A Complete Guide to Water Treatment

Written and Designed by Lancaster Water Treatment

Table of Contents

Why Does My Water Need Treatment? 3

Well Water 3

City Water 3

What's in My Water? 4-8

TDS 4

Hardness 4

Acidity 5

Iron 5

Lead 6

Bacteria 6

Sulfur 8

Chlorine/Chloramines 8

Water Treatment Solutions 9-13

Reverse Osmosis: Treat TDS 9

Water Softener: Remove Hardness 9

Acid Neutralizer with Calcite or Corosex & Chemical Feed with Soda Ash: Treating Acidity 10

Birm Filter, Aeration System, Softener for Iron and Hardness: Treating Iron 11

Reverse Osmosis and Water Softener: Treating Lead 11

Ultraviolet Purification or Chemical Feed with Chlorine: Treating Bacteria 12

Chemical Feed with Chlorine and Aeration Units: Treating Sulfur 13

Carbon Filter: Treating Chlorine 13

Choosing an Installer and Manufacturer 14-15

Who is Qualified? 15

Who to Beware of? 15

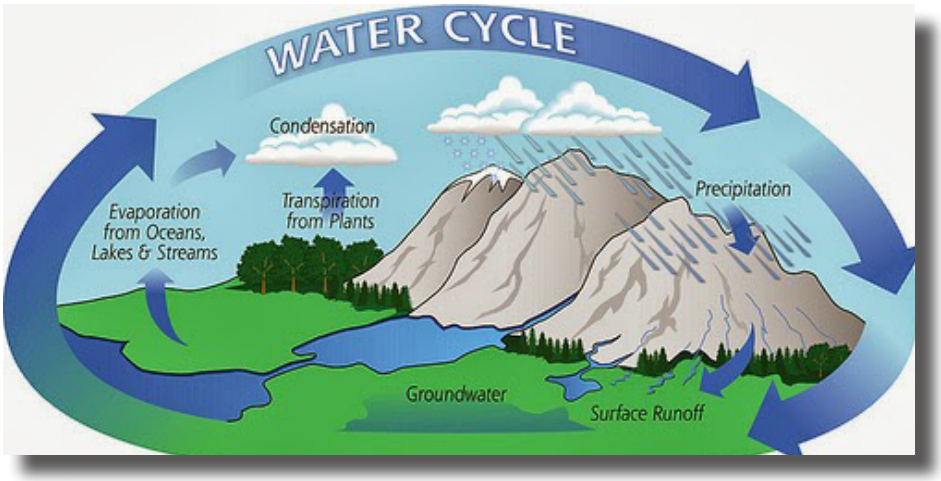
How do I Get Started? 15

Why Does My Water Need Treatment?

Water is a universal solvent. Anything that water comes in contact with will eventually dissolve into the water causing nuisance issues along with possible health concerns. The possible contaminants depend on where you get your water from, as well water and city water can have different variations of contamination.

Well Water

The contamination from well water typically comes from chemical or fuel spills/leaks, wildlife or livestock populations, improper refuse disposal, minerals in the ground, and anything else in or around the well supply.



City Water

The contaminants from city water can be a little different, but are just as problematic. If you have city supplied water, the most common contaminants you'll see are disinfecting products used during treatment, corrosion from pipes and distribution, hardness from calcium and magnesium, and contaminants from distribution line breaks.

What's in My Water?

Water quality differs from well to well and from municipality to municipality so a water test is extremely important to determine what is in your water. The following are very specific things that are common in the water systems.

TDS

Total Dissolved Solids or "TDS" refers to the total amount of all inorganic and organic substances (like minerals, salt, and metal) that are in your water. TDS concentrations are used to evaluate the quality of water systems.

These solids typically get into the water through agricultural run-off, industrial wastewater, sewage, and more natural sources like leaves, dirt, and rocks. The piping in your own home can even cause some of it, especially if the pipes are starting to corrode.
It's pretty easy to tell if there are dissolved solids in your water because you can usually taste them or sometimes see them. They tend to make water either bitter or salty and can make your water and dishes cloudy as well. You can have your water tested for an estimate of the TDS concentration levels.

