Mn) Hydrogen Sulfide	If taste, color, odor or surrounding land use change	Fe ≥ 0.3 mg/l Mn ≥ 0.05 mg/l	•Find an alternative water supply. •An appropriate treatment system is dependent on your overall water chemistry and what needs to be removed or reduced •An effective removal system at the point of entry (whole home) for this group of constituents is the pyrolox iron removal system for the effective removal of iron, manganese and/or hydrogen sulfide. Iron can be replaced by salts using a softener, is ineffective with manganese and only masks the rotten egg smell of hydrogen sulfide.
Color Odor-Threshold Chloride		15 units 3 units 500 mg/l	•Color and odor depending on other test results to specify the correct treatement, usually only carbon based needed. •Also related to salts or sodium, proper removal by reverse osmosis.
Total Dissolved Solids (TDS)		1,000 mg/l	•TDS is naturally occuring, found in Spring Water, and under normal circumstances not harmful, excessive levels reduced with reverse osmosis.
Additional Constituents Analyzed - Non-Health Related, Aesthetic, No Standards Set			
pH	If blue-green staining occurs or taste chages. Excessive build-up for higher levels or blue-green staining for low levels	nss	•Acceptable pH range between 6.8 and 8.2, best 7.2-7.6 Too low water is acidic and corrosive, too high is basic and chalky. Use pH increaser or decreaser as needed. •Hardness is the measure of the naturally found calcium and magnesium in the water. Measured in mg/l or ppm, the common reference to grains (per gallon (gpg)) is derived by dividing the mg/l or ppm by 17.1. Not a contaminant and very misunderstood, please see additional information on this subject within this guide.
Hardness (CaCO3) Calcium Magnesium (Mg)		nss nss nss	

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Common Water Problems, Possible Causes and Health Risks

What do I test for when my water has specific taste, odor, or appearance problems?

Below is a guide for some potential problems in drinking water and substances you can test for (in bold). Not all of the problems and possible causes pose a health risk to the consumer.

Problem	Possible Cause	Health Risk Category**
Water is orange or reddish brown	This may be due to high levels of **iron (Fe)**.	1
Porcelain fixtures or laundry are stained brown or black	This is commonly a result of high **manganese (Mn)** and/or **iron (Fe)** levels. As little as 50 parts per billion (ppb) manganese and 300 ppb iron can cause staining.	1
White spots on the dishes or white encrustation around fixtures	High levels of **calcium (Ca)** and **manganese (Mn)** can cause hard water, which leaves spots. **Hardness** can also be measured directly.	1
Water is blue	Blue water or blue deposits may be due to high levels of **copper (Cu)**, especially if coupled with corrosive water.	2
Water smells like rotten eggs	This is most likely caused by **hydrogen sulfide (H_2S)**.	1
Water heater is corroding	Water can be corrosive, neutral, or noncorrosive. Water that is very corrosive can damage metal pipes and water heaters. The lab can calculate the corrosivity of your water by measuring **calcium**, **pH**, **total dissolved solids (TDS)**, and **alkalinity**.	1
Water appears cloudy, frothy, or colored	**Suspended particulates**, measured directly or as **turbidity**, can cause the water to appear cloudy, frothy, or colored. **Detergents** and/or **sewage waste** may also be the culprit.	2
Home's plumbing system has lead pipes, fitting, or solder joints	Corrosive water can cause **lead (ppb)**, **copper (Cu)**, **cadmium (Cd)**, and/or **zinc (Zn)** to be leached from lead pipes, fittings, and solder joints.	2
Water has a turpentine odor	This may be due to **methyl tertiary butyl ether (MTBE)**.	2
Water has a chemical smell or taste	This may be due to **volatile** or **semivolatile organic compounds (VOCs)** or **pesticides**.	2

Are you concerned that a nearby activity may be contaminating your well?

Here are some land uses and possible contaminants to test for.

