Valley Sanitary District

Water Reclamation Facility Master Plan

FINAL

September 2015

Prepared for Valley Sanitary District
Indio, California

Prepared by MWH
Pasadena, California

Executive Summary

This Executive Summary of the Water Reclamation Facility (WRF) Master Plan for Valley Sanitary District (VSD) provides a concise description of the objectives, background, existing and future flow projections, existing capacity and recommendations for future plant expansion. Also summarized is the recommended phasing and costs for each phase.

ES.1 OBJECTIVES

This Master Plan has been developed under Task Authorization No. 3 between VSD and MWH Americas, Inc. (MWH) dated October 17, 2014.

The key objectives of the Master Plan are to:

- Assess the capacity of existing WRF unit processes.
- Determine the feasibility of continued use of the Biological Treatment Pond System (located to the south of the main WRF near the bird sanctuary) for secondary treatment.
- Prioritize unit process expansion or improvement.
- Forecast future flows using the 2013 Sewer Master Plan.
- Forecast future wastewater constituent loads to provide a basis for treatment unit sizing
- Select and size future treatment unit processes.
- Recommend phasing of treatment process expansion and improvements.
- Provide cost estimates (Capital and Operation & Maintenance) that can be incorporated into a phased Capital Improvement Program for the WRF.

In October 2006, Lee & Ro completed a Valley Sanitary District Wastewater Treatment Plant Master Plan. In November 2013, MWH completed a Collection System Master Plan, and among other outcomes determined the build-out flow for the area.

The goal of this Master Plan is to review the current capacities of pre-2006 as well as newly installed processes initially recommended in the Lee & Ro Master Plan, and to update treatment upgrades recommendations, phasing, and anticipated costs. Water recycling and cogeneration (developing electric power from digester gas) is also considered as part of this report. The future of the Biological Treatment Pond System is also discussed.

ES.2 BACKGROUND

The WRF is located adjacent to and on the southwest bank of the Whitewater River (also referred to as the Coachella Valley Stormwater Channel - CVSC). This stream ultimately discharges to the Salton Sea 15 miles to the east of the WRF.

The service area is 96% in the City of Indio. Using the City population projections as a basis, future population projection is shown in **Table ES-1**.

Table ES-1 Projected Population and Flow for Service Area

Year	City of Indio Population Projection	Projected Average Flow, mgd
2010	76,036	
2014 (current)	**82,398**	**6.0**
2015	87,486	6.4
2020	100,387	7.3
2025	106,923	7.8
2030	113,681	8.3
2035	120,676	8.8
2040	128,097	9.4
2045	135,976	9.9
2050	144,338	10.5
Build-Out	274.000	20.0

The flow is projected based on multiplying the City of Indio projected population by the average of 73 gallons per capita per day from 2014 (6,000,000 gallons / 82,398 = 73 gallons). Parameters developed for flow projections is shown in **Table ES-2**.

Flow projections are shown in **Figure ES-1**.

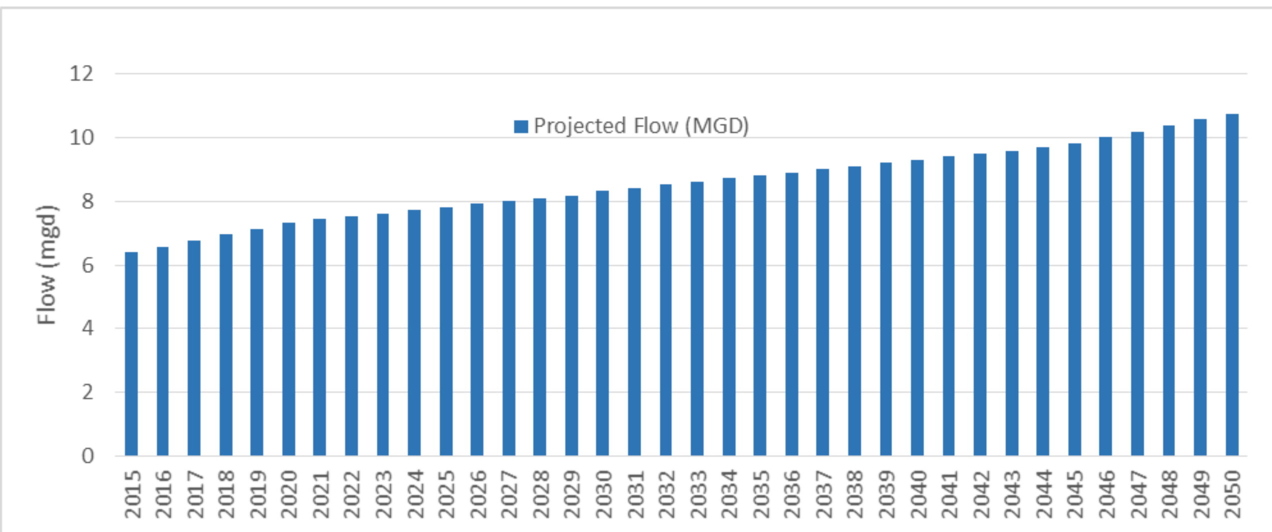


Figure ES-1 Projected flows

Table ES-2 Basis of Flow Projections

Existing Conditions		
Average daily flow	6.0	million gallons per day (mgd)
Served population	82,398	persons
Average per capita flow	73	gal/capita/day
Max Observed Wet Weather Inflow	16.5	mgd
Build Out		
Build-out Average Daily Flow	20	mgd
Build-out Peak Wet Weather Flow	44.5	mgd
Build-out Wet Weather Peaking Factor	2.2	-

Load projections for Biochemical Oxygen Demand, suspended solids and nitrogen are shown in **Table ES-3**.