Hardness

This is a major concern for homeowners because hard water is prevalent everywhere. Hard water is dissolved minerals, like calcium and magnesium, and it causes a slew of problems.

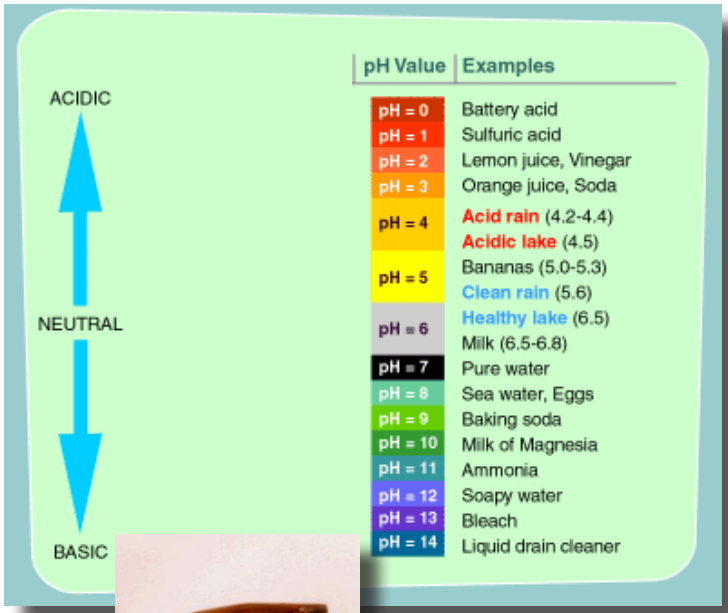
These minerals get in your water from the soil and rocks that it moves through naturally. These naturally occurring minerals get dissolved and flow into the ground water supply.

Hard water is one of the most easily identifiable problems because hard water and soap don't work together. This causes the soap you use in the shower, dishwasher, and laundry machines to leave behind soap scum, not effectively lather, and ultimately not effectively clean. You may start to notice soap scum build up in your showers and on your dishes, and your shampoo failing to lather. This buildup happens in your appliances too, and can cause your water heater to be less efficient and your water pressure to be reduced because of buildup in the pipes. Etching and cloudy glassware is usually also a telltale sign along with many other nuisance problems.

Acidity

You read right, there is a pH level in your water due to acidity. Your water becomes acidic because rain water is naturally acidic, and increasingly so with environmental pollution, which mixes with your water.

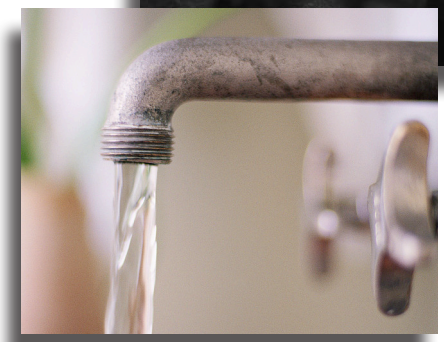
Water with a low pH can be acidic, naturally soft and corrosive. Acidic water can leach metals from pipes and fixtures, such as copper, lead and zinc. It can also damage metal pipes and cause aesthetic problems, such as a metallic or sour taste, laundry staining or blue-green stains in sinks and drains. Water with a low pH may contain metals in addition to the before-mentioned copper, lead and zinc. Drinking water with a pH level above 8.5 indicates that a high level of alkaline minerals are present. High alkalinity does not pose a health risk, but can cause aesthetic problems, such as an alkali taste that makes coffee taste bitter; scale buildup in plumbing; and lowered efficiency of electric water heaters.



Iron

Iron and manganese are common minerals found in the earth's crust. They get into the water by the water percolating through soil and rock and dissolving minerals with iron in them. Iron piping can also lead to iron in the water.

When there's iron in your water, you know it. Iron has a tendency to stain your laundry and fixtures a red or brownish color and it also gives water a metallic taste. Iron can either be soluble or oxidized. Water with soluble iron will look clear coming out of the faucet, but you can see red rust flakes when the water is standing. Oxidized iron will look red when it's coming out of the tap.

