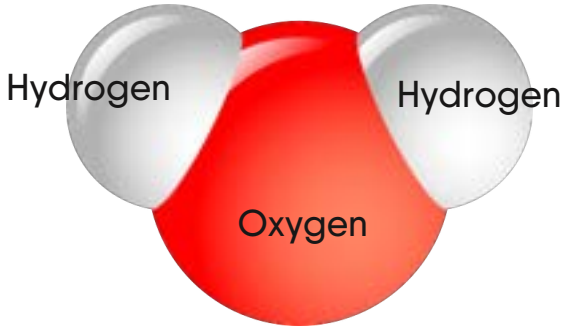
Fundamentals of Water

James Alaimo, CWS *National Brand Manager*

What is Water Anyway?



Water is a molecule composed of two atoms of Hydrogen and one atom of Oxygen (H_2O). In its pure form, it is a transparent, odorless, and tasteless liquid found in lakes, rivers, aquifers and oceans.

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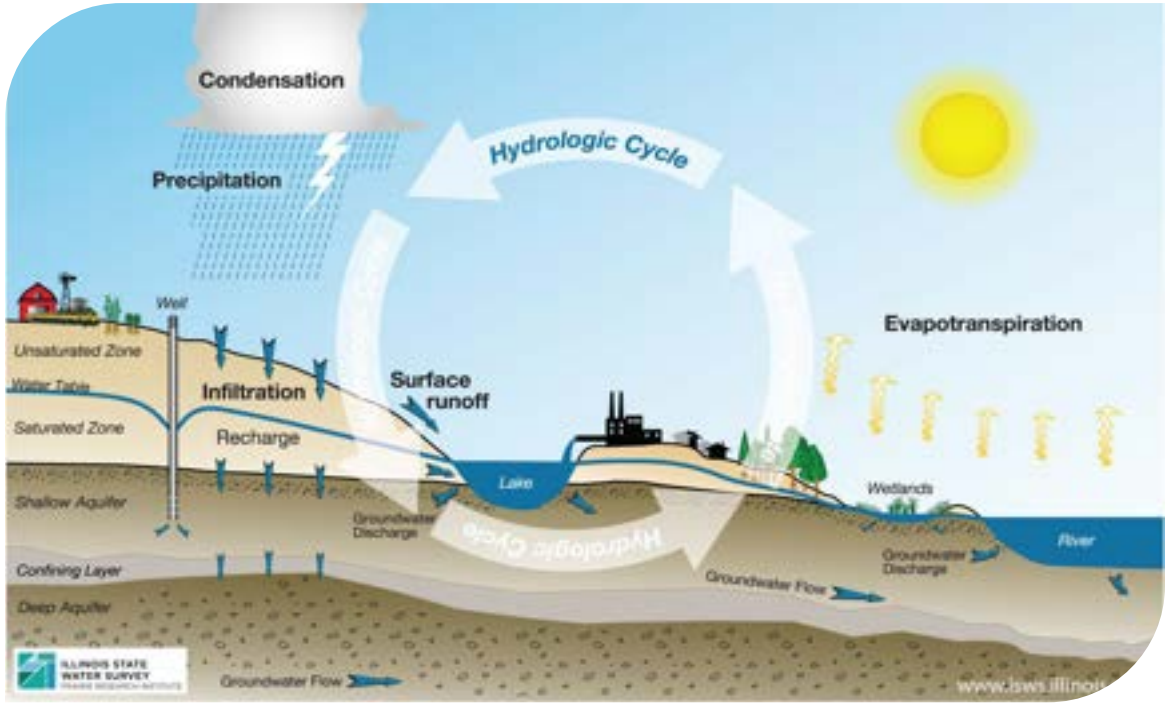
Where Does it Come From?



Water was formed in nature and cannot be manufactured or reproduced. Every drop on earth has been here from the beginning of time and recycles through the hydrological cycle. As it passes through underground aquifers and collects in lakes, rivers and oceans, it evaporates forming clouds and falls to the earth as rain or snow.

We harvest water from surface impoundments (lakes and reservoirs), rivers, oceans, and from underground aquifer wells.

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How Does Water Become Contaminated?

