City of Riverside

WASTEWATER COLLECTION AND TREATMENT FACILITIES INTEGRATED MASTER PLAN

VOLUME 4: WASTEWATER TREATMENT SYSTEM
CHAPTER 1: EXISTING FACILITIES

FINAL
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City of Riverside

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CHAPTER 1: EXISTING FACILITIES

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EXISTING FACILITIES

1.1 PURPOSE

The purpose of this chapter is to summarize the existing facilities at the Regional Water Quality Control Plant (RWQCP). This includes descriptions of treatment facilities, support facilities, plant access, parking, and a summary of the surrounding area. This report does not include the design and reliability criteria of the unit processes, which will be described in Volume 4, Chapter 3 - Process Design/Reliability Criteria report.

1.2 BACKGROUND

The RWQCP began operation as a regional facility in 1978. Primary and secondary treatment capacity was constructed to provide treatment for wastewater from the Rubidoux and Jurupa Community Service Districts. Tertiary capacity was built at the same time. Subsequent projects have added capacity and upgraded the existing primary, secondary, tertiary, and solids handling facilities to increase the treatment capacity at the RWQCP.

With the installation of the new headworks, the RWQCP has the hydraulic capacity to convey peak flows up to 100 mgd through the treatment works.

1.3 EXISTING SUPPORTING AND TREATMENT FACILITIES

Figure 1.1 shows the layout of the existing facilities. The RWQCP consists of approximately 121 acres of land, including an additional 25 acres on the east end acquired in 1990. The main entrance to the plant is on Acorn Street. To the right of the entrance is the employee and visitor parking lot. To the left of the entrance is the Lab/Administration building. The Laboratory Services Program provides technical support for the Sewerage Systems Service Program and for Jurupa, Rubidoux, and Edgemont Community Services Districts. Analytical services provided include chemical, biological, and microbiological analyses.

The major crossroads of the RWQCP are Van Buren Road on the west, Jurupa Avenue on the south, and Payton Road on the east. There is not much of a buffer zone around the plant except by the Santa Ana River on the north side. There are businesses to the immediate east and south sides of the plant.

Figure 1.2 shows a flow schematic for the plant based on current operation. The RWQCP incorporates two separate plants (Plant 1 and Plant 2). The sewerage comes into the RWQCP at the headworks, where it is then sent to Plant 1 and Plant 2 for independent treatment to a primary and secondary level. The flow is split 40 percent to Plant 1 and 60 percent to Plant 2.

Plant 1 has a total of six rectangular primary clarifiers, four rectangular aeration basins, and four rectangular secondary clarifiers. Plant 2 has four circular primary clarifiers, six rectangular aeration basins, and four circular secondary clarifiers. The secondary effluents from both plants combine and go into four equalization ponds, which are then sent to tertiary treatment.

The equalized secondary effluent feeds into the two tertiary filter trains, where it gets further treatment. Currently, the tertiary effluent goes through Chlorine Contact Basin No. 1 (CCB1) and Chlorine Contact Basin No. 3 (CCB3) for disinfection. The final effluent is discharged either to the Santa Ana River directly or to the Hidden Valley Wetlands for further nitrogen treatment before discharge to the Santa Ana River.

The following sections describe the major treatment processes in further detail.

1.3.1 Influent Sewers

The RWQCP receives influent from six lines: the Arlanza trunk, the Riverside trunk, the Hillside trunk, the Acorn trunk, and the Jurupa and Rubidoux force mains. Each trunk line is metered and sampled for 5-day Biological Oxygen Demand (BOD_5), suspended solids, ammonia nitrogen, and other parameters. The City of Riverside (City) and each of the Community Service Districts are responsible for the operation and maintenance of their own collection facilities. The City is planning to upgrade the influent metering facilities to obtain accurate information on the sewerage entering the RWQCP. Table 1.1 describes the meter types, trunk sizes, and average dry weather flow (ADWF) as of the year 2005.

Table 1.1 Influent Sewers
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Influent Line	Current Meter Type	Trunk Size (in.)	2005 (ADWF) Flows (mgd)
Arlanza	(Combined) Open Channel insert	51	11(1)
Acorn		36	3(1)
Riverside	(Combined) Open Channel insert	45	13.4(2)
Hillside		24	3.8(2)
Jurupa	Magnetic Parshall Flume	18	2.75
Rubidouz	Magnetic	18	2.1

Notes:
(1) Flow is estimated based on ratios of the cross-sectional areas of the Acorn/Arlanza lines, as these lines share one meter. The combined flow for these lines is 14 mgd.
(2) Flow is estimated based on ratios of the cross-sectional areas of the Riverside/Hillside lines, as these lines share one meter. The combined flow for these lines is 17.2 mgd.