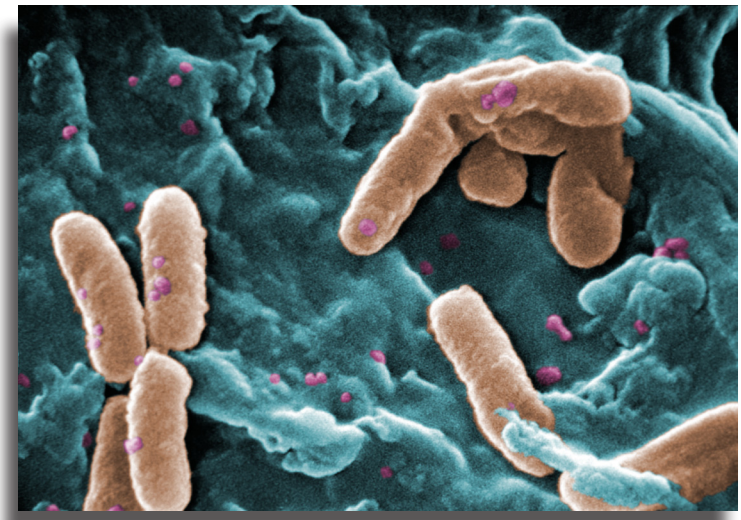


Lead

Lead is a highly toxic metal that was used for many years in products found in and around our home, including pipes and fittings.

Lead gets into your water after the water leaves your well and as it travels through your plumbing system. Leaching from lead pipe, lead-based solder pipe joints and brass alloy faucets is caused by corrosion, a reaction between water and the lead pipes or solder. Dissolved oxygen, low pH (acidity) and low mineral content in water are common causes of corrosion. All kinds of water, however, may have high levels of lead.

You should be concerned if your home has lead pipes (lead is a dull gray metal that is soft enough to be easily scratched with a house key), if you see signs of corrosion (frequent leaks, rust-colored water, or stained dishes or laundry), you should have your water tested for lead. Because you cannot see, taste or smell lead in water, testing is the only sure way to tell if there are harmful quantities of lead in your drinking water.



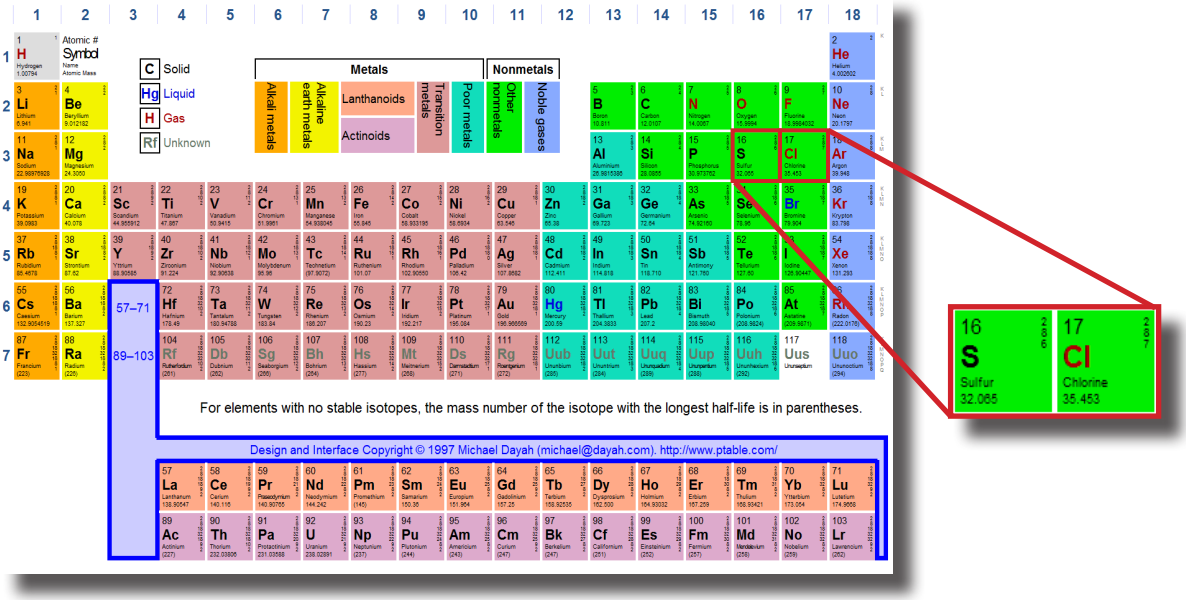
Bacteria

Bacteria are microscopic life forms; a single-celled, often parasitic microorganism without distinct nuclei or organized cell structures. Various species are responsible for decay, fermentation, nitrogen fixation, and many plant and animal diseases.

