Greensboro Water Supply and Treatment

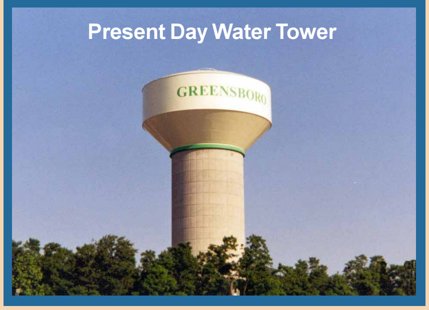
The City of Greensboro Water Supply Division is dedicated to producing high quality drinking water that meets or surpasses all standards for health, safety, and aesthetic appeal. Our drinking water is pumped from three reservoirs to one of two treatment plants where the water is treated, tested, and pumped into the system of storage tanks and pipes that lead to your home. Our plants treat and deliver about 32 million gallons of water on an average day. Greensboro residents have been provided with safe, clean water for over 100 years. Certified water treatment operators, maintenance specialists, and lab specialists accomplish this by working around the clock - year round, performing more than 200,000 analyses annually to ensure that the water delivered to you continues to be of the highest quality.

Beginnings

Greensborough, renamed Greensboro in the mid-1800s, was founded in 1808 as the county seat of Guilford and established in the center of the county. The earliest service provided to city residents was water. In 1810, the public well in Greensboro was enclosed and a bucket and chain provided. Public hand pumps were an improvement over the well and in 1829, the city outlawed watering horses at the pumps with violators subject to a $1 fine. The two public hand pumps were frequently out of order. In response, Town Commissioners levied a personal property tax of $.10 and outsourced maintenance of the pumps to the lowest bidder.

The first public works department was established in 1837 when new wells were dug and all the men of the town were divided into four teams and required to build and maintain the streets within Greensboro's one square mile borders. In 1872, city leaders placed an iron watering trough for horses and a wooden pump with a long iron handle in front the newly constructed courthouse. A statue of an angel was placed on the sidewalk in front of the courthouse, near the pump, "as a symbol of hospitality to thirsty throngs."

Elm Street Tower - Late 1800s



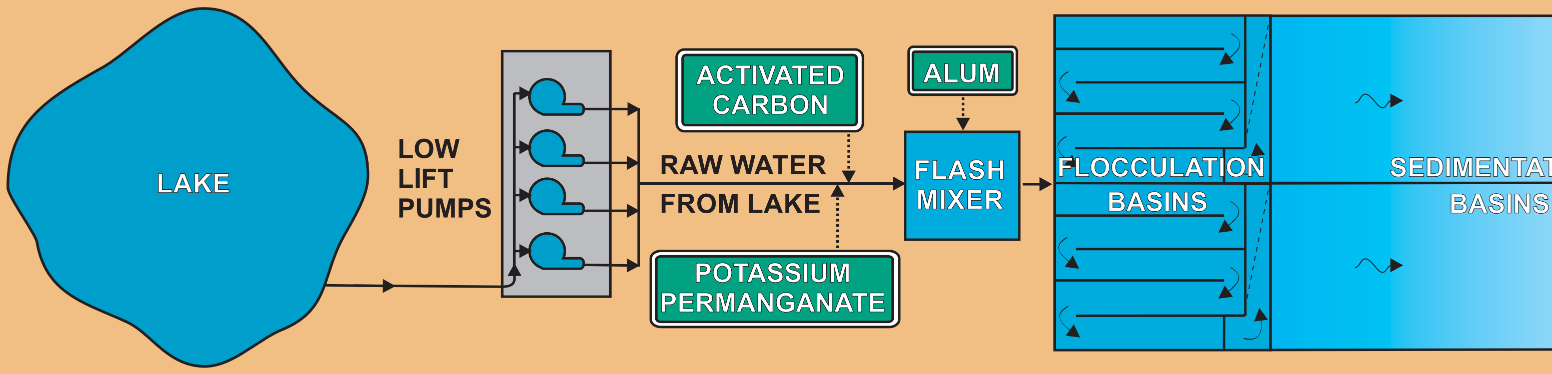
Present Day Water Tower

In 1882, work started on a city water and sewer system, and in 1887 the city contracted with the Greensboro Water Supply Company to provide water service. Pipes were installed downtown and a lighthouse-shaped tower near the end of South Elm St. provided storage and pressure. The City of Greensboro has operated the water utility since 1901.

Water Treatment

The water treatment process starts at one of our three drinking water reservoirs: Lake Townsend, Lake Brandt or Lake Higgins. Water from Lake Brandt is pumped to the Mitchell Water Treatment Plant and water from Lake Townsend is pumped to the Townsend Water Treatment Plant. Water from Lake Higgins is used to help fill Lake Brandt in times of drought. The first step of treatment is coagulation/flocculation.