Land Use	Possible Contaminants	Health Risk Category**
Landfill, industry, or dry cleaning operation	Consider testing for **volatile organic compounds (VOCs)**, **pH**, **total dissolved solids (TDS)**, **chloride (Cl)**, **sulfate (SO_4)**, and **metals**.	2
Agricultural crop production	Consider testing for **pesticides** commonly used near the well (consult the farmer or Department of Agriculture for a list), **nitrate (NO_3)**, **pH**, and **total dissolved solids (TDS)**.	2
Livestock enclosure, manure, or compost storage area	Consider testing for **bacteria**, **nitrate (NO_3)**, and **total dissolved solids (TDS)**.	2
Gas station or automobile repair shop	Consider testing for **total petroleum hydrocarbons (TPHg)**, **total oil and grease (TOG)**, **benzene**, **toluene**, **ethylbenzene**, **xylenes (BTEX)**, **MTBE**, and **ethylene dibromide (EDB)**.	2

**1 - NO KNOWN HEALTH RISK AT COMMONLY FOUND CONCENTRATIONS
2 - SOME OF THE POSSIBLE CAUSES CAN HAVE A DETRIMENTAL EFFECT ON HEALTH EVEN IF PRESENT IN LOW CONCENTRATIONS

Common Water Problems, Possible Causes and Treatment Options

SYMPTON	PROBLEM	CAUSE	TREATMENT
white deposits, scale in pipes, water heater	Hard Water	calcium and magnesium (not contaminants)	**not necessary w/ maintenance or conditioning/softening to assist
corrosivity to pipes, heaters, faucets - very aggressive	Soft Water	lack of calcium and magnesium, low/no hardness, low pH	non-metal pipes or chemical adjustments to well
abrasive water, residual grit, left in sink or tub	Grittiness	fine sand, silt, particulate material	repair well screen; install pre-filter; sand filter; see well info
fishy, musty or earthy smell	Odors	organic matter, algae	GAC filter, chlorination
chlorine		chlorination disinfection	GAC filter
rotten egg, sulfurious smell		hydrogen sulfide sulfur or iron bacteria	pyrolox media filtration chlorination/disinfection
gasoline smell		leaking underground or surface tank spills	GAC filter for short term seek new water supply
chemical odor		Industrial wastes	GAC filter for short term seek new water supply
blue/green stains on sinks; blue- green cast to water	Acid Water or Low pH	Low pH, acid or carbon dioxide reacting with copper pipes	install pH neutralizer; make well deeper and/or use other piping materials
salty or brackish water	Taste	high chloride or magnesium content	reverse osmosis; distillation
metallic taste		low pH or high metals and/or inorganic contaminants	pH neutralizer; and/or filters
yellowish cast to water; stains on clothes and fixtures	Yellow Water	tannins created from decaying vegetation	chlorinate then GAC filter
brown-red stains on fixtures, clothes; water turns red when heated, darkens beverages	Red Water Iron Water	dissolved iron; water appears clear when water first drawn	pyrolox media filtration
reddish-colored water with settling particles		precipitated iron; water not clear when drawn iron bacteria	pyrolox media filtration
black stains; fixtures, clothes	Black Water	carbon dioxide; organic matter with manganese	disinfect well and plumbing then pyrolox media filtration

The charts on this page and the previous page provide the most common symptoms of problems found in well water applications, as well as, some regulated water systems. All the information provided allows you to determine what is a health risk and what may simply be an annoyance. Issues of bacterial, pH ranges, discolored water, and other problems may require pre-treatment prior to any additional point of entry and/or point of use filtration. Concerns for, or actual issues of contamination may require the proper application of a point of entry and/or point of use filtration system.

Water is Very Important to You!

The body is composed of 70-80% water. Water is one of the four main nutrients of the body. A healthy human being can go without food for two weeks but only three days without water. Many vital functions and all chemical reactions in the body take place in the medium of water. Water aids in all bodily processes - assimilation of nutrients, digestion, circulation and elimination. Water lubricates the joints of the body and helps regulate its' temperature. Drinking sufficient quantities of water helps flush out impurities, discourages bloating and the retention of water, and helps restore moisture to the skin and hair, while discouraging wrinkles and dryness.

You Know there are Several Ways to Intake Water!