We are in contact with millions of bacteria every day and nearly all of them are harmless. Yet some of these small organisms are responsible for waterborne illnesses. Coliforms are one group of mostly harmless bacteria that live in soil and water, as well as the intestines of animals but the presence of total coliforms in drinking water can indicate that more dangerous germs, particularly fecal coliforms, have contaminated the water. The most common source of bacteria is the soil surrounding the well. Fecal bacteria in drinking water is usually the result of contamination by a nearby sewer, septic tank, feedlot or farm. Bacterial contaminants also may be introduced into a well during construction or repairs. Most bacterial problems happen right at the well or as water travels through a distribution system. Therefore, it is common to have contaminated and uncontaminated wells in close proximity to one another. Municipally supplied water can also contain bacteria caused by human error or contamination after leaving the treatment facility.

You should test for bacteria yearly, usually in the spring, or if you notice any change in your water.
You should also test if:

- ❑ Anyone in the household suffers recurring bouts of gastrointestinal illness.
- ❑ An infant is living in the house, or someone in the house is pregnant.
- ❑ Flooding has occurred in your area, or the well has been inundated by surface runoff.
- ❑ You are buying a home and wish to assess the quality of the drinking water.
- ❑ You wish to monitor the performance of home water treatment devices.
- ❑ New well equipment has been installed or maintenance has been performed on the well, such as repairs to the pump.
- ❑ You have done landscaping near your well, where the well cap may have been disturbed.
- ❑ If there is consistent boiling advisories in your local area.



Sulfur

Two forms of sulfur are commonly found in drinking water: hydrogen sulfide and sulfate-reducing bacteria. Hydrogen sulfide gas occurs naturally in some ground water. Sulfate is a combination of sulfur and oxygen, and is part of naturally occurring minerals in some soil and rock.

Hydrogen sulfide gas occurs in ground water that contains decaying organic matter, such as wetlands, marshes, swamps and river beds. It may be found in deep or shallow wells. Hydrogen sulfide is often present in wells drilled in shale or sandstone, or near coal or peat deposits or oil fields.

Sulfate occurs when mineral dissolves over time and are released into ground water. Sulfur odor is produced when a non-harmful sulfur-reducing bacteria digests a small amount of the sulfate mineral.

Sulfates give water a bitter taste and can have a laxative effect that may lead to dehydration. Hydrogen sulfide gives water a “rotten egg” odor and taste, and can cause nausea. Hydrogen sulfide is corrosive to metals such as iron, steel, copper and brass. It can tarnish silverware and discolor copper and brass utensils. Hydrogen sulfide can also cause yellow or black stains on kitchen and bathroom fixtures. Coffee, tea and other beverages made with water containing hydrogen sulfide may be discolored and the appearance and taste of cooked foods can be affected. High concentrations of dissolved hydrogen sulfide can also foul the resin bed of an ion exchange water softener making it no longer effective. A test to determine if sulfur is present must be done on site as it is a gas and can dissipate upon transfer.

If rotten egg smell is present it is important to determine if it is in the hot water only or both the hot and cold. If it is in the hot and cold then it is coming from the well and needs to be treated. If it is in the hot water only it may be because of the water heater and not require treatment but maintenance on the water heater.

Chlorine/Chloramines

Chlorine is a disinfectant used to kill harmful bacteria and parasites, such as E. coli and giardia lamblia, in drinking water. Chlorine is so common in water, because water treatment requires so much disinfecting. Disinfectants are used routinely by more than 98 percent of public water systems to protect their customers from waterborne diseases. The treatment dates back nearly 100 years.