Water Treatm



Coagulation and Flocculation

In the coagulation/flocculation process, very fine suspended particles are caused to come together to form larger particles that can be settled and filtered out of the water. These include fine silts, bacteria, color causing particles and viruses that might not settle for days, months or even years. Although individual particles cannot be seen with the naked eye, their combined effect is often seen as color or cloudiness in the water. These particles are small enough to pass through later treatment processes if not properly coagulated and flocculated. This could adversely affect not only the clarity of the water, but its taste and odor, as well as the effectiveness of chlorine disinfection.

During coagulation, the chemical Aluminum Sulfate, or filter alum, is added to the incoming raw water. The water is stirred vigorously in a flash mixer to assure quick, uniform dispersion of the alum. The alum reacts with compounds in the water to produce a jelly-like substance that absorbs impurities. At the same time, alum with a positive charge, neutralizes the negative charge common to natural particles, which draws them together. Small particles called microfloc are formed.

The water moves from the flash mixer to the flocculation basins, which contain horizontal paddle systems. The basins provide a gentle, constant mixing of the microfloc formed during coagulation. This stirring promotes formation of larger and heavier floc. After 20 to 30 minutes, the floc particles are usually visible and will look like tiny tufts of cotton or wool, separated by clear water. Next, the water moves into the sedimentation or settling basins.

Sedimentation

Sedimentation is the removal of solids from water by gravity settling. Basins are designed to hold large volumes of water for several hours and to give a smooth, even flow. This design allows the velocity and turbulence of the water to be decreased to the point that the water will no longer transport the flocculated solids and they will settle to the bottom of the basin.

The inlet side of each basin is 16 feet deep and tapers up to a depth of 10.8 feet at the outlet. As the water moves slowly through the basin, it gradually becomes clearer over a four to five hour period. The solids that settle out are periodically removed, de-watered and sent to the landfill.

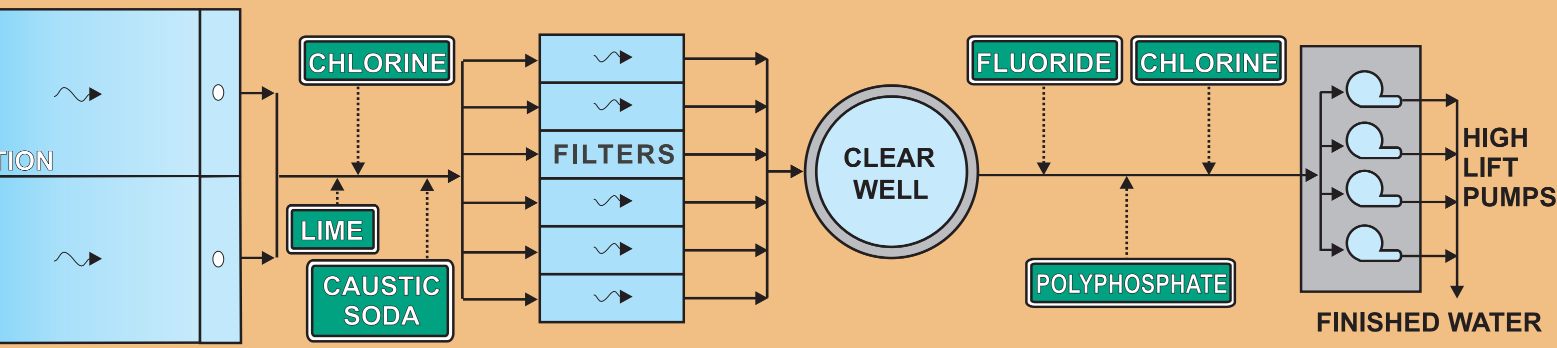
At the end of the settling basin, hydrated lime is added to the water to increase its pH. This is necessary because the alum added during the coagulation/flocculation process is acidic. After pH adjustment, chlorine is added for disinfection and to keep aquatic growths from becoming established on the filters during the next treatment process.


