Executive Summary

This General Sewer Plan (GSP) has been prepared by the City of Yelm (City) in accordance with Washington State Administrative Code (WAC) Chapter 173-240-050, the Washington State Department of Ecology's (Ecology) Criteria for Sewage Works Design Section G1-3, and applicable local/regional plans.

The City's wastewater utility consists of three separate systems: (1) wastewater collection system (STEP), (2) water reclamation facility (WRF), and (3) reclaimed water distribution system. This GSP presents analyses of each of these systems, including:

- Description and condition assessment of the existing systems
- Capacity analysis related to the systems' ability to serve future growth
- Identification of necessary improvements and development of a Capital Improvement Program (CIP) to implement those improvements

Analysis of alternatives to address system needs are supported by business case evaluations (BCEs). A BCE is a structured economic analysis used to make decisions based on life-cycle costs and community, environmental, and risk considerations. "Life-cycle" means not only the costs to build an asset, but also the cost to operate, maintain, repair, and ultimately decommission and replace an asset while it is owned and operated by the City. The BCE tool is a repeatable, defensible, and quantitative decision-making process.

This Executive Summary presents the major findings and recommendations of each section of the GSP.

Section 1 - System Background, Service Area, and Policies

The existing wastewater system serves a portion of the area within city limits as shown in Figure ES-1. The City intends to provide wastewater service within the entire Urban Growth Area (UGA) in the future, including the Thurston Highlands Master Planned Community (MPC) located inside city limits in southwest Yelm (see Figure 2-2). This GSP evaluates system growth with and without development of the Thurston Highlands MPC. Separate analysis of the two development scenarios provides a transparent basis for identifying costs for wastewater utility infrastructure that should be paid for by the developer. Chapter 13.08 of the City of Yelm Municipal Code defines regulations related to wastewater service for the City. The City requires parcels within 200 feet of the existing collection system to be connected within 30 days after notification by the City that service is available. Failed on-site systems and all new development are also required to connect to the collection system. If sewer service has not already been extended to the parcels being developed, the necessary extensions are to be constructed as a cost of development.

The cost of major component improvements to the existing system is reflected in sewer service charges and connection fees. Policies presented in this GSP guide the development and financing of the infrastructure required to provide wastewater service throughout the existing and future service area.

Section 2 - Planning, Flows, and Loads

Over the last decade, Yelm has been the fastest growing city in Thurston County and one of the fastest growing cities in the state. Between 2000 and 2010 the population within Yelm city limits more than doubled, increasing at an annual rate of 7.6 percent, while population within the UGA has increased 2.1 percent annually. The population forecast developed in this GSP applies this growth rate for the period between 2010 and 2015. After 2015, it is assumed that growth will stabilize and occur at the lower

growth rates projected in the forecasts developed by the Thurston Regional Planning Council (TRPC) in 2007 (see Table 2-3).

The sewered population is projected to more than double by 2020 (120 percent increase) and more than triple by 2030 (217 percent increase) with a similar rate of growth for commercial development. These projections do not include development within the Thurston Highlands MPC, which are described separately below. Projected populations to be served by the City's wastewater system for the "without MPC" scenario are summarized in Table ES-1.

Table ES-1. Projected Wastewater System Service Population [a,b]

Year	Population served
2010	6,348
2020	13,976
2030	20,094

a. *Not including Thurston Highlands MPC.*

b. *See Table 2-4 for detailed population projection calculation.*

Section 2 presents projections of future wastewater flows and corresponding pollutant loads to the WRF based on current per capita flows and loads, and the results of wastewater sampling to estimate flows and loads from commercial customers. All projections assume continued development of the wastewater system utilizing STEP collection systems, which has flow and loading characteristics significantly different from other collection system technology alternatives. Projected flows and loads for the without MPC scenario are summarized in Table ES-2.

Table ES-2. Projected Wastewater System Flows and Loads [a,b,c]

Year	Flow (mgd)	BOD_5 load (lb/day)	TSS load (lb/day)	TKN load (lb/day)
2010	0.35	608	164	184
2020	0.8	1,405	378	417
2030	1.16	2,077	557	611

a. *Not including Thurston Highlands MPC.*

b. *See Section 2.6 for detailed flow and load projection calculations.*

c. *Parameters shown are for average annual conditions.*

Section 3 - Collection System Analysis

The City's existing STEP collection system consists of approximately 2,125 STEP tanks, 759 valves, and 40 miles of STEP collection line. Figure ES-2 shows a map of the existing collection system.