Table ES-3 Existing BOD and TKN Loading

Water Quality Analysis		**50 percentile**	**90 percentile**	**99 percentile**
BOD	Concentration (mg/L)	256	313	354
TSS	Concentration (mg/L)	201	246	290
TKN	Concentration (mg/L)	49	52	53

BOD = Biochemical Oxygen Demand
TSS = Total Suspended Solids
TKN = Total Kjeldahl Nitrogen (measure of total organic nitrogen)

The 90%-ile BOD, TKN and TSS will be used for sizing the activated sludge basins, clarifiers and digesters. The 99%-ile BOD and TKN will be used for determining aeration requirements for the activated sludge plant.

ES.3 EXISTING WRF CAPACITY

The existing WRF liquid flow diagram is as shown in **Figure ES-2**. Biosolids process flow diagram is shown in **Figure ES-3**.

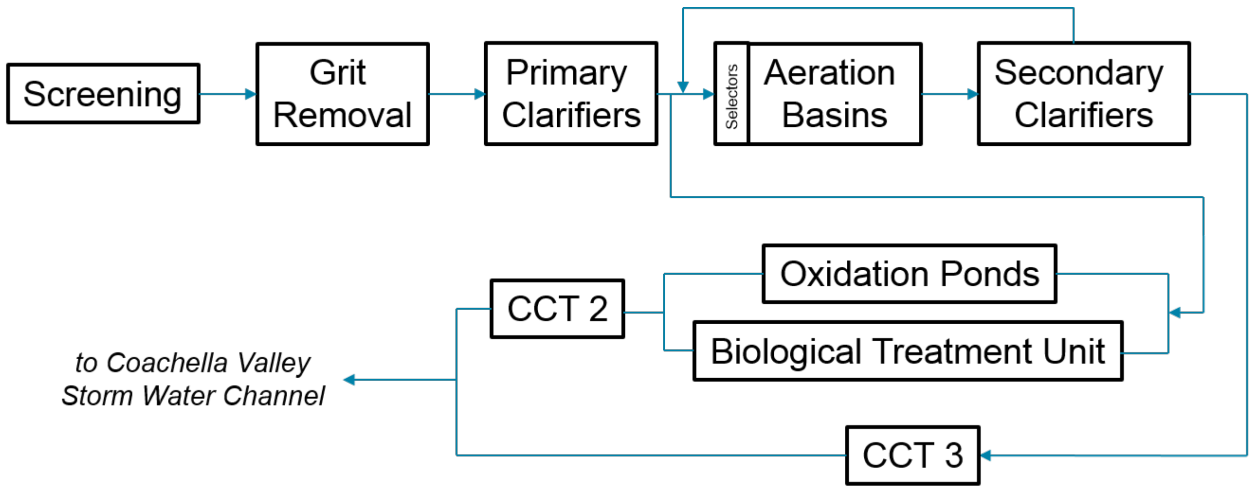


Figure ES-2 Existing Liquid Process Flow Diagram

The existing Biological Treatment Pond System (BTPS) south of Pond 3 has proven to be an ineffective secondary treatment facility. The recommendation is to decommission this facility to remove the vector attraction liability and cost of maintaining the facility.

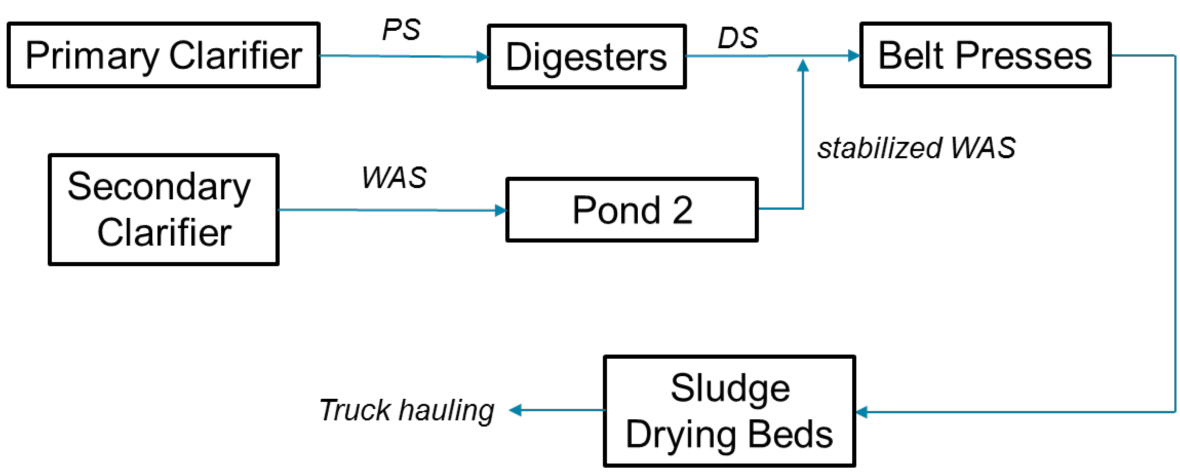


Figure ES-3 Existing Solids Process Flow Diagram

Figure ES-4 summarizes the capacity of each process in the existing WRF. As the graph shows, the most undersized processes are the grit chambers and the sludge drying beds. These will be the focus of the next phases of expansion for the WRF.

