



City of  
**Evanston™**



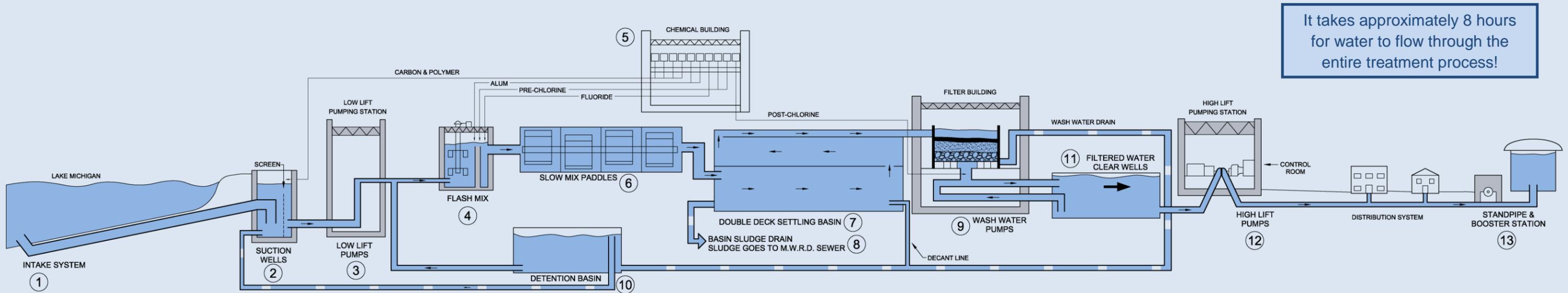
City of Evanston  
CELEBRATING  
**100**  
Years  
1914 - 2014



clean  
safe  
reliable  
drinking  
water

**EVANSTON WATER  
TREATMENT FACILITY  
EVANSTON, IL**

# HOW DOES THE EVANSTON WATER TREATMENT PROCESS WORK?



It takes approximately 8 hours for water to flow through the entire treatment process!

## 1. INTAKE SYSTEM

Water is drawn from Lake Michigan through three large intake pipes. The 54-, 48-, and 36/42-inch intake pipes each average 5500 feet in length at a depth of approximately 28 feet. Chlorine is added at the end of the intakes to prevent mussel colonization within the intakes and to start disinfection. A low voltage electric heating system is used to prevent anchor ice from clogging the intakes.

## 2. SUCTION WELLS

Lake water flows by gravity through the intake pipes into three suction wells. Two of these wells have mechanical traveling screens and three rows of stationary screens to remove any debris from entering the low lift pumps. Activated carbon is added in the suction wells when needed to remove taste and odors.

## 3. LOW LIFT PUMPS

Six centrifugal pumps with a total capacity of 135 million gallons per day are utilized to lift the water approximately 25 feet from lake level into the flash mix to start the treatment process. Water flows by gravity through the rest of the treatment plant. Four of the pumps have auxiliary natural gas engine drives for emergency operation in case of a power failure, providing 75 mgd of emergency capacity.

## 4. FLASH MIX BASIN

The flash mix is a concrete tank with a vertical mixing paddle driven by a motor on the deck above. This is the point where treatment begins by adding aluminum sulfate, polymer, and fluoride to the raw water. The aluminum sulfate and polymer are added to form a precipitate, or floc, in the water. This action causes the suspended solids to settle out. Fluoride is added to help reduce the incidence of dental decay.

## 5. CHEMICAL FEEDERS

The chemical feeders supply accurately measured amounts of liquid chemicals. The dosage rates are determined by chemical analysis and are set to the water pumping rate to be sure the proper amounts of chemicals are fed into the water.

## 6. SLOW MIX BASIN

The slow mix basins are large chambers containing slow moving horizontal paddles. The water is gently agitated to allow the floc to form and increase in size before entering the settling basins.

## 7. SETTLING BASINS

Upon leaving the slow mix basins, the water enters the four large settling basins which have a total capacity of 14,330,000 gallons. It takes from 4 to 8 hours for the water to flow through the settling basins, depending on the pumpage. This gives ample time for the floc to settle, carrying with it suspended matter, bacteria, and algae. In this process over 90% of all suspended impurities are removed. Twice each year all basins are drained one at a time and the accumulated sludge is washed out.