A hydraulic model of the collection system was developed to evaluate system pressures and flow velocities which indicate whether system improvements are necessary now or in the future, based on projected wastewater flows. The hydraulic model was calibrated using data collected during peak flow conditions in November and December 2011. Modeling results showed that there are no areas in the existing collection system where system pressures or velocities are high enough to require immediate improvements to the collection system.

Future collection system conditions were modeled by allocating flows to areas where growth is projected to occur and where new basins are projected to be connected to the system. As described in Section 6,

Thurston Highlands will be served by a separate collection system and is not included in the model of the City's existing and future collection systems.

The model of future collection system conditions identified a total of six separate projects that will need to be constructed by 2030 to address issues related to high system pressures and velocities. These projects are summarized in Table ES-3:

Table ES-3. Collection System Improvements [a,b]

Project	Scope
Prior to 2020	
Longmire Street replacement	Install 800 LF of 4-inch pipe
Yelm Avenue replacement	Install 320 LF of 4-inch pipe
Mountain View Road replacement	Install 3,000 LF of 6-inch pipe
Prior to 2030	
Main sewer line replacement	Install 4,325 LF of 6-inch and 10-inch pipe
Rhoton Road replacement	Install 1,500 feet of 10-inch pipe
Mill Road replacement	Install 130 LF of 6-inch pipe

a. *Not including Thurston Highlands MPC.*

b. *See Figure 3-12 for map of collection system improvement projects.*

Several BCEs were performed to evaluate the City's repair and replacement strategy for collection system components, and future use of STEP technology for collection system growth. Results of the collection system BCEs are summarized as follows:

- The City will implement an "enhanced" reactive maintenance approach, as compared to purely reactive or proactive approaches, for STEP pump repair and replacement. The additional time required at each scheduled maintenance event to thoroughly inspect the STEP equipment will maximize service life while minimizing the risk of potential failures for aging equipment. Much of this enhanced approach has already been implemented as of July 2012.
- There are 150 STEP tanks in the collection system that are shared by multiple single-family dwellings. The City receives additional service calls that are directly attributed to operation of the shared STEP tanks and must expend greater administrative time (cost) as compared to un-shared tanks. The City will separate the five most problematic shared STEP tanks in order to resolve problems with the connections that require the most administrative and field staff effort.
- A BCE was developed to determine if gravity or grinder pump collection systems should be used for expansion of the existing collection system. Based on results of the BCE, the City will continue to use STEP collection system technology to serve growth within existing service areas (infill) as well as growth to new services areas outside of the Thurston Highlands MPC. The STEP collection system alternative is favored because it has a decreased risk during extended power outages and lower equipment repair and replacement costs versus grinder pump systems. The cost of a new gravity collection system compared to continued use of the STEP collection system technology would be cost prohibitive.

Section 4 - Water Reclamation Facility Analysis

The GSP analysis of the water reclamation facility (WRF) and its performance covers the period up to December 2011. Changes to the operation of the WRF made in early 2012 have improved WRF

performance over what was experienced through 2011. These operational changes have been documented by the City and will be provided outside of this GSP.

The City's WRF produces Class A reclaimed water using several treatment steps including sequencing batch reactors (SBRs), sand filters, and chlorine disinfection. Excess reclaimed water and treated effluent that does not meet reclaimed water standards is discharged to the Centralia Power Canal and the Nisqually River.

The WRF has consistently met its discharge permit limits with the exception of periodic exceedances of total nitrogen and ammonia limits for reclaimed water, most recently for an extended period in late 2010, much of 2011, and early 2012.

In June 2011 the City retained Brown and Caldwell to develop a computerized process model (Bio-Win) to help determine the reasons that the WRF was unable to reliably achieve its permit limits for reclaimed water. Results of the model indicated that the WRF is essentially operating at capacity with respect to meeting the total nitrogen limit for reclaimed water due to a lack of sufficient carbon food sources to support denitrification, a lack of alkalinity, and inadequate process controls. Reliable WRF operation over the next 2 to 3 years will require short-term improvements to modify process controls to address these issues. Short-term WRF improvements were evaluated in a BCE which concluded that the following WRF improvements are the most cost effective method for meeting reclaimed water permit limits by the summer of 2012:

- A new carbon addition system
- Refurbishment of the existing alkalinity system
- SBR control modifications and instrumentation upgrades

Immediate planning for long-term WRF improvements is necessary to provide additional treatment capacity for the projected future growth. Following the adoption and approval of the GSP, a long-term plan will be developed in detail in a Facilities Plan to provide enough capacity to serve long-term growth. The Facilities Plan will evaluate plant expansion options and will also examine potential level-of-service alternatives for future reclaimed water production. Potential level-of-service alternatives for reclaimed water include:

- Continue to treat all wastewater to Class A reclaimed water standards
- Produce reclaimed water as necessary to meet current mitigation obligations and requirements of existing reclaimed water user agreements

Solids handling facilities at the WRF are projected to be sufficient for the next 10 to 15 years, after which time it is recommended that solids handling at the City WRF be coordinated with plans for solids handling at the Thurston Highlands MPC treatment facility.

