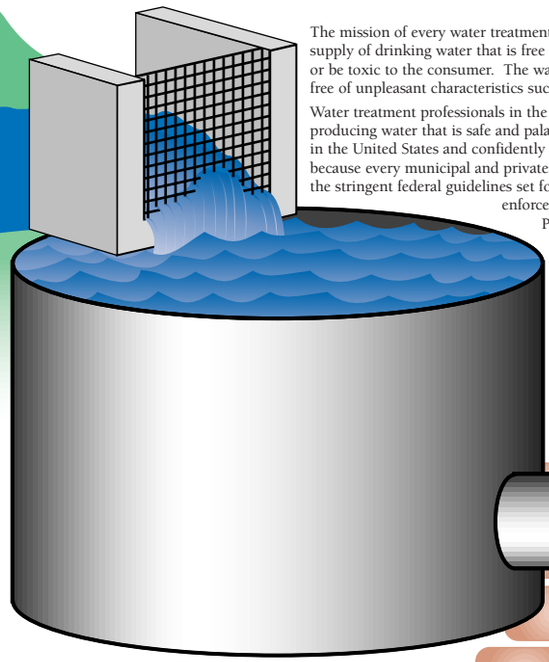
A Closer Look at Water Treatment

The mission of every water treatment professional is to provide a continuous supply of drinking water that is free of contaminants that can cause disease or be toxic to the consumer. The water must also be palatable — that is, free of unpleasant characteristics such as color, turbidity, taste and odor.

Water treatment professionals in the United States do an excellent job of producing water that is safe and palatable. You can go virtually anywhere in the United States and confidently drink water from the tap. That's because every municipal and private water treatment facility must meet the stringent federal guidelines set forth in the Safe Drinking Water Act and enforced by the United States Environmental Protection Agency.

The methods used to treat water depend on the characteristics of the raw water. Surface water sources (rivers, lakes, and reservoirs) generally require more extensive treatment than ground-water sources (well water) because of greater exposure to contamination. Most water treatment processes include a multi-step approach to ensure that finished water meets established standards.



