The Advancement of Water in the City of Fairfax

A History of the Town's Water-Sewer System & Insight into the Local Water Treatment Plant

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WELL WATER SYSTEM:

Consideration for construction of a well water system in the Town of Fairfax began in 1928. Fairfax was one of the first towns in the county to attempt implementation of such a complex system and the idea would prove to be a major turning point in the growth of the area surrounding the Town.

It was determined that a 100,000 gallon water tank and deep well water would be needed to supply enough water to the town. In 1929, after negotiations, the Town Council was presented with a $100,000 estimate for a complete water and sewer system. Property taxes would have to be increased 81% in order to accommodate costs of the system. This considerable increase did not seem unmanageable at the time because the economy was "booming". Later that year, when the stock market crashed, the approach to the utilize taxes began to dissipate. Fear for the economic future of the town set in and the system proposal was put on hold.

In 1930 citizens voted to issue a $50,000 bond to build the water system alone. Determination of a water tank location posed some obstacles because of the lack of aesthetic appeal, nonetheless citizens agreed to cooperate. Consequently, five acres were purchased for the water tower site on Judicial Drive; however this structure is no longer present today.

The initial specifications for the system were that streets in the center of town had 8-inch diameter mains, remaining

streets had 6-inch diameter or greater, and 42 hydrants were to be installed so all sections of town had sufficient fire protection. Furthermore, wells were to be deep and substantial enough to supply at least 50 gallons per minute for the system. On May 29, 1931 the water system was completed. The initial well turned out to be 305 feet deep; supplying 60 gallons per minute. All in-town homes were connected to the water pipes and the State Board of Health rated the water supply as "excellent for town use……perfectly pure and good for drinking"

The efficient water system restored hope for construction of its "other half"- the sewer line. During the Great Depression, the Town of Fairfax was awarded a grant from FDR's Public Works Administration (PWA). The PWA would provide $45,000 toward the $100,000 sewer proposal.

At the October 1935 town meeting it was decided that 10.5 miles of sewer pipe would be placed in order to service the entire town. The Town Council passed the proposal to issue a $55,000 bond for sewer construction. Though citizens would be responsible for repaying the bond, the benefits of a modern sewer system was deemed worth the cost.

In November of 1935, the Town accepted the bid of $97,425.40 from A.G. Pinkerton Company to do labor for the system. In order to keep the PWA grant, The Town had to sign construction contracts by December 15, 1935. The Council was still hesitant about the high price of the bid. Since using a lower grade filter in the treatment plant was rejected by the Board of Health, the Council decided to get rid of pipe lines to a small local school in order to cut costs.

In January of 1936, trench digging commenced. The pipes used were made from cast cement without steel reinforcement. After some delay, the Town acquired Harry Wilcoxon's property as

the site for the sewage disposal plant. Today this site is just off Picket Road and is home to the city property yard and recycling post.

A year later, in January of 1937, the sewer collection and treatment system was officially complete for the Town of Fairfax and approved for use. The Town's initiative set the tone for other areas in the county, such as Herndon and Falls Church, to follow. Because of its careful construction, invasive repair of the system was not needed until the 1980s.

The water and sewer systems were the first steps toward suburban development in the Town of Fairfax following the First World War. Over the years, these systems have kept up with the demand set by the growing population of greater Fairfax. Today, the City of Fairfax Utility Department works to provide its citizens with the same quality service that undoubtedly has kept the systems going since the 1930s.

SURFACE WATER SYSTEM:

The City of Fairfax and its service area is supplied water from the city owned treatment plant, which is located just east of Leesburg Virginia, on Goose Creek upstream from the concrete dam. The water treatment and filtration plant was completed in 1961, under Mayor Wood and City Council. Originally the plant was designed to function at a capacity of 6 million gallons per day, with a threshold of 7.2 million gallons per day for peak times. In 1980, under Mayor Silverthorne, the plant capacity was expanded to 12 million gallons per day, with a hydraulic peak capacity of 18 million gallons per day. The safe yield of the system can be increased to 15 million gallons per day by

raising the overflow level of the spillway by five feet at the Beaverdam reservoir.