- **Drinking:** Water may be ingested, ie: water, coffee, tea, ice and mixes.
- **Absorption:** Taking a shower exposes you to the equivalent of consuming an additional 1/2 gallon of water each day. After soaking in a bath tub or spa for ten minutes, you may be up to 4 lbs. heavier upon your exit.
- **Inhalation and absorption:** The greatest intake may be your shower, where gases are vaporized. Inhalation exposure was found to be comparable to direct ingestion. Steam and sauna are included.

Concerns With the Water?

Chlorine is used almost universally in the treatment of public drinking water because of its toxic effect on harmful bacteria and other waterborne, disease-causing organisms. But there is a growing body of scientific evidence that shows chlorine in drinking water may actually pose greater long-term dangers than those for which it was used to eliminate. These effects of chlorine may result from either ingestion or absorption through skin. Scientific studies have linked chlorine and chlorination by-products to cancer of the bladder, liver, stomach, rectum and colon, as well as, heart disease, anemia, high blood pressure, and allergic reactions and skin sensitivities. We know chlorine has issues with protein in our body and that of the skin and hair, just remember the last time you were in a pool.

Problems also arise from other chemical compounds. These compounds include, but are not limited to, chemicals associated with various pesticides, herbicides, fuels, dyes, solvents, and industrial and agricultural by-products. Misuse of these materials and/or improper storage and disposal has allowed drinking water supplies, both municipally-treated or individual wells, to become suspect. Trace elements of these chemicals may be within acceptable limits, however their long-term effects are unknown. Since disinfectants, their by-products, and other chemical compounds, and volatile organic compounds (VOC's) are present in all our water supplies, one might want to remove these substances at the point of entry.

What Can I Do About Problems With My Water?

If you have had your water tested and found a problem that you want to treat, there are many different types of treatment available. Not all water treatment systems work for every contaminant or for every water type. Once installed, most systems require routine maintenance to continue performing properly. Improperly maintained systems can cause more damage than having no system at all. You need to know what you want to remove and if you will be able to perform the routine maintenance before you invest any money in a system. See the guide provided for the options available for your particular problem(s). Some options remove a greater percent of the concentration than other options listed for the same substance. We highly recommend that you visit our website, talk with us corporately, or with a factory representative, or with an informed sales associate at any of our distribution outlets to find out what will work for your specific situation. Some water may need to be conditioned or pre-filtered or the pH may need to be adjusted prior to treatment.

What is Water Hardness?

Water hardness is caused by naturally found minerals in water, usually calcium and magnesium, derived from water naturally filtering through the earth's strata and dissolving rocks. While not a health hazard (80-90% of fresh water is hard), hard water has its aesthetic disadvantages, as well as, problems with scale build-up. Most problems are easy to maintain. Conditioning/softening devices can offer assistance but nothing eliminates spots or the need for routine maintenance or clean-up. Softeners exchange these minerals for sodium or potassium chloride and effect quality and taste. Softeners create soft water or a low mineral content which can be highly corrosive and the brine discharge adversely effects septic and municipal waste water treatment systems. Refer to restrictions on softeners' brine discharge and other product warranty issues. Calcium and magnesium are measured in grains per gallon (gpg) or parts per million (ppm). Please refer to the section on conventional Softening product or the Environmental Water Systems to condition hardness minerals (as an alternative to softening) and GAC filtration for the entire home or facility.

What is Iron Water? (red water and/or brown or blackish water)

These problems are caused by water passing through iron bearing strata and is seen in sitting water at 0.3 mg/l. Iron bacteria is a bacteria that thrives on iron in water and is not harmful for health purposes. The same issues result when manganese is found above 0.3 mg/l and water is brown or blackish. See Pyrolox Media Systems and their capabilities to remove iron, manganese and hydrogen sulfide.

What is Acid Water?

Caused by water passing through impervious rocks and not dissolving minerals, this leaves water, which is a natural solvent, very aggressive. Measured by pH - a pH under 6.8 is becoming acidic; above 8.2 is becoming alkaline. See pH Increasing Reagent System to raise and balance pH.

What are Actual Contamination Problems?

Contamination issues are actual water quality issues as they relate to human health. Please refer to pages in this guide for actual issues that are health risks and then filter as necessary. GAC filtration and its' upgrade optiions are very effective at handling a wide variety of contaminants. Reverse osmosis also has its' capabilities. Refer to our complete catalog of product from the sink (for oral intake) to the entire home (for absorption, inhalation and/or plumbing issues) for the correct product(s); for you, your family and your home.

