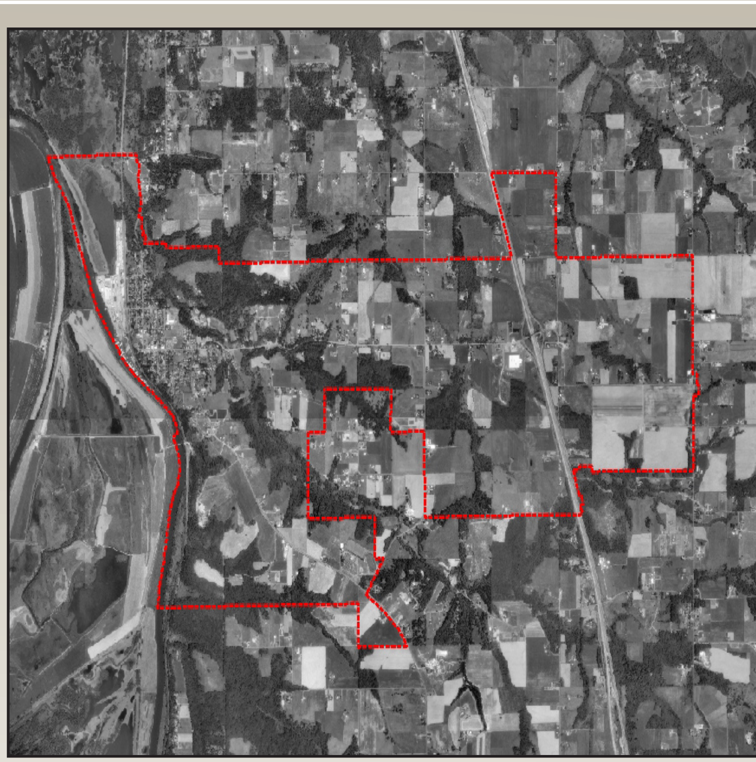
CITY OF RIDGEFIELD

CLARK COUNTY, WASHINGTON

GENERAL SEWER AND WASTEWATER FACILITY PLAN VOLUME 1



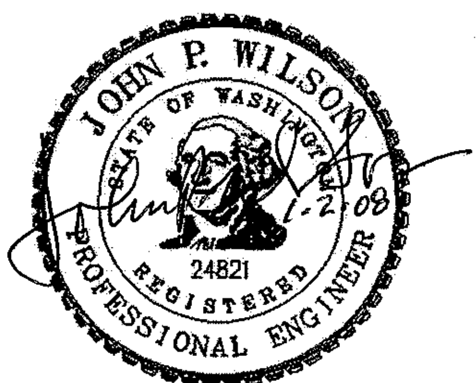
G&O No. 04326
December 2007

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF RIDGEFIELD

CLARK COUNTY **WASHINGTON**

GENERAL SEWER PLAN/FACILITIES PLAN



EXPIRES: 1-15-2008

G&O #04326
DECEMBER 2007

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OVERVIEW

The City of Ridgefield has emerged from an extended period of low growth to being one of the most rapidly growing communities in southwest Washington. At current growth rates, the capacity of the wastewater treatment facility will be consumed within the next 2 to 3 years. Given the lead-time required to finance and construct major wastewater improvements, the City will need to proceed rapidly to construct the improvements necessary to accommodate the growth assigned to the City's Urban Growth Area (UGA). Improvements to major components of the City's collection system will also be needed.

A 10- and 20-year projection of wastewater flows is identified in this plan. These projections are most pertinent to determining expansion needs for the wastewater treatment plant. The projections are based on the City's 2004 (Land Use) Comprehensive Plan Update. Actual flows may vary depending on the pace of growth and/or contributions from a large single customer. A more detailed basin-by-basin projection of buildout flows based on zoning is also provided in this plan. These flows are used to size new collection system infrastructure.

THE EXISTING COLLECTION SYSTEM

The existing sewer system was constructed in the 1950s and primarily serves the downtown core area. The system is currently in good shape and does not exhibit excessive infiltration and inflow (I/I). However, the downtown system does not have the hydraulic capacity to convey the projected flows that will be generated by the UGA to the existing Lake River Wastewater Treatment Plant (WWTP). Given this constraint, plus the natural topography within the UGA, this report recommends that the City use pump stations and force mains to bypass the downtown collection system and transmit new flows from the south and east portions of the UGA directly to the treatment plant.

This report also provides a series of recommendations concerning proper operation and maintenance of the collection system. These recommendations include the initiation of a pretreatment program to protect both the integrity of the collection system, the operability of the WWTP and the receiving water environment. A long-term program for replacement of the older segments of the collection system is also recommended.

COLLECTION SYSTEM IMPROVEMENTS

The City of Ridgefield will require a substantial expansion of its wastewater collection system over the next 20 years. Based on topography and natural drainages, a series of additional trunk lines and wastewater pumping stations has been identified as necessary to accommodate community growth. Table E-1 summarizes the recommended projects and estimated project costs of the collection system expansion identified in this report.

The costs of the improvements are divided between City costs and developer costs. This division is based on an assessment of the percentage of the improvement that will serve the existing customer base versus the percentage of the improvement required to accommodate new growth.

EXISTING WASTEWATER TREATMENT PLANT

The existing wastewater treatment plant provides secondary treatment using an activated sludge system and UV disinfection of the effluent. The facility is currently operating at about 70 percent of its permitted capacity. The WWTP consistently complies with permit limitations at current loadings. Bioassay testing also confirms that the plant is producing a high quality effluent. The plant has limited solids management capabilities and contracts with the Clark County Salmon Creek WWTP for sludge hauling and treatment. The Ridgefield WWTP also has limited laboratory facilities.

TREATMENT PLANT EXPANSION

To meet future treatment capacity needs without excessive rate impacts, this Plan identified four phases of expansion at the existing plant location. The first phase (Phase 1) is an expansion to 0.7 mgd to accommodate the City's growth until 2009. The second phase (Phase 2) would expand the WWTP to 1.0 mgd (design year 2012) to fully utilize the capacity of the Lake River Outfall. The third (Phase 3) is an expansion to 1.83 mgd to meet needs until 2019. The fourth phase (Phase 4) would be an expansion to 2.68 mgd to meet the projected demand in 2024. Phase 3 includes the construction of an outfall to the Columbia River.

Three treatment process alternatives were evaluated in this plan to provide the necessary capacity and levels of treatment for the projected 2024 flow and loading rates: conventional activated sludge, membrane bioreactor, and sequencing batch reactor. The lowest cost alternative is an expansion of the existing conventional activated sludge system. A membrane bioreactor facility also appears to be a feasible alternative, but the estimated capital and operation costs are significantly higher for this system. Although the anticipated effluent quality would be better for the membrane bioreactor alternative, the discharge to the Columbia River would not make the improved quality necessary for effluent disposal.

Table E-2 summarizes the estimated costs for the recommended alternative for each project phase.

TABLE E-1

Recommended Collection System Expansion Projects

Project	Estimated Cost (Millions $)	Developer Share %	Developer Contribution (Millions $)	City Share %	City Contribution (Millions $)
T-21	1.72	100	1.72	0	0
T-20	0.281	0	0	100	0.281
T-17W	1.54	10	0.154	90	1.38
T-18	0.296	10	0.030	90	0.266
T-17E	1.083	90	0.975	10	0.108
T-9W	1.12	50	0.558	50	0.558
T-16W	0.620	90	0.558	10	0.062
T-16E	1.09	100	1.09	0	0
T-9E	0.648	50	0.324	50	0.324
T-10	1.26	50	0.630	50	0.630
T-11	0.537	100	0.537	0	0
T-23	0.890	100	0.890	0	0
T-12E	1.32	0	0	100	1.32
T-12WB	0.965	100	0.965	0	0
T-15	0.949	100	0.949	0	0
T-12W	0.844	20	0.169	80	0.675
T-12WA	1.07	100	1.07	0	0
T-8	1.67	75	1.25	25	0.417
45th Avenue PS & FM	1.10	50	0.549	50	0.549
279th Street PS & FM	0.464	75	0.348	25	0.116
Basin 1 PS & FM	0.735	100	0.735	0	0
Total	**20.2**		**13.5**		**6.7**

TABLE E-2

Estimated Costs of Treatment Plant Expansion

	Phase 1	Phase 2	Phase 3	Phase 4
Service Year(1)	2009	2012	2019	2024
Construction Year(2)	2007	2009	2011	2017
Maximum Month Flow (mgd)	0.7	1.0	1.83	2.68
Estimated Cost(3)	$3,198,000	$7,250,000	$24,467,000(4)	$7,499,000

(1) Year when the capacity will be consumed.
(2) Year when improvements should be constructed.
(3) Estimated cost includes engineering, construction, and sales tax.
(4) Includes the Columbia River outfall and Class A biosolids management system.

BIOSOLIDS

Sludge from the treatment plant is held in two on-site aerobic tanks until it can be hauled in a tank truck to the Clark County Salmon Creek Treatment Plant for further treatment and disposal. The sludge is then blended with the solids from the Salmon Creek plant and processed to produce Class B biosolids at Salmon Creek. The County also handles disposal at a permitted facility.

The County provides laboratory analysis, permitting, processing, and most of the hauling related labor as part of this arrangement. The hauling and disposal agreement between the City and the County is not formalized and the County has had to limit the biosolids removed from the Ridgefield plant when equipment or operational problems occur at Salmon Creek. The County is not currently planning to add additional processing capacity to accommodate growth in Ridgefield. Meanwhile, the Salmon Creek facility is adding additional customers who will consume the excess biosolids processing capacity at Salmon Creek.

The cost effectiveness of the existing arrangement will change as the City of Ridgefield generates more biosolids. The additional labor and hauling costs will eventually justify additional biosolids processing capital expenditures for the Ridgefield plant. Salmon Creek will continue to be the preferred option for the first phase of the Ridgefield plant expansion, but it is recommended that the next projected phase include the costs of equipment to allow Ridgefield to process their own biosolids.

The timing and nature of the improvements required of the City wastewater system are largely driven by growth needs and regulatory requirements. The exception is the biosolids processing improvements. The City will have a choice between the lower costs of managing Class B quality biosolids or the more readily disposable Class A biosolids. Table E-3 identifies the management options that Ridgefield can consider in determining the future biosolids processing and disposal program. It should be noted that these options could also be modified to include continued collaboration with Clark County for biosolids analysis and disposal.

TABLE E-3

Summary of Biosolids Management Alternatives

Alternative (expected solids concentration)	Annual Operations Cost Estimate[1]	Capital Cost Estimate	20-Year Net Present Value[2]
Short-Term: 2005-2006			
City Hauls Raw Sludge to Salmon Creek (1.67%)	$ 59,400	N/A	N/A
County Hauls Raw Sludge to Salmon Creek (1.67%)	$ 45,000	N/A	N/A
Phase 1 and 2: 2007-2012			
County Hauls Raw Sludge to Salmon Creek (3%)	$106,700	N/A	N/A
Contracted Hauling Class "B" Sludge to Land Application Site (3%)	$230,000	N/A	N/A
Phase 3 and 4: 2012-2024			
County Hauls Raw Sludge to Salmon Creek (3%)	$401,000	N/A	$5,615,000
Contracted Hauling Class "B" Sludge to Land Application Site (18%)	$219,000	$3,002,500	$5,588,000
Class "A" Sludge Drying with Public Giveaway (90%)	$193,000	$6,215,000	$8,030,000

(1) Annual operations costs are estimated at the projected sludge productions rates for 2006 (short-term), 2009 (Phase 1) and 2024 (Phase 2).

(2) Assuming 1.5 percent interest rate on a loan for the capital costs, 4 percent discount rate, and 2.5 percent annual inflation rate.

RECEIVING WATER ISSUES

The Lake River WWTP discharges to the east bank of Lake River, a tidally influenced tributary of the Lower Columbia River. Classification of Lake River as a receiving water at the point of the Ridgefield discharge is not definitively established. The river at the Ridgefield discharge exhibits characteristics of both a river and an estuary. The dilution zone study provided in this plan notes that the physical and hydrological behavior of the river in this location is more estuarine.

The Department of Ecology, however, has indicated that they believe Lake River should be considered as a river for receiving water classification purposes. The implications of this classification are significant from the perspective of the City of Ridgefield. The amount of receiving water available for effluent dilution and the boundaries of the dilution zone are considerably more restrictive if Lake River is classified as a river for receiving water purposes. Within the 20-year UGA projected flows identified in this plan, Lake River could continue to be a suitable receiving water environment for well nitrified effluent from a secondary wastewater treatment facility if Lake River is classified as an estuary, as previously indicated in the City's NPDES permit.

Since the City cannot delay WWTP expansion to resolve the issue of the proper classification of Lake River, the mixing zone studies performed for projected future flows have considered the effect on discharge permit limits of using both river classifications. The river classification greatly reduces the WWTP flow that can be discharged without probable permit violations, involving potential effluent metal and ammonia limits. This maximum allowable discharge flow is also affected by the outfall design and the critical minimum flow in Lake River.

Mixing zone studies have determined that Lake River has sufficient dilution for accommodating the 0.7 mgd WWTP Phase 1 expansion by 2009 with an extension of the outfall to mid channel of Lake River. Adequate dilution is provided for this WWTP flow regardless of the classification of Lake River, as long as the existing outfall is extended.

The minimum amount of receiving water available in Lake River for effluent dilution year-round is dependent on Lake River flow, tidal flux, and the complex hydrodynamic behavior of the receiving water system. As described in the mixing zone studies appended to this report, Columbia River flow enters the Lake River channel and moves past the WWTP discharge point at flood tides during periods of low seasonal Lake River flow. The reversing tide flushes this entering volume of water back into the Columbia River, where it moves downstream and does not reflux into Lake River. This “residual circulation” supplies the majority of dilution water at the outfall when the flow in Lake River from upstream sources is low. The overall effect of these two sources of dilution water is a minimum critical discharge of 400 cfs in Lake River. This flow should be the basis of dilution calculations for the Lake River outfall.

Assuming a 400 cfs critical flow in Lake River, mixing zone studies show that the extended outfall in Lake River should provide enough dilution to accommodate a WWTP flow of as much as 1.0 mgd.

However, in addition to the conclusions of the dilution zone studies that were conducted as part of this planning effort, there are other factors that need to be considered in determining whether the City of Ridgefield should continue to anticipate long-term use of Lake River as a receiving water. The factors that are most significant in this consideration are as follows:

- Assuming that this region continues to grow beyond the 20-year projections provided in this plan, once the treatment plant flows exceed 1 mgd if Lake River is classified as a “river,” or exceed 4 mgd if it is classified as an “estuary,” it will become increasingly difficult to treat effluent to a level suitable for discharge into Lake River. Given the potential for additional expansion of the UGA and/or possible acquisition of additional system customers with significant wastewater flows, it appears to be in the City’s best long-term interests to move towards moving the discharge location to the mainstem Columbia River where effluent limitations based on dilution zones are less restrictive. The uncertainty of the classification of Lake River should not delay the City from pursuit of this new outfall location.

- The environmental permitting issues relating to crossing the Ridgefield National Wildlife Refuge with a new effluent pipeline to an outfall in the Columbia River will only become more complex over time. As such, it is advantageous for the City to construct this outfall as soon as the required environmental permits can be obtained.

- The City is currently in a period of rapid growth and can presently collect an appropriate contribution for outfall permitting and construction from new growth and development. Without these revenues, the existing customer base will not be able to afford the costs of constructing the Columbia River outfall.

- The analysis of continued discharge into Lake River is based on hydraulic modeling. Water quality issues quantified in a future Total Maximum Daily Load (TMDL) study for the Columbia River may generate additional effluent constraints for discharges into Lake River.

Therefore, this plan recommends that the City move forward to acquire the necessary permits and construct an outfall to the Columbia River. On an interim basis, as the customer base is increased and the system acquires the funds necessary for the capital investment required to reach the Columbia River, the City should continue to request the authorization from Ecology to discharge into Lake River. It has been noted that the existing treatment plant outfall to Lake River is not submerged at all times and visibly discharges across the bank at low tide. This situation does not meet the regulatory requirements for a continuously submerged outfall, nor does the existing bank discharge provide adequate effluent dilution to meet permit limits. As a condition for the continued use of Lake River for effluent disposal on an interim basis, a submerged diffuser will be installed mid channel at a minimum 7-foot depth in Lake River to provide adequate interim dilution until the outfall to the Columbia River can be constructed.

OUTFALL TO THE COLUMBIA RIVER

Developing a new outfall in the Columbia River will require three major construction elements. These elements consist of a 24-inch-diameter effluent force main to the river, a diffuser installed in the mainstem of the Columbia River, and an effluent pump station located at the WWTP. The system will be designed to serve the buildout flows for the Ridgefield UGA. Due to permitting restrictions, the City has decided to pursue a northern outfall alignment to the Columbia River that avoids crossing the Ridgefield National Wildlife Refuge. The estimated project cost of the outfall line and diffuser is $8,248,000 based on the preferred route.

Table E-4 identifies the individual permitting requirements, including estimated time for the permitting process that must be completed before construction of the new outfall can begin. The table includes a schedule for completing each permit; however, the time periods are not cumulative since several elements of work can proceed simultaneously.

TABLE E-4

Columbia River Outfall Permitting Process

Permits and Studies	Estimated Duration (Years)	Probable Schedule
Federal Permits		
Env. Assessment (NEPA)	2	2008-2010
Nat. Historic Preservation Act Sec. 106	0.5	2009
ESA Section 7 Consultation Report	2	2008-2010
ACOE Rivers & Harbors Act Section 10, Clean Water Act Section 404, Nationwide Permit #7 Outfalls	2.5	2008-2011
Geotechnical Analysis for Pipeline Route	0.5	2010
Washington State Permits		
Hydraulic Project Approval, WDFW	0.5	2009
SEPA Env. Checklist/MDNS	Completed as part of NEPA	2008-2010
Diffuser Siting Study	1	2009
Outfall Analysis and Review (Ecology)	0.5	2010
Local Permits		
Shoreline Substantial Development	0.5	2010
Private Permits		
Right-of-Way Lease/Easements	0.5	2008

RECLAIMED WATER OPPORTUNITIES

This plan includes a consideration of treating wastewater to reuse standards for use in the community rather than disposing the effluent in receiving waters. Two reclaimed water facility options were considered, a satellite plant and a separate side stream treatment process at the Lake River plant. However, as with many reclaimed water situations, the demand for reclaimed water is seasonal and tied to the irrigation season. During the non-irrigation season, effluent must still be discharged to receiving waters. With the requirement to construct an outfall to the Columbia River for discharge and the capability of that discharge location to accommodate the disposal of all of the City's effluent, it is not cost effective to generate reclaimed water solely for the irrigation season. The costs of constructing and operating a reclaimed water system with a satellite facility as compared to current potable water costs are provided in Table E-5.

TABLE E-5

Comparison of Reclaimed Water and Potable Water Costs

	Reclaimed Water Production	Development of Additional Water Rights	Purchase Water Rights from the County	Conservation Based Water Rate Structure
Capital Cost	$8,943,000	NA(2)	NA(2)	NA(3)
Annual O&M Cost (2005)	$ 146,200	NA(2)	NA(2)	NA(3)
Net Present Value (2005)(1)	$9,222,500	$4,593,000(4)	$4,044,000(4)	NA(3)
Cost of Water ($/1000 gal) (2005)	$25.33(6)	NA(3)	NA(3)	$8.57(5)

(1) Discount rate = 4.5%, interest rate = 1.5%, and inflation rate = 3%.
(2) Varies by year over the twenty year period; presented in Tables 8-3, 8-4, and 8-5 in the *City of Ridgefield Water System Plan Update* (Gray & Osborne, 2005).
(3) Not applicable, not calculated, not used in the comparison.
(4) From Table 8-6, *City of Ridgefield Water System Plan Update* (Gray & Osborne, 2005) for the production of 632 million gallons over 20 years.
(5) Assumes a very large monthly use of 64,328 gallons, which is selected because it is in the third tier of a conservation based water rate structure. The first tier is based on the existing City of Ridgefield water rate (including a monthly base charge); the second and third tiers were based on the conservation based water rate structure for the City of Seattle.
(6) Cost of water based on 2005 annual O&M cost and debt payment on capital cost for 26,000,000 gallons of reclaimed water produced per year.

SUMMARY OF RECOMMENDATIONS

The total estimated project costs of the improvements recommended in this Plan are summarized in Table E-6. This cost information also assumes a four-phase implementation plan for the treatment plant improvements to help the City manage the significant financial outlays associated with the improvements. The years identified in the table are when the construction must begin for improvements to be on line for growth requirements. The costs in this table can be reduced by choosing the option of Class B instead of Class A biosolids processing. Otherwise, the costs represent the lowest cost alternatives available to the City for meeting future growth and regulatory requirements.

TABLE E-6

Summary of Wastewater Project Estimated Costs

Project Element	2007	2009	2011	2017	Unassigned Date[1]
Outfall to Columbia River	N/A	N/A	$8,248,000	N/A	N/A
Wastewater Treatment Plant	$3,198,000	$7,250,000	$16,219,000	$7,499,000	N/A
Collection System Improvements	N/A	N/A	N/A	N/A	$6,697,000
Total	$3,198,000	$7,250,000	$24,467,000	$7,499,000	$6,697,000

(1) Date depends on development patterns.

FINANCING

The City of Ridgefield is facing a considerable investment in wastewater infrastructure to meet both existing regulatory requirements and to accommodate growth. To pay for this investment, the City has revised the System Development Charges (SDC) for both the water and wastewater systems. With the new wastewater SDC of $6,950 per Equivalent Dwelling Unit (EDU), the City should develop sufficient financial resources to complete this plan. However, since wastewater capacity must be constructed prior to development, a substantial amount of interim financing in the form of loans or bonds will be required to implement this plan.

CHAPTER 1

INTRODUCTION

PURPOSE

In July 2004, the City of Ridgefield retained the services of Gray & Osborne Inc., Consulting Engineers, to prepare this combined General Sewer Plan/Wastewater Facilities Plan (Plan). The Plan addresses the City's comprehensive planning needs for wastewater collection, transmission, treatment, and disposal over the next 20 years. The Plan has been prepared in accordance with the provisions of the following regulations:

- Revised Code of Washington (RCW), Section 90.48, Water Pollution Control
- Washington Administrative Code (WAC), Section 173-240-050, General Sewer Plan, and Section 173-240-060, Engineering Report
- United States Code of Federal Regulations (CFR), Section 40 CFR 35.917, Facilities Planning

Development of the Plan has been coordinated with the City's development regulations and Capital Facility Plan, the Washington State Growth Management Act, Clark County planning efforts, and the City of Ridgefield Water System Plan. This Plan updates the previous General Sewer Plan completed in 1994 and the Facility Plan that was completed in 1997. This Plan also summarizes and incorporates the results of the studies required in the City's current National Pollutant Discharge Elimination System (NPDES) Permit. This permit, the permit fact sheet, and regulatory correspondence relating to this Plan is provided in Appendix A.

This Plan is based on three major objectives. The first objective is to ensure that the City remains in compliance with applicable regulations governing the discharge of treated wastewater into the environment. The second objective is to define the City's future growth needs and identify wastewater system improvements necessary to support this growth. The third objective is to ensure that wastewater service provides an affordable plan and funding program.

The Plan is intended to be feasible in terms of engineering, economic, regulatory, and political frameworks. The plan includes conceptual designs and cost estimates for recommended facility improvements, as well as proposed construction schedules and financing plans. A State Environmental Policy Act (SEPA) checklist and State Environmental Review Process (SERP) document are provided in Appendix B. The projects described in the Plan are consistent with State regulations relating to the prevention and control of discharge of pollutants into State waters, anti degradation of existing and future beneficial uses of groundwater, management, and disposal of biosolids, and anti degradation of surface waters. Reclamation and reuse of wastewater is also considered in this Plan.

EXISTING SYSTEM

OVERVIEW OF EXISTING CONDITIONS

The City of Ridgefield is located within Clark County in southwestern Washington, about 160 miles south of Seattle and 20 miles north of Portland, Oregon. Figure 1-1, Vicinity Map, shows the location of the City relative to the rest of the state of Washington. The current City limits constitute an area of approximately 4,300 acres. The majority of the City's 2004 estimated population of 2,200 is connected to sewer service with the exception of a few homes in the more rural eastern area of the City.

The topography of Ridgefield and the Urban Growth Area (UGA) slopes from the eastern boundary of the City west to Lake River. The City encompasses land on either side of Interstate 5. Figure 1-2 shows the City limits and the Urban Growth Area Boundary that is designated for Ridgefield in the Clark County Urban Growth Plan. The environment in and around the City, as well as the growth anticipated for the City, is discussed in more detail in Chapters 2 and 3 of this Plan.

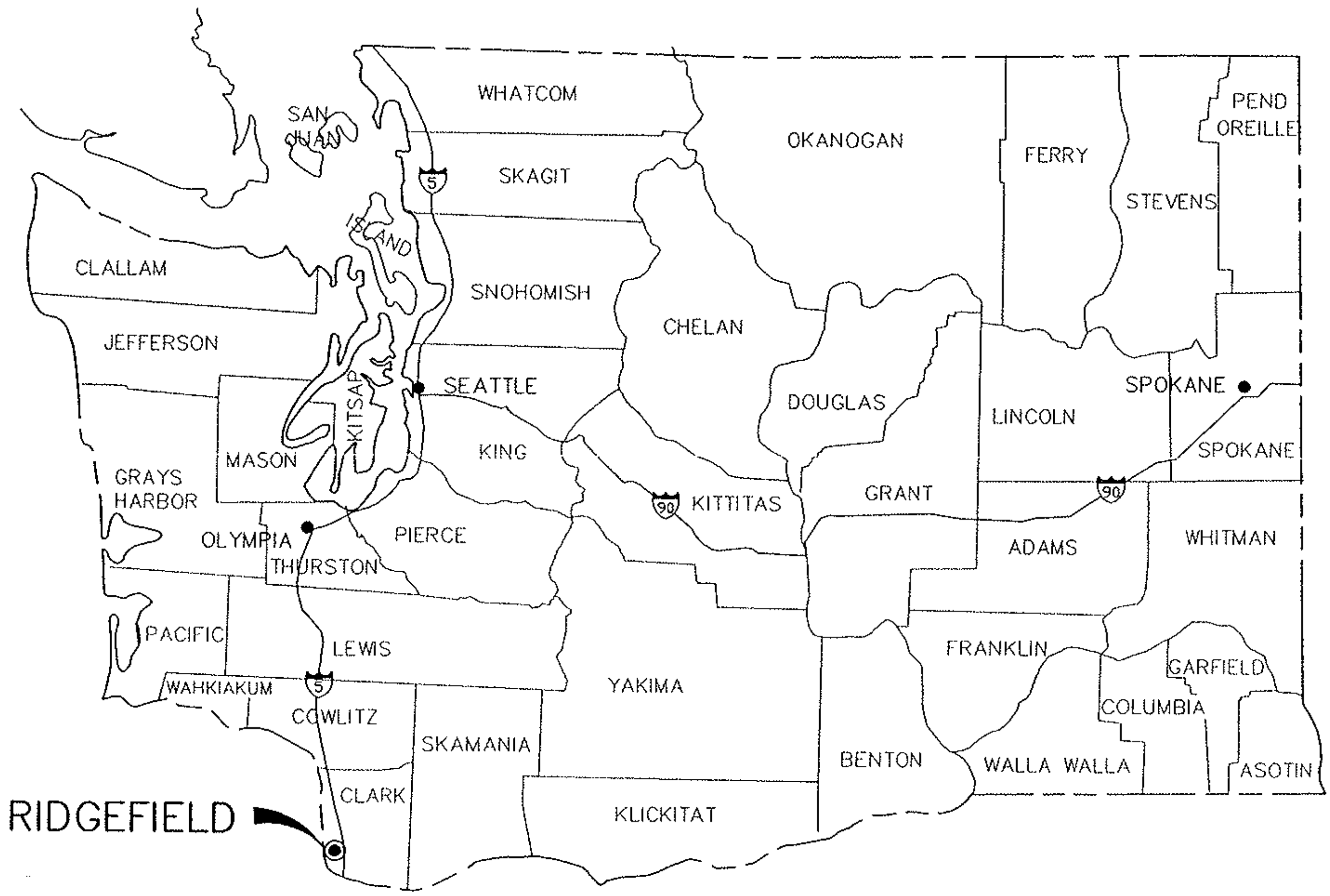
The City is governed by a City Council/City Manager form of government. The Public Works Department manages the sewer, water, road, and storm sewer systems. The City's contact information is listed as follows:

Justin Clary, P.E.	E-mail address:
Public Works Director	justin.clary@ci.ridgefield.wa.us
City of Ridgefield	
P.O. Box 608	Phone: (360) 887-8251
230 Pioneer Street	Fax: (360) 887-2507
Ridgefield, Washington 98642	

Existing Reports

The existing documents and reports that were reviewed in the preparation of this Plan include:

- *General Sewer Plan*, Wallis Engineering, April 1994
- *Wastewater Facility Plan for the City of Ridgefield*, Wallis Engineering, February 1997
- *Wastewater Treatment Plant Operation and Maintenance Manual*, Wallis Engineering, December 2001



VICINITY MAP

NOT TO SCALE

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/FACILITY PLAN

FIGURE 1-1

VICINITY MAP

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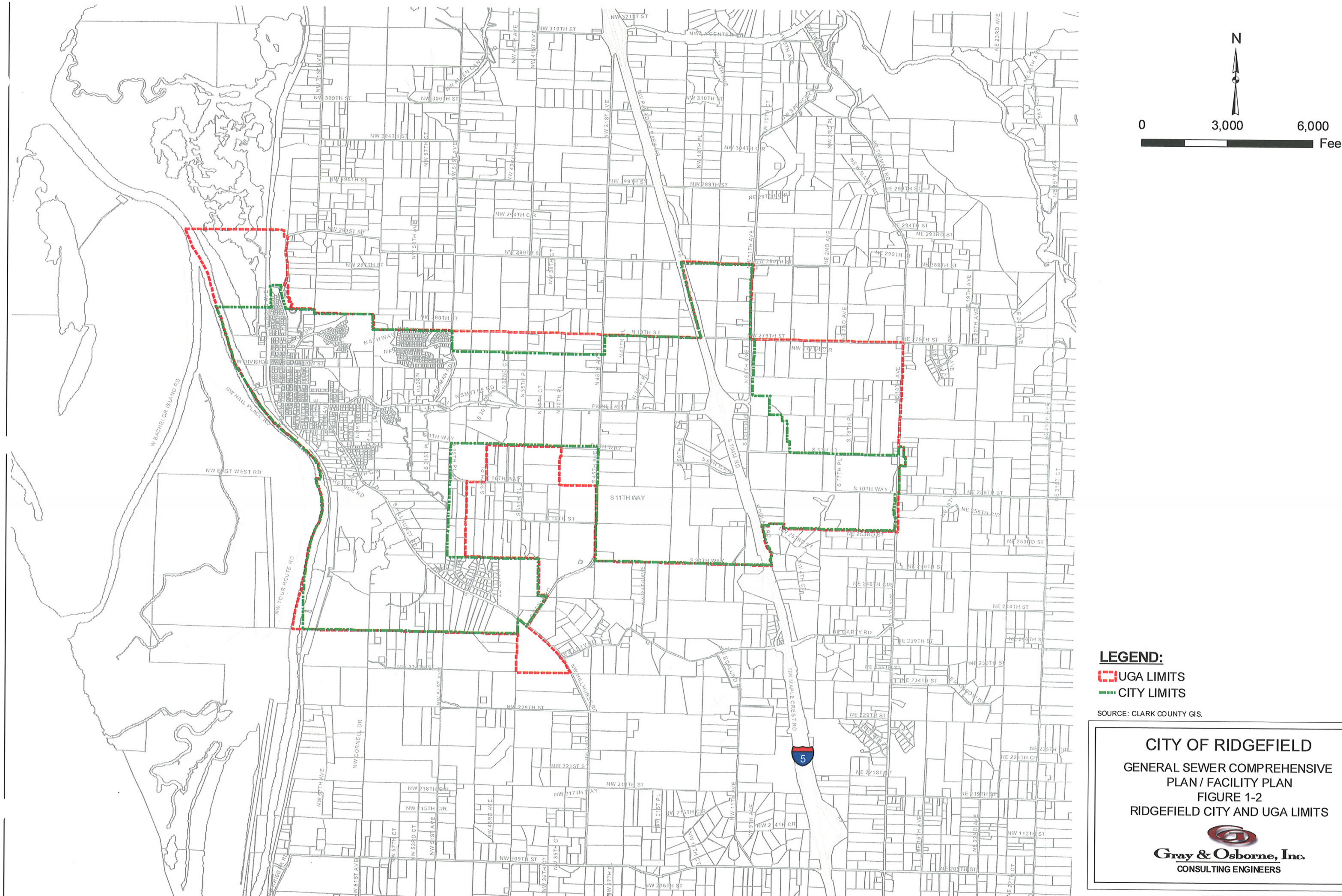

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN

FIGURE 1-2

RIDGEFIELD CITY AND UGA LIMITS

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CONSULTING ENGINEERS

- *Ridgefield Urban Area Comprehensive Plan*, E2 Land Use Services, November 2004

In addition, planning data such as urban growth maps, zoning maps, billing records, wastewater treatment plant (WWTP) discharge monitoring reports, and pertinent correspondence from the City of Ridgefield and Clark County were reviewed and incorporated in this Plan. Interviews with operations staff and field investigations were also used in the preparation of the Plan.

Existing System

The City owns and operates a municipal sewer system and wastewater treatment plant, with an outfall to Lake River. The sewer system serves residents, institutions, and businesses within City limits. The existing system consists of a sewage collection system and a secondary wastewater treatment plant. The collection system includes an older (1950s era) gravity system located in the Downtown core of the City plus a network of newer gravity lines, force mains, and pump stations expanding to the north, south, and east of the gravity system.

The original treatment plant was built in 1959. The most recent upgrade of the plant was completed in 2002. Secondary treatment is provided by an activated sludge plant with ultraviolet disinfection. Solids generated in the treatment process are disposed of by hauling to the Clark County Salmon Creek wastewater treatment plant. Most of the lab analysis that is required for NPDES reporting is also performed at the Salmon Creek plant.

The condition and capabilities of the collection and treatment system are discussed in greater detail in Chapters 5 and 7 of this Plan.

CRITICAL ISSUES AND PROBLEM AREAS

A number of critical issues and problem areas were identified in the development of this Plan. These issues and problem areas are summarized below.

TREATMENT PLANT

The wastewater treatment plant (WWTP) is located on the western edge of Ridgefield. The WWTP is projected to reach capacity by the expiration of the current NPDES cycle in December 2009. The WWTP was designed to provide secondary treatment for 0.7 mgd maximum month flow. However the plant is currently limited to 0.5 mgd in the NPDES permit. This capacity limitation is due to several factors. The first factor is the lack of secondary clarifier redundancy. The second is the capacity to accomplish nitrification. Although not currently required in the NPDES permit, Ecology anticipates that nitrification will be a future requirement and has noted that the plant must have sufficient aeration capacity to achieve nitrification to meet effluent ammonia limits. A third factor is uncertainty about the receiving water capacity to provide adequate dilution. The current bank outfall located on Lake River does not provide significant diffusion of effluent.

The WWTP discharges into Lake River, a tributary of the Columbia River. Lake River is currently water quality listed by EPA on the 303 (d) list for temperature and fecal coliform water quality deficiencies. The sampling locations for this listing are upstream of the WWTP discharge into Lake River, however the Department of Ecology (Ecology) has required the City to conduct receiving water quality and mixing zone studies in Lake River during the current 5-year NPDES permit cycle. In particular, there is a concern that ammonia loadings might be adversely impacting the river.

The 1997 Facility Plan recommended expansion of the wastewater treatment plant in two phases, with the first phase designed for 0.75 mgd and the second phase designed for 1.53 mgd. The Facility Plan identified Phase One as two steps:

1. An interim upgrade to 0.50 mgd capacity utilizing Lake River as an outfall location, and

2. the complete Phase One expansion to 0.75 mgd capacity, with an outfall to the Columbia River.

The plant is currently rated at 0.5 mgd capacity. The secondary clarifier constructed (50 foot diameter) was smaller than indicated in the approved facility plan (55 foot diameter). As a result of the smaller clarifier, the plant would have been rated at 0.7 mgd capacity rather than the specified design capacity of 0.75, as stated in the 1997 Facility Plan, if the Columbia River outfall had been built. However, the outfall to the Columbia River was not constructed. Due to the recommended phases defined in the 1997 Facility Plan, Ecology has declared that the Plant is operating in the interim Phase One with a capacity of 0.5 mgd.

The maximum capacity of Lake River to receive WWTP effluent without violations of water quality standards affects the rated capacity of the treatment plant. The 1997 Facility Plan failed to establish the point at which Lake River can no longer handle flows and loadings from the Ridgefield WWTP. A rigorous determination of critical flow in Lake River was also not developed. Therefore, the preliminary outfall dilution study in the 1997 Facility Plan concluded additional data must be collected to determine if Lake River can provide sufficient dilution for greater effluent flows. Ecology requested this additional river water quality data and expressed concerns over whether Lake River is capable of providing sufficient dilution to meet water quality standards in the future. The City has since provided additional data on Lake River water quality and has conducted outfall mixing zone studies (Appendices C and D). These studies establish minimum critical Lake River flow and the amount of effluent dilution provided by the River at future WWTP flows.

As noted above, the Ridgefield WWTP is presently disposing of solids by liquid hauling to the Clark County Salmon Creek treatment plant. The Salmon Creek Plant then provides additional processing and eventual disposal of the biosolids. This arrangement is described in greater detail in Chapter 9. Chapter 9 also includes an evaluation of other biosolids management options available for the City. A pretreatment program is also identified as a means to protect biosolids quality and maintain options for biosolids disposal.

The existing WWTP is adjacent to the Pacific Wood Treating hazardous waste cleanup site. Soil tests have identified industrial levels of wood preservative chemical contamination in the treatment plant soils. This soil condition is not a significant problem for the current site use, but this contamination will increase both the costs and regulatory complexity of any expansion at the existing site.

The existing WWTP lab does not have the capability of performing the performance testing required for this facility. Additional space and equipment will be required if the City intends to perform these tests on-site. Alternatively, the City may choose to expand their contract with Clark County to provide continued analytical support.

The current landscaping and stormwater system on the site is not consistent with City standards for public works facilities. Plant improvements should include improvements in these areas as well.

COLLECTION SYSTEM

In previous plans, the downtown gravity collection system was identified as being in good condition. However, the increased flows resulting from growth to the east and north of Downtown have resulted in surcharging and capacity concerns. The Downtown system is becoming a bottleneck, restricting the flows that can reach the WWTP. The main gravity trunk line that connects Downtown to the WWTP has a maximum capacity of 0.75 mgd. This problem can be solved in part by adding pump stations and force mains that bypass the downtown collection system. However, this practice will likely create surging problems at the WWTP influent pump station and headworks, as the dampening effect of the gravity system is also bypassed through this practice. There is also a growing concern that odor problems may become more frequent and noticeable as the force main systems are expanded and lengthened. It will also become necessary to improve the collection system telemetry as the number of pump stations increase.

The initiation of a Capacity Management Operation and Maintenance (CMOM) program will be evaluated for the City. Although the City is not currently required to implement such a program, there are elements of the CMOM requirements that will eventually apply to the City and the CMOM program is most effective if implemented early in the life cycle of a capital improvement.

The City has revised their pretreatment ordinance to control non-residential discharges to the sewer system to protect the City's infrastructure.

SYSTEM GROWTH AND FINANCIAL ISSUES

The City is currently growing at a very rapid rate. Pressures from the Vancouver and Portland housing markets have resulted in developer interest in the Ridgefield area. In 2003, the City issued 15 new building permits for new homes; in 2004, the City issued 206 building permits. The City has reevaluated and updated the System Development Charges (SDC) for utility hookups.

The City has an existing debt of $2.7 million from the 2002 wastewater treatment plant upgrade. Ridgefield will need to use a combination of additional debt, increased SDCs and developer constructed improvements to accomplish the recommendations that will be identified in this plan.

CHAPTER 2

SEWER SERVICE AREA

SEWER SERVICE AREA LOCATION

The sewer service area is located entirely within the current City limits in Clark County, Washington, as shown on Figure 2-1. Background information on the service area is presented below.

CLARK COUNTY

Clark County was established in 1849 and is situated in southwestern Washington. The County consists of 657 square miles and is ranked 35 smallest out of 39 counties for land area. The county boundaries are located about 130 miles southwest of Seattle, 100 miles south of Tacoma, 70 miles south of Olympia, and 1 mile north of Portland, Oregon. The county is bordered on the north by Cowlitz County, on the east by Skamania County and on the south and west by the Columbia River and the State of Oregon (as shown in Figure 1-1). Clark County is becoming increasingly urbanized, sharing rapid growth with the City of Portland. With a year 2002 population of 363,400, Clark County is ranked 5th most populous out of the 39 Washington counties. The Washington State Office of Financial Management estimates the county's population will increase to between 474,000 to 622,000 by the year 2025. The largest city in the county is Vancouver, which also serves as county seat. The County also includes the incorporated Cities of La Center, Yacolt, Battle Ground, Camas, Washougal, and Ridgefield.

Clark County is located at the head of the navigable portion of the Columbia River, approximately 70 miles from the Pacific Ocean. The Columbia River forms the western and southern boundaries of the county and provides over 41 miles of river frontage. Urban Clark County is part of the northeast quadrant of the Portland, Oregon, metropolitan area. From an urban hub on the Columbia, the county spreads through a rapidly growing suburban band, across agricultural lands and a network of towns, to the slopes of the Cascade Mountain Range. It is compact, measuring approximately 25 miles across in either direction. The Columbia River and the Pacific Ocean exert a strong influence on the climate, economy, and recreational activities of the county. The Columbia is the only fresh-water harbor for ocean-going commerce on the entire West Coast of North America and the only water-grade route through the Cascade Range between Canada and California. The county has served deep-sea commerce since 1906.

Clark County lies within a geographic basin known as the Willamette-Puget Trough, formed by the Cascade and Pacific Coast Mountain Ranges. It is bounded on the south and west by the Columbia River, on the north by the Lewis River, and on the east by the foothills of the Cascades. Along the Columbia are low-lying bottomlands, from which a series of alluvial plains and terraces extend north and northeast. Land elevations rise from less than 10 feet on the south and west floodplains to over 3,000 feet above mean sea level (msl) in the eastern portion. The western half of Clark County lies at the junction of the Columbia River and Willamette Valleys and is comparatively level over the southern portion. While progressing northward and eastward, the terrain develops into rolling hills, culminating in the Cascade Range.

CITY OF RIDGEFIELD

The City of Ridgefield is located in southwestern Washington approximately two miles east of the Columbia River and 25 miles north of Portland, Oregon. Rolling hills and ravines surround the City. Lake River borders Ridgefield to the west and the existing city limits extend past I-5 to the east. Gee Creek is the main water body in the City service area. Elevations range from a maximum of approximately 300 feet msl on the West side of I-5 to a minimum of 0 feet msl at Lake River within the City limits.

NATURAL FEATURES OF THE SEWER SERVICE AREA

Various natural features of the study area are discussed below, including climate and precipitation, geology, soils, topography, and site sensitive areas, such as floodplains, wetlands, surface and groundwater resources, and fish and wildlife habitat. The public utilities available in the area are also discussed.

CLIMATE AND PRECIPITATION

The climate of the City of Ridgefield is typical of that of the Pacific Northwest region between the Cascade Mountains and the Pacific Ocean. Winters are wet and mild and summers are relatively warm and dry. The mean annual temperatures range from 40.4 to 62 degrees Fahrenheit (F), with a minimum day temperature of -11 degrees F and a maximum day temperature of 107 degrees F. From June to September, temperatures typically range from 49.2 to 76.3 degrees F. Winter temperatures typically range from 32.7 to 47.4 degrees F.

Based on data from the NOAA weather station located in nearby Battle Ground, the City receives an average of 52.9 inches of rain per year. December is historically the wettest month, and July the driest. Table 2-1 shows precipitation data that were measured at the NOAA Battle Ground weather station for the years 1948 through 2003.

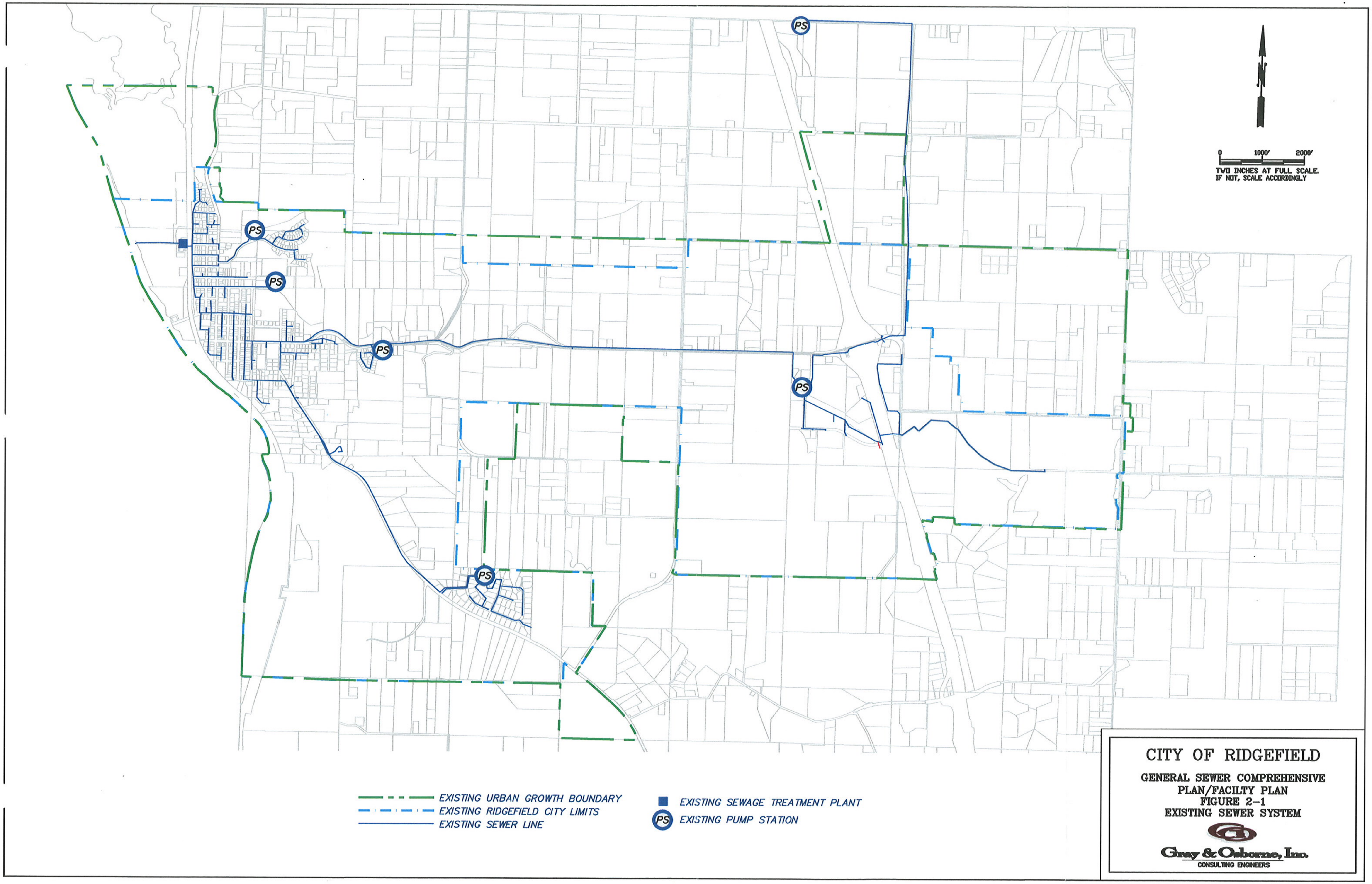

PS
PS
PS
PS
PS
PS
PS
0
1000'
2000'
TWO INCHES AT FULL SCALE.
IF NOT, SCALE ACCORDINGLY
EXISTING URBAN GROWTH BOUNDARY
EXISTING RIDGEFIELD CITY LIMITS
EXISTING SEWER LINE
EXISTING SEWAGE TREATMENT PLANT
PS EXISTING PUMP STATION
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN/FACILTY PLAN
FIGURE 2-1
EXISTING SEWER SYSTEM
Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 2-1

Monthly Average Precipitation in the Ridgefield Area, 1948 through 2003

Month	Average Monthly Precipitation (inches)
January	7.32
February	5.66
March	5.31
April	3.99
May	2.97
June	2.34
July	0.84
August	1.25
September	2.28
October	4.50
November	7.48
December	8.05
Average Annual Total(1)	**51.98**

(1) From averages of annual data, not the sum of the months in this table.

SOILS AND GEOLOGY

Geologic Areas

The underlying geology of Clark County is predominantly sedimentary and igneous rock approximately 10,000 feet deep from the Miocece-Pliocene period. The base soils were placed by the Columbia River Flood that resulted from the Lake Missoula ice dam flood that occurred in the late Pleistocene. The area has also been subject to more recent deposits of alluvium soils along stream courses such as Gee Creek and other streams in the area.

There are six soil series identified within the City of Ridgefield's sewer service area. These soils, shown on Figure 2-2, include Gee silt loams, Hillsboro silt loam, Sara silt loam, Sauvie silt loam, Cove silt clay loam, and Odne silt loam, and are further described below.

Gee Soil Series

Gee silt loam is the predominate soil series located throughout the City. Slopes are generally level or undulating ranging from 0 to 60 percent. The Gee series consists of deep, moderately well drained soils formed in old alluvium on dissected high terraces and terrace escarpments.

From 0 to 9 inches the soil is very dark grayish brown silt loam, grayish brown with a dry moderate coarse and medium granular structure. From 9 to 14 inches the soil is dark grayish brown silt loam with many coarse, medium, and fine pores. From 14 to 22 inches the soil is a mottled dark grayish brown and dark brown silt loam, light brownish gray. From 22 to 72 inches the soil is dark brown silty clay loam. These soils are usually moist but are dry for 45 to 60 consecutive days following summer solstice.

The soils are moderately well drained with slow runoff, moderate permeability in the upper horizons, and moderately slow grading to very slow in the lower horizon. The soil is used for woodland and cropland. Hay, pasture, and small grain are common crops. Native vegetation is Douglas fir, grand fir, western red cedar, and red alder with an understory of western swordfern, salal, Oregon grape, vine maple, and western brackenfern.

Hillsboro Soil Series

Hillsboro soils are found primarily in the older part of Ridgefield and appear to be associated largely with the drainages within the City. The soil slopes range from 0 to 65 percent. The series consists of deep, well drained soils that formed in mixed alluvium.

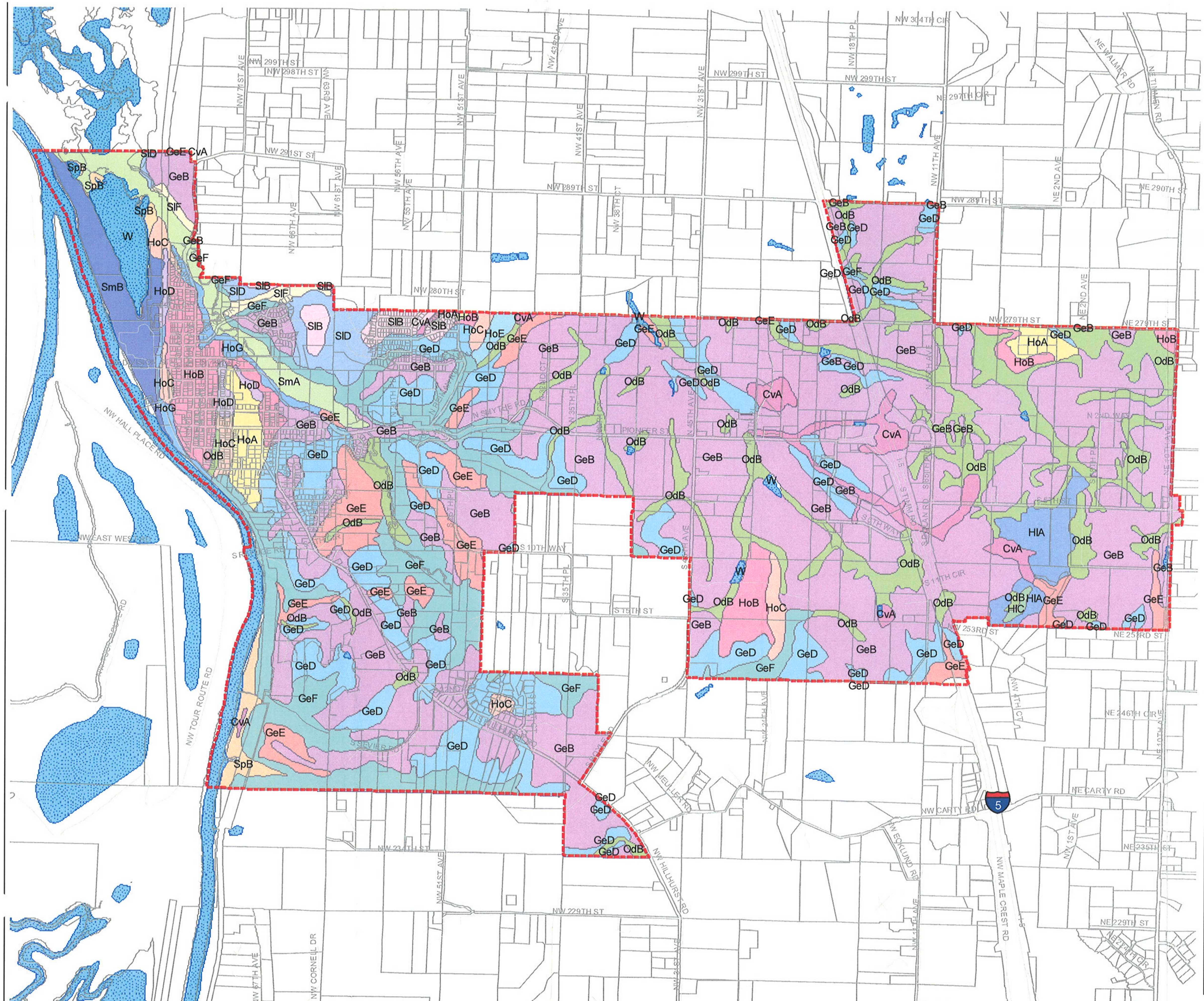
From 0 to 4 inches the soil is dark brown loam, with a fine subangular blocky structure and a slightly hard, friable, nonsticky, and nonplastic texture. From 4 to 11 inches the soil is dark brown loam with a moderate medium subangular blocky structure. From 11 to 81 inches the soil is a yellowish brown loam with a weak medium prismatic and weak medium subangular blocky structure.

The soils are usually moist but are dry throughout between depths of 4 and 12 inches for more than 45 consecutive days during the summer. Clay films are few to many and thin to moderately thick. Stratified lenses of loamy and sandy material occur below a depth of 40 inches.

The Hillsboro soils are on nearly level to gently undulating broad valley terraces with moderate to strongly sloping fronts at elevations of 160 to 240 feet. The soils formed in mixed, silty, and loamy old alluvium. The soils are well drained with slow to medium runoff and moderate permeability. The soils are used for orchards, berries, nursery stock, vegetables, small grain, hay, and pasture. Native vegetation is Douglas fir, hazelbrush, blackberries, grasses, and weeds.

Sara Soil Series

Sara soils are found along the northern edge of the City limits. The slope for this soil series ranges from 0 to 50 percent. The Sara series consists of very deep, moderately well drained soils formed in old alluvium on terraces and terrace escarpments.



N

0 2,100 4,200 Feet

LEGEND:

UGA LIMITS
CITY LIMITS
WATER

SOIL CODES DESCRIPTION:

CvA	COVE SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES
GeB	GEE SILT LOAM, 0 TO 8 PERCENT SLOPES
GeD	GEE SILT LOAM, 8 TO 20 PERCENT SLOPES
GeE	GEE SILT LOAM, 20 TO 30 PERCENT SLOPES
GeF	GEE SILT LOAM, 30 TO 60 PERCENT SLOPES
HIA	HILLSBORO SILT LOAM, 0 TO 3 PERCENT SLOPES
HIC	HILLSBORO LOAM, 8 TO 15 PERCENT SLOPES
HoA	HILLSBORO SILT LOAM, 0 TO 3 PERCENT SLOPES
HoB	HILLSBORO SILT LOAM, 3 TO 8 PERCENT SLOPES
HoC	HILLSBORO SILT LOAM, 8 TO 15 PERCENT SLOPES
HoD	HILLSBORO SILT LOAM, 15 TO 20 PERCENT SLOPES
HoE	HILLSBORO SILT LOAM, 20 TO 30 PERCENT SLOPES
HoG	HILLSBORO SILT LOAM, 30 TO 65 PERCENT SLOPES
OdB	ODNE SILT LOAM, 0 TO 5 PERCENT SLOPES
SIB	SARA SILT LOAM, 0 TO 8 PERCENT SLOPES
SID	SARA SILT LOAM, 8 TO 20 PERCENT SLOPES
SIF	SARA SILT LOAM, 30 TO 50 PERCENT SLOPES
SmA	SAUVIE SILT LOAM, 0 TO 3 PERCENT SLOPES
SmB	SAUVIE SILT LOAM, 3 TO 8 PERCENT SLOPES
SpB	SAUVIE SILTY CLAY LOAM, 0 TO 8 PERCENT SLOPES
HoG	HILLSBORO SILT LOAM, 30 TO 65 PERCENT SLOPES

SOURCE: CLARK COUNTY GIS.

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN

FIGURE 2-2

SOIL MAP

Gray & Osborne, Inc.

CONSULTING ENGINEERS

From 0 to 5 inches the soil is a dark brown silt loam, brown with a moderate fine granular structure. From 5 to 10 inches the soil transitions to a moderate medium platy structure that is hard and slightly plastic. From 10 to 72 inches the soil is a dark grayish brown silty clay loam.

These soils are usually moist and have a perched water table during the winter and early spring, but are dry for 45 to 60 consecutive days following summer solstice. These soils formed in alluvium. The series is moderately well drained with slow to very rapid runoff and moderately slow permeability. A perched water table is as high as 1 to 2 feet from December to April. The soils are used mainly for hay, pasture, and small grain. Some strawberries and potatoes are grown. Native vegetation is Douglas fir, red alder, western red cedar, and big leaf maple, with an understory of salal, Oregon grape, western swordfern, western brackenfern, salmonberry, and Douglas spirea.

Sauvie Soil Series

Sauvie soils are found immediately adjacent to Lake River and run from 0 to 8 percent slopes. These areas will not be suitable for development of any kind. The Sauvie series consists of deep, poorly drained soils that formed mainly in alluvium. Throughout the soil cross section, the soil is a very dark grayish brown silty clay loam, grayish brown, dry, slightly sticky, and slightly plastic.

The soils are saturated with water from about December through June and are subject to freshwater overflow during high tides unless diked and artificially drained. The Sauvie soils are found on flood plains along the lower Columbia River and its tributaries. The soils are characterized by poor drainage, slow runoff, and moderately slow permeability. When diked and drained, the soils are used for improved hay and pasture, small grain, and truck corps. Areas outside of a dike are in native vegetation or used for hay and pasture and commercial waterfowl areas. The native vegetation is red alder, ash, willow, cottonwood, grasses, and tussocks.

Cove Silty Clay Loam Soil Series

Cove silty clay loam soil is found in a few isolated locations within the City. The slopes range from 0 to 3 percent. These locations are affiliated with isolated small wetlands and are not suitable for future development. The Cove series consists of very deep, poorly to very poorly drained soils that formed in mixed alluvium from sedimentary and basic igneous rocks. Throughout the cross section, the soil is a very dark gray silty clay loam with many fine distinct yellowish brown lenses and averages 50 to 60 percent clay with reddish brown masses of iron accumulation.

The Cove soils are on flood plains and low stream terraces. The soils formed in deep clayey recent alluvium washed mainly from areas underlain by sedimentary and basic igneous rocks. The soils are very poorly drained, slow to ponded runoff with very slow permeability. Common flooding for brief periods occurs from December to April. A high water table fluctuates between 0 and 1.0 foot from the soil surface from December to June. Most of these soils are cultivated. Most of the soil is in hay and pasture, and some spring grain is grown. Native vegetation is sedges, grasses and a few ash, willows, and other trees.

Odne Silt Loam Soils

Odne silt loam soil is generally found in concave areas in drainageways or depressions within areas of Gee soils. In most places the slope is 1 to 2 percent; some side slopes that lead into the drainageways are steeper. In a typical profile the surface layer is about 10 inches thick. It is mottled, dark-gray heavy silt loam in the upper part, and mottled, dark-gray silty clay loam in the lower part. The subsurface layer is firm, mottled, gray silt loam about 9 inches thick. The next 8 inches is very firm, mottled, dark-gray silty clay loam that overlies 6 inches of firm, mottled, dark-gray clay loam. Below this, to a depth of 50 inches, is mottled dark-gray loam. This soil is poorly drained and very slowly permeable. The compact subsoil limits effective root penetration to a depth of less than 30 inches.

TOPOGRAPHY

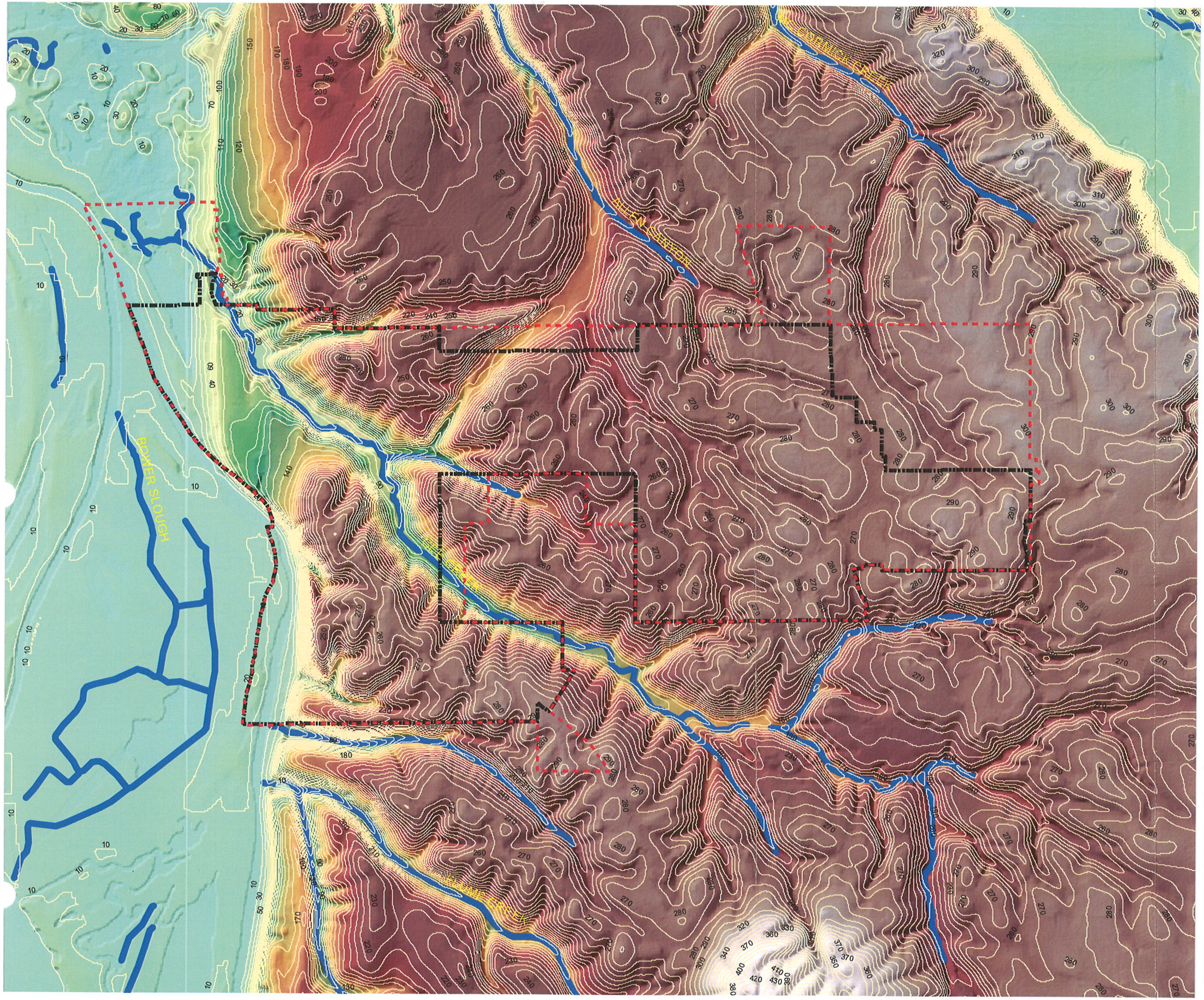
The City of Ridgefield is located on a series of ridges and hills that gradually descend from the east side of Interstate 5 to Lake River in the west. The highest point in the City is about 300 feet above mean sea level (msl) and the lowest point within City limits is at sea level (Lake River). The City's WWTP is located near Lake River and at the edge of the Ridgefield National Wildlife Refuge. The outfall discharges into Lake River at a location east of the treatment plant. Figure 2-3 provides a topographic overlay of the City.

