



THE BOSSIER CITY WATER TREATMENT PLANT **(Background and Current Water Treatment Process Layout Updated 2025)**

PLANT HISTORY

The Bossier City Water Treatment Plant was built in 1958 and is situated on a twenty-five-acre parcel alongside the Red River. The original plant had a treatment capacity of 6 million gallons per day (MGD) and the water was pumped directly from the Red River before being treated. Plant expansions and treatment modifications were made over the years to keep up with increased drinking water demands required for Bossier City and surrounding areas. Production capacity was increased in 1972 to 16 MGD and again in 1996 to 25 MGD. In the 1996 upgrade, new treatment techniques and technologies such as the addition of ozone and computer-controlled systems were employed to contend with the unique treatment challenges that resulted with newly adopted State and Federal Drinking Water Regulations.

The most recent production increase was completed in 2013 bringing the total production capability to 50 MGD. This addition included the installation of a low-pressure membrane microfiltration system along with additional ozone injection technologies and granular activated carbon treatment processes in order to further improve the finished water quality.

Water Treatment Plant personnel work 24/7, 365 days each year to maintain, protect, monitor, control and manage all related processes and systems, while meeting and/or exceeding very stringent drinking water regulatory compliance requirements.

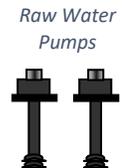
In addition, to save money through department-wide optimization strategies, the City of Bossier decided to restructure management within the Public Utilities Department. On July 1, 2016, Bossier City and Manchac Consulting Group, Inc. (Manchac) formed a Public-Private Partnership whereas the management and oversight of Bossier City's Utilities Department would be Manchac's responsibility. This mutual agreement provides that Manchac deliver planning, design, construction management, financial assistance, operational assistance, maintenance oversight and all management of day-to-day activities associated with Bossier City's Public Utilities Department. This department includes the following five divisions: Wastewater Treatment, Drinking Water Treatment, Water Distribution Maintenance, Lift Station Maintenance and Sewer Pre-Treatment.

The Bossier City Water Treatment Plant has the versatility of having three independent treatment schemes that can be utilized together or separately. The processes that are placed in service are dependent on various environmental and other conditions ranging from source water quality changes that may impact treatment requirements to consumer water demand fluctuations that dictate the untreated and treated water flow requirements that are needed to keep up with these numerous and continuously changing variables.

Below is a description of the different processes that make up entire water treatment system. Since two of the water plant's treatment schemes are similar and conventional by definition, they are summarized together in sequence. The third treatment scheme is the newest of the three and therefore, it is much more advanced. So, although the water from all three treatment plants combines together near the end of the treatment process, the layout of Plant 3 is described in sequence but done so separately. The process description for Plant 3 is summarized directly after the treatment process descriptions for Plant's 1 and 2.

Pre-Treatment

Large pumps (13 Vertical Turbine Units Total) bring "raw" or untreated water, from the City's Reservoir (600 Million Gallon Capacity) and/or directly from the Red River into the treatment plant through screens that exclude fish, weeds, branches and large debris.

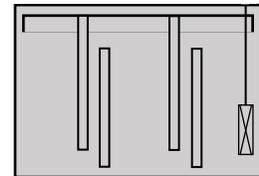


CONVENTIONAL WATER TREATMENT PROCESS (Plants 1 & 2)

Ozone Disinfection

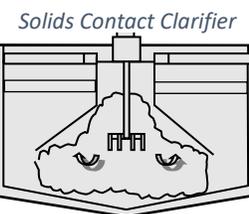
Ozone (O_3) is a very powerful oxidant and disinfectant that must be generated onsite due to its unstable properties. The ozone generation system located in the Ozone Building supplies ozone to both the raw water and pre-filter ozone contactors at Plants 1 and 2 and to the pre-filter ozone contactors at Plant 3. Liquid oxygen is used in the process of generating ozone onsite. The raw water for Plants 1 and 2 is ozonated as it flows through two ozone contact chambers. Ozone is fed at this point to remove organic substances from the source water to control taste and odor causing compounds in the raw water that is being pumped into the plant, to oxidize iron and manganese and to reduce color. Ozone is very effective in destroying most of the harmful bacteria in the water. Next, the effluent from these contactors flows via gravity to the solids contact clarifiers located at Plants 1 and 2. Ozone is also injected (side-stream) into the pre-filter ozone contactors located at Plant 3.