WATER QUALITY TREATMENT

What If My Total Coliform Test Results Are Positive?

Step 1.
First, try to determine where the contamination came from. The table below lists some possible problems and some recommended corrective actions. Some problems you may be able to fix yourself, while others, marked by an asterisk (*), may legally require the assistance of a licensed well contractor. Contact your district for a list of licensed professionals.

Problem	Recommended Corrective Action
The well is newly constructed, or maintenance or repair was recently done. The pump was primed with impure water.	Go to Step 2 below.
There is standing water around the well or water draining toward the well.	Re-grade around the well so the ground slopes away from your well.
The concrete well pad is cracked or separated from the well casing.	Re-pour pad or fix and seal all cracks and gaps.
The well is not completely sealed against surface water, insects, or other foreign matter.	Replace any missing plugs, cap any open pipes, and seal any openings, gaps, or cracks. *Contact a licensed well contractor to replace or install a new wellhead gasket.
The storage tank is dirty or unprotected.	Contact a contractor to clean and seal.
There are cross-connections in the plumbing system.	Make sure that your plumbing is not connected to another source of water that may be contaminated (e.g. a defunct community water system).
There is not adequate back-flow protection.	Install a back-flow prevention device on every outdoor faucet (available at most hardware/plumbing supply stores). *Contact a licensed well contractor to ensure that there is proper back-flow protection within the well.
There are dead-end or unused water lines connected to your plumbing system.	Flush lines regularly or remove any unused lines or sections of the water system.
The well casing is corroded.	*Contact a licensed well contractor to assess and repair.
There is sediment at the bottom of the well. The well casing is perforated too high or the sanitary seal is not adequate.	*Contact a licensed well contractor to drill a new well and to properly destroy to old well.

Step 2.
Once you have located and eliminated the source of the bacteria, disinfect the system. For instructions on how to properly disinfect your well and distribution system, contact your district, call a licensed well contractor, or visit www.ewswater.com/techandspec.html and see a complete procedure to disinfect your system.

Step 3.
IMPORTANT: Before drinking the water, test a new sample for total coliform bacteria. If the results are still positive, start at Step 1 again.

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schematic for varied or difficult well water conditions

CONDITIONS	APPLICATIONS
Source Water - Test Results	Based on Test Results
Pre-Treatment: Coliform/Bacterial/E-Coli microorganism problems, decaying vegetation, organic bonding, Iron/manganese bacteria Tannins (yellow)	**Chlorination/Chemical Feed *(as needed)*** Ozonation UV (only safeguard, not a solution)
Oxidation/aeration *(as needed)* *location or sequence of tank may vary* Low supply water flow and/or pressure	Storage tank and Equipment Booster Pump (Need minimum of 40 psi & 8 gpm (or 12 gpm for all 1354 tank systems)
Iron Removal *(as needed)*: Iron (red or pinkish) Manganese (black or brownish) Hydrogen sulfide (rotten egg smell)	(pictured) High Purity - High Oxidation Media Systems
Pre-Sediment Filtration *(as needed)*: Silt, dirt, heavy particulate matter *location or sequence of unit may vary*	3-micron Self Cleaning System or (pictured) 5-micron Pre-Sediment Cartridge Unit (not a whole home filter)
pH Balancing *(as needed)*: Low pH, less then 6.6, corrosive, acidic water High pH, more then 8.6, corrosive, basic water *location or sequence of unit may vary*	Custom Blended, (pictured) pH Increasing Reagent System pH Decreasing Ion-Exchange
Point of Entry Filtration *(as needed)*: Chlorine, VOC's, herbicides, pesticides, solvents, dyes, fuels, odor, taste, clarity	CWL Series - Filtration only EWS Series - Filtration and Conditioning vs. Softening
Point of Use Filtration *(as needed)*: Dependent upon test results, removal and/or safeguard, as applicable	Various Drinking Water Systems or (pictured) Reverse Osmosis Units

Pre-treatment is the primary need to disinfect, break down organic bonds and/or add oxygen to water. To remove iron, manganese, pre-filter, balance pH and/or generally prepare the water for consumption additional filtration is used to minimize water issues for use in the home.