An analysis of water quality of the WRF discharge to the Nisqually River and Centralia Power Canal showed that there are no surface water quality concerns requiring long term planning for treatment.

Section 5 - Reclaimed Water System Analysis

Reclaimed water produced at the WRF is pumped from the plant site to various points of application throughout the City, including a constructed wetlands and rapid infiltration basins (RIBs) at Cochrane Park, and during the summer months, to several irrigation/landscaping applications. Components of the reclaimed water system are shown in Figure ES-3.

The City's current policy is to treat all effluent to Class A reclaimed water standards. However, only 34 percent, on average, of WRF effluent is currently discharged to the reclaimed water distribution system. This could be due to lack of demand outside of the summer months, wet weather during the summer months, and treatment reliability issues. Mitigation requirements associated with the City's existing and future water rights are conditioned upon recharge of reclaimed water at the Cochrane Memorial Park

infiltration basins and the opportunity to provide reclaimed water to additional reuse projects. A BCE was performed to weigh the relative advantages and disadvantages of reclaimed water alternatives with respect to the City's goals, commitments related to water rights mitigation, and the cost of providing a higher standard of treatment. The most favorable alternative is expansion of the existing Cochrane Park RIBs. The next most favorable alternatives include connection of future users, which would be evaluated on a case-by-case basis, and construction of new infiltration basins to be prioritized after expansion at Cochrane Park. Reclaimed water system pumping and storage improvements would be required to implement the reclaimed water alternatives identified in the BCE.

Expanding the Cochrane Park RIBs would provide additional year-round demands with a flexible use pattern. Additionally, increasing the groundwater infiltration rate could provide the opportunity for future water rights mitigation.

The City is in compliance with applicable reclaimed water system operation, monitoring, and record-keeping requirements. However, in 2010, Ecology began drafting an update to the state's reclaimed water rules. Although the Draft Rules were originally scheduled for adoption by the end of 2010, the final revisions and adoption have been delayed until no earlier than June 30, 2013. The Draft Rules, in their current form, have the potential to impact many of the City's existing and identified uses for reclaimed water.

Section 6 - Service to the Thurston Highlands Master Planned Community

The Thurston Highlands MPC, as currently proposed, would include a mixture of residential (5,000 homes) and commercial development (825,000 square feet) constructed over a period of up to 30 years. This GSP assumes development of the MPC starting in 2020, with an additional City population of 5,195 and 352,000 square feet of commercial development by 2030. Projected MPC population and associated flows and loads are summarized in Table ES-4.

Table ES-4. Projected Thurston Highlands Population, Flows and Loads [a,b,c]

Year	Population	Flow (mgd)	BOD_5 and TSS load (lb/day)	TKN (lb/day)
2020	1,244	0.13	252	36
2030	5,195	0.62	1,070	165
2040	9,079	1.09	1,870	290
2050	12,963	1.56	2,670	440

a. *Assumed gravity collection system.*

b. *See Section 6.5 for detailed flow and load projection calculations.*

c. *Parameters shown are for average annual conditions.*

Projected wastewater flows/loads generated within the MPC in 2030 would be approximately 75 percent of those generated within the existing City service area. Due to this significant potential loading increase, careful infrastructure planning is necessary to ensure that City planning and wastewater service goals, for both existing and future customers, will be met.

The analyses in this GSP support a policy for the wastewater system infrastructure serving the Thurston Highlands MPC to be developed as a satellite wastewater system. While physically separate from the existing Yelm wastewater system, this new satellite system would be owned and operated by the City as part of its wastewater utility. Furthermore, the Thurston Highlands development will support the City's

policy that "growth pays for growth," and a satellite infrastructure system will provide a transparent basis for identifying costs that should be paid by the developer and not existing rate payers.