Chloramines are a mixture of chlorine and ammonia that are starting to be used by municipalities in certain areas in the same way as chlorine.

Chlorine and Chloramines have completed their job once they enter the household and are then safe to remove. If not properly treated they can cause eye and nasal and respiratory irritation, stomach discomfort, undesirable taste and odor and drying out of hair and skin.

Water Treatment Solutions

Reverse Osmosis: Treat TDS

A Reverse Osmosis unit is used in the reduction of TDS from a water supply. Reverse Osmosis, otherwise known as “RO”, creates high quality water by pushing untreated water through a semi permeable membrane. The membrane is selective in what it allows to pass through and what it prevents from passing. These membranes in general pass water very easily because of its small molecular size; but also prevents many other contaminants from passing by trapping them. Most of the impurities and contaminants are rinsed to a drain while the refined water is routed to a holding tank. An RO unit is typically used as a point-of-use system that is contained under or near the sink and used for cooking and drinking water but whole house ROs are also available.

Water Softener: Remove Hardness

The most common and efficient method of hardness reduction is using a water softener. A water softener uses an ion exchange process to remove hardness from the water supply. Inside the softener is a material known as softening resin. Softening resin is made up of permanent insoluble anions to which sodium cations are chemically bonded. As water flows through the softener tank the hardness cations are drawn to the anions of the exchange material. In the process, the hardness minerals are adsorbed and a chemically equivalent number of sodium ions are released into the water. In brief, harmless sodium ions have replaced the trouble producing hardness ions.

After a vast number of hardness ions in the water have become affixed to the softening material through the attraction of positive and negative charges, and most of the sodium ions have been released, the unit can no longer soften the water. It has become temporarily exhausted. A reverse ion exchange operation, or regeneration, is needed to take place in order to recharge the resin material. This typically takes place about once a week depending on water usage and water quality along with the size of the unit.

What occurs in all examples of ion exchange is a “swap” or balanced exchange of ions. The hardness ions are not destroyed. They have merely been replaced by a chemically equivalent amount of sodium ions. When the unit is regenerated, these hardness ions are washed down the drain and sodium ions are attached to the resin. The amount of sodium in the water is very minimal. If any salt in the water is a concern a potassium supplement, called K-Life, can be used in place of sodium chloride. Or a reverse osmosis unit (as discussed earlier) can be installed at the kitchen sink to be used for cooking and drinking water.

Softener manufacturers produce two basic types of ion exchange softeners: fully automatic (time clock) and demand initiated (metered) units. Metered units are known to be more efficient as they count the number of gallons used in the household and only regenerate when necessary whereas timed models regenerate every certain number of days whether water is used or not.

Acid Neutralizer with Calcite or Corosex & Chemical Feed with Soda Ash: Treating Acidity

There are a few different treatment methods for low pH (acidic) water. The first and most common is by use of an Acid Neutralizer. An Acid Neutralizer is a mineral tank that is filled with calcite. Calcite is a rock type of mineral and as water passes over it the mineral dissolves raising the pH. Calcite will raise the pH 1 point and will not raise it much above neutral of 7. There are two standard types of calcite filters. One is a backwashing unit and the other is an in/out unit. A backwashing unit is preferred because it cleans any sediment out of the tank weekly while also lifting and keeping the mineral bed fresh. As the calcite dissolves new mineral will need to be added to the mineral tank.

If the pH is between a 5.5 and 6 an acid neutralizer with a special blend of media called Super Mix is recommended. The media is a mixture of calcite and another media called corosex. Coresex cannot be used alone as it can harden. This mix can raise the pH higher than calcite alone but can also raise it higher than 7 which is why it is not recommended for every job. Just like calcite, this mineral will dissolve over time and more will need to be added.

Note: calcite will raise the hardness of the water. The two methods listed above would most likely need the use of a softener after them.

If the pH is below a 5.5 the use of chemical feed system with soda ash is recommended. A chemical feed pump is placed on top of a solution tank. When the homeowner's well pump initiates, the chemical feed pump also initiates mixing the soda ash solution with the incoming water allowing the pH to raise. Soda ash does not affect the hardness of the water. When the solution runs out more mixture will need to be placed inside the solution tank.

