Design Criteria

Plant Flow		
Maximum In-Plant Flow	44	mgd
Maximum Plant Production	40	mgd
Carbon Dioxide		
Number of Storage Tanks	1	
Total Storage Capacity	50	Tons
Design Dose	3 - 40	mg/L
Liquid Oxygen		
Number of Storage Tanks	2	
Capacity of Each Storage Tank	9,000	gallons
Total Storage Capacity	18,000	gallons
Number of Ambient Vaporizers	3	
Ozone Generators		
Number of Ozone Generators	3 (2 duty, 1 standby)	
Capacity of Each Ozone Generator	750	lbs/day
Total Firm Ozone Generation Capacity	1,500	lbs/day
Total Ozone Generation Capacity	2,250	lbs/day
Design Dose	1 - 4	mg/L
Ozone Contactor Structure		
Type	Over/Under Baffle, Fine Bubble Diffusion	
Number of Contactor Basins	2	
Number of Cells Per Basin	8	
Volume of Each Contactor Basin	126,400	gallons
Total Volume of Contactor Basins	252,800	gallons
Theoretical Detention Time at Max Flow	8	minutes
Filters		
Number of Filters	8	
Filter Media Area Per Filter	676	sf
Total Filter Media Area (All Filters)	5,408	sf
Underdrain Type	Gravel-less	

Filter Media		
Anthracite		
Depth	44 - 48	inches
Effective Size	1.2 - 1.3	mm
Uniformity Coefficient	<1.4	
Silica Sand		
Depth	8 - 12	inches
Effective Size	0.6 - 0.7	mm
Uniformity Coefficient	<1.4	
Filter Empty Bed Contact Time at Max Flow		
With All Filters Online	5.3	minutes
With One Filter Offline	4.6	minutes
Filter Backwashing		
Maximum Backwash Water Flowrate	25	gpm/sf
Air Scour Rate	4	scfm/sf
Chlorine Contact Pipeline		
Length	580	ft
Diameter	72	inches
Design Chlorine Residual	2.9	mg/L
Contact Time at Max Flow	4	minutes
Utility Water Pump Station		
Number of Utility Water Pumps	3 (2 duty, 1 standby)	
Capacity of Each Utility Water Pump	900	gpm
Total Firm Capacity of Utility Water Pumps	1,800	gpm
Number of Jockey Pumps	2 (1 duty, 1 standby)	
Capacity of Each Jockey Pump	100	gpm

Zone 7 Water Agency

About Us

Zone 7 Water Agency supplies treated drinking water to retailers serving nearly 240,000 people in Pleasanton, Livermore, Dublin, and through special agreement with Dublin San Ramon Services District, to the Dougherty Valley area of San Ramon. In a typical year, approximately 80 percent of the agency's water supply originates in the Sierra and is imported through the Delta, with the rest pumped from the groundwater basin or coming from rain runoff in our Lake Del Valle watershed. Zone 7 also supplies irrigation water primarily to agricultural customers, manages the groundwater basin, and provides flood protection to all of eastern Alameda County. The Agency operates two surface water treatment plants, ten municipal supply wells, and a groundwater demineralization plant.

Acknowledgements

Zone 7 Water Agency Board of Directors

John Greci, President
Jim McGrail, Vice President
Dick Quigley
Sandy Figuers
Sarah Palmer
Angela Ramirez Holmes
Bill Stevens

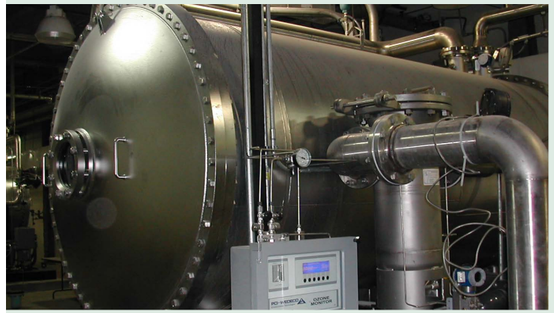
Designed by: CDM Smith

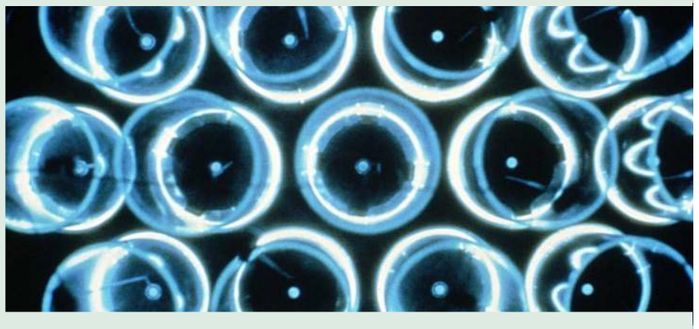
Prime Contractor: C. Overaa & Co.