Figure 1: Goose Creek Treatment Plant

The City of Fairfax raw water system facilities are fed water from reservoirs located at Beaverdam Creek and Goose Creek. Construction of the Beaverdam Creek Reservoir was completed in 1972. The reservoir at Beaverdam Creek is held by a compacted earthen dam which is 1,000 feet long and 50 feet high. The dam is located at an elevation of 298 feet and has a design storage capacity of 1,340 million gallons. This reservoir can provide raw water supply to the City in the event of a prolonged drought or other natural disaster. The Goose Creek reservoir is contained by a concrete dam that is 730 feet long and 24 feet high. The design storage capacity at Goose Creek is 300 million gallons. A "fish ladder" used for migration through the dam and upstream ran along the eastern side of the dam.

Figure 2: Goose Creek Dam

Figure 3: Beaverdam Creek Dam and Spillway

TREATMENT PROCESS TODAY:

The water treatment process is a complex series of settling tanks and filters that separate suspended particles and mix the water with disinfectants to make it safe to drink. Operators

monitor the treatment plant 24/7. Each day the processed water is tested, at the on-site laboratory, for chemical concentrations after about 6 hours of mixing, settling and filtration. A pumping station is located where the dam at Goose Creek meets the shoreline. The station pumps the collected water several hundred feet up to the filtration plant. Water pumped to the plant from the Goose Creek reservoir is immediately treated with powdered activated carbon and potassium permanganate to control taste and odor.

Next, ferric sulfate and lime are added to aid in coagulation of small charged particles in the high speed rapid mixer. Chemicals, called coagulants, and viscous precipitates called floc, are the result of the reaction of the alkalinity of water. Coagulant aids are the polymers used in conjunction with ferric sulfate to produce heavier flocs in basins for higher rates of flow. Filter aids are polymers which are fed into water after the sedimentation step, but before filtering. They cause smaller floc to cling together so the particles do not penetrate into the filter beds. Filter aids allow higher volume flow rates of water through the media composed of gravel, sand, and anthracite. Flocculants form from entanglement during slow stirring and grow by adhering to other adjacent flocs. The agglomeration of the floc causes an increase in the particle density, which results in settling. This process significantly reduces the particle volume that the filters must remove from the water. Since the processes of coagulation and flocculation are impacted by pH, the pH levels must be cautiously monitored by water plant operators.

After flocs are formed in the mixing basins, the water slowly passes through settling tanks and flows to the filters. Flow rate controllers move a specific water volume per unit of

time through the filters so as to maintain the efficiency and effectiveness of the filters. At the filtration point, the water is visibly clearer and chlorine is added as a disinfectant. A series of laboratory tests are run on the water at this point and more chlorine may be added if the processed water is insufficient for consumption by the public.

Finally, fluoride is added to the filtered water and tests are carried out every 8 hours on the treated water to monitor any changes in chemical properties. All mixing and settling basins are cleaned every four to six months. Since daily records of operation are gathered, the plant operators are on site 24/7.