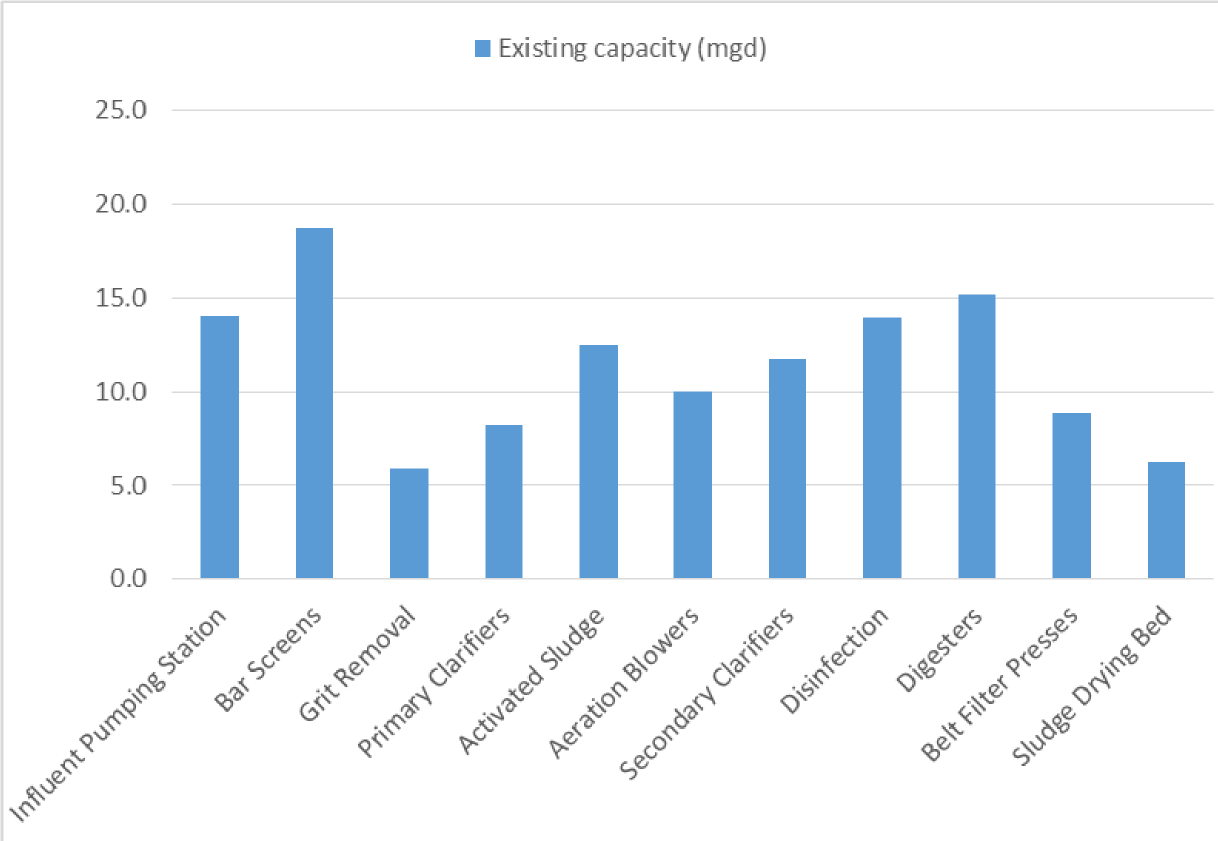


Figure ES-4 Existing WRF Process Capacity (Average Daily Flow)

ES.4 LIQUID PROCESS OPTIONS

Three liquid process options were developed, each with a different final effluent quality, but all sized for the build-out flow and loads.

- Option 1: Secondary without Nitrogen Removal (same as existing)
- Option 2: Secondary with Nitrogen Removal
- Option 3: Tertiary with Filtration (for recycling)

Figure ES-5, **Figure ES-6** and **Figure ES-7** show the process flow diagram differences between the three options.

