CHAPTER 5

Wastewater Treatment Plant

Chapter 5 – **Wastewater Treatment Plant**

5.1 Introduction

This Chapter of the General Sewer Plan evaluates the capacity and condition of the existing facilities at the City of Richland Wastewater Treatment Plant (WWTP) to adequately treat current and projected flow and loads to meet current NPDES permit discharge requirements. The chapter relies heavily on both previous work and plant input to determine the reliable treatment capacity of each individual unit process. A list of short-term recommended improvements and subsequent process evaluations is the primary outcome of the chapter.

The WWTP treats primarily municipal wastewater through primary sedimentation and secondary activated sludge process. Chlorine is injected prior to discharge to the Columbia River for disinfection. Solids are thickened with dissolved air flotation, mesophillicaly digested, dewatered on belt presses and transported to the City composting facility to attain a Class A compost which is sold to the public through wholesale distributors.

Except for the aeration basins and air delivery system, the facilities at WWTP have not been substantially upgraded since original design. The original surface aerated basins were converted in 2000 and 2003 to plug flow staged aeration basins with disc diffuser aeration.

5.1.1 Approach

Documentation review was used as the basis of the evaluation of the hydraulic and treatment capacity of the unit processes. This documentation review included previous sewer comprehensive plans, design documentation of plant facilities, and process capacity evaluations. Primary sources include the following:

- WWTP Capacity Assessment Report (2003)
- General Sewer Plan Update (2004)
- Original Design documentation (1988)
- Operations and Maintenance Manual (2008)

Current and projected flow and loads were adopted from the analysis presented in **Chapter 3**. Additional analysis on the solids stream was conducted in this Chapter to identify any gross incongruities in the WWTP solids balance, and analyze digester loadings under different solid thickening scenarios than those currently in use. The current and projected loadings were compared to the estimated unit capacities developed from previous documentation to estimate available capacity in each unit process.

Subsequent to the preliminary unit process capacity analysis, a workshop was held with City staff to review the initial findings and assess the condition of existing facilities. The workshop presentation is included as **Appendix L**. A two-hour walkthrough with WWTP plant staff of the facilities identified plant reliability concerns with existing equipment. Plant staff highlighted the criticality of existing equipment for reliable operation of plant facilities. Both the condition and criticality of equipment to plant operations were inventoried and used to determine the recommended upgrades.

5.1.2 Current Plant Upgrades

The Solids Upgrade Project, currently in construction, includes replacement of thickening and dewatering equipment, and the waste activated sludge (WAS) pumps. The Disinfection Upgrade Project replaces the existing chlorine gas system with a hypochlorite generation and supply system. The City is procured and installed the new hypochlorite production and injection system in June 2015.

5.1.3 NPDES Permit

A summary of the 2009 NPDES permit is shown in **Tables 4.1** and **4.2** which identify the allowed influent flows and loads as well as the discharge requirements. As can be noted by the ammonia discharge limit, which is below the influent ammonia concentration, partial nitrification in the secondary process is required. The permit and fact sheet are included in **Appendix O**.

5.1.4 Influent Flows and Loads

The current influent flow and loads are shown in **Table 5-1** and the projected influent flow and loads are shown **Table 5-2**. As described in **Chapter 3**, these are based on measured influent loads with projections calculated using current peaking factors and projected population growth. **Table 5-3** presents the current influent values compared to rated plant capacity. **Table 5-4** presents the projected influent values compared to rated plant capacity. The current TSS and BOD loadings are nearly 80 percent of rated plant capacity and the projected 20-year BOD and TSS loadings are over 100 percent of plant rated capacity. Both current and projected influent flows remain below plant rated capacity. Both the BOD and TSS concentration have increased over 50 percent from the original design criteria. The increases in concentration can be due to water conservation measures and sewer conveyance system upgrades. However, the highest loadings tend to be during the lowest flows, which points to the influent sampler measuring settled as well as suspended material. In the 2004 General Sewer Plan the accuracy of influent sampling of BOD and TSS was questioned. The solids balance analysis, as described in **Section 5.3** of this chapter, also reveals discrepancies between the influent loadings and primary solids production. To verify the accuracy of the influent sampler, plant staff increased the flow rate near the sampler. BOD and TSS loadings initially decreased to concentrations more in-line the plant effluent permit, but in the wet weather months of 2014 the BOD and TSS loadings were in-line with previous years data analyzed in Chapter 3. Continued monitoring is required to verify the influent loadings continue to trend downward over seasonal variations in flow and load conditions.