Raw Water Ozone Contactor



Coagulation, Flocculation, and Solids Contact Clarifiers

The flow then combines into a single pipe at the end of the ozone contactors. A coagulant chemical (TMB-903 / Primary Polymer) is fed into the water directly prior to these units. These solids contact units combine the coagulation, flocculation, and sedimentation processes within each unit. These units are also referred to as upflow clarifiers or sludge-blanket clarifiers. Within these units, the water flows in an upward direction through a sludge blanket of flocculated suspended solids. This coagulant chemical works to clear the water of the small particles that cause it to be turbid or cloudy, as turbidity renders the water hard to disinfect. The water is then rapidly agitated to disperse the coagulant chemical throughout these units. The smaller discrete particles begin to agglomerate into larger floc particles. In the flocculation process, the water is mixed gently so that these larger floc particles become heavy

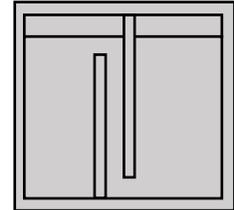


enough to settle out by gravity more rapidly away from the water that is being treated through these clarifiers. Approximately 85 to 90 percent of the suspended particles responsible for turbidity are removed at this point, including large amounts, but not all, of the bacteria present.

Pre-Filter Ozone Disinfection

Ozone is once again fed into the ozone contactor located between the Plant 1 and Plant 2 filter complex via bubble diffusion. Ozone is fed at this juncture for further iron and manganese removal, to induce micro-flocculation of soluble organics and for additional color, taste and odor removal. Pre-Filter ozone disinfection helps enable the dual-media filters to remove the remaining organic matter, which is very important as the water nears final disinfection. Pre-Filter ozone disinfection also provides for partial Plant disinfection log inactivation credit by removing Giardia and Viruses that could possibly still be present in the water treatment process at this point.

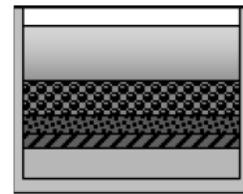
*Pre-Filter Ozone
Contactor*



Dual Media Filtration

The water is then filtered through a multilayer medium filters (12 Total) composed of sand, anthracite coal, and garnet sand in order to remove up to 99.5 percent of the solid materials remaining in it, such as flocs, microbes, minerals and/or parasites. A small amount of a coagulant chemical filter aid (TMB-1912 / Secondary Polymer) is then added to further improve filter performance. Filtration is the last stage in the treatment process that removes solids from the water. Filtered water is collected in a common underdrain system and conveyed through filtered water conduits within the pipe gallery and then into the finished water blending structure located directly prior to three underground clear wells.

Dual Media Filter

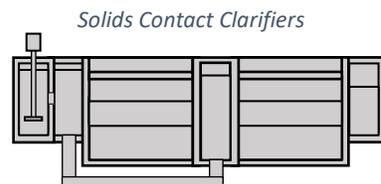


ADVANCED WATER TREATMENT PROCESS (Plant 3)

Coagulation, Flocculation and Solids Contact Sludge Blanket Clarifiers

The Bossier City Water Treatment Plant uses a relatively new process at Plant 3 that consists of concrete treatment basins called Super-Pulsator (Super P) Clarifiers designed to remove particles from the water. There are two independent treatment basins located within this unit. Each Super P basin can treat up to 12.5 million gallons of water a day. A coagulant chemical

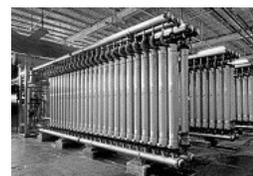
(TMB-1112G / Polyaluminum Chloride-PAC) is fed directly prior to these clarifiers to the clear untreated water of the small particles that cause it to be turbid or cloudy. These smaller discrete particles, known as floc, including many categories of bacteria, begin to agglomerate into larger groups of floc, as the water continues to flow, thus increasing their size to a point where they can settle more rapidly away from the water that is being treated through these clarifiers. The basins use a vacuum chamber for pulsing action as water flows upward, becoming clearer as larger particles settle. Pulsing prevents particles from settling completely and, over time, these particles form a sludge blanket that helps filter the water as it flows upward through the units.