SITE SENSITIVE AREAS

Site sensitive areas within the sewer service area include those classified as seismic hazard areas, flood hazard areas, wetlands, and surface waters.

Seismic Hazard Areas

Seismic hazard areas are those with low density soils (unconsolidated sediments) that are more likely to experience greater damage due to seismic-induced subsidence, liquefaction, or landslides. Seismic hazard areas are regulated mainly with respect to public safety and with the exception of potential damage due to an earthquake, these hazard areas do not impact wastewater facilities or natural resources. After an earthquake, there could be considerable damage to sewers and lift stations in some areas that might experience very severe earth movement. Earthquake areas of concern are identified in Figure 2-4.



N

0 1,250 2,500 5,000 Feet

SCALE 1" = 2500'

LEGEND:

- UGA LIMITS
- CITY LIMITS
- 10 FT CONTOURS

ELEVATION

- High : 590
- Low : 0

- RIVERS

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE
PLAN / FACILITY PLAN
FIGURE 2-3
TOPOGRAPHY MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

MSEIDEL D:\GIS\RIDGEFIELD\TOPO.MXD

Landslides are a particular concern in unstable areas such as those identified in Figure 2-5. These locations are along the steep slopes affiliated with the ravines on either side of Gee Creek and other drainages in Ridgefield.

Flood Hazard Areas

Flood hazard areas are areas adjacent to lakes, rivers, and streams that are prone to flooding during peak runoff periods. Flood hazard areas deserve special attention due to the sensitive nature of their ecosystems as well as the potential for damage to structures located within the floodplain.

Construction of buildings and other development in flood hazard areas is regulated in accordance with the County's flood hazard construction standards. Typically, construction in flood hazard areas is not allowed or is limited to specific activities. Allowed activities might be mining or gravel extraction, recreational uses, repair to existing structures, utility and road construction or uses dependent upon water such as docks, wharves, and boating activities.

The 100-year and 500-year floodplains in the vicinity of Ridgefield are shown on Figure 2-6. The floodplains are associated with Lake River and Gee Creek. The City's wastewater treatment plant is located above Lake River and above the 100-year flood plain.

Wetlands

Wetlands are defined by EPA as areas that are inundated with water for at least part of the year. The US Fish and Wildlife Service defines wetlands as those areas that have characteristics such as hydrophyte plants, hydric soils, and frequent flooding. Wetlands support valuable and complex ecosystems and consequently development is severely restricted if not prohibited in most wetlands. The Clark County Wetlands Inventory map (Figure 2-7) identifies small wetlands scattered throughout Ridgefield. The wetlands are usually affiliated with the drainages that define the ridges with the City. In addition, there is a large area of wetlands affiliated with the Ridgefield National Wildlife Refuge on the western edge of the City. Ridgefield has Lacustrine, Palustrine and Riverine wetlands within City limits.

Surface Waters and Drainage Basins

Lakes and streams are classified as sensitive areas due to the variety of plants and animals they support. The primary surface water features within or near the City of Ridgefield sewer service area are Lake River and Gee Creek. Lake River, a tributary of the Columbia River, defines the western edge of the City. Gee Creek bisects the western third of the City. Figure 2-8 shows the drainage basins around the City of Ridgefield. The East Fork drainage refers to the East Fork of the Lewis River, which is located to the north of the City. The Salmon drainage refers to the Salmon Creek/Lake River drainage located to the south and east of the City. Salmon Creek is tributary to Lake River and all three water bodies are part of the Columbia River estuary.

Groundwaters and Recharge Areas

The aquifers in and around Ridgefield are highly productive, providing a large volume of potable water for the area. Figure 2-9 identifies the category one and two aquifer recharge areas in the Ridgefield area. The more western recharge area is affiliated with the City's water production wells located in Abrams Park.

Fish and Wildlife Habitat

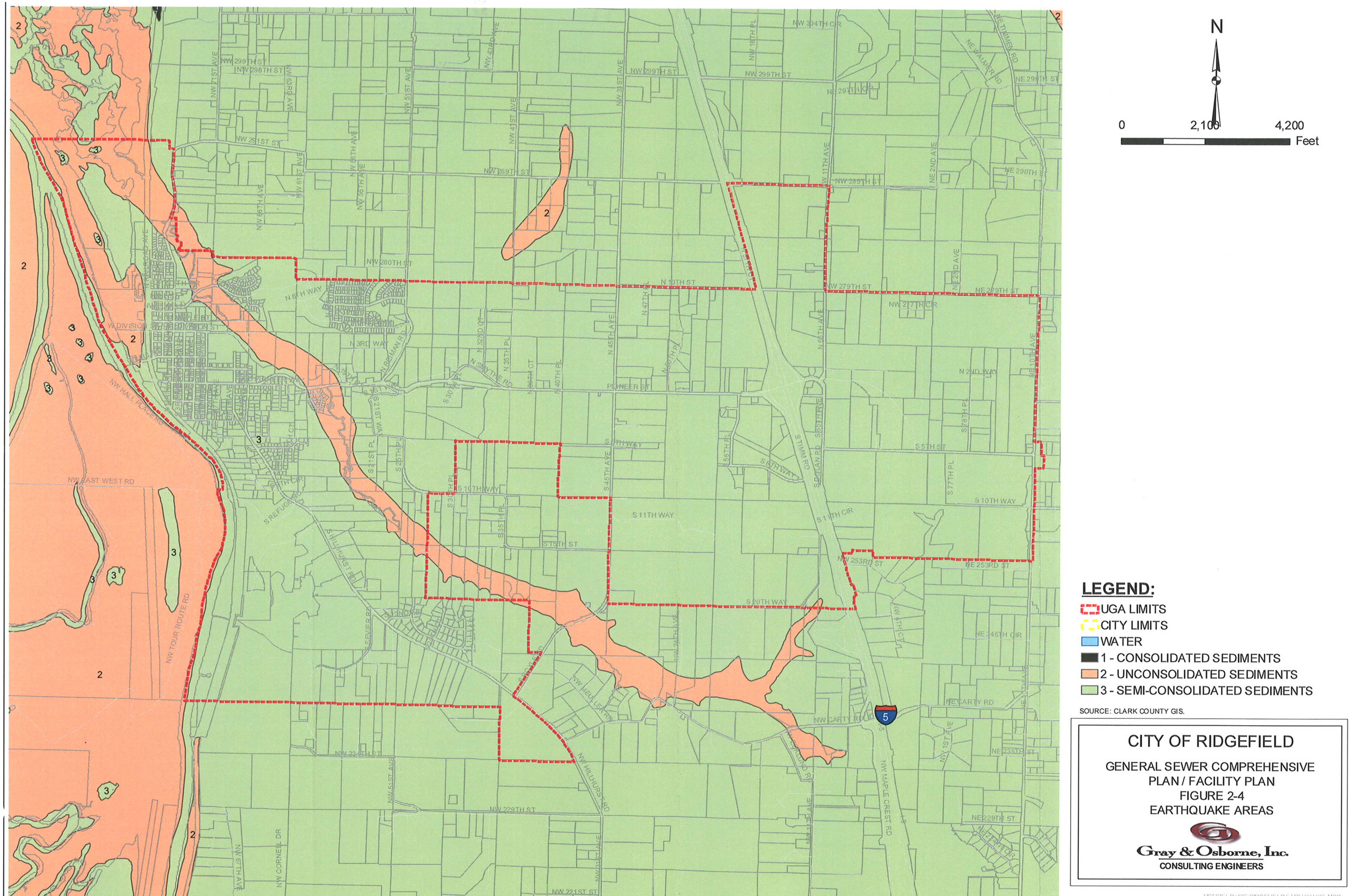
Fish and wildlife habitat is defined as areas essential for maintaining specifically listed species in suitable habitats. This definition was provided in "Fish and Wildlife Habitat Critical Area" section of WAC 365-190-080(5). The WAC further states that any proposed activity within 300 feet of these areas requires the preparation of a habitat assessment. This assessment is circulated to all the appropriate agencies for review. After agency review, a Habitat Management Plan may be required that would address the impacts the project would have on habitat, provide background information of specific species, and recommend protection and mitigation measures for those species.

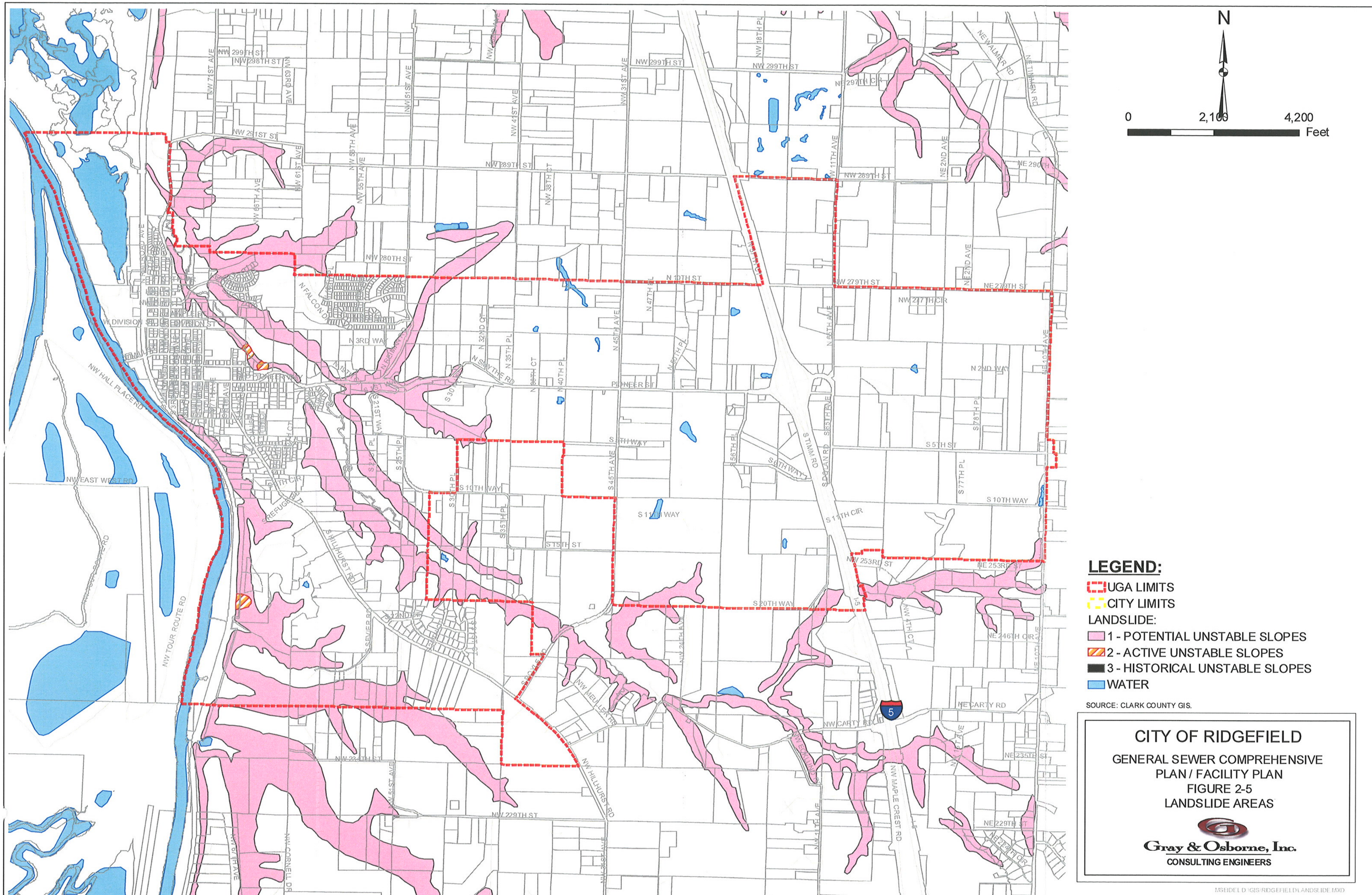
After project implementation, an assessment and evaluation of the success of the identified measures is required. This plan is again circulated to the appropriate agencies for review. Minimum buffers from the critical habitat area may be required. As the main watercourses in the area, the habitat and water quality in Gee Creek and adjacent to Lake River are of particular concern. Figure 2-10 provides the sensitive and critical areas for the City of Ridgefield.

VEGETATION

Much of the land within the City has been cleared for agricultural purposes. Native vegetation remains in the Gee Creek drainage and in other locations such as steep hillsides and ravines where farming was impractical. The eastern side of the City is largely in grass pasture or blackberries where farming has been discontinued.

The dominant tree species in the Ridgefield area includes conifers such as Douglas fir, western red cedar, and western hemlock. Pacific red alder, big leaf maple, and other deciduous trees make up a significant portion of the second and third growth forests along with native conifer species. Dense brush grows on both unstable and stable areas and consists predominantly of blackberries, huckleberries, salal, and various fern species. The dense forest and brush cover mediates runoff and provides for uptake of water. On individual residential lots, the vegetation varies from dense forest on larger lots, to grass lawns, landscaping with shrubs, and ornamental trees.

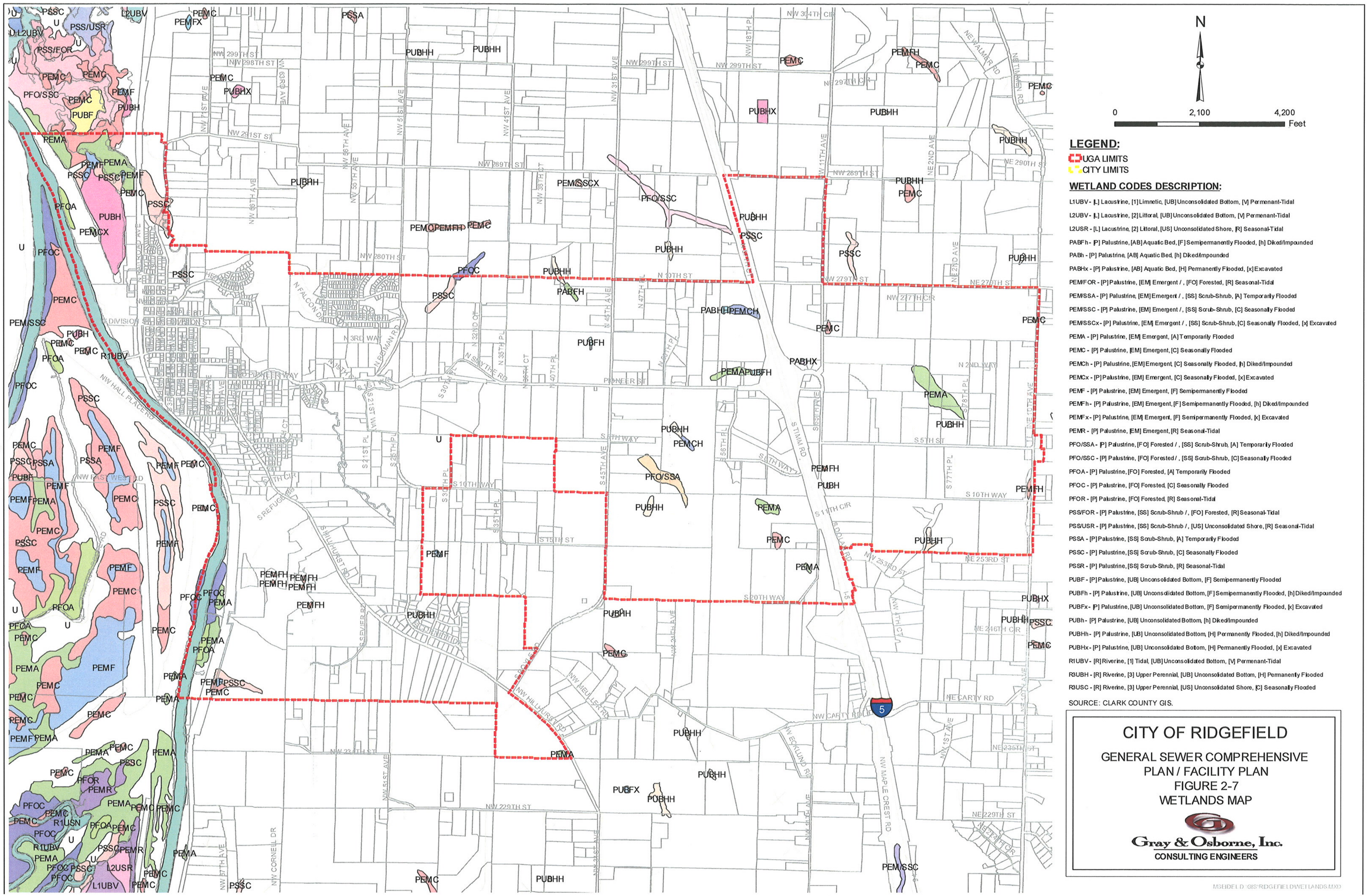

N
0
2,100
4,200
Feet
LEGEND:
UGA LIMITS
CITY LIMITS
WATER
1 - CONSOLIDATED SEDIMENTS
2 - UNCONSOLIDATED SEDIMENTS
3 - SEMI-CONSOLIDATED SEDIMENTS
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN / FACILITY PLAN
FIGURE 2-4
EARTHQUAKE AREAS
Gray & Osborne, Inc.
CONSULTING ENGINEERS
NW 304TH CIR
NW 299TH ST
NW 298TH ST
NW 291ST ST
NW 289TH ST
NW 280TH ST
N 10TH ST
NW 289TH ST
NE 290TH ST
NE 299TH ST
NW 279TH ST
NE 279TH ST
NW 277TH CIR
N 67TH WAY
N 3RD WAY
PIONEER ST
N 2ND WAY
S 5TH WAY
S 57TH ST
S 10TH WAY
S 11TH WAY
S 15TH ST
S 20TH WAY
NW 253RD ST
NE 253RD ST
NE 246TH CIR
NW EAST WEST RD
NW HALL PLACE RD
NW TOUR ROUTE RD
NE CARTY RD
NW CARTY RD
NE 235TH ST
NW 234TH ST
NW 229TH ST
NE 229TH ST
NW 221ST ST
NW CORNELL DR
NW 67TH AVE
NW 51ST AVE
NW HILLHURST RD
NW MAPLE CREST RD
S TIMM RD
S 11TH CIR
NW 71ST AVE
NW 63RD AVE
NW 51ST AVE
NW 43RD AVE
NW 41ST AVE
NW 31ST AVE
NW 11TH AVE
NE 2ND AVE
NE TIMMEN RD
NE WALMER RD
5


N
0
2,100
4,200
Feet
LEGEND:
UGA LIMITS
CITY LIMITS
LANDSLIDE:
1 - POTENTIAL UNSTABLE SLOPES
2 - ACTIVE UNSTABLE SLOPES
3 - HISTORICAL UNSTABLE SLOPES
WATER
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN
FIGURE 2-5
LANDSLIDE AREAS
Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN
FIGURE 2-6
FLOODPLAIN MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS



N
0
2,100
4,200
Feet
LEGEND:
UGA LIMITS
CITY LIMITS
WETLAND CODES DESCRIPTION:
L1UBV - [L] Lacustrine, [1] Limnetic, [UB] Unconsolidated Bottom, [V] Permenant-Tidal
L2UBV - [L] Lacustrine, [2] Littoral, [UB] Unconsolidated Bottom, [V] Permenant-Tidal
L2USR - [L] Lacustrine, [2] Littoral, [US] Unconsolidated Shore, [R] Seasonal-Tidal
PABFh - [P] Palustrine, [AB] Aquatic Bed, [F] Semipermanently Flooded, [h] Diked/Impounded
PABh - [P] Palustrine, [AB] Aquatic Bed, [h] Diked/Impounded
PABHx - [P] Palustrine, [AB] Aquatic Bed, [H] Permanently Flooded, [x] Excavated
PEM/FOR - [P] Palustrine, [EM] Emergent / , [FO] Forested, [R] Seasonal-Tidal
PEM/SSA - [P] Palustrine, [EM] Emergent / , [SS] Scrub-Shrub, [A] Temporarily Flooded
PEM/SSC - [P] Palustrine, [EM] Emergent / , [SS] Scrub-Shrub, [C] Seasonally Flooded
PEM/SSCx - [P] Palustrine, [EM] Emergent / , [SS] Scrub-Shrub, [C] Seasonally Flooded, [x] Excavated
PEMA - [P] Palustrine, [EM] Emergent, [A] Temporarily Flooded
PEMC - [P] Palustrine, [EM] Emergent, [C] Seasonally Flooded
PEMCh - [P] Palustrine, [EM] Emergent, [C] Seasonally Flooded, [h] Diked/Impounded
PEMCx - [P] Palustrine, [EM] Emergent, [C] Seasonally Flooded, [x] Excavated
PEMF - [P] Palustrine, [EM] Emergent, [F] Semipermanently Flooded
PEMFh - [P] Palustrine, [EM] Emergent, [F] Semipermanently Flooded, [h] Diked/Impounded
PEMFx - [P] Palustrine, [EM] Emergent, [F] Semipermanently Flooded, [x] Excavated
PEMR - [P] Palustrine, [EM] Emergent, [R] Seasonal-Tidal
PFO/SSA - [P] Palustrine, [FO] Forested / , [SS] Scrub-Shrub, [A] Temporarily Flooded
PFO/SSC - [P] Palustrine, [FO] Forested / , [SS] Scrub-Shrub, [C] Seasonally Flooded
PFOA - [P] Palustrine, [FO] Forested, [A] Temporarily Flooded
PFOC - [P] Palustrine, [FO] Forested, [C] Seasonally Flooded
PFOR - [P] Palustrine, [FO] Forested, [R] Seasonal-Tidal
PSS/FOR - [P] Palustrine, [SS] Scrub-Shrub / , [FO] Forested, [R] Seasonal-Tidal
PSS/USR - [P] Palustrine, [SS] Scrub-Shrub / , [US] Unconsolidated Shore, [R] Seasonal-Tidal
PSSA - [P] Palustrine, [SS] Scrub-Shrub, [A] Temporarily Flooded
PSSC - [P] Palustrine, [SS] Scrub-Shrub, [C] Seasonally Flooded
PSSR - [P] Palustrine, [SS] Scrub-Shrub, [R] Seasonal-Tidal
PUBF - [P] Palustrine, [UB] Unconsolidated Bottom, [F] Semipermanently Flooded
PUBFh - [P] Palustrine, [UB] Unconsolidated Bottom, [F] Semipermanently Flooded, [h] Diked/Impounded
PUBFx - [P] Palustrine, [UB] Unconsolidated Bottom, [F] Semipermanently Flooded, [x] Excavated
PUBh - [P] Palustrine, [UB] Unconsolidated Bottom, [h] Diked/Impounded
PUBHh - [P] Palustrine, [UB] Unconsolidated Bottom, [H] Permanently Flooded, [h] Diked/Impounded
PUBHx - [P] Palustrine, [UB] Unconsolidated Bottom, [H] Permanently Flooded, [x] Excavated
R1UBV - [R] Riverine, [1] Tidal, [UB] Unconsolidated Bottom, [V] Permenant-Tidal
R3UBH - [R] Riverine, [3] Upper Perennial, [UB] Unconsolidated Bottom, [H] Permanently Flooded
R3USC - [R] Riverine, [3] Upper Perennial, [US] Unconsolidated Shore, [C] Seasonally Flooded
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN / FACILITY PLAN
FIGURE 2-7
WETLANDS MAP
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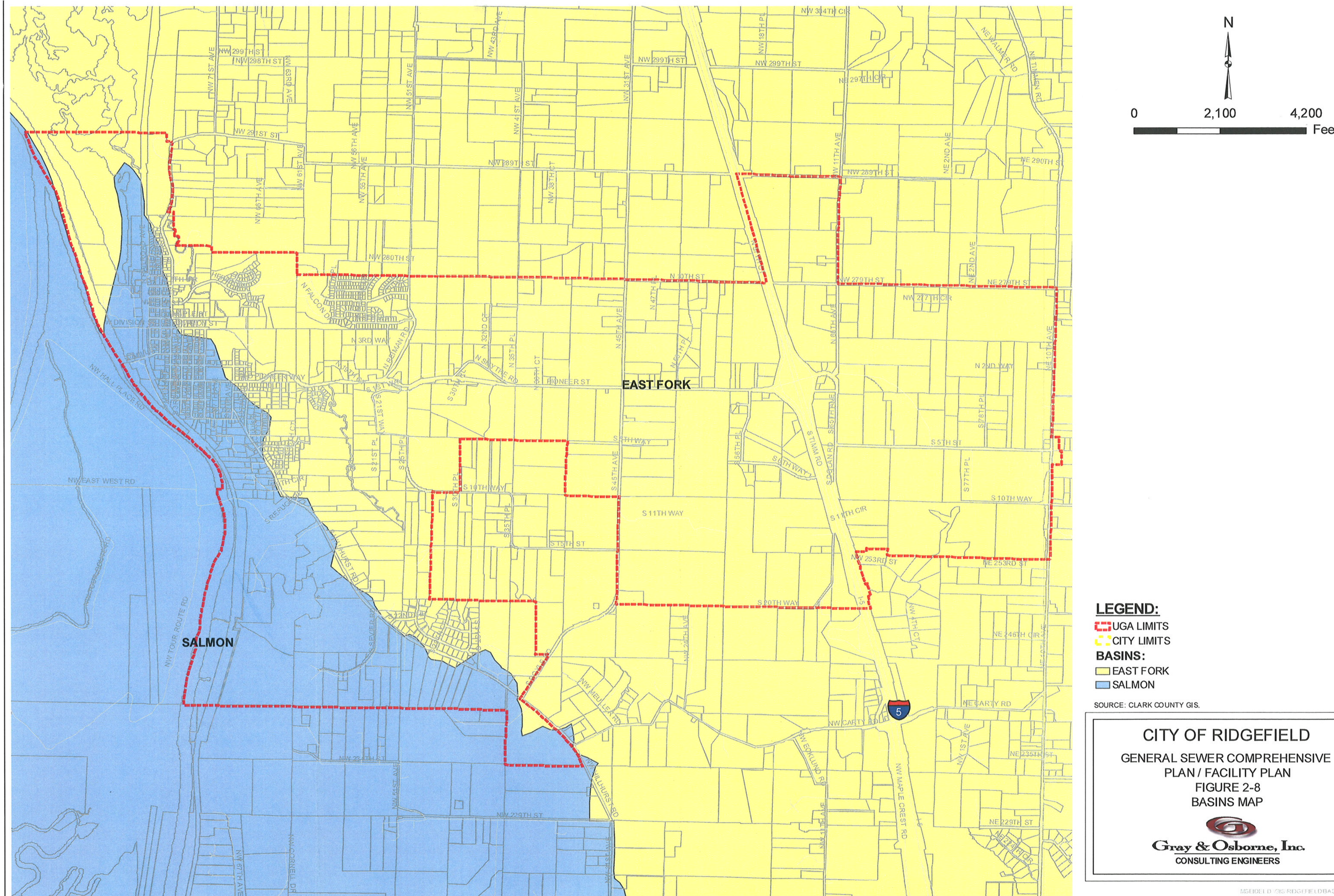


CITY OF RIDGEFIELD

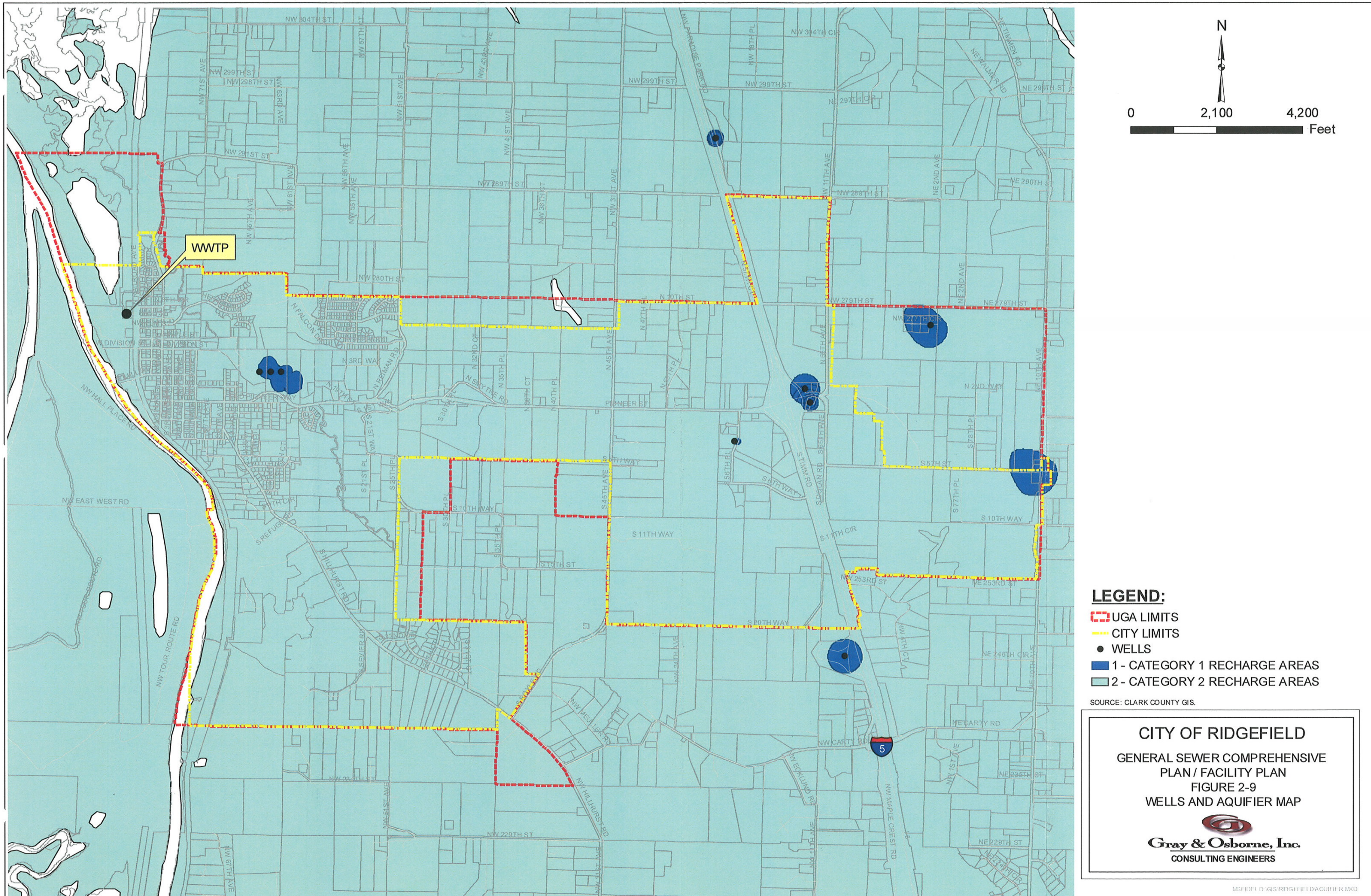
GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN

FIGURE 2-8

BASINS MAP

Gray & Osborne, Inc.

CONSULTING ENGINEERS



CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN
FIGURE 2-9
WELLS AND AQUIFIER MAP

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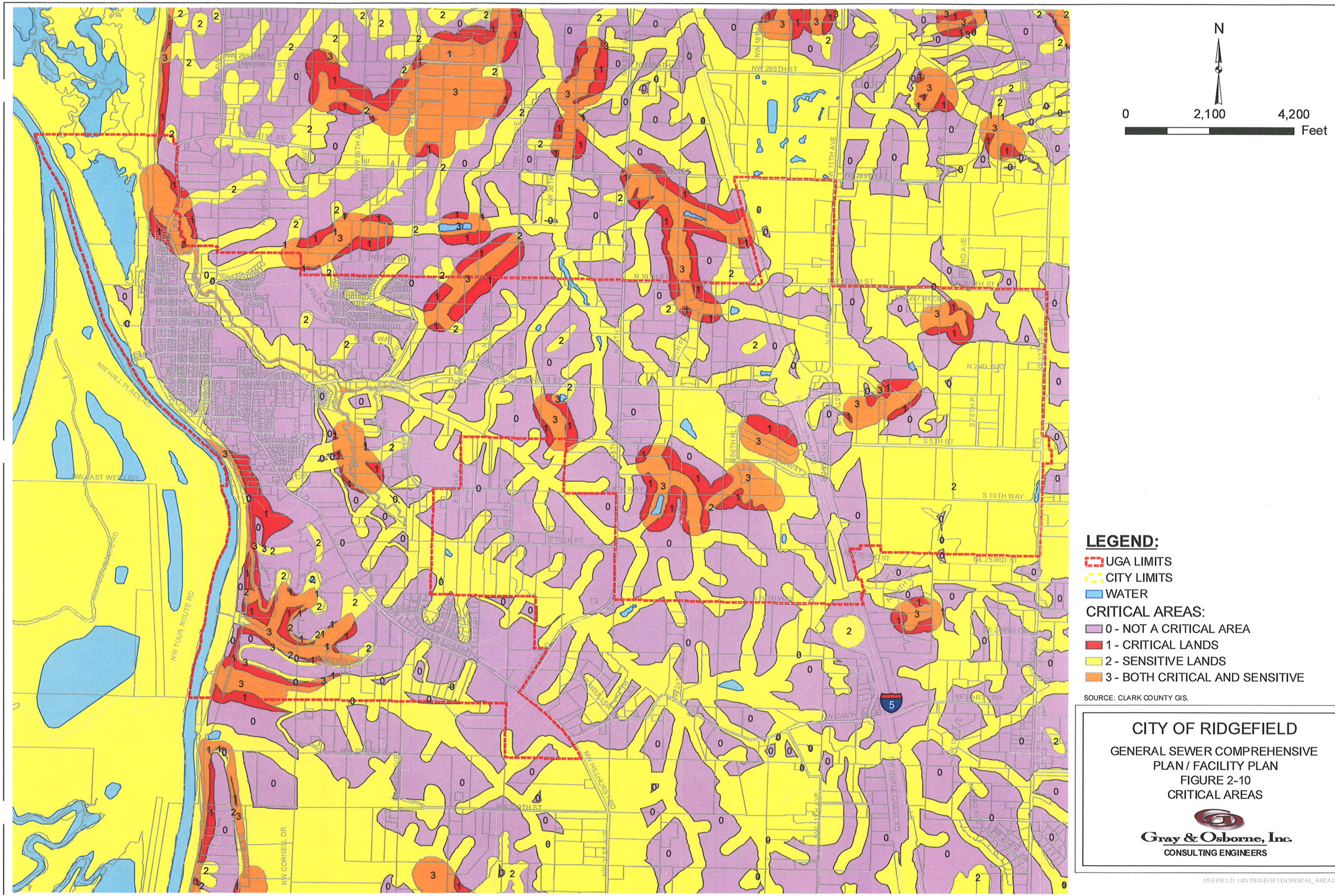

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN
FIGURE 2-10
CRITICAL AREAS

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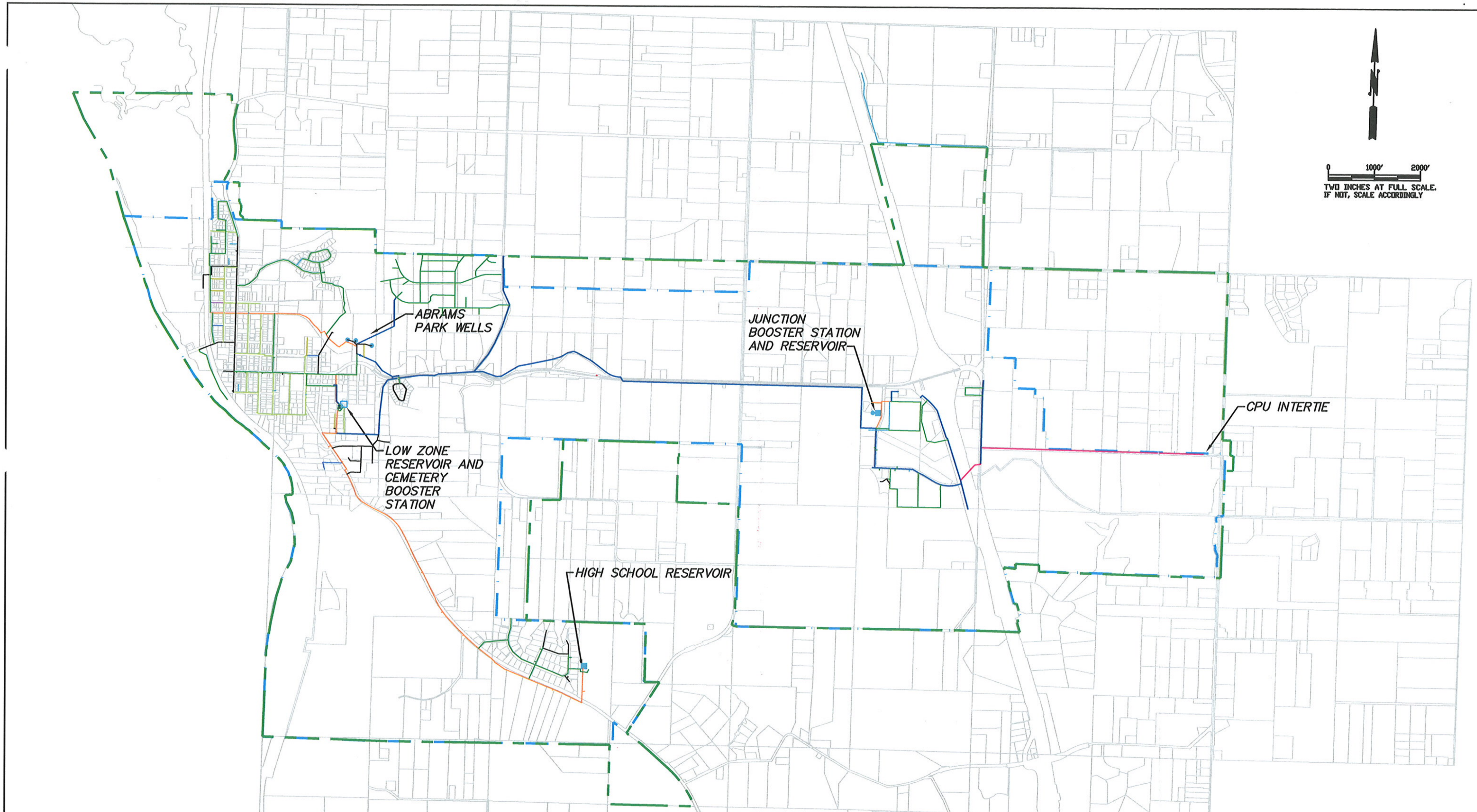
PUBLIC UTILITIES

Public utilities in the City of Ridgefield area include water, sewer, power, natural gas, and telephone. QWEST provides the telephone service to the area and Clark Public Utilities provides electrical power to this area. Natural gas is provided by Northwest Natural Gas.

The City of Ridgefield provides water service within the City limits. Some homes in the less developed areas of the City are still on individual wells, but they are expected to eventually tie into the City water system as the system expands. Clark Public Utilities (CPU) provides water service immediately to the east of the City limits and to the Tri Mountain Golf Course located to the northeast of the City. Figure 2-11 shows the water system for the City of Ridgefield. The existing WWTP is not within 3,000 feet of any public or private well. All public water supplies are shown on Figure 2-11. The City maintains a network of water distribution facilities designed to have minimum separation per the Department of Ecology's Criteria for Sewage Works Design.

ADJACENT WASTEWATER SERVICES

There are several providers of wastewater collection and treatment services within 20 miles of the City of Ridgefield's WWTP. La Center is approximately 2.7 miles to the northeast of Ridgefield and the Salmon Creek WWTP is approximately 10 miles south of Ridgefield. Salmon Creek WWTF is owned by Clark County and serves the City of Battle Ground, the north end of unincorporated Clark County, and the Hazel Dell area. Marine Park WWTF is southeast of Ridgefield and is the City of Vancouver's South WWTF and Water Reclamation Facility. The Cities of Kalama and Woodland are also within 20 miles of the City of Ridgefield. Accessing either facility would require a substantial redirection of current wastewater flows and crossing areas of land outside the UGAs of the service areas for these communities. Although these facilities are close enough to collaborate in areas such as biosolids disposal and laboratory services, it is not feasible to consider these facilities as options for wastewater services. There are no industrial WWTFs within the direct vicinity of the City of Ridgefield, although there are likely industrial WWTFs in Vancouver, Washington.



EXISTING URBAN GROWTH BOUNDARY
EXISTING RIDGEFIELD CITY LIMITS

4" EXISTING WATER LINE
6" EXISTING WATER LINE
8" EXISTING WATER LINE

14" AND GREATER EXISTING WATER LINE
EXISTING WELL
EXISTING RESERVOIR

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/FACILTY PLAN
FIGURE 2-11
WATER SYSTEM FACILITIES

Gray & Osborne, Inc.
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CHAPTER 3

LAND USE AND PLANNING CRITERIA

INTRODUCTION

The configuration of a wastewater system is influenced by land use, development trends and timing, regulatory requirements, the location of other utility systems, growth management, and topography. This Plan will develop a logical system of facilities to serve the City of Ridgefield based on topography, the drainage characteristics of the area, Urban Growth Area (UGA) considerations, and the City's growth objectives as set forth in the 2004 *Comprehensive Plan.*

BACKGROUND

The City of Ridgefield was originally situated along the shoreline of Lake River. The primary employer for the community was Pacific Wood Treating, a riverside industry that provided treated wood products to various national and international markets. Pacific Wood Treating ceased operations in the 1970s. After a decade of low growth, the City of Ridgefield has become a rapidly growing community with residential, commercial, and industrial sources of wastewater. The City also has an elementary school, middle school, and high school. Much of the recent growth has derived from the housing and commercial markets that have reached the capacity limits in the UGAs for the larger communities of Portland and Vancouver. These markets have now moved north to the City of Ridgefield.

RELATED PLANNING DOCUMENTS

The following plans and reports were used in the preparation of this Chapter.

- *City of Ridgefield Comprehensive Plan, 2004*
- *City of Ridgefield Capital Facilities Plan, 2004*
- *City of Ridgefield Facility Plan, 1997*
- *City of Ridgefield General Sewer Plan, 1994*

GROWTH MANAGEMENT

The City of Ridgefield Comprehensive Plan was updated in 2004 and meets the requirements of the State Growth Management Act. The Plan identifies the current City limits and the Urban Growth Area (UGA) for Ridgefield. The boundaries for the UGA and the current City limits are provided in Figure 3-1.

STUDY AREA

The study area consists of the City's UGA. The City can be described as consisting of several subareas that will be impacted by future growth. The first subarea is the downtown area adjacent to Lake River and which consists of the oldest part of the community. This area is largely built out, and is served by an existing gravity collection system. The second subarea is the land to the southeast of the City, and on the east and west sides of Hillhurst Drive. This area is zoned to become largely residential. The third subarea is to the east and northeast of the City and this area will also be largely residential. The fourth subarea consists of the commercial/industrial zoned areas located east of the City and adjacent to Interstate 5. This part of the City is typically identified as the "Junction" area and the zoning in this area is intended to attract family wage jobs to the City.

PLANNING PERIOD

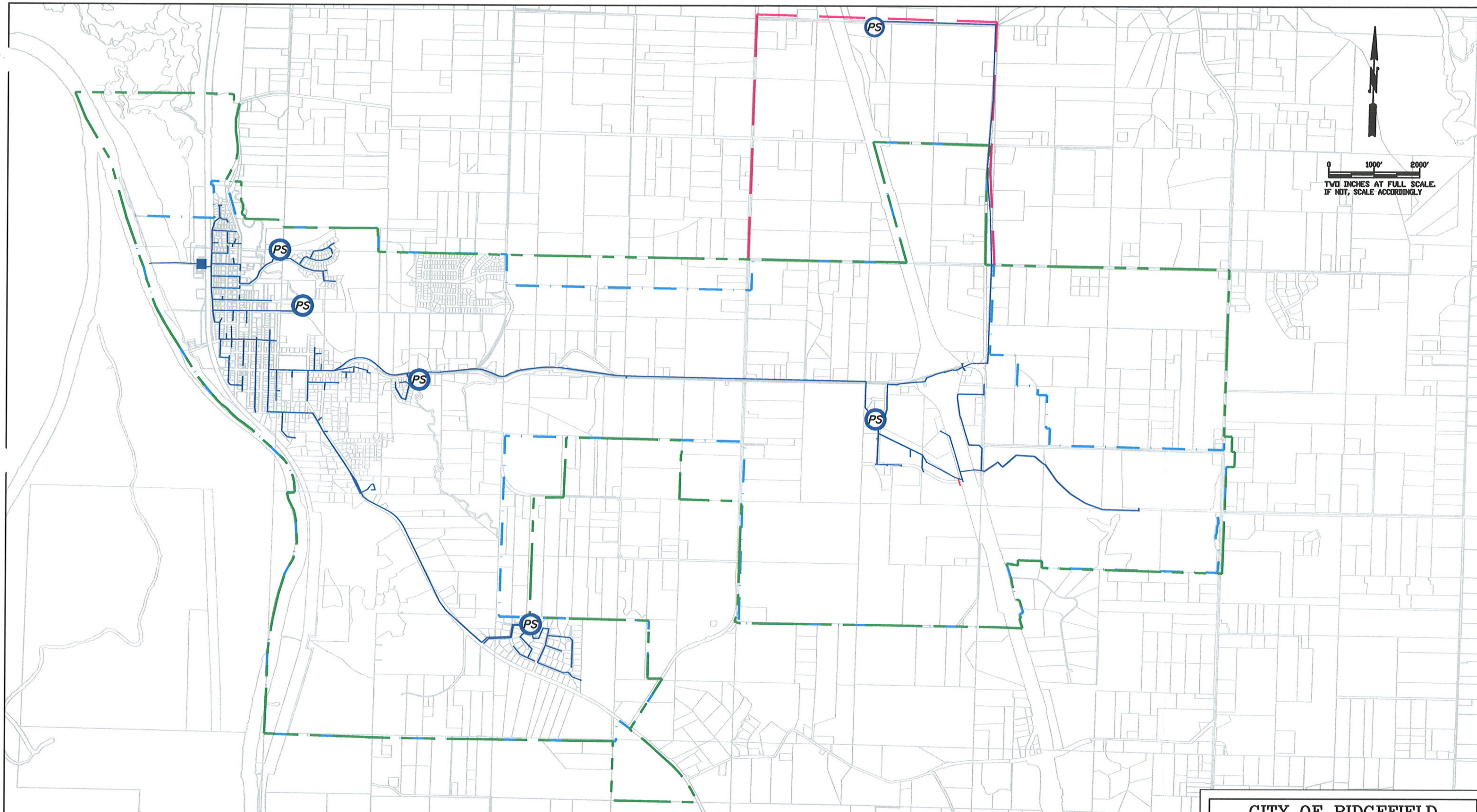
In order to provide wastewater services for growth, a wastewater system is in need of continuous evaluation and improvement. A planning period for the evaluation of the wastewater utility should be long enough to be useful for an extended period of time, but not so long as to be impractical. The planning period for this General Sewer Plan/Facility Plan is from 2004 through 2024, coinciding with a 20-year planning interval. A 15 year growth increment for the wastewater treatment system is identified to address the rapid growth needs of the City. A 10- year collection system improvement schedule for 2004 to 2014 will also be provided to enable the City to plan collection system improvements for growth needs. Build out requirements are also identified for structures such as interceptors.

For an orderly and methodical approach to the expansion and financing of the City's wastewater system, 10-year and 20-year time frames are evaluated.

CURRENT LAND USE

The primary land use in Ridgefield is single-family residential, with major undeveloped areas of land within the city limits and the UGA. Figure 3-2 provides the current land use zoning within the City of Ridgefield. Figure 3-2 also shows the zoning designations within the urban growth area for the City of Ridgefield.

The City of Ridgefield is currently comprised of approximately 4,300 acres. Land use throughout the City is broken up into 5 major land use categories: urban residential, urban employment, urban mixed use, urban public, and urban holding. The City of Ridgefield land use categories, the governing Municipal Code Chapter, total acreage for each land use category, and percentage of the total acreage are listed in Table 3-1. Figure 3-3 identifies the land use designations within the current city limits and the urban growth area for the City of Ridgefield.



EXISTING URBAN GROWTH BOUNDARY
EXISTING RIDGEFIELD CITY LIMITS
EXISTING URBAN RESERVE BOUNDARY
EXISTING SEWER LINE
EXISTING SEWAGE TREATMENT PLANT
PS EXISTING PUMP STATION

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/FACILITY PLAN
FIGURE 3-1
EXISTING WASTEWATER SYSTEM

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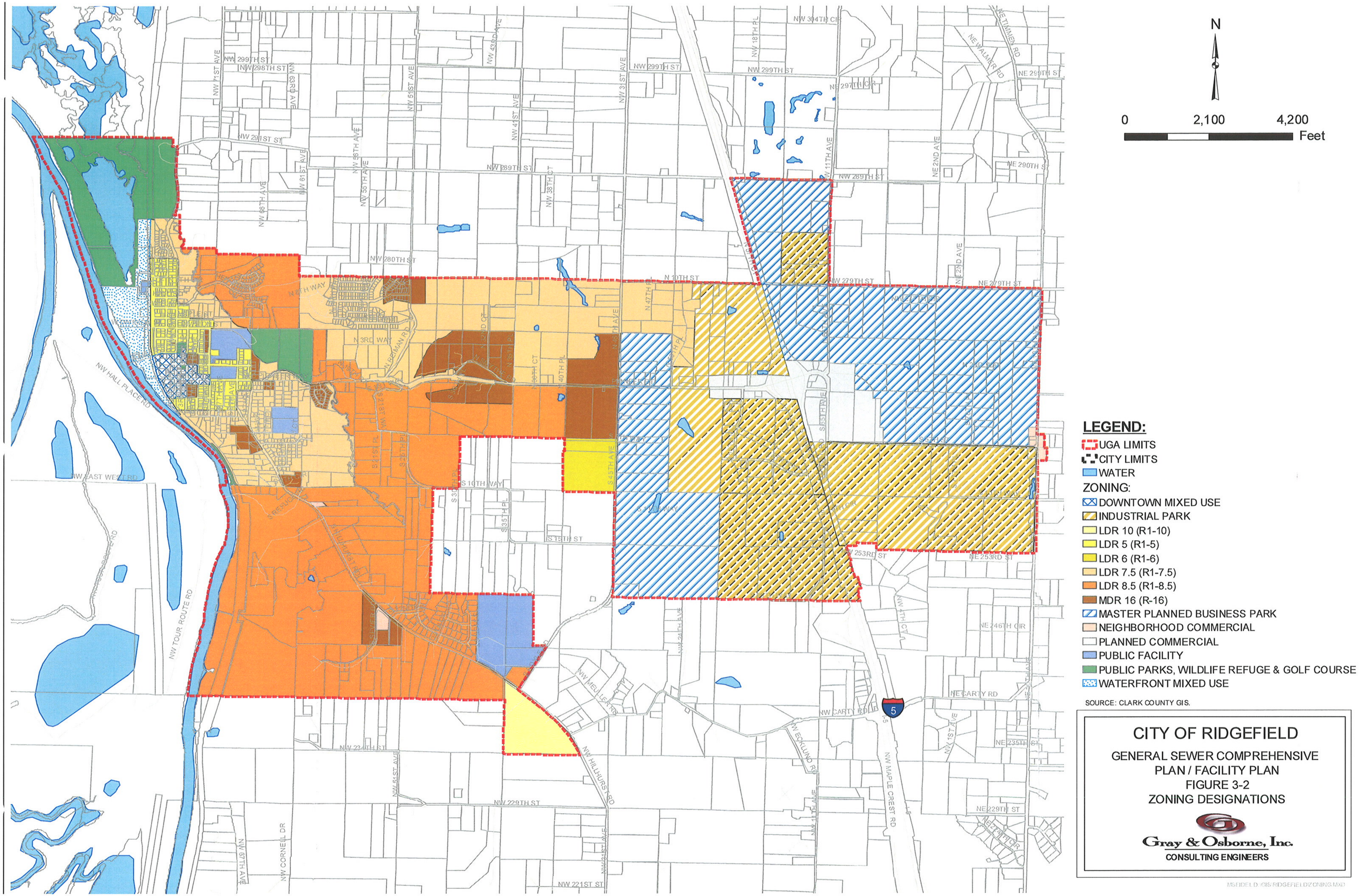
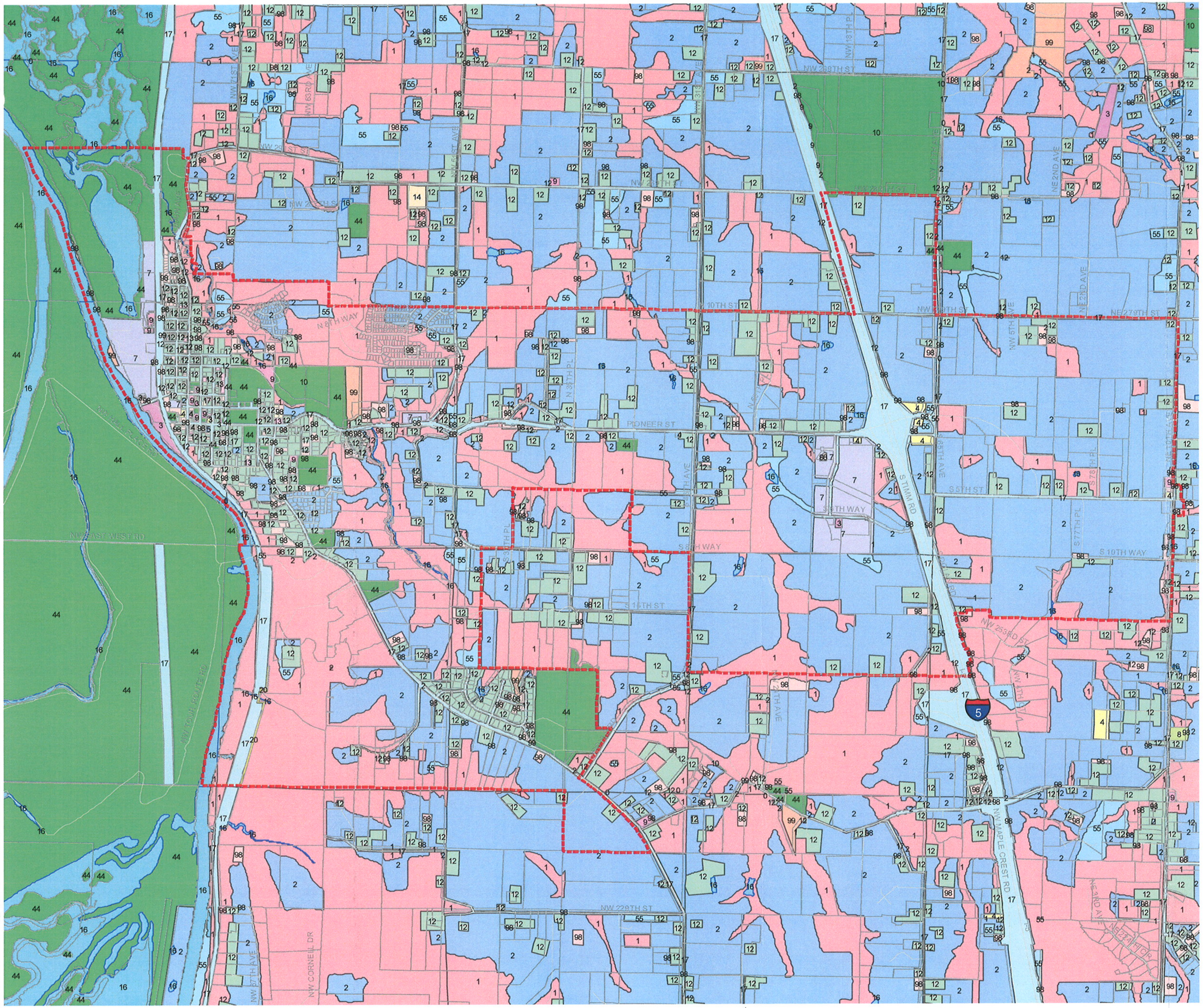

N
0 2,100 4,200
Feet
LEGEND:
UGA LIMITS
CITY LIMITS
WATER
ZONING:
DOWNTOWN MIXED USE
INDUSTRIAL PARK
LDR 10 (R1-10)
LDR 5 (R1-5)
LDR 6 (R1-6)
LDR 7.5 (R1-7.5)
LDR 8.5 (R1-8.5)
MDR 16 (R-16)
MASTER PLANNED BUSINESS PARK
NEIGHBORHOOD COMMERCIAL
PLANNED COMMERCIAL
PUBLIC FACILITY
PUBLIC PARKS, WILDLIFE REFUGE & GOLF COURSE
WATERFRONT MIXED USE
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN / FACILITY PLAN
FIGURE 3-2
ZONING DESIGNATIONS
Gray & Osborne, Inc.
CONSULTING ENGINEERS
NW 299TH ST
NW 298TH ST
NW 291ST ST
NW 289TH ST
NW 280TH ST
NE 279TH ST
NE 253RD ST
NE 246TH CIR
NE CARTY RD
NW CARTY RD
NE 235TH ST
NW 229TH ST
NE 229TH ST
NW 221ST ST
NW HALL PLACE RD
NW EAST WEST RD
NW TOUR ROUTE RD
NW HILLHURST RD
NW MAPLE CREST RD
NW ECKLUND RD
NW 11TH AVE
NE 2ND AVE
N 3RD WAY
S 10TH WAY
S 15TH ST
S 45TH AVE
5



N

0 2,100 4,200
Feet

LEGEND:

- UGA LIMITS
- CITY LIMITS

LANDUSE:

- 0 - VACANT
- 1 - FOREST
- 2 - AGRICULTURE
- 3 - SERVICE
- 4 - RETAIL
- 5 - HIGHWAY
- 7 - HEAVY INDUSTRY
- 8 - LIGHT INDUSTRY
- 9 - PUBLIC FACILITIES
- 10 - PARK/SCHOOL
- 12 - SINGLE FAMILY
- 13 - DUPLEX
- 14 - MULTI
- 16 - WATER
- 17 - ROADS & EASEMENTS
- 20 - VACANT
- 44 - PARKS/SCHOOLS/INSTITUTIONAL/REC.
- 55 - BRUSH
- 98 - ASSESSED AS UNUSED
- 99 - UNKNOWN

SOURCE: CLARK COUNTY GIS.

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN

FIGURE 3-3

LAND USE DESIGNATIONS

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CONSULTING ENGINEERS

LAND USE DESIGNATIONS

The following bulleted list briefly describes each of the land use categories. For more information regarding land use categories specific references to the City's Municipal Code (in Chapter 18) are identified.

- Low Density Residential – 5, New development is limited to 5,000 sf per lot.
- Low Density Residential – 7.5, New development is limited to 7,500 sf per lot.
- Low Density Residential – 8.5, New development is limited to 8,500 sf per lot.
- Low Density Residential – 10, New development is limited to 10,000 sf per lot.
- Medium Density Residential – 16, New development must have a minimum of eight buildings per buildable acre with a minimum of two acres developed.

TABLE 3-1

Existing Land Use

Land Use Category	Governing City Code Chapter	Acreage$^{(1)}$	Percent of Total Acreage
Urban Residential			
Low Density Residential – 5	18.210	90	2.1
Low Density Residential – 6	18.210	40	0.9
Low Density Residential – 7.5	18.210	633	15
Low Density Residential – 8.5	18.210	1,045	24.4
Low Density Residential – 10	18.210	48	1.1
Medium Density Residential – 16	18.220	204	4.8
Urban Commercial/Industrial			
Planned Commercial	18.230	114	2.7
Neighborhood Commercial	18.230	10	0.2
Master Planned Business Park	18.240	854	20
Industrial Park	18.240	858	20

TABLE 3-1 – (continued)

Existing Land Use

Land Use Category	Governing City Code Chapter	Acreage[1]	Percent of Total Acreage
Mixed Use			
Water Front Mixed Use	18.230	55	1.3
Downtown Mixed Use	18.230	23	0.5
Urban Public			
Public Park/Wildlife Refuge	18.260/18.280	209	4.9
Public Facility	18.260/18.280	93	2.2
TOTAL		4,277	100

(1) Acreages calculated based on land use mapping.

POPULATION

EXISTING POPULATION

Table 3-2 provides Washington State Office of Financial Management (OFM) census data and population projections for the City of Ridgefield.

TABLE 3-2

Population 2000 to 2004

Year	Census Population
2000[1]	2,147
2001[2]	2,175
2002[2]	2,145
2003[2]	2,185
2004[2]	2,195

(1) US Census data
(2) OFM Estimates

The City is anticipating rapid population growth over the next 20 years. The projected population growth identified in Table 3-3 is based on the projections provided in the City's 2004 Comprehensive Plan Update.

TABLE 3-3

**Population Projections
2004-2024**

Year	Population
2002	2,145
2003	2,185
2004	2,195
2005	2,495
2006	2,795
2007	3,095
2008	3,395
2009	3,755
2010	4,115
2011	4,475
2012	4,835
2013	5,195
2014	5,755
2015	6,315
2016	6,875
2017	7,435
2018	7,995
2019	8,795
2020	9,595
2021	10,395
2022	11,195
2023	11,995
2024	12,000

WASTEWATER GENERATION PROJECTIONS

Wastewater system capacity requirements are usually evaluated in terms of the number of equivalent dwelling units (EDUs) requiring sewer service. An EDU is considered equivalent to the average wastewater flow amount from a typical single family home. In keeping with assumptions used in the City's 2004 Comprehensive Plan, an EDU is defined as accommodating an average of 2.5 residents. Commercial and industrial facilities are quantified in the context of sewer capacity as being equivalent to the number of EDUs that generate the same average amount of flow into the wastewater system.

