City of Riverside

WASTEWATER COLLECTION AND TREATMENT FACILITIES INTEGRATED MASTER PLAN

VOLUME 8: SOLIDS TREATMENT AND HANDLING
CHAPTER 1: EXISTING FACILITIES

FINAL
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Chapter 1

EXISTING FACILITIES

1.1 PURPOSE

The purpose of this chapter is to summarize the existing solids handling facilities at the Regional Water Quality Control Plant (RWQCP). This chapter does not include the design and reliability criteria of the unit processes, which will be described in Volume 8, Chapter 3 - Design Criteria.

1.2 BACKGROUND

Treatment is provided at the RWQCP, which provides preliminary, primary, secondary, and tertiary treatment. The RWQCP currently treats approximately 33 mgd (annual average flow). The RWQCP has a rated capacity of approximately 40 mgd (annual average flow). The City of Riverside (City) seeks to develop an Integrated Master Plan for the Wastewater Systems Facilities to identify and plan for expansion and replacement needs for up to the year 2025. Efficient solids handling processing is an integral part of the RWQCP operation. With proper planning and appropriate implementation of biosolids handling process improvements, the RWQCP will be able to cost-effectively treat and dispose of wastewater solids.

1.3 EXISTING SOLIDS HANDLING FACILITIES

The solids handling facilities that are part of the RWQCP consist of Dissolved Air Flotation Thickening (DAFT) of Waste Activated Sludge (WAS), mesophilic anaerobic digestion of primary and secondary solids, and belt press and centrifuge dewatering of digested sludge. The plant originally had 29 sludge drying beds (total area of 8 acres) as part of its sludge disposal practice, but they have been abandoned or demolished due to the odor complaints from neighboring businesses and due to their land requirement. Currently, solids are being disposed off-site and used as soil amendment.

1.3.1 Dissolved Air Flotation Thickening

DAFT is used to thicken the WAS from the secondary clarifiers. This process reduces the overall volume of the solids and concentrates them into a stream that can be more economically treated. Settled solids from the secondary clarifiers from Plant 1 and Plant 2 are combined and thickened in the DAFTs to a solids concentration of about 2 percent. The RWQCP has three DAFTs, but only DAFT No. 2 is in service. The RWQCP is in the process of rebuilding DAFT No. 1. DAFT No. 3 has been cannibalized for spare parts. Criteria for the DAFTs are shown in Table 1.1.

Table 1.1 Dissolved Air Flotation Thickeners Criteria Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Description	**Value**
DAF Thickeners	
Number	2 (only 1 in service currently)
Diameter (feet)	37
Gross Surface Area (sq. ft.) each	1,018
Effective Surface Area (sq. ft) each	943
Total Surface Area w/one unit out of service (sq. ft.)	943
Air-to-Solids Ratio	0.025 to 0.04
Capture rate, %	95
TWAS Transfer Pumps	
Number	1 per DAF
Type	Progressive Cavity
Capacity, gpm/each	150
Recycle Pressurization Pumps (Duplex)	
Number	1 per DAF
Type	Duplex, Centrifugal
Flow Rate, gpm/each	1,000

1.3.2 Anaerobic Digesters

In anaerobic digestion, the solids from primary treatment and the DAF thickeners are processed in the absence of air. This reduces the solids volume, stabilizes the sludge, and produces methane gas as a byproduct that can be burned for energy.

The existing anaerobic digestion process includes five digesters ranging in size from 0.603 to 1.8 million gallons. The RWQCP currently operates the two 90-foot diameter tanks as active digesters. These are labeled Digester Nos. 1 and 2. Thickened primary and secondary sludge and primary scum are fed separately, directly to the digesters. WAS is thickened in the DAF, and primary sludge is thickened in the primary sedimentation tanks. Primary sludge from Plant 1 is sent to Plant 2 for thickening along with the raw wastewater coming to Plant 2. Currently, the RWQCP is adding restaurant grease to Digester No. 2 to increase gas production. After digestion, the stabilized solids are transferred into Digester No. 4, which serves as a holding tank for the dewatering belt presses and centrifuges. Digester Nos. 3 and 5 are no longer in service. However, the City is planning on placing Digester No. 3 back in service. Criteria for the existing anaerobic digestion equipment are shown in Table 1.2.