Birm Filter, Aeration System, Softener for Iron and Hardness: Treating Iron

The treatment of iron all depends on the water quality. The pH can play a factor in the equipment chosen along with what type of iron and how much iron is present. There are four main types of treatment.

The first type is a standard iron removal filter. These filters typically use a mineral called Birm housed inside a mineral tank with a control valve on top. Iron is filtered out of the water as it flows over the Birm. Water samples are important because Birm becomes ineffective with acidic water. A pH below 7 can strip the coating of the Birm and render it useless. If the pH is neutral or above and there are no other water quality issues a Birm Filter is a good way to go.

Another method of treatment would be an aeration system. A standard aeration set up would include a mineral tank that has an air draw built into the valve. This system would have carbon or birm in the bottom of the tank (again depending on pH). The air bubble is placed in the top of the tank and as the iron filled water passes through the air bubble it oxidizes the iron and removes it through the media bed in the bottom. This is a nice way to go as it is a chemical free solution but may not be sufficient depending on the amount of iron in the water.

A third method of treatment is by use of a water softener. Some manufacturers have a unit that can remove iron while it softens water. These units are very popular as a lot of wells with iron have a hardness content as well. These are set up with a special blend of medias but are run just like the softeners we spoke of before with the ion exchange process in the section on Treating Hardness.

Reverse Osmosis and Water Softener: Treating Lead

The removal of lead is best accomplished with a reverse osmosis unit for cooking and drinking water utilizing membrane technology.

A water softener can be installed to treat soluble lead throughout the home through ionic exchange.

Ultraviolet Purification or Chemical Feed with Chlorine: Treating Bacteria

There are two common methods of treating bacteria in a water supply. The first is Ultraviolet purification, or UV. The second would be a chemical feed pump using chlorine.

Ultraviolet purification uses a high-intensity ultraviolet bulb and core chamber technology to neutralize bacteria. Water passes through the chamber surrounding the UV bulb and is exposed to UV rays that penetrate the bacteria, disinfecting the water while inactivating 99.99% of harmful microorganisms. The water then exits the chamber disinfected. Pre-treatment of the water supply is required as any sort of sediment, iron, hardness, etc, can cause a coating on the interior sleeve causing the UV rays to not come in contact with the water long enough.

Chemical Feeders introduce solutions into household water supply for treatment. Similar to city water treatment plants, chlorine is used for bacteria disinfection. As discussed previously, the chemical feed pump is placed on top of a solution tank where the chlorine solution is mixed. After leaving the solution tank it goes into a retention tank to allow contact time for the chlorine to disinfect. After leaving the retention tank the water would go through a carbon tank to remove the chlorine and then either to a softener or it would proceed for use.

Chemical Feed with Chlorine and Aeration Units: Treating Sulfur

For a while the only option to treat that pesky rotten egg smell caused by sulfur was a chemical feed set up with chlorine. The chlorine would oxidize the gas and turn it into a solid and then that would be filtered out with carbon. That is still the method of choice when the sulfur smell is extreme or there are other issues in the water that need chemical treatment but there is an alternative.

For lower to mid levels of sulfur there is a chemical free alternative called an aeration unit. This was briefly discussed in the iron section but is a great product for sulfur treatment. For sulfur, the basic aeration unit consists of a mineral tank with a valve on top. The valve has an air check that draws in air and the tank has carbon in the bed. As the water passes through the air bubble in the top of the tank it oxidizes the sulfur gas and turns it into a solid. It then proceeds to the carbon and is filtered out.

There are more advanced systems for larger houses that involve an air pump as well, but the most basic and commonly used model is the aeration system described above. For extreme cases of sulfur, chlorination is still the method of choice for reduction.

Carbon Filter: Treating Chlorine

The use of carbon inside a mineral tank is used for color, taste, and odor. This includes chlorine. Once municipal water is supplied to the house the chlorine has done its job. It is now safe to remove so that it is not inhaled while in the shower. A backwashing carbon unit is the preferred method of treatment. If your municipality is using CHLORAMINE instead of chlorine a special carbon called CAT-HAC is needed for reduction.