Capacity of the wastewater treatment plant (WWTP) is typically set by the Maximum Month flow. This term refers to the average daily flow during the highest month of wastewater flow in a year and is the design capacity identified in the plant's National Pollutant Discharge Elimination System (NPDES) permit as issued by the Washington State Department of Ecology (Ecology). In communities where the wastewater has the strength of typical municipal wastewater, this Maximum Month value is a convenient way of determining the growth needs for treatment. Therefore, treatment plant capacity will be discussed in terms of Maximum Month flows. A maximum month value for an EDU with 2.5 residents at 150 gallons per capita day, is 375 gallons per day. As with EDUs, this Maximum Month value is based on the values used in the City's 2004 Comprehensive Plan.

The sewer flow evaluation must consider an estimate of non-residential (commercial, governmental, and industrial) flows. The 2004 Comprehensive Plan Update provides an estimate of 750 gallons per non-residential acre per day for wastewater flows from land areas zoned for non-residential growth.

As shown in Figure 3-4, there are a small number of septic systems still operating within City/UGA limits. Eventually these systems will become part of the Ridgefield sewer system. However, most of these septic systems are affiliated with larger land parcels that will be acquired by developers for subdivisions or commercial growth. Therefore, the flows from these septic systems will be considered as having been incorporated as part of the growth related flows for the City.

Table 3-4 provides a summary of the planning flow estimates that will be used for the wastewater system.

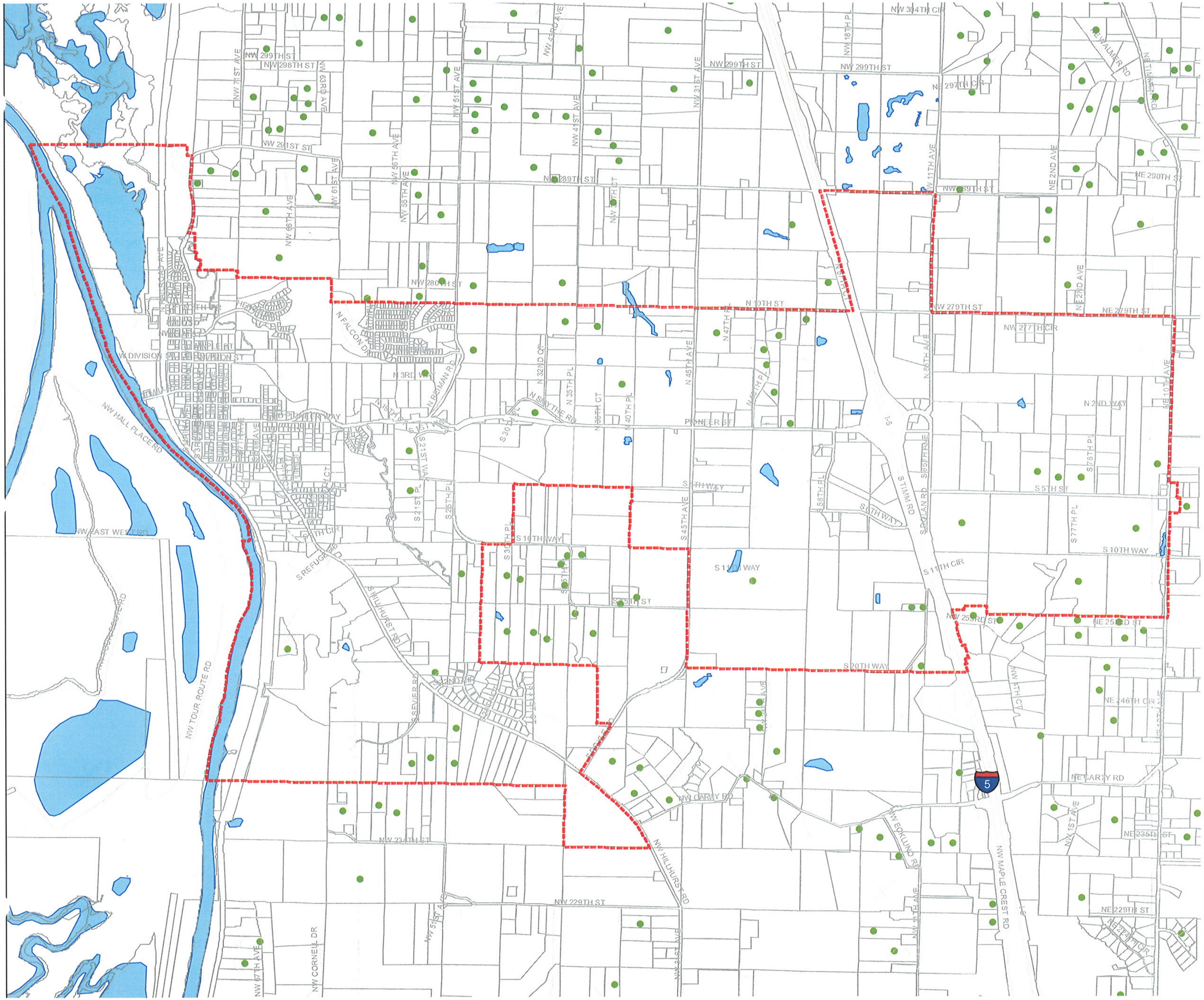
TABLE 3-4

Planning Flows for Sanitary Sewer Facilities
Per Land-Use Designation

Land-Use	Projected Maximum Month Flow
Residential	150 gal/cap/day
Residential	375 gal/EDU/day(1)
Non-residential	750 gal/acre/day

(1) Based on 2.5 persons per home

Using the population growth estimate provided in Table 3-3 and the flows for maximum month provided in Table 3-4, future additional flows deriving from population growth can be estimated. The increases in non residential flows are more difficult to project than for population increases since a single new industry can add significant new flows to the system. For the purposes of this plan, it is assumed that the non residential flows will increase as estimated in the City's 2004 Comprehensive Plan. These estimated additional flows are provided in Table 3-5. The column of Total Maximum Month Flows provided in Table 3-5 includes an existing base flow of 320,000 gpd.



LEGEND:

- UGA LIMITS
- CITY LIMITS
- WATER
- SEPTICS

SOURCE: CLARK COUNTY GIS.

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN

FIGURE 3-4

SEPTIC SEWER LOCATIONS

Gray & Osborne, Inc.

CONSULTING ENGINEERS

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TABLE 3-5

Population, Flow, and EDU Projections

Year	New Non Residential Acreage	New Non Residential Flows(1) (gpd)	New Resident Population	New Residential Flows(2) (gpd)	Total Maximum Month Flow (gpd)	New EDUs(3)	Total EDUs(3)
2004	NA	NA	NA	NA	320,000	-	800
2008	151	113,250	1,200	180,000	689,750	186	986
2014	471	353,250	3,000	450,000	1,207,250	2,366	3,166
2019	696	522,000	5,800	870,000	1,832,000	4,032	4,832
2024	1,186	889,500	9,800	1,470,000	2,680,250	6,294	7,094

(1) Assumes 750 gallons per acre per day for maximum month, non residential land use.
(2) Assumes 150 gallons per capita day for maximum month flow.
(3) Assumes 375 gallons per day per EDU.

The wastewater flow projections from Table 3-5 will be used in Chapter 6 to generate flow and loading projections for the treatment facilities for Ridgefield.

Growth Increments

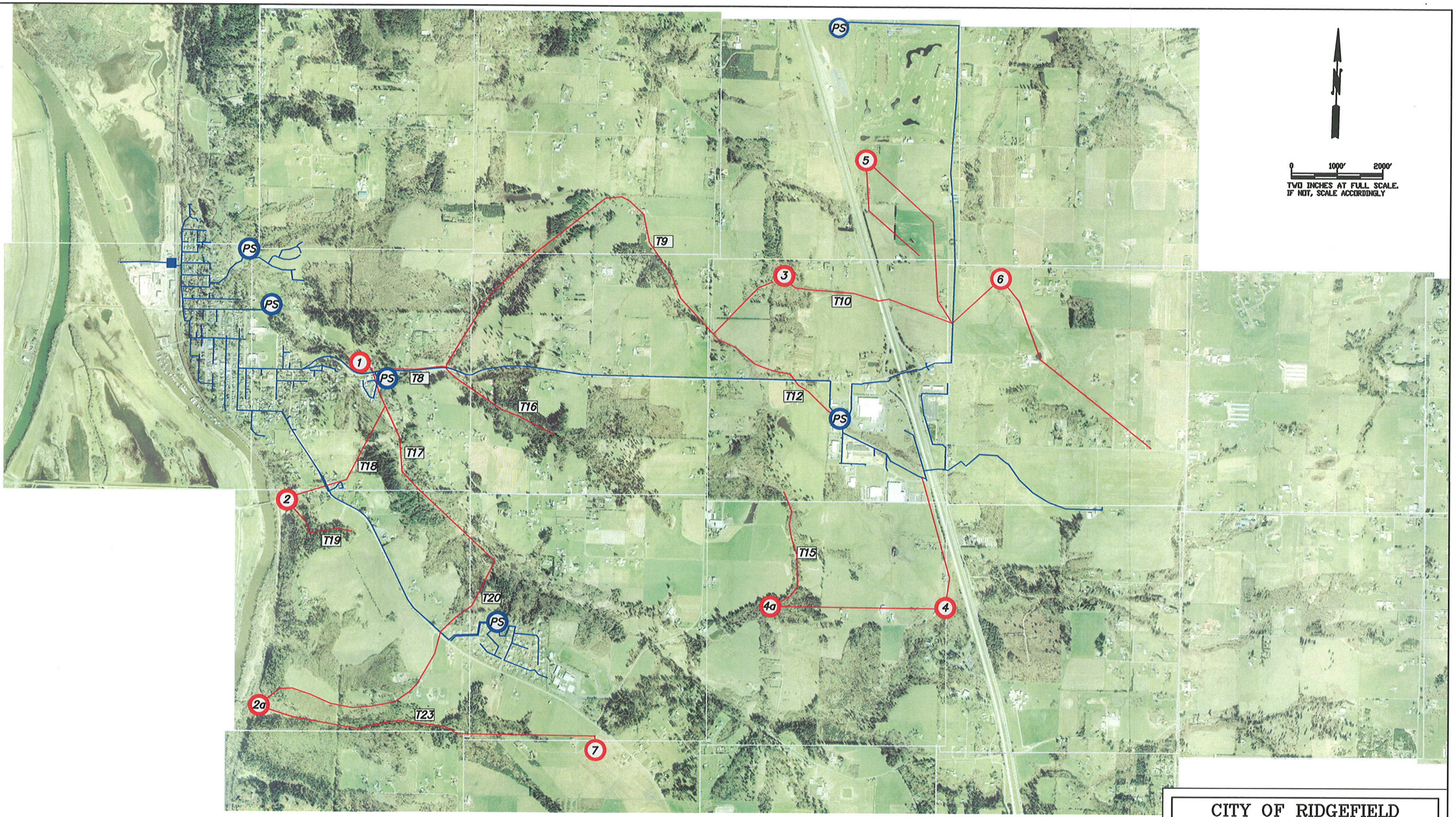
In the year 2000, the City's treatment plant was expanded as the interim first phase of an expansion that would ultimately provide a Maximum Month capacity of 2.63 mgd. The first phase was designed for a capacity of 0.7 mgd, but was permitted for only 0.5 mgd due to clarifier redundancy and outfall deficiencies. The 1997 plan was that when the City built the outfall line and pump station (for Columbia River discharge) and built another clarifier, the POTW would have a 0.75 mgd capacity. This capacity was lowered to 0.7 mgd in plans and specifications for the "interim Phase 1" system because the clarifier constructed (50 feet diameter) was smaller than called for in the approved facility plan (55 feet diameter). Also, since these plans were approved, the backup (rectangular) clarifier has failed. The clarifier is required to be maintained in a ready status until a replacement clarifier is available. Currently, the wastewater treatment plant has a permitted design capacity of 500,000 gpd and has experienced Maximum Monthly flows in excess of 300,000 gpd. The City is currently growing at a rate of 250 to 300 EDUs per year. At this growth rate, the remaining treatment plant capacity of 200,000 gpd will be used in 2 to 3 years. The City must begin additional improvements in summer 2006 to attain the full 0.7 mgd capacity for the existing plant.

Additional expansions will need to follow as soon as final discharge locations and limits can be determined. To have capacity on-line in time to accommodate the current growth rate will require construction for an additional expansion to begin by the summer of 2009.

Collection System Planning

The City of Ridgefield is anticipating significant increases in collection system flows from new development within the City. These flows will exceed the hydraulic capacity of the downtown gravity collection system. Ridgefield's 1997 Wastewater Facility Plan (1997 Plan) proposed the construction of an interceptor and pump station to intercept and pump wastewater flows from the east and south parts of the City's Urban Growth Area. A pump station and force main would be used to bypass these flows around the downtown collection system directly to the treatment plant. These improvements (interceptor, lift station, and force main) were collectively referred to as the T-7 interceptor project and are also known as the Lower Gee Creek interceptor project. The City has obtained funding for this project from the Public Works Trust Fund and the project is currently in construction. The interceptor is anticipated to be in operation in late 2007.

The 1997 Facility Plan also identified four major sewers systems that would discharge into the Lower Gee Creek Pump Station that was originally planned to be located north of



EXISTING URBAN GROWTH BOUNDARY
EXISTING RIDGEFIELD CITY LIMITS
EXISTING URBAN RESERVE BOUNDARY
EXISTING SEWER LINE
FUTURE SEWER LINE

EXISTING SEWAGE TREATMENT PLANT
1 LOWER GEE CREEK SYSTEM
2 LAKE RIVER SYSTEM
3 ALLEN CANYON SYSTEM
4 UPPER GEE CREEK SYSTEM

T10 TRUNK IDENTIFIER
5 NORTH JUNCTION STATION
6 EAST JUNCTION STATION
7 HIGH SCHOOL STATION

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/FACILITY PLAN
FIGURE 3-5
2004 COMPREHENSIVE PLAN WASTEWATER SYSTEM

Gray & Osborne, Inc.
CONSULTING ENGINEERS

Abrams Park. In 2000, a smaller pump station was built in that location to serve new developments (Heron Ridge and Bellwood Heights) located north of Abrams Park. The Heron Ridge & Bellwood Heights developments also built a sewer collection system that negated the need for previously planned trunk sewers T4 and T6. As a result, the Lower Gee Creek Pump Station will now be located south of Abrams Park.

Chapter 7 provides details on the flows from subareas of the City and UGA, and the related collection system improvements needed to carry these flows. Interceptor size and costs for collection system improvements are also provided in Chapter 7.

CHAPTER 4

REGULATORY REQUIREMENTS

INTRODUCTION

The purpose of this chapter is to identify and summarize the regulations that affect the planning, design and approval of improvements discussed in this report. These regulatory requirements were used in developing the design criteria for the City of Ridgefield's wastewater collection, treatment, and disposal systems.

This chapter does not describe each regulation in detail; rather, it addresses important facets of the regulations that affect the planning and design process. Subsequent sections of this report address technical requirements of the regulations at a level of detail appropriate for the evaluation provided by that section. For instance, Chapter 9 contains a discussion of biosolids regulations, while Chapter 10 contains more detailed information on wastewater reuse regulations.

FEDERAL AND STATE STATUTES, REGULATIONS AND PERMITS

In this section, some of the various state and federal laws that may affect wastewater system construction and operations are discussed, as well as other relevant permits, programs, and regulations.

FEDERAL CLEAN WATER ACT

The Federal Water Pollution Control Act is the principal law regulating the water quality of the nation's waterways. Originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was given the common title of the "Clean Water Act" (CWA). The CWA has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the State Revolving Fund (SRF), which provides low-cost financing for a range of water quality infrastructure projects.

The National Pollutant Discharge Elimination System (NPDES) is established by Section 402 of the CWA and subsequent amendments. The Department of Ecology (Ecology) administers NPDES permits for the United States Environmental Protection Agency (EPA) in Washington State. Most NPDES permits have a 5-year life span and place limits on the quantity and quality of pollutants that may be discharged. NPDES permits granted under Phase I of the CWA are required for point source discharges, including wastewater discharges to surface waters from municipal or industrial wastewater treatment facilities, stormwater discharges from industrial facilities, runoff from construction sites of more than five acres, and stormwater discharges from separate storm sewers serving populations of more than 100,000.

The City's current NPDES permit, No. WA0023272, along with the permit Fact Sheet, is attached as Appendix A. The City's current NPDES permit effluent limits and capacity limits are shown in Table 5-4 in Chapter 5.

The permit, issued in December 2003, has extensive dilution zone modeling and effluent testing requirements that are being carried out in the first 2 years of the 5 year permit life. The results of these investigations are presented in Appendices C and D.

Projected future permit limits, based on mixing zone modeling, effluent testing and evaluations by Ecology are discussed in Chapter 6.

Condition S.4. of the City's NPDES permit requires the City to prepare a plan to maintain adequate capacity when flows and loadings to the WWTP exceed 85 percent of design capacity. The City extrapolated that this requirement would be triggered within the life of the 2003 permit. Ecology was notified in July 2004 that the City was beginning to plan for the next system expansion through the development of this updated General Sewer/Facility Plan. This Plan includes an evaluation of the WWTP operating conditions and provides recommendations for improving and maintaining adequate treatment capacity to ensure long-term NPDES permit compliance.

Section 303 of the CWA established the Total Maximum Daily Load (TMDL) program. Under this program, states must establish a list of water bodies that will not achieve water quality standards even with "all known available and reasonable technology (AKART)" in place. In such situations, Ecology conducts a TMDL analysis to determine the capacity of the water body to absorb pollutants and allocates pollutant loads among point and nonpoint discharges. Based on this loading capacity, "waste load allocations" are established for different pollutant sources in the watershed. Lake River has been identified as being non compliant with applicable water quality criteria. The pollutants of concern that have been identified are temperature and coliforms. Lake River has not yet been evaluated under the TMDL program.

Section 307 of the CWA established the National Pretreatment Program. This program is designed to protect publicly owned treatment works (POTWs) and limits the amount of industrial or other non-residential pollutant discharged to municipal sewer systems.

A 401 Water Quality Certification is required under the CWA for any activity that may result in discharge to surface waters including excavation activities that occur in streams, wetlands, or other waters of the nation. The USEPA has delegated 401 Certification to the Department of Ecology.

Section 404 of the CWA regulates discharges of fill or dredged materials in wetlands, including any related draining, flooding, and excavation. Pipeline and pump station projects in wetlands will require a Section 404 permit, in addition to any related local permits. In most cases, activities impacting greater than 1/3 of an acre will also require a Section 401 Certification.

CAPACITY, MANAGEMENT OPERATION AND MAINTENANCE

The Environmental Protection Agency (EPA) has drafted an amendment to the NPDES regulations to address Sanitary Sewer Overflows (SSOs). The legal basis for this Capacity, Management Operation and Maintenance (CMOM) regulation is that nearly all collection systems have unplanned releases at some time and that these releases must be regulated under the jurisdiction of the Clean Water Act. The schedule for final release of this regulation has not been set.

The draft collection system regulatory requirements are as follows:

1. Meet additional general sewer system performance standards including up to date system maps, information management systems, and odor control requirements.

2. Maintain program documentation including the goals, organizational and legal authority of the organization operating the collection system.

3. Develop an overflow response plan that can respond to releases in less than one hour and is demonstrated to have sufficient and adequate personnel and equipment, etc. Estimated volumes and duration of overflows must be measured and reported to the regulatory agency.

4. Plan for system maintenance and evaluation requirements that will mandate that the entire collection system be cleaned on a scheduled basis (for example, once every 5 years), be regularly inspected through TV work and that a program for short and long term rehabilitation and replacement be generated. EPA has suggested a 1-1/2- to 2-percent system replacement rate, which implies that an entire collection system is replaced in a 50- to 70-year time period.

5. Develop a capacity assurance and management plan with flow meters to model Infiltration and Inflow (I&I) and system capacity. Ensure pump stations are properly metered, operated, and maintained.

6. Develop a self-audit program to evaluate and adjust performance.

7. Develop a program to communicate information on problems, costs, and improvements to the public and decision-makers.

This program will issue NPDES permits for tributary collection systems (owned and operated by local governments) that do not have NPDES permits for their own treatment plant(s). These requirements will likely be issued through a general NPDES permit instead of individual permits. Communities that have NPDES permits through their treatment plants will have these new CMOM requirements added to the existing permits.

There will be some relaxation of these requirements for small communities with design flows less than 1 mgd. However, it is uncertain exactly what streamlining will be applied, and the integrity of the collection system may be more important than size in determining which requirements will apply to a community. Because the underlying legal authority for this program is the Federal Clean Water Act, these regulatory requirements will also be subject to enforcement through citizen lawsuits.

An assessment of the City of Ridgefield's operation and maintenance efforts relative to CMOM is provided in the discussion of local ordinances at the end of this chapter.

BIOSOLIDS

See Chapter 9, Biosolids Management Alternatives, for a detailed discussion of regulatory requirements.

FEDERAL ENDANGERED SPECIES ACT

On March 16, 1999, the National Marine Fisheries Service (NMFS) listed the Puget Sound Chinook as "threatened" under the Endangered Species Act (ESA). In 1999, the United States Fish and Wildlife Service (USFWS) listed the Bull Trout as "threatened." ESA listings are expected to significantly impact activities that affect salmon and trout habitat, such as water use, land use, construction activities, and wastewater disposal. Impacts to the City may include revised wasteload allocations developed under the Section 303 of the Clean Water Act, longer timelines for permit applications, and more stringent regulation of construction impacts and activities in riparian corridors.

The purpose of the 1972 ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved..." In pursuit of this goal, the ESA authorizes NMFS and USFWS to list species as endangered or threatened, and to identify and protect the critical habitat of listed species. USFWS has jurisdiction over terrestrial and freshwater plants and animals such as Bull Trout, while NMFS is responsible for protection of marine species including anadromous salmon. Under the ESA, endangered status is conferred upon "any species which is in danger of extinction throughout all or a significant portion of its range," while threatened status is conferred upon "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The ESA defines critical habitat as the "geographical area containing physical and biological features essential to the conservation of the species."

Once a species is listed as endangered or threatened, the ESA makes it illegal for the government or individuals to "take" a listed species. "Take" has been interpreted by the federal courts to include "significant modification or degradation of critical habitat" that impairs essential behavior patterns. For species listed as endangered, the blanket prohibitions against "take" are immediate.

The ESA Section 9 "take" prohibition applies to all "persons" including local public entities. State and local governments may face double exposures through both their direct conduct and through the exercise of the regulatory authorities over activities, which can be construed as a "take."

Federal rules also allow threatened species to be protected through a more flexible Section 4(d) rule describing specific activities that are likely to result in a "take." The draft of the Section 4(d) rule prepared by NMFS was published in the Federal Register on January 3, 2000 (Federal Register, Vol. 65, No. 1). The final 4(d) rule was published in June 2000 and became effective January 8, 2001.

The 4(d) rules may exempt certain activities from "take" liabilities and thereby offer an alternative mechanism by which to secure relief from potential "take" liability. The 4(d) rule approves some specific existing state and local programs, and creates a means for NMFS to approve additional programs if they meet certain standards set out in the rule. NMFS published "A Citizen's Guide to the 4(d) Rule for Threatened Salmon and Steelhead on the West Coast" in June 2000. The guide introduces and explains the rule. The following discussion summarizes this guide.

Section 4(d) requires NMFS to issue regulations deemed "necessary and admissible to provide for the conservation to the species." NMFS must establish protective rules for all species now listed as threatened under the ESA. The rules need not prohibit all "take." There may be an "exception" from the prohibitions on take so long as the take occurs as the result of a program that adequately protects the listed species and its habitat. The 4(d) rule can "limit" the situations to which the take prohibitions apply. By providing limitation from take liability, NMFS encourages governments and private citizens to adjust their programs and activities to be "salmon safe."

One of the limitations on the take prohibitions contained in the 4(d) rule is Limit No. 12 – Municipal, Residential, Commercial, and Industrial development and redevelopment (MRCI). The 4(d) rule recognizes that MRCI development and redevelopment have a significant potential to degrade habitat and injure or kill salmon and steelhead in a variety of ways. The 4(d) guide states that with appropriate safeguards, MRCI development can be specifically tailored to minimize impacts on listed fish to the extent that additional Federal protections would not be needed to conserve the listed ESU. The guide further states that NMFS would individually apply the following 12 evaluation considerations when determining whether MRCI development ordinances or plans adequately conserve listed fish:

1. A MRCI development ordinance or plan ensures that development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high

habitat value, and similarly constrained sites.

2. A MRCI development ordinance or plan adequately prevents stormwater discharge impacts on water quality and quantity and stream flow patterns in the watershed – including peak and base flows in perennial streams.

3. A MRCI development ordinance or plan protects riparian areas well enough to attain or maintain Proper Functioning Condition (PFC), habitat that provided for the biological requirements of the fish, around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams.

4. A MRCI development ordinance or plan avoids stream crossings – whether by roads, utilities, or other linear development – wherever possible and, where crossings must be provided, minimize impacts.

5. A MRCI development ordinance or plan adequately protects historic stream meander patterns and channel migration zones and avoids hardening stream banks and shorelines.

6. A MRCI development ordinance or plan adequately protects wetlands, wetland buffers, and wetland function – including isolated wetlands.

7. A MRCI development ordinance adequately preserves permanent and intermittent streams' ability to pass peak flows.

8. A MRCI development ordinance or plan stresses landscaping with native vegetation to reduce the need to water and apply herbicides, pesticides, and fertilizer.

9. A MRCI development ordinance or plan contains provisions to prevent erosion and sediment run-off during (and after) construction and thus prevent sediment and pollutant discharge to streams, wetlands and other water bodies that support listed fish.

10. A MRCI development ordinance or plan ensures that demands on the water supply can be met without affecting either directly or through groundwater withdrawals – the flows salmon need.

11. A MRCI development ordinance or plans provides mechanisms for monitoring, enforcing, funding, reporting, and implementing its program.

12. A MRCI development ordinance or plan complies with all other state and Federal environmental and natural resource laws and permits.

The City has adopted an MRCI development ordinance.

In response to existing and proposed ESA listings of salmon, steelhead, and trout species throughout Washington State, Governor Locke established the Office of Salmon Recovery in 1997 to direct the State's salmon recovery efforts. The Office of Salmon Recovery is also supported by the Joint Natural Resources Council (composed of representatives of state natural resource agencies) in the preparation of the Statewide Strategy to Recover Salmon, entitled "Extinction is Not an Option" (January 1999). The goal of the Statewide Strategy is to restore wild salmon, steelhead, and trout populations to harvestable levels. Rather than attempting to avert additional ESA listings, the Statewide Strategy intends to provide local input into, and hopefully maintain some local control over the salmon recovery regulatory processes that will inevitably affect the majority of Washington State. The Statewide Strategy was submitted to NMFS in 1999 for possible inclusion in the Section 4(d) rule. The draft of the Section 4(d) rule was published in the Federal Register on January 3, 2000 (Federal Register, Vol. 65, No. 1). The final 4(d) rule was published in June 2000 and became effective January 8, 2001. The Statewide Strategy to Recover Salmon was not included in the 4(d) rule.

In order to minimize liability under the ESA, local governments must demonstrate that their land use regulations will not result in a prohibited "take" of a listed species, including adverse modification of critical habitat. Possible regulatory impacts may include the following:

- Adopt model critical areas ordinances designed to protect critical habitat.
- Amend critical areas ordinances to include riparian buffers, vegetation retention, soil retention, maximum road density within a watershed, maximum impervious surface in a watershed, and limits on road crossings of streams.
- Amend GMA comprehensive plans to require an "environmental protection element.
- Adopt stormwater operation and maintenance ordinances requiring regular, frequent maintenance of stormwater facilities.
- Increase inspection and enforcement of stormwater best management practices.
- Require monitoring of best management practices.
- Provide adequate funding of stormwater infrastructure, which may include implementation of stormwater utilities.

- Amend Shoreline Master Programs to encourage greater use of conservancy and natural designations, and limit conversion of agricultural and forest land.

It should be noted that the ESA includes a third-party citizen suit provision. Compliance with the Section 4(d) rule does not, therefore, rule out legal challenges, although it is likely to provide greater protection from successful litigation.

RECLAIMED WATER STANDARDS

The standards for the use of reclaimed water are outlined in RCW 90.46 and in a separate document published by the Washington State Department of Health and Ecology entitled "Water Reclamation and Reuse Standards." Reclaimed water is the effluent derived in any part from wastewater from a wastewater treatment system that has been adequately and reliably treated, such that it is no longer considered wastewater and is suitable for a beneficial use or a controlled use that would not otherwise occur. The legislature has declared that "the utilization of reclaimed water by local communities for domestic, agricultural, industrial, recreational, and fish and wildlife habitat creation and enhancement purposes (including wetland enhancement) will contribute to the peace, health, safety, and welfare of the people of the State of Washington." The Reclaimed Water Use Statute, Chapter 90.46 RCW, requires the issuance of a single permit for the development and implementation of a reclaimed water project. Therefore, all regulatory concerns and permit limitations will be included in one document, combining requirements of the Department of Health, Ecology's Water Quality, and Ecology's Water Resources Division. Chapter 10 provides additional information on reclaimed water opportunities for the City of Ridgefield.

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal permits or funding. Federally delegated activities such as NPDES permits or Section 401 Certification are considered state actions and do not require NEPA compliance. If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued, otherwise an Environmental Impact Statement (EIS) is required. NEPA is not applicable to projects that do not include a federal component that would trigger the NEPA process.

FEDERAL CLEAN AIR ACT

The Federal Clean Air Act requires all wastewater facilities to plan to meet the air quality limitations of the region. The City falls in the jurisdiction of the Southwestern Washington Clean Air Authority. An air quality permit for the City of Ridgefield's WWTP is not required.

STATE STATUTES, REGULATIONS AND PERMITS

STATE WATER POLLUTION CONTROL ACT

The intent of the state Water Pollution Control Act is to "maintain the highest possible control standards to ensure the purity of all waters of the state consistent with public health and the enjoyment…the propagation and protection of wildlife, birds, game, fish, and other aquatic life, and the industrial development of the state." Under the Revised Code of Washington (RCW) 90.48 and the Washington Administrative Code (WAC) 173-240, Ecology issues permits for wastewater treatment facilities and also land application of wastewater under WAC 246-271.

Submission of Plans and Reports for Construction of Wastewater Facilities, WAC 173-240

Prior to construction or modification of domestic wastewater facilities, engineering reports and plans, and specifications must be submitted to and approved by Ecology. This regulation outlines procedures and requirements for the development of an engineering report, which thoroughly examines the engineering and administrative aspects of a domestic wastewater facility project. This regulation defines a facility plan as described in federal regulations, 40 CFR Part 35, as an engineering report.

Key provisions of WAC 173-240 are provided below.

- An engineering report for a wastewater facility project must contain everything required for a general sewer plan unless an up-to-date general sewer plan is on file with Ecology.

- An engineering report shall be sufficiently complete so that plans and specifications can be developed from it without substantial changes.

- A wastewater facility engineering report must be prepared under the supervision of a professional engineer.

- The engineering report shall include the following information (letter designations are taken from WAC 173-240-060; requirements that include those found in 40 CFR 35.917 for federal facility plan requirements are noted with an asterisk, "*").

    (a) Name, address, phone number of owner.
    (b) Project description.
    (c) Current and projected wastewater flows and loadings.
    (d) Treatment standards.
    (e) Receiving water characteristics, including dilution zone.

(f) Proposed treatment and disposal process, including an evaluation of alternatives.*
(g) Basic design data and calculations for each unit process.
(h) Site availability and relationship to 25/100 flood cycles and residential or developed areas.
(i) Flow diagram with hydraulic profile.
(j) Discussion of inflow and infiltration.*
(k) Provisions for treating industrial waste, including pre-treatment programs.*
(l) Outfall analysis.
(m) Method of final sludge disposal and alternatives considered.
(n) Provisions for future needs.
(o) Staffing and testing requirements.
(p) Estimated capital and O&M costs, evaluated in terms of annual costs and present worth.*
(q) A statement regarding compliance with any applicable state or local water quality plan.
(r) A statement regarding compliance with the State (or National) Environmental Policy Act, SEPA (or NEPA) as applicable.

Criteria for Sewage Works Design, Washington State Department of Ecology

Ecology has published design criteria for collection systems and wastewater treatment plants. While these criteria are not legally binding, their use is strongly encouraged by Ecology since the criteria are used by the agency to review engineering reports for upgrading wastewater treatment systems. These design criteria, commonly referred to as the "Orange Book," primarily emphasize unit processes through secondary treatment. Any expansion or modification of the City of Ridgefield collection system and/or treatment plant will require continued conformance with Ecology criteria.

Certification of Operators of Wastewater Treatment Plants, WAC 173-230

Wastewater treatment plant operators are certified by the State water and wastewater operators' certification board. The operator assigned overall responsibility for operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." This individual must have State certification at or above the classification rating of the plant.

The City of Ridgefield Wastewater treatment plant is currently assigned a Class II rating. The certified staff assigned to the operation of the plant are as follows:

Person	Certification Level
Frederick Crippen	Level 2
James Strickler	Level 2
John Duback	Level 2
Doug Forsberg	Level 1
Nick Crockford	Level 1
Krystal Reed	Operator In Training

The plant is staffed Monday through Friday from 7:30 a.m. to 4:00 p.m. A one hour plant check is conducted on weekends and holidays and a staff person is on call at all times to respond to alarm calls. The City staff also handles collection system maintenance and operates the water system. The total staff time dedicated to the plant is estimated to be 2.69 full-time employees (FTEs).

WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON, CHAPTER 173-201A WAC

Basis of Regulations

The State of Washington has authority under the Federal Water Pollution Control Act, also known as the Clean Water Act, (CWA) to establish and administer programs to meet the requirements of the CWA. Under RCW 98.40.35, the Washington Department of Ecology has the authority to establish "rules and regulations relating to standards of quality for waters of the State and for substances discharged therein..." The State of Washington also implements the National Pollutant Discharge Elimination System (NPDES) program, created under the CWA.

Description of Regulations

WAC 173-201A establishes water quality standards for the State of Washington. The State adopted revised water quality standards on July 1, 2003, which are subject to approval by EPA. EPA is expected to complete their review in spring 2005. The standards are based on two objectives: protection of public health and enjoyment, and protection of fish, shellfish, and wildlife. For each surface water body in the state, the revised standards assign specific uses, such as aquatic life, recreation, or water supply uses. Water quality standards have been developed for each use, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, deleterious substances. The water uses that are defined in the standards for freshwater are:

<u>Aquatic life uses</u>

- Char
- Salmon and trout spawning, core rearing, and migration

- Salmon and trout spawning, non-core rearing, and migration
- Salmon and trout rearing and migration only
- Non-anadromous interior redband trout
- Indigenous warm water species

Recreational uses

- Extraordinary primary contact recreation
- Primary contact recreation
- Secondary contact recreation

Water supply uses

- Domestic water supply
- Agricultural water supply
- Industrial water supply
- Stock watering

Miscellaneous uses

- Wildlife habitat
- Harvesting
- Commerce and navigation
- Boating
- Aesthetics

Water Quality Classification

Lake River is a tributary to the Columbia River. Because Lake River is not separately identified in the water quality standards, the Columbia River standards apply. **WAC 173-201A-602** identifies the following uses in the segment of concern:

- Aquatic life use: Non-core rearing, and migration for salmon and trout
- Recreation use: Primary contact recreation
- Water supply uses: domestic water supply, agricultural water supply, industrial water supply, stock watering
- Miscellaneous uses: wildlife habitat, harvesting, boating, commerce & navigation, aesthetics.

Water quality criteria for the salmon and trout spawning use is shown in Table 4-1:

TABLE 4-1

Water Quality Criteria for the
Salmon and Trout Spawning, Non-core Rearing and Migration Use

Parameter	Surface Water Criteria Value
Dissolved Oxygen	>8.0 mg/L
Temperature	17.5 degrees C (7-day average of daily maximum), (1) with no increase greater than t=28/(T+5) or (2) if natural temperature is >17.5 degrees C, then no increase >0.3 degrees C
pH	Not outside the range of 6.5 to 8.5 standard units, with no human-caused variation >0.5 standard units
Turbidity	<5 NTU over background (background <50 NTU) <10% increase over background (background >50 NTU)
Total dissolved gas	<110% of saturation

The bacterial water quality criteria for Lake River is based on the assigned recreational use as follows:

Freshwater

- Primary contact recreation: 100 fecal coliform colonies/100 mL

The water supply and miscellaneous uses do not have additional numerical criteria.

The water quality standards also have narrative criteria regarding toxic, radioactive, otherwise deleterious materials, or materials that impair aesthetics. These materials are prohibited in concentrations that affect aquatic life, human health or impair aesthetics.

Numeric criteria for 29 toxic substances are listed in WAC 173-201A-040. Criteria are listed on both an acute and chronic basis and for certain substances (e.g., metals, chlorine, and ammonia), the criteria must be calculated as a function of receiving water pH, hardness, and whether salmonids are present.

The water quality standards allow for variances and site-specific criteria to be developed in individual cases.

As noted previously, Lake River has non attainment status for fecal coliforms and temperature. These measurements that support the non attainment status were taken upstream of the WWTP outfall.

Because the alternatives to be considered in this Plan include moving the WWTP discharge to the Columbia River, the water quality standards for the Columbia are also relevant to possible discharge limitations. These standards are identified in WAC 173-201A Table 602.

To remove a use from the list of uses for which a water body is protected, a use attainability analysis (UAA) must be performed. The UAA must demonstrate that the use does not exist in the water body or would not be attainable. The proposed change to the assigned uses must be consistent with Federal laws and subject to a public involvement process including consultations with Native American tribes.

Mixing Zones

WAC 173-201A-700 has provisions for mixing zones for a permitted discharge. Deviations from water quality standards for the surface water are allowed within the mixing zone. Mixing zones are allowed under the following conditions:

1. All known, available, and reasonable treatment (AKART) is applied prior to discharge to the mixing zone.

2. Water quality is not violated outside the mixing zone boundary.

3. When potential does not exist for damage to sensitive ecosystem or aquatic habitat, adverse public health effects, or interference with characteristic uses of the water.

Anti-Degradation Policy

The anti-degradation policy aims to maintain the highest possible quality of water in the State, by preventing the deterioration of water bodies that currently have higher quality than the water quality standards require. The revised water quality standards define three tiers of waters in the anti-degradation policy.

Tier I water bodies are those with violations of water quality standards, from natural or human-caused conditions. The focus of water quality management is on maintaining or improving current uses, and preventing any further human-caused degradation.

Tier II water bodies are those of higher quality than required by the water quality standards. The focus of the policy is on preventing degradation of the water quality, to preserve the excellent natural qualities of the water body. New or expanded actions are not allowed to cause a “measurable change” in the water quality, unless they are demonstrated to be “necessary and in the overriding public interest”.

New or expanded actions that may cause a measurable change in water quality must have a Tier II review conducted. For increased wastewater treatment plant discharges, this review will take place as part of the NPDES permit modification process. Measurable change, for the purpose of the anti-degradation policy, is defined as follows:

- Temperature increase greater than 0.3 degrees C
- Dissolved oxygen concentration decrease greater than 0.2 mg/L
- Bacteria level increase greater than 2 CFU/100 mL
- pH change greater than 0.1 standard units
- Turbidity increase greater than 0.5 NTU
- Any detectable change in concentration of toxic or radioactive substances, which include ammonia and chloride.

A new or expanded action may be determined by the Department of Ecology to be necessary and in the overriding public interest based on a review of the following factors:

- Economic benefits, such as job creation
- Providing or contributing to necessary social services
- Status as a demonstration project using innovative technical or management approaches that produce a significant improvement over AKART
- Prevention or remediation of environmental or public health threats
- Societal or economic benefits of better health protection
- The loss of assimilative capacity for future industry or development
- The loss of benefits associated with the current high water quality, i.e., uses such as fishing or tourism.

The new or expanded action would be allowed to measurably reduce the water quality only if it is demonstrated that the action has selected the combination of site, technical and managerial approaches that will minimize the effect on water quality. Alternative approaches that must be evaluated include:

- Pollution prevention or source control to reduce toxic compound discharges
- Reuse or recycling of wastewater
- Water conservation to minimize production of wastewater
- Land application or infiltration to reduce surface water discharges
- Alternative or enhanced treatment technologies
- Improved operation and maintenance of existing facilities
- Seasonal or controlled discharge to avoid critical water quality conditions
- Water quality offsets with another water quality action (point or non-point source), providing no net decrease of water quality.

Discharge Permits

The primary means for achieving the water quality standards of WAC 173-201A is the issuance of discharge permits, such as NPDES permits or State Waste Discharge permits, by the Department of Ecology.

Compliance Schedules

When it is not possible to immediately achieve compliance with the standards in WAC 173-201A, Ecology may issue an order with a compliance schedule to allow for further water quality studies, implementation of best management practices or construction of necessary treatment capability. Compliance schedules may only be issued for existing discharges.

Assimilative capacity is a term that describes a surface water's ability to accept waste loadings without a permanent degradation of water quality. Ecology is presently conducting waste load capacity studies (also known as Total Maximum Daily Load, or TMDL, studies) for several major watersheds in the State of Washington. These studies will be utilized to determine the assimilative capacity of watersheds that are noted as "impaired" for having too high a temperature or having too high a concentration of a pollutant, such as BOD_5 or potentially toxic pollutants such as chlorine, ammonia, and metals. For example, the assimilative capacity of a surface water with respect to BOD_5 will be based on the mass of an oxygen-depleting substance (e.g., organic matter and ammonia) that can be discharged into a surface water without depleting dissolved oxygen to levels that would be detrimental to aquatic life.

The federal Environmental Protection Agency, in consultation with Ecology, establishes and maintains a list of impaired water body segments, known as the 303(d) list. TMDL studies will generally be necessary to determine an allotted wasteload for any single discharger.

Discharging to surface water requires a National Pollutant Discharge Elimination System (NPDES) permit issue by Ecology under WAC 173-220. The minimum level of treatment required for discharge is called "All Known Available and Reasonable Treatment" (AKART) and represents a technology based standard for treatment plant performance. Minimum discharge standards for activated sludge (secondary treatment) facilities discharging to surface water, taken from WAC 173-221 are shown in Table 4-2. Secondary standards were developed for "conventional pollutants," and do not establish AKART for toxic pollutants. Ammonia is a toxic pollutant, and therefore, not the subject of Chapter 173-220 WAC, but of Chapter 173-201A WAC.

TABLE 4-2

Minimum WWTP Effluent Standards for Surface Water Discharge from a Secondary Treatment Plant

Parameter	Average Monthly	Average Weekly
5-day Biochemical Oxygen Demand (BOD_5)	Most stringent of the following: 30 mg/L may not exceed 15 percent of the average influent concentration	45 mg/L
Total Suspended Solids (TSS)	Most stringent of the following: 30 mg/L may not exceed 15 percent of the average influent concentration	45 mg/L
Fecal Coliform Bacteria[(1)]	200/100 mL	400/100 mL
pH	Shall be within the range of 6.0 to 9.0	

(1) The averages for fecal coliform are based on the geometric mean of the samples taken.

Under WAC 173-201A-060, State Water Quality Standards, Ecology is authorized to condition NPDES permits so that the discharge meets water quality standards. Therefore, other permit conditions in addition to or more stringent than the above could be added to ensure that the water quality of the receiving water is not degraded. For example, effluent limits for ammonia and chlorine could be added and the BOD_5 limit could be lowered to prevent degradation of the receiving water.

Mixing Zone Analysis

The City's treatment plant currently has an outfall located on the east bank of Lake River. A study and computer model analysis was performed of the existing discharge into Lake River. This study determined that the existing diffuser does not meet Department of Ecology requirements for diffuser design. The outfall study and model required in the NPDES permit is summarized in Chapter 8 and the full study is provided in Appendix C.

STATE ENVIRONMENTAL POLICY ACT

The WAC 173-240-050 requires a statement in all wastewater comprehensive plans that proposed projects are evaluated using the State Environmental Policy Act (SEPA), if applicable. The capital improvements proposed in this plan will fall under SEPA regulations. A non-project SEPA checklist is included in Appendix B of this report to comply with the requirements of SEPA. The City has issued a determination of non-significance (DNS).

STATE ENVIRONMENTAL REVIEW PROCESS

The State Environmental Review Process (SERP) is the state's approved environmental review process required for POTW's facility plan approval. The review shall be done in compliance with the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA). A SERP document for this project is included in Appendix B of this Plan.

GROWTH MANAGEMENT

The City of Ridgefield has conducted planning under the 1990 State Growth Management Act. This planning is discussed in detail in Chapter 3 of this Plan.

ACCREDITATION OF ENVIRONMENTAL LABORATORIES (WAC 173-050)

The State of Washington requires that all laboratories reporting data to comply with NPDES and Solid Waste Disposal (SWD) permits must be generated by an accredited laboratory. This accreditation program establishes specific tasks for quality control and quality assurance (QA/QC) that are intended to ensure the integrity of laboratory procedures. Accreditation requirements must be met for any on-site laboratory or outside laboratory used to analyze samples. Only accredited commercial laboratories may be used for analyses reported for compliance with NPDES or SWD permits.

The City of Ridgefield currently contracts out most of the compliance related laboratory testing to the Clark County Salmon Creek WWTP. The City is considering performing these tests on site in an expanded laboratory at the City WWTP. In planning for an on-site laboratory, staffing must be sufficient to allow for QA/QC procedures to be performed.

MINIMUM STANDARDS FOR SOLID WASTE HANDLING (WAC 173-304)

Grit and screenings are not subject to the sludge regulations in WAC 173-308, but their disposal is regulated under the State solid waste regulations, WAC 173-304. Waste placed in a municipal solid waste landfill must not contain free liquids, nor exhibit any of the criteria of a hazardous waste as defined by WAC 173-303. To be placed in a municipal solid waste landfill, grit and screenings must pass the paint filter test, which determines the amount of free liquids associated with the solids, and the toxic characteristics leachate procedure (TCLP) test, which determines if the waste has hazardous characteristics.

WETLANDS

Dredging and Filling Activities in Natural Wetlands (Section 404 of the Federal Water Pollution Control Act)

A U.S. Army Corps of Engineers permit is required when locating a structure, excavating, or discharging dredged or fill material in waters of the United States or transporting dredged material for the purpose of dumping it into ocean waters. Typical projects requiring these permits include the construction and maintenance of piers, wharves, dolphins, breakwaters, bulkheads, jetties, mooring buoys, and boat ramps.

If wetland fill activities cannot be avoided, negative impacts can be mitigated by creating new wetland habitat in upland areas, and if other federal agencies agree, the Corps will generally issue a permit.

Wetlands Executive Order 11990

This order directs federal agencies to minimize degradation of wetlands and enhance and protect the natural and beneficial values of wetlands. The order also mandates avoidance and mitigation of impacts to wetlands, and must be considered before an NPDES permit is issued. Assurances must be provided that the natural and beneficial values of wetlands will be protected and enhanced by the discharge.

SHORELINE MANAGEMENT ACT

The Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to shoreline uses that protect water quality and the natural environment, depend on proximity to the water, and preserve or enhance public access to the water. Shoreline Management Act jurisdiction extends to lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cubic feet per second (CFS) or greater, marine waters, and an area inland 200 feet from the ordinary high water mark. Projects are reviewed by local governments according to state guidelines and a local Shoreline Master Program.

Local Shoreline Master programs are developed in accordance with guidelines from the Department of Ecology (Ecology). Although this rule does impose a varying level of scrutiny within the shoreline area, the purpose is to use “Best Available Science” as required by the Growth Management Act to ensure that regulations are substantively linked to the protection of shoreline functions and values.

FLOODPLAIN DEVELOPMENT PERMIT

Local governments that are participating in the National Flood Insurance Program are required to review projects (including wastewater collection facilities) in a mapped flood plain and impose conditions to reduce potential flood damage from flood water. A Floodplain Development Permit is required prior to construction.

HYDRAULIC PROJECT APPROVAL

Under the Washington State Hydraulic Code (WAC 220-110), the Washington State Department of Fish and Wildlife (WDFW) requires a hydraulic project approval (HPA) for activities that will “use, divert, obstruct, or change the natural flow or bed” of any waters of the state. For activities such as pipeline crossings of streams, an HPA will be required, and will include provisions necessary to minimize project specific and cumulative impacts to fish.

Because of ESA listings throughout Washington, WDFW and NMFS are revising the Hydraulic Code to protect species listed as threatened or endangered. If NMFS determines that the revisions are sufficient to protect listed species, the State hopes the revised Code will constitute an acceptable Habitat Conservation Plan (HCP) under Section 10 of the ESA. If the HCP is approved, NMFS issues an incidental take permit (ITP) allowing incidental take of a listed species if the permittee has complied with the Habitat Conservation Plan. This ITP expires after an agreed upon period of time, and may then be revised by NMFS.

REGULATORY AGENCIES

The above regulations, permits, and programs are administered by various local, state, and federal agencies. The history, purpose, and authority of these agencies are discussed below.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

The stated mission of the EPA is to protect human health and to safeguard the natural environment upon which life depends. The EPA's purpose includes protecting all Americans from significant human health risks and the environment, ensuring that national environmental efforts are based on the best available scientific information, ensuring that federal laws are enforced fairly, and that environmental protection contributes to making our communities and ecosystems diverse, sustainable, and economically productive. Ecology currently administers NPDES permits, 401 Water Quality Certifications, and State Revolving Fund (SRF) loans for the EPA.

THE NATIONAL MARINE FISHERIES SERVICE

Under the ESA, NMFS is responsible for the protection of marine life, including anadromous salmon such as the Lower Columbia Chinook. When a species is listed as "endangered," the prohibitions against "take" of the species are immediate under Section 9 of the ESA. Although NMFS may choose to invoke the blanket prohibitions of Section 9, the "threatened" status of the Lower Columbia Chinook allows more flexibility to establish regulations designed to protect these species. These regulations, known collectively as a Section 4(d) rule, outline activities exempted from the "take" prohibitions of Section 9.

Table 4-3 shows the evolutionarily significant units (ESU) of salmon that use the Columbia River for rearing and transport portions of their life cycles, according to the National Marine Fisheries Service, (from the NMFS Northwest Region webpage, 9/04).

TABLE 4-3

Evolutionarily Significant Units of Columbia River Salmon

Species/ESU	Status	Date	FR Notice
Salmonids Under NMFS Jurisdiction:			
Lower Columbia Chinook	Threatened Critical habitat	3-24-98 2-16-00	63 FR14308 65 FR 7764
Lower Columbia Steelhead	Threatened Critical habitat	3-19-98 2-16-00	63 FR 13347 65 FR 7764
Columbia River Chum	Threatened Critical habitat	3-25-99 2-16-00	63 FR 30455 65 FR 7764
SW Washington & Lower Columbia Coho	Candidate	7-25-95	60 FR 38011

UNITED STATES ARMY CORPS OF ENGINEERS

Under Section 404 of the CWA, the US Army Corps of Engineers (Corps) is authorized to regulate discharge of fill and dredged material to waters of the United States, including wetlands. The Corps employs a system of General or Nationwide Permits for blanket authorization of activities such as utility lines that have minimal adverse impact on the environment. In situations where adverse impact is probable, the Corps may issue an Individual Permit after reviewing an analysis of alternatives. Enforcement actions may be taken by the Corps or EPA.

WASHINGTON STATE DEPARTMENT OF ECOLOGY

The mission of Ecology's Water Quality Program is to protect, preserve, and enhance the state surface and ground water quality and to promote the wise management of water for the benefit of current and future generations. Ecology performs various functions under state and federal authority and has both local and regional offices. Ecology is also responsible for awarding low interest loans for pollution control projects through the State Revolving Fund.

Ecology issues permits under the State Water Pollution Control Act, Section 401 Water Quality Certification, and NPDES permits in compliance with the CWA under EPA authority. Ecology also reviews and approves plans for on-site systems exceeding 14,500 gallons per day (gpd), all systems receiving state or federal construction grants under the CWA, and systems using mechanical treatment or lagoons with ultimate design flows above 3,500 gpd. Ecology regulates discharge of waste to state groundwater, discharge of industrial or commercial waste to sewers, and the use of reclaimed water through the State Waste Discharge permit program. Local Ecology offices issue

Temporary Modification of Water Quality Criteria Permits for construction near or in water that might cause short-term water quality violations.

Ecology also regulates the management and disposal of biosolids. The biosolids permit is a general permit that provides coverage for applicants that have conducted the required biosolids analysis. Because biosolids management is a significant component of this Plan, Chapter 9 provides a more comprehensive assessment of the biosolids issues applicable to Ridgefield.

WASHINGTON STATE DEPARTMENT OF FISH AND WILDLIFE

Under WAC 220-110 and RCW 75.20, any form of work that uses, diverts, obstructs, or changes the natural flow or bed of any fresh water of the state requires hydraulic project approval from the Department of Fish and Wildlife. Approval would be required for all City construction projects that cross or otherwise take place in streams or shorelines.

STATE AND LOCAL HEALTH DEPARTMENTS

The Department of Health (Health) was formed in 1989 and is the primary state agency responsible for protecting public health. Health issues Waste Discharge Permits for reclaimed water use in conjunction with Ecology and approves onsite wastewater disposal systems between 3,500 and 14,500 GPD.

CITY AND COUNTY PLANNING POLICIES

The Washington Administrative Code (173-240-050) requires a statement in all Wastewater Comprehensive Plans regarding compliance with any adopted water quality management plan pursuant to the Federal Water Pollution Control Act as amended. The City complies with the Federal Water Pollution Control Act by having an NPDES permit for the WWTP.

The Washington Administrative Code (173-240-050) requires a statement in all Wastewater Comprehensive Plans regarding compliance with the State Environmental Policy Act (SEPA), if applicable.

ON-SITE SEPTIC SYSTEM REGULATIONS

In some cases wastewater may be treated and disposed of on-site either by individual septic systems or community on-site systems. On-site septic systems should be designed to meet the Washington Department of Health design standards. Approval of the systems will be made either by the local health department for systems under 3,500 gallons per day, or the Washington State Department of Health for systems less than 14,500 gallons per day but greater than 3,500 gallons per day, or the Washington State Department of Ecology for systems that are over 14,500 gallons per day in capacity. The State Board of

Health statute that provides the authority for the Department of Health (DOH) to adopt rules for sewage is found in RCW 43.20.

Septic systems that are currently active within City limits will be phased out as the wastewater collection system is expanded. Properties within county jurisdiction surrounding the City are usually served by septic systems. However, the Tri Mountain Golf Course and the Washington State Patrol truck weighing station located on northbound I-5 (and outside the Ridgefield UGA) are served by a force main connected to the City sewer system.

CITY SEWER ORDINANCES AND PLANNING POLICIES

Title 13 of the Ridgefield Municipal Code sets rules and regulations for the City's sewer system. The ordinance establishes rates and connection charges for City sewer customers. The City also has construction standards for developer constructed additions and connections to the City system, and the City has also adopted Pretreatment Standards for the Sanitary Sewer Collection System. Chapter 11 provides an analysis of sewer rates and connection charges for sewer customers.

The siting of any wastewater facilities such as pump stations or wastewater treatment facilities must comply with the City planning and zoning policies at the time of construction.

CHAPTER 5

EXISTING CONDITIONS

INTRODUCTION

The City of Ridgefield owns and operates a wastewater collection system and treatment plant. The collection system derives from two different periods in the City's history. The older part of the system is concrete pipe constructed largely in the 1950s. Starting in the 1990s, a considerable amount of new PVC pipe has been added to the collection system. The collection system is a dedicated sanitary sewer and does not carry stormwater flows. The City has a separate dedicated storm sewer system that manages storm sewer flows.

The current wastewater treatment plant uses an activated sludge process that was constructed in 2001. Originally built in the 1950s, the plant has undergone several major upgrades. Some plant equipment from the 1950s is still in use at the plant. The older equipment includes the outfall, an Imhoff tank currently used for sludge storage, and sludge basins. The plant site is located adjacent to Lake River at the lowest point of the community. The plant's mechanical components and tankage are above the 100-year flood plain.

EXISTING WASTEWATER COLLECTION SYSTEM

A network of 6- to 10-inch diameter gravity sewers serves the older areas of the City. Most of the collection system is located on the "ridge" between Lake River and Gee Creek, where most of the older part of the City is situated. These sewers were constructed in the mid-1950s to serve only the then-developed portions of the City and were not sized to be large enough to accommodate the future growth areas now being planned.

Most of the City's new growth has been in areas outside of the older part of the City. Three such areas, the south Hillhurst Road area, the Ridgefield Junction area, and the Heron Ridge/Bellwood Heights developments have collection systems that discharge to pump stations which pump to 4- and 6-inch diameter sewer force mains that discharge to the downtown system. The discharges from the growth served by these systems are beginning to consume the remaining capacity of the older gravity collection system.

In all, the City maintains approximately 90,000 lineal feet of gravity sewer and force mains. In Chapter 3, Figure 3-1 presented the area served by the existing sewer system. A sewer system base map is provided in Appendix G. Table 5-1 provides an inventory of the gravity sewer and force mains in the system.

TABLE 5-1

Inventory of Gravity and Force Mains

Sewer Main					
Area Description	**Type(1)**	**Size**	**Material**	**Length (lf)**	**Year Built**
Downtown – San. General Plan	G	4 in.	Concrete	100	1959
Downtown – San. General Plan	G	6 in.	Concrete	3,750	1959
Downtown – San. General Plan	G	8 in.	Concrete	19,600	1959
Downtown – San. General Plan	G	10 in.	Concrete	2,350	1959
Hidden Village PUD	G	8 in.	PVC	870	1996
Hidden Village PUD	G	6 in.	PVC	150	1996
Junction Area Sewer System – FM	FM	4 in.	PVC	2,100	1986
Junction Area Sewer System – FM	FM	6 in.	PVC	11,350	1986
Port of Ridgefield Improvements	G	6 in.	PVC	250	1990
Port of Ridgefield Improvements	G	8 in.	PVC	2,750	1990
Gee Creek Meadows	FM	6 in.	PVC	435	1993
Gee Creek Meadows	G	8 in.	PVC	1,155	1993
Golf Course – FM	FM	4 in.	PVC	10,500	1994
Old Pioneer Estates	G	6 in.	PVC	250	1994
Old Pioneer Estates	G	8 in.	PVC	300	1994
View Port Ridge	G	8 in.	PVC	2,100	1994
Carolee’s Mountain View	G	6 in.	PVC	250	1995
Carolee’s Mountain View – FM	FM	4 in.	PVC	900	1995
Port of Ridgefield – Pacific Diesel Area	G	6 in.	PVC	50	1997
Port of Ridgefield – Pacific Diesel Area	G	8 in.	PVC	1,450	1997
Port of Ridgefield – Pacific Diesel Area	G	12 in.	PVC	550	1997
11th Avenue – S. 56th	G	12 in.	PVC	500	1998
Tri-Mountain Business Park	G	8 in.	PVC	2,900	2000
Corwin Beverage Co. (Timm Rd.)	G	6 in.	PVC	250	2001
Corwin Beverage Co. (Timm Rd.)	G	8 in.	PVC	850	2001
Heron Ridge – Entrance Road	FM	6 in.	PVC	1,400	2002
Heron Ridge – Entrance Road	G	8 in.	PVC	600	2002
Heron Ridge – Phase I	G	8 in.	PVC	2,800	2002
Union Ridge Mixed Use Development	G	8 in.	PVC	1,300	2003
Union Ridge Mixed Use Development	G	10 in.	PVC	1,300	2003
Union Ridge Mixed Use Development	G	12 in.	PVC	1,600	2003
Hillhurst Road – FM	FM	6 in.	PVC	4,850	1992
Wishing Well	FM	4 in.	PVC	400	1992
Wishing Well	FM	6 in.	PVC	2,200	1992
Wishing Well	G	8 in.	PVC	6,400	1992

(1) G is a gravity line. FM is a Force Main.

One particular concern for the City is the capacity and condition of the downtown collection system. A capacity analysis of the downtown system was performed. The results of this analysis are presented in Table 5-2. The analysis indicates that the line connecting manhole T-1 to the treatment plant limits the maximum capacity of the downtown collection system. This line runs east to west; passing under the Burlington Northern Railroad line and drains into the WWTP influent lift station. This line is estimated to have a maximum capacity of 0.72 mgd.

TABLE 5-2

WWTP Influent Pipe Hydraulic Analysis

Trunk Line Designation	Manhole		Diameter (in)	Length (ft)	Slope (ft/ft)	Manning Coefficient	Capacity	
	Upstream	Downstream					(cfs)	(mgd)
T-3	CO	MH71	6	188	0.0081	0.014	0.47	0.30
T-3	MH71	D4	8	400	0.031	0.014	1.98	1.28
T-3	D4	MH70	8	400	0.039	0.014	2.22	1.44
T-3	MH70	MH69	8	254	0.0461	0.014	2.42	1.56
T-3	MH69	MH68	8	265	0.138	0.014	4.18	2.70
T-3	MH68	MH67	8	194	0.1491	0.014	4.34	2.81
T-3	MH67	MH66	8	290	0.058	0.014	2.71	1.75
T-3	MH66	MH63	8	350	0.0522	0.014	2.57	1.66
T-3	MH63	MH62	8	324	0.065	0.014	2.87	1.85
T-3	MH62	MH61	8	420	0.0055	0.014	0.83	0.54
T-3	MH61	D3	8	500	0.003	0.014	0.62	0.40
T-2	MH57	MH56	8	227	0.004	0.014	0.71	0.46
T-2	MH56	MH54	8	214	0.005	0.014	0.80	0.51
T-2	MH54	MH49	8	129	0.005	0.014	0.80	0.51
T-2	MH49	MH48	8	340	0.025	0.014	1.78	1.15
T-2	MH48	MH46	8	332	0.037	0.014	2.16	1.40
T-2	MH46	D3	8	182	0.05	0.014	2.52	1.63
T2	D3	MH45	8	344	0.025	0.014	1.78	1.15
T2	MH45	MH44	8	307	0.004	0.014	0.71	0.46
T2	MH44	MH39	8	276	0.0045	0.014	0.75	0.49
T2	MH39	MH37	8	276	0.004	0.014	0.71	0.46
T2	MH37	MH35	8	263	0.004	0.014	0.71	0.46
T2	MH35	MH27	8	245	0.06	0.014	2.76	1.78
T2	MH27	MH26	8	25	0.004	0.014	0.71	0.46
T-1	MH26	MH25	8	365	0.005	0.014	0.80	0.51
T-1	MH25	MH24	8	115	0.0544	0.014	2.62	1.70
T-1	MH24	MH19	8	276	0.0083	0.014	1.03	0.66
T-1	MH19	MH15	10	228	0.003	0.014	1.12	0.72
T-1	MH15	MH12	10	267	0.003	0.014	1.12	0.72
T-1	MH12	D2	10	256	0.003	0.014	1.12	0.72
T-1	D2	D1	10	180	0.003	0.014	1.12	0.72
T-1	D1	WWTP	10	188	0.003	0.014	1.12	**0.72**

EXISTING PUMP STATIONS AND FORCE MAINS

Wishing Well Estates

The Wishing Well Estates subdivision pump station is located at South 22nd Circle in Wishing Well Estates. Constructed in 1992, the pump station has a capacity of 100 gallons per minute (gpm) and serves both the subdivision and Ridgefield High School, where a school pump station discharges to the subdivision gravity sewers. The Wishing Well Estates station discharges to the Hillhurst force main.