Membrane Filtration

The water then gravity flows from the clarifiers into our membrane filtration system. Micro/Ultra-Filtration is used to remove particulate matter from the water. Each of the round vertical modules (shown on each rack within this photo) contains approximately 6,200 hollow micro-fibers. In this process, the water is pumped through these hollow micro-fibers. Our membrane filtration system includes twelve (12) individual racks spread throughout the Membrane Building and each of these filter racks contains 106 modules. The fiber walls are porous, letting water through while holding particles behind. They act as a sieve; whereby larger material is left and eventually cleansed. This entire process is comprised of nearly eight million hollow micro-fibers packed into more than 1,200 individual modules. All of these micro-fibers are needed to accommodate flows of up to twenty-five million gallons per day.

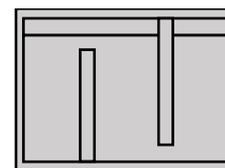
MF/UF Membrane Modules



Post-Membrane Ozone Disinfection

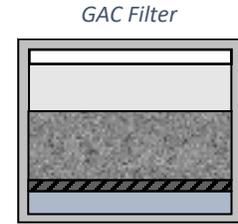
Ozone is introduced into an ozone contactor by means of side-stream injection. It is fed into the water just prior to the Granular Activated Carbon (GAC) filters. Ozone is a very strong oxidant that is very effective for the degradation of a wide range of organic chemicals. Post-Membrane ozone disinfection enables the filters to remove any remaining organic matter (important for final disinfection). Post-Membrane ozone disinfection also provides for partial Plant disinfection log inactivation credit by removing Giardia and Viruses that could possibly still be present in the water treatment process at this point.

Post-Membrane Ozone Contactor



Granular Activated Carbon Filtration

The water is then filtered through six (6) Granular Activated Carbon (GAC) filters. These GAC filters remove certain chemicals, particularly organic chemicals, from the water. They also aid in removing chemicals that project objectionable odors and/or tastes from the water. This step is the last one in the process that removes solids from the water. After filtration, this water combines with the treated water from Plants 1 and 2 inside the finished water blending structure.



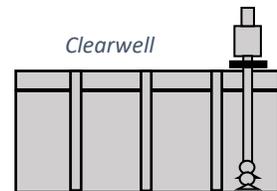
THE FINAL STAGES IN THE PROCESS (Plants 1, 2 & 3)

Disinfection, Fluoridation and Corrosion Control

As previously mentioned, the water from all three treatment plants combines together within the finished water blending structure located just prior to the three underground clearwells. At this stage, free chlorine, and then gaseous ammonia are injected into the water to form chloramines. The ammonia combines with the chlorine to make its disinfection ability last longer. Chloramine is a very efficient disinfectant and is needed to meet current water regulations. This disinfectant kills off disease-bearing organisms such as bacteria and viruses that are present in the water. Fluoride (Hydrofluosilicic Acid) is then added within this same structure (for dental health) prior to this treated water being pumped out to our customers. Fluoride primarily prevents dental decay. Lastly, we feed Zinc Ortho Phosphate (TMB-462) into this same structure to inhibit corrosion from occurring in our distribution system piping.

Clearwells

Lastly, the water gravity flows into three underground storage reservoirs (5 Million Total Capacity) located at the Water Treatment Plant. These finished water basins ensure contact time is allotted for adequate disinfection. They also store the water before it enters the Bossier City's Water Distribution System. At this point in the process, large pumps pump the water from these clearwells and send clean, safe drinking water to consumers throughout the community.



ADDITIONAL INFORMATION ABOUT OUR SYSTEM

Our constant goal is to provide our customers with a safe and dependable supply of drinking water, to always work toward improving the water treatment process and to protect our natural water resources while achieving these efforts. If you would like more information about our water, you can obtain additional data on the quality Bossier City's drinking water by typing <http://www.bossiercity.org/files/bossierwater.pdf> into any Web browser for direct access to Bossier City's latest Water Quality Report.