1.3.2 Headworks Facilities

Headworks facilities are installed for protection of the plant's equipment. These processes include screening and grit removal. Both screenings and grit are washed, dewatered, and sent to a sanitary landfill. In 1999, the RWQCP completed construction of a new headworks facility. This facility combines the flow from the incoming sewers, including the Community Service Districts of Jurupa and Rubidoux. The combined flow is passed through four parallel screens and two vortex grit removal basins. Once the water has been screened and degritted, it is divided between Plants 1 and 2 for additional treatment. Table 1.2 describes the headworks treatment processes.

Table 1.2 Headworks Facilities
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
HEADWORKS	
Influent screenings Generation, cu. yds/day(1)	
Average (wet screenings)	15
Average (washed/compacted)	7.5
Maximum (wet screenings)	22.5
Maximum (washed/compacted)	11
Grit Production, cu. yds/day(1)	
Average	4
Maximum	8
Influent Bar Screens	
Numbers	4
Width, ft	3.5
Clear Openings Between Bars, inch	0.5
Type	Climber
Wet Screenings Conveyor	
Numbers	2
Type	Shaftless Screw
Screenings washing compactor units	
Numbers	2
Dry Screenings Conveyor	
Numbers	2
Type	Shaftless Screw

Table 1.2	Headworks Facilities Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside
Description	**Value**
Vortex Grit Removal Units	
Numbers	2
Diameter, ft	20
Capacity, each, mgd	50
Grit Removal Efficiency, percent	
>50 Mesh	95
>100 Mesh	65
Grit Pumps	
Number per tank	1
Capacity, gpm	250
Head, ft	45
Type	Centrifugal Recessed Impeller
Grit Classifiers (Teacup)	
Number	2
Type	Hydraulic Vortex
Diameter, inch	42
Capacity, gpm/each	250
Grit Dewatering Equipment (Snail)	
Number	2
Belt Width, inch	18
BIOFILTER	
Air Residence Time, seconds	62
Biomedia Depth, ft	3
Air Velocity through media, fpm	2.89
Air humidity	Saturated
Foul Air blower, each	2
Capacity, scfm	13,800
Type and material	Centrif., Fiberglass
Drive	Variable Speed, Flow Controlled

Notes:
(1) Based on a design average daily flow of 50 mgd and a peaking factor of 2.0.

1.3.3 Primary Clarifiers

The purpose of the primary clarifiers is to remove settleable organic materials from the wastewater. Primary clarifiers typically remove about 70 percent of the incoming total suspended solids (TSS) and about half of the biochemical oxygen demand (BOD). The primary effluent from the primaries flows by gravity to the aeration basins of each plant.

The primary sedimentation facilities at Plant 1 were originally designed to pump the settled solids into gravity thickeners. The gravity thickeners have since been taken out of service and the settled solids from the Plant 1 primaries are pumped into the primary influent splitter box for Plant 2. There, they are resettled with the Plant 2 primary solids. The Plant 2 primary clarifier solids are thickened in the primaries and are pumped directly to the anaerobic digesters. Ferric Sulfate is added to the primary clarifiers at Plant 1 to keep the hydrogen sulfide levels within the South Coast Air Quality Management District (SCAQMD) limits.

Table 1.3 Primary Treatment
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
PRIMARY SEDIMENTATION	
Plant 1A	
Basins	Rectangular
Number	4
Length, ft	104
Width, ft	26
Volume Total, gals	688,700
Surface Area, Total ft^2	10,816
Sludge Pumps	
Number	3
Type	Non-Clog Centrifugal
Size, gpm/each	450
Plant 1B	
Basins	Rectangular
Number	2
Length, ft	163.5
Width, ft	37
Volume Total, gals	768,900
Surface Area, Total ft^2	12,100

Table 1.3	Primary Treatment Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside
Description	**Value**
Sludge Pumps	
Number	2
Type	Non-Clog Centrifugal
Size, gpm/each	450
Plant 2	
Basins	Circular
Number of Basins	4
Diameter, ft	95
Volume Total, mill-gals	2.004
Surface Area, Total ft^2	28,350
Sludge Pumps	
Number	6
Type	Progressive Cavity
Size, gpm/each	100
FERRIC SULFATE	
Number of Tanks	1
Volume, gallons	6,000
Usage, gallons/day	700-1,200

1.3.4 Secondary Treatment

1.3.4.1 Aeration Basins

The aeration basins provide biological treatment. In these units, the wastewater is actively mixed with a large concentration of microorganisms that break down the soluble organic matter and convert it into carbon dioxide. In addition, ammonia nitrogen is converted to nitrate. The RWQCP includes modifications to the aeration basins for denitrification. The Plant 1 and Plant 2 aeration basins have been modified to include a section with low dissolved oxygen known as an anoxic zone. These zones are where nitrate is converted to nitrogen gas. The anoxic zones in both plants occupy approximately 20 to 25 percent of the total volume of the aeration basins. The aeration basins include high volume mixed liquor recycle pumps that allow for a more effective use of the anoxic zones by recycling the nitrates formed in the aerobic zone to this section. Additional nitrogen removal occurs in the portion of the effluent that passes through the Hidden Valley Wetlands.