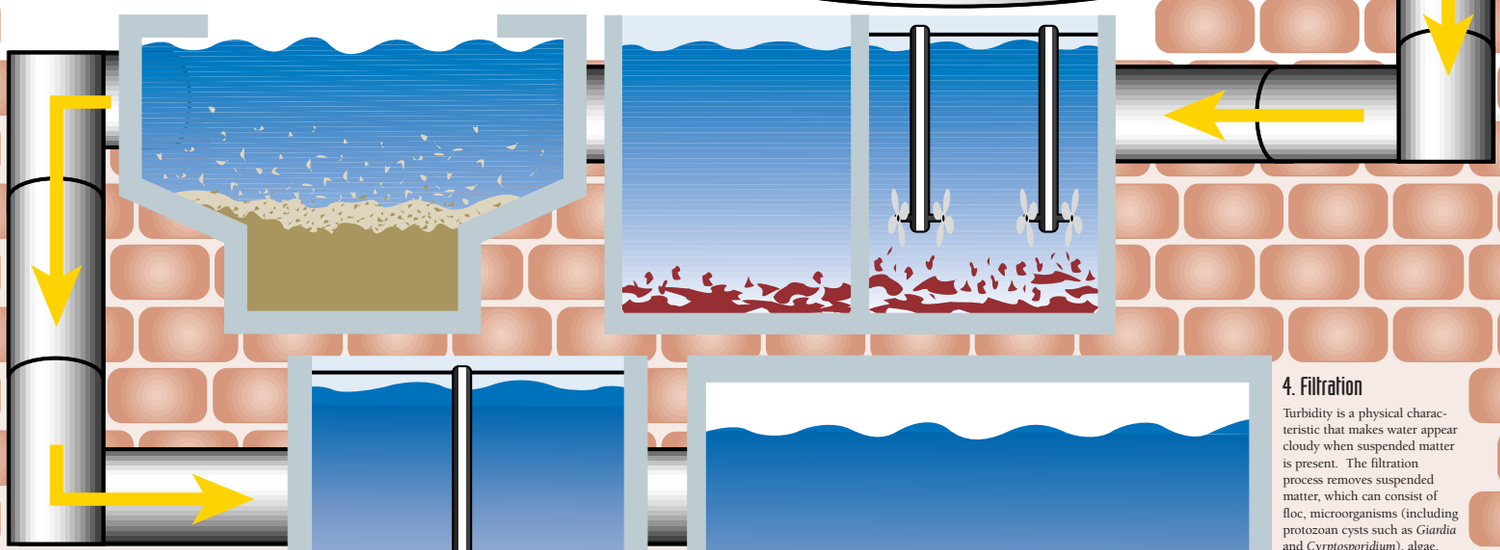
1. Preliminary Treatment

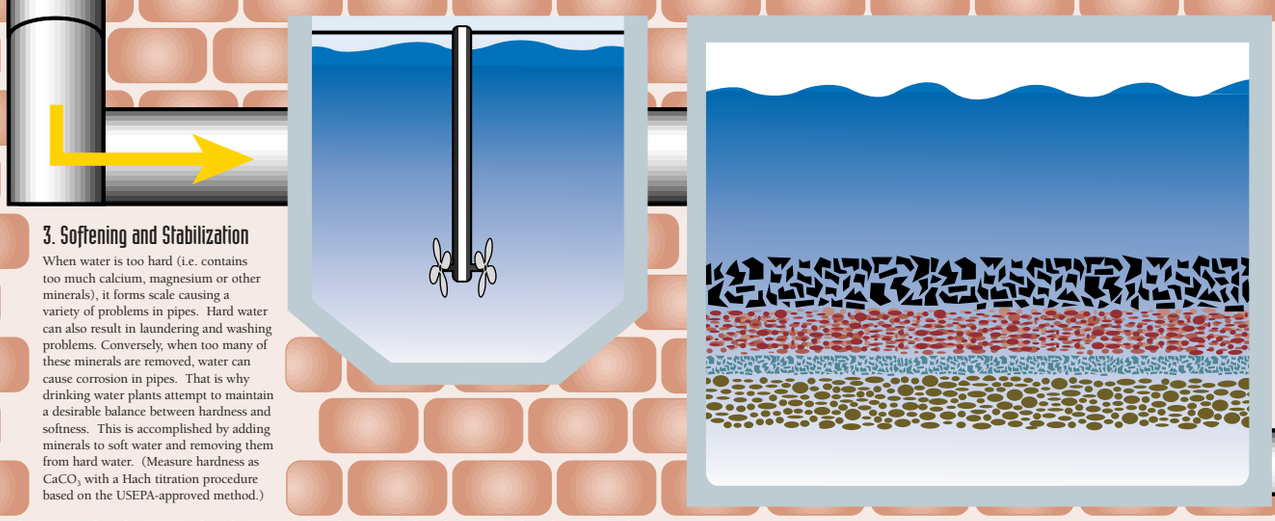
Preliminary treatment or pretreatment is any physical, chemical or mechanical process used on water before it undergoes the main treatment process. During preliminary treatment, screens can be used to remove rocks, sticks, leaves and other debris; chemicals can be added to control the growth of algae; and presedimentation can settle out sand, grit and gravel from raw water.

2. Coagulation, Flocculation and Clarification

To remove small particles that are made up of microbes, silt and other suspended material in the water, treatment chemicals such as alum are added to the water and mixed rapidly in a large basin. The chemicals cause small particles to clump together (coagulation). Gentle mixing brings the clumps together to form larger groups of particles (floc). During flocculation, the heavy, dense floc slowly settles out of the water in large tanks.

Clarification occurs in a large basin where water is allowed to flow very slowly. Sludge, a residue of solids and water, accumulates at the basin's bottom and is pumped or scraped out for eventual disposal. Clarification is sometimes called sedimentation.



