Wastewater Treatment Facilities Plan Update

City of Wenatchee, WA

August 2016

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Chapter 1 - Executive Summary

City of Wenatchee

Wastewater Treatment Facilities Plan Update

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Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
AD	Anaerobic Digester	MOP	Manual of Practice
AER	Aerobic	MPN	Most Probably Number
ALK	Alkalinity	MW	Maximum Week
ASP	Aerated Static Pile	NH_4-N	Ammonia as Nitrogen
BFP	Belt Filter Press	NO_2-N	Nitrite-Nitrogen
BNR	Biological Nutrient Removal	NO_3-N	Nitrate-Nitrogen
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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1 Introduction and Purpose

In the State of Washington, wastewater treatment systems must be approved before construction is begun (RCW 90.48.110). This Facilities Plan has been developed to be in conformance with Chapter 173-240 Washington Administrative Code (WAC) involving the Submission of Plans and Reports for Construction of Wastewater Facilities and Table G1-1 of the Washington Department of Ecology (Ecology) "Criteria for Sewage Works Design." To enable the City of Wenatchee (City) to improve unit process maintenance, and continue to meet effluent quality requirements, the recommended plan includes modifications to both the City's WWTP and Biosolids Drying Beds Facility. This plan's recommendations are based on a detailed evaluation of feasible alternatives, with recommendations for improvements that are found to be the most cost-effective solutions to the City's near-term and long-term needs.

The primary purposes of this plan are to:

- Update the facility flow and loading projections that correlate to more recent data collected following the recent upgrades to the wastewater treatment facility that included a new Screenings Building;
- Evaluate facility unit process capacity and to show that adequate capacity exists to treat the projected influent flows and loads through the planning period; and
- Recommend process improvements to provide for needed process unit redundancy and to assure capacity is available for future wastewater flows. The planning period for the plan is years 2015 through 2035 (20 years).

WAC 173-240-060(2) requires that "engineering reports shall be sufficiently complete so that plans and specifications can be developed from it without substantial changes." This plan has been developed to provide the City with a Capital Improvements Program that will enable the City to utilize their existing user charge financial model to determine appropriate user charge adjustments and to develop a comprehensive financing strategy for the utility. A multi-year, phased expansion program is recommended to allow the City to consider cash reserves and internal financing options as well as the use of State Revolving Fund (SRF) loan assistance for planning, design, and construction. The recommended program allows the City to provide the necessary improvements at both the WWTP and Biosolids Drying Beds Facility in a timely manner, all without creating an overly complex construction management program.

1.1 Approach

Facilities plan development included a review of the study area characteristics comprising the physical environment, population growth projections, land use regulations, and project permitting requirements. This plan was focused on the wastewater and biosolids treatment systems. Condition and capacity assessments of the wastewater collection system were recently completed by the City in a separate Comprehensive Sewer Plan. This effort has relied upon the population and planning projections that were also included in the 2014 Wasteload Assessment.

The Report is comprised of this Executive Summary and six (6) additional Chapters, including:

- Chapter 2: Basis of Planning
- Chapter 3: Wastewater and Treatment Plant Evaluation

- Chapter 4: Biosolids Management Evaluation
- Chapter 5: Wastewater Treatment Alternatives Evaluation
- Chapter 6: Recommended Alternatives
- Chapter 7: Capital Improvements Plan

The City recognized early in the facilities planning process that the influent wastewater composition changed significantly in 2012 (likely due to a change in the location of the influent sampler) and identified a need to further evaluate the treatment plant influent composition prior to beginning the facilities plan update effort. Chapter 2 reflects the added sampling and testing the City conducted and also establishes flow and loading projections for the 20-year planning horizon to year 2035. Flows and loads presented in Chapter 2 are based upon a projected served population within the City of Wenatchee of 46,500 in 2035, and also include the associated commercial and industrial component. In addition, other potential additional industrial loads are presented in Chapter 2 and their potential impacts are considered in Chapter 3.

The condition of each existing unit process at the WWTP was evaluated and included as part of Chapter 3. In addition, the capacity of each unit process was developed using treatment process modeling and mass balance for the updated flows and loads developed during the basis of planning. Chapter 3 provides a summary of the capacity of each unit process at the treatment plant, and also presents the impact should any of the City-identified industrial loads be added to the system. Results of the unit process condition assessment and capacity evaluation was used to develop facility process improvement alternatives to be considered for further evaluation in Chapter 5. In general, the capacity evaluation conducted in Chapter 3 found that there are no capacity related limitations at the treatment plant through the full planning period, and recommended actions are directed more at the provision for additional process unit redundancy.

Chapter 4 presents an evaluation of the City's biosolids management systems and provides a more detailed evaluation of the existing biosolids drying beds for Class A biosolids production. In addition, this chapter identifies other potential biosolids management alternatives and completed an evaluation of the identified alternatives using both economic and non-economic evaluation criteria. The findings of the evaluation indicate that the City should continue to operate their Biosolids Drying Beds Facility for the production of Class A biosolids, and an increase in biosolids drying bed infrastructure will be required during the planning period.

The City had originally intended to develop site-wide treatment process alternatives as part of the alternative analysis for the wastewater treatment facilities. Following the initial evaluation of the unit process condition and capacity, it was determined that process improvement and system redundancy alternatives would be best evaluated individually by unit process area and selection of recommended capital improvements would be recommended by each unit process area in Chapter 5. Chapter 5 findings resulted in recommending improvements in Chapter 6 to only selected unit process areas, with the City continuing to operate much of the facilities as they do now through the planning period while practicing typical operation and maintenance upgrades to the existing facilities.

Chapter 6 presents the recommended improvements to both the WWTP and Biosolids Drying Beds Facility. In addition to the recommended improvements by unit process area, additional maintenance items identified during the evaluations are also presented. Chapter 7 summarizes the costs associated with the recommended improvements along with implementation considerations and a recommended capital improvement plan.

1.2 Overview of the Recommended Plan

As noted above, the project team had initially planned to develop and evaluate whole-plant alternatives for initial screening of overall process unit configurations. However, after conducting the initial flow and loading analysis and existing process unit capacity evaluation, it was determined that evaluation of unit process alternatives would be a more appropriate approach. This was based upon the finding that adequate capacity currently exists for all unit processes at the WWTP through the planning period, and the successful operation of the City's Biosolids Drying Beds Facility for production of Class A biosolids.

1.2.1 Planning Projections

Several plant parameters and plant capacities are shown in Table 1-1. Current flows are approximately 50% of the estimated capacity of the existing facility. Based on current TSS loading values, the plant was shown to exceed the original TSS design capacity. However, Chapter 2 includes a discussion on the influent TSS, which is questionable as it is highly atypical for municipal wastewater relative to BOD, and the evaluation found that the plant actually has sufficient capacity to treat the flows and loads through the planning period.

Table 1-1. Plant Parameters and Capacities

Parameter	Unit	Current (2015)	Future (2035)	Current Capacity (Estimated)	Original Design Capacity[a]
Flow	mgd	3.03	4.1	6.0[b]	5.5
BOD	lb/d	10,750[c]	14,200[c]	>14,200[d]	13,006
TSS	lb/d	16,300[c]	19,800[c]	>19,800[d]	13,111
TKN	lb/d	1,200[c]	1,600[c]	>1,600[c]	1,800

[a] NDPES Permit WA – 002394-9
[b] Based on a 50% UVT for the UV Disinfection System. Peak capacity of UV System is 12 mgd with equipment controls modified to bioassay validated performance.
[c] BOD removal only, maximum month
[d] BOD removal only, 35% PCL BOD removal, 65% PCL TSS removal, Max 3 day SRT

The above loadings are based upon typical commercial and industrial contributions and do not take into account any added industrial load. Should the City receive added industrial loads that are above the typical contribution that is correlated to the served population, industrial pretreatment should be considered prior to allowing discharge to the City's wastewater collection system.

1.2.2 Driving Forces

Key driving forces behind the recommended improvements include:

Change in Plant Loadings - The City of Wenatchee completed their review of plant influent flows and loads using data going back to 2008. In 2012, the City completed a facility upgrade that added influent screening in front of the Influent Pumping Station that modified the location of influent sampling. The results of the review showed that the (measured) influent composition changed significantly following the 2012 improvements, and a higher influent TSS is apparent.

The data indicates that the influent wastewater is approaching 85% of the TSS loading presented in the City's NPDES permit for rated capacity. This finding elevated the need for the City to complete this facilities planning effort. Chapter 3 presents the City's recent evaluation of the plant process unit capacity, and Chapter 5 addresses an alternative evaluation of improvements considered for the facility over the planning period to year 2035. The information included in Chapters 3 and 5 of this plan form the rating study required by Ecology for any proposed changes to the wastewater treatment facility.

System Redundancy - Available unit process redundancy is limited with the primary sludge, secondary clarification, secondary solids thickening, dewatering and digestion processes, and scheduling of regular maintenance activities must occur during non-peak flow and loading events. The anaerobic digestion process for both primary and secondary (WAS) digestion has adequate capacity, only if all digester tanks are in service. However, there is no available spare capacity should either Primary Digester No. 1 or Secondary Digester No. 3 (larger digester basins equipped with heating) need to be removed from service for maintenance.

Age and Condition - The City recently upgraded the influent screening, influent pumping, primary clarifiers and primary sludge/scum pumping, aeration basins, UV disinfection, and digester gas handling facilities. A number of the treatment facilities still remain in operation that are 15 years old (or older), and technically are nearing the end of their useful life.

Process Improvements - Some process improvements will reduce operational costs and/or delay the need for capacity expansions in other portions of the treatment systems. By increasing the amount of primary and secondary sludge thickening, added capacity is automatically generated in the downstream solids digestion and dewatering processes. Investing in these improvements will reduce the overall cost to operate the WWTP.

Capacity Limitations - Based on the planning projections presented above, the UV disinfection system currently is rated at a peak capacity of 7.5 mgd. The UV system is not able to serve the peak hour design condition of 10.51 mgd (nominal 11 mgd). Careful operation of the existing flow equalization basin and modifications to the existing system should be implemented in addition to completing improvements to the existing UV equipment to re-capture needed capacity. The capacity of the digestion facilities does not allow for regular maintenance activities when the digester must be removed from service for cleaning or routine maintenance, and the digestion system and downstream solids processing processes are vulnerable should unplanned repairs be required in any of the two existing digesters.

The Biosolids Drying Beds Facility capacity is based upon the space needed to assure compliance with the City's Class A Treatment Method under WAC 173-308-170. Because of the need for careful materials control, protection from co-mingling of treated biosolids during drying, sampling times required for treatment verification and storage of treated material for contract haul, the City will need additional drying bed area to meet projected solids loadings for the planning period to year 2035.

Good Neighbor Considerations - Residential and commercial development is encroaching on the WWTP. To ensure the long-term viability of this site for wastewater service, the City recently invested in significant visual and odor control improvements at the site to enhance the interface between the treatment facilities and surrounding uses. Additional process enhancements and redundancy improvements included as part of this plan will ensure the City is able to maintain their good neighbor policy for the WWTP campus.

1.2.3 Alternatives Evaluation

Evaluation of the alternatives for biosolids management is presented in Chapter 4 and evaluation of alternatives for the wastewater treatment facilities is presented in Chapter 5. Liquid stream alternatives considered for the wastewater treatment facilities are presented in Table 1-2. Similarly, alternatives considered for the solids stream at the WWTP are presented in Table 1-3.

Table 1-2. Liquid Stream Process Enhancements Alternatives Evaluated

Alternative No.	Description	Result
PCL – 1	Primary Clarification and Primary Pumping: No Action	Primary Clarification remains unchanged, no redundant capacity provided for operations and maintenance
PCL – 2	Primary Clarification and Primary Pumping: Clarifier Replacement and/or Enhancement with Primary Microfiltration (Belt Filters)	Primary clarification redundant capacity for beyond year 2030 condition with replacement or augmenting of Primary Clarifier 2 with a belt (Salsnes) filter
SC/RAS – 1	Secondary Clarification and RAS Flow Control : No Action	Secondary clarification redundant capacity for beyond year 2023 condition, no redundant capacity provided for aeration basin or clarifier maintenance
SC/RAS – 2	Secondary Clarification and RAS Flow Control: New Clarifier with Gravity RAS Flow Control	Secondary clarification redundant capacity for beyond year 2023 condition, new clarifier with gravity RAS flow measurement and existing pumping capacity expansion
SC/RAS – 3	Secondary Clarification and RAS Flow Control: New Clarifier and Pumped RAS Flow Control	Secondary clarification redundant capacity for beyond year 2023 condition, new clarifier with new RAS pumping station including metering
UV – 1	UV Disinfection: No Action	Effluent disinfection capacity limited to flow condition of 7.5 mgd
UV – 2	UV Disinfection: Manufacturer Recommended Enhancements	Effluent disinfection capacity restored to 11 mgd through equipment corrective actions recommended by manufacturer
UV – 3	UV Disinfection: Equipment Replacement	Effluent disinfection capacity improved to 12 mgd through equipment replacement

Table 1-3. Solids Stream Unit Process Enhancements Alternatives Evaluated

Alternative No.	Description	Deficiency Addressed
PST – 1	Primary Sludge Thickening: No Action (Clarifier Thickening)	Primary sludge thickening to remain as-is, primary clarifier capacity limited to year 2030 condition, and no redundancy provided.
PST – 2	Primary Sludge Thickening: Gravity Thickener Addition	Primary sludge thickening to address year 2030 clarifier capacity limitation, separate gravity thickener, and redundancy is provided.

Alternative No.	Description	Deficiency Addressed
PST – 3	Primary Sludge Thickening: Rotary Screen Thickener Addition	Primary sludge thickening to address year 2030 clarifier capacity limitation, separate rotary drum thickener, and thickening redundancy provided.
WAS – 1	WAS Thickening: No Action	WAS processing remains unchanged, batch wasting continued, and no WAS redundancy provided.
WAS – 2	WAS Thickening: Rotary Screen Thickener Addition	WAS thickening redundancy and performance improvement, allows 24-hour wasting via RST, and reduction in solids volume delivered to WAS digestion.
WAS – 3	WAS Thickening: Dissolved Air Flotation Addition	WAS thickening redundancy and performance improvement, allows 24-hour wasting via DAFT unit, and reduction in solids volume delivered to WAS digestion.
DIG – 1	Digestion: No Action	Continue digestion operation with no changes and primary digestion capacity limitation at year 2016 not addressed.
DIG – 2	Digestion: Sludge Thickening Addition	Increase primary digestion through installation of enhanced primary sludge thickening including recuperative thickening capability, and addresses year 2016 primary digestion limitation.
DIG – 3	Digestion: Added Digestion Capacity	Increased primary digestion through installation of new primary digester.
DEW – 1	Dewatering: No Action	Continue dewatering with single belt filter press. No dewatering system redundancy provided.
DEW – 2	Dewatering: Belt Filter Press Addition	Add dewatering redundancy through installation of an additional belt press.
DEW – 3	Dewatering: Screw Press Addition	Add dewatering redundancy and ability for unmanned dewatering through installation of a screw press.

1.2.4 Elements of the Recommended Plan

The alternatives presented above were evaluated by the project team as described in Chapter 4 and Chapter 5 and the preferred improvements were recommended based upon the criteria identified. The elements of the recommended plan are presented in detail Chapter 6. The recommended capital improvements to the wastewater treatment facilities include:

- **Continuing to operate the preliminary and primary treatment process units with no changes in facilities or operation.** Primary sludge and scum pumping will be operated with pumping units dedicated to each primary clarifier used for both sludge and scum pumping. The sludge pumping frequency would continue to be controlled through pumping time to achieve thickening of primary sludge solids to a concentration above 4 percent dry weight solids. Primary sludge and scum pumping would be alternated manually by operations staff through field observation. In the event of a high flow and loading condition to the primary treatment facilities, additional loading will be directed to the secondary treatment process for treatment.
- **Construction of Secondary Clarifier No. 3 and connection of the new clarifier to the existing gravity controlled return flow system and RAS pumping station.** Construction of the new clarifier would also require installation of a new aeration basin effluent pipeline from the aeration basin Effluent Junction Box to the clarifier and extension of a clarifier effluent pipeline from the clarifier effluent launder to the influent channel of the UV Disinfection Building. Return flow recirculation and secondary scum piping will be directed to the Sludge Recirculation Pump Station via the abandoned chlorine contact channel contiguous with existing Secondary Clarifier No. 1 and combined with the existing pumping systems. When the existing two RAS pumping units are replaced under regular maintenance upgrades, it is recommended the replacement pumping units be increased in size to provide for full pumping redundancy for the 100 percent return, or recycle, flow condition.
- **Modifications to the UV light disinfection system and installation of continuous UVT monitoring to enhance the firm peak flow capacity of the disinfection system.**
- **Construction of a new Anaerobic Digester No. 4 that matches the capacity of existing Anaerobic Digester No. 3.** A new Digester Control Building expansion will provide an additional hot water boiler, gas, and recirculation pumping systems to support the digester and additional piping modifications to the other digesters on site to enable full redundancy of digester tankage. Installation of gas handling and odor control systems would also be incorporated into the digestion upgrade, and space within the Digester Control Building would be provided to allow installation of a future waste activated sludge rotary screen thickener (RST) that would also be able to be used for digester recuperative thickening. Additional digester capacity is necessary to provide for required redundancy of downstream unit processes (primary clarification, aeration basins, secondary clarification) to ensure full compliance with the Cities discharge permit during times when a digester must be removed from service for maintenance or repairs.
- **Construct additional coarse fraction grit removal in front of the Influent Pump Station, including the installation of an influent sewer grit collection manhole upstream from the existing Screenings Building.** This manhole would enable removal of heavy fraction grit from the influent sewer with an eductor truck and help avoid accumulation of grit in the treatment plant from the Screenings Building to the existing Vortex Grit Removal Units. In order to maintain grit in suspension between the Screenings Building and the existing Grit Removal Basins, construction of a dedicated scour air blower for the Influent Pump Wetwell and a separate dedicated air scour blower for the Grit Removal Inlet Channel is also recommended.

Elements of the recommended plan at the City's Biosolids Drying Beds (Class A) Facility include:

- **Construction of four additional biosolids drying beds located in a mirrored fashion immediately north of the existing drying beds.** This configuration would allow efficient operations for solids handling equipment and will promote avoidance of co-mingling of processed and non-processed materials. It has been assumed that the City will not be required to purchase additional property to provide for the added Biosolids Drying Beds Facility capacity.
- **Construction of additional finished Class A biosolids storage.** Added storage capacity is needed for segregation of the processed biosolids from the new drying beds addition, which assures processed material cannot be comingled with solids undergoing treatment within the facility.
- **Construction of a second storm water retention facility that will operate using evaporative disposition similar to the existing storm water facility.** The retention facility will also be mirrored with the existing facility as a separate pond from the existing facility. The existing perimeter fence will be extended around the new facilities and the new access road and drying beds will be paved.

1.2.5 Implementation

The primary goal of this planning effort was to develop a flexible, dynamic facilities plan that covers potential social, environmental, and economic changes. An implementation plan was prepared to allow for the development of a capital plan that can be responsive to changing criteria. Each component of the recommended plan is recommended on the basis of a distinct need - condition, capacity, performance, redundancy, or some combination thereof. Consideration of both operational and maintenance priorities was made when developing the recommended capital improvement plan. In addition, the following additional technical items should be considered during implementation of the recommended improvements:

- **NPDES Permit.** Chapter 2 provides a summary of the City's current Effluent Quality Permit that became effective on September 1, 2010. The requirements of the City's Effluent Permit remained essentially unchanged from previous permits and significant changes for the future permit are not expected. The City's permit will be updated during the implementation of the recommended improvements. It is recommended that the City continue to closely monitor water quality requirements for the Columbia River that could have longer-term impacts on future permit cycles.
- **Biosolids Management.** The City's current Class A biosolids treatment process follows methods approved by the USEPA and Ecology in the City's General Permit Dated October 31, 2012. Although the City does also have the ability to produce Class B biosolids, the City prefers to meet the conditions set forth in their approved process for further reduction of pathogens (PFRP) that can be started between May 1 and September 30 in any given year. As biosolids quantities continue to increase, the City needs to carefully plan for the expansion of the drying bed area and site management of biosolids to assure there is no compromise to the integrity of the Class A product produced or inability to properly process biosolids transferred to the site in any give year (during the allowed processing time during the year).
- **Potential Industrial Loads.** Chapter 2's Table 2-12 presents a list of known potential additional industrial loads that the City has identified as potential significant industrial loads. The development of these significant loads within the planning area are uncertain, and

highly unpredictable. The City has included an industrial component in the flows and loads used for the basis of planning, but has not included the added impact of these loads on the available plant capacity. Therefore, the City needs to closely evaluate the impact of any large industry that develops during the implementation period. Preliminary treatment prior to discharge to the City's treatment facilities should be considered.

- **Land Acquisition and Land Use.** The recommended plans for both treatment plant site and the Biosolids Drying Beds Facility have assumed that no additional land acquisition will be required for implementation of the plans. The treatment facility site is limited in available space for construction activities, and project phasing and construction planning will very likely need to account for off-site storage and staging. The City's current long-term use arrangement for the Biosolids Drying Beds Facility site will need to be modified to accommodate the recommended drying beds addition, and careful consideration of site use limitation will need to be planned for during the final design of the recommended facilities.
- **Site Geotechnical.** Construction activities at the WWTP site have routinely encountered subsurface debris from historic landfilling operations that occurred in the area along the Columbia River prior to the original construction of the WWTP. This debris not only requires special care and handling for off-site disposition, but also can have significant impact on shoring operations necessary for construction of new facilities on such a congested site. Careful consideration of the likelihood of encountering refuse and debris during excavation activities need to be included in the project geotechnical planning.
- **Facility Aesthetics and Landscape Buffer.** The City recently completed a comprehensive improvement of the WWTP that incorporated visual mitigation, art, and decorative lighting and perimeter landscape buffering and landscape features. New construction activities on site will require removal of some of these aesthetic amenities during construction of new process units. Reclamation and restoration activities for the recommended improvements need to be completed in a manner where landscape features are returned to an equal or better condition. Residential and commercial development is encroaching on the City's treatment plant site. To assure the long-term viability of the site for wastewater service, the City has identified the importance of their good neighbor policy for the site. Improvements will continue to be needed to enhance the interface between the treatment facilities and surrounding uses.
- **Odor Control.** The recent odor control and visual mitigation improvements project the City completed at the WWTP site planned for future digestion facilities to be incorporated into the new foul air collection and treatment system. During detailed preliminary and final design of the recommended solids handling facilities, odor control for any new foul air sources need to be considered. The odor control system does not currently include collection and treatment of air from secondary treatment units, and continuance of this design philosophy is recommended.
- **Staffing.** A detailed staffing evaluation has not been conducted as part of this facilities planning effort. The modifications recommended to the treatment plant processes will provide for better process redundancy and improve maintenance and operations conditions at the site. The recommended improvements do not increase capacity, but provide for better process flexibility and reliability. The City currently closely monitors staffing needs and will continue to do so as the flows and loadings increase to the treatment facility. There are no recommended staff additions directly attributed to the improvements recommended at the

treatment pant, and decisions on staff changes are recommended to be made through continued monitoring.

Similarly, operations at the Biosolids Drying Beds Facility are reported to be appropriate for the City's current solids hauling and processing needs. It is recommended that the City continue to monitor staff requirements as loading to the facility gradually increases and make staff augmentation determinations based upon reporting from current operations and maintenance staff.

- **Ecology Review.** The initial evaluation of the treatment plant performance data during the development of Chapter 2 identified significant differences in the influent total suspended solids (TSS) received at the treatment plant. The project team determined this difference was, in part, attributable to the changes made in the sampling location and screenings system completed as part of the City's Odor Control and Visual Mitigation Project. Because of the difference in data, the City decided to delay completion of this Facilities Plan to collect additional data for use in the basis of planning that is now presented as part of Chapter 2.

1.2.6 Financial Requirements

Table 1-4 presents the recommended capital improvements plan that includes the recommended improvements for both the WWTP and the Biosolids Drying Beds Facility.

Table 1-4. Total Capital Requirements For The Wastewater Utility

Improvement	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2035[a]
WWTP Grit Removal Improvements Design/Construction Engineering	$24,000	$24,000				
WWTP Grit Removal Improvements Construction		$161,000				
WWTP UV Light Disinfection System Modifications		$135,000				
WWTP Digester No. 4 and Digester Control Building Design/Construction Engineering		$541,000		$541,000		
WWTP Digester No. 4 and Digester Control Building Construction				$3,610,000		
WWTP Secondary Clarifier No. 3 and Return Flow Control Design/Construction Engineering					$309,000	$309,000
WWTP Secondary Clarifier No. 3 and Return Flow Control Construction						$2,057,000
Rotary Screen Thickener (RST) Addition						$784,000
Drying Bed Expansion Design/Construction Engineering				$331,000		$331,000
Drying Bed Expansion Construction						$2,208,000
Total	**$24,000**	**$861,000**	**$0**	**$4,482,000**	**$309,000**	**$5,689,000**

Table 1-4. Total Capital Requirements For The Wastewater Utility

Improvement	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2035[a]
Increased Annual O&M Cost [b]				**$72,300**		**$39,200**

[a] Recommended Improvements that exceed the 3 to 5 year capital improvements planning horizon
[b] Includes added O&M for Digester No. 4 and associated facilities, Secondary Clarifier No. 3 and RST addition

Table 1-4 presents the estimated cost of the recommended improvements, including assumed dates of completion, at both the WWTP and at the Biosolids Drying Beds Facility. The recommended project prioritization is presented by funding year to enable the City to incorporate the recommended plan into their ongoing rate analysis. The recommended improvements presented in Table 1-4 are presented in Chapter 6, and are also included in the DRAFT Capital Improvement Budget Worksheets included in Appendix A of Chapter 7.

The costs and their timing in Table 1-4 represent a simplified cash flow and are intended to provide a general understanding of the costs for calculation of potential changes in residential sewer rates. The table shows that priority near-term investment of approximately $885,000 is needed initially. The table also shows that $4,482,000 will be expended in 2017-2019 for design and construction of Digester No. 4 at the WWTP and design of the expansion of the Biosolids Drying Beds Facility with $309,000 expended by 2020 for design of Secondary Clarifier No. 3 to the WWTP and $5,689,000 expended beyond 2020 for the addition of Secondary Clarifier No. 3 and a RST thickener at the WWTP and design and construction of the drying beds expansion.

The added O&M costs associated with the recommended plan are also identified in Table 1-4. An increase in annual O&M cost of $72,300 is expected when additional anaerobic digestion facilities are constructed. This is due to the added pumping costs and operation and maintenance associated with the new facility. The added secondary clarifier is estimated to add an additional $19,700 in annual O&M, primarily associated with equipment maintenance and drive electricity. The addition of the future RST unit is expected to add an additional $19,500 in annual O&M costs. The expanded drying beds are not considered to be improvements that will add to the current operation and maintenance requirements. In the case of the drying beds expansion, the planned improvements are expected to increase operating efficiency as a result of the improvements, without appreciably increasing maintenance requirements.

The evaluation of the potential changes in residential sewer rates has not been included as part of this Wastewater Facilities Plan Update, and the City will continue to evaluate their rate structure through their existing models that will be updated using the projected capital expenditures presented above. It is expected that the City will continue to bill approximately 57 percent of the cost of the improvements to residential accounts (the estimated contribution of residential customers based upon City records), with the remainder being billed to commercial and industrial users. The expected methods of financing include the use of cash reserves, revenue bond financing and the Ecology State Revolving Fund (SRF) loan program. In order for the City to assure eligibility for the SRF program, concurrence must be obtained from Ecology on environmental documents prepared and determinations issued by the City. The Washington State Environmental Policy Act (SEPA) environmental checklist has been completed for the recommended plan by the City, and is included as Appendix C of Chapter 7.

Chapter 2-Basis of Planning

City of Wenatchee

Wastewater Treatment Facilities Plan Update

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Tables

Figures

Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
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cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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2 Basis of Planning

2.1 Introduction

Wastewater flow and wasteload evaluations were conducted to establish a planning basis for development of future planning of necessary improvements at the Wenatchee WWTP. The flows and wasteloads are based on the existing environment, the population and land use in the service area, and infiltration and inflow to the collection system. Historical data from monthly DMRs were provided by the City of Wenatchee and were used to establish loadings specific to the Wenatchee WWTP. From this information, wastewater influent per-capita flow and loading projections were developed for flow, 5-day BOD, TSS, VSS, TKN and ammonia for the years 2015, 2020, 2025, 2030, and 2035. In addition, peak hour flow projections were developed assuming the plant flow equalization/surge basin will continue to be used for flows that exceed the firm capacity of the plant influent pumping facilities.

The projected 2035 values will be used as the planning basis for all proposed improvements developed as part of the facilities planning effort. The Wenatchee WWTP must be capable of complying with overall performance requirements over a wide range of probable conditions. In fulfilling this objective, the influence of the flow rates and loading factors, must be fully understood. Table 2-1 lists the flow and mass loading parameters typically used in the design and operations of wastewater treatment facilities and how they are applied to design. The following paragraphs summarize the planning objectives and flow and load criteria, consistent with Table 2-1, that are used for development of the Wenatchee WWTP capital improvement planning recommendations presented in the Plan.

Table 2-1. Typical Flow and Mass Loading Parameters Used for the Design and Operation of Wastewater Treatment Facilities

Flow Rate	
Peak Hour	Size of plant gravity and pumping conveyance systems. Physical sizing of unit processes.
Maximum Week	Sizing of secondary sedimentation tanks utilized.
Maximum Hour	Recordkeeping and reporting; sizing of chemical storage facilities.
Minimum Hour	Sizing turndown of pumping facilities and flow meters; sizing of channels to control solids deposition.
Mass Loading	
Maximum Day	Sizing of selected pumping systems.
Maximum Week	Sizing of selected biological process units; sizing of sludge thickening and dewatering systems.
Maximum Month	Sizing of selected biological process units.

2.2 Existing Environment

The City of Wenatchee is located in central Washington on the east side of the Cascade Mountain Range. The City lies in the Columbia River Valley, just south of the confluence of the Wenatchee and Columbia Rivers. The Columbia River forms much of the eastern boundary of the Wenatchee City limits.

2.2.1 Climate

The climate of the area is heavily influenced by the Cascade Mountain Range. The prevailing westerly flow of air across the Cascades loses much of its moisture before reaching the Wenatchee area. The result is a relatively dry and mild climate pattern. The area experiences average precipitation of around 9 inches, with snowfall averaging 30 to 35 inches in the winter. Precipitation patterns are characterized by infrequent rainfalls of high intensity. Temperatures range from an average of 26 degrees Fahrenheit (ºF) in January to 73ºF in July.

2.2.2 Geology and Soils

The major geologic formation underlying the area is the Wenatchee Formation. This formation is composed of medium- to course-grained sandstone that is cross-bedded with pebbly sandstone. Stream deposits (alluvium) consisting of un-cemented silt, sand, or gravel overlie the Wenatchee Formation. Flooding during the Ice Age is thought to have deposited a layer of clay in the valley that has rendered much of the area unsuitable for septic tanks.

Available City records and existing borings drilled at the existing wastewater treatment plant site in 1972 for a previous plant improvements project indicate that the site has been used as a solid waste disposal area. Refuse has not been accepted at the site since 1958.

Much of the refuse was excavated and removed from the site during construction of the secondary clarifiers and aeration basins in 1975, during construction in 1992 and additional construction in 2010. Additional refuse remains within the WWTP site and in areas surrounding the WWTP site. The WWTP site is greatly disturbed and soils at the site are not considered prime or unique soils.

The soils existing at the site of the existing drying beds are PrB-Pogue gravelly fine sand loam, which is on the prime soils list, and PrC-Pogue gravelly fine sandy loam, which is on the unique soils list. However, these are not considered prime or unique soils unless they are irrigated, which they are not.

2.2.3 Surface Water Resources

The Columbia and Wenatchee Rivers are two major surface water resources in the area. Both are regulated for hydroelectric power generation and irrigation supply. Effluent from the Wenatchee WWTP discharges into the Columbia River in an area where it is designated as a Class A water course by Ecology. Columbia River water quality in the Wenatchee area is generally quite good and influenced more by naturally occurring impurities gathered at times of high runoff than by human activities.

To protect the water quality of the receiving water resource from contamination by elements in wastewater discharged by the WWTP, treatment standards must be met as specified in the NPDES permit issued for the plant (see Section 2.7 Effluent Quality Requirements). Reliability and redundancy in the treatment works are also specified in regulations to protect the water quality of surface water resources receiving treated effluent. The designation of Reliability Class II (as defined in Technical Bulletin “Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability” by US EPA issued 1974 and described in Table G2-8 of Criteria for Sewage Works Design by the Washington Department of Ecology in August 2008) applies to works for which “discharge or potential discharge as a result of volume and/or character would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days).” Tables G2-9 and 10 of the Criteria contains specific requirements excerpted from the EPA technical bulletin. The Wenatchee treatment system is designated to meet requirements of Reliability Class II, which include works with a discharge or potential discharge moderately distant from shellfish areas, drinking water intakes, areas used for contact water sports, and residential areas.

In accordance with the requirements of Reliability Class II, capabilities must be provided for satisfactory operation of the Wenatchee treatment works during power failures, flooding, peak loads, equipment failure, and maintenance shutdown.

2.2.4 Sensitive Areas

Neither the existing WWTP site nor the existing drying bed site is located in a sensitive area. The WWTP and biosolids drying beds are located at a higher elevation than the 100-year-flood elevation and are not subject to flooding. Both sites do not contain and are not located adjacent to wetlands.

2.2.5 Endangered and Threatened Species

The WDFW has determined the Columbia River to be priority habitat for certain species of resident and anadromous fish. The upper Columbia River spring run of Chinook salmon and the upper Columbia River steelhead are listed as federal threatened species under the Endangered Species Act. The WDFW also calls out the City of Wenatchee as being a part of the historical winter range for mule deer. This winter range has been lost due to agriculture, housing development, and game fences. The drying bed site has not yet been mapped by WDFW for priority habitats and/or species.

2.2.6 Public Health

The Chelan-Douglas Health District does not have a system for tracking failing septic tanks. However, according to the Health District, failing septic systems have become a major issue for many jurisdictions in the area near Wenatchee. The Health District believes that it can be assumed that many of the older septic tanks in the area are failing or will fail in the near future. The Health District believes that planning to expand capacity to allow those with failing septic tanks to connect to the sewer system would be beneficial in the long term for public health.

2.2.7 Prime or Unique Farmland

There is no record of the WWTP site or the biosolids drying bed site ever having been used as farmland. Available City records and existing borings drilled at the plant site in 1972 for a previous plant improvement project indicate that the site has been used as a solid waste disposal area. Refuse has not been accepted at the site since 1958. Much of the refuse was excavated and removed from the site during construction of the secondary clarifiers and aeration basins in 1975. Additional refuse remains within the WWTP site and in areas surrounding the site.

2.2.8 Archaeological and Historical Sites

A field survey of the area in the vicinity of the drying bed site was conducted in January 1990. Consultation with the Colville Federated Tribes and the Washington Department of Archaeology and Historic Preservation must be conducted before any work is performed in the area.

2.2.9 Federally Recognized Wild and Scenic Rivers

The Columbia River and the Wenatchee River are not federally recognized wild and scenic rivers. However, both rivers are important to the region because they provide habitat for threatened and endangered species. They also provide recreation for local residents and tourists.

2.3 Population and Land Use

2.3.1 Introduction

The City of Wenatchee's NPDES Waste Discharge Permit (No. WA-002394-9), issued in 2010, required a Wasteload Assessment of the wastewater treatment plant. The last assessment was completed in 2008 and was documented in both the Wastewater Treatment Facilities Plan (November 2008) and the City of Wenatchee Comprehensive Sewer Plan (April 2009). In the 2014 assessment, the influent flows and waste loads from 2009 to 2013 were compared with the design criteria and data from 2007. The population projections were updated based on information from the State of Washington Office of Financial Management and the number of new sewer connections was estimated through 2030. This Facilities Plan update has conducted an independent review of wastewater characteristics and has utilized the same population projections as the 2014 Wasteload Assessment.

2.3.2 Population

The City’s Urban Area Comprehensive Plan (2006 and 2013 Update) provides the following information:

“With 29,920 residents [in 2006], Wenatchee is currently the 34th largest city in the state of Washington. Of all cities in Washington State, Wenatchee places 12th in terms of people per square mile. Wenatchee experienced strong growth in the 1990s. Between 1990 and 2000, Wenatchee’s population grew 28 percent, similar to the growth rate of Chelan County (27

percent). Wenatchee's population represented 42 percent of the total county population during both census years."

For wastewater facility planning, it is necessary to plan for the connected population, which is the population that is currently connected and is forecasted to be connected to the sewer system within a specified time period, and who send wastewater to the City treatment plant. There are still homes in Wenatchee that use on-site septic systems and are not connected to the sewer system.

The City of Wenatchee recently completed a Wasteload Assessment that was required by their NPDES permit update. The Assessment stated "*The City of Wenatchee's sewer service area as defined in the 2009 comprehensive sewer plan is the city's urban growth area (UGA). Outside city limits within the UGA, the city provides sewer to two main areas: Sunnyslope which is primarily residential and Olds Station which is mostly industrial and commercial. At the time of this report, there are only four sewer connections in the Sunnyslope area while most of the businesses in Olds Station are connected to sewer. The only area within Olds Station currently not connected to sewer is located on the west side of Highway 97A.*

During the last sewer comprehensive planning process, the City had anticipated that sewer would be extended to the Sunnyslope area. The sewer extensions have not occurred as planned and development has continued to occur on septic systems. In addition, a significant industrial user closed in 2009 and in the past few years a major grocery store and several restaurants have closed as well. With regards to residential development, there have been five new major subdivisions connecting to the city sewer system in the last five years; three of these subdivisions are still under construction. Between 2009 and 2013, the city has primarily seen redevelopment of vacant lots and the conversion of single family properties into multi-family complexes. The city's riverfront area has seen a recent increase in redevelopment including a new public market and an apartment complex with just over 300 units."

The population estimates, presented later in this Section for the City of Wenatchee UGA for 2009 through 2030, were obtained from the State of Washington, Office of Financial Management and represent the medium growth expectations. The estimated population in the UGA connected to sewer was estimated based on information from the 2009 comprehensive sewer plan and utility billing information for 2009 through 2013. For the future connected population estimates, approximately 86% of the growth in the UGA was assumed to be connecting to sewer.

The Sunnyslope UGA, located north of the Wenatchee River, currently is located in unincorporated Chelan County and will be served by the City of Wenatchee WWTP. The Chelan County Draft Sunnyslope Subarea Plan (Studio Cascade 2007) lists a current estimated population of about 3,100 people for the Sunnyslope UGA. Currently, there are only four properties at Sunnyslope that are served with sewer: Sunnyslope Elementary School, the US Forest Service building, a car wash and a residence next to the car wash. Earlier Wastewater Comprehensive Planning efforts had assumed more rapid connections to the City's wastewater collection and treatment system. These connections did not materialize, and the City has seen population increases occur within the existing service area in the form of increases in population numbers within the existing housing infrastructure and new developments have connected to septic systems.

The Olds Station area includes land and buildings for industrial and other economic development opportunities. Because of the unpredictable nature of the development within this area, this Facilities Plan effort has linked the per-capita loading to known population and has developed loading projections that are consistent with projected population increases in lieu of speculation on industrial influences. However, a list of potentially significant industrial loads is included at the end of this section and discussed in Chapter 3 of this Plan.

2.3.3 Land Use

The City of Wenatchee currently encompasses approximately 4,725 acres (City of Wenatchee Urban Area Comprehensive Plan, 2013 Update). Within the City limits there is a mix of residential land use of varying densities, commercial uses, and warehouse industrial uses. Residential use dominates the land use in Wenatchee, more than 60 percent of the City. Slightly more than 10 percent of the urban area is used for commercial purposes. Similarly, Public Facilities also comprise slightly over 10% of the City (City of Wenatchee Urban Area Comprehensive Plan, 2013 Update).

2.4 Design Horizon

Wastewater treatment facilities must be designed to handle not only the average annual flows and loads coming into the facility, but must also be able to treat all peak flows and loads. The most common design criteria for treatment facility unit processes include flows and loadings for average annual conditions, maximum monthly average conditions, and peak daily conditions. The plant must also be able to hydraulically manage the peak hourly flow.

A peaking factor is defined as the peak flow or load (maximum monthly, peak daily, or peak hourly) divided by the average annual flow or load. Peaking factors are important for projections of future peak flows and loads. The historic loading and current conditions were used to prepare a series of peaking factors that were also applied to project the flows and loads for the design criteria of the unit processes.

2.5 Flows and Wasteloads Review

2.5.1 Objective

The objective of the flows and loads review was to determine the influent wastewater compositions for the different design conditions (average, maximum month, maximum week, and maximum day), identify the model calibration period, and evaluate long term trends. Plant influent data going back to 2008 were included in the flows and loads review.

The review showed that the (measured) influent composition changed significantly during 2012, likely as a result of relocating the influent sampler to a position where it was receiving a more representative influent sample (Figure 2-1). The trends, since the relocation noted above, show that the initial high TSS spikes have been gradually decreasing. The reason for this is not known.

The influent TSS is unusually high relative to the measured BOD resulting in a BOD to TSS ratio of 1.26, versus a more typical value of approximately 1.0. After primary clarification, the BOD to TSS ratio is lower than one would expect under typical conditions (65% TSS removal, 35% BOD removal). The actual average BOD removal was 42% and average TSS removal was 73%. The average influent BOD load of 8,600 lb/d represents 65,000 PEs based on 60 gal/PE/d suggesting that industrial and commercial costumers in the service area contribute roughly 40 percent of the influent load as the 35,280 residences alone would only account for 5,300 lb/d.

The high industrial and commercial fraction could explain the unusual influent composition, but a definitive answer can only be obtained through more rigorous collection system and influent sampling campaigns. The change in the influent sample location is believed to more accurately reflect the true influent composition. Plant staff also confirmed that plant operation, energy use, and solids yield did not change in relationship to the difference in the measured influent composition. This suggests that the actual influent load did not change; only the measured value. The primary consequence of the modified measurements is that the measured value is now much higher. This pushes the plants effluent quality reporting to near or over the 85 percent capacity threshold for TSS that is part of the City's 2010 NPDES Waste Discharge Permit.

On the other hand, the fact that the TSS increased abruptly with the sample location change at a greater rate than BOD suggests that either sample location or sample collection is compromised because a) the BOD to TSS ratio before the change was 1.02 and primary clarifier TSS and BOD removal rates were identical to after the change, and b) unless the additional TSS solely consists of inert material a proportional increase in BOD would be expected. The 30-day averages (Figure 2-2) clearly illustrate that only the TSS increases.

Whether or not it is warranted to conduct a special sampling in order resolve the discrepancies regarding influent TSS and BOD will be determined through a sensitivity analysis comparing the plant capacity with the measured TSS and with a corrected TSS (TSS:BOD ratio of 1.0). This evaluation will be addressed in Section 3 of this Plan. If the measured value does not trigger capital improvements that would otherwise not be required then no further actions are immediately required.

The influent nitrogen also shows some atypical or unusual trending. While the influent TKN load (Figure 2-3) has remained fairly constant, the influent ammonia load is diverging from TKN showing a declining trend. Because the flows are also declining over the same period, the reduction in ammonia relative to TKN cannot be explained with reduced collection system retention time. This trend is of little consequence to the plant because: a) nitrification or nitrogen removal is not required and, b) most TKN will eventually be converted to ammonia throughout the process.

Finally, the influent flow trend (Figure 2-2) is consistent with what can be observed in most communities that includes a gradual decline in flows when loads are still increasing. In most communities in the Northwest, this is due to water conservation through increased awareness and passive through updated plumbing codes that require low volume fixtures as well as more water efficient appliances. This is not the case for Wenatchee. Dividing the average (dry) weather flow (2.7 mgd) by the connected population (35,280) the per capita water use amounts to 76 gal/PE/d. This is low for the US. When dividing the same flow by the number of PEs based on the influent BOD load, the PE flow is reduced to 41 gal/PE/d. This is an extremely low number. This suggests that most of the commercial and industrial load is of higher strength.

It should be noted here that the recorded flow is effluent flow, and some unknown fraction of the influent flow is used internally for non-potable uses. The actual flow may be slightly higher, which would also impact the calculated load.

The variability of the influent characteristics does not suggest any particular time frame that may be better suited for the model calibration.

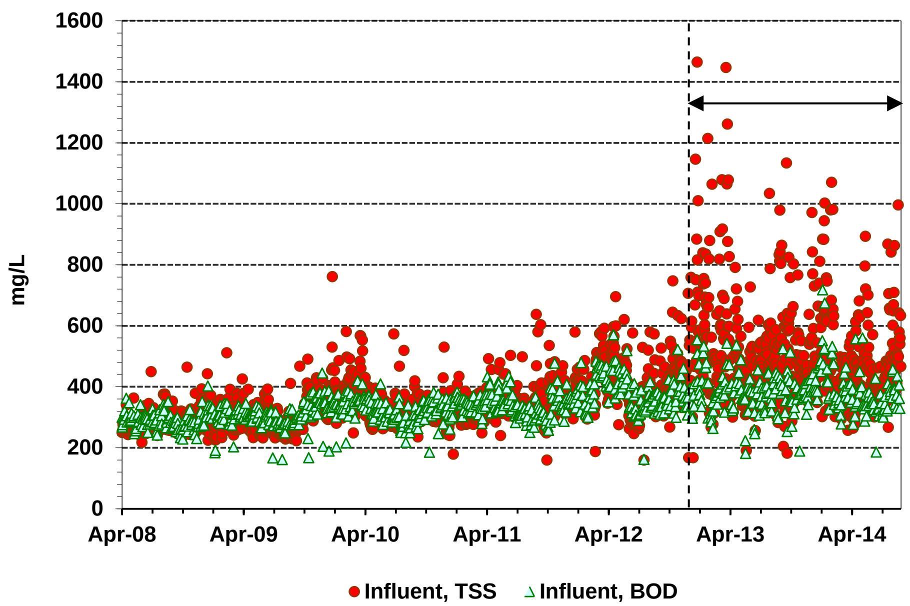

Figure 2-1: Influent BOD and TSS
(Note – Double Line Arrow and Vertical Dashed Line Indicates Sampling at New Location)

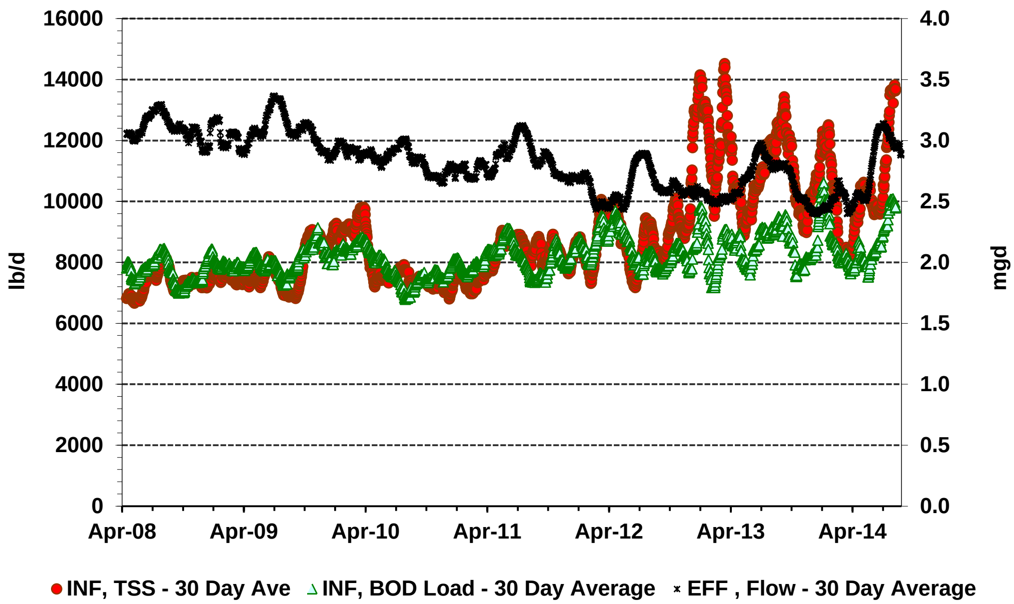

Figure 2-2: Influent Flow, TSS, and BOD – 30 day averages

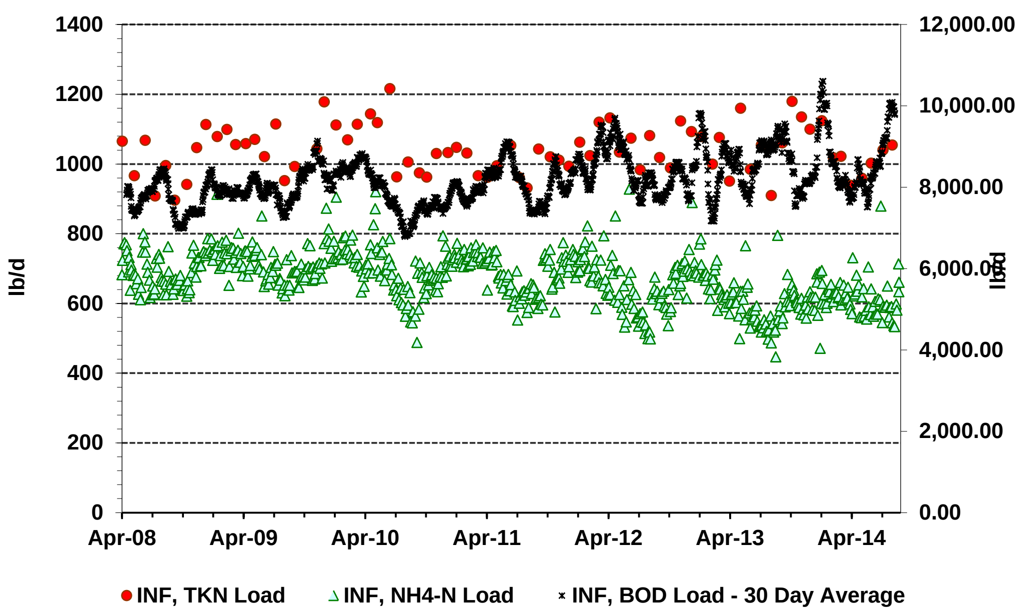

Figure 2-3: Influent TKN, NH_4-N and BOD Load

2.5.2 Wastewater Characterization

Figure 2-4 through Figure 2-8 show the log probability plot of the influent flows and loads dating back to November 2012. This reflects conditions after the change in the influent sampler location. Municipal loads are typically log normal distributed. The charts noted above confirm the log normal distribution, which permit the use of the log normal values for medium or average, maximum month (11/12), maximum week (55/56), and maximum day (364/365).

The calculated influent flows and loads and resulting influent concentrations are listed in Table 2-2. Table 2-3 contains the expanded influent wastewater composition, which incorporates typical ratios to attain the wastewater parameters and fractions that are not measured.

Table 2-2. 2012 – 2014 Flows and Loads

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day
Flow	mgd	2.7	3.1	3.3	3.6
TSS	lb/d	10,900	16,300	20,650	25,800
VSS	lb/d	9,950	15,000	19,100	24,000
BOD	lb/d	8,600	10,750	12,150	13,650
TKN	lb/d	1,050	1,200	1,250	1,300
NH_4-N	lb/d	650	750	800	850
TSS	mg/L	492	637	747	868
VSS	mg/L	448	586	691	808
BOD	mg/L	388	420	439	459
TKN	mg/L	47.4	45.1	43.9	42.8
NH_4-N	mg/L	27.9	27.8	27.7	27.7

Table 2-3. Influent Wastewater Characterization

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day
TSS	mg/L	542	637	747	868
TSS(adj) [a]	mg/L	388	420	439	459
VSS	mg/L	448	586	691	808
COD	mg/L	815	963	922	969
sCOD [b]	mg/L	278	300	314	328
ffCOD [b]	mg/L	181	195	204	213
BOD	mg/L	388	420	439	459
sBOD [c]	mg/L	177	191	201	210
VFA [b]	mg/L	15	11.2	10	10
TKN	mg/L	47.4	45.1	43.9	42.8
NH_4-N	mg/L	27.9	27.8	27.7	27.7
TP [d]	mg/L	5.8	6.3	6.6	6.9
PO4-P	mg/L	2.9	3.1	3.3	3.4
ALK	mg/L	230	200	200	200

[a] based on TSS:BOD ratio of 1.0
[b] based on assumed (typical) x COD/COD ratio
[c] Adjusted to achieve 35% BOD removal at 65% TSS removal
[d] 1.5% of INF BOD

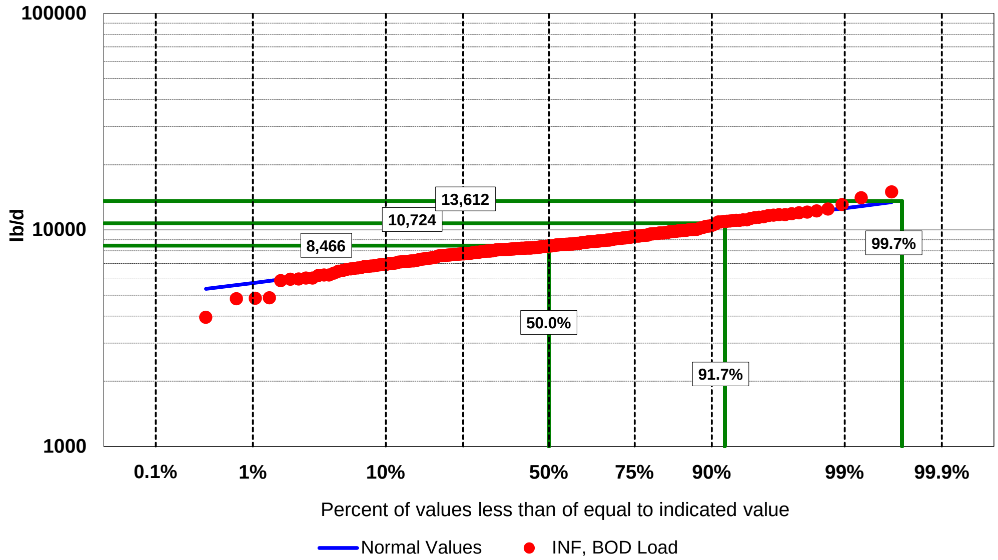

Figure 2-4: Log Probability Plot for Influent BOD 11/2012 – 8/2014

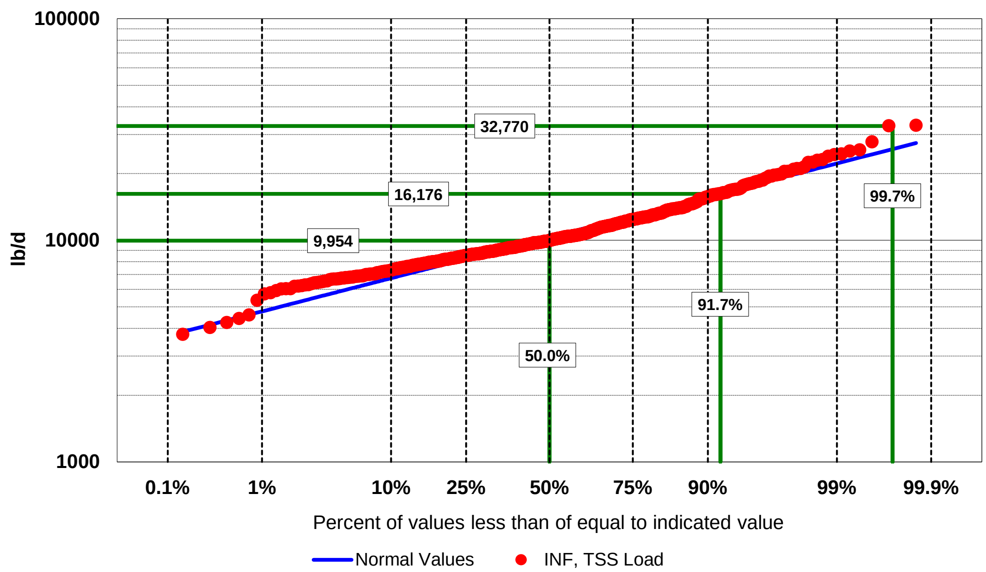

Figure 2-5: Log Probability Plot for Influent TSS 11/2012 – 8/2014

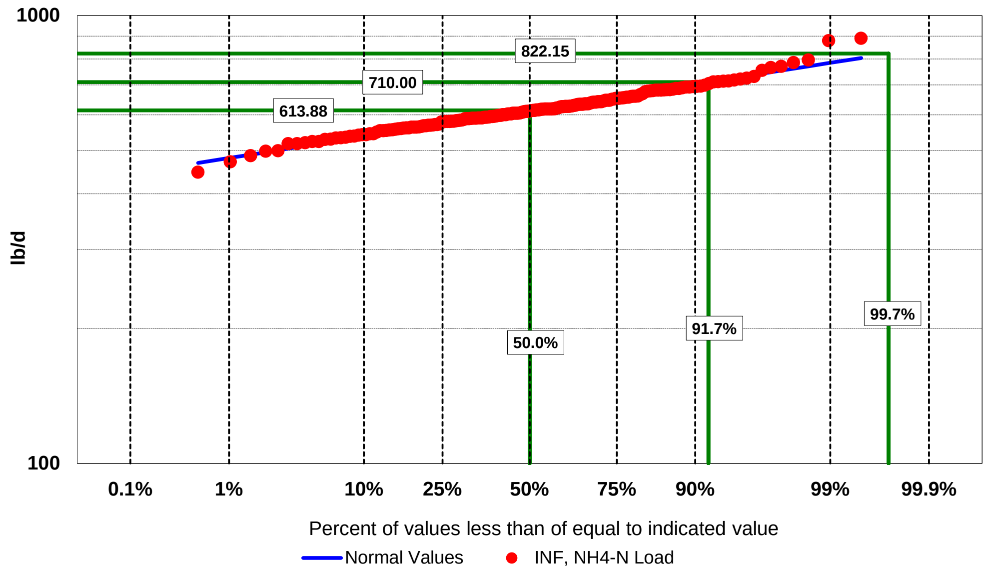

Figure 2-6: Log Probability Plot for Influent NH_4-N 11/2012 – 8/2014

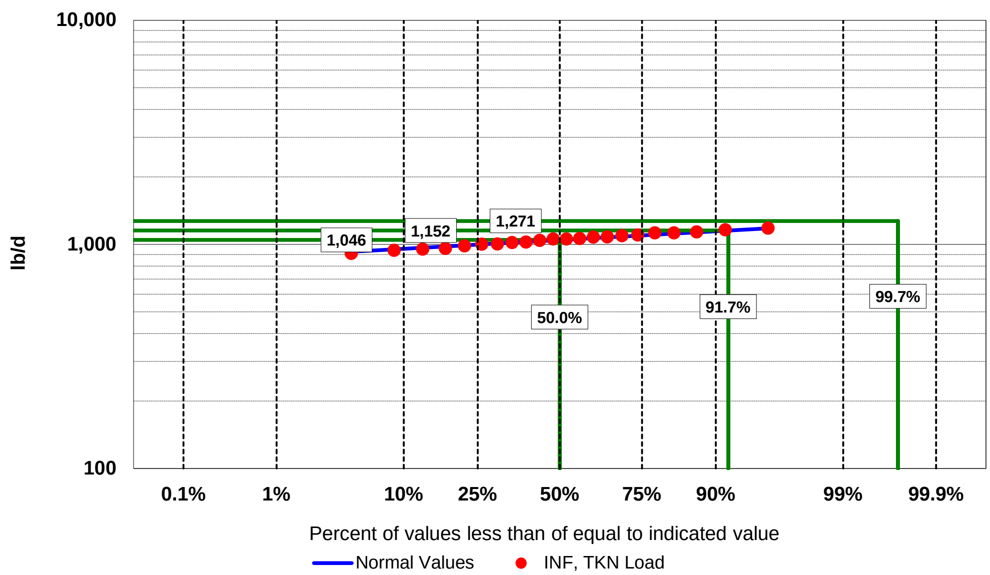

Figure 2-7: Log Probability Plot for Influent TKN 11/2012 – 8/2014

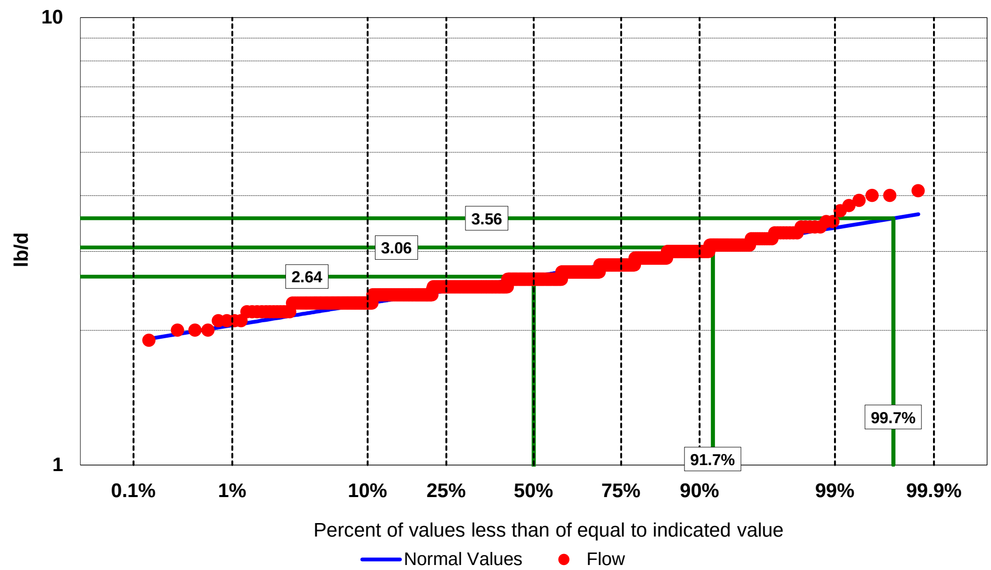

Figure 2-8: Log Probability Plot for Influent Flow 11/2012 – 8/2014

2.6 Flows and Loads Projections

The future flows and loads for the City of Wenatchee WWTP were developed using a combination of historical data and current as well as future population projection as discussed in Section 2.3.2. The historical data was used to determine the current per capita flow and waste load. Due to the significant industrial load contribution, the per capita loads are higher than for typical municipal waste. This also means that by applying the per capita loads to the future population projections, it is assumed that the industrial contribution will increase linearly with the population. Given the nature of the local commercial and industrial contributors (fruit processing and restaurants) this assumption is acceptable; especially given the link between local employment and population growth.

Table 2-4 shows the population projection from the most recent waste load assessment completed by the City of Wenatchee in 2014. The City of Wenatchee experienced an economic downturn between 2009 and 2011. In 2013, new development in the sewer system increased. The City of Wenatchee Community and Economic Development Department forecasted in 2015 that the growth in the Wenatchee urban growth area was expected to continue at a medium growth rate. The population projections shown in Table 2-4 fall between the medium and high population projections as estimated by Community and Economic Development. The City of Wenatchee is currently evaluating strategies to extend sewer to new development and connections to sewer are expected to increase with growth as a result. The connected population number used to determine the 2014 per capita waste loads was 35,280, consistent with the Wasteload Projection. The 2014 per capita flows and waste loads are summarized in Table 2-5.