Water the Universal Solvent - H_2O is neutral and has great solvency properties, always dissolving and absorbing whatever it contacts.

Common Contaminants Found in Drinking Water – When we drink our daily eight glasses of refreshing, nourishing water, how often do we consider the huge host of contaminants living inside our tap water?

- Nitrates
- Arsenic
- Microorganisms, Bacteria, & Viruses
- Aluminum
- Fluoride
- Lead
- Sediment
- Ammonia
- Pharmaceuticals
- Pesticides/Herbicides

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How Does the Environment Affect Water?

As water falls from the sky it passes through airborne contaminants: gases and particulate.

- Carbon Dioxide
- Smoke
- Soot
- Sulfur Oxides
- Pollen and more

As water comes in contact from Earth, it continues to dissolve and absorb whatever it contacts: minerals, salts, heavy metals, and microorganisms.

- Calcium
- Magnesium
- Iron
- Nitrates
- Arsenic
- Sulfur
- Bacteria
- Cysts
- Radon
- Mercury and more

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Contaminant Characteristics

Typically, unwanted items in water are unhealthy and make water either inefficient or unusable, reducing water's ability to perform its intended use.

Water contaminants fall into two categories:

TSS (Total Suspended Solids)

- Particulates in water that are not dissolved.
- They can be trapped and filtered out by mechanical means.
- Exceed 2 microns in size
- Examples: Sand, Silt, Clay, Algae

TDS (Total Dissolved Solids)

- Minerals, metals, organic matter that are dissolved in solution with water. Smaller than 2 microns.
- Measured in ppm, mg/L.
- They can be removed by Reverse Osmosis or converted by Ion Exchange.

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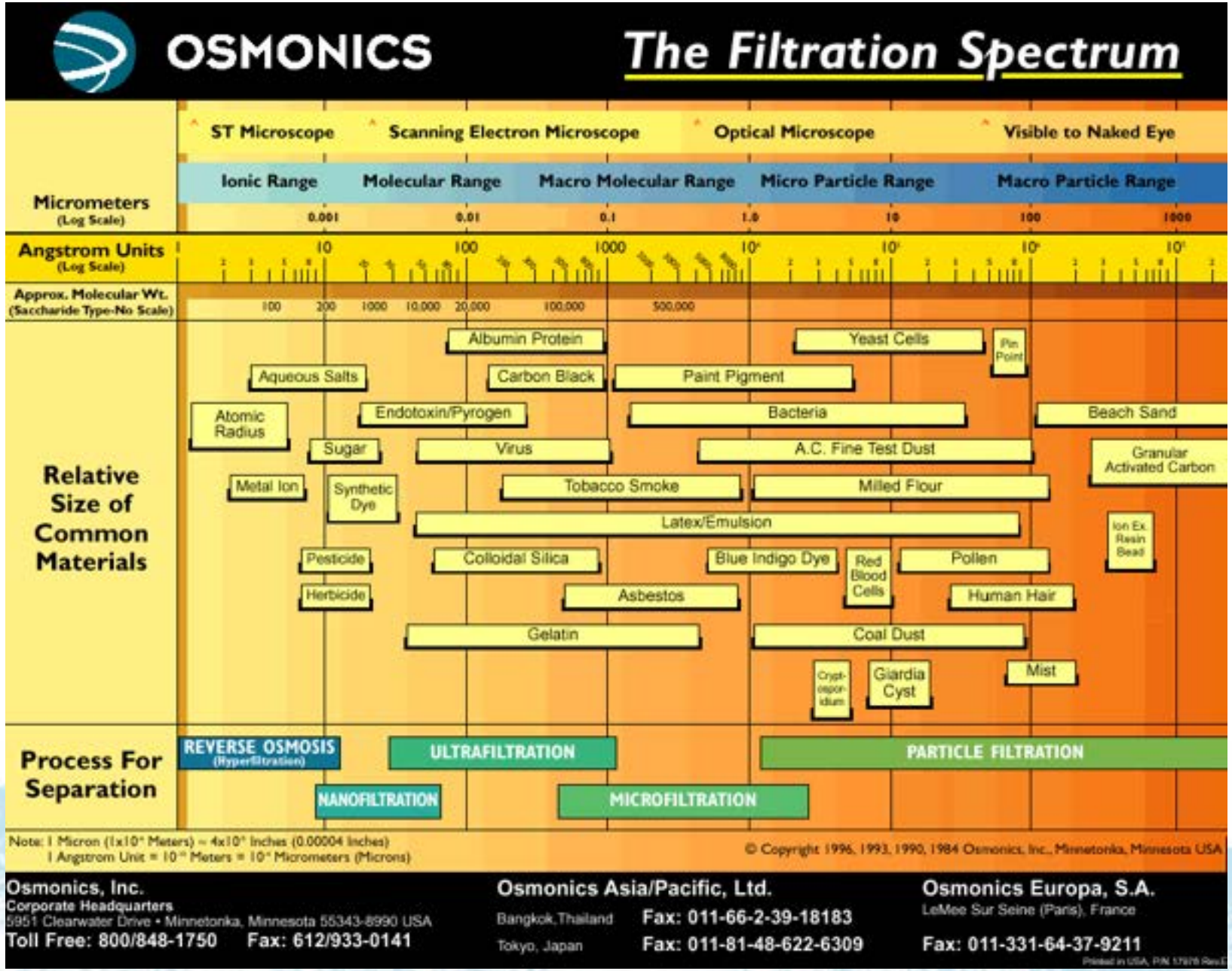
Comparative Micron Sizes