BCEs were performed to evaluate alternatives for providing wastewater service to the proposed Thurston Highlands MPC. Results of the BCE analyses are as follows:

- The MPC will be served by a gravity collection system. Lower risk and equipment repair/replacement costs for the gravity alternative outweigh the potential advantages related to familiarity with STEP technology.
- Wastewater generated within the MPC will be treated at a satellite treatment facility located within Thurston Highlands. Based upon current City goals and the lack of a disposal option other than groundwater recharge in rapid infiltration basins or some other means, Class A reclaimed water production is the only viable treatment alternative.
- Class A reclaimed water produced at the satellite treatment facility will be used for groundwater recharge and irrigation, as well as a potential supplement to the City reclaimed water supply via a reclaimed water system intertie. Reclaimed water will be a resource that is to be managed for the benefit of the City, not the developer.

Capital costs of wastewater collection, treatment, and reclaimed water infrastructure will be paid to the City by the MPC developer, including costs for permitting, planning, design, and construction. A Developer Agreement will be prepared that defines how all developer and City costs will be paid by the developer.

Section 7 - Operation and Maintenance Program

The wastewater system operation and maintenance (O&M) program was evaluated with respect to the adequacy of existing staffing level and O&M procedures. The City currently employs five full-time equivalent (FTE) staff in the Public Works Department and an additional two FTE outside of Public Works who contribute to wastewater system administration. The existing staff is appropriate to efficiently operate, sample, maintain, repair, and to perform recordkeeping duties for the wastewater system. Based upon projected wastewater system growth, not including wastewater facilities at Thurston Highlands, an additional four full-time Public Works staff will be necessary to perform wastewater system O&M duties in 2030. Staffing requirements for the Thurston Highlands MPC would represent approximately 2.5 FTE based on the development schedule described above.

Existing wastewater system O&M procedures, with implementation of the standard operating procedures (SOPs) discussed previously, were found to be adequate. However, software combining record-keeping and scheduling functions, will save time and effort for City staff and will become more critical as the collection system grows and ages. The City will develop and implement a computerized inventory tracking and maintenance system to better organize system record-keeping, track regularly scheduled maintenance tasks, manage spare parts, and generate reports on system operating parameters.

Section 8 - Design and Construction Standards

The utilities existing standards for the design and construction of new collection system and reclaimed water distribution facilities are documented in this GSP. No significant changes to existing standards are proposed.

Section 9 - Capital Improvement Program

The CIP for the utility through 2030 is described in Section 9, along with planned O&M projects. Tables ES-5 and ES-6 present a summary of the planned O&M projects and the CIP. Total O&M project cost is estimated to be approximately $960,000; the total CIP through 2030 totals approximately $3.0 million. The CIP includes budget for the preparation of a Facilities Plan to evaluate WRF capacity in detail; this

Plan will likely identify the need for additional capital projects. The CIP also includes $300,000 in short-term improvements to the WRF to improve process performance and reliability.

Section 10 - Financial Program

Section 2 of this GSP presents population growth projections through 2015 that reflect a population growth rate of 7.6 percent that was experienced over the period from 2000-10. Projected growth rates for the period from 2015-30 are consistent with TRPC projections.

Section 4 of this GSP presents analyses of WRF capacity that show that the available capacity to produce reclaimed water will be exceeded in the next 2-3 years if recent growth rates continue. Section 4 then identifies the need for the preparation of a wastewater Facilities Plan to develop a detailed plan for how to accommodate projected future growth within the service area.

The financial plan presented in Section 10 is designed to support the utility in the short-term until the Facilities Plan is completed and costs for providing additional capacity can be completely understood. This financial plan is conservatively based on a lower growth rate that reflects the most recent growth rates in utility revenues. An updated financial plan will be prepared as part of the Facilities Plan.

The financial plan recommends increasing utility revenues through annual rate increases to fund the capital improvement program and pay for new O&M projects. Annual rate increases of 5.4 percent in 2013, 4.0 percent in 2014-16, and 3.0 percent in 2017are recommended.

Section 11 – Environmental Documentation

The SEPA checklist for this General Sewer Plan is presented in Section 11.

Section 12 – Public Involvement

This section describes the public meetings that were held to discuss the GSP. This section also identifies the agencies to which the draft GSP was submitted for review and comment. Agency comments and respective City responses are provided in Appendices 12A and 12B.