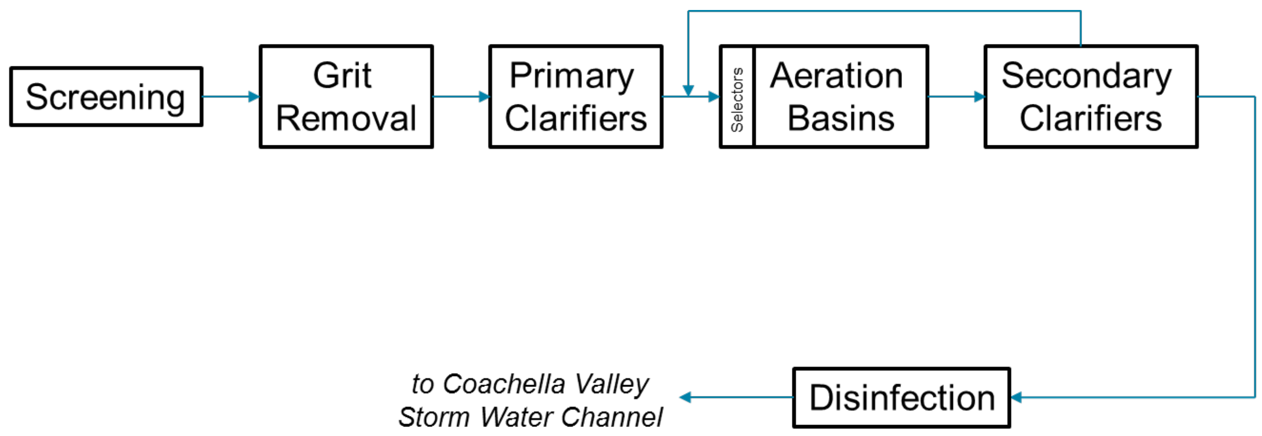


Figure ES-5 Option 1 Process Flow Diagram

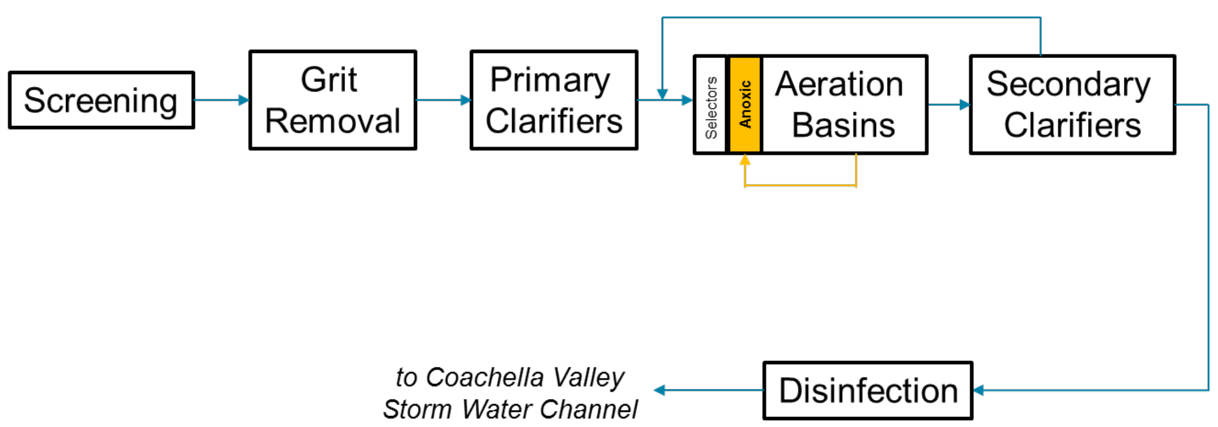


Figure ES-6 Option 2 Process Flow Diagram

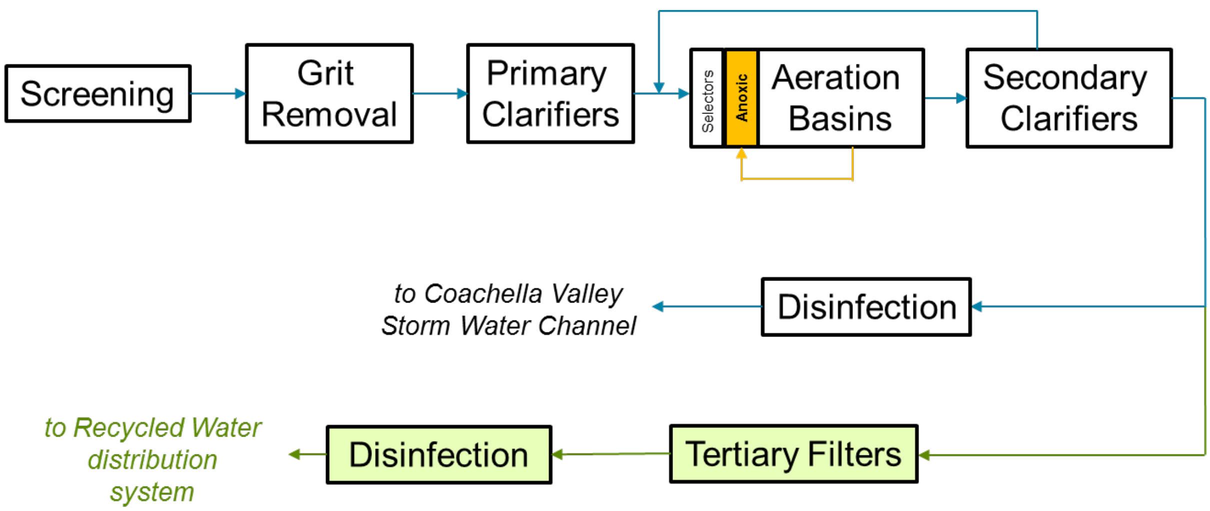


Figure ES-7 Option 3 Process Flow Diagram

The differences between Option 1 and 2 are the size of the aeration tanks (larger for Option 2), the size of aeration blowers (greater capacity for Option 2), and the addition of mixed liquor recycle (for Option 2). The headworks, primary clarifiers, (if selected) tertiary filters and all biosolids handling unit sizing are unaffected. Chlorine contact tanks size and (if selected) ultraviolet disinfection are not affected.

In the phasing plan assumptions were made that initially no changes to the effluent quality will be required (Option 1). When the plant reaches the capacity of the existing activated sludge plant (10 mgd as limited by blowers or 11.7 mgd as limited by secondary clarifiers), the new aeration tanks that replace the existing tanks are sized for nitrogen removal (Option 2).