For reference, a human hair is approximately 75 microns in diameter.



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Units of Measure

1 ppm - mg/l	One inch – 16 Miles
.001 ppm – mg/l	One inch – 16,000 Miles

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1 ppb - µg/l	One Heartbeat in 27 Years

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1 ppt – ng/l	One cent in $10,000,000.00 ($10 Million) One second in 32,000 years

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Municipally Treated Water/City Water

The U.S. has the safest drinking water in the World. But with a vast distribution system, the potential for contamination is very real.

Remember the “Universal Solvent” properties of water? Once the water leaves the WTF (Water Treatment Facility) the whole process of absorbing whatever the water comes in contact with making the water at your faucet potentially much different than the water leaving the WTF. In addition, it contains Chlorine or Chloramine content for disinfection as well as Fluoride.

Typical causes for contamination on route to your home: pipe repairs and maintenance, power outages, leaks, corrosion, leaching from pipe walls, disinfection byproducts, biofilms, and more.

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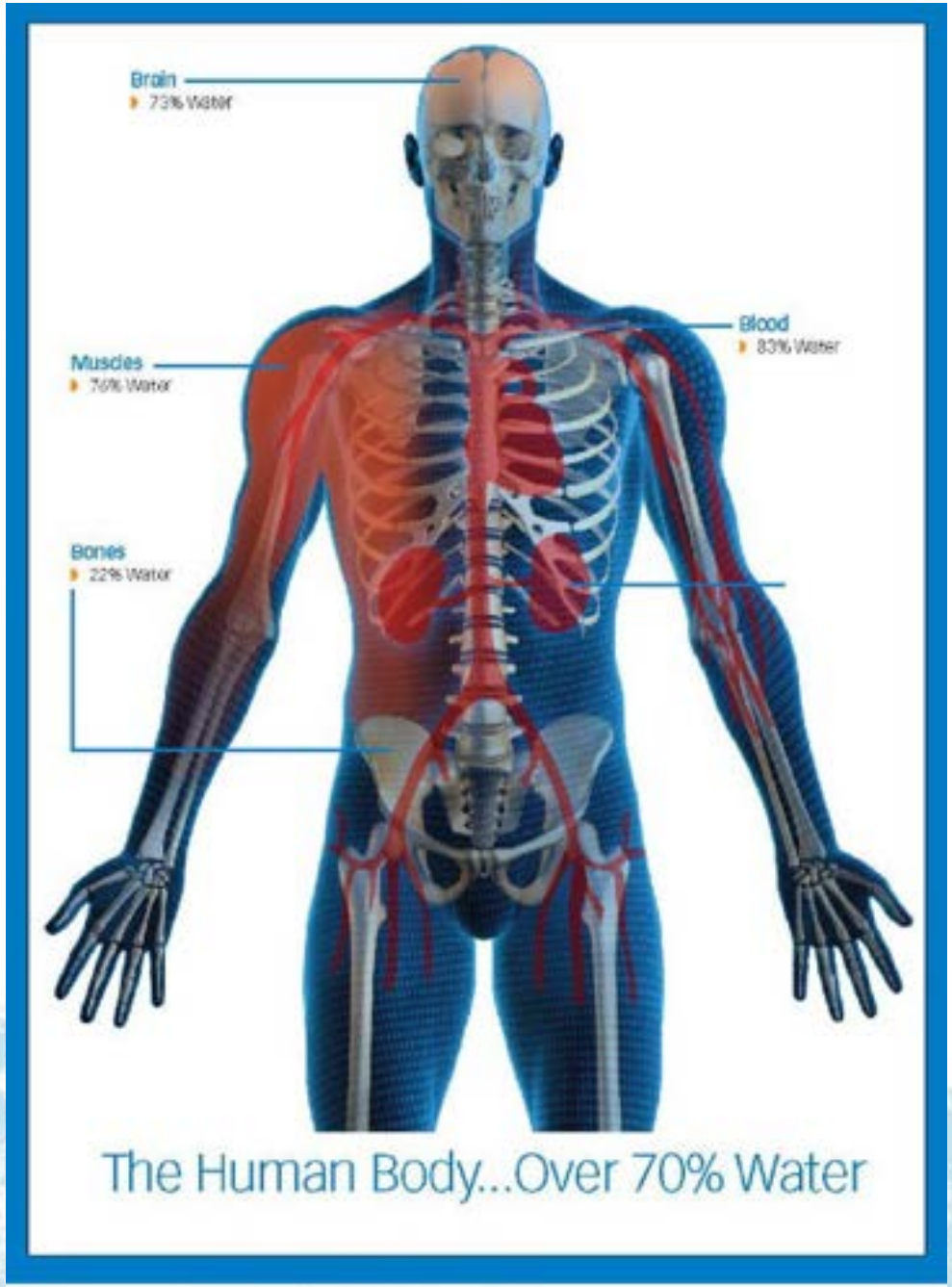
Why is Clean, Pure, Soft, Safe Water Important?



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What is “The Final Barrier” and Why?

Only about 1% of water treated by municipalities is consumed by people. The remaining 99% is “Working Water” used for irrigation, flushing toilets, firefighting, and industrial processes.

Final barrier treatment, the 1% we consume, can be economically treated to the highest safety levels at the “point of use”.

Final Barrier Technologies:

