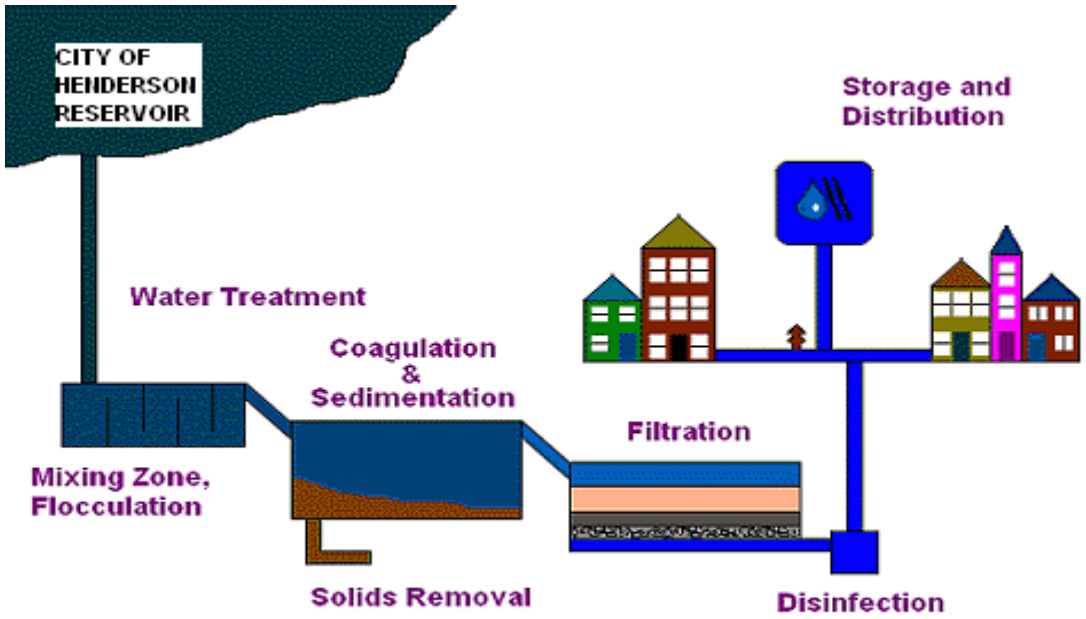
# CITY OF HENDERSON

## WATER PRODUCTION

The City of Henderson has two sources of water to meet the needs of residential, commercial and industrial customers. In August of 2001, the City's new surface water treatment plant became operational. Together, the surface water plant and eight wells can provide up to ten million gallons per day. The City employs FIVE state licensed Surface Water Operators.




## Sabine River Water Treatment Plant (4.5 MGD)

The Sabine River Pump Station is located between the cities of Kilgore & Longview on FM 2087 approximately 3 miles north of Interstate 20. The raw water quality of the Sabine River is monitored by the Sabine River Authority and volunteers of the Texas Watch Program. Sabine River Authority steering committee members meet in Longview annually to discuss water quality issues of the Sabine River and the river's tributaries.

The raw water is pumped 21 miles from the Sabine River through a 24-inch water line to the City of Henderson's 4.5 million gallon per day capacity Surface Water Treatment Plant. Turbidity is a test performed by water operators to determine the extent of contamination from silt and debris in a water supply. The Sabine River has a turbidity that fluctuates from a low of 50 NTU to as high as 2000 NTU. When the water reaches the plant, it is stored in the plant's 40-acre reservoir, which holds approximately 140 million gallons of water.

