

Sacramento Regional County Sanitation District

Interceptor Sequencing Study

Technical Memorandum 10
Life Cycle Costs for Centralized, Scalping, and Satellite Facilities

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NO. 10**

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LIFE CYCLE COSTS FOR CENTRALIZED, SCALPING, AND SATELLITE FACILITIES

1.0 INTRODUCTION

The Sacramento Regional County Sanitation District (SRCSD) is carrying out a high-level Interceptor Sequencing Study (ISS) to determine alternatives that would provide build-out regional sewer service for future developments. This technical memorandum (TM) addresses the lifecycle costs of centralized, satellite, and scalping treatment facilities for this planning effort. Traditional water recycling alternatives are not being evaluated through this process. The Operations and Maintenance (O&M) will be derived as percentages of the constructions costs. Due to the high level nature of the ISS, allowances for details are very limited and this analysis excludes the following:

- Value for remaining life of the assets including the conveyance system and decentralized treatment facilities.
- Cost savings for the potential delay and/or elimination of capital improvement projects at the SRWTP
- Potential revenue from the distribution of recycled water

2.0 BACKGROUND

SRCSD has experience constructing and operating major wastewater treatment processes at the Sacramento Regional Wastewater Treatment Plant (SRWTP). The SRWTP is a secondary treatment facility with a permitted capacity of 181 million gallons per day (mgd) seasonal dry weather flow and includes on-site solids disposal facilities. SRCSD also operates a Water Reclamation Facility (WRF) within the SRWTP property. A small amount of the secondary effluent is diverted to the WRF for tertiary treatment and the remaining flow is discharged to the Sacramento River.

The cost estimating methodology used to evaluate the decentralized treatment plant alternatives come from several different sources:

- The Water Recycling Opportunities Study (WROS) was completed in 2007 to evaluate the feasibility of implementing a large scale water Recycling Program. Project alternatives were evaluated for potential costs, which were used to determine the potential costs of the liquid treatment processes of satellite and scalping treatment facilities. The WROS uses Membrane BioReactor (MBR) technology, which this TM assumes for decentralized facilities. The use of any other technology would require re-evaluation of the projected costs.

- The Update of Estimated Project Costs for the SRCSD 2020 Master Plan Advanced Treatment Alternatives Technical Memorandum, completed by Carollo Engineers in 2007, provided the costs for advanced tertiary treatment.
- The Walnut Grove Wastewater Treatment Plant Reconnaissance-Level MBR, RO, and Chemical Precipitation Cost Estimate Technical Memorandum was completed in 2006 by SRCSD. This study provided the specific process costs for solids treatment at the satellite plants.
- The Legal and Permitting Issues Associated with Future South Sacramento County Satellite Facility Discharging to the Cosumnes River Memorandum was completed in 2010 by Somach Simmons & Dunn (SSD). This memo provided the high level potential treatment requirements for satellite plants.

3.0 PIPELINES

3.1 Transmission Pipe O&M Costs

Recycled water is delivered to the local distribution system by a series of transmission pipes from the WRF (at the SRWTP) or the satellite/scalping facility. The ISS analysis is limited to build out conditions, and therefore do not require regular maintenance. Pipe O&M costs are assigned at 0.5% of the base construction costs (construction costs before any contingencies).

3.2 Discharge Pipe O&M Costs

The discharge pipes from a satellite facility transport treated effluent to the discharge point, the Cosumnes River. The gravity pipes are relatively large and are designed to be self cleansing at normal flow conditions, so O&M costs are minimal. Costs are assigned at 0.5% of the base construction costs

4.0 PUMPING FACILITIES

Operation and maintenance costs for the recycled water pumping facilities vary with facility size, average flow, and facility age. The size of the facility will impact the number of preventative maintenance (PM) tasks due to the number and complexity of equipment. The average flow will impact the intervals that PM work is required due to equipment run times. The facility age will impact the overall maintenance costs due to equipment obsolescence and/or mortality.

Pump station O&M is considered to be 5% of the base construction costs.

5.0 CENTRALIZED TREATMENT

The SRWTP is a secondary treatment facility with a permitted capacity of 181 mgd seasonal dry weather flow and includes on-site solids disposal facilities. The treatment train includes: aerated grit chambers followed by primary sedimentation, secondary treatment with high-purity oxygen activated sludge process and secondary clarifiers, and a disinfecting process that includes chlorination/dechlorination basins. SRCSD also operates a Water Reclamation Facility (WRF) for tertiary treatment and the remaining flow is discharged to the Sacramento River.

Centralized treatment will be provided by a new or expanded Water Reclamation Facility at the SRWTP, which will provide Title 22 tertiary treatment of the secondary effluent produced by the SRWTP. The tertiary effluent (i.e. Recycled Water) is then transported from the SRWTP via distribution pipes to the point of discharge for the local system. Solid waste is treated on-site at the SRWTP.