- Ion Exchange Water Softeners
- Reverse Osmosis
- Activated carbon filtration
- Catalytic carbon filtration
- Distillation
- Sediment micron filtration
- Multiple combinations of technologies

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Private Well Water

Private water wells have their own set of challenges and require a more comprehensive testing procedure and treatment technologies.

Potential Contaminants:

- Iron
- Bacteria
- Chemicals from agricultural run-off
- Sulfur
- Microbial
- Organics
- Tannins
- Nitrates
- Elevated or Reduced pH

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Water Falls into Three Categories:

Life Support:

- Drinking
- Food Preparation

Working Grade:

- Bathing
- Washing
  - Clothes & Dishes
- Appliances
  - Hot Water Heaters
  - Clothes Washing Machines
  - Dishwashers

Utility Grade:

- Irrigation
- Industrial Processes
- Firefighting

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What is Hard Water?

Hard water is a common quality of water which contains dissolved compounds of calcium, magnesium, iron and sometimes other divalent and trivalent metallic elements.

Scale deposits are a typical indicator of hard water.

The term hardness was originally applied to water that was hard to wash, referring to the soap-wasting properties of hard water. Hardness prevents soap from lathering by causing the development of an insoluble, curdy precipitate in the water; hardness typically causes the buildup of hardness scale (such as seen in cooking pans). Dissolved calcium and magnesium salts are primarily responsible for most scaling in pipes and water heaters and cause numerous problems in laundry, kitchen and bath. Hardness is usually expressed in grains per gallon (or gpg) as calcium carbonate equivalent.