Hillhurst Force Main

The Hillhurst force main is a 6-inch diameter PVC pipeline located along Hillhurst Road, running from the pump station located at South 22nd Circle in the Wishing Well Estates subdivision to the gravity collection system south of Cemetery Road. The discharge from this force main may be directed either to the Gee Creek Meadows pump station or to the planned T-7 gravity interceptor in the future. The sewage from the Hillhurst force main has caused sulfide corrosion problems in the downstream gravity sewer mains and the mains were repaired by relining the interior of the pipes. A sulfide control system should be added to this system in order to protect downstream sewers from future damage. The cost of sulfide control facilities is estimated at $150,000.

Junction Pump Station

The Junction area pump station, constructed in 1985, is located west of 56th Place and south of Pioneer Street. The capacity of the Junction pump station is approximately 200 gpm, which pumps into the Pioneer Street force main. Some nearby single-property Septic Tank Effluent Pump (STEP) systems also discharge to the same force main. The Junction area station will have to be expanded and improved or replaced to serve the growing needs of the Junction area until such time as a gravity-flow trunk sewer system becomes available for this area.

Pioneer Street Force Main

The Pioneer Street force main serves the Junction area. This force main is a 6-inch diameter PVC pipeline that extends from the Junction pump station near 56th Place to the gravity sewer system in Pioneer Street near South 9th Avenue. The capacity of this system could be increased if flow equalization is provided to dampen peak flows. Without flow equalization, the 6-inch force main has to accommodate peak flows of relatively short duration.

Gee Creek Meadows Pump Station

The Gee Creek Meadows pump station located south of Pioneer Street just west of Gee Creek also discharges to the Junction area force main. This station was constructed in 1993. The Gee Creek Meadows pump station provides a 400 gpm discharge to the Pioneer Street force main when the Junction pump station is not pumping into the same force main. This pump station currently serves the Hawkins Ridge and Gee Creek Meadows residential areas. In the near future, it will also serve the Hillhurst and Cedar Ridge developments and the developments connecting to the Hillhurst force main.

Heron Ridge Pump Station

The Heron Ridge pump station is located north of Heron Drive and serves the subdivisions of Heron Ridge and Bellwood Heights north of Gee Creek. The pump station discharges to a 6-inch force main along Heron Drive that ultimately discharges to the downtown gravity system at the sewer main in Main Avenue. The station was completed in 2002 with a capacity of 300 gpm.

Other Pump Stations

There are several other smaller pump stations located throughout the Ridgefield UGA. These stations serve facilities that are located below the gravity system. One pump station, serving Abrams Park and the surrounding homes, pumps through a force main that discharges into the gravity-flow system manhole at the intersection of Fifth and Division. Other stations are located at the Marina and other Port facilities located west of the railroad tracks. There is also an existing pump station for the Tri Mountain golf course and WSDOT weigh station located in the Allen Canyon drainage basin outside of the UGA. This station discharges to a 4-inch-diameter force main that carries the wastewater south to the Junction gravity collection system where all the flows are directed to the Junction pump station and Pioneer Street force main.

Table 5-3 provides a summary of the pump stations currently in the City collection system.

TABLE 5-3

Inventory of Existing Pump Stations

Sewer Lift Stations Description	Type	Number of Pumps	Horsepower	Year Built
Wishing Well Estates	Submersible	2	2 @ 18	1992
Junction	Submersible	2	2 @ 10	1985
Gee Creek Meadows	Submersible	2	2 @ 10	1993
Heron Ridge	Submersible	2	2 @ 15	2002
Golf Course	Submersible	2	2 @ 25	1994
Abrams Park	Submersible	2	2 @ 7.5	1987
Marina Lift Station	Submersible	2	2 @ 5	Unknown
Lake River Industrial Lift Station	Submersible	1	1 @ 2	Unknown

SEWER SYSTEM CONNECTIONS

The City sewer system currently serves approximately 737 residential sewer connections and 64 commercial connections. The commercial connections consist of warehouse facilities, restaurants, stores, and offices. The wastewater from the non-residential sources consists mostly of toilet and food preparation flows. None of the commercial flows represent an unusual waste stream.

EXISTING WASTEWATER TREATMENT FACILITY

The City of Ridgefield operates a conventional activated sludge wastewater treatment facility (WWTP) to provide secondary treatment of municipal sewage from the City of Ridgefield and the area within the sewer service area. After treatment, the effluent is discharged through an outfall to Lake River. The WWTP process flow diagram is provided in Figure 5-1.

The as-built plans for the last WWTP expansion (dated June 2000) indicate that the existing facility was designed to treat a maximum month flow of 0.7 mgd, with a maximum month organic loading of 853 lb BOD_5/day and an annual average solids loading of 751 lb TSS/day. The WWTP design loadings and effluent limits, as indicated in the existing NPDES permit (WA0023272), are shown below in Table 5-4. The reason for the discrepancy for the BOD and TSS values between the permit and the design criteria in the as-built plans for the last upgrade is not known; however, the permit values are more reflective of the current loadings and concentrations. The NPDES permit also limits the plant flows to a maximum month value of 0.5 mgd due to regulatory concerns over the lack of clarifier redundancy and adequate nitrification capacity in the treatment process. The NPDES permit, which was issued in 2003, and the permit fact sheet are included in Appendix A. The fact sheet identifies the existing WWTP as a reliability Class 2 Plant.

TABLE 5-4

Existing WWTP Design Criteria and NPDES Permit Limits

Parameter	Value
Maximum Month Flow	0.5 mgd
Maximum Month Influent BOD_5 Loading	1,083 lbs/day
Maximum Month Influent TSS Loading	1,083 lbs/day
Effluent Limits:	
BOD_5 Concentration (monthly avg.*)	30 mg/L
BOD_5 Concentration (weekly avg.)	45 mg/L
BOD_5 Loading (monthly avg.)	125 lbs/day
BOD_5 Loading (weekly avg.)	188 lbs/day
TSS Concentration (monthly avg.*)	30 mg/L
TSS Concentration (weekly avg.)	45 mg/L
TSS Loading (monthly avg.)	125 lbs/day
TSS Loading (weekly avg.)	188 lbs/day
Fecal Coliform Count (monthly avg.)	200/100 mL
Fecal Coliform Count (weekly avg.)	400/100 mL
pH	Shall not be outside the range 6.0 to 9.0

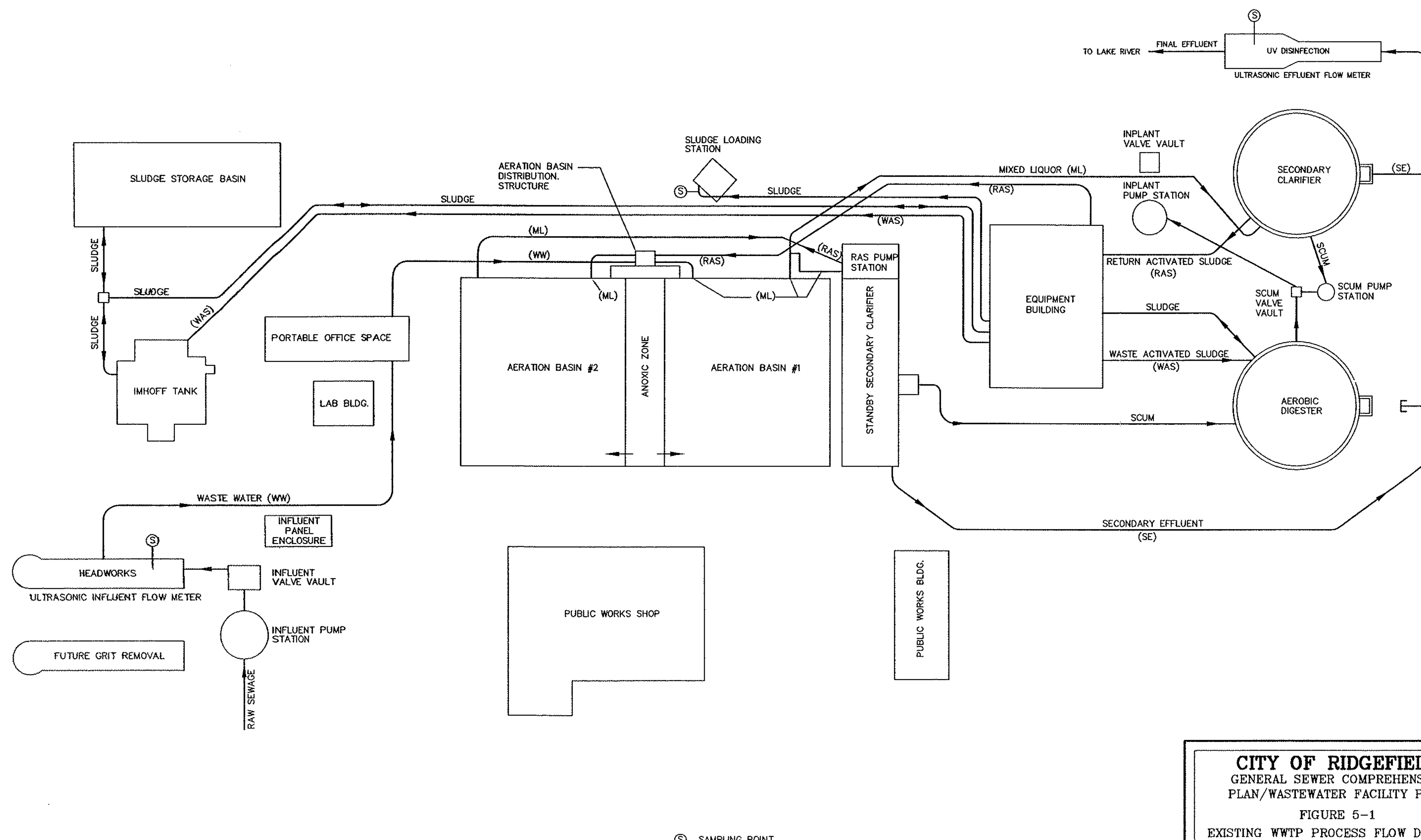
* The average monthly effluent concentration for BOD_5 and TSS shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentration.

EXISTING UNIT PROCESSES

A description of each unit process at the existing WWTP is presented below and a summary of each unit process is presented in Table 5-5 at the end of this chapter.

Influent Pump Station

Raw sewage flows by gravity from the 10-inch diameter interceptor sewer, which crosses under the adjacent railroad tracks, to the influent pump station located at the southeast corner of the plant. The influent pump station wet well is 10'-0" inside diameter, 11'-0" deep and equipped with three submersible centrifugal pumps. All three of the influent pumps are equipped with a variable frequency drive (VFD), which varies the speed of each pump based on a signal from the ultrasonic level sensor located in the wet well. A low level float and high level float generate an alarm via the plant programmable logic controller (PLC) and provide backup control of the pumps. All three pumps discharge to a common 8-inch force main. Each pump has an isolation plug valve and check valve on the 6-inch discharge line, all of which are located in a below-grade valve vault adjacent to the wet well. The influent pumps each have 7.5 hp, 460 V motors and a design operating condition of 520 gpm at 29.8 feet of head. The capacity of the existing influent



CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN

FIGURE 5-1

EXISTING WWTP PROCESS FLOW DIAGRAM

Gray & Osborne, Inc.
CONSULTING ENGINEERS

pump station with one pump out of service, per DOE criteria, is 950 gpm (1.4 mgd). The station was constructed in 2000.

Headworks

Raw sewage is pumped from the Influent Pump Station to the headworks. The headworks is an above-grade concrete structure, which has a mechanical fine screen, manually cleaned bypass bar screen, influent sampler, and influent flow meter. The mechanical fine screen and manually cleaned bar screen are located in adjacent 1'-8"-wide concrete channels separated by isolation stop gates. Screenings from the mechanical fine screen drop into a dumpster for landfill disposal. The influent sampler is located upstream of the influent flow meter. The influent flow meter consists of a 9-inch Parshall flume equipped with an ultrasonic level sensor. The influent sampler is a refrigerated automatic unit, which collects flow-proportional samples.

Grit System

A grit removal system was added to the headworks in 2003. The grit removal process begins with a Smith & Loveless Pista Grit system. The City has a Model 2.5 Pista Grit circular settling tank system driven by 3/4-hp motor. Settled grit is removed with a Wemco recessed impeller pump and lifted into a classifier which both drains the grit and conveys the grit by a screw conveyor into the same dumpster that is used for the headworks screenings. The Wemco pump is powered by a Duty Master 7.5-hp motor. The classifier is a Goodman Conveyor. Drainage from the classifier is returned to the headworks.

Aeration Basins

The Ridgefield WWTP operates as a conventional activated sludge system. The purpose of the activated sludge system is to remove suspended and colloidal solids and dissolved organic matter from wastewater. This removal is accomplished by introduction of the wastewater into a biological reactor (aeration basin) containing a high concentration of actively growing microorganisms in the presence of dissolved oxygen. The microorganisms utilize the waste material as a source of food to obtain the energy necessary for their own life processes and growth. The rapid growth of these organisms' results in the creation of a flocculant biological mass which can be removed from the liquid stream by sedimentation in the secondary clarifier, thus creating a clear effluent with a low organic content. In the activated sludge process, the high concentration of active biological mass is maintained by continuously recycling the organisms back into the aeration basin. Effective settling and separation of the biological mass from the liquid stream in the secondary clarifiers is essential for the proper operation of the activated sludge system. Some removal (wasting) of the biological mass is also conducted in order to maintain a steady-state population in the system.

Wastewater flows by gravity from the headworks to a concrete distribution structure adjacent to the aeration basins. The distribution structure also receives discharge from the plant drain pump station and return activated sludge (RAS) flow, which is pumped from the secondary clarifier. The combined wastewater and RAS, which is commonly called mixed liquor, flows by gravity from the distribution structure to the aeration basins. The aeration basins are a concrete structure consisting of two equally sized aeration basins with a volume of 175,000 gallons each and a single anoxic basin with a volume of 48,000 gallons. The anoxic basin is located between the aeration basins, sharing a common wall with each basin, and is equipped with four platform-mounted surface mixers. Aeration and mixing of the aeration basins is provided by three aeration blowers, which are located in the equipment building, and a fine bubble air diffusion system. A submersible recycle pump is located in each basin to recirculate mixed liquor to the anoxic basin.

Mixed liquor flows by gravity from the distribution structure through the anoxic basin and then to each aeration basin over isolation slide gates. Mixed liquor from the aeration basins discharges over effluent weirs and then combines the flow to the secondary clarifier.

The aeration blowers are positive displacement blowers equipped with VFDs. The PLC automatically adjusts the aeration rate as a function of an operator-adjusted time schedule, the dissolved oxygen concentration in the aeration basin, or in proportion to influent flow. The constant speed submersible recycle pumps operate continuously. Two of the anoxic basin mixers are constant speed and two mixers are equipped with VFDs that can be adjusted by the operator.

Secondary Clarifier

Mixed liquor normally flows from each aeration basin to a 50-foot-diameter circular, concrete secondary clarifier through a 14-inch diameter center influent pipe. The clarifier is equipped with a clarifier mechanism with a 1/2-hp drive motor, sludge scrapers, scum skimmer blade, scum collection box, energy dissipating inlet, and flocculating feedwell. The clarified effluent flows over the peripheral v-notch weir to the effluent trough where it flows by gravity to the UV disinfection system. Settled solids are collected in a sludge hopper, which has suction piping connection to two horizontal screw centrifugal Return Activated Sludge (RAS) pumps and one horizontal screw centrifugal Waste Activated Sludge (WAS) pump, located in the equipment building. Scum flows by gravity from the scum collection box to the scum pump station.

A smaller secondary clarifier is available for use when the 50-foot diameter clarifier is out of service. This backup clarifier is a 44-foot-long, 12-foot-wide concrete tank with an 11-foot side water depth. Mixed liquor flows by gravity from the aeration basin to the backup clarifier through a 10-inch pipe. Clarified effluent flows over a v-notch weir to the UV disinfection system. A chain-driven rake mechanism transfers settled solids to a sludge hopper and skims floating scum toward a rotating scum trough. The backup clarifier has a dedicated RAS pump, which is located on a pad adjacent to the clarifier and a dedicated submersible scum pump in the concrete wet well attached to the clarifier.

UV Disinfection System/Effluent Flow Measurement

Secondary effluent flows by gravity from the secondary clarifier to the UV disinfection system structure. This structure consists of a concrete channel with three UV banks, a downstream finger weir for level control, a 3-foot-wide effluent trapezoidal weir with an ultrasonic level sensor, and an effluent sampler. The effluent sampler is a refrigerated automatic unit, which collects flow-proportional samples.

River Outfall

Treated effluent is discharged to Lake River via a 10-inch concrete outfall pipe constructed in the 1950s. There is no diffuser on the outfall. The 10-inch line discharges on the east side of the river’s bank. The outfall is submerged during high tide, but visible during low tide. Figure 5-2 is a photograph of the existing outfall at low tide. Surveyed location and elevation data for the outfall is provided in Figure 5-2.

In 1995, a video inspection of the outfall line was conducted. Numerous locations with heavy root penetration were identified in the inspection. The root penetration appeared to be from blackberries that overlay the pipeline route between the treatment plant and Lake River.

In 2004, a dilution zone study was conducted at the current outfall location in Lake River. The study is provided in Appendix C. The study indicates that the outfall does not comply with current Department of Ecology mixing zone requirements. This deficiency derives from the location of the outfall on the bank of Lake River, the fact that the outfall is not fully submerged at all times and the absence of any diffuser at the terminus of the outfall.

Non-Potable Water System

A non-potable water system supplies plant effluent for process and maintenance uses. Two end suction centrifugal pumps, located adjacent to the UV disinfection system channel, pump plant effluent to a strainer and hydropneumatic tank in the equipment building. A pressure transducer on the hydropneumatic tank piping controls the on/off status of the non-potable water pumps to maintain the desired water pressure. The non-potable water pumps transfer effluent from a section of the UV disinfection system channel located downstream of the finger weir and upstream of the trapezoidal weir. This section is 4'-0" long and 6'-8" wide, with a side water depth of 6'-6" and with a storage volume of 1,300 gallons.

Solids Handling System

The existing sludge stabilization process consists of a 50-foot-diameter concrete aerobic digester with a 14-foot side water depth and a volume of 220,000 gallons. Waste activated sludge is pumped from the clarifier sludge hopper by the WAS pump, which is located in the equipment building adjacent to the two RAS pumps. A magnetic flow meter is installed on the WAS discharge line for WAS flow measurement. The scum pump transfers scum to the aerobic digester from the scum pump station. Aeration and mixing are supplied to the aerobic digester via coarse bubble air diffusers, which receive low-pressure air from the variable speed positive displacement digester blower, located in the equipment building. Supernatant is decanted using a telescoping valve, which is connected by a 4-inch pipe to the plant drain pump station. Sludge is wasted from the digester to sludge hauling trucks using the sludge transfer pump located in the equipment building. The sludge transfer pump discharge piping extends to a 3-inch camlock fitting for connection to the sludge hauling truck at the concrete sludge loading pad. Currently, all sludge is disposed of off site by contract to the Clark County Salmon Creek Wastewater Treatment Plant.

Sludge can also be transferred from the aerobic digester to an auxiliary aerobic digester or a sludge storage basin. The auxiliary digester is a converted concrete Imhoff tank with a volume of 50,000 gallons, and is equipped with coarse bubble diffusers, which receive low-pressure air from a designated dual-speed blower located in the equipment building. The sludge storage basin is a 60,000-gallon concrete tank that is not equipped with aeration equipment.

Aeration System

There are five aeration blowers, located in the equipment building, which supply air to the various processes. The three aeration basin blowers are variable speed 50-hp positive displacement blowers. The discharge piping of each of the blowers is connected to a common header. The aerobic digester blower (No. 1) is a variable speed 100-hp positive displacement blower. The auxiliary digester blower (No. 2) is a dual-speed 25-hp positive displacement blower.

Plant Drain Pump Station

A plant drain pump station receives flows from the plant drain lines and has the ability to drain the secondary clarifier and aerobic digester. The plant drain pump station wet well is an 8-foot I.D., 12-foot-deep, manhole equipped with two submersible centrifugal pumps. Each pump discharge line has an isolation plug valve and a check valve, which are located in a below-grade valve vault adjacent to the wet well. The discharge lines are connected to a common 6-inch pipe, which is connected to the aeration basin distribution structure. The wet well is equipped with four floats for pump control and alarms.

Survey data for the Ridgefield sewer outfall

Washington State Plane Coordinates:

186285.2500 Northing
1065866.7900 Easting

In Lat./Long:

Latitude: North 45deg-49min-17.969sec
Longitude: West 122deg-45min-13.665sec

Elevation 7.95 feet based on the North American Vertical Datum

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN/FACILTY PLAN
FIGURE 5-2
EXISTING OUTFALL

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CONSULTING ENGINEERS

Auxiliary Generator

The existing auxiliary diesel generator and automatic transfer switch are located in the equipment building. The generator is rated at 400 kW, 3 phase, 480 V.

Equipment Building

The equipment building has a pump room, electrical room, and a blower room. The pump room has two RAS pumps; one WAS pump, one sludge transfer pump, and space for two future pumps. The non-potable water system hydropneumatic tank and strainer and a waterline with reduced pressure backflow preventer are also located in the pump room. The blower room contains the five aeration blowers and the auxiliary generator. The electrical room contains the main switchboard, automatic transfer switch, panel board, PLC control panel, and equipment motor control centers (MCC) for all of the equipment that was installed in the latest upgrade. The equipment building has a separate utility service from the lab building, which has MCCs for equipment items that were in place before the previous upgrade.

Lab and Office Buildings

The plant has two portable buildings that serve as a lab building and an office building. The lab building has a small process control laboratory, a bathroom, and a storage room. The Clark County Salmon Creek Wastewater Plant performs the majority of the laboratory analysis required for monthly compliance reporting purposes. The office serves as the location where reporting data is compiled and provided to the regulatory agencies. Telemetry data from lift stations, the wastewater treatment plant, and the City water system are also received and monitored in this building.

EXISTING WWTP UNIT PROCESS DATA

Table 5-5 summarizes some key parameters for the existing WWTP unit processes.

TABLE 5-5

Existing WWTP Unit Process Data

Influent Pump Station	
Influent Pumps:	
Quantity of Pumps	3
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive	Variable Speed
Capacity (each)	520 gpm @ 29.8 ft
Pump Station Capacity	950 gpm (1.4 mgd)
Influent Screens	
Mechanical Fine Screen	
Quantity	1
Type	Helical Auger
Screen Width	20 inches
Mesh Diameter	0.25 inch
Motor Size	1 hp
Capacity	3.5 mgd
Bypass Bar Screen:	
Quantity	1
Type	Manual Coarse Bar
Screen Width	24 inches
Bar Spacing	0.75-inch
Grit Removal	
Grit Removal System	
Quantity	1
Type	Vortex
Motor Size	0.75 hp
Grit Cyclone	
Quantity	1
Grit Classifier	
Quantity	1
Screw Diameter	9-inch
Motor Size	0.75 hp
Grit Pump	
Quantity	1
Motor Size	7.5 hp

TABLE 5-5 (continued)

Existing WWTP Unit Process Data

Influent Flow Measurement	
Type	Parshall Flume
Size	9 inch
Capacity	3.3 mgd
Anoxic Basin	
Quantity	1
Side Water Depth	15 ft
Volume	48,000 gal
Mixing:	
Type	Vertical Shaft
Quantity	4
Drive	2 Variable Speed, 2 Constant Speed
Motor Size	1 hp
Aeration:	
Type	Fine Bubble Diffusers
Aeration Basins	
Quantity	2
Side Water Depth	12 ft
Volume, Each	175,000 gal
Effluent Weir Length	7 feet
Aeration:	
Type	Fine Bubble Diffusers
Mixed Liquor Recycle Pumps	
Quantity	2
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive	Variable Speed
Capacity (each)	1,000 gpm @ 18.2 ft
Aeration Basin Blowers	
Quantity	3
Type	Positive Displacement
Capacity, Each	800 scfm @ 9 psi
Motor Size	50 hp
Drive	Variable Speed
Maximum Speed	1,850 rpm

TABLE 5-5 (continued)

Existing WWTP Unit Process Data

Secondary Clarifiers	
Quantity	2
Clarifier No. 1	
Diameter	50 ft
Effective Settling Area	1963 ft^2
Effective Side Water Depth	14 ft
Volume	205,600 gal
Weir Length	141 ft
Drive Size	1/2 hp
Clarifier No. 2 (Backup)	
Length x Width	44 ft x 12 ft
Effective Settling Area	528 ft^2
Effective Side Water Depth	11 ft
Volume	43,500 gal
Weir Length	69 ft
Drive Size	1/4 hp
Effluent Disinfection	
Type	Ultraviolet
UV Tube Type	Low Pressure, Low Output, Horizontal
Quantity of Channels	1
Channel Width	27 in
Channel Depth	4 ft
Channel Length	32 ft
Flow Control Weir Length	27 ft
Quantity of Banks	3
Quantity of Modules Per Bank	4
Quantity of Lamps Per Module	8
Total Quantity of Lamps	96
Design UV Transmittance (Min)	65%
Effluent Disinfection Standard	200 cfu/100 mL
Disinfection Dose Required	33,000 μW sec/cm^2
Peak Rated Flow To Meet Standard	1.93 mgd
Effluent Flow Measurement	
Type	Trapezoidal Weir
Size	3 ft
Capacity	0.584 mgd Min – 12.0 mgd Max

TABLE 5-5 (continued)

Existing WWTP Unit Process Data

Non-Potable Water Pumps	
Quantity of Pumps	2
Pump Type	Close Coupled End Suction Centrifugal
Motor Size	15 hp
Drive	Constant Speed
Capacity (each)	100 gpm @ 233.3 ft
Plant Drain Pumps	
Quantity of Pumps	2
Pump Type	Submersible Centrifugal
Motor Size	5 hp
Drive	Constant Speed
Capacity	226 gpm @ 32 ft
Return Activated Sludge Pumps	
Quantity of Pumps	3
Clarifier No. 1 Pumps	
Quantity of Pumps	2
Pump Type	Horizontal Screw Centrifugal
Motor Size	3 hp
Drive	Variable Speed
Capacity (each)	375 gpm @ 6 ft
Clarifier No. 2 Pump	
Quantity of Pumps	1
Pump Type	Recessed Impeller Centrifugal
Motor Size	3 hp
Drive	Variable Speed
Capacity	375 gpm @ 6 ft
Waste Activated Sludge Pumps	
Quantity of Pumps	1
Pump Type	Vertical Screw Centrifugal
Motor Size	3 hp
Drive	Constant Speed
Capacity	100 gpm @ 5 ft
Sludge Transfer Pump	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	15 hp
Drive	Constant Speed
Capacity	225 gpm @ 50 psi

TABLE 5-5 (continued)

Existing WWTP Unit Process Data

Scum Pump	
Quantity of Pumps	2
Scum Pump No. 1 (Clarifier No. 1)	
Pump Type	Submersible Centrifugal
Motor Size	1.9 hp
Drive	Constant Speed
Capacity	111 gpm @ 15 ft
Aerobic Digester	
Quantity	2
Digester No. 1	
Diameter	50 ft
Side Water Depth	14 ft
Volume	220,000 gallons
Aeration:	
Type	Coarse Bubble Diffusers
Digester No. 1 Blower:	
Quantity	1
Type	Positive Displacement
Capacity	1,477 scfm, 7.5 psig
Motor Size	100 hp
Drive	Variable Speed
Maximum Speed	1,850 rpm
Digester No. 2 (Auxiliary)	
Length x Width	20 ft x 20 ft
Side Water Depth	17 ft
Volume	50,000 gallons
Aeration:	
Type	Coarse Bubble Diffusers
Digester No. 2 Blower:	
Quantity	1
Type	Positive Displacement
Capacity	345 scfm, 10 psig
Motor Size	25 hp
Drive	Dual Speed
Maximum Speed	1,190 rpm

TABLE 5-5 (continued)

Existing WWTP Unit Process Data

Auxiliary Generator	
Quantity	1
Rating	400 kW, 480 V, 3 Phase

OPERATIONS AND MAINTENANCE

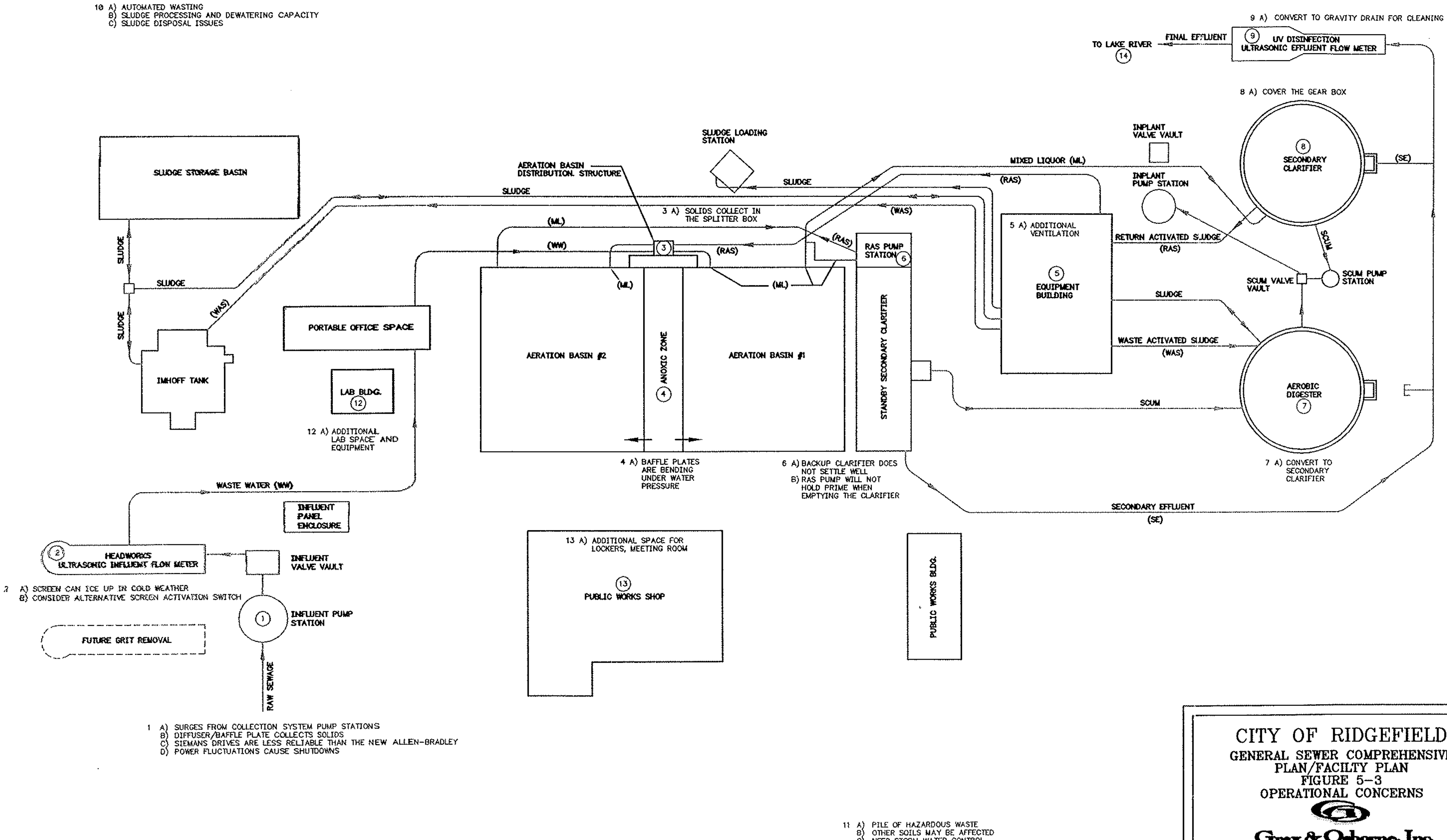
Operations and maintenance is provided in compliance with the NPDES permit and as described in the treatment plant's Operations and Maintenance Manual.

PERMIT VIOLATIONS

A review of monthly monitoring reports (DMRs) from January 2002 through May 2004 was made to determine the number and nature of permit violations reported by the WWTP. In this review, it was noted that there was a discrepancy between data generated by the influent flow meter and the effluent flow meter. After a review of the meter data, it was concluded that the influent flow meter was providing the more accurate flow information. It was necessary to then adjust the historic loading data in the monthly report to reflect the new flow values. The DMR reports are provided in Appendix F.

One violation of permit requirements was identified in September 2003. The violation was due to exceeding fecal coliform limits. The problem was traced to algae growth on the UV bulbs. The implementation of a regular cleaning program has resolved this problem and no further violations have occurred since that single violation, based on either the original DMRs or in Table 6-2, where the DMR data is presented as corrected for the adjusted flow meter data.

As indicated in the DMR data, the plant generally operates in a manner compliant with the permit. The maximum month flow of 310,000 gpd identified in this report is below the plant's rated maximum month capacity of 0.5 mgd. The plant does need some improvements that could be made to improve reliability and operability. In discussions with the treatment plant operators, a number of operational improvements were identified for future plant expansions. The operator concerns are summarized in Figure 5-3.



CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/FACILTY PLAN
FIGURE 5-3
OPERATIONAL CONCERNS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CHAPTER 6

EXISTING AND PROJECTED WASTEWATER FLOWS AND CHARACTERISTICS

INTRODUCTION

Adequate design of wastewater treatment and conveyance facilities requires the determination of the quantity and quality of wastewater generated from each of the contributing sources. Ridgefield wastewater is predominantly domestic in origin with lesser amounts contributed by commercial and industrial businesses and by public use facilities such as schools, parks, and municipal functions. Infiltration and inflow contributions result from groundwater and surface water entering the sewer system during periods of high groundwater levels and rainfall, respectively.

DEFINITION OF TERMS

In this Chapter, the existing wastewater characteristics for the service area will be analyzed and projections made for future conditions. The terms and abbreviations used in the analysis are described below.

WASTEWATER

Wastewater is water-carried waste from residential, business and public use facilities, together with quantities of groundwater and surface water which enter the sewer system through defective piping and direct surface water inlets. The total wastewater flow is quantitatively expressed in millions of gallons per day (mgd).

DOMESTIC WASTEWATER

Domestic Wastewater is wastewater generated from single and multifamily residences, permanent mobile home courts, and group housing facilities such as nursing homes. Domestic wastewater flow is generally expressed as a unit flow based on the average contribution from each person per day. The unit quantity is expressed in terms of gallons per capita per day (gpcd).

EQUIVALENT DWELLING UNIT (EDU)

A baseline wastewater contributor that represents the average single-family residential household. An EDU can also express the average annual flow contributed by a single-family household, in units of gallons per day. The City's 2004 Comprehensive Plan identifies a residential EDU as equivalent to 2.5 residents.

INFILTRATION

Infiltration is groundwater entering a sewer system by means of defective pipes, pipe joints, or manhole walls. Infiltration quantities exhibit seasonal variation in response to groundwater levels. Storm events trigger a rise in the groundwater levels and increase infiltration flows. The highest infiltration flows are observed following significant storm events or following prolonged periods of precipitation. Since infiltration is related to the total amount of piping and appurtenances in the ground and not to any specific water use component, it is generally expressed in terms of the total land area being served. The unit quantity generally used is gallons per acre per day (gpad).

INFLOW

Inflow is surface water entering the sewer system from yard, roof, and footing drains, from cross connections with storm drains and through holes in manhole covers. Peak inflow occurs during heavy storm events when storm sewer systems are taxed beyond their capacity, resulting in hydraulic backups and local ponding. Inflow, like infiltration, can be expressed in terms of gallons per acre per day (gpad).

AVERAGE DRY WEATHER FLOW

Average Dry Weather Flow (ADWF) is wastewater flow during periods when the groundwater table is low and precipitation is at its lowest of the year. The dry weather flow period in western Washington normally occurs from June through September. During this time, the wastewater strength is highest, due to the lack of dilution with the ground and surface water components of infiltration and inflow (I/I). The higher strength coupled with higher temperatures and longer detention times in the sewer system create the greatest potential for system odors during this time. The average dry weather flow is the average daily flow during the three lowest consecutive flow months of the year. For this study, average flows for June, July, and August were used for determining the Average Dry Weather Flow.

AVERAGE ANNUAL FLOW

Average Annual Flow (AAF) is the average daily flow over a calendar year. This flow parameter is used to estimate annual operation and maintenance costs for treatment and pump station facilities.

MAXIMUM MONTHLY FLOW (TREATMENT DESIGN FLOW)

Maximum Monthly Flow (MMF) is the average daily flow during the highest flow month of the year. This wintertime flow is composed of the normal domestic, commercial and public use flows with significant contributions from inflow and infiltration. The predicted maximum monthly flow at the end of the design period is used as the design flow for sizing treatment processes and selecting treatment equipment. The City’s 2004

Comprehensive Plan establishes that the maximum month flows associated with all new connections will be based on a residential contribution of 375 gal/EDU/day and a non-residential contribution of 750 gpad.

PEAK DAY FLOW

Peak Day Flow (PDF) is the highest flow occurring during a one day period in a calendar year. In western Washington, the peak day flow occurs in the winter due to the presence of more infiltration and inflow (I/I). This wintertime flow is composed of the normal domestic, commercial and public use flows with significant contributions from inflow and infiltration. The peak day flow at the end of the design period is used to design some wastewater treatment processes.

PEAK HOUR FLOW

Peak Hour Flow (PHF) is the maximum expected peak hourly flow, which typically occurs during a wet weather day. The peak hour flow occurs in response to a significant storm event preceded by prolonged periods of rainfall, which have previously developed a high groundwater table in the service area. Peak hourly flows are used in sizing the hydraulic capacity of wastewater collection, treatment and pumping components. Historical peak hourly flow is typically determined from the treatment plant flow records.

COMMERCIAL AND INDUSTRIAL WASTEWATER

Commercial and Industrial Wastewater is non-residential wastewater generated from business activities, such as restaurants, retail and wholesale stores, service stations, and office buildings. In addition, as noted in Chapter 3, the City is anticipating significant future commercial growth. Commercial and industrial wastewater quantities are expressed in this Plan as equivalent dwelling units (EDUs). Based on the maximum month flow assumptions discussed above, the future new non-residential wastewater quantities will be based on an equivalent of 2.0 EDU/acre/day (= 750 gal/acre/day ÷ 375 gal/EDU/day).

BIOCHEMICAL OXYGEN DEMAND (BOD)

Biochemical Oxygen Demand (BOD) is a measure of the oxygen required by microorganisms in the biochemical oxidation of organic matter. BOD is an indicator of the organic strength of the wastewater. If BOD is discharged untreated to the environment, biodegradable organics will deplete natural oxygen resources and result in the development of septic conditions. BOD data together with other parameters are used in the sizing of the treatment facilities and provide a measurement for determining the effectiveness of the treatment process. BOD is expressed as a concentration in terms of milligrams per liter (mg/L) and as a mass load in terms of pounds per day (lb/day). The term BOD typically refers to a test conducted over a 5-day period, often written as BOD_5.

SUSPENDED SOLIDS

Suspended Solids is the solid matter carried in the waste stream. Suspended solids are expressed in the same terms as BOD; milligrams per liter for concentration and pounds per day for mass load. The amount of suspended solids in the wastewater is used in the sizing of treatment facilities and provides another measure of the treatment effectiveness. The concentration of total suspended solids (TSS) in wastewater affects the treatment plant sludge production rate and ultimate disposal requirements.

OTHER CONTAMINANTS OF CONCERN

Other contaminants of concern in wastewater include nutrients such as nitrogen and phosphorous, ammonia, priority pollutants, heavy metals and dissolved organics. Secondary treatment standards are concerned with the removal of biodegradable organics, suspended solids, and pathogens. Many of the more stringent water quality and biosolids standards that have been developed recently deal with the removal of nutrients, metals, and priority pollutants.

Nutrients such as nitrogen and phosphorus, along with carbon, are essential requirements for growth. When discharged to the aquatic environment, these nutrients can lead to the growth of undesirable aquatic life. When discharged in excessive amounts on land, they can also lead to the pollution of groundwater. The ammonia form of nitrogen can exert both an oxygen demand and is toxic to aquatic life.

Priority pollutants are organic and inorganic compounds selected on the basis of their known or suspected carcinogenicity, mutagenicity, teratogenicity, or high acute toxicity. Many of these compounds are found in wastewater.

Heavy metals usually result from commercial and industrial discharges and may result in violations of water quality standards or biosolids standards. Inorganic constituents such as calcium, sodium, and sulfate are added to the original domestic water supply as a result of water use and may have to be removed if the wastewater is reused.

EXISTING WASTEWATER SERVICE POPULATION, FLOWS AND LOADINGS

Wastewater treatment plant (WWTP) records for the 29-month period from January 2002 through May 2004 were reviewed and analyzed to determine current wastewater characteristics and influent loadings. Current wastewater flows and loadings were then used in conjunction with projected population data to determine projected future wastewater flows and loadings. Monthly discharge monitoring report (DMR) data for this period are provided in Appendix H.

It should be noted that DMR data preceding January 2002 are considered unreliable due to problems with the plant flow meters, sampling, and record keeping. It should also be noted that the influent flow meter was used for reporting plant flows in the DMRs from January through April of 2002, and the effluent flow meter was used for reporting plant flows in the DMRs from May 2002 to May 2004. It was decided, for the time period used for the existing flow and loading analysis of this report, that only data from the influent flow meter would be used, based on the following reasoning. An analysis of the influent and effluent flow data shows that the monthly average influent flows were 5 to 43 percent greater than the average corresponding effluent flows, as shown in Table 6-1. In addition it was noted that flows reported by the effluent meter decreased each year, while population increased during the same period. It was also noted that the influent meter correlated better with water use data and also matched well with typical literature values for per capita wastewater generation. Upon review of the flow meter data log and evaluation of the meters, it appears that the effluent flow meter is oversized for the current plant flows and is zeroing out during periods of low flow late at night. The conclusion of this assessment was that the influent flow meter was reporting within an acceptable range and would provide more accurate flow data for the purposes of this plan. Therefore, the influent flow meter data was used to revise the data of the DMRs, which used effluent flow meter data (May 2002 through May 2004). Table 6-2 provides monthly plant data based on the influent flow meter monthly average readings. Note that this table does not match DMR data for the time period from May 2002 through May 2004 because the effluent flow meter data was used in the DMRs.

Graphical representations of the Table 6-2 values for average monthly WWTP flows, 5-day biochemical oxygen demand (BOD_5) loading and total suspended solids (TSS) loading from this period are shown in Figures 6-1, 6-2, and 6-3, respectively.

TABLE 6-1

Comparison of Influent and Effluent Flow Meter Data (Monthly Averages) for City of Ridgefield WWTP (January 2002 – May 2004)

Month	Average Monthly Influent Flow Measured (mgd)	Average Monthly Effluent Flow Measured (mgd)	Percent Difference (Influent > Effluent)
Jan-02	0.272	0.240	11.8%
Feb-02	0.219	0.187	14.6%
Mar-02	0.215	0.186	13.5%
Apr-02	0.171	0.153	10.5%
May-02	0.150	0.141	6.0%
Jun-02	0.138	0.131	5.1%
Jul-02	0.137	0.125	8.8%
Aug-02	0.139	0.125	10.1%
Sep-02	0.147	0.125	15.0%
Oct-02	0.170	0.131	22.9%
Nov-02	0.183	0.134	26.8%
Dec-02	0.244	0.192	21.3%
Jan-03	0.280	0.219	21.8%
Feb-03	0.246	0.190	22.8%
Mar-03	0.250	0.202	19.2%
Apr-03	0.255	0.200	21.6%
May-03	0.175	0.143	18.3%
Jun-03	0.153	0.120	21.6%
Jul-03	0.149	0.114	23.5%
Aug-03	0.162	0.120	25.9%
Sep-03	0.176	0.127	27.8%

TABLE 6-1 – (continued)

Comparison of Influent and Effluent Flow Meter Data (Monthly Averages) for City of Ridgefield WWTP (January 2002 – May 2004)

Month	Average Monthly Influent Flow Measured (mgd)	Average Monthly Effluent Flow Measured (mgd)	Percent Difference (Influent > Effluent)
Oct-03	0.187	0.119	36.4%
Nov-03	0.202	0.116	42.6%
Dec-03	0.258	0.147	43.0%
Jan-04	0.319	0.192	39.8%
Feb-04	0.305	0.179	41.3%
Mar-04	0.233	0.132	43.3%
Apr-04	0.201	0.114	43.3%
May-04	0.198	0.111	43.9%

TABLE 6-2

Summary of WWTP Data (Monthly Averages) for City of Ridgefield WWTP (January 2002 – May 2004)

Month	Avg. Monthly Influent Flow (mgd)	Influent BOD Conc. (mg/L)	Influent BOD Loading (lb/day)	Influent TSS Conc. (mg/L)	Influent TSS Loading (lb/day)	Effluent BOD Conc. (mg/L)	Effluent BOD Loading (lb/day)	Effluent TSS Conc. (mg/L)	Effluent TSS Loading (lb/day)	BOD Removal (%)	TSS Removal (%)
Jan-02	0.272	137	311	315	715	5	11	4	9	97	99
Feb-02	0.219	172	314	208	380	5	8	4	7	97	98
Mar-02	0.215	129	231	302	542	6	11	9	16	95	97
Apr-02	0.171	173	247	349	498	4	5	6	9	98	98
May-02	0.150	207	259	294	368	4	5	3	4	98	99
Jun-02	0.138	196	226	279	321	4	4	4	4	98	99
Jul-02	0.137	214	245	267	305	4	4	5	5	98	98
Aug-02	0.139	174	202	242	281	4	5	3	4	98	99
Sep-02	0.147	186	228	308	378	4	4	2	3	98	99
Oct-02	0.170	206	292	329	466	3	4	2	3	98	99
Nov-02	0.183	242	369	271	414	4	5	3	5	99	99
Dec-02	0.244	195	397	247	503	3	7	5	11	98	98
Jan-03	0.280	131	306	192	448	3	7	5	11	98	98
Feb-03	0.246	160	328	296	607	3	6	4	9	98	99
Mar-03	0.250	145	302	197	411	3	5	2	5	98	99
Apr-03	0.255	127	270	170	362	2	4	3	6	99	98
May-03	0.175	193	282	269	393	2	2	2	3	99	99
Jun-03	0.153	127	162	170	217	2	2	4	5	99	98

TABLE 6-2 – (continued)

Summary of WWTP Data (Monthly Averages) City of Ridgefield WWTP (January 2002 – May 2004)

Month	Avg. Monthly Influent Flow (mgd)	Influent BOD Conc. (mg/L)	Influent BOD Loading (lb/day)	Influent TSS Conc. (mg/L)	Influent TSS Loading (lb/day)	Effluent BOD Conc. (mg/L)	Effluent BOD Loading (lb/day)	Effluent TSS Conc. (mg/L)	Effluent TSS Loading (lb/day)	BOD Removal (%)	TSS (%)
Jul-03	0.149	206	256	337	419	2	2	3	3	99	99
Aug-03	0.162	215	290	323	436	2	2	3	4	99	99
Sep-03	0.176	266	390	313	459	2	4	5	7	99	98
Oct-03	0.187	243	379	361	563	2	3	2	3	99	99
Nov-03	0.202	212	357	299	504	1	2	1	2	99	100
Dec-03	0.258	205	441	504	1084	2	4	4	9	99	99
Jan-04	0.319	162	431	206	548	2	6	6	15	99	97
Feb-04	0.305	169	430	263	669	2	4	4	10	99	98
Mar-04	0.233	211	410	319	620	2	4	4	7	99	99
Apr-04	0.201	227	381	350	587	1	2	1	2	99	100
May-04	0.198	233	385	445	735	1	2	2	3	99	100
Average(1)	0.204	194	323	290	489	2	4	3	6	99	99
Min(2)	0.137	127	162	170	217	1	2	1	2	95	97
Max(3)	0.319	266	441	504	1084	6	11	9	16	99	100

(1) 2-Year Average (June 2002 – May 2004)
(2) Minimum Monthly Average (January 2002 – May 2004)
(3) Maximum Monthly Average (January 2002 – May 2004)

FIGURE 6-1

Monthly Average Flows and Influent NPDES Limit (January 2002 – May 2004)

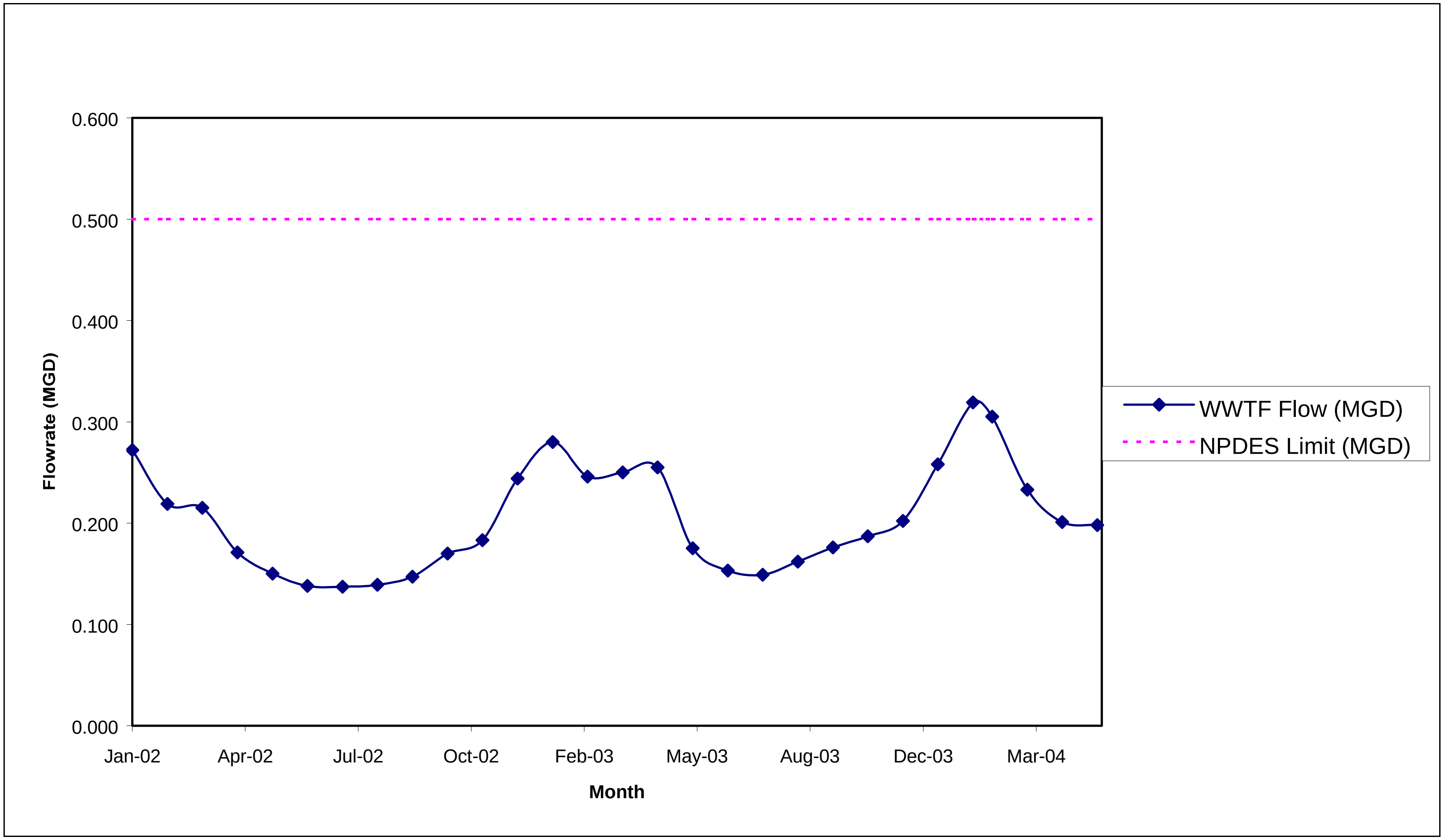


FIGURE 6-2

Monthly Average Influent BOD5 Loading and Influent NPDES Limit (January 2002 – May 2004)

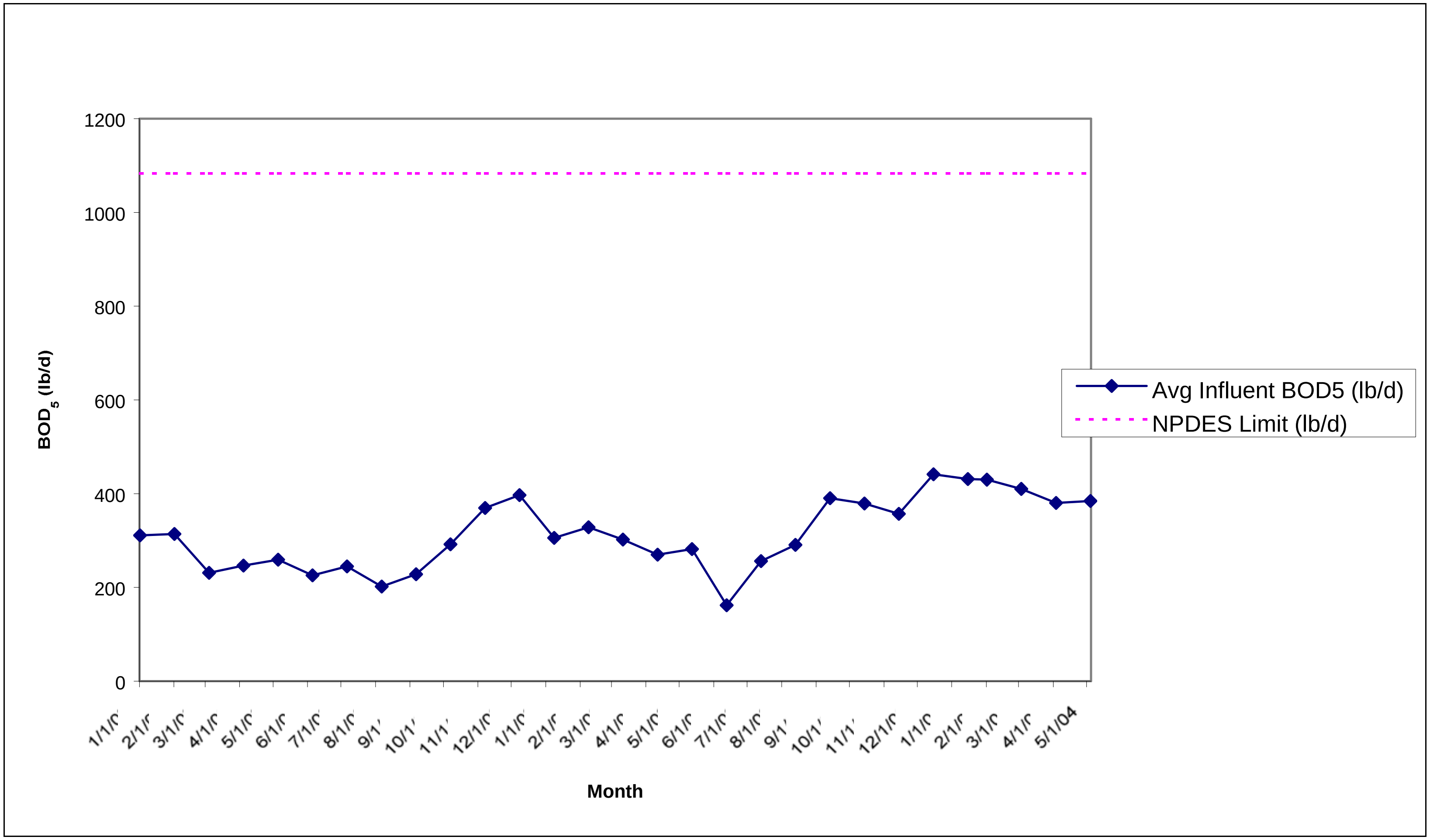
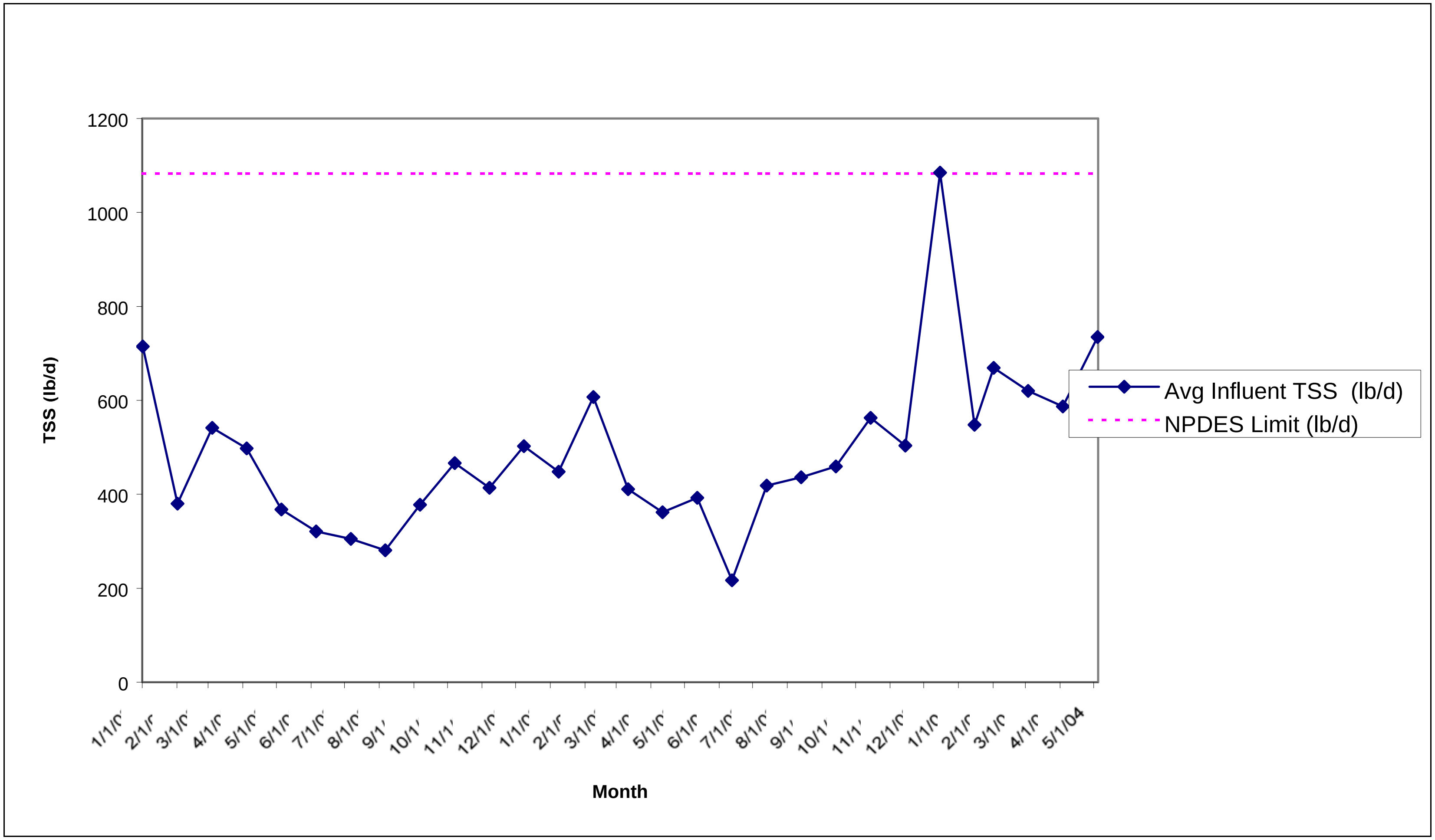


FIGURE 6-3

Monthly Average Influent TSS Loading and Influent NPDES Limit (January 2002 – May 2004)



EXISTING WASTEWATER SERVICE POPULATION

The existing and historic census population data are presented in Table 3-2.

EXISTING FLOWS

Wastewater Flows at WWTP

Table 6-2 and Figure 6-1 show that monthly WWTP flows ranged from 0.137 mgd to 0.319 mgd, and the maximum month permitted flow of 0.500 mgd was not exceeded during the 29-month period of analysis.

The average dry weather flow for 2002 – 2004 was 0.161 mgd. With an average residential population of 2,190 during this time period, this translates to a dry weather per capita flow of 74 gal/cap/day (gpcd) and 184 gal/EDU/day, based on 2.5 persons per EDU. The winter water consumption is typically compared to dry weather flows because of the limited irrigation activity during the winter months. Water consumption records were averaged for December and January of 2002 – 2004. The average water consumption was 0.170 mgd, with 62 percent (0.105 mgd) from residential users and 38 percent (0.065 mgd) from commercial users.

The average annual flow for the 2-year period from June 2002 to May 2004 was measured at 0.204 mgd.

The maximum monthly flow of 0.319 mgd occurred in January of 2004. The peak day flow of 0.603 mgd was recorded on January 7, 2002. There is no record of peak hour flows.

Existing flows at the WWTP are summarized in Table 6-3.

TABLE 6-3

Existing WWTP Flows

Flow Type	Flow Rate (mgd)
Dry Weather Flow(1)	0.161
Annual Average Flow(2)	0.204
Maximum Month Flow(3)	0.319
Peak Day Flow(3)	0.603
Peak Hour Flow	Not Recorded

(1) Based on average for 2002 – 2004.
(2) Based on average for June 2002 – May 2004
(3) Based on period January 2002 – May 2004

Infiltration and Inflow

The U.S. EPA manual entitled *I/I Analysis and Project Certification* provides guidelines on how to determine if infiltration and/or inflow are excessive. The manual states that if the highest average daily flow recorded over a period of seasonal high groundwater without precipitation is greater than 120 gpcd, then further studies must be conducted to quantify excessive infiltration and evaluate corrective measures. WWTP rainfall records show an 11-day period, February 3 through 13, 2003, during which time no rainfall was measured and the groundwater table was high due to a total rainfall of 13.06 inches in January 2003. The highest daily flow recorded during this time period is 0.235 mgd, on February 3. With a total residential population of sewer users in 2003 of 2,185 (Table 3-2), this flow and population translates to 108 gpcd. Because this value is less than the EPA guideline of 120 gpcd, Ridgefield is not considered to have excessive infiltration by EPA criteria.

The EPA manual also states that if the average daily flow recorded in any single day is greater than 275 gpcd, then further studies must be conducted to quantify excessive inflow and evaluate corrective measures. The peak day flow at the WWTP was 0.676 mgd on November 6, 2006. With a total City population of 3,229 through the month of November (as reported by the Office of Financial Management), this flow and population translate to 209 gpcd. Because this value is significantly less than the EPA guideline of 275 gpcd, Ridgefield is not considered to have excessive inflow by EPA criteria, and it is not required that a comprehensive investigation be conducted to quantify, evaluate corrective measures, and reduce inflow in the collection system. However, the City of Ridgefield does have an ongoing I/I reduction program, which includes the following:

- Maintenance of storm drains;
- Removal of roof drain connections to sanitary sewers;
- Repairing leaks in sewers, manholes and pumping stations;
- Smoke testing and televising sewers;
- Replacing leaking manhole covers;
- Monitoring wastewater flows throughout the collection system; and
- Performing quality assurance inspections on sewer pipe installed in the new City developments.

EXISTING BOD_5 LOADING

Monthly average influent BOD_5 loadings ranged from 162 lb/day to 441 lb/day for the 29-month period of analysis as shown in Table 6-2 and Figure 6-2. The permitted monthly average influent BOD_5 design loading of 1,083 lb/day was not exceeded during the 29-month period of analysis. The average influent BOD_5 concentration for the 2-year period of June 2002 – May 2004 was 194 mg/L, which is typical of medium strength domestic wastewater. The maximum month BOD_5 loading of 441 lb/day was observed in December of 2003. The resident population in 2003 was 2,185. This BOD_5 loading and population translates to a maximum month BOD_5 loading of 0.20 lb per capita per day (lb/cap/day) or 0.5 lb/EDU/day. This value is equivalent to the design criteria of 0.2 lb/cap/day recommended by the Washington State Department of Ecology. The average influent BOD_5 loading for the 2-year period of June 2002 – May 2004 is 323 lb/day. The ratio of maximum month to annual average BOD_5 loading is 1.4:1.