Table 2-4. Population Projections For the City of Wenatchee

	2009	2010	2011	2012	2013	2015	2020	2025	2030	2035
Total in Urban Growth Area	37,149	37,388	37,566	37,697	37,877	40,115	43,521	46,820	47,109	–
Connected to Sewer	32,090	32,129	32,157	32,756	33,355	34,499	37,564	40,533	43,137	*46,497*

Table 2-5. 2014 Per Capita Flows and Waste Loads

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day
Flow	gal/PE/d	76.53	87.87	93.54	102.04
TSS	lb/PE/d	0.31	0.46	0.59	0.73
VSS	lb/PE/d	0.28	0.43	0.54	0.68
BOD	lb/PE/d	0.24	0.30	0.34	0.39
TKN	lb/PE/d	0.03	0.03	0.04	0.04
NH_4-N	lb/PE/d	0.02	0.02	0.02	0.02

The 2035 population number was extrapolated by applying the average growth rate (1.5%) between 2015 and 2030 from Table 2-4 to the 2030 population number connected to the sewer (Figure 2-9). This resulted in a projected population connected to the sewer of 46,500 in 2035. The projected flows and loads are summarized in Table 2-6.

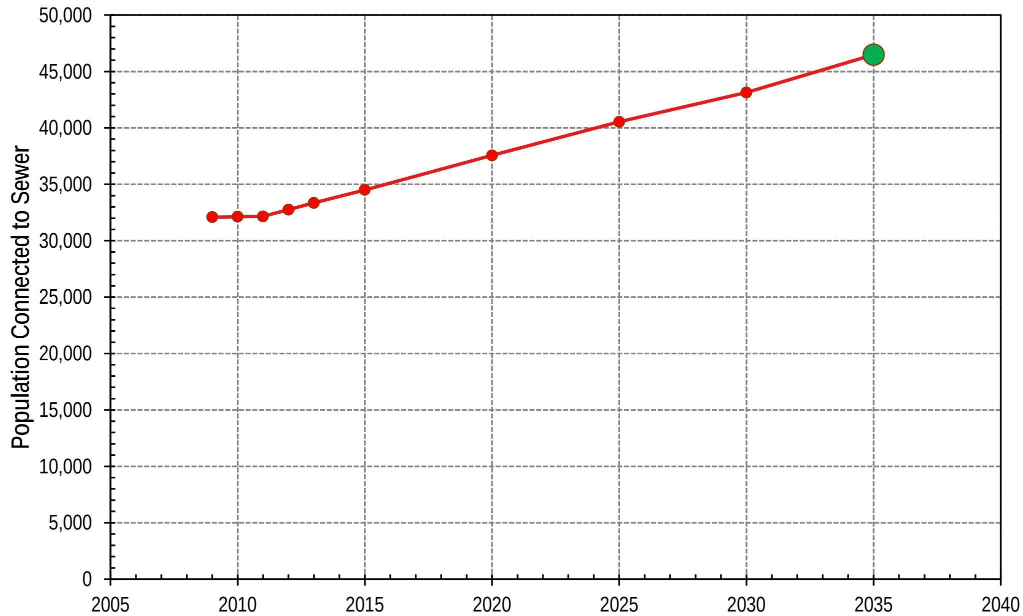

Figure 2-9: Extrapolated Projected Population Connected to the Sewer

Table 2-6. 2035 Flows and Load Projections (rounded)

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day	Peak Hour [a]
Flow	mgd	3.56	4.09	4.35	4.74	10.51
TSS	lb/d	14,400	21,500	27,300	34,100	-
VSS	lb/d	13,200	19,800	25,200	31,700	-
BOD	lb/d	11,400	14,200	16,100	18,000	-
TKN	lb/d	1,400	1,600	1,650	1,725	-
NH_4-N	lb/d	860	990	1,060	1,130	-

[a] Based upon the firm pumping capacity of the Raw Sewage Pumps (Primary Influent). All flows in excess are directed to the flow equalization basin.

Comparing the average 2030 BOD and TSS loadings from Table 2-7 with the projections from the previous waste load assessment, it shows that average BOD is basically the same at 10,600 lb/d versus 10,800 lb/d. Similarly, loadings are also close with TSS at 13,400 lb/d versus 14,700 lb/d.

Flows are significantly different. The previous waste load assessment shows an average flow of 4.3 mgd for 2030 versus 3.3 mgd, based upon the 2014 per capita flows and the 2030 connected population projections. While the previous assessment documented the decrease in flow, it is not reflected in the revised projections in this Plan because it was based upon the Ecology recommended 100 gal per capita per day. Long term flow and population data now shows that the per capital flow is much lower in Wenatchee.

Table 2-8 and Table 2-9 provide the average and maximum month flows and loads from 2015 through 2035.

Table 2-7. 2030 Flows and Loads Projections (rounded)

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day
Flow	mgd	3.30	3.79	4.03	4.40
TSS	lb/d	13,400	20,000	25,300	31,600
VSS	lb/d	12,200	18,400	23,400	29,400
BOD	lb/d	10,600	13,200	14,900	16,700
TKN	lb/d	1,300	1,475	1,550	1,600
NH_4-N	lb/d	800	920	980	1,040

Table 2-8. Average Flows and Loads 2015 - 2035

Parameter	2015	2020	2025	2030	2035
Flow (mgd)	2.64	2.87	3.10	3.30	3.56
TSS (lb/d)	10,700	11,700	12,600	13,400	14,400
VSS (lb/d)	9,800	10,600	11,500	12,200	13,200
BOD (lb/d)	8,500	9,200	9,900	10,600	11,400
TKN (lb/d)	1,050	1,125	1,225	1,300	1,400
NH_4-N (lb/d)	640	700	750	800	860

Table 2-9. Maximum Month Flows and Loads 2015 - 2035

Parameter	2015	2020	2025	2030	2035
Flow (mgd)	3.03	3.30	3.56	3.79	4.09
TSS (lb/d)	16,000	17,400	18,800	20,000	21,500
VSS (lb/d)	14,700	16,000	17,300	18,400	19,800
BOD (lb/d)	10,600	11,500	12,400	13,200	14,200
TKN (lb/d)	1,175	1,300	1,400	1,475	1,600
NH_4-N (lb/d)	740	800	870	920	990

It should be noted again that applying the current per capita flow and waste loads to the projected population assumes both a linear growth in commercial and industrial waste loads that are tied to projected population growth. In addition, it also assumes that flows will increase at the same rate as the loads. Long term trends (almost universally around the US) show that flow increases at a lesser rate than loads. This is due to gradual reduction in per capita water use. The reduction is a result of passive conservation due to water use efficiency programs regulated by the Department of Health, plumbing code changes, more efficient appliances (washer, dishwasher), and active conservation through a more environmentally conscious public.

The current per capita wastewater flow is 76 gal per person per day, which is at the low end for the US where the average is around 90 gal per person per day. Per capita water uses in other developed countries are as low as 30 gal per person per day; meaning per capita flows have the potential to continue decreasing for an extended period of time. The long term implication for Wenatchee is that the plant's hydraulic capacity will likely be sufficient much longer than its treatment capacity. When plant capacity is related to flow, it should be footnoted with the per capita capacity so that the overall capacity is accurately stated.

2.7 Effluent Quality Requirements

2.7.1 Existing Effluent Quality Permit

The City of Wenatchee's current NPDES Permit became effective on September 1, 2010. Effluent quality requirements presented in the NPDES Permit for a design flow of 5.8 mgd to the outfall are summarized in Table 2-10.

Table 2-10. Existing NPDES Permit (#WA 002394-9 – Outfall #001) Effluent Limitations

Parameter	Units	Average Monthly Limit [a]	Average Weekly Limit [b]	Maximum Daily Limit [e]
Carbonaceous Biological Oxygen Demand (5-day)	mg/L	25	40	--
	lbs/d	1,147	1,835	--
	% removal	85	85	--
Total Suspended Solids (TSS)	mg/L	30	45	--
	lbs/d	1,376	2,064	--
	% removal	85	85	--
Fecal Coliform Bacteria [c]	No./100ml	200	400	--
pH [d], in standard units	Daily minimum is equal to or greater than 6.0 and the daily maximum is less than or equal to 9.0.			
Total Ammonia	mg/L	25	--	47
	lbs/d	1,147	--	2,156

Parameter	Units	Average Monthly Limit [a]	Average Weekly Limit [b]	Maximum Daily Limit [e]
Acute WET Limit [f]	The acute toxicity limit shall be no statistically significant difference in test organism response between the chronic critical effluent concentration (ACEC), 0.72% of the effluent, and the control.			

[a] Average monthly effluent limit means the highest allowable average daily discharges over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total-number of daily discharges measured. See footnote c) for fecal coliform calculations.

[b] Average weekly discharge limitation means the highest allowable average of “daily discharges “over a calendar week, calculated as the sum of all ``daily discharges'' measured during a calendar week divided by the number of “daily discharges” measured during that week. See footnote c) for fecal coliform calculations.

[c] To calculate the average monthly and average weekly values for fecal coliforms you must use the geometric mean. Ecology gives directions to calculate this value in publication No. 04-10-020, Information Manual for Treatment Plant Operators available at: http://www.ecy.wa.gov/pubs/0410020.pdf

[d] Indicates the range of permitted values. The Permittee must report the instantaneous maximum and minimum pH monthly. Do not average pH values.

[e] Maximum daily effluent limit means the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day. For pollutants with limits expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For other units of measurement, the daily discharge is the average measurement of the pollutant over the day. This does not apply to pH.

[f] The acute WET Limit refers to the response of a test organism placed in effluent at a concentration equivalent to the concentration found at the edge of the acute mixing zone.

2.8 Biosolids Quality Requirements

2.8.1 Biosolids Classification

According to the State Biosolids Management Code WAC 173-308-170, biosolids are classified either Class A or Class B with respect to pathogens. They must meet the pathogen requirements as listed in Table 2-11. In addition, Class A biosolids must meet the requirements of one of the four Alternatives in testing and processing the biosolids in WAC 173-308-170. Class B biosolids must meet the requirements of one of the three Alternatives in testing and processing the biosolids in WAC 173-308-170. Both of the Class A and Class B biosolids also need to meet the vector attraction reduction requirements in WAC 173-308-180 and pollutant limits in WAC 173-308-160.

Table 2-11. Class A and Class B Pathogen Requirements

Biosolids	Pathogen Requirements [c]
Class A [a]	Fecal Coliform < 1,000 MPN/gram TS or Salmonella sp. bacteria < 3 MPN/4 gram TS
Class B [b]	Fecal Coliform < 2,000,000 MPN/gram TS or Fecal Coliform < 2,000,000 CFU/gram TS

[a] The fecal coliform or salmonella sp. bacteria density requirements must be met at the time the biosolids are used, at the time the biosolids are prepared for sale or give away in a bag or other container for application to the land, or at the time the biosolids or material derived from biosolids is prepared to meet the requirements for exemption in WAC 173-308-200.

[b] A minimum of seven samples of the biosolids must be collected at the time the biosolids are used and the geometric mean of the samples shall be taken.

[c] TS = total solids (dry weight basis);
MPN = Most Probably Number;
CFU = Colony Forming Unit

2.8.2 Wenatchee WWTP Biosolids Quality Requirements

The City currently uses drying beds located about 10 miles south of Wenatchee to dry dewatered biosolids to produce Class A under the Notice of Final Coverage Under the General Permit issued by Ecology on October 31, 2012. The Final Coverage allows the City to produce biosolids that are either Class A or Class B for pathogens depending on the process the City uses.

Class A Biosolids Requirements

If the City is to achieve Class A biosolids, the following requirements must be complied with:

1 Follow the conditions set forth in the Wenatchee Biosolids Class A Treatment Method, October 24, 2012. The conditions in the Class A biosolids treatment method include:

   1) The PFRP process may be started any time between May 1 and September 30 in any given year as long as the temperature requirements set forth below have been met:

      i) The dewatered biosolids cake consists of solids that are anaerobically digested for an average of 20 days at 35 to 55°C (95 to 131°F) and then dewatered on a belt filter press to 10-20% total solids.

      ii) PFRP shall be conducted as a batch system. This means that there will be separate, discrete amounts of biosolids specifically identified that will be turned and dried for the minimum period of 35 days. All sampling and process parameters shall be conducted separately on the individual batches.

Documentation shall be kept of each batch. Such documentation shall include date started, drying bed(s) used, ambient air temperature during the process, date that the turnings took place, and all sampling and analytical results.

iii) Starting on May 1, batches may be created at the drying beds as long as the average daily ambient air temperatures have reached 15°C for at least 7 consecutive days before the process starting date. The PFRP process can be started as late as September 30 as long as the temperature requirements are met.

iv) Separate areas shall be designated for the following:

a) Storage of the dewatered Class B biosolids cake;

b) Class B biosolids that are undergoing the PFRP process, and;

c) Storage of processed Class B biosolids to indicate that the biosolids are still Class B and awaiting return of analysis results.

v) The temperature at the drying beds is monitored daily using a weather station. During the treatment period(s), the average ambient air temperature must be at least 15°C.

vi) Each batch must be turned completely at least once a week during processing.

vii) After a minimum of 35 days, the total solids of each batch must be 90% total solids for three consecutive days and the Fecal Coliform Level must be less than 1,000 MPN per gram of total solids (dry weight basis).

viii) Each batch must be sampled for viable helminth ova after the sampling in item vii above is complete. This sampling shall be conducted in accordance with the Sampling and Analysis Plan dated October 18, 2012.

ix) Once all of the PRFP requirements have been met and documented for a batch, including the helminth ova sampling and analysis if required, a green flag will be placed in that batch.

x) The Class A biosolids will be removed from the drying beds facility within approximately 30 days after meeting the PRFP requirements.

2) Any dewatered biosolids delivered to the drying beds facility between October 1 and April 30 shall be land applied as Class B, or stored until the following May when the PFRP process may be initiated.

2 Follow the requirements of the Sampling and Analysis Plan dated October 20, 2015. Section 3.1 and subsections thereof apply specifically to sampling at the drying beds for purpose of achieving Class A biosolids.

It is noted that Wenatchee Biosolids Class A Treatment Method is an equivalent treatment process to further reduce pathogens which has been demonstrated by the City and approved by the US EPA and Ecology.

Exceptional Quality Rated Biosolids Requirements

The City produced biosolids can also be considered Exceptional Quality by Ecology and may be distributed to non-permitted entities if the biosolids meet the following three criteria:

1. Class A for pathogens;
2. Pollutant concentrations at levels equal to or below Table 3 in WAC 173-308-160, and,
3. Meet the vector attraction standard in WAC 173-308-180.

Class B Biosolids Requirements

If the City is to achieve Class B biosolids, there are three options for land application of Class B biosolids:

1. Option 1 – use a beneficial use facility;
2. Option 2 – land apply biosolids at currently permitted sites in Grant County;
3. Option 3 – permit new land application sites through procedures set forth in WAC 173-308, and in the City of Wenatchee's General Land Application Plan – Final, October 15, 2008.

If the City chooses to land apply Class B biosolids on their currently permitted sites in WRIA 41 (Grant County), they must follow the provisions set forth in the City of Wenatchee's Site Specific Land Application Plan – Final, October 15, 2015.

In addition, the City must follow the Spill Prevention and Response Plan dated September 10, 2012 when hauling biosolids, and Sampling and Analysis Plan dated October 20, 2015 for all the testing required for pollutants under WAC 173-308-160.

2.9 Unit Process Design Criteria

Generally, the facility requirements identified in this preliminary design report are based on projected flows, loading and effluent quality requirements for the year 2035. For some unit processes, facility requirements were based on a 2015 design condition to allow for effective phasing of the processes into the plan capacity of 2035 conditions. Design flows for unit processes are presented in Chapter 3 of this Plan.

2.10 Potential Additional Industrial Loads

The projected waste loads estimated in this plan include industrial loads which are linked to population growth. However, the City is aware of several potentially significant industrial users that could also discharge to the sewer system that are presented in Table 2-12.

Development in the planning area is unpredictable so the possibility of these additional loads is unknown. However, the impact of these industrial loads on the available plant capacity will be addressed in Chapter 3 of this Plan.

Table 2-12. Potential Industrial Loads

Industry	Flow (gpd)	BOD (mg/L)	TSS (mg/L)	Cu (µg/L)	Zinc (µg/L)	pH
Apple Slicing	20,000	4,363	53.5			5.2
After SBR		300	50			8.0
Winery	4,000	7,890	785			
After Pretreatment		450	150			
Food Processor	72,000	2,000 (est.)				
Paper Product Manufacturer	144,000	2,780	54	27.2	436	6.5

Chapter 3-Wastewater and Treatment Plant Evaluation

City of Wenatchee

Wastewater Treatment Facilities Plan Update

August 2016

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Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
AD	Anaerobic Digester	MOP	Manual of Practice
AER	Aerobic	MPN	Most Probably Number
ALK	Alkalinity	MW	Maximum Week
ASP	Aerated Static Pile	NH_4-N	Ammonia as Nitrogen
BFP	Belt Filter Press	NO_2-N	Nitrite-Nitrogen
BNR	Biological Nutrient Removal	NO_3-N	Nitrate-Nitrogen
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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3 Wastewater and Treatment Plant Evaluation

3.1 Process Modeling and Mass Balance

3.1.1 Model Calibration

The wastewater process simulator BioWin 4.1 was used for the calibration and unit process capacity evaluation. The simulator uses mathematical models that describe key biological, chemical and physical reactions that occur in a wastewater treatment plant. The model does not however represent reality and was developed around the typical municipal wastewater environment. To insure the validity of the model and its applicability to this facility and its specific wastewater, the first step is to calibrate the model.

The process of model calibration requires a thorough familiarization with the existing facility, its process design, and how it is operated. Completing the calibration process thus assures the validity of the model as well as insuring sufficient understanding of design and operation of the facility.

The goal of calibration is not to achieve an exact match to every single measured parameter but rather to find an overall good fit between the data and the simulated results. This subsequently requires prioritizing the more critical parameters with respect to facility planning such as biological yield or effluent nutrients over other less critical parameters such as effluent TSS or aeration basin DO.

Models are typically calibrated to a period of time that shows reasonably consistent operating conditions and performance. The calibration period should encompass enough data points to average the natural variability in wastewater treatment but not be too long to limit the range of conditions (e.g. temperature range, flow range).

The combined variability of influent flows and loads and unit process operation did not suggest any particular time period over the past two years that would be particularly well suited for the model calibration. For the steady state whole plant model calibration the period of March 2014 was selected.

The influent composition for the calibration period is summarized in Table 3-1. The influent TKN was unusually low relative to the BOD for the calibration period resulting in a ratio of 0.09. Typical TKN to BOD ratios in raw influent are about 0.16. This may be attributed to industrial BOD discharge which, given the nature of the local industries, is plausible except for this is the time of the year during which no major fruit processing would be expected. The nitrogen limit was also considered, and is not expected in this planning horizon. The unusual TKN to BOD ratio is of no consequence for this planning effort.

Table 3-1. Calibration Influent Composition

Parameter	Unit	Data	Model
Flow	mgd	2.5	2.5
COD [a]	mg/L	-	794
sCOD [b]	mg/L	-	246
TSS	mg/L	405	412
VSS	mg/L	370	375
BOD	mg/L	379	379
sBOD [c]	mg/L	-	170
VFA [d]	mg/L	-	15
TKN	mg/L	35	35
NH_4-N	mg/L	29	29
TP [e]	mg/L	-	5.5
PO4-P [e]	mg/L	-	2.75
Alkalinity [f]	mg/L	250	250

[a] Assumes COD:BOD ratio of 2:1
[b] sCOD adjusted to fit sBOD
[c] sBOD estimated based on measured PCL BOD removal
[d] Assumed VFA value
[e] Assumed Total P and P04 values
[f] Based on primary effluent alkalinity

Figure 3-1 shows the screen capture of the Wenatchee whole plant Biowin model. Because of the unusual influent BOD to TKN ratio a state variable input module was used instead of a COD or BOD input.

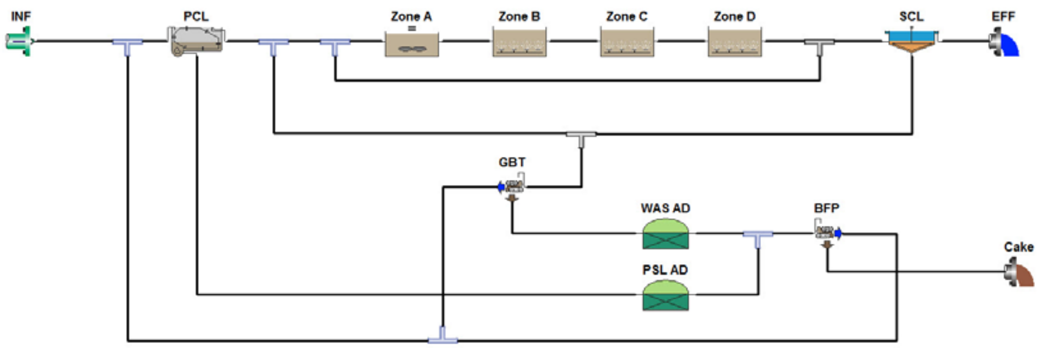

Figure 3-1. Wenatchee BioWin Model Screen Capture

Table 3-2 contains the calibration summary. Overall the calibration results are acceptable and without significant efforts a better fit cannot be attained. Such efforts would include both more modeling as well as additional sample analysis and flow meter field verification. Since this is a planning application of process modeling, the achieved model fit is acceptable and the discrepancies that do not err on the safe side can be addressed through specific safety factors.

The actual PSL load is higher than the predicted BioWin results. PSL samples are usually grab samples and thus do not provide a very reliable data point. PE TSS and BOD match well, which is more critical from a secondary capacity point of view.

The measured yield is higher than what the model is suggesting. Similar to PSL, WAS measurements are not very reliable. Further, it is not unusual for flow meters to have inaccuracies of 5% to 10%. Unless very reliable data are available for the yield it is not recommended to change fundamental kinetic or stoichiometric model settings in order to force a better match for the yield. The discrepancy in simulated yield will be addressed by lowering the design MLSS by 10%.

Table 3-2. Calibration Summary

Parameter	Unit	Data	Model
PE TSS	mg/L	116	115
PE BOD	mg/L	229	221
PCL TSS Removal	%	72	72
PCL BOD Removal	%	40	40
PSL Flow	gpd	12,400	10,500
PSL TS	%	4.7	4.6
PSL Load	lb/d	4,860	4,080
AB SRT (AER)	d		5.8
AB MLSS	mg/L	2,150	2,140
AB MLVSS	mg/L	1,800	1,690
RAS TSS	mg/L	6,700	6,600
Temp	°C	15	15
WAS Load	lb/d	3,650	2980
Yield	lb TSS/lb BOD	0.76	0.64
Dewatering Feed TS	%	2.3	2.3
Cake TS	%	-	15
EFF TSS	mg/L	12	2.3
EFF NH_4-N	mg/L	5.7	0.5
EFF NO_3-N	mg/L	3.4	0.3
EFF NO_2-N	mg/L	13.6	10.5

Matching the MLSS results in a 5.8 day aerobic SRT, which at 15°C would be sufficient for full nitrification. The full suite of performance data indicate only partial nitrification, and averaging of the data is misleading as the plant was transitioning back into nitrification. In addition, a steady state model will always simulate better nitrification and nitrogen removal performance since the impact of diurnal flows and loads is not captured.

Digester operation was not well captured by the process model. The TS entering the digesters match actual data, but the blended TS from the dewatering feed is higher in the model suggesting the plant has a higher rate of VSS destruction. While this may be occurring, the inherent difference is acceptable for two reasons. (1) The error is on the safe side (operating better than the model suggests), and (2) The aforementioned statement regarding WAS and PSL load measurement reliability.

The model calibration produced an acceptable fit for the plant data. Steady state models are quick and simple but do not capture changes in operation and influent flows and loads well as those typically take several weeks to fully establish. This means at any given time the steady state model does not reflect the most recent changes just before the calibration period.

This limitation is acceptable for planning level type work. The use of the model for the facility plan will be limited to the general mass balance for the future flows and loads in order to evaluate unit process capacities.

3.1.2 Mass Balance

The calibrated model was used to develop the 2035 mass balance for two different conditions; (1) BOD removal or winter operation, which represents the worse case from a solids generation perspective and (2) nitrification or summer mode when a longer sludge age is used for full nitrification. Table 3-3 summarizes key flows and loads for 2035. Additional detail about the future wastewater composition can be found in Chapter 2: Basis of Planning.

Table 3-3. 2035 Flows and Loads Projections (rounded)

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum Day
Flow	mgd	3.56	4.09	4.35	4.74
TSS	lb/d	14,400	21,500	28,000	34,100
VSS	lb/d	13,200	19,800	25,200	31,700
BOD	lb/d	11,400	14,200	16,100	18,000
TKN	lb/d	1,400	1,600	1,650	1,725
NH_4-N	lb/d	860	990	1,060	1,130

The future flows and loads and wastewater characteristics were applied to the calibrated model to project the future mass loadings. Figure 3-2 and Figure 3-3 show the graphical representation of the 2035 mass balances for summer and winter and the same results are summarized in Table 3-4 and Table 3-5.

Table 3-4. 2035 Winter Mass Balance Summary (TSS in lb/d)*

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day
Influent	lb/d	14,400	21,500	28,000	34,100
Primary Effluent	lb/d	5,250	7,700	9,800	12,050
Secondary Effluent	lb/d	200	290	360	410
Primary Sludge	lb/d	8,250	12,800	16,700	17,000
Waste Activated Sludge	lb/d	6,050	7,550	8,950	9,450
Thickened WAS	lb/d	5,750	7,150	8,500	9,000
Digested Sludge	lb/d	7,350	10,500	14,450	13,400
Cake	lb/d	7,200	10,300	14,150	13,150

* model output rounded up

Table 3-5. 2035 Summer Mass Balance Summary (TSS in lb/d)*

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day
Influent	lb/d	14,400	21,500	28,000	34,100
Primary Effluent	lb/d	5,200	7,700	9,750	12,000
Secondary Effluent	lb/d	380	560	720	810
Primary Sludge	lb/d	8,200	12,700	16,550	18,450
Waste Activated Sludge	lb/d	4,350	5,550	6,750	7,000
Thickened WAS	lb/d	4,150	5,250	6,400	6,650
Digested Sludge	lb/d	6,850	10,650	14,800	14,100
Cake	lb/d	6,700	10,450	14,500	13,850

* model output rounded up

The results from the mass balance analysis are the basis for the unit process capacity evaluation that is outlined in remaining section of this chapter.

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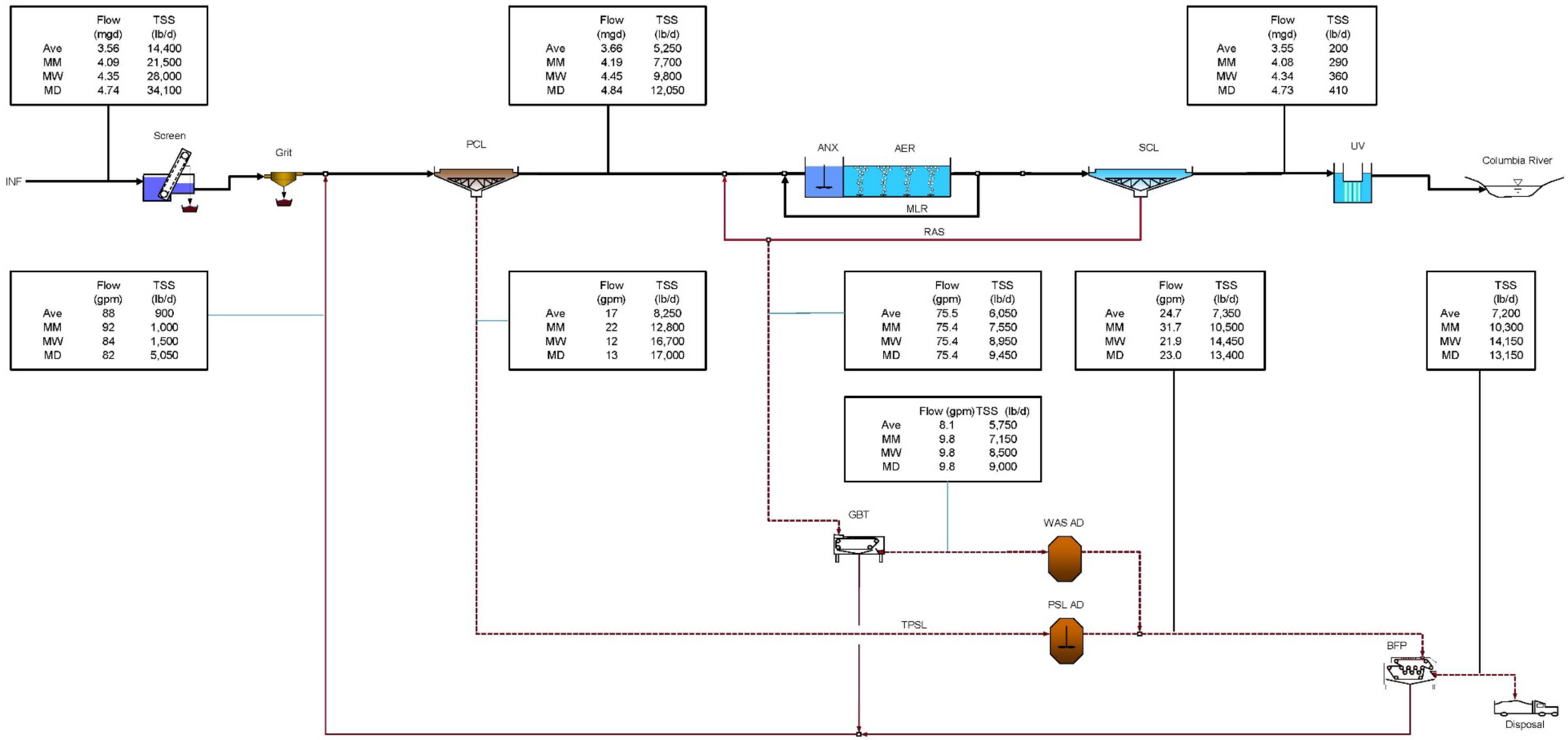

Figure 3-2: 2035 Winter Mass Loadings Schematic

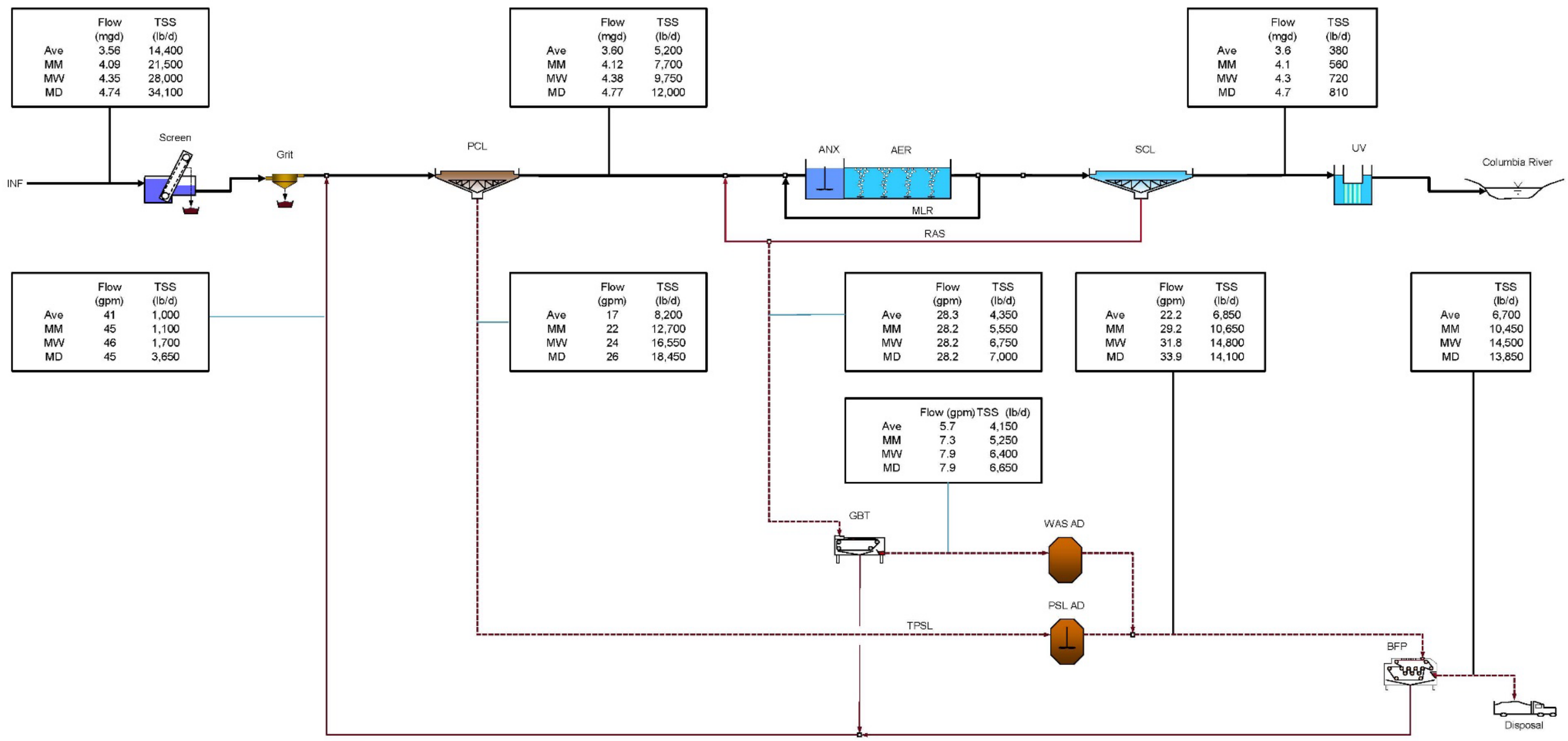

Figure 3-3: 2035 Summer Mass Loadings Schematic

3.2 Unit Process Capacity and Condition Evaluation

3.2.1 Grit Removal

The existing grit removal system consists of two vortex grit removal chambers with a peak hydraulic capacity of 11 mgd each. The peak flow is limited by the equalization basin to 11 mgd, where all excess flows are directed to the open storage basin located immediately west of the plant site on the other side of North Worthen Street. The existing grit removal facilities have sufficient capacity throughout the planning horizon. Condition of the interior of the grit removal chambers was not reviewed as part of this planning effort and condition of the tank interiors and grit removal unit paddle mechanisms is not known. Visual inspection of the grit washer and compactor equipment showed no significant signs of corrosion or disrepair. Operation staff did not indicate any known problems and, with the age of the mechanisms, it is expected they have a reasonable life expectancy with regular maintenance being performed. It is recommended the City plan for equipment replacement in their planning within the next 10 years (2025).

3.2.2 Screening

The plant has two new perforated plate screens which were recently installed and commissioned in in 2012. Screenings are processed by new washer compactor equipment provided with each screen mechanism. Each screen and washer/compactor system has a capacity of 15 mgd. No additional expansion or improvements to the screens are projected to be needed in the near-term planning horizon.

3.2.3 Primary Clarification

The two existing 65-foot and 85-foot diameter primary clarifiers have a combined total surface area of 8,340 sf. The primary clarifiers were recently refurbished (paint and metals repair) and covered with low profile aluminum odor control covers. The primary clarification process units do not have specific redundancy requirements with respect to the number of units online, meaning the firm capacity may assume all units are online. This is contingent on the plant meeting effluent treatment requirements while one primary clarifier is offline.

The assessment of primary clarifier capacity is complicated by the fact that they are also used for primary sludge thickening. This requires carrying a sludge blanket which impacts the peak loading capacity. Solids removal rates can be greatly reduced at peak flows due to high sludge blankets. These issues can be avoided with necessary operational adjustments, such as temporary lowering of the sludge blanket in the presence of anticipated peak hydraulic flows.

The plant peak flows are capped at 12 mgd at the flow equalization basin; limiting the peak hydraulic loading rate to 1440 gal/sf/d with both clarifiers online. The 85-foot clarifier alone has sufficient capacity based on the peak hydraulic loading rate of 2,500 gal/sf/d. Therefore the peak hydraulic loading rate is not capacity limiting for the 2035 planning horizon.

The average primary clarifier hydraulic loading rates are shown in Figure 3-5 for all three scenarios; both clarifiers online or just one at a time. The 65-foot clarifier alone will exceed the average loading rate of 1000 gal/sf/d by 2030. Because the primary clarifiers are also used for primary sludge thickening, the primary clarifier capacity would be insufficient to allow any long term maintenance (mechanism replacement, recoating, etc.) of the 85-foot clarifier. It is recommended that dedicated primary sludge thickening be considered by 2030. Eliminating the need for thickening in the primary clarifiers would allow higher primary clarifier loading rates when required for maintenance. If necessary, temporary operation of chemically enhanced primary clarification can be employed to insure solids removal rates.

Because foot print is at a premium at the site, the 65-foot primary clarifier could also be replaced with primary microfiltration, for example a Salsnes Filter (Figure 3-6), if space is needed to allow expansion of other unit processes (e.g. a new secondary clarifier). Two microfiltration units would be more than sufficient to replace the smaller clarifier. If used as redundant units and for peak flow conditions only, they would require relatively little maintenance and the built-in dewatering function would produce high TS (~40%) primary sludge cake for direct disposal. For longer term operation separate sludge thickening would be required.

Presently, the smaller clarifier is used as temporary storage for influent when toxic spills or discharges are suspected. It is also used for flow equalization during peak flow events. The ability to temporarily store influent is not critical, but it does provide added protection of downstream unit processes from any influent toxic event that may occur and is valued by the plant staff.

Figure 3-4. Existing 85 ft PCL before Odor Control Covers

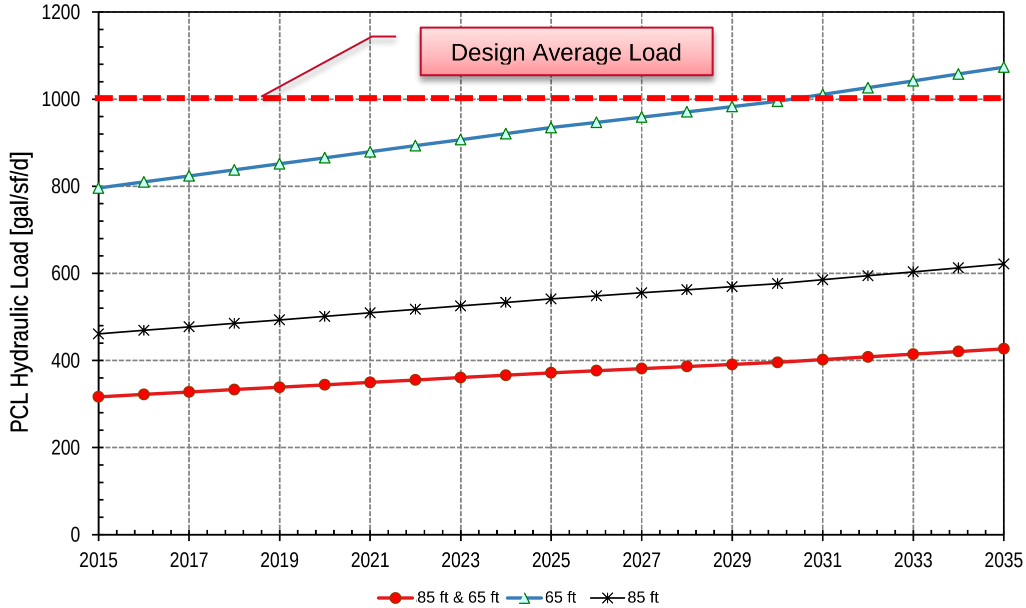

Figure 3-5. Average Primary Clarifier Loading Rates

Figure 3-6. Salsnes Filter (Replacement Option for 65 ft PCL)

Presently the primary clarifiers are used for primary sludge thickening. The thickened primary sludge solids concentration ranges between 3% and 5%. Table 3-6 shows the primary sludge flow ranges for 2035. The existing primary sludge lobe pumps were recently replaced by the City, and have a firm capacity of approximately 100 GPM.

Table 3-6. 2035 Primary Sludge Flow

Parameter	Unit	Value
Thickened Primary Sludge (3% - 5%)		
Minimum	GPM	14
Average	GPM	20
Maximum month	GPM	30
Peak	GPM	72
Primary Sludge (un-thickened 0.2% - 0.7%)		
Minimum	GPM	91
Average	GPM	160
Maximum month	GPM	240
Peak	GPM	720

Switching to dedicated primary sludge thickening would increase the primary sludge pumping requirements by a factor of 10 at peak flows. This means switching to dedicated primary sludge thickening would require replacing the existing primary sludge pumps (Figure 3-7). The existing primary sludge yard piping is 6 inch diameter and is sufficient in size. Peak velocities would reach 8 ft/s, which is acceptable in the main line for short periods of time. Some of the smaller primary sludge piping and fittings (flow meters, valves, etc.) would have to be upsized to accommodate the higher flows. Until the plant switches to dedicated primary sludge thickening and thin sludge pumping, the existing pumps have sufficient capacity.

The thin sludge flows are based on an assumed sludge thickness for thin sludge pumping. In practice peak sludge flows result in a backup of primary solids and sludge will thicken, reducing the sludge pumping requirement. Therefore, the thin primary sludge pumping has factor of safety built in.

Figure 3-7. Primary Sludge Pump Station

3.2.4 Secondary Treatment

Secondary treatment capacity can be limited by retention time and oxygen uptake rate in the aeration basins, in the secondary clarifiers (solids or hydraulic loading), solids return, and the ability of the aeration system to provide the required oxygen transfer. The capacity evaluation is therefore divided into:

- Aeration basin
- Secondary clarifiers and RAS pumping
- Aeration system and blowers

The minimum redundancy requirement of being able to treat 50% of the flow with the largest unit out of service may not be sufficient to meet the effluent quality. Therefore permit compliance requirements may likely govern treatment capacity rating of the secondary treatment system.

3.2.4.1 Aeration Basins

The existing 15-foot deep aeration basins (Figure 3-8) consist of two trains with a total volume of 1.11 MG. Each train has a 0.065 MG selector basin which can be operated in either aerobic or anoxic mode when the plant is nitrifying, or de-nitrifying in an anaerobic condition. Presently, the selector basin is operated in the anoxic mode most of the time. The Ecology Orange Book[1] does not provide specific requirements for the hydraulic retention time in the aeration basin, and largely refers to the WEF MOP 8 for guidance on aeration basin design. Because the existing aerations are configured as plug flow, the minimum maximum month hydraulic retention time may be as short as 2 hours for BOD removal and as long as 6 hours for nitrification. These HRT minimums are not firm numbers, but reflect basic hydraulic limitations for proper treatment due to basin geometries, i.e. to prevent short circuiting. Based on the projected flows the aeration basins HRT will not be limiting within the 2035 planning horizon (Figure 3-9).

The second aeration basin limitation is the average oxygen uptake rate. For maximum month conditions the typical maximum average oxygen update rate for design is 55 mg/L/HR. Using the total basin volume minus the selector basin volume, this results in a maximum oxygen transfer of 10,800 lb/d with both trains in service under maximum month conditions or 5,400 lb/d with a single train under average conditions.

Figure 3-10 illustrates the oxygen requirements for the planning horizon for average and maximum month loads. Both theoretical demands are for BOD removal only and full nitrification are only shown. Based on the oxygen transfer limitation the plant has sufficient capacity to operate in BOD removal mode until 2035 and beyond with two trains in service. To allow diffuser maintenance or replacement, extended operation with one train has to be possible while meeting the discharge permit. In BOD mode this is possible under average conditions through 2033. To take a train offline beyond 2033, it may require the use of chemically enhanced primary clarification to offload the secondary treatment system.

Under average flows and loads and with two trains online, the aeration basins can support nitrification throughout the planning horizon. Operation in nitrification mode, with only a single train, is not possible at the minimum temperatures assumed during process modeling. If nitrification or nitrogen removal became a future permit requirement, then additional treatment trains or system

[1] "Criteria for Sewage Works Design", Washington Department of Ecology - 98-37 WQ

upgrades would be needed. The condition of the aeration basins and pipe supports were analyzed from the top of the tanks; and concrete and pipe supports appeared in good condition and immediate rehabilitation of replacement of basin concrete and miscellaneous metals is not needed in the near future.

Figure 3-8. Existing Aeration Basins

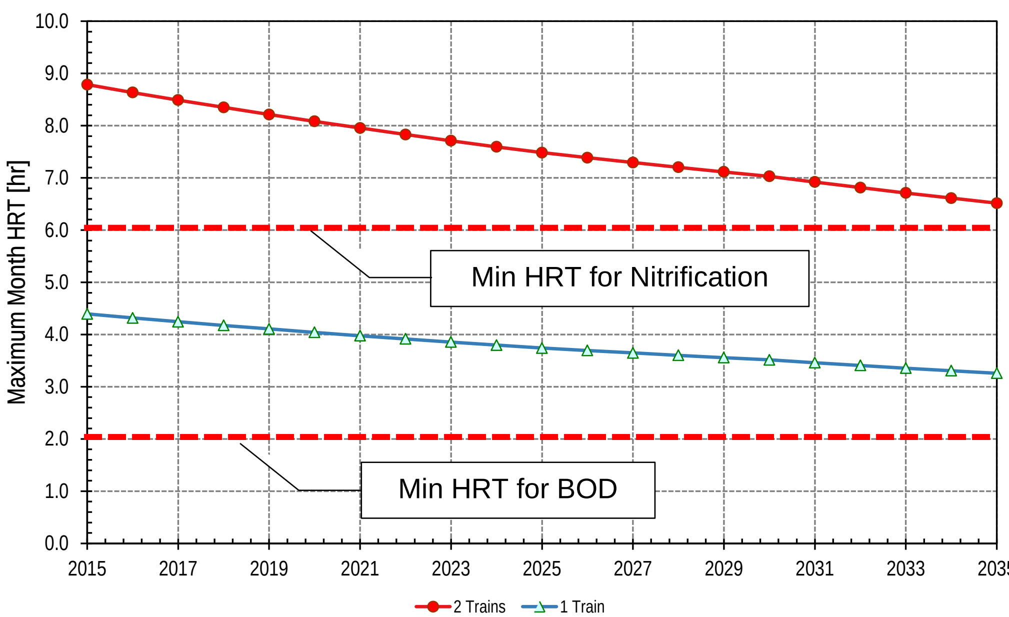

Figure 3-9. Aeration Basin HRT Through Planning Horizon

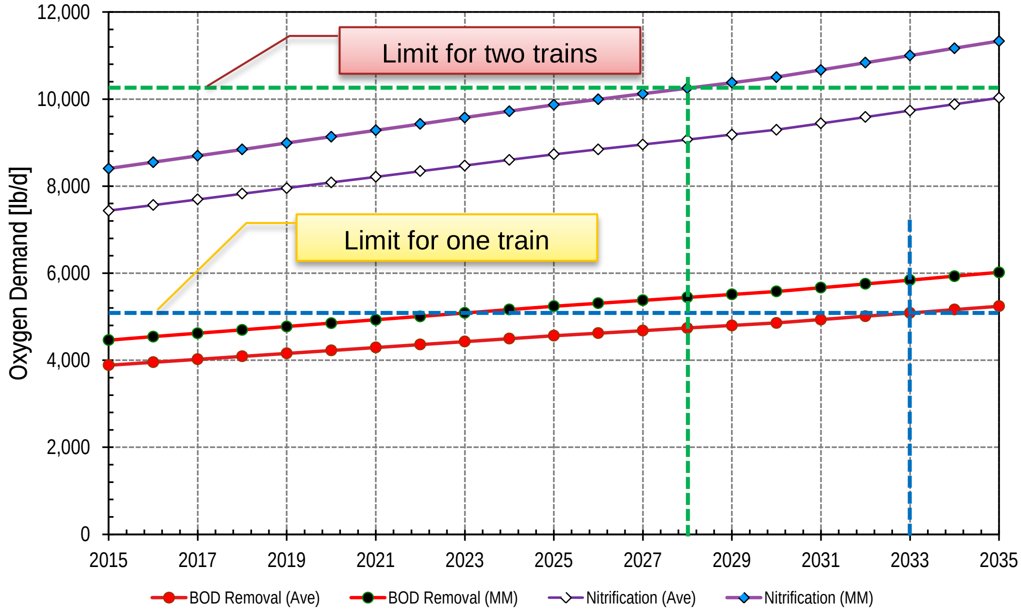

Figure 3-10. BOD and Nitrification Oxygen Demand for Average and Maximum Month Loads

3.2.4.1 Secondary Clarifiers and RAS

Modern secondary clarifiers can handle a TSS loading of 25 - 35 lb/sf at maximum month flows but would typically have a side wall depth of 16 feet or more. The existing clarifiers (Figure 3-11) have a sidewater depth of 12 feet deep, which is relatively shallow. Assuming sludge volume index's (SVIs) of 150 g/mL or better, the maximum solids loading rate is assumed to be 20 lb/sf to account for the shallow clarifier. If the clarifier loading is capacity limiting, a clarifier rating study should be conducted to determine the actual clarifier capacity.

The relationship between required MLSS for either BOD removal or nitrification and the maximum MLSS with either one or two secondary clarifiers online is shown in Figure 3-12. The plant will need a third clarifier by approximately 2023 in order to have necessary redundancy to assure permit compliance during periods when one aeration basin or one clarifier must be removed to maintenance purposes. The Ecology Orange Book redundancy requirement is for 50% capacity with the largest unit out of service, yet without a redundant secondary clarifier permit compliance cannot be obtained or guaranteed with one secondary clarifier out of service for any extended period of time. The secondary clarifiers have not been re-conditioned and re-painted recently, and the provision of a third clarifier will also help provide the needed facility capacity to accommodate future clarifier preventive maintenance and rehabilitation.

The existing RAS pumping station has a firm capacity of 2.7 mgd, which translates into a maximum RAS rate of 67% at 2035 maximum month flows. Additional RAS pumping capacity is recommended as existing RAS pumping units are replaced under regular equipment replacement. Added capacity is not needed to be provided with the construction of a third secondary clarifier.

Figure 3-11. Secondary Clarifiers

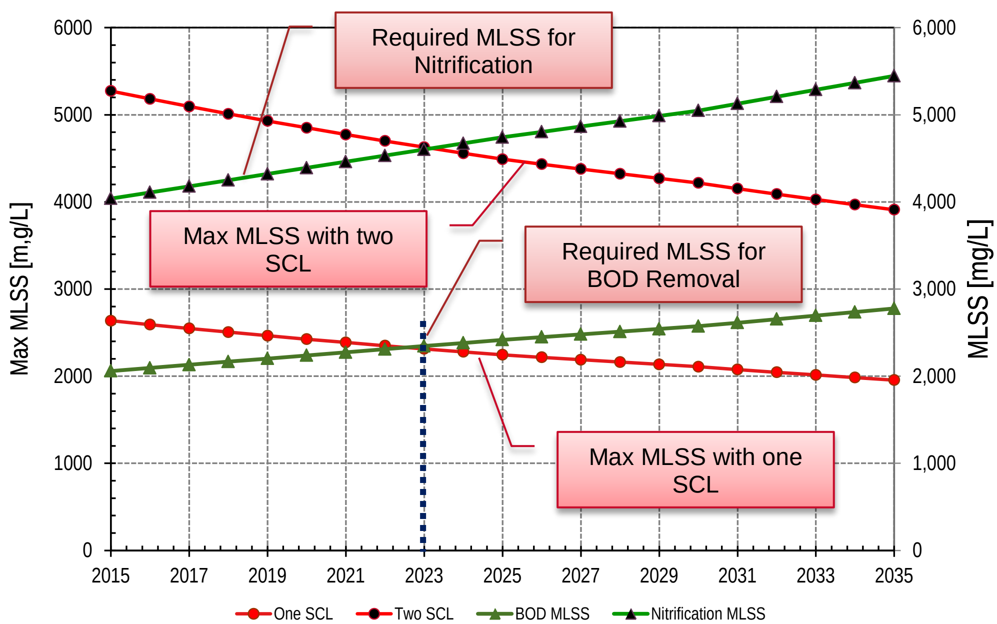

Figure 3-12. Maximum MLSS Based on SCL Solids Load vs. Minimum MLSS and BOD Removal and Nitrification

3.2.4.1 Aeration System and Blowers

The existing aeration system uses nine inch Sanitair membrane diffusers. Table 3-7 summarizes the aeration system capacity for maximum month conditions using a combination of design information (number of diffusers, basin volumes, etc.) and assumed values for alpha and the DO set point. The maximum oxygen transfer capacity for a single train is 4,250 lb/d using 1.5 SCFM per diffuser as the design basis. The nine inch membrane diffusers can handle higher airflows such that when operating with a single train higher air flows and oxygen transfers are possible. Within the planning horizon the plant has sufficient aeration capacity to meet the effluent requirements (BOD removal). Even full nitrification is possible with the aeration capacity through at least 2020 (Figure 3-10) and beyond with both train in service. The exact aeration system capacity could be determined through off gas testing. Independent of that the aeration capacity may be increased some by adding additional diffusers specifically to Grid 2, which has fairly low floor coverage

The existing three aeration blowers have a capacity of 5,500 SCFM each. With the firm capacity of 11,000 SCFM roughly 3.8 SCFM per diffuser with both trains on line can be delivered. Unless full nitrification is required before 2035, no improvements to the aeration system with regard to capacity and distribution are required. Further, the condition of the blowers was observed to be good, with no suggested maintenance upgrades in the near future. The aeration diffusers have been reported by City staff to be aged, and an inspection of the membrane conditions is recommended to be conducted within the next year. The City should also be planning on a full replacement of the diffuser membranes in their operation and maintenance budgeting.

Figure 3-13. Existing Blowers

Table 3-7. Aeration Capacity Summary per Train

		Grid 1	Grid 2	Grid 3
Volume	MG	0.1080	0.2160	0.1600
Depth	ft	15	15	15
Number of Diffusers		504	572	340
Diffuser Coverage	%	22%	12%	5%
Design DO @ MM	mg/L	2	2	2
alpha		0.35	0.45	0.6
Design Air/Diffuser	SCFM	1.5	1.5	1.5

Table 3-7. Aeration Capacity Summary per Train

		Grid 1	Grid 2	Grid 3
SOTE	%	24.5	24.5	24.5
Total Air	SCFM	756	859	509
Total Oxygen Transfer	lb/d	1,176	1,720	1,357

3.2.5 Effluent Disinfection

The City constructed an ultraviolet light disinfection system in 2004/2005 to replace their existing gaseous chlorination system.

The UV was originally designed for a peak design flow of 11 mgd, with two UV channels in operation and the third channel serving as a redundant channel. The UV dosage was designed to meet an NPDES fecal coliform 30-day average geometric mean count of no greater than 200/100mL when UV transmittance values are as low as 50%. Since startup of the UV system, the City has indicated they have had difficulty operating the system in automatic control mode to meet fecal deactivation requirements, and operations staff has been forced to manually determine the number of channels in operation and the delivered UV dosage from the system. The City has exceeded the maximum fecal coliform requirement in their NPDES effluent discharge permit on several occasions.

The design of the existing UV system (circa 2004) was setup originally to deliver a minimum UV dose of 40,000 mW-s/cm^2 at peak flow, in effluent with a UV transmittance of 50% at end of lamp life (EOLL) after reductions for quartz sleeve fouling. The basis for the design included a calculated dosage algorithm that was not based upon evaluating the UV dose delivered by the UV system through an independent third party bioassay. Since 2006, the US EPA has required the design of UV systems include bioassay validation methodology following protocols described in NWRI Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (May 2003). The UV system controls and dose requirement was recently reviewed by the UV system manufacturer, and they have indicated that through the use of a newer system sizing algorithm that is based upon bioassay validation, they can obtain approximately 7.5 mgd (68%) of the original design capacity of the system with existing equipment. Through several changes with the existing UV equipment it is likely the original design capacity can be achieved through lamp changes and additions to the lamp count. It is recommended the City work with their current UV equipment manufacturer over time to work to regain validated capacity of the system to assure needed system performance over the planning period. The City has also acquired replacement parts for the existing UV channel level control gate cushioning system which the City is in the process of installing. Closer channel level control is also expected to enhance the reliability and installed capacity of the existing UV system.

3.2.6 Impact of Nitrification or Nutrient Removal Requirements

Presently the requirements for discharging to the Columbia River do not include limits for nutrient removal for discharge to the Columbia River. Nevertheless, the City may want to consider the impact of future requirements for full nitrification and/or nutrient removal in future facilities planning efforts. In particular, the limited space for expanding secondary treatment facilities. Technical solutions exist to produce very high quality wastewater effluent within the footprint of the existing treatment plant.

However, they come with a much higher capital and operation cost that together could result in significant rate increases.

With a third secondary clarifier in place, the existing aeration basin could be modified to biological nutrient removal (BNR) by increasing the biomass inventory it can hold. One option would be to deepen the basins by raising basin walls to increase the volumes by 30% - 50%. Whether this approach is practical or economical would have to be determined. Constructability, construction sequencing, as well as hydraulic issues would need to be considered.

Other options to increase the biomass inventory are Integrated Fixed Film Activated Sludge (IFAS) and BioMag. Both are technology solutions specifically designed to add capacity within an existing basin. IFAS adds suspended biofilm carriers to the aeration basins, which are contained within the basins through retention screens. The fine bubble diffusers would be replaced with stainless steel coarse bubble diffusers.

BioMag adds magnetite to the activated sludge as ballast which results in superior settling characteristics that allow clarifier loads of 50 – 100 lb/sf/d. While some of the magnetite is lost and has to be replenished on a regular basis, most is retained and separated from the WAS with magnets before the solids are further processed. Because of the resulting “heavy” sludge additional mechanical mixing may be required in all basins to ensure the sludge remains in suspension. No other basin modification would be necessary. The potential increase in capacity of either technology would be limited by oxygen transfer due to the shallow basins.

Converting the existing aeration basins to a membrane bioreactor or constructing a parallel MBR train would allow both expanding the capacity of the existing aeration basins as well as freeing up space for more basins by eliminating the need for secondary clarifiers. Due to the complexity of the need to operate two very different process configurations, and the fact that nutrient removal is not needed through the planning period, construction of a parallel MBR train is not recommended. A low phosphorus and nitrification requirement could be addressed through a nitrifying tertiary MBR that combined chemical phosphorus removal with nitrification, but construction of a tertiary MBR for the full forward flow of the facility would require a significant investment.

Phosphorus removal alone could be achieved with moving bed filters with a single or two stages depending on the limit. Due to the low flows this type of effluent filtration would be more attractive than membrane solutions for cost implications.

3.3 Solids Processing

The existing solids processing train consists of WAS thickening, separate WAS and primary sludge digestion, and dewatering. Primary sludge is thickened in the primary clarifiers and pumped to the primary digesters. Waste activated sludge is thickened with a gravity belt filter before separate digestion. Both digested sludges are blended upstream of dewatering and dewatered with a two meter belt filter press. The dewatered cake is taken to nearby drying beds.

3.3.1 Primary Sludge Thickening

Presently the plant has no dedicated primary sludge thickening. The sludge is settled in the primary clarifiers with varying results. Thickened primary sludge TS concentration ranges between 3% and 5%. To insure that Class B requirements are being met all the time, primary sludge thickened to a 4% concentration was assumed as the design basis.

3.3.2 WAS Thickening

Waste activated sludge is thickened with a single two meter gravity belt thickener (GBT) with a capacity of 800 lb/HR - 1400 lb/HR or 200 GPM - 400 GPM. For the capacity analysis a loading rate of 1,000 lb/HR was assumed. Based on that loading rate, the required run time for the GBT does not exceed 8 hours per day throughout the planning horizon (Figure 3-15). However, with only one GBT the thickening operation has no redundancy. In addition, the GBT is approximately 25 years old. Due to the age of the equipment, there is some risk that the City could begin to experience extended downtimes for maintenance and repairs. Presently the secondary digester is operated to overflow to the unheated digested sludge storage tank. This effectively separates the thickening and dewatering operation by providing a wide spot in the line, as the digester is operated in displacement mode where flow entering the digester results in flow leaving the digester.

However, feeding the digester intermittently is not ideal and a better long term solution would be to have a digester feed blending/equalization tank from which the digester could be fed continuously. Another option is to install a drum thickener to replace the GBT or have the GBT serve as a redundant unit. A drum thickener can be operated on a 24-hour seven day a week basis and would provide the continuous digester feed without the need of a feed tank and additional pumps. The ability to operate a drum thickener on a continuous basis is well proven and is recommended to be considered.

Figure 3-14. Gravity Belt Thickener

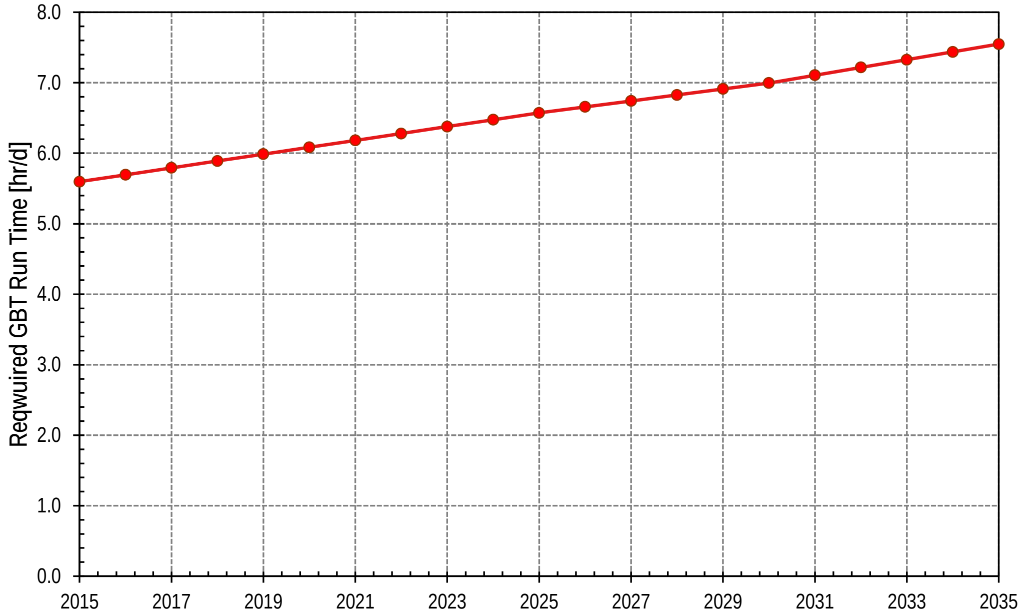

Figure 3-15. Required Daily GBT Run Time

3.3.3 Digestion

The two primary sludge digesters (combined) provide adequate volume to maintain an approximate recommended minimum 15 day HRT goal (Figure 3-16), but both units must be online. A single digester is not sufficient to meet the minimum recommended HRT goal of 15 days unless the primary sludge is thickened to TS values greater than 6%.

The secondary sludge digester HRT meets the 15 day goal throughout the planning horizon (Figure 3-17), but does so without unit process redundancy.

The digesters are operated to digest primary and secondary sludge separately, which is the preferred mode of operation going forward. Upgrading the existing sludge storage tank to a primary sludge digester was discussed with City staff and the project team, but the consensus was that it would create too many operational problems by not having a digested sludge storage tank. A sludge storage tank is a very common solution to address variability in dewatering operations, digester loadings, facility shutdowns or simply to have the ability to store solids when sludge hauling is not possible due to inclement weather conditions.

The primary sludge digester is capacity limited today under the design condition of 4% TSS feed sludge and maximum month flows and loads. A second digester would be required to guarantee meeting a recommended 15 day solids retention time (SRT) or hydraulic retention time (HRT) goal. Unless recuperative thickening is used, HRT is the same as SRT for the digester.

In addition, downstream biosolids processing unit processes (digestion, dewatering and drying) are directly dependent upon proper SRT to assure their rated performance. An additional digester is needed to enable downstream processes to meet rated capacities when a single digester is removed from service for cleaning or repairs.