Symptoms Include:

- Stiff and dingy laundry
- Mineral deposits on dishes and glassware
- High soap usage & need for fabric softener
- Dry, itchy skin and scalp
- Unmanageable hair
- Extra work to remove soap curd on bathtubs and shower stalls
- High energy costs, possibly due to scale build-up in pipes and on appliances
- Scale build-up in sinks, tubs, faucets, and appliances

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How Do We Measure Hardness?

Hardness is measured by a titration process which measures calcium and magnesium in parts per million and divides by 17.1 expressed in grains.

Degree of Hardness	Grains per Gallon (GpG)	Parts per Million (or mg/L)
Soft	<1.0	<17.0
Slightly Hard	1.0-3.5	17.1-60
Moderately Hard	3.5-7.0	60-120
Hard	7.0-10.5	120-180
Very Hard	>10.5	>180

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What are the Effects of Hard Water?

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What is Soft Water?

Water is considered soft when dissolved minerals are removed to a level of 1.0 grain per gallon (gpg) or less. The most efficient and economical method is through ion exchange.
Where the dissolved minerals (Calcium and Magnesium) ions are exchanged for Sodium Ion.

Why Soft Water?
Soft water provides both aesthetics and economic benefits. You will see, feel, and taste the difference.

Aesthetics

- Improves taste and odor
- Removes cloudiness & discoloration
- Prevents staining
- Fluffier laundry
- Silkier shinier hair
- Softer and smoother skin
- Sparkly glassware
- Spot free shower doors

Economics:

- 75% less soaps & cleaning chemicals
- 20% less hot water usage
- 75% improvement in the life of plumbing and water appliances

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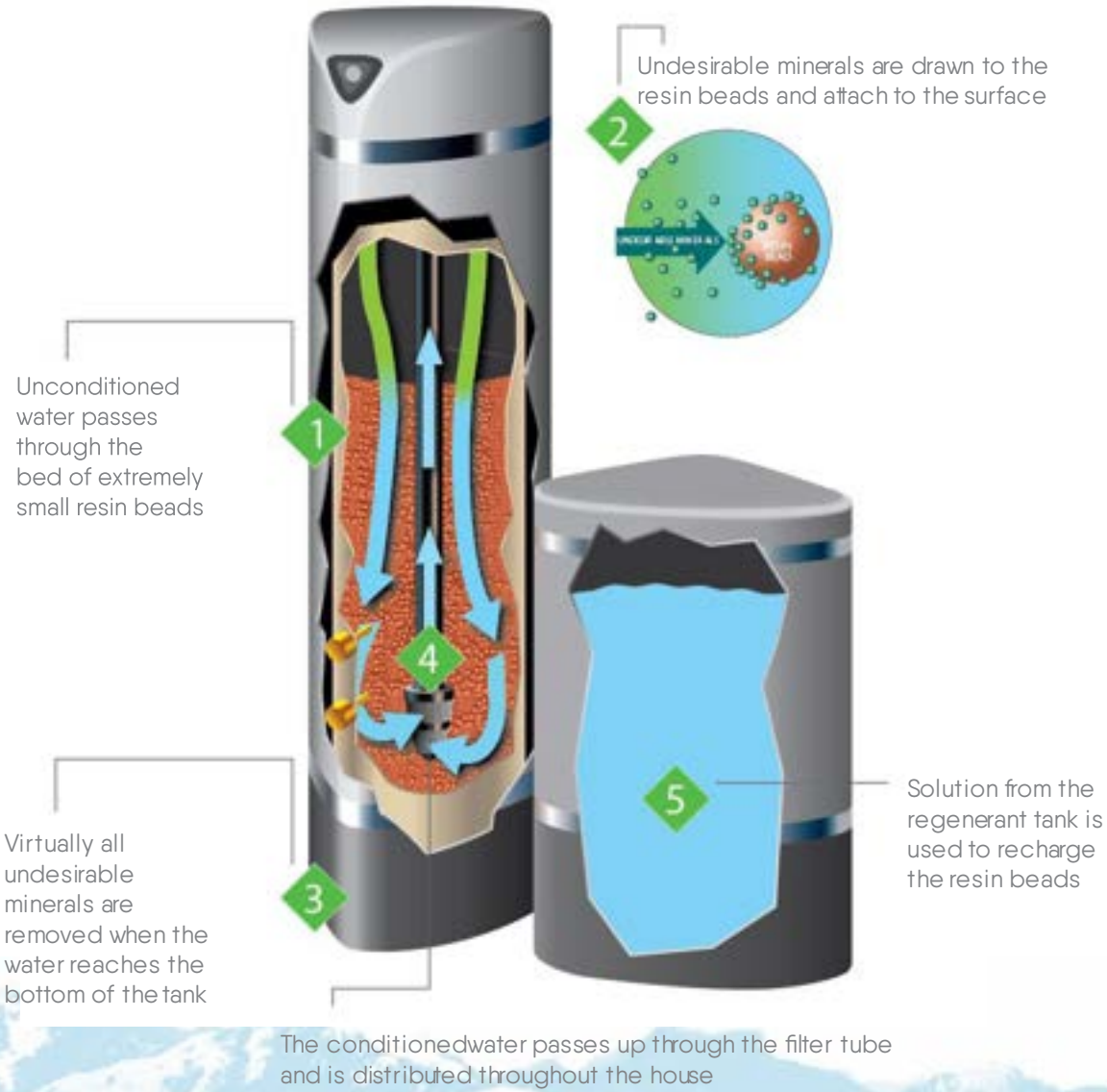
How Do We Improve Water?