Table 1.2 Anaerobic Digesters Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Description	**Value**
Anaerobic Digesters	
Number of Units	5
Diameter (feet) Units 1 and 2	90
Diameter (feet) Unit 3	75 (out of service)
Diameter (feet) Unit 4	88 (storage)
Diameter (feet) Unit 5	60 (out of service)
Side Water Depth Units 1 and 2	32.0
Side Water Depth Unit 3	32.0
Side Water Depth Unit 4	38.5
Side Water Depth Unit 5	28.5
Total Current Digester Volume, MG (Units 1 and 2)	3.28
Total Current Storage Volume, MG (Unit 4)	1.8
Mixing Pumps	
Number	2 per Units 1 and 2; 1 per Units 3, 4, and 5
Type	Vortex Propeller, Centrifugal

1.3.3 Sludge Dewatering Facilities

Sludge dewatering is a physical (mechanical) unit operation used to reduce the moisture content of sludge. The RWQCP currently uses two belt presses and one centrifuge for the sludge dewatering process.

Dewatering belt filter presses are used to reduce the volume of material that requires off-site disposal. Polymer is first added to the sludge, and then it is introduced on a gravity drainage section, where it is allowed to thicken. Then low pressure is applied to the digested solids in between two wide belts where the solids are pressed with rollers to mechanically expel the excess water. The belts are arranged to perform the conveying, pressing, and dewatering functions. The final dewatered sludge cake is removed from the belts by scraper blades. The RWQCP produces a cake of about 16-percent solids. Drying beds were previously used to further reduce the volume of sludge to a solids-content greater than 60 percent, before disposal off-site. However, due to odor problems, the drying beds are no longer in service. Currently, the dewatered solids are discharged to a truck loading facility for off-site disposal.

Centrifuge thickening and dewatering is a high-speed process that uses the force from rapid rotation of a cylindrical bowl to separate wastewater solids from liquid. A high-speed centrifuge creating “G” forces in the range of 2,500 to 2,800 is producing a sludge cake of approximately 25 percent. Solids capture is slightly better for operating centrifuge systems than belt press operations. Electrical power load per machine is substantially higher with centrifuges, but this is largely offset by the following advantages: fewer number of operating machines required with centrifuges, less foul air ventilation horsepower required since centrifuge room air does not usually need foul air treatment, and cheaper hauling costs due to a higher percentage of solids. The City currently uses one centrifuge. The City is in the process of installing two additional centrifuges that will relegate the existing belt presses to standby status. Table 1.3 presents the dewatering facilities criteria.

Table 1.3 Sludge Dewatering Facilities Criteria
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
Dewatering Belt Presses	
Number	2 duty
Belt Width (meters)	2
Dewatered Cake Solids Concentration, %	16
Solids Capture (%)	95
Feed Rate (average), gpm	120
Belt Press Feed Pumps	
Number	2
Type	Variable Speed, Progressive Cavity
Capacity, gpm	250
Polymer System	
Polymer Bulk Transfer Pumps	
Number	1+1
Type	Constant Speed, Progressive Cavity
Capacity, gpm	10 (20 to 50% solution)
Polymer Recirculation Pump	
Number	1
Type	Constant Speed, Progressive Cavity
Capacity, gpm	10 (20 to 50% solution)

Table 1.3 Sludge Dewatering Facilities Criteria Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside	
Description	**Value**
Polymer Solution Transfer Pumps	
Number	1 duty +1 standby
Type	Constant Speed, Progressive Cavity
Capacity, gpm	140
Polymer Solution Feed Pumps	
Number	1 duty +1 standby
Type	Variable Speed, Progressive Cavity
Capacity, gpm	4 to 25
Storage Tanks	
Type	Fiberglass
Numbers	2
Diameter, feet	10
Nominal Capacity, gallons	6,000
Centrifuge	
Number	1
Feed rate (average), gpm	200
Dewatered Cake Solids Concentration, %	25
Solids Capture (%)	96

1.3.4 Solids Disposal

The RWQCP currently produces "Class B" sludge. The RWQCP avoids on-site solids storage to reduce odors. Fleet transportation services sends trucks to the RWQCP daily to pick up the dewatered sludge and haul it to alfalfa and cotton farms in Arizona as soil amendment. According to the City, it fills about five trailers a day, averaging about 73,000 pounds each. In an emergency, solids are stored on the ground in the old sludge drying beds; otherwise, the plant must be shut down.