Some consumers think that since they pay for municipally supplied water it is the best water they can get. The two major issues of municipally supplied water are chlorine and hardness. Chlorine is more harmful as a gas in the shower than it is in the drinking water which makes it vital to remove from the water supply once it enters the house. Some advanced companies have “city” units that use one mineral tank along with a brine tank and they remove chlorine and hardness. These units are a more efficient and they save space while treating the “city” water.

Choosing an Installer and Manufacturer

In choosing the right water treatment equipment, a recommendation has to be specific to the individual needs of the consumer and their water quality. There is no “one size fits all”. Each family should have a water test performed from their home to determine what equipment will satisfy their concerns. A certified installer has both the ability to test your water for secondary contaminates including Iron, Hardness, pH and TDS and recommend a total solution for the job. The certified installer also has the ability to take a water sample at the residence which will later be evaluated and analyzed by the engineering department of the manufacturer. The certified installer should have a good base of water treatment knowledge along with a good relationship with the manufacturer.

The manufacturer should be well recognized in the water treatment industry with relation to engineered product innovation and strong customer service. They should have a good reputation of quality products and service along with years of experience. The best water treatment manufacturers will talk to you over the phone whether you are a wholesaler, contractor, or homeowner. When you have questions on what something does or why it was recommended these trusted manufacturers will be there to explain.

Other	LANCASTER® WATER TREATMENT	**Qualities to look for:**
	✔	Engineering department is on staff and certified by the WQA
	✔	Made in the USA
	✔	A customer service team with a combined total of over 200 years of experience and is a just a phone call away
	✔	Systems are 98% efficient
	✔	Fully adjustable and programmable equipment
	✔	Plate & mid-plate technology with a water savings of up to 30%
	✔	Proprietary X-Factor technology developed in Lancaster, Pennsylvania
	✔	Up to 4 regenerations per day
	✔	Historical data recorded in software to deliver advanced troubleshooting
	✔	Diagnostics for “real time” troubleshooting
	✔	Recorded memory feature to plan for future personal heavy usage water events
	✔	Treated brine water refill
	✔	9 hour battery back up feature to save the “time of day”
	✔	Solar options are available upon request
	✔	Full lines of residential, commercial, and industrial water treatment to handle any and all of you needs

Use this chart to compare companies when you’re considering installing a water treatment system.

Who is qualified?

Finding a great technician is sometimes just as important as finding the right doctor. They should be certified to a high level of education through the water treatment manufacturer and at the same time be highly recommended by them. Support should always be accessible from both your technician and the water treatment manufacture which will give the homeowner the added value and piece of mind they deserve. They should provide testimonials from other homeowners attesting to the quality of installation and their level of satisfaction with regard to professionalism and results.

Who to beware of?

There are red flags to be considered when choosing the right installer including:

- Not a certified installer
- Lack of positive customer testimonials
- Lack installation experience
- Lack of product knowledge
- Use of unproven technology.
- High pressure/franchise

How do I get started?

The first step for fixing your water quality is defining what the issues are. This process is done through a water test. Local labs can do tests for you but there is a charge associated with doing so. The best installers offer free water sample tests. These tests include your basic water treatment issues we have discussed including Iron, Hardness, pH, TDS, and maybe even a few more per request. When contacting a local plumber, ask them if they can test your water at no charge. The best manufacturers will be able to recommend equipment right away from the results of the water test and provide you and the plumber literature so you know exactly how much space the units will need along with what they look like and how they perform. Contact that plumber or manufacturer if any explanations are needed and the installer can install the equipment as soon as it arrives.

Thank you for reading this brief but intensive overview of water treatment. We hope that it has been informative and helps you make your water treatment decisions with ease. Please contact your plumber and let them know that you are interested in knowing what is in your water.

LANCASTER®
WATER TREATMENT
A DIVISION OF C-B TOOL CO.
1340 MANHEIM PIKE ● LANCASTER PA 17601-3196 ● TEL:717-397-3521 ● FAX: 717-392-0266
www.lancasterwatertreatment.com ● E-mail: info@lancasterpump.com