Stellar Unity
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Technical Information Sheet

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Raw Water Treatment

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Product Category	• **Raw Water Treatment** • **Build, Design, Install, Operate**
Application	• **Raw Water Treatment**
Key Function(s)	• **Improve current raw water treatment process** • **Optimize raw water treatment process** • **Extend and digitalize raw water treatment process**

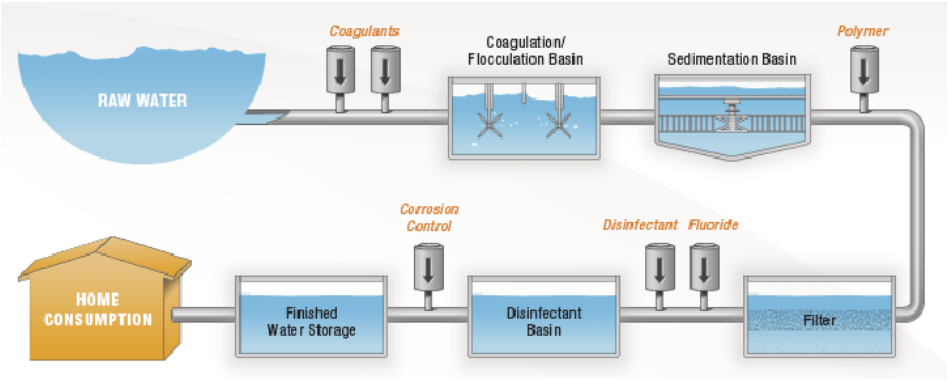
What is a raw water treatment system?

A raw water treatment system is a system made up of several individual technologies that address the facility's specific raw water treatment needs.

Treating raw water is rarely a static process, and a raw water treatment system that is engineered to accommodate fluctuations in treatment needs will go a long way in avoiding costly replacements/upgrades down the line.

An efficient and well-designed raw water treatment system should be able to handle:

- seasonal variations in turbidity and flow
- variations in water chemistry needs and required chemical volumes adjustments
- changes in water quality requirements (such as the quality of feed water required for a new boiler)



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What's included in a basic raw water treatment system?

As mentioned above, the exact components of a raw water treatment system will depend on the quality of water being drawn from in relation to the quality of water needed, but in general, a basic raw

water treatment system typically includes some type of:

- Chemical feed to help facilitate the flocculation or coagulation of any suspended solids
- Clarifier to settle out the larger solids
- Filtration to remove the smaller particles
- Control panel (depending on the level of automated operation needed)

Depending on the needs of the plant and process, these standard components are usually adequate, however, if the plant requires a system that provides a bit more customization, there might be some features or technologies that will need to be added on.

What does a raw water treatment system typically remove?

A raw water treatment system might be made up of the technologies necessary to remove any number of the following:

- **Suspended and colloidal solids:** they can cause unpleasant odors in food and beverage products, foul process equipment, and create energy losses for the plant.
- **Silica and colloidal silica:** they often foul and scale boiler equipment, reduce the efficiency of plant equipment, and cause product contamination.
- **Iron:** coats fixtures, fouls industrial processes, causes foul tastes and odors in products.
- **Bacteria:** can cause sickness and severe digestive issues/health problems as well as coat cooling tower components.
- **Hardness:** coats equipment fixtures, plugs pipes, scales equipment, and causes a buildup of sludge.

How does a raw water treatment system work?

A typical raw water treatment facility process will usually include the following steps:

Raw water intake Raw water (untreated water found naturally in the environment) can come from many sources, including rivers, lakes, oceans, or groundwater. Usually, when an industrial plant draws in the water from their surface water source, they pull it in (with pipes or by gravity) through a mesh screen or grate to eliminate the larger objects, such as twigs, leaves, and fish. The water is then pumped to the main facility where treatment begins.

Coagulation After all the large objects are removed from the raw water source, various chemicals are added to a reaction tank to remove the bulk suspended solids and other various contaminants. This process starts off with an assortment of mixing reactors, typically one or two reactors that add specific chemicals to take out all the finer particles in the water by combining them into heavier particles that settle out. The most widely used coagulates are aluminum-based such as alum and polyaluminum chloride. Sometimes a slight pH adjustment will help coagulate the particles, as well.

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Flocculation When coagulation is complete, the water enters a flocculation chamber where the coagulated particles are slowly stirred together with long-chain polymers (charged molecules that grab all the colloidal and coagulated particles and pull them together), creating visible, settleable particles that resemble snowflakes.

Sedimentation The gravity settler (or sedimentation part of the raw water treatment process) is typically a large circular device where flocculated material and water flow into the chamber and circulate from the center out. In a very slow settling process, the water rises to the top and overflows at the perimeter of the clarifier, allowing the solids to settle down to the bottom of the clarifier into a sludge blanket.

The solids are then raked to the center of the clarifier into a cylindrical tube where a slow mixing takes place and the sludge is pumped out of the bottom into a sludge-handling or dewatering operation. The dewatering process takes all the water out of the sludge with filter or belt presses, yielding a solid cake. The sludge water is put onto the press and runs between two belts that squeeze the water out, and the sludge is then put into a big hopper that goes to either a landfill or a place that reuses the sludge. The water from this process is typically reused and added to the front end of the clarifier.

Filtration The next step is generally running the water overflow into gravity sand filters. These filters are big areas where they put two to four feet of sand, which is a finely crushed silica sand with jagged edges. The sand is typically installed in the filter at a depth of two to four feet, where it packs tightly. The feed water is then passed through, Trapping the particles.
On smaller industrial systems, you might go with a packed-bed pressure multimedia filter versus gravity sand filtration. Sometimes, depending on the water source and whether or not it has a lot of iron, you can also use a green sand filter instead of the sand filter, but for most part, the polishing step for conventional raw water treatment is sand filtration.

Ultrafiltration (UF) can also be used after the clarifiers instead of the gravity sand filter, or it can replace the entire clarification process altogether. Membranes have become the newest technology for treatment, pumping water directly from the raw water source through the UF (post-chlorination) and eliminating the entire clarifier/filtration train.

Disinfection After the water flows through the gravity sand filter, the next step is typically disinfection or chlorination to kill the bacteria in the water. Sometimes this step is done upstream before filtration so the filters are disinfected and kept clean. If the system utilizes this step prior to filtration, more disinfectant will be needed. By managing well, the filters are disinfected and kept free from bacteria (as well as the filtered water).

When chlorine is added upfront, bacteria is being killed and will cause less fouling. If bacteria sits in the bed, you might grow slime and have to backwash the filters more often. So it all depends upon how the system operates whether the system is set up to chlorinate upstream (prior to filtration) or downstream (after filtration).

Distribution If the raw water treatment is being used in an industrial process, it's typically pumped into a holding tank where it can be used based on the demands of the facility.

At Stellar Unity, we are open for customers to exchange their challenges and issues. Contact our Sales Presentative for more details.