Two blowers, Blower Nos. 4 and 5, are used for supplying variable volumes of air to the aeration basins for Plant 1 and two blowers, Blower Nos. 1 and 2, are used for supplying variable volumes of air to the aeration basins for Plant 2. One blower, Blower No. 3, serves as a “swing”/standby blower. All five blowers are motor driven, single-stage centrifugal, vertical split type.

1.3.4.2 Secondary Clarifiers

Secondary clarifiers settle out the microorganisms following the aeration basins. The majority of the solids removed from the wastewater stream, referred to as return activated sludge (RAS), are returned to the aeration basins to maintain the mixed liquor concentration. The remaining solids, known as waste activated sludge (WAS), are thickened in the dissolved air flotation (DAF) thickeners before being sent to anaerobic digestion. The secondary clarifiers in Plant 1 have the capability of accepting mixed liquor from Plant 2, if a Plant 2 clarifier is out of service.

Table 1.4 Secondary Treatment
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
AERATION BASINS	
Plant 1	
Number of Basins	4
Volume in Service, MG	4.05
Anoxic Fraction, %	22
Internal Recycle Capacity, mgd	56
Plant 2	
Number of Basins	6
Volume In Service, MG	7.85
Anoxic Fraction, %	25
Internal Recycle Capacity, mgd	80
Blower Nos. 1, 2, and 3	
Types	Single-Stage Centrifugal, vertical Split
Flow, scfm each	12,500
Discharge pressure, psig	9.2
Inlet Temp, degrees F	110
Blower Nos. 4 and 5	
Types	Single-Stage Centrifugal, vertical Split
Flow, scfm each	9,000
Discharge pressure, psig	8.8

Table 1.4 Secondary Treatment
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
Inlet Temp, degrees F	110
SECONDARY CLARIFIERS	
Plant 1	
Rectangular	
Number of Basins	4
Length, ft	220
Width, ft	40
Surface Area, Total ft^2	35,200
Plant 2	
Circular	
Number of Basins	4
Diameter Units 5 and 6, ft	100
Diameter Units 7 and 8, ft	130
Surface Area, Total ft^2	42,250
RAS PUMPING	
Plant 1	
Number of Units	4 duty + 1 standby
Capacity, gpm each	4,000
Type	Vertical Centrifugal
Plant 2	
Number of Units	4 duty + 2 standby
Capacity, gpm each	3 @ 3,000, 3 @ 5,700
Type	Vertical Centrifugal
WAS PUMPING	
Plant 1	
Number of Units	1 duty + 1 standby
Capacity, gpm each	500
Type	Vertical Centrifugal
Plant 2	
Number of Units	3 duty + 3 standby
Capacity, gpm each	2 @ 300, 4 @ 315
Type	Vertical Centrifugal

1.3.5 Flow Equalization

Flow equalization precedes the final filtration. These units are constructed basins that dampen daily variations in flow and provide the filters with a stable flow. The flow equalization basins are shared by the two plants. Flow into the equalization basins is by gravity. The secondary effluent is pumped from the basins to the tertiary filters.

Table 1.5 Flow Equalization
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
EQUALIZATION PONDS	
Number of Units	4
Volume, Each, MG	1.5

1.3.6 Tertiary Treatment

Filtration removes suspended solids that are not eliminated by settling, which reduces the chlorine demand of the water and improves the disinfection process. The current installation includes 16 filters, Filters 1 to 10 and Filters 11 to 16. Each of the filters has a 24-inch layer of anthracite and a 15-inch layer of silica sand. Filters 11 to 16 are preceded by a chemical flocculation step that aggregates very small particles so that they can be efficiently removed in the filters.The plant uses alum ew-401 as a coagulant to aid in the filtration process. Alum is dosed continuously as required by the permit.