Further, the phasing is based on providing Tertiary with Filtration (Option 3) when the plant flow approaches 8.2 mgd.

Note that filtration is not dependent on nitrogen removal and can work well with or without nitrogen removal in the secondary treatment process.

ES.5 BIOSOLIDS MANAGEMENT

Future biosolids processes are independent of which liquid treatment scheme is in use. Process selection is shown below in terms of technologies:

- Waste Activated Sludge thickening — Gravity Belt Thickener
- Biosolids Stabilization — Anaerobic Digestion
- Biosolids Dewatering — Belt Press
- Solids Drying — Solar Drying Beds

The above selections of biosolids management technologies do not differ from the existing solids processing system at the WRF with the exception of the handling of waste activated sludge (WAS). At present, WAS is discharged to Pond 2, stored and stabilized using surface aerators, then dredged to an existing belt press for dewatering. This method produces a well-stabilized sludge.

The future WAS will be thickened so that it is suitable for stabilization in the anaerobic digesters. In this manner, the digester gas production level will increase substantially once a means of thickening and digester capacity are available.

At present, well over 50% of all digester gas generated at the WRF is flared as a means of disposal. A small amount of digester gas is used in winter for heating water in the boilers for the digesters to maintain temperature.

ES.6 COGENERATION SUMMARY

General

For the WRF, cogeneration refers to generation of power from digester gas. Due to the relatively small amount of digester gas that is required for digester heating, a large fraction of the gas generated in the digesters will be available for energy generation.

The following technologies were evaluated for cogeneration at VSD:

- Internal Combustion Engines
- Microturbines
- Fuel Cells

Internal Combustion Engines are the most efficient of these three technologies. All three technologies require digester gas pretreatment, which can be complex. However, at the scale of gas production that would be available at the WRF at the build-out condition (20 mgd influent flow), the return on investment for cogeneration may be insufficient to warrant the investment.

At the current electricity cost of $0.107/kWh implementation of co-generation does not provide the required ROI of 50% to be financially feasible. Electricity costs need to rise slightly above $0.11/kWh to provide an adequate ROI.

Power Purchase Agreement

Another option for VSD would be contracting a specialized company through a Power Purchase Agreement (PPA) to purchase, install, maintain, and operate cogeneration units at the WRF. Such a company would guarantee an electrical output given a guaranteed gas production by VSD. VSD, in exchange, would buy the power produced by the cogen units. The advantages are that the capital investment, ownership, operation and maintenance of the cogen system is done by the power purchase contractor. The gas conditioning systems, in particular, can be difficult and require specialized knowledge. For small systems such as the one that could be installed at the WRF, there are many benefits of a contractor owning and operating the cogen system.

Typically, those types of agreement become beneficial when the production of the biogas production of the WRF reaches 100,000 cf/day. This type of gas production would be attained at VSD at the WRF after TWAS digestion begins and after the plant routinely receives 6 mgd.

Depending on the size of the system and the cost of power, the cogeneration electricity rate as purchased by VSD from the PPA could be as low as 80% of the utility rate, which would represent cost savings for VSD as well as biogas reuse.

A PPA would allow reusing the biogas without initial capital investment, would save power, and potentially reduce costs for VSD. In addition, the risks associated with operation of a complex gas conditioning and energy recovery system is transferred to the PPA.

Although the economies of cogeneration for an individual wastewater treatment facility may not be worthy of investment, many utilities have found that contracting with a cogeneration operator offers a viable means of benefiting from the production of digester gas.

ES.7 DESIGN CRITERIA SUMMARY

A list of all design criteria for the master planning phase are listed in **Table ES-4**. Note that the Biological Treatment Pond System may be demolished at any time.

Table ES-4 Phasing Plan

Process Unit or Parameter	Existing	Phase 2b	Phase 2c	Phase 3	Phase 4	Buildout
Design Flow (mgd)	5.9	5.9	8.2	10.0	13.3	20.0
Influent Pumps	5	5	5	5	5	6
Bar Screens ½”	2	2	2	--	--	--
Bar Screens ¼”	--	1	1	3	3	3
Aerated Grit Chamber	1	--	--	--	--	--
Vortex Grit Chamber (22-ft diameter)	--	1	1	1	2	2
Primary Clarifier (170’x20’x12’)	2	2	2	2	4	6
Aeration Tank Exist.	4	4	4	4	--	--
Aeration Tank New (281’x30’x20’)	--	--	--	--	4	6
Blowers, 4,500 cfm	3	3	3	3	--	--
Blowers, 6,000 cfm	--	--	--	--	5	7
Secondary Clarifier (95-ft diameter)	3	3	3	3	4	6
Ponds Available	2,3,N,S	2,3,N,S	3,N,S	3 (part),N	3 part	3 part
Biological Treatment Ponds	3	--	--	--	--	--
Chlorine Contact Capacity (mgd)	22.3	22.3	22.3	32.3	26.2	26.2
UV Disinfection Capacity (mgd)					13.5	20
Filters Capacity (mgd)	--	--	--	10	13.3	20
Gravity Belt Thickeners	--	2	2	2	2	3
Digesters (85-ft dia.)	1	2	2	2	3	4
Sludge Holding Tank	--	1	1	1	2	2
Belt Press (2 meter)	2	2	2	3	4	4
Solar Drying Bed Area (acres)	1.8	1.8	3	3	4	6

Figure ES-8 shows the capacity of each unit process with color code for each plant expansion phase.