We have many proven and universally accepted methods to improve the quality of water. Most systems require multiple components to achieve the desired level. We have developed patented technology that removes contaminants, dissolved minerals, chlorine, and other undesirables in one compact, highly efficient component.



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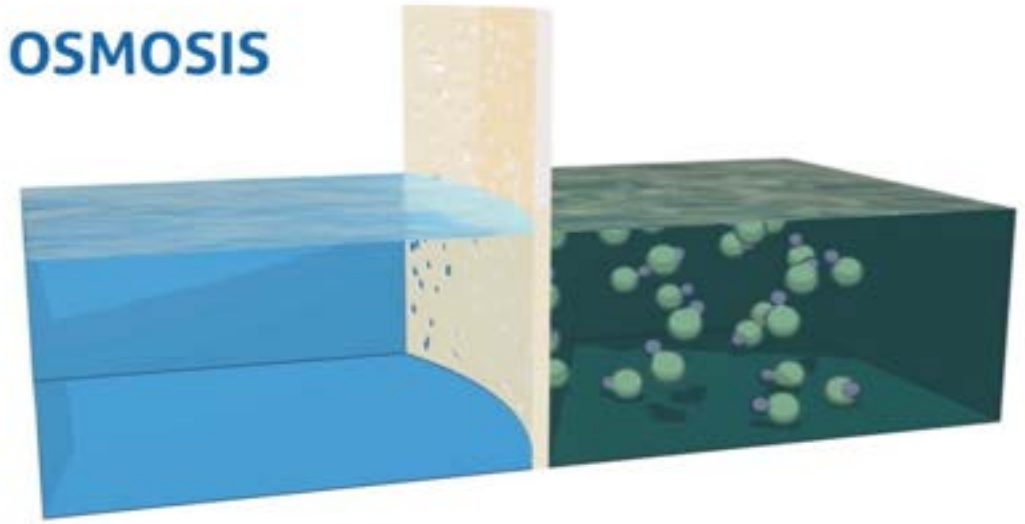
Reverse Osmosis – How It Works

Reverse Osmosis (RO) is a water purification technology that uses a semipermeable membrane to remove ions, molecules, and larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure of the fluid.

In the normal osmosis process, the feed water will go from dilute to higher concentration. By applying external pressure to reverse the natural flow of clean water is Reverse Osmosis.



https://www.youtube.com/watch?v=4RDA_B_dRQ0

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Water Softener Myths and Facts

MYTH 1: ION EXCHANGE SOFTENERS ARE THE ONLY WAY TO SOFTEN WATER.

Fact 1: Sure, traditional water softeners that use salt to attract calcium and magnesium are the most popular water softener, but they're not your only option.