The north side of the reservoir is supplied with raw water from the Sabine River. The raw water intake for the Surface Water Treatment Plant is located on the south side of the reservoir. This allows adequate time for silt and debris to settle out before reaching the plant for treatment. Three floating surface aerators are located near the water plant's reservoir intake and are used to add dissolved oxygen to the water, to oxidize iron and manganese, and to push surface algae away from the intake. In the event of lake turnover or excessive concentrations of iron and manganese in the water, a Potassium Permanganate solution is added at the raw water intake to aid in oxidizing these contaminants. Reservoir water is then gravity fed into an intake pipe, and three 1600 gpm pumps are located below the intake pipe's grade to pump water up to the clarifiers, which is the next step in the treatment process. Operators monitor the incoming water's turbidity, pH, alkalinity, iron, and manganese levels. Powdered Activated Carbon is also fed post intake to aid in taste and odor control and to aid in the coagulation process. An approximately 50% concentrated Aluminum Sulfate solution is then added to the water for coagulation purposes. Water then passes through an inline static mixer to mix the Alum in the raw water and begin the flocculation process. Water is then fed upwards into two upflow-style clarifiers. The upflow clarifiers are economical due to being able to provide coagulation, flocculation and sedimentation all in unit, thereby requiring a smaller footprint. Coagulation is the formation of large particles from smaller particles using a coagulant. Flocculation is the mixing process that brings the particles together to form the larger floc. Sedimentation is the process of settling out these particles. In the upflow clarifiers, the desired operation is to settle out the floc particles while the clarified water rises upwards. A sludge blanket consisting of the floc particles is maintained within the clarifier to catch the floc particles after they are formed before the clarified water rises to the top of the clarifiers. Each clarifier has an inline Turbiwell that constantly measure each clarifier's effluent turbidity. The clarifier effluent is then gravity fed into a chlorine contact basin. Chlorine gas is mixed with water to form a chlorine acid that is added to the water for disinfection. The chlorine contact basin's effluent flow is then gravity fed into four dual-media filters. The media consists of anthracite coal and sand, and removes remaining solids from the water. Each filter's effluent has an inline Turbiwell that constantly monitors the effluent turbidity of each filter. Each filter's effluent flow is combined into one line and that combined flow's turbidity is constantly monitored by an inline Turbidwell. Annhydrous Ammonia is then added to form chloramines, which are a longer lasting disinfectant than free chlorine. Sodium Hydroxide (Caustic Soda) is then added to adjust the pH of the water. Operators utilize the

Bayliss Curve to determine the best pH range for the finished water to create water that is “stable”, or water that is neither corrosive or scale-forming. The fully treated water is then gravity fed into two one-million-gallon ground storage tanks, and can then be pumped by one of three 1700 gpm pumps into the distribution system as needed to meet the water demand.

The surface water plant pumps water from the reservoir into the plant for treatment by chemical coagulation, disinfection, dual media filtration, and pH adjustment for corrosion control. After the reservoir, the turbidity of the water is much more stable and ranges from 5 to 15 NTU.

50% Aluminum Sulfate solution is used to coagulate small particles or contaminants in the water to larger more dense particles of Aluminum Hydroxide (floc). When the particles become denser than water, the particles will trap and settle contaminants to the bottom of the sedimentation basins so that they may be removed from the treatment process. Powdered activated carbon is also used for taste and odor control, as well as total organic carbon (TOC) reduction.

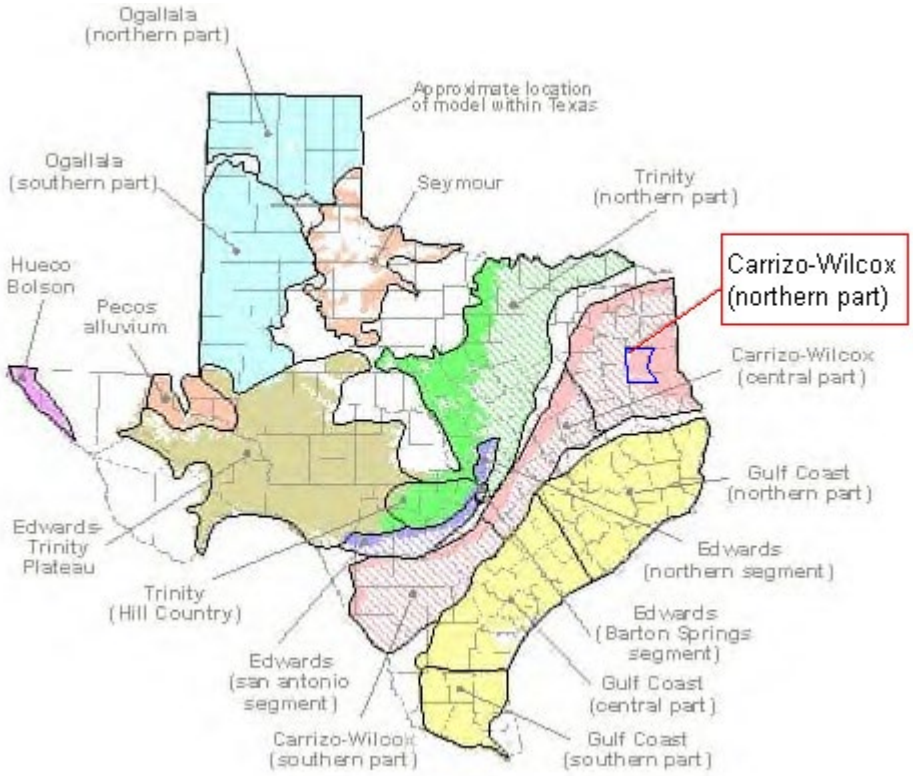
After coagulation, the turbidity is required to be less than 5.0 NTU. However, it is very rare for the turbidity after coagulation to be more than 2.0 NTU.

