57 Years of Reduction in San Jose/Santa Clara Regional Wastewater Facility BOD and Nutrient Loads

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Raw sewage flowed to the Lower South San Francisco Bay from the vicinity of San Jose, Milpitas and Alviso prior to construction of San Jose/Santa Clara Regional Wastewater Facility in 1957. Over the years sewage flows increased with population, but the sewage treatment facility also grew and improved.

Problem Statement: Did Facility expansion and improvements allow sewage treatment to keep pace with population growth?

Approach: Facility effluent data from hard copy reports were compared with Santa Clara Valley population estimates and facility historical reports.

Results: Facility effluent data shows that sewage flows increased dramatically with population from the 1950s through the 1990s, but there has been decline in flows since the late 1990s. At the same time, pollutant loads discharged to the Lower South San Francisco Bay decreased significantly as a result of a series of facility improvements despite the increase in sewage flows into the wastewater facility.

Conclusions: Long-term data collection and periodic resurrection of historic data helps demonstrate the value of public investment in a large wastewater facility and helps document long term impact on the local environment.

Keywords: Wastewater, BOD, TSS, Sewage, San Jose, Milpitas, Alviso

Poster Topic: San Jose/Santa Clara Regional Wastewater Facility: 57 Years of Data Collection

40 Years of Reduction in San Jose/Santa Clara Regional Wastewater Facility Toxic Pollutant Loads

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From its earliest days, the San Jose/Santa Clara Regional Wastewater Facility was designed to remove "conventional pollutants," otherwise known as BOD, TSS, and Ammonia. The Clean Water Act of 1972 and subsequent regulation identified and eventually set concentration limits for 126 additional "toxic pollutants." As a result, the Facility commenced monitoring for heavy metals and some organics in 1975.

Problem Statement: Did Facility improvements have any impact on toxic pollutant removal?

Approach: Trace-level and eventually ultratrace-level monitoring for a suite of toxic pollutants was performed monthly or quarterly. Establishment of ever lower regulatory limits and changes in technology over the decades required changes to laboratory methods. Concerns over some specific pollutants (e.g. copper, PCBs, and mercury) prompted special studies to determine what specific Facility processes were responsible for the removal. Concerns about emerging contaminants added new pollutants to the monitoring list.

Results: The addition of a treatment plant filtration process in 1979 greatly reduced the loads of metals and other particulate-bound pollutants. Continued reductions were measured in the 1980s and 1990s as source control programs were initiated or improved. Changes in laboratory analytical techniques are also responsible for some apparent load reductions.

Conclusions: Overall there has been a substantial reduction in toxic pollutant loads discharged from the facility.

Keywords: Wastewater Treatment, San Jose, Milpitas, Alviso, Toxic Pollutants, Metals

Poster Topic: San Jose/Santa Clara Regional Wastewater Facility: 57 Years of Data Collection

50 Years of Improving Water Quality in Lower South Bay

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The San Jose/Santa Clara Regional Wastewater Facility (Facility) was constructed as a primary-only treatment plant in 1957. Population growth in the 60s and 70s led to decreased water quality in the Lower South Bay. In response to population growth and new regulations, the Facility expanded and improved treatment, adding nitrification and filtration in 1979, and converting to biological nutrient removal (BNR) in 1998. Five decades of changes in receiving water quality in the Lower South Bay in the context of those Facility expansions and improvements helps answer the question: Did Facility expansion and improvements correspond to observed improvements in Lower South San Francisco Bay water quality?
We examined fifty years of ambient receiving water data for dissolved oxygen, water clarity, nutrients, and pH for temporal correlations to key Wastewater Facility improvements.
The 1979 upgrade corresponds to an immediate improvement in effluent BOD, TSS, and ammonia, with corresponding improvements in Lower South Bay dissolved oxygen and ammonia levels. The 1998 conversion to BNR lowered nitrate and phosphate loads to the Lower South Bay and a reduction in ambient nitrate and phosphate concentrations is evident.
Long-term data collection of effluent and receiving water quality clearly demonstrates the benefit of facility improvements.