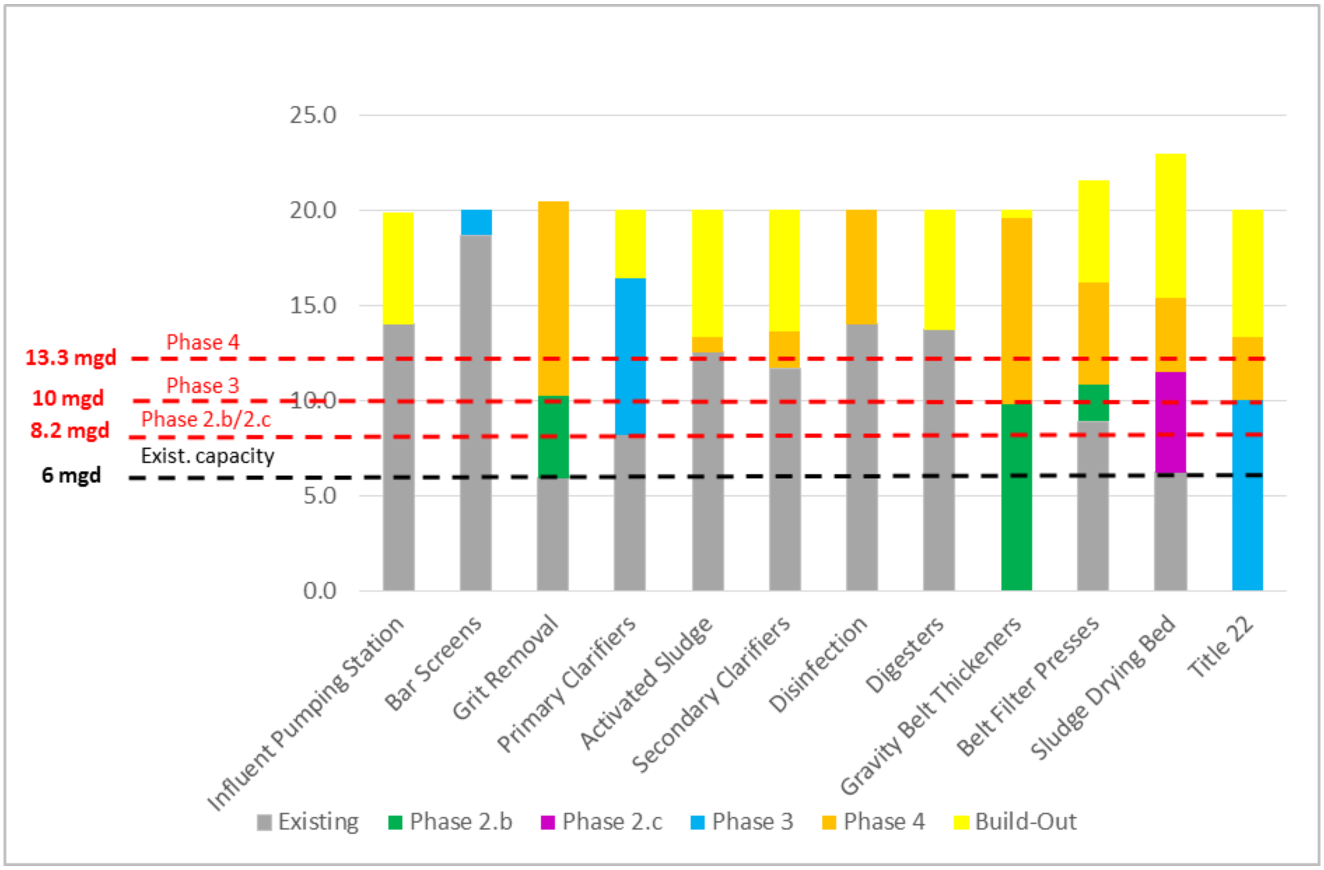


Figure ES-8 Process Treatment Capacities by Phase

Figure ES-9 shows the WRF flow projection together with the timing of each expansion phase.