Softeners strictly soften water and have their application. However, softeners replace valuable calcium and magnesium minerals (non-contaminants) with sodium or potassium chloride. The resultant water may be of lesser water quality, has warranty issues with other products and may be legally restricted due to the damaging brine discharge. The EWS Series of appliances is applicable up to 30 grains of hardness and is an alternative.

EWS/CWL system can be installed at the main service line and a softener after the EWS/CWL system or on the hot side (supply line the heater(s) based on the preference of the consumer or water condition.

Both types of systems have their advantages, capabilities, and in the case of reverse osmosis, some disadvantages. EWS, Inc. can provide either system correctly specified for the application and with UV disinfection options.

All systems should be correctly applied and installed based on water issues, concerns and/or consumer preference. Contact EWS Customer Service if you have any questions.

Well Water - Where to Begin and How to Proceed

Well Water Specifications:
The Need for Proper Testing and Adequate Information

EWS Well Water Statement:

EWS, Inc. is focused on the manufacture of quality water treatment equipment and is not a water testing laboratory. Since other organizations, including water dealers, test for the sale, EWS, Inc. considers the testing of water and the specification of equipment a conflict of interest. *(Editor's note: Municipal water is treated and tested by water districts. Water quality results are readily available to the public. Door-to-door salespeople testing water are only running a program to sell product and are incapable of providing any valid or meaningful testing information to the consumer)*

Lab Testing of Well Water Prior To Any Proper Specifications:

EWS, Inc. requires test results that are independent, complete *(the basic complete test along with a referral is a pdf file located within www.ewswater.com or available upon request by e-mail or fax)*, and done in accordance with EPA compliances and chain of custody. EWS, Inc. has no affiliation with any lab, and only refers consumers to a lab that tests in accordance with standards that will allow for proper specification of treatment methods or options.
EWS, Inc. allows and encourages a consumer that may elect to use a lab of their own choosing based on their research, locale and/or pricing. However, the standard must be met for independence, completeness of the testing *(which may include additional items known to be potentially in the area)*, and compliances of testing and custody.

Water Testing Information Requirements:

EWS, Inc. will not specify, nor make any recommendation for any treatment equipment or options, under the following testing circumstances; no test results available, incomplete testing performed, on-site salesperson door-to-door testing, the use of assumptions based on physical observations without any complete testing.

Well Equipment and Well Water Requirements for Proper Specifications:

EWS, Inc. requires that the consumer supply information on the well, well water, well equipment and pumping circumstances that will allow for proper specification of treatment methods or options. Circumstances may require, but are not limited to, the following; pumping equipment, adequate pressure and flow rates, volume or production of water from the well, disinfection, chemical feed, oxidation, water storage, physical debris, silt, silica, sediment, and/or particulate material.

Well Equipment and Well Water Information Requirements:

EWS, Inc. will not specify, nor make any recommendation for any treatment equipment or options, under the following well, well water, well equipment and/or pumping circumstances; no well depth disclosed or accurate information available, inadequate information on well equipment in use, inadequate information on pumping flow rates and pressure, inadequate information on well water volume or production, need for upgraded and/or other equipment or treatment to provide proper water and/or mechanical results to satisfy treatment equipment parameters.

Equipment recommendations are based on lab results and other information provided. All information should be available to EWS, Inc. prior to the recommendation of any equipment to verify that the concentrations and other factors are within the limitations of the equipment. There are items over which EWS, Inc. has no control, or of which EWS, Inc. has no knowledge, which may cause unsatisfactory performance of the recommended equipment. It is the responsibility of the consumer to verify the application information required above. EWS, Inc. assumes no liability for equipment installed based on inadequate information, improper installation and/or changes in water quality. EWS, Inc. will make every reasonable effort to provide information, in order to, assist in solving any problems that may occur.

No equipment is intended for use where water is microbiologically unsafe or with water of unknown quality without adequate disinfection before any equipment. Filter maintenance schedules will vary and must be replaced, as necessary, as determined by usage and local water conditions.