In addition to the requisite flow and load parameters of Average Day, Maximum Month, Peak Hour and Peak Event which are considered in determining the hydraulic and treatment capacity of each unit process, a Maximum Three Month value has been calculated for current and projected flow and loads. Washington Administrative Code (WAC) requires that a WWTP upon exceeding 85% of the permitted flows and loads for three consecutive months must undertake either improvements to increase treatment capacity or an engineering report to reevaluate or "rerate" the plant capacity.

Table 5-1 – Current Flow and Loads

	Flow (mgd)	BOD (ppd)	TSS (ppd)	BOD (mg/L)	TSS (mg/L)
Average Day	5.70	11,032	12,911	235	273
Maximum 3 Month	6.20	13.238	16.547	260	321
Maximum Month	6.25	14,099	18,146	270	348
Peak Day	7.50	18,870	25,157	302	419
Peak Hour	9.41	-	-	-	-

Table 5-2 – Projected Flow and Loads

	Flow (mgd)	BOD (ppd)	TSS (ppd)	BOD (mg/L)	TSS (mg/L)
Average Day	8.21	15,910	18,620	235	273
Maximum 3 Month	8.95	19,090	23,830	260	321
Maximum Month	9.03	20,360	26,250	269	348
Peak Day	10.83	27,210	36,310	301	418
Peak Hour	13.54	-	-	-	-

Table 5-3 – Current Flow and Load Compared to Plant Capacity

	Flow (mgd)	BOD (ppd)	TSS (ppd)	BOD (mg/L)	TSS (mg/L)
Maximum 3 Month	6.25	13,238	16,547	270	348
Permitted Max Month	11.4	17,250	21,500	181	226
% of Permitted Capacity	52%	77%	77%	-	-

Table 5-4 – Projected 20-Year Flow and Load Compared to Plant Capacity

	Flow (mgd)	BOD (ppd)	TSS (ppd)	BOD (mg/L)	TSS (mg/L)
Maximum 3 Month	8.78	19,090	23,830	260	321
Permitted Max Month	11.4	17,250	21,500	181	226
% of Permitted Capacity	77%	111%	111%	-	-

Table 5-3 and **Table 5-4** indicate that in the near future (approximately 2020) the three month loadings will exceed 85% of plant rate capacity assuming a continuation of the current sources to the WWTP. At that time an engineering report will be required by the WAC as stated in the NPDES permit to reassess the capacity of plant and either rerate the capacity or develop plant improvements to provide more capacity. The trigger for this evaluation will be determined when three consecutive monthly DMRs show 85% capacity. We estimate this to be approximately 2020; however, recent changes in influent sampling may delay the realization of this requirement further.

5.2 Unit Process Capacity and Condition Evaluation

A process flow chart of existing facilities is provided in **Figure 5-1**. Key parameters of major unit processes are shown in **Table 5-5**. The following unit processes were evaluated in this Chapter:

- Influent Screening
- Influent Pumping
- Secondary Screening
- Aerated Grit Removal
- Primary Clarifiers
- Aeration Basins
- Secondary Clarification
- Digestion