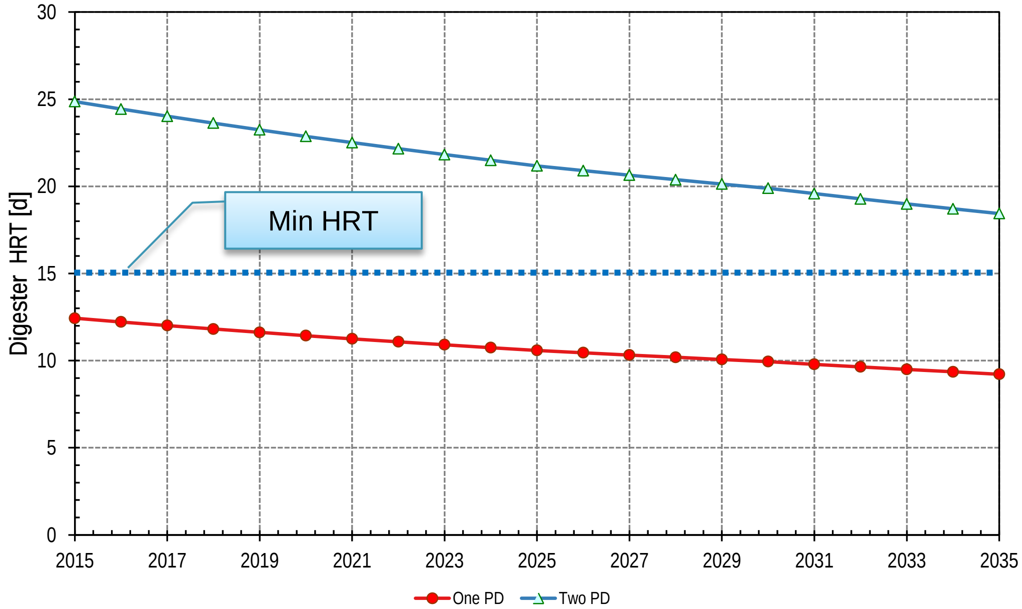

Figure 3-16. Primary Sludge Digester HRT

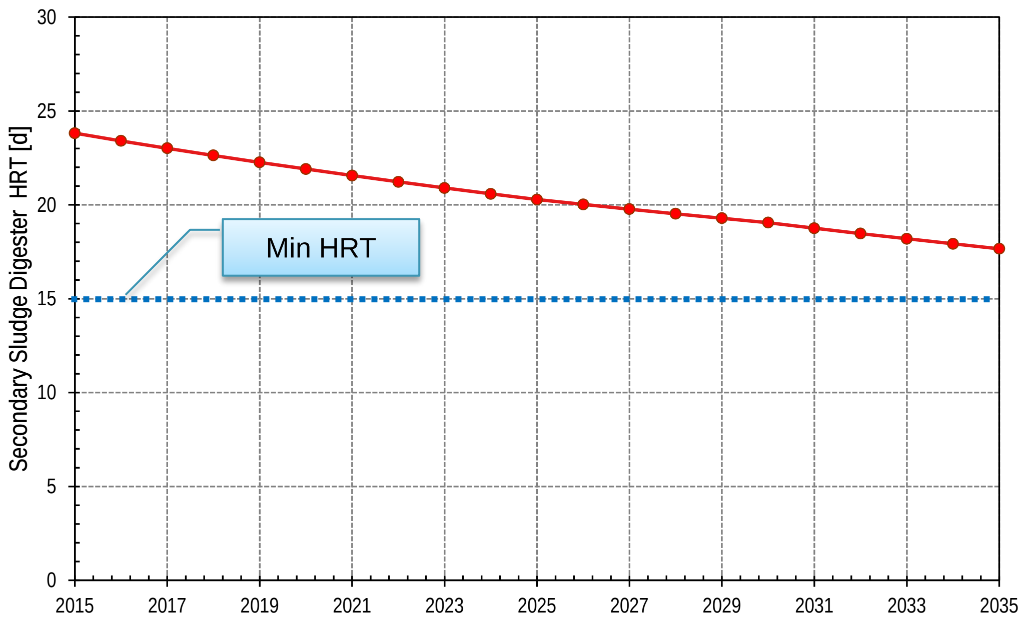

Figure 3-17. Secondary Sludge Digester HRT

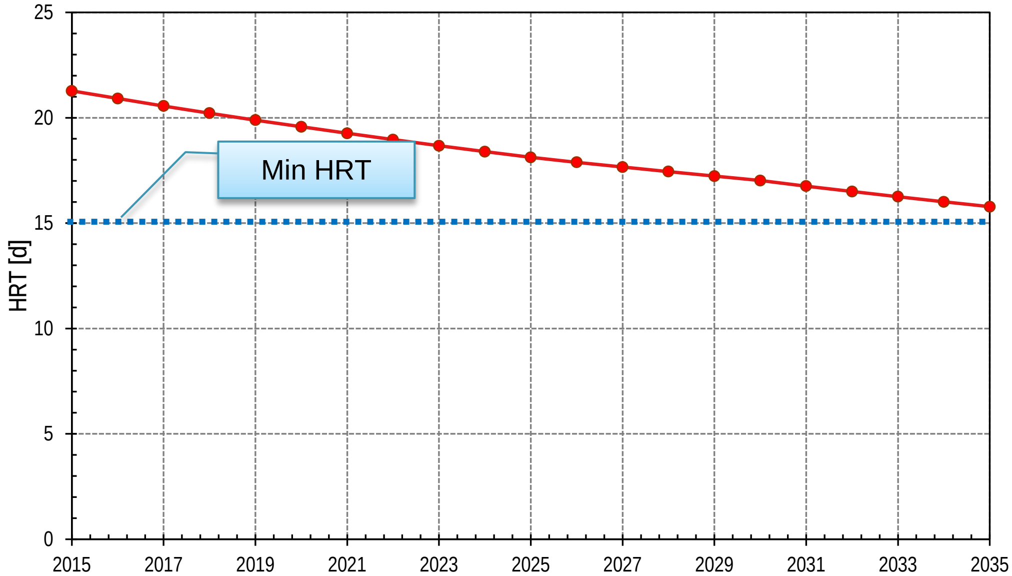

Figure 3-18. HRT with Two Primary Digesters and Co-Thickening to 6.5%

3.3.4 Dewatering

The plant operates a single belt filter press (Figure 3-19) with a capacity of 1,000 – 2,400 lb/HR which is sufficient capacity throughout the planning horizon. Additional dewatering redundancy is recommended. To provide added redundancy or continuous dewatering capability, then installation of a separate dewatering technology is recommended to be considered.

Figure 3-19. Existing Belt Filter Press

3.4 Unit Process Capacity Summary

The unit capacity evaluation was conducted by applying criteria from the Ecology Orange Book, or when not specified using established industry typical design parameters. The evaluation was based on meeting the current discharge requirements presented in Table 2-10 of Chapter 2 for BOD and TSS removal, which implied a non-nitrifying operation whereas the plant is currently operated in nitrification mode with an anoxic selector basin.

The unit process capacity evaluation has shown that, with the exception of the primary sludge digester, no capacity driven expansions are required within the planning horizon. However, having sufficient unit process capacity and meeting the minimum redundancy requirements alone does not translate into an assured permit compliance. The ability to operate the plant under adverse conditions, or conduct preventative maintenance throughout the year promotes installation of redundant units for key parts of the treatment plant. Equipment and facilities recommended for maintenance upgrades and unit processes where redundancy is needed are summarized in Chapter 5 of this Plan.

3.4.1 Liquid Stream Capacity

The primary clarifiers have sufficient capacity based on hydraulic loading. However, they are also used to thicken primary sludge. That not only limits primary sludge thickness but also solids retention during peak events or when the sludge blanket is high for other reasons. These items and the resulting capacity limiting impacts on the solids train suggest adding mechanical thickening of primary sludge.

For secondary treatment, the issue is not lack of unit process capacity but the lack of system redundancy. If one unit process is out of service (e.g. an aeration basin or secondary clarifier) the secondary treatment system operates at or beyond capacity such that it is not possible for operators to conduct regular maintenance except during times of low flows and loads. Even then, operations staff has only short periods of time for executing the required maintenance work. Adding a third secondary clarifier would alleviate these issues.

Because there is a known deficiency in the existing UV disinfection system that limits its ability to meet minimum deactivation of fecal coliforms, capacity of the UV system will remain limited until modifications can be made to the existing UV system. Modifying the UV system through a manufacturer supported upgrade is recommended as soon as practical.

3.4.2 Solids Stream Capacity

The solids processing train generally lacks redundancy. Operators have no direct control over primary sludge thickening as it is performed in the primary clarifiers. WAS thickening relies on a single gravity belt thickener. The unit is reliable and operates well, but the day shift operation mandates the City operate it through batch wasting of the secondary process since there is no WAS storage tank to allow for continuous wasting and batch thickening. Replacing the GBT with a unit process that is able to operate on a 24 hour per day basis would allow separating activated sludge control from the solids processing operations. In addition, thickening recycle loading back to the liquid stream process would then occur over the full day, versus a batch loading basis.

The primary sludge digester is at 85% of its design capacity, assuming a total solids feed concentration of 4%. The capacity of primary digestion can be extended significantly (≥50%) by adding dedicated mechanical primary sludge thickening using for instance a rotating screen or drum thickener (RST). Installation of an RST would be lower in capital cost compared to constructing another digester. However, the lack of digester unit redundancy issue would not be addressed by dedicated primary sludge thickening. If one digester has to be taken out of service, the process can switch digesters and co-digest. Even with mechanical primary sludge thickening installed there would not be sufficient capacity in one digester to provide the recommended 15 days of hydraulic retention time for co-digestion by 2035. It is recommended the City consider adding mechanical primary sludge thickening during the initial planning horizon and construct a second primary sludge digester (third digestion process unit) by 2030.

With the sludge storage tank in place the lack of dewatering redundancy is of lesser concern. The existing belt filter press dewatering unit does not produce high solids cake. However, given the dewatered sludge is hauled to the biosolids drying beds as described in Chapter 4, greater dewatered cake dryness is not an imperative issue. Dewatering performance can likely be optimized if needed through polymer feed optimization. When the City's existing belt filter press dewatering unit reaches the end of its useful life, it is recommended the City evaluate additional dewatering equipment options in addition to belt filter press technology. It is possible the City could replace the existing technology with equipment that can achieve better drying performance.

3.5 PE and EDU Normalized Plant Capacity

Wastewater treatment capacity has historically been expressed in units of flow rate (e.g. mgd). For planning proposes, this is problematic for a number of reasons.

- While wastewater treatment plants are designed in part for hydraulic capacity they also treat organic load. Operational costs are predominantly associated with the oxygen required to remove BOD or ammonia, chemicals used to dewater or remove phosphorus, and/or sludge for disposal. In addition, all bioreactors and most mechanical equipment (e.g. dewatering, thickening, aeration, etc.) are sized based on both hydraulics and loading.
- Per capita water consumption has continued to be declining. This decline may accelerate in areas of drought where water conservation efforts are accelerating.
- Sewer rates are commonly based on water use. If the reduction in water use is not factored into the rate structure, then wastewater treatment will become underfunded as revenue based on water use declines while per capita loads remain the same.
- Projecting plant flow linearly with population will over project flow. If the plant capacity is tied to flow, it may trigger wastewater treatment planning or upgrades too early based on actual flow and/or too late based on actual loading.

The appropriate per capita BOD load is somewhat difficult to determine because of the common use of waste disposals. For Wenatchee, a per capita BOD contribution of 90 g/d was used for evaluation, which is in the middle of the range of values found in references. Applying the per-capita BOD loading to the 2015 average influent load, the City's treatment plant treats roughly 42,000 population equivalents (PEs). With a population of 34,500, this translates into an industrial contribution of approximately 7,500 PEs (or a 17% contribution).

Table 3-8 and Figure 3-20 express the existing treatment plant unit process capacities relative to the average per capita loading. The equivalent dwelling units (EDUs) shown Table 3-8 are based upon 2.53 PEs per EDU. This is consistent with the EDU population densities presented in the City of Wenatchee 2013 Urban Area Comprehensive Plan. Unit processes that are hydraulically limited (e.g. pumping stations and primary and secondary clarifiers) are not included.

Table 3-8. Load Based Unit Process Capacity in Population Equivalents

Unit Process	Capacity [PE]	Capacity [EDU]	Max Year of Capacity
Aeration Basin	92,000	36,300	> 2035
Secondary Clarifier	70,800	28,000	> 2035
WAS Thickening	70,000	27,500	> 2035
Primary Digester	36,700	14,500	2015
Secondary Digester	58,400	23,000	> 2035

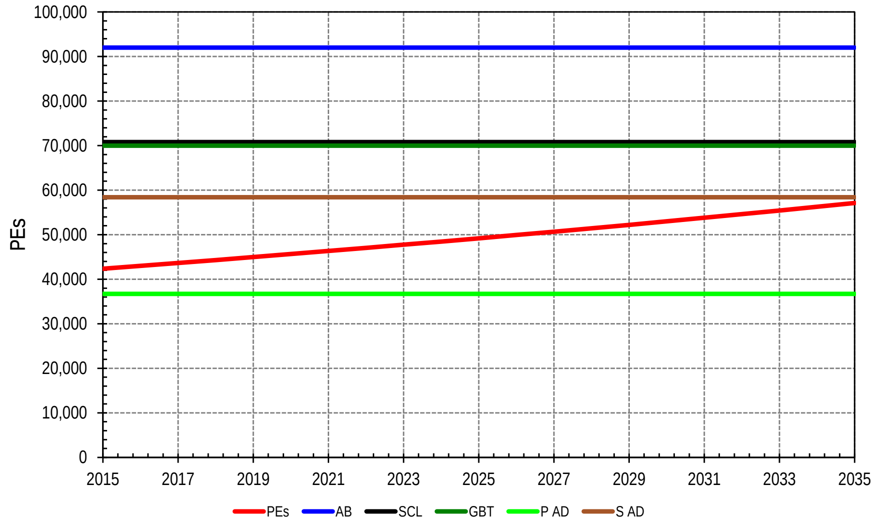

Figure 3-20. PE Projections (including Industrial) vs. Unit Process Capacity

The City of Wenatchee Wastewater Treatment Plant Unit Process capacity rating evaluation is summarized in Table 3-9. The table reveals that both secondary treatment and solids handling systems set the overall capacity of the wastewater treatment plant. Existing treatment plant unit process design criteria is presented in Appendix A at the end of this Chapter.

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Table 3-9. Unit Process Capacity Summary

Unit Process	Capacity Criteria	Rated Capacity	Current Condition	2035 Condition	@ 85% of Capacity	Comment
Grit Removal	Hydraulic	Peak: 22 mgd	Peak: 12 mgd	Peak: 12 mgd	> 2035	
Screening	Hydraulic	Peak: 15 mgd	Peak: 12 mgd	Peak: 12 mgd	> 2035	two screens with 15 mgd capacity each
Primary Clarification	Hydraulic	Average: 1,000 gal/sf/d Peak: 2,500 gal/sf/d	Average:280 gal/sf/d Peak: 780 gal/sf/d	Average:430 gal/sf/d Peak: 1,070 gal/sf/d	> 2035 > 2035	with both clarifiers on line
Primary Sludge Pumping	Hydraulic	Firm: 100 GPM	Peak: 54 GPM	Peak: 72 GPM	> 2035	for thickened sludge pumping
Aeration Basins	Hydraulic Organic	min HRT: 2 HR (Max Month) Max Month OUR: 55 mg/L/HR	Max Month HRT: 8.9 HR Max Month OUR: 22 mg/L/HR	Max Month HRT: 6.3 HR Max Month OUR: 31 mg/L/HR	> 2035 > 2035	BOD removal only average basin OUR
Blower and Diffusers	Mechanical	Oxygen Transfer: 9,500 lb/d Peak Air: 11,000 SCFM	Max Month: 4,460 lb/d Peak Air: < 11,000 SCFM	Max month: 6,020 lb/d Peak Air: < 11,000 SCFM	> 2035 > 2035	both trains online BOD removal only
Secondary Clarifiers	Organic	SCL Load at MM: 20 lb/sf/d	Max Month Load: 11.4 lb/sf/d	Max Month Load: 15.4 lb/sf/d	> 2035	@ 3,000 mg/L, BOD two clarifiers on line, plant cannot operate with one SCL for extended periods and meet permit.
UV Disinfection	Hydraulic	Average: 6 mgd @ 50% UVT Average: 11 mgd @ 64% UVT	Peak: 12 mgd	Peak: 12 mgd	2015	UV system limited in capacity by UV equipment controls. Needs to be addressed with UV system manufacturer as soon as possible.
Odor Control					2035	beds designed for biosolids processing expansion, including new digester
RAS Pumping	Hydraulic	Peak: 2.7 mgd	Peak: 1.3 mgd	Peak: 1.75 mgd	> 2035	50% of max month flow
WAS Thickening	Organic	Max Load: 1000 lb/HR	Max Month load: 550 lb/HR	Max Month load: 750 lb/HR	> 2035	8 hour par day run time
Primary Sludge Digestion	Organic & Hydraulic	HRT: 15 d	HRT: 12.4 d	HRT: 9.2 d	2016	4% TSS @ Max Month capacity can be extended with mechanical thickening

Table 3-9. Unit Process Capacity Summary

Unit Process	Capacity Criteria	Rated Capacity	Current Condition	2035 Condition	@ 85% of Capacity	Comment
WAS Digestion	Organic & Hydraulic	HRT 15 d	HRT: 23 d	HRT: 17.6 d	2035	6% TSS @ Max Month no redundancy for WAS digestion, co-digestion available for backup
Sludge Storage	Hydraulic	Min HRT: 7 d	HRT: 7.4 d	HRT: 5.4 d	2015	seven d of storage desired at max month, not a requirement
Dewatering	Organic	Capacity: 2,000 lb/HR	MM Load: 830 lb/HR	MM Load: 1150 lb/HR	> 2035	based on 8 HR/d, five d per week
Biosolids Drying						see Chapter 4

3.6 Plant Capacity

Several plant parameters and plant capacities are shown in Table 3-10. Current flows are approximately 50% of the estimated capacity of the existing facility. Based on current TSS loading values the plant has already exceeded the original TSS design capacity. Chapter 2 includes a discussion on the influent TSS, which is questionable as it is highly atypical for municipal wastewater relative to BOD. Even with the TSS corrected to a more typical value, both BOD and TSS will exceed the permitted design values within the planning horizon. The individual unit process analyses discussed previously in this section show the plant actually has sufficient capacity to treat the flows and loads and the discrepancy is due in part to changing wastewater strength.

Table 3-10. Plant Parameters and Capacities

Parameter	Unit	Current (2015)	Future (2035)	Current Capacity (Estimated)	Original Design Capacity [a]
Flow	mgd	3.03	4.1	6.0 [b]	5.5
BOD	lb/d	10,750 [c]	14,200 [c]	>14,200 [d]	13,006
TSS	lb/d	16,300 [c]	19,800 [c]	>19,800 [d]	13,111
TKN	lb/d	1,200 [c]	1,600 [c]	>1,600 [c]	1,800

[a] NDPES Permit WA – 002394-9

[b] Based on a 50% UVT for the UV Disinfection System. Peak capacity of UV System is 12 mgd with equipment controls modified to bioassay validated performance.

[c] BOD removal only, maximum month

[d] BOD removal only, 35% PCL BOD removal, 65% PCL TSS removal, Max 3 day SRT

3.6.1 City-Identified Additional Industrial Loads

The City of Wenatchee has received contact from several potential industrial customers who have shown interest in connection to the City's system and have provided preliminary loading data. Although flow and loading projections completed as part of this Chapter have included an industrial component in the unit loadings used for the projections, the City has identified several customers that have the potential to have a greater impact on the facility planning, and are therefore highlighted for further evaluation in addition to the standard industrial flows and loads already accounted for in the projections. A list of potential additional industrial loads was included in Table 2-12 of Chapter 2. If industrial wastewater is pretreated prior to discharge to the City's sewer system, then these loads would be considered negligible, and it can be assumed they have been included in the per-capita unit loadings used for future projections.

Table 3-11. Identified Potential Added Industrial Load

Industry	BOD Load (LB/D)	TSS Load (LB/D)
Apple Slicing	728	9
Winery	263	26
Food Processor No. 1	1,201	N/A
Paper Product Manufacturer	3,339	65

The identified additional industrial loads, if not subject to preliminary treatment requirements, are listed in Table 3-11. Because there is available remaining hydraulic capacity, the flow component of these potential customers would have little to no impact on the capacity of the existing facilities. None of the industries identified would add TSS loading above available capacity. The most significant potential industrial load is the paper product manufacturer, with the potential to add 3,339 lbs of BOD loading to the current loading projections. This equates to approximately 5,600 equivalent dwelling units of treatment plant capacity which would require the majority of the remaining organic treatment capacity of the existing treatment facilities. If the City is contacted by this manufacturer regarding construction of a new facility, the City should pursue preliminary treatment from this customer, and a more detailed analysis of impacts on plant capacity should be performed.

Appendix A. Existing Design Criteria

Item	Value
INFLUENT SCREENS	
Number of Units	2
Type	Perforated Plate Screen
Peak Flow with 1 Screen in Service	15 mgd
Screening Channel Depth	5 ft
Screening Channel Width	3 ft
Water Depth Downstream of Screen	
Average Flow	0.5 ft
Peak Flow	2 ft
Maximum Headloss Across Screen at Peak Flow	
For Clean Water	0.8 ft
50% Blinding Factor	1.2 ft
Screen Panel Perforation Diameter	6 MM
SCREENINGS WASHER/COMPACTOR	
Number of Units	2
Min. Compacted Screenings Volume	10 cf/d
Min. Screenings Volume Reduction	70%
Min. Removal of Organic Constituents	90%
Min. Screenings Weight Reduction	60%
Min. Solids Concentration	50%
RAW SEWAGE PUMPS	
Number of Units	6
Type	Vertical Dry Pit Non-Clog
Capacity	
Nos. 1 and 2	3,150 GPM at 47 ft TDH
No. 3	2,000 GPM
No. 4	2,500 GPM
No. 5	5,500 GPM
No. 6	6,000 GPM
FLOW EQUALIZATION BASIN	

Item	Value
Number of Units	1
Volume	1.7 MG below EL 639.0 (NAVD 88)
Flow Equalization Effluent Pump	
Type	Submersible
Capacity	700 GPM at 31 ft TDH
Horsepower	10 HP
GRIT SEPARATION CHAMBERS	
Grit Chambers	
Number of Units	2
Type	Circular with Paddle
Peak Capacity	11 mgd
Grit Agitation Blowers	
Number of Units	2
Type	Rotary Positive Displacement
Capacity	75 SCFM, each
Grit Removal Pumps	
Number of Units	2
Type	Recessed Impeller Centrifugal
Capacity	260 GPM
Cyclone Degritters	
Number of Units	2
Capacity	250 GPM, each
Size	10 in
Classifiers	
Number of Units	1
Type	Inclined Screw
Size	12 in
CHANNEL AERATION	
Aeration Rate	4 CFM/ft
Blowers (Headworks Channel and Scum Boxes)	
Number of Units	1
Type	Rotary Lobe

Item	Value			
Capacity	20 SCFM			
Control	Constant Speed			
PRIMARY CLARIFICATION				
Primary Clarifiers				
Number of Units	2			
Diameter	1-65 ft, 1–80 ft			
Sidewall Depth at the Wall	14 ft (80 ft DIA.) 10 (65 ft DIA.)			
Overflow Rate (Both Units in Service)				
Average Maximum Month Wet Weather Flow	600 gal/sf/d			
Peak Flow	1,320 gal/sf/d			
Overflow Rate (80 FT DIA Unit in Service)				
Average Maximum Month Wet Weather Flow	995 gal/sf/d			
Peak Flow	2,200 gal/sf/d			
Overflow Rate (65 FT DIA Unit in Service)				
Average Maximum Month Wet Weather Flow	1,610 gal/sf/d			
Peak Flow	3,300 gal/sf/d			
Detention Time (Both Units in Service)				
Average Maximum Month Wet Weather Flow	1.7 Hours			
Performance (Assumed)				
BOD Removal	30%			
TSS Removal	60%			
Primary Sludge/Scum Pumps				
Number of Units	2			
Type	Rotary Lobe			
Capacity	100 GPM			
AERATION BASINS				
Number of Units	2			
Each Basin	Volume	Length	Width	SWD
Zone A	0.065 MG	18 ft	35 ft	15 ft
Zone B	0.108 MG	28 ft	35 ft	15 ft
Zone C	0.216 MG	56 ft	35 ft	15 ft
Zone D	0.151 MG	40 ft	35 ft	15 ft

Item	Value			
Total	0.54 MG			
Blowers				
Number of Units	3			
Type	Multiple Stage Centrifugal			
Capacity	5,500 SCFM at 8.8 PSIG			
Horsepower	300 HP			
Control	Inlet Throttling			
Anoxic Mixers				
Aeration Zone	A			
Number per Aeration Zone	1			
Horsepower	5 HP			
Mixed Liquor Recirculation Pumps				
Number per Aeration Basin	1			
Type	Submersible Propeller			
Capacity	3,800 GPM at 1.8 ft TDH			
Horsepower	10 HP			
SECONDARY CLARIFIERS				
Number of Units	2			
Type	Spiral Rake			
Diameter	80 ft			
Overflow Rate				
Average	550 gal/sf/d			
Peak	1,100 gal/sf/d			
Solids Loading Rate	Max. Month		Peak	
Summer				
Plug Flow	23 lbs/sf/d		45 lbs/sf/d	
Step Feed	16 lbs/sf/d		33 lbs/sf/d	
Winter				
Plug Flow	25 lbs/sf/d		51 lbs/sf/d	
Step Feed	23 lbs/sf/d		45 lbs/sf/d	
SVI	150			
RETURN ACTIVATED SLUDGE PUMPS				

Item	Value
Number of Units	2
Type	Vertical Sewage Pumps
Capacity	1,900 GPM at 26 ft TDH, each
Control	Weir Gates to each Clarifier with Electric Actuators to Control RAS Rate. Adjusted Speed Pump Drives.
WASTE ACTIVATED SLUDGE PUMPS	
Number of Units	1
Type	Non-Clog Centrifugal
Capacity	70-400 GPM
Control	Modulating Valve
SECONDARY SCUM PUMP	
Number of Units	1
Type	Simplex Plunger
Capacity	80 GPM
UV DISINFECTION	
Number of Channels	3
Capacity per Channel	5.5 mgd
Minimum Transmittance	50%
NPDES Fecal Coliform – 30 Day	200 / 100 mL
UV Dosage	40,000 µW-s/cm^2
SERVICE WATER SYSTEMS	
W1 System	
System Pressure	110 PSI
Number of Pumps	2
Pump Capacities	210 GPM, 105 GPM
Blower Building System	
System Pressure	110 PSI
Number of Pumps	2
Pump Capacity	45 GPM, each
NON-POTABLE WATER PUMPS	
Number of Units	2
Type	Non-Clog Centrifugal
Capacity	325 GPM at 180 ft TDH

Item	Value	
Horsepower	25 HP	
BIOFILTER		
Design Treatment Flow Rate	21,000 SCFM	
Removal Efficiency		
Hydrogen Sulfide		
Concentration > 10 PPMV	99% Removal	
Concentration < 10 PPMV	Discharge Less Than 100 PPMV	
Ammonia		
Concentration > 50 PPMV	90% Removal	
Concentration < 50 PPMV	Discharge Less Than 5 PPMV	
Layer Thickness		
Plenum Zone	12 in	
Soil Filter Media	36 in	
Cover Rock	3 in	
FOUL AIR FANS		
Fan and Operating		
Dewatering Fan	4,605 SCFM at 2 in W.C.	
Truck Loadout Fan	6,440 SCFM at 2.25 in W.C.	
Screenings Fan	2,270 SCFM at 2 in W.C.	
Primary Area Fan	1,835 SCFM at 2 in W.C.	
Biofilter Fan (A)	10,435 SCFM at 9 in W.C.	
Biofilter Fan (B)	10,435 SCFM at 9 in W.C.	
SODIUM HYPOCHORLITE SYSTEM		
Storage Tank		
Number of Units	1	
Tank Volume	1,000 gallons	
Sodium Hypochlorite Pumps		
Number of Units	3	
	Pump Nos. 1 and 2	Pump No. 3
Type	Positive Displacement, nonhydraulic, solenoid drive, diaphragm type metering pump	Mechanically actuated, motor-drive, diaphragm type metering pump
Capacity	0.37 GPH	27 GPH

Item	Value
MAGNESIUM HYDROXIDE SYSTEM	
Storage Tank	
Number of Units	1
Tank Volume	5,000 gallons
Tank Diameter	10 ft
Magnesium Hydroxide Pumping	
Number of Units	1
Type	Peristaltic
Capacity	11.4 gph, 30 psig max
Tank Mixer	
Number of Units	1
Type	Constant speed, fixed mount gear drive
Size	45 rpm, 53 in Impeller, 2.5 in dia. shaft
Horsepower	5 HP
ALUM SYSTEM	
Storage Tank	
Number of Units	1
Tank Volume	5,000 gallons
Tank Diameter	10 ft
Alum Pumping	
Number of Units	1
Type	Motor-driven, mechanically actuated diaphragm
Capacity	19.2 GPH, 58 psig max
POLYMER SYSTEM	
Storage Tank	
Number of Units	1
Tank Volume	2,500 gallons
Tank Diameter	8 ft
Alum Pumping	
Number of Units	1
Type	Progressive cavity
Capacity	1.3 GPM at 15 psig

Item	Value
Tank Mixer	
Number of Units	1
Type	Constant speed, fixed mount gear drive
Size	70 rpm, 34 in impeller, 1.5 in dia. shaft
Horsepower	1.5 HP
COUNTERACTANT SYSTEM	
High-pressure Pumps	
Type	Belt-driven, triplex piston
Capacity	90 GPH at 1,200 psig
Chemical Feed Pumps	
Type	Solenoid-driven, diaphragm feed pumps
Capacity	14 gpd at 60 psig

Chapter 4-Biosolids Management Evaluation

City of Wenatchee

Wastewater Treatment Facilities Plan Update

August 2016

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Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
AD	Anaerobic Digester	MOP	Manual of Practice
AER	Aerobic	MPN	Most Probably Number
ALK	Alkalinity	MW	Maximum Week
ASP	Aerated Static Pile	NH_4-N	Ammonia as Nitrogen
BFP	Belt Filter Press	NO_2-N	Nitrite-Nitrogen
BNR	Biological Nutrient Removal	NO_3-N	Nitrate-Nitrogen
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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4 Introduction

4.1 Purpose and Scope

The City of Wenatchee has historically dewatered biosolids from the WWTP and performed land application. In 1993, the City of Wenatchee began dewatering biosolids with drying beds located about 10 miles south of the city limits. Class A biosolids are produced by following the Wenatchee Biosolids Class A Treatment Method.

The purpose of this biosolids management plan is to:

- Update the biosolids treatment requirements, originally presented in the 2008 Wastewater Facilities Plan, to reflect current Washington Department of Ecology regulatory biosolids management requirements,
- Update dewatered biosolids production to 2035 based flow and loading projections presented in Chapter 2,
- Evaluate the capacity of the existing Biosolids Drying Beds Facility for the future planning year 2035 dewatered solids loadings, and
- Develop alternative biosolids management options in the event the drying beds become unavailable to produce Class A biosolids.

4.2 Background

The existing WWTP has two primary digesters and one secondary digester. Primary sludge is thickened in the primary clarifiers to a TS concentration of approximately 5 percent before it is anaerobically digested in a primary digester (Digester No. 1). Digested sludge is then settled in the second primary digester (Digester No. 2). WAS from the secondary treatment process is thickened by a GBT and is then anaerobically digested in the secondary digester (Digester No. 3). Digested sludge from Digesters No. 2 and No. 3 is mixed in a blending tank at a ratio of 3:1, respectively. Blended sludge is then dewatered by a 2-meter BFP to achieve a solids concentration from 12 to 18 percent. Dewatered solids are hauled off-site to the Biosolids Drying Beds Facility site located about 10 miles south of the City of Wenatchee to produce either Class A or Class B biosolids. Figure 4-1 shows an aerial view of the Biosolids Drying Beds Facility.

Figure 4-1. City of Wenatchee Biosolids Drying Beds Facility

According to the 2008 Wastewater Facilities Plan, the City historically achieved Class A biosolids by drying the biosolids at the offsite facility using Method 4 of Code of Federal Regulations (CFR) 503 and Ecology regulations. Ecology removed this method of meeting Class A biosolids in 2007, therefore the biosolids produced were then considered Class B not Class A.

The 2008 Wastewater Facilities Plan also documents the need for the existing drying beds to be expanded by 2010 to add additional capacity for wet weather conditions. A conceptual design of the Biosolids Drying Beds Facility expansion was presented in the 2008 Plan (Figure 4-2).

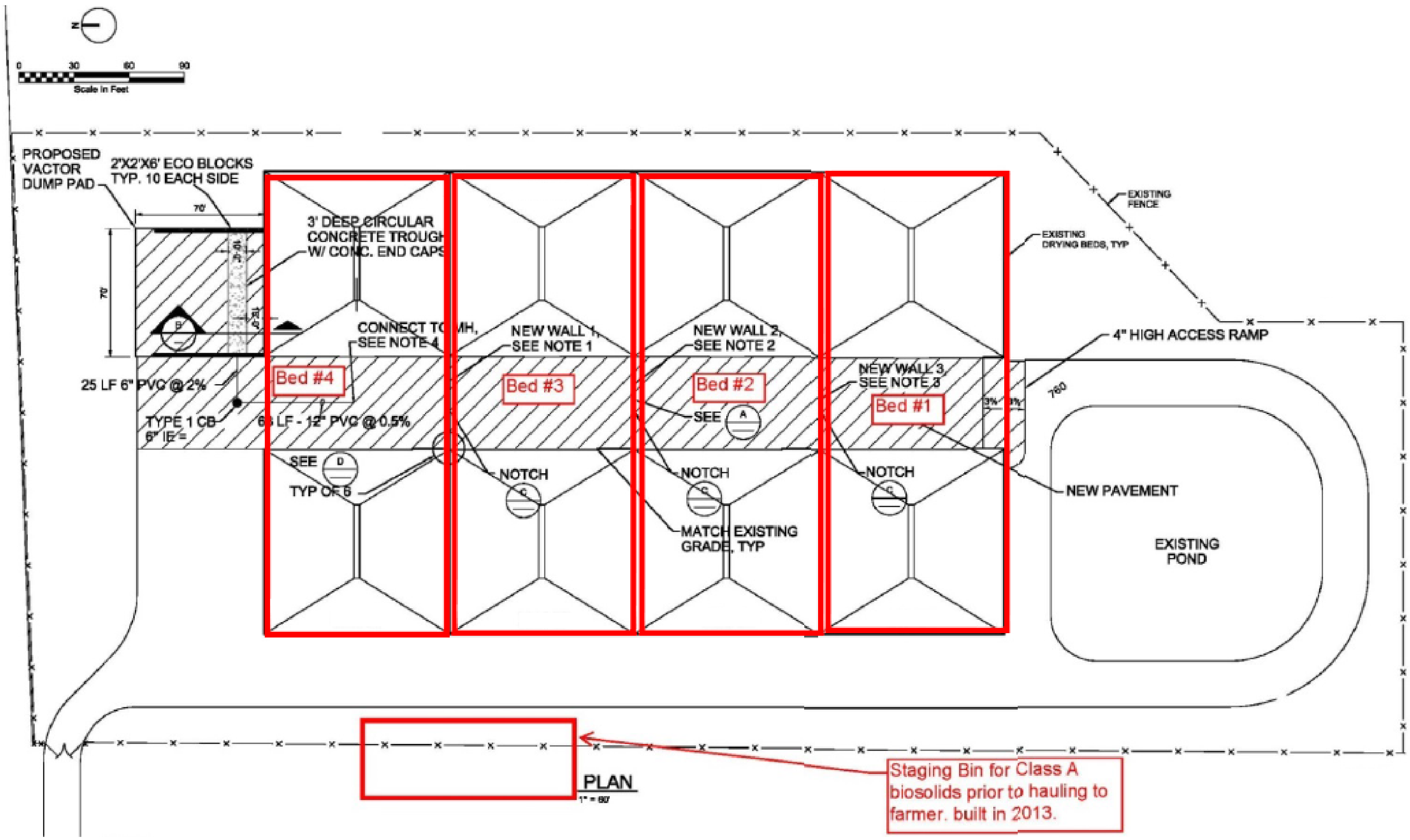

Figure 4-2: Biosolids Drying Beds Facility Plan View

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As seen in Figure 4-2, the number of the drying beds was modified from the original 8 small beds to 4 larger beds. The original access road in between the beds was converted to part of the new drying area of each bed. This conversion resulted in an additional 20,000 square feet of drying bed area. A Vactor dump pad was also added to allow Vactor waste to be discharged to the facility. The drying area of each drying bed is 25,133 square feet after the expansion. Each bed is 100 feet wide and 251.3 feet long.

The City completed the Biosolids Drying Beds Facility expansion in 2008 per the 2008 Wastewater Facilities Plan recommendation. A staging bin was added by the City in 2013 to store Class A biosolids before hauling for land application (Figure 4-2).

4.3 Biosolids Regulatory Requirements Updates

In 2011, The City worked in conjunction with the US EPA’s Pathogen Equivalency Committee and Ecology to conduct a field experiment to demonstrate a method for pathogen reduction that is equivalent to methods set forth in the revised regulation WAC 173-308-170. This pathogen reduction method would provide the City an alternative way to achieve Class A biosolids again.

Ecology issued the Notice of Final Coverage under the General Permit on October 31, 2012 which granted the City of Wenatchee WWTP Final Coverage for Biosolids Management under Chapter 173-308 of the WAC. Under this Final Coverage, Ecology approved the City demonstrated method for further pathogen reduction to produce Class A biosolids. This Final Coverage allows the City to produce either Class A or Class B biosolids for pathogens depending on the process the City uses.

If the City is to achieve Class A biosolids, the following requirements must be met:

1. Follow the conditions set forth in the Wenatchee Biosolids Class A Treatment Method, October 24, 2012. The conditions in the Class A biosolids treatment method include:
    a) The PFRP process may be started any time between May 1 and September 30 in any given year as long as the temperature requirements set forth below have been met:
        i) The dewatered biosolids cake consists of solids that are anaerobically digested for an average of 20 days at 35° to 55°C (95° to 131°F) and then dewatered on a belt filter press to 10-20% total solids.
        ii) PFRP shall be conducted as a batch system. This means there will be separate, discrete amounts of biosolids specifically identified that will be turned and dried for the minimum period of 35 days. All sampling and process parameters shall be conducted separately on the individual batches. Documentation shall be kept of each batch. Such documentation shall include date started, drying bed(s) used, ambient air temperature during the process, date that the turnings took place, and all sampling and analytical results.
        iii) Starting on May 1, batches may be created at the drying beds as long as the average daily ambient air temperatures has reached 15°C for at least 7 consecutive days before the process starting date. The PFRP process can be started as late as September 30 as long as the temperature requirements are met.
        iv) Separate areas shall be designated for the following:
            (a) Storage of the dewatered Class B biosolids cake;
            (b) Class B biosolids that are undergoing the PFRP process, and;

(c) Storage of processed Class B biosolids to indicate the biosolids are still Class B and awaiting return of analysis results.

v) The temperature at the drying beds is monitored daily using a weather station. During the treatment period(s), the average ambient air temperature must be at least 15°C.

vi) Each batch must be turned completely at least once a week during processing.

vii) After a minimum of 35 days, the total solids of each batch must be 90% total solids for three consecutive days and the Fecal Coliform Level must be less than 1,000 MPN per gram of total solids (i.e., dry weight basis).

viii) Each batch must be sampled for viable helminth ova after the sampling in item vii) above is complete. This sampling shall be conducted in accordance with the Sampling and Analysis Plan dated October 20, 2015.

ix) Once all of the PRFP requirements have been met and documented for a batch, including the helminth ova sampling and analysis if required, a green flag will be placed in that batch.

x) The Class A biosolids will be removed from the Biosolids Drying Beds Facility within approximately 30 days after meeting the PRFP requirements.

b) Any dewatered biosolids delivered to the Biosolids Drying Beds Facility between October 1 and April 30 may be land applied as Class B, or stored until the following May when the PFRP process may be initiated.

2. Follow the requirements of the Sampling and Analysis Plan dated October 18, 2012. Section 3.1 of the Sampling and Analysis Plan, and subsections thereof; apply specifically to sampling at the drying beds for the purpose of achieving Class A biosolids.

The City has three options for land application of Class B biosolids:

- Option 1 – use a beneficial use facility;
- Option 2 – land apply biosolids at currently permitted sites in Grant County;
- Option 3 – permit new land application sites through procedures set forth in WAC 173-308, and in the City of Wenatchee's General Land Application Plan – Final, October 15, 2008.

If the City chooses to land apply Class B biosolids on their currently permitted sites in Grant County, they must follow the provisions set forth in the City of Wenatchee's Site Specific Land Application Plan dated October 15, 2015. In addition, the City must follow the Spill Prevention and Response Plan dated September 10, 2012 when hauling biosolids and the Sampling and Analysis Plan dated October 20, 2015 for all the testing required for pollutants under WAC 173-308-160.

4.4 Dewatered Biosolids Loading Update

As discussed in Chapter 2, the future flows and loads for the City of Wenatchee WWTP were developed using a combination of historical and current data, as well as future population projections. A mass balance model of the entire treatment facility was developed using a Biowin™ wastewater process simulator based on the 2035 flow and load projections. Two mass balance simulations were developed with the results distinguished as 2035 summer and 2035 winter, simulating nitrification occurring and not occurring in the secondary treatment, respectively. Table 4-1 and Table 4-2 present the projected 2035 winter and summer dewatered biosolids hauled to the Biosolids Drying Beds Facility.

Table 4-1. Projected 2035 Winter Dewatered Biosolids Loading

	TS [a] (lb/d)		Volume [b] (cy/d)	
	Design	Max	Design [c]	Max [d]
Winter Average	7,000	7,800	27.7	38.6
Max Month (MM)	9,700	10,900	38.4	53.9
Max Week (MW)	12,800	14,400	50.6	71.2
Max Day (MD)	13,200	14,800	52.2	73.2

[a] Assumes the BFP solids capture rate is 98.8%.
[b] The dewatered biosolids volume was calculated based on the assumed density of 1,000 kg/m^3
[c] The future design dewatered biosolids volume was calculated using future design total solids and the average solids content of 15%.
[d] The future maximum dewatered biosolids volume was calculated using future maximum total solids and the minimum solids content of 12%.

Table 4-2. Projected 2035 Summer Dewatered Biosolids Loading

	TS [a] (lb/d)		Volume [b] (cy/d)	
	Design	Max	Design [c]	Max [d]
Summer Average	6,500	7,200	25.7	35.6
Max Month (MM)	9,100	10,100	36.0	49.9
Max Week (MW)	12,500	13,900	49.4	68.7
Max Day (MD)	12,800	14,200	50.6	70.2

[a] Assumes the BFP solids capture rate is 98.8%.
[b] The dewatered biosolids volume was calculated based on the assumed density of 1,000 kg/m^3
[c] The future design dewatered biosolids volume was calculated using future design total solids and the average solids content of 15%.
[d] The future maximum dewatered biosolids volume was calculated using future maximum total solids and the minimum solids content of 12%.

Because more sludge needs to be wasted if the WWTP does not perform nitrification, the 2035 winter dewatered biosolids production presented in Table 4-1 will be used in the drying beds capacity and other biosolids management alternatives evaluation.

It should be noted that the solids contents in the dewatered biosolids produced by the existing BFP, 12% to 18%, is low compared to the normal solids content range of 20% to 22% produced by other BFPs dewatering anaerobically digested sludge. If the solids content of the dewatered sludge produced by the existing BFP could be increased to 20%; the hauling volume to the Biosolids Drying Beds Facility, drying bed area, and storage area at the facility would be significantly reduced. Table 4-3 presents the 2035 winter design and maximum dewatered biosolids volume with the average and minimum solids content at 20% and 18%, respectively. When the solids content in the dewatered biosolids increases from 15% to 20%, a biosolids volume reduction of approximately 25% could be achieved.

Table 4-3. Projected 2035 Winter Dewatered Biosolids with Average TS of 20%

	TS [a] (lb/d)		Volume [b] (cy/d)	
	Design	Max	Design [c]	Max [d]
Winter Average	7,000	7,800	20.8	25.7
Max Month (MM)	9,700	10,900	28.8	35.9
Max Week (MW)	12,800	14,400	38.0	47.5
Max Day (MD)	13,200	14,800	39.2	48.8

[a] Assumes the BFP solids capture rate is 98.8%.

[b] The dewatered biosolids volume was calculated based on the assumed density of 1,000 kg/m^3.

[c] The future design dewatered biosolids volume was calculated using future design total solids and the average solids content of 20%.

[d] The future maximum dewatered biosolids volume was calculated using future maximum total solids and the minimum solids content of 18%.

4.5 Drying Beds Capacity Evaluation for Class A Biosolids Production

4.5.1 Current Drying Beds Capacity and Operation

As mentioned previously, solar drying beds are currently used by the City to further reduce pathogens and produce Class A biosolids. There are a total of four paved drying beds and an evaporation pond at the Biosolids Drying Beds Facility. The evaporation pond receives and stores on site runoff and drainage from the four drying beds and vactor dump area. The drying beds also retain a portion of the on site runoff during big storm events. Table 4-4 lists the design criteria of the drying beds and evaporation pond.

Table 4-4. Existing Drying Beds Design Criteria

Parameter	Value
Number of Beds	4
Bed Dimensions, each	100 ft wide x 251.3 ft long
Bed Area, each	25,133 sf
Drying Bed Runoff Storage Volume	45,833 cf
Evaporation Pond Runoff Storage Volume	56,900 cf

Source: City of Wenatchee Wastewater Treatment Facilities Plan, 2008, Table 6-3.

According to data provided by the City, the annual average daily dewatered biosolids production in 2014 was 2,478 pounds per day (dry solids weight) and 12.1 cubic yards per day. The current biosolids production rate is approximately 35% and 44% of the 2035 projected biosolids production rate in dry solids weight and volume, respectively.

In 2014, the City of Wenatchee began producing Class A biosolids using drying beds by following the Wenatchee Biosolids Class A Treatment Method. Figure 4-3 through Figure 4-7 illustrate the City's Class A biosolids production operation during the drying season of 2014.

Figure 4-3. Dewatered Solids Stored in Drying Beds at the End of Non-Drying Season

As shown in Figure 4-3, dewatered solids were stored in stockpiles at the east end of the drying beds comprising up to approximately 40% of the bed area throughout the entire non-drying season (October to April).

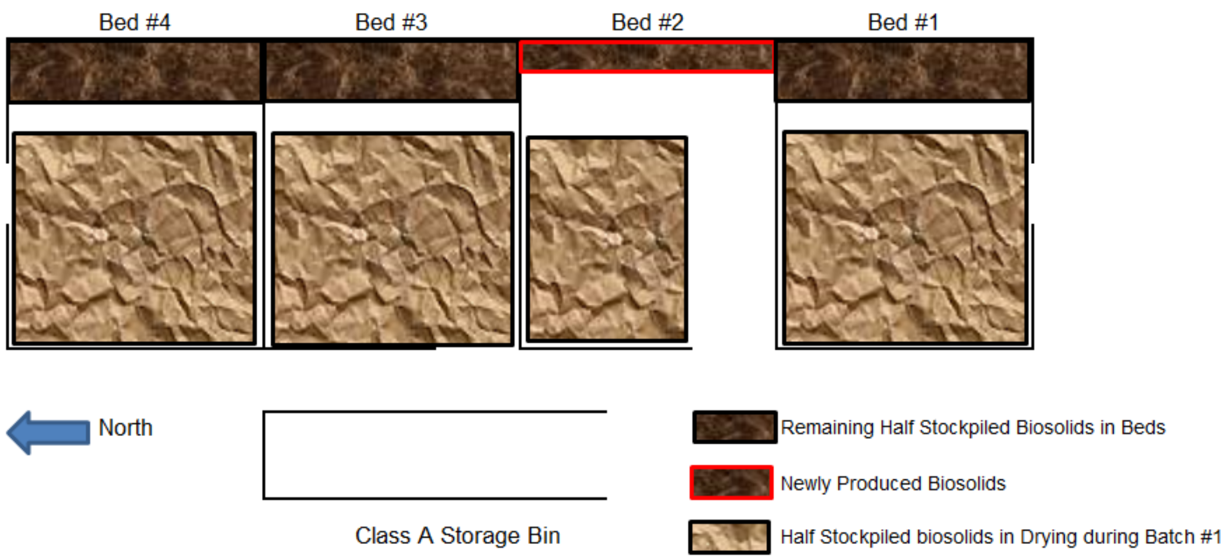

Figure 4-4. Batch No. 1 in Drying Process

At the beginning of the drying season (May to September), the City initiates two drying batches in each bed. At the beginning of the drying Batch No. 1, the operator spreads half of the stockpiled biosolids, which had reached 40% of the bed area, to the west end of the beds for drying. The beds still have the storage volume available to continue receiving newly dewatered biosolids during drying Batch No. 1. Clearance between the biosolids drying area and the storing area is maintained in the beds according to the requirements of the Class A Treatment Method. A truck access path to unload the newly dewatered biosolids was also kept clear in the partially stockpiled beds. During the drying process, the operator turns the biosolids completely every 7 days by pushing up the solids to one end of the beds and then spread it back out to the drying area. Figure 4-4 shows half of the stockpiled biosolids in the drying process with the newly dewatered biosolids unloaded in Bed No. 2 during Batch No. 1.

The biosolids are dried in the beds for 35 days before samples are taken. The dried biosolids in each bed need to pass the following tests before being classified as Class A:

- Total solids test
    - The total solids contents of all the samples should be 90% or greater for three consecutive days.
- Fecal coliform test
    - The fecal coliform level of the biosolids should be less than 1,000 MPN per gram of total solids.
- Viable helminth ova test
    - After the fecal coliform requirement is met, two additional samples are taken for viable helminth ova testing. The result of this test should be less than one viable helminth ova per four grams of total solids.

Due to the biosolids drying time, sample testing time, and turnaround time for test results, each drying batch processing time is approximately 85 days. Dried biosolids remain in the beds during the entire sample testing time for additional drying until all the test results met or exceed the Class A biosolids classification requirements.

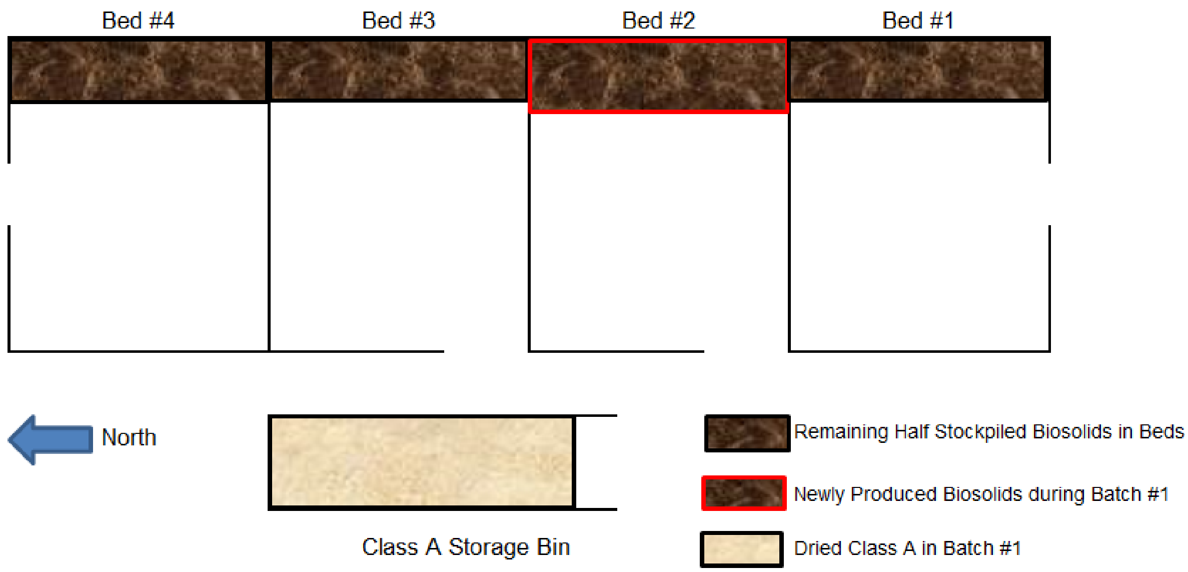

Figure 4-5. Drying Beds at the End of the Drying Batch No. 1

After the dried biosolids meet all Class A requirements, the operators move the biosolids into the Class A storage bin and begin drying the remaining stockpiled biosolids as well as the new biosolids stored during Batch No. 1 (Figure 4-5).

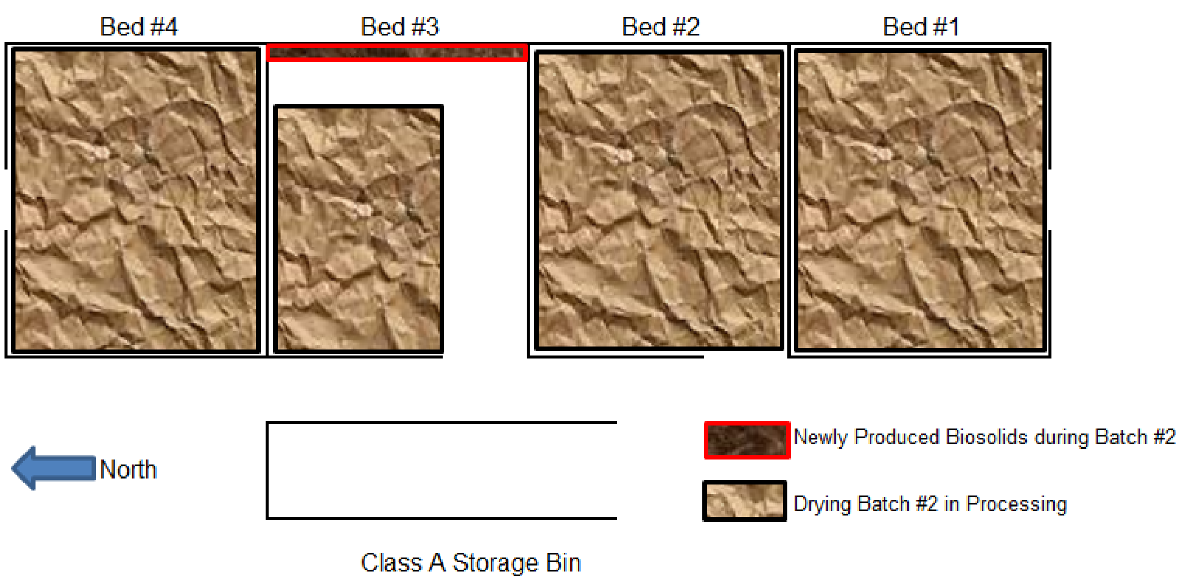

Figure 4-6. Batch No. 2 in Drying Process

Figure 4-6 illustrates drying Batch No. 2 in process. In Batch No. 2, one of the drying beds (Bed No. 3) is designated to receive newly dewatered biosolids. The Class A biosolids produced in Batch No. 1 are hauled from the facility during Batch No. 2 for land application at permitted sites in Grant County.

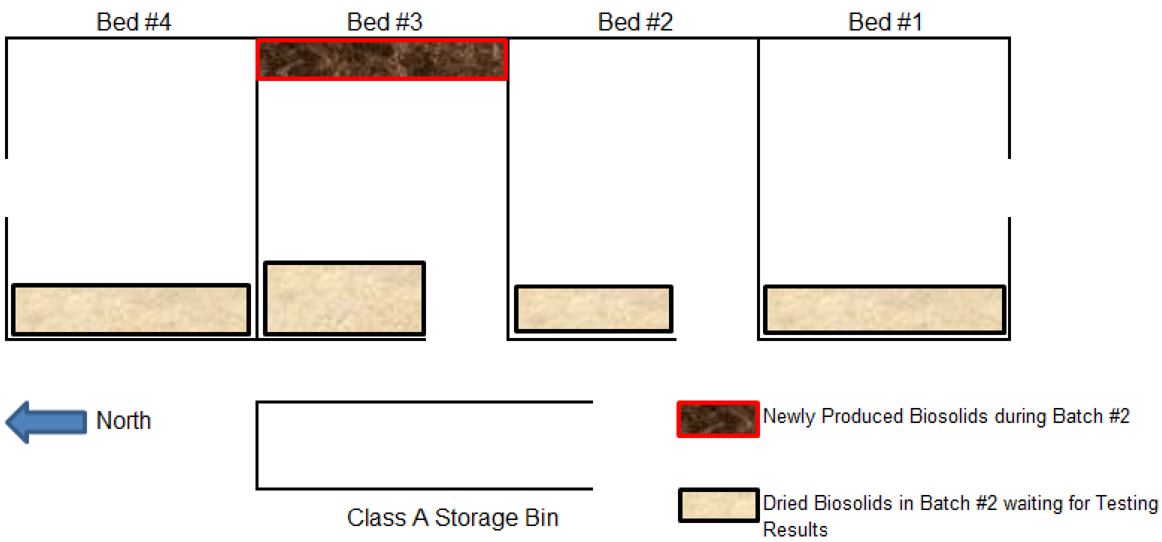

Figure 4-7. Drying Beds at the End of the Drying Batch No. 2

Figure 4-7 shows the status of the drying beds at the end of the Batch No. 2 drying period. Dried biosolids are stockpiled at the opposite end of the beds from the biosolids being stored which are awaiting testing results. After successful test results are obtained, the dried biosolids are classified as Class A and moved to the Class A storage bin. The Class A biosolids are eventually hauled off site for land application. The newly produced biosolids during Batch No. 2 are stored in the bed until the next drying season.

Table 4-5 summarizes the test results of the Class A biosolids produced by the City in 2014. The results show the biosolids produced by the City not only meet Class A biosolids classification but also meet Ecology Exceptional Quality (EQ) requirements which may be distributed to non-permitted entities.

Table 4-5. 2014 Class A Biosolids Testing Results vs. Washington Biosolids Requirements (WAC 173-308)

Parameters	Testing Values		WAC 173-308-160 Requirements
Metals, mg/Kg (WAC 173-308-160) [a]			
Arsenic	4		41
Cadmium	2		39
Chromium	46		
Copper	784		1500
Lead	59		300
Mercury	1		17
Molybdenum	7		18
Nickel	26		420
Selenium	7		36
Zinc	1194		2800
Pathogen Reduction (WAC 173-308-170, Class A - Alternative 4)			
	First Batch	Second Batch	
Total Solids, %	92.4	92.1	≥90%
Fecal Coliform, MPN/g dry solids	8.66	187	<1000
Viable Helminth Ova, MPN/4g dry solids	<1	<1	<3
Vector Attraction Reduction (WAC 173-308-180, Class A –Alternative 1) [a]			
Volatile Solids Reduction, %	42.3		≥38

[a] Testing values are yearly average values.

4.5.2 Future Drying Beds Capacity Evaluation

The future drying beds capacity was evaluated based on the City's current successful experience in Class A biosolids production as described in Section 4.5.1. The projected 2035 winter average dewatered biosolids production as shown in Table 4-1 was used as the future biosolids loads to the Biosolids Drying Beds Facility in this evaluation. The assumptions and data sources used in the evaluation are summarized as follows:

- The future dewatered biosolids production rate is 7,000 pounds per day in dry solids weight and 27.7 cubic yards per day (747.9 cubic feet per day) as shown in Table 4-1.
- According to the City's current experience in producing Class A biosolids, 40% of the drying bed area will be used as the dewatered biosolids storage area and 50% of the bed area will be used to dry biosolids during the drying season. The remaining 10% of the bed area will be designated as the buffer area between storage area and drying area. The buffer area will also allow truck access to the storage area.

- Based on the 2014 dewatered biosolids volume data, the average depth of the stored biosolids stockpile was estimated to be 2.5 feet. Therefore, the available storage volume of each bed is 25,133 cubic feet.
- Two drying batches will be performed in each bed during the drying season in the future, which is the same as the current biosolids drying operation. This allows adequate drying and testing periods for each batch. Biosolids remain in the beds for drying for a minimum of 35 days before samples are taken for testing. Dried biosolids are kept in the beds during the entire sample testing time for additional drying until all the test results meet or exceed the Class A biosolids classification requirements. Operators turn the biosolids every 7 days during processing.
- Based on the biosolids data summary of 2014, the average initial total solids content when the biosolids were unloaded to the beds was 15%. Final total solids content at the end of the non-drying season is 20%, due to the evaporation throughout the entire non-drying period, resulting in a 25% reduction in volume during storage of the biosolids in the beds.
- The pan evaporation data acquired from the Western Regional Climate Center were used in estimating the volume reduction of the stored biosolids in beds due to evaporation during the drying season (May to October). An effective factor of 0.75 was applied to the data to compensate for the difference between the pan evaporation results and the actual evaporation from wet solids.
- It was assumed no initial draining of free water in the dewatered biosolids occurred after the biosolids are unloaded to the beds. This assumption is based on the City's observation that no drainage has ever been observed at the drying beds under drain discharge at the evaporative pond. It is suspected the under drains of the beds are clogged.

Table 4-6 presents the total storage volume required for dewatered biosolids produced in 2035. The detailed storage volume calculations are included in Appendix B.

Table 4-6. 2035 Dewatered Biosolids Storage Volume Requirements

Periods	Biosolids Loading to Beds [a] (cf)	Storage Volume Required [b] (cf)	Number of Beds Required [c]
October to April (non-drying season)	158,555	118,916	4.73
May to Mid-August (Batch No. 1)	76,286	59,703	2.21
Mid-August to September (drying period Batch No. 2)	38,143	32,262	1.23
Total			**8.17**

[a] Biosolids loading to beds was calculated using future daily biosolids production rate 27.7 cy/day multiplied by days in that period.

[b] Storage volume required was calculated by deducting the volume reduction due to evaporation from the biosolids loading volume.

[c] Number of beds required was calculated using storage volume required divided by available storage volume in each bed which is 25,133 cf/bed.

The storage evaluation shows that a total of 8.2 beds would be required for the City to produce Class A biosolids with all the dewatered biosolids produced in 2035. Therefore, the facility may need up to nine drying beds. However, because the assumptions used in the estimation, e.g., future projected biosolids loading, adjusted evaporation data, and available storage volume in each bed, could be more conservative than the actual conditions in the future, it is possible eight drying beds would be enough for the City to produce Class A biosolids with all the dewatered biosolids produced in 2035. Therefore, it is recommended the Biosolids Drying Beds Facility be expanded to a total of eight beds to handle the future Class A biosolids production. The City should continue to monitor biosolids loading to the facility and the beds drying capacity annually and add a ninth bed if necessary.

Figure 4-8 through Figure 4-12 illustrate the future Class A biosolids production operation procedure which will be similar to the current operation procedure. The figures present the ultimate nine bed facility layout to match the future required drying beds estimated in Table 4-6.