Go to ewswater.com and find the tab for Well Water.
For the most complete information on well water - Review, download or print out the "Guide For The Private Well Owner" and the link for Independent Well Water Testing Companies.

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Well Water Testing

Make sure labs are independent, compliant, and certified testing facilities offering complete well water testing and analysis. Labs should have complete tests for well water, including microbiological, inorganics, organics and water balance. Kits are normally shipped to the consumer with sterile bottles and simple instructions. Once the testing is performed the kit is shipped back overnight (may be included in the cost, inquire with lab) to preserve the samples, create a chain of custody and properly test the water.

Make sure to see the following list of what to completely test for in order for proper specification of product. Any incomplete test will not be reviewed for specification. Additional items may have to be tested based on the local water conditions and environment.

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Mandatory Microbiological Drinking Water Standards
Required Test and Required Absent or “Safe” Result
Prior to Any Water Filtration and/or Treatment Product

Coliform Bacteria “Safe Water Test”
Coliform bacteria or “Potability” testing measures possible harmful bacteria in your water. E. Coli is the test for contamination due to waste product. This test is recommended for all wells at least on an annual basis by the Environmental Protection Agency. Test results should always read absent, negative or N/D. A lab should provide you with a sterile sampling bottle & preservative, as well as detailed sampling instructions.

Mandatory Primary Drinking Water Standards

Nitrate (N03) **+ Nitrite** (NO2) (Annual Test)
An important addition to the your water test kit, in accordance with the Safe Drinking Water Act. These compounds cause electrolyte imbalances and are essential for homes with an infant under six months of age. The EPA has established a primary drinking water standard of 10 mg/L (1.0 ppm or mg/l for nitrate) for these parameters in water.

Conductivity (EC) (Annual Test)
A low or negative number would be water aggressive or corrosive in nature (softened water will have this issue due to the exchange of naturally found minerals for salts) Water with a higher number exceeding 0.78 umhos/cm will have higher concentrations of TDS, hardness, and/or other factors. This is a simple and inexpensive test that should be performed annually as a benchmark as to whether or not you have changes in your water.

Lead (Pb)
It is important to whether any Lead results from the actual water source or from the piping or delivery system into the home. Lead is a toxic metal that was used in older water pipes in some homes. As water stands in the pipes, the lead will slowly dissolve into the water. The water sampled for a lead test must be a “first draw” or the water first out of the pipe, which should be at least six hours prior to the last run of the faucet. The established primary drinking water standard is 0.01 ppm or mg/l.

Fluoride (F)
Fluoride is added to water by some municipalities to encourage healthy teeth in children and young adults. The EPA has established a primary drinking water standard of 4.0 mg/L for fluoride. A contaminant in higher concentrations or to people with chemical sensitivities, this test will allow you do discover the amounts of fluoride your water contains.

Mercury (Hg)
A toxic liquid metal that can easily be stored in human tissue if absorbed. The maximum contaminant level designated by the EPA is 0.002 mg/L. A certified lab can determine if your water is safe and under the harmful limit.

Arsenic (As)
Arsenic is more common than one may imagine. It is a natural element found below the Earth’s surface. If your well has a crack in it, there is a possibility of it becoming contaminated. The effects of arsenic are similar to those of mercury. The EPA limit for arsenic in drinking water is 0.01 ppm or mg/l (10 ug/l, micro-grams/liter or parts per billion). A very small amount.

Well Water Testing

Mandatory Secondary Drinking Water Standards

Sodium (Na)
Sodium can be a major concern for people with circulatory ailments and critical for low sodium diets. Even though there is no official standard, sodium is considered present at 50 ppm or mg/l and above 150 ppm may be actionable.

Chloride (Cl)
Chloride can have an effect on the taste of your water. Standards placed at 250 ppm or mg/l are actionable.

Sulfate (SO4)
Sulfates can have an effect on the taste of your water. Standards placed at 250 ppm or mg/l are actionable.

Iron (Fe)
The EPA has established a secondary drinking water standard of 0.30 mg/L for Iron. The secondary drinking water standards were designed for aesthetic purposes (i.e. taste, odor, color, etc.)