EXISTING TOTAL SUSPENDED SOLIDS LOADING

Monthly average TSS loadings ranged from 217 lb/day to 1,084 lb/day as shown in Table 6-2 and Figure 6-3. The permitted TSS loading of 1,085 lb/day was not exceeded during the 29-month period of analysis. The average influent TSS concentration of 290 mg/L for this time period is typical of medium to high strength domestic wastewater. The maximum month TSS loading of 1,084 lb/day was observed in December of 2003 during which time the resident population was 2,185, giving a loading of 0.50 lb/cap/day. This loading is 2.5 times greater than the Ecology criteria of 0.2 lb/cap/day.

The maximum month TSS loading of 1,084 lb/day in December 2003 is considered to be unrepresentative of actual loadings due to a reported TSS concentration of 1,115 mg/L. This value appears to be an error since it is nearly twice a large as any other reported value during the period of analysis. The second highest monthly average TSS loading from May 2004 of 735 lb/day with a residential population of 2,195 in 2004 translates to a maximum month loading of 0.33 lb/cap/day or 0.8 lb/EDU/day, which also greatly exceeded the historical maximum month BOD_5 loading of 0.20 lb/cap/day. The average TSS loading of 489 lb/day for the 2-year period of June 2002 – May 2004 was 51 percent greater than the average BOD_5 loading of 323 lb/day. These high TSS loadings are believed to be the result of excessive inert debris entering the sewer system, possibly from construction activities in the City. There are no known industrial or non-domestic sources of such high levels of influent suspended solids. This situation appears to indicate that the unusually high solids levels are not representative of future influent quality, since the majority of future flows are expected to derive from residential sources. Therefore, the design TSS criteria for future loading to the wastewater treatment plant will be set equal to the BOD_5 loading of 0.20 lb/cap/day or 0.5 lb/EDU/day. This TSS loading is consistent with Ecology’s recommended design criteria for new residential flows. The ratio of maximum month to annual average TSS loading will be 1.4:1, the same as for BOD_5.

PROJECTED WASTEWATER FLOWS AND LOADINGS

INTRODUCTION

Projected wastewater flows and loadings are based on historical per capita or EDU based loadings for the City and the projected residential population and non-residential area size. Population projections and non-residential areas for the 20-year planning horizon are discussed in Chapter 3. Populations were projected based on zoning, and are used to size collection system components such as gravity sewers and lift station wet wells. A population of 12,000 is projected to be reached in 2024.

Projected wastewater flows and loadings have been developed for the 20-year design period. Peak hour wastewater flows are used as the basis for sizing the hydraulic components of the WWTP, while maximum month flows and loading are used to size process components.

Projected Flows

The future maximum month WWTP flows are projected based on adding the projected maximum month flows from future residential and non-residential sources to the existing maximum month flows. The maximum month flow contribution from future residential connections is defined in the City's 2004 Comprehensive Plan as 375 gal/EDU/day, which is equivalent to 150 gpcd at 2.5 residents per EDU. Note that the current maximum month flow rate of 0.319 mgd occurred in January 2004 and the population in 2004 was 2,195, giving a residential contribution of 145 gpcd. The maximum month flow contribution from future non-residential sources is defined in the City's 2004 Comprehensive Plan as 750 gallons per acre of new non-residential area per day (gpad). Based on the residential wastewater contribution of 375 gal/EDU/day, the non-residential contribution of 750 gpad will be considered equivalent to 2 EDU/acre. The new EDUs per year, which are used for future projected flows and loadings, are discussed in Chapter 3.

The future annual average flows are projected by multiplying the projected maximum month flows by the current annual average to maximum month flow ratio of 0.64:1.

The peak day flows are projected by using a weighted peak day flow to annual average flow peaking factor. This weighted peaking factor uses the current peak day to annual average flow ratio of 2.9:1 for the current population to projected population ratio and uses a projected future peak day to annual average ratio of 2.0:1 for the new population to projected population ratio. This approach assumes that the peak day per capita I/I component from new sources will be less than that of existing sources because new sewer construction materials and methods will allow less I/I than the existing sewers. The peak hour to annual average flow ratio of 2.0:1 is based on data from various cities in Western Washington. The equation for calculating the projected peak day flow is given below:

$$\text{PDF} = \text{AAF} * 2.9 * \left(\frac{\text{Current Population}}{\text{Projected Total Population}}\right) + \text{AAF} * 2.0 * \left(1 - \frac{\text{Current Population}}{\text{Projected Total Population}}\right)$$

Where PDF = Peak Day Flow and AAF = Annual Average Flow.

The above equation can be rearranged to give the weighted hourly peaking factor:

$$PDF = AAF * PF_{PD}$$

Where PF_{PD}= Weighted hourly (peak day) peaking factor =

$$2.9 * \left(\frac{\text{Current Population}}{\text{Projected Total Population}}\right) + 2.0 * \left(1 - \frac{\text{Current Population}}{\text{Projected Total Population}}\right)$$

The current and future peak hour flows are projected by multiplying the annual average flow by a population-based peaking factor, given by the equation:

$$PF = (18 + sqrt(P))/(4 + sqrt(P))$$

where P = population, in thousands of people (Department of Ecology *Criteria for Sewage Works Design*, 1998).

A summary of existing and projected flows is given below in Table 6-4.

TABLE 6-4

Existing and Projected Flows

Parameter	Year				
	2004	2009	2012	2019	2024
New EDUs	(1)	1,032	1,814	4,032	6,294
Total Residential Population	2,195	3,755	4,730	8,795	12,000
Annual Average Flow, mgd	0.20	0.45	0.64	1.17	1.72
Max Month Flow, mgd	0.32	0.70	1.00	1.83	2.68
Daily Peaking Factor	3.0	2.5	2.4	2.2	2.2
Peak Day Flow, mgd	0.60	1.14	1.56	2.60	3.71
Hourly Peaking Factor	3.6	3.4	3.3	3.0	2.9
Peak Hour Flow, mgd	0.73	1.51	2.10	3.63	4.93

(1) In 2004 it was estimated that the City served 853 EDUs.

Projected BOD_5 and TSS Loadings

Future WWTP maximum month BOD_5 and TSS loadings are estimated by adding the projected maximum month loading from future residential and non-residential sources to the existing maximum month loading. The future BOD_5 and TSS loadings will be based on the current loading of 0.5 lb/EDU/day for both loading parameters. Future annual average BOD_5 and TSS loadings are estimated using the ratio of the maximum month to annual average loadings of these parameters. The ratio of the maximum month to annual average BOD_5 and TSS is 1.4:1 for both parameters. Table 6-5 provides a summary of projected future WWTP influent BOD_5 and TSS loadings.

Projected Nitrogen Loading

There is no available information on influent ammonia (NH_4-N) nitrogen or Total Kjeldahl nitrogen (TKN) loading since the current and previous NPDES permits did not contain effluent limits for ammonia nitrogen, and consequently, monitoring of TKN or ammonia was not performed. Therefore, the influent wastewater was assumed to have nitrogen concentrations consistent with that of medium strength domestic wastewater since historical influent BOD_5 and TSS loadings were typical of medium strength domestic wastewater. A TKN/NH_4-N ratio of 1.5:1 was used to project future nitrogen loadings. The ratio of BOD_5 to ammonia nitrogen loading is assumed to be 6:1 based on similar WWTP influent sample analysis results. Therefore, projected future ammonia nitrogen and TKN loadings are estimated using a ratio with the projected BOD_5 loading. Table 6-6 provides a summary of projected future WWTP influent ammonia nitrogen and TKN loadings.

Summary of Loadings

Projected future WWTP loadings are summarized in Table 6-5.

TABLE 6-5

Existing and Projected WWTP Loadings

Parameter		Year				
		2004	2009	2012	2019	2024
New EDUs		(1)	1,032	1,814	4,032	6,294
Annual Average BOD_5	(lb/day)	323	684	963	1,755	2,563
	(mg/L)	194	182	180	180	179
Max Month BOD_5	(lb/day)	441(2)	957(3)	1,348	2,457	3,588
	(mg/L)	165	164	162	161	161
Annual Average TSS	(lb/day)	323	684	963	1,755	2,563
	(mg/L)	194	182	180	180	179
Max Month TSS	(lb/day)	441	957(3)	1,348	2,457	3,588
	(mg/L)	165	164	162	161	161
Annual Average NH_4-N	(lb/day)	54	114	160	293	427
	(mg/L)	32	30	30	30	30
Max Month NH_4-N	(lb/day)	74	160	225	410	598
	(mg/L)	28	27	27	27	27
Annual Average TKN	(lb/day)	81	171	241	439	641
	(mg/L)	48	46	45	45	45
Max Month TKN	(lb/day)	110	239	337	614	897
	(mg/L)	41	41	40	40	40

(1) In 2004 it was estimated that the City served 853 EDUs.
(2) NPDES permit limits monthly average influent BOD5 to 1,083 lb/day.
(3) The *Wastewater Treatment Plant Capacity Analysis* (Appendix L) estimated the influent loading capacity as 1,240 lb/day of BOD_5 and TSS each.

Projected Effluent NPDES Permit Limits

The WWTP currently discharges into Lake River, a tributary of the Columbia River. Lake River is currently water quality listed for temperature and fecal coliform. The sampling locations for this listing is upstream of the WWTP discharge, however, Ecology has required the City to conduct receiving water quality studies on Lake River as part of the current NPDES permit cycle. In particular, there is a concern that ammonia loadings might be adversely impacting the river. Projected future effluent NPDES permit limits are listed in Table 6-6. The limits are presented for the projected future design flows for the years 2009, 2012, 2019, and 2024. The projections assume the outfall is in Lake River up to 2012 and in the Columbia River for the years 2019 and 2024. Projected limits shown on Table 6-6 for ammonia and copper are based on mixing zone studies presented in Appendix D. The mixing zone modeling performed in these studies indicates that use of the Lake River extended outfall at a WWTP design flow of 1.0 mgd would result in monthly average and maximum daily effluent ammonia limits of 1.2 mg/L and 3.0 mg/L, respectively.

TABLE 6-6

Projected Future Effluent NPDES Permit Limits

	Year/Flow (mgd)			
	2009[1] (0.7)	**2012[1] (1.0)**	**2019[2] (1.83)**	**2024[2] (2.68)**
BOD_5 Conc. (monthly avg.)[3]	30 mg/L	30 mg/L	30 mg/L	30 mg/L
BOD_5 Conc. (weekly avg.)	45 mg/L	45 mg/L	45 mg/L	45 mg/L
TSS Conc. (monthly avg.)[3]	30 mg/L	30 mg/L	30 mg/L	30 mg/L
TSS Conc. (weekly avg.)	45 mg/L	45 mg/L	45 mg/L	45 mg/L
Fecal Coliform Count (monthly avg.)	100 cfu/ 100 mL	100 cfu/ 100 mL	100 cfu/ 100 mL	100 cfu/ 100 mL
Fecal Coliform Count (weekly avg.)	200 cfu/ 100 mL	200 cfu/ 100 mL	200 cfu/ 100 mL	200 cfu/ 100 mL
Ammonia Conc. (monthly avg./weekly avg.)	1.5/3.4 mg/L[4]	1.2/3.0 mg/L[4]	18/41 mg/L[7]	15/33 mg/L[7]
Copper Conc. (monthly avg./weekly avg.)	27/39 μg/L[5]	25/37 μg/L[6]	64/93 μg/L[7]	58/85 μg/L[7]
pH	Shall not be outside the range of 6.0 to 9.0			

(1) Assuming conventional secondary permit limits for discharge to Lake River.
(2) Assuming conventional secondary permit limits for discharge to the Columbia River.
(3) The average monthly effluent concentration for BOD_5 and TSS shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentration.
(4) mg/L as N. See Appendix D, Final Addendum to the City of Ridgefield Mixing Zone Study (November 2006). Assumes Lake River single-port diffuser alternative.
(5) See Appendix D, Correspondence from Bill Fox, February 15, 2007. Assumes Lake River single-port diffuser alternative.
(6) See Appendix D, Mixing Zone Study – Part II (Appendix F-3) (December 2005). Assumes Lake River single-port diffuser alternative.
(7) See Appendix D, Mixing Zone Study – Part II (Appendix F-3) (December 2005). Assumes Columbia River single-port diffuser alternative.

RECEIVING WATER ISSUES

As a requirement of the City's current NPDES permit, the City completed a two phase mixing zone assessment of Lake River. The first phase was an assessment of the existing outfall. The second phase evaluated the mixing zone characteristics of Lake River relative to projected future flows. The studies included an in-field evaluation to provide validation of the computer models used to project future effluent limits. The first phase of the study is provided in Appendix C and the second phase in Appendix D.

The WWTP discharges to the east bank of Lake River, a tidally influenced tributary of the Lower Columbia River. Classification of Lake River as a receiving water at the point of the Ridgefield discharge is not definitively established. The river at the Ridgefield discharge exhibits characteristics of both a river and an estuary. The dilution zone study provided in this plan notes that the physical and hydrological behavior of the river in this location is more estuarine.

Ecology, however, has indicated that they believe Lake River should be considered as a river for receiving water classification purposes. The implications of this classification are significant from the perspective of the City of Ridgefield. The amount of receiving water available for effluent dilution and the boundaries of the dilution zone are considerably more restrictive if Lake River is classified as a river for receiving water purposes. Within the 20-year UGA projected flows identified in this plan, Lake River could continue to be a suitable receiving water environment for well nitrified effluent from a secondary wastewater treatment plant if Lake River is classified as an estuary, as previously indicated in the City's NPDES permit.

Since the City cannot delay WWTP expansion to resolve the issue of the proper classification of Lake River, the mixing zone studies performed for projected future flows have considered the effect on discharge permit limits of using both river classifications. The river classification greatly reduces the WWTP flow that can be discharged without probable permit violations, involving potential effluent metal and ammonia limits. This maximum allowable discharge flow is also affected by the outfall design and the critical minimum flow in Lake River.

Mixing zone studies have determined that Lake River has sufficient dilution for accommodating the 0.7 mgd WWTP Phase 1 expansion by 2009 with an extension of the outfall to mid channel of Lake River. Adequate dilution is provided for this WWTP flow regardless of the classification of Lake River, as long as the existing outfall is extended.

The minimum amount of receiving water available in Lake River for effluent dilution year-round is dependent on Lake River flow, tidal flux, and the complex hydrodynamic behavior of the receiving water system. As described in the mixing zone studies appended to this report, Columbia River flow enters the Lake River channel and moves past the WWTP discharge point at high tides during periods of low seasonal Lake River flow. The reversing tide flushes this entering volume of water back into the Columbia

River, where it moves downstream and does not reflux into Lake River. This "residual circulation" supplies the majority of dilution water at the outfall when the flow in Lake River from upstream sources is low. The overall effect of these two sources of dilution water is a minimum critical discharge of 400 ft^3/s (cfs) in Lake River. This flow should be the basis of dilution calculations for the Lake River outfall.

Assuming a 400 cfs critical flow in Lake River, mixing zone studies show that the extended outfall in Lake River should provide enough dilution to accommodate a WWTP flow of as much as 1.0 mgd.

However, in addition to the conclusions of the dilution zone studies that were conducted as part of this planning effort, there are other factors that need to be considered in determining whether the City of Ridgefield should continue to anticipate long-term use of Lake River as a receiving water. The factors that are most significant in this consideration are as follows:

- Assuming that this region continues to grow beyond the 20-year projections provided in this plan, once the treatment plant flows exceed 1 mgd if Lake River is classified as a "river," or exceed 4 mgd if it is classified as an "estuary," it will become increasingly difficult to treat effluent to a level suitable for discharge into Lake River. Given the potential for additional expansion of the UGA and/or possible acquisition of additional system customers with significant wastewater flows, it appears to be in the City's best long-term interests to move towards moving the discharge location to the mainstem Columbia River where effluent limitations based on dilution zones are less restrictive. The uncertainty of the classification of Lake River should not delay the City from pursuit of this new outfall location.

- The environmental permitting issues relating to extending the effluent pipeline to an outfall in the Columbia River will only become more complex over time. As such, it is advantageous for the City to construct this outfall as soon as the required environmental permits can be obtained.

- The City is currently in a period of rapid growth and can presently collect an appropriate contribution for outfall permitting and construction from new growth and development. Without these revenues, the existing customer base will not be able to afford the costs of constructing the Columbia River outfall.

- The analysis of continued discharge into Lake River is based on hydraulic modeling. Water quality issues quantified in a future Total Maximum Daily Load (TMDL) study for the Columbia River may generate additional effluent constraints for discharges into Lake River.

Therefore, this plan recommends that the City move forward to acquire the necessary permits and construct an outfall to the Columbia River. On an interim basis, as the customer base is increased and the system acquires the funds necessary for the capital investment required to reach the Columbia River, the City should continue to request the authorization from Ecology to discharge into Lake River. It has been noted that the existing treatment plant outfall to Lake River is not submerged at all times and visibly discharges across the bank at low tide. This situation does not meet the regulatory requirements for a continuously submerged outfall, nor does the existing bank discharge provide adequate effluent dilution to meet permit limits. As a condition for the continued use of Lake River for effluent disposal on an interim basis, a submerged diffuser will be installed mid channel at a minimum 7-foot depth in Lake River to provide adequate interim dilution until the outfall to the Columbia River can be constructed.

CHAPTER 7

WASTEWATER COLLECTION SYSTEM

INTRODUCTION

The purpose of this Chapter is to identify and provide cost estimates for those improvements to the City of Ridgefield wastewater collection system that will be required to remain in regulatory compliance and accommodate growth projections within the Urban Growth Area (UGA). Recommendations for improvements in collection system management in order to protect the investment in the collection system are also provided.

In 2005 the City updated City engineering and design standards to ensure that the following issues were addressed:

- Odor and hydrogen sulfide control, using a system that the City can operate cost effectively.
- System telemetry requirements for a system that is reliable and can be readily expanded and improved as the City grows.
- Construction quality control to ensure that the new system elements are not a source of infiltration and inflow.
- A requirement that grinder pumps rather than STEP systems be used when needed for individual property service.

The new City engineering standards for the sanitary collection system and pretreatment standards for the sanitary sewer collection system are provided in Appendix I.

EXISTING COLLECTION SYSTEM ISSUES

The existing collection system was described in Chapter 5. Chapter 6 provided an analysis of the infiltration and inflow for the existing collection system. Significant conclusions from these two previous chapters are summarized in the following paragraphs.

Much of the existing collection system in the downtown area was constructed of concrete pipe in the 1950s. In general, this part of the collection system is in good condition. The system is limited to an estimated capacity of 0.72 mgd by bottlenecks in the downtown area including the 10-inch pipeline that passes under the Burlington Northern railroad track. This pipeline can be allowed to surcharge and provide an estimated 1 mgd carrying capacity to the treatment plant. This does not provide sufficient capacity for the growth needs of the UGA. The City can bypass this problem by pumping around the downtown bottlenecks. Wastewater flows from the eastern part of the UGA will be consolidated at the previously planned T-7 (Lower Gee Creek Meadows) pump station and pumped directly to the headworks of the treatment plant. Wastewater from the southeastern part of the UGA will also be pumped directly to the plant. In addition to bypassing the downtown bottlenecks, this strategy also takes advantage of the hydraulic gradient that is available after the wastewater is pumped over the ridge that is on the western edge of the downtown collection system.

The downtown collection system does not exhibit excessive infiltration and inflow as defined by USEPA guidelines. This non-excessive I/I is due to the City's on going I/I reduction program, which includes maintenance of storm drains; removal of roof drains from sanitary sewers; repairing leaks in sewers, manholes and pumping stations; smoke testing and televising sewers; replacing leaking manhole covers; and monitoring sewage flows throughout the system. Evaluation of historic videotapes of the system indicates that there is some root penetration and grease buildup within the downtown sewers. The problems identified do not appear to require a capital expenditure. However, additional attention should be directed to collection system cleaning. A pretreatment ordinance has also been provided as part of this plan to assist the city in strengthening control of fats, oils, and grease (FOG) discharges into the collection system.

CAPACITY MANAGEMENT OPERATION AND MAINTENANCE (CMOM)

The City may face new responsibilities under the proposed Capacity Management Operation and Maintenance (CMOM) regulation by the Environmental Protection Agency. The legal basis for the CMOM regulation is that nearly all collection systems have occasionally unplanned releases as sanitary sewer overflows (SSOs) and that these releases are regulated under the jurisdiction of the Clean Water Act. The purpose of CMOM regulations is to ensure that collection systems are operated and maintained with the same level of attention that treatment plants receive. The regulation has been issued only in draft form and it is uncertain when the final regulation will be issued. Current city flows are less than the minimum rate at which the draft regulation requires implementation of a CMOM program. However, anticipated growth will put the City above the requirement cutoff in the near future. The CMOM requirements provide a model the City can use to evaluate and develop maintenance programs for the collection system.

The draft regulation contains several requirements regarding the operation of the wastewater collection system. The City has already addressed some of the proposed requirements through its current operations. However, other requirements will represent new commitments that have not previously been part of the City's normal operation. Each of the draft regulatory requirements under CMOM is presented below along with a brief discussion of how the City is addressing or will need to address each one.

1. Meet general sewer system performance standards including up to date system maps, information management systems, and odor control requirements.

Through this Plan, the City has developed an up to date sewer base map. The City also operates and maintains odor control systems at pump stations throughout the City. In addition, the City has prepared Developer Standards to ensure consistency and quality control for future sewer construction. The City also requires that all as-builts be provided in an AutoCAD format compatible with the City's mapping system.

2. Maintain program documentation including the goals, organization, and legal authority of the organization operating the collection system.

The City has well defined lines of authority for the operation of its wastewater collection system.

3. Develop an overall response plan that can respond to releases in less than 1 hour and is demonstrated to have sufficient personnel and resources.

The City should develop a response plan in order to respond to releases in a timely manner. As the system expands, additional personnel and resources will be necessary.

4. Plan for system maintenance, evaluation, and replacement requirements mandating that the collection system be cleaned on scheduled basis, regularly video inspected, and develop a short- and long-term program for pipeline replacement and rehabilitation.

Because much of the collection system is, or soon will be, relatively new, the City is in a good position to begin a program for ongoing maintenance and line replacement. An operation and maintenance manual for the collection system should be provided by 2015 when the City will likely be subject to the requirements of the CMOM regulations.

5. Plan for controlling Fats, Oils, and Grease (FOG) that impact incidences of SSOs.

The City should initiate a program to periodically clean its sewers to limit the impact of FOG on the collection system. In addition, part of the Sewer Comprehensive Plan Update is the adoption of a pretreatment resolution discussed in Chapter 4. Control of Fats, Oils, and Grease (FOG) is part of this resolution. The City will need to incorporate an education element into the existing program to assist existing and future customers to understand the cost and system performance impacts from FOG. Enforcement authority is also provided in the pretreatment resolution.

6. **Develop a capacity assurance and management plan with flow meters to model Infiltration and Inflow (I/I) and system capacity.**

Run time meters are located at each of the City's major pump stations. Implementation of the new City design standards will maintain this requirement. By 2015, the City should also consider the acquisition of a portable flow meter to allow isolation and flow measurement of gravity flow components of the collection system. A portable flow meter, including software, will cost around $8,300 in 2005 dollars.

7. **Develop a self-audit program to evaluate and adjust performance.**

The City maintains collection system records at its wastewater treatment plant. The City has the capability of determining the success of any pipeline replacement or rehabilitation program through its historical plant flow records and flow meters located at the main pump stations. The City will need to implement a program for compiling and evaluating these records and a system for maintenance based on identified and recurring problem areas.

8. **Develop a program to communicate information on problems, costs, and improvements to the public and decision-makers.**

The City has consistently updated its sewer and facility plans specifically to identify needs, develop costs for improvements, and inform the decision-makers. The City Council conducts regularly scheduled public meetings where sewer issues are discussed. The City will need to periodically provide information to the public on the number of sewer spills and backups during the year and explain the City's short- and long-term response to these incidents.

As part of the CMOM program, EPA has provided an assessment checklist, which has been used to evaluate sewer utility operations. Following the initial assessment, periodic updates will allow a comparison of performance over time.

9. **Other recommendations**.

The City may wish to consider partnerships with other municipal collection system operations in Clark County to share the costs and use of video, metering, and cleaning equipment.

The City downtown collection system is over 50 years old. As noted previously, video inspections indicate that the lines are in good condition. However, given the age of the system, the City should plan on beginning a program to replace these lines. Following the draft CMOM guidelines, a replacement rate of 2 percent of the system per year should be budgeted starting in 2015. Based on a 2-percent replacement rate, the downtown system would be replaced at a rate of 173 feet per year. To avoid excessive disruption of the downtown area, projects could be compiled into 5-year increments (800 linear feet or more) and/or coordinated with road improvement projects when possible.

COLLECTION SYSTEM CAPITAL IMPROVEMENT PLAN

The City of Ridgefield is currently undergoing a period of rapid growth. The wastewater collection system is being expanded to serve this growth located to the south, north, and east of the existing downtown core. Within the next 10 to 20 years, the City system will consist predominately of a new collection system constructed by current city standards by the developers working in Ridgefield. The City will acquire several new developer designed and constructed lift stations as well.

System Expansion

For the purposes of sizing major collection system improvements, an evaluation of project wastewater flows in the UGA was conducted. The UGA was broken into drainage basins based on topography. Figure 7-1 shows the drainage basins that were identified in this evaluation. The acreage of each zoning designation within each drainage basin was determined using a Geographic Information System. The zoning designations and acreages within each basin were then used to compile flows along likely routes for trunk systems and in drainage areas for pump stations, when necessary. As in the City's Growth Management Plan, a correction factor of 42.5-percent buildable land for new residential developments was used to correct for unbuildable acreage, buffer areas, sensitive lands, parking areas and other uses that do not generate wastewater. Maximum month flow was determined using the following assumptions:

Maximum month flow for non-residential development = 750 gal. per acre
Maximum month flow for residential development = 375 gallons per EDU

Annual average flow was derived from maximum monthly flow by multiplying maximum month flow by the ratio of current average annual flow to maximum month flow (0.205 mgd/0.318 mgd).

Table 7-1 summarizes the flows for each of the 14 drainage basins identified in this evaluation. Tables with the full analysis for each drainage basin are provided in Appendix G. Peaking factors were identified for each of the drainage basins using the Department of Ecology Criteria for Sewage Works Design peaking factor formula and recalculated as the flow from drainages were combined to form larger service areas and higher flows.

TABLE 7-1

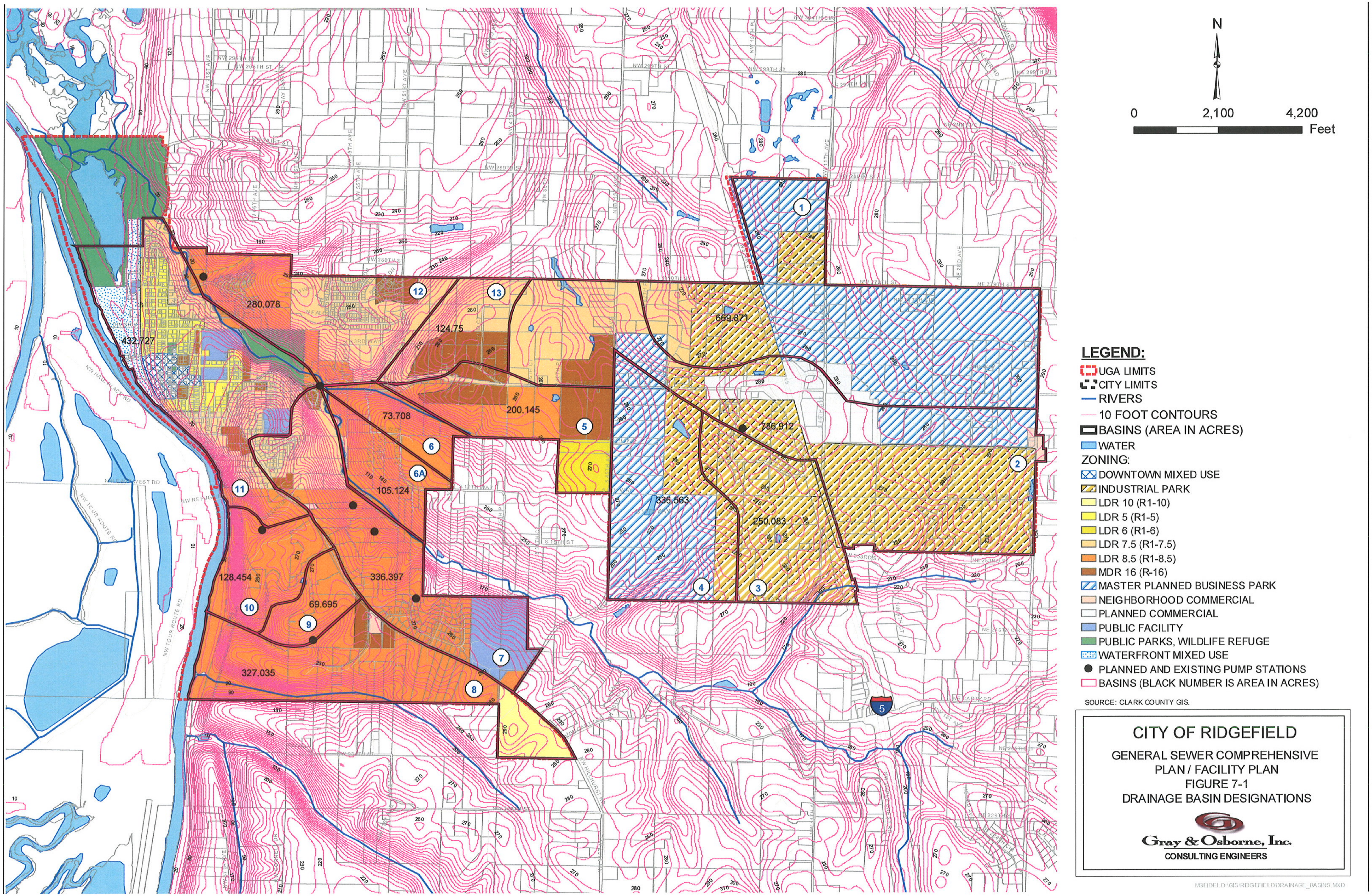
Basin Summary Information

Basin Identification(1)	Total Acreage	Peak Month Flow in Gallons Per Day(2)	Average Annual Flow in Gallons Per Day(2)	Peaking Factor	Peak Flow in Gallons per Minute
1	676	514,600	330,700	3.4	779
2	606	454,700	292,200	3.4	698
3	240	179,800	115,600	3.7	301
4	336	252,400	162,200	3.6	410
5	200	299,900	192,700	3.6	780
6	73	59,900	38,500	4.0	107
6A	105	85,900	55,200	3.9	151
7	336	309,700	199,000	3.6	500
8 (3)	327	286,400	189,000	3.6	460
9 (3)	69	56,700	36,400	4.0	102
10 (3)	128	105,500	67,800	3.9	183
11	345	308,000	198,300	3.6	490
12	265	260,000	166,000	3.6	420
13	124	189,300	121,600	3.7	315

(1) Per Figure 7-1.
(2) Rounded to hundreds of gallons.
(3) Developer designed and constructed pump stations will serve these drainage basins.

Previous plans for trunk sewers assumed that the sewers would follow natural stream corridors. Due to the need to protect the stream environment, sewers will likely have to be constructed up-slope of the stream rather than at the low point. This means that the sewers may, in some locations, run parallel and on either side of a stream in order to serve adjacent drainage basins.

Figure 7-2 identifies the new trunk lines that were determined within the identified drainage basins and sized using the flows described above. The labels previously used for future trunk lines were retained in order to be consistent with previous sewer plans and the City's GMA plan to the maximum extent possible. The trunk line sizes were estimated using minimum slope and the City requirement that trunk sewers should flow no more than 50 percent full at startup. Project cost estimates generated for the trunk lines are provided in Table 7-2. It should be noted that diameters, lengths and alignments are conceptual in nature and will change based on more detailed evaluation and survey elevations to be determined at the time of actual design.


N
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2,100
4,200
Feet
LEGEND:
UGA LIMITS
CITY LIMITS
RIVERS
10 FOOT CONTOURS
BASINS (AREA IN ACRES)
WATER
ZONING:
DOWNTOWN MIXED USE
INDUSTRIAL PARK
LDR 10 (R1-10)
LDR 5 (R1-5)
LDR 6 (R1-6)
LDR 7.5 (R1-7.5)
LDR 8.5 (R1-8.5)
MDR 16 (R-16)
MASTER PLANNED BUSINESS PARK
NEIGHBORHOOD COMMERCIAL
PLANNED COMMERCIAL
PUBLIC FACILITY
PUBLIC PARKS, WILDLIFE REFUGE
WATERFRONT MIXED USE
PLANNED AND EXISTING PUMP STATIONS
BASINS (BLACK NUMBER IS AREA IN ACRES)
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN / FACILITY PLAN
FIGURE 7-1
DRAINAGE BASIN DESIGNATIONS
Gray & Osborne, Inc.
CONSULTING ENGINEERS
432.727
280.078
124.75
669.871
73.708
200.145
786.912
105.124
336.563
250.083
128.454
336.397
69.695
327.035
1
2
3
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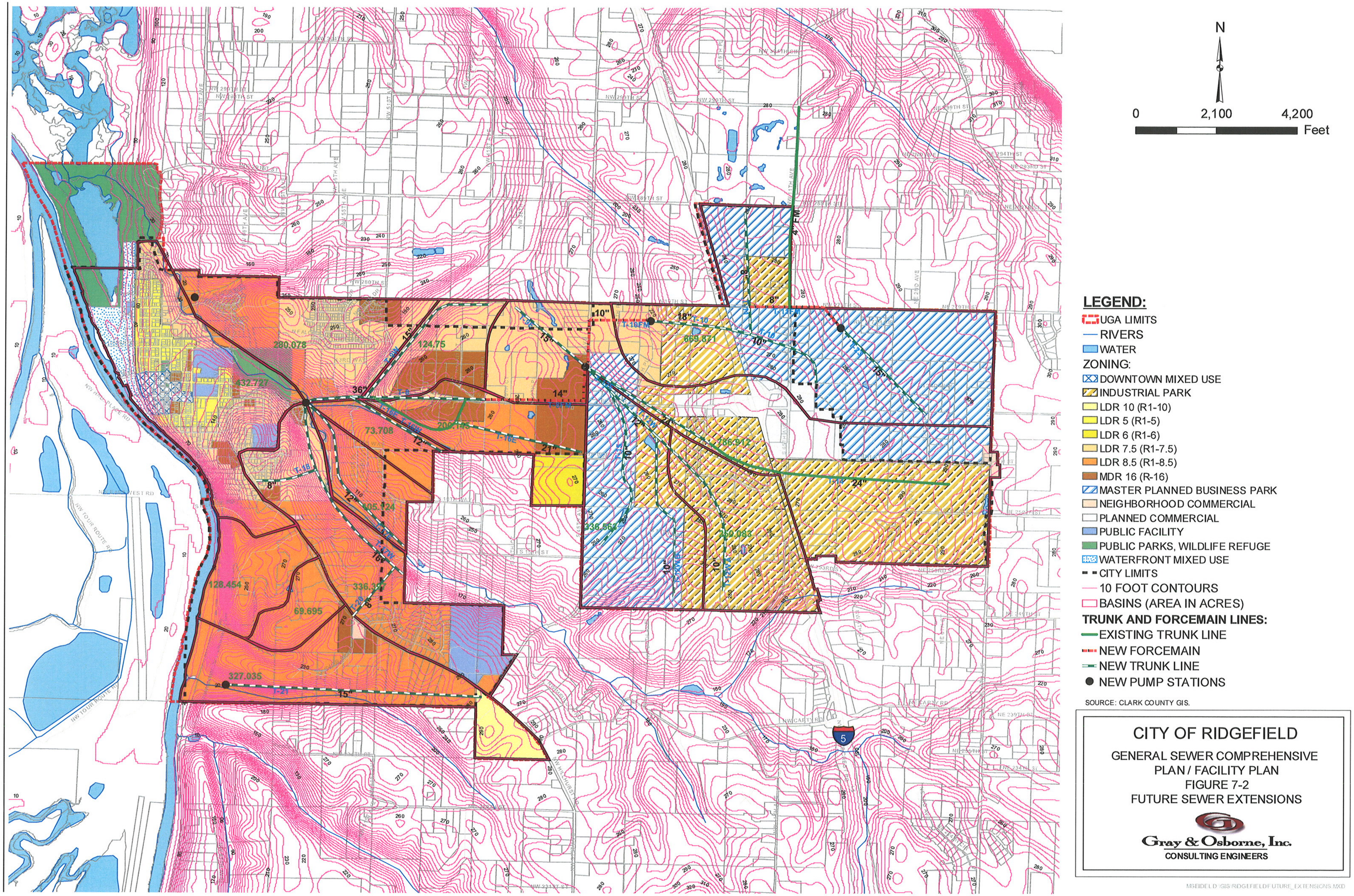

N
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2,100
4,200
Feet
LEGEND:
UGA LIMITS
RIVERS
WATER
ZONING:
DOWNTOWN MIXED USE
INDUSTRIAL PARK
LDR 10 (R1-10)
LDR 5 (R1-5)
LDR 6 (R1-6)
LDR 7.5 (R1-7.5)
LDR 8.5 (R1-8.5)
MDR 16 (R-16)
MASTER PLANNED BUSINESS PARK
NEIGHBORHOOD COMMERCIAL
PLANNED COMMERCIAL
PUBLIC FACILITY
PUBLIC PARKS, WILDLIFE REFUGE
WATERFRONT MIXED USE
CITY LIMITS
10 FOOT CONTOURS
BASINS (AREA IN ACRES)
TRUNK AND FORCEMAIN LINES:
EXISTING TRUNK LINE
NEW FORCEMAIN
NEW TRUNK LINE
NEW PUMP STATIONS
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN / FACILITY PLAN
FIGURE 7-2
FUTURE SEWER EXTENSIONS
Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 7-2

City of Ridgefield Project Cost Estimates Gravity Trunk Lines

Trunk Line Label	Diameter	8"	10"	12"	15"	18"	21"	24"	36"
T-21	Pipe Length, ft				6600				
	Construct. Cost				$1,375,000				
	Project Cost				$1,719,000				
T-20	Pipe Length, ft	1500							
	Construct. Cost	$225,000							
	Project Cost	$281,000							
T-17W	Pipe Length, ft					5300			
	Construct. Cost					$1,230,000			
	Project Cost					$1,538,000			
T-18	Pipe Length, ft	1600							
	Construct. Cost	$237,000							
	Project Cost	$296,000							
T-17E	Pipe Length, ft			4700					
	Construct. Cost			$866,000					
	Project Cost			$1,083,000					
T-9W	Pipe Length, ft				4300				
	Construct. Cost				$893,000				
	Project Cost				$1,116,000				
T-16W	Pipe Length, ft			2700					
	Construct. Cost			$496,000					
	Project Cost			$620,000					
T-16E	Pipe Length, ft						3300		
	Construct. Cost						$875,000		
	Project Cost						$1,094,000		
T-9E	Pipe Length, ft				2400				
	Construct. Cost				$518,000				
	Project Cost				$648,000				

TABLE 7-2

City of Ridgefield Project Cost Estimates Gravity Trunk Lines

Trunk Line Label	Diameter	8"	10"	12"	15"	18"	21"	24"	36"
T-10	Pipe Length, ft		2500			2500			
	Construct. Cost		$416,000			$593,000			
	Project Cost		$520,000			$741,000			
T-11	Pipe Length, ft	2500				700			
	Construct. Cost	$378,000				$159,000			
	Project Cost	$473,000				$199,000			
T-23	Pipe Length, ft				3300				
	Construct. Cost				$712,000				
	Project Cost				$890,000				
T-12E	Pipe Length, ft							3800	
	Construct. Cost							$1,060,000	
	Project Cost							$1,325,000	
T-12WB	Pipe Length, ft		4400						
	Construct. Cost		$772,000						
	Project Cost		$965,000						
T-15	Pipe Length, ft		4400						
	Construct. Cost		$759,000						
	Project Cost		$949,000						
T-12W	Pipe Length, ft						2600		
	Construct. Cost						$675,000		
	Project Cost						$844,000		
T-12WA	Pipe Length, ft		2600	2100					
	Construct. Cost		$465,000	$388,000					
	Project Cost		$581,000	$485,000					
T-8	Pipe Length, ft								3200
	Construct. Cost								$1,335,000
	Project Cost								$1,669,000

Figure 7-2 also shows locations where additional pump stations and associated force mains were identified as necessary. Where necessary, sub flows within basins were calculated to estimate the flows that pump stations and their corresponding force mains would need to serve. Combined flows from multiple drainage basins were also estimated for the pump station identified at 45th Avenue. The calculations for the sub drainages and combined drainages are provided in Appendix G.

Table 7-3 provides summary data on the design for the three new pump stations identified for Basins 1 and 2. The other future pump stations shown in Figure 7-2 and located in Basins 8, 9, and 10 will be constructed by developers to serve their specific projects.

TABLE 7-3

Pump Station/Force Main Design Data

Pump Station Identification	Location	Peak Flow (gpm)	Estimated Static Lift[(1)]	Force Main Diameter	Force Main Length
45th Avenue	45th Avenue	2,510	40'	14 in.	3,450 ft.
279th Street	279th Street	480	10'	8 in.	2,600 ft.
Basin One East Station	To be determined	780	40'	10 in.	2,900 ft.

(1) Based on the difference in ground elevation from the approximate pump station location to the end of the force main.

Table 7-4 provides a project level cost estimate for these pump stations and force mains. The details of the cost estimates are provided in Appendix H.

TABLE 7-4

Pump Station and Force Main Project Costs[(1)]

Pump Station Identification	Location	Pump Station Estimate[(2)]	Force Main Estimate[(2)]	Total[(2)]
45th Avenue	45th Avenue	$503,000	$595,000	$1,098,000
279th Street	279th Street	$229,000	$235,000	$464,000
Basin One East Station	To be determined	$295,000	$440,000	$735,000

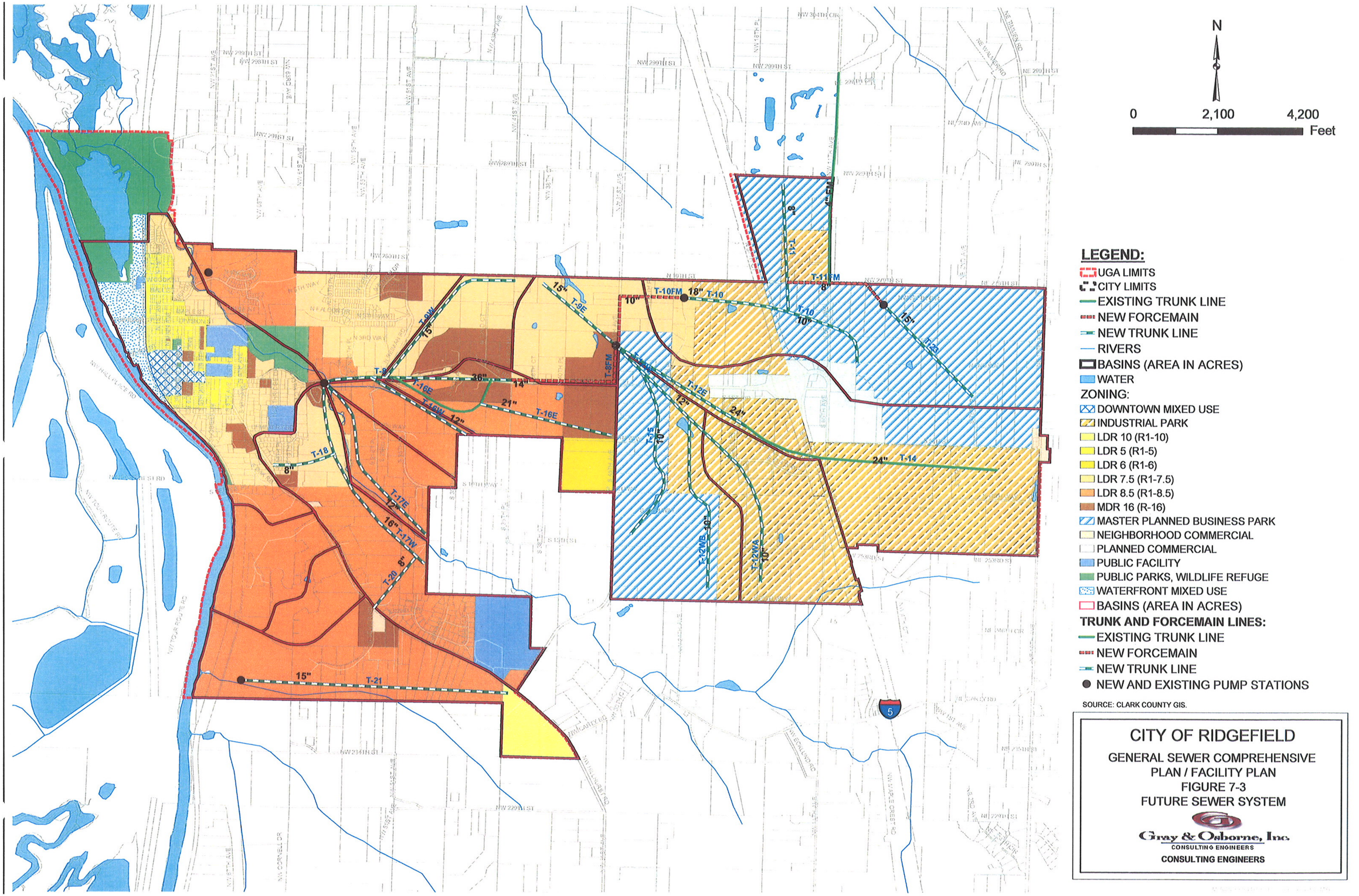
(1) Includes tax, engineering, contingency, and construction costs.
(2) 2005 dollars.

In addition to the pump stations and force mains listed above, a pump station identified as T-7 in previous sewer plans is currently being designed. This station will be located in the Gee Creek Meadows area and will receive flows from trunk lines T-17W, T-17E, and T-8. The development of the T-17W interceptor will enable the City to divert flows from Basin 7 (currently entering the downtown system) to the new pump station. This will bypass a projected 550 gpm of flow around the downtown area directly to the headworks of the treatment plant.

Figure 7-3 shows all of the major trunk lines and pump stations that exist now, are in active design or that are planned to be added to the City system to meet future UGA requirements. This only includes major sewer trunk lines and major pumping stations necessary to serve larger geographic areas defined somewhat by natural drainage patterns and the UGA boundary. Sewers connecting to the trunk sewers to serve individual developments will be constructed by developers as part of development projects.

The increased environmental protection requirements for wetlands and restoration of threatened or endangered species under the Endangered Species Act presents permitting difficulties when stream corridor construction is being considered. Recognizing these difficulties, the City may modify this plan to use additional pump stations and force mains for conveying wastewater when necessary to reduce environmental impacts. All pump stations will be constructed consistent with City standards.

The costs of the collection system improvements identified in this Chapter will be shared between the City and the developers whose projects drive the need for the improvements and extensions. Table 7-5 provides a summary of the capital improvement needs for the collection system. For each project, a portion of the eligible cost has been allocated to the City and a portion has been allocated to developers. The allocation is based on several factors including the proximity to existing sewers, construction and permitting issues, and known and anticipated development patterns. The division of costs will change based on developer capacity needs, parcel subdivisions and other factors that cannot be fully predicted at this time.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Feet
LEGEND:
UGA LIMITS
CITY LIMITS
EXISTING TRUNK LINE
NEW FORCEMAIN
NEW TRUNK LINE
RIVERS
BASINS (AREA IN ACRES)
WATER
ZONING:
DOWNTOWN MIXED USE
INDUSTRIAL PARK
LDR 10 (R1-10)
LDR 5 (R1-5)
LDR 6 (R1-6)
LDR 7.5 (R1-7.5)
LDR 8.5 (R1-8.5)
MDR 16 (R-16)
MASTER PLANNED BUSINESS PARK
NEIGHBORHOOD COMMERCIAL
PLANNED COMMERCIAL
PUBLIC FACILITY
PUBLIC PARKS, WILDLIFE REFUGE
WATERFRONT MIXED USE
BASINS (AREA IN ACRES)
TRUNK AND FORCEMAIN LINES:
EXISTING TRUNK LINE
NEW FORCEMAIN
NEW TRUNK LINE
NEW AND EXISTING PUMP STATIONS
SOURCE: CLARK COUNTY GIS.
CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN / FACILITY PLAN
FIGURE 7-3
FUTURE SEWER SYSTEM
Gray & Osborne, Inc.
CONSULTING ENGINEERS
T-21
15"
T-18
T-9W
T-9E
T-10FM
T-10
T-11FM
T-12E
T-14
24"
T-16E
T-16W
T-17E
T-17W
T-20
T-15
T-12WA
T-12WB
T-8FM
T-23
36"
21"
14"
18"
5

TABLE 7-5

Collection System Capital Improvement Plan

Project	Estimated Cost (In Millions $)(1)	Developer Share % (2)	Developer Contribution (In Millions $)	City Share % (2)	City Contribution (In Millions $)
T-21	1.72	100	1.7	0	0
T-20	0.28	0	0	100	0.28
T-17W	1.5	10	0.15	90	1.4
T-18	0.30	10	0.03	90	0.27
T-17E	1.1	90	0.98	10	0.11
T-9W	1.1	50	0.56	50	0.56
T-16W	0.62	90	0.56	10	0.06
T-16E	1.1	100	1.1	0	0
T-9E	0.65	50	0.32	50	0.32
T-10	1.3	50	0.63	50	0.63
T-11	0.54	100	0.54	0	0
T-23	0.89	100	0.89	0	0
T-12E	1.3	0	0	100	1.3
T-12WB	0.97	100	0.97	0	0
T-15	0.95	100	0.95	0	0
T-12W	0.84	20	0.17	80	0.68
T-12WA	1.1	100	1.1	0	0
T-8	1.7	75	1.3	25	0.42
45th Avenue PS & FM	1.1	50	0.55	50	0.55
279th Street PS & FM	0.46	75	0.35	25	0.12
Basin 1 PS & FM	0.74	100	0.74	0	0
Total	**20**		**14**		**6.7**

(1) The estimated share for City and developer is based on several factors including proximity to existing sewers, construction and permitting issues and known and anticipated development patterns. Actual City share will be provided through City constructed public works projects and compensation for over sizing of developer built sewer facilities as allowed by City code.

The trunk line projects identified in Figure 7-2 as T-17W, T-20, and T-18 are provided in part for the purpose of eliminating small development lift stations that are currently located in or planned for sub drainages located within Basin 7. At this time, there are also two private lift stations in this area. One is Carolees Rest Home and the other is a STEP station affiliated with the Methodist Church. There is also one City operated station (Wishing Well Estates) and two additional lift stations planned for the Cassinni View and Kirschenbaum developments that will be owned and operated by the City. All of these stations except the Methodist Church could be shut down and converted to gravity flow if the trunk line projects are completed.

The total estimated project cost of the T-17W, T-20, and T-18 projects is $ 2.115 million. At a 1.5-percent loan interest rate and 20-year repayment period, the annual cost to the City for this project would be $123,090. The historic operational costs of the Wishing Well development pump station were used as a baseline for estimating future operational costs for the City operated stations. Table 7-6 provides information on the projected costs for the lift stations including an additional allowance for odor control.

TABLE 7-6

Annual O&M Cost for Basin 7 Pump Stations

Item	Cost
Power(1)	$ 3,340
Labor(1)	$ 1,343
Maintenance(1)	$ 2,000
Subtotal(1)	$ 6,683
Odor Control	$ 4,000
Total	$10,683
Total Annual Cost for three pump stations	$32,100

(1) Based on the Wishing Well Pump station

Based on these costs, replacing the Basin 7 pump stations with the trunk line projects T-17W, T-20, and T-18, may not be cost effective unless the construction of the lines can be justified by the need to serve additional customers located south of the current UGA.

CHAPTER 8

WASTEWATER TREATMENT PLANT EVALUATION

INTRODUCTION

The City of Ridgefield has recently become one of the most rapidly growing communities in southwest Washington, and is projected to continue growing rapidly during the 20-year planning period of this report. At current growth rates, the existing permitted 0.5 mgd capacity of the wastewater treatment plant (WWTP) will be exceeded within 2 to 3 years. Significant WWTP expansions will be required to meet the projected 2024 wastewater flow and loading rates. As it would be a severe burden on the existing residents of Ridgefield to finance WWTP improvements to serve the projected 2024 population within three years, WWTP improvements are evaluated in four phases in this report.

In this chapter, several treatment process alternatives are evaluated for WWTP improvements to provide capacity for design year 2024. Each alternative will provide adequate treatment to meet the existing and projected future NPDES effluent permit limits for the flows and loadings projected for the year 2024, and each will meet the requirements for a reliability class 2 plant. After a preliminary screening process, the top two ranked wastewater treatment alternatives are compared in a final screening process with a detailed cost estimate for each. The preferred alternative is recommended and further described in detail at the end of this chapter.

It is recommended that the WWTP improvements be divided into four phases. Phase 1 would expand the current conventional activated sludge facility to allow the plant capacity rating to be increased to the flow and loading rates projected for the year 2009, with a maximum month flow of 0.7 mgd. As noted in Chapter 6, receiving water studies have indicated that the Lake River outfall has capacity to discharge up to 1.0 mgd maximum month flow (with the outfall extension recommended for construction in Phase 1). Phase 2 would expand the WWTP to provide treatment capacity for this 1.0 mgd maximum month flow (design year 2012).

Expansion of the wastewater system beyond 1.0 mgd maximum month flow requires construction of a new effluent pipeline and outfall into the main stem of the Columbia River. Phase 3 of the WWTP improvements would be concurrent with construction of the new outfall, and would provide treatment capacity through design year 2019. WWTP improvements Phase 4 would provide the required treatment capacity for the 20-year planning period (design year 2024). The four phases are summarized below:

- Phase 1: Design year 2009, maximum month flow rate = 0.7 mgd

- Phase 2: Design year 2012, maximum month flow rate = 1.0 mgd
- Phase 3: Design year 2019, maximum month flow rate = 1.83 mgd
- Phase 4: Design year 2024, maximum month flow rate = 2.68 mgd

The City has also considered regional alternatives for future wastewater treatment and disposal. Wastewater in excess of 1.0 mgd (the maximum capacity of an outfall into Lake River) could be transferred to a neighboring wastewater utility, such as the Clark Regional Wastewater District. The City and the District would share costs of construction for a raw wastewater force main, and the City would purchase capacity in the District's facilities. The City's lifecycle costs for this alternative may exceed the costs to develop an outfall in the Columbia River and expand the WWTP.

WWTP SOILS CONTAMINATION

The wastewater treatment plant is located next to the Pacific Wood Treating Corporation hazardous-waste cleanup site. The property located to the south of the WWTP was used for the manufacturing of chemically treated wood products containing a wide variety of hazardous materials. The remediation of the cleanup site is being managed by the Port of Ridgefield.

The south end of the WWTP site is immediately adjacent to one of the most contaminated properties in the cleanup. Anecdotal information from the operators and investigations by the Port indicates that creosote and pentachlorophenol contamination is present along the south fence and immediately below the soil surface. This information is corroborated by the historical use of this property as the retort processing area where chemicals were applied to the raw wood and by cleanup investigation reports. Therefore, plant expansion to the south would require a significant soil cleanup prior to construction of treatment plant improvements.

The central and north end of the WWTP site was historically used for bringing in untreated timber products. The property in this direction has been tested and characterized as being suitable for industrial uses. Although some contamination is present, the levels do not exceed Model Toxics Control Act (MTCA) limitations for industrial soils as noted in contaminated soils studies for the site. A majority of the proposed improvements identified for the treatment plant improvements are therefore planned for the central and north sections of the existing WWTP property. Any expansion on the south end of the site, such as the new headworks discussed below, will be limited to shallow excavation for foundations and pipe trenching.

WWTP IMPROVEMENTS PHASE 1

The Phase 1 WWTP improvements will expand the current conventional activated sludge facility to allow the plant capacity to be increased to the flows and loadings projected for the year 2009, with a maximum month flow of 0.7 mgd. The components of Phase 1 are described below. The site plan for Phase 1 is shown in Figure 8-1.

It is important to note that the existing WWTP was designed to treat a maximum month flow of 0.7 mgd; however, the current NPDES permit limits the plant influent flows to a maximum month value of 0.5 mgd due to regulatory concerns over the lack of clarifier redundancy and adequate nitrification capacity in the treatment process. The existing 50-foot-diameter circular aerobic digester was designed to be converted to a secondary clarifier in a future expansion to provide the required redundancy for the existing 50-foot-diameter secondary clarifier. An analysis of the existing aeration basins indicates that, for the flows and loadings associated with the 0.7 mgd flow, the existing volume of the basins will have an aerobic solids retention time (SRT) of 12.5 days with a mixed liquor suspended solids (MLSS) concentration of 3,500 mg/L. This SRT value is adequate for nitrification. Therefore, Phase 1 will consist of modifying the circular aerobic digester to a secondary clarifier and constructing a new aerobic digester.

CONVERT EXISTING AEROBIC DIGESTER TO SECONDARY CLARIFIER

The existing 50-foot-diameter aerobic digester will be converted to a secondary clarifier of equal size to the existing circular secondary clarifier. Modifications will include the removal of the existing air diffusion system and scum, decant, and waste activated sludge (WAS) piping, and the installation of a concrete, peripheral launder, and a new secondary clarifier mechanism complete with a walkway bridge, an FRP effluent weir and scum baffle and algae sweeps. The secondary clarifier mechanism will be equipped with an energy dissipating inlet (EDI) well within a center flocculating feed well (FFW) and an effluent weir located around the perimeter of the concrete launder. The central EDI well will be equipped with outlet vanes that will be designed to improve settling efficiency by directing flow tangentially outward within the FFW. Influent flow will then pass down below the FFW into the clarifier basin. The effluent weir will be located within the interior of the clarifier to utilize the inboard effluent launders as wall baffles to prevent upward wall currents. The clarifier will be equipped with spiral scrapers to improve solids removal in the unit. A new scum box will be installed in the new clarifier which will connect to the existing capped 6-inch ductile iron pipe to the scum pump station. The dam located in the existing effluent drop box, which consists of two-by-fours and angle iron, will be removed. The record drawings show that a 24-inch secondary effluent line from the effluent drop box to the ultraviolet light disinfection system is installed and does not require any modifications.

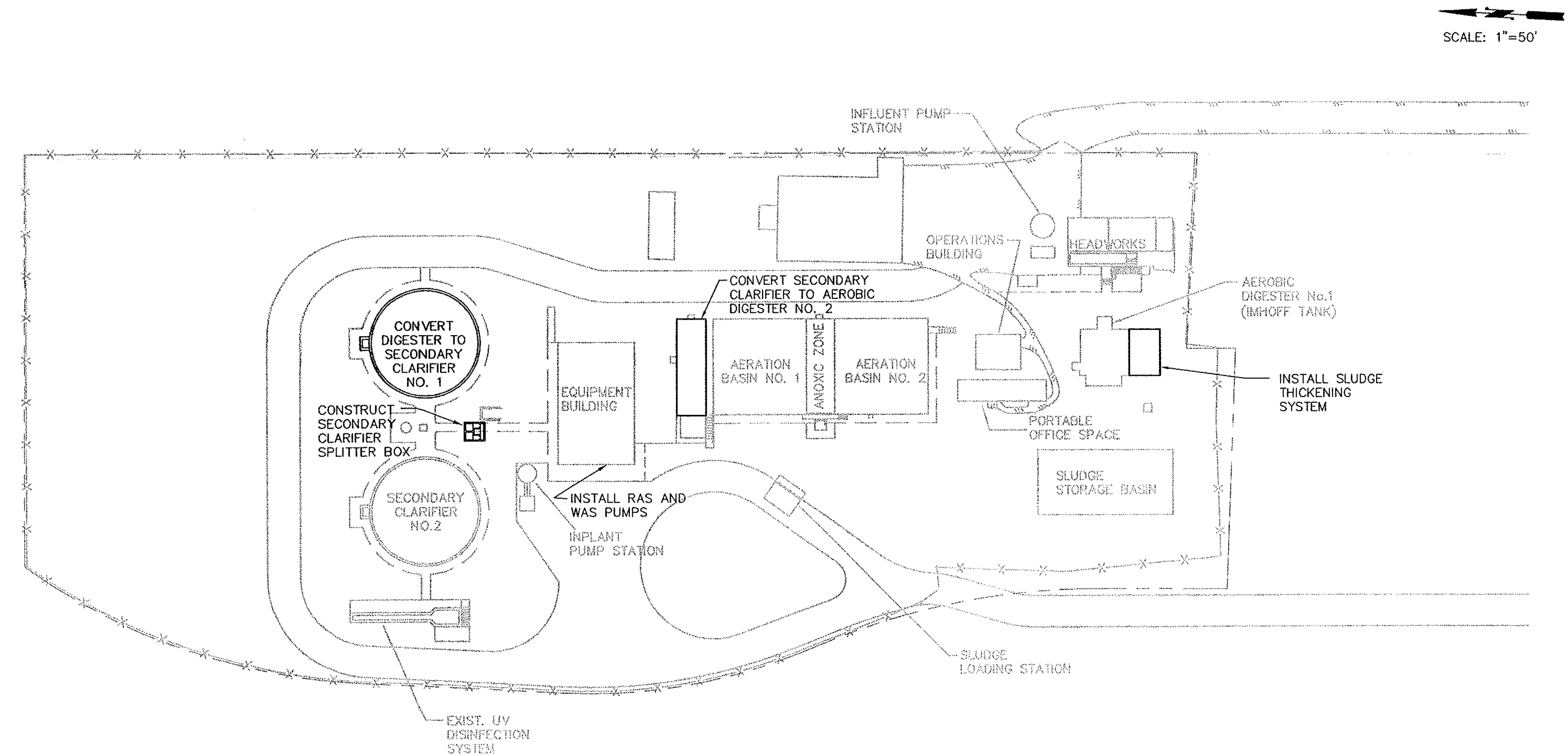
A new return activated sludge (RAS) pump and a new waste activated sludge pump (WAS) will be installed in the existing equipment building to serve the new clarifier and backup the existing RAS pumps and WAS pump. These pumps will be equivalent to the existing RAS and WAS pumps. The new RAS and WAS pumps will be located on new concrete housekeeping pads in the existing Equipment Building pump room in the locations which are shown as reserved for future pumps on the previous upgrade record drawings. Piping modification will be made in the pump room to connect the existing RAS/WAS pump common suction line to the existing 8-inch ductile iron sludge line, which is connected to the existing aerobic digester sludge hopper. Piping which connects this 8-inch sludge line to the sludge transfer pump will be removed and a new connection to the sludge transfer pump will be made to allow the existing sludge transfer pump to transfer sludge to and from the new aerobic digester as discussed in the aerobic digester section of this report. WAS piping in the pump room will be modified to connect the new WAS pump to the existing common RAS/WAS suction and discharge lines. The existing underground 4-inch WAS discharge line to the existing aerobic digester, which is currently plugged, will be abandoned and the 4-inch piping in the pump room will be removed and reconfigured to connect to the sludge transfer pump line to the new aerobic digester to allow WAS to be transferred by the WAS pumps directly to the new aerobic digester if necessary. Normal operation will continue to be to pump WAS to the existing Imhoff tank for thickening and then transferring the sludge from the Imhoff tank to the new aerobic digester.