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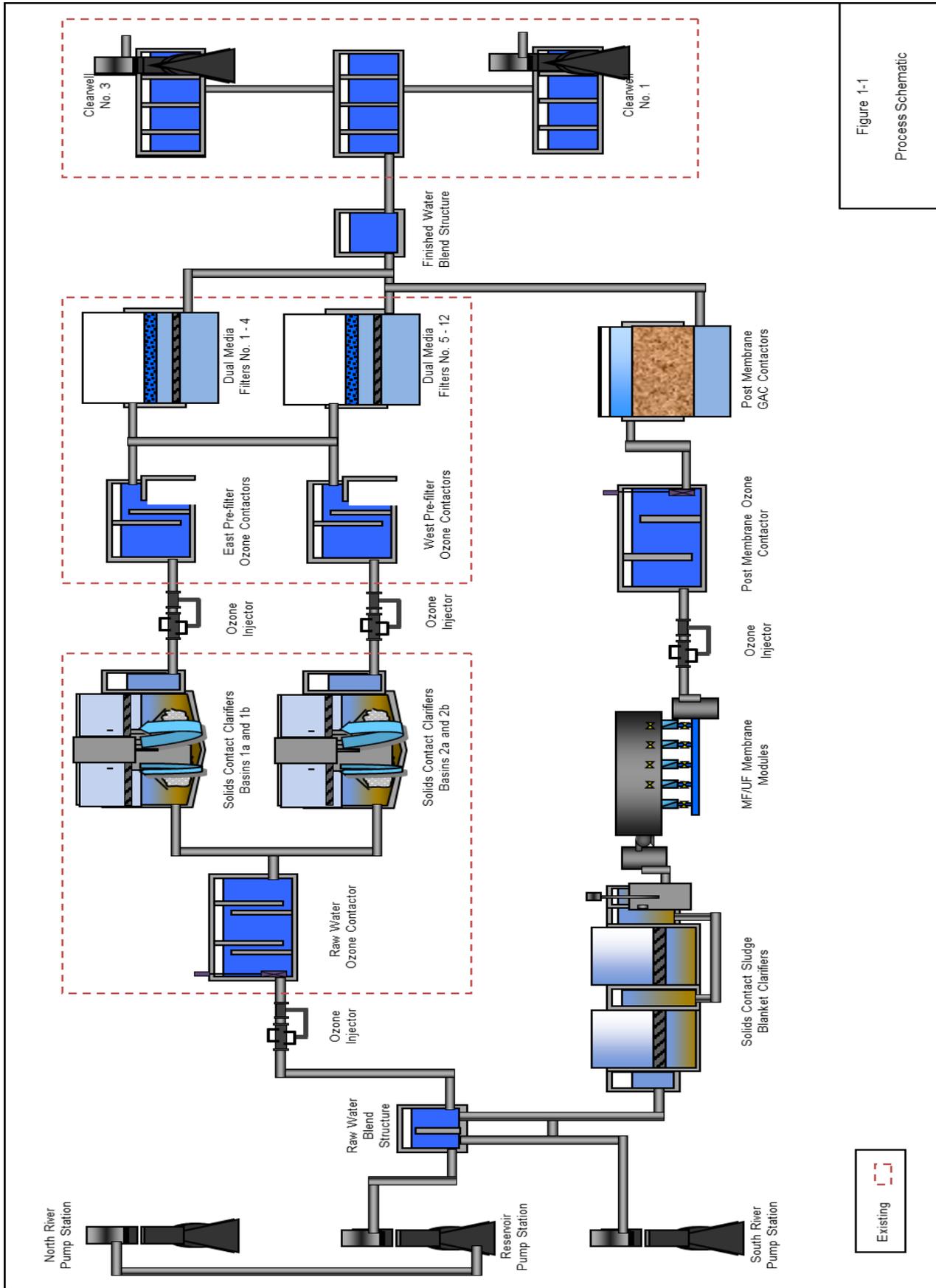


Figure 1-1
Process Schematic