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Table ES-5. O&M Projects

Project No.	Name	Description	Estimated project cost (2012 dollars)	Section in GSP	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
COM-1	STEP Tank Pump Repair and Replacement	Repair/replace as needed based upon scheduled inspections as described in BCE.	$637,500	Section 3.6.2		$1,500	$4,500	$7,500	$15,000	$30,000	$120,000	$120,000	$120,000	$45,000	$30,000	$21,000	$13,500	$10,500	$12,000	$15,000	$19,500	$22,500	$30,000
COM-2	Reserve fund for STEP tank replacement	Set up reserve for repair of major STEP tank failure.	$50,000	Section 3.6.1		$10,000	$10,000	$10,000	$10,000	$10,000													
COM-3	Convert shared STEP tanks to individual STEP tanks	Convert five most problematic shared STEP tanks to separate STEP tanks (requires six new STEP tanks to be installed).	$42,000	Section 3.6.2			$7,000		$7,000		$7,000		$7,000		$14,000								
COM-4	Replace ARVs	Replace all 116 existing air release valves in collection system. The first 20 valves replaced in 2012 will be funded with Fund 413 reserves. 2013-2017 will require additional O&M funds.	$71,050	Section 3.4.1	$12,250	$11,760	$11,760	$11,760	$11,760	$11,760													
WRFOM-3	SBR Handrails	SBRs do not have handrails around the perimeter; installation is recommended as a safety improvement.	$51,620	Section 4.4.2.1		$51,620																	
RWOM-1	Reclaimed water valve replacement	Replacement of five corroded distribution system valves and installation of a new valve at the WRF. The first RW valve will be replaced in 2012 out of existing O&M funds. Balance in 2013 and 2014 will require additional O&M funds.	$24,000	Section 5.2.3.4		$12,000	$12,000																
RWOM-2	Reclaimed Water Tank Inspection	Inspect interior of Reclaimed Water Storage Tank every 10 years.	$20,000	Section 5.2.3.2				$10,000										$10,000					
ADMIN-1	Utility administration improvements	Institute asset management program; institute O&M program; implement upgraded pretreatment program.	$30,000			$7,500	$7,500	$7,500	$7,500														
WRFOM-2	Replace SBR Valve Actuators	Six actuators total at SBRs, one does not need to be replaced and one replacement has already been ordered. Four actuators yet to be replaced.	$8,520	Section 4.4.2.3	$8,520																		
WRFOM-1	Replace Influent Flow Meter	Existing 6-include flow meter has failed and needs to be replaced	$8,000	Section 4.4.2.6	$8,000																		
WRFOM-4	PAX System Relocation	Relocation to an FRP building to get the system out of an electrical room. Further improvements would be implemented as part of a plant upgrade.	$8,600	Section 4.4.2.7	$8,600																		
	O&M Projects Total		$951,290		$37,370	$94,380	$52,760	$46,760	$51,260	$51,760	$127,000	$120,000	$127,000	$45,000	$44,000	$21,000	$13,500	$20,500	$12,000	$15,000	$19,500	$22,500	$30,000

Note: CIP does not include water rights mitigation projects that do not directly require reclaimed water (such as in-kind contributions, habitat restoration, etc.); these were included on WSP CIP.

Table ES-6. 20-Year Capital Improvement Plan

Project No.	Name	Description	Estimated project cost (2012 dollars)	Year On-Line	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
C-1	Collection System Upgrades	Collection system upgrades necessary to address anticipated pressure issues, based on hydraulic modeling.	$1,349,765	2020, 2030						$162,740	$162,740	$162,740								$287,182	$287,182	$287,182	
WRF-1	Short Term Improvements:	Implement short term improvements described in Section 4: carbon addition, alkalinity system upgrade, I&C, blower modifications.	$300,000	2013																			
		Carbon addition system				$43,000																	
		Alkalinity system upgrade				$59,000																	
		I&C upgrade (includes replacement of DO probes in each SBR basin, a new influent ammonia instrument, new effluent ammonia and nitrate instruments at the common effluent of the SBRs, and programming necessary for changes)				$198,000																	
RW-1	Expand Cochrane Park RIBs	Complete improvements to expand the capacity of the RIBs at Cochrane Park, including piping modifications, further investigation to determine capacity of RIBs, and placing the underground RIB into service.	$661,000	2014			$661,000																
WRF-2	Facilities Plan	Prepare planning document conforming to WAC 173-240 for upgrades to WRF to increase treatment capacity.	$400,000	2013	$50,000	$350,000																	
	Capital Projects Totals		$2,710,765		$50,000	$650,000	$661,000	$0	$0	$162,740	$162,740	$162,740	$0	$0	$0	$0	$0	$0	$0	$287,182	$287,182	$287,182	$0

Figure ES-1

Figure ES-2

Figure ES-3