Manganese (Mn)
The EPA has established a secondary drinking water standard of 0.05 mg/L for Manganese. Just like Iron, it may cause rusty water, stains, deposits, and affect water's taste, but it is not a health hazard.

Iron/Sulfur Bacteria
Although this bacteria does not present a health threat, this type of bacteria can make water smell and taste bad. By linking to the iron or managanese it plugs plumbing equipment and diminishes the effectiveness of treatment systems. Test results should always read absent, negative or N/D. If not, pre-treatment before any equipment is required

Tannins
There are many factors that may cause color in water. The most common are organic matter, and/or colloidal solids that are too small and too fine to settle out properly. These suspended particles can cause problems with disinfection and filtration processes, and also be an indicator of bacterial activity in the water. Frequently seen in shallow wells, wells under the influence of surface run-off water, or area that have heavy rainy periods.

Aesthetic Drinking Water Standards

pH
Acceptable pH range is between 6.6 and 8.6, best results should be between 7.2 – 7.6. Too low water pH (below 6.5) is acidic and corrosive (staining of blue/green may be present), too high pH (above 8.8) is basic and chalky (staining also be present or may make water hardness issues, if applicable appear to be greater).

Alkalinity
This is a good test for when the household plumbing contains lead, objectionable taste or smell are indicators. Below 40 mg/l the water can be more agrressive. Above 240 mg/l water is more basic and is more chaulky which makes water hardness appear more of an issue then it may actually be.

Total Hardness
Measured in mg/l the number can seem high, however if you divide this number of mg/l by 17.1 (ie: 200mg/l divide by 17.1 = 11.7 grains) you will get the common reference number of grains of hardness (or grains per gallon - gpg). Water hardness can be very frustrating. When problems arise with hard water, any surface the water comes into contact with can be affected. A perfect example of this build-up is on drains and faucets. Total Hardness test is a good measure of how much naturally found calcium & magnesium (not comtaminants) are in your water. Hardness concentrations greater than 35 grains/gallon are considered high and softening the water should be considered. Result can determine exactly where you want to be and how to address this mostly aesthetic issue.

Total Dissolved Solids (TDS)
Water containing more than 1500 mg/l total dissolved solids is not recommended for human consumption. Some mineral water such as Panna or Pelligrino can have TDS exceeding 900 ppm. Averages usually can be found around between 250 and 650 while 1,000 ppm may be actionable depending on other results found.

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ENVIRONMENTAL WATER SYSTEMS®
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Providing Specifications to Correct Well Water Problems

FAX our offices at 702-256-3744

well water test results and the additional required information,

or

e-mail us at customerservice@ewswater.com

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As discussed in this guide, we require complete and independent results much like a doctor requires results from a lab to make any determinations.

Our offices will FAX back the potential solution(s), or a request for additional information, and specifications on the unit(s) to be applied. We advise you to make a copy of your results and any information provided and keep updated records as discussed in this guide (see: Record Keeping).

Be aware - not all well water problems or a combination of problems can be satisfactorily solved. Our sole intention is to do it right or not at all. Knowing that your water is “hard” is not enough (up to 90% of all fresh water is hard). Remember this is a process.

Door to door salesmen and other organizations will test for and apply only what they have available to sell. As a manufacturer of a complete line of filtration and conditioning product, represented throughout the USA. by Building Wholesale Suppliers, Kitchen & Bath Showrooms and Appliance Distributors, we can provide to the consumer the correct product based on the consumer’s needs, and not that of a commissioned sales individual. Be informed and not sold.

EWS, Inc. and Environmental Water Systems can provide solutions to common well water problems.

From sink to the whole home;
learn about the correct systems for your application that will provide less maintenance and less impact on your environment.

A free or simple test is a sales pitch by the local door-to-door salesperson or a company trying to sell you something. It is unethical and the incorrect approach.

This guide is something they would not want you to see or understand.

Be Informed, not sold.

The EWS, Inc./Environmental Water System Product available through:

Authorized Kitchen & Bath Showrooms, Appliance Showrooms, Building & Plumbing Wholesale Supply Locations and their building, plumbing, HVAC and service contractors, and Authorized Online Distributors.

EWS is a Proud Contributor and Sponsor of Organizations Dedicated to Improving Health, Well-Being and the Environment

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