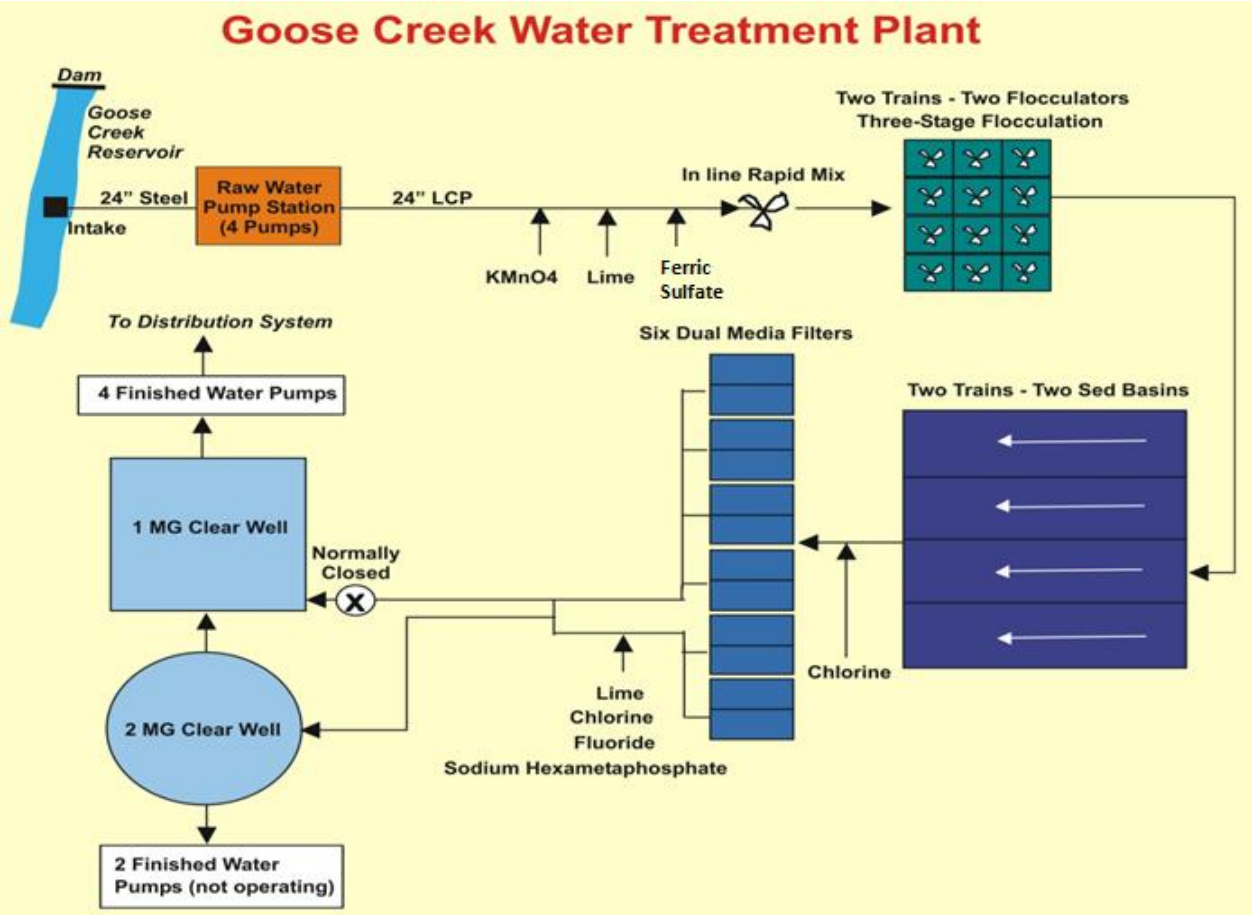

Figure 4: Diagram of Goose Creek water treatment process

The clarified and disinfected water is ready for consumption and then pumped from the Goose Creek Plant along a 22 mile underground water transmission main. This main was put in place in the year 1961. It consists of a 24-inch diameter pre-stressed concrete pipe that stretches 15.3 miles from the treatment plant, along the W. & O.D. Railroad, to Hunter Mill Road. A 16-inch diameter cast iron pipeline runs from the Hunter Mill Road junction, along Route 123 and Route 50, into Fairfax City. Today, the City holds approximately 240 miles of cast and ductile iron piping for the distribution water line and connects to about 500 hydrants for fire protection. The water main from Goose Creek into the City fills multiple storage tanks located at specific elevations that serve over 60,000 users.

Storing water above ground level generates the pressurized water that flows through the system, which is why water towers are so tall. The elevated water is stored in such a way that the potential energy of the system provides sufficient water pressure for the entire City distribution system. Water tower storage tanks are not only placed at high elevations, but also quite large. As a comparison, a normal backyard swimming pool holds about 25,000 gallons of water and a typical water tower will hold 50 times that amount. The tank is sized to hold enough water to serve the surrounding community for fires as well as about a half day in cases of power outages or when back-up is needed.