Construction Manager: Covello Group

Zone 7 Water Agency

Del Valle Water Treatment Plant Ozonation Project





The Ozonation Project will add raw water ozonation to the Del Valle Water Treatment Plant's existing treatment process. Ozonation will bring several improvements to the treatment process and finished water quality:

- *Minimize the formation of chlorinated disinfection byproducts by using ozone in lieu of chlorine as the primary disinfectant*
- *Enhance the treatability of the water, improving the reliability and performance of downstream treatment processes*
- *Remove many of the compounds that cause tastes and odors to improve the drinking water's aesthetics*
- *Provide the most effective technology for destroying cyanotoxins, endocrine disruptors and pharmaceuticals.*

Project Facts

Major Improvements:

- New ozonation facilities, including liquid oxygen storage and vaporization, ozone generation, ozone contactor, and ozone offgas destruct
- Conversion of traditional filters to biological filters with water/air backwash
- New carbon dioxide system for pH adjustment prior to ozonation
- Modifications to existing chemical systems
- New Chlorine Contact Pipeline to provide post-filtration and back-up disinfection during ozone system outage
- Plant overflow and flow splitting modifications
- New water softening system for chemical systems
- New utility water pump station to replace existing plant water pumps and supply cooling water to ozone equipment
- Modifications to plant electrical system to accommodate new loads and provide reliable power supply to the entire plant
- New electrical facilities to purchase power from the Power and Water Resources Pooling Authority (PWRPA)
- New emergency generator /back up power generator

Project Costs:

- Planning and design: $3.5 million
- Construction and construction management: approximately $45 million

Schedule:

- Anticipated to be completed and online by March 2020

Project History

The Del Valle Water Treatment Plant (DVWTP) was constructed in 1975 with a capacity of 24 million gallons per day (mgd) and subsequently expanded to 40 mgd. The plant's existing major treatment process consists of clarification using Superpulsators, dual-media filtration using anthracite and sand, and disinfection using chlorine.

The major source of raw water supply for the DVWTP is surface water imported through the Sacramento-San Joaquin River Delta and conveyed via the South Bay Aqueduct, along with local runoff from Del Valle Reservoir. In recent years, treating this water supply with currently installed treatment processes at the DVWTP has become increasingly difficult due to more frequent algae blooms that can cause taste and odor problems, blue-green algae blooms that can produce algal toxins, high levels of organic matter, diurnal fluctuations in temperature and pH, and high alkalinity. Temporary powdered activated carbon facilities were installed as a short-term solution to remove T&O compounds. There have been numerous studies completed over the years that led to identifying ozone as the most effective alternative to chlorine in treating SBA water to improve the overall treatment process and finished water quality. This includes the 2008-2009 pilot testing of ozone and peroxone (ozone with hydrogen peroxide), and 2015 bench-scale evaluation of the potential destruction of cyanotoxins using treatment technologies on SBA water. More specifically, raw water ozonation with biofiltration was selected as the most effective alternative for DVWTP with the objectives of improving finished water quality with regard to disinfection, minimizing chlorinated disinfection by-products, and mitigating T&O compounds and contaminants of emerging concern such as cyanotoxins, endocrine disruptors and pharmaceuticals.

Treatment Process

This project adds ozonation and biological filtration, as well as pretreatment and backup disinfection processes, to the DVWTP's existing treatment train.

Pretreatment

Prechloramination and pH Adjustment: Low doses of chlorine and ammonia, as well as carbon dioxide, are added to the raw water. Chlorine and ammonia combine to form chloramines, while carbon dioxide lowers and stabilizes the raw water pH. Prechloramination and pH adjustment/stabilization help to control the formation of bromate, a byproduct of ozonation, and enhance the performance of downstream treatment processes.

Ozonation

Liquid Oxygen Storage and Vaporization: High-purity liquid oxygen (LOX) is stored in two outdoor cryogenic storage tanks. Three air vaporizers use ambient heat to vaporize the LOX into oxygen gas, which then passes through a particulate filter and flows to ozone generators.

