Evaluation of Long-Term Trends and Variations in the Average Total Dissolved Solids Concentrations in Wastewater and Recycled Water

Regional Southern California

CLIENT

Southern California Salinity Coalition

HIGHLIGHTS

- **Created multivariate statistical models to estimate TDS contributions from water supply and conservation measures**
- **Demonstrated unintended consequences of water conservation measures**
- **Produced reference document for local and state policy makers**

DBS&A evaluated long-term trends and variations in the average total dissolved solids (TDS) concentrations in wastewater and recycled water in southern California. This study was prompted by California's unprecedented five-year drought between 2011 and 2016 and the response by the governor of California to impose mandatory conservation policies on urban water use. During this drought period, several Southern California Salinity Coalition (SCSC) member agencies that operate and manage wastewater treatment plants (WWTPs) faced increasing challenges meeting regulatory discharge requirements.

DBS&A evaluated data from seven regional water treatment systems and used multiple linear regression analysis on the WWTP's influent water quality data; specifically TDS, and concluded that there are two primary contributors of TDS entering WWTPs: (1) the quality of the water supply, and (2) influent flow to WWTPs. The statistical models show that water supply quality has the largest influence on influent water quality (approximately 80 percent). Cyclical climatic trends have a significant influence on water supplies, which have higher TDS concentrations during drought conditions, especially for agencies that are more dependent on imported water for source supply. Per capita influent flow, which is a good approximation of per capita indoor urban water use, has a smaller but significant influence (approximately 20 percent) on influent water quality. Every region showed a decade-long gradual decline in per capita indoor water. The statistical models estimate that there is a 1.2 and 1.7 mg/L increase of influent TDS for every 1.0 gallon per capita per day decrease in indoor water use.

SCSC/National Water Research Institute member agencies include: Eastern Municipal Water District, Inland Empire Utilities Agency, Metropolitan Water District of Southern California, Orange County Sanitation District, Orange County Water District, San Diego County Water Authority, Sanitation Districts of Los Angeles County, and Santa Ana Watershed Project Authority.

Evaluation of TDS Trends and Variations in Wastewater and Recycled Water *(page 2)*

Both water supply quality and per capita indoor use are beyond the control of the water and wastewater agencies. Long-term increases in wastewater TDS may result in permit violations or in additional, expensive treatment plant desalination. Water and wastewater agencies can use this study as the scientific framework to begin discussions with the Regional Water Quality Control Boards concerning permit requirements. Changes to existing permits may include a longer averaging period and a less-restrictive increment from use limit; these changes would take into account mandatory conservation measures and the effects of drought. This study can also serve to inform other state and local policy makers and regulators of the unintended consequences of conservation.

The key findings of this study include:

- Volume-weighted source water TDS concentration is the significant determiner of influent TDS. Source TDS explains more of the variability in influent/effluent TDS than any other factor, including decreased indoor water use.
- There is a strong inverse correlation between drought conditions and TDS concentrations in imported water for both State Water Project (SWP) water and Colorado River Aqueduct (CRA) water. TDS concentration can vary by 300 mg/L from wet years to dry years for CRA water and by 200 milligrams per liter (mg/L) for SWP water.
- Long-term conservation efforts account for a smaller, but still significant, increase in TDS. IEUA and EMWD statistical models predict a 1.2 to 1.7 mg/L increase in TDS for every 1.0 gallon per capita per day (gpcd) decrease in indoor water use.
- Other unintended consequences of water conservation measures include loss of revenue from water sales, less available recycled water, and increased infrastructure operation and maintenance costs. Benefits of water conservation measures include a reduction in energy costs and decreased greenhouse gas formation.
- The reduction in the number of self-regenerating water softener (SRWS) units can significantly reduce the concentration of TDS in influent flows to the WWTPs. In a case study, Santa Clarita Valley Sanitation District (SCVSD) removed 8,000 SRWS units, thereby reducing the TDS in the WWTP influent flow by nearly 80 mg/L.
- The duration of rolling-average periods can determine whether or not an agency is in violation of their permit limits. A compliance limit based on a 5-year rolling average instead of a 1-year rolling average for the Perris Valley WWTP would keep the WWTP discharge within permit limits.