One of the advantages of a water tower is that it lets a municipality size its pumps for average, rather than peak, demand. This can save quite a bit of energy. Water consumption varies throughout the day, with more usage in the morning when people wake up, and early evening when people return from work. There is a significant difference between usage rates at these

peak times. Because of the implementation of the water tower, a city can purchase a pump that functions at an average capacity and let the water tower cover the peak demand. Then late at night, when demands drop drastically to almost zero, the pump can make up the difference and refill the water tower.

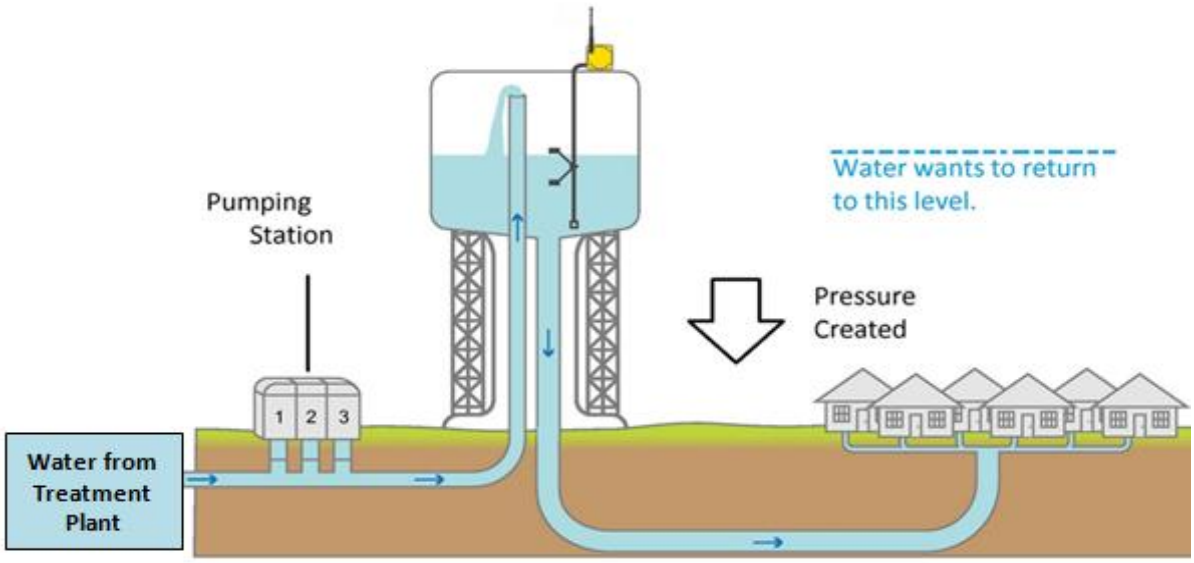

Figure 5: Schematic of a typical water tower

Water towers also have a positive effect on insurance rates. During a fire, the water demand more than doubles and can far exceed the capacity of the pumps at the water plant. Water towers guarantee that there will be enough pressure to keep water flowing through the fire hydrants, as well as to keep water flowing to the rest of the community. Fire insurance premiums are typically lower in communities where there is a central water system. The City of Fairfax currently has three water towers. The first is located off University Drive and Patriot circle by George Mason University. The second is can be found adjacent to Lyndhurst Drive. The third is located near William Place. Both the Lyndhurst and University towers can

hold 4.0 million gallons of water, while the William Place tower can hold 0.9 million gallons.

Standpipes are large vertical pipes which are completely filled with water. They may hold a large volume of water, but unless they are located at a high elevation, only the water at the top may be used. The term "gross amount" of water refers to all the water contained within the standpipe. In a typical standpipe, the top 1/3 of the water height is usable if the pressure in the system is to be maintained. This top 1/3 section is referred to as the "net water" for actual use.

Overall, the mission of the Fairfax city utility department is to serve the public. We work diligently to produce safe potable water in sufficient quantities for Fairfax residents, as well as to provide reliable sanitary sewer service to protect the health and welfare of the customers and the surrounding environment.

Resources

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