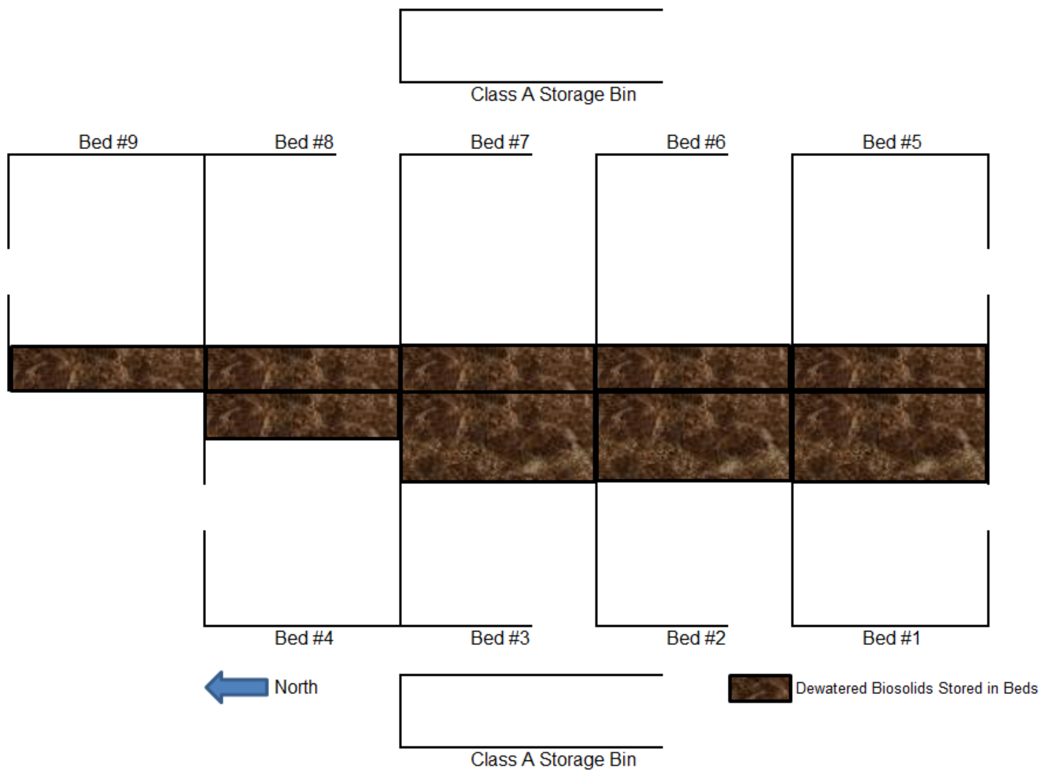

Figure 4-8. Future Dewatered Biosolids Stored in Drying Beds at the End of Non-Drying Season

Figure 4-8 shows the status of the future drying beds at the end of the non-drying season. The dewatered biosolids produced during the entire non-drying season (October to April) as well as the biosolids produced during drying Batch No. 2 of the previous year will be stored in stockpiles at one end of the drying beds comprising approximately 40% of the total bed area. Six drying beds will be required to store the biosolids produced during the non-drying season and the drying Batch No. 2 periods (Table 4-6). In order to maximize the use of the drying beds in the drying season, the biosolids need to be stored with half stockpiles in six beds and full stockpiles in the remaining three beds.

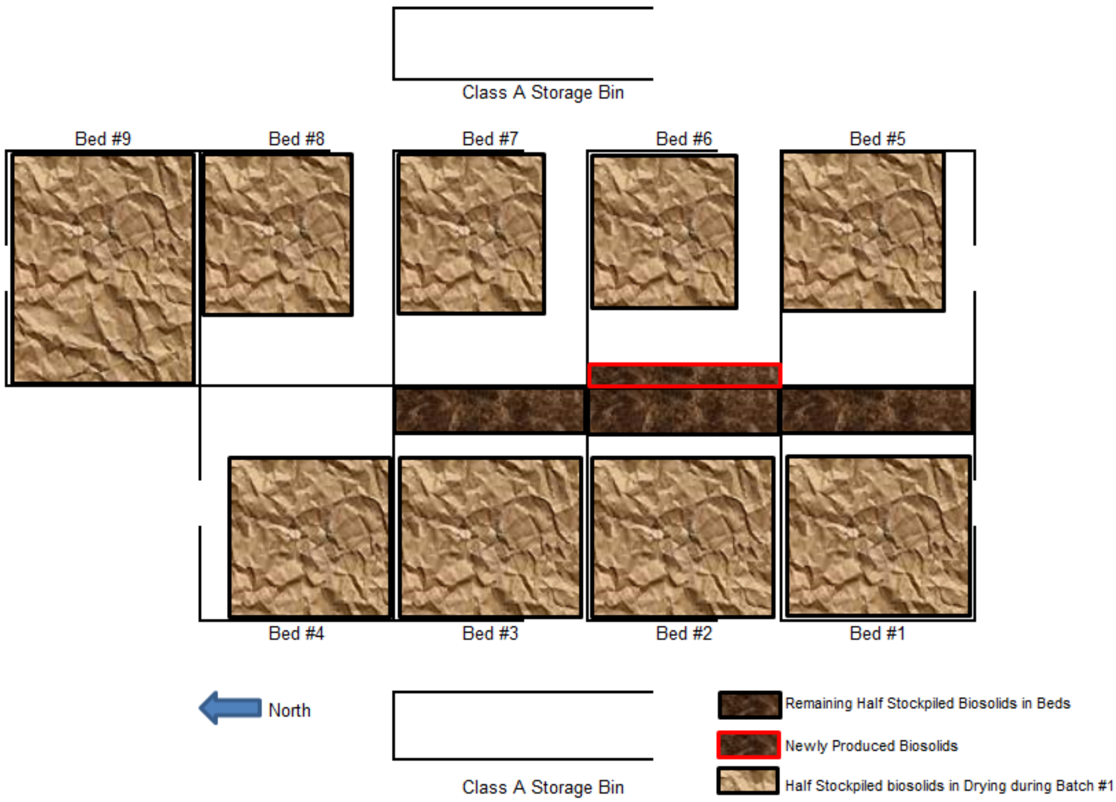

Figure 4-9. Future Batch No. 1 with Half of Stockpiled Biosolids in Drying Process

Figure 4-9 shows the future drying Batch No. 1 in process. The six beds with half of the stockpiled biosolids stored will have all the stored biosolids spread out to the other end of the beds for drying. The three beds with full stockpiled biosolids stored will have half of the stockpiled biosolids remain in beds to be dried in the next batch. The newly produced biosolids during the Batch No. 1 will require approximately 2.2 fully stockpiled beds for storage (Table 4-6). These biosolids will be stored in half stockpiles in five beds (Beds No. 4 through No. 8 as shown in Figure 4-9) to maximize the use of the drying beds in the drying Batch No. 2.

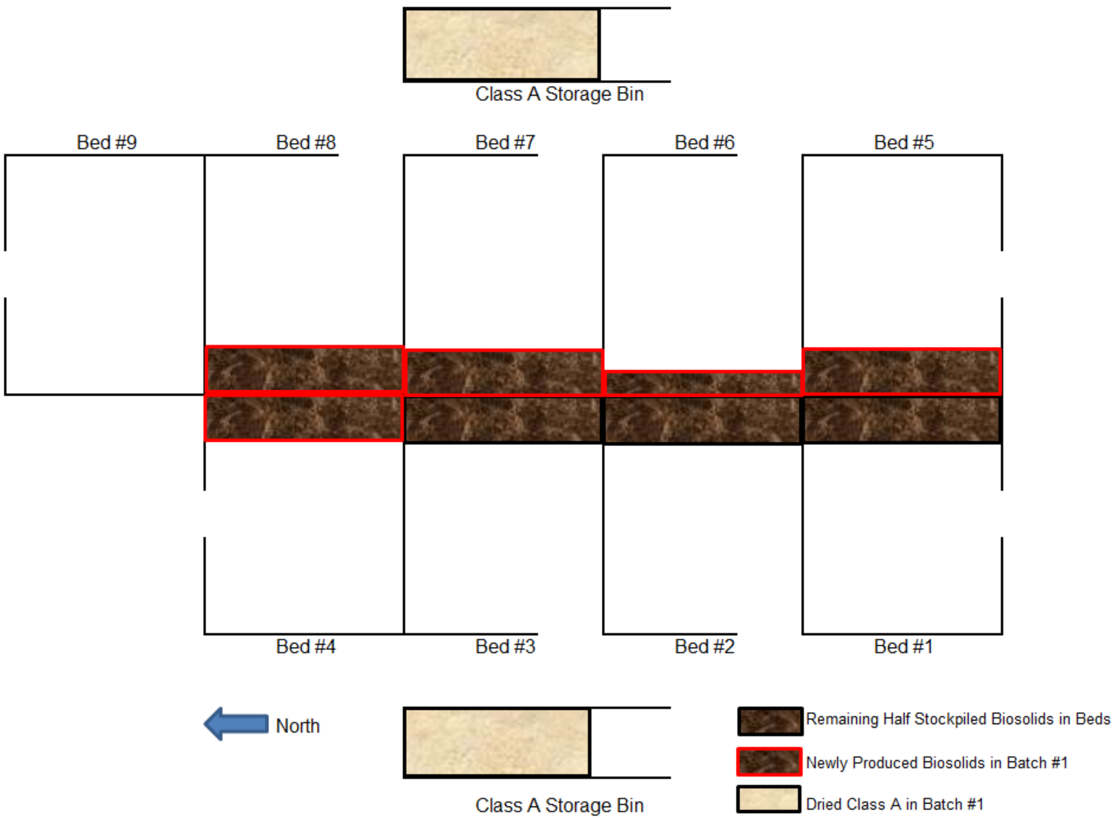

Figure 4-10. Drying Beds at the End of the Drying Batch No. 1

Figure 4-10 shows the status of the future drying beds at the end of the drying Batch No. 1. The Class A biosolids produced in Batch No. 1 are temporarily stored in the storage bin. The remaining half stockpiled biosolids and the newly produced biosolids during Batch No. 1 are ready for drying in next drying batch.

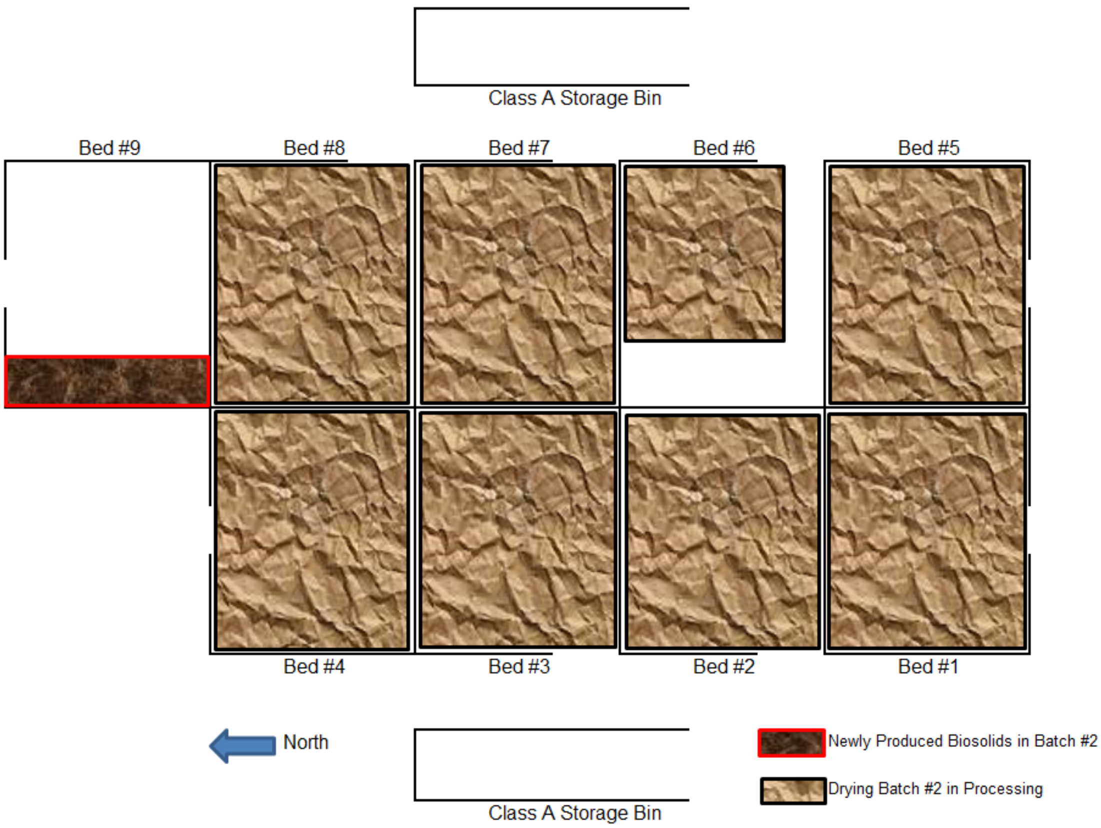

Figure 4-11. Future Drying Batch No. 2 in Drying Process

Figure 4-11 illustrates the future Batch No. 2 drying process. Approximately 1.2 fully stockpiled beds will be required to store newly produced dewatered biosolids during the Batch No. 2 (Table 4-6). Therefore, the clear bed after Batch No. 1 and one additional bed will be used to receive newly produced dewatered biosolids during the Batch No. 2. The Class A biosolids produced in Batch No. 1 will be hauled from the facility for land application at permitted sites in Grant County during Batch No. 2.

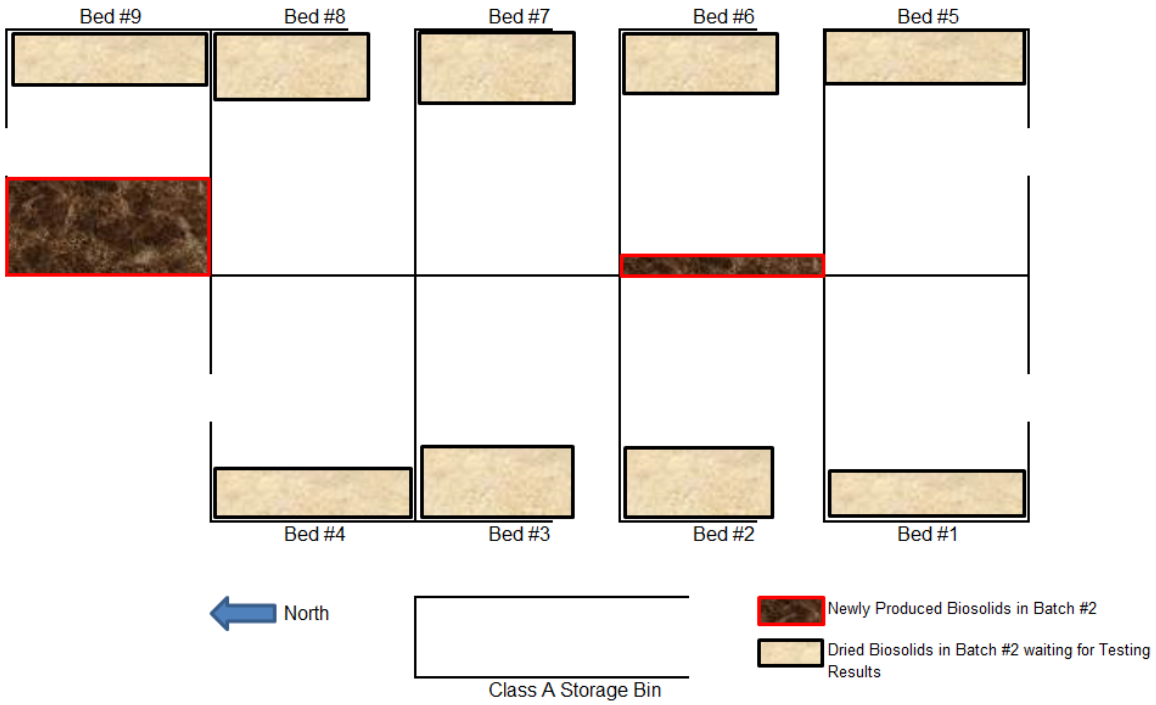

Figure 4-12. Future Drying Beds at the End of the Drying Batch No. 2

Figure 4-12 shows the status of drying beds at the end of the drying period of Batch No. 2. Dried biosolids will be stockpiled at the opposite end of the beds from the biosolids being stored prior to receiving test results. After successful test results are attained, the dried solids will be classified as Class A and moved to the Class A storage bin and eventually hauled for land application. The newly produced biosolids during Batch No. 2 will be stored in the beds until the next drying season.

4.5.3 Onsite Runoff Detention

Current Facility Runoff Storage Capacity Review

According to the 2008 Facility Plan, the onsite runoff of the current facility is retained and evaporated within the drying beds and the existing evaporative pond. The storage capacity of the existing evaporative pond and four drying beds is in excess of the volume required to detain and evaporate the 25-year, 24-hour storm event plus the mean annual precipitation.

Using the 2004 Eastern Washington Stormwater Management manual, a water balance calculation was performed to verify the current facility onsite runoff storage capacity documented in the 2008 Facility Plan.

The runoff storage capacity of the drying beds was assumed to be 45,833 cubic feet in the water balance calculation, which is the same as the capacity listed in the 2008 Facility Plan. In the 2008 Facility Plan, this volume was calculated by adding a 6 in tall ramp at the access openings of the two interior beds (Beds No. 2 and No. 3) and a 4 in tall ramp at the access opening of Bed No. 1. From field observation, there are no ramps at the access openings of Beds No. 2 and No. 3, but the grade of the drive way at the access openings of these two beds are approximately 6 inches higher than the bed bottom. The ramp at the access opening of Bed No. 1 is approximately 9 inches high. Therefore, it would be conservative to use the same runoff storage capacity documented in the 2008

Facility Plan. When the drying beds reach the runoff storage volume, water overflows south to the evaporative pond.

The water balance for the existing drying beds and evaporative pond were calculated separately. Areas tributary to the drying beds include the paved beds, paved access road to Bed No. 4, gravel area surrounding the vactor dump pad, and unpaved drive way along the west of the facility. In addition to the precipitation that falls directly into the evaporative pond, areas that drain to the pond and contribute to the storage volume are the vactor dump pad and the unpaved pond perimeter road. These drainage areas match the runoff drainage area listed in the 2008 Facility Plan.

Average monthly precipitation and pan evaporation data from 1950 to 1997 were obtained from the Wenatchee Experimental Station. Evaporation was adjusted from the pan evaporation data using a 0.75 effective factor. This is slightly more conservative than the 0.8 effective factor used in the 2008 Facility Plan.

The water balance of the drying beds and pond reserves an initial dead storage volume equivalent to the runoff from the 25-year, 24-hour storm event. Table 4-7 shows the reserved dead storage volume documented in the 2008 Facility Plan and the volume used in the water balance in this Facility Plan. The reserved dead storage volume documented in the 2008 Facility Plan is significantly smaller than those in the water balance in this Facility Plan.

Table 4-7. Dead Storage Volume for 25-Year, 24-Hour Storm

	2008 Facility Plan	2015 Facility Plan
Drying Beds	2,933 cf	10,607 cf
Evaporative Pond	1,662 cf	2,641 cf

In the 2008 Facility Plan, the storage capacity of the existing evaporative pond is listed as 56,900 cubic feet with a total pond depth of 6 feet (5 feet sidewater depth plus 1 foot of freeboard). However, the existing evaporative pond shown on the original Biosolids Drying Beds Facility design drawing (Drawing No. 800-B-2, Nov 1990) has a total pond depth of 8 feet. An emergency spillway is located on the east side of the pond with the invert of the spillway a foot below the pond top. The pond storage capacity calculated based on this drawing is 90,176 cubic feet with a sidewater depth of 7 feet and 1 foot of freeboard.

The water balance results show the current Biosolids Drying Beds Facility have runoff storage capacity in excess of the volume needed to detain and evaporate the 25-year, 24-hour storm event plus the average annual precipitation. Figure 4-13 shows the required pond storage volume over time. The required storage volume in the pond initially increases before reaching a steady state condition at approximately 53,000 cubic feet, or about 59% of the pond storage capacity. The water balance calculation worksheets are included in Appendix B.

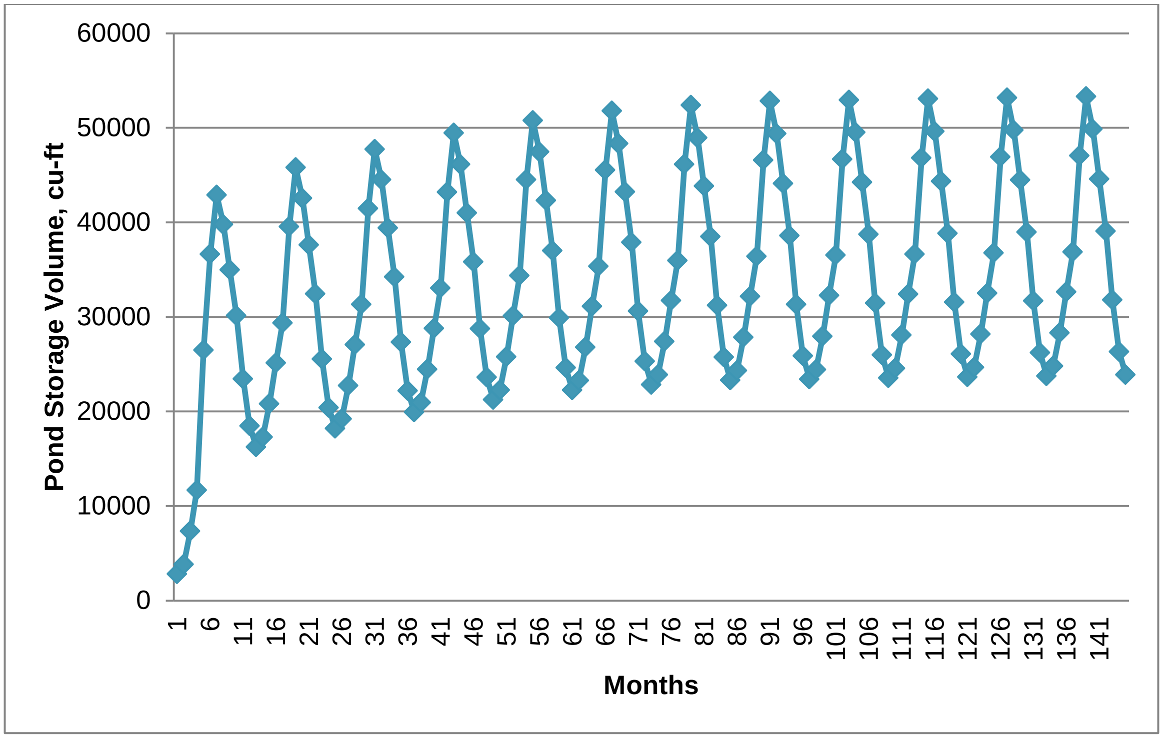

Figure 4-13. Existing Evaporative Pond Water Balance

Future Facility Runoff Storage Capacity

As discussed previously, eight drying beds are anticipated to be required for the future drying beds facility to produce the Class A biosolids. Because of the addition of the four new equally sized beds, a new evaporative pond with the same runoff storage capacity as the existing pond would be required for the future facility. The drainage of the new expansion of the facility would be designed the same as the existing drainage system. The new drying beds will have a total runoff storage volume of 45,833 cubic feet. Areas tributary to the new drying beds include the paved beds, gravel area to the north of the new Bed No. 8, and unpaved drive way along the east side of the facility. In addition to the precipitation that falls directly into the pond, the new evaporative pond would collect the runoff from the unpaved pond perimeter road and the unpaved road between Pond No. 1 and Pond No. 2. Because of the reduction of paved area on the new expansion, the total volume of the runoff to the beds and the pond is expected to be slightly reduced. Therefore, the new evaporative pond would have enough storage capacity for the new expansion of the facility.

In case the ninth drying bed is required in the future, a new water balance calculation should be performed to make sure the onsite runoff storage capacity would be enough to accommodate the runoff from the ninth bed and the surrounding area around the bed.

4.5.4 Future Drying Beds Facility Design Criteria

Table 4-8 lists the preliminary future drying beds facility design criteria. Construction of an additional four drying beds with the same size as the existing beds is recommended to handle the future Class A biosolids production. The City will continue to monitor the biosolids loading to the facility and the drying beds capacity annually and add the ninth bed in the future if necessary. A new evaporative pond the same size as the existing pond will also be added for the additional on site runoff storage after the expansion. Figure 4-14 shows a preliminary layout of the future drying beds facility with a total of eight beds and two evaporative ponds. If the ninth bed is required, it can be added to the east of the vactor dump area adjacent to Bed No. 8. If additional storage of Class A biosolids is needed in the future, a second Class A storage bin could be installed on the east side of the facility, as shown in Figure 4-8.

Table 4-8. Future Drying Beds Facility Design Criteria (8 Beds)

Parameter	Value
Number of Beds	8 (4 existing and 4 new)
Bed Dimensions, each	100 ft wide x 251.3 ft long
Bed Area, each	25,133 sf
Total Drying Bed Runoff Storage Volume	100,520 cf
Existing Evaporation Pond Runoff Storage Capacity	90,176 cf
New Evaporation Pond Runoff Storage Volume	90,176 cf
Pond Top Dimensions (L x W)	148 ft x 132 ft
Pond Bottom Dimensions (L x W)	100 ft x 82 ft
Side Slope (H:V)	3:1
Pond Sidewater Depth	7 ft
Freeboard	1 ft

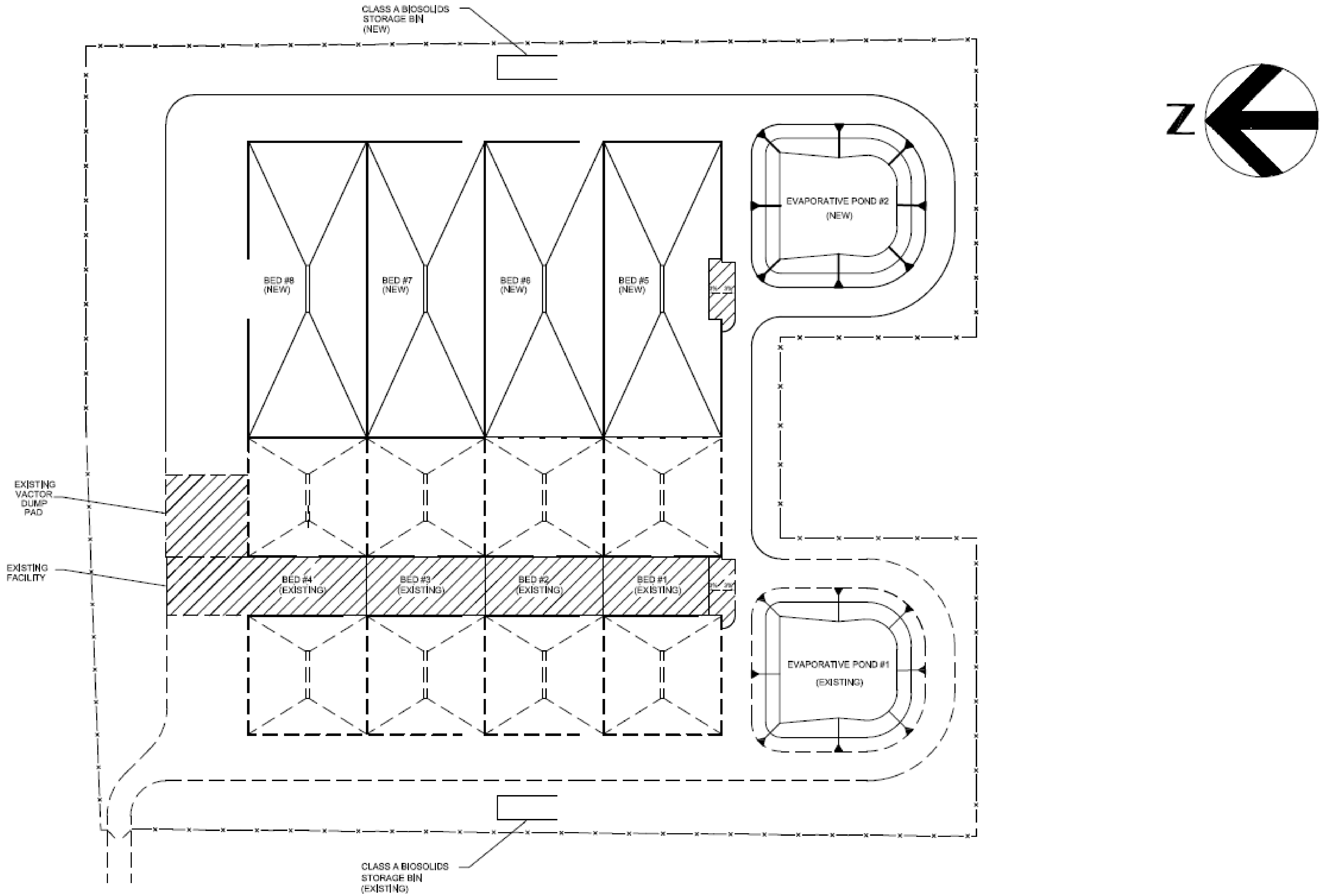

Figure 4-14. Future Biosolids Drying Beds Facility Expansion

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4.6 Biosolids Management Alternatives

In addition to using drying beds to produce Class A biosolids for land application, there are other biosolids management alternatives available. These include:

- Dry Class B biosolids using drying beds for land application,
- Haul dewatered Class B biosolids to the Greater Wenatchee Regional Landfill, or haul to a beneficial use site.
- Compost Class B biosolids to produce Class A biosolids

The following sections will briefly describe each biosolids management alternative for a potential option to handle the dewatered Class B biosolids produced in the future.

4.6.1 Dry Class B Biosolids Using Drying Beds for Land Application

This alternative would use the Biosolids Drying Beds Facility to further dry dewatered Class B biosolids produced in the future.

Class B Biosolids Classification Requirements

The WAC 173-308 has the following requirements for Class B biosolids classification:

- The metal pollutant concentration limits for biosolids land application shall meet the requirements in the WAC 173-308-160.
- The biosolids must be treated in one of the processes described in (a) through (e) below to significantly reduce pathogens per the WAC 173-308-170, Class B – Alternative 2:

  (a) Aerobic Digestion – The Biosolids must be agitated with air or oxygen to maintain aerobic conditions for specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature must be between 40 days at 20°C or 60 days at 15°C.

  (b) Air Drying – The biosolids must be dried on sand beds or on paved or unpaved basins. The biosolids must dry for a minimum of three months. During two of the three months, the ambient average daily temperature must be above 0 °C. During the air drying period, no additional material may be added.

  (c) Anaerobic Digestion – The biosolids must be treated in the absence of air for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature must be between 15 days at 35 to 55°C or 60 days at 20°C.

  (d) Composting – Using the within-vessel, static aerated pile, or windrow composting methods, the temperature of the biosolids must be raised to 40°C or higher and remain at 40°C or higher for 5 days. For four hours during the five days, the temperature in the compost pile must exceed 55°C.

  (e) Lime Stabilization – Sufficient lime must be added to the biosolids to raise the pH of the biosolids to twelve after two hours of contact.

- The Class B biosolids must meet one of the vector attraction reduction requirements in the WAC 173-308-180 for land application. The Alternative 1 vector attraction reduction is the volatile solids reduction. It requires the mass of volatile solids in the biosolids be reduced by a minimum of 38%.

The metal contents of the City's biosolids meet the WAC 173-308-160 requirements based on the testing results presented in Table 4-5. According to the City, the raw sludge from the primary clarifier and secondary waste sludge is digested anaerobically at an average temperature greater than 97°F for an average retention time greater than 21 days, which meets the pathogen reduction requirements in the WAC 173-308-170, Class B – Alternative 2. The average percent volatile solids reduction in 2014 was 46.6% from the raw sludge, which exceeds the vector attraction reduction required in the WAC 173-308-180. Therefore, the City's anaerobically digested biosolids meet the Class B biosolids requirements. The Class B digested biosolids are dewatered by a 2-meter belt filter press to an average total solids content of 15%.

Future Drying Bed Capacity Evaluation for Drying Class B Biosolids

To ease the biosolids handling during transportation and reduce hauling cost, the dewatered Class B biosolids could be further dried in the Biosolids Drying Beds Facility. The dewatered Class B biosolids are conservatively assumed to be dried to achieve 25% TS concentration in this alternative evaluation. However, the City currently dries their biosolids to 90% regardless of the location or means of disposition including beneficial reuse site(s) or landfill.

The following additional assumptions and data sources were used in the evaluating the drying beds capacity to further dry the Class B biosolids produced in the future for land application:

- The future dewatered biosolids production rate is 7,000 pounds per day in dry solids weight and 27.7 cubic yard per day (747.9 cubic feet per day) as shown in Table 4-1.
- According to the City, drying Class B follows the similar schedule as drying Class A. Therefore, assume Class B drying is performed from May to September each year.
- For sustainability reasons, the City prefers to continue to haul to beneficial reuse site versus landfill disposition.
- Use 50% of the bed area in each bed for storing Class B and the average depth of the biosolids stockpile is 2.5 feet. Therefore, the available storage volume of each bed is 31,416 cubic feet.
- Assume the drying area in each bed is 40% of the total bed area in the summer and the average application depth is 1 foot when drying the Class B biosolids.
- Based on the solids data summary of 2014, the average initial total solids content when the biosolids are unloaded to the beds is 15%. Due to the evaporation throughout the entire non-drying period, the final total solids content at the end of the non-drying season is 20% resulting in a 25% reduction in biosolids volume while stored in the drying beds. The evaluation assumes that the biosolids dryness will range between 25% and 90%, providing the City greater flexibility to balance drying costs with hauling costs for this option.
- The pan evaporation data acquired from the Wenatchee Experimental Center was used in estimating the volume reduction of the stored biosolids in the beds due to evaporation during the drying season (May to October). An effective factor of 0.75 was applied to the data to compensate the difference between the pan evaporation results and the actual evaporation from wet solids.

- No initial draining of free water in the dewatered biosolids occurs after the biosolids are unloaded to the beds. This assumption is based on the City's statement that no drainage has ever been observed at the drying beds under drain discharge at the evaporative pond. It is suspected the under drains of the beds are clogged.

Table 4-9 presents the total drying beds required for drying dewatered Class B biosolids produced in 2035. Detailed calculations are included in Appendix B.

Table 4-9. Number of Drying Beds Required for Drying Class B Biosolids Produced in 2035

Periods	Biosolids Loading to Beds [a] (cf)	Storage Volume Required [b] (cf)	Number of Beds Required [c]
October to April (non-drying season)	158,555	118,916	3.79
May to September (Drying Season)	76,286	53,823	1.71
		Total Beds Required	**3.79 [d]**

[a] Biosolids loading to beds was calculated using future daily biosolids production rate of 27.7 cy/day multiplied by days in that period.
[b] Storage volume required was calculated after deducting the volume reduction due to evaporation from the biosolids loading volume.
[c] Number of beds required was calculated using storage volume required divided by available storage volume in each bed, which is 31,416 cf/bed.
[d] The newly produced Class B biosolids during the drying season does not require additional drying beds storage volume.

According to the calculation results, it would take approximately 14 days to dry Class B biosolids to achieve 25% TS concentration (greater biosolids cake quantity). At the application depth of 1 foot and drying area equivalent to 40% of the total bed area, it would take approximately one third of the fully stored stockpile to dry. A short drying period is required to produce the Class B biosolids. Therefore, they can be evenly distributed in the beds during the drying season utilizing all the available storage volume after a portion of the biosolids stockpiled are applied for drying. Therefore, no additional drying beds would be needed to store biosolids produced during the drying season. The total drying beds required for drying Class B biosolids produced through the entire year would be equivalent to the number of the beds required to store Class B biosolids during the non-drying season.

As the existing Biosolids Drying Beds Facility has 4 beds, the existing facility has sufficient capacity to further dry Class B biosolids produced in the future to achieve 25% TS concentration and additional spare space is available when biosolids are dried to 90% TS concentration.

Class B Land Application

As discussed previously, the City can either land apply Class B biosolids at the currently permitted sites in Grant County or apply for permits for new land application sites through procedures set forth in WAC 173-308 and in the City of Wenatchee's General Land Application Plan dated October 20, 2015. In addition to Grant County, which accepts both Class A and Class B biosolids, farmer owned companies, such as Boulder Park, Inc., and biosolids management companies, such as, Parker Ag Service, can also take Class B biosolids for use in land application in Douglas County. However, the City would need a site specific land application plan if sending the Class B biosolids to Douglas County in the future.

If the Class B biosolids are to be hauled to the currently permitted sites in Grant County, the City must follow the provisions set forth in the City of Wenatchee's Site Specific Land Application Plan – Final, dated October 15, 2015, the Spill Prevention and Response Plan dated September 10, 2012, and Sampling and Analysis Plan dated October 20, 2015.

Compared to Class A biosolids, especially Class A biosolids with an EQ rating, land application of Class B biosolids has more restrictions on buffer requirements, public access, and crop harvesting.

4.6.2 Haul Dewatered Class B Biosolids to Landfill

In this alternative dewatered Class B biosolids would be hauled from the City's WWTP to the Greater Wenatchee Regional Landfill. Design criteria for this alternative are listed in Table 4-10. The existing Biosolids Drying Bed Facility would not be needed. Based on the projected future biosolids production rate an estimated four truckloads per day would need to be hauled to the landfill. Using existing City trucks a truck driver would haul biosolids approximately eight hours per day. Alternatively, a local contract hauler could be used. The annual operating costs to haul dewatered Class B biosolids to the Greater Wenatchee Regional Landfill would include tipping fees, fuel costs, and City staff labor or contract hauler costs.

Table 4-10. Hauling Biosolids to Landfill Design Criteria

Sizing Criteria	Values
Future dewatered biosolids production	27.7 cy/day
Future dewatered biosolids average solids concentration	15%
Hauling truck capacity	7 yds
Hauling distance (round trip)	18 miles
Number of hauling loads per day	4 truckloads
Number of hauling loads per year	1,460 truckloads

4.6.3 Compost Biosolids to Produce Class A biosolids

This alternative would compost the dewatered Class B biosolids using ASPs to produce Class A biosolids.

Regulatory Requirements

According to WAC 173-308-170, if biosolids are treated with the ASP composting method to further reduce pathogens, the following requirements must be met in order for the compost to be classified as Class A biosolids:

- The temperature of the biosolids during composting must be maintained at 55°C (131°F) or higher for three days.
- The fecal coliform in the compost must be less than 1,000 MPN per gram of total solids (dry weight basis), or,
- The density of *Salmonella* sp. bacteria in the compost must be less than 3 MPN per 4 grams of total solids (dry weight basis) at the time the compost is used, prepared for sale, or given away in a bag or other container for application to the land; or prepared to meet the requirements for exemption in WAC 173-308-200.

Aerated Static Pile Composting System Introduction

Composting is the biological decomposition of organic material under aerobic conditions. The micro-organisms involved fall into three major categories: bacteria, actinomycetes, and fungi. The process is a self-limited biological process. Available nutrients, temperature, aeration, moisture content, and pH play the most important roles in limiting the microbial population. The composting process produces heat as a result of the bacteriological metabolism. Initially, the heat generated by the mesophilic bacteria elevates the temperature to 50°C. As the mesophilic population decreases due to high temperature, the number of thermophilic bacteria increases and elevate the temperature to 60°C. If the environmental conditions, such as, air, water, and nutrients are appropriate, the micro-organisms are self-limiting and the temperature stabilizes around 55°C.

Aerated static pile is one of the composting systems. It consists of a grid of aeration or exhaust piping over which a mixture of dewatered sludge and bulking agent is placed. The bulking agent is usually woodchips or hog fuel, which are mixed with the dewatered solids by a mixer. Composting requires carbon to nitrogen ratios of 30:1 since micro-organisms use approximately 30 parts of carbon for each part of nitrogen. Homogeneous mixtures of sludge and bulking agent usually provide a carbon to nitrogen ratio of about 30:1. Therefore, it is not normally necessary to add additional nutrients. Mixed material is composted for approximately 21 to 30 days and then cured for another 30 days or longer. The purpose of the curing process is to provide enough time for the compost product to be fully stabilized prior to distribution. The important process limiting conditions of air and water are controlled by regulating the supply of air to the compost pile and by adjusting the moisture content to the desirable level of 50 to 60 percent.

Typical ASP heights are about 7 to 8 feet. A layer of screened compost is placed on top of the pile for insulation. Disposable corrugated plastic drainage pipe is commonly used for air supply and each individual pile is recommended to have an individual blower for more effective aeration control. Screening of the cured compost is usually performed to reduce the quantity of cured compost and recover the bulking agent. Figure 4-15 shows a schematic of a typical aerated static pile system. Figure 4-16 shows an example aerated static pile facility in Coeur d’Alene, ID.

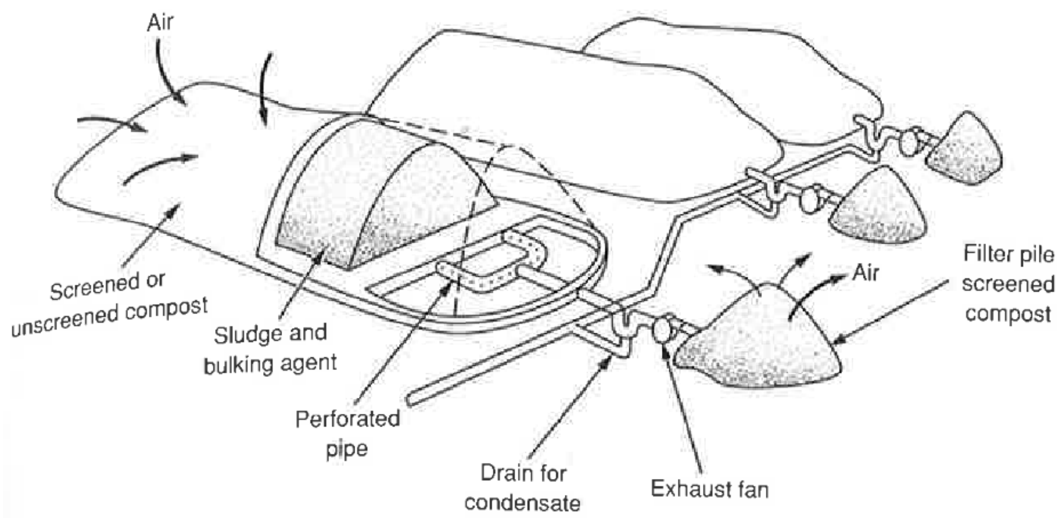

Figure 4-15. A Typical Aerated Static Pile System Schematics

(Source: Wastewater Engineering, Treatment, Disoposal, and Reuse, Matcalf & Eddy, 3rd Ed.)

Figure 4-16. Example Aerated Static Pile Composting Facility (Coeur d'Alene, ID)

An ASP composting facility typically includes the following components:

- aerated static piles,
- cure piles,
- mixer, to mix dewatered solids with bulking agent,
- aeration blowers, to supply air or create negative pressure in the ASPs,
- screen, to separate compost from bulking agent,
- biofilter(s), for facility odor control if required,
- storage areas for new and recycled bulking agent, and
- storage area for cured compost.

Aerated Static Pile Composting Facility Sizing Criteria

If aerated static pile composing system is used by the City to produce Class A biosolids in the future, the existing Biosolids Drying Beds Facility could be converted to an aerated static pile composing facility. The composting facility will be designed to handle the year 2035 winter average dewatered biosolids loading listed in Table 4-1. There are many types of bulking materials and amendments that have been used successfully in composting operation, such as, woodchips, hog fuel, yard waste, grass seed meal, and grass straw. For the purpose of this alternative evaluation, woodchips are assumed to be used as the bulking agent. The system will be composting under aerobic conditions for approximately 21 days before the compost is screened and cured for an additional 30 days. The preliminary sizing criteria for the composting facility are described in Table 4-11.

Table 4-11. Aerated Static Pile Composting Facility Preliminary Design Criteria

Sizing Criteria	Values
Dry Solids load	7,000 lb/day
Solids to Woodchip Ratio	1:3
Aerated Composting Time	Approx. 21 days
Curing Time	Approx. 30 days
Compost Pile Height	8.5 ft with 1 foot base of chips
Compost Pile Width	12 ft
Compost Pile Length	100 ft
Cured Compost Storage Capacity	6 months cured compost
New Woodchip Storage Capacity	30 days capacity
Recycled Woodchip Storage Capacity	1 time recycle for 21 days

Based on the sizing criteria, the future composting facility would need 22 ASPs and 5 cure piles. An additional ASP and cure pile are included in the facility as standby. Storage areas for cured compost are also included. New and recycled woodchips were sized based on an assumption of 5 feet deep stockpile in the storage area. Detailed sizing calculation is included in Appendix B. A schematic layout of the future composting facility converted from the existing Biosolids Drying Beds Facility is shown in

Figure 4-17. The figure shows the footprint of the existing Biosolids Drying Beds Facility would be enough for the future composting facility.

In order to control compost pile temperature and moisture more efficiently, the ASP, cure pile, and aeration blowers should be installed in a building.

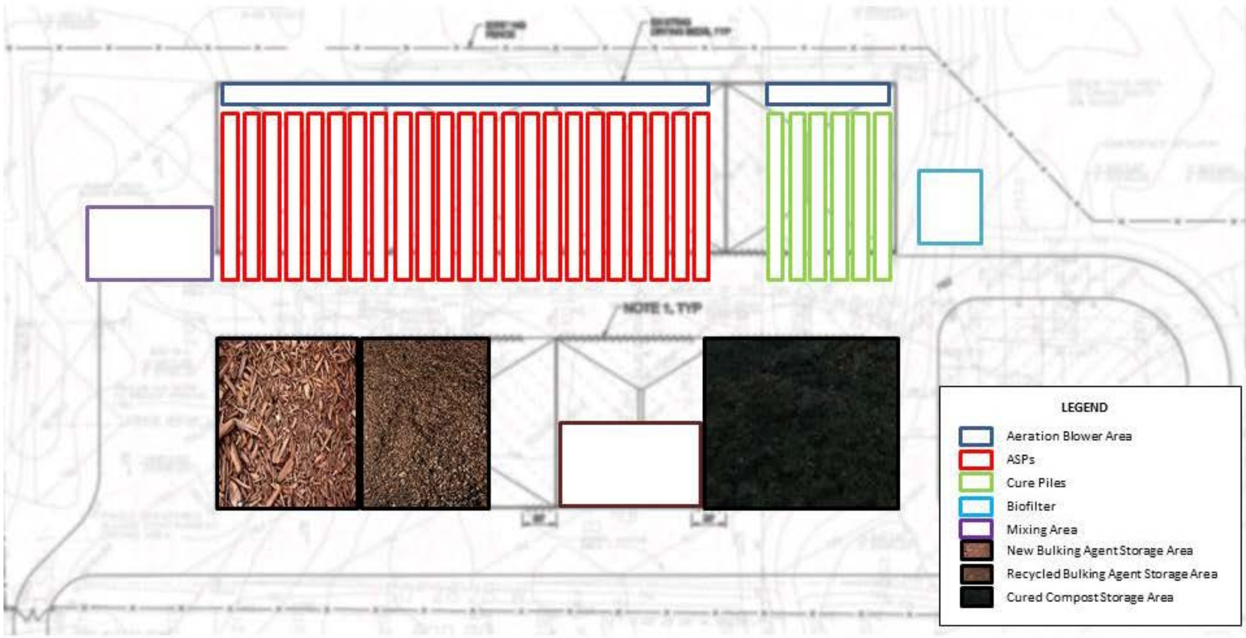

Figure 4-17. Future Composting Facility Schematic Layout

4.7 Evaluation of Biosolids Management Alternatives

This section presents a non-economic evaluation of the City's current biosolids management, which is using drying beds to produce Class A biosolids, and other potential biosolids management alternatives identified in Section 4.6 to initially screen the biosolids management alternatives.

4.7.1 Evaluation Methodology

A weighting and scoring method was used in this evaluation to screen the biosolids management alternatives. The weighting and scoring method includes the following procedures:

- Select non-economic evaluation criteria representing important benefits or attributes of an alternative that are independent, provide differentiation, and can be objectively assessed.
- Weight each criterion to prioritize the importance of the benefit or attribute to the biosolids management alternative selection process.
- Score each biosolids management alternative with respect to each evaluation criterion.
- Select the preferred biosolids management alternative based on the evaluation results.

4.7.2 Non-Economic Evaluation Criteria

The following sections describe the non-economic evaluation criteria that are to be used for screening the biosolids management alternatives:

- City and Farmland Owner Preferences
- Biosolids Management Improvements
- Operation & Maintenance

- Impacts on Current Biosolids Handling Facility
- Sustainability

City and Farmland Owner Preferences

The City has successfully proven to Ecology that an equivalent further reduction of pathogens method to produce Class A biosolids using drying beds meets the WAC 173-308 requirements. The City would prefer to keep using this treatment method if possible. The farmland owner would also prefer receiving Class A biosolids due to its high quality, easy handling, and fewer restrictions in application. Therefore, an alternative which would produce Class A, especially using drying beds in treatment, is rated highest.

Biosolids Management Improvements

Biosolids Quality – The City currently uses drying beds to produce Class A biosolids with an EQ rating, which may be distributed to non-permitted entities according to Ecology. Can any other proposed biosolids management alternatives produce the same high quality biosolids? An alternative which would produce the high quality Class A biosolids is rated highest.

Resistance to Weather Impacts – Do the weather conditions or seasonal changes impact the performance of the biosolids management alternatives? An option with high resistance to the weather and seasons impacts scores the highest.

Operation & Maintenance

Energy Consumption – Does the biosolids management alternative require electrical power? Alternatives with zero energy consumption score the highest.

Operation Familiarity and Complexity – Are the City operators familiar with the biosolids treatment technology presented in the biosolids management alternative? Do the operators have any experience in operating the biosolids treatment facility presented in the biosolids management alternative? Any equipment control and monitoring required in the facility? A biosolids treatment alternative that the City operator is familiar with and simple to operate is rated the highest.

Maintenance Complexity – Is the biosolids management alternative easy to maintain? Are there any regular maintenance requirements on equipment, such as parts replacement or adjustment and lubrication, are required? A biosolids management alternative with minimal maintenance is rated the highest.

Solids Content – Percent solids measures the amount of water that remain in the final biosolids product. Higher solids content in the final biosolids products means smaller volume of the products and thus lower hauling cost to land application locations or landfill. It is also more difficult to handle the biosolids when the solids content of the biosolids is less than 25%. An alternative which produces biosolids with high solids content is rated higher.

Impacts on the Current Biosolids Handling Facility

Would the biosolids management alternative need to expand or modify the existing Biosolids Drying Beds Facility? How does alternatives compare in term of construction disruption of the City's daily biosolids treatment operation? Alternatives which require no changes to the current facility are rated highest.

Sustainability

This criteria concerns environmental impacts related to GHGs, vehicle emissions, and transportation of biosolids (accidents, congestion, and pavement maintenance costs). The preference is for alternatives that use green energy, less truck hauling, and minimal construction to biosolids treatment facility.

4.7.3 Evaluation Criteria Weighting

The suggested weighting factors of all the non-economic evaluation criteria developed in Section 4.7.2 are listed in Table 4-12. The weighting factors were determined by assessing the prioritization of the importance of each evaluation category to the solids management option selection. The weighting distribution among all the evaluation categories are presented in Figure 4-18.

Table 4-12. Non-Economic Evaluation Criteria Weighting Factors

Evaluation Criteria	Weighting Factors, %
City and Farmland Owner Preferences	20
Biosolids Management Improvements	
Biosolids Quality	15
Resistance to Weather Impacts	5
Operation & Maintenance	
Energy Consumption	10
Operation Familiarity and complexity	10
Maintenance Complexity	10
Solids Contents	8
Impacts on Current Biosolids Handling Facility	12
Sustainability	10
TOTAL	100

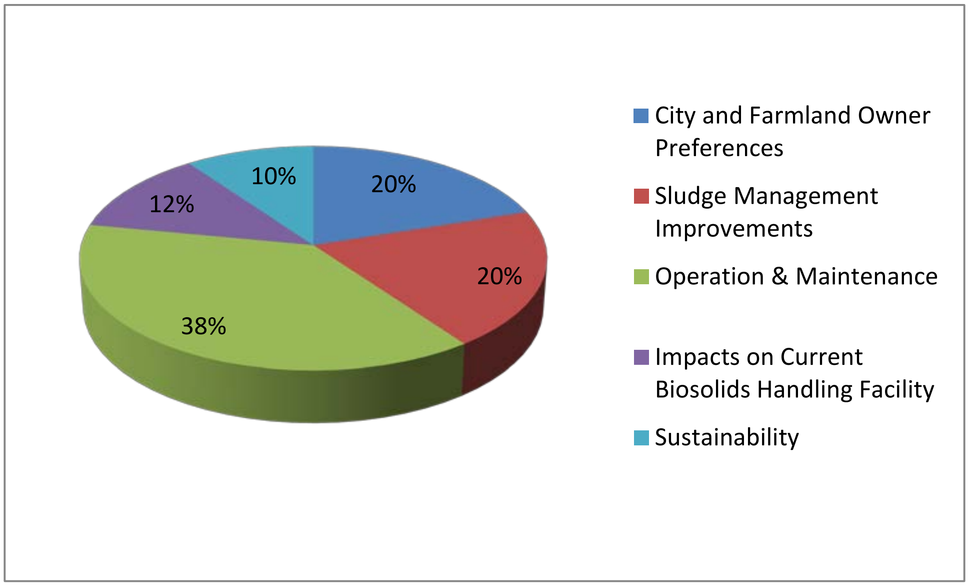

Figure 4-18. Non-Economic Weighting Distribution Between Evaluation Criteria

4.7.4 Biosolids Management Alternative Scoring

Each biosolids management alternative is scored on a relative scale of 1 to 5, with 5 being the highest and 1 the lowest, for each evaluation criterion and sub criterion. The score is then multiplied by the weighting factor of that evaluation criterion. The sum of all the multiplications of the criterion score number and weighting factor is the final score of that alternative. The alternative with the highest score would be the best biosolids management alternative for the City to gain the most benefits from the non-economic criteria identified in Section 4.7.2.

Table 4-13. Biosolids Management Alternative Scoring

Evaluation Criteria/Alternative Description	Weighting	Use Drying Beds to Produce Class A	Use Drying Beds to Further Dry Class B	Haul Dewatered Class B to Landfill	Use ASP to Compost Biosolids to Produce Class A
City and Farmland Owner Preferences	20	5	3	1	4
Solids Management Improvements					
Biosolids Quality	15	5	3	3	5
Resistance to Weather Impacts	5	1	3	5	5
Operation & Maintenance					
Energy Consumption	10	5	5	5	1
Operation Familiarity and Complexity	10	5	5	5	1
Maintenance Complexity	10	4	4	5	1
Solids Contents	8	5	2	1	4

Evaluation Criteria/Alternative Description	Weighting	Use Drying Beds to Produce Class A	Use Drying Beds to Further Dry Class B	Haul Dewatered Class B to Landfill	Use ASP to Compost Biosolids to Produce Class A
Impacts on Current Biosolids Handling Facility	12	2	5	3	1
Sustainability	10	4	3	1	2
Total		**424**	**366**	**294**	**274**

As shown in Table 4-13, the City's current biosolids management of using drying beds to produce Class A biosolids scores the highest among all four alternatives evaluated. The current management of biosolids is a proven treatment method that produces high quality biosolids using solar energy. The operation is simple and maintenance is minimal. The high solids content in the final biosolids product minimizes the hauling volume to land application sites, thus keeping operation costs low and improving the facility's sustainability. The disadvantage of this option is it would require the largest footprint, doubling the size of the existing Biosolids Drying Beds Facility.

The biosolids management alternative of using drying beds to further dry Class B biosolids ranks second in the biosolids management alternatives evaluation. An advantage to this alternative is the existing Biosolids Drying Bed Facility has enough capacity to further dry future Class B biosolids, so expansion of the facility would not be required. Additionally, the drying operation would be similar to the current operation. The Class B biosolids could be land applied in currently permitted sites or the City can apply for permits for new land application sites. However, the more restrictive requirements for land applying Class B biosolids are a disadvantage in this alternative. Additional hauling costs would also be associated with hauling biosolids with lower TS concentrations than current biosolids.

The third ranked biosolids management alternative is hauling dewatered Class B biosolids to the Greater Wenatchee Regional Landfill. An advantage to this alternative would be the reduced labor effort associated with operating the existing Biosolids Drying Beds Facility. However, hauling biosolids to the landfill requires increased hauling costs and this alternative ranks the lowest for sustainability.

Using ASPs to compost biosolids producing Class A biosolids ranked the lowest of the four biosolids management alternatives evaluated. Although high quality biosolids would be produced in this alternative, the existing Biosolids Drying Beds Facility would require modifications including construction of a building. Operating ASPs would be a new process for City operators and requires additional equipment and energy consumption.

A recommended biosolids management alternative is given in Chapter 6.

Appendix B. Detailed Calculations

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Project	Wenatchee Facility Plan Update	Computed	XD	Date	1/26/2015
Subject	Biosolids Management Plan	Checked	DH	Date	
Task	Drying Beds Sizing for Future Class A Production	Sheet		Of	

Number of Existing Drying Beds: 4

Dimension of each bed:

L = 251.33 ft

W = 100 ft

Surface Area = 25133 sq. ft

1. Storage Depth Estimation:

The City stockpiles the dewatered biosolids at one end of drying beds throughout the non-drying season (October to April) in 2014.
Approximately up to 40% of the bed area was used to store biosolids in 2014.

The average TS% of the biosolids when unloading to the beds =		15%	(per the City's data)			
The TS% of the biosolids at the end of the non-drying season =		20%	(per the City's data)			
Therefore, the volume reduction in the drying beds during storage =		25.00%				
2014 dewatered biosolids production =	891,621 gallons/yr. =	12.1	cu yd./day =	326.6	cu ft/day	(per the City's data)
Volume of the biosolids after volume reduction =				244.9	cu ft/day	
Storage area in each bed (40% of the bed area) =		10053.2	sq. ft			

Potential average storage depth	Storage volume in each bed	# of beds required
ft	cu ft/bed	
1.5	15080	5.93
2	20106	4.45
2.5	25133	3.56

From the above calculation and field observation, the average storage depth is most likely at 2.5 ft. Therefore, an average storage depth of 2.5 ft is used for the future beds sizing calculation.

2. Future Dewatered Biosolids Storage Volume Requirement from October to April

Projected 2035 winter daily dewatered biosolids =	27.7 cu yd./day =	747.9	cu ft/day	(Table 4-1)
Future volume of the biosolids produced from Oct to Apr =		158554.8	cu ft	
Percent of volume lost during storage =		25%		
Storage volume required from Oct to Apr =		118916	cu ft	
Available storage volume in each bed (40% of the bed area at 2.5 ft depth) =		25133	cu ft	
Number of beds required to store biosolids from October to April =		4.73	beds	

3. Future Drying Batches and Storage Requirements in Drying Season

Based upon information provided by City operations, during the drying season and when the ambient temperature is 15 deg C or above, the stockpile is spread to the rest of the bed area for drying, while maintaining the rest of the material in the same bed. 50% of storage area in each bed is used as the drying area. 10% of the bed area is for maintaing a clearance between the storage area and the drying area and a truck unloading path. The partially stored beds are used to continue hauling to the drying bed facility.
According to the City and 2014 test data, two drying batches were performed in 2014. Each batch, including drying and testing periods, took about 85 days (5/17/14 to 8/8/14 and 8/9/14 to 10/31/14) before the biosolids were removed from the beds to the storage bin.
The drying periods of both batches were 35 days before taking samples.

It is assumed the City will perform two drying batches in the future and each batch, including drying and testing, will take 85 days.

Storage Volume Required during Batch #1 (assume Batch #1 ends on 8/10)

Future Volume of the biosolids produced from 5/1 to 8/10 = 76285.8 cu ft

Volume Reduction due to Evaporation from 5/1 to 8/10 =	20728.4	cu ft		
Net Evaporation Rate in May, E, inches/month	5.1525	=	0.16621	inches/day
Daily volume loss =	174.06	cu ft/day		
Net Evaporation Rate in June, E, inches/month	5.9025	=	0.190403	inches/day
Daily volume loss =	199.39	cu ft/day		
Net Evaporation Rate in July, E, inches/month	7.035	=	0.226935	inches/day
Daily volume loss =	237.65	cu ft/day		
Net Evaporation Rate in August, E, inches/month	5.8725	=	0.189435	inches/day
Daily volume loss =	198.38	cu ft/day		

(Net evaporation rate data was acquired from pan evaporation data on http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#WASHINGTON, a effective factor of 0.75 was applied to the pan evaporation data.)

Storage volume required during Batch 1 = 55557.4 cu ft

Number of beds needed to store biosolids during drying Batch 1 = 2.21 beds

Storage Volume Required during Batch #2 (assume Batch #2 ends on 10/31)

Storage volume requirement is calculated until 9/30. The storage volume required in October is included in the non-drying season calculation already

Future Volume of the biosolids produced from 8/11 to 9/30 = 38142.9 cu ft

Volume Reduction due to Evaporation from 8/11 to 9/30 =	7350.6	cu ft		
Net Evaporation Rate in August, E, inches/month	5.8725	=	0.189435	inches/day
Daily volume loss =	198.38	cu ft/day		
Net Evaporation Rate in September, E, inches/month	3.1425	=	0.101371	inches/day
Daily volume loss =	106.16	cu ft/day		

(Net evaporation rate data was acquired from pan evaporation data on http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#WASHINGTON, a effective factor of 0.75 was applied to the pan evaporation data.)

Storage volume required during Batch 2 = 30792.26 cu ft

Number of beds needed to store biosolids during drying Batch 2 = 1.23 beds

4. Future Drying Beds Facility Sizing

Periods	# of beds required
October to April (non-drying season)	4.73
May to Mid August (Batch #1)	2.21
Mid August to September (drying period of Batch #2)	1.23
Total	**8.17**

5. Conclusion:

This evaluation is based on the City's current Class A production procedure performed in 2014, and future projected biosolids production from the mass balance results.
Based on the above calculation, the City would need a minimum of 8 beds in the facility to produce Class A with all the dewatered biosolids produce in 2035 and have enough storage volume for storing the biosolids year round.
Due to the assumptions used in the future solids production and storage volume requirements, HDR recommends the City equip 8 drying beds initially to handle future loads, while monitoring the solids production and storage volume requirement at the drying bed facility.
A ninth bed may be added if the future monitoring results show there is a need for it.
As the current facility only has four drying beds. An additional four drying beds at the same size as existing would be required initially.
Material handling procedures promotes installation of beds end to end, to avoid the need to drive out of the drying bed to move material.

Drying Beds Facility Water Balance with Evaporative Pond

Drying Beds	
Surface Area of Each Bed (sq-ft)	*25000*
Number of Beds	*4*
Total Surface Area (sq-ft)	100000
Impervious Area (sq-ft)	*103500*
Permeable Area (sq-ft)	*36590*
Average Depth of Each Bed (ft)	*0.46*
Volume of Each Bed (cu-ft)	*11458*
Total Volume (cu-ft)	*45833*

Notes:
1. Impervious area includes paved bed area and paved access area to Pond 4.
2. Beds permeable areas includes the areas north of the access road to Pond 4 and original Pond 4 and drive way to the west of the facility. they were estimated based on the Original Sludge Drying Beds Site and Grading Plan (drawing No. 800-B-2) dated 11/1990.
3. Average pond depth of each bed was estimated based on the Original Sludge Drying Beds Site and Grading Plan (drawing No. 800-B-2) dated 11/1990.

	AMC II Apri-Oct	AMC II Nov & Mar	Dec-Feb
Impervious CN	98	98	98
Permeable CN	85	85	85
Impervious S	0.20	0.20	0.20
Permeable S	1.76	1.76	1.76

Notes:
1. Assume average runoff condition and Ia = 0.2S
2. direct runoff = $(percipitation-0.2S)^2/(precipitation+0.8S)$

Volume Reserved for 25 yr, 24 hr storm:	
25-yr 24-hr storm (in.)	2
Total amount of rainfall during the storm (in.)	1.32
Impervious Runoff Depth (in.)	1.10
permeable Runoff Depth (in.)	0.34
Beds Total Runoff Volume (cu-ft)	10559
Pond Runoff Volume (cu-ft)	2807

Evaporative Pond		
Number of Ponds	*1*	
Pond Bottom Length (ft)	*100*	
Pond Bottom Width (ft)	*84*	
Slope (H:V)	*3:1*	
Impervious Area (sq-ft)	*26191*	0.60
Permeable Area (sq-ft)	*14013*	0.32
Total Pond Depth (ft)	*8.0*	
Free Board (ft)	*1.0*	
Pond Storage Volume (Capacity) (cu-ft)	*90176*	

Notes:
1. Impervious area includes the pond top area and the vactor dump area at which the runoff drains to the pond.
2. Permeable area includes access road around the pond.
3. Pond dimensions, volume, impervious and permeable areas were based on the Original Sludge Drying Beds Site and Grading Plan (drawing No. 800-B-2) dated 11/1990.

	Weather Data				Beds Water Balance							Pond Water Balance						
Month	Monthly Average Precipitation[a] (in.)	Impervious Runoff Depth (in.)	Permeable Runoff Depth (in.)	Adjusted Pan Evap.[c] (in.)	Beds Impervious Runoff Volume (cu-ft)	Beds Permeable Runoff Volume (cu-ft)	Beds Total Runoff Volume (cu-ft)	Beds Evap. Volume (cu-ft)	Volume Needed in Beds (cu-ft)	Bed Overflow to Pond (cu-ft)	Volume Stored in Beds (cu-ft)	Pond Impervious Runoff Volume (cu-ft)	Pond Permeable Runoff Volume (cu-ft)	Pond Total Runoff Volume (cu-ft)	Pond Evap. Volume (cu-ft)	Volume Needed in Pond (cu-ft)	Pond Overflow (cu-ft)	Volume Stored in Pond (cu-ft)
									10559	0.00	10559					2807	0	2807
October	0.64	0.45	0.04	0.00	3855	122	3977	0	14536	0.00	14536	975	47	1022	0	3830	0	3830
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	27687	0.00	27687	2945	580	3525	0	7354	0	7354
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	43698	0.00	43698	3527	794	4321	0	11675	0	11675
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	57059	11225.45	45833	2988	595	3583	0	26484	0	26484
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	36640	0	36640
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	42899	0	42899
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	3977	39784	0	39784
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5616	34962	0	34962
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6099	30125	0	30125
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7073	23440	0	23440
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	5586	18456	0	18456
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	2823	16256	0	16256
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	17278	0	17278
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	20803	0	20803
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	25124	0	25124
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	29373	0	29373
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	39529	0	39529
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	45788	0	45788
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4081	42569	0	42569
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5764	37599	0	37599
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6433	32429	0	32429
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7270	25547	0	25547
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	5745	20404	0	20404
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	2823	18203	0	18203
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	19226	0	19226
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	22750	0	22750
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	27071	0	27071
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	31321	0	31321
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	41477	0	41477
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	47736	0	47736
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4081	44516	0	44516
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5915	39395	0	39395
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6433	34225	0	34225
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7270	27343	0	27343
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	5745	22200	0	22200
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	2906	19916	0	19916
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	20939	0	20939
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	24463	0	24463
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	28784	0	28784
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	33034	0	33034
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	43190	0	43190
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	49449	0	49449
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4186	46125	0	46125
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5915	41004	0	41004
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6433	35833	0	35833
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7466	28755	0	28755
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	5745	23612	0	23612
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	2989	21246	0	21246
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	22268	0	22268
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	25793	0	25793
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	30113	0	30113
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	34363	0	34363
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	44519	0	44519
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	50778	0	50778
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4186	47454	0	47454
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5915	42333	0	42333
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6602	36993	0	36993
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7466	29915	0	29915
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	5905	24613	0	24613
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	2989	22246	0	22246
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	23269	0	23269
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	26793	0	26793
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	31114	0	31114
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	35364	0	35364
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	45520	0	45520
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	51779	0	51779
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	48347	0	48347
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5915	43227	0	43227
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6602	37887	0	37887
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	30607	0	30607
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	5905	25305	0	25305
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	22853	0	22853
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	23875	0	23875
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	27400	0	27400
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	31720	0	31720
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	35970	0	35970
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	46126	0	46126
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	52385	0	52385
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	48954	0	48954
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	5915	43833	0	43833
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6602	38493	0	38493
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	31214	0	31214
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	6068	25747	0	25747
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	23295	0	23295
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	24318	0	24318
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	27842	0	27842
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	32163	0	32163
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	36413	0	36413
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	46569	0	46569
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	52828	0	52828
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	49396	0	49396
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	6067	44124	0	44124
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6776	38611	0	38611
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	31331	0	31331
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	6068	25865	0	25865
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	23413	0	23413
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	24435	0	24435
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	27960	0	27960
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	32281	0	32281
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	36530	0	36530
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	46686	0	46686
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	52945	0	52945
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	49514	0	49514
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	6067	44242	0	44242
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6776	38728	0	38728
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	31449	0	31449
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	6068	25982	0	25982
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	23530	0	23530
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	24553	0	24553
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	28077	0	28077
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	32398	0	32398
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	36648	0	36648
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	46804	0	46804
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	53063	0	53063
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	49631	0	49631
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	6067	44359	0	44359
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6776	38846	0	38846
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	31566	0	31566
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	6068	26100	0	26100
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	23648	0	23648
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	24670	0	24670
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	28195	0	28195
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	32516	0	32516
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	36765	0	36765
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	46921	0	46921
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	53180	0	53180
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	49749	0	49749
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	6067	44477	0	44477
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6776	38963	0	38963
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	31684	0	31684
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	6068	26217	0	26217
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	23765	0	23765
October	0.64	0.45	0.04	0.00	3855	122	3977	0	3977	0.00	3977	975	47	1022	0	24788	0	24788
November	1.57	1.35	0.50	0.00	11636	1515	13151	0	17128	0.00	17128	2945	580	3525	0	28312	0	28312
December	1.84	1.62	0.68	0.00	13937	2074	16011	0	33139	0.00	33139	3527	794	4321	0	32633	0	32633
January	1.59	1.37	0.51	0.00	11806	1554	13361	0	46500	666.64	45833	2988	595	3583	0	36883	0	36883
February	1.07	0.86	0.21	0.00	7408	632	8040	0	53873	8039.52	45833	1875	242	2116	0	47039	0	47039
March	0.75	0.55	0.07	0.00	4750	222	4972	0	50806	4972.22	45833	1202	85	1287	0	53298	0	53298
April	0.57	0.38	0.02	3.56	3294	72	3366	29625	19575	0.00	19575	834	28	861	4293	49866	0	49866
May	0.54	0.35	0.02	5.15	3056	55	3111	42938	0	0.00	0	773	21	794	6067	44594	0	44594
June	0.74	0.54	0.07	5.90	4668	212	4880	49188	0	0.00	0	1181	81	1263	6776	39081	0	39081
July	0.34	0.18	0.00	7.04	1534	0	1534	50000	0	0.00	0	388	0	388	7668	31801	0	31801
August	0.45	0.27	0.01	5.87	2355	15	2370	48938	0	0.00	0	596	6	602	6068	26335	0	26335
September	0.46	0.28	0.01	3.14	2432	19	2450	26188	0	0.00	0	615	7	622	3074	23883	0	23883

Notes:
[a] Monthly average precipitation data were obtained from http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?wa9079.
[b] Pan evaporation data were acquired from the Western Regional Climate Center, 75% effective was assumed.

Project	Wenatchee Facility Plan Update	Computed	XD	Date	1/26/2015
Subject	Biosolids Management Plan	Checked	DH	Date	
Task	Drying Beds Sizing for Further Dry Class B for Land Application	Sheet		Of	

Number of Existing Drying Beds: 4
Dimension of each bed:
L = 251.33 ft
W = 100 ft
Surface Area = 25133 sq ft

1. Assumptions

1. According to the City's plant data, the dewatered biosolids meet Class B biosolids classification requirement.
2. The drying beds facility is used for storing all the Class B biosolids produced year round and further drying the biosolids to 25% total solids (TS)
3. According to the City, drying Class B biosolids follows the similar schedule as drying Class A biosolids. Therefore, assume Class B drying is practiced from May to September of each year.
4. Assume using the same storage volume in each bed for storing Class B biosolids as storing Class A biosolids. That is, only 40% of the bed volume in each bed is used for storing Class B biosolids and the average depth of the biosolids stockpile is 2.5 ft.
5. Assume the average application depth is 1 ft when drying the Class B biosolids in the summer and the drying area in each bed is 50% of the total bed area.
6. Assume the total solids (TS)% of the Class B biosolids stored in beds before drying is 20%.

2. Drying Period Required to Dry Class B biosolids to 25% Total Solids

Appplication Depth when drying =	1	ft		
Initial stored Class B biosolids TS% before drying =	20%			
Average Net Evaporation Rate May-Sep =	5.42	inches/month =	0.18	inches/day
Final Class B TS% after drying	25%			
Initial Loading rate =	12.5	lb/sf		
Final Depth =	0.8	ft		
Change in Depth due to evaporation =	0.2	ft		
Drying Time =	0.4	month =	13.3	days

3. Number of Applications Required to Dry Class B biosolids in Each Bed

Area avialable in each bed for drying Class B biosolids =	12566.5	sq ft	(50% of bed area)
Volume taken from the stockpile each time for drying =	12566.5	cu ft	(1 ft application depth)
Fully stored Stockpile volume in each bed =	25133	cu ft	(40% of bed area and 2.5 ft deep stockpile)
Number of time to dry the entire stored volume in each bed =	2		

Therefore, when drying Class B in summer time, half of the stockpiled Class B in each bed will be laid to the other end of the bed with a foot depth that occupies about 50% of the bed area to dry. It takes about 14 days in each application to dry the Class B to achieve 25% TS.

4. Number of Drying Beds Required to Dry Class B biosolids

From the calcutation results in drying Class B biosolids:

The number of beds required to store biosolids from October to April = 4.73 beds
The number of beds needed to store biosolids from May to September = 3.44 beds

Because there is no drying between October and April, all the Class B biosolids produced between October and April needs to be stored in the drying beds, up to five beds will be required to store Class B biosolids produced during this period.
When half of the stockpiled Class B biosolids in each bed is in drying, the newly produced Class B biosolids during the drying season can be evenly stored in the remaining half of the storage area of each bed. Therefore, no additional beds are needed for storing the Class B biosolids produced.
Because each bed is utilized twice in drying Class B biosolids during the drying season and the total drying period is only about a month using the assumptions above, it is possible to reduce the number of the drying beds by using the beds more efficiently.

5. Modified Assumptions

Modify assumptions 4 and 5 above as follows:

4. Assume using **50%** of the bed volume as the storage volume in each bed for storing Class B biosolids and an average depth of the biosolids stockpile of 2.5 ft.
5. Assume the average application depth is 1 ft when drying the Class B biosolids in summer and the drying area in each bed is **40%** of the total bed area.

Because the application depth remains 1 ft, the drying period required for drying Class B to achieve 25% TS will be the same at 13.3 days.

6. Modified Number of Drying Beds Required to Dry Class B biosolids

Future Class B Biosolids Storage Volume Requirement from October to April

Projected 2035 winter daily dewatered biosolids =	27.7	cu yd./day =	747.9	cu ft/day	(Table 4-1)
Future volume of the biosolids produced from October to April =			158554.8	cu ft	
Percent of volume lost during storage =			25%		
Storage volume required from October to April =			118916	cu ft	
Available storage volume in each bed (50% of the bed area at 2.5 ft depth) =			31416	cu ft	
Number of beds required to store biosolids from October to April =			3.79	beds	

Future Class B Biosolids Storage Volume Requirements from May to September

Future Volume of the biosolids produced from May to September =	76285.8	cu ft		
Volume Reduction due to Evaporation from May to September =	22463.2	cu ft		
Net Evaporation Rate in May, E, inches/month	5.1525	=	0.1662097	inches/day
Daily volume loss =	139.24	cu ft/day		
Net Evaporation Rate in June, E, inches/month	5.9025	=	0.1904032	inches/day
Daily volume loss =	159.51	cu ft/day		
Net Evaporation Rate in July, E, inches/month	7.035	=	0.2269355	inches/day
Daily volume loss =	190.12	cu ft/day		
Net Evaporation Rate in August, E, inches/month	5.8725	=	0.1894355	inches/day
Daily volume loss =	158.70	cu ft/day		
Net Evaporation Rate in September, E, inches/month	3.1425	=	0.101371	inches/day
Daily volume loss =	84.93	cu ft/day		

(Net evaporation rate data was acquired from pan evaporation data on http://www.wrcc.dri.edu/htmlfiles/westevap.final.html#WASHINGTON, a effective factor of 0.75 was applied to the pan evaporation data.)

Storage volume required during drying = 53822.6 cu ft

Number of beds required to store biosolids from October to April = 1.71 beds

From the above calculation, if the storage volume in each bed increases to 50% of the bed volume, only 4 beds would be required. The Class B biosolids produced during the drying season can be evenly stored in the storage area of each bed. The drying area in each bed will need to be reduced to up to 40% of the bed area in order to accommedate the increased storage area needed.

3. Modified Number of Applications Required to Dry Class B in Each Bed

Area avialable in each bed for drying Class B =	10053.2	sq ft	(40% of bed area)
Volume taken from the stockpile each time for drying =	10053.2	cu ft	(1 ft application depth)
Fully stored Stockpile volume in each bed =	31416	cu ft	(50% of bed area and 2.5 ft deep stockpile)
Number of time to dry the 50% bed storage volume in each bed =	3.1		

Therefore, when drying Class B biosolids in the summer time, a third of the stockpiled Class B biosolids in each bed will be laid to the other end of the bed with a foot depth and occupies about 40% of the bed area to dry. It takes about 14 days in each application to dry the Class B to achieve 25% TS.

Conclusion

Based on the calculations above, the existing four drying beds would be enough to dry the Class B biosolids produced in the future to achieve 25% TS and store all the Class B year round.

Project	Wenatchee Facility Plan Update		Computed	XD		Date	3/12/2015
Subject	Biosolids Management Plan		Checked	DH		Date	
Task	Composting Facility Sizing		Sheet			Of	

Facility Sizing Criteria

1. ASP dimensions:			
Woodchip base width =	12	ft	
Woodchip base height =	1	ft	
Composting material width =	10	ft	
Pile length =	100	ft	
Pile total height =	8.5	ft	
Screened compost cover thickness =	1	ft	
2. Cure Pile dimensions:			
Woodchip base width =	12	ft	
Woodchip base height =	1	ft	
Cure pile width =	12	ft	
Cure pile length =	100	ft	
Cure pile total height =	8.5	ft	
3. Future dewatered biosolids production =	27.7	cu yd/day	
Future dewatered biosolids average solids contents =	15%		
4. Solids to woodchip ratio =	3:1		
5. Number of days in composting =	21	days	
6. Number of days in curing =	30	days	
7. Total solids after composting =	60%		
8. Woodchip recovery efficiency =	85%		
9. Cured compost storage capacity =	180	days	(6 months)
10. New woodchip storage capacity =	30	days	
11. Recycled woodchip storage capacity =	21	days	(1 time recycle for 21 day process)

ASP Piles

Composting material volume of each ASP =	3185	cu ft =	118	cu yd
Days to build each ASP =	1	days		
Number of ASP needed	22	piles		
Design number of ASP =	23	piles	(one ASP as standby)	

Cure Piles

Screened compost volume of sent to cure pile each day =	20	cu yd/day		
Each cure pile volume =	4500	cu ft =	167	cu yd
Number of days to build each cure pile =	8	days		
Number of cure piles needed =	4.6	piles		
Design number of cure piles =	6	piles	(one cure pile as standby)	

Cured compost Storage Area

Cured compost storage volume for 6 month =	3571	cu yd
Depth of storage =	8	ft
Area needed for cured compost storage =	12051	sq ft

New Bulking Agent Storage Area

New bulking agent storage volume =	2493	cu yd
Depth of storage =	8	ft
Area needed for cured compost storage =	8414	sq ft

Recycled Bulking Agent Storage Area

Recycled woodchip storage volume =	2119	cu yd
Depth of storage =	8	ft
Area needed for cured compost storage =	7152	sq ft

Chapter 5-Wastewater Treatment Alternatives Evaluation

City of Wenatchee

Wastewater Treatment Facilities Plan Update

August 2016

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Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
AD	Anaerobic Digester	MOP	Manual of Practice
AER	Aerobic	MPN	Most Probably Number
ALK	Alkalinity	MW	Maximum Week
ASP	Aerated Static Pile	NH_4-N	Ammonia as Nitrogen
BFP	Belt Filter Press	NO_2-N	Nitrite-Nitrogen
BNR	Biological Nutrient Removal	NO_3-N	Nitrate-Nitrogen
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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5 Wastewater Treatment Plant Improvement Alternatives Development

During the City of Wenatchee's previous facilities planning effort completed in 2008, the City planned for improvements to the WWTP that would accomplish the following:

- Increase capacity for forecasted flows and wasteloads in response to Ecology regulations
- Improve anaerobic digestion
- Reduce impact of the WWTP on surrounding land uses
- Reclaim wastewater for irrigation

Prior to the completion of the 2008 Facilities Plan, the secondary treatment facilities (aeration basins) were upgraded (2006) to increase treatment capacity. Flow equalization and effluent ultraviolet light (UV) disinfection were also added at that time. Following completion of the 2008 Facilities Plan, in 2009 the City added an amendment to the Plan to specifically address visual mitigation and odor control. Following that amendment, a visual mitigation and odor control project was completed in 2012 that added an odor control system and also included significant aesthetic improvements to the site.

The initial scoping of this Facilities Plan Update planned to once again evaluate existing facility unit process capacity versus flow and loading projections that were based upon recent and accurate flow measurement and influent analytical testing results. The City also identified that the Total Suspended Solids loading (TSS) to the facility had exceeded 85 percent of the facility's permitted design criteria which also created a need to update the facility planning. During initial influent sampling data review, it was determined that the City should delay completion of this Facilities Planning effort until an additional year of influent sampling and laboratory analyses could be completed. The flow and loading projections presented in Chapter 2 reflect an additional year of data collected at the site using revised sampling locations that more accurately reflect actual flow and load conditions.

The scope of services planned to develop and evaluate whole-plant alternatives for initial screening of overall process unit configurations. In conjunction with this effort, the project team also planned to develop and evaluate unit process technologies with results of these evaluations intended to be incorporated into development of several complete site-wide alternatives. After completion of the basis of planning and the initial plant capacity evaluation, it was determined that the majority of existing plant unit processes have sufficient capacity to meet both current and projected flow and loading conditions, without need for significant expansion of existing plant infrastructure. As such, the alternatives evaluation presented in this Chapter have been tailored to individually address several process areas that include:

1. Primary Clarification and Primary Sludge Pumping
2. Secondary Clarification and RAS Pumping
3. UV Disinfection
4. Primary Sludge Thickening
5. WAS Thickening

6. Digestion
7. Biosolids Management

The Biosolids Management alternatives development and biosolids alternative evaluation associated with processing of biosolids off campus from the WWTP are included in Chapter 4. Alternative development for WWTP liquids and solids stream unit processes identified above involved initial brainstorming with treatment plant staff and the project consultant team through a single workshop conducted at the WWTP site. During the workshop, individual unit process components identified as potential process enhancements were discussed. As part of this discussion, certain unit processes were eliminated due to lack of feasibility, or failure to meet regulatory or Wenatchee WWTP goals. The focus of this discussion was not specific to technologies, but rather overall process unit configurations.

5.1 Basis for Cost Estimates

The proposed economic analysis is conducted using the present worth of the alternatives, including capital costs and O&M costs. All costs are reported in 2015 dollars. Construction cost projections are made at stated escalation rates. Costs developed for the Wenatchee WWTP Facilities Plan will be Class 4 estimates as defined by the Association for the Advancement of Cost Engineering (AACE) International and adopted by the American National Standards Institute in Recommended Practice No. 17R-97: *Cost Estimate Classification System* (2011) and Recommended Practice No. 18R-97: *Cost Estimating Classification System as Applied in Engineering, Procurement, and Construction for the Process Industries* (2011). Construction, operation and maintenance cost opinions allow comparison of alternatives for the short- and long-term planning periods. The sizes of support buildings (if required) are selected based on similar-sized designs, and current similar building prices per square foot are applied to the floor space requirements. The cost of electrical and instrumentation and control, yard piping, site work, bond, insurance, mobilization, painting, and coatings is estimated by applying percentages of the construction subtotal of the process unit costs. The percentages are based on HDR's experience and knowledge of the costs of these items on similar WWTP projects.

Total construction costs include contractor markups and profit, sales tax, and appropriate contingency. Actual construction costs will depend on a variety of factors such as the final project scope and market conditions at the time of project bidding. Overall project costs include the total construction costs, but also an additional markup to estimate the costs of engineering design, construction contracting, construction management, project administration, and legal costs.

Cost comparisons are made on the basis of present-worth costs over the planning period. The present worth analyses include an assumed inflation of the annual costs. This stipulation is based on the assumption that prices for treatment and collection facilities will tend to change over time by approximately the same percentage. Changes in the general level of prices will not affect analysis results but will impact the overall funding requirements for the selected alternative.

5.1.1 Level of Accuracy

All project costs will be derived using the same level of estimating accuracy and, therefore, will be comparable. Actual construction costs may differ from the estimates presented, depending on specific design requirements and the economic climate at the time a project is bid. The level of detail used in the development of cost estimates in this facilities plan is approximately 10 percent.

This corresponds with a typical Class 4 estimate. An estimate of this type is normally expected to be within –15 to +50 percent of the actual construction cost. The final cost of the projects will depend on actual labor and materials costs, actual site conditions, productivity, competitive market conditions, bid dates, seasonal fluctuations, final project scope, final project schedule, and other variables. As a result, the final project costs will vary from the estimates presented in this report. The range of accuracy for a Class 4 cost estimate is broad, but these are typical levels of accuracy for planning work and they apply equally to all alternatives so that the relative estimated costs of the alternatives are comparable and can be used for sound decision-making. It is important to communicate this level of accuracy to policymakers and decision-makers.

5.1.2 Planning Period

The planning effort for the Wenatchee WWTP Facilities Plan includes developing a plan that will provide wastewater treatment services through 2035. A key planning aspect is to consider potential future regulatory changes in development and selection of improvements. When sizing and siting treatment facilities, the ultimate planning period is also used to consider whether adequate space is available for expanding treatment facilities to meet ultimate capacity needs.

5.1.3 Project Cost Parameters

Costs are based on facilities to accommodate the projected flows and loads for the 20-year planning period. All costs include facilities sized for the 2035 flows and loads. All costs will be estimated and presented in 2015 dollars.

5.1.4 Cost Index

Cost estimates will be obtained from projects in different locations and in different years. In order to bring all costs to a common, comparable base, the *Engineering News Record* (ENR) Construction Cost Index (CCI) is used. This is a common, industry accepted means for adjusting costs from different time periods and locations. The ENR CCI tracks construction costs in 22 U.S. cities and is computed from construction, materials, and labor costs. For this project, adjustments to costs will be made with the ENR 20 Cities Average CCI. The current ENR CCI for July 2015 is 10,037.40.

5.1.5 Engineering, Legal, and Administration

Legal services often are required to coordinate construction efforts with the local governmental agencies, and to facilitate permitting, and interagency coordination. Similarly, ancillary engineering services will be required, such as special investigations, surveys, geotechnical reports, location of interfering utilities, detailed design, preparation of plans and specifications, construction inspection and materials testing, startup assistance, and O&M manual preparation. These potential fees for legal and ancillary engineering services are not included in the base construction cost estimates. An administrative effort (project management) will also be required to coordinate the engineering and legal efforts of all projects. A factor of 30 percent has been added to base construction costs to account for engineering, legal, permitting, and administrative costs for projects described in this report, of which engineering fees comprise approximately 20 percent of the amount.

5.1.6 Land

Land acquisition for all alternatives considered has not been included. It is assumed all improvements considered would need to occur within property already held by the City of Wenatchee at no additional capital cost.

5.1.7 Contingencies

Budgetary studies represent a rough level of construction cost estimating. To account for unknowns, construction cost estimates of the alternatives considered include a contingency factor of 25 percent.

5.1.8 Operation and Maintenance Costs

The Operation and Maintenance (O&M) costs were developed in the following categories:

- Labor
- Energy
- Chemicals
- Maintenance costs including equipment replacement and maintenance material costs
- Dewatered sludge hauling for final disposition

5.1.8.1 Labor

Hourly labor rates used for estimating labor cost for each alternative are listed in Table 5-1. The labor rates include fringe benefits.

Table 5-1. Hourly Labor Rates

Labor Category	Estimated hourly rate, $/HR
Labor operating	$40.00
O&M labor	$45.00

5.1.8.2 Energy

The electrical power costs for each alternative were calculated using motor horsepower, estimated overall efficiency, and expected hours of service of the equipment. Natural gas costs for heating are calculated based on building size and differences between the building design temperature and local temperature. Average unit costs of electrical power and natural gas costs are listed in Table 5-2.

Table 5-2. Energy Unit Cost

Labor Category	Unit Cost
Electrical Power	$0.0235/kW-HR
Natural Gas	$7.89/GJ

5.1.8.3 Chemicals

Table 5-3. Chemical Unit Costs lists unit costs of polymer and chemicals used in the alternatives evaluation.

Table 5-3. Chemical Unit Costs

Chemicals	Unit Cost
Polymer	$2.67/lb active polymer
Sodium Hypochlorite	$1.36/gal

5.1.8.4 Maintenance Costs

Equipment replacement and maintenance material costs with the 20-year life cycle were included in the maintenance costs as a percentage of the total estimated equipment and electrical and control system cost as listed in Table 5-4.

Table 5-4. Maintenance Costs

Category	Cost Percentage
Equipment replacement	5%
Maintenance materials	2%

5.1.8.5 Dewatered Sludge Hauling

Dewatered sludge hauling costs are addressed as part of the off-site biosolids management alternatives evaluation presented in Chapter 4.

5.1.9 Present-Worth (Life Cycle Cost) Analysis

The 20-year net present value (NPV) for each alternative is calculated using 2015 as the base year and extending into 2035. A real discount rate of 4 percent is used in converting the future costs into present values.

Present worth is defined as: PW = Pw (capital) + Pw (O&M)

5.2 Liquid Stream Alternatives

The unit process options identified are described below. Because the process enhancements identified do not affect the capacity of any of the primary unit processes, whole-plant alternatives were not developed. Decisions on each of the process enhancement alternatives can be made independent from each other, also at differing times for implementation. Related enhancements have been identified in the enhancement alternatives descriptions presented below. Table 5-5 provides a summary of the process alternatives, deemed viable through an initial screening effort by the project team, for the liquid stream.

Table 5-5. Liquid Stream Process Enhancements Summary

Alternative No.	Description	Result
PCL – 1	Primary Clarification and Primary Pumping: No Action	Primary Clarification remains unchanged, no redundant capacity provided for operations and maintenance
PCL – 2	Primary Clarification and Primary Pumping: Clarifier Replacement and/or Enhancement with Primary Microfiltration (Belt Filters)	Primary clarification redundant capacity for beyond year 2030 condition with replacement or augmenting of Primary Clarifier 2 with a belt (Salsnes) filter
SC/RAS – 1	Secondary Clarification and RAS Flow Control : No Action	Secondary clarification redundant capacity for beyond year 2023 condition, no redundant capacity provided for aeration basin or clarifier maintenance
SC/RAS – 2	Secondary Clarification and RAS Flow Control: New Clarifier with Gravity RAS Flow Control	Secondary clarification redundant capacity for beyond year 2023 condition, new clarifier with gravity RAS flow measurement and existing pumping capacity expansion
SC/RAS – 3	Secondary Clarification and RAS Flow Control: New Clarifier and Pumped RAS Flow Control	Secondary clarification redundant capacity for beyond year 2023 condition, new clarifier with new RAS pumping station including metering
UV – 1	UV Disinfection: No Action	Effluent disinfection capacity limited to flow condition of 7.5 mgd
UV – 2	UV Disinfection: Manufacturer Recommended Enhancements	Effluent disinfection capacity restored to 11 mgd through equipment corrective actions recommended by manufacturer
UV – 3	UV Disinfection: Equipment Replacement	Effluent disinfection capacity improved to 12 mgd through equipment replacement

5.2.1 Primary Clarification and Primary Pumping

The primary sludge pumping system operates with two primary sludge pumps, each dedicated to one of the two primary clarifiers. Typically, one clarifier is in operation at one time and primary sludge thickening is performed within the online clarifier basin. The primary sludge pumping units were recently upgraded to rotary lobe (Vogelsang) pumping units (100 GPM @ +/- 50 psig), and typically a primary sludge pump dedicated to each is in operation to pump clarifier-thickened solids and primary scum to digestion. The pumps are operated manually for pumping primary scum from the active clarifier and are automated for pumping clarifier-thickened solids.

The required clarifier area was determined using overflow criteria of 1,000 gpd/sf at annual average conditions, and 2,500 gpd/sf at peak hour conditions. The City does not have redundancy criteria established beyond those required by the Washington Department of Ecology, and therefore it is assumed all clarifiers will be online for peak hydraulic conditions without process unit redundancy.

5.2.1.1 Key Findings

- A single sludge/scum pipeline is used to deliver primary sludge and scum from the primary clarifiers to the digestion facilities.
- If two clarifiers are in operation, manually operated valves and pumping units are used to pump from each clarifier. Primary scum is pumped manually.
- A thickened sludge solids concentration of approximately 5 percent dry weight solids content is achieved.
- Considering the use of the flow equalization basins, the lack in clarifier redundancy is not currently an issue since sufficient clarifier capacity currently exists. Clarifier loading will eventually drive the need for placing the second clarifier into continuous operation. Clarifier capacity is not driven by the need for basin redundancy, but the ability to achieve 4-5 percent thickened sludge consistency will be impacted during peak flow events when less sludge blanket (settled solids) can be retained in the active clarifier should one clarifier need to be out of service for an extended period of time.
- With one clarifier removed from service for maintenance, it is generally acceptable to relax reliability requirements if there is sufficient biological capacity to handle any reduced primary treatment capacity. There is secondary capacity both organically (BOD removal) and hydraulically to handle additional loadings delivered to the secondary treatment process. Secondary clarifier enhancements proposed later in this Chapter would provide added secondary capacity for this operating scenario.

5.2.1.2 Alternatives Considered

In light of the conditions described above, and limitations on available site area for construction of additional process basins, two viable alternatives have been identified for consideration for addressing redundancy for the primary treatment process during required maintenance activities. They include:

PCL – 1: No Action

Under this alternative, primary treatment operations would remain unchanged with clarifier operation, primary sludge and scum pumping manually controlled. If a clarifier is removed from service for maintenance, peak flow conditions would impact the treatment capacity of the single clarifier online. The primary clarifiers were recently upgraded and clarifier odor control covers were installed, which makes the need for repairs of the clarifiers unlikely during high peak flow conditions. However, added process reliability can be achieved under these conditions if additional emphasis is placed on added secondary treatment capacity included in other alternatives presented below.

PCL – 2: Clarifier Replacement and/or Enhancement with Belt Filters

Although little to no site area is available for added primary clarifier basins, additional primary clarifier capacity may be achieved through installation of a primary treatment belt filter. The belt filter process involves mechanical equipment that requires a small footprint for installation. A belt filter could be installed in the existing footprint of Primary Clarifier No. 2, or at a separate location such as the former Chemical Storage area within the existing Blower Building. As an alternative, a new building could also be constructed immediately adjacent to Primary Clarifier No. 2. For the purposes of this evaluation, it is assumed a belt filter would be installed within the former Chemical Storage

Area of the Blower Building to eliminate the need for a new building. This would require additional sludge piping modifications to enable pumping to the digestion facilities.

Presently, because Primary Clarifier No. 2 is not needed for added capacity and it is generally empty, it is used as temporary storage for influent when toxic spills or discharges are suspected. It is also used for flow equalization during peak flow events. The ability to temporarily store influent is not critical, but it does provide added protection of downstream unit processes from any influent toxic event that may occur and is valued by the plant staff. Because available space is at a premium at the site, Primary Clarifier No. 2 (65-foot diameter) could be augmented or replaced with primary microfiltration (belt filters). An example of a microfiltration unit (Salsnes) is shown in Figure 5-1 below. If space is needed to allow expansion of other unit processes (e.g. a new secondary clarifier), two microfiltration units would be more than sufficient to replace the smallest of the City's clarifiers or serve as added clarifier redundancy. If used as redundant units and for peak flow conditions only, they would require relatively little maintenance, and the built-in dewatering function would produce high TS (~40 percent) primary sludge cake for direct disposal to the drying bed facilities or landfill. For longer term operation separate sludge thickening would be recommended to reduce operations and maintenance costs associated with the equipment.

Figure 5-1. Salsnes™ Primary Belt Filter

Table 5-6 Primary Clarification Alternatives Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
PCL – 1	No Action: Utilize Additional Secondary Treatment Capacity for Peak Loading Conditions	$0	$0
PCL – 2	Clarifier Replacement and/or Enhancement with Primary Microfiltration (Belt Filters)	$1,155,000	$330,000

Refer to Section 5.4.3 and Figure 5-10 for the full economic and non-economic evaluation of the Primary Clarification and Primary Pumping Alternatives.

5.2.2 Secondary Clarification and RAS Pumping

The City currently operates both secondary clarifiers at all times unless removal of a clarifier is needed for maintenance purposes. The flow split from the secondary treatment process is delivered to the secondary clarifiers through a submerged outlet junction box located at the east wall of the aeration basins. The return activated sludge (RAS) flow from each clarifier is accomplished through a sludge recirculation junction box where RAS from each clarifier and forward flow are delivered to the junction box via modulating downward acting weir gates. The flow split to each secondary clarifier, including RAS flows, is controlled via these weir gates though a cascade control that includes a gate bias that enables the City to better control flow split to each clarifier.

The required secondary clarifier area was determined using a comparison of projected organic versus the rated capacity of the clarifiers at maximum month conditions of 20 lb/sf/d. The City does not have redundancy criteria established beyond those required by the Washington Department of Ecology, and therefore it has been assumed all clarifiers will be online for peak loading conditions without process unit redundancy. Current loading condition is 11.4 lb/sf/d for the maximum month condition and the projected maximum month loading condition is 15.4 lb/sf/d. Although the projected loading is below rated capacity, the secondary treatment process cannot reliably operate with only a single clarifier online for an extended period of time and meet discharge permit limits because of the risk of solids carry-over due to the high clarifier solids loading.

During initial startup of the RAS flow control, the City reported they had problems with gaining an effective flow split between the basins; however, since the additional gate bias was programmed into the control system, the flow control works well. Discharge from each clarifier weir gate is directed to the common sludge recirculation box where RAS is pumped back to the aeration basins via two dry pit centrifugal pumps. The two pumps operate from variable frequency drives to deliver RAS flows to a common header that is directed back to the aeration basin flow split structure. A single RAS pump is operated at any given time, and the second pump serves as a redundant unit that will also turn on should the lead pump not be able to meet the required pumping conditions. The firm peak capacity of the RAS pumping system (with one pumping unit in operation) is 2.7 mgd, with a projected peak hydraulic RAS flow of 1.75 mgd (50 percent of the 2035 maximum month plant influent flow).

5.2.2.1 Key Findings

- Although the *Washington Department of Ecology Criteria for Sewage Works Design (Orange Book, Table G2-9)* does not require additional basin capacity for redundancy, the treatment plant evaluation presented in Chapter 3 does identify the need for added redundancy for secondary clarifier capacity. The rationale for the suggested additional clarifier capacity is based upon the need for maintenance flexibility and the assurance that adequate capacity is available in the secondary treatment process to handle peak loading conditions while necessary maintenance activities are conducted. Should modifications to primary sludge thickening not be deployed, or if delayed, added secondary clarifier capacity would become even more critical to assure compliance with the City's NPDES permit requirements.
- There is limited room in the RAS pumping area to expand to a third RAS pumping unit, and a fourth RAS pumping unit would not be possible within the existing RAS pumping room of the existing facility.

- Although the existing RAS flow control is now working effectively, there is limited room to add a third clarifier and clarifier RAS flow control weir to the gravity overflow structure. Adding flow measurement of individual combined (forward flow and RAS) flows is not possible for each individual clarifier. Flow measurement using head over the overflow weirs is adequate, but measurement of the flow split between basins has low resolution.
- The RAS pumping units cannot be easily configured for individual suction lines and flow metering directly from each clarifier in the event a third secondary clarifier is added. RAS gravity suction lines from the clarifiers are located below the clarifiers and associated Sludge Recirculation Pump Station, and any modification of the existing RAS return system will involve careful planning for construction implementation.
- The waste sludge pumping and secondary waste pumping are served by a dedicated pumping unit for each service. The secondary scum pumping unit is a progressive cavity pump and the secondary waste pump is a centrifugal unit. Each pump can serve as redundant to the other. However, full pumping redundancy is not provided. Secondary waste flows are pumped from the RAS pumping system common header located at the discharge from the RAS pumps.
- The secondary clarifier effluent piping was modified in 2006 for connection to the UV Disinfection facilities. Two effluent pipelines are extended through a very congested area between the two existing clarifiers and the UV structure. The effluent outfall and abandoned effluent Parshall Flume are located in this same area, making installation of an additional secondary effluent pipeline using the same route very difficult. Installation of a third secondary clarifier will likely require installation of the third secondary effluent pipeline immediately to the east of the UV Disinfection Building along the eastern perimeter of the existing site.
- The plant space available for construction of an additional secondary clarifier is located immediately north of Secondary Clarifier No. 1, in an existing parking lot area located south of the Plant Pump Station Wetwell. There is known refuse located in this area from just below ground surface to approximately 20-foot below grade. This material was encountered during the excavation of Secondary Clarifiers No. 1 and No. 2.
- Subsurface shoring installed during the construction of the UV Disinfection Building may exist along the eastern property boundary to better enable construction of a secondary effluent pipeline. For the purposes of this plan, it is assume the shoring was removed during construction down to a depth that would not benefit new construction activities. However, it is recommended the presence of this shoring be investigated during detailed design if construction is needed in this area. The pipeline route to the east will require removal and reinstallation of pervious pavers that are located on the ground surface east of the UV Disinfection facilities, and the vehicle access to the east side of the UV Disinfection Building would also need to be modified.

5.2.2.2 Alternatives Considered

Due to the need for added capacity of the secondary treatment system to better enable maintenance activities within the primary treatment and secondary treatment unit processes, the addition of more secondary clarifier capacity has been identified as a higher priority at the Wenatchee WWTP. Additional clarifier capacity, when coupled with added pumping system and flow control redundancy, will alleviate operations bottlenecks within the facility, and will limit or eliminate the flow and loading restrictions that currently exist for maintenance activities at the plant. Three viable alternatives for consideration have been identified for addressing capacity enhancement for the secondary clarification unit process. They include:

SC/RAS – 1: No Action

Under this alternative, the secondary clarifier operations would remain unchanged and regular maintenance activities will continue to be scheduled for the primary clarification, secondary treatment and secondary clarification unit processes. This alternative would not include additional redundancy protection for the primary clarifiers. As a result, sludge thickening during peak flow events would impact the clarifier performance and more dilute sludge would be directed to the digestion process. This additional impact on the digestion process would continue to build as plant flows and loads increase. Added protection for the secondary treatment processes would not be provided, hindering the treatment facility’s ability to meet NPDES permit requirements if unit process maintenance is necessary during higher flow and loading events.

SC/RAS – 2: New Clarifier with Gravity RAS Flow Control

This alternative includes construction of a third new 80-foot diameter clarifier with a perimeter launder, and connection of the clarifier to the existing secondary treatment gravity RAS flow control system. The clarifier would include center feed and a spiral sludge collection mechanism, similar to the two existing clarifier units. Construction of the new clarifier would require installation of site shoring along the eastern site perimeter and additional shoring along the existing Pump Station Wetwell and Secondary Clarifier No. 1. Construction would also involve the excavation and legal off-site disposal of refuse that likely still exists in the projected excavation area.

Under this alternative, secondary effluent would be directed to the new clarifier location by extending a 30-inch diameter secondary clarifier influent (WS) pipeline from the existing aeration basin Effluent Junction Box. Connection to the existing junction box would require core drilling the existing effluent box on its north wall which would be accomplished during a short duration shutdown of flows to the secondary treatment process by directing plant influent flow to the existing plant equalization basin and an empty primary clarifier. The clarifier influent pipeline would be extended north along the existing plant access road to the clarifier center well via a pipeline buried under the clarifier floor, similar to the existing clarifier configuration.

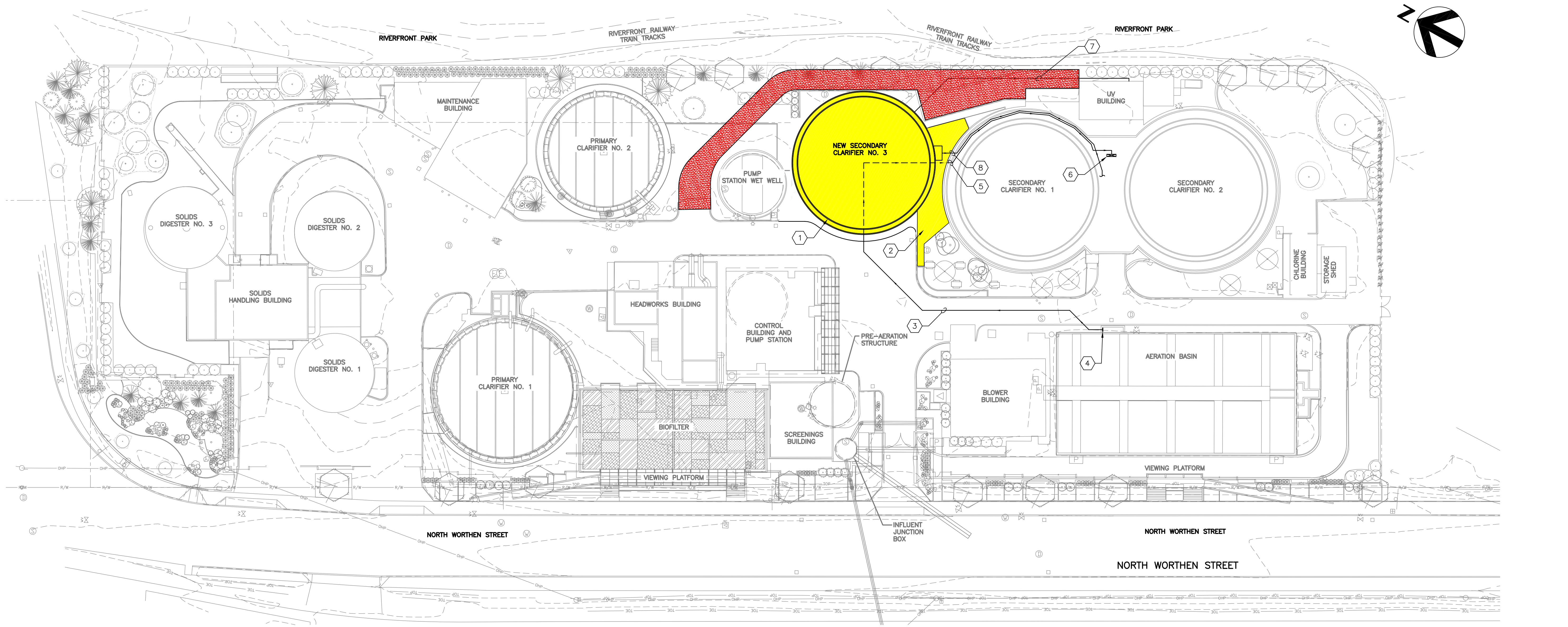
Secondary clarifier effluent would be extended from the clarifier effluent launder via a 30-inch secondary clarifier effluent pipeline to the east side of the UV Disinfection Building, where it would be connected to the east wall of the UV Disinfection influent channel via a concrete core drill penetration. Connection to the UV channel would be scheduled to be completed at the same time the secondary treatment process is idle while the connection of the secondary influent pipeline to the aeration basin Effluent Junction Box is completed.

The existing gravity controlled RAS system that utilizes downward acting weir gates for RAS flow control would remain in service, and a third RAS pipeline and downward acting weir gate would be installed on the east side of the waste sludge recirculation box using a stainless steel weir box. The weir box would be an extended box installed on the east outside wall of the recirculation structure, and would require a sawcut opening in the recirculation box east wall. The sawcut opening in this location would be positioned at the centerline of the existing clarifiers immediately above the current non-potable water pumping wetwell. This sawcut would be a significant construction work item, as the existing concrete wall is approximately 3-feet thick at this location. The existing RAS pumping system would be utilized for RAS recirculation without the addition of another RAS pumping unit.

Full system redundancy is still provided with this pumping arrangement when considering the full forward flow of the secondary treatment process, but the percent return rate through each clarifier will be reduced when all three secondary clarifiers are in operation until the RAS pumping capacity is increased through regular equipment replacement or a change in pump impeller diameter to capture added flow capacity. The cascade flow control of the RAS system would be modified to accommodate a third downward acting gate, and flow split between clarifiers would be controlled by the number of clarifiers active online.

Secondary scum from the clarifier launder would be directed via a secondary scum pipeline that would be routed in the abandoned chlorine contact channel for Secondary Clarifier No. 1. The scum pipeline would be connected to the abandoned 6-inch drain from the Secondary Clarifier No. 1 chlorine contact channel that currently extends to the Secondary Scum Pit.

The new clarifier installation is shown on Figure 5-2 presented on the next page.



PLAN

1" = 60'-0"

KEY NOTES:

1. NEW 80' DIAMETER SECONDARY CLARIFIER
2. CONCRETE WALK/PAVEMENT
3. 30 INCH WS (AERATION BASIN EFFLUENT) PIPELINE
4. 30 INCH SLIDE GATE
5. 18 INCH RAS PIPELINE (VIA ABANDONED CHLORINE CONDUIT CHANNEL)
6. RAS FLOW CONTROL GATE
7. 30 INCH SE (OUTFALL PIPELINE)
8. 6 INCH SECONDARY SCUM TO SCUM PIT (VIA ABANDONED CHLORINE CONDUIT CHANNEL)

KEY:

- NEW UNIT PROCESS STRUCTURE
- REVISED LANDSCAPING FOR UV BUILDING ACCESS

HDR

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee

WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 5-2
NEW SECONDARY CLARIFIER NO. 3
GRAVITY RAS FLOW CONTROL

0 1" 2"

FILENAME 5-2.dwg

SCALE AS NOTED

FIGURE 5-2

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SC/RAS – 3: New Clarifier and Pumped RAS Flow Control

Similar to Alternative SC/RAS – 2, this alternative also includes construction of a third new 80-foot diameter clarifier with a perimeter launder. In lieu of connection of the clarifier to the existing secondary treatment gravity RAS flow control system, this alternative provides for connection of the new clarifier to a pumped RAS system with dedicated RAS pumping and RAS flow measurement from each secondary clarifier. Once again, the clarifier would include center feed and a spiral sludge collection mechanism, similar to the two existing clarifier units. Construction of the new clarifier would require installation of site shoring along the eastern site perimeter and additional shoring along the existing Pump Station Wetwell and Secondary Clarifier No. 1. Construction would also involve the excavation and legal off-site disposal of refuse that likely still exists in the projected excavation area.

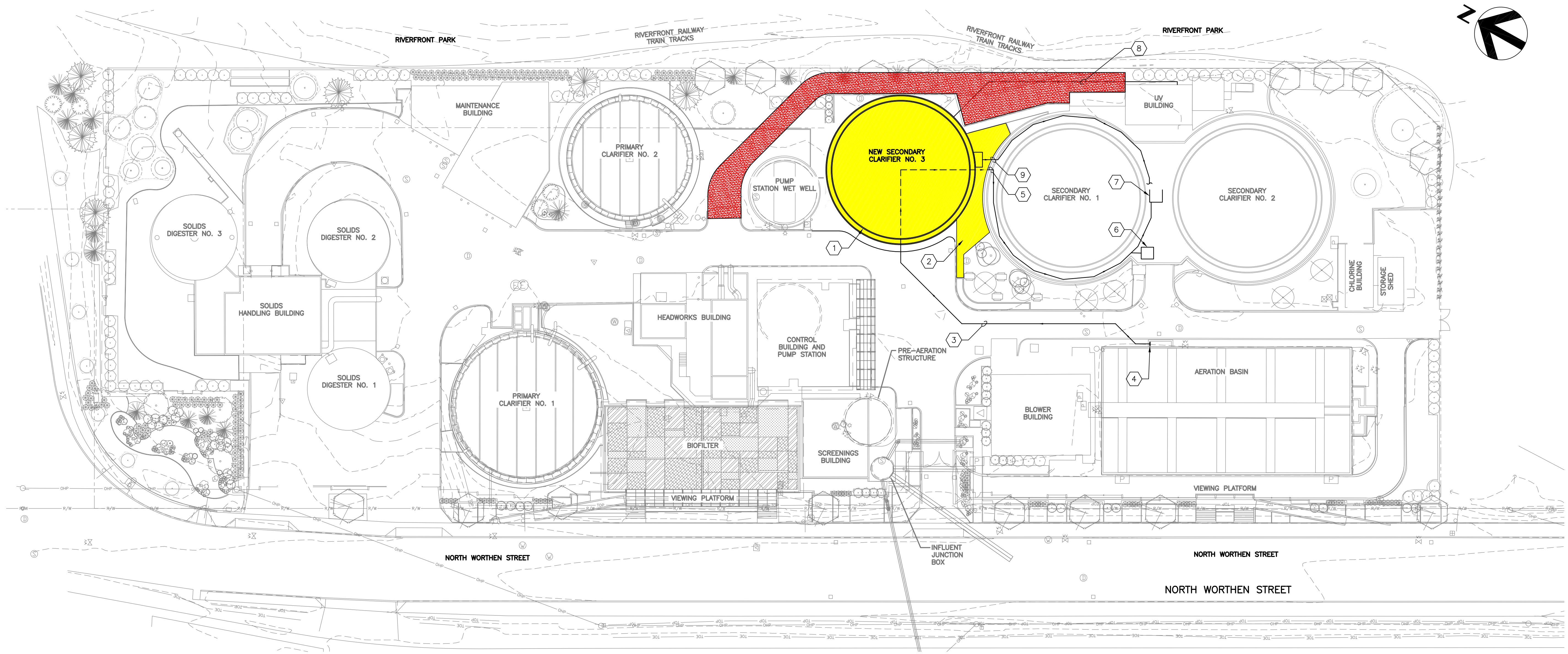
Secondary clarifier effluent would be extended from the clarifier effluent launder via a 30-inch secondary clarifier effluent pipeline to the east side of the UV Disinfection Building, where it would be connected to the east wall of the UV Disinfection influent channel via a concrete core drill penetration. Connection to the UV channel would be scheduled to be completed at the same time the secondary treatment process is idle while the connection of the secondary influent pipeline to the aeration basin Effluent Junction Box is completed.

Under this alternative, secondary effluent would be directed to the new clarifier location by extending a 30-inch diameter secondary clarifier influent (WS) pipeline from the existing aeration basin Effluent Junction Box. Connection to the existing junction box would require core drilling the existing effluent box on its north wall. This would be accomplished during a short duration shutdown of flows to the secondary treatment process by directing plant influent flow to the existing plant equalization basin and an empty primary clarifier. The clarifier influent pipeline would be extended north along the existing plant access road to the clarifier center well via a pipeline buried under the clarifier floor, similar to the existing clarifier configuration.

The existing gravity controlled RAS system that utilizes downward acting weir gates for RAS flow control would be re-purposed, with its ultimate function to only provide flow split to each of the secondary clarifiers. RAS recirculation would be modified to provide individual RAS pumping and flow measurement from each clarifier. A new RAS pump serving the new secondary clarifier would be installed in the existing Sludge Recirculation Pump Station in the northwest corner of the pumping gallery in the vicinity of the existing work bench. A new RAS suction pipeline would be extended out of the northwest corner of the station, and extended to the new Secondary Clarifier No. 3 where it would withdraw RAS from the clarifier via a deep RAS pumping hopper. The new clarifier would be configured to enable startup and operation of the clarifier independent from the existing secondary clarifier system with secondary effluent being connected directly to the UV Disinfection Building on the east side of the structure. The existing RAS pumping system would be modified for RAS recirculation by modifying the RAS pump suction and discharge headers to manifold the suction and discharge from each clarifier to enable each clarifier RAS recirculation to operate independently from each other, and also provide for the ability for each pump to serve as a redundant unit to another clarifier. Only three pumps would be installed, with two clarifiers still providing the firm capacity of the system. Each clarifier RAS pump discharge will include a magnetic flow meter for flow measurement and the pump discharge manifold will still be directed back to the aeration basins via the existing 16-inch waste sludge pipeline. The cascade flow control of the original RAS recirculation system would be modified to accommodate a third downward acting gate. Forward flow and flow split through the clarifiers would be controlled by the number of clarifiers that are active online using the cascade control logic currently employed at Secondary Clarifiers No. 1 and No. 2.

Similar to Alternative SC/RAS – 2, secondary scum from the new clarifier launder would be directed via a secondary scum pipeline that would be routed in the abandoned chlorine contact channel for Secondary Clarifier No. 1. The scum pipeline would be connected to the abandoned 6-inch drain from the Secondary Clarifier No. 1 chlorine contact channel that currently extends to the Secondary Scum Pit.

The new clarifier installation is shown on Figure 5-3 presented on the next page.



PLAN

1" = 60'-0"

KEY NOTES:

1. NEW 80' DIAMETER SECONDARY CLARIFIER
2. CONCRETE WALK/PAVEMENT
3. 30 INCH WS (AERATION BASIN EFFLUENT) PIPELINE
4. 30 INCH SLIDE GATE
5. 18 INCH RAS PIPELINE TO NEW RAS PUMPING COMMON HEADER (VIA ABANDONED CHLORINE CONDUIT CHANNEL)
6. NEW 30 INCH COMMON SUCTION RAS PUMP AND COMMON SUCTION PIPELINE
7. SLUDGE RECIRCULATION STATION RAS SUCTION PIPING MODIFICATIONS.
8. 30 INCH SE (OUTFALL PIPELINE)
9. 6 INCH SECONDARY SCUM TO SCUM PIT (VIA ABANDONED CHLORINE CONDUIT CHANNEL)

KEY:

- NEW UNIT PROCESS STRUCTURE
- REVISED LANDSCAPING FOR UV BUILDING ACCESS

HDR

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee

WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 5-3
NEW SECONDARY CLARIFIER NO. 3 PUMPED RAS FLOW CONTROL

0 1" 2"

FILENAME 5-3.dwg

SCALE AS NOTED

FIGURE 5-3

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Table 5-7. Secondary Clarification and RAS Flow Control Alternatives Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
SC/RAS – 1	No Action	$0	$0
SC/RAS – 2	New Clarifier With Gravity RAS Flow Control	$2,675,000	$267,000
SC/RAS – 3	New Clarifier With Pumped RAS Flow Control	$3,171,000	$488,000

Refer to Section 5.4.3 and Figure 5-11 for the full economic and non-economic evaluation of the Secondary Clarification and RAS Flow Control Alternatives.

5.2.3 UV Disinfection

Since startup of the UV Light Disinfection system in approximately 2004/2005, the WWTP has occasionally experienced difficulty meeting the NPDES permit Fecal Coliform effluent limits. Fecal coliform counts have been exceeded on several occasions, and the UV system is now operated with all three channels generally available at all times. The UV system is also typically operated on full electrical power when a channel is active. The original design for the UV system was developed prior to the USEPA requirement for third party validation that is based on a bioassay calculation or point source summation method. Current requirements, as presented in the US EPA Design Manual - Municipal Wastewater Disinfection (625/1-86/021) “Protocols”, generally require the sizing to be based upon performance specific to the equipment provided.

The original UV Equipment was manufactured by WEDECO, and included the WEDECO TAK 55 design using a triple UV channel configuration with three UV lamp banks configured to provide 11 mgd capacity assuming two channels in operation. The TAK 55 design was developed using a calculated model that resulted in the following general design parameters:

- Design Flow (Firm): 11 mgd (two channels in operation)
- UV Dose: >40,000 microW-s/cm^2
- Suspended Solids: 40.0 mg/L
- UV Transmittance (253.7 nm): 50.0 percent minimum
- Effluent Fecal Coliform Standard:
- Electrical Load: 32.7 kVA maximum per bank, 98.1 kVA total
- Headloss: 5.5 inches (with two channels in operation)

Review of operating data from 2006 to present found the system typically operates with the UV transmittance at or above 63 percent, with only an occasional transmittance value dropping below 60 percent and never below the 50 percent assumed for the original design. A system conditions assessment and capacity analysis was recently conducted with service personnel from the manufacturer. Following cleaning of the UV lamps and verification of proper operation of the system, UV light dosage testing was performed. The results of the field testing found that capacity of the installed system is less when evaluated against the new validation based design criteria. WEDECO has completed an updated secondary effluent 3rd party validation for the TAK 55, and has recently input the Wenatchee system (at the request of the City) into the bioassay validation equation that was generated from the 3rd party validation. The result was a determination that the existing system should now be rated at approximately 7.5 mgd capacity.

5.2.3.1 Key Findings

- The US EPA will be revising future virus criteria that may result in the existing fecal coliform effluent limits being changed to virus criteria. When US EPA develops water quality criteria for viruses, and if the State of Washington adopts them as State water quality standards, the City may need to fortify its disinfection system since UV light does not fully inactivate viruses. This would likely include the use of chlorine in combination with UV light for disinfection. The City currently has sodium hypochlorite storage and feed capabilities on site, but the facilities are not sized or configured to provide effluent chlorination
- UV transmittance values measured since startup of the UV disinfection system indicates UV transmittance has not dropped below the minimum set for the original design (50 percent minimum). The transmittance values experienced are generally well above minimum design values.
- UV light power output has regularly been increased and all three UV channels are maintained in service to assure the system can meet the fecal coliform standards included in the NPDES permit. The design fecal coliform standards are consistent with the standards currently required in the NPDES permit.
- Field evaluation of the existing WEDECO TAK 55 UV equipment at other installations has found that the firm capacity of these older systems should be set at no greater than 50 percent of the original design rating (Sioux Falls, SD; Fremont, CA). Although WEDECO and the City recently cleaned the lamps in operation at the Wenatchee WWTP and also conducted dosage intensity testing, the revised expected capacity of the system at 7.5 mgd is less than originally planned. Additional UV capacity is needed to update the original design to meet the desired design flow of approximately 11 mgd. At present, the peak hydraulic capacity of the treatment plant is set at 10.51 mgd, with all flows in excess being diverted to the existing Equalization Basin. Upgrade of the UV Disinfection system to the original design flow of 11 mgd will provide for needed disinfection beyond the year 2035 flow and loading conditions.

5.2.3.2 Alternatives Considered

Due to the capacity limitation experienced since startup of the original UV Disinfection system, the need for upgrade of the UV is needed to capture the original capacity of the system. Three alternatives have been identified for consideration for addressing the capacity limitations of the existing UV Disinfection unit process. They include:

UV – 1. No Action

The continuation of the use of the existing WEDECO TAK 55 equipment will result in manual operation of system, with all three UV channels generally in operation and at the highest power intensity. Under this operating scenario 7.5 mgd of capacity can be reliably disinfected. This capacity is greater than the year 2035 projected maximum month flow of 4.35 mgd and maximum day flow of

4.74 mgd. As a result, the City is able to operate the majority of the time without risk of exceeding the system capacity; however, there are still occasions where the peak hour flow may reach as high as 10.51 mgd. During these peak events, the City will need to carefully monitor the system and divert to the flow equalization basin if exceedance of the fecal coliform standard is identified as a potential concern.

UV – 2. Manufacturer Recommended Enhancements

WEDECO provided the City of Wenatchee an evaluation of the existing UV system following completion of their capacity evaluation using the bioassay validation. WEDECO recommended an upgrade of the control philosophy within the current UV PLC system to comply with the current validation. This modification would allow the site to control the UV system to a Wenatchee-specific pathogen sensitivity validation to maintain consistent performance while realizing additional cost savings via turndown. Dose certainty would be provided through real-time UVT monitoring. This will be the most cost efficient upgrade for the plant.

WEDECO also indicated the addition of UV banks within the existing channels at Wenatchee will be challenging. There is insufficient overall channel length to accommodate equipment in this direction. There is adequate depth to add an additional row of lamps to each module, for 9 lamp rows total. The system as stands, according to the dose per log validation, is entirely capable of achieving disinfection.

WEDECO also has suggested that the existing level control gates should be monitored to assure stable flow control is provided through all flow scenarios. The City of Wenatchee has recently purchased replacement parts for the level control gates and is in the process of implementing equipment replacement.

UV – 3. Equipment Replacement

The existing Xylem/WEDECO TAK 55 is approximately 11 years old and was designed and installed prior to the US EPA requirements for biosassay validation. Full UV disinfection equipment replacement would assure greater compliance with the fecal coliform requirements in the NPDES permit and would provide added reliability and needed process unit redundancy.

UV technology comparisons in terms of lamp technologies, lamp orientation and reactor configurations are presented in the following sections. The UV technologies discussed herein have been installed and operated in wastewater treatment facilities nationwide for many years with the exception of the Trojan Signa™ and Severn Trent MicroDynamics® and Xylem/WEDECO Duron™ systems.

Horizontal vs. Vertical Lamp Configurations

In open channel UV systems, there are two typical lamp orientations: 1) horizontal and parallel to flow (i.e. Trojan's 3000plus and Xylem/WEDECO's TAK55HP); and 2) vertical and perpendicular to flow (i.e. Ozonia Aquaray® 3X and STS MicroDynamics®). The newly developed Trojan Signa™ and Xylem/WEDECO Duron™ systems are equipped with diagonal or inclined lamps.

Vertical lamp modules consist of an open rectangular frame that rests on the bottom of the channel. A vertical module typically contains a large number of lamps (i.e. 36 lamps per module in Aquaray 3X). A single module forms a bank in a vertical system, while multiple modules form one bank in a horizontal system. With the vertical lamp orientation, all electrical connectors in the system can be located above water, while lamp connectors are completely submerged in the system with horizontal lamps.

Water level control, similar to that currently installed at the Wenatchee WWTP, is critical to the horizontal lamp system. Typically, the allowable variation of the water level in channels with horizontal lamps is only two (2) to three (3) -inches: if the wastewater is too low, it would potentially expose the top row of lamps to air, likely causing lamp damage; and too high would cause short-circuiting of the water surface layer without receiving the sufficient UV dose, hence, not enough disinfection. Therefore, a reliable level control mechanism is important for design of systems with horizontal lamps. The open channel system with vertical lamps is not that sensitive to the water level variation. Partial exposure does not damage the lamps. The allowable water level change could be between four and a half (4-1/2) to seven (7) -inches for an open channel system with vertical lamps. Vertical systems have a higher headloss than horizontal systems and this must be taken into account when hydraulic constraints exist.

UV System Design Options

Numerous UV manufacturers are available with competitive and unique processes for wastewater applications. However, only a few manufacturers are well known in the industry for municipal wastewater disinfection. Those prominent in the industry as of today are Aquionics, Calgon, Ozonia, Severn Trent Services, Siemens, Trojan Technologies, and Xylem/WEDECO. Among them, Ozonia, Trojan and Xylem/WEDECO have the greatest number of installations in the United States, along with larger plant applications similar to the Wenatchee WWTP.

For the Wenatchee WWTP disinfection project, six (6) systems would be recommended for further evaluation during a preliminary design including:

- TrojanUV3000plus™ by Trojan Technologies (Trojan 3000plus)
- Trojan Signa™ by Trojan Technologies (Trojan Signa)
- Ozoina Aquaray® 3X “HO” by Ozonia (Aquaray 3X)
- Severn Trent Services Microdynamics® by Severn Trent Services (STS Microdynamics)
- Xylem/WEDECO TAK55HP™ (TAK55 - improved to meet current bioassay requirements)
- Xylem/WEDECO Duron™ (Duron)

Trojan 3000plus and Xylem/WEDECO TAK55 have a horizontal lamp configuration. Ozonia’s Aquaray 3X has a vertical lamp configuration. Trojan Signa and Xylem/WEDECO Duron have a diagonal lamp configuration. A brief description of each system is provided below:

Trojan 3000plus

The Trojan UV3000plus system has been extensively tested and validated for wastewater disinfection. The 3000plus System features a low intensity high intensity horizontal lamp array and variable output electronic ballasts to allow UV output to be adjusted (flow/dose pacing). Ballasts located within an enclosure in the module frame are air cooled by convection. Due to the location, these ballasts are relatively difficult to service. The system is equipped with an automatic lamp cleaning mechanism combining both mechanical and chemical cleaning functions.

Dose pacing can be achieved with the Trojan UV3000plus system by adjusting lamp output or by turning off and on an entire bank of lamps. The Trojan’s dose pacing is flow-based control technology. UV lamp output can be modulated between 100 percent and 60 percent and banks can be switched on and off based on measured inflow rates and inflow water quality (UV transmittance).

The Trojan UV3000plus system uses an in-channel wiper system for each individual lamp which operates while the system is in use. The wiper contains an acid cleaning gel. The cleaning gel is circulated under pressure within the wiper as it moves along the lamps, automatically cleaning the lamp sleeves without interrupting the treatment process. The cleaning gel can be changed when it becomes less effective. A small amount of gel may be left on the lamps, but the amounts are minor and not toxic. The wipers are driven along the length of each lamp using a hydraulic system. Removal of the lamps for cleaning is not necessary. Cleaning frequency is operator-adjustable.

Lamps for this system are guaranteed for 8,760 hours (one year) of full power use. A portable davit crane is required, at a minimum, to access lamps and ballasts for replacement.

The Trojan 3000plus system is the most widely installed, with more than 300 in operation nationwide, and more systems in various stages of design and installation.

Trojan Signa

The Trojan Signa system is relatively new for wastewater disinfection. The Signa System features a low pressure high intensity diagonal lamp array and variable output electronic ballasts to allow UV output to be adjusted. Ballasts located within an enclosure in the module frame are air cooled by convection. The system is equipped with an automatic lamp cleaning mechanism combining both mechanical and chemical cleaning functions.

Dose pacing and lamp cleaning for the Signa system is similar to the Trojan 3000plus system described above. UV lamp output can be modulated between 100 percent and 30 percent and banks can be switched on and off based on measured inflow rates and inflow water quality (UV transmittance). Lamps for this system are guaranteed for 15,000 hours of full power use. Lamps and ballasts can be changed while the system is in service so the banks are not required to come out of the channel. The system is mounted on a hinged auto rising mechanism should channel maintenance be required or for system replacement.

The Trojan Signa is one of two most recent technologies investigated here. The technology validation has been performed following the testing protocol of the US EPA Ultraviolet Disinfection Guidance Manual (UVDGM, November 2006) and the Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute (NWRI)/American Water Works Association research Foundation (AwwaRF, May 2003); and the equipment sizing algorithm was developed based on the validation testing.

Ozonia Aquaray 3X

The Ozonia Aquaray 3X System features a staggered vertical low pressure high intensity lamp array. Staggered lamps and flow baffles create turbulent conditions and reduce or eliminate wall influencing effects. Also the vertical orientation ensures that with a lamp off, wastewater still encounters repeated areas of maximum intensity UV energy, which may not be the case for horizontal orientated lamps. Each 3X module consists of 36 low pressure high output amalgam UV lamps. An automatic row-by-row dose pacing and dimming scheme can be achieved with the Aquaray 3X system by turning off and on one row of lamps at a time plus dimming of lamp output between 100 percent and 60 percent. The Ozonia's dose pacing is a flow-based control technology which reduces energy consumption and extends lamp life.

The Aquaray 3X System is provided with a fully automatic wiper cleaning system. The wiper is a single plate that wipes all lamps in an entire module (36 lamps) at a time while the system is in use. Removal of the lamps for cleaning is not necessary. The vertical system can incorporate an optional air scrub feature (not evaluated here) that prevents excess deposition of solids in the disinfection channel and retards the fouling rate. Cleaning and scrubbing frequency is operator-adjustable. Lamps for this system are guaranteed for 12,000 hours at a minimum of 85 percent of original output at the end of the warranty period. Access to lamps and ballasts for replacement can be achieved by pulling and inserting an individual lamp or ballast in place while the system is in operation.

An overhead monorail and hoist or a jib crane is recommended to access the modules for periodic maintenance and cleaning. The Aquaray 3X system came to the wastewater market in 2006 and has been tested and validated for wastewater disinfection in various applications, such as in water reuse application in meeting the most stringent criteria for California Title 22 water reuse.

STS MicroDynamics

The Severn Trent Services MicroDynamics system features a vertical low pressure high intensity lamp array and variable output allowing UV output to be adjusted (dose pacing). The magnetron is the ballast equivalent for the system (it is powered by microwaves) located above the lamps on the bank. The system is equipped with an automatic lamp cleaning mechanism similar to other systems however less heat is generated by this system theoretically generating less need for cleaning. Dose pacing can be achieved with the MicroDynamics system by varying lamp power automatically (up or down) to compensate for UV intensity fluctuations caused by changes in water quality, lamp aging or quartz sleeve cleanliness. The MicroDynimics dose pacing is intensity-based and controlled by measuring the ultraviolet intensity within the UV system itself. The lamp output modulating feature is similar to a dimmer switch used for incandescent lighting and allows precise dose pacing control.

The MicroDynamics system uses an in-channel wiper system for each individual lamp that operates while the system is in use. This is a relatively new system with few installations.

Xylem/WEDECO TAK55

The Xylem/WEDECO TAK55 system is currently installed at the Wenatchee WWTP. The TAK55 is the earliest UV technology tested and validated for wastewater disinfection. Prior to approximately 2006, validation was completed using calculated models without following the US EPA testing protocol. Since that time, this equipment has been validated and equipment sizing algorithms do exist. The TAK55 System features a horizontal lamp array and variable output electronic ballasts allow UV output to be adjusted (dose pacing). Ballasts are located within a vented cabinet in an environmentally controlled building. The maximum distance from ballast cabinets to lamps in a channel is typically restricted to within 65 feet.

The system is equipped with a mechanical automatic lamp cleaning mechanism. Dose pacing can be achieved with the Xylem/WEDECO system by varying lamp power automatically (up or down) to compensate for UV intensity fluctuations caused by changes in water quality, lamp aging or quartz sleeve cleanliness. The Xylem/WEDECO dose pacing is UVT-based and controlled by measuring the water quality inflow to the UV system. The lamp output modulating feature is similar to a dimmer switch used for incandescent lighting and allows precise dose pacing control. The system has a turndown capacity of 100 percent to 50 percent. The Xylem/WEDECO system uses an in-channel dual wiper system for each individual lamp that operates while the system is in use. The wipers are driven along the length of each lamp using a pneumatic or hydraulic system and are not aided by cleaning chemicals. The cleaning frequency is operator adjustable.

The lamps for this system are guaranteed for 12,000 hours full power use. Access to lamps and ballasts for replacement can be achieved by rotating a module out of the channel with a hoist system. A portable davit crane is required, at a minimum, to access lamps and ballasts for replacement. Xylem/WEDECO has an extensive list of installations for the TAK55 product, the large majority of which are in Europe. There are over 225 operating installations in the United States, with more in construction and startup.

Xylem/WEDECO Duron

The Xylem/WEDECO Duron system is relatively new for wastewater disinfection. The WEDECO Duron System features a low pressure high intensity diagonal lamp array and variable output electronic ballasts to allow UV output to be adjusted. Ballasts located within an enclosure in the module frame are air cooled by convection. The system is equipped with an automatic lamp cleaning mechanism combining both mechanical and chemical cleaning functions.

Dose pacing for the Duron system is similar to the TAK 55 system described above. UV lamp output can be modulated and banks can be switched on and off based on measured inflow rates and inflow water quality (UV transmittance). Lamp cleaning for the Duron system is a chemical free self cleaning arrangement. The system is mounted on a hinged rising mechanism should channel maintenance be required or for system replacement and each module may be lifted individually.

The Xylem/WEDECO Duron system is the second of the two most recent technologies investigated. The technology validation has been performed following the testing protocol of the US EPA Ultraviolet Disinfection Guidance Manual (UVDGM, November 2006) and the Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (National Water Research Institute (NWRI)/American Water Works Association Research Foundation (AwwaRF, May 2003); and the equipment sizing algorithm was developed based on the validation testing. As of today, there are currently 18 installations in the United States and a number of Duron systems are also in the evaluation and design stage for full-scale installation.

For the purposes of evaluation of the UV Disinfection equipment replacement alternative, HDR has assumed that the system would be replaced with a Trojan 3000Plus or upgraded Xylem/WEDECO TAK55 system, both of which have a horizontal installation with a downstream level control arrangement that is similar to the existing Xylem/WEDECO system currently installed at the Wenatchee WWTP.

Table 5-8. UV Disinfection Alternatives Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
UV – 1	No Action	$0	$0
UV – 2	Manufacturer Recommended Enhancements	$135,000	$0
UV – 3	Equipment Replacement	$1,010,000	$0

Refer to Section 5.4.3 and Figure 5-12 for the full economic and non-economic evaluation of the UV Disinfection Alternatives.

5.3 Solids Stream Alternatives

Table 5-9 provides a summary of the process alternatives, deemed viable through an initial screening effort by the project team, for the solids stream unit processes located at the WWTP site. Solids handling options associated with the sludge drying beds and other off-site options are addressed in Chapter 4.

Table 5-9. Solids Stream Unit Process Enhancements Summary

Alternative No.	Description	Deficiency Addressed
PST – 1	Primary Sludge Thickening: No Action (Clarifier Thickening)	Primary sludge thickening to remain as-is, primary clarifier capacity limited to year 2030 condition, and no redundancy provided.
PST – 2	Primary Sludge Thickening: Gravity Thickener Addition	Primary sludge thickening to address year 2030 clarifier capacity limitation, separate gravity thickener, and redundancy is provided.
PST – 3	Primary Sludge Thickening: Rotary Screen Thickener Addition	Primary sludge thickening to address year 2030 clarifier capacity limitation, separate rotary drum thickener, and thickening redundancy provided.
WAS – 1	WAS Thickening: No Action	WAS processing remains unchanged, batch wasting continued, and no WAS redundancy provided.
WAS – 2	WAS Thickening: Rotary Screen Thickener Addition	WAS thickening redundancy and performance improvement allows 24-hour wasting via RST, and reduction in solids volume delivered to WAS digestion.
WAS – 3	WAS Thickening: Dissolved Air Flotation Addition	WAS thickening redundancy and performance improvement, allows 24-hour wasting via DAFT unit, and reduction in solids volume delivered to WAS digestion.
DIG – 1	Digestion: No Action	Continue digestion operation with no changes and primary digestion capacity limitation at year 2016 not addressed.
DIG – 2	Digestion: Sludge Thickening Addition	Increase primary digestion through installation of enhanced primary sludge thickening including recuperative thickening capability, and addresses year 2016 primary digestion limitation.
DIG – 3	Digestion: Added Digestion Capacity	Increased primary digestion through installation of new primary digester.
DEW – 1	Dewatering: No Action	Continue dewatering with single belt filter press. No dewatering system redundancy provided.

Alternative No.	Description	Deficiency Addressed
DEW – 2	Dewatering: Belt Filter Press Addition	Add dewatering redundancy through installation of an additional belt press.
DEW – 3	Dewatering: Screw Press Addition	Add dewatering redundancy and ability for unmanned dewatering through installation of a screw press.

5.3.1 Primary Sludge Thickening

Primary sludge is thickened in-basin within the primary clarifiers, and is delivered to Digesters No. 1 and No. 2 where it is digested independently from thickened WAS. Primary sludge thickening has not met the originally planned 4 percent concentration. Because digester capacity is not an issue at this time, the City has not focused on increasing the thickening of primary sludge within the clarifiers. At current flow and loading conditions, operations staff can increase the sludge blanket within the clarifiers to meet the minimum 4 percent if needed without impact to the primary clarification process. As flows and loads increase, the capacity of the primary clarifiers will not be sufficient to reliably thicken to a minimum of 4 percent within the basins. In addition, although the two digesters used for primary sludge digestion have sufficient volume to maintain a minimum 15 day solids retention time, one digester does not provide the minimum solids retention time of 15 days unless primary sludge is thickened to a minimum of 6 percent.

5.3.1.1 Key Findings

- The primary sludge and scum pumps were recently replaced with positive displacement pumps. Sufficient capacity is available unless separate primary sludge thickening is implemented.
- The WWTP has the ability to thicken primary sludge to at or above 4 percent solids content if needed. However, clarifiers are operated with a thicker sludge blanket at this time since digestion capacity is not an issue and the City achieves up to 5 percent solids content. Should primary clarifier performance be critical later in the planning period, and added loading to the secondary process proves to be detrimental, then separate primary sludge thickening is recommended.
- One primary digester does not provide the recommended minimum solids retention time of 15 days unless the primary sludge is thickened to a minimum of 6 percent at the peak loading conditions.
- There is no redundancy provided for the primary sludge thickening process when both primary clarifiers are online. Although process redundancy is not required, separate primary sludge thickening could be configured for process unit redundancy if additional primary sludge pumping capacity is provided.
- Under current operations, a minimum primary sludge solids concentration of 4-5 percent is needed for the projected 2035 loading conditions to the primary digesters.
- The use of thickening facilitates process control because clarification and thickening functions can be optimized independently (as opposed to managing competing objectives when thickening in the clarifiers).

- The former dissolved air flotation thickener area of the Blower Building is no longer used for chemical storage as it was re-purposed. The former thickener area would be available for installation of WAS thickening and pumping systems if needed.

5.3.1.2 Alternatives Considered

Currently the City operates their solids handling process that produces Class A biosolids at the City's drying bed location. The minimum 15 day solids retention time is not needed through the planning horizon unless the Class A treatment process is removed from service. Because primary sludge thickening within the primary clarifiers does impact primary clarification capacity and available space within the site is limited for additional unit processes, only three viable primary sludge thickening alternatives are identified to be considered. They include:

PST – 1: No Action

Under this alternative, primary treatment operations would remain unchanged with clarifier operation and primary sludge and scum pumping manually controlled and primary sludge thickening occuring within the primary clarifiers. If a clarifier is removed from service for maintenance, peak flow conditions would impact the ability to thicken primary solids to a higher concentration (at or above 4 percent) without impacting the treatment capacity of a single clarifier online. The primary clarifiers were recently upgraded and clarifier odor control covers were installed, which makes the need for repairs of the clarifiers unlikely during high peak flow conditions. Added process reliability can be achieved under peak flow conditions if additional emphasis is placed on added secondary treatment capacity included in other alternatives presented below.

PST – 2: Gravity Thickener Addition

This alternative would change the primary sludge pumping operation to direct primary sludge pumped from both primary clarifiers to a gravity sludge thickener pumping station located to the north of the existing Headworks Building Primary Sludge and Scum Pumping Room and gravity thickener north of Primary Clarifier No. 1. Under this alternative, the existing primary sludge pumps would be removed and relocated. They would be replaced with new larger primary sludge pumps that are increased in size to accommodate a peak flow of up to 720 gpm with both pumps in operation. The existing rotary lobe primary sludge pumps would be relocated to a lower level extension (basement room) extended north from the existing Headworks Building, and the gravity thickener would be constructed immediately north of Primary Clarifier No. 1 to avoid impacts with existing site piping. Installation of the thickener pumping room would require relocation of the existing 24-inch primary influent pipeline to Primary Clarifier No. 2 and the existing 36-inch primary effluent bypass pipeline serving the primary clarifiers. New 6-inch primary scum and primary sludge pipelines would be connected from the new pumping room to existing buried primary scum and thickened primary sludge pipelines.

Un-thickened primary sludge would be pumped from the primary clarifiers at a greater rate to minimize impact to the clarifier capacity during high flow and loading conditions, and would be thickened to 5-6 percent in the gravity thickener and pumped via the new thickened primary sludge pumps to primary digestion. The two relocated (thickened) primary sludge pumps would be installed to provide for pumping unit redundancy for the gravity thickener, and a single new thickener float pump would also be installed.

Based upon a peak primary sludge loading of 17,000 lbs/d and a peak hydraulic flow of 720 gpm, the gravity thickener would be sized to provide a minimum of 680 sf. A single 30-foot diameter thickener has been assumed for this alternative. The thickener would include a flat profile cover for odor control and the thickened sludge pumping would also be configured to pump directly from the primary clarifiers to enable the gravity thickener to be removed from service for maintenance.

The new gravity thickener and thickener pumping station alternative layout is shown on Figure 5-4.

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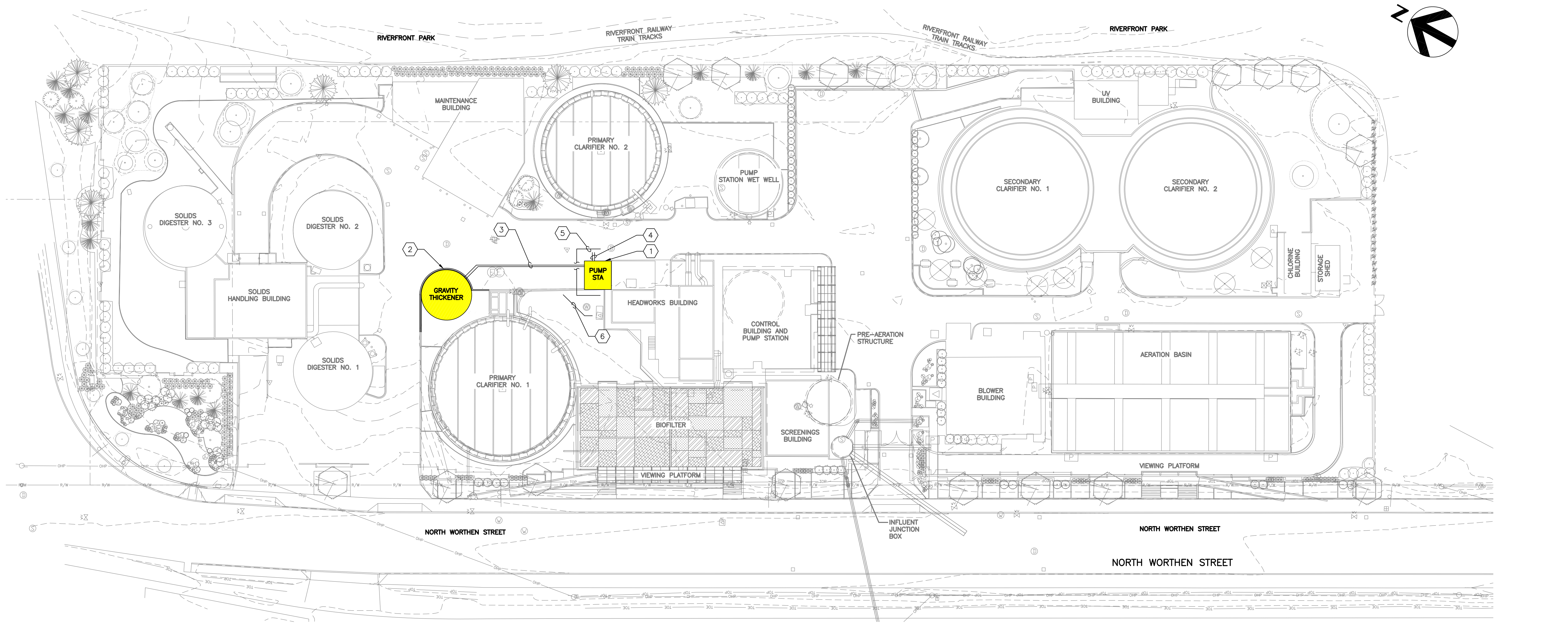

PLAN
1" = 60'-0"

KEY NOTES:

1. THICKENED SLUDGE PUMPING STATION (EXTENSION OF PRIMARY SLUDGE PUMPING ROOM)
2. NEW 30' DIAMETER GRAVITY THICKENER WITH ODOR COVER
3. 6 INCH PSM AND TPS PIPELINES
4. 6 INCH TPS AND PSM PIPELINES, OCNNECTED TO EXISTING TPS AND PSM PIPELINES IN ROAD
5. RE-LOCATED 24 INCH PI PIPELINE
6. RE-LOCATED 36 INCH PE PIPELINE

KEY:

NEW UNIT PROCESS STRUCTURE

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee
WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 5-4
NEW PRIMARY SLUDGE THICKENER AND THICKENED SLUDGE PUMPING STATION

0 1" 2"

FILENAME 5-4.dwg
SCALE AS NOTED
FIGURE 5-4

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PST – 3: Rotary Screen Thickener Addition

Rotary screen thickening is a technology that uses a solids-liquid separation process that relies on coagulation and flocculation of solids in a dilute slurry and drainage of free water from the slurry through a slow moving porous media. The rotary screen thickener (RST) consists of an internally fed cylindrical screen with an integral ridge inside the screen for transporting thickened solids out of the screen. The screen rotates and is driven by a variable or constant speed drive. Rotary screens are typically used in small to medium sized applications with maximum flows of approximately 400 gpm. Inlet consistencies are typically less than 1 percent solids concentration with outlet consistencies between 4 and 8 percent solids. Recent installations in the northwest (Coeur d'Alene, ID; Bozeman, MT) have resulted in outlet consistency in excess of 6 percent solids with inlet concentrations of approximately 1.5 to 1.8 percent solids.

For this alternative, it is assumed the rotary screen thickener would be located in a new thickening room constructed adjacent to the existing Solids Handling Facility to the north. This building would be at grade, with access to the RST unit via an overhead door facing west. Alternatively, the RST could be located within a new building immediately adjacent to Primary Clarifier No. 2. For the purposes of this evaluation, it is assumed the RST would be installed in a new building extension located north of the existing Solids Handling Facility.

Installation of the RST unit would involve extension of the primary sludge pipeline to the new building extension where it would connect to the RST process at an RST operating platform. The RST would discharge its filtrate to a new 8-inch drain that would be directed back to the plant influent via manhole MH-6. The thickened primary sludge from the RST would discharge into a thickened sludge hopper and then would be pumped via a dedicated thickened sludge pump through the existing 4-inch thickened sludge pipeline to the Solids Handling Building where it would be directed to primary digestion. A second redundant thickened sludge pump would also be provided under the new RST platform for redundancy. The RST and associated thickened sludge hopper would require the addition of odor control. It is assumed a new odor control fan and foul air duct system would be installed and extended across the plant access drive to the existing foul air collection system serving the Screenings Building. A typical rotary screen thickener installation with RST platform is shown in Figure 5-5.

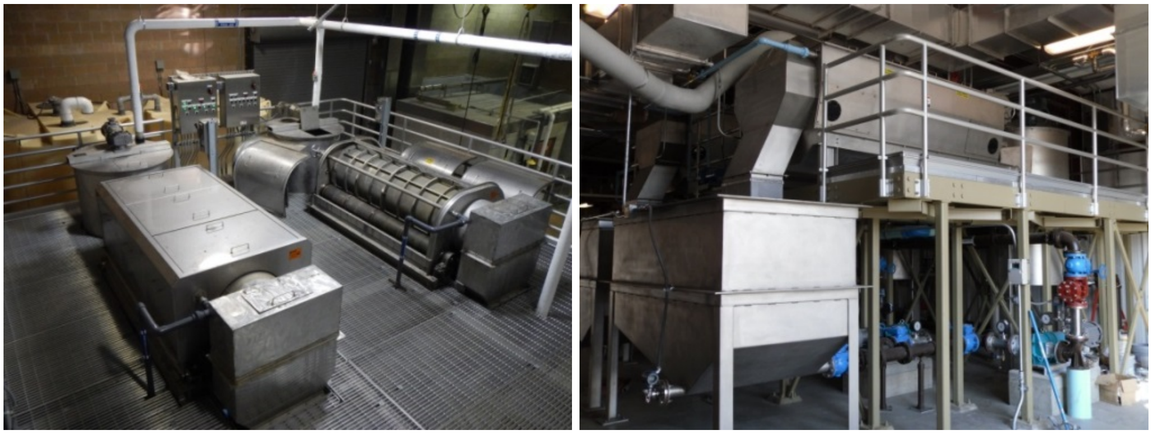

Figure 5-5. Typical RST Thickener Installations (Coeur d'Alene, ID; Bozeman, MT)

Table 5-10. Primary Sludge Thickening Alternative Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
PST – 1	No Action: Utilize Additional Secondary Treatment Capacity for Peak Loading Conditions	$0	$0
PST – 2	Gravity Thickener Addition	$1,370,000	$283,000
PST – 3	Rotary Screen Thickener Addition and Building Extension	$784,000	$265,000

Refer to Section 5.4.3 and Figure 5-13 for a full economic and non-economic evaluation of the Primary Sludge Thickening Alternatives.

5.3.2 WAS Thickening

Waste activated sludge is thickened with a single two meter gravity belt thickener (GBT) with a capacity of 800 lb/HR - 1400 lb/HR or 200 GPM - 400 GPM. For the capacity analysis a loading rate of 1,000 lb/HR was assumed. Based on that loading rate, the required run time for the GBT does not exceed 8 hours per day throughout the planning horizon. However, with only one GBT the thickening operation has no redundancy. In addition, the GBT is approximately 25 years old. Due to the age of the equipment, there is some risk that the City could begin to experience extended downtimes for maintenance and repairs. Presently Digester No.1 is operated to overflow to the unheated Digester No. 2. Digester No. 2 contents are then transferred to the Sludge Blend Tank and any excess flows are directed via overflow to the treatment plant influent. This effectively separates the thickening and dewatering operation by providing a wide spot in the line, as the digester is operated in displacement mode where flow entering the digester results in flow leaving the digester. The City regularly monitors the supernatant for control of the system.

Feeding the secondary intermittently is not ideal for digestion stability and performance. Construction of a new a digester feed blending/equalization tank from which the digester could be fed continuously was initially considered; however, this alternative was eliminated due to the lack of available plant site area for construction of this basin. Thickening options were determined to be the best solution to provide equipment redundancy to the existing gravity belt filter. Options considered the most viable for Wenatchee were rotary screen thickening and dissolved air flotation (DAF) thickening. Both the rotary screen thickener and dissolved air flotation thickener processes can be operated on a 24-hour per day basis which, in addition to providing redundancy and better water removal performance, would provide the ability for continuous digester feed without the need of a feed tank and additional pumps.

5.3.2.1 Key Findings

- The waste activated sludge system does not operate on a continuous basis, and process wasting must be conducted on a batch basis both from the activated sludge process and to the secondary digestion facilities. Process stability can be increased if continuous wasting is incorporated into the operating plan.
- Recycle stream loadings returned to the secondary treatment process have a small impact on the treatment process capacity.
- The existing gravity belt thickener operates well, but is over 20 years old and will eventually need to be replaced or upgraded. The gravity belt thickener is operated as cost effectively as possible without optimizing thickened sludge solids concentration. The typical WAS solids concentration is approximately 4 percent. Thickening to a solids concentration of 5-6 percent would provide for enhanced digestion capacity, and would reduce the amount of biosolids ultimately delivered to the dewatering process.
- The existing gravity belt thickener process replaced an earlier dissolved air flotation system located in the Blower Building. The gravity belt thickener does not have redundancy, and if needed to be bypassed dilute waste activated sludge is delivered to the secondary digester direct.
- The use of thickening facilitates process control because clarification and thickening functions can be optimized independently (as opposed to managing competing objectives when thickening in the clarifiers).
- The former dissolved air flotation thickener area of the Blower Building is no longer used for chemical storage as it was repurposed. The former thickener area would be available for installation of WAS thickening and pumping systems if needed.

5.3.2.2 Alternatives Considered

Additional WAS thickening capacity provided for system redundancy, coupled with added system process improvements by lowering the secondary recycle waste stream, will enable the City to reduce impacts to the secondary process from dewatering activities, increase secondary digestion solids retention time and reduce the amount of digested biosolids to be directed to biosolids dewatering. Two viable WAS thickening alternatives were identified in addition to continuing the use of the existing gravity belt thickener. Both options have the ability to be operated unmanned on a continuous basis and can accept continuous wasting from the secondary treatment process. They include:

WAS – 1: No Action

Under this alternative, WAS thickening operations would remain unchanged with the gravity belt thickener operation and thickened sludge pumping would be operated during daytime work hours when operations staff are on-site. Secondary treatment wasting would continue to be on a batch basis to thicken waste secondary solids to of approximately 4 percent. The condition of the gravity belt thickener is good; however, if removed from service for maintenance operations, staff will need to direct dilute waste activated sludge to the secondary digestion process. This will impact the capacity of the digestion process if bypass is needed for an extended period of time.

WAS – 2: Rotary Screen Thickener Addition

Rotary screen thickening technology is summarized for Alternative PST–3. For this alternative, it is assumed a single rotary screen thickener, sized for approximately 80 gpm and 9,450 lbs/d solids loading, would be located in a separate dewatering room located north of the existing Solids Handling Facility. It may be possible to locate the unit in the upper dewatering room in the Solids Handling Building to eliminate the need for a new building; however, it is conservatively assumed the unit would be installed in a separate at grade structure with access to the room facing the west side of the facility.

Installation of the RST unit would involve installation of an RST operating platform with dewatered WAS pumping and a thickened WAS hopper located under the RST unit and platform. The RST, sized for a WAS flow of 80 gpm, would discharge its filtrate to the same floor drain system as the existing gravity belt thickener. The thickened waste activated sludge from the RST would discharge into the thickened sludge hopper, and would then be pumped from sludge hopper via a dedicated thickened sludge pump to secondary digestion. It is assumed the added thickened sludge pumping would be necessary due to the thicker solids consistency expected from the RST. A second redundant thickened sludge pump would also be provided under the new RST platform for redundancy. The thickener piping would also be configured to enable recuperative thickening of either secondary or primary sludge from the digestion facilities if needed at any time. Odor control would be provided to the unit through a direct connection of the screen enclosure to the existing foul air collection system within the Solids Handling Building.

A similar typical rotary screen thickener installation with RST platform is shown in Figure 5-5.

WAS – 3: Dissolved Air Flotation Thickener Addition

The secondary sludge thickening process at Wenatchee originally included a dissolved air flotation thickening process located in the Blower Building. The technology as originally employed included a recirculation and pressurization recycle pumping unit and associated pressurization tank for the addition of air for flotation. This type of technology requires a significant amount of energy to operate, and is more difficult to operate than newer DAF technology. For this alternative, it is assumed that dissolved air recirculation and air injection would be provided by a newer technology using an aspirating air pumping system that provides both recirculation pumping and air injection though a single pumping unit.

Dissolved air flotation thickeners operate continuously and can produce a float concentration of 4 percent dry weight solids with typical secondary sludge. With hydraulic loading criteria of 1 gpm/sf and a solids loading of 0.8 lb/HR/sf, a single DAF unit sized for approximately 310 sf of floatation area. For this alternative, it is assumed the DAF unit will accommodate approximately 80 gpm and

9,450 lbs/d solids loading, and would be located in the former DAF area of the existing Blower Building to eliminate the need for a new building.

The thickened waste activated sludge from the DAF would discharge into a thickened sludge hopper or pit, and would then be pumped via a dedicated thickened sludge pump to secondary digestion. It is assumed the added thickened sludge pumping would be necessary due to the thicker solids consistency expected from the DAF. A second redundant thickened sludge pump would also be provided for redundancy. Odor control would be provided to the unit through a basin cover and direct connection of the cover to the existing foul air collection system via a duct to the Screenings Building odor collection system.

A typical DAF thickening system is shown in Figure 5-6.

Figure 5-6. Typical DAF Thickener Installation

Table 5-11. WAS Thickening Alternatives Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
WAS – 1	No Action	$0	$0
WAS – 2	Rotary Screen Thickener Addition	$784,000	$165,000
WAS – 3	Dissolved Air Flotation Thickener Addition	$1,710,000	$1,021,000

Refer to Section 5.4.3 and Figure 5-14 for the full economic and non-economic evaluation of the WAS Thickening Alternatives.

5.3.3 Digestion

Sludge digestion processes are used to produce a biologically stable product, to reduce pathogen concentrations to acceptable levels and to condition the sludge prior to dewatering and beneficial reuse operations. The City of Wenatchee currently anaerobically digests their primary sludge separately from their secondary sludge, with the digested sludge ultimately dewatered and delivered to the City's sludge drying bed system where Class A biosolids are produced. Unlike other facilities operating anaerobic digestion facilities, the City of Wenatchee does not solely rely on minimum solids residence time within their digesters for full stabilization, because of the very rigorous and effective drying process conducted in the City's drying bed facilities. The minimum residence time as set forth for Class A equivalency has been set at a minimum 20-day SRT (based upon the average of the combined Primary and Secondary solids) for the City of Wenatchee. The City achieves Class A biosolids through the Pathogen Equivalency Committee (PEC) treatment process described in detail in Chapter 4. The process within the drying beds produces a minimum 90 percent solids content and meets very stringent microbial criteria before being applied to land.

The Washington State "Orange Book", Metcalf and Eddy, and the EPA Process Design Manual list 10-20 days of solids retention time (SRT) as the design criteria for anaerobic digesters. Where the SRT is further defined in terms of digester temperature, mesophilic digestion at 35 deg-C (95 deg-F) is listed as requiring a 10 day SRT. Under US EPA regulations for control of pathogens and vector attraction in sewage sludge, "Treated sewage sludge (biosolids) is considered to be Class B if treated in one of the 'Processes to Significantly Reduce Pathogens' (PSRPs) listed in Appendix B of Part 503." The PSRP for anaerobic digestion reads:

> "Sewage sludge is treated in the absence of air for a specific mean cell residence time (i.e., solids residence time) at a specific temperature. Values for the mean cell residence time and temperature shall be between 15 days at 35 deg-C (95 deg-F) to 55 deg-C (131 deg-F) and 60 days at 20 deg-C (68 deg-F)."

This PSRP ensures that the digested sludge will be considered Class B biosolids in the absence of any other criteria that might be used to produce Class B biosolids. Because the City's drying bed process exceeds the minimum requirements for vector attraction, the minimum 38 percent VSS destruction requirement for Class B in the WAS digester is not an issue and does not drive the recommend digestion capacity. Digester No. 1 (primary digester) and Digester No. 3 (single WAS digester) combined have sufficient volume to maintain a minimum 15 day hydraulic or solids retention time. A single digester does not have adequate capacity to provide the minimum of 20 day detention time through the planning period and Digester No. 2 (storage tank only) is not interchangeable with Digester No. 1 and Digester No. 2. Digestion capacity was not identified as an issue in Chapter 3, due to the robust capabilities of the City's sludge drying bed unit process. After further evaluation, it was determined that the digestion alternatives evaluated should be selected for enhanced digestion capacity and digestion redundancy.

5.3.3.1 Key Findings

- The City practices single-stage mesophilic digestion. It involves high-rate digestion in a single reactor at a process temperature of 95 deg-F. An unheated second primary digester is used for sludge holding and digester gas management.
- The City recently upgraded the primary digester gas handling system, and the digester heating and recirculation systems are in good operating condition. The primary digester mixing is accomplished using sludge recirculation pumping only.
- There is no recirculation pumping and heat exchanger installed on the primary sludge second digester (Digester No. 2). That tank serves as secondary sludge storage only. No sludge heating and mixing is provided at the tank, but gas holding is provided with a floating steel cover.
- Pumped mixing and hot water heating is used at the Primary Digester No. 1 and Secondary (WAS) Digester No. 3. One dual gas (digester gas and natural gas) hot water boiler supports the digester heating hot water system.

- Primary and secondary sludge is digested separately for process stability reasons. The City has tried combining primary and secondary materials but experienced problems with digester upset and foaming. WAS is fed to the digestion process on a batch basis, when WAS is processed through the gravity belt thickener during normal operating hours. Primary sludge and WAS are combined prior to dewatering at the blend tank, and the combined material is dewatered to approximately 15 to 18 percent via the belt filter press dewatering unit.
- Digester tank redundancy is not provided for the digestion process, and the City does not have the ability to remove a digester from service for maintenance or repairs.

5.3.3.2 Alternatives Considered

Additional digester capacity, provided for system redundancy, will enable the City to avoid the need for combining sludge for digestion and increase digestion solids retention time. If thickening of the sludge feed to digestion is employed, the amount of digested biosolids to be directed to dewatering will be reduced. The City identified two viable digestion alternatives in addition to the no action alternative. They include:

DIG – 1: No Action

Under this alternative, digestion operations would remain unchanged with the gravity belt thickener operation and thickened sludge pumping being operated during daytime work hours when operations staff members are on-site. Secondary wasting would continue to be on a batch basis to thicken waste secondary solids to approximately 4 percent prior to introduction to the secondary digester. The City would continue to thicken primary and secondary sludge separately, and direct to the primary and secondary digestion facilities that are also segregated.

DIG – 2: Sludge Thickening Addition

Under this alternative, added digestion capacity and redundancy would be provided by thickening the sludge feed to each digestion process train to a minimum of 6 percent solids. It is assumed this alternative would involve primary sludge thickening similar to Alternatives PST – 3 and WAS – 2 that employ the use of rotary screen thickening for both primary and secondary thickening. In addition, the rotary screen thickener piping would also be configured to enable recuperative thickening of the contents of either the two primary digesters or the secondary digester if needed. Recuperative thickening would provide the additional advantage of the ability to create added digester storage capacity through removal of water from the digester contents. Point source odor control would be included to limit the volume of odorous air to be treated and provide for a clean working environment adjacent to the thickener unit.

DIG – 3: Added Digester Capacity

Under this alternative, an additional digester would be constructed to provide for added digester capacity and redundancy. The digester would be sized to match the size of Digesters No 1 and No. 2 at roughly 39,000 cubic feet. The digester would be installed to the west of existing Digester No. 3 at the northwest corner of the existing Solids Handling Building. The new digester would be supported from the existing Solids Handling Building with enhancements made to digester gas, heating and sludge pumping systems. For the purposes of this evaluation, it is assumed that the digester will be a fixed cover digester with pumped mixing to match the existing systems used for Digesters No. 1 and No. 3. The digester will be 45-feet in diameter, with a side depth of 25-feet, also to match existing digester configuration.

Table 5-12. Digestion Alternatives Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
DIG – 1	No Action	$0	$0
DIG – 2	Sludge Thickening Addition	$784,000	$265,000
DIG – 3	Added Digester Capacity	$4,692,000	$983,000

Refer to Section 5.4.3 and Figure 5-15 for the full economic and non-economic evaluation of the Digestion Alternatives.

5.3.4 Dewatering

The current WWTP dewatering facility is operated during a single daily shift, typically 5 days per week. Dewatering is provided from a single 2 meter belt filter press that dewaters combined primary and secondary sludge from the primary and secondary digesters. Sludge is drawn from the digesters and combined in a sludge blend tank immediately upstream of the belt filter press. Polymer is injected in the sludge feed just prior to entering the belt press unit for dewatering. The belt filter press achieves 15 to 18 percent solids content for the dewatered cake. The existing belt filter press was originally installed in approximately 1990/1991. Although the press is now approximately 25 years old, the machine appears to be in good working condition. Wear parts, including belts, have been routinely replaced in accordance with manufacturer's recommendations and the City believes there is still useful life available with the equipment.

5.3.4.1 Key Findings

- The dewatering room within the Solids Handling Building houses both the dewatering belt press and the WAS gravity belt thickener. The dewatering room was recently fitted with odor control ventilation that has helped to reduce higher levels of ammonia and humidity from the open water from these process units.
- Dewatering operations are typically completed in 5 shifts during the week. The City transfers sludge to the blend tank from Digester No. 2 and WAS Digester No. 3.
- The City does not have equipment redundancy for the belt filter press. As available digestion storage is reduced through flow and loading growth, the available digestion storage will be reduced making it more important for the City to consider the addition of more dewatering capability.
- The recycle streams from the dewatering process are returned to the plant influent, and ammonia and solids loading does have a minor impact on plant treatment capacity. More continuous dewatering would serve to equalize the recycle streams to the treatment process.
- The existing belt filter press in in good mechanical condition, and City operations and maintenance personnel are comfortable with its operation.

5.3.4.2 Alternatives Considered

The City is satisfied with the performance of the machine, and there is no identified need for expediting equipment replacement. Spare parts and filter belt availability is not a concern at this time, and operations staff are very comfortable and knowledgeable with the system operation. Because there is no redundancy for the dewatering process, and the age of the existing equipment, three alternatives have been presented for evaluation for the provision of dewatering redundancy. They include:

DEW – 1: No Action

Under this alternative, dewatering operations would remain unchanged with the belt filter press operation and digested sludge pumping being operated during daytime work hours when operations staff members are on-site. The belt filter press will also not have unit redundancy under this alternative, and any routine maintenance or equipment repairs will need to be coordinated with the amount of digester storage available.

DEW – 2: Belt Filter Press Addition

Under this alternative, a second belt filter press would be installed to serve as a fully redundant unit to the existing belt filter press. The unit would be sized for a capacity of 2,000 lb/HR to match the existing unit capacity and enable an 8 HR/d operation five days per week. Insufficient space is available in the upper dewatering room of the Solids Handling Building to accommodate a second belt filter press, and installation of the second dewatering unit will require construction of a dewatering room addition to the Solids Handling Building.

The dewatering room would be constructed to the north of the existing Solids Handling Building immediately north of the boiler room, and would include the belt press and associated support equipment and access platform at ground level. Dewatered biosolids from this dewatering unit would be conveyed via vertical and horizontal centerless conveyors, through the Solids Handling Building Dewatering Room to the existing truck loading bay. Odor control would be provided to the new dewatering room via the existing foul air collection duct serving the solids handling facilities.

The added belt filter press and dewatering room addition is shown in Figure 5-7.

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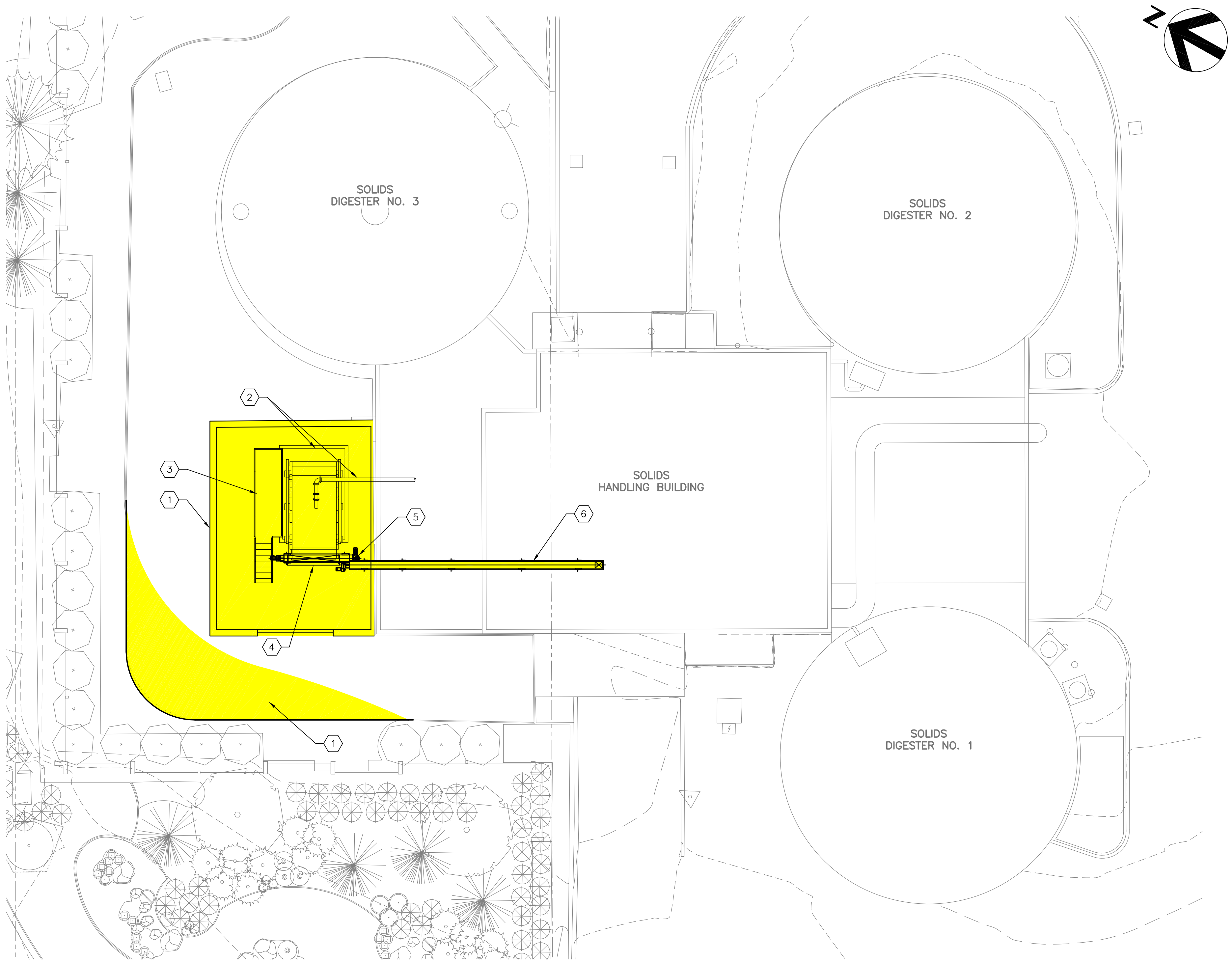

SOLIDS HANDLING AREA PARTIAL PLAN

1" = 20'-0"

KEY:

NEW UNIT PROCESS STRUCTURE

KEY NOTES:

1. NEW 26 FT X 34 FT DEWATERING BUILDING WITH 10 FT X 12 FT OVERHEAD DOOR AND ODOR CONTROL
2. BELT FILTER PRESS WITH WASHDOWN SPRAY WATER, POLYMER FEED AND ODOR CONTROL
3. BELT PRESS ACCESS PLATFORM
4. HORIZONTAL CENTERLESS CONVEYOR TO SLUDGE TRUCK LOADING BAY IN SOLIDS HANDLING FACILITY
5. VERTICAL CENTERLESS CONVEYOR
6. DEWATERED BIOSOLIDS CHUTE TO SLUDGE LOADING
7. ASPHALT PAVEMENT MODIFICATION

HDR

PROJECT MANAGER

ISSUE | DATE | DESCRIPTION

PROJECT NUMBER

City of Wenatchee

WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 5-7
BELT FILTER PRESS AND DEWATERING ROOM ADDITION

0 1" 2"

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SCALE AS NOTED

FIGURE 5-7

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DEW – 3: Added Screw Press

Under this alternative, a new screw press would be installed to serve as a fully redundant unit to the existing belt filter press. The unit would be sized for a capacity of 500 lb/HR, and would be operated on a 24 hour basis to limit peak recycle loadings returned back to the treatment process. Insufficient space is available in the upper dewatering room of the Solids Handling Building to accommodate a the screw press and associated sludge conditioning systems, and installation of this second dewatering unit will also require construction of a dewatering room addition to the Solids Handling Building.

The dewatering room would be constructed north of the existing Solids Handling Building and immediately north of the boiler room. The room would include the screw press and associated support equipment at ground level. Dewatered biosolids from this dewatering unit would be conveyed via vertical and horizontal centerless conveyors, through the Solids Handling Building Dewatering Room to the existing truck loading bay. Odor control would be provided to the new dewatering room via the existing foul air collection duct serving the solids handling facilities.

The added screw press and dewatering room addition is shown in Figure 5-8 and a typical screw press dewatering unit is shown in Figure 5-9.

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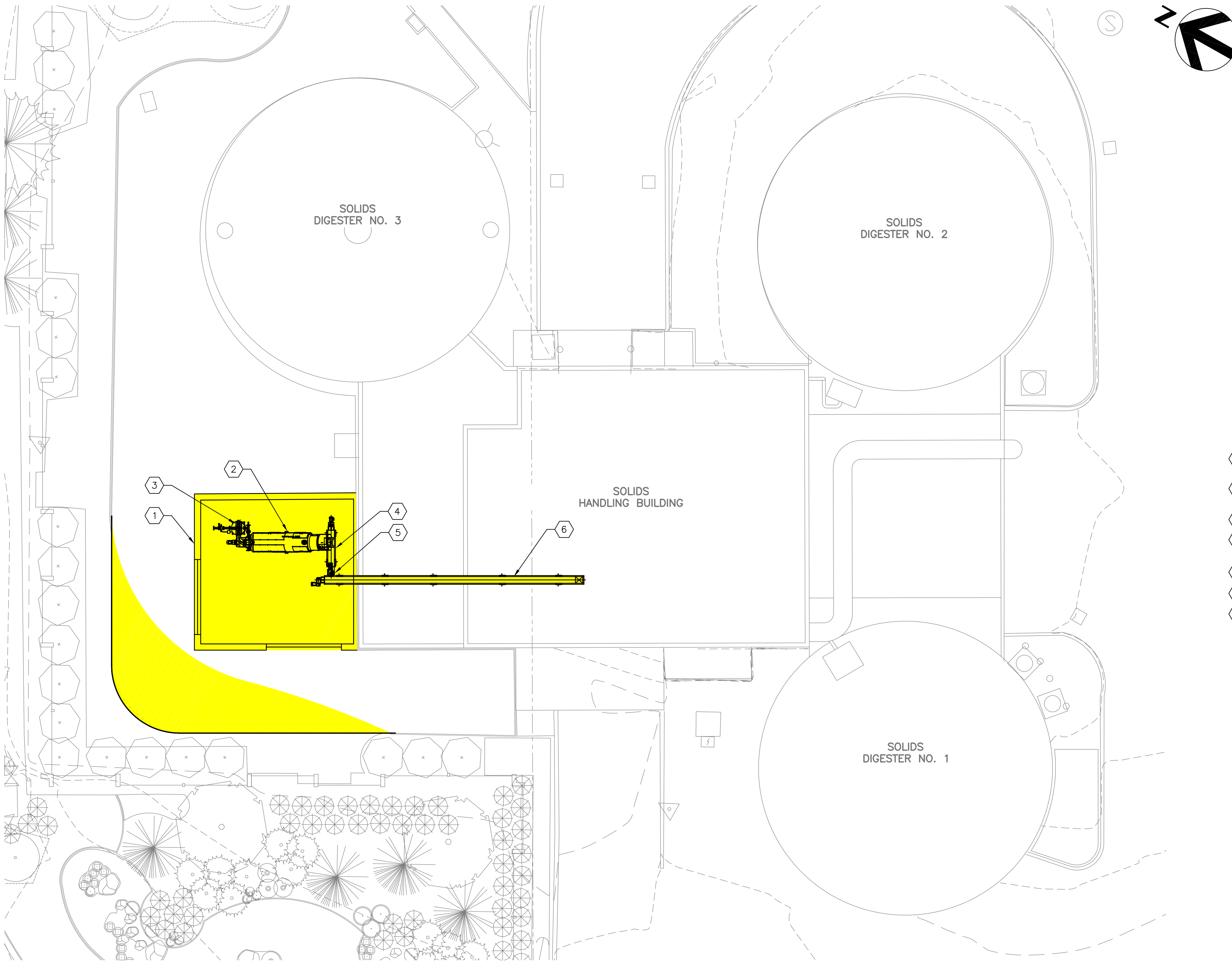

SOLIDS HANDLING AREA PARTIAL PLAN
1" = 20'-0"

KEY:

NEW UNIT PROCESS STRUCTURE

KEY NOTES:

1. NEW 26 FT X 25 FT DEWATERING BUILDING WITH 10 FT X 12 FT OVERHEAD DOOR AND ODOR CONTROL
2. SCREW PRESS WITH WASHDOWN SPRAY WATER, POLYMER FEED AND ODOR CONTROL
3. SCREW PRESS FEED CONDITIONING TANK
4. HORIZONTAL CENTERLESS CONVEYOR TO SLUDGE TRUCK LOADING BAY IN SOLIDS HANDLING FACILITY
5. VERTICAL CENTERLESS CONVEYOR
6. DEWATERED BIOSOLIDS CHUTE TO SLUDGE LOADING
7. ASPHALT PAVEMENT MODIFICATION

HDR

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee
WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 5-8
SCREW PRESS
AND DEWATERING ROOM ADDITION

FILENAME 5-8.dwg
SCALE AS NOTED
FIGURE 5-8

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Figure 5-9. Typical Screw Press Dewatering Unit

Table 5-13. Dewatering Alternatives Cost Estimates

Alternative No.	Description	Total Construction Cost $	Net Present Value (NPV) Added Operation and Maintenance Cost $
DEW – 1	No Action	$0	$0
DEW – 2	Added Belt Filter Press	$1,820,000	$685,000
DEW – 3	Added Screw Press	$2,132,000	$817,000

Refer to Section 5.4.3 and Figure 5-16 for the full economic and non-economic evaluation of the Dewatering Alternatives.

5.4 Alternatives Evaluation

The following sections describe the economic and non-economic evaluation criteria under the following seven categories that are to be used for the Wastewater Treatment Plant Improvement Alternatives evaluation:

- Regulatory Compliance
- Implementation
- Operations/Technology
- Community/Environmental
- Cost
- Risk
- Compatibility with Site

5.4.1 Evaluation Process

Alternatives were identified and evaluated through an interactive process involving both the City and the HDR project team. Major elements of the process are described below.

5.4.1.1 Define Process Methodology and Evaluation Criteria

To provide a consistent planning basis, an evaluation methodology was developed for the wastewater facilities. This process defined evaluation criteria, outlined the decision-making process, and prescribed cost estimating procedures. The evaluation criteria are listed in Table 5-14. Except for cost, these criteria were applied on a non-weighted, qualitative basis.

5.4.1.2 Brainstorm and Screen Ideas

The potential process enhancements workshop was conducted in February 2015 to identify potential alternatives for improving the Wenatchee WWTP facility. Following the initial one-day brainstorming session, an initial screening step was conducted to eliminate ideas that were fatally flawed, technically unproven, excessively expensive or otherwise unworthy of detailed evaluation.

5.4.1.3 Alternatives Development and Evaluation

Alternatives surviving the initial screening step were developed as presented in earlier paragraphs of this Chapter. Preliminary sizing and cost estimating were conducted for both the liquid stream alternatives presented in Table 5-5 and solids stream alternatives presented in Table 5-9. Alternatives were compared based on cost and non-economic criteria. Based on this analysis, preliminary recommendations for facility improvements were made. Results are summarized in Table 5-14 on the next page.

Table 5-14. Evaluation Criteria

Regulatory Compliance	Implementation Criteria
• Meets current NPDES requirements	• Ability to logically phase expansion
• Flexible – Allows for potential future NPDES requirements	• Ease of construction
• Meets current and anticipated biosolids regulations	• Ability to maintain operation during construction
Operations/Technology	• Permit/approval requirements
• Proven performance/proven treatment process	**Community/Environmental Criteria**
• Low complexity	• Odor potential
• Operational ease	• Noise potential
• Ease of automation	• Vector potential
• Reasonable maintenance	• Air quality impacts (non-odor)
• Reliability	• Truck traffic
• Longevity	• Hazardous chemicals
• Flexible – allows for future growth	• Public safety
• Compatible with existing facilities	**Risk**
• Safe/low use of hazardous chemicals	• Potential for practice to fail due to changes in future regulations, public perception or land use
Cost	
• Construction cost/cash flow	**Compatibility with Site**
• Operations cost	• Ability to fit on site
• Land acquisition cost	• Compatibility with surrounding land uses
• Life cycle cost	

5.4.1.4 Alternatives Selection.

Based on the results of the evaluation process, and incorporating the comments received during the City reviews, final alternatives and recommendations for consideration by the City Staff are presented in Chapter 6. Initial evaluation of both the liquid stream and solids stream alternatives are presented in Section 5.4.3. Each evaluation criteria were weighted equally and assigned a numerical score, with a possible score of 1.0 for each criteria and a total maximum score of 7.0 for each alternative.

5.4.2 Driving Forces

Process enhancements to the Wenatchee WWTP are needed to provide reliable treatment capacity, to improve operational efficiency and to enhance the interface with encroaching commercial development. The key driving forces behind the needed improvements are summarized below.

- **Process Improvements.** Some process improvements will reduce operational costs and/or delay the need for capacity expansions in other portions of the treatment systems.
- **Age and Condition.** A number of the treatment facilities are 25 years old (and older) and now are beginning to approach their useful life. Some plant components warrant consideration for providing unit redundancy, to better enable maintenance without an elevated threat for exceeding permit limits.
- **Service Area Growth.** Wenatchee's service population is growing modestly at an annual rate of 1.5 percent, modestly increasing wastewater loadings to the treatment plant (see Chapter 2). At this rate of growth, the projected flows and loads do not result in any major unit process modifications that are required due to growth at the treatment plant.
- **Good Neighbor Considerations.** Commercial development is encroaching on the City's treatment plant site. To ensure the long-term viability of the site for wastewater service, improvements were recently constructed to enhance the interface between the treatment facilities and surrounding uses. Any additional improvements must be completed in conformance with the standards recently developed.

5.4.3 Evaluation of Alternatives

Following the initial screening steps, the remaining alternatives selected for process enhancement at the WWTP were developed and compared against the selected evaluation criteria. The alternatives evaluated were originally identified in Table 5-14, and key findings associated with the evaluation of alternatives are presented below.

The comparison of alternatives for primary clarification and primary sludge pumping is shown in Figure 5-10. Key findings include:

- There is no regulatory requirement to add unit redundancy. The primary concern for the City is the availability of primary treatment capacity to enable sludge thickening to a point where the digestion process is not impacted and to avoid sending too much organic loading to the secondary treatment process.
- Construction of a belt filter press would require installation in the existing Blower Building to avoid construction of a new building. Piping, odor control and building demolition impacts the capital costs of this alternative.
- Screenings from the belt filter press would add additional odor treatment requirements that would impact the existing odor control facilities. In addition, screenings handling of solids removed from the primary filter process will require washing and compacting and facilities for refuse hauling.
- Operations and maintenance costs would increase with the addition of a separate thickener device.
- Primary sludge thickening within the primary clarifiers may be implemented with only subtle changes in sludge pumping operations. If consideration is given to added secondary treatment capacity, primary clarifier loading could be addressed in the downstream

secondary treatment process during peak flow and load conditions or during maintenance of a primary clarifier.

Evaluation Criteria	PCL-1 No Action	PCL-2 Belt Filter Addition	Comments
Regulatory Compliance	◒	◒	There is no regulatory requirement for redundancy.
Operations/ Technology	◕	◔	
Compatibility With Site	●	○	Limited site area available, requires thickeners to be installed in Blower Building.
Implementation	●	○	Operations staff can increase thickening in primary clarifiers if sufficient capacity available in secondary treatment.
Community/ Environmental	◕	○	Belt filter will add odors to be treated.
Risk	◕	◔	
Cost	●	○	No action will avoid operations and maintenance costs associated with separate thickeners.
Total	◕	◔	
Numeric Total	5.75	2.25	

Worse ← ○ ◔ ◒ ◕ ● → Better

Figure 5-10. Summary Comparison of Primary Clarification and Primary Pumping Alternatives

The comparison of alternatives for secondary clarification and RAS flow control is shown in Figure 5-11. Key findings include:

- Construction of a new secondary clarifier will require installation of site shoring and careful coordination of construction activities due to a very limited amount of site available. The existing Pump Wet Well and Secondary Clarifier No. 1 will require special protection during excavation and backfill activities.

- During construction, the access road east of the existing Control Building would need to be used for construction activities which would limit available access by plant personnel.
- Excavation for a new secondary clarifier will likely encounter landfill debris which will require legal disposition off site during construction.
- A new secondary clarifier will be constructed similar to the existing clarifiers on site, with the exception that perimeter chlorine contact channels will no longer be needed.
- Installation of pipeline connections to the new secondary clarifier will require planned shutdown of the flows to the secondary treatment process that will require the use of the Flow Equalization Basin and spare primary clarifier capacity to facilitate construction.
- The use of the existing gravity flow and RAS control for the new secondary clarifier is possible, but will add complexity to the existing RAS control cascade control loop.
- Construction of pumped RAS flow control and metering is possible to implement using space available within the existing Sludge Recirculation (RAS Pumping) Building. Piping modifications would include revision of the RAS pumping to a common RAS suction pumping header and dedicated magnetic flow meters and RAS lines directed back to the aeration basin influent chnnel via the existing 16-inch activated sludge return pipeline.
- The new return sludge and secondary scum pipelines serving the new secondary clarifier would be installed in the chlorine contact channel of the existing Secondary Clarifier No. 1. Connection of the scum line to the existing scum pit would require a concrete bore into the scum pit box. Construction of the return sludge flow control would involve installation of a downward acting RAS flow control gate installed on a fabricated weir gate box attached to the return sludge pumping wetwell. A significant concrete sawcut and demolition of a portion of the east wall of the recirculation wetwell would be required. Installation of this box would need to be coordinated with other pipeline connections. A staged activities schedule would likely be required for construction implementation to avoid impact to the treatment process.
- Construction of the new secondary clarifier effluent pipeline to the UV Disinfection Building will require excavation along the eastern side of the UV Disinfection Building. Existing shoring from past construction will need to be verified, and shoring will be required for pipeline installation.
- Access to the existing UV Disinfection Building along the north side will be provided by modification to the existing site landscaping to enable access to the building via a permeable grass paver access path located east of new Secondary Clarifier No. 3.
- Installation of pumped RAS flow control would provide the ability to eliminate the use of the downward acting weir gates, but would add significant capital cost to the pumped alternative. Operation and maintenance costs associated with the pumped option are also greater.

Evaluation Criteria	SC/RAS-1 No Action	SC/RAS-2 New Clarifier with Gravity RAS Flow Control	SC/RAS-3 New Clarifier and Pumped RAS Flow Control	Comments
Regulatory Compliance	◔	◕	◕	Added secondary treatment capacity will improve capability to ensure compliance with NPDES permit during maintenance activities.
Operations/ Technology	○	●	◑	Pumped RAS flow adds maintenance complexity.
Compatibility With Site	●	◕	◑	
Implementation	●	◕	◔	Construction of pumped RAS systems will be challenging within existing building.
Community/ Environmental	◔	◕	◕	
Risk	○	◑	◑	
Cost	●	◕	◑	Gravity RAS flow control will require less initial capital cost and less operations and maintenance cost.
Total	◑	◕	◑	
Numeric Total	4.75	5.25	3.75	

Worse ← ○ ◔ ◑ ◕ ● → Better

Figure 5-11. Summary Comparison of Secondary Clarification and RAS Flow Control Alternatives

The comparison of alternatives for ultraviolet light disinfection is shown in Figure 5-12. Key findings include:

- The existing UV disinfection system has less available capacity when evaluated using bioassay validated design criteria. The system has a rated capacity of 7.5 mgd, which is greater than the 2035 maximum month flow of 4.35 mgd and also greater than the 2035 maximum day flow of 4.74 mgd.

- Peak hourly flows will need to be monitored closely, and the flow equalization basin should be used if elevated fecal coliform trends are recognized.
- The no-action alternative is satisfactory for near-term normal flow conditions, but there would be risk for fecal coliform excursions under peak flow conditions.
- Modest improvements in UVT monitoring, dosage intensity controls and flow regulation recommended by the original system manufacturer.
- Purchase and installation of a complete new UV disinfection system would require a significant capital investment.
- The City is comfortable with the existing system operation.

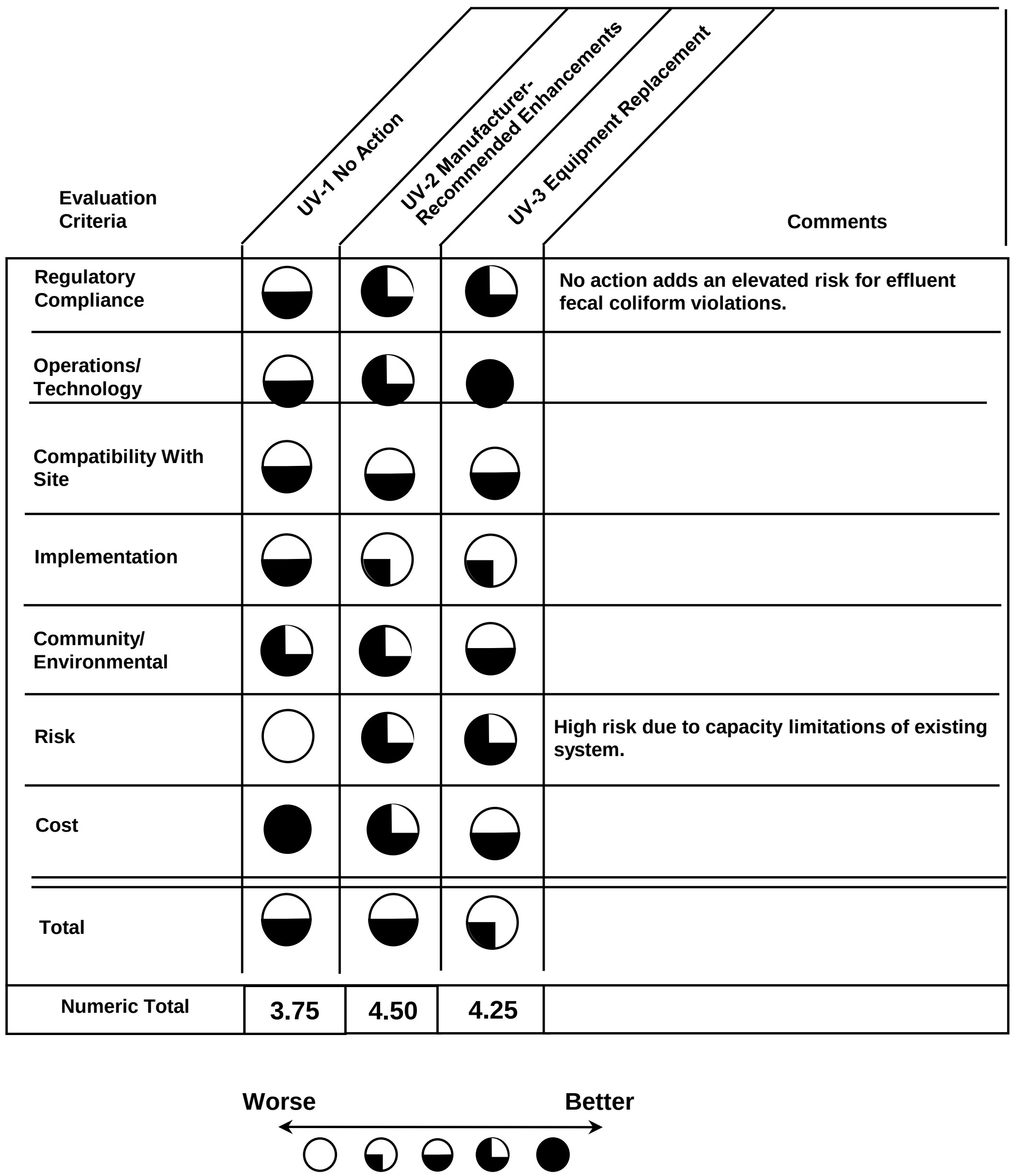

Figure 5-12. Summary Comparison of Ultraviolet Light Disinfection Alternatives

The comparison of alternatives for primary sludge thickening is shown in Figure 5-13. Key findings include:

- The City is satisfied with the current procedures for primary sludge thickening, and they do focus specifically on solids content in the primary sludge delivered to digestion. The City does thicken to 4 to 5 percent solids and is able to do so under most flow conditions. Under peak flow conditions, the City can continue their same mode of operation provided adequate secondary treatment capacity is present.
- The primary sludge thickening alternatives considered would add odor collection and treatment. The rotary screen thickener alternative would generate far less odorous air necessary for treatment.
- Addition of thickening for primary sludge would be challenging, due to limited site area available and the need to be closer to the primary clarifiers and digestion facilities. Installation of the gravity thickener alternative would likely require a significant amount of yard piping relocation. Installation of the rotary screen thickener would likely require construction of a new thickener building located immediately north of the existing Solids Handling Facility.
- Both the sludge gravity thickener and rotary screen thickener alternatives would enable thickening of primary sludge to beyond 4 percent solids on a 24 hour basis.
- Construction of separate primary sludge thickening will add operation and maintenance costs associated with the thickening and thickened sludge pumping processes.
- The rotary screen thickener will represent a new technology from City staff.

Evaluation Criteria	PST-1 No Action	PST-2 Gravity Thickener Addition	PST-3 Rotary Screen Thickener Addition	Comments
Regulatory Compliance	◑	◑	◑	Thickening in primary clarifier to 4% solids concentration may be continued if sufficient secondary treatment capacity is available.
Operations/ Technology	●	◔	◔	
Compatibility With Site	●	◔	◔	Addition of thickening will be challenging with limited available site area.
Implementation	●	◑	◑	
Community/ Environmental	◕	○	○	Thickening will require odor control addition to existing odor control system.
Risk	◑	◕	◕	Secondary treatment capacity is needed for primary thickening in primary clarification during peak flow conditions.
Cost	◕	○	◑	
Total	◕	◔	◑	
Numeric Total	5.50	2.25	2.75	

Worse ← ○ ◔ ◑ ◕ ● → Better

Figure 5-13. Summary Comparison of Primary Sludge Thickening Alternatives

The comparison of alternatives for WAS thickening is shown in Figure 5-14. Key findings include:

- The City is satisfied with their existing WAS thickening operation using the gravity belt thickener. Operation of the WWTP does not focus on increased solids concentration of the thickened WAS at this time, and the gravity belt thickener is operated in the most cost effective manner possible. The WWTP has the ability to thicken to 4 percent solids concentration if needed.
- Construction of the dissolved air flotation thickening alternative would result in remote installation of WAS handling in the Blower Building to avoid even greater capital costs

associated with a new building. Construction of the DAF would also require significant odor control additions due to the surface area of the flotation zone and introduction of air into the system.

- WAS thickening using the rotary screen thickener would also make the rotary screen thickener available for recuperative thickening to all digesters. This improvement is a benefit that would enhance effective digester capacity.
- The rotary screen thickening alternative would require less modification to the odor control facilities since point source odor control can be provided at the RST unit. The RST unit could serve as the primary thickening unit, or as redundant processing capability to the existing gravity belt thickener.
- Rotary screen thickening will represent a new technology for the City staff.

Evaluation Criteria	WAS-1 No Action	WAS-2 Rotary Screen Thickener Addition	WAS-3 Dissolved Air Flotation Floatation Addition	Comments
Regulatory Compliance	◑	◑	◑	
Operations/ Technology	◑	◑	◔	RST Technologies require less energy and operator attention.
Compatibility With Site	●	◕	◔	WAS thickening will need to be destructed in the existing Blower Building, remote from the digestion facilities.
Implementation	●	◕	◑	Installation of WAS thickening will require installation in the existing Blower Building.
Community/ Environmental	◕	○	◔	Odor control would need to be added for the thickening additions.
Risk	○	●	●	There is some risk in not thickening WAS due to the lack of digestion redundancy. Less digester capacity impacts maintenance time.
Cost	●	◕	◑	Operations and maintenance costs for the rotary screen thickener are less than DAF technology.
Total	◑	◑	◔	
Numeric Total	4.75	4.75	3.25	

Worse ○ ◔ ◑ ◕ ● **Better**

Figure 5-14. Summary Comparison of WAS Thickening Alternatives

The comparison of alternatives for Digestion is shown in Figure 5-15. Key findings include:

- There is no regulatory requirement to add unit redundancy. When digestion is considered without impact to downstream unit processes, the primary concern for the City is the availability of digestion capacity to enable removal of digestion facilities for maintenance purposes. Dewatering and solids drying would be impacted should a digester need to be removed for maintenance or repair. In addition, although the sludge drying beds achieve significant solids dryness and pathogen destruction, digestion and dewatering of the sludge before truck haul to the sludge drying site does expose the dewatered cake to the public and full digestion is desirable from an odor and vector attraction standpoint.

- The City prefers to digest primary and secondary biosolids separately.
- Digestion capacity is available for the full planning period provided all digesters are available for service and if thickening of primary sludge and secondary sludge delivered to the digestion process is a minimum of 4 percent solids concentration under normal loading conditions. With the current digestion capacity, a solids concentration of 6 percent solids is necessary at peak loading conditions for the primary digesters which would impact primary and secondary treatment capacity.
- Digester maintenance is limited due to available digester capacity.
- Construction of a new digester would require significant capital investment.
- A rotary screen thickener constructed for other purposes could be used for recuperative thickening of both the primary and WAS digester if needed in an emergency or for planned maintenance of a digester.

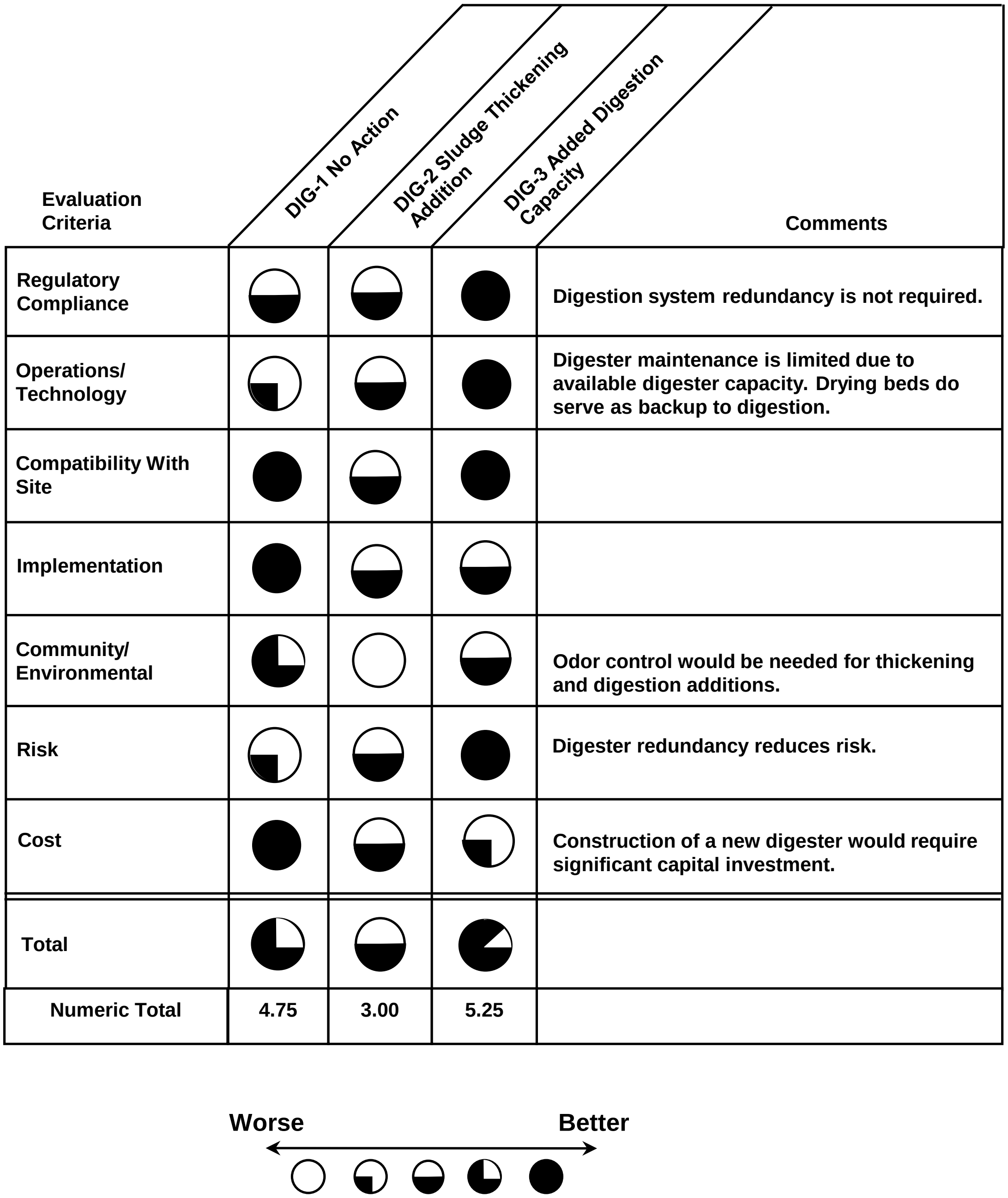

Figure 5-15. Summary Comparison of Digestion Alternatives

The comparison of alternatives for Dewatering is shown in Figure 5-16. Key findings include:

- The City is satisfied with the performance of the belt filter press dewatering unit and operations staff is familiar with the technology. The condition of the belt filter press is good with no imminent need for equipment replacement.
- The City operates the dewatering equipment 5 days a week during daytime working hours and does not want to staff nighttime hours for dewatering. Any dewatering alternate must be able to be operated reliable unmanned.

- The recycle stream from dewatering is not a significant impact on the treatment process, but recycle streams will have greater influence on the secondary treatment capacity as flows and loads increase.
- Capacity of the belt filter press is adequate though the planning period; however, there is no redundancy for the dewatering equipment. There is no regulatory requirement for redundancy, and added capacity within the digestion facilities could provide for the additional time needed for maintenance and equipment repairs provided they are needed.
- Capital cost for the addition of redundant dewatering capability, either through a second belt filter press or a screw press, will likely require construction of a new dewatering building north of the existing Solids Handling Facility. The expanded dewatering system can be constructed at ground level, with conveyance provided to enable the use of the existing sludge truck loading bay. Regardless of dewatering technology, odor control and service water utilities will be needed in addition to polymer feed. Odor control and service water required will be greater for a belt filter press installation.

Evaluation Criteria	DEW-1 No Action	DEW-2 Added Belt Filter Press	DEW-3 Added Screw Press	Comments
Regulatory Compliance	◑	◕	◕	Continuous dewatering and dewatering redundancy adds safety margin to permit compliance.
Operations/ Technology	◕	◑	◔	A screw press can be operated reliably 24 hours per day and requires less operator attention and wash water.
Compatibility With Site	●	◔	◔	Added dewatering will require a building expansion at the Solids Handling Building.
Implementation	●	◑	◑	Expansion to the Solids Handling Building will require conveyance making solids handling more complex.
Community/ Environmental	◕	◔	◑	Dewatering expansion will require added odor control for new building addition.
Risk	◔	◑	◑	There is no redundancy with the dewatering system, which places more emphasis on maintenance and equipment upkeep.
Cost	●	◑	◑	Addition of screw press requires less odor control and service water.
Total	◕	◑	◑	Addition of screw press offers operation advantages for 24-hour operation.
Numeric Total	4.75	3.25	3.25	

Worse ← ○ ◔ ◑ ◕ ● → Better

Figure 5-16. Summary Comparison of Dewatering Alternatives

5.5 Additional Maintenance Item Identified

The City of Wenatchee recently completed a treatment plant upgrade in 2012. As part of the plant upgrade, a new Screenings Building was constructed that also included upgrades to the influent piping and Pre-aeration Basin (Grit Works) where primary sewage enters the plant. The existing Grit Works was a large covered circular basin where plant influent would pass through an aerated basin prior to being directed to the plant Influent Pumping Station. The air introduced in the Grit Works for freshening purposes also would promote collection of grit within the basin that would be removed by the City (typically once per year). The improvements to the Grit Works included the construction of concrete channels and installation of mechanical bar screens within the basin. These improvements resulted in effective removal of screenings prior to the Influent Pumping Station, but also resulted in the elimination of grit accumulation in the basin.

Since the startup of the new Screenings Building in 2012, the City has not noted a recognizable increase in grit removal from the downstream grit removal basins that are located downstream from influent pumping. As such, there is some concern that grit accumulation may be occurring at the Influent Pumping Wetwell or in channels within the Headworks Building that are also upstream from the grit removal basins. The screened sewage is first directed to the plant Pump Station Wetwell. The Pump Station Wetwell includes two influent channels, approximately 3-feet in width with a manual bar screen in both of the channels. Typically, the City operates both channels at the same time and full manual bar screen functionality remains available. Odor covers were installed on the wetwell and wetwell influent channels in 2012. The active channels discharge to a semi-circular wetwell with an approximate 7-foot water depth when the station is at a full pool condition. The wetwell includes a concrete conical (filleted) bottom, with the pump suction pipelines extending to the center lower cone section. The wetwell currently does not have coarse bubble process air for freshening or mixing, and is covered and ventilated to the odor control system using point source odor collection to minimize the amount of foul air to be treated.

Following pumping, the raw sewage is discharged to the former screenings channels at the Headworks Building. There are two 2.5-feet wide channels that originally included mechanical bar screens that were installed in the midpoint of the channels. The mechanical bar screens were removed in 2012 when the new Screenings Building was placed into service. A small 1-inch supply air line with air diffusers is in installed at the front location of the channels where flow splits to each channel. Freshening and mixing air is not provided the full length of the channels. Once through the former screening channels, raw sewage discharges into the grit removal system influent channel that is equipped with a 3-inch aeration air header with diffusers for freshening and mixing. Flow from the grit influent channel is then directed to the two vortex grit removal chambers.

Depending upon flow conditions, accumulation has the opportunity to occur within the system between the new Screenings Building and the existing Vortex Grit Removal Chambers in the following areas:

- Plant Pump Station Wetwell influent channels
- Plant Pump Station Wetwell
- Former screenings channels, downstream from the influent split chamber beyond where mixing air is provided

It is recommended the City conduct an influent pumping test, where the influent pump station is allowed to fill and operate the station at a high of flow delivery as possible to draw down the wetwell to a low-flow condition. Prior to initiating the test, place a single wetwell channel and single former screenings channel in service. Following drawdown pumping, inspect (both visually and with probes) the three locations noted above for accumulation of grit. Should any of the locations show signs of grit accumulation, consider the following actions:

5.5.1 Plant Pump Station Wetwell Influent Channels

The City is not able to easily operate the wetwell channels where only a single channel is in service at any time and channel configuration does not lend to adding more isolation gates without creating areas where grit accumulation would occur. To prevent grit accumulation during low flow conditions, consideration should be given to installation of a smaller concrete basin (over-sized manhole) outside the treatment plant site in an area where it could be serviced via eductor truck to remove accumulated grit and rocks. Odor control would be necessary at the manhole location using an access manway activated carbon treatment unit. It is also recommended that the City consider installation of concrete channel fillets wherever possible to effectively reduce the channel lower cross section area to increase low flow velocities. Channel velocities for the low flow condition (wetted height) should be set at a minimum of 5-feet per second with concrete filleting that is not extreme enough to create an overflow condition during a peak flow event (12 mgd).

5.5.2 Plant Pump Station Wetwell

Should grit accumulation prove to be problematic at the wetwell, it is recommended that the City implement an automated flushing cycle into the pumping station controls. Alternatively, the City can setup a regular manual maintenance activity to do the same. Given the current odor control strategy, it is not recommended the City consider installation of an aeration system for continuous mixing. Should the regular flushing of the station through pumping not prove to be successful, the installation of a coarse bubble aeration system should be considered which would be operated periodically on a manual basis to scour the wetwell and move the accumulated debris toward the grit removal facilities. The low pressure air supply could be provided by a dedicated positive displacement blower or from a shared blower also serving the former screenings channels.

5.5.3 Former Screenings Channels

The former screenings channels should be operated where only a single channel is in service at any time. Diffused air and odor control ventilation is currently provided at the channels. Should grit accumulation prove to be a problem in the channels downstream from the existing aerated chamber, it is recommended the 3-inch aeration header and diffusers be extended through the full channel length to enable periodic aeration scour of the full length of the channel in operation to move grit to the grit removal chambers. Low pressure air supply is recommended to be provided by a dedicated positive displacement blower that would be located in the Blower Room of the Headworks Facility.

Chapter 6 - Recommended Alternatives

City of Wenatchee

Wastewater Treatment Facilities Plan Update

August 2016

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Contents

Tables

Figures

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Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
AD	Anaerobic Digester	MOP	Manual of Practice
AER	Aerobic	MPN	Most Probably Number
ALK	Alkalinity	MW	Maximum Week
ASP	Aerated Static Pile	NH_4-N	Ammonia as Nitrogen
BFP	Belt Filter Press	NO_2-N	Nitrite-Nitrogen
BNR	Biological Nutrient Removal	NO_3-N	Nitrate-Nitrogen
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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6 Introduction

Aging facilities, higher influent loading conditions, and the need for improved equipment and unit process redundancy are all driving the need for improvements to the City of Wenatchee's wastewater treatment and biosolids management and solids handling facilities. These issues have led the City to complete this Facility Plan for the WWTP and the Biosolids Drying Facility that presents necessary improvements and resource requirements for both facilities. In addition, the plan provides for a long-term master plan while identifying a program for immediate upgrade of the plant to assure permit compliance and meet system redundancy needs. It is anticipated that the recommended plan will satisfy the City's wastewater management needs through the planning year 2035.

6.1 Overview of the Recommended Plan

To meet capacity and effluent quality requirements, the recommended plan includes a number of improvements to the liquid treatment and solids handling processes at the WWTP, and plans for expansion of the Biosolids Drying Beds Facility to provide for necessary system capacity as needed in the future. Based on a detailed evaluation of feasible alternatives, these improvements were found to be the most cost-effective solutions to the City's near-term and long-term needs at both locations.

All of the recommended improvements involve ordinary, commonly-used wastewater treatment technologies. To a large degree, the existing unit processes at the wastewater treatment plant have sufficient capacity to serve the City of Wenatchee through the planning period; however, several unit processes are reliant on all process units on-line during peak flow and loading periods which limits when maintenance activities may occur and places stress on the plant treatment capabilities should an unplanned process unit shutdown be required during a peak loading event. The plan involves continuing current primary treatment and sludge processing, an upgrade and expansion of the secondary clarification and RAS flow control system, upgrade and expansion of WAS thickening facilities and an increase in digestion capacity.

The plan will utilize treatment processes already in use at the Wenatchee plant, and adds unit process redundancy in the identified key process areas to strengthen the existing successful operations. To address all potential effluent disinfection violations, the existing system will require an upgrade to the UV equipment to provide for the needed rated nominal capacity of 11 mgd. This program allows the City to provide the necessary improvements at the plant in a timely manner without creating an overly complex construction management program.

6.2 Consequences of Inaction

Failure to implement the recommended improvements in a timely manner could have significant adverse impacts on the City of Wenatchee, including:

- Non compliance with discharge permit requirements for disinfection
- Water quality impairment of the Columbia River
- Inability to handle wastewater generated by the community, primarily during peak loading conditions
- Inability to handle the projected waste biosolids generated by the community

These consequences could likely lead to regulatory enforcement actions and fines, and could result in a moratorium on construction within the City's service area.

6.3 Planning Projections

Developing realistic flow and loading projections is crucial to defining the facilities and space required for near-term and longer-term planning conditions. In collaboration with the City project team, a comprehensive update of flow and loading projections (that also included consideration of possible additional industrial loads) was developed in Chapter 2. This effort resulted in the flows and load projections presented in Table 6-1 and Table 6-2 below. The results indicate that the average plant flow will be 3.56 mgd at the planning year of 2035, with maximum month and peak flows of 4.09 mgd and 10.51 mgd respectively. The higher value has been used for space planning at the treatment site, and the maximum monthly loadings were used for capacity evaluation of the secondary treatment process.

Table 6-1. 2035 Flow and Load Projections (rounded)

Parameter	Unit	Average	Maximum Month	Maximum Week	Maximum day	Peak Hour [a]
Flow	mgd	3.56	4.09	4.35	4.74	10.51
TSS	lb/d	14,400	21,500	27,300	34,100	-
VSS	lb/d	13,200	19,800	25,200	31,700	-
BOD	lb/d	11,400	14,200	16,100	18,000	-
TKN	lb/d	1,400	1,600	1,650	1,725	-
NH_4-N	lb/d	860	990	1,060	1,130	-

[a] Based upon the firm pumping capacity of the Raw Sewage Pumps (Primary Influent). All flows in excess are directed to the flow equalization basin.

Table 6-2. Maximum Month Flows and Loads 2015-2035

Parameter	2015	2020	2025	2030	2035
Flow (mgd)	3.03	3.30	3.56	3.79	4.09
TSS (lb/d)	16,000	17,400	18,800	20,000	21,500
VSS (lb/d)	14,700	16,000	17,300	18,400	19,800
BOD (lb/d)	10,600	11,500	12,400	13,200	14,200
TKN (lb/d)	1,175	1,300	1,400	1,475	1,600
NH_4-N (lb/d)	740	800	870	920	990

With exception of the UV Disinfection system, currently all unit processes at the wastewater treatment plant site have capacity to meet the projected 2035 flow and loading conditions.

6.4 Driving Forces

The key driving forces behind the recommended improvements are summarized below.

6.4.1 Change in Plant Loadings

The City of Wenatchee completed a review of plant influent flows and loads using data going back to 2008. In 2012, the City completed a facility upgrade that added influent screening in front of the Influent Pumping Station that modified the location of influent sampling. The results of the review showed that the (measured) influent composition changed significantly following the 2012 improvements, and a higher influent TSS is apparent. This higher TSS loading, likely a result of the industrial and commercial fraction, does have a greater impact on peak capacity of the primary clarification system where process redundancy becomes more important during peak loading events.

6.4.2 System Redundancy

Available unit process redundancy is limited with the primary sludge, secondary clarification, secondary solids thickening, dewatering and digestion processes and scheduling of regular maintenance activities must occur during non-peak flow and loading events. As noted above, higher TSS loadings to the primary clarification system will place additional stress on the primary clarifiers and downstream unit processes. Presently, the primary clarifiers have adequate capacity for the 2035 planning horizon; however, Primary Clarifier No. 2 (65 ft diameter) alone will exceed the recommended average loading rate by the year 2030. Dedicated primary sludge pumps serve each primary clarifier without pumping unit redundancy. In addition, operations staff must manually control primary sludge and scum pumping using the two dedicated primary sludge/scum pumps that provide dual service at each clarifier.

Capacity is adequate in the secondary treatment aeration basins and aeration blower system, and some spare capacity is available. This spare capacity can be used for accommodating higher loading from the primary clarifiers for short durations. The secondary clarification system meets the requirements of the Ecology Orange Book for system redundancy, yet at higher loadings the secondary clarifier capacity is vulnerable if one clarifier is removed from service for maintenance.

Due to the capacity limitations with the UV Disinfection system noted below, system redundancy with the UV Disinfection unit process is limited and the City is implementing equipment modifications and will also utilize the flow equalization basin during peak flow events. The anaerobic digestion process for both primary and secondary (WAS) digestion has adequate capacity, only if all digester tanks are in service. However, there is no available spare capacity should either Primary Digester No. 1 or Secondary Digester No. 3 (larger digester basins equipped with heating) need to be removed from service for maintenance. In addition, secondary Primary Digester No. 2 is not fitted with heating or mixing, and is not able to serve as a redundant unit to Primary Digester No. 1.

Digestion system redundancy is needed to assure protection is provided to the dewatering and solids drying processes in the event a digester must be removed for maintenance (planned or unplanned) or cleaning.

The biosolids WAS gravity belt thickener is a single unit with no redundancy available. Similarly, the biosolids dewatering belt filter press is a single unit with no means for unit redundancy.

6.4.3 Age and Condition

The City recently upgraded the influent screening, influent pumping, primary clarifiers and primary sludge/scum pumping, aeration basins, UV disinfection and digester gas handling facilities. A number of the treatment facilities still remain in operation that are 15 years old (or older), and technically are nearing the end of their useful life. Although there are really no plant components suffering from deteriorated condition, several items should receive greater consideration for system redundancy to enable the City to effectively implement maintenance upgrades when needed. These items include the secondary clarifier mechanisms, secondary RAS flow control gates, secondary (WAS) thickening belt thickener, biosolids dewatering belt filter press, digester system including a hot water boiler, digested sludge recirculation and feed pumping and thickened sludge pumping. It is recommended the City plan for construction of a backup unit to their gravity belt WAS thickener due to its age that is in excess of 25 years.

6.4.4 Process Improvements

Some process improvements will reduce operational costs and/or delay the need for capacity expansions in other portions of the treatment systems. By increasing the amount of primary and secondary sludge thickening, added capacity is automatically generated in the downstream solids digestion and dewatering processes. Investing in these improvements will reduce the overall cost to operate the WWTP.

6.4.5 Capacity Limitations

Based on the planning projections presented above, the UV Disinfection system currently is rated at a peak capacity of 7.5 mgd. The UV system is not able to serve the peak hour design condition of 10.51 mgd (nominal 11 mgd). Careful operation of the existing flow equalization basin and modifications to the existing system should be implemented

The capacity of the digestion facilities does not allow for regular maintenance activities when a digester must be removed from service for cleaning or routine maintenance, and the digestion system and downstream solids processing processes are vulnerable should unplanned repairs be required in any of the three existing digesters. The capacity of the biosolids drying beds is based upon the space needed to assure compliance with the City's Class A Treatment Method under WAC 173-308-170. Because of the need for careful materials control, protection from co-mingling of treated biosolids during drying, sampling times required for treatment verification and storage of treated material for contract haul, the City will need additional drying bed area to meet projected solids loadings for the planning period to year 2035.

6.4.6 Good Neighbor Considerations

Residential and commercial development is encroaching on the WWTP. To ensure the long-term viability of this site for wastewater service, the City recently invested in significant visual and odor control improvements at the site to enhance the interface between the treatment facilities and surrounding uses. Additional process enhancements and redundancy improvements included as part of this plan will ensure the City is able to maintain their good neighbor policy for the WWTP campus.

6.5 Treatment Plant Elements of the Recommended Plan

The following sections include the recommended facilities improvements or process enhancements for each unit process at the wastewater treatment plant that were identified in Chapter 5 for further consideration and evaluation. In each case, the long-term recommendation is presented following by a listing of specific improvements needed to address the recommended upgrade. The specific improvements are designed to provide adequate capacity and operations flexibility for a nominal flow of 4.09 mgd (peak flow of 10.51 mgd), meaning the facilities should provide adequate treatment capability for the next 20-years.

6.5.1 Primary Clarification

The conventional circular primary clarifiers will continue to provide good performance for primary treatment. Both clarifier mechanisms have recently been painted and the clarifier basins and associated odor control covers are in good condition. Primary sludge will continue to be withdrawn from the clarifiers, thickened to a minimum of 4 percent dry weight solids within the clarifier basins. Primary clarifier capacity is such that, during required clarifier maintenance, both basins may serve as redundant to each other. During peak loading events when a single clarifier is on operation, available secondary treatment capacity would be used to treat any loading not captured by the clarifier.

Primary sludge and scum will continue to be withdrawn from each of the clarifiers using dedicated pumping units. The primary sludge and scum pumps were recently replaced, and are in good working condition. Similar to the primary clarifiers, the primary sludge and scum pumps may serve as redundant units to each other.

Based upon the above, there are no additional recommended improvements for the primary treatment facilities.

6.5.2 Secondary Clarification and RAS Flow Control

The process recommendation for secondary treatment is to operate the existing aeration basins and blower facilities in their current mode of operation. This configuration provides the lowest-cost approach to reliably meet the current and projected effluent limits. The activated sludge process will be used to handle higher organic loading rates in the event a primary clarifier is removed from service during peak loading events. The aeration basins and secondary clarifiers have adequate capacity to year 2023 with only a single clarifier on-line. The treatment capacity requirements, coupled with added loading from the primary treatment facilities, make installation of a third clarifier necessary. In addition, clarifier unit redundancy is strongly suggested to ensure secondary treatment capacity can support both primary treatment and aeration basin maintenance activities.

Return activated sludge pumping has a firm capacity of 2.7 mgd, which translates into a maximum RAS rate of 67 percent at 2035 maximum month flows. Although not a high priority, additional RAS pumping is recommended to be added during the planning period when equipment replacement becomes necessary with the existing RAS pumping units.

The recommended facilities for Secondary Clarification and RAS flow control are as follows:

- Construction of a third new 80-foot diameter clarifier with a perimeter launder, and connection of the clarifier to the existing secondary treatment gravity RAS flow control system. The clarifier would include center feed and a spiral sludge collection mechanism, similar to the two existing clarifier units.
- Construction of new yard piping facilities to direct aeration basin effluent to the new clarifier location. This would include extending a 30-inch diameter secondary clarifier influent (WS) pipeline from the existing aeration basin Effluent Junction Box. Connection to the existing junction box would require core drilling the existing effluent box on its north wall which would be accomplished during a short duration shutdown of flows to the secondary treatment process by directing plant influent flow to the existing plant equalization basin and an empty primary clarifier. The clarifier influent pipeline would be extended north along the existing plant access road to the clarifier center well via a pipeline buried under the clarifier floor, similar to the existing clarifier configuration.

- Construction of secondary clarifier effluent piping from the clarifier effluent launder, via a 30-inch secondary clarifier effluent pipeline, to the east side of the UV Disinfection Building. At the UV Building, it would be connected to the east wall of the UV Disinfection influent channel via a concrete core drill penetration. Connection to the UV channel would be scheduled to be completed at the same time the secondary treatment process is idle while the connection of the secondary influent pipeline to the aeration basin Effluent Junction Box is completed.
- Connection to the existing gravity controlled RAS system that utilizes downward acting weir gates for RAS flow control. A third RAS pipeline and downward acting weir gate would be installed on the east side of the waste sludge recirculation box using a stainless steel weir box. The weir box would be an extended box installed on the east outside wall of the recirculation structure, and would require a sawcut opening in the recirculation box east wall. The sawcut opening in this location would be positioned at the centerline of the existing clarifiers immediately above the current non-potable water pumping wetwell. The existing RAS pumping system would be utilized for RAS recirculation without the addition of another RAS pumping unit. Full system redundancy is still provided with this pumping arrangement when considering the full forward flow of the secondary treatment process, but the percent return rate through each clarifier will be reduced when all three secondary clarifiers are in operation. The cascade flow control of the RAS system would be modified to accommodate a third downward acting gate, and flow split between clarifiers would be controlled by the number of clarifiers active online. Additional RAS pumping capacity would be added as noted above.
- Direct secondary scum from the clarifier launder via a secondary scum pipeline routed in the abandoned chlorine contact channel for Secondary Clarifier No. 1. The scum pipeline would be connected to the abandoned 6-inch drain from the Secondary Clarifier No. 1 chlorine contact channel that currently extends to the Secondary Scum Pit.

6.5.3 Ultraviolet Light Disinfection

The existing WEDECO TAK 55 UV system was reviewed using a third party bioassay supported validation equation. In addition, the original equipment manufacturer conducted a field evaluation. These efforts resulted in a revised rated capacity of 7.5 mgd for the existing system without modifications. Recommended improvements to the UV system include:

- Upgrade to the existing UV system control philosophy and installation of continuous UVT monitors to comply with the current validation algorithm.
- Replacement of City purchased spare parts for the UV channel level control gates to provide for more stable operation of the gates during changing hydraulic conditions.

6.5.4 Primary Sludge Thickening

The process recommendation for primary sludge thickening is to continue with thickening within the existing primary clarifier basins. It is recommended that the pumping of primary sludge be closely monitored to assure that clarifier solids delivered to the primary digester be maintained at 4 percent dry weight solids, or greater.

There are no additional recommended improvements for primary sludge thickening.

6.5.5 WAS Thickening

The waste activated sludge thickening process, which utilizes a single 2 meter gravity belt thickener, does not operate on a continuous basis. In addition, equipment redundancy is not available mandating direct wasting of the waste activated sludge from the secondary treatment process when the gravity belt thickener is removed from service for maintenance. The existing gravity belt thickener is in good operating condition, but is 25 years old and backup for the aging equipment will eventually be needed. Further, the City could better facilitate process control by enabling continuous wasting over a 24 hour period. It is recommended that the City plan for the installation of a rotary screen thickener (RST) within the new Digester No. 4 Control Building associated with a new Digester No. 4. Installation of the RST will also provide the needed process unit redundancy. In addition to thickening of WAS, the RST has the ability to also thicken primary sludge and recuperative thicken the contents of either the primary or secondary digesters.

The recommended facilities for WAS thickening are as follows:

- Installation of a rotary screen thickener (RST) sized for 80 gpm and 9,450 lbs/d solids loading. The RST would be located in a separate dewatering room addition to the existing Solids Handling Building or within a new control building for Digester No. 4.
- Installation of new RST feed pumping units configured to draw from WAS Digester No. 2. In addition, the RST feed pump suction piping will be configured to enable drawing from Primary Digesters No. 1 and No. 2 and new Digester No. 4 for using the RST as a recuperative thickening unit.
- Installation of a thickened sludge hopper and thickened sludge pumps located under the RST unit that are capable of pumping to all digesters. The pumping units will be sized to enable continuous feed to the digesters for stable sludge feed delivery to digestion.
- Installation of an elevated RST operating platform to allow easy access to the RST for operation and maintenance.
- Installation of a dedicated polymer feed unit for support of the RST. Polymer consumption is relatively small for RST operation, and it is envisioned that polymer will be provided using totes or a small dry preparation unit. Emulsion polymer supplied in totes is recommended.
- Installation of point source odor control ventilation from the RST unit and associated thickened sludge hopper and connection into the existing odor collection system located within the existing Solids Handling Building.

6.5.6 Digestion

The digestion systems capacity currently does not provide for removal of any of the digesters for routine maintenance or repairs. The City currently operates their digestion facilities where primary and waste activated (secondary) sludge are digested separately. This operation has served the City well, and has enabled operations staff to avoid digester upsets and problems associated with digester foaming. The City prefers to continue operating under this scenario for process stability reasons, and also prefers to continue to batch waste during normal operating hours.

For the reasons stated above, it is recommended that the City construct additional digestion capacity that would include:

- Construction of a fixed cover Digester No. 4 with a digester diameter and side water depth that matches existing Digester No. 3 (45-feet diameter and 25-feet side water depth).

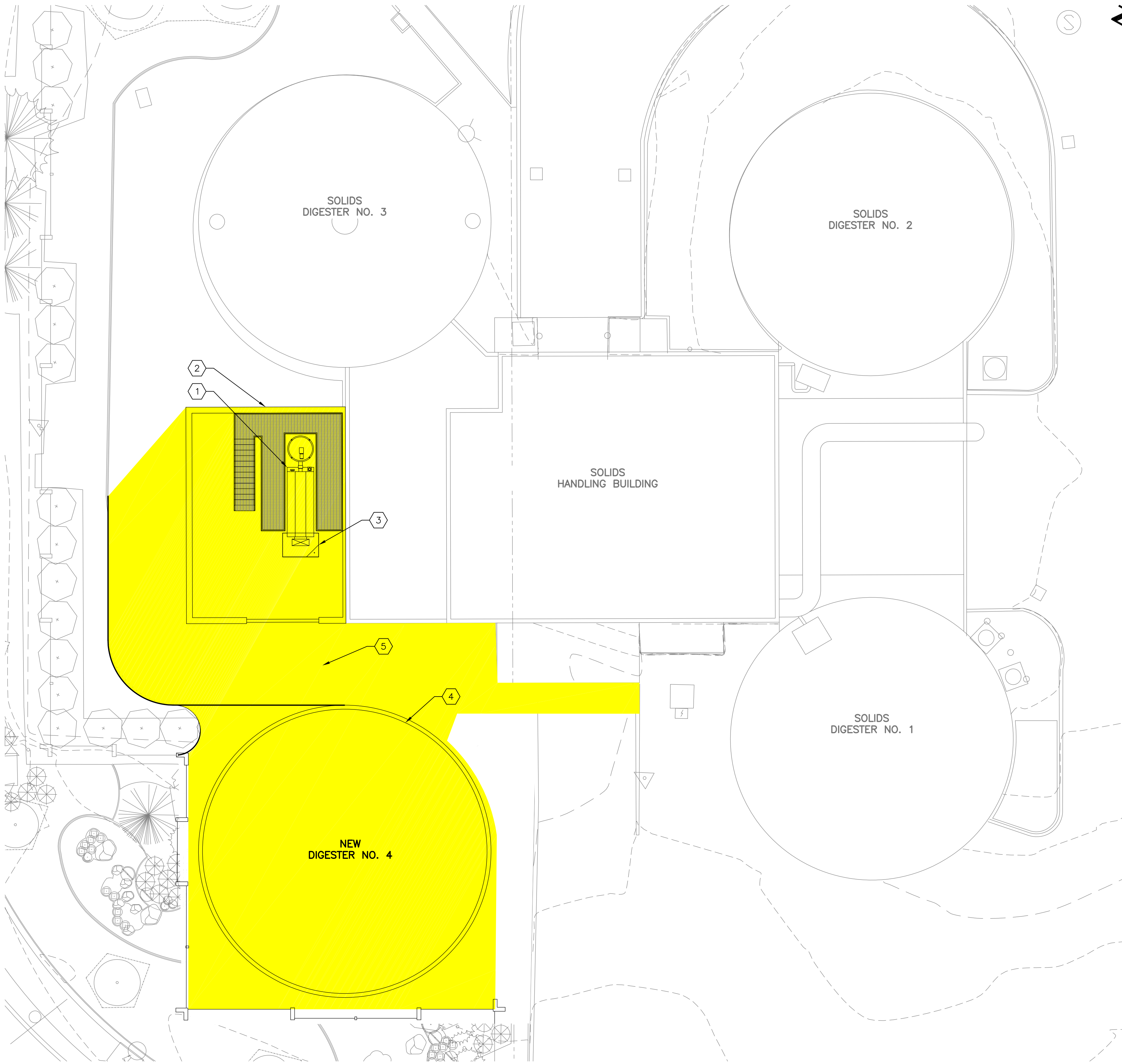
- Construction of a Control Building for Digester No. 4 that houses an additional hot water boiler, pumped mixing systems and foam suppression systems. It is recommended that the digester be constructed as a fixed cover digester with gas holding capability within its headspace that will also enhance foaming control.
- Construction of the Digester No. 4 Control Building with sufficient space to enable the installation of a Rotary Screen Thickener (RST) in the future for provision of redundancy in the WAS thickening operation and also for recuperative thickening of all digesters.
- Installation of digester feed and recirculation piping to enable transfer of contents from any digester to the other digesters on site and to enable full redundancy of digester tankage.
- Installation of gas handling and odor control facilities to support the new digester and RST dewatering system.
- Installation of site improvements and exterior architectural features to match the recent architectural theme established during the recently completed Odor Control and Visualization Improvements Project.

6.5.7 Dewatering

The existing belt filter press is in good operating condition, and City operations and maintenance personnel are comfortable with its operation. The City does not have unit redundancy for the belt filter press and the press is approximately 25 years old. However, the City has routinely replaced wear parts and maintenance items and useful life is still available with the equipment. Added digestion capacity, through additional digester tankage volume and future recuperative thickening of existing digester contents, will enable storage within the digestion unit processes to allow maintenance or repair of the belt filter press.

There are no additional recommended improvements for biosolids dewatering.

The recommended improvements for the wastewater treatment plant are shown on Figure 6-1 and on Figure 6-2.



KEY:

NEW UNIT PROCESS STRUCTURE

KEY NOTES:

1. NEW 36 FT X 26 FT THICKENING BUILDING WITH 10 FT X 12 FT OVERHEAD DOOR AND ODOR CONTROL
2. RST UNIT
3. THICKENED SLUDGE HOPPER
4. NEW DIGESTER NO. 4
5. ASPHALT PAVEMENT MODIFICATION

PARTIAL PLAN – NORTH

1" = 20'-0"

HDR

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee

WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 6-1
RECOMMENDED IMPROVEMENTS PLAN
SOLIDS THICKENING AND DEWATERING

0 1" 2"

FILENAME 6-1.dwg

SCALE AS NOTED

FIGURE 6-1

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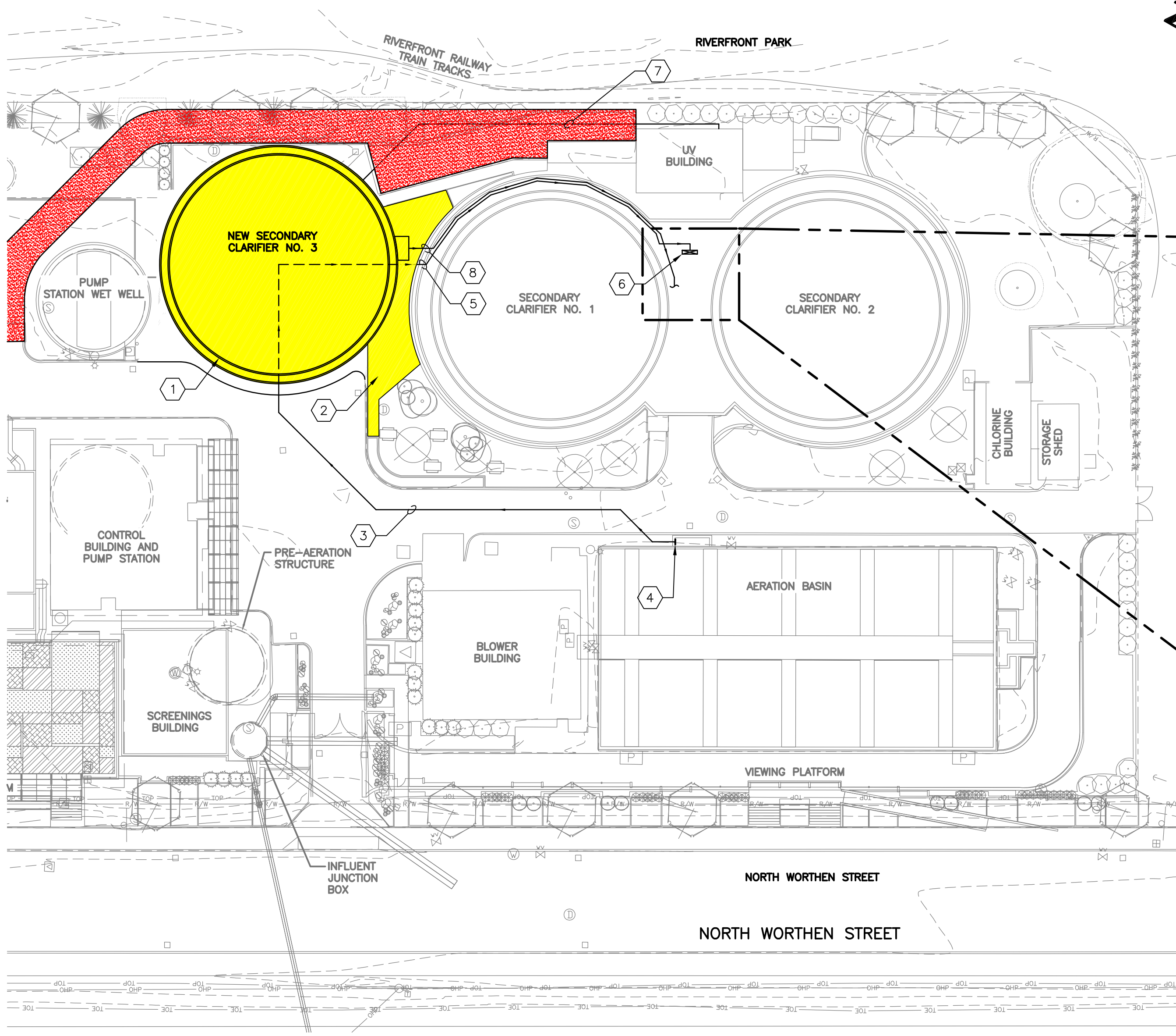
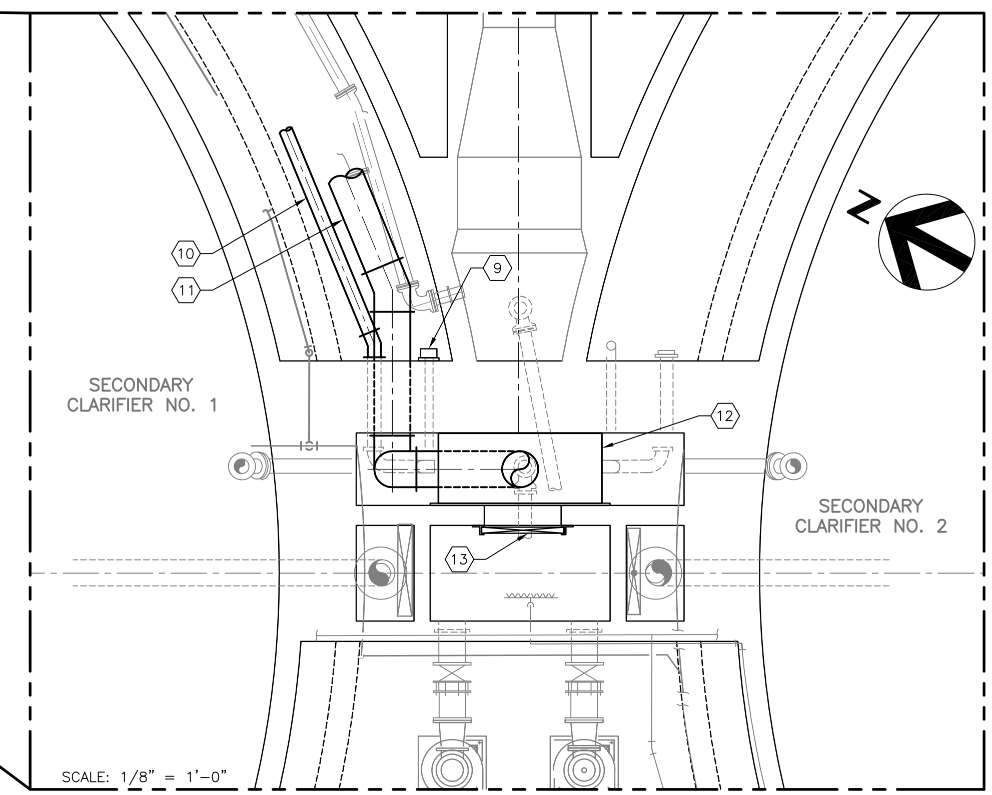


PARTIAL PLAN – SOUTH

1" = 60'-0"



KEY NOTES:

1. NEW 80' DIAMETER SECONDARY CLARIFIER
2. CONCRETE WALK/PAVEMENT
3. 30 INCH WS (AERATION BASIN EFFLUENT) PIPELINE
4. 30 INCH SLIDE GATE
5. 18 INCH RAS PIPELINE (VIA ABANDONED CHLORINE CONDUIT CHANNEL)
6. RAS FLOW CONTROL GATE
7. 30 INCH SE (OUTFALL PIPELINE)
8. 6 INCH SECONDARY SCUM TO SCUM PIT (VIA ABANDONED CHLORINE CONDUIT CHANNEL)
9. INSTALL FLANGE BACK DRAIN GATE ON 4 INCH SCUM PIPELINE
10. 6 INCH SECONDARY SCUM EXTENDED IN ABANDONED CHLORINE CONTACT CHANNEL, CONNECT TO 6 INCH DRAIN
11. 18 INCH RAS PIPELINE EXTENDED IN ABANDONED CHLORINE CONTACT CHANNEL
12. FABRICATED ALUMINUM WEIR BOX CONNECTED TO THE 10 INCH RAS PIPELINE FROM NEW CLARIFIER NO. 3
13. DOWNWARD ACTING RAS FLOW CONTROL GATE

KEY:

- NEW UNIT PROCESS STRUCTURE (yellow)
- REVISED LANDSCAPING FOR UV BUILDING ACCESS (red)

HDR

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee

WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 6-2
RECOMMENDED IMPROVEMENTS PLAN SECONDARY CLARIFIER AND RAS CONTROL

0 1" 2"

FILENAME 6-2.dwg

SCALE AS NOTED

FIGURE 6-2

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6.6 Biosolids Drying Beds Facility Elements of the Recommended Plan

The City's Class A biosolids processing is evaluated in detail in Chapter 4. The storage evaluation showed that, when operating under the current Class A treatment process, the City has the greatest amount of options for solids processing at the lowest operating cost. The evaluation also showed that a total of 8.2 beds would be required for the City to produce Class A biosolids at the planning period 2035 biosolids loading condition. Therefore, the facility may need up to nine drying beds. Because the assumptions used in the estimation, e.g., future projected biosolids loading, adjusted evaporation data, and available storage volume in each bed, could be more conservative than the actual conditions in the future, it is recommend that the City plan for eight drying beds for the planning period. The existing facility currently includes approximately half the required capacity for the planning period, mandating the existing facility be doubled in capacity.

The City should continue to monitor biosolids loading to the facility and the beds drying capacity annually to verify 8 beds will be required at future loading condition. The existing drying bed configuration works well for maintaining integrity of the solids management on the site, and the physical condition of the drying beds is good. The stormwater management lagoon associated with the process is fitted with an impervious membrane liner that appears to be in good working condition. The liner facility is older and should be monitored for eventual replacement when it reaches the end of its useful life.

Expansion of the drying beds could be implemented in phases to provide for needed additional capacity just ahead of when it is required. However, construction of the new facilities involves work activities (earthwork and excavation of pond facilities, construction of a second lined stormwater retention facility and paving) all of which are not cost effectively phased. Therefore, it is recommended that the City plan for doubling the capacity of the Biosolids Drying Beds Facility at a time when the City can complete the expansion under a single construction project.

The recommended expansion improvements for the Biosolids Drying Beds Facility are as follows:

- Construction of four additional biosolids drying beds located in a mirrored fashion immediately east of the existing drying beds. This configuration will allow efficient operations for solids handling equipment and will promote avoidance of co-mingling of processed and non-processed materials. It has been assumed that the City will not be required to purchase additional property to provide for the added Biosolids Drying Beds Facility capacity.
- Construction of an additional Class A storage bed to enable storage of finished material separately from the drying beds similar to the existing facilities.
- Construction of a second stormwater retention facility that will operate using evaporative disposition similar to the existing stormwater facility. The retention facility will also be mirrored with the existing facility as a separate pond from the existing facility.
- Extension of the existing perimeter fence around the new facilities.
- Paving of the new access road and drying beds.

The recommended improvements for the Biosolids Drying Beds Facility are shown on Figure 6-3.

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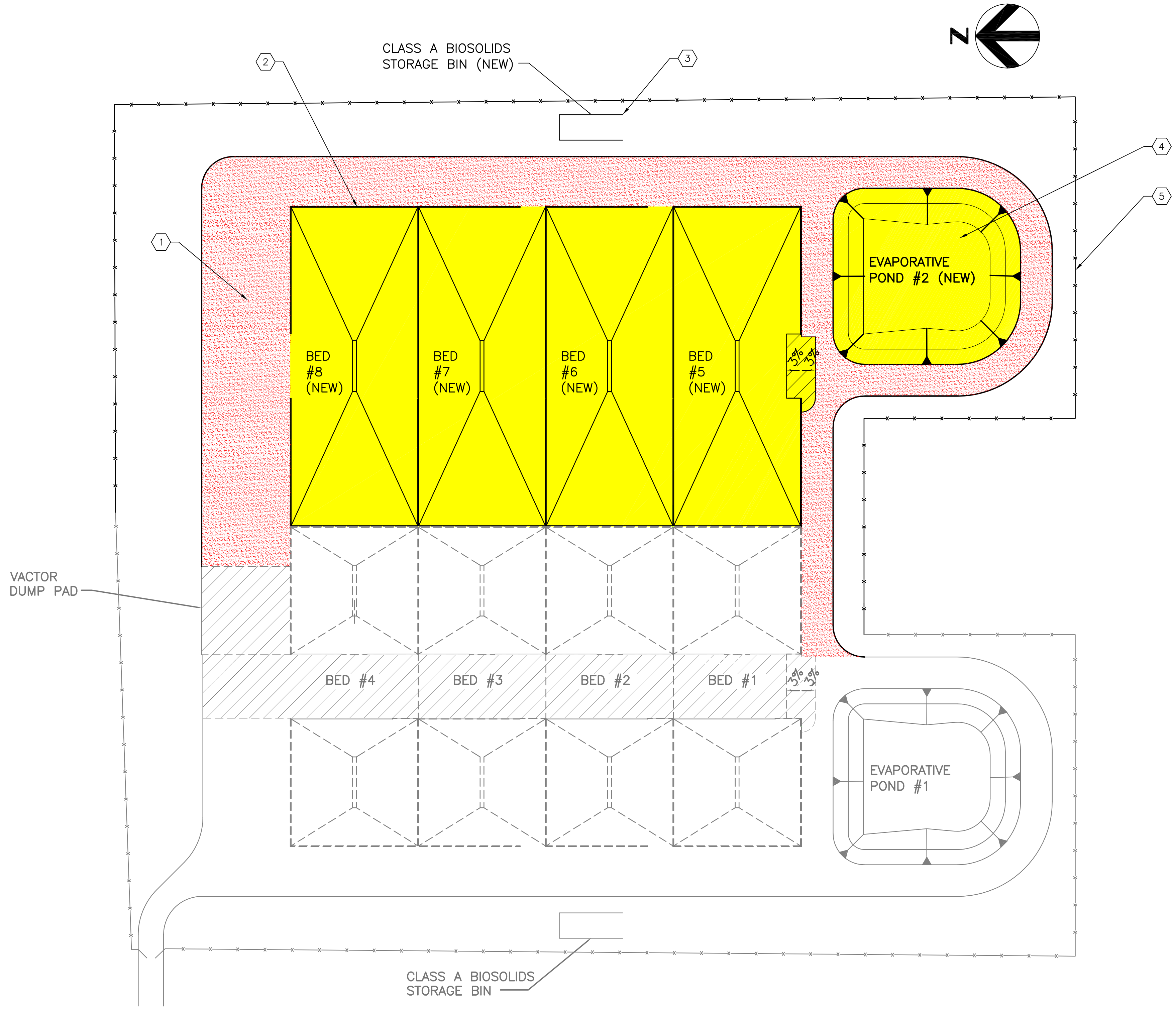

PLAN
1" = 100'-0"

KEY:

- NEW UNIT PROCESS STRUCTURE
- NEW ASPHALT ACCESS

KEY NOTES:

1. NEW ASPHALT PAVEMENT ACCESS
2. NEW DRYING BED EXPANSION WITH ENHANCED ACCESS
3. ADDITIONAL CLASS A BIOSOLIDS STORAGE
4. EXPANDED EVAPORATION POND FOR STORM WATER MANAGEMENT
5. SITE PERIMETER FENCE ADDITION.

ISSUE	DATE	DESCRIPTION	PROJECT MANAGER
			PROJECT NUMBER

City of Wenatchee
WASTE WATER TREATMENT PLANT IMPROVEMENTS

FIGURE 6-3
RECOMMENDED IMPROVEMENTS PLAN
SLUDGE DRYING BEDS

FILENAME 6-3.dwg
SCALE AS NOTED
FIGURE 6-3

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6.7 Additional Elements

The City has identified that accumulation of grit is occurring in the treatment plant downstream from the recently constructed Screenings Building, as a result of the removal of the former Pre-aeration Structure (Grit Works) during the City's Odor Control and Visual Mitigation Project. Grit that previously accumulated in the grit Works was periodically removed via a vacuum eductor truck does not appear to be accumulating in the existing Grit Removal Basins and is accumulating in the Influent Pump Station Wetwell and Grit Removal Basins influent channels. To address this unintended consequence from the previous plant modifications, it is recommended that the following operational and physical improvements be implemented and/or constructed:

- City conduct an influent pumping test, where the influent pump station is allowed to fill and operate the station at as high of flow delivery as possible to draw down the wetwell to a low-flow condition. Prior to initiating the test, place a single wetwell channel and single former screenings channel in service. Following drawdown pumping, inspect (both visually and with probes) the three locations noted above for accumulation of grit. This will better determine where grit accumulation is the greatest and help operations staff understand where to focus future operations actions.
- Install a smaller concrete basin (over-sized manhole) outside the treatment plant site in an area where it could be serviced via vacuum truck to remove accumulated grit and rocks. Odor control would be necessary at the manhole location using an access manway activated carbon treatment unit.
- Consider installation of concrete channel fillets wherever possible to effectively reduce the channel lower cross section area to increase low flow velocities. Channel velocities for the low flow condition (wetted height) should be set at a minimum of 5-feet per second with concrete filleting that is not extreme enough to create an overflow condition during a peak flow event (12 mgd).
- Given the current odor control strategy, it is not recommended the City consider installation of an aeration system for continuous mixing. The installation of a coarse bubble aeration system should be considered which could be operated periodically (on a manual basis) to scour the wetwell and move the accumulated debris toward the grit removal facilities via the influent pumping system. The low pressure air supply could be provided by a dedicated positive displacement blower or from a shared blower also serving the former screenings channels. It is assumed a separate blower will be provided for each application to avoid impacts to the existing site surfacing.
- Operate the former screenings channels where only a single channel is in service at any time. In addition, install a 3-inch aeration header with coarse bubble diffusers that is extended through the full channel length of both screenings channels. This would enable periodic aeration scour of the full length of the channel in operation to move grit to the grit removal chambers. Once again, the low pressure air supply that is needed for this improvement is recommended to be provided by a dedicated positive displacement blower that would be located in the Blower Room of the Headworks Facility.

6.8 Site Layout

The recommended site layout plans for the construction of the new Secondary Clarifier and Digestion facilities within the existing treatment plant site along the east side of Worthen Street. No additional property is needed to be purchased, and new facilities are not planned on the City's property located on the west side of Worthen Street at this time. Modifications to the site landscaping and visual mitigation amenities that were constructed in the City's last project will need to be modified to allow construction of the new Digester No. 4, Digester Control Building and new Secondary Clarifier.

It is recommended that the site restoration re-capture as much of these visual mitigation features as part of the new facility design. A pervious paver system is also recommended to be installed along the east site boundary in the vicinity of the UV Disinfection Building to enable the necessary construction of improvements and also assure necessary facility access for operations and maintenance is provided in the future.

6.9 Implementation

Successful implementation of the recommended plan requires resolution of both the technical and financial aspects of the project. Technical items identified with the recommended improvements that must be carefully considered throughout the improvement implementation period include:

- **NPDES Permit.** Chapter 2 provides a summary of the City's current Effluent Quality Permit that became effective on September 1, 2010. The requirements of the City's Effluent Permit remained essentially unchanged from previous permits and significant changes for the future permit are not expected. The City's permit will be updated during the implementation of the recommended improvements. It is recommended that the City continue to closely track water quality requirements for the Columbia River that could have longer-term impacts on future permit cycles.
- **Biosolids management.** The City's current Class A biosolids treatment process follows methods approved by the USEPA and Ecology in the City's General Permit Dated October 31, 2012. Although the City does also have the ability to produce Class B biosolids, the City prefers to meet the conditions set forth in their approved process for further reduction of pathogens (PFRP) that can be started between May 1 and September 30 in any given year. As biosolids quantities continue to increase, the City needs to carefully plan for the expansion of the drying bed area and site management of biosolids to assure there is no compromise to the integrity of the Class A product produced or inability to properly process biosolids transferred to the site in any give year (during the allowed processing time during the year).
- **Potential Industrial Loads.** Table 2-12 of Chapter 2 presents a list of known potential additional industrial loads that the City has identified as potential significant industrial loads. The development of these significant loads within the planning area are uncertain, and highly unpredictable. The City has included an industrial component in the flows and loads used for the basis of planning, but has not included the added impact of these loads on the available plant capacity. Therefore, the City needs to closely evaluate the impact of any large industry that develops during the implementation period. Preliminary treatment prior to discharge to the City's treatment facilities should be considered.