Keywords: Wastewater Treatment, Water Quality, Dissolved Oxygen, Ammonia Phosphate, Pollutant Loads

Poster Topic: San Jose/Santa Clara Regional Wastewater Facility: 57 Years of Data Collection

Managing Nutrients at Northern California's Only Large Biological Nutrient Removal Facility

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In 1998, the San Jose/Santa Clara Regional Wastewater Facility modified its separate secondary and nitrification processes to a single step-feed Biological Nutrient Removal (BNR) process. Since that time, the facility has achieved a significant level of denitrification and phosphorous removal. Ironically, the amount of nutrient removal was never accurately quantified because the Facility had no effluent limits for nutrients other than ammonia. The impact on nutrient removal of various minor facility process changes made since the late-1990s is not well understood. The Facility optimal operating parameters for nutrient removal are also unknown.

Problem Statement: What conditions optimize nutrient removal in the Facility BNR process?

Approach: Ammonia, nitrate, nitrite, organic nitrogen, and phosphate were measured monthly in Facility effluent prior to, and after, modification to the step-feed BNR process. Both facility influent and effluent were monitored for nutrient concentrations to determine loads removal. Nutrients concentrations were also measured after primary and secondary treatment and at several points through the secondary BNR process to determine where and how nutrients are removed.

Results: The facility removes roughly 60% of incoming nitrogen and well over 90% of phosphorous from wastewater. Factors affecting seasonal variability in nutrient removal are only beginning to be understood.

Conclusion: The Facility's BNR process is very effective in removing nutrients during the warm season. Lower temperature and higher flows among other factors reduce that effectiveness in the winter season.

Keywords: Wastewater, Nutrient Removal, Ammonia Nitrate, Phosphate, Nitrogen, BNR, Nitrification, Denitrification

Poster Topic: San Jose/Santa Clara Regional Wastewater Facility: 57 Years of Data Collection

23 Years of Marsh Growth Downstream of the San Jose/Santa Clara Regional Wastewater Facility

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By the late 1980s, there were concerns that increased freshwater flow from the San Jose/Santa Clara Regional Wastewater Facility was causing downstream marshes to change from predominantly salt marsh to fresh water marsh. Salt marsh provides critical habitat for endangered Salt Marsh Harvest Mouse (*Reithrodontymys raviventris*) and the California Clapper Rail (*Rallus longirostris obsoletus*). To address this concern, the facility contracted with H.T. Harvey and Associates to monitor marsh plant associations in Lower South San Francisco Bay since 1989.

Over 24 years, the extent of salt, brackish, and freshwater marsh plant types was surveyed on 18 occasions. Tidal marshes were mapped in a Main Study Area, composed of 3 reaches (Lower, Transition, and Upper Reaches), and a Reference Area, which is outside the influence of the Plant's freshwater effluent.

The distribution of freshwater marsh in the Upper Reach (closest to the Plant) has remained fairly constant. However, salt and brackish marsh distributions have been dynamic in the Transition Reach and the central portion of the Reference Area. Despite the year-to-year shifts, the proportion of salt and brackish marsh has been similar over time as marsh area increased which suggests that abiotic factors other than the constant discharge from the Plant are responsible for large-scale shifts between brackish and salt marsh. It is likely that rainfall and associated stream flows, sediment deposition, and salinity changes associated with salt pond restoration actions are the primary factors influencing marsh habitat changes.

Since 1989, salt marsh in the Main Study Area increased by 490 acres. In the Reference Area, salt marsh increased 40 acres. Increase in salt marsh coincides with a measured increase in overall marsh area and is likely helped by recent restoration actions associated with the South Bay Salt Pond Restoration Project since 2006.

Keywords: Wastewater, Marsh Habitat, Salt Pond Restoration, Rail, Mouse

Poster Topic: San Jose/Santa Clara Regional Wastewater Facility: 57 Years of Data Collection