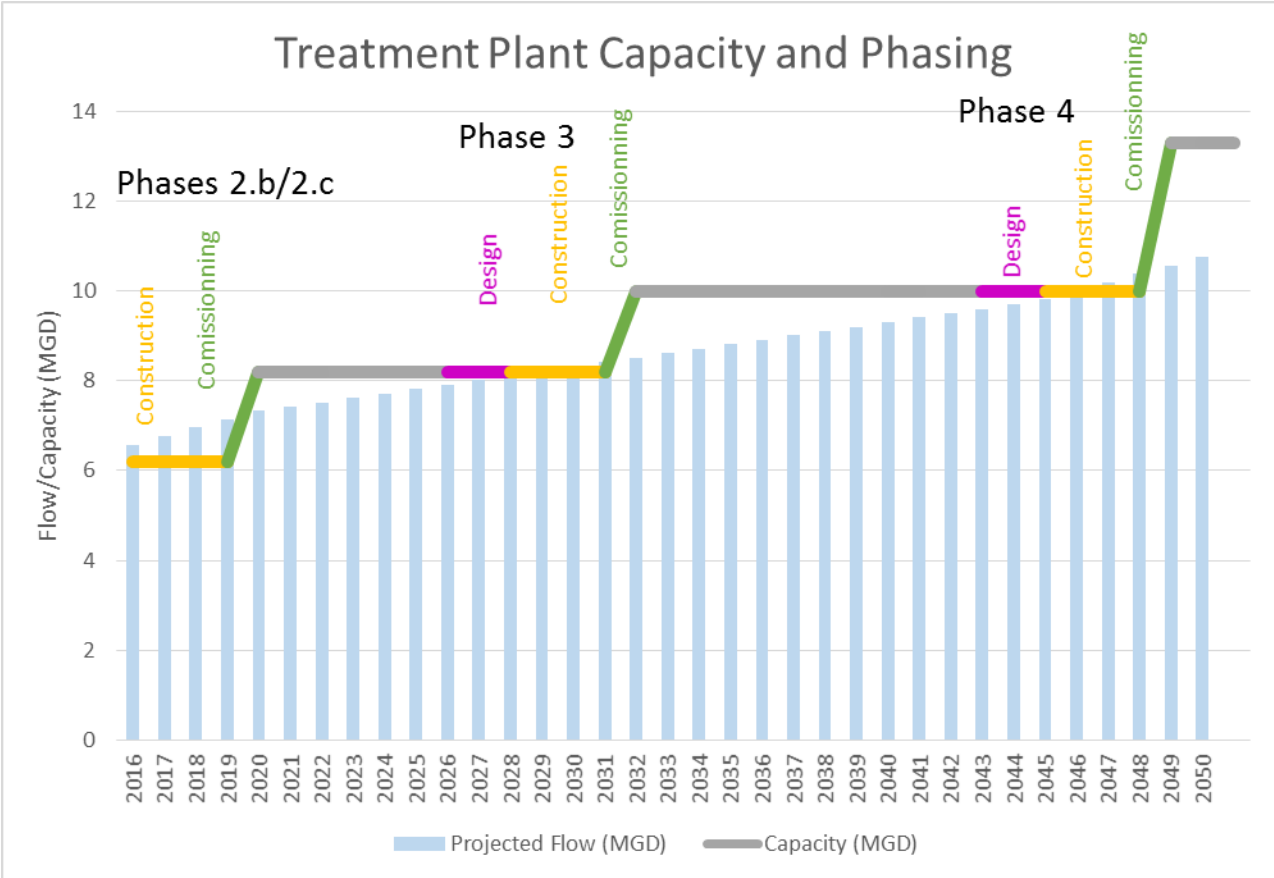


Figure ES-9 Flow Projection, Plant Capacity, and Proposed Phasing

Upgrades and costs per phase are summarized below:

<u>Phase 2b ($27.3 million)</u>

- Bar Screen, ¼-inch Spacing (1)
- Vortex Grit Chamber (1)
- Gravity Belt Thickeners (2)
- Digester (1)
- Sludge Holding Tank (1)
- Thickeners building
- BTPS decommissioning

<u>Phase 2c – 8.2 mgd ($15.7 million)</u>

- Solar Drying Bed Area (1.2 acres)
- Gas Storage Bladder
- Pond system decommissioning

Phase 3 – 10.0 mgd ($52.6 million)

- Bar Screen, ¼-inch Spacing (2)
- Filters (10 mgd)
- Chlorine Contact Capacity
- Belt Press (1)

Phase 4 – 13.3 mgd ($71.9 million)

- Vortex Grit Chamber (1)
- Primary Clarifiers (2)
- Aeration Tanks (4)
- Blowers (5)
- Secondary Clarifier (1)
- Filters (3.3 mgd)
- UV Disinfection Capacity (in existing Chlorine Contact Tank 3 – 13.5 mgd)
- Digester (1)
- Sludge Holding Tank (1)
- Belt Press (1)
- Solar Drying Bed Area (1.0 acre)