A new separate RAS discharge line, which will connect to the common RAS discharge line will be installed in the pump room. This new discharge line will have a new RAS magnetic flow meter to match the existing RAS magnetic flow meter. The plant control system will use the signal from each RAS magnetic flow meter to control the speed of the RAS pump which is associated with it.

CONVERT EXISTING RECTANGULAR SECONDARY CLARIFIER TO AEROBIC DIGESTER

The existing standby secondary clarifier will be modified to serve as an aerobic digester by raising the wall height an additional 4 feet and installing an air diffusion system. The modified aerobic digester will have the capability of being operated as a process to significantly reduce pathogens (PSRP), in conjunction with the existing Imhoff tank and sludge storage tank, when accommodating the entire projected maximum month sludge loadings. The PSRP requires a solids retention time (SRT) between 40 days at 20 degrees C and 60 days at 15 degrees C. The total aerobic digestion volume required to obtain a SRT of 60 days for the loadings associated with the 2009 design year at a sludge concentration of 3.0 percent is 165,000 gallons. The new aerobic digester will have sufficient capacity to produce a Class “B” biosolid suitable for land application when combined with a sludge thickening system which will thicken the sludge in the range of 3 percent. The volume of the modified aerobic digester will be 64,000 gallons. The total combined volume of the aerobic digestion system will be 172,000 gallons, or 0.172 million gallons (MG).

A new coarse bubble diffuser system will be installed in the modified aerobic digester for oxidation and mixing. The existing digester blower will be retained to provide air to the new aerobic digester and new underground piping will be installed to connect to the existing air line in the vicinity of the modified aerobic digester.



LEGEND:

- FENCE
- PROPERTY LINE

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN
FIGURE 8-1
PHASE 1
WWTP SITE PLAN (2009, 0.7 MGD)

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Piping will be installed to allow WAS to be transferred to the new aerobic digester by either the WAS pumps or the sludge transfer pump. An 8-inch PVC overflow pipe will be installed from the digester to the plant drain pump station and the digester will be equipped with a high level alarm float. A new sludge thickening system will be installed to thicken the sludge to 3 percent, as discussed below. The aerobic digester design calculations are presented below and the aerobic digester design criteria are summarized at the end of this section.

The total solids (TS) in the aerobic digesters is calculated as follows:

Total Solids in Digesters = (0.172 MG)(30,000 mg/L)(8.34) = 43,000 lb

With a volatile solids (VS) production of 642 lb/day and 305 lb/day of inert total suspended solids, and assuming 40 percent VS destruction in the aerobic digesters, the mass of solids to be removed is:

Mass of Solids Wasted = (642 lb/day)(0.6) + 305 = 690 lb/day

The SRT is then estimated:

SRT = (Mass of solids in the digester)/(mass flow rate of solids leaving the digester)
SRT = (43,000 lb)/(690 lb/day) = 62 days

The existing 100 horsepower (hp) aerobic digester blower has sufficient capacity for aeration and mixing of the new aerobic digesters. This blower will alternate on and off in conjunction with the new submersible mixers on a time schedule. A new sludge loading pump will be installed adjacent to the converted aerobic digester to transfer digested sludge from the converted digester to the sludge loading station.

INSTALL SLUDGE THICKENING/DEWATERING SYSTEM

A sludge thickening system will be installed to thicken the aerobic digester biosolids to 3 percent. Thickening the digester biosolids reduces the required treatment volume and dewatering the waste sludge reduces the sludge disposal costs. The sludge thickening system will consist of a rotary drum thickener, polymer addition system, magnetic flow meter, and rotary lobe sludge thickener transfer pump. The rotary drum thickener, new sludge thickener pump and polymer addition system will be located adjacent to the existing Imhoff tank on a new concrete pad as shown on Figure 8-1. A new structural steel supported canopy will be constructed to protect the sludge thickening system from rain.

The new polymer addition system will be located within a heated enclosure, which will also contain a reduced pressure backflow preventer and attachment to the potable water system for polymer dilution. The sludge thickener pump will recirculate sludge from the existing Imhoff tank to the rotary drum thickener at a rate of about 50 gal/min (gpm). A liquid polymer preparation system will inject polymer solution downstream of a static mixer located on the influent sludge line to the screw press. Thickened sludge will discharge from the rotary drum thickener discharge chute and drop back into the existing Imhoff tank at a concentration of about 6 percent. When operated in this fashion, approximately half of the contents of the Imhoff tank are required to thicken a full tank to 3 percent. With a full volume of 54,000 gallons, about 27,000 would be required to be thickened to 6 percent in the thickener. At a flow rate of 50 gpm, thickening of a full tank would take approximately 9 hours. Batch thickening can then be accomplished approximately once a week for 9 hours or twice a week for 4.5 hours. Upon shutdown of the rotary drum thickener hand hose-down of the unit is required to prevent sludge from drying of the drum and clogging the drum screen. The rotary drum thickener will have a solenoid valve and connection to the non-potable water system for the thickener spray bar assembly and will have a drain connection to the existing drain line connected to the Imhoff tank decant line.

CONSTRUCT SECONDARY CLARIFIER SPLITTER BOX

A secondary clarifier splitter box will be constructed to divide flows equally to the two secondary clarifiers. Each splitter box will have an 8-inch cutthroat flume at the same elevation to split the flow equally with minimal head loss and will be equipped with stop gates, which can be closed to allow flow isolation of a clarifier.

CONSTRUCT OUTFALL MODIFICATIONS IN LAKE RIVER

As described in the Outfall Mixing Study/Water Quality Evaluation presented in Appendix D of the Facility Plan, it is recommended that the outfall be modified to improve the mixing of effluent within Lake River. It is recommended that the outfall be extended approximately 100 feet to discharge through a new diffuser located 7 feet below the water surface. These modifications will increase the dilution available in the mixing zone at the diffuser, such that no reasonable potential to exceed state water quality standards will exist, based on the outfall modeling. It is recommended that this outfall extension be constructed in 2006 as part of the Phase 1 WWTP Improvements.

PROJECT COST ESTIMATE

The estimated capital project costs for Phase 1 of the WWTP improvements are presented in Table 8-1.

TABLE 8-1

Ridgefield WWTP – Phase 1 Preliminary Project Cost Estimate (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1.	Mobilization/Demobilization	1 LS	$220,000	$220,000
2.	Demolition	1 LS	$ 20,000	$ 20,000
3.	Convert Existing Aerobic Digester to Secondary Clarifier	1 LS	$227,000	$227,000
4.	Build New Aerobic Digester	1 LS	$150,000	$150,000
5.	Secondary Clarifier Splitter Box	1 LS	$ 60,000	$ 60,000
6.	Install Sludge Thickening System	1 LS	$300,000	$300,000
7.	Extend outfall to Lake River	1 LS	$ 90,000	$ 90,000
8.	Dewatering	1 LS	$ 75,000	$ 75,000
9.	Earthwork	1 LS	$200,000	$200,000
10.	Site Work	1 LS	$ 73,000	$ 73,000
11.	Miscellaneous Metals	1 LS	$ 60,000	$ 60,000
12.	Painting	1 LS	$ 23,000	$ 22,000
13.	Mechanical/Yard Piping	1 LS	$200,000	$200,000
14.	Electrical	1 LS	$200,000	$200,000

Subtotal $1,897,000
Construction Contingency (25%) .... $ 474,000
Subtotal $2,371,000
Washington State Sales Tax (7.9%) .... $ 187,000
Total Estimated Construction Cost $2,558,000
Engineering, Administrative & Legal Services (25%) .... $ 640,000
Total Estimated Project Cost $3,198,000

The City commissioned Gray & Osborne to perform a capacity analysis of the WWTP following the Phase 1 improvements. The Capacity Analysis, included in Appendix L, determined that the WWTP has the capacity to treat a maximum month influent loading of 1,240 lb/day or BOD_5 and TSS, each.

WWTP IMPROVEMENTS PHASE 2

The Phase 2 WWTP improvements will further expand the current conventional activated sludge operation, to allow the plant capacity rating to be increased to the flow and loading rates projected for the year 2012 (maximum month flow of 1.0 mgd). The Phase 2 improvements are necessary to utilize the full capacity of the Lake River outfall and to accommodate growth of City population during the time period required for obtaining permits for constructing an outfall to the Columbia River.

The Phase 2 WWTP improvements site plan is shown in Figure 8-2. The components of Phase 2 are outlined below.

HEADWORKS MODIFICATIONS

No influent pump station modifications are anticipated due to the capacity increase associated with new collection system pump stations that will pump directly to the headworks. Collection system pump station modifications are presented in Chapter 7.

The design peak hour flow for the Phase 2 project is 2.10 mgd. The existing headworks facilities, such as the mechanical fine screen, grit removal system and Parshall flume, have capacities exceeding 2.1 mgd per Table 5-5.

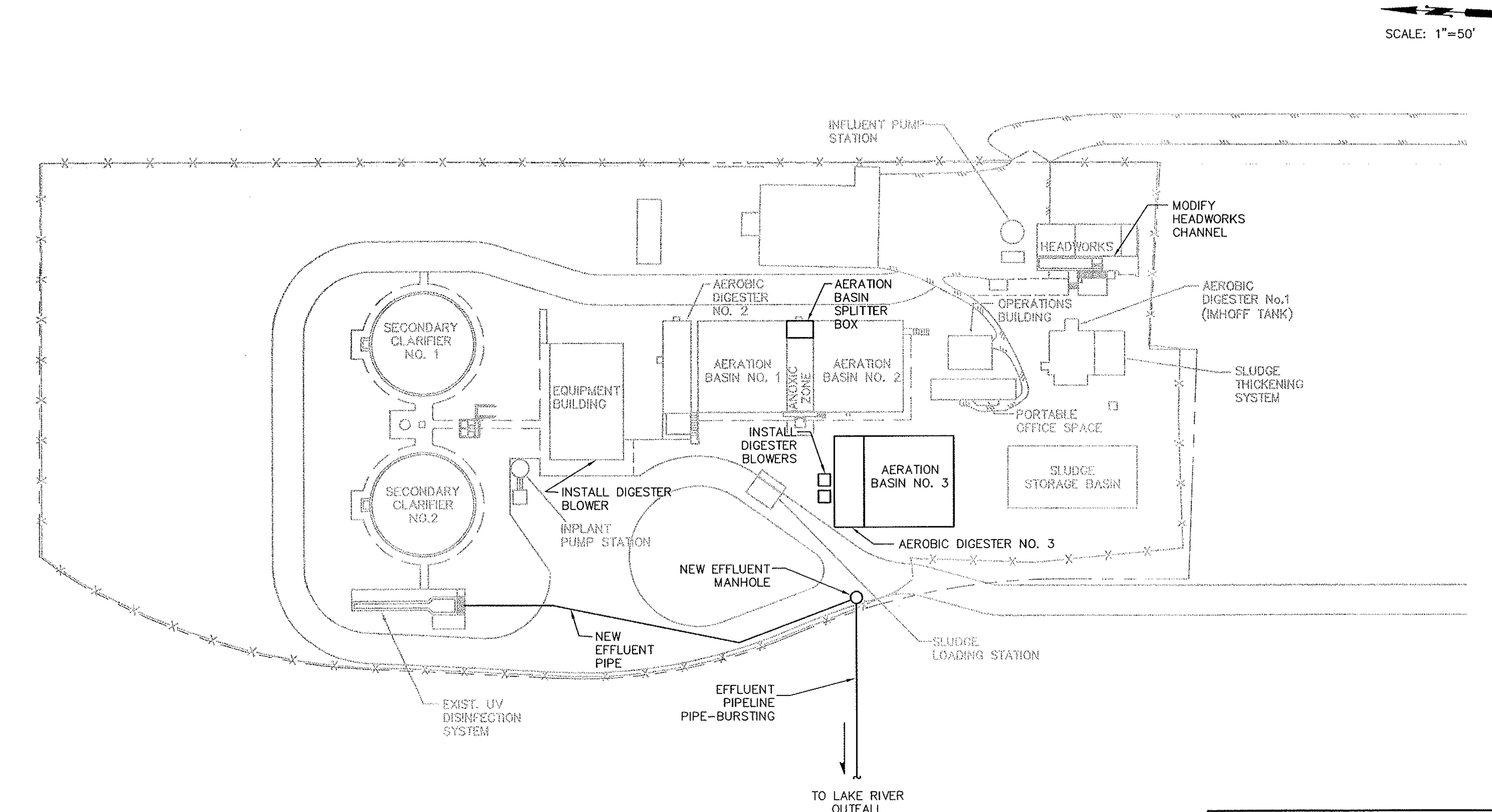
City staff have noted that surging currently occurs at the headworks upstream of the mechanical fine screen under some conditions. The influent pump station force main and the Gee Creek force main discharge into a concrete box immediately upstream of the fine screen. When multiple pumps are in operation simultaneously, surging will occur in the influent box and the headworks channel. It is recommended that the influent box be modified to increase energy dissipation of the pumped influent and thereby reduce the surging action when multiple pumps operate simultaneously.

CONSTRUCT ADDITIONAL AERATION BASIN

The biological removal of both carbonaceous and nitrogenous material will be performed utilizing the two existing aeration basins and a new third aeration basin. Suspended microbial growth in the basins will remove both organic pollutants and nitrogen from the wastewater. The system will be designed to provide complete nitrification and organic material oxidation to meet the expected NPDES permit effluent limits, with an aerobic SRT of 11.4 days. The aeration basin volume required to provide an 11.4 day SRT for the year 2012 flow and loading rates, with an MLSS concentration of 3,500 mg/L, is 521,000 gallons. The existing aeration basins provide an aerobic volume of 348,000 gallons. It is recommended that a third aeration basin be constructed with an aerobic volume of 174,000 gallons, which is equivalent to the volume of each existing basin.

The existing anoxic zone volume will continue to be used as an anoxic biological selector, with three zones in series designed to promote the rapid uptake of soluble substrate and to yield a mixed liquor with good settling characteristics. The anoxic selector will provide a limited amount of denitrification which will recover some of the alkalinity consumed by nitrification in the aeration basin. An aeration basin splitter structure will be constructed in the east end of the anoxic basin. Equally-sized troughs with cutthroat flumes will divide flows equally to each of the three aeration basins. This splitter box design minimizes head losses.

A new aeration basin would be constructed west of the existing Aeration Basin No. 1. Aeration and mixing of the new aeration basin will be accomplished using an air



LEGEND:

FENCE

PROPERTY LINE

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN
FIGURE 8-2
PHASE 2 WWTP SITE PLAN
(2012, 1.0 MGD)

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distribution system consisting of stainless steel and PVC pipe, and fine bubble diffusers. Air will be supplied to the diffusers by the existing aeration manifold. A new low head, high volume propeller pump will recirculate nitrified mixed liquor from the new aeration basin back to the selector zones for denitrification. The new basin will be equipped with a dissolved oxygen probe, which will be connected into the existing dissolved oxygen/blower speed control loop in the plant's programmable logic controller (PLC).

The combined aeration demand for the three aeration basins, include mixing air in the selector basin, is 1290 standard cubic feet per minute (scfm). The existing three 50 hp aeration basin blowers (two duty, one standby) have sufficient capacity for the modified aeration basin system (800 scfm each) and will be used for this system.

ALKALINITY ADDITION SYSTEM

The nitrification process in the aeration basins consumes alkalinity. If the influent wastewater does not contain sufficient alkalinity to act as a buffer, the alkalinity can be depleted to the point that the pH of the system begins to drop. Low pH could inhibit nitrification and result in violation of the NPDES permit (the effluent pH must be between 6 and 9 standard units).

Based on limited data to the alkalinity of the influent wastewater is estimated at 250 mg/L. Due to this low concentration of alkalinity, and limited alkalinity recovery from denitrification, under some conditions alkalinity addition will be needed. The two most cost-effective sources of alkalinity are 25 percent sodium hydroxide and hydrated lime. Due to the maintenance and cleaning requirements of lime systems and the ready availability of sodium hydroxide in the Ridgefield area, it is recommended to install a sodium hydroxide addition system.

An alkalinity addition system will be installed to provide up to 350 lb/day of alkalinity in the form of 25 percent sodium hydroxide (NaOH). This volume will be sufficient for the loading requirements for the conditions in the Capacity Analysis (Appendix L) and for the Phase 2 improvements.

In order to provide the 350 lb/day of alkalinity as $CaCO_3$, 105 gallons of 25 percent sodium hydroxide will need to be added each day. To provide the City with three weeks of storage, the alkalinity addition system will consist of one 2,500-gallon storage tank installed within a concrete secondary containment structure.

Two chemical metering pumps will be installed to feed the sodium hydroxide into the aeration basin influent box. The pumps will be positive displacement peristaltic pumps complete with spring loaded pump heads, self-contained variable speed drives, and flexible extruded hose tubing. The pumps will each have a flow capacity of between 0.01 and 20 gph.

UV DISINFECTION SYSTEM CAPACITY

The WWTP currently provides ultraviolet (UV) light disinfection through an open-channel, horizontal, low-pressure, low-intensity system. The system consists of a single channel with three banks in series (two duty, one standby). The UV system was designed to disinfect 1.93 mgd with a UV transmittance of 65 percent at a dose of 33 mJ/cm^2.

UV disinfection systems are typically designed to hydraulically pass the peak hour flow while providing disinfection capacity for the peak day flow. The Phase 2 design peak day flow rate is 1.56 mgd. Therefore, the existing UV disinfection system has sufficient capacity for Phase 2.

EFFLUENT PIPELINE MODIFICATIONS

Final effluent travels through a 10-inch pipeline from Effluent Manhole #3 to the Lake River outfall. The recommended third aeration basin will be in the same location as the existing Effluent Manhole #3. In addition, head losses through the effluent pipeline would result in submergence of the UV system at the Phase 2 peak hour flow rate of 2.1 mgd.

The capacity of the effluent pipeline will be increased by pipe-bursting the existing 10-inch concrete pipe to install a new 12-inch pipeline between existing Effluent Manhole #1 (nearest the outfall) and Effluent Manhole #3. This alignment is primarily along a road in Port of Ridgefield property (the City has an access easement). Pipe bursting will reduce ground disturbance and the volume of (contaminated) soils that must be removed.

It is recommended that Effluent Manhole #3 be replaced with a new manhole at a new location west of the third aeration basin. A new 15-inch pipe will be installed between the UV structure and the new outfall manhole, to reduce head losses at peak flow rates.

No modifications to the in-river outfall are required.

CONSTRUCT ADDITIONAL AEROBIC DIGESTER

The total aerobic digestion volume required to obtain a SRT of 60 days for the sludge production rates associated with the 2012 design year at a digested sludge concentration of 3.0 percent is 233,000 gallons. The volumes of the existing digester tanks are:

- Digester No. 1 (former Imhoff Tank): 54,000 gallons
- Digester No. 2 (modified rectangular clarifier): 64,000 gallons
- Sludge Storage tank: 54,000 gallons.

It is recommended that a new 64,000 gallon aerobic digester be constructed, with a common wall with the new aeration basin, to provide a total digestion volume of 236,000 gallons. The new tank would have a maximum side water depth of 16 feet. Sludge could overflow from Digester No. 2 into the new Digester No. 3, which would be operated in a fill and draw mode. Piping would be provided to use the existing Sludge Loading Pump to transfer digested sludge from Digester No. 3 to the existing sludge loading station. The digester would be equipped with two submersible, propeller-type mixers to provide mixing when the aeration blower is turned off.

Two existing blowers in the Equipment Building would be available to provide air to the aerobic digestion process (the three 50 hp blowers will be used for the aeration basins). The design criteria for the digesters blowers per the equipment operation and maintenance manuals are as follows:

- Blower No. 4 – 100 hp motor; 1,477 scfm @ 7.5 psig
- Blower No. 5 – 25 hp motor; 345 scfm @ 10 psig

The total blower demand for the aerobic digesters is 1,003 scfm, with almost half of that demand in the first digester (where much of the volatile solids reduction will take place). As piping will be available to direct WAS to any digester, it is recommended that each digester, except for the new Digester No. 3 which will be used for sludge loading, be provided with a dedicated 30 hp blower capable of providing at least 475 scfm. The existing Blower No. 5 (25 hp) will be used to provide air to the new Digester No. 3, which will have the lowest air demand. The air supply to each digester will be separate, as the digesters may be operated at different sludge depths and provide different backpressure on the blowers. Separate blowers and air piping will allow the air flow to each digester to be adjusted individually.

It is recommended that Blower No. 4 (100 hp) be replaced with three new 30 hp blowers. One blower would be installed in the space for Blower No. 4, and two blowers will be installed in weatherproof enclosures adjacent to the new digester. The third blower will provide standby capacity for the blowers dedicated to each of the digesters.

PROJECT COST ESTIMATE

The estimated capital project costs for Phase 2 of the WWTP improvements are presented in Table 8-2.

TABLE 8-2

Ridgefield WWTP – Phase 2 Preliminary Project Cost Estimate
(2007 Dollars)

No.	Item	Quantity		Unit Price	Amount
1	Mobilization/Demobilization	1	LS	$500,000	$500,000
2	Demolition	1	LS	$ 25,000	$ 25,000
3	Headworks Modifications	1	LS	$ 15,000	$ 15,000
4	Modify Anoxic Zone/New Splitter Box	1	LS	$ 65,000	$ 65,000
5	Aeration Basin (0.174 MG)	1	LS	$700,000	$700,000
6	Aerobic Digester No. 3 (0.064 MG)	1	LS	$350,000	$350,000
7	Digester Blowers	3	EA	$ 45,000	$135,000
8	Pipe-burst Effluent Pipeline	1,000	LF	$ 200	$200,000
9	Site Dewatering	1	LS	$ 75,000	$ 75,000
10	Earthwork	1	LS	$225,000	$225,000
11	Misc. Metals	1	LS	$ 90,000	$ 90,000
12	Painting	1	LS	$ 90,000	$ 90,000
13	Site Work (incl. contaminated soils removal)	1	LS	$225,000	$225,000
14	Mechanical/Yard Piping	1	LS	$675,000	$675,000
15	Electrical	1	LS	$850,000	$850,000
16	Instrumentation	1	LS	$ 50,000	$ 50,000
17	I&C Programming	1	LS	$ 30,000	$ 30,000

Subtotal..$4,300,000
Construction Contingency (25%)..$1,075,000
Subtotal..$5,375,000
Washington State Sales Tax (7.9%)..$ 425,000
Total Estimated Construction Cost $5,800,000
Engineering, Administrative & Legal Services (25%)........................$1,450,000
Total Estimated Project Cost $7,250,000

PRELIMINARY SCREENING FOR WWTP PHASE 3 AND 4 IMPROVEMENTS ALTERNATIVES

Processes which were selected for preliminary screening for Phase 3 and 4 of the WWTP improvements were those which were similar to the existing process or those using components of the existing WWTP. Screening in this manner ensures cost-effective use of existing facilities and allows improvements to be constructed within the confines of the existing WWTP, thereby reducing overall project costs and impact to the local environment. Each alternative incorporates additional new headworks facilities, new UV disinfection facilities, a new effluent pump station, a new outfall to the Columbia River, and expansion of the aerobic digestion process for biosolids handling. All of the processes considered incorporate nitrification to ensure compliance with future projected NPDES permit effluent limits.

The volume of the existing aeration basins is insufficient for treating projected future flows and loadings for the liquid stream process alternatives, but this volume combined with the volume of the existing standby, rectangular secondary clarifier is sufficient for aerobic digester expansion when combined with a sludge thickening system. Therefore, it is recommended that the existing aeration basin and standby secondary clarifier be used to expand the aerobic digestion process to operate in series with the existing aerated sludge storage basins.

Each of the preliminary alternatives will also have the capability to be expanded beyond the design capacity and upgraded to incorporate other forms of advanced treatment such as phosphorus removal if required in the future.

The three alternative processes selected for preliminary screening are conventional activated sludge, activated sludge membrane bioreactor (MBR), and sequencing batch reactor (SBR). Each alternative will provide adequate treatment to meet the existing and projected future NPDES effluent permit limits for the flows and loadings projected for the year 2024, and each will meet the requirements for a reliability class 2 plant.

CONVENTIONAL ACTIVATED SLUDGE – ALTERNATIVE NO. 1

This alternative would require the construction of new conventional activated sludge aeration basins, since the existing aeration basins are not adequately sized for the design loadings. Each new aeration basin would have three selector zones designed to promote the rapid uptake of soluble substrate, yielding a mixed liquor with good settling characteristics. Each aeration basin would also have four aerobic zones and two anoxic zones for nitrification control. A third secondary clarifier would be required to provide efficient and effective solids separation for the flows and loadings projected for the year 2024.

A summary of the advantages and disadvantages of this treatment process is presented below:

Advantages	Disadvantages
• Ability to pass scum through aeration basins • Reliable process for removal of scum in secondary clarifiers • Produces sludge with excellent settling characteristics • Good expansion capabilities • Resistant to shock loads • Process can remove nitrogen • Similar to existing process	• Operational complexity • High operating costs • Large plant area

ACTIVATED SLUDGE/MEMBRANE BIOREACTOR – ALTERNATIVE NO. 2

Activated sludge with membrane filtration, which is commonly referred to as a Membrane Bioreactor (MBR) Process, involves the use of activated sludge aeration basins with equipped with submerged membrane filtration units. Modules containing the membrane filtration units can be placed directly in the aeration basin to provide filtration of the mixed liquor. A low vacuum pump draws the mixed liquor through the micropores of the membrane filter, or hydrostatic pressure above the membranes pushes mixed liquor through the membrane micropores, resulting in a very high quality filtrate (permeate). Fouling of the filtration units is controlled by air injection around the membranes and by chemical cleaning. The use of membrane filtration eliminates the need for secondary clarifiers and allows for the MLSS concentration in the aeration basin to be maintained at 8,000 mg/L or greater, thereby reducing the aeration basin volume required when compared with the conventional activated sludge process, which typically operates at 2,000 to 4,000 mg/L MLSS. Membrane filtration processes typically require influent flow equalization to reduce the quantity of membrane units. The existing secondary clarifier and circular aerobic digester can be modified to serve as equalization tanks. A summary of the advantages and disadvantages of this treatment process is presented below.

Advantages	Disadvantages
• Secondary clarifiers not required • Process can be altered to remove nitrogen • Produces high quality effluent that can be suitable for water reclamation • High operational MLSS results in smaller aeration basin volume • Smaller land area requirement	• Possibility of scum accumulation in aeration basins • System dependent on filter pumps • Relies on computer controlled cleaning and pumping operations • Cleaning of membrane filters required • Greater aeration requirements required for air scouring of membranes • Very high membrane capital costs • Operational Complexity • High operating costs/high membrane replacement costs • Equalization basin and additional pumps required for systems with high I/I flows • Lifting mechanisms for membrane units recommended

SEQUENCING BATCH REACTORS – ALTERNATIVE NO. 3

This option includes the construction of two new SBR basins. An SBR is a fill-and-draw activated sludge process treatment system. Unlike the conventional activated sludge process, which requires separate units for aeration and solids separation, the SBR utilizes a single unit to accomplish both processes in timed sequence. The five steps of an SBR system are as follows:

1. Fill
2. React (aeration)
3. Settle (sedimentation/clarification)
4. Draw (decant)
5. Idle (sludge wasting)

Flow equalization of the discharge from the SBR process is needed to reduce the required capacity of downstream disinfection and effluent pumping/conveyance systems. The existing secondary clarifier and circular aerobic digester can be modified to serve as equalization tanks. A summary of the advantages and disadvantages of this treatment process is presented below.

Advantages	Disadvantages
• Eliminates possibility of short circuiting • Provides a quiescent settling environment • Secondary clarifiers and sludge return pumps not required • Process can be altered to remove nitrogen • Less land area is required if I/I flows not excessive • Flow splitting to SBR basins not required	• Scum control difficult due to trapping in SBR basin. • Requires a sludge pump for each basin • Operational Complexity: Relies on computer controlled cycle times, equipment operation, and valve actuators • High operating costs/larger blowers required • High decant flow requires equalization or larger UV system • Poor bioselection results in high SVI sludge; more dilute sludge to aerobic digester • More sensitive to peak flows from I/I

COMPARISON OF ALTERNATIVES

Each of the three preliminary wastewater treatment process alternatives was evaluated based on a list of criteria encompassing a variety of economic, environmental, and non-monetary considerations. The eleven criteria used for this comparative analysis, along with a brief description of each, are listed below.

- Proven reliability - ranks the operational reliability of each process based on experience at existing installations using similar process configurations.

- Operational stability - refers to the stability of each treatment process in terms of operational parameters such as MLSS, SRT, and sludge volume index (SVI) etc.

- Phased expansion - ranks the ability of each alternative to accommodate a phased expansion schedule while utilizing the existing facilities to their fullest extent.

- Aesthetics/visibility - rates the extent to which the expanded plant will visually impact those living and working in the vicinity of the treatment plant.

- Odor control - considers the need for and cost of the odor control measures that would be required to maintain the release of objectionable odors below acceptable limits.

- Capital Costs - capital expenditures required for design and construction of the treatment plant.
- Operating Costs - the cost of operating and staffing the facility once the treatment plant has been constructed.
- WWTP footprint – ranks the alternative on the required WWTP footprint in consideration of real estate costs.
- Maintenance levels - ranks the alternatives based on the level of maintenance required to maintain the equipment in good working condition.
- Operational complexity - gives an indication of the complexity of the treatment process in terms of operator knowledge and required attention.

The three preliminary wastewater treatment alternatives were rated as poor, fair or good for each of the criteria listed above. The results of this analysis are presented in Table 8-3.

TABLE 8-3

Ridgefield WWTP Preliminary Comparison of Wastewater Treatment Process Alternatives

Criteria	Alt. No. 1 Conventional Activated Sludge	Alt. No. 2 Activated Sludge with MBR	Alt. No. 3 SBR
Proven Reliability	3	2	2
Operational Stability	3	3	2
Suitability to Phased Expansion	3	3	2
Aesthetics/Visibility	2	3	1
Odor Control	2	2	2
Capital Costs	3	1	2
Operating Costs	2	1	2
WWTP Footprint	2	3	2
Maintenance Levels	3	1	2
Operational Complexity	3	2	2
Total	**26**	**21**	**19**
Legend: 3 – good, 2 – fair, 1 – poor Higher total indicates the more preferred alternative.			

The preliminary screening performed in Table 8-3 indicates that the SBR alternative is lower ranked than the other two alternatives.

Based on the preliminary screening of the three alternatives presented, two alternatives have been selected for further selection. Alternative No. 1 will expand the current mode of conventional activated sludge treatment. Alternative No. 2 will convert the existing treatment plant to activated sludge with membrane bioreactor.

ALTERNATIVE NO. 1 – CONVENTIONAL ACTIVATED SLUDGE EXPANSION

This alternative will expand the WWTP capacity and continue the use of conventional activated sludge treatment, similar to the existing operation, to treat the projected 2024 flows and loadings to meet the existing and projected future NPDES permit effluent limits. The completed Alternative No. 1 site plan for Phase 4 is shown in Figure 8-3.

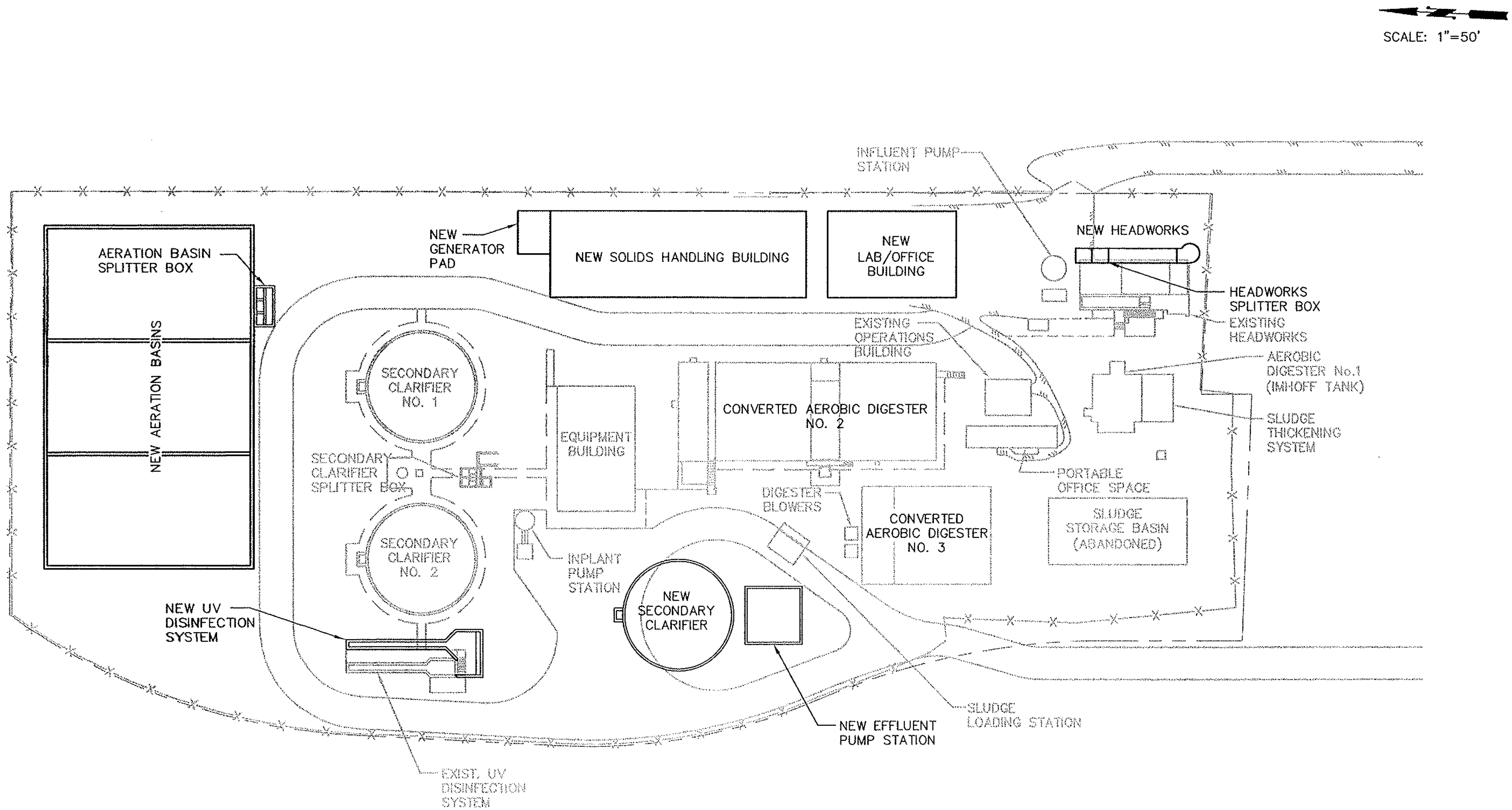
Phases 3 and 4 of WWTP improvements will further expand the current conventional activated sludge operation to allow the plant capacity rating to be increased to the flows and loadings projected for the year 2024, with a maximum month flow of 2.68 mgd. The components of Alternative No. 1 are outlined below:

CONSTRUCT HEADWORKS/MODIFY EXISTING HEADWORKS

The record drawings for the previous WWTP upgrade show space allocated for a future second headworks structure. In order to accommodate the flows associated with the design year 2024, the new headworks will receive pumped flow from both the existing influent pump station and the new collection system pump station. A magnetic flow meter will be installed on each of the influent force mains to measure the influent flow rate. The new headworks structure will have a new high capacity self-cleaning filter screen capable of screening the 20-year peak hour flow, screenings washer/compactor, bypass bar screen, and a Pista grit chamber. The existing headworks will be retained to provide grit removal and overflow screening. A splitter box will be installed downstream of the new filter screen in the new headworks to split the flow of screened influent to the two Pista grit chambers. The existing headworks will be modified to increase its capacity by removing the existing mechanical fine screen and the existing influent flume. The existing grit dewatering system will be retained to serve both headworks.

CONSTRUCT AERATION BASINS

The biological removal of both carbonaceous and nitrogenous material will be performed utilizing three new aeration basins. Suspended microbial growth in the parallel basins will remove both organic pollutants and nutrients, in the form of ammonia and nitrate nitrogen, from the wastewater. Three new equally sized aeration basins will be



LEGEND:

FENCE

PROPERTY LINE

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN

FIGURE 8-3

ALTERNATIVE NO. 1, PHASE 4 WWTP SITE PLAN (2024, 2.68 MGD)

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constructed. Flows entering each basin will first pass through three selector zones designed to promote the rapid uptake of soluble substrate, yielding a mixed liquor with good settling characteristics. The selector walls will be fabricated with HDPE panels and structural steel supports. The selector zones will be followed by two anoxic zones and three aerobic zones. The anoxic and aerobic zones will be separated by internal concrete walls. Aeration and mixing of the aerobic zones will be accomplished using an air distribution system consisting of stainless steel and PVC pipe, and fine bubble diffusers. Air will be supplied to the diffusers by new multi-stage, low-noise centrifugal blowers, which will be located in the existing equipment building. Mixing of the anoxic zones will be achieved using submerged, low speed, propeller mixers. Low head, high volume propeller pumps will recirculate nitrified mixed liquor from the aerobic zones back to the anoxic zones for denitrification.

In order to provide adequate treatment to meet NPDES permit effluent limits and provide nitrification, an 11.4 day SRT is recommended. The aeration basin volume required to provide an 11.4 day SRT for the year 2024 flows and loadings, with an MLSS concentration of 3,500 mg/L is 1.386 MG. An additional 0.462 MG of anoxic zones will be constructed to optimize denitrification.

CONSTRUCT AERATION BASIN SPLITTER BOX

An aeration basin splitter box will be constructed to divide flows equally to the three aeration basins. The aeration basin splitter box will share a common wall with the aeration basins. The splitter box will have three overflow weir gates, which can be raised to allow flow isolation of an aeration basin. The aeration basin splitter box will receive flow from the headworks structures, as well as pumped flow from the secondary clarifier RAS pumps and plant drain pumps.

CONSTRUCT THIRD SECONDARY CLARIFIER

A third secondary clarifier will be constructed to accommodate the flows and loadings associated with the design year 2024. The new clarifier will be a circular center feed unit, with a diameter of 50-feet, to match the size of the other two clarifiers. The clarifier will be designed for both solids separation and solids thickening. Each clarifier will be equipped with an energy dissipating inlet (EDI) well within a center flocculating feed well (FFW) and an effluent weir located around the perimeter of each basin. The central EDI well will be equipped with outlet vanes that will be designed to improve settling efficiency by directing flow tangentially outward within the FFW. Influent flow will then pass down below the FFW into the clarifier basin. The effluent weirs will be located within the interior of the clarifier to utilize the inboard effluent launders as wall baffles to prevent upward wall currents. The new clarifier will be equipped with spiral scrapers to improve solids removal in the unit.

A new RAS pump will be installed in the equipment building to serve the new clarifier. The two existing RAS pumps will be modified with new motors to provide the required capacity. A third additional new WAS pump will also be installed in the equipment building.

CONSTRUCT UV DISINFECTION SYSTEM MODIFICATIONS

The existing low pressure, low intensity UV disinfection system will be replaced by a low pressure high intensity system. A second parallel channel will be constructed to contain half of the UV banks. Flow to each of the channels will be equally split upstream, and both channels will discharge to a new drop box with a common extended finger weir.

CONSTRUCT EFFLUENT PUMP STATION AND PIPELINE TO OUTFALL IN COLUMBIA RIVER

A new effluent pump station and outfall to the Columbia River will be constructed downstream of the UV disinfection system. Two new vertical turbine pumps will be installed in a new concrete wet well. The pumps will discharge to a 24-inch force main to a six-port diffuser outfall in the Columbia River. This pump station wet well structure will also serve as a non-potable water wet well.

INSTALL AERATION BLOWERS

Three new centrifugal blowers capable of supplying 875 scfm each will be installed in the equipment building to supply air to the new aeration basins. One of the three existing aeration basin blowers, the existing Digester No. 1 Blower, and the existing generator, which are currently located in the equipment building, will be removed. Two of the new blowers will be capable of supplying sufficient air to all three of the new aeration basins for aeration and mixing. The third blower will be supplied to allow for the required redundancy for air supply to the aeration basins.

The laterals to each of the aeration basins will be equipped with an air flow meter and an automatic throttling valve. The blowers will be multi-stage centrifugal blowers equipped with variable frequency drives. Blower output and consequently air flow to the basins will be modulated based on the dissolved oxygen concentration in the first oxic zone. The dissolved oxygen concentration in these zones will be measured using in-situ dissolved oxygen probes. There will be two probes in each of the first oxic zones and the blowers will be controlled to target a predetermined dissolved oxygen concentration using an average of the middle two measured dissolved oxygen values. An overall aeration control software package will be implemented that will simultaneously control the blower intake valves, the blower speed and the throttling valves on each of the laterals. This will maintain the desired dissolved oxygen concentration in the aeration basins, while at the same time minimizing the blower discharge pressure and output to conserve power.

CONVERT EXISTING AERATION BASIN TO AEROBIC DIGESTER

The existing aeration basin will be converted to serve as an aerobic digester. The combined volume of the existing aeration basins, anoxic basin, the aerobic digester converted in Phase 1, the third aeration basin and aerobic digester constructed in Phase 2, and converted Imhoff tank is 704,000 gallons. The total aerobic digestion volume required to obtain a SRT of 60 days for the loadings associated with the 2024 design year at a sludge concentration of 3 percent is 620,000 gallons. The combined volume of these process units will therefore have sufficient capacity to produce a Class “B” biosolid suitable for land application when combined with a sludge thickening system which will thicken the sludge in the range of 3 percent. The rotary drum thickener, which will be installed in Phase 1, will be moved to the vicinity of the converted aerobic digester during Phase 3.

One of the existing aeration basin blowers will be sufficient to provide aeration and mixing to the converted digester. A second existing aeration basin blower will also be retained for redundancy.

INSTALL SLUDGE DEWATERING SYSTEM

Digested sludge will be dewatered using a new screw press, located in the new solids handling building. The digested sludge will be pumped from the aerobic digesters to the screw press using a new digested sludge pump. The influent solids concentration of the digested sludge will be about 3 percent. This will then be injected with activated polymer and thickened to approximately 20 to 25 percent by the screw press. Dewatered sludge will be discharged to a spiral conveyor for transport to the sludge dryer system.

INSTALL SLUDGE DRYER

A sludge dryer can be installed to produce Class “A” biosolids and significantly reduce biosolids volume. Biosolids that are Class “A” with respect to pathogen removal may be land applied with fewer restrictions than Class “B” biosolids. Class “A” biosolids must meet the same pollutant concentration and vector attraction reduction requirements as Class “B” biosolids. WAC 173-308 lists several Processes to Further Reduce Pathogens (PFRPs), which along with fecal coliform monitoring (less than 1000 Most Probable Number [MPN]/gram total solids), will demonstrate that the treated biosolids are Class “A” with respect to pathogens. Two PFRPs may apply to the sludge drying system:

1. Heat drying: Biosolids dried to 90 percent or greater solids content, by direct or indirect contact with hot gases, while the temperature of the biosolids exceeds 80 degrees C.

2. Pasteurization: Biosolids must be maintained at a temperature of 70 degrees C or greater for a period of at least 30 minutes.

The vector attraction reduction requirement may be met by producing biosolids with greater than 75 percent solids content prior to mixing with any other materials.

Sludge dryers may receive unstabilized (undigested) dewatered biosolids. However, raw sludges that are dried may produce odors or attract vectors when re-wetted during storage or land application. The converted aerobic digesters will have the required capacity to produce a Class "B" biosolid, therefore the risk of odors and vector attraction is eliminated. Note that it is required that the biosolids achieve 90 percent dryness to be classified as Class "A."

The new dewatering screw press and conveyor would be used to dewater the dryer feed to 20 to 25 percent solids as discussed above. The sludge dryer would be located adjacent to the dewatering screw press in the solids handling building. For one type of indirect fixed dryer, sludge would be mixed with mixers on a hollow central shaft. The mixers and shaft are filled with recirculating hot oil. The hot oil causes evaporation of the water in the feed sludge. Dried biosolids (at approximately 115 degrees C) exit the dryer onto a product cooling conveyor, which cools and transports the biosolids into a storage hopper. Dried biosolids may be stored in a 20 cubic yard container for land application hauling, or in a 5 cubic yard container for local deliveries.

Off-gases from the sludge dryer would be passed through a condenser/cooler unit and a compressor for discharge to the aeration basins. The sludge dryer manufacturer recommends passing the condensed off-gases through the aeration basin by a compressor and coarse-bubble diffuser for further treatment. Other odor treatment methods could be evaluated during the design phase.

The temperature of the recirculating hot oil for the sludge dryer would be maintained at 200 degrees C by a natural gas fired boiler. WWTP record drawings indicate that a 2-inch natural gas line terminates at the existing public works shop. The boiler and associated equipment would also be housed in the new solids handling building.

CONSTRUCT LAB/OFFICE BUILDING

A new laboratory and control building will be constructed to accommodate the increased staff and workload needed to operate the expanded WWTP, provide for a new laboratory, and house the electrical motor control centers. The new laboratory and control building will be approximately 40 feet by 60 feet in dimension and will contain an electrical room, a laboratory, an office, a locker room with shower and toilets, and a mechanical room. The new laboratory will be equipped with the analytical instruments necessary to perform in-plant testing and will have more bench space to prepare and layout sampling equipment and samples than the existing laboratory.

CONSTRUCT SOLIDS HANDLING BUILDING

A new solids handling building will be constructed to house the dewatering equipment and the sludge dryer equipment. The new solids handling building will be approximately 4,800 square feet. Construction of the new solids handling building and lab/office building will require the existing public works shop to be demolished as shown in the proposed site plan.

AUXILIARY GENERATOR

A new diesel generator will be installed to provide emergency power to the modified WWTP.

ALTERNATIVE NO. 1 PROJECT AND O&M COSTS

The estimated capital project costs for the combined Phase 3 and 4 WWTP improvements, Alternative No. 1, are presented in Table 8-4. Costs for the Columbia River effluent pipeline and outfall project are not included. The estimated annual operation and maintenance costs for the design year 2024 (Phase 4) for Alternative No. 1 are presented in Table 8-5.

TABLE 8-4

Ridgefield WWTP – Alternative No. 1, Phases 3 and 4 (Conventional Activated Sludge) Preliminary Project Cost Estimate (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1.	Mobilization/Demobilization	1 LS	$1,012,000	$1,012,000
2.	Demolition	1 LS	$ 70,000	$ 70,000
3.	Construct Effluent Pump Station	1 LS	$ 300,000	$ 300,000
4.	Build New Aeration Basin	1 LS	$1,938,000	$1,938,000
5.	Install Aeration Basin Blowers	1 LS	$ 225,000	$ 225,000
6.	Construct New Sec. Clarifier	1 LS	$ 290,000	$ 290,000
7.	Convert Ex Aeration Basin to Aerobic Digester	1 LS	$ 20,000	$ 20,000
8.	Install Sludge Dewatering System	1 LS	$ 400,000	$ 400,000
9.	Install Sludge Dryer	1 LS	$1,200,000	$1,200,000
10.	Solids Handling Building	1 LS	$ 720,000	$ 720,000
11.	Add UV	1 LS	$ 200,000	$ 200,000
12.	Build Aeration Basin Splitter	1 LS	$ 50,000	$ 50,000
13.	Exist Headworks Modifications	1 LS	$ 130,000	$ 130,000
14.	Construct New Headworks	1 LS	$ 175,000	$ 175,000
15.	Construct Lab/Office Building	2400 SF	$250	$600,000

TABLE 8-4 – (continued)

Ridgefield WWTP – Alternative No. 1, Phases 3 & 4 (Conventional Activated Sludge) Preliminary Project Cost Estimate (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
16.	Install New Generator	1 LS	$ 60,000	$ 60,000
17.	Dewatering	1 LS	$ 75,000	$ 75,000
18.	Earthwork	1 LS	$ 480,000	$ 480,000
19.	Site Work	1 LS	$ 633,000	$ 633,000
20.	Miscellaneous Metals	1 LS	$ 253,000	$ 253,000
21.	Painting	1 LS	$ 380,000	$ 380,000
22.	Mechanical/Yard Piping	1 LS	$1,706,000	$1,706,000
23.	Electrical	1 LS	$1,898,000	$1,898,000

Subtotal $12,815,000
Construction Contingency (25%) ....$ 3,204,000
Subtotal $16,019,000
Washington State Sales Tax (7.9%) ....$ 1,266,000
Total Estimated Construction Cost $17,285,000
Engineering, Administrative & Legal Services (25%) ....$ 4,321,000
Total Estimated Project Cost..$21,606,000

TABLE 8-5

Ridgefield WWTP – Alternative No. 1 (Phase 4) (Conventional Activated Sludge) Estimated Annual O&M Costs (2007 Dollars)

Item	Cost
Labor	$400,000
Power	$223,000
Polymer	$ 42,000
Natural Gas (Sludge Dryer)	$ 35,000
Maintenance	$113,000
Miscellaneous (lab and permit fees, etc.)	$ 30,000
Total	**$843,000**

ALTERNATIVE NO. 2 – ACTIVATED SLUDGE WITH MEMBRANE BIOREACTOR

This alternative will expand the WWTP capacity and ultimately convert the operation to activated sludge treatment with a membrane bioreactor (MBR) in order to treat the projected flows and loadings to meet the existing and projected future NPDES permit effluent limits. The completed Alternative No. 2, Phase 4 site plan is shown in Figure 8-4. Figure 8-4 shows the expanded WWTP to fit within the existing WWTP site.

The WWTP Phase 3 and 4 improvements will modify the plant operation to activated sludge with membrane bioreactor to allow the plant capacity rating to be increased to the flows and loadings projected for the year 2024, with a maximum month flow of 2.68 mgd. The components of Alternative No. 2 Phases 3 and 4 are outlined below:

CONSTRUCT NEW HEADWORKS/MODIFY EXISTING HEADWORKS

The record drawings for the previous WWTP upgrade show space allocated for a future second headworks structure. In order to accommodate the flows associated with the design year 2024, the new headworks will receive pumped flow from both the existing influent pump station and the new collection system pump station. A magnetic flow meter will be installed on each of the influent force mains to measure the influent flow rate. The new headworks structure will have a new high capacity 2-mm self-cleaning filter screen capable of screening the 20-year peak hour flow, screenings washer/compactor, bypass bar screen, and a Pista grit chamber. This level of fine screening (2-mm) is required to protect the membranes in the MBR process. The existing headworks will be retained to provide grit removal and overflow screening. A splitter box will be installed downstream of the new filter screen in the new headworks to split the flow of screened influent to the two Pista grit chambers. The existing headworks will be modified to increase its capacity by removing the existing mechanical fine screen and the existing influent flume. The existing grit dewatering system will be retained to serve both headworks.

CONSTRUCT NEW MBRS

The biological removal of both carbonaceous and nitrogenous material and the solids separation process will be performed utilizing three MBR process trains. Suspended microbial growth in the parallel basins will remove both organic pollutants and nutrients, in the form of ammonia and nitrate nitrogen, from the wastewater. The biological process in the MBR process is identical to that of the conventional activated sludge process with the addition of membrane filters, which filter the biomass solids from the MBR effluent and thereby eliminate the need for secondary clarifiers for gravity solids separation. The mixed liquor concentration within the MBR units can be maintained at two to three times the typical concentrations used in activated sludge processes. Due to the high MLSS concentration, longer SRTs can be maintained in a smaller tank. In general, the overall plant footprint for MBR systems can be smaller than that required by a conventional activated sludge system due to smaller activated sludge basins and absence of secondary clarifiers. However, to minimize the number of membranes required, flow equalization is required to provide influent storage during flow periods in excess of the maximum month flow. The MBR process will produce a high quality effluent suitable for water reclamation purposes. However, in order to provide a direct comparison between the two alternatives, costs for additional components required for Class A water reclamation, such as reclaimed water storage, post aeration, post chlorination, bypass facilities, additional monitoring requirements and reclaimed water distribution are not included in the comparison of alternatives. It should also be noted that if reclaimed water storage capacity is needed, additional land may be required outside of the current WWTP footprint.

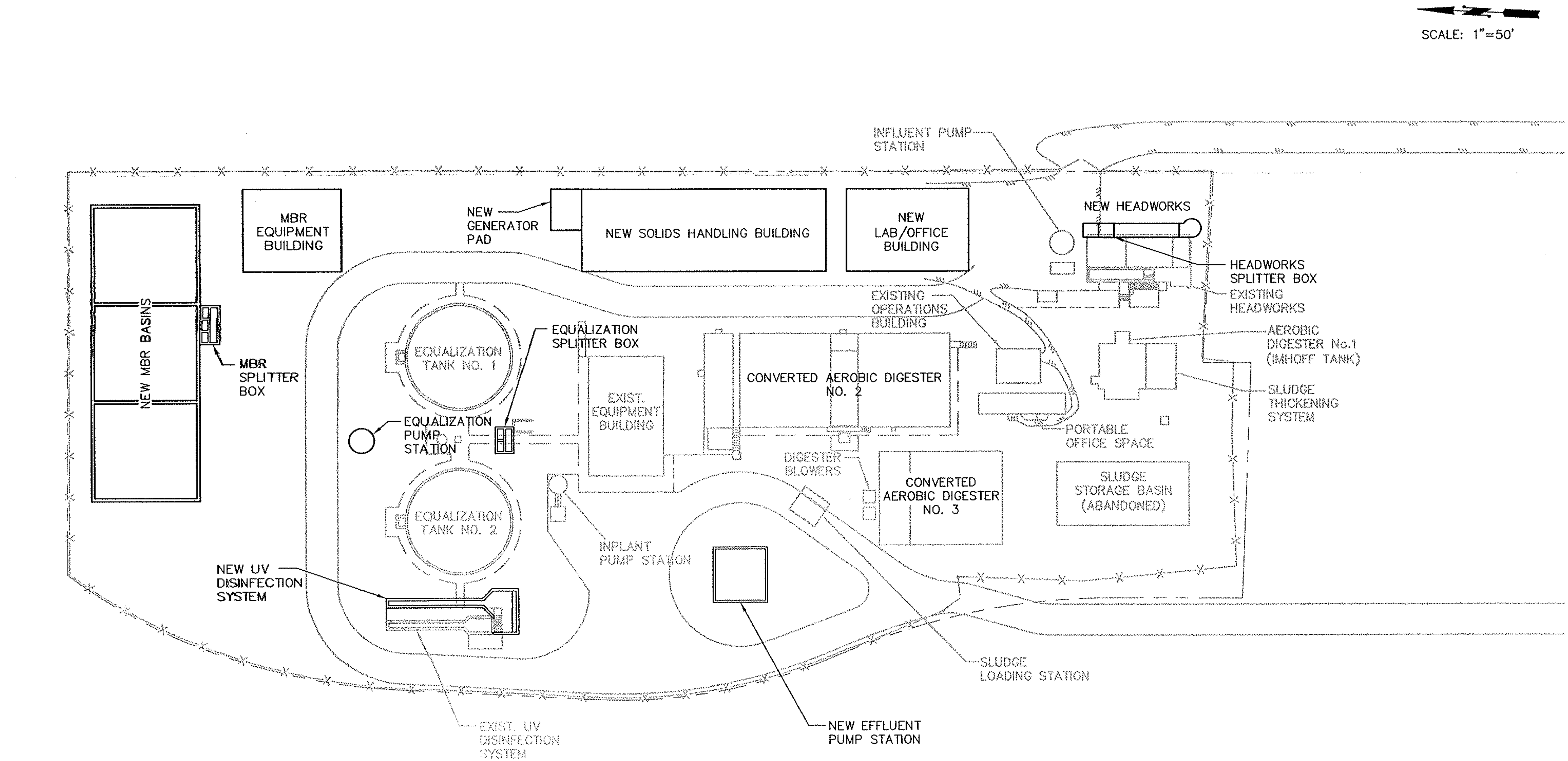
Three new equally sized MBRs will be constructed. Flows entering each basin will pass through two anoxic zones and four aerobic zones. The anoxic and aerobic zones will be separated by internal concrete walls. Aeration and mixing of the aerobic zones will be accomplished using an air distribution system consisting of fine bubble diffusers. Air will be supplied to the diffusers by new multi-stage, low-noise centrifugal blowers, which will be located in the existing equipment building. Mixing of the anoxic zones will be achieved using submerged, low speed, propeller mixers. Low head, high volume propeller pumps will recirculate nitrified mixed liquor from the aerobic zones back to the anoxic zones for denitrification.

In order to provide adequate treatment to meet NPDES permit effluent limits, provide nitrification and to provide a stable process for membrane filtration, an SRT of 12.5 days is recommended. The MBR volume required to accommodate the membrane filters and to provide a 12.5 day SRT for the year 2024 flows and loadings and provide anoxic zones with an MLSS concentration of 8,000 mg/L is 0.872 MG.

Equipment which will be supplied by the MBR manufacturer includes all of the process equipment associated with the MBRs including the submerged membrane units, aeration blowers, air diffusion equipment, membrane chemical cleaning system, permeate pumps, recycle pumps, WAS pumps, flow meters, level transmitters, pressure transmitters, MBR control system, piping and valves. The MBR equipment will be sized to treat the year 2024 maximum flow of 2.68 mgd.

CONSTRUCT MBR EQUIPMENT BUILDING

A new building will be constructed to house the MBR equipment discussed above. The new MBR equipment building will be approximately 40 foot by 45 foot in dimension.



LEGEND:

FENCE

PROPERTY LINE

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN
FIGURE 8-4
ALTERNATIVE NO. 2, PHASE 4
WWTP SITE PLAN (2024, 2.68 MGD)

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CONSTRUCT MBR SPLITTER BOX

A MBR splitter box will be constructed to divide flows equally to the three MBRs. The MBR splitter box will share a common wall with the MBR tanks. The splitter box will have three overflow weir gates, which can be raised to allow flow isolation of an MBR. The MBR splitter box will receive pumped flow from the equalization pump station.

CONVERT EXISTING SECONDARY CLARIFIERS TO EQUALIZATION TANKS/CONSTRUCT EQUALIZATION PUMP STATION

To minimize the MBR equipment and operation and maintenance costs, flow equalization is required to provide influent storage during flow periods in excess of the maximum month flow. Assuming the MBR equipment can process peak flows of 2.0 times the design maximum month flow for 8 hours duration and 1.3 times the design maximum month flow for 24 hours duration, an equalization volume of 316,000 gallons is required. The two 50-foot-diameter clarifiers have a total volume of 412,000 gallons with 2 feet of freeboard and therefore have sufficient volume for flow equalization.

Screened and degritted effluent from the headworks will flow by gravity to the MBR splitter box to the MBRs. When the water surface elevation in the MBR reaches high level, overflow from the MBR splitter will flow to the secondary clarifier splitter box which will be constructed as part of Phase 1 construction and redesignated as the equalization tank splitter box in Phase 3. This splitter box will serve to split the flow to the converted equalization tanks and allow for either of the equalization tanks to be isolated by raising the slide gate to that tank. The existing clarifier mechanisms will be removed, an air diffusion system will be installed, and each clarifier will be equipped with a cover for odor control. A new equalization pump station will be constructed to convey flow to the MBR splitter box when the water surface elevation in the MBRs is below high level. The equalization pump station will be a precast concrete manhole with three pumps. Two pumps will be capable of pumping two times the maximum flow and the third pump will serve as a redundant backup pump.

CONSTRUCT UV DISINFECTION SYSTEM MODIFICATIONS

The existing low pressure, low intensity UV disinfection system will be replaced by a low pressure high intensity system. A second parallel channel will be constructed to contain half of the UV banks. Flow to each of the channels will be equally split upstream, and both channels will discharge to a new drop box with a common extended finger weir.

CONSTRUCT EFFLUENT PUMP STATION AND PIPELINE TO OUTFALL IN COLUMBIA RIVER

A new effluent pump station and outfall to the Columbia River will be constructed downstream of the UV disinfection system. Two new vertical turbine pumps will be installed in a new concrete wet well. The pumps will discharge to a 24-inch force main to a six port diffuser outfall in the Columbia River. This wet well structure will also serve as a non-potable water wet well.

CONVERT EXISTING AERATION BASIN TO AEROBIC DIGESTER

The existing aeration basin will be converted to serve as an aerobic digester. The combined volume of the existing aeration basins, anoxic basin, the aerobic digester converted in Phase 1, the third aeration basin and aerobic digester constructed in Phase 2, and converted Imhoff tank is 704,000 gallons. The total aerobic digestion volume required to obtain a SRT of 60 days for the loadings associated with the 2024 design year at a sludge concentration of 3 percent is 620,000 gallons. The combined volume of these process units will therefore have sufficient capacity to produce a Class “B” biosolid suitable for land application when combined with a sludge thickening system which will thicken the sludge in the range of 3 percent. The rotary drum thickener, which will be installed in Phase 1, will be moved to the converted aerobic digester during Phase 3.

One of the existing aeration basin blowers will be sufficient to provide aeration and mixing to the converted digester. A second existing aeration basin blower will also be retained for redundancy.

INSTALL SLUDGE DEWATERING SYSTEM

Digested sludge will be dewatered using a new screw press, located in the new solids handling building. The digested sludge will be pumped from the aerobic digesters to the screw press using a new digested sludge pump. The influent solids concentration of the digested sludge will be about 3 percent. This will then be injected with activated polymer and thickened to approximately 20 to 25 percent by the screw press. Dewatered sludge will be discharged to a spiral conveyor for transport to the sludge dryer system.

INSTALL SLUDGE DRYER

A sludge dryer can be installed to produce Class “A” biosolids and significantly reduce biosolids volume. Biosolids that are Class “A” with respect to pathogen removal may be land applied with fewer restrictions than Class “B” biosolids. Class “A” biosolids must meet the same pollutant concentration and vector attraction reduction requirements as Class “B” biosolids. WAC 173-308 lists several Processes to Further Reduce Pathogens (PFRPs), which along with fecal coliform monitoring (less than 1,000 MPN/gram total solids), will demonstrate that the treated biosolids are Class “A” with respect to pathogens. Two PFRPs may apply to the sludge drying system:

1. Heat drying: Biosolids dried to 90 percent or greater solids content, by direct or indirect contact with hot gases, while the temperature of the biosolids exceeds 80 degrees C.

2. Pasteurization: Biosolids must be maintained at a temperature of 70 degrees C or greater for a period of at least 30 minutes.

The vector attraction reduction requirement may be met by producing biosolids with greater than 75 percent solids content prior to mixing with any other materials.

Sludge dryers may receive unstabilized (undigested) dewatered biosolids. However, raw sludges that are dried may produce odors or attract vectors when re-wetted during storage or land application. The converted aerobic digesters will have the required capacity to produce a Class “B” biosolid, therefore the risk of odors and vector attraction is eliminated. Note that it is required that the biosolids achieve 90 percent dryness to be classified as Class “A.”

The new dewatering screw press and conveyor would be used to dewater the dryer feed to 20 to 25 percent solids as discussed above. The sludge dryer would be located adjacent to the dewatering unit in the solids handling building. For one type of indirect fixed dryer, sludge would be mixed with mixers on a hollow central shaft. The mixers and shaft are filled with recirculating hot oil. The hot oil causes evaporation of the water in the feed sludge. Dried biosolids (at approximately 115 degrees C) exit the dryer onto a product cooling conveyor, which cools and transports the biosolids into a storage hopper. Dried biosolids may be stored in a 20 cubic yard container for land application hauling, or in a 5 cubic yard container for local deliveries.