Table 1.6 Tertiary Treatment
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
TERTIARY FILTRATION	
Number of filters	16
Anthracite Depth, inches	24
Silica Sand Depth, inches	15
Surface Area, Each, ft^2 Filters 1-10	552
Surface Area, Each, ft^2 Filters 11-16	650
FLOCCULATION BASINS	
Number	10
Number of stages, each	2
Volume per basin, gallons	178,000
FILTER INFLUENT PUMPS	
Plant 1	2 duty + 1 standby
Plant 2	2 duty + 1 standby

Table 1.6	**Tertiary Treatment Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside**
Description	**Value**
Plant 1 Capacity, gpm	3 @ 13,050
Plant 2 Capacity, gpm	3 @ 8,000
MAIN BACKWASH PUMPS	
Number	2 duty + 1 standby
Capacity, gpm	3,200
Max. filter backwash rate, ft rise/min	0.3-0.4
Max. filter backwash rate, gpm/sf (unit)	25.52-26
Max filter backwash rate, gpm/filter	14,082/16,900
BACKWASH STORAGE TANKS	
Number	2
Volume, MG (each)	0.66
ALUM FEED SYSTEM	
Average Alum dosage, mg/L	10
Max. alum dosage, mg/L	20
Metering Pumps	2 duty + 1 standby
Capacity, gph each	48
Alum Storage Capacity, gallons	12,900
POLYMER FEED SYSTEM	
Average polymer dosage, mg/L	0.1
Max. polymer dosage, mg/L	1.0
Metering pumps	2
Capacity, gph each	410
Polymer storage capacity, gallons	3,000

1.3.7 Disinfection

Disinfection of the wastewater stream destroys the remaining pathogens in the treated effluent. This is accomplished by adding sodium hypochlorite and providing adequate contact time. Dechlorination, removal of the excess chlorine through the addition of sodium bisulfite, protects aquatic life after discharge to the Santa Ana River or the Hidden Valley Wetlands. This is done at the end of the chlorine contact basins before the water is discharged. The RWQCP has three chlorine contact basins. CCB1 discharges into Chlorine Contact Basin No. 2 (CCB2) or CCB3. Currently, CCB1 effluent is discharged into CCB3 and CCB2 is out of service.

Table 1.7	Disinfection Wastewater Collection and Treatment Facilities Integrated Master Plan City of Riverside
Description	**Value**
CHLORINE CONTACT BASINS	
Number of Units	3
CCB1	
Volume, gallons	448,320
Length to Width ratio	18.5:1
CCB2	
Volume, gallons	1,426,470
Length to Width ratio	63.5:1
CCB3	
Volume, gallons	2,900,000
Length to Width ratio	48:1
CHLORINATION SYSTEM	
Sodium hypochlorite	
Storage tanks, gallons	2 @ 20,000
Chemical metering pumps, gph	2 @ 360
Dechlorination System	
Sodium Bisulfite	
Storage tanks, gallons	2 @ 8,000
Chemical metering pumps, gph	2 @ 350

1.3.8 Other Facilities

1.3.8.1 Cogeneration

Cogeneration is a reliable power source, which could use existing energy resources such as the gas produced from the plant's anaerobic digesters and/or from the City-owned Tequesquite Landfill. By definition, cogeneration is the simultaneous production of two useful forms of energy from the same fuel source. Along with electric generation from cogeneration, recovered waste heat from the process is also used to meet the facilities' thermal demands.

Currently, the RWQCP is using digester gas sweetened with natural gas as the fuel source for the cogeneration. The cogeneration facility is made up of three units with internal combustion engines, each producing approximately 1,100 kW of power.

1.3.8.2 Impure Water and Makeup Water System

Many water uses within the plant do not require the potable quality of the City water system. An impure water system and a makeup water system have been installed to provide non-potable water for seal water for pumps, foam spray in aeration basins, polymer mixing/dilution water, alum mixing/dilution water, chlorine solution and injection, wash-down water, makeup water for process operation, and water hydrants throughout plant site. Table 1.8 shows the details of the impure water and makeup water pumps.

Table 1.8 Impure Water and Makeup Water Pumps
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
IMPURE WATER PUMPS (PUMP STATION NO. 21)	
Number of Units	5
Type	Centrifugal
Capacity, gpm	4 @ 500, 1 @ 1,050
MAKE-UP WATER PUMPS (PUMP STATION NO. 8)	
Number of Units	4
Type	Non-Clog Centrifugal
Capacity, gpm	2 @ 700, 2 @ 800

1.3.8.3 Hidden Valley Wetlands

Constructed wetlands are a treatment process that uses natural wetland species to control nitrogen. The Hidden Valley Wetlands are used to reduce the total inorganic nitrogen (TIN) in the plant effluent. Approximately 10 mgd of flow is diverted through the wetlands. A total of 70 acres of wetlands has been developed. Additional wetlands may be developed in the future as flow increases.

Table 1.9 Hidden Valley Wetlands
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Description	Value
HIDDEN VALLEY WETLANDS	
Number of Acres	
Maximum Amount	490
Currently Operated	49

1.3.8.4 Solids Handling Facilities

The solids handling facilities are discussed in the Biosolids section of the Master Plan in Volume 8, Chapter 1 - Existing Facilities.