You can pick a salt-free water softener alternative that gets the same results, just in a different way. Our salt-free water softener, for instance, actually leaves in the minerals that typically cause an off-taste and scale buildup. However, it neutralizes their effects, meaning you still get all the benefits without the scum.

We get it. Comparing these two systems might sound difficult, especially if you just found out a salt-free alternative is a thing. Learn more about the difference between a water softener and a salt-free water softener alternative.

MYTH 2: SOFT WATER FEELS SLIPPERY AND LEAVES A FILM ON YOUR SKIN.

Fact 2: There's no denying the different feel of soft water vs. hard water. Let's be upfront though, the differences you're feeling are not a film. To understand it better, you have to ask yourself, "what does a water softener do?" Most water softeners work by replacing the calcium and magnesium molecules in your water — the ones responsible for the white residue around your tub and sink — with sodium or potassium. This is a good thing because it means the mineral scum that's typically in hard water isn't clinging to your skin.

That softness you're feeling is what it feels like to be clean without minerals interfering. It's not soap — it's just your body's natural oils. Soft water actually rinses you cleaner than hard water, which is why it can feel more slippery.

MYTH 3: SALT (OR ION EXCHANGE) SOFTENERS DON'T INTRODUCE ANY SODIUM TO THE WATER.

Fact 3: Without adding sodium to the water, an ion exchange softener wouldn't function. Here's why: Ions are the electrically charged, dissolved form of an element. Calcium and magnesium ions (the two baddies that cause hard water) carry a double positive charge (++). Sodium carries a single (+) electric charge. Thus, for every calcium or magnesium ion removed by a whole house water softener, two sodium ions are introduced to the water.

These sodium ions are necessary to remove the calcium and magnesium from the water, so there's no way around it unless you choose a salt-free softener alternative. However, most people don't notice that their softened water tastes salty or is any different.

MYTH 4: THE AMOUNT OF SODIUM IN SOFTENED WATER IS UNHEALTHY.

Fact 4: Do water softeners add sodium to drinking water? As we learned above, the answer is yes. Luckily though, for most people, the amount of sodium added isn't a health issue.

The FDA recommends adults eat 2,300 mg of sodium per day. However, according to research, a liter of softened water only has 278 mg of sodium, meaning that you'd have to drink a large amount to come close to exceeding that limit.

While most people can safely drink and cook with water from a salt-based water softener, people on low sodium diets or who live with high blood pressure should consider a whole house water softener alternative with salt-free technology.

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Water Softener Myths and Facts, Cont.

MYTH 5: ALL WATER SOFTENERS PUT SALT IN YOUR WATER.

Fact 5: While it's true all salt-based water softeners leave residual amounts of sodium in your water, you have alternatives. A whole house water softener alternative with salt-free technology skips the salt. Instead, it changes the composition of hard water minerals to prevent the minerals from adhering to plumbing and appliance surfaces or your skin.

MYTH 6: WATER SOFTENERS FILTER WATER.

Fact 6: Water softeners are great at removing minerals from water, but they may not get rid of other contaminants. That's where a water filter comes in. When thinking about a water softener vs. water filter, consider the source of your water. Do you use a well or cistern? In that case, a water softener is probably more important to you. Do you have municipal water and want to get rid of the chlorine taste? Then you might appreciate a water filter more. Of course, you can get both systems for the best tasting water of your life.

MYTH 7: HARD WATER FADES CLOTHING AND DRIES MY SKIN AND HAIR.

Fact 7: It's not technically the hard water on its own fading your clothing. It may actually have more to do with the soap you're using. Some detergents mix with the minerals in the hard water to form a residue that makes it look like your clothes have faded. You can fix this by using hotter water or switching detergents.

As for your skin and hair, typical dry skin and hair is the result of chlorine in the water, which will dry out your skin and hair. Remember how your skin and hair are affected after swimming in a chlorinated pool? Get a whole house water filter to prevent skin drying due to chlorine.

MYTH 8: SALT SOFTENERS ARE ALLOWED IN ANY STATE.