Off-gases from the sludge dryer would be passed through a condenser/cooler unit and a compressor for discharge to the aeration basins. The sludge dryer manufacturer recommends passing the condensed off-gases through the aeration basin by a compressor and coarse-bubble diffuser for further treatment. Other odor treatment methods could be evaluated during the design phase.

The temperature of the recirculating hot oil for the sludge dryer would be maintained at 200 degrees C by a natural gas fired boiler. WWTP record drawings indicate that a 2-inch natural gas line terminates at the existing public works shop. The boiler and associated equipment would also be housed in the new solids handling building.

CONSTRUCT NEW LAB/OFFICE BUILDING

A new laboratory and control building will be constructed to accommodate the increased staff and workload needed to operate the expanded WWTP, provide for a new laboratory, and house the electrical motor control centers. The new laboratory and control building will be approximately 40 feet by 60 feet in dimension and will contain an electrical room, a laboratory, an office, a locker room with shower and toilets, and a mechanical room. The new laboratory will be equipped with the analytical instruments necessary to perform in-plant testing and will have more bench space to prepare samples and layout equipment than the existing laboratory.

CONSTRUCT NEW SOLIDS HANDLING BUILDING

A new solids handling building will be constructed to house the dewatering equipment and the sludge dryer equipment. The new solids handling building will be approximately 4,800 square feet. Note that the construction of the new solids handling building and lab/office building require the existing public works shop to be demolished as shown in the proposed site plan.

AUXILIARY GENERATOR

A new diesel generator will be installed to provide emergency power to the modified WWTP.

ALTERNATIVE NO. 2 PROJECT AND O&M COSTS

The estimated capital project costs for the combined Phase 3 and 4 WWTP improvements, Alternative No. 2, are presented in Table 8-6. Costs for the Columbia River effluent pipeline and outfall project are not included. The estimated annual operation and maintenance costs for the design year 2024 (Phase 4) for Alternative No. 2 are presented in Table 8-7.

TABLE 8-6

Ridgefield WWTP – Alternative No. 2, Phases 3 and 4 (Activated Sludge with MBRs) Preliminary Project Cost Estimate (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1.	Mobilization/Demobilization	1 LS	$1,400,000	$1,400,000
2.	Demolition	1 LS	$ 70,000	$ 70,000
3.	Construct Effluent Pump Station	1 LS	$ 300,000	$ 300,000
4.	Construct Three New MBRs	1 LS	$ 675,000	$ 675,000
5.	MBR Equipment	1 LS	$3,500,000	$3,500,000
6.	MBR Equipment Building	1,800 SF	$ 225	$ 405,000
7.	Construct Equalization Tank Pump Station	1 LS	$ 105,000	$ 105,000
8.	Convert Secondary Clarifier to Equalization Tanks	1 LS	$ 190,000	$ 190,000
9.	Convert Secondary Clarifier Splitter to Equalization Tank Splitter	1 LS	$ 20,000	$ 20,000
10.	Convert Existing Aeration Basin to Aerobic Digester	1 LS	$ 40,000	$ 40,000

TABLE 8-6 – (continued)

Ridgefield WWTP – Alternative No. 2, Phases 3 and 4 (Activated Sludge with MBRs) Preliminary Project Cost Estimate (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
11.	Install Sludge Dewatering System	1 LS	$ 400,000	$ 400,000
12.	Install Sludge Dryer	1 LS	$1,200,000	$1,200,000
13.	Solids Handling Building	1 LS	$ 720,000	$ 720,000
14.	Add UV	1 LS	$ 200,000	$ 200,000
15.	Build Aeration Basin Splitter	1 LS	$ 50,000	$ 50,000
16.	Existing Headworks Modifications	1 LS	$ 130,000	$ 130,000
17.	Construct New Headworks	1 LS	$ 175,000	$ 175,000
18.	Construct Influent Pump Station	1 LS	$ 200,000	$ 200,000
19.	Construct Lab/Office Building	2,400 SF	$ 250	$ 600,000
20.	Generator	1 LS	$ 60,000	$ 60,000
21.	Dewatering	1 LS	$ 75,000	$ 75,000
22.	Earthwork	1 LS	$ 575,000	$ 575,000
23.	Site Work	1 LS	$ 890,000	$ 890,000
24.	Miscellaneous Metals	1 LS	$ 380,000	$ 380,000
25.	Painting	1 LS	$ 534,000	$ 534,000
26.	Mechanical/Yard Piping	1 LS	$2,670,000	$2,670,000
27.	Electrical	1 LS	$2,918,000	$2,918,000

Subtotal $18,482,000
Construction Contingency (25%) ....$ 4,621,000
Subtotal $23,103,000
Washington State Sales Tax (7.9%) ....$ 1,825,000
Total Estimated Construction Cost $24,928,000
Engineering, Administrative & Legal Services (25%) ....$ 6,232,000
Total Estimated Project Cost..$31,160,000

TABLE 8-7

Ridgefield WWTP – Alternative No. 2, Phase 4 (Activated Sludge with MBRs)
Estimated Annual O&M Costs
(2007 Dollars)

Item	Cost
Labor	$ 430,000
Power	$ 439,000
Polymer	$ 42,000
Natural Gas (Sludge Dryer)	$ 35,000
Maintenance	$ 141,000
Membrane Replacement Reserves(1)	$ 88,000
Miscellaneous (lab and permit fees, etc.)	$ 30,000
Total	**$1,205,000**

(1) Annual reserves to fund membrane replacement every 12 years.

SELECTED WWTP IMPROVEMENTS ALTERNATIVE

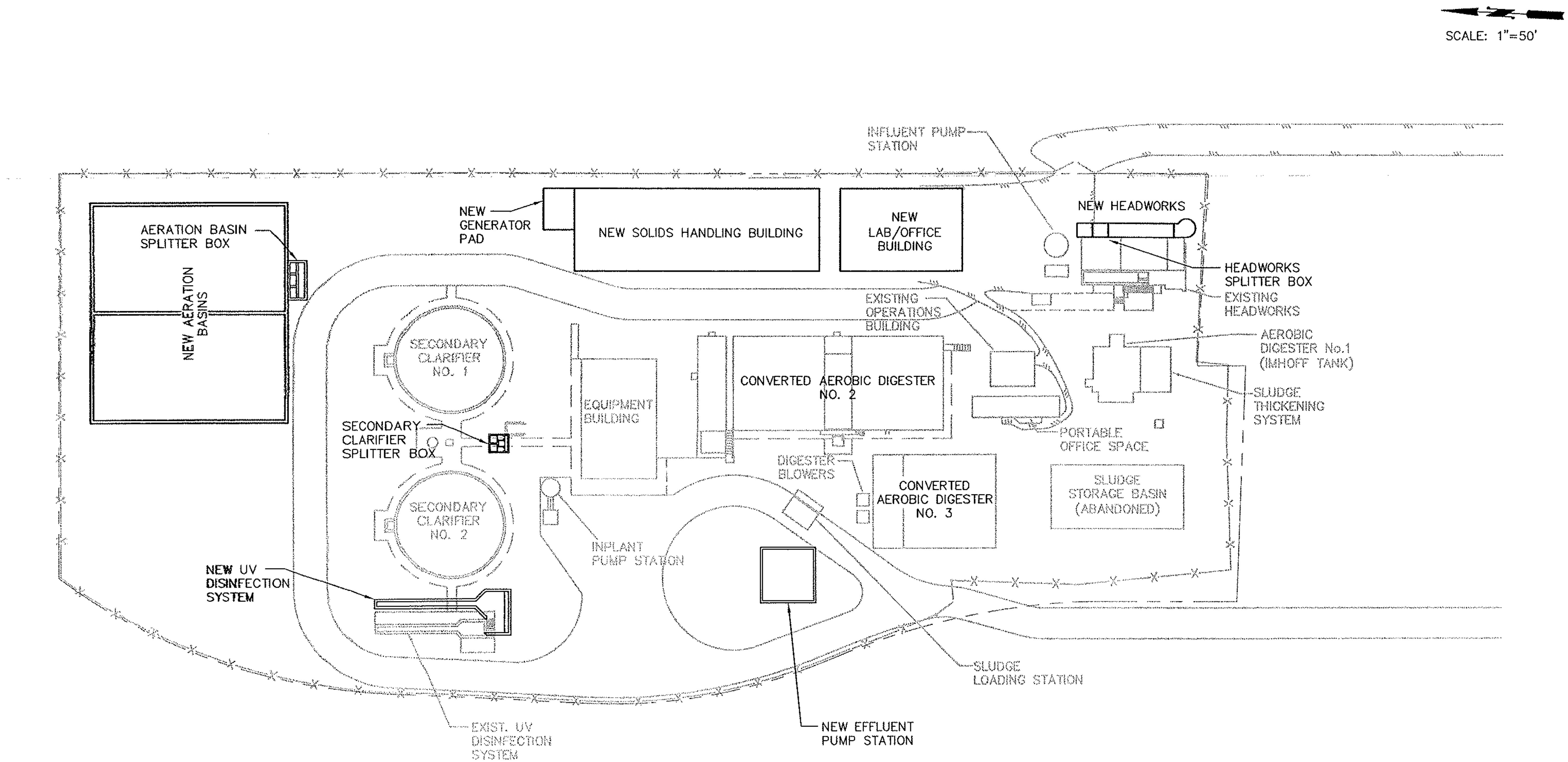
A comparison of capital and O&M costs for the two WWTP improvements alternatives shows that Alternative No. 1 is the best alternative for expanding the WWTP to provide adequate treatment to meet the existing and projected future NPDES effluent permit limits for the flows and loadings projected for the year 2024 and is therefore the recommended alternative. Although Alternative No. 1 has the lowest capital and O&M costs, it will have a significant rate impact on sewer customers. Therefore it is recommended that Alternative No. 1 be implemented in two phases of construction: Phases 3 and 4.

PHASING OF WWTP IMPROVEMENTS

The Alternative No. 1, Phase 3 improvements will provide adequate treatment to meet the existing and projected future NPDES effluent permit limits for the flows and loadings projected for the year 2019. The Alternative No. 1, Phase 4 improvements will provide adequate treatment to meet the existing and projected future NPDES effluent permit limits for the flows and loadings projected for the year 2024.

The site plan for Alternative No. 1, Phase 3 is shown in Figure 8-5.

The major elements for improvements for Alternative No. 1 Phases 1 through 4 are summarized below.



LEGEND:

FENCE

PROPERTY LINE

CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN

FIGURE 8-5

ALTERNATIVE NO. 1, PHASE 3 WWTP SITE PLAN (2019, 1.83 MGD)

Gray & Osborne, Inc.

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Alternative No. 1, Phase 1 – Design Year 2009:

1. Convert the existing 50-foot diameter aerobic digester to a secondary clarifier and install a new RAS pump and WAS pump in the existing equipment building.

2. Convert existing standby secondary clarifier to an aerobic digester.

3. Install a new waste sludge thickening facility.

4. Construct a new secondary clarifier splitter box.

5. Extend the existing effluent outfall 100 feet into Lake River to a new diffuser located 7 feet below the water surface.

Alternative No. 1, Phase 2 – Design Year 2012:

1. Modify headworks.

2. Modify the existing anoxic basin to include a new aeration basin splitter box.

3. Construct and equip a third aeration basin.

4. Construct and equip a third aerobic digester basin.

5. Remove one blower and install three new aerobic digester blowers.

6. Increase the diameter of the existing effluent pipeline.

Alternative No. 1, Phase 3 – Design Year 2019:

1. Construct new effluent pipeline and Columbia River outfall.

2. Construct new effluent pump station.

3. Construct new Aeration Basins No. 1 and No. 2.

4. Install new aeration basin blowers.

5. Convert existing aeration basin to an aerobic digester.

6. Install sludge dewatering system and solids handling building.

7. Modify UV disinfection system.

8. Construct headworks improvements.

Alternative No. 1, Phase 4 – Design Year 2024:

1. Construct third aeration basin.
2. Construct third secondary clarifier.
3. Construct lab/office building.
4. Modify UV disinfection system.

The detailed estimated capital project cost for Phases 3 and 4 are presented in Tables 8-8 and 8-9, respectively.

TABLE 8-8

Ridgefield WWTP – Alternative No. 1, Phase 3
Preliminary Project Cost Estimate
(2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1.	Mobilization/Demobilization	1 LS	$ 800,000	$ 800,000
2.	Demolition	1 LS	$ 70,000	$ 70,000
3.	Construct Effluent Pump Station	1 LS	$ 300,000	$ 300,000
4.	Build Two New Aeration Basins	1 LS	$1,295,000	$1,295,000
5.	Convert Existing Aeration Basin to Aerobic Digester	1 LS	$ 40,000	$ 40,000
6.	Install Sludge Dewatering System	1 LS	$ 400,000	$ 400,000
7.	Install Sludge Dryer	1 LS	$1,200,000	$1,200,000
8.	Add UV	1 LS	$ 150,000	$ 150,000
9.	Build Aeration Basin Splitter	1 LS	$ 50,000	$ 50,000
10.	Solids Handling Building	1 LS	$ 720,000	$ 720,000
11.	Aeration Blowers	1 LS	$ 225,000	$ 225,000
12.	Existing Headworks Modifications	1 LS	$ 130,000	$ 130,000
13.	Generator	1 LS	$ 60,000	$ 60,000
14.	Dewatering	1 LS	$ 60,000	$ 60,000
15.	Earthwork	1 LS	$ 350,000	$ 350,000
16.	Miscellaneous Metals	1 LS	$ 190,000	$ 190,000

TABLE 8-8 – (continued)

Ridgefield WWTP – Alternative No. 1, Phase 3
Preliminary Project Cost Estimate
(2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
17.	Painting	1 LS	$ 290,000	$ 290,000
18.	Site Work	1 LS	$ 470,000	$ 470,000
19.	Mechanical/Yard Piping	1 LS	$1,410,000	$1,410,000
20.	Electrical	1 LS	$1,410,000	$1,410,000

Subtotal .... $ 9,620,000
Construction Contingency (25%) .... $ 2,405,000
Subtotal $12,025,000
Washington State Sales Tax (7.9%) .... $ 950,000
Total Estimated Construction Cost $12,975,000
Engineering, Administrative & Legal Services (25%) .... $ 3,244,000
Total Estimated Project Cost $16,219,000

TABLE 8-9

Ridgefield WWTP – Alternative No. 1, Phase 4
Preliminary Project Cost Estimate
(2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1.	Mobilization/Demobilization	1 LS	$500,000	$500,000
2.	Demolition	1 LS	$ 20,000	$ 20,000
3.	Construct Third Aeration Basin	1 LS	$780,000	$780,000
4.	Construct Third Secondary Clarifier	1 LS	$290,000	$290,000
5.	Add UV	1 LS	$150,000	$150,000
6.	Construct New Headworks	1 LS	$175,000	$175,000
7.	Construct Lab/Office Building	2,400 SF	$ 250	$600,000
8.	Dewatering	1 LS	$ 60,000	$ 60,000
9.	Earthwork	1 LS	$350,000	$350,000
10.	Site Work	1 LS	$210,000	$210,000
11.	Miscellaneous Metals	1 LS	$ 85,000	$ 85,000
12.	Painting	1 LS	$120,000	$120,000
13.	Mechanical/Yard Piping	1 LS	$458,000	$458,000
14.	Electrical	1 LS	$650,000	$650,000

Subtotal $4,448,000
Construction Contingency (25%) $1,112,000
Subtotal $5,560,000
Washington State Sales Tax (7.9%) .... $ 439,000
Total Estimated Construction Cost $5,999,000
Engineering, Administrative & Legal Services (25%) $1,500,000
Total Estimated Project Cost $7,499,000

OUTFALL TO THE COLUMBIA RIVER

Developing a new outfall in the Columbia River will require three major construction elements. These consist of a 24-inch-diameter effluent pipeline, a diffuser to be placed in the main stem and an effluent pump station located at the WWTP. The system will be designed to serve the buildout flows for the Ridgefield UGA. In the 1990's the City pursued an effluent pipeline route across the Ridgefield National Wildlife Refuge. More recent evaluations have determined that routes across the wildlife refuge may not feasible due to permitting requirements. Appendix K includes a *Final Alternatives Risk Evaluation* prepared by the City in 2007. The City has decided to pursue a northern outfall route to the Columbia River (shown in Appendix K). The estimated project cost for the effluent pipeline and outfall for this route is included in Table 8-10.

TABLE 8-10

Columbia River Outfall
Preliminary Project Cost Estimate

No.	Item	Quantity		Unit Price	Amount
1	Mobilization, Cleanup, and Demobilization	1	LS	$419,000	$ 419,000
2	24-inch C905 Pipe, incl. fittings and bedding	27,200	LF	$ 85	$2,312,000
3	24-inch Steel Pipe incl. Weld, Casing, and Boring	1,400	LF	$ 350	$ 490,000
4	Locate Existing Utilities	1	LS	$ 20,000	$ 20,000
5	Erosion Control	1	LS	$ 50,000	$ 50,000
6	Additional Pipe Fittings	20,000	LB	$ 3	$ 60,000
7	Trench Safety Systems	1	LS	$ 54,000	$ 54,000
8	Drain Stations	3	EA	$ 25,000	$ 75,000
9	Combo Air Valve Station	5	EA	$ 30,000	$ 150,000
10	Gravel Backfill	10,000	CY	$ 20	$ 200,000
11	Foundation Gravel	1,000	TN	$ 25	$ 25,000
12	Crushed Surfacing, Top Course	8,300	TN	$ 30	$ 249,000
13	Cold Mix Asphalt	660	TN	$ 60	$ 40,000
14	HMA Cl. 3/8" PG. 58-22 (3"lift)	3,300	TN	$ 100	$ 330,000
15	Sawcutting	35,000	LF	$ 2	$ 70,000
16	Top Soil	300	CY	$ 35	$ 11,000
17	Hydroseed	6,100	SY	$ 3	$ 18,000
18	Traffic Control	700	HR	$ 45	$ 32,000

Subtotal $4,605,000
Construction Contingency (25%) $1,151,000
Subtotal $5,756,000
Washington State Sales Tax (7.9%) .... $ 455,000
Total Estimated Construction Cost $6,211,000
Engineering, Administrative and Legal Services (25%) $1,553,000
Right-of-Way Cost .... $ 484,000
Total Estimated Project Cost $8,248,000

Table 8-11 identifies the individual permitting components, including estimated time for the permitting processes that must be completed before construction of the new outfall can begin. The table includes a schedule for the time frame for completing each permit, however the time periods are not cumulative since several elements of work can proceed simultaneously.

TABLE 8-11

Columbia River Outfall Permitting Process

Permits[(1)]	Estimated Duration (Years)	Likely Schedule
Federal Permits		
Environmental Assessment (NEPA)	2	2008-2010
National Historic Preservation Act Sec. 106	0.5	2009
ESA Section 7 consultation report	2	2008-2010
ACOE Rivers & Harbors Act Section 10, Clean Water Act Section 404, Nationwide Permit #7 Outfalls	2.5	2008-2011
Geotechnical analysis for pipeline route	0.5	2010
Washington State Permits		
Hydraulic Project Approval, WDFW	0.5	2009
SEPA Environmental Checklist/MDNS	Completed as part of NEPA	2008-2010
Diffuser siting study	1	2009
Outfall analysis and review (Ecology)	0.5	2010
Local Permits		
Shoreline Substantial Development	0.5	2010
Private Permits		
Right-of-way lease/easements	0.5	2008

(1) Permitting requirements required for most construction projects.

SUMMARY OF COST ESTIMATES AND DESIGN CRITERIA

A comparison of the capital costs for Alternative No. 1 with Phases 3 and 4 constructed separated or together are presented in Table 8-12.

TABLE 8-12

Ridgefield WWTP – Alternative No. 1 Cost Estimate Summary (2007 Dollars)

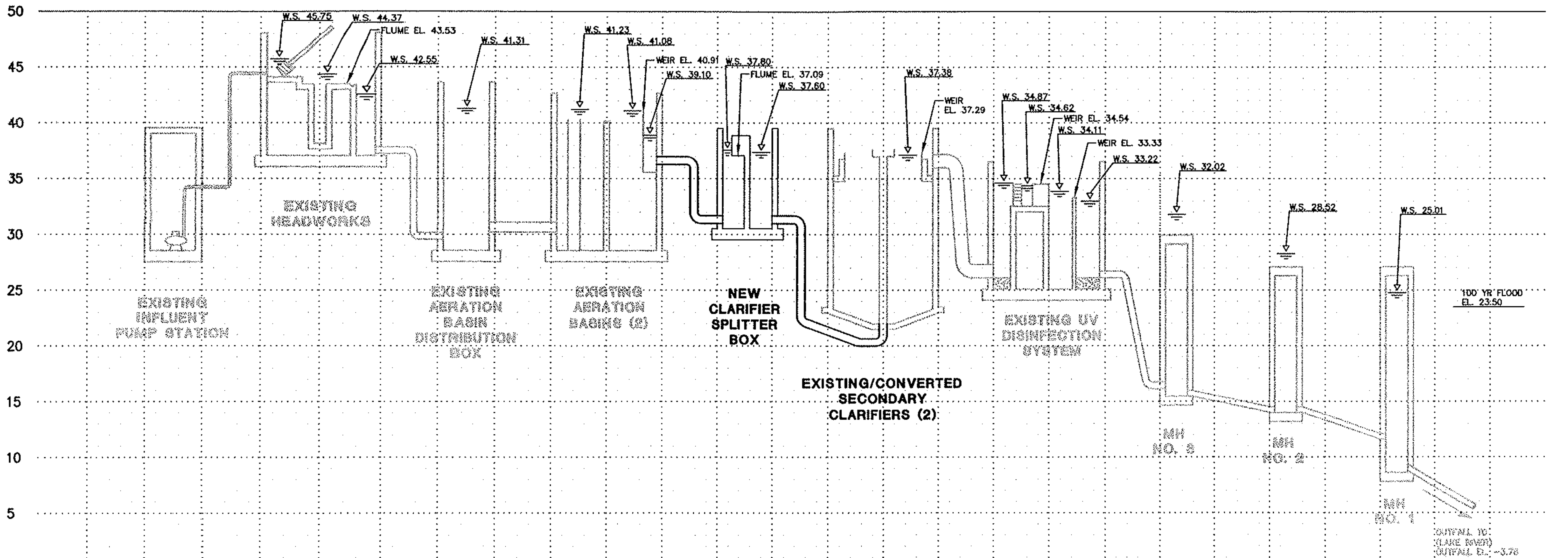
Project Description	Capital Cost
Phase 1	$ 3,198,000
Phase 2	$ 7,250,000
Columbia River Outfall	$ 8,248,000
Alternative No. 1 Phase 3 & 4 (combined)	$21,606,000
Total Alternative No. 1 - Phases 3 & 4 combined	**$40,302,000**
Phase 1	$ 3,198,000
Phase 2	$ 7,250,000
Columbia River Outfall	$ 8,248,000
Alternative No. 1 Phase 3	$16,219,000
Alternative No. 1 Phase 4	$ 7,499,000
Total Alternative No. 1 – Phases 3 & 4 constructed separately	**$42,414,000**

The recommended alternative for WWTP improvements is the conventional activated sludge option, which is described as “Alternative No. 1” in this chapter. It is recommended that the Phase 3 and 4 improvement projects, which are described in Alternative No. 1 presentation above, be completed in two separate phases as outlined in the preceding section. The design data for each phase of the recommended WWTP improvements (design years 2009, 2012, 2019, and 2024) are presented in Tables 8-13, 8-14, 8-15 and 8-16, respectively. The construction components for each of the construction phases are described in the preceding pages of this chapter. The WWTP improvements are designed to comply with the requirements for the current class 2 reliability classification. The hydraulic profiles for the 2009 (Phase 1), 2012 (Phase 2), 2019 (Phase 3), and 2024 (Phase 4) design year peak hour flow rates are presented in Figures 8-6, 8-7, 8-8 and 8-9, respectively.

TABLE 8-13

Summary of WWTP Unit Process Data for Design Year 2009 (Phase 1, 0.7 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Pump Station (Existing)	
Influent Pumps:	
Quantity of Pumps	3
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	520 gpm @ 29.8'
Pump Station Capacity	950 gpm (1.4 mgd)
Influent Screens (Existing)	
Mechanical Fine Screen	
Quantity	1
Type	Helical Auger
Screen Width	20"
Mesh Diameter	0.25"
Motor Size	1 hp
Capacity	3.5 mgd
Bypass Bar Screen:	
Quantity	1
Type	Manual Coarse Bar
Screen Width	24"
Bar Spacing	0.75"
Grit Removal (Existing)	
Grit Removal System	
Quantity	1
Type	Vortex
Motor Size	0.75 hp
Grit Cyclone	
Quantity	1
Grit Classifier	
Quantity	1
Screw Diameter	9"
Motor Size	0.75 hp
Grit Pump	
Quantity	1
Motor Size	7.5 hp
Influent Flow Measurement (Existing)	
Type	Parshall Flume
Size	9"
Capacity	3.3 mgd



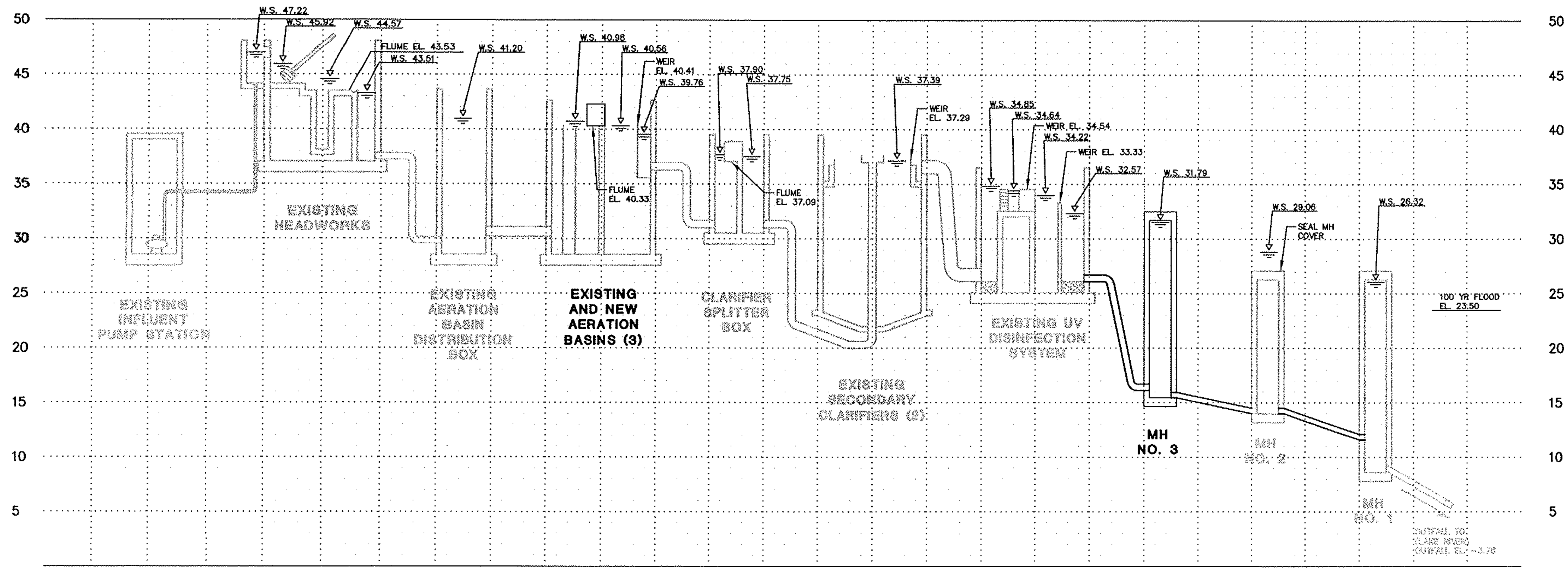
HYDRAULIC PROFILE

SCALE: 1"=5', VERTICAL
NOT TO SCALE, HORIZONTAL
DATUM = NGVD 29 (47)

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN

FIGURE 8-6
WWTP PHASE 1 (2009) HYDRAULIC PROFILE AT PEAK HOUR FLOW (1.51 MGD)

Gray & Osborne, Inc.
CONSULTING ENGINEERS



HYDRAULIC PROFILE

SCALE: 1"=5', VERTICAL
NOT TO SCALE, HORIZONTAL
DATUM = NGVD 29 (47)

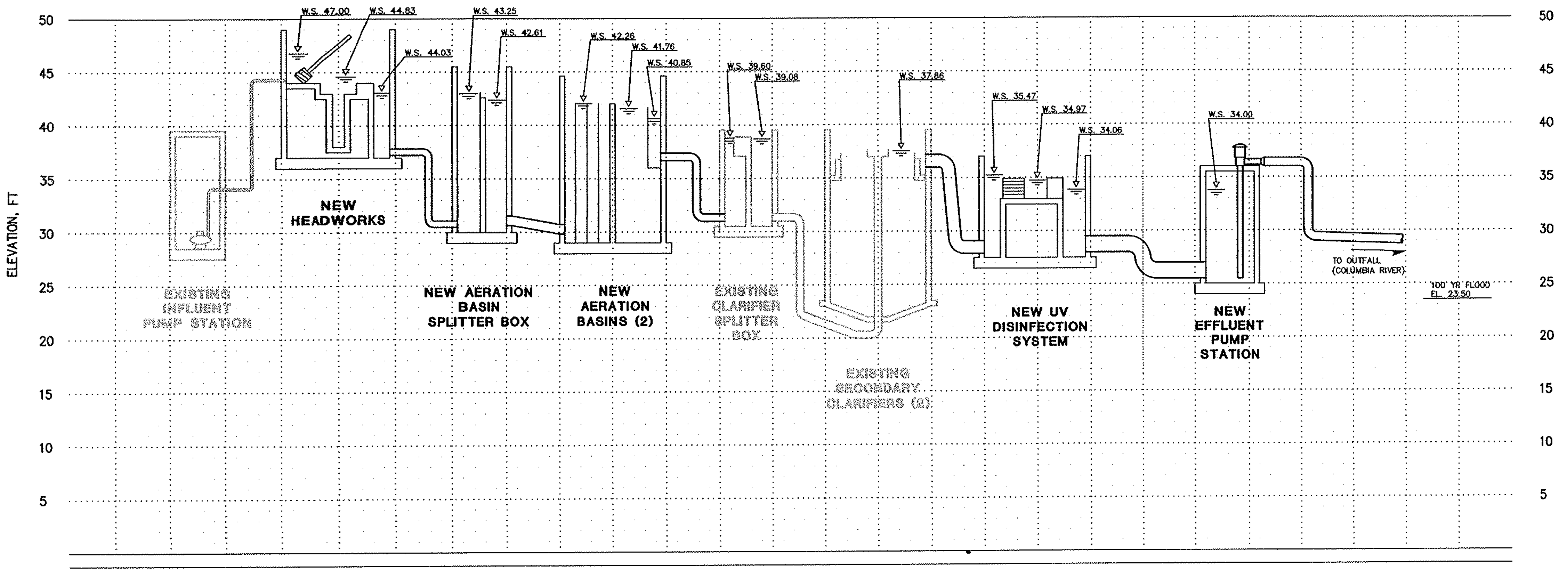
CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN

FIGURE 8-7

WWTP PHASE 2 (2012) HYDRAULIC PROFILE AT PEAK HOUR FLOW (2.10 MGD)

Gray & Osborne, Inc.
CONSULTING ENGINEERS



HYDRAULIC PROFILE

SCALE: VERT. 1"=10'
HORIZ. NOT TO SCALE
DATUM = NGVD 29 (47)

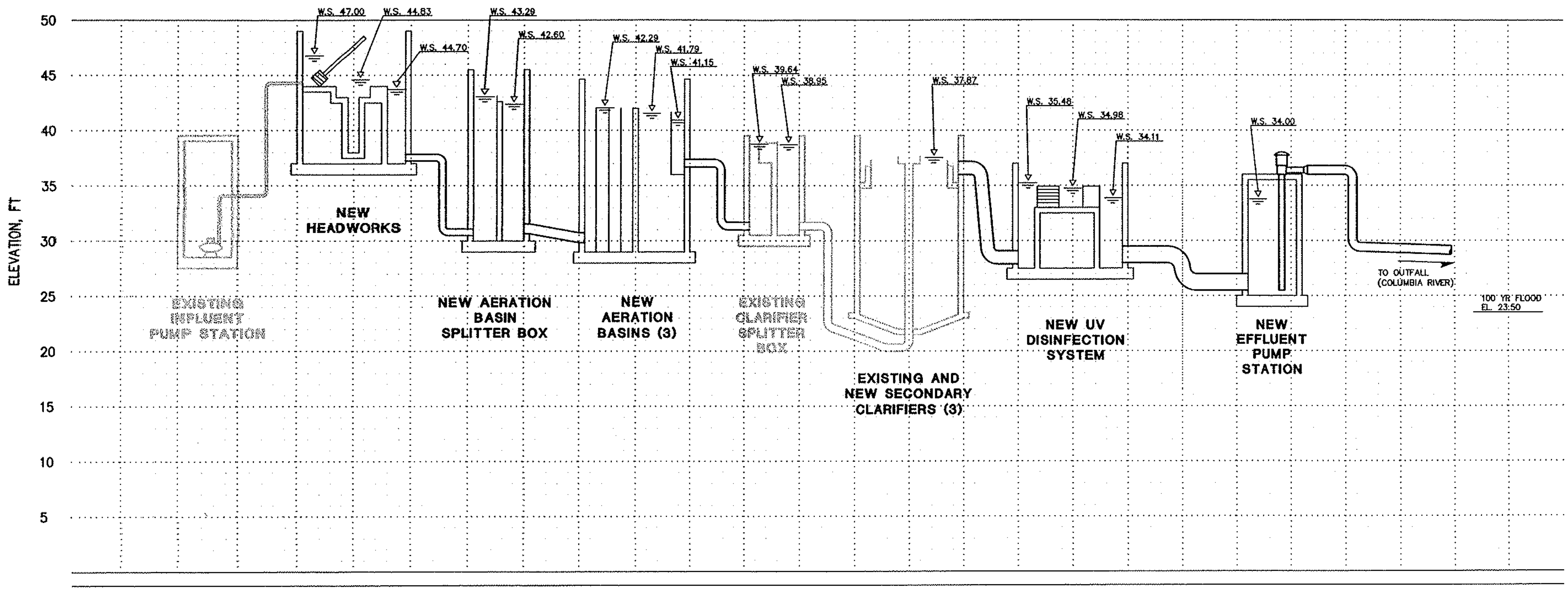
CITY OF RIDGEFIELD

GENERAL SEWER COMPREHENSIVE PLAN/WASTEWATER FACILITY PLAN

FIGURE 8–8

WWTP PHASE 3 (2019) HYDRAULIC PROFILE AT PEAK HOUR FLOW (3.63 MGD)

Gray & Osborne, Inc.
CONSULTING ENGINEERS



HYDRAULIC PROFILE

SCALE: VERT. 1"=10'
HORIZ. NOT TO SCALE
DATUM = NGVD 29 (47)

CITY OF RIDGEFIELD
GENERAL SEWER COMPREHENSIVE
PLAN/WASTEWATER FACILITY PLAN

FIGURE 8-9

WWTP PHASE 4 (2024) HYDRAULIC PROFILE
AT PEAK HOUR FLOW (4.93 MGD)

Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 8-13 – (continued)

Summary of WWTP Unit Process Data for Design Year 2009 (Phase 1, 0.7 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Anoxic Basin (Existing)	
Quantity	1
Side Water Depth	12'
Volume	48,000 gal
Mixing:	
Type	Vertical Shaft
Quantity	4
Motor Size	1 hp
Drive Type	2 Variable Speed, 2 Constant Speed
Aeration Type	Fine Bubble Diffusers
Aeration Basins (Existing)	
Quantity	2
Side Water Depth	12'
Volume, Each	174,000 gal
Effluent Weir Length	7'
MLSS Concentration	3,720 mg/L
Solids Retention Time	11.4 days
Aeration Type	Fine Bubble Diffusers
Mixed Liquor Recycle Pumps	
Quantity	2
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	1,000 gpm @ 18.2'
Aeration Basin Blowers (Existing)	
Quantity	3 (2 duty, 1 standby)
Type	Positive Displacement
Capacity, Each	800 scfm @ 9 psi
Motor Size	50 hp
Drive Type	Variable Speed
Maximum Speed	1,850 rpm
Secondary Clarifier Splitter Box	
Splitter Type	Cutthroat flume
Quantity of Flumes	2
Throat Size	8"

TABLE 8-13 – (continued)

Summary of WWTP Unit Process Data for Design Year 2009 (Phase 1, 0.7 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Secondary Clarifiers*	
Quantity	2 (1 existing, 1 modified)
Diameter, Each	50'
Effective Settling Area, Each	1,963 ft^2
Effective Side Water Depth, Each	14'
Design SVI	150 mL/g
RAS Concentration	10,000 mg/L
RAS Flow Rate at AAF	0.24 mgd
RAS Flow Rate at MMF	0.38 mgd
RAS Flow Rate at PHF	1.08 mgd
Surface Loading Rate AAF	229 gpd/ft^2
Surface Loading Rate at MMF	357 gpd/ft^2
Surface Loading Rate at PHF	764 gpd/ft^2
Solids Loading Rate AAF	11 lb/day/ft^2
Solids Loading Rate at MMF	17 lb/day/ft^2
Solids Loading Rate at PHF	41 lb/day/ft^2
Detention Time at AAF	11.0 hrs
Detention Time at MMF	7.0 hrs
Detention Time at PHF	3.3 hrs
Drive Motor Size, Each	0.5 hp
*Loadings based on one clarifier in operation	
Effluent Disinfection (Existing)	
Type	Ultraviolet
UV Tube Type	Low Pressure, Low Output, Horizontal
Quantity of Channels	1
Channel Width	27"
Channel Depth	4'
Channel Length	32'
Flow Control Weir Length	27'
Quantity of Banks	3
Quantity of Modules Per Bank	4
Quantity of Lamps Per Module	8
Total Quantity of Lamps	96
Design UV Transmittance (Min)	65%
Effluent Disinfection Standard	200 cfu/100 mL
Disinfection Dose Required	33,000 μW sec/cm^2
Peak Treatment Flow	1.93 mgd

TABLE 8-13 – (continued)

Summary of WWTP Unit Process Data for Design Year 2009 (Phase 1, 0.7 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Effluent Flow Measurement (New)	
Type	V-notch Weir
Depth	1'
Angle	120°
Capacity	2.85 mgd
Non-Potable Water Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Close Coupled End Suction Centrifugal
Motor Size	15 hp
Drive Type	Constant Speed
Capacity (each)	100 gpm @ 233'
Plant Drain Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Submersible Centrifugal
Motor Size	5 hp
Drive Type	Constant Speed
Capacity	226 gpm @ 32'
Return Activated Sludge Pumps	
Quantity of Pumps	3 (2 existing, 1 new)
Pump Type	Screw Centrifugal
Motor Size	3 hp
Drive Type	Variable Speed
Capacity (each)	375 gpm @ 13.5'
Waste Activated Sludge Pumps	
Quantity of Pumps	2 (1 existing, 1 new)
Pump Type	Vertical Screw Centrifugal
Motor Size	1 hp
Drive Types	Two Speed (existing) Variable Speed (new)
Capacity	100 gpm @ 5'
Scum Pump (Existing)	
Quantity of Pumps	1
Pump Type	Submersible Centrifugal
Motor Size	1.9 hp
Drive Type	Constant Speed
Capacity	111 gpm @ 15'

TABLE 8-13 – (continued)

Summary of WWTP Unit Process Data for Design Year 2009 (Phase 1, 0.7 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Sludge Transfer Pump (Existing)	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	15 hp
Drive Type	Constant Speed
Capacity	225 gpm @ 50 psi
Aerobic Digesters (Modified)	
Quantity	3
Total Volume	172,000 gal
Avg. Solids Concentration	3% (with thickening)
Total SRT	62 days
Aerobic Digester No. 1 (Existing Imhoff Tank)	
Length x Width	20' x 20'
Side Water Depth	18'
Volume	54,000 gal
Aeration and Mixing Type	Coarse Bubble Diffusers
Aerobic Digester No. 2 (Modified Standby Clarifier)	
Side Water Depth	16'
Volume	64,000 gal
Aeration Type	Coarse Bubble Diffusers
Mixing Type	Submersible Mixers
Aerobic Digester No. 3 (Existing Storage Tank)	
Volume	54,000 gal
Aeration and Mixing Type	Coarse Bubble Diffusers
Digester Blower No. 4	
Type	Positive Displacement
Capacity	1,477 scfm @ 7.5 psig
Motor Size	100 hp
Drive Type	Variable Speed

TABLE 8-13 – (continued)

Summary of WWTP Unit Process Data for Design Year 2009 (Phase 1, 0.7 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Digester Blower No. 5	
Type	Positive Displacement
Capacity	345 scfm @ 10 psig
Motor Size	25 hp
Drive Type	Dual Speed
Sludge Thickening System (New)	
Sludge Thickener	
Quantity	1
Type	Rotary Drum
Flow Rate	50 gpm
Feed Solids	1-1.5%
Thickened Solids	5-7%
Motor Sizes	
Flocculator	0.5 hp
Drum Main Drive	0.5 hp
Booster Pump	1.5 hp
Polymer Addition System	
Quantity	1
Type	Liquid Emulsion
Max Polymer Feed Rate	4.5 gph
Max Dilution Water Rate	600 gph
Power Required	120 V, 1-Phase, 60 Hz, 5 amp max
Sludge Thickener Pump	
Quantity	1
Type	Rotary Lobe
Capacity	45 gpm @ 11.9 psig
Motor Size	3 hp
Sludge Thickener Flow Meter	
Quantity	1
Type	Magnetic
Size	4"
Auxiliary Generator (Existing)	
Quantity	1
Rating	400 kW, 480 V, 3 Phase

TABLE 8-14

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Pump Station (Existing)	
Influent Pumps:	
Quantity of Pumps	3
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	520 gpm @ 29.8'
Pump Station Capacity	950 gpm (1.4 mgd)
Influent Screens (Existing)	
Mechanical Fine Screen	
Quantity	1
Type	Helical Auger
Screen Width	20"
Mesh Diameter	0.25"
Motor Size	1 hp
Capacity	3.5 mgd
Bypass Bar Screen:	
Quantity	1
Type	Manual Coarse Bar
Screen Width	24"
Bar Spacing	0.75"
Grit Removal (Existing)	
Grit Removal System	
Quantity	1
Type	Vortex
Motor Size	0.75 hp
Grit Cyclone	
Quantity	1
Grit Classifier	
Quantity	1
Screw Diameter	9"
Motor Size	0.75 hp
Grit Pump	
Quantity	1
Motor Size	7.5 hp

TABLE 8-14 – (continued)

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Flow Measurement (Existing)	
Type	Parshall Flume
Size	9"
Capacity	3.3 mgd
Anoxic Basin (Existing)	
Selector Zone One (S_x-1)	
Volume	11,700 gal
F/M	4 lb BOD_5/lb MLSS/day
Selector Zone Two (S_x-2)	
Volume (Total)	11,700 gal
F/M	2 lb BOD_5/lb MLSS/day
Selector Zone Three (S_x-3)	
Volume (Total)	23,400 gal
F/M	1 lb BOD_5/lb MLSS/day
Aeration and Mixing	Fine Bubble Diffused Air and Mixers (existing)
Mixing:	
Type	Vertical Shaft
Quantity	4 (existing)
Motor Size	1 hp
Drive Type	2 Variable Speed, 2 Constant Speed
Aeration Basin Splitter Box (New)	
Splitter Type	Cutthroat flume
Quantity of Flumes	3
Throat Size	8"
Aeration Basins (Existing and New)	
Quantity	3 (2 existing, 1 new)
Side Water Depth	12'
Volume, Each	174,000 gal
Effluent Weir Length	7'
MLSS Concentration	3,500 mg/L
Solids Retention Time	11.4 days

TABLE 8-14 – (continued)

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Aeration Basins (Existing and New) – (continued)	
Aeration Type	Fine Bubble Diffusers
Mixed Liquor Recycle Pumps	
Quantity	3 (2 existing, 1 new)
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	1,000 gpm @ 18.2'
Aeration Basin Blowers (Existing)	
Quantity	3 (2 duty, 1 standby)
Type	Positive Displacement
Capacity, Each	800 scfm @ 9 psi
Motor Size	50 hp
Drive Type	Variable Speed
Maximum Speed	1,850 rpm
Secondary Clarifier Splitter Box (Existing)	
Splitter Type	Cutthroat flume
Quantity of Flumes	2
Throat Size	8"
Secondary Clarifiers (Existing)	
Quantity	2
Diameter, Each	50'
Effective Settling Area, Each	1,963 ft^2
Effective Side Water Depth, Each	14'
Design SVI	150 mL/g
RAS Concentration	10,000 mg/L
RAS Flow Rate at AAF	0.34 mgd
RAS Flow Rate at MMF	0.53 mgd
RAS Flow Rate at PHF	1.08 mgd
Surface Loading Rate AAF	163 gpd/ft^2
Surface Loading Rate at MMF	255 gpd/ft^2
Surface Loading Rate at PHF	535 gpd/ft^2
Solids Loading Rate AAF	7.3 lb/day/ft^2
Solids Loading Rate at MMF	11 lb/day/ft^2
Solids Loading Rate at PHF	24 lb/day/ft^2
Detention Time at AAF	15.4 hrs
Detention Time at MMF	9.9 hrs

TABLE 8-14 – (continued)

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Secondary Clarifiers (Existing) – (continued)	
Detention Time at PHF	4.7 hrs
Drive Motor Size, each	0.5 hp
Effluent Disinfection (Existing)	
Type	Ultraviolet
UV Tube Type	Low Pressure, Low Output, Horizontal
Quantity of Channels	1
Channel Width	27"
Channel Depth	4'
Channel Length	32'
Flow Control Weir Length	27'
Quantity of Banks	3
Quantity of Modules Per Bank	4
Quantity of Lamps Per Module	8
Total Quantity of Lamps	96
Design UV Transmittance (Min)	65%
Effluent Disinfection Standard	200 cfu/100 mL
Disinfection Dose Required	33,000 μW sec/cm^2
Peak Treatment Flow	1.93 mgd
Peak Hydraulic Flow	2.1 mgd
Effluent Flow Measurement (Existing)	
Type	V-notch Weir
Depth	1'
Angle	120°
Capacity	2.85 mgd
Non-Potable Water Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Close Coupled End Suction Centrifugal
Motor Size	15 hp
Drive Type	Constant Speed
Capacity (each)	100 gpm @ 233'
Plant Drain Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Submersible Centrifugal
Motor Size	5 hp
Drive Type	Constant Speed
Capacity (each)	226 gpm @ 32'

TABLE 8-14 – (continued)

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Return Activated Sludge Pumps (Existing)	
Quantity of Pumps	3
Pump Type	Screw Centrifugal
Motor Size	3 hp
Drive Type	Variable Speed
Capacity (each)	375 gpm @ 13.5'
Waste Activated Sludge Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Vertical Screw Centrifugal
Motor Size	1 hp
Drive Types	Two Speed (existing) Variable Speed (new)
Capacity	100 gpm @ 5'
Scum Pump (Existing)	
Quantity of Pumps	1
Pump Type	Submersible Centrifugal
Motor Size	1.9 hp
Drive Type	Constant Speed
Capacity	111 gpm @ 15'
Sludge Transfer Pump (Existing)	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	15 hp
Drive Type	Constant Speed
Capacity	225 gpm @ 50 psi
Aerobic Digesters (Existing and New)	
Quantity	4
Total Volume	236,000 gal
Avg. Solids Concentration	3% (with thickening)
Total SRT	61 days
Aerobic Digester No. 1 (Existing Imhoff Tank)	
Length x Width	20' x 20'
Side Water Depth	18'
Volume	54,000 gal
Aeration and Mixing Type	Coarse Bubble Diffusers

TABLE 8-14 – (continued)

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Aerobic Digesters (Existing and New) – (continued)	
Aerobic Digester No. 2 (Modified Standby Clarifier)	
Side Water Depth	16'
Volume	64,000 gal
Aeration Type	Coarse Bubble Diffusers
Mixing Type	Submersible Mixers
Aerobic Digester No. 3 (New)	
Side Water Depth	16'
Volume	64,000 gal
Aeration Type	Coarse Bubble Diffusers
Mixing Type	Submersible Mixers
Aerobic Digester No. 4 (Existing Storage Tank)	
Volume	54,000 gal
Aeration and Mixing Type	Coarse Bubble Diffusers
Digester Blower Nos. 1, 2 and 3	
Quantity	3 (2 duty, 1 standby) (new)
Type	Positive Displacement
Capacity, each	475 scfm @ 10 psig
Motor Size	30 hp
Drive Type	Variable Speed
Digester Blower No. 4	
Quantity	1 (existing)
Type	Positive Displacement
Capacity	345 scfm @ 10 psig
Motor Size	25 hp
Drive Type	Dual Speed

TABLE 8-14 – (continued)

Summary of WWTP Unit Process Data for Design Year 2012 (Phase 2, 1.0 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Sludge Thickening System (Existing)	
Sludge Thickener	
Quantity	1
Type	Rotary Drum
Flow Rate	50 gpm
Feed Solids	1-1.5%
Thickened Solids	5-7%
Motor Sizes	
Flocculator	0.5 hp
Drum Main Drive	0.5 hp
Booster Pump	1.5 hp
Polymer Addition System	
Quantity	1
Type	Liquid Emulsion
Max Polymer Feed Rate	4.5 gph
Max Dilution Water Rate	600 gph
Power Required	120 V, 1-Phase, 60 Hz, 5 amp max
Sludge Thickener Pump	
Quantity	1
Type	Rotary Lobe
Capacity	45 gpm @ 11.9 psig
Motor Size	3 hp
Sludge Thickener Flow Meter	
Quantity	1
Type	Magnetic
Size	4"
Auxiliary Generator (Existing)	
Quantity	1
Rating	400 kW, 480 V, 3 Phase

Note: Equipment listed as existing specifies equipment which will exist at the time of construction for the Design Year 2012 construction phase.

TABLE 8-15

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Pump Station (Existing)	
Influent Pumps:	
Quantity of Pumps	3
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	520 gpm @ 29.8'
Pump Station Capacity	950 gpm (1.4 mgd)
Headworks (New and Existing)	
Mechanical Fine Screen	
Quantity	1 (new)
Screen Width	28"
Mesh Diameter	0.25"
Motor Size	1 hp
Capacity	5.0 mgd
Bypass Bar Screen:	
Quantity	1 (new)
Type	Manual Coarse Bar
Screen Width	24"
Bar Spacing	0.75"
Grit Removal System:	
Quantity	2 (1 existing, 1 new)
Type	Vortex
Motor Size	0.75 hp
Grit Cyclone:	
Quantity	1 (existing)
Grit Classifier:	
Quantity	1 (existing)
Screw Diameter	9"
Motor Size	0.75"
Grit Pump:	
Quantity	1 (existing)
Motor Size	7.5 hp
Influent Flow Measurement (New)	
Quantity	2
Influent Pump Station Flow Meter	
Type	Magnetic Flow Meter
Size	8"
Capacity	7.2 mgd

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Flow Measurement (New)	
Collection System Pump Station Flow Meter	
Type	Magnetic Flow Meter
Size	10"
Capacity	11.2 mgd
Splitter Boxes (New and Existing)	
Aeration Basin Splitter Box	
Quantity	1
Center Box Dimensions	5' x 17' x 15' height
Effluent Box Dimensions	5' x 5' x 15' height
Secondary Clarifier Basin Splitter Box	
Quantity	1
Center Box Dimensions	5' x 17' x 11' height
Effluent Box Dimensions	5' x 5' x 11' height
Aeration Basins (New)	
Quantity of Basins	2
Sidewater Depth	19'
Volume (Each)	0.624 MG
Aerobic Volume (Total)	0.947 MG
Anoxic Volume (Total)	0.307 MG
MLSS Concentration	3,500 mg/L
Aerobic Solids Retention Time	11.4 days
HRT @ Design Max Month Flow	16 hrs
Selector Zone One (S_x-1)	
Volume (Total)	14,000 gal
F/M	6 lb BOD_5/lb MLSS/day
Selector Zone Two (S_x-2)	
Volume (Total)	14,000 gal
F/M	3 lb BOD5/lb MLSS/day
Selector Zone Three (S_x-3)	
Volume (Total)	28,000 gal
F/M	1.5 lb BOD5/lb MLSS/day

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Aeration Basins (New)	
Selector Zones	
Type of Mixing	Coarse Bubble Diffused Air
Mixing Rate	20 scfm/1000 ft^3
Total Volume	64,000 gal
Air Required	180 scfm
Aerobic Zone	
Aerator Type	Fine Bubble Diffused Air
Standard Oxygen Requirement	11,600 lb O_2/day
Air Flow Requirement	1,200 scfm
Anoxic Zone Mixing	
Quantity	4
Mixer Type	Submersible Propeller
Motor Size	7.5 hp
Internal Recycle Pumps	
Quantity	2
Motor Size	7.5 hp
Aeration Basins Blowers	
Quantity	3
Type	Single-Stage Centrifugal
Capacity, Each	875 scfm @ 9.3 psig
Motor Size	60 hp
Secondary Clarifiers (Existing)	
Quantity	2
Diameter, Each	50'
Effective Settling Area, Each	1,963 ft^2
Effective Side Water Depth, Each	14'
Design SVI	150 mL/g
RAS Concentration	10,000 mg/L
RAS Flow Rate at AAF	0.62 mgd
RAS Flow Rate at MMF	0.97 mgd
RAS Flow Rate at PHF	1.44 mgd
Surface Loading Rate AAF	298 gpd/ft^2
Surface Loading Rate at MMF	466 gpd/ft^2
Surface Loading Rate at PHF	917 gpd/ft^2

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Secondary Clarifiers (Existing)	
Solids Loading Rate AAF	13 lb/day/ft^2
Solids Loading Rate at MMF	21 lb/day/ft^2
Solids Loading Rate at PHF	38 lb/day/ft^2
Detention Time at AAF	8.4 hrs
Detention Time at MMF	5.4 hrs
Detention Time at PHF	2.7 hrs
Drive Size, Each	0.5 hp
Effluent Disinfection (Modified)	
Type	Ultra-Violet
UV Tube Type	Low Pressure, Low Output, Horizontal
Quantity of Channels	1 (existing)
Channel Width	27"
Channel Depth	4'
Channel Length	40'
Flow Control Weir Length	150'
Quantity of Banks	3
Quantity of Modules Per Bank	6 (2 new/bank)
Quantity of Lamps Per Module	8
Total Quantity of Lamps	144
UV Transmittance (Min)	65%
Effluent Disinfection Standard	200 cfu/100 mL
Disinfection Dose Required	33,000 μW sec/cm^2
Peak Treatment Capacity	2.90 mgd
Peak Hydraulic Capacity	3.63 mgd
Effluent Flow Measurement (New)	
Type	Magnetic Flow Meter
Size	24"
Capacity	64 mgd Max
Effluent Pump Station (New)	
Quantity of Pumps	2
Pump Type	Vertical Turbine
Motor Size	60 hp
Drive Type	Constant Speed
Capacity (each)	1,760 gpm @ 108'
Wet Well Volume	30,000 gal

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Non-Potable Water Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Close Coupled End Suction Centrifugal
Motor Size	15 hp
Drive Type	Constant Speed
Capacity (each)	100 gpm @ 233'
Plant Drain Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Submersible Centrifugal
Motor Size	5 hp
Drive	Constant Speed
Capacity	226 gpm @ 32'
Return Activated Sludge Pumps (New)	
Quantity of Pumps	3
Pump Type	Horizontal Screw Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	500 gpm @ 33'
Waste Activated Sludge Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Vertical Screw Centrifugal
Motor Size	3 hp
Drive Types	Two Speed (1) Variable Speed (1)
Capacity	100 gpm @ 5'
Scum Pump (Existing)	
Quantity of Pumps	1
Pump Type	Submersible Centrifugal
Motor Size	1.9 hp
Drive Type	Constant Speed
Capacity	111 gpm @ 15'
Sludge Transfer Pump (Existing)	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	15 hp
Drive Type	Constant Speed
Capacity	225 gpm @ 50 psi

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Sludge Thickening System (Existing)	
Sludge Thickener	
Quantity	1
Type	Rotary Drum
Flow Rate	50 gpm
Feed Solids	1-1.5%
Thickened Solids	5-7%
Polymer Addition System	
Quantity	1
Type	Liquid Emulsion
Sludge Thickener Pump	
Quantity	1
Type	Rotary Lobe
Capacity	45 gpm @ 11.9 psig
Motor Size	3 hp
Aerobic Digesters (Modified)	
Quantity	3
Total Volume	704,000 gal
Avg. Solids Concentration	3%
Total SRT*	99 days
Aerobic Digester No. 1 (Existing Imhoff Tank)	
Length x Width	20' x 20'
Side Water Depth	18'
Volume	54,000 gal
Aeration and Mixing Type	Coarse Bubble Diffusers
Aerobic Digester No. 2 (Converted Aeration Basin Nos. 1 and 2 and Modified Standby Clarifier)	
Side Water Depth	12' and 16'
Volume	412,000 gal
Aeration Type	Fine and Course Bubble Diffusers
*Value applies to total volume of aerobic digester process	

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Aerobic Digesters (Modified)	
Aerobic Digester No. 3 (Converted Aeration Basin No. 3 and Existing Aerobic Digester No. 3)	
Side Water Depth	12' and 16'
Volume	238,000 gal
Aeration Type	Fine and Course Bubble Diffusers
Digester Blower Nos. 1, 2 & 3 (existing)	
Quantity	3
Type	Positive Displacement
Capacity	475 scfm @ 10 psig
Motor Size	30 hp
Drive Type	Variable Speed
Digester Blower No. 4 (existing)	
Quantity	1
Type	Positive Displacement
Capacity	345 scfm @ 10 psig
Motor Size	25 hp
Drive Type	Dual Speed
Digester Blower Nos. 5, 6 & 7 (previously Aeration Blowers)	
Quantity	3
Type	Positive Displacement
Capacity	800 scfm @ 9 psig
Motor Size	50 hp
Drive Type	Variable Speed
*Value applies to total volume of aerobic digester process	
Digested Sludge Pump (New)	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	10 hp
Drive Type	Variable Speed
Capacity	120 gpm @ 40'

TABLE 8-15 – (continued)

Summary of WWTP Unit Process Data for Design Year 2019 (Alternative No. 1, Phase 3, 1.83 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Sludge Dewatering Screw Press (New)	
Quantity	1
Influent Flow Rate	120 gpm
Influent Solids Concentration	3%
Solids Processing Rate	1,600 lbs/hr
Dewatering Polymer System (New)	
Quantity	1
Type	2-Tank
Polymer Type	Liquid or Dry
Mixing Tank Volume	360 gal
Holding Tank Volume	360 gal
Metering Pump Capacity	35 gph
Mixer Motor Size	1.5 hp
Metering Pump Motor Size	1/8 hp
Sludge Dryer (New)	
Quantity	1
Capacity	1.54 Wet Tons/hr
Feed Solids Concentration	20%
Auxiliary Generator (New)	
Quantity	1
Rating	500 kW, 480 V, 3 Phase

Note: Equipment listed as existing specifies equipment which will exist at the time of construction for the Design Year 2019 construction phase.