Once the coagulation process is complete, filtration is the next step. Filtration, using constant rate dual media filters, brings turbidity levels to 0.05 to 0.30 NTU. These filters contain 18-inches of anthracite (coal) on top of 12-inches of sand. The sand sits on top of a Leopold underdrain system.  Texas Commission of Environmental Quality (TCEQ) requires turbidity levels be below 0.3 NTU.

Disinfection is next and uses chlorine and ammonia. Chlorine is used in conjunction with ammonia to form chloramines. Chloramines as a disinfectant will not form trihalomethanes (THMs) or haloacetic acids (HAA5). These contaminants are monitored by the Texas State Department of Health at various areas around the City of Henderson and the surface water treatment plant. THMs and HAA5s are two of the ninety-two contaminants listed on the EPA’s list of contaminants to monitor.

After coagulation, filtration, and disinfection, the pH of the water leaving the plant for storage is adjusted to a pH between 8.4 and 8.8. The pH is determined using the Balis Curve for determining the pH required for a non-corrosive slightly scale forming water.

## Groundwater from wells (Corrizo Wilcox Aquifer)




WATER PUMPED FROM THE CARRIZO-WILCOX AQUIFER & TOTAL OF TEXAS' MAJOR AQUIFERS.

1. PUMPED 1990 (ACRE-FEET)
2. PUMPED 1995 (ACRE-FEET)
3. EFFECTIVE ANNUAL RECHARGE RATE
4. PROJECTED SAFE ANNUAL AVAILABILITY 1990-1999

Carrizo-Wilcox

1. 0.45 million
2. 0.49 million
3. 0.64 million
4. 0.85 million

Total of all major aquifers in the state of Texas

1. 8.56 million
2. 9.15 million
3. 3.92 million
4. 8.19 million

*Source: Texas Water Development Board, "1995 Estimated Ground Water Pumpage Summary by Major Aquifer Units"(1997) and Texas Department of Water Resources, Groundwater Availability in Texas: Estimates and Projections through 2030 (July 1987)*

Note: Recharge Rate is the amount of precipitation and infiltration of surface water which adds to the level of the aquifer each year. Safe annual availability refers to both the annual recharge and additional waters stored in the aquifer which can be pumped without unduly creating either water quality problems or land subsidence. Thus, aquifers which have no storage can only provide the annual recharge rate. Note that annual recharge is an estimated average; actual recharge depends upon annual precipitation.

If you have any questions or comments or if you would like to schedule a group tour of the plant send your email to *mlinthicum@hendersontx.us*

For immediate assistance with a water quality problem please call (903) 657-6551 between the hours of 8:00 a.m. and 5:00 p.m. Monday through Friday. If you need assistance outside of normal working hours please call (903) 657-3512.

You can contact the Texas Commission on Environmental Quality at 512-239-1000 or https://www.tceq.texas.gov/

You can contact the Environmental Protection Agency (EPA) at *http://www.epa.gov/*