## 8. BASIN SLUDGE DRAIN

The sludge that is periodically cleaned from the settling basins and backwash detention basin is pumped through an 8" force main into a large interceptor sewer to be treated by the Metropolitan Water Reclamation District of Greater Chicago at their local facilities.

## 9. FILTERS

In the rapid sand filters the last traces of turbidity and bacteria are removed. There are 24 filters operating in parallel for a total rated capacity of 108 million gallons per day. The filters are constructed in shallow concrete tanks with a filter block under-drain system at the bottom. The 12 newer filters have 14 inches of filter sand and 22 inches of anthracite coal over the filter blocks. The rate of filtration is two to four gallons per minute per square foot of filter area. When the filters become full of solids, they are backwashed by reversing the flow for about 9 minutes. Four pumps deliver finished water for backwashing. The average filter wash takes approximately 200,000 gallons.

## 10. DETENTION BASIN

The water from filter washes is collected in the detention basin and held there to allow the debris to settle out. As more filter wash water enters the tank, the clearer water at the top flows by gravity to the north and south suction wells. In this way wash water is recycled back into the incoming raw water at approximately 10% of total raw water intake. The tank is divided into two sections to allow one section at a time to be taken out of service for cleaning and inspection. A 700 gpm pump discharges the sludge to the basin sludge drain as described in Step 8.

## 11. CLEAR WELLS AND UNDERGROUND STORAGE

Clear well reservoirs beneath the filters and an underground storage clear well provide 9,400,000 gallons of reserve from which the distribution system is supplied. Before entering storage, a final chemical treatment of chlorine is added along with a blended phosphate corrosion control compound.

## 12. HIGH LIFT PUMPS

Nine centrifugal pumps with a total capacity of 147 million gallons per day supply water pressure at 50 to 65 pounds per square inch to the distribution system. Five of the units are equipped with auxiliary natural gas engine drives for emergency operation in the event of a power failure, providing 82 mgd emergency capacity.

## 13. ELEVATED STORAGE AND REMOTE BOOSTER STATIONS

The Evanston distribution system contains two standpipes with remote booster pumps. The south standpipe can store up to 5.0 million gallons and the north standpipe up to 7.5 million gallons. A 5.0 million gallon standpipe and a 5.0 million gallon surface reservoir, both with remote booster pumps are located in Skokie. The standpipes float on the system and level out peak loads, pressure fluctuations, and provide a reserve storage for emergencies.

## Did you know...

In 1874, the citizens of the Village of Evanston, with a population of 3500, started to build a communal water system. The system consisted of a 16-inch intake pipe extending 1200 feet into the lake, a small Holly steam engine capable of pumping 2 million gallons per day, a hand fired boiler, and a few miles of cast iron water main. The original cost of the steam engine and boiler was \$24,000. During the first year of operation, the plant pumped 95 million gallons of water.

## EVANSTON ENERGY FACTS

- It takes approximately 1 kilowatt-hour of electricity to treat and deliver 1,000 gallons of potable water.
- The Evanston Water Treatment Facility uses over 1.2 megawatt hours of electricity annually – enough to power 1,360 homes.
- In 2014, the City of Evanston began purchasing electricity generated from 100% renewable sources.
- Solar panels located at the water treatment plant generate over 30,000 kilowatt-hours of electricity annually. That is a carbon offset of 21.8 tons/year!

## MAJOR REGULATORY REQUIREMENTS

- **Safe Drinking Water Act (SDWA)**

The Safe Drinking Water Act (SDWA) is the main federal law that ensures the quality of drinking water in the United States. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources.

- **Total Coliform Rule (TCR)**

The purpose of the 1989 TCR is to protect public health by ensuring the integrity of the drinking water distribution system and monitoring for the presence of microbial contamination. The TCR specifies the frequency and timing of microbial testing by water systems based on population served. The rule also requires public notification as indicated by monitoring results. The Evanston Water Quality Laboratory performs microbial tests from 80 homes and businesses each month!

