



### **What are Total Dissolved Solids?**

Total Dissolved Solids (TDS) are the compounds in the water that cannot be removed by a traditional filter. TDS are made up of salts or compounds which dissociate in water to form ions. This means that a salt has two parts, one with a positive charge and one with a negative charge, which separate and mix with the water (H<sub>2</sub>O) molecules. Table salt, for example, is sodium (Na<sup>+</sup>) and Chloride (Cl<sup>-</sup>) together to form sodium chloride (NaCl). Some common salts which make up TDS are sodium (Na<sup>+</sup>), sulfate (SO<sub>4</sub><sup>2-</sup>), chloride (Cl<sup>-</sup>), calcium (Ca<sup>2+</sup>), magnesium (Mg<sup>2+</sup>), and bicarbonate (HCO<sub>3</sub><sup>-</sup>). For a reference, sea water has a TDS of around 35,000 ppm, and the Missouri River near Great Falls has TDS in the neighborhood of 250 ppm.

### **Are Total Dissolved Solids a Problem?**

Total Dissolved Solids are classified as a secondary contaminant by the Environmental Protection Agency (EPA) and a suggested maximum is 500 ppm. Concerns with secondary standards relate to aesthetic or cosmetic quality of the water rather than health concerns. TDS can give water a murky appearance and detract from the taste quality of the water. Gastrointestinal irritation in some individuals can be caused by high TDS levels. TDS can also interfere with treatment devices and is an important consideration when choosing a treatment system.

### **What is Hard Water?**

Water is considered hard when it has a relatively high concentration of calcium and magnesium ions (two of the salts which make up TDS). Hard water received this name because it requires more soap to get a good lather and makes the water “hard” to work with. Water hardness can be reported in milligrams per liter, parts per million (which is equivalent to milligrams per liter), or grains of hardness. One grain of hardness is equal to 17.1 milligrams per liter. In addition to making washing more difficult, hard water can cause scaling on sinks and fixtures, deposits in hot water heaters and pipes, and buildup in pumps and water using appliances, which can shorten appliance life. Hard water can be treated with a water softener which can remove a significant amount of the calcium and magnesium from the water.

**Note:** Water softeners do not reduce TDS. Water softeners remove magnesium and calcium ions which cause hard water, but these ions are replaced with an equal number of sodium or potassium ions. This leaves overall TDS unchanged.

### **Additional Resources:**

#### **EPA Secondary Drinking Water Regulations**

<http://www.epa.gov/safewater/consumer/2ndstandards.html>

#### **World Health Organization Total Dissolved solids in Drinking-Water**

[http://www.who.int/water\\_sanitation\\_health/dwq/chemicals/en/tds.pdf](http://www.who.int/water_sanitation_health/dwq/chemicals/en/tds.pdf)

**Water Systems Council: Hardness in Drinking Water**

<http://www.watersystemscouncil.org/VAiWebDocs/WSCDocs/1683274HARDNESS.PDF>

**Water Softening for Household Water Supplies; North Dakota State University Extension:**

<http://www.ext.nodak.edu/extpubs/h2oqual/watsys/ae1031w.htm>