Pumping Station


Lake Townsend


Quality Control Laboratory

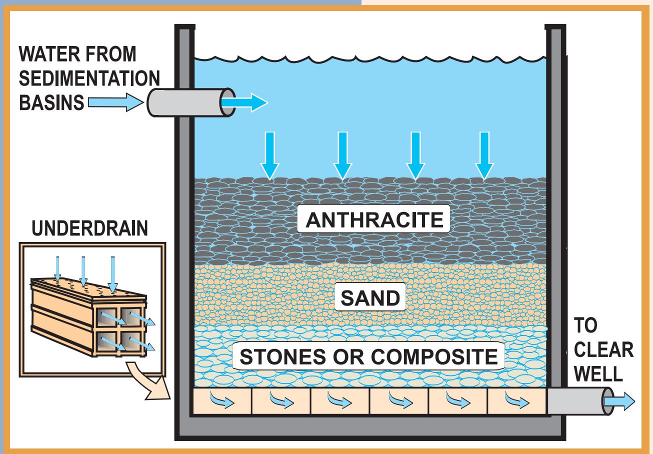
ment Process



Filtration

The water flows from the sedimentation basins into the filter beds. Filters contain material of graduated size in layers that remove solids from the water. The first layer of the filter is anthracite coal and the second layer is filter sand. Under the sand is a layer of stone or plastic composite. At the bottom of the filter is an underdrain system that supports the filter.

Water is pumped onto the filters, leaving behind suspended matter as it passes downward through the filter. Solids that are larger than the pores or holes between the grains are captured by the filter. Also, some suspended matter sticks to the surface of the filter or the previously deposited material.



After a period of time, the accumulated solids begin to clog the filter, so the filter is backwashed. Backwashing is the reversal of the direction of the water flow through the filter. A rapid upward flow lifts the particles and keeps them in suspension until they can be washed out. Following filtration, the water flows underground into a storage tank called a clearwell. Water leaving the storage tank is stabilized, fluoridated and chlorinated in-line on the way to the distribution pumps.

Final Treatments

Stabilization is a protective measure that reduces corrosion in water lines. Corrosive waters can cause problems related to public health, aesthetics and economics. Polyphosphate, a chemical that prevents corrosion, is added to the finished water to prevent these problems.

Fluoridation is a safe and economical process that is endorsed by public health groups worldwide to reduce tooth decay. Fluoride is added to the line leaving the storage tank so the fluoride dosage can be very precisely controlled.

Chlorination of public water supplies is the most important process used to produce safe drinking water. A sufficient amount of Sodium Hypochlorite, essentially a strong bleach, is added to the finished water so that a minimum amount of chlorine remains in the water until it reaches the customer's tap. Because the distribution system is more than 2000 miles long, re-chlorination is sometimes necessary.

After the addition of chlorine, fluoride and a corrosion inhibitor, the water is pumped into the pipes that lead to the customer's tap. The pumping system includes electric as well as diesel pumps to ensure uninterrupted water service, even during power outages or other distribution challenges.

Filter Backwash

Instrumentation Panel

Process Piping

Facts and Figures

Lake Townsend

Completed in 1969
1542 acres (27.4 square miles)
717 feet above sea level
6.33 billion gallons

Lake Brandt

Completed in 1926, rehabilitated in 1948
817 acres (58.9 square miles)
741 feet above sea level
1.99 billion gallons

Lake Higgins

Completed in 1958
226 acres (11.6 square miles)
763.8 feet above sea level
793 million gallons

Interesting Facts and Recent Facility Improvements

Mitchell Water Treatment Plant and Distribution Control Center

- 24 million gallons per day treatment capacity
- 30 million gallons per day distribution pumping capacity
- Automated solids removal process added in 2001
- Filtration systems rebuilt and improved in 2003
- 11 million gallons Lake Daniel finished water storage reservoir and transfer pumping system refurbished in 2001
- Computer control (SCADA, Supervisory Control and Data Acquisition) upgrades for system semi-automation added in 2001
- Activated carbon for taste and odor control in 2003

Townsend Water Treatment Plant

- 30 million gallons per day treatment/pumping capability
- Automated solids removal process added in 2003
- Filter operation/backwash improvements completed in 2002
- Computer control (SCADA, Supervisory Control and Data Acquisition) upgrades for system semi-automation added in 2001
- Haw River pump station emergency water supply added in 2003
- Activated carbon for taste and odor control in 2003

Lake Brandt Raw Water Pumping Station

- 30 million gallons per day pumping capability
- Dam and flood control gate renovations in 2003

Total Watershed Area: 107 square miles
Watershed Safe Yield: 36 million gallons per day
Maximum Capacity: 52 million gallons per day
Number of water connections: 95,000

Interconnects:

Winston-Salem	2 MGD
High Point	2 MGD
Reidsville	2-5 MGD
Burlington	2-5 MGD

Raw Water Pipeline from the Haw River to Lake Townsend - 10 MGD in times of drought

WATER Resources
City of Greensboro

City of Greensboro
Water Resources Department

Water Supply Division
(336) 373-5855

www.greensboro-nc.gov/water

Rev. 10/03