Seminar by,
Dr. Saqib H. Shirazi (Project Manager)
Mr. Kevin Morrison (Geologist)

San Antonio Water Systems, Texas

H_2Oaks Brackish Groundwater Desalination – Operational challenges and Lessons Learned

Dr. Shirazi: Dr. Saqib H Shirazi is a project manager at San Antonio Water System. He earned doctorate from the Civil and Environmental Engineering Department of Lamar University, Beaumont, TX in 2005. He is a registered professional engineer in the state of Texas. He has over sixteen years of professional experience in desalination, water reuse, and advanced and conventional water & wastewater treatment. He is currently a member of the American Water Works Association, and the Water Environment Association of Texas. He published numerous articles on desalination and membrane filtration in various conference proceedings and scientific journals.

Mr. Morrison: Kevin Morrison is registered Professional Geoscientist in Texas, with a Bachelor of Science degree in geology from the University of Texas at Austin. He spent twenty years working in the mining industry both domestically and international. In his twenty plus years with the San Antonio Water System, he's worked on numerous water supply projects including the feasibility, design, and construction of the SAWS Brackish Groundwater Desalination facility. Kevin is currently a Project Coordinator in the Water Resources Department where his duties include oversight of water supply project feasibility work, optimization of operational water projects, construction and maintenance of municipal supply wells, and oversight of all activities associated with SAWS Class I injection wells.

Date: Friday March 25th, 2022
Time: 4:00 – 4:50 PM
WebEx Link: Will be provided

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Abstract: The San Antonio Water System (SAWS) started the operation of the second largest brackish groundwater desalination (BGD) facility of the State of Texas at the end of 2016. The BGD water treatment plant (WTP) is situated at the same location where SAWS aquifer storage and recovery (ASR) and Carrizo WTP are present. The ASR facility was commissioned in 2004. Between 2007 and 2009, SAWS drilled seven production wells in the Carrizo aquifer. After installing water production wells at the Carrizo aquifer, SAWS started utilizing the un-used capacity of the ASR plant to treat additional production from the new Carrizo wells.

Design capacities of Carrizo WTP, ASR, and BGD are a 10 million gallons per day (MGD), 60 MGD, and 12 MGD, respectively. Raw water sources of Carrizo WTP, ASR, and BGD are Carrizo aquifer, Edwards aquifer, and Wilcox aquifer, respectively. While raw water source from Edwards and Carrizo aquifers are fresh in nature, Wilcox aquifer's raw water is brackish. SAWS controls and manages the treatment and distribution of these three sources of water from a single central facility, H2Oaks Center, which is located at Elmendorf, Texas – approximately twenty miles south of San Antonio downtown.
SAWS practices three different approaches to manage these three different sources of water. Raw water obtained from Carrizo aquifer is treated with a conventional water treatment plant that includes air stripping, lime addition, coagulation, flocculation, sedimentation, filtration, and chlorination. ASR system primarily stores excess Edwards water at Carrizo aquifer and recovers when necessary. Raw water from Wilcox aquifer is brackish in nature. This raw water source is treated using a reverse osmosis (RO) system. SAWS BGD plant is the only public BGD facility in the State of Texas that uses a three-stage RO system along with approximately 90 percent feed water recovery through an RO system. It uses twelve production wells, a pre-treatment system, a three-stage RO system, a post-treatment system and two injection wells to treat brackish water of the Wilcox aquifer.

One of the major challenges of managing these three sources of water is to maintain water quality and to avoid corrosion in the distribution system. SAWS regularly monitors several water quality indices including Langelier Saturation index, Ryznar index, and Calcium Carbonate precipitation potential to avoid corrosion and other detrimental effects in the distribution system from these three sources of water.

In addition to maintaining water quality in the distribution system, SAWS encounters significant challenges, particularly operating and managing the BGD plant. SAWS BGD is the only facility in the southern Texas that uses Wilcox aquifer as the raw water source. During the planning phase, SAWS developed a hydrogeologic model to predict the drawdown of the Wilcox aquifer. However, it was really challenging to calibrate the model using a real-time data because very limited information on the hydrogeologic parameters of the Wilcox aquifer was available. During the past five years of operation, SAWS collected real-time data of the Wilcox aquifer for the southern part of Texas. The data were used to re-calibrate the hydrogeologic model that was developed in the planning phase. Recalibration of the model shows that the drawdown of the aquifer in the first three years of operation of the BGD facility was significantly greater than initially predicted. To overcome the issue, SAWS decided to install two more production wells. This presentation will discuss the drawdown scenarios of Wilcox aquifer. The discussion will help engineers and hydrogeologists to design and develop brackish water production wells at Wilcox aquifer in the future.

In addition to expedited drawdown of Wilcox aquifer, SAWS BGD facility encountered frequent fouling on the third stage of the RO system. Membrane autopsy revealed that silicon, iron, and calcium were the significant foulants on the membrane surface. To overcome frequent fouling, feed water recovery in the third stage was reduced. Implementing the change helped mitigate the frequency of the fouling on the third stage of the RO system significantly. It also improved permeate water quality from the third stage of the RO system.
This presentation reviews the performance of the high recovery RO membrane process during the first five years of operation. Additionally, the presentation focuses on challenges and lessons learned to manage three different sources of water using a central operation and control system. The information provided in this presentation will benefit water utilities, engineers and operators that currently utilize or plan to implement multiple sources of water using a single centralized control system.