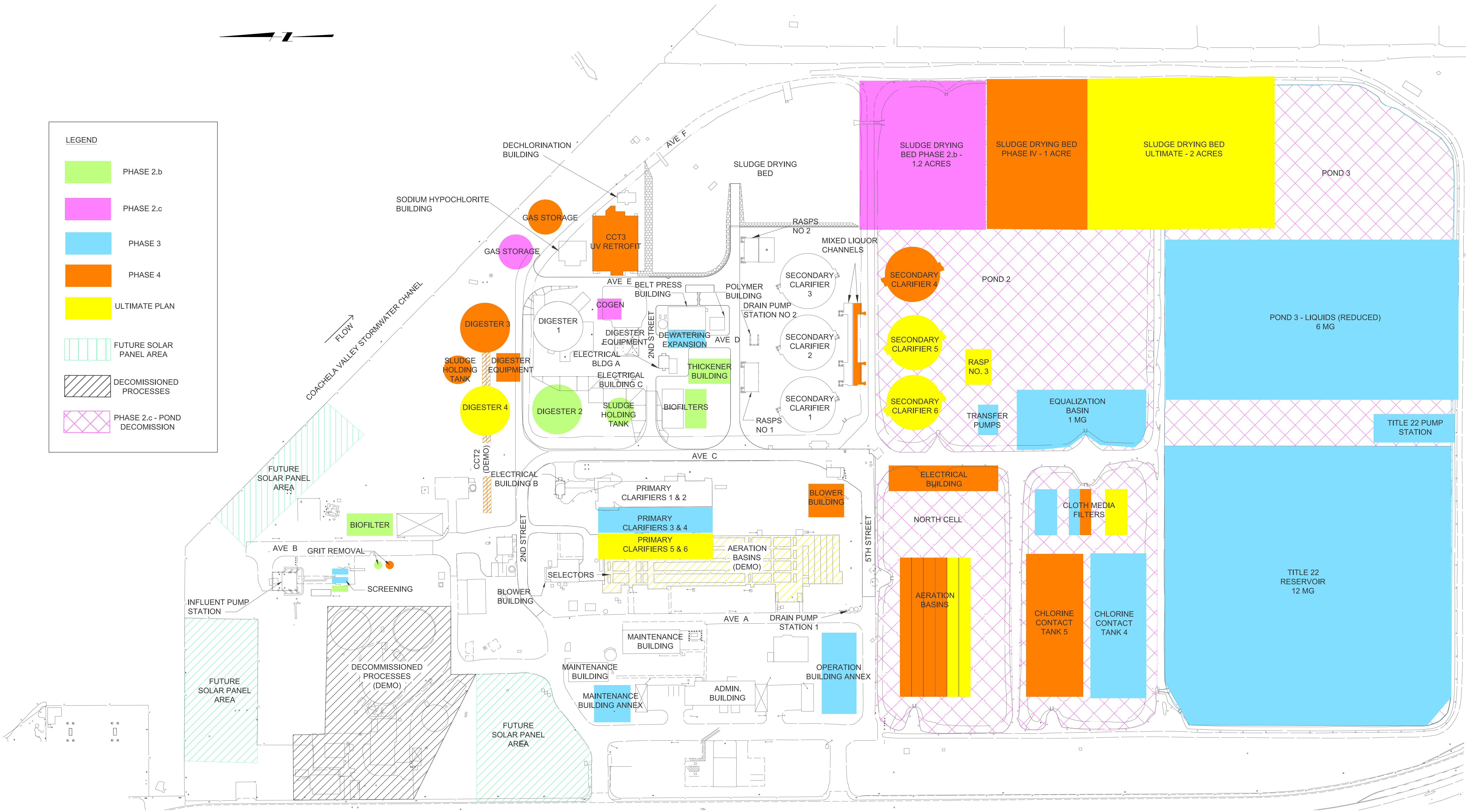
Buildout – 20.0 mgd ($47.6 million)

- Primary Clarifiers (2)
- Aeration Tanks (2)
- Secondary Clarifiers (2)
- Filters (6.3 mgd)
- Digester (1)
- Solar Drying Bed Area (2.0 acres)

ES.8 WRF SITE PLAN AND PHASING

The proposed site plan for the WRF and the phasing of improvements is shown on **Figure ES-10**. WRF expansion and improvements can fit on the existing north section of the WRF property, leaving the southerly portion now occupied by the BTPS for other uses.

Since the existing system for handling WAS involves use of one of the Ponds, and that same pond area will be required for the first phase of Solar Drying Bed addition, this places a constraint on construction sequencing. Before additional solar drying beds can be constructed, a new means of thickening and stabilizing WAS must be implemented. For this reason, two phases are required to bring the plant process units fully to 8.2 mgd at average flow (Phases 2b and 2c).



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SCALE 1"=80'

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DESIGNED S CALVET
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MWH

VALLEY SANITATION DISTRICT
Figure ES-10
Site Plan and Phasing

WATER RECLAMATION FACILITY
MASTER PLAN

SHEET

JobNumber

ES.9 BIOLOGICAL TREATMENT POND SYSTEM DECOMMISSIONING

The existing Biological Treatment Pond System (BTPS) serves no wastewater treatment purpose. The plan for decommissioning the BTPS includes several steps and options.

All three ponds may be fully decommissioned, or a partial decommissioning may be done leaving one or two ponds in place. Partial decommissioning will not eliminate the annual cost of maintaining the ponds, but will reduce the cost.

However, the recommended action is to completely decommission all three of the BTPS ponds.

ES.10 CAPITAL AND OPERATION & MAINTENANCE COST SUMMARY

Table ES-5 below summarizes for each phase of WRF expansion the capital and annual O&M cost. Capital costs include construction, contingency, engineering and administration. Staffing requirements for Treatment Plant O&M is also estimated for each phase.

Note that Annual O&M Cost does not include an accounting for depreciation. Nor do the O&M costs include Laboratory, Collection System or Administration. The table includes the current plant O&M figure (excluding depreciation).

Table ES-5
Summary of Capital Improvement Program

Phase	Constr. Year	Flow Capacity, mgd	Project Cost WRF Only (2015 $M)	Project Costs Tertiary Only (2015 $M)	Total capital cost (2015 $M)	O&M Staffing	Annual O&M Cost (2015 $M)	Annual O&M per MG
Current	--	6.2	--	--	--	13	$3.22	$1,420
2b	2016	6.2	$27.0	--	$27.0	13	$3.22	$1,420
2c	2017	8.2	$15.7	--	$15.7	15	$4.09	$1,370
3	2027	10.0	$18.0	$34.6	$52.6	17	$5.57	$1,530
4	2045	13.3	$57.6	$14.3	$71.9	21	$7.26	$1,500
Build-out	--	20.0	$39.8	$7.8	$47.6	26	$10.0	$1,370