Ozone Generation: The Ozone Generation Building houses three ozone generators, each with its own power supply unit (PSU), as well as cooling water pumps and heat exchanger, electrical, and other ancillary equipment. Ozone generators are stainless steel vessels containing horizontal dielectric tubes that generate an ozone-in-oxygen gas mixture with 5-10% ozone by weight. A small amount of nitrogen gas is added to the oxygen feed stream to maintain optimum ozone generation efficiency. The PSU consists of transformers and other equipment that convert plant electrical power to the voltage and frequency used by the ozone generator, and conditions the power to ensure a stable and reliable power supply to the ozone generator.

Ozone Contacting: The ozone-in-oxygen gas mixture is bubbled into the pretreated raw water at two ozone contactor basins. The ozone contacting process provides primary disinfection in the DVWTP's treatment train. Disk-style ceramic fine bubble diffusers provide constant and uniform distribution of the emergent diffused ozone-oxygen bubbles. The basins have internal baffle walls that facilitate an efficient hydraulic flow path and ensure that the ozone contacting process meets disinfection contact time requirements.

Ozone Offgas Destruct: Not all of the applied ozone gas reacts with the raw water. Unused ozone gas, called ozone offgas, is collected in the sealed headspace of the ozone contactor basins and treated by an offgas destruct system. Each offgas destruct unit consists of a blower that draws ozone offgas from the headspace of the contactor basins through a heater and catalyst bed, converting ozone into oxygen. The resulting ozone-free oxygen gas is continuously monitored and discharged to the atmosphere above the contactor basins.

Monitoring and Control: The ozone-in-water residual is continuously monitored by DVWTP's automatic analyzers and control system at various sampling points along the ozone contactor basins. The control system continuously calculates the disinfection compliance ratio achieved by the ozonation process and automatically makes adjustments to various parameters, such as the ozone dose, so the ozonation process complies with disinfection requirements.

Biological Filtration

Ozonation of drinking water prior to filtration breaks up larger organic carbon molecules into smaller molecules that are more easily metabolized by bacteria. Waters with higher levels of bioavailable organic carbon have been linked to biofilm growth and instability in the distribution system. This project converts the DVWTP's existing dual-media filters into biological filters, which allows the biological population in the filters to degrade organics as the water is filtered through the granular media, reducing the amount of bioavailable organic carbon in the treated water.

Prior to this project, the DVWTP achieved primary disinfection via chlorination upstream of the filters. Since raw water ozonation will provide primary disinfection after this project, chlorine will no longer be regularly fed directly upstream of the filters. This allows a biological population to be established in the filters. Several other modifications are also being made to the filters to accommodate biological filtration.

Deeper, Coarser Media: Operational experience at other utilities indicates that converting traditional filters to biological filters without changing the media to a deeper, coarser configuration can lead to higher headloss accumulation rates, shorter filter run times, and higher backwash frequency. Therefore, in this project, the existing media are replaced with coarser sand and anthracite media. In addition, the depth of the anthracite layer is approximately doubled after the project.

New Underdrain System and Air Scour: To allow for a deeper media configuration without making structural modifications to the filter boxes, the existing underdrain system is replaced with a stainless steel, gravel-less underdrain design with a lower profile. An air scour blower and piping system is also added to effectively remove unattached particles and microorganisms from the filter media during backwashing.

Backup Primary Disinfection and Chlorination for Multibarrier Treatment

The post-filter Pipeline Chlorine Contactor (CCP) will consist of approximately 580 linear feet of 72-inch diameter pipe. Chlorine will normally be fed to the filtered water, upstream of the CCP, to provide additional virus and HPC bacteria inactivation. The CCP will provide sufficient contact time to meet disinfection requirements. Should the ozone process go down, additional chlorine dosing at the CCP will then also provide primary disinfection. Downstream addition of caustic soda and ammonia to the finished water provides a chloramine residual in the distribution system.

Emergency Power

Because the ozone system is critical to providing disinfection of the DVWTP's treated water, a new 1500 kW emergency generator is installed to provide power to the ozone equipment, as well as other plant equipment, during an interruption of utility power. This emergency generator will start automatically when power loss is detected and will supply the emergency circuits via an automatic transfer switch. It will start and provide power within 10 seconds or less of losing the normal power source.

Ozone Life-Safety System

An extensive life-safety system detects any ozone or oxygen leaks and prevents plant personnel from exposure to ozone gas. This system includes ozone and oxygen leak detection monitors, emergency alarm systems, ventilation equipment for ozone areas, and automatic sequences in the plant control system to issue alarms and/or initiate equipment shutdown in the event of a leak. The life-safety equipment and instruments are connected to the emergency power system, allowing them to function even during a utility power interruption.