Fact 8: Many states have chosen to ban salt-based water softeners outright because of their negative ecological effects. It's inevitable that a salt-based system discharges some brine. In places that see a lot of droughts, this wastewater can have a huge ecological impact and make it harder for water treatment plants to treat.
Many states have imposed some kind of ban on water softeners, including California, Texas, Massachusetts, Arizona, and Connecticut. If you live in an area that banned salt-based softeners, a whole house water softener alternative with salt-free technology may be your best choice.

MYTH 9: WATER SOFTENERS WASTE WATER AND ENERGY.

Fact 9: While water softeners do require small amounts of water and energy, it's not wasteful if it's creating a product you love. In fact, our salt-based water softeners feature an on-demand water regeneration system that reduces water waste drastically compared to traditional systems. Even better, this system is electronically programmable, so you can save energy when you don't need it to be running.
If you're truly concerned about wasting water and energy, a salt-free water softener alternative might ease your mind. It doesn't use any electricity to run, keeping your energy bill low.

MYTH 10: HARDNESS IS A CONTAMINANT THAT SHOULD BE REMOVED.

Fact 10: Here's a little secret — the calcium and magnesium found in hard water aren't actually bad for you. They're just minerals. You don't have to remove them to drink your water. But, if you want great-tasting water you can trust, we recommend a water softener. Hardness can also do a number on your appliances, dishes, and sinks, which is another reason we recommend removing it.

MYTH 11: YOU DON'T NEED A WATER SOFTENER IF YOU HAVE CITY WATER

Fact 11: Over 85% of Americans have hard water coming out of their tap. Contrary to popular belief, water utilities do not soften water, as it's not required by law. If you want to put a stop to your water's hardness, it's all on you. A whole house water softener will do what your water utility won't — provide you with softer, tastier water.

KENAI™

ProElite

Features and Benefits:

- Professional grade 1” control valve
- Intelligent programmable digital interface
- Three different size systems for application flexibility
- Stylish enclosure that provides protection from rain and UV exposure
- Analyzer function monitors condition of bed in real time and eliminates human error
- High quality media is more resistant to degradation from water disinfection agents

KENAI™

EcoPro

Features and Benefits:

- Professional grade 1” control valve
- Intelligent programmable digital interface
- Simple elegant lines
- Flexible options for high efficiency or high capacity
- Integrated bypass with easy operation
- Internal metering system learns water usage patterns
- Interval service reminder
- Salt level indicator
- Blue lit screen
- Upgraded 10% resin media

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FreshStream Reverse Osmosis Systems

Features and Benefits:

- Purified water in your kitchen
- Proprietary twist-off filter cartridges
- High capacity 75 GPD TFC RO membrane assembly for easy replacement
- Ultra conservative 1:1 membrane system
- Quick connect o-ring seal fittings
- Compact size takes less space than most systems

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Soft, filtered, conditioned water saves money and will ALWAYS pay for itself over time.

		Monthly		Yearly	
	% Savings	Spending	Savings	Spending	Savings
Bottled Water	100%	$33.33	$33.33	$400.00	$400.00
Soaps	75%	$10.42	$7.81	$125.00	$93.75
Cleaning Products	75%	$50.00	$37.50	$600.00	$450.00
Hot Water Usage	20%	$41.67	$8.33	$500.00	$100.00
Plumbing and Appliances	75%	$10.00	$7.50	$120.00	$90.00
Clothing and Linens	30%	$43.75	$13.13	$525.00	$157.50
	Totals	**$189.17**	**$107.60**	**$2270.00**	**$1291.25**

Figures based upon the average family of 4 with an average water hardness of 10 grains per gallon.

Sources: Water Quality Association - www.wqa.org • NSF International - www.nsf.org
US Department of Labor • US Department of Commerce • National Bureau of Standards • US Geological Survey

$12,910.00
Potential 10- year savings

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Quick Reference

Salt Usage Table

Occupants	Regeneration Days	Replenish Brine Systems*
2	24	20-30
4	12	10-12
6	8	5-8
8	6	4-6

**Check and add 40 lbs of softener salt at the intervals indicated above.*

Based on 8 gpg (grains per gallon) hardness 75 gallons per day, per occupant

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