- **Long Term 2 Enhanced Surface Water Treatment Rule (LT2)**

The purpose of the LT2 rule is to reduce illness linked with the contaminant Cryptosporidium and other disease-causing microorganisms in drinking water. The rule supplements existing regulations by targeting additional Cryptosporidium treatment requirements to higher risk systems. The LT2 rule went into effect in 2009.

- **Lead and Copper Rule (LCR)**

In 1991, the USEPA published a regulation to control lead and copper in drinking water, known as the Lead and Copper Rule. The treatment technique for the rule requires systems to monitor drinking water at customer taps. If lead concentrations exceed an action level of 15 ppb or copper concentrations exceed an action level of 1.3 ppm in more than 10% of customer taps sampled, the system must undertake a number of additional actions to control corrosion. The City of Evanston has been in continuous compliance with the LCR since 1992!

- **Stage II Disinfectants and Disinfection Byproduct Rule (Stage 2 DBP rule)**

The Stage 2 DBP rule builds upon earlier rules that addressed disinfection byproducts to improve drinking water quality and provide additional public health protection from disinfection byproducts. This final rule strengthens public health protection for customers by tightening compliance monitoring requirements for two groups of DBPs: total trihalomethanes (TTHM) and haloacetic acids (HAA5). The City of Evanston has been in continuous compliance with the original DBP Rule as well as Stage 2 DBP since 1998.

- **Illinois Department of Public Health (IDPH) Laboratory Certification**

The City of Evanston Water Quality Laboratory must be certified by the IDPH in order to process water samples and conduct laboratory tests necessary to the operation of the water treatment facility and water distribution system. Prior to issuing certification, the IDPH conducts a biannual audit of the laboratory. The audit consists of an onsite evaluation in which procedures, records and equipment are inspected. Over 200 different criteria must be met in order to be in perfect compliance with zero deviations. The laboratory achieved a zero deviation score in 2007, 2009, 2011 and 2013.

## MAJOR EXPANSIONS OF THE WATER TREATMENT FACILITY

**1874** The original Evanston Waterworks was built, including a 16" pipe extending 1200 feet into the lake, a small Holly steam engine capable of pumping 2 million gallons per day, a hand fired boiler, and a few miles of cast iron water main. The total cost, including the water main, was \$86,000. During the first year of operation, the plant pumped 95 million gallons of water.

**1911** Hypochlorite of lime was added on an emergency basis as a disinfectant. The success of this treatment in curbing the ongoing epidemic of typhoid fever helped convince the residents to build a permanent filtration plant.

**1914** A 12 million gallon per day (mgd) filter plant was put into service. It was the first water treatment plant to be constructed along the shores of Lake Michigan. It had six rapid sand filters (rated at 2 mgd) and included two steam turbine driven low lift (raw water) pumps. Water was disinfected using hypochlorite of lime.

**1924** The filter capacity was doubled by adding six more rapid sand filters rated at 2 mgd. This brought the total capacity to 24 mgd.

**1934** A 5 million gallon underground clear well was added to the Evanston system to provide storage for emergencies.

**1948** The rapid growth in Evanston and Skokie made expansion of the entire plant imperative and construction of the new facilities was started and financed by a \$2,890,000 Water Revenue Bond issue. The expansion included a new all-electric high lift pumping station, new mixing and settling basins, a chemical building and laboratory, dry chemical feeders, and the addition of six 4 mgd filters, bringing the total filter capacity to 48 mgd.

**1956** The population growth continued and it was necessary to construct a new 48-inch intake, two suction wells, a new low lift pumping station, and additional feeder mains, including a new 36" feeder main to supply Skokie. A 100 KW 480 volt generator was added to the plant for emergency service in the event of a power failure.

**1964** Two additional mixing and settling basins, a flash mix basin, and liquid chemical feed facilities were constructed. Another 24 million gallon per day filter addition brought the total filter capacity to a rating of 72 mgd. Two washwater pumps with all automatic filter washes and a new control room for the filter plant were also added. Another 36" feeder main to Skokie was added to supply the increasing demand.