TABLE 8-16

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Pump Station (Existing)	
Influent Pumps:	
Quantity of Pumps	3
Pump Type	Submersible Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	520 gpm @ 29.8'
Pump Station Capacity	950 gpm (1.4 mgd)
Headworks (Existing)	
Mechanical Fine Screen	
Quantity	1
Screen Width	28"
Mesh Diameter	0.25"
Motor Size	1 hp
Capacity	5.0 mgd
Headworks (Existing)	
Bypass Bar Screen:	
Quantity	1
Type	Manual Coarse Bar
Screen Width	24"
Bar Spacing	0.75"
Grit Removal System:	
Quantity	2
Type	Vortex
Motor Size	0.75 hp
Grit Cyclone:	
Quantity	1
Grit Classifier:	
Quantity	1
Screw Diameter	9"
Motor Size	0.75"
Grit Pump:	
Quantity	1
Motor Size	7.5 hp

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Influent Flow Measurement (Existing)	
Quantity	2
Influent Pump Station Flow Meter	
Type	Magnetic Flow Meter
Size	8"
Capacity	7.2 mgd
Collection System Pump Station Flow Meter	
Type	Magnetic Flow Meter
Size	10"
Capacity	11.2 mgd
Splitter Boxes (Existing)	
Aeration Basin Splitter Box	
Quantity	1
Center Box Dimensions	5' x 17' x 15' height
Effluent Box Dimensions	5' x 5' x 15' height
Secondary Clarifier Basin Splitter Box	
Quantity	1
Center Box Dimensions	5' x 17' x 11' height
Effluent Box Dimensions	5' x 5' x 11' height
Aeration Basins (Existing and New)	
Quantity of Basins	3 (2 existing, 1 new)
Sidewater Depth	19'
Internal Dimensions (Each)	51' x 90'
Volume (Each)	0.624 MG
Aerobic Volume (Total)	1.420 MG
Anoxic Volume (Total)	0.461 MG
MLSS Concentration	3,500 mg/L
Aerobic Solids Retention Time	11.4 days
HRT @ Design Max Month Flow	16 hrs
Selector Zone One (S_x-1)	
Volume (Total)	21,000 gal
F/M	6 lb BOD_5/lb MLSS/day
Selector Zone Two (S_x-2)	
Volume (Total)	21,000 gal
F/M	3 lb BOD_5/lb MLSS/day

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Aeration Basins (Existing and New) – (continued)	
Selector Zone Three (S_x-3)	
Volume (Total)	42,000 gal
F/M	1.5 lb BOD_5/lb MLSS/day
Aeration and Mixing:	
Selector Zones	
Type of Mixing	Coarse Bubble Diffused Air
Mixing Rate	20 scfm/1000 ft^3
Total Volume	96,000 gal
Air Required	260 scfm
Aerobic Zone	
Aerator Type	Fine Bubble Diffused Air
Standard Oxygen Requirement	15,700 lb O_2/day
Air Flow Requirement	1,750 scfm
Anoxic Zone Mixing	
Quantity	6 (4 existing, 2 new)
Mixer Type	Submersible Propeller
Motor Size	7.5 hp
Internal Recycle Pumps	
Quantity	3 (2 existing, 1 new)
Motor Size	7.5 hp
Aeration Basins Blowers	
Quantity	3 (existing)
Type	Single-Stage Centrifugal
Capacity, Each	875 scfm @ 9.3 psig
Motor Size	60 hp
Secondary Clarifiers (Existing and New)	
Quantity	3 (2 existing, 1 new)
Diameter, Each	50'
Effective Settling Area, Each	1,963 ft^2
Effective Side Water Depth, Each	14'
Design SVI	150 mL/g
RAS Concentration	10,000 mg/L
RAS Flow Rate at AAF	0.91 mgd

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Secondary Clarifiers (Existing and New)	
RAS Flow Rate at MMF	1.42 mgd
RAS Flow Rate at PHF	1.44 mgd
Surface Loading Rate AAF	292 gpd/ft^2
Surface Loading Rate at MMF	455 gpd/ft^2
Surface Loading Rate at PHF	849 gpd/ft^2
Solids Loading Rate AAF	13 lb/day/ft^2
Solids Loading Rate at MMF	20 lb/day/ft^2
Solids Loading Rate at PHF	32 lb/day/ft^2
Detention Time at AAF	8.6 hrs
Detention Time at MMF	5.5 hrs
Detention Time at PHF	3.0 hrs
Drive Size, Each	0.5 hp
Effluent Disinfection (Modified)	
Type	Ultra-Violet
UV Tube Type	Low Pressure, High Intensity
Quantity of Channels	2 (1 existing, 1 new)
Channel Width	27"
Channel Depth	4'
Channel Length	40'
Flow Control Weir Length	150'
Quantity of Banks	4
Quantity of Modules Per Bank	2
Quantity of Lamps Per Module	8
Total Quantity of Lamps	64
UV Transmittance (Min)	65%
Effluent Disinfection Standard	200 cfu/100 mL
Disinfection Dose Required	33,000 μW sec/cm^2
Peak Treatment Capacity	3.71 mgd
Peak Hydraulic Capacity	4.93 mgd
Effluent Flow Measurement (Existing)	
Type	Magnetic Flow Meter
Size	24"
Capacity	64 mgd Max

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Effluent Pump Station (Existing)	
Quantity of Pumps	2
Pump Type	Vertical Turbine
Motor Size	60 hp
Drive Type	Constant Speed
Capacity (each)	1,760 gpm @ 108'
Wet Well Volume	30,000 gal
Non-Potable Water Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Close Coupled End Suction Centrifugal
Motor Size	15 hp
Drive	Constant Speed
Capacity (each)	100 gpm @ 233'
Plant Drain Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Submersible Centrifugal
Motor Size	5 hp
Drive Type	Constant Speed
Capacity	226 gpm @ 32'
Return Activated Sludge Pumps (Existing)	
Quantity of Pumps	3
Pump Type	Horizontal Screw Centrifugal
Motor Size	7.5 hp
Drive Type	Variable Speed
Capacity (each)	500 gpm @ 33'
Waste Activated Sludge Pumps (Existing)	
Quantity of Pumps	2
Pump Type	Vertical Screw Centrifugal
Motor Size	3 hp
Drive Types	Two Speed (1) Variable Speed (1)
Capacity	100 gpm @ 5'
Scum Pump (Existing)	
Quantity of Pumps	1
Pump Type	Submersible Centrifugal
Motor Size	1.9 hp
Drive Type	Constant Speed
Capacity	111 gpm @ 15'

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Sludge Transfer Pump (Existing)	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	15 hp
Drive Type	Constant Speed
Capacity	225 gpm @ 50 psi
Sludge Thickening System (Existing)	
Sludge Thickener	
Quantity	1
Type	Rotary Drum
Flow Rate	50 gpm
Feed Solids	1-1.5%
Thickened Solids	5-7%
Polymer Addition System	
Quantity	1
Type	Liquid Emulsion
Sludge Thickener Pump	
Quantity	1
Type	Rotary Lobe
Capacity	45 gpm @ 11.9 psig
Motor Size	3 hp
Aerobic Digesters (Existing)	
Quantity	3
Total Volume	704,000 gal
Avg. Solids Concentration	3%
Total SRT*	68 days
Aerobic Digester No. 1 (Existing Imhoff Tank)	
Length x Width	20' x 20'
Side Water Depth	18'
Volume	54,000 gal
Aeration and Mixing Type	Coarse Bubble Diffusers

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Aerobic Digesters (Existing)	
Aerobic Digester No. 2	
(Converted Aeration Basin Nos. 1 and 2 and	
Modified Standby Clarifier)	
Side Water Depth	12' and 16'
Volume	412,000 gal
Aeration Type	Fine and Course Bubble Diffusers
Aerobic Digester No. 3	
(Converted Aeration Basin No. 3 and Existing	
Aerobic Digester No. 3)	
Side Water Depth	12' and 16'
Volume	238,000 gal
Aeration Type	Fine and Course Bubble Diffusers
Digester Blower Nos. 1, 2 & 3 (existing)	
Quantity	3
Type	Positive Displacement
Capacity	475 scfm @ 10 psig
Motor Size	30 hp
Drive Type	Variable Speed
Digester Blower No. 4 (existing)	
Quantity	1
Type	Positive Displacement
Capacity	345 scfm @ 10 psig
Motor Size	25 hp
Drive Type	Dual Speed
Digester Blower Nos. 5, 6 & 7 (previously	
Aeration Blowers)	3
Quantity	Positive Displacement
Type	800 scfm @ 9 psig
Capacity	50 hp
Motor Size	Variable Speed
Drive Type	
*Value applies to total volume of aerobic digester process	

TABLE 8-16 - (continued)

Summary of WWTP Unit Process Data for Design Year 2024 (Alternative No. 1, Phase 4, 2.68 mgd) per the Design Flows and Loadings in Tables 6-4 and 6-5

Digested Sludge Pump (Existing)	
Quantity of Pumps	1
Pump Type	Progressing Cavity
Motor Size	10 hp
Drive Type	Variable Speed
Capacity	120 gpm @ 40'
Sludge Dewatering Screw Press (Existing)	
Quantity	1
Influent Flow Rate	120 gpm
Influent Solids Concentration	3%
Solids Processing Rate	1,600 lbs/hr
Dewatering Polymer System (Existing)	
Quantity	1
Type	2-Tank
Polymer Type	Liquid or Dry
Mixing Tank Volume	360 gal
Holding Tank Volume	360 gal
Metering Pump Capacity	35 gph
Mixer Motor Size	1.5 hp
Metering Pump Motor Size	1/8 hp
Sludge Dryer (Existing)	
Quantity	1
Capacity	1.54 Wet Tons/hr
Feed Solids Concentration	20%
Auxiliary Generator (Existing)	
Quantity	1
Rating	500 kW, 480 V, 3 Phase

Note: Equipment listed as existing specifies equipment which will exist at the time of construction for the Design Year 2024 construction phase.

CHAPTER 9

BIOSOLIDS MANAGEMENT ALTERNATIVES

INTRODUCTION

In this Chapter, biosolids regulations are described and the current and future methods for management of the City's biosolids are evaluated. Currently, the City has an agreement with Clark County for transport, treatment, and land application of the waste sludge generated at the Lake River Wastewater Treatment Plant. As the quantity of sludge increases along with population growth in the service area, the City may need to implement other biosolids management alternatives. The evaluation considers management alternatives for three periods, based on the WWTP upgrade phases in Chapter 8: short term (2005-06), Phases 1 & 2 (2007-12) and Phases 3 and 4 (2012-2024).

The alternatives evaluated for the management of current and future biosolids in this chapter include:

1. Continuing agreement with Clark County for partial processing and land application

2. Class "B" biosolids processing and contracted land application

3. Class "A" biosolids processing and City-managed beneficial use, sale or giveaway

Land application of treated sewage sludge for agricultural purposes has been carried out in the United States for many years, and is encouraged by federal and state regulations. Treated sewage sludge has long been recognized for its value as a crop fertilizer. Because of high organic content, this material also serves as an excellent soil conditioner by increasing the ability of a soil to retain water and promote desirable biological activity in the soil that can, in turn, enhance plant growth. Land application represents the only final treatment method that allows this material to be fully recycled for the beneficial use of its nutrient and organic content. Biosolids meeting the Class "A" standards may be land applied with fewer management restrictions. Unrestricted application by the public is allowed with Class "A" biosolids.

The evaluation of each alternative includes an economic analysis that addresses operation costs and capital costs where applicable. Ancillary issues that affect each alternative, including risk, social impacts, and public opinion, are also important considerations, and are addressed in this chapter. Sludge treatment processes and equipment are described in Chapter 8.

BIOSOLIDS REGULATIONS

Regulations pertaining to biosolids include 40 CFR Part 403, WAC 173-308, and WAC 173-200.

40 CFR PART 503

40 CFR Part 503, regulating the disposition of municipal sewage sludge went into effect in 1993. The 503 rules apply to the sewage sludge generated from municipal wastewater systems, i.e., municipal wastewater treatment systems, and domestic septic tanks. EPA allows states the ability to enforce their own version of biosolids regulations. Under 40 CFR 503, the state biosolids regulations must be at least as stringent as the federal 503 regulations.

WAC-173-308 BIOSOLIDS MANAGEMENT

The State of Washington has adopted the 40 CFR Part 503 requirements in its own regulations governing the use of biosolids, WAC 173-308. These regulations, effective March 1998, are enforced by the Washington State Department of Ecology (Ecology). The requirements in WAC 173-308 are very similar to the requirements of the federal 503 regulations.

There are three fundamental elements of the federal 503 and state 308 regulations that establish minimum criteria for beneficial use of biosolids:

1. pollutant concentrations and application rates
2. pathogen reduction measures
3. vector attraction reduction measures

Trace Pollutant Concentrations and Application Rates

Maximum allowable concentrations in biosolids are established for nine heavy metals (arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc). If a biosolids sample exceeds the ceiling concentration of any of these metals, it cannot be land applied. A second pollutant threshold concentration is identified for Exceptional Quality (EQ) biosolids. To be considered “EQ,” biosolids must meet the EQ *pollutant* requirement, the Class “A” pathogen reduction requirement, and the vector attraction reduction requirement (see below). EQ biosolids are eligible for relatively unrestricted land application.

Cumulative trace pollutant loading rates for biosolids are designated for these nine heavy metals. These rates cannot be exceeded during the life of an application site. Once a cumulative loading limit is reached for a particular limiting pollutant, the land can no longer receive biosolids containing any level of the limiting pollutant. Annual trace pollutant loading rates are also set for the same nine heavy metals.

Pathogen Reduction Requirements

In order for biosolids to be land applied, they must meet specific criteria demonstrating a minimum level of treatment to reduce the density or limit growth of pathogenic bacteria. By meeting these minimum criteria, a biosolids sample is referred to as meeting Class "B" pathogen reduction requirements. The term "Class "B" biosolids" is sometimes erroneously referred to as any biosolids meeting all minimum criteria that allow the biosolids to be land applied, which is not the case. Biosolids must meet vector attraction reduction requirements and minimum pollutant concentration standards as well as Class "B" pathogen reduction requirements (at minimum) in order to be acceptable for land application.

Class "B" biosolids must meet one or more of three alternative criteria for pathogen reduction described in the 503 and 308 regulations. A higher level of treatment known as a Process to Further Reduce Pathogens (PFRP) will permit biosolids to meet the Class "A" pathogen reduction requirement. The 503 and 308 regulations provide six alternative PFRP standards for Class "A" biosolids. When biosolids meet the Class "A" standard, they are subject to fewer restrictions for land application as long as they also meet the lower (WAC-173-308) Table 3 pollutant concentration thresholds and vector attraction reduction standards.

Vector Attraction Reduction Requirements

The third minimum requirement for biosolids to be land applied is the vector attraction requirement. This measure is designed to make the biosolids less attractive to disease-carrying pests such as rodents and insects. These measures typically reduce the liquid content and/or volatile solids content of the biosolids or they make the biosolids relatively inaccessible to vector contact by soil injection or tilling. The 503 and 308 regulations list seven alternative treatment techniques and/or laboratory tests that would qualify a sludge as meeting vector attraction reduction requirements. If vector attraction reduction is not completed by one of these seven methods, the requirements may also be met during land application by subsurface injection or immediate tilling into the ground.

Management Practices

Once the three basic criteria discussed above have been met, the 503 and 308 regulations identify specific management practices, which must be followed during land application of biosolids. The biosolids must be applied at a rate that is equal to or less than the agronomic rate. The placement of biosolids on land cannot adversely affect a threatened or endangered species. Biosolids cannot be applied to ground so that it may enter wetlands or a surface water body (e.g. on frozen ground or snow-covered ground), nor can they be applied within 10 meters of a surface water body. Biosolids applied to a lawn or garden must meet Class "A" standards for pathogen reduction under the 503 and 308 regulations.

If biosolids meet lower pollutant threshold limits, Class "A" pathogen reduction requirements, and vector attraction reduction requirements, they are eligible for relatively unrestricted application. Biosolids in this category are referred to as "Exceptional Quality" (EQ). EQ biosolids can be containerized and sold or given away in quantities up to one metric ton provided a label or information sheet is provided with:

1. the biosolids preparer's name and address,
2. sufficient information (nitrogen concentrations) for the recipient to determine an agronomic rate of application,
3. a statement that application is prohibited except in accordance with instructions provided with the container.

Monitoring Requirements

Monitoring frequencies are based on quantities of biosolids produced. (It is not generally necessary to verify that pathogen and vector attraction reduction measures are met for each individual load of biosolids that is land applied, per WAC 173-308-150 (3)). The actual monitoring frequencies will depend on the frequency of applications.

Recordkeeping, Reporting and Certifications

The 503 and 308 regulations have specific recordkeeping, reporting and certification requirements for land application of biosolids. The general biosolids permit implements requirements for recordkeeping and reporting in accordance with WAC 173-308-290 and –295. Records must be kept for meeting all pathogen reduction and vector attraction reduction requirements for biosolids and domestic septage. For biosolids, records must be kept of analyses performed for meeting trace pollutant criteria. The 503 regulations dictate that publicly owned treatment works with design flow rates greater than 1.0 million gallons per day (mgd), or serving more than 10,000 persons, or that have been designated as Class I facilities, must make annual reports to the EPA. In addition, Ecology requires that *all* facilities, regardless of size, make annual reports to both Ecology's headquarters and the appropriate regional office, by March 1 of each year.

Permitting

WAC-173-308-310 lists permitting requirements for municipalities managing biosolids. The primary permit required for biosolids management activities is *the State General Permit for Biosolids Management*. The permittee must carry out public notice as required under WAC 173-308-310(11), and public hearings if required, in accordance with WAC 173-308-310(12), and comply with requirements of the State Environmental Policy Act (SEPA) as stipulated under WAC 173-308-310(030).

Treatment works treating domestic sewage that come under the State general permit must also comply with requirements of the State Environmental Policy Act (SEPA) per WAC 173-308-030. Ecology carries out public notice as a part of the process of issuing a general permit. Public notice requirements for facilities subject to this permit vary depending on the purpose the notice is serving and the quality of biosolids being managed. When a facility applies for initial coverage under the general permit, it must carry out public notice for that purpose as specified in WAC 173-308-310(11). Notification must be made to the general public, affected local health departments, and interested parties.

CURRENT BIOSOLIDS MANAGEMENT SYSTEM

At present (2005), the City has an agreement with Clark County for the management of the biosolids generated at the WWTP. The City stores the biosolids in the treatment facility in one of three locations. The biosolids are held in the aerobic digester at the north end of the facility; or in a converted Imhoff tank or sludge storage basin, both located at the south end of the WWTP. Some degree of aerobic digestion is provided in these storage tanks. The sludge is hauled an estimated 10 miles one way to the Salmon Creek WWTP, where it is blended with the Salmon Creek primary and secondary sludge and processed through anaerobic digestion. The digested sludge is then dewatered to approximately 18 percent solids using a belt filter press and applied at the County's permitted land application site located at Peterson's Farm in Woodland, Washington.

The County provides laboratory analysis, permitting, processing, and most of the hauling-related labor as part of this arrangement. The hauling and land application agreement is not formalized and the County has had to limit the biosolids removed from the Ridgefield WWTP when equipment or operational problems occur at Salmon Creek.

Clark County's charge for biosolids hauling, treatment and land application in 2003 and 2004 was as follows:

- $0.068 per gallon for liquid sludge up to 3 percent solids
- $0.199 per gallon for liquid sludge between 3.01 and 6 percent solids

Clark County has increased its charges for biosolids hauling, treatment and land application for 2005-2006, which are listed in Table 9-1 at various percent solids values and delivery options. Clark County charges are expected to continue to increase as fuel costs and sludge quantities rise.

TABLE 9-1

2005-2006 Clark County Charges for Sludge Hauling, Treatment and Land Application

Sludge solids concentration (%)	Cost per 5,000 gallon truckload	Cost per gallon	Cost per dry ton
With County hauling to Salmon Creek WWTP			
1.67	$ 434.91	$0.087	$1,249
2	$ 434.91	$0.087	$1,043
3	$ 434.91	$0.087	$ 696
3.01	$1,000.70	$0.200	$1,595
4	$1,000.70	$0.200	$1,200
5	$1,000.70	$0.200	$ 960
6	$1,000.70	$0.200	$ 800
With City hauling to Salmon Creek WWTP			
1.67	$ 130.92	$0.073	$1,045
2	$ 130.92	$0.073	$ 872
3	$ 130.92	$0.073	$ 582
3.01	$ 337.75	$0.188	$1,495
4	$ 337.75	$0.188	$1,125
5	$ 337.75	$0.188	$ 900
6	$ 337.75	$0.188	$ 750

A copy of the Memorandum of Agreement between the County and the City of Ridgefield for sludge processing is provided in Appendix I. Analytical costs for the management of Ridgefield biosolids are included in the agreement. A copy of the biosolids permit for the Woodland application site is provided in Appendix J.

To ensure that the biosolids provided to Clark County remain suitable for the processing and land application systems used by the County, it is recommended that the City implement a pretreatment program.

BIOSOLIDS QUANTITY AND QUALITY

Presently, only aerated storage of sludge is provided at the WWTP. Waste activated sludge (WAS) is stored in a sludge holding tank until it is hauled to Clark County's facilities. Therefore, minimal digestion (solids reduction of waste sludge) occurs, and the volume of sludge that is hauled is equivalent to the WAS production rate. Also, the sludge does not meet Class "B" pathogen removal or vector attraction reduction requirements. These requirements for land application are met at Clark County's sludge treatment facilities.

During 2004, 29.5 dry tons of sludge were hauled to the Salmon Creek WWTP, at an average concentration of 1.67 percent solids. Table 9-2 presents information on sludge production in 2004.

TABLE 9-2

2004 Biosolids Quantity

Unit of Measurement	Sludge Production
Dry tons/year	29.5
Dry lbs/week	1,135
Dry lbs/day	162
Solids concentration	1.67%
Gallons/week	8,150
Gallons/day	1,160

The City monitors regulated pollutants (metals) in the sludge annually by taking a sample and having the sample analyzed by a contract lab. Testing has indicated that the biosolids meet the pollutant concentration limits in Table 3 and the ceiling concentration limits in Table 2 of WAC 173-308-160, as shown in Table 9-3. Therefore, the land application rate would not be limited due to pollutant concentrations.

TABLE 9-3

2004 Biosolids Pollutant Concentrations(1)

Pollutant	8/31/2004 (mg/kg dry)	12/27/2004 (mg/kg dry)	WAC-173-308 Standards Table 3 Threshold (EQ) (mg/kg dry)	WAC-173-308 Standards Table 1 Ceiling Conc. Limits (mg/kg dry)
Antimony	0.99	0.64	N/A	N/A
Arsenic	5.82	0.74	41	75
Beryllium	0.25	0.17	N/A	N/A
Cadmium	4.69	2.55	39	85
Chromium	36.1	19.2	N/A	N/A
Copper	1,160	892	1,500	4,300
Lead	48.0	31.4	300	840
Mercury	0.75	0.38	17	57
Molybdenum	NA	NA	N/A	75
Nickel	22.6	16.5	420	420

TABLE 9-3 – (continued)

2004 Biosolids Pollutant Concentrations(1)

Pollutant	8/31/2004 (mg/kg dry)	12/27/2004 (mg/kg dry)	WAC-173-308 Standards Table 3 Threshold (EQ) (mg/kg dry)	WAC-173-308 Standards Table 1 Ceiling Conc. Limits (mg/kg dry)
Selenium	10.7	1.02	100	100
Silver	2.01	0.76	N/A	N/A
Thallium	0.06	0.04	N/A	N/A
Zinc	1,250	886	2,800	7,500

(1) All results reported in mg/kg on a dry basis, based on average 1.67% solids concentration.
NA = Not analyzed
N/A = Not applicable

As the City does not provide biosolids treatment, monitoring for compliance with pathogen and vector attraction reduction requirements is not performed. Therefore, data on fecal coliform density and the specific oxygen uptake rate (SOUR) are not available. Salmon Creek WWTP blends Ridgefield sludge with their own sludge and digests the mixture. Salmon Creek monitors pathogen and vector attraction reduction for the blended, treated biosolids prior to land application.

Similarly, the City does not monitor the nutrient or mineral content of the biosolids because they are blended with Salmon Creek WWTP's biosolids and treated prior to land application.

SHORT-TERM BIOSOLIDS MANAGEMENT (2005-2006)

The City will continue the current biosolids management system until the Phase 1 WWTP upgrade is completed, projected for 2007.

In 2004, the County hauled an average of 8,150 gallons/week of City sludge to the Salmon Creek WWTP. The City is currently limited to hauling 10,000 gallons per week to the Salmon Creek WWTP. Based on a conversation with Greg Ganson, the biosolids coordinator for Clark County, this limitation is the result of a combination of several factors. The County is currently providing a staff person for two days per week for the sludge hauling and cannot provide additional staffing for hauling purposes. Also, the Salmon Creek WWTP provides additional processing of Ridgefield solids to meet Class "B" standards for biosolids land application.

Short-term management cost estimates will be based on the current limit of sludge hauling at 10,000 gallons per week (36 dry tons per year at 1.67 percent solids).

If the City continues having the County process the sludge at 1.67 percent solids, the cost for biosolids management in 2005-2006 will be about $1,250 per dry ton, per Table 9-1, for an annual total of $45,000. The Salmon Creek WWTP prefers to obtain the sludge at less than three percent because introducing the sludge into their treatment process is simplified if the sludge can be readily pumped. If the City of Ridgefield could increase the percent solids to 3 percent, the cost per dry ton would decrease to about $695 per dry ton. However, the City will not have the capability to further thicken sludge until the completion of the Phase 1 WWTP upgrade in 2007.

The City has the option of delivering the biosolids using City staff, which reduces the Clark County charge from $0.087 to $0.073 per gallon. Using City staff, the Clark County charges in 2005-2006 could be reduced to $1,045 per dry ton, for an annual total of $37,600. This could save $7,400 per year in hauling costs paid to the County, but the City would need to hire additional staff to meet the additional labor demand. With the City's 1,800-gallon truck, approximately six truck loads would be required per week, with 2.5 labor hours per trip. This would equate to 780 labor hours per year (0.4 FTE), and would cost the City $21,800 at $28/hour. Sludge management would then cost the City an annual total of at least $59,400 if it hauled sludge, compared to $45,000 per year with the County providing the hauling to Salmon Creek. In addition, the City would have truck maintenance costs if it hauled sludge to Salmon Creek. Therefore, it is recommended that the City continue to contract with the County for sludge hauling to Salmon Creek.

PHASE 1 AND 2 BIOSOLIDS MANAGEMENT ALTERNATIVES (2007-2012)

The Phase 1 and Phase 2 upgrades, described in Chapter 8, will increase the capacity of the WWTP to 0.7 mgd and 1.0 mgd respectively. Improvements will result in a sludge thickened to 3 percent solids. Biosolids will be Class "B" with respect to pathogen removal, and meet vector attraction reduction requirements allowing for direct land application.

Table 9-4 provides the projected annual average quantity of raw waste activated sludge (WAS) and digested biosolids for 2009. The annual average WAS production rate for 2009 is estimated as 677 dry lbs/day, with 40 percent volatile solids destruction in the digester, the quantity of digested biosolids is estimated as 493 dry lbs/day.

TABLE 9-4

Projected Annual Average 2009 Biosolids Quantities

Unit of Measurement	Raw Sludge Production	Digested Solids Production
Dry tons/year	123.2	90
Dry lbs/week	4,739	3,451
Dry lbs/day	677	493
Gallons/year @ 3% solids	985,000	717,000
Gallons/week @ 3% solids	19,000	13,800
Gallons/day @ 3% solids	2,700	1,970

SELECTION FACTORS AND ALTERNATIVES

The alternatives evaluated for management of biosolids between 2007 and 2009 include:

1. Continue contracting with Clark County for partial processing and land application

2. Class “B” biosolids processing and contracted land application

Biosolids cost estimates are provided for planning purposes only. Actual construction and operational costs may vary as much as 30 percent. For implementation of the alternatives recommended in this section, a more detailed engineering analysis should be performed prior to final design.

ALTERNATIVE 1: CONTINUED CONTRACT MANAGEMENT UNDER AGREEMENT WITH CLARK COUNTY

Under this alternative, the City will continue to contract with Clark County for analysis, hauling, treatment, and beneficial use of City generated sludge.

The addition of a rotary drum sludge thickener will allow the City to provide thickened sludge to the County (up to 3 percent solids) at a lower per-gallon cost than for unthickened sludge. The Salmon Creek WWTP prefers to obtain the sludge at less than 3 percent because introducing the sludge into their treatment process is simplified if the sludge can be readily pumped.

If the City continues to haul raw sludge to the County, it will not be necessary to digest the sludge to Class “B” standards in the new aerobic digester. Raw sludge may continue to be stored in the old Imhoff tank (54,000 gallons capacity, 16 days detention time at maximum month sludge production and 3 percent solids concentration). The new sludge thickener would be used to thicken the raw sludge prior to storage in the old Imhoff tank.

The County recommends maintaining one month worth of sludge storage capacity at Ridgefield in the event of a mechanical problem at the Salmon Creek Plant. If Salmon Creek could not receive sludge temporarily, the new aerobic digester could be used to store sludge for 60 days.

Regulations/Permitting

The City remains responsible for submitting annual reports to Ecology. By contracting with the County, the City avoids the other regulatory and permitting issues involved with land application of biosolids.

Operations Costs

The annual operations cost of hauling raw sludge to the County has been estimated for the quantity of sludge projected for 2009. For this alternative, the new aerobic digester would be constructed but not used. Raw sludge would be thickened using the new sludge thickener and polymer, and then stored in the old Imhoff tank. The County would haul 15,200 gallons of raw sludge per week at 3 percent solids to the Salmon Creek WWTP.

The costs of County sludge hauling and processing have been estimated using rates for 2005-2006, in Table 9-5. The costs of maintaining sludge management through the contract with the County are expected to increase in the future. Fuel and labor costs will increase and the City may need to pay higher fees for additional capacity at the Salmon Creek WWTP in the future.

TABLE 9-5

Phase 1 and 2 Biosolids Management (2009) – County Hauling
Annual Operations Cost Estimate

Item	Annual Quantity	Unit	Unit Price	Annual Cost
Electricity	194,000	kWh	$0.069	$ 14,000
Polymer(1)	3,677	wet lbs	$1.70	$ 7,000
Sludge Hauling @ 3% solids	985,000	gal	$0.087	$ 85,700
Total Annual Costs				**$106,700**

(1) Assumes 13 lbs active polymer/dry ton sludge for thickening, and 35 percent polymer activity.

Capital Costs

The capital costs associated with this alternative are included in the proposed Phase 2 WWTP upgrade cost estimate shown in Chapter 8. The new aerobic digester would be constructed with this alternative, to provide capacity for long-term storage of sludge.

Risk Assessment

The County is currently limited to receiving 10,000 gallons per week of sludge from Ridgefield, due to capacity and staff limitations. In 2009, it is projected that the City will produce 15,200 gallons of raw sludge per week at 3 percent solids. When the County's biosolids permit is approved (by 2007), the County will probably accept additional solids; however, due to staffing limitation, the City may need to provide for the delivery of the solids.

However, the County may not be able to receive all of the City's sludge in the future. The County is not currently planning to add processing capacity in order to accommodate growth in Ridgefield. Meanwhile, the Salmon Creek facility is also adding additional customers who will consume the excess biosolids processing capacity at Salmon Creek. Therefore, the City should consider other biosolids management alternatives.

Advantages

The advantages of continued County hauling, processing and land application of biosolids are as follows:

- Easy to implement.
- Currently the most cost-effective solution.
- The City uses established expertise of others to oversee environmental permitting and monitoring of land application.
- No local public opposition to using established services.
- The City-County collaboration helps maintain an economy of scale for both entities.
- The City does not need to invest in the training and laboratory equipment associated with biosolids analysis and reporting.

Disadvantages

The disadvantages of continued County hauling, processing and land application of biosolids are as follows:

- The City has little control over the hauling, treatment or land application costs.
- The City has no control over the acquisition of capacity for growth needs affiliated with County/City growth.

- The City will need to enact a sewer use/pretreatment ordinance consistent with the County ordinance in order to protect the quality of the biosolids.

ALTERNATIVE 2: CLASS "B" BIOSOLIDS TREATMENT AND CONTRACTED LAND APPLICATION

The City can have an increased level of control of its biosolids management if the City treats sludge to Class "B" land application standards, and develops its own contract with a biosolids beneficial use site.

As described in Chapter 8, in this alternative the City would use the new aerobic digester to stabilize the raw sludge to produce Class "B" biosolids. Polymer and the rotary drum thickener would be used to thicken the raw sludge to 3 percent solids. The biosolids would be hauled to a permitted biosolids beneficial use facility by a hauling company. The City would develop a long-term contract with a hauling company and a beneficial use facility to receive Class "B" biosolids.

Regulations/Permitting

Biosolids regulations pertaining to land application were discussed earlier in this chapter. In addition to producing a Class "B" biosolid, under this alternative the City would have to develop a general land application plan, which would guide the selection of acceptable beneficial use facilities. The City would be responsible for all biosolids sampling, monitoring, and reporting.

Capital Costs

The capital costs associated with this alternative are included in the proposed Phase 2 WWTP upgrade cost estimate shown in Chapter 8.

Operations Expenses

The annual operations cost of treating Class "B" biosolids with contracted land application has been estimated for the annual average quantity of sludge projected for 2009 in Table 9-6. Raw sludge would be thickened using the new sludge thickener and polymer, and then stabilized in the new aerobic digester. A hauling company would transport 11,200 gallons per week of Class "B" biosolids, per Table 9-4, at 3 percent solids to a beneficial use facility.

The hauling cost per wet ton, assuming a one-way trip of 140 miles, is estimated at $30/wet ton, ($0.12 per gallon). Additionally, the cost for land application at a beneficial use facility has been estimated at $30/wet ton ($0.12 per gallon), based on similar facilities in Western Washington.

TABLE 9-6

Phase 1 and 2 Biosolids Management (2009) – Class "B" Biosolids Annual Operations Cost Estimate

Item	Annual Quantity	Unit	Unit Price	Annual Cost
Electricity	738,000	kWh	$0.069	$ 51,000
Polymer (1)	3,677	wet lbs	$1.70	$ 7,000
Biosolids Hauling @ 3% solids	717,200	gallons	$0.12	$ 86,000
Land Application	717,200	gallons	$0.12	$ 86,000
Total Annual Costs				**$230,000**

(1) Assumes 13 lbs active polymer/dry ton sludge for thickening, and 35 percent polymer activity.

Risk Assessment

The reliability of the Class "B" biosolids management system described above depends upon the availability of sludge haulers and permitted beneficial use facilities for land application. The City does not own equipment for hauling dewatered biosolids, or land that could be developed as a land application site. The costs or liability of contracted Class "B" biosolids may increase during the planning period.

Advantages

The advantages of treatment to produce Class "B" sludge, with contracted land application, are as follows:

- City has long-term control over biosolids application
- City biosolids production is not limited

Disadvantages

The disadvantages of treatment to produce Class "B" sludge, with contracted land application, are as follows:

- Hauling costs could increase if more distant application sites must be found.
- Backup management option may be needed since the long-term cost and viability of contracted Class "B" land application are somewhat uncertain.
- Requires some degree of program administration.

PHASE 3 AND 4 BIOSOLIDS MANAGEMENT ALTERNATIVES (2012-2024)

The Phase 3 and 4 upgrades, described in Chapter 8, will increase the capacity of the WWTP to 2.68 mgd to meet the projected flow and loading rates for 2024. New aeration basins will be constructed, and the existing aeration basins will be converted into aerobic digesters. The rotary drum thickener from Phase 1 will continue to be used to thicken raw sludge to 3 percent solids. The new digester will provide sufficient detention time to produce biosolids that are Class "B" with respect to pathogen removal, and meet the vector attraction reduction requirements. The Phase 3 upgrade will also include a dewatering screw press to produce dewatered biosolids at a minimum of 18 percent solids.

Table 9-7 provides the projected annual average quantities of raw sludge and digested biosolids for 2024. The annual average waste activated sludge production rate in 2024 is estimated as 2,536 lbs/day, and with 40 percent volatile solids destruction in the digester, the quantity of digested biosolids is 1,848 lbs/day.

TABLE 9-7

Projected 2024 Annual Average Biosolids Quantities

Unit of Measurement	Raw Sludge Production	Digested Solids Production
Dry tons/year	462	336
Dry tons/week	8.9	6.5
Dry lbs/day	2,536	1,848
Gallons/year @ 3% solids	3,689,000	2,689,000
Gallons/week @ 3% solids	70,900	51,7000
Gallons/day @ 3% solids	10,100	7,400
Wet tons/year @ 18% solids	N/A	1,860
Wet tons/week @ 18% solids	N/A	38
Wet tons/day @ 18% solids	N/A	5

SELECTION FACTORS AND ALTERNATIVES

The alternatives evaluated for management of biosolids between 2012 and 2024 include:

1. Continuing contracting with Clark County for partial processing and land application

2. Class "B" biosolids processing and contracted land application

3. Class “A” biosolids processing and City-managed beneficial use, sale or giveaway

The timing and nature of the improvements required of the City wastewater system are largely driven by growth needs and regulatory requirements. The exception is the biosolids processing improvements. The City will have a choice between Class “B” biosolids management, at lower capital and operational costs, or Class “A” biosolids management, which provides a more readily disposable product and better control of disposal requirements and costs.

Biosolids cost estimates are provided for planning purposes only. Actual construction and operations costs may vary as much as 30 percent. For implementation of the alternatives recommended in this section, a more detailed engineering analysis should be performed prior to final design.

ALTERNATIVE 1: CONTINUED CONTRACT MANAGEMENT UNDER AGREEMENT WITH CLARK COUNTY

Under this alternative, the City will continue to contract with Clark County for analysis, hauling, treatment, and beneficial use of City generated sludge.

If the City continues to haul raw sludge to the County, it will not be necessary to digest the sludge to Class “B” standards in the new aerobic digester. The new aerobic digester should be used, however, to store thickened sludge at 3 percent solids. The old Imhoff tank will not be large enough for the volume of sludge projected for 2024. The County recommends maintaining one month worth of sludge storage capacity at Ridgefield in the event of a mechanical problem at the Salmon Creek Facility. If Salmon Creek could not receive sludge temporarily, the new aerobic digester would provide 60 days of sludge storage capacity.

Regulations/Permitting

The City remains responsible for submitting annual reports to Ecology. By contracting with the County, the City avoids the other regulatory and permitting issues involved with land application of biosolids.

Operations Costs

The annual operations cost of hauling raw sludge to the County has been estimated for the quantity of sludge projected for 2024. For this alternative, raw sludge would be thickened using the sludge thickener and polymer, and then stored in the new aerobic digester. The County or the City would haul 57,000 gallons of raw sludge weekly, at 3 percent solids, per Table 9-7, to the Salmon Creek WWTP.

The costs of County sludge hauling and processing have been estimated using rates for 2005-2006 in Table 9-8. The costs of maintaining sludge management through the contract with the County are expected to increase in the future. The City may need to haul the sludge using City equipment and staff. Fuel and labor costs will increase and the City may need to pay higher fees for additional capacity at the Salmon Creek WWTP in the future.

TABLE 9-8

Phase 3 and 4 Biosolids Management (2024) – County Hauling Annual Operations Cost Estimate

Item	Annual Quantity	Unit	Unit Price	Annual Cost
Electricity	738,000	kWh	$0.069	$ 51,000
Polymer[(1)]	17,160	wet lbs	$1.70	$ 29,000
Sludge Hauling @ 3% solids	3,689,000	gal	$0.087	$321,000
Total Annual Costs				**$401,000**

(1) Assumes 13 lbs active polymer/dry ton sludge for thickening, and 35 percent polymer activity.

Capital Costs

The capital costs associated with this alternative are included in the proposed Phase 4 WWTP upgrade cost estimate shown in Chapter 8. The new aerobic digester would be constructed with this alternative to provide capacity for long-term storage of sludge. The centrifuge and solids processing building, included in the Phase 4 cost estimate in Chapter 8, are not required for this alternative.

Risk Assessment

As described in the previous section, the County is currently limited to receiving 10,000 gallons per week of sludge from Ridgefield, due to capacity and staff limitations. In 2024, it is projected that the City will produce 57,000 gallons of raw sludge per week at 3 percent solids. The County is not currently planning to add additional processing capacity in order to accommodate growth in Ridgefield. Meanwhile, the Salmon Creek facility is also adding additional customers who will consume the excess biosolids processing capacity at Salmon Creek. Meeting biosolids capacity requirements beyond the Phase 1 upgrade (0.7 mgd) cannot be guaranteed by the County. Therefore, the City should consider other biosolids management alternatives.

Advantages

The advantages of continued County hauling, processing and land application of biosolids are as follows:

- Easy to implement.
- The City uses established expertise of others to oversee environmental permitting and monitoring of land application.
- No local public opposition to using established services.
- The City-County collaboration helps maintain an economy of scale for both entities
- The City does not need to invest in the training and laboratory equipment associated with biosolids analysis and reporting.

Disadvantages

The disadvantages of continued County hauling, processing and land application of biosolids are as follows:

- The County may not be able to accept these quantities of raw sludge without significant expansions to the Salmon Creek WWTP sludge processing system. The City may be liable for a share of these expansion costs.
- The City has little control over the management costs.
- The City will need to enact a sewer use/pretreatment ordinance consistent with the County ordinance in order to protect the quality of the biosolids.

ALTERNATIVE 2: CLASS "B" BIOSOLIDS TREATMENT AND CONTRACTED LAND APPLICATION

The City can have an increased level of control of its biosolids management if the City treats sludge to Class "B" land application standards, and develops its own contract with a biosolids beneficial use site.

As described in Chapter 8, in this alternative the City would use the new aerobic digester to stabilize the raw sludge to produce Class "B" biosolids. Polymer and the rotary drum thickener would be used to thicken the raw sludge to 3 percent solids. A new screw press would be used with polymer to dewater the digested biosolids to 18 percent solids concentration. The dewatered biosolids could be economically hauled to a permitted biosolids beneficial use facility by a hauling company. The City would develop a long-term contract with a hauling company and a beneficial use facility to receive Class "B" biosolids.

Regulations/Permitting

Biosolids regulations pertaining to land application were discussed earlier in this chapter. In addition to producing a Class "B" biosolid, under this alternative the City would have to develop a general land application plan, which would guide the selection of acceptable beneficial use facilities. The City would be responsible for all biosolids sampling, monitoring, and reporting.

Capital Costs

Compared with Alternative 1 (continued hauling to Salmon Creek WWTP), Alternative 2 includes installation of a dewatering screw press. A solids handling building would be constructed to house the screw press and related equipment. Table 9-9 provides a summary of the capital costs estimated for Class "B" biosolids management in the Phase 3 and 4 WWTP upgrades.

TABLE 9-9

Phase 3 and 4 Biosolids Management (2024) – Class "B" Biosolids Capital Cost Estimate

Item	Quantity		Unit Price	Cost
Mobilization/Demobilization	1	LS	$180,645	$ 181,000
Install Sludge Dewatering System	1	LS	$400,000	$ 400,000
Solids Handling Building	1	LS	$720,000	$ 720,000
Site Work	1	LS	$ 90,322	$ 90,000
Misc. Metals	1	LS	$ 36,129	$ 36,000
Painting	1	LS	$ 18,064	$ 18,000
Mechanical/Yard Piping	1	LS	$180,645	$ 181,000
Electrical	1	LS	$180,645	$ 181,000

Subtotal	$1,807,000
Construction Contingency (25%)	$ 451,750
Subtotal	$2,258,750
Washington State Sales Tax (7.9%)	$ 143,000
Total Estimated Construction Cost	$2,402,000
Engineering, Administrative & Legal Services (25%)	$ 600,500
Total Estimated Project Cost	**$3,002,500**

Operations Expenses

The annual operations cost of treating Class "B" biosolids with contracted land application has been estimated for the quantity of sludge projected for 2024. Raw sludge would be thickened using the sludge thickener and polymer, and then stabilized in the new aerobic digester. A new screw press would dewater the digested sludge. A hauling company would transport 29 wet tons of Class "B" biosolids weekly, at 18 percent solids, to a beneficial use facility.

The hauling cost per wet ton, assuming a one-way trip of 140 miles, is estimated at $30/wet ton. Additionally, the cost for land application at a beneficial use facility has been estimated at $30/wet ton, based on similar facilities in Western Washington. Table 9-10 provides an estimated of the annual operations cost for the Class "B" biosolids system.

TABLE 9-10

Phase 3 and 4 Biosolids Management (2024) – Class "B" Biosolids Annual Operations Cost Estimate

Item	Annual Quantity	Unit	Unit Price	Annual Cost
Electricity	816,000	kWh	$0.069	$ 57,000
Thickening Polymer(1)	17,160	wet lbs	$1.70	$ 29,000
Dewatering Polymer(1)	12,480	wet lbs	$1.70	$ 21,000
Biosolids Hauling @ 18% solids	1,860	WT	$30	$ 56,000
Land Application	1,860	WT	$30	$ 56,000
Total Annual Costs				**$219,000**

(1) Assumes 13 lbs active polymer/dry ton sludge for both thickening and dewatering, and 35 percent polymer activity.

Risk Assessment

The reliability of the Class "B" biosolids management system described above depends upon the availability of sludge haulers and permitted beneficial use facilities for land application. The City does not own equipment for hauling dewatered biosolids, or land that could be developed as a land application site. The costs or liability of contracted Class "B" biosolids may increase during the planning period.

Advantages

The advantages of treatment to produce Class "B" sludge, with contracted land application, are as follows:

- City has long-term control over biosolids application
- City biosolids production is not limited by County system
- Lower capital costs than Class "A" biosolids production

Disadvantages

The disadvantages of treatment to produce Class "B" sludge, with contracted land application, are as follows:

- Hauling costs could increase if more distant application sites must be found.
- Backup management option may be needed since the long-term cost and viability is somewhat uncertain.
- Requires biosolids management program administration.

ALTERNATIVE 3: CLASS "A" BIOSOLIDS TREATMENT AND CITY-MANAGED BENEFICIAL USE

Biosolids drying is a process by which digested biosolids are dewatered and then dried to a solids concentration of 90 percent or more, thus producing a Class "A" biosolid that meets vector attraction requirements and has a greatly reduced volume. The Class "A" biosolid can be used by the City, sold, or given away to the general public or landscapers as a soil amendment.

The Phase 3 WWTP upgrade would optionally contain a sludge dryer, located in the solids handling building. The dryer may operate on natural gas (if available) or propane.

Regulations/Permitting

Regulations governing the design, permitting, and operation of a biosolids drying facility are addressed in WAC 173-308. Class "A" biosolids must meet the same pollutant concentration and vector attraction reduction requirements as Class "B" biosolids. WAC 173-308 lists several Processes to Further Reduce Pathogens (PFRPs), which along with fecal coliform monitoring (less than 1,000 Most Probable Number [MPN]/gram total solids), will demonstrate that the treated biosolids are Class "A" with respect to pathogens. Two PFRPs may apply to the sludge drying system:

1. Heat drying: Biosolids dried to 90 percent or greater solids content, by direct or indirect contact with hot gases, while the temperature of the biosolids exceeds 80 degrees C.
2. Pasteurization: Biosolids must be maintained at a temperature of 70 degrees C or greater for a period of at least 30 minutes.

The vector attraction reduction requirement may be met by producing biosolids with greater than 75 percent solids content prior to mixing with any other materials.

In addition to producing a Class "A" biosolid, under this alternative the City would have to develop a general land application plan, which would guide the selection of acceptable uses for the biosolids, and for a contingency plan. The City would be responsible for all biosolids sampling, monitoring, and reporting.

Capital Costs

Class "A" sludge drying will require the installation of sludge drying equipment, in addition to the capital facilities required for Class "B" biosolids. Table 9-11 provides a summary of the capital costs estimated for Class "A" biosolids in the Phase 3 and 4 WWTP upgrades.

TABLE 9-11

Phase 3 and 4 Biosolids Management (2024) – Class "A" Biosolids Capital Cost Estimate

Item	Quantity		Unit Price	Cost
Mobilization/Demobilization	1	LS	$ 374,194	$ 374,000
Install Sludge Dewatering System	1	LS	$ 400,000	$ 400,000
Solids Handling Building	1	LS	$ 720,000	$ 720,000
Install Sludge Dryer	1	LS	$1,200,000	$1,200,000
Site Work	1	LS	$ 187,097	$ 187,000
Misc. Metals	1	LS	$ 74,839	$ 75,000
Painting	1	LS	$ 37,419	$ 37,000
Mechanical/Yard Piping	1	LS	$ 374,194	$ 374,000
Electrical	1	LS	$ 374,194	$ 374,000

Subtotal	$3,741,000
Construction Contingency (25%)	$ 935,250
Subtotal	$4,676,250
Washington State Sales Tax (7.9%)	$ 296,000
Total Estimated Construction Cost	$4,972,000
Engineering, Administrative & Legal Services (25%)	$1,243,000
Total Estimated Project Cost	$6,215,000

Operations Costs

The annual operations cost of treating Class "A" biosolids for City use or public giveaway has been estimated for the quantity of sludge projected for 2024. Raw sludge would be thickened using the sludge thickener and polymer, and then stabilized in the new aerobic digester. A new screw press would dewater the digested sludge to 18 percent solids. The dewatered sludge would be dried in the sludge dryer to 90 percent solids, producing a Class "A" biosolids material.

Table 9-12 provides an estimated annual operation cost for the Class “A” biosolids system. The labor, electricity, and natural gas demands of the sludge dryer have been estimated based on experience with similar projects. The cost estimate assumes that the biosolids could be used by the City or given away to the public at no cost to the City.

TABLE 9-12

Phase 3 and 4 Biosolids Management (2024) – Class “A” Biosolids Annual Operations Cost Estimate

Item	Annual Quantity	Unit	Unit Price	Annual Cost
Labor (4.5 hr/day)[1]	1,300	hr	$28	$ 37,000
Electricity[2]	971,600	kWh	$0.073	$ 71,000
Natural Gas (37 therm/hr)[2]	53,872	therm	$0.648	$ 35,000
Thickening Polymer[3]	17,160	wet lbs	$1.70	$ 29,000
Dewatering Polymer[3]	12,480	wet lbs	$1.70	$ 21,000
Sludge Disposal[4]	372	WT	$0	$ 0
Total Annual Costs				**$193,000**

(1) Labor includes 2 hr/day dryer start-up and shut-down, and 2.5 hr/day during dryer operation (50 percent attended).
(2) Electricity and Natural gas usage based on estimate from Komline-Sanderson.
(3) Assumes 13 lbs active polymer/dry ton sludge for both thickening and dewatering, and 35 percent polymer activity.
(4) Assumes 90 percent solids in Class "A" biosolids.

Risk Assessment

The reliability of the Class “A” biosolids management system described above depends upon the development of a local market for dried biosolids, or on the continued availability of sludge haulers and permitted beneficial use facilities for land application. The City does not currently own biosolids hauling equipment.

Ecology requires facilities producing Class “A” biosolids to have a management contingency plan in case the biosolids do not meet the Class “A” Exceptional Quality (EQ) standards. This would occur if the sludge dryer is out of service or if pollutant concentrations exceed the limits. If the dryer were out of service, the digested biosolids could be hauled to a Class “B” land application facility on an interim basis. The biosolids general permit for Washington State allows emergency disposal of biosolids in a municipal landfill for up to one year. If the pollutant concentration limits were exceeded, disposal of the biosolids in a municipal landfill on an emergency basis is recommended.

Advantages

The advantages of Class “A” biosolids management are as follows:

- Can be used to obtain Class “A” biosolids
- Provides a beneficial end product for local public use, with minimal sludge management costs
- Significant reduction in the volume of the final product
- City can maintain control of biosolids disposition.

Disadvantages

The disadvantages of Class “A” biosolids management are as follows:

- High capital costs
- Higher labor and utilities costs than other alternatives
- Continual need to maintain market and customer base for the Class “A” biosolids, unless the Class “A” product is land applied as Class “B” material.

SUMMARY OF BIOSOLIDS MANAGEMENT ALTERNATIVES

The capital and operations costs for the biosolids alternatives for each phase are included in Table 9-13. The net present value of each of the Phase 4 alternatives, over a 20-year period, is presented in the table. The net present value calculation assumes that the capital costs were financed through a 20-year loan with a 1.5-percent annual interest rate. It was assumed that annual O&M costs would increase during the 20-year period at a 2.5 percent annual inflation rate.

TABLE 9-13

Biosolids Management Alternatives Cost Comparison

Alternative (expected solids concentration)	Annual Operations Cost Estimate(1)	Capital Cost Estimate	20-year Net Present Value(2)
Short-term: 2005-2006			
City hauls raw sludge to Salmon Creek (1.67%)	$ 59,400	N/A	N/A
County hauls raw sludge to Salmon Creek (1.67%)	$ 45,000	N/A	N/A
Phase 1 and 2: 2007-2012			
County hauls raw sludge to Salmon Creek (3%)	$106,700	N/A	N/A
Contracted hauling Class "B" sludge to land application site (3%)	$230,000	N/A	N/A
Phase 3 and 4: 2012-2024			
County hauls raw sludge to Salmon Creek (3%)	$401,000	N/A	$5,615,000
Contracted hauling Class "B" sludge to land application site (18%)	$219,000	$3,002,500	$5,588,000
Class “A” sludge drying with public give-away (90%)	$193,000	$6,215,000	$8,030,000

(1) Annual operations costs are estimated at the projected sludge productions rates for 2006 (short-term), 2012 (Phases 1 and 2) and 2024 (Phases 3 and 4).

(2) Assuming 1.5 percent interest rate on a loan for the capital costs, 4 percent discount rate, 2.5 percent annual inflation rate.

There is some degree of risk associated with selecting any of the biosolids management alternatives. Because of the current public sensitivity over biosolids land application sites, it is difficult to predict whether today’s best management method will be feasible in 10 years. For this reason, process flexibility is one of the most important criteria for selecting any of the alternatives.

RECOMMENDED BIOSOLIDS MANAGEMENT ALTERNATIVE

For the short-term and Phases 1 and 2, the recommended biosolids management alternative is to continue the contract with Clark County. This alternative has the lowest annual cost, is the easiest to implement and has relatively low administrative requirements. This method allows flexibility in the future by allowing the City to explore other biosolids management options if necessary.

For Phases 3 and 4, the Class “B” and Class “A” biosolids alternatives are both feasible; the net present values for each alternative are within 20 percent of the mean. Although the net present value for continued sludge hauling to Clark County is similar to the other alternatives, this is not recommended as Clark County will not have capacity to treat these biosolids. For the purpose of estimating future rates, connection fees and construction costs, the Class "A" biosolids process is recommended.

CHAPTER 10

WATER RECLAMATION AND REUSE EVALUATION

INTRODUCTION

The State Legislature has declared there is "a primary interest in the development of facilities to provide reclaimed water to replace potable water in non-potable applications, to supplement existing surface and groundwater supplies, and to assist in meeting the future water requirements of the state." In accordance with this declaration and RCW 90.48.112 this Facility Plan must evaluate the potential for water reuse. Wastewater reclamation can also provide some benefit to wastewater disposal responsibilities, where receiving water constraints preclude increased discharge into a surface water body. In addition to minimizing the environmental impacts of wastewater disposal, water reuse can address problems associated with diminishing potable water supplies and acquiring new water rights. Wastewater reclamation can potentially be cost effective through reducing potable water costs, creating an additional new water supply, and generating revenue by selling reclaimed water to customers for irrigation and other non-potable water uses. The production and beneficial use of reclaimed water is the development of a new water supply that can be especially beneficial to public water systems facing water supply shortages through physical and legal (water rights) supply limits.

The City of Ridgefield's *2005 Draft Comprehensive Water Plan Update* evaluated the City's projected future water demands based on projected growth in population and employment. The Plan suggests the City develop an additional water source as a means to meet the future water demands of the City, reinforcing the value of an additional water supply such as reclaimed water for the City of Ridgefield. This chapter evaluates the feasibility of generating reclaimed water for the City of Ridgefield.

REGULATIONS CONCERNING REUSE

"Reclaimed water" is defined in RCW 90.46.010 as "effluent derived in any part from sewage from a wastewater treatment system that has been adequately and reliably treated, so that as a result of that treatment, it is suitable for a beneficial use or a controlled use that would not otherwise occur, and is no longer considered wastewater."

Use of reclaimed water is an alternative to effluent disposal. In the State of Washington, any type of direct beneficial reuse of municipal wastewater is defined as water reuse or reclamation. *Water Reuse and Reclamation Standards* have been issued jointly by the Departments of Health and Ecology. This discussion is based on the current standards dated September 1997, which are adopted by reference in RCW Chapter 90.46, Reclaimed Water Use.

Washington State reuse standards are based on similar standards used throughout the United States. Washington's reuse standards for municipal wastewater can be broken down into four categories:

- Treatment Standards
- Permitted Uses of Reclaimed Water
- Use Area Requirements
- Operational and Reliability Requirements

A key difference between *water reuse* and *effluent disposal* is in the level of reliability required in the treatment process. Washington's reuse treatment standards call for *continuous* compliance, meaning that the treatment standard must be met on a constant basis or the treated water cannot be used as reclaimed water.

GROUNDWATER QUALITY STANDARDS

One alternative considered for effluent reuse in many areas is groundwater recharge. State groundwater quality regulations are contained in WAC 173-200. The State's groundwater quality regulations apply to all groundwater's of the State that occur in the saturated zone beneath the land surface. These standards do not apply to contaminant concentrations found in saturated soils, where such contaminants have been applied at agronomic rates for agricultural purposes, or under approved methods of land treatment as long as the contaminants do not cause groundwater pollution below the root zone.

While groundwater may support a number of beneficial uses, the overriding basis for the State's groundwater standards is to protect potential drinking water sources. Accordingly, the numeric groundwater standards in WAC 173-200 are human health based standards that, for many parameters, are the same as the State Department of Health (DOH) Drinking Water Standards.

The key to protecting groundwater quality from any adverse impacts of a wastewater discharge is found in the language of the State groundwater regulation. The wastewater must be applied in a manner that "will not cause pollution of any groundwaters below the root zone."

It is the policy of the State of Washington that groundwater quality will not be degraded beyond existing background conditions. In accordance with WAC 173-200-030, degradation above background levels can be allowed on a case-by-case basis only when "an overriding consideration of the public interest will be served" and "all contaminants have been provided with all known available and reasonable methods of prevention, control, and treatment (AKART) prior to entry."

Beneficial reuse of reclaimed water to recharge water supplies is consistent with the policy of antidegradation of state waters. Specifically, RCW 90.46.005 states:

> "The legislature further finds and declares that the use of reclaimed water is not inconsistent with the policy of antidegradation of state waters announced in other state statutes, including the water pollution control act, chapter 90.54 RCW."

When recharging groundwater with reclaimed water, RCW 90.46 only requires maintenance of primary drinking water standards in the aquifer that is recharged. This issue is of particular importance when considering that the drinking water standard for nitrate is 10 mg/L, whereas background nitrate levels in a relatively pristine aquifer are typically less than 1 mg/L.

TREATMENT STANDARDS

The State of Washington's standards for municipal wastewater reuse have four classifications based on the type of treatment provided. The classifications are summarized below in Table 10-1.

The beneficial use of reclaimed water is permitted under a single, reclaimed water permit. The reclaimed water permit will incorporate all other permitting requirements, which could include NPDES permit limits if a reliability feature relied upon waste discharge to a navigable stream, a state waste discharge permit for waste disposal to ground water through land treatment and disposal, and water rights limits if any modifications are required. The City will have to obtain a state waste discharge permit if land application of the effluent is part of the treatment process and the treatment standards of reclaimed water are not part of the approved treatment process.

TABLE 10-1

State of Washington Reclaimed Water Treatment Standards

Reuse Class	Continuously Oxidized(1)	Continuously Coagulated(2)	Continuously Filtered(3)	Disinfection (Total Coliform Density)(4)	
				7-Day Median Value	Single Sample
A	Yes	Yes	Yes	≤2.2/100 mL	23/100 mL
B	Yes	No	No	≤2.2/100 mL	23/100 mL
C	Yes	No	No	≤23/100 mL	240/100 mL
D	Yes	No	No	≤240/100 mL	no standard

(1) Oxidized wastewater is defined as wastewater in which organic matter has been stabilized such that the biochemical oxygen demand (BOD) does not exceed 30 mg/L and the total suspended solids (TSS) do not exceed 30 mg/L (monthly average basis), is non-putrescible (does not have a foul smell) and contains dissolved oxygen.

(2) Coagulated wastewater is defined as an oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated prior to filtration by the addition of chemicals or an equally effective method.

(3) Filtered wastewater is defined as an oxidized, coagulated wastewater that has been passed through natural undisturbed soils or filter media, such as sand or anthracite, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 nephelometric turbidity units (NTU), determined monthly, and does not exceed 5 NTU at any time.

(4) Disinfection is a process that destroys pathogenic organisms by physical, chemical, or biological means. The disinfection standards use coliform density as the measure of pathogen destruction. DOH recommends that a chlorine residual of 0.5 mg/L be maintained during conveyance from the reclamation plant to the use area to avoid biological growth in the pipeline and sprinkler heads.

PERMITTED USES OF RECLAIMED MUNICIPAL WASTEWATER

Allowable water reuse methods are presented in Table 10-2. Most of these methods provide limited opportunity for reuse due to the relatively small quantities and seasonal nature of the reuse demand. Two reuse methods that offer the potential for 100 percent reuse on a year-round basis are groundwater recharge and streamflow augmentation. A more detailed discussion of groundwater recharge and streamflow augmentation is provided after Table 10-2.

TABLE 10-2

Allowable Uses of Reclaimed Water

Use	Class of Reclaimed Water Allowed			
	Class A	Class B	Class C	Class D
Irrigation of Non-Food Crops				
Trees and fodder, fiber, and seed crops	YES	YES	YES	YES
Sod, ornamental plants for commercial use, pasture to which milking cows or goats have access	YES	YES	YES	NO
Irrigation of Food Crops				
Spray Irrigation:				
All food crops	YES	NO	NO	NO
Food crops which undergo physical or chemical processing sufficient to destroy all pathogenic agents	YES	YES	YES	YES
Surface Irrigation:				
Food crops where there is no reclaimed water contact with edible portion of crop	YES	YES	NO	NO
Root crops	YES	NO	NO	NO
Orchards and vineyards	YES	YES	YES	YES
Food crops which undergo physical or chemical processing sufficient to destroy all pathogenic agents	YES	YES	YES	YES
Landscape Irrigation				
Restricted access areas (e.g. cemeteries, freeway landscaping)	YES	YES	YES	NO
Open access areas (e.g. golf courses, parks, playgrounds, etc.)	YES	NO	NO	NO
Impoundments				
Landscape impoundments	YES	YES	YES	NO
Restricted recreational impoundments	YES	YES	NO	NO
Nonrestricted recreational impoundments	YES	NO	NO	NO
Fish Hatchery Basins	YES	YES	NO	NO
Decorative Fountains	YES	NO	NO	NO
Flushing of Sanitary Sewers	YES	YES	YES	YES

TABLE 10-2 – (continued)

Allowable Uses of Reclaimed Water

Use	Class of Reclaimed Water Allowed			
	Class A	Class B	Class C	Class D
Street Cleaning				
Street sweeping, brush dampening	YES	YES	YES	NO
Street washing, spray	YES	NO	NO	NO
Washing of Corporation Yards, Lots, and Sidewalks	YES	YES	NO	NO
Dust Control (Dampening Unpaved Roads, Other Surfaces)	YES	YES	YES	NO
Dampening of Soil for Compaction (Construction, Landfills, etc)	YES	YES	YES	NO
Water Jetting for Consolidation of Backfill Around Pipelines				
Pipelines for reclaimed water, sewage, storm drainage, gas, electrical	YES	YES	YES	NO
Fire Fighting and Protection				
Dumping from aircraft	YES	YES	YES	NO
Hydrants or sprinkler systems in buildings	YES	NO	NO	NO
Toilet and Urinal Flushing	YES	NO	NO	NO
Ship Ballast	YES	YES	YES	NO
Washing Aggregate and Making Concrete	YES	YES	YES	NO
Industrial Boiler Feed	YES	YES	YES	NO
Industrial Cooling				
Aerosols or other mist not created	YES	YES	YES	NO
Aerosols or other mist created (e.g. cooling towers, spraying)	YES	NO	NO	NO
Industrial Process				
Without exposure of workers	YES	YES	YES	NO
With exposure of workers	YES	NO	NO	NO

Groundwater Recharge

Groundwater recharge with reclaimed water is permitted under the water reuse standards. Three categories of groundwater recharge are covered in the water reuse standards:

1. direct injection to a drinking water aquifer,
2. direct injection to a non-drinking water aquifer, and
3. surface percolation.

Direct Injection to a Drinking Water Aquifer

Direct injection of reclaimed water to a drinking water aquifer must meet the water quality standards for primary contaminants (except nitrate), secondary contaminants, radionuclides and carcinogens contained in Table 1 of WAC 173-200, as well as maximum contaminant limits (MCLs) contained in the State Drinking Water Standards, WAC 246-290.

Additionally, for direct injection to a drinking water aquifer, preinjection treatment must include the following:

1. reverse osmosis treatment
2. turbidity ≤0.1 NTU (average) and ≤0.5 (maximum)
3. total organic carbon levels ≤1.0 mg/L
4. total nitrogen ≤10 mg/L as N

Direct Injection to a Non-Drinking Water Aquifer

Direct injection of reclaimed water to a non-drinking water aquifer must meet Class A reclaimed water treatment standards as well as the following additional criteria:

1. BOD_5 ≤5 mg/L
2. TSS ≤5 mg/L
3. (3) any additional criteria deemed necessary by DOH or Ecology

Surface Percolation

Groundwater recharge using surface percolation requires at least Class A reclaimed water unless a lesser level is allowed under a pilot project status by DOH and Ecology. In addition to secondary treatment to provide oxidized wastewater, the process must include a “step to reduce nitrogen prior to final discharge to groundwater.”

Streamflow Augmentation

For small streams where fish habitat has been degraded due to low instream flows, streamflow augmentation is an option allowed under the water reuse regulations and standards. This reuse method requires an NPDES permit and adherence to the Surface Water Quality Standards (WAC 173-201A). However, the key difference between streamflow augmentation and surface water disposal is that a determination of beneficial use has been established based on a need to increase flows to the stream. To make this determination requires concurrence from the Washington State Department of Fish and Wildlife that the need exists for additional instream flows.

Other Uses

The water reuse standards allow for other uses that are not discussed in detail in this chapter. However, the general basis for the reuse criteria is that when unlimited public access to the reclaimed water is involved (as is the case for the reuse scenarios that might apply for the City of Ridgefield) the criteria will require Class A reclaimed water. Essentially, for a water reclamation project to have the flexibility to allow for relatively unrestricted use, the reclaimed water should meet the Class A reuse standard.

The use of reclaimed water for agriculture is allowed under the water reuse standards including irrigation of food crops. The Class A reuse standard is not applied for non-food crop irrigation as long as proper setback distances are employed. These setback distances are discussed in the next section.

USE AREA REQUIREMENTS

The water reuse standards establish criteria for siting and identifying water reclamation projects and their facilities. Water reclamation storage facilities, valves, and piping must be clearly labeled and no cross connections between potable water and reclaimed water lines are allowed. Another key requirement for a water reclamation project is setback distance. Table 10-3 summarizes setback requirements for water reclamation facilities.

TABLE 10-3

Setback Distances for Reclaimed Water in the State of Washