Section 6 - Basis of Planning

6.1. Regulatory Requirements

Regulatory requirements form the basis for planning and design. For the Sheridan WWTP facilities, applicable regulatory requirements include the National Pollutant Discharge Elimination System (NPDES) permit, regulations for land application of treated wastewater, the South Yamhill River Total Maximum Daily Load (TMDL), State Water Quality Standards, Recycled Water (Reuse) Regulations, and Land Use and Comprehensive Plan Requirements.

6.1.1. NPDES Permit

DEQ issued a renewal NPDES permit for the Sheridan WWTP on September 30, 2010. The permit contains waste discharge standards, monitoring and reporting requirements, special conditions, and general conditions. The waste discharge limitations not to be exceeded are as follows.

All treated effluent discharged to the waters of the state shall be discharged to the South Yamhill River at Outfall 001, which is the submerged discharge pipe installed by the City in 1999. There shall be no discharge to waters of the State from May 1 to October 31. The discharge limitations from November 1st to April 30th are as shown in Table 6-1.

TABLE 6-1: NPDES Permit Effluent Limits

Parameter		Effluent Concentrations			Effluent Loads		
	Units	Monthly Average	Average Weekly	Maximum Daily	Monthly Average	Average Weekly	Maximum Daily
BOD_5	mg/L	30	45				
TSS	mg/L	50	75				
BOD_5	ppd				810	1,200	1,600
TSS	ppd				1,300	2,000	2,700
BOD_5 and TSS Removal Efficiency	%	65					
E. coli	MPN/100 mL	126[a]		406			
pH	S.U.			6.3 to 9.0			
Total Residual Chlorine	mg/L	0.02[b]		0.04[b]			
Ammonia -N	mg/L	3.1[c]		8.0[c]			

a: Geometric mean
b: When total residual chlorine is below 0.1 mg/L, DEQ shall use 0.10 mg/L as the compliance evaluation level.
c: When receiving stream flow is 175 cfs or less, otherwise no limit.

Note that at the permitted concentrations, the BOD mass loading would be reached at a flow of 3.25 MGD and the TSS mass loading would be reached at 3.12 MGD. At higher flows, lower effluent concentrations would be required to meet mass loadings.

All treated effluent discharged for land application must be discharged at Outfall 002, which consists of two center-pivots. The permit specifies that treated effluent "shall receive at least

Class C treatment as defined in OAR 340-055 to reduce total coliform to 240 organisms per 100 mL in two consecutive samples, and a 7-day median of 23 organisms per 100 mL."

6.1.2. South Yamhill TMDL

DEQ completed the Total Maximum Daily Load (TMDL) for the Yamhill River, including the South Yamhill River, in 1992 (1992 TMDL). The 1992 TMDL established a goal of 0.07 mg/L total phosphorus in the South Yamhill River. The TMDL did not allocate any phosphorus loading to the City of Sheridan because the City was not discharging during the critical months of May - October. Thus, if the City would ever amend their permit to request year-round discharge, the City would have to meet the 0.07 mg/L total phosphorus as an effluent limit.

DEQ is still developing additional TMDLs for other constituents for the South Yamhill River. If waste load allocations for Sheridan are included in the final TMDL, then the NPDES permit can be reopened to allow modifications of the permit to comply with the final TMDL. The South Yamhill is listed for temperature. However, DEQ has indicated that there are no current plans to implement discharge limits for temperature.

6.1.3. State Water Quality Standards

The State of Oregon has defined water quality standards for the Willamette River and its tributaries, including the South Yamhill River. These standards were used by DEQ to establish the NPDES permit effluent limits. The parameters considered when the limits were established include bacteria, dissolved oxygen, temperature, ammonia, pH, BOD and TSS.

The South Yamhill River is water quality limited for fecal bacteria during the Sheridan discharge period. The bacteria limits in the NPDES permit meet the Oregon bacteria rule for fresh waters provided in OAR 340-041-0009(1).

According to the Oregon Department of Fish and Wildlife (ODF&W) Fish Use Designation and Fish Use and Spawning maps (OAR 340-041, Tables 340A and 340B), the section of the South Yamhill River around Outfall 001 is not used for fish spawning but is used for fish rearing and migration. Since the South Yamhill River is no longer designated as a salmonid spawning area, the current listing for dissolved oxygen is no longer valid and the OAR will be corrected by ODF&W.

OAR 340-041-0028(4)(c) establishes the minimum temperature for salmon and trout rearing and migration waters at 18°C during the period from November 1st to April 30th. DEQ determined that the discharge from the Sheridan WWTP has always met that limit and chose to not include temperature as an effluent limit.

The Ammonia concentration may not exceed a daily maximum of 8.0 mg/L and a monthly average of 3.1 mg/L when receiving stream flow is 175 cfs or less.

The pH standard for water in the Willamette basin is set at 6.5 to 8.5 in OAR 340-041-0345 (1)(a). DEQ conducted a reasonable potential analysis to set the permit limits to 6.3 to 9.0 to maintain the pH in the river at the edge of the mixing zone within 6.5 to 8.0.

The minimum design criteria for treatment and control of sewage wastes that can be discharged from the WWTP are established by OAR-340-041-0345(3)(a)(B) for the discharge period of November 1st to April 30th as secondary treatment or equivalent. DEQ used this standard to set the effluent limits for BOD_5 and TSS.

6.1.4. Recycled Water (Reuse) Regulations

Recycled water use in Oregon typically requires an NPDES or Water Pollutant Control Facility (WPCF) permit and a Recycled Water Use Plan (RWUP).

Reuse of wastewater effluent is governed by recycled water regulations as outlined in Oregon Administrative Rules (OAR) 340-055. The April 2008 revisions to Oregon's Recycled Water Use Rules allow the use of recycled water for beneficial purposes if the use provides a resource value and protects public health and the environment. Replacing another water source that would be used under the same circumstances or supplying nutrients to a growing crop, are considered as resource values and beneficial purposes.

OAR 340-055 defines five categories of effluent, identifies allowable uses for each category, and provides requirements for treatment, monitoring, public access, and setback distances. Irrigation of fodder, fiber, and seed crops not for human consumption is allowed for any class of effluent. Fewer restrictions are imposed for higher quality effluent, as shown in the table below. Sheridan's NPDES permit establishes Class C requirements for reuse of the treated effluent for irrigation based on the crops grown on the fields at Outfall 002.

TABLE 6-2: Requirements for Reuse of Effluent by Category

	Class A	Class B	Class C	Class D	Non-disinfected
Treatment[1]	O,D,F	O,D	O,D	O,D	O
Total coliform, 7-day median #/100 mL	2.2	2.2	23	-	Per permit
E. coli, 30-day log mean	-	-	-	126	
Public access[2]		Limited	Limited	Controlled	Prevented
Setback to property line[3]		10 feet	70 feet	100 feet	Per RWUP
Setback to water supply source		50 feet	100 feet	100 feet	150 feet

[1] O = oxidized, D = disinfection, F = filtration
[2] Limited public access: no direct contact during irrigation cycle
[3] Sprinkler irrigation assumed

For recycled water use, groundwater must be protected in accordance with the requirements of OAR 340-040. For agricultural use, this typically translates to irrigating at agronomic rates to match the net irrigation requirements of the crops.

Reuse in treatment plant processes or for landscape irrigation at the plant is exempt from the rules of OAR 340-055 if the water is oxidized and disinfected, there is no off-site spray drift, and public access is restricted.

6.1.5. Land Use and Comprehensive Plan Requirements

The land south of State Highway 18 within the city limits is all zoned for public facilities; see Figure 1 in Appendix A. The property where the Main Lift Station is located (old treatment plant), is located outside the city limits. This should be addressed by the City Planning Department. It is currently zoned by Yamhill County as rural residential. Any recommended facilities for the treatment plant will have to be located within the aforementioned public facilities zoning south of the highway, be annexed into the city and zoned as public facilities, or be included in a future UGB expansion, annexed into the city and zoned as public facilities.

6.2. System Reliability Criteria

Oregon DEQ prepared a draft document titled *Reliability Requirements for Sewage Treatment Facilities in Western Oregon,* dated July 2011. These reliability criteria are summarized in Sections 6.2.1 and 6.2.2, respectively, for collection systems and treatment systems. Criteria based on peak hour flows (marked with an *) are considered questionable for systems with long detention times; Section 6.2.3 summarizes the outcome of further discussion with DEQ (Western Region) regarding the applicability of these criteria to a lagoon treatment system.

6.2.1. Collection Systems

- Collection systems should be designed to handle the peak hourly flow associated with the 5 year, 24-hour storm event for winter flows and the 10 year, 24-hour storm event for summer flows.
- Sewage pumping stations should have a firm capacity (largest pump out of service) equivalent to the peak hourly flow associated with the 5 year, 24-hour storm event for winter flows and the 10 year, 24-hour storm event for summer flows. However, in-system storage (flow equalization) may be considered to reduce the design peak hourly flow on a case-by-case basis. Backup power is also required for sewage pump stations.

6.2.2. Treatment Systems

- All units should be able to handle the peak hourly flows without overflowing or damaging the equipment, with the largest flow capacity unit out of service. The system should have sufficient flexibility to enable the wastewater flow to any unit out of service to be distributed to the remaining units in service.
- Wastewater pumping stations should have a firm capacity (largest pump out of service) equivalent to the peak hourly flow.
- Headworks should be sized for peak hourly flow. A minimum of two units are required. Facilities with only one mechanical screen may include a manual bar screen for redundancy. No redundancy is needed for grit removal units.
- Primary clarifiers, when utilized, should be sized for peak daily flow. No redundancy is needed if the secondary processes are adequate to treat dry weather flows without primary treatment.

- Aeration basins, when utilized, should be sized using modeling to generate desired treatment, typically 10 mg/L effluent BOD and TSS at $MMDWF_{10}$ (Summer) and 30 mg/L at $MMWWF_5$ (Winter). A minimum of two units are required.
- Secondary clarifiers, when utilized, should be sized for either the $PDAF_5$ with all clarifiers operational or the $MMDWF_{10}$ with the largest clarifier off line, whichever results in the greater treatment capacity. A minimum of two secondary clarifiers are required. Overflow rates for the separate seasons should be used.
- The disinfection system should be sized for peak hour flow* with full redundancy.
- For chlorination systems, the contact chamber should be sized for at least 15 minutes of contact time at the peak hour flow*, 20 minutes at peak day, or 60 minutes at ADWF, whichever results in the largest basin.
  - A minimum of two contact units is required. Operation in series is recommended until one chamber needs to be taken offline for maintenance.
  - A minimum length to width ratio of 40:1 is required, with 72:1 preferred.
- For UV systems, a minimum of two units is required. Sizing should be based on a minimum dose of 30 mJ/cm^2 at peak hour flow with all units on or at max day dry weather flow with largest unit offline, whichever results in the larger design. This dose must be calculated for a certain percentage of fouling and end of lamp life statistics as discussed in the Ten State Standards.
  - Full redundancy of the ballasts and controls is required. One control panel is acceptable, as long as there is full redundancy within the panel.
  - A UV transmittance of more than 65% should be verified prior to selecting UV. Collimated beam tests are recommended.
  - UV transmittance (UVT) <u>and</u> UV intensity (UVI) meters are required. UVT and UVI based control is recommended.

6.2.3. Applicability to Lagoon Treatment Systems

The reliability criteria summarized above apply to flow-through systems, where hourly and daily fluctuations in influent flow are reflected in the effluent flows. In a system with extended storage (such as a lagoon), short-term variations are attenuated and thus are not reflected in the effluent discharge rates. Because of this, the Oregon Western Region DEQ has indicated that chlorination system sizing for a lagoon system can be based on the flow associated with the daily maximum effluent load for BOD, to meet the peak day contact time. The flow associated with the daily maximum BOD load for Sheridan (1600 ppd from Table 6-1), assuming an effluent concentration of 30 mg/L, is 6.4 MGD.

DEQ has also indicated that, as a rule, they do not approve UV disinfection for lagoon systems; however, they would consider the use of UV disinfection if filtration of the lagoon effluent is provided.

6.3. Design Concepts and Constraints

The design concept for treatment and disposal of wastewater from the City and FCI includes the following components:

- ✓ Provide facilities capable of consistently meeting current permit limits.
- ✓ Maximize use of existing facilities.
- ✓ Address storage limitations.
- ✓ Find solutions that are practical and cost-effective.

Constraints include the treatment capabilities of lagoon systems, the availability of land for expanding facilities, and the limited irrigation demand by area farmers. These constraints will be addressed for the alternatives considered in Section 7.

6.4. Evaluation Methodology

The following method has been used in the selection of the treatment process:

- ✓ Selection of relevant criteria
- ✓ Identifying options
- ✓ Narrowing the list of candidate systems
- ✓ Selecting a system

The process selection procedure consists of developing treatment and disposal systems that are compatible with one another and satisfy local relevant criteria. A system is then recommended based on the ability to best meet the criteria. In order to be considered, systems must be able to meet the following criteria:

1. System able to provide reliable treatment and disposal at all times under all circumstances
2. Legally acceptable
3. Sites for treatment equipment and disposal readily available
4. Environmental and health risks sufficiently low to satisfy regulators and the public
5. Cost competitive with other alternatives on an initial analysis
6. Equipment and materials readily available
7. Constructability – facilities can be constructed without unacceptably impacting effluent quality
8. Construction must be able to begin after design and bidding are completed, and the system must be operational after construction is completed
9. Financing available and assured

Secondary candidate alternatives must be able to meet items 2 through 9 above, but do not have to provide reliable treatment or disposal at all times under all conditions. Secondary candidate alternatives will be considered if they have the potential to reduce costs.

6.5. Basis for Cost Estimate

Cost estimates for this report were prepared using estimated construction costs with 15% contractor overhead and profit, plus a contingency of 30%, and engineering services of 9% for design and 9% for engineering services during construction (based on total construction cost). Legal, administrative, and permitting costs of 1% are included in the estimates for the final alternatives and 2% for the collection system improvements. Land costs were assumed at $10,000 per acre. Present worth analyses are based on a discount rate of 3.5% and a 20-year time period. An average rate of $0.085 per kwh was used for estimating power costs.

6.6. Water Balance Analysis of Wastewater Treatment Impoundments

A water balance for the existing facilities, using estimated 2011 flows, monthly 2010/2011 precipitation values (from the Western Regional Climate Center for McMinnville), and the reported 2011 irrigation application rate, is included in Appendix F . This water balance shows that, under current operating conditions, the available storage capacity in the lagoons is insufficient. Water balances based on a projected annual flow cycle developed from average and maximum monthly seasonal flows will also be provided for the various alternatives considered that include storage.

6.7. Design Criteria for Conveyance System and Wastewater Treatment Plant

The design criteria used for this facilities planning effort are summarized below.

6.7.1. Collection System

The City's conveyance system will be sized for the projected 2032 peak hourly flow rates associated with the 5-year, 24-hour storm event (peak hourly flow in Table 6-3). The gravity collection system will be sized to carry these flows without surcharging, and sewage pump stations will be designed to handle these flows with the largest pump out of service.

6.7.2. Wastewater Treatment Plant Facilities

The characteristics of the combined City and FCI influent (see Section 4) and the effluent requirements that form the basis for sizing the treatment plant facilities are summarized in Table 6-3. Flow criteria that will be used for sizing various potential treatment components are summarized in Table 6-4.

TABLE 6-3: 20-Year (2032) Design Criteria for Sheridan WWTP

Parameter	Units	Influent	NPDES Effluent Permit Requirements	
			Average Monthly Limit	Average Weekly Limit
Average Day Flow	MGD	1.54		
Maximum Month Flow	MGD	3.36		
Peak Day Flow*	MGD	6.98		
Peak Hourly Flow	MGD	10.13		
Maximum Month BOD	mg/L	-	30	45
Maximum Month BOD	lb/day	2,300	810	1,200
Maximum Month TSS	mg/L	-	50	75
Maximum Month TSS	lb/day	2,400	1,300	2,000
BOD and TSS removal	%		65%	
E. coli	MPN/100 mL		126 colonies/100 ml	406 colonies/100 ml
Residual Chlorine	mg/L		0.02	
Average Ammonia-N	mg/L		3.1**	
pH	SU		6.3 to 9.0	6.3 to 9.0

* Peak day effluent flow =6.4 MGD, based on maximum allowable daily effluent BOD of 1600 ppd (Section 6.2.3)
** Only when receiving stream flow is 175 cfs or less; otherwise no limit

TABLE 6-4: Design Criteria for Component Sizing

Treatment Component	Sizing Criteria	Flow, MGD
Influent Flow Metering	Peak Hour	10.13
Headworks	Peak Hour	10.13
Biological Treatment Facilities	Maximum Month	3.36
Disinfection	Peak Day	6.4
Solids Removal	Maximum Month	3.36

6.7.3. Seasonal Land Irrigation

From May 1st to October 30th when water is being used for irrigation of crops, the treated effluent water quality must meet the total coliform requirements of no more than 240 organisms per 100 mL in two consecutive samples, and a 7-day median of 23 organisms per 100 mL.

Two application rates will be considered for irrigation options. One, 6 inches per acre per year, which reflects the historical usage on the existing site, and two, 21.8 inches per acre per year, which is based on the 17.4 inches per acre per year for fall grass seed reported in the Willamette

Valley (*Oregon Crop Water Use and Irrigation Requirements*, 1992, OSU Ext. Pub. 8530), and an assumed irrigation efficiency of 80%.

Since usage on the existing irrigation site has historically been significantly less than the theoretical published rates, it is not anticipated that the farmer would be willing to accept more effluent than is currently being applied. Therefore, it is assumed that the City would need to purchase farm land in order to increase the application rate.