Figure 5-1 – Process Flow of Existing Facilities

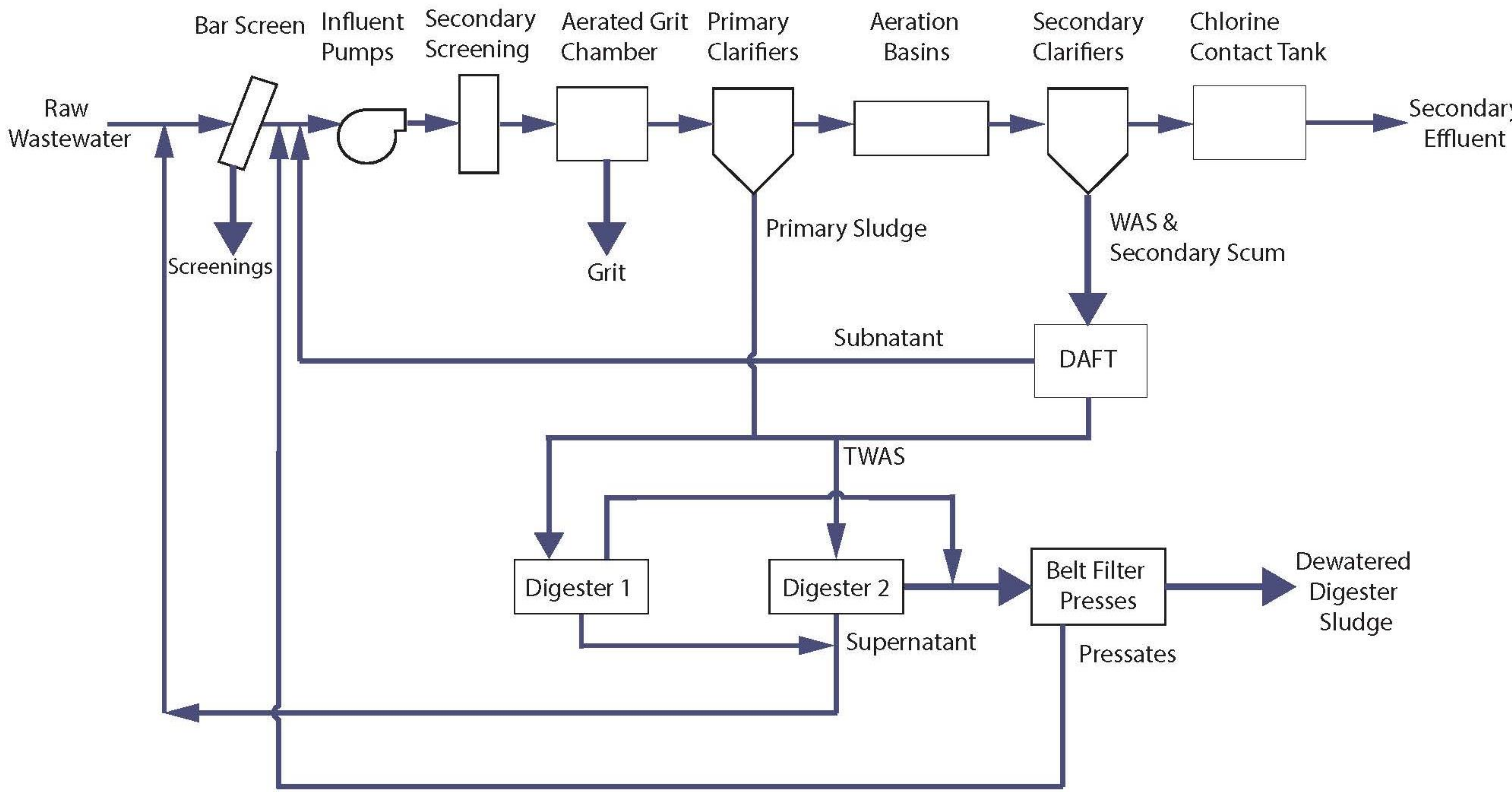


Table 5-5 – Major Unit Process Key Parameters

Process Element	Number of Units	Design Data
Bar Screens	1	
Openings Between Bars, inch		3/8"
Influent Pumps	4	
Power, hp		1@75, 3@100
Total firm capacity, mgd		24
Aerated Grit Chambers	1	
Length, feet		38
Width, feet		22
Depth, feet		16.5
Total volume, gallons		130,000
Primary Clarifiers	2	
Diameter, feet		85
Sidewater depth, feet		10
Surface area per clarifier, square feet		5,674
Aeration Basins	2	
Length, feet		145
Width, feet		100
Sidewater depth, feet		20
Volume per basin, MG		1.8
Secondary Clarifiers	2	
Diameter, feet		85
Sidewater depth, feet		15
Surface area per clarifier, square feet		14,314
Chlorine Contact Chamber	1	
Volume per chamber, cubic feet		34,000
Dissolved Air Flotation Thickener	1	
Diameter, feet		35
Depth, feet		10
Surface area, square feet		962
Anaerobic Digester	2	
Diameter, feet		60
Depth, feet		28
Volume per digester, gallons		617,000
Belt Filter Press	2	
Belt width, meter		2

5.2.1 Influent Screening

Influent screening consists of one automated 3/8-inch bar screen and one manual bar screen, one screenings washer-compactor, and a screenings bin. Odor treatment facilities are no longer in-service. Plant staff directs all flow to the automated bar screen when it is in-service.

Performance and Capacity: In previous documentation, neither the hydraulics nor the condition of the bar screen facility were analyzed: therefore, in this report a hydraulic model was developed to assess the capacity of the bar screen. Assuming 50 percent blockage, 14 mgd produces a hydraulic loss that matches the peak hydraulics conditions indicated on the original design drawings.

Plant staff reports the performance of the bar-screen to be unsatisfactory. It is over 30 years old and replacement parts are difficult to find. Several major mechanical failures have occurred recently to bearings, motor, and frame structure. Therefore, it is scheduled for replacement in 2017.

Redundancy: The manual bar screen provides 100 percent redundancy on failure of automated bar screen.

Condition: The automated bars screen is nearing the end of its useful life. Deterioration of metal components due to exposure to hydrogen sulfide as well as 20 years of uninterrupted service has reduced the reliability of this critical unit process. The washer/compactor is also at the end of its useful life. Staff report that the automated bar screen has been out of service for repairs multiple times in the past year. This requires use of the manual bar screen and results in less effective screening and a higher demand on plant personnel.

The odor control equipment in the screening facility has been out-of-service for multiple years and is no longer functioning. Ventilation facilities do not adequately remove odors from the screenings building exposing staff and equipment to hydrogen sulfide.

5.2.2 Influent Pumping

Influent pumping system includes four vertical turbine pumps with associated valving. Typical operation is one to two pumps in-service with the additional pumps providing redundancy.

Performance and Capacity: Three pumps, each with a rated capacity of 9 mgd and one with a 6 mgd capacity provide 24 mgd of reliable capacity, which is well above the peak flow values projected over the next 20 years. The combination of smaller and larger pumps allows for diurnal variations in flow to be met without the need to store influent in the conveyance system.

Redundancy: The multiple pumps available for service provide suitable redundancy for current and future flows.

Condition: The pumps are well-maintained by plant staff, but are over 20 years old and will require major rebuilds in the future. The discharge valves had evidence of leaking and corrosion and may need to be replaced in the next 10 years. Although the pumps are nearing the end of their useful life, the substantial redundancy in the pumping capacity reduces the criticality of an influent pump failure to plant operations.

5.2.3 Secondary Screening

The secondary screening consists of fine screening, washing and compacting. These facilities were added after initial plant construction and designed to remove a higher level of screenings material to improve the quality of biosolids.

5.2.4 Aerated Grit System

The aerated grit system consists of an aerated grit chamber, aeration blowers, grit pumps, classifiers, and grit bins. It is located directly upstream of the primary clarifiers.

Performance and Capacity: The capacity of the aeration grit tank, blowers, pumps and classifiers exceeds the rated plant maximum month capacity of 11.5 mgd, applying industry standards and Department of Ecology Orange Book design criteria. The equipment is well-maintained and has suitable redundancy. Plant staff reports the aerated grit removal system operates reliably, and excessive grit deposition has not been evident upon cleaning of the aeration basins or primary clarifiers.

Redundancy: The aerated grit pumps and blowers have suitable redundancy under maximum hydraulic loadings as noted in the referenced publications.

Condition: Plant reports all equipment operates reliably. Equipment was not directly observed in the plant walk-through; therefore, the condition assessment relies on plant staff observations. Plant staff have noted the need to update the odor control in this room.

5.2.5 Primary Clarifiers

Primary clarification consists of two circular primary clarifiers, with scum removal, and two air diaphragm pumps, which pump both primary sludge and primary scum by alternating the pump suction location. The liquid stream continues from primary clarification to the aeration basins. The primary sludge is thickened in the clarifiers then transferred with the scum to the digesters.

Performance and Capacity: The Process Capacity Evaluation in 2002 estimated the removal efficiency of primary clarifiers under the hydraulic and solids loading of 7.46 mgd and 15,000 ppd to be around 60 percent for total suspended solids (TSS) and 40 percent for BOD which is in the expected range of performance. Estimates of the primary clarifier hydraulic capacity from previous reports indicate the discharge weir will be submerged at 14 mgd, well below the projected plant hydraulic peak loadings. At current flow and loads plant staff operate only one of the two clarifiers year-round; however, the plant did start operating both clarifiers in December 2015 to alleviate some problems that were occurring in the aeration basins.. The reduction in removal efficiency of the primary clarifiers at higher hydraulic loadings, than previously assessed, places a larger treatment burden on the aeration basins. However, as described in the subsequent section, only one of two aeration basins is currently operated year-round. Current and projected overflow rates with two clarifiers in-service are compared in **Table 5-6** to Orange Book recommended values.

Table 5-6 – Projected Overflow Rates Compared to Orange Book

	Current Flow (mgd)	Overflow Rate (gpd/sf)	Projected Flow (mgd)	Overflow Rate (gpd/sf)	Orange Book (gpd/sf)
Average Annual	5.70	494	7.99	693	800
Maximum Month	6.25	542	8.79	762	1,200
Peak Day	7.50	651	10.50	911	2,000

The primary sludge diaphragm pumps reliably convey thickened primary sludge to the digesters. However primary sludge flow measurement based on pump stroke and volume calculations may be inaccurate, as was the case with WAS flow calculation prior to replacement of the air diaphragm pumps with rotary lobe pumps and magnetic flow meters.

Redundancy: At current flows and loads, 100 percent year round redundancy of the primary clarification system exists. At projected loads, plant staff will have the flexibility to run a primary clarifier during higher flow periods to increase the removal efficiency of the system and reduce the loading to the secondary system.

Condition: The primary clarifiers are well-maintained, but will require recoating to prevent deterioration of the mechanism and extend the equipment's useful life. The gear drives are scheduled to be rebuilt in 2017. The air diaphragm pumps are near the end of their useful life, but continue perform reliably.

5.2.6 Aeration Basins

The aeration basins consist of two aeration basins, two 300-hp turbo blowers and four 125-hp multi-stage centrifugal blowers. Each aeration basin has seven zones with automated dissolved oxygen control at each stage. Typically the first stage is unaerated and operated as a biological selector. The remaining zones are aerated under normal operation although the second zone can also be run as unaerated in a larger selector is required.

Performance and Capacity: The performance and the capacity of the aeration basins has been extensively studied in previous documentation including the WWTP Capacity Assessment Report (2004). This analysis relies on the biological modeling presented in those studies. Currently the plant operates year-round with one aeration basin in-service and one 300-hp blower in-service. The projected flows and loads over the planning period increased by only 50 percent. Sufficient aeration and treatment capacity will exist over the planning period, assuming current solids retention times are maintained.

Condition: The aeration basins and blowers are in good condition. However, staff have noted some warping of the marine plywood separating the five individual cells – this may be causing some by-passing of mixed liquor from Cell 1 directly to Cell 5. Repair or replacement of the plywood should be considered. Maintenance and repair of the diffuser system and blowers is ongoing to maintain reliable operation.

5.2.7 Secondary Clarifiers

The secondary clarifier system consists of two secondary clarifiers, two return activated sludge (RAS) pumps and two waste activated sludge pumps.

Performance and Capacity: A single secondary clarifier reliably treats current flows and loads year-round. Sludge volume indexes (SVI) vary from 300 to 120 over the data period, but more recently have been in the range of 180 to 120. At these lower SVIs and assuming a MLSS of less than 2,500 mg/L previous studies, including the WWTP Capacity Assessment Report (2004), have shown the clarifiers have nearly 21 mgd of treatment capacity. This will accommodate even the projected peak hydraulic loadings. The hydraulic analysis included in the WWTP Capacity Assessment Report (2004) indicated the discharge weir will be submerged at 14 mgd. Secondary Clarifier overflow rates at current and future flows and loads are compared to applicable Orange Book values in the **Table 5-7**.

Table 5-7 – Secondary Current and Future Flows and Loads Compared to Orange Book

	Current Flow (mgd)	Overflow Rate (gpd/sf)	Projected Flow (mgd)	Overflow Rate (gpd/sf)	Orange Book (gpd/sf)
Average Annual	5.70	199	7.99	279	600
Maximum Month	6.25	218	8.79	307	800
Peak Day	7.50	262	10.50	367	1,200

One operational parameter that may need to be addressed in the future is the low RAS and WAS concentration which is often below 5,000 mg/L. The inability to effectively control or increase the RAS and WAS concentration results in a higher return flow rate as the loadings increase. This higher return flow increases both the hydraulic and solids loading on the secondary clarifier system. During the plant walk-through the City discussed upgrading the RAS rate control by implementing variable frequency drives (VFD) on the RAS pumps. Currently valves at the Aeration Basin Distribution Structure are modulated to adjust the RAS flow rate and thus the concentration. In addition to increased loading to the secondary clarifier, lack of RAS flow control can result in swings in the solids retention time (SRT) of the diurnal flows if wasting rates remain constant. Finally, the WAS concentration affects the cost and performance of the thickening process. Higher WAS concentrations could result in lower polymer costs, greater digester capacity and operational flexibility, and potentially higher dewatered solids concentration.

Capacity of the WAS pumps is also of concern to plant staff. The Solids Upgrade Project will replace existing WAS pumps with larger capacity rotary lobe pumps.

Redundancy: Currently the secondary clarifier system operates with 100 percent redundancy year-round. At projected flow and loads plant staff will have the flexibility to operate two secondary clarifiers as flow and loads warrant, or as SVI increases.

Condition: The secondary clarifiers and RAS and WAS pumping systems are well-maintained and in good condition. The WAS pumps are of different manufacturers and require multiple part inventories. Coating of clarifiers and possible future mechanism replacement will be required to maintain reliable operation in the future. The gear drive is scheduled to be rebuilt in 2017.

5.2.8 Digestion System

The digestion system consists of two parallel operating mesophilic digesters each with a pump mix system. A single boiler which runs on biogas with diesel fuel back-up provides heat to two sludge/water heat exchangers to maintain mesophilic temperatures within the digesters. Additional equipment within the digester control building includes the dewatering feed pumps, thickened WAS pumps and heat exchanger recirculation pumps.

Performance and Capacity: With both digesters in-service year-round in parallel feed mode, the digestion system operates reliably with volatile acids being steadily below 100 mg/L and alkalinity above 5000 mg/L. The current SRT value of 38 days is above the 15 days required to meet Class B and maintain reliable digester operation. The solids loading on the digestion system due to the lower concentration of the thickened WAS and RAS is below 0.10 pounds per cubic foot per day under current and projected conditions.

The current parallel feed mode, where both digesters are fed thickened WAS and primary sludge has been adopted to replace the series feed mode intended in the original design. Historically, foaming issues limited the loading to the digesters and required both digester volumes be used in parallel. Currently, the lower concentration of thickened primary sludge and thickened WAS decreases the SRT for single digester operation below recommended values during maximum month conditions so parallel digester operation is required. The assumed digester feed concentration during original design was 6-7 percent. Current operation feeds solids at 3-4 percent, which produces a volumetric increase of the 100 percent compared to the original design. The current Solids Upgrade Project will replace existing thickening equipment and may be able to produce a higher concentration of thickened WAS. The ability of the plant to operate on one digester during digester cleaning activities is unknown. A digester cleaning event scheduled for the summer of 2014 has been postponed to 2016.

Heating efficiency has been improved through insulation of the two digester roofs. Mesophilic temperatures are maintained throughout the year using biogas as the primary heating fuel.

SRT and volatile solids loading rates under current and projected loads is shown in **Table 5-8**. In calculating the SRT it is assumed the digesters are fed over a 24 hour period. Values shown are for two digesters operating in series.

Table 5-8 – Digestion System Operational Evaluation

Flow Condition (mgd)	Current SRT (days)	Current vs. Loading Rate (ppd/cf)	Projected SRT (days)	Projected vs. Loading Rate (ppd/cf)
Maximum Month	38	0.05	27	0.08

The capacity of the digestion system is highly dependent on the operating parameters of the solids thickening processes which determine the SRT and the operation of the selector in the aeration basins to remove the microbial organisms that cause foaming.

Condition: The digesters and associated pumping equipment are in good condition. Relocation of digester gas piping from the digester control building is desirable to plant staff for current code compliance and safety reasons. The relocation of the piping would improve the equipment life of the motor control centers. The current motor control centers are scheduled for replacement in the near future. Coating of the digester interiors and improvements to the Digester Control Building HVAC will enhance the digestion systems reliability and ease of operation (one was coated three years ago). Additional controls on the boiler were completed last year and will improve monitoring and energy efficiency, and lessen O&M costs associated with boiler operation. Wholesale replacement of the boiler is being completed now as it is nearing the end of its useful life.

5.3 Solids Stream Unit Process Loading Analysis

To better determine the effect of variation in the operation of the solids thickening process and to estimate the effect of projected flows and loads on the loadings to the digestion system, a solids balance model was developed as shown in **Figure 5-2**, which is included to demonstrate the process stream evaluated. This model uses solids stream flow and loading inputs along with adjustable performance criteria of the solids stream unit processes to assess performance of the digestion system at the selected flows and loads. The figure does not represent a current or projected operational point. Plant data from 2009-2014 was used to determine current solids stream flow and loads. Projected conditions were estimated by increasing solids stream flow and loads by the same percentage as the projected influent flow and loads. Although this approach does not account for variations in the primary and secondary operational protocols, it does provide a reliable assessment assuming solids production processes do not vary substantially over the planning period.

5.3.1 Data Analysis

In developing the current solids stream flow and loads, three discrepancies in the data were observed as listed below along with probable explanations for the deviations. These deviations occur less frequently after the adjustment to the flow rate near the influent sampler – reference **Section 3.2.2**.

1. The measured thickened WAS flow increased dramatically in 2013 by up to 30 percent. Plant staff identified this change as a result of replacing the air diaphragm pumps with rotary lobe pumps and installing a magnetic flow meter.
2. The measured thickened primary total solids in pounds per day was less than 30 percent of expected given the influent solids loading and expected removal percentages for the primary clarifiers. Two factors may account for this under measurement.
    - The influent TSS and BOD measurements are higher than the actual concentrations especially during low flow periods. The location of the intake to the sampling unit measures settled material, increasing the measured concentration. TSS and BOD concentrations dropped when plant staff increased flows near the BOD and TSS sampler intake but increased again to expected levels.
    - The flow calculation from the primary sludge pumps may be lower than the actual flow, as was the case with the thickened WAS flow rate calculation prior to replacing the pumps with rotary lobe pumps. With ODS pumps, the flow is calculated from the volume of each stroke and the number of strokes.
3. The measured flow to dewatering is 15 to 20 percent higher than the sum of the measured thickened primary sludge and thickened WAS flows. Digestion will reduce the solids concentration but should not increase or decrease the digester feed flow rate compared to the digested sludge flow rate. Again this discrepancy may be explained by the under calculation of the thickened primary sludge.

In the data from July 2014-October 2014 the measured values for the primary sludge production (ppd basis) were more representative of expected removal rates for primary clarifiers operating at the reported overflow rates. Although the solids balance between the influent solids and the sum of the primary sludge and primary effluent did not consistently match, this could be explained by the weekly frequency of TS measurements for the primary sludge. The sum of digestion influent flow rates over a month of operation matched consistently the flows reported from dewatering. In summary this data set has less discrepancies than previously observed in the data from 2011 to 2013.

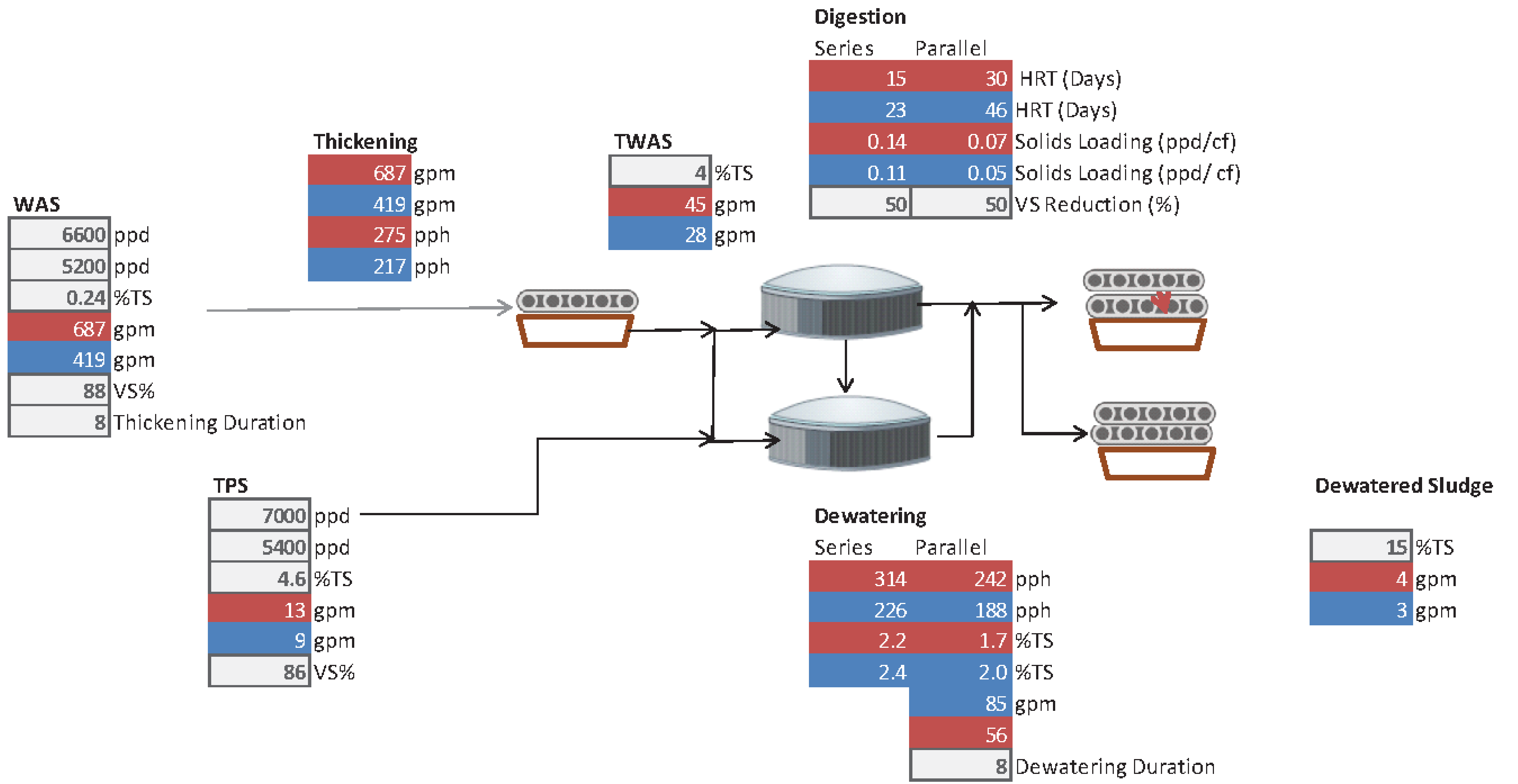
Although these measurement discrepancies do not in themselves reduce treatment capacity, the inability to accurately assess loading and treatment performance affects process reliability, especially during periods when the treatment process is operating near capacity. Accurate measurement of key parameters allows for the treatment train to more easily absorb unplanned treatment loads and for the City to have a clear understanding of their operational capacity. Therefore it is suggested the plant perform, at least quarterly, a solids balance to assure the calculated loadings match the actual process loadings.

Table 5-9 shows the current and projected loads for the solids stream. These values depend on the process management of the primary and secondary clarifiers. Operational choices will affect these loading rates, especially those associated with Peak Day and Maximum Month.

Table 5-9 – Solids Stream Flow Rates

Flow Condition	Primary Sludge Total Solids (ppd)	WAS Total Solids (ppd)
Current		
Average Annual	4,000	3,900
Maximum Month	4,800	4,800
Peak Day	6,500	5,600
Projected		
Average Annual	5,400	5,500
Maximum Month	6,500	6,700
Peak Day	9,200	7,900

Figure 5-2 – Solids Balance Model



5.4 Recommended Improvements

The following discussion identifies the recommend improvements or actions to assure reliable operation of the WWTP to meet the projected loads over the planning period for the unit processes analyzed in this report. The improvements detailed below primarily address current conditions at the WWTP which affect reliability, redundancy and ease of operation and maintenance. To address future limitations in rated capacity it is suggested that the City budget for an engineering report be undertaken in approximately 2020. This report will not only adjust the current influent loading limitations, but also provide the City with an increase in rated capacity to treat additional industrial loads.

Influent Screenings Facility: Due to the condition of the existing screening facilities and the lack of automated redundancy, a renovation of the screenings facilities including replacement of the existing screen and the addition of another automated screen, new compacting and washing equipment, upgrades and replacement to the ventilation and odor treatment systems is required. This upgrade should be implemented in 2-5 years to assure continued reliable screenings and protection

Influent Solids Loading: Plant should continue to monitor the influent solids loading data for an entire year to better substantiate that the observed reduction in solids loading is due to low flow at the sample location. The City should plan in the next 5 years to undertake either a rerating study to rerate the treatable influent BOD and TSS loadings or an Engineering Report to develop plant upgrades to treat the projected BOD and TSS loadings, until a year of influent data under the new sample conditions verifies the actual loadings are lower than those measured over the past 5 years.

RAS Pump Station: Plant Staff should test the efficacy of controlling RAS with the existing butterfly valves under all loading conditions to assure that the RAS concentration can be increased to a minimum of 0.7 percent TS. Controlling the thickening of the RAS and WAS in the secondary clarifier to a more standard 0.7-1.0 percent total solids will increase the digester SRT and increase the solids concentration to the dewatering process.

Other improvements, identified by plant staff, will maintain the exceptional level of treatment performance demonstrated at the WWTP historically. **Table 5-10** summarizes the recommended improvements for the next 1 to 5 years. Dollar values are 2014 probable construction costs. Engineering, administrative, legal and construction management costs are not included.

In addition to the capital improvements listed in **Table 5-10**, the City should budget for ongoing O&M activities not associated with Capital Improvements. Typically O&M cost to maintain plant facility are estimated based on the facility capacity, age, and complexity. For a facility such as the Richland the range is between $75,000 and $100,000 per mgd and average annual conditions, which annually equates to between approximately $425,000 and $590,000. $500,000 is a reasonable value to adopt considering the new solids improvements and solids pump upgrades.

Table 5-10 – Near Term Capital Improvements

Description	Cost [a]
–Influent Screening	$2,000,000
Plant Wide HVAC Improvements	$290,000
Digester Building MCC	$80,000
Primary Clarifier #2 Coating	$160,000
Digester #1 Tank Coating	$320,000
Secondary Clarifier #2 Coating	$220,000
Clarifier Gear Drive Replacements	$305,000
Plant Pump & Piping Replacement - 2017	$75,000
TOTAL	$3,450,000

[a] *Based on Wastewater Treatment Facility Renewal & Replacement List from City of Richland*

5.5 Plant Staffing

Plant is staffed by the following: one Operations Manager, four shift operators (Group III), three operators in training, and two laboratory technicians. There are also two plan mechanical craftsmen and a part-time electrical and instrumentation technician. Even with current tight market for qualified operators the Plant has been able to structure the plant personnel to train and promote young operators to overtake lead responsibilities. Staffing is consistent with other treatment plants of this size considering the number of shifts and level of automation. Futher discussion on staffing is provided in Chapter 9.

Until recently the WWTP was staffed 24 hours a day, seven days a week. Automation of certain plant processes substantially reduced plant staff demands and allowed current staffing levels to suitably operate and maintain the plant, which resulted in eliminating the graveyard shift.