The advantage of centralized treatment is that it eliminates the need for an off-site facility, and that the WRF can be operated seasonally, producing recycled water for irrigation only during summer or dry months. The plant would not operate during wet months when the demand is low or non-existent, when the minimal requirements could more cost-effectively be met by other sources.

The Water Reclamation Facility is a small, specialized facility that provides additional treatment to that already provided by the SRWTP. Many supporting facilities and staff are already in place, so the O&M costs are much less than that of a satellite or scalping facility. O&M costs are considered to be 3% of the base construction costs.

6.0 SCALPING TREATMENT FACILITY

A scalping plant is an MBR treatment facility located along a major interceptor sewer to treat wastewater generated from certain areas. These plants are typically placed in close proximity to water recycling opportunities, which significantly reduces the transmission costs of pumping treated wastewater from the SRWTP to the recycled water place of use. As would be expected, the transmission savings associated with building a satellite facility increase with the distance from the SRWTP.

Depending on the interceptor flow rate, the scalping facility can be designed to provide recycled water based on the demand pattern or based on a steady flow making the design flexible with minimal need of redundant units. This facility treats the “scalped” sewer flows, discharges the tertiary treated effluent to a local distribution system, and returns the solid waste back into the sewer collections system for standard treatment at the SRWTP.

A scalping plant can be operated seasonally, producing recycled water for irrigation during summer or dry months. The plant would not operate during wet months when the demand

is low or non-existent, when the minimal requirements could more cost-effectively be met by other sources.

The advantage of discharging the residuals back to the sewer interceptor to be treated downstream at the SRWTP facility is that it eliminates the need for on-site solid handling processes, which in turn reduces the footprint, costs, and odor emissions of the scalping facility.

The O&M costs for a scalping facility are similar to that of the SRWTP, with all the processes required for tertiary treatment, but on a much smaller scale. The O&M costs are therefore a larger portion of the overall costs, and are considered to be 9% of the base construction costs. The solids handling costs are handled under a separate item.

7.0 SATELLITE TREATMENT FACILITY

A satellite plant is a MBR treatment facility that treats all influent flows and consistently produces acceptable water quality. As a result, sufficient reliability must be installed to allow for one or more membrane basins to be out of service and still maintain sufficient capacity to treat the influent flow under all conditions. This “end of pipe” treatment facility must accommodate the flow fluctuation from both diurnal flow and peak flows by either installing larger treatment units or by adding equalization tanks. Solid waste is treated on-site at the satellite facility or trucked back to the SRWTP for treatment. It also requires a discharge permit for excess flows and solid handling processes, which makes them less desirable in neighborhood locations due to its footprint.

The advantage of treating solids on-site is that it eliminates the need for an extensive network of interceptor pipes connecting to the SRWTP.

The O&M costs for a satellite facility are similar to that of the SRWTP, with all the processes required for tertiary treatment, but on a much smaller scale. The O&M costs are therefore a larger portion of the overall costs, and are considered to be 9% of the base construction costs.

8.0 LIFE CYCLE DURATION

Life cycle refers to the number of years to be considered in the cost analysis. A forty year life cycle has been adopted by the SRCSD. Although most of the assets in an alternative will have a useful life greater than 40 years, using an analysis period greater than 40 years is not recommended due to the uncertainty in the assumptions beyond a 40 year time frame. This analysis has been conducted with a 40 year life cycle.

9.0 RISK QUANTIFICATION

The ISS has a separate risk evaluation section, and this Technical Manual (TM) does not further evaluate the risks.

10.0 SENSITIVITY (UNCERTAINTY) ANALYSIS

There are generally two main sources of error in life cycle analysis: variability and uncertainty. Variability reflects the natural variations in an estimate due to its properties or the forces acting on it. Uncertainty stems from a lack of knowledge about the true value of a specific variable. Variability and uncertainty can be addressed by evaluating the project outcomes based on a range of values rather than a single estimate. The ISS effort is a high level analysis and therefore the level of detail in the life cycle is relatively low.

Table 10.1 Life Cycle Costs		
O&M Costs		
WRF, Satellite and Scalping Plants	9%	Of the construction costs
Pump Station	5%	Of the construction costs
Storage Facilities	1%	Of the construction costs
Transmission Piping	3%	Of the construction costs
Discharge Piping	3%	Of the construction costs
Distribution Piping	3%	Of the construction costs
Solids Handling (SRWTP)	3%	Of the construction costs
Advanced Treatment: NTF	\$78,524	Per mgd
Advanced Treatment: UV	\$200	Per mgd
Advanced Treatment: RO	\$31	Per mgd
Advanced Treatment: Ozone	\$1,400	Per mgd
Power Cost	\$.10	Per KWh