- **Land acquisition and land use.** The recommended plans for both treatment plant site and the Biosolids Drying Beds Facility have assumed that no additional land acquisition will be required for implementation of the plans. The treatment facility site is limited in available space for construction activities, and project phasing and construction planning will very likely need to account for off-site storage and staging. The City's current long-term use arrangement for the Biosolids Drying Beds Facility site will need to be modified to accommodate the recommended drying beds addition, and careful consideration of site use limitation will need to be planned for during the final design of the recommended facilities.
- **Site geotechnical.** Construction activities at the wastewater treatment plant site have routinely encountered subsurface debris from historic landfilling operations that occurred in the area along the Columbia River prior to the original construction of the wastewater treatment plant. This debris not only requires special care and handling for off-site disposition, but also can have significant impact on shoring operations necessary for construction of new facilities on such a congested site. Careful consideration of the likelihood of encountering refuse and debris during excavation activities need to be included in the project geotechnical planning.
- **Facility aesthetics and landscape buffer.** The City of Wenatchee recently completed a comprehensive improvement of the wastewater treatment plant that incorporated visual mitigation, art and decorative lighting and perimeter landscape buffering and landscape features. New construction activities on site will require removal of some of these aesthetic amenities during construction of new process units. Reclamation and restoration activities for the recommended improvements need to be completed in a manner where landscape features are returned to an equal or better condition. Residential and commercial development is encroaching on the City's treatment plant site. To assure the long-term viability of the site for wastewater service, the City has identified the importance of their good neighbor policy for the site. Improvements will continue to be needed to enhance the interface between the treatment facilities and surrounding uses.
- **Odor control.** The recent odor control and visual mitigation improvements project the City completed at the wastewater treatment plant site planned for future digestion facilities to be incorporated into the new foul air collection and treatment system. During detailed preliminary and final design of the recommended solids handling facilities, odor control for any new foul air sources need to be considered. The odor control system does not currently include collection and treatment of air from secondary treatment units, and continuance of this design philosophy is recommended.
- **Staffing.** A detailed staffing evaluation has not been conducted as part of this facilities planning effort. The modifications recommended to the treatment pant processes will provide for better process redundancy and improve maintenance and operations conditions at the site. The recommended improvement do not increase capacity, but provide for better process flexibility and reliability. The City currently closely monitors staffing needs and will continue to do so as the flows and loadings increase to the treatment facility. There are no recommended staff additions directly attributed to the improvements recommended at the treatment pant, and decisions on staff changes are recommended to be made through continued monitoring.

  Similarly, operations at the Biosolids Drying Beds Facility are reported to be appropriate for the City's current solids hauling and processing needs. It is recommended that the City continue to monitor staff requirements as loading to the facility gradually increases and make staff augmentation determinations based upon reporting from current operations and maintenance staff.

- **Ecology review.** The initial evaluation of the treatment plant performance data during the development of Chapter 2 identified significant differences in the influent total suspended solids (TSS) received at the treatment plant. The project team determined this difference was, in part, attributable to the changes made in the sampling location and screenings system completed as part of the City's Odor Control and Visual Mitigation Project. Because of the difference in data, the City decided to delay completion of this Facilities Plan to collect additional data for use in the basis of planning that is now presented as part of Chapter 2.

  The data indicates that the influent wastewater is approaching 85% of the TSS loading presented in the City's NPDES permit for rated capacity. This finding has elevated the need for the City to complete the facilities planning effort. Chapter 3 presents the City's recent evaluation of the plant process unit capacity, and Chapter 5 addresses an alternative evaluation of improvements considered for the facility over the planning period to year 2035. The information included in Chapters 3 and 5 of this plan form the rating study required by Ecology for any proposed changes to the wastewater treatment facility.

  A draft copy of the Facilities Plan will be provided to Ecology for review. Following their review, the City and HDR will meet with Ecology to discuss their comments and questions. The final copy of the Facilities Plan will incorporate the remaining outstanding comments following the review meeting. The SEPA environmental checklist for the recommended plan is provided in Appendix C of Chapter 7, and the City of Wenatchee will fully comply with the requirements of the Washington State Environmental Policy Act that are necessary for implementation of the recommendations provided in this report.

6.10 Cost and Project Phasing

The costs associated with the improvements presented in this Chapter, in addition to the recommended phasing of the improvements, are presented in Chapter 7 of this Facility Plan.

Chapter 7-Capital Improvements Plan

City of Wenatchee

Wastewater Treatment Facilities Plan Update

August 2016

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Tables

Appendices

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Abbreviations

AB	Aeration Basin	MM	Maximum Month or Millimeter
AD	Anaerobic Digester	MOP	Manual of Practice
AER	Aerobic	MPN	Most Probably Number
ALK	Alkalinity	MW	Maximum Week
ASP	Aerated Static Pile	NH_4-N	Ammonia as Nitrogen
BFP	Belt Filter Press	NO_2-N	Nitrite-Nitrogen
BNR	Biological Nutrient Removal	NO_3-N	Nitrate-Nitrogen
BOD	Biological Oxygen Demand	NPDES	National Pollutant Discharge Elimination System
cf	Cubic Feet	OUR	Oxygen Uptake Rate
CFU	Colony Forming Unit	PCL	Primary Clarifier
COD	Chemical Oxygen Demand	PE	Primary Effluent, Population Equivalents
cy	Cubic Yard	PO4-P	Phosphate
d	Day	PFRP	Process to Further Reduce Pathogens
DAFT	Dissolved Air Flotation Thickener	PPMV	Parts Per Million by Volume
DMR	Discharge Monitoring Report	PSI	Pounds Per Square Inch
DO	Dissolved Oxygen	PSL	Primary Sludge
DS	Digested Sludge	RAS	Return Activated Sludge
EDU	Equivalent Dwelling Unit	RST	Rotary Screen Thickener
EFF	Effluent	sBOD	Soluble (filtered) BOD
EPA	Environmental Protection Agency	sCOD	Soluble COD
ft	Feet	SCFM	Standard Cubic Feet Per Minute
gal	Gallons	SCL	Secondary Clarifier
GBT	Gravity Belt Thickener	SE	Secondary Effluent
gpd	Gallons Per Day	sf	Square Feet
GPH	Gallons Per Hour	SRT	Solids Retention Time
GPM	Gallons Per Minute	SVI	Sludge Volume Index
HP	Horsepower	TKN	Total Kjeldahl Nitrogen
HR	Hour	TP	Total Phosphorus
HRT	Hydraulic Retention Time	TS	Total Solids
IFAS	Integrated Fixed Film Activated Sludge	TSS	Total Suspended Solids
INF	Influent	UGA	Urban Growth Area
L	Liter	US	United States
lb	Pound	UV	Ultraviolet Light
MBR	Membrane Bioreactor	UVT	Ultraviolet Transmittance
MD	Maximum Day	VFA	Volatile Fatty Acids
µg	Micrograms	VSS	Volatile Suspended Solids
mg	Milligrams	WAC	Washington Administrative Code
MG	Million Gallons	WAS	Waste Activated Sludge
mgd	Million Gallons Per Day	WDFW	Washington Department of Fish and Wildlife
MLSS	Mixed Liquor Suspended Solids	WEF	Water Environment Federation
MLVSS	Mixed Liquor Volatile Suspended Solids	WWTP	Wastewater Treatment Plant

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7 Introduction

The primary goal of this planning effort was to develop a flexible implementation plan to allow for the development of capital expenditure planning that can be responsive to changing criteria and the City's available resources. The implementation plan presented below is for improvements recommended to occur within the 2035 planning horizon, with detailed development of the CIP for what has been determined to be the most critical improvements that fall into near-term budgeting and planning. The recommended implementation plan is designed to provide timely construction of the necessary improvements at both the WWTP and the Biosolids Drying Beds Facility, without creating an overly complex construction management program.

7.1 Elements of the Recommended Plan

The elements of the recommended plan are presented in detail in Chapter 6. Each component of the plan is recommended on the basis of a distinct need (condition, performance, capacity, regulatory criteria, or some combination thereof). Elements of the recommended plan at the City's WWTP include:

- **Continuing to operate the preliminary and primary treatment process units with no changes in facilities or operation.** Primary sludge and scum pumping will be operated with pumping units dedicated to each primary clarifier used for both sludge and scum pumping. The sludge pumping frequency would continue to be controlled through pumping time to achieve thickening of primary sludge solids to a concentration above 4 percent dry weight solids. Primary sludge and scum pumping would be alternated manually by operations staff through field observation. In the event of a high flow and loading condition to the primary treatment facilities, additional loading will be directed to the secondary treatment process for treatment.
- **Construction of Secondary Clarifier No. 3 and connection of the new clarifier to the existing gravity controlled return flow system and RAS pumping station.** Construction of the new clarifier would also require installation of a new aeration basin effluent pipeline from the aeration basin Effluent Junction Box to the clarifier and extension of a clarifier effluent pipeline from the clarifier effluent launder to the influent channel of the UV Disinfection Building. Return flow recirculation and secondary scum piping will be directed to the Sludge Recirculation Pump Station via the abandoned chlorine contact channel contiguous with existing Secondary Clarifier No. 1 and combined with the existing pumping systems.
- **Modifications to the UV light disinfection system control philosophy, and installation of continuous UVT monitoring to enhance the firm peak flow capacity of the disinfection system.**
- **Construction of a new Anaerobic Digester No. 4 that matches the capacity of existing Anaerobic Digester No. 3.** A new Digester Control Building expansion to provide an additional hot water boiler, gas, and recirculation pumping systems to support the digester and additional piping modifications to the other digesters on site to enable full redundancy of digester tankage. Installation of gas handling and odor control systems would also be incorporated into the digestion upgrade, and space within the Digester Control Building

would be provided to allow installation of a future waste activated sludge rotary screen thickener (RST) that would also be able to be used for digester recuperative thickening.

- **Construct additional coarse fraction grit removal in front of the Influent Pump Station, including the installation of an influent sewer grit collection manhole upstream from the existing Screenings Building.** This manhole would enable removal of heavy fraction grit from the influent sewer with a vacuum truck and help avoid accumulation of grit in the treatment plant from the Screenings Building to the existing Vortex Grit Removal Units. In order to maintain grit in suspension between the Screenings Building and the existing Grit Removal Basins, construction of a dedicated scour air blower for the Influent Pump Wetwell and a separate dedicated air scour blower for the Grit Removal Inlet Channel is also recommended.

Elements of the recommended plan at the City's Biosolids Drying Beds (Class A) Facility include:

- **Construction of four additional biosolids drying beds located in a mirrored fashion immediately north of the existing drying beds.** This configuration would allow efficient operations for solids handling equipment and will promote avoidance of co-mingling of processed and non-processed materials. It has been assumed that the City will not be required to purchase additional property to provide for the added Biosolids Drying Beds Facility capacity.
- **Construction of additional finished Class A biosolids storage.** Added storage capacity is needed for segregation of the processed biosolids from the new drying beds addition is needed to assure processed material cannot be comingled with solids undergoing treatment within the facility.
- **Construction of a second storm water retention facility that will operate using evaporative disposition similar to the existing storm water facility.** The retention facility will also be mirrored with the existing facility as a separate pond from the existing facility. Extension of the existing perimeter fence around the new facilities and paving of the new access road and drying beds.

7.2 Project Phasing

Decisions to construct improvements need to occur several years prior to when facility improvements are needed. This is due to the long lead time for financing, design, bidding, and construction. Should the City desire to obtain State Revolving Fund (SRF) loan funds for planning, design, and construction, an additional 3-4 years is necessary. Several options were considered by the project team for construction phasing. These ranged from one large construction contract to as many as eight smaller construction packages. The recommended approach is to implement three general construction packages, through a program that allows the City to provide the necessary improvements at both the WWTP and at the biosolids drying bed facility without creating an overly complex construction management program.

As a result of the 2008 Facilities Plan Update, the City has completed a capacity upgrade at the biosolids drying beds, enhanced the wastewater treatment facility including new influent pumps, a new screenings building including mechanical bar screens and washer/compactors, completed visual aesthetic improvements, constructed odor control improvements, completed a biosolids management plan, and solidified their Class A biosolids Alternative Treatment Method with the Washington Department of Ecology. One key component from the 2008 Facilities Plan Amendment that has not been implemented is the anaerobic digestion process expansion, including the addition of Anaerobic Digester No. 4 and its associated support facilities. Construction of additional anaerobic digestion capacity is a key recommendation of this Facilities Plan Update. The City's additional efforts to collect and review additional influent flow and loading data for the wastewater treatment facilities (presented in Chapter 2) resulted in a facility capacity determination that does not mandate capacity improvements at the WWTP through the 2035 planning period.

7.2.1 Early Action Elements

The elimination of the existing influent junction box during the recent odor control and visual mitigation project has raised concerns for detrimental buildup of grit in the existing Influent Pumping system and the Headworks building. This unintended consequence of installation of the new Screenings Building is considered by the project team as a high priority for action at the WWTP. Construction of the new grit removal manhole in the City's collection system immediately upstream from the Screenings Building and construction of coarse bubble aeration (for use in manually scouring grit that accumulates in the Influent Pump Station Wetwell and Headworks Grit Inlet Channels) are recommended to be completed as soon as practical.

The City has experienced occasional elevated effluent fecal coliform levels since installation of their UV light system. Because of the potential for these excursions and the known UV light firm peak flow capacity limitations, improvements to the ultraviolet light system recommended by the equipment manufacturer should also be incorporated as soon as possible. The City currently has the equipment replacement improvements to the UV light channel level control gates planned, and modification of the system control philosophy and installation of continuous UVT monitoring is also suggested to be a high priority.

7.2.2 Wastewater Treatment Plant Process Enhancement Elements

The recommended wastewater treatment facilities process improvements are related to the need for added process unit redundancy to better enable routine maintenance of unit processes, and also provide for better process flexibility during peak flow and loading events. Because none of the recommended improvements are required to meet capacity needs or changing effluent permit limits, the project team has determined that City has greater flexibility for prioritization. Because of the lack of digestion tank redundancy and the lack of ability to easily remove an existing digester for cleaning, construction of the new Anaerobic Digester No. 4 and its associated support facilities is recommended as a higher priority to construction of new Secondary Clarifier No. 3.

Design and construction of the recommended WWTP facilities can be completed most efficiently through a single design and construction contract. However, these unit processes and improvements are not directly related to each other and may easily be phased as two construction projects, if necessary. To allow for greater flexibility in phasing, it is suggested that the design of these recommended improvements be completed in a single coordinated design effort, which will enable project funding to be planned well in advance of construction.

7.2.3 Biosolids Drying Beds Facility Expansion Elements

The current operation of the City's drying beds for Class A biosolids production is working well for the City with no near-term capacity limitations. The recommended increase in facility capacity will involve doubling the size of the current drying bed area, and the same increase in facility storm water controls. Construction of the recommended expansion of the drying beds, and the type of general civil construction involved (materials excavation, membrane liner and asphalt paving), can be most efficiently and cost effectively completed as a single construction project.

Similarly, design of the facility expansion can be most cost effectively completed in a single design contract. For these reasons, it is recommended the City prioritize the expansion of their biosolids drying beds as a lower priority, longer-term improvement project scheduled separately from the recommended improvements at the WWTP.

7.3 Financial Requirements

This section presents the financial aspects of the implementation plan, which includes a capital expenditure schedule that identifies the total project cost and associated design elements for each recommended project. The costs are total project costs that include Washington State Sales Tax and construction contingencies. Where engineering, legal, and administrative costs are not separated out as a separate design cost, they are included as part of the overall improvement costs presented.

Table 7-1 on the following page presents the estimated cost of the recommended improvements, including assumed dates of completion, at both the WWTP and at the biosolids drying beds. The recommended project prioritization is presented by funding year to enable the City to incorporate the recommended plan into their ongoing rate analysis. The recommended improvements presented in Table 7-1 are presented in Chapter 6, and are also included in the DRAFT Capital Improvement Budget Worksheets included in Appendix D of this Chapter.

The costs and their timing in Table 7-1 represent a simplified cash flow and are intended to provide a general understanding of the costs for calculation of potential changes in residential sewer rates. The table shows that priority near-term investment of approximately $885,000 is needed initially. The table also shows that $4,482,000 will be expended in 2017-2019 for design and construction of Digester No. 4 at the WWTP and design of the expansion of the Biosolids Drying Beds Facility with $309,000 expended by 2020 for design of Secondary Clarifier No. 3 to the WWTP and $5,689,000 expended beyond 2020 for the addition of Secondary Clarifier No. 3 and a RST thickener at the WWTP and design and construction of the drying beds expansion.

The added O&M costs associated with the recommended plan are also identified in Table 7-1. An increase in annual O&M cost of $72,300 is expected when additional anaerobic digestion facilities are constructed. This is due to the added pumping costs and operation and maintenance associated with the new facility. The added secondary clarifier is estimated to add an additional $19,700 in annual O&M, primarily associated with equipment maintenance and drive electricity. The addition of the future RST unit is expected to add an additional $19,500 in annual O&M costs. The expanded drying beds are not considered to be improvements that will add to the current operation and maintenance requirements. In the case of the drying beds expansion, the planned improvements are expected to increase operating efficiency as a result of the improvements, without appreciably increasing maintenance requirements.

Table 7-1. Total Capital Requirements For The Wastewater Utility

Improvement	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2035 [a]
WWTP Grit Removal Improvements Design/Construction Engineering	$24,000	$24,000				
WWTP Grit Removal Improvements Construction		$161,000				
WWTP UV Light Disinfection System Modifications		$135,000				
WWTP Digester No. 4 and Digester Control Building Design/Construction Engineering		$541,000		$541,000		
WWTP Digester No. 4 and Digester Control Building Construction				$3,610,000		
WWTP Secondary Clarifier No. 3 and Return Flow Control Design/Construction Engineering					$309,000	$309,000
WWTP Secondary Clarifier No. 3 and Return Flow Control Construction						$2,057,000
Rotary Screen Thickener (RST) Addition						$784,000
Drying Bed Expansion Design/Construction Engineering				$331,000		$331,000
Drying Bed Expansion Construction						$2,208,000
Total	**$24,000**	**$861,000**	**$0**	**$4,482,000**	**$309,000**	**$5,689,000**
Increased Annual O&M Cost [b]				**$72,300**		**$39,200**

[a] Recommended Improvements that exceed the 3 to 5 year capital improvements planning horizon
[b] Includes added O&M for Digester No. 4 and associated facilities, Secondary Clarifier No. 3 and RST addition

7.4 Water Quality Management Plan Conformance

There is no formal Ecology water quality management plan in place for the Columbia River in the vicinity of the City of Wenatchee. Because of the relative health of this stretch of the Columbia River, Ecology has not closely studied this reach of the river and does not currently have plans to do so. Therefore, implementation of a water quality management plan or other additional water quality requirements for the study area is not anticipated in the foreseeable future. The City remains committed to meeting or exceeding their current effluent quality and meeting the plant's NPDES discharge permit obligations.

7.5 Financing and Rate Impacts

The evaluation of the potential changes in residential sewer rates has not been included as part of this Wastewater Facilities Plan Update, and the City will continue to evaluate their rate structure through their existing models that will be updated using the projected capital expenditures presented above. It is expected that the City will continue to bill approximately 57 percent of the cost of the improvements to residential accounts (the estimated contribution of residential customers based upon City records), with the remainder being billed to commercial and industrial users. The expected methods of financing include the use of cash reserves, revenue bond financing and the Ecology State Revolving Fund (SRF) loan program. In order for the City to assure eligibility for the State Water Pollution Control Revolving Fund (SRF) program, concurrence must be obtained from Ecology on environmental documents prepared and determinations issued by the City.

7.6 SERP Compliance and SEPA Environmental Checklist

Federal law requires states conduct environmental review of all State Water Pollution Control Revolving Fund (SRF) water pollution control facilities projects. Therefore, before the City of Wenatchee is eligible to apply for a facilities design or construction loan, the City will need to formally submit environmental documentation to Ecology in conformance with the State of Washington State Environmental Policy Act (SEPA).

Concurrence from Ecology must be obtained through the State Environmental Review Process (SERP), which helps ensure public bodies select environmentally sound alternatives for the planning, design, construction, and implementation of the SRF water pollution control facilities projects. The SERP process is to be conducted during the development of the facilities plan. To complete the SERP, the City must comply with SEPA and also the National Environmental Policy Act (NEPA), and other applicable environmental statutes, regulations, and executive orders. The City has developed a SEPA environmental checklist for the recommended plan presented in this report which is included in Appendix C of this Chapter. A preliminary threshold determination of non-significance [DNS] is issued for this Facilities Plan for final concurrence by Ecology. If the project is found to comply with SERP, the City expects Ecology will concur with the preliminary DNS and will notify the City to issue the threshold determination. If Ecology does not concur with the determination, a notification letter is expected to be sent to the City that directs the City to address any unresolved issues in order to complete SERP. Once the City has addressed issues, SERP will be completed.

7.7 Required Permits

Facilities plan approval and SERP compliance from Ecology will be required for the recommended facility improvements. Facilities plan amendments will be required, in the form of detailed project preliminary designs, to meet Ecology project requirements because this plan does not contain preliminary design information. Modification of the rated capacity of the WWTP will require modification of the NPDES permit. Plant capacity modification is supported by the detailed evaluation of existing and projected flows and loads, and capacity determination of each unit process that has been included as part of this Facilities Plan Update. This can be completed during renewal processing of the City's NPDES permit that is expected to occur soon with Ecology.

For construction of the proposed facilities at the WWTP and biosolids drying beds, the following permits could be required:

- For the WWTP facilities, commercial building and grading permits from the City of Wenatchee – excavation at the WWTP site is expected to encounter refuse and other materials from past disposal practices. These materials must be properly tested and disposed of at a legal landfill site.
- For the drying beds, grading permits from Chelan County

- Electrical permits from the Department of Labor and Industries
- Plumbing permits from the Department of Health
- NPDES general construction permit from Ecology
- For the drying beds, amendment of the Conditional Use Permit (CUP 1777) from Chelan County – this process takes a minimum of 4 months to complete

It is not expected that proposed modifications to the drying beds will encounter wetlands, streams or riverine lands in the area. Should any of these be expected following a detailed preliminary design, permits from the U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife (WDFW) would also be required.

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Appendix C. DRAFT State Environmental Policy Act (SEPA) Checklist

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

***Instructions for applicants*:**

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals: [help]

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background

1. Name of proposed project, if applicable: Wastewater Treatment Facilities Plan Update, City of Wenatchee, October 2016

2. Name of applicant: City of Wenatchee

3. Address and phone number of applicant and contact person:

1350 McKittrick Street, Suite A
Wenatchee, WA 98801
Contact: Jessica Shaw, Environmental Manager
(509) 888-3225

4. Date checklist prepared: December 1, 2015

5. Agency requesting checklist: City of Wenatchee Community & Economic Development Department

6. Proposed timing or schedule (including phasing, if applicable): The plan will be implemented in phases beginning in 2016 through 2035.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain. Yes, this SEPA checklist provides a programmatic analysis of the proposed technologies that could be used to expand and/or improve the existing Wastewater Treatment Plant and Biosolids Drying Beds Facility.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. Wastewater Treatment Facilities Plan Update, City of Wenatchee, October 2015.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. Yes, the City of Wenatchee is currently working with the Washington State Department of Ecology (Ecology) on a new National Pollutant Discharge Elimination System permit for the Wastewater Treatment Plant.

10. List any government approvals or permits that will be needed for your proposal, if known.

- State Environmental Review Process compliance from Ecology.
- Facilities Plan Approval from Ecology.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)

The purpose of the Wastewater Treatment Facilities Plan was to update the facility flow and loading projections, evaluate facility unit process capacity and recommend process improvements for the planning period of 2015 through 2035. All proposed improvements will be within the exisiting boundaries of the Wastewater Treatment Plant and the Biosolids Drying Beds Facility.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The existing Wastewater Treatment Plant is located at 201 North Worthen Street, Wenatchee, WA. The proposed improvements would be located within the existing site which is located in the NW ¼ of the SE ¼ of Section 3, Township 22 North, Range 20 East, W.M., Chelan County, Washington. The Biosolids Drying Beds Facility is located on the Malaga-Alcoa Highway, approximately 10 miles south of Wenatchee.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site:

(circle one): **Flat**, rolling, hilly, steep slopes, mountainous, other _____________

b. What is the steepest slope on the site (approximate percent slope)?

The Wastewater Treatment Plant driveway on Worthen Street next to the headworks building is sloped at approximately 20%. However, the area where construction would occur is flat. At the Biosolids Drying Beds Facility, the access road is estimated to be less than 20% and the remainder of the site is mostly flat.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

Soil at the treatment plant is a combination of clay and sand. The property was previously used as a garbage dump. Most of the garbage has been removed from the site, but some garbage is expected in areas near the property line and north of the secondary clarifiers. The soils at the drying beds are PrB-Pogue gravelly fine sand loam, which is on the prime soils list, and PrC-Pogue gravelly fine sandy loam, which is on the uniques soils list. These are not considered prime or unique soils unless they are irrigated, which they are not.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

No.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Excavation will be required for installation of the new anaerobic digester and secondary clarifier at the Wastewater Treatment Plant. Any garbage encountered will be removed and disposed of at the regional landfill. Proposed improvements at the Biosolids Drying Beds Facility will require minimal grading and excavation for the new stormwater pond. No fill is expected to be needed.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Soils excavated and potentially stockpiled for construction of proposed facilities could experience erosion if not properly covered. Appropriate best management practices will be used during construction to reduce erosion potential.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 65% of the Wastewater Treatment Plant site is currently covered by impervious surfaces consisting of parking, buildings, and access roads. The amount of impervious surface added depends on the proposed improvements that would be implemented. As part of the aesthics of the treatment plant, the City plans to make sure any improvements are consistent with the existing screening and landscaping. New access roads, when feasible, will be constructed with pervious pavers. At the drying beds site, approximately 2% of the area is currently covered by impervious surfaces. Approximately 5% or less would be covered by the proposed improvements.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Appropriate best management practices will be used during construction to reduce erosion potential.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Some dust and exhaust fumes might occur during the proposed construction, but it is not expected to be significant. The air emissions from the operation and maintenance of the wastewater treatment plant are regulated under an air quality permit issued by Ecology. Odor control measures will be considered in implementation of the improvements presented in the plan.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None are known.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Odor-reducing technology and best available control technology for reducing emissions will be implemented as required.

3. **Water**

a. Surface Water:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes, the Columbia River is just over 200 feet from the eastern fence line of the Wastewater Treatment Plant and approximately 900 feet from the southeast fence line of the Biosolids Drying Beds Facility.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No work over, in or within 200 feet of the Columbia River is anticipated at this time.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The wastewater treatment plant effluent currently discharges through an existing outfall to the Columbia River. The proposed improvements are intended to maintain and possibly improve the water quality of the effluent being discharged. By 2035, flows to the wastewater treatment plant are expected to reach 4.1 million gallons per day.

b. Ground Water:

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

No.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

Not applicable.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

Stormwater and snow melt are the two main sources of runoff. All of the runoff from the wastewater treatment plant site is captured on-site and is discharged to the wastewater treatment plant headworks for treatment. Runoff at the Biosolids Drying Beds Facility is routed to an evaporation retention pond, and a new pond is proposed for runoff from future expansion of the beds.

2) Could waste materials enter ground or surface waters? If so, generally describe.
No.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.
No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Runoff from the Wastewater Treatment Plant will be routed to the headworks of the plant for treatment and runoff at the Biosolids Drying Beds Facility will be discharged to the evaporative retention ponds.

4. **Plants**

a. Check the types of vegetation found on the site:

__X__deciduous tree: alder, maple, aspen, other
__X__evergreen tree: fir, cedar, pine, other
__X__shrubs
__X__grass
____ pasture
____ crop or grain
____ Orchards, vineyards or other permanent crops.
____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____ water plants: water lily, eelgrass, milfoil, other
__X__other types of vegetation : Sagebrush at the Biosolids Drying Beds Facility.

b. What kind and amount of vegetation will be removed or altered?
Improvements at the wastewater treatment plant may result in some shrubs and grass being removed. At the Biosolids Drying Beds Facility, vegetation is sparse and some sage brush will most likely need to be removed.

c. List threatened and endangered species known to be on or near the site.
None known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:
Landscaping for visual mitigation will be maintained and considered as part of all construction projects at the

wastewater treatment plant facility. Vegetation restoration is not anticipated at the Biosolids Drying Bed Facility.

e. List all noxious weeds and invasive species known to be on or near the site.

Noxious weeds including puncture vine and knapweed can be found at both sites. The City of Wenatchee is proactive in managing noxious weeds at the wastewater treatment plant and the Biosolids Drying Beds Facility.

5. **Animals**

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

Examples include:

birds: hawk, heron, eagle, songbirds, other: **duck**
mammals: **deer,** bear, elk, beaver, other: **coyote, racoons**
fish: **bass, salmon, trout**, herring, shellfish, other ________

b. List any threatened and endangered species known to be on or near the site.

Upper Columbia River spring run of Chinook salmon and upper Columbia River run of steelhead.

c. Is the site part of a migration route? If so, explain.

Neither site is part of a migration route.

d. Proposed measures to preserve or enhance wildlife, if any:

None.

e. List any invasive animal species known to be on or near the site.

None known.

6. **Energy and Natural Resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

The Wastewater Treatment Plant uses electricity for running pumps, blowers and other equipment for treating the wastewater. Digester gas produced by the anaerobic digesters is used to heat the digesters and buildings at the plant. Natural gas is used as a back-up when there is not enough digester gas to keep up with heating demands as well as for laboratory testing.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

Anaerobic digestion produces gas that is used for heating and reduces the need to use natural gas or electricity. High-efficiency motors and variable frequency drives are used to minimize the consumption of electricity. At the Biosolids Drying Beds Facility, the arid climate is used to dry the biosolids.

7. **Environmental Health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

Methane gas is stored in the anaerobic digesters and could be an explosion hazard.

1) Describe any known or possible contamination at the site from present or past uses.

The Wastewater Treatment Plant Facility is built on a closed municipal landfill. No contamination is known or expected to be present at the Bisosolids Drying Beds Facility.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

There are no existing hazardous chemicals or conditions that might affect project development or design.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

None are expected at this time.

4) Describe special emergency services that might be required.

None.

5) Proposed measures to reduce or control environmental health hazards, if any:

The City operates and maintains the digester gas system to reduce the risk of emissions.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

None.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

On a short-term basis, construction projects would create some noise on weekdays during normal working hours. No long-term noise is expected with this project.

3) Proposed measures to reduce or control noise impacts, if any:

None.

8. **Land and Shoreline Use**

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The proposed improvements would occur at the current site of the Wastewater Treatment Plant and the biosolids drying beds. Adjacent to the south of the plant is a parking lot and along the east side of the plant is Riverfront Park. To the west across Worthen Street is a strip of property owned by the City of Wenatchee and currently used for the flow equalization basin. To the north of the plant is a frozen food shipping warehouse. The Biosolids Drying Beds Facility is mostly surrounded by vacant land. Approximately 0.13 miles from the SW corner of the facility is an orchard.

The proposal is not expected to affect current land uses on nearby or adjacent properties.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:
No.

c. Describe any structures on the site.
On the north end of the Wastewater Treatment Plant are three digesters and the solids handling building. A garage and maintenance shop is located on the northeast side of the facility. The headworks/control buildings are located in the central part of the plant and consists of four buildings closely placed with walkways between them. To the north of the headworks/control buildings are two primary clarifiers and directly east is the influent wet well.

d. Will any structures be demolished? If so, what?
No.

e. What is the current zoning classification of the site?
The zoning at the Wastewater Treatment Plant site is Waterfront Mixed Use and the zoning at the Biosolids Drying Beds Facility is Rural Industrial.

f. What is the current comprehensive plan designation of the site?
Both sites are designated as industrial.

g. If applicable, what is the current shoreline master program designation of the site?
Not applicable.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify. No.

i. Approximately how many people would reside or work in the completed project?
The Wastewater Treatment Plant staff consists of eight positions. Additional staff may be needed as the community grows and equipment is added.

j. Approximately how many people would the completed project displace?
None.

k. Proposed measures to avoid or reduce displacement impacts, if any:
Not applicable.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The recently completed odor control technology and aesthetics improvements at the Wastewater Treatment Plant Facility were completed with consideration of new development occurring along the waterfront. Odor control and asesthetics will also be considered in the proposed improvements.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

Not applicable.

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable.

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The new anaerobic digester will be approximately 30 feet tall. The principal exterior building material would be concrete. No additional structures are planned at the drying beds.

b. What views in the immediate vicinity would be altered or obstructed?

None.

e. Proposed measures to reduce or control aesthetic impacts, if any:

Visual mitigation will be considered in all of the proposed projects at the wastewater treatment plant facility to preserve the aesthetic and visual mitigation features added in the most recent improvements.

11. **Light and Glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?
The Wastewater Treatment Plant currently has onsite lighting and additional lighting for aesthetics. No other lighting is anticipated.

b. Could light or glare from the finished project be a safety hazard or interfere with views?
No.

c. What existing off-site sources of light or glare may affect your proposal?
None.

d. Proposed measures to reduce or control light and glare impacts, if any:
None.

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?
The east side of the Wastewater Treatment Plant borders Riverfront Park, which has a trail for walking and bicycling. The Saunders Train, a miniature train, is located adjacent to the plant in the park.

b. Would the proposed project displace any existing recreational uses? If so, describe.
No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:
None.

13. **Historic and cultural preservation**

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.
No.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.
The Wastewater Treatment Plant fFacility is built on a former municipal landfill. A cultural resources survey of the area in the vicinity of the Biosolids Drying Beds Facility site was conducted in 1990 that identified two cultural resources sites(“A Survey of A Proposed Sludge Processing Site For The City of Wenatchee, Chelan County, Washington; By Kevin J.

Lyons and Larry J. Fredin, Principal Investigator: Jerry R. Galm; Short Report 211 Archealogical and Historical Services, Eastern Washington University; January 1990).

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.
Consultation with the Colville Federated Tribes and the Washington Department of Archaeology and Historic Preservation must be conducted before any work is performed in the area of the biosolids drying bed site.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.
No loss or disturbance of resources is anticpated.

14. **Transportation**

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.
The wastewater treatment plant facility is accessed through three entrances from North Worthen Street. The plant can also be accessed through a gate at the south end of the plant through the public parking lot. The biosolids drying bed facility is accessed from the Malaga-Alcoa Highway.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?
No. The nearest bus stop is located approximately 1 block south of the wastewater treatment plant facility.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?
No additional parking is proposed. Approximately 12 parking spots on the Wastewater Treatment Plant site would be eliminated with the addition of the third secondary clarifier.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).
No.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.
Burlington Northern Railroad tracks are located to the west of the Wastewater Treatment Plant. Biosolids would continue to

be transported by truck from the wastewater treatment plant to the Biosolids Drying beds Facility.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?
No additional vehicle trips are projected beyond truck traffic to transport dewatered biosolids to the Biosolids Drying Beds Facility.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.
No.

h. Proposed measures to reduce or control transportation impacts, if any:
None.

15. **Public Services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.
No.

b. Proposed measures to reduce or control direct impacts on public services, if any.
Not applicable.

16. **Utilities**

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other ___________

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
No additional utilities will be needed.

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: ____

Name of signee ____

Position and Agency/Organization ______________________________________

Date Submitted: _____________

D. supplemental sheet for nonproject actions

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   As the City of Wenatchee grows, discharges to the wastewater treatment plant and ultimately the Columbia River will increase. The proposed improvements to the Wastewater Treatment Plant and Biosolids Drying Beds Facility have been developed to ensure that wastewater and biosolids can continue to be treated to water quality standards set by state and federal regulations. Increases to toxic or hazardous substances and production of noise are not applicable.

   Proposed measures to avoid or reduce such increases are:

   The projects set forth in the plan will ensure that growth of the community does not negatively impact local water resources.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   The purpose of the Wastewater Treatment Plant Facilities Plan Update is to lay out a series of projects to protect people, plants, animals and the environment through consistent and effective treatment of wastewater and biosolids.

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

   Implementation of the proposed projects provides protection of plants, animals, fish and marine life.

3. How would the proposal be likely to deplete energy or natural resources?

   The proposal is not expected to deplete energy or natural resources.

   Proposed measures to protect or conserve energy and natural resources are:

   None needed.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   The proposal will protect the Columbia River.

   Proposed measures to protect such resources or to avoid or reduce impacts are:
   No negative impacts are expected.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?

   No affect to land and shoreline use is expected.

   Proposed measures to avoid or reduce shoreline and land use impacts are:
   Not applicable.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?

   No increased demand on transportation or public services and utilities is expected.

   Proposed measures to reduce or respond to such demand(s) are:
   None needed.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.

   This proposal does not conflict with local, state, or federal laws or requirements for the protection of the environment.

Appendix D. Capital Improvements Program Budget Worksheets

Capital Improvement Project Budget

Date: October 27, 2015

Project Name: **WWTP Grit Removal Improvements** **Project Category:** **Sewer - WWTP**

Project Description: Construction of a grit removal manhole in the influent sewer immediately upstream from the WWTP Screenings Building to reduce grit accumulation upstream from the Influent Pump Station. Installation of scour air in the WWTP Influent Pumping Wetwell and Headworks to enable periodic manual transfer of accumulated grit to the Grit Removal Units.

Staff Lead:	J. Shaw/P. Moser	**Start Year:**	2015
Assigned Department:	Sewer - WWTP	**End Year:**	2016
Original Project Budget:	$209,000	**Project Number:**	
Budget Amendment:	$0	**Total City Revenues:**	
		Total External Revenues:	

Revenue Notes and/or Requests for Budget Changes:

Project Expenditures by Category		**Original Budget**	**Amended Budget**	**Prior Years Spent**	**Estimates 2016**	**2017**	**2018**	**Project Total**
Design Engineering		24,000			24,000			**24,000**
								-
Right of Way								
								-
Construction Contract		129,000				129,000		**129,000**
Construction Engineering		24,000				24,000		**24,000**
Contingencies		32,000				32,000		**32,000**
Art Fund								
Other								
Total Project Expenditures		**209,000**			**24,000**	**185,000**		**209,000**

Project Revenues by Category		**Original Budget**	**Amended Budget**	**Prior Years**	**Estimates 2016**	**2017**	**2018**	**Project Total**
Fund:								-
Fund:								-
Fund:								-
Fund:								-
Fund:								-
								-
Washington State TIB Grant								-
								-
								-
								-
								-
Total Project Revenues								-

Approved by: ______________________ Date: ____________

Deanne McDaniel, Finance Director

Funds list:	Other list:	Consultant list:	Project Category:	Contingency:
General Fund	Pre-purchase equipment	Anchor	Arterial Streets	5%
#109 - Arterial Streets	Permitting	CH2M Hill	Regional Water	10%
#401 - Water/Sewer		ECS	Sewer	15%
#410 - Storm Drain Utility		HCWL	Sewer - WWTP	25%
#415 - Regional Water		HDR	Storm Sewer	
		RH2	Water	
		West Coast		

Capital Improvement Project Budget

Date: October 27, 2015

Project Name: **WWTP UV Light Disinfection Improvements**

Project Category: **Sewer - WWTP**

Project Description: Modifications to the UV light disinfection equipment control philosophy and installation of continuous UVT monitoring to increase the firm peak capacity of the disinfection equipment to 7.7 mgd flow rate.

Staff Lead:	J. Shaw/P. Moser	**Start Year:**	2016
Assigned Department:	Sewer-WWTP	**End Year:**	2016
Original Project Budget:	$135,000	**Project Number:**	
Budget Amendment:		**Total City Revenues:**	
		Total External Revenues:	

Revenue Notes and/or Requests for Budget Changes:

Project Expenditures by Category		**Original Budget**	**Amended Budget**	**Prior Years Spent**	**Estimates 2016**	**2017**	**2018**	**Project Total**
Design Engineering		15,500			15,500			**15,500**
								-
Right of Way								
								-
Construction Contract		83,000			83,000			**83,000**
Construction Engineering		15,500			15,500			**15,500**
Contingencies		21,000			21,000			**21,000**
Art Fund								
Other								
Total Project Expenditures		**135,000**			**135,000**			**135,000**

Project Revenues by Category		**Original Budget**	**Amended Budget**	**Prior Years**	**Estimates 2016**	**2017**	**2018**	**Project Total**
Fund:								-
Fund:								-
Fund:								-
Fund:								-
Fund:								-
								-
Washington State TIB Grant								-
								-
								-
								-
								-
Total Project Revenues								-

Approved by: ______________________ Date: ______________

Deanne McDaniel, Finance Director

Funds list:	Other list:	Consultant list:	Project Category:	Contingency:
General Fund	Pre-purchase equipment	Anchor	Arterial Streets	5%
#109 - Arterial Streets	Permitting	CH2M Hill	Regional Water	10%
#401 - Water/Sewer		ECS	Sewer	15%
#410 - Storm Drain Utility		HCWL	Sewer - WWTP	25%
#415 - Regional Water		HDR	Storm Sewer	
		RH2	Water	
		West Coast		

Capital Improvement Project Budget

Date: October 27, 2015

Project Name: **WWTP Digester No. 4 and Digester Control Building** **Project Category:** **Sewer - WWTP**

Project Description: Construction of Digester No. 4 and associated support facilities within a digester control building expansion to provide necessary digester unit redundancy and capacity. Support facilities include digester gas handling, hot water boiler and heating, digester recirculation and building area for future installation of a rotary screen thickener.

Staff Lead:	J. Shaw/P. Moser	**Start Year:**	2017
Assigned Department:	Sewer - WWTP	**End Year:**	2020
Original Project Budget:	$4,692,000	**Project Number:**	
Budget Amendment:		**Total City Revenues:**	
		Total External Revenues:	

Revenue Notes and/or Requests for Budget Changes:

Project Expenditures by Category		Original Budget	Amended Budget	Prior Years Spent	Estimates 2016	2017	2018	Project Total
Design Engineering		541,000			541,000			**541,000**
								-
Right of Way								
								-
Construction Contract		2,888,000					2,888,000	**2,888,000**
Construction Engineering		541,000					541,000	**541,000**
Contingencies		722,000					722,000	**722,000**
Art Fund								
Other								
Total Project Expenditures		**4,692,000**			**541,000**		**4,151,000**	**4,692,000**

Project Revenues by Category		Original Budget	Amended Budget	Prior Years	Estimates 2016	2017	2018	Project Total
Fund:								-
Fund:								-
Fund:								-
Fund:								-
Fund:								-
								-
Washington State TIB Grant								-
								-
								-
								-
								-
Total Project Revenues								-

Approved by: ______________________ Date: ____________

Deanne McDaniel, Finance Director

Funds list:	Other list:	Consultant list:	Project Category:	Contingency:
General Fund	Pre-purchase equipment	Anchor	Arterial Streets	5%
#109 - Arterial Streets	Permitting	CH2M Hill	Regional Water	10%
#401 - Water/Sewer		ECS	Sewer	15%
#410 - Storm Drain Utility		HCWL	Sewer - WWTP	25%
#415 - Regional Water		HDR	Storm Sewer	
		RH2	Water	
		West Coast		

Capital Improvement Project Budget

Date: October 27, 2015

Project Name: **WWTP Secondary Clarifier No. 3** | **Project Category:** **Sewer - WWTP**

Project Description: Construction of Secondary Clarifier No. 3 and its associated gravity return recycle flow controls and yard piping. Additional clarifier capacity is necessary for peak flow backup to the primary treatment unit process and to enable maintenance and repair activities for the secondary treatment systems.

Staff Lead:	J. Shaw/P. Moser	**Start Year:**	2017
Assigned Department:		**End Year:**	2020
Original Project Budget:	$2,675,000	**Project Number:**	
Budget Amendment:		**Total City Revenues:**	
		Total External Revenues:	

Revenue Notes and/or Requests for Budget Changes:

Project Expenditures by Category	Original Budget	Amended Budget	Prior Years Spent	Estimates 2016	2017	2018	Project Total
Design Engineering	309,000						-
							-
Right of Way							
							-
Construction Contract	1,645,000						-
Construction Engineering	309,000						-
Contingencies	412,000						
Art Fund							
Other							
Total Project Expenditures	**2,675,000**						

Project Revenues by Category	Original Budget	Amended Budget	Prior Years	Estimates 2016	2017	2018	Project Total
Fund:							-
Fund:							-
Fund:							-
Fund:							-
Fund:							-
							-
Washington State TIB Grant							-
							-
							-
							-
							-
Total Project Revenues							-

Approved by: ______________________ Date: ____________

Deanne McDaniel, Finance Director

Funds list:	Other list:	Consultant list:	Project Category:	Contingency:
General Fund	Pre-purchase equipment	Anchor	Arterial Streets	5%
#109 - Arterial Streets	Permitting	CH2M Hill	Regional Water	10%
#401 - Water/Sewer		ECS	Sewer	15%
#410 - Storm Drain Utility		HCWL	Sewer - WWTP	25%
#415 - Regional Water		HDR	Storm Sewer	
		RH2	Water	
		West Coast		

Capital Improvement Project Budget

Date: October 27, 2015

Project Name: **WWTP Rotary Screen Thickener Addition**

Project Category: **Sewer - WWTP**

Project Description: Installation of a rotary screen thickener in the Digester Control Building for Digester No. 4 to provide backup equipment redundancy for the existing aging waste activated sludge gravity belt thickener.

Staff Lead: J. Shaw/P. Moser
Assigned Department: Sewer - WWTP
Original Project Budget: $784,000
Budget Amendment:
Start Year: 2020
End Year: 2020
Project Number:
Total City Revenues:
Total External Revenues:

Revenue Notes and/or Requests for Budget Changes:

Project Expenditures by Category	Original Budget	Amended Budget	Prior Years Spent	Estimates 2016	Estimates 2017	Estimates 2018	Project Total
Design Engineering	90,000						-
							-
Right of Way							
							-
Construction Contract	483,000						-
Construction Engineering	90,000						-
Contingencies	121,000						
Art Fund							
Other							
Total Project Expenditures	**784,000**						

Project Revenues by Category	Original Budget	Amended Budget	Prior Years	Estimates 2016	Estimates 2017	Estimates 2018	Project Total
Fund:							-
Fund:							-
Fund:							-
Fund:							-
Fund:							-
							-
Washington State TIB Grant							-
							-
							-
							-
							-
Total Project Revenues							-

Approved by: ______________________ Date: ____________
Deanne McDaniel, Finance Director

Funds list:	Other list:	Consultant list:	Project Category:	Contingency:
General Fund	Pre-purchase equipment	Anchor	Arterial Streets	5%
#109 - Arterial Streets	Permitting	CH2M Hill	Regional Water	10%
#401 - Water/Sewer		ECS	Sewer	15%
#410 - Storm Drain Utility		HCWL	Sewer - WWTP	25%
#415 - Regional Water		HDR	Storm Sewer	
		RH2	Water	
		West Coast		

Capital Improvement Project Budget

Date: October 27, 2015

Project Name: **Drying Beds Expansion** **Project Category:** **Sewer - WWTP**

Project Description: Construction of additional drying beds and associated access drive and storm water collection pond to accommodate increased dewatered sludge quantities received from the wastewater treatment facility.

Staff Lead:	J. Shaw/P. Moser	**Start Year:**	2020
Assigned Department:	Sewer - WWTP	**End Year:**	2025
Original Project Budget:	$2,870,000	**Project Number:**	
Budget Amendment:		**Total City Revenues:**	
		Total External Revenues:	

Revenue Notes and/or Requests for Budget Changes:

Project Expenditures by Category		**Original Budget**	**Amended Budget**	**Prior Years Spent**	**Estimates 2016**	**2017**	**2018**	**Project Total**
Design Engineering		331,000					331,000	**331,000**
								-
Right of Way								
								-
Construction Contract		1,766,000						-
Construction Engineering		331,000						-
Contingencies		442,000						
Art Fund								
Other								
Total Project Expenditures		**2,870,000**					**331,000**	**331,000**

Project Revenues by Category		**Original Budget**	**Amended Budget**	**Prior Years**	**Estimates 2016**	**2017**	**2018**	**Project Total**
Fund:								-
Fund:								-
Fund:								-
Fund:								-
Fund:								-
								-
Washington State TIB Grant								-
								-
								-
								-
								-
Total Project Revenues								-

Approved by: ______________________ Date: ______________

Deanne McDaniel, Finance Director

Funds list:	Other list:	Consultant list:	Project Category:	Contingency:
General Fund	Pre-purchase equipment	Anchor	Arterial Streets	5%
#109 - Arterial Streets	Permitting	CH2M Hill	Regional Water	10%
#401 - Water/Sewer		ECS	Sewer	15%
#410 - Storm Drain Utility		HCWL	Sewer - WWTP	25%
#415 - Regional Water		HDR	Storm Sewer	
		RH2	Water	
		West Coast		

DETERMINATION OF NONSIGNIFICANCE
ISSUED BY
THE CITY OF WENATCHEE
COMMUNITY AND ECONOMIC DEVELOPMENT DEPARTMENT

Description of proposal:
The City of Wenatchee is updating the Wastewater Treatment Facilities Plan. The purpose is to update the facility flow and loading projections, evaluate facility unit process capacity and recommend improvements for the planning period of 2015 through 2035. All the proposed improvements in the plan will be within the existing boundaries of the Wastewater Treatment Plant and the Biosolids Drying Beds Facility.

Proponent: City of Wenatchee

Location of proposal, including street address, if any:
The project is located at the existing Wastewater Treatment Plant at 201 N. Worthen Street, Wenatchee, WA, identified by Assessor's Parcel No. 22-20-03-821-007; and the Biosolids Drying Beds Facility at 1745 S. Wenatchee Avenue, Wenatchee, WA, identified by Assessor's Parcel No. 22-20-14-310-050.

Lead agency: City of Wenatchee, Department of Community and Economic Development

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ There is no comment period for this DNS.

☐ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

☒ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by October 13, 2016.

Responsible official: Kirsten Larsen **Phone:** (509) 888-3254

Position/title: Associate Planner

Address: 1350 McKittrick St., Suite A, Wenatchee, WA 98801

Date: October 6, 2016 **Signature** ____________________

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

Instructions for applicants:

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals: [help]

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background

1. Name of proposed project, if applicable: Wastewater Treatment Facilities Plan Update, City of Wenatchee, October 2016

2. Name of applicant: City of Wenatchee

3. Address and phone number of applicant and contact person:

1350 McKittrick Street, Suite A
Wenatchee, WA 98801
Contact: Jessica Shaw, Environmental Manager
(509) 888-3225

4. Date checklist prepared: December 1, 2015

5. Agency requesting checklist: City of Wenatchee Community & Economic Development Department

6. Proposed timing or schedule (including phasing, if applicable): The plan will be implemented in phases beginning in 2016 through 2035.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain. Yes, this SEPA checklist provides a programmatic analysis of the proposed technologies that could be used to expand and/or improve the existing Wastewater Treatment Plant and Biosolids Drying Beds Facility.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal. Wastewater Treatment Facilities Plan Update, City of Wenatchee, October 2015.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain. Yes, the City of Wenatchee is currently working with the Washington State Department of Ecology (Ecology) on a new National Pollutant Discharge Elimination System permit for the Wastewater Treatment Plant.

10. List any government approvals or permits that will be needed for your proposal, if known.

- State Environmental Review Process compliance from Ecology.
- Facilities Plan Approval from Ecology.

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)
The purpose of the Wastewater Treatment Facilities Plan was to update the facility flow and loading projections, evaluate facility unit process capacity and recommend process improvements for the planning period of 2015 through 2035. All proposed improvements will be within the exisiting boundaries of the Wastewater Treatment Plant and the Biosolids Drying Beds Facility.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.
The existing Wastewater Treatment Plant is located at 201 North Worthen Street, Wenatchee, WA. The proposed improvements would be located within the existing site which is located in the NW ¼ of the SE ¼ of Section 3, Township 22 North, Range 20 East, W.M., Chelan County, Washington. The Biosolids Drying Beds Facility is located on the Malaga-Alcoa Highway, approximately 10 miles south of Wenatchee.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site:

(circle one): **Flat**, rolling, hilly, steep slopes, mountainous, other ____________

b. What is the steepest slope on the site (approximate percent slope)?
The Wastewater Treatment Plant driveway on Worthen Street next to the headworks building is sloped at approximately 20%. However, the area where construction would occur is flat. At the Biosolids Drying Beds Facility, the access road is estimated to be less than 20% and the remainder of the site is mostly flat.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.
Soil at the treatment plant is a combination of clay and sand. The property was previously used as a garbage dump. Most of the garbage has been removed from the site, but some garbage is expected in areas near the property line and north of the secondary clarifiers. The soils at the drying beds are PrB-Pogue gravelly fine sand loam, which is on the prime soils list, and PrC-Pogue gravelly fine sandy loam, which is on the uniques soils list. These are not considered prime or unique soils unless they are irrigated, which they are not.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.
No.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

Excavation will be required for installation of the new anaerobic digester and secondary clarifier at the Wastewater Treatment Plant. Any garbage encountered will be removed and disposed of at the regional landfill. Proposed improvements at the Biosolids Drying Beds Facility will require minimal grading and excavation for the new stormwater pond. No fill is expected to be needed.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

Soils excavated and potentially stockpiled for construction of proposed facilities could experience erosion if not properly covered. Appropriate best management practices will be used during construction to reduce erosion potential.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 65% of the Wastewater Treatment Plant site is currently covered by impervious surfaces consisting of parking, buildings, and access roads. The amount of impervious surface added depends on the proposed improvements that would be implemented. As part of the aesthics of the treatment plant, the City plans to make sure any improvements are consistent with the existing screening and landscaping. New access roads, when feasible, will be constructed with pervious pavers. At the drying beds site, approximately 2% of the area is currently covered by impervious surfaces. Approximately 5% or less would be covered by the proposed improvements.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Appropriate best management practices will be used during construction to reduce erosion potential.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Some dust and exhaust fumes might occur during the proposed construction, but it is not expected to be significant. The air emissions from the operation and maintenance of the wastewater treatment plant are regulated under an air quality permit issued by Ecology. Odor control measures will be considered in implementation of the improvements presented in the plan.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

None are known.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

Odor-reducing technology and best available control technology for reducing emissions will be implemented as required.

3. **Water**

a. Surface Water:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Yes, the Columbia River is just over 200 feet from the eastern fence line of the Wastewater Treatment Plant and approximately 900 feet from the southeast fence line of the Biosolids Drying Beds Facility.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

No work over, in or within 200 feet of the Columbia River is anticipated at this time.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

No.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

The wastewater treatment plant effluent currently discharges through an existing outfall to the Columbia River. The proposed improvements are intended to maintain and possibly improve the water quality of the effluent being discharged. By 2035, flows to the wastewater treatment plant are expected to reach 4.1 million gallons per day.

b. Ground Water:

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.
No.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.
Not applicable.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.
Stormwater and snow melt are the two main sources of runoff. All of the runoff from the wastewater treatment plant site is captured on-site and is discharged to the wastewater treatment plant headworks for treatment. Runoff at the Biosolids Drying Beds Facility is routed to an evaporation retention pond, and a new pond is proposed for runoff from future expansion of the beds.

2) Could waste materials enter ground or surface waters? If so, generally describe.
No.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.
No.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Runoff from the Wastewater Treatment Plant will be routed to the headworks of the plant for treatment and runoff at the Biosolids Drying Beds Facility will be discharged to the evaporative retention ponds.

4. **Plants**

a. Check the types of vegetation found on the site:

__X__deciduous tree: alder, maple, aspen, other
__X__evergreen tree: fir, cedar, pine, other
__X__shrubs
__X__grass
____ pasture
____ crop or grain
____ Orchards, vineyards or other permanent crops.
____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____ water plants: water lily, eelgrass, milfoil, other
__X__other types of vegetation : Sagebrush at the Biosolids Drying Beds Facility.

b. What kind and amount of vegetation will be removed or altered?

Improvements at the wastewater treatment plant may result in some shrubs and grass being removed. At the Biosolids Drying Beds Facility, vegetation is sparse and some sage brush will most likely need to be removed.

c. List threatened and endangered species known to be on or near the site.

None known.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Landscaping for visual mitigation will be maintained and considered as part of all construction projects at the wastewater treatment plant facility. Vegetation restoration is not anticipated at the Biosolids Drying Bed Facility.

e. List all noxious weeds and invasive species known to be on or near the site.

Noxious weeds including puncture vine and knapweed can be found at both sites. The City of Wenatchee is proactive in managing noxious weeds at the wastewater treatment plant and the Biosolids Drying Beds Facility.

5. **Animals**

a. <u>List</u> any birds and <u>other</u> animals which have been observed on or near the site or are known to be on or near the site.

Examples include:

birds: hawk, heron, eagle, songbirds, other: **<u>duck</u>**
mammals: **<u>deer,</u>** bear, elk, beaver, other: **<u>coyote, racoons</u>**
fish: **<u>bass, salmon, trout</u>**, herring, shellfish, other ________

b. List any threatened and endangered species known to be on or near the site.
Upper Columbia River spring run of Chinook salmon and upper Columbia River run of steelhead.

c. Is the site part of a migration route? If so, explain.
Neither site is part of a migration route.

d. Proposed measures to preserve or enhance wildlife, if any:
None.

e. List any invasive animal species known to be on or near the site.
None known.

6. **Energy and Natural Resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.
The Wastewater Treatment Plant uses electricity for running pumps, blowers and other equipment for treating the wastewater. Digester gas produced by the anaerobic digesters is used to heat the digesters and buildings at the plant. Natural gas is used as a back-up when there is not enough digester gas to keep up with heating demands as well as for laboratory testing.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.
No.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:
Anaerobic digestion produces gas that is used for heating and reduces the need to use natural gas or electricity. High-efficiency motors and variable frequency drives are used to

minimize the consumption of electricity. At the Biosolids Drying Beds Facility, the arid climate is used to dry the biosolids.

7. **Environmental Health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.
Methane gas is stored in the anaerobic digesters and could be an explosion hazard.

1) Describe any known or possible contamination at the site from present or past uses.
The Wastewater Treatment Plant Facility is built on a closed municipal landfill. No contamination is known or expected to be present at the Bisosolids Drying Beds Facility.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.
There are no existing hazardous chemicals or conditions that might affect project development or design.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.
None are expected at this time.

4) Describe special emergency services that might be required.
None.

5) Proposed measures to reduce or control environmental health hazards, if any:
The City operates and maintains the digester gas system to reduce the risk of emissions.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?
None.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

On a short-term basis, construction projects would create some noise on weekdays during normal working hours. No long-term noise is expected with this project.

3) Proposed measures to reduce or control noise impacts, if any:
None.

8. **Land and Shoreline Use**

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The proposed improvements would occur at the current site of the Wastewater Treatment Plant and the biosolids drying beds. Adjacent to the south of the plant is a parking lot and along the east side of the plant is Riverfront Park. To the west across Worthen Street is a strip of property owned by the City of Wenatchee and currently used for the flow equalization basin. To the north of the plant is a frozen food shipping warehouse. The Biosolids Drying Beds Facility is mostly surrounded by vacant land. Approximately 0.13 miles from the SW corner of the facility is an orchard.

The proposal is not expected to affect current land uses on nearby or adjacent properties.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?
No.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:
No.

c. Describe any structures on the site.

On the north end of the Wastewater Treatment Plant are three digesters and the solids handling building. A garage and maintenance shop is located on the northeast side of the facility. The headworks/control buildings are located in the central part of the plant and consists of four buildings closely placed with walkways between them. To the north of the headworks/control buildings are two primary clarifiers and directly east is the influent wet well.

d. Will any structures be demolished? If so, what?
No.

e. What is the current zoning classification of the site?
The zoning at the Wastewater Treatment Plant site is Waterfront Mixed Use and the zoning at the Biosolids Drying Beds Facility is Rural Industrial.

f. What is the current comprehensive plan designation of the site?
Both sites are designated as industrial.

g. If applicable, what is the current shoreline master program designation of the site?
Not applicable.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.
No.

i. Approximately how many people would reside or work in the completed project?
The Wastewater Treatment Plant staff consists of eight positions. Additional staff may be needed as the community grows and equipment is added.

j. Approximately how many people would the completed project displace?
None.

k. Proposed measures to avoid or reduce displacement impacts, if any:
Not applicable.

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:
The recently completed odor control technology and aesthetics improvements at the Wastewater Treatment Plant Facility were completed with consideration of new development occurring along the waterfront. Odor control and asesthetics will also be considered in the proposed improvements.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:
Not applicable.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.
Not applicable.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.
Not applicable.

c. Proposed measures to reduce or control housing impacts, if any:
Not applicable.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?
The new anaerobic digester will be approximately 30 feet tall. The principal exterior building material would be concrete. No additional structures are planned at the drying beds.

b. What views in the immediate vicinity would be altered or obstructed?
None.

e. Proposed measures to reduce or control aesthetic impacts, if any:
Visual mitigation will be considered in all of the proposed projects at the wastewater treatment plant facility to preserve the aesthetic and visual mitigation features added in the most recent improvements.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?
The Wastewater Treatment Plant currently has onsite lighting and additional lighting for aesthetics. No other lighting is anticipated.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

No.

c. What existing off-site sources of light or glare may affect your proposal?
None.

d. Proposed measures to reduce or control light and glare impacts, if any:
None.

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?
The east side of the Wastewater Treatment Plant borders Riverfront Park, which has a trail for walking and bicycling. The Saunders Train, a miniature train, is located adjacent to the plant in the park.

b. Would the proposed project displace any existing recreational uses? If so, describe.
No.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:
None.

13. **Historic and cultural preservation**

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.
No.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.
The Wastewater Treatment Plant fFacility is built on a former municipal landfill. A cultural resources survey of the area in the vicinity of the Biosolids Drying Beds Facility site was conducted in 1990 that identified two cultural resources sites("A Survey of A Proposed Sludge Processing Site For The City of Wenatchee, Chelan County, Washington; By Kevin J. Lyons and Larry J. Fredin, Principal Investigator: Jerry R. Galm; Short Report 211 Archealogical and Historical Services, Eastern Washington University; January 1990).

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.

Consultation with the Colville Federated Tribes and the Washington Department of Archaeology and Historic Preservation must be conducted before any work is performed in the area of the biosolids drying bed site.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.
No loss or disturbance of resources is anticpated.

14. **Transportation**

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.
The wastewater treatment plant facility is accessed through three entrances from North Worthen Street. The plant can also be accessed through a gate at the south end of the plant through the public parking lot. The biosolids drying bed facility is accessed from the Malaga-Alcoa Highway.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?
No. The nearest bus stop is located approximately 1 block south of the wastewater treatment plant facility.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?
No additional parking is proposed. Approximately 12 parking spots on the Wastewater Treatment Plant site would be eliminated with the addition of the third secondary clarifier.

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).
No.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.
Burlington Northern Railroad tracks are located to the west of the Wastewater Treatment Plant. Biosolids would continue to be transported by truck from the wastewater treatment plant to the Biosolids Drying beds Facility.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

No additional vehicle trips are projected beyond truck traffic to transport dewatered biosolids to the Biosolids Drying Beds Facility.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.
No.

h. Proposed measures to reduce or control transportation impacts, if any:
None.

15. **Public Services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.
No.

b. Proposed measures to reduce or control direct impacts on public services, if any.
Not applicable.

16. **Utilities**

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other ___________

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.
No additional utilities will be needed.

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Jessica M Shaw

Name of signee: Jessica M. Shaw

Position and Agency/Organization: Environmental Manager

Date Submitted: 9/26/16

D. supplemental sheet for nonproject actions

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

   As the City of Wenatchee grows, discharges to the wastewater treatment plant and ultimately the Columbia River will increase. The proposed improvements to the Wastewater Treatment Plant and Biosolids Drying Beds Facility have been developed to ensure that wastewater and biosolids can continue to be treated to water quality standards set by state and federal regulations. Increases to toxic or hazardous substances and production of noise are not applicable.

   Proposed measures to avoid or reduce such increases are:

   The projects set forth in the plan will ensure that growth of the community does not negatively impact local water resources.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

   The purpose of the Wastewater Treatment Plant Facilities Plan Update is to lay out a series of projects to protect people, plants, animals and the environment through consistent and effective treatment of wastewater and biosolids.

   Proposed measures to protect or conserve plants, animals, fish, or marine life are:

   Implementation of the proposed projects provides protection of plants, animals, fish and marine life.

3. How would the proposal be likely to deplete energy or natural resources?

   The proposal is not expected to deplete energy or natural resources.

   Proposed measures to protect or conserve energy and natural resources are:

   None needed.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?

   The proposal will protect the Columbia River.

Proposed measures to protect such resources or to avoid or reduce impacts are:
No negative impacts are expected.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?
No affect to land and shoreline use is expected.

Proposed measures to avoid or reduce shoreline and land use impacts are:
Not applicable.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?
No increased demand on transportation or public services and utilities is expected.

Proposed measures to reduce or respond to such demand(s) are:
None needed.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.
This proposal does not conflict with local, state, or federal laws or requirements for the protection of the environment.