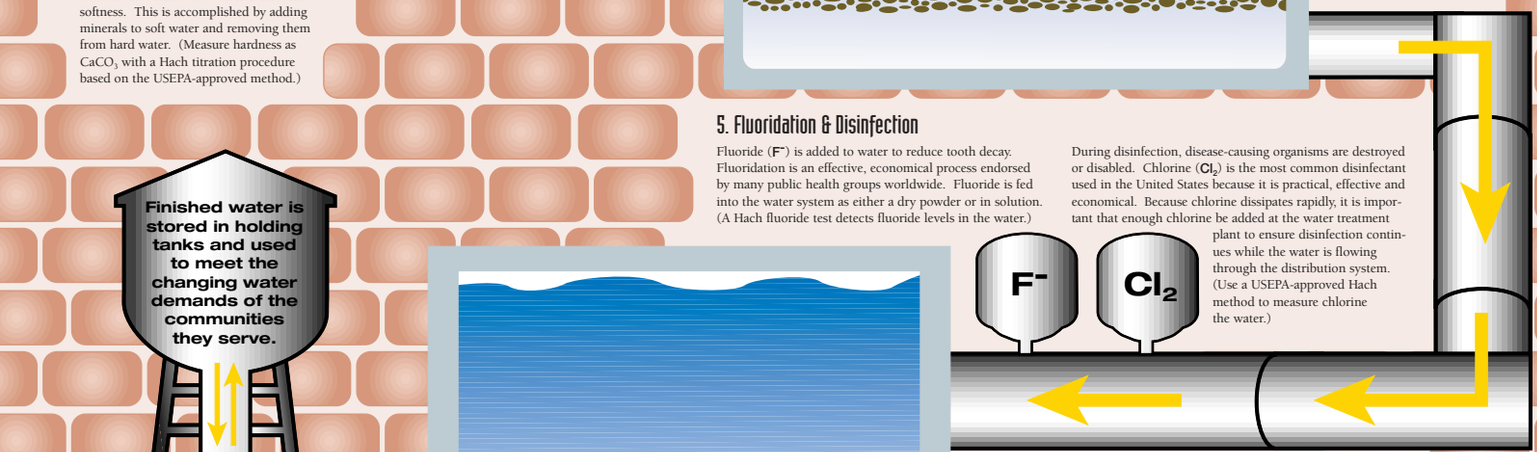


3. Softening and Stabilization

When water is too hard (i.e. contains too much calcium, magnesium or other minerals), it forms scale causing a variety of problems in pipes. Hard water can also result in laundering and washing problems. Conversely, when too many of these minerals are removed, water can cause corrosion in pipes. That is why drinking water plants attempt to maintain a desirable balance between hardness and softness. This is accomplished by adding minerals to soft water and removing them from hard water. (Measure hardness as $CaCO_3$ with a Hach titration procedure based on the USEPA-approved method.)

4. Filtration

Turbidity is a physical characteristic that makes water appear cloudy when suspended matter is present. The filtration process removes suspended matter, which can consist of floc, microorganisms (including protozoan cysts such as *Giardia* and *Cyrptosporidium*), algae, silt, iron and manganese precipitates from ground-water sources, as well as precipitants which remain after the softening process. These suspended materials are filtered out when water passes through beds of granular material, usually composed of layers of sand, gravel, coal, garnet, or related substances. (Measure turbidity with a Hach turbidimeter.)



5. Fluoridation & Disinfection

Fluoride (F^-) is added to water to reduce tooth decay. Fluoridation is an effective, economical process endorsed by many public health groups worldwide. Fluoride is fed into the water system as either a dry powder or in solution. (A Hach fluoride test detects fluoride levels in the water.)

During disinfection, disease-causing organisms are destroyed or disabled. Chlorine (Cl_2) is the most common disinfectant used in the United States because it is practical, effective and economical. Because chlorine dissipates rapidly, it is important that enough chlorine be added at the water treatment plant to ensure disinfection continues while the water is flowing through the distribution system. (Use a USEPA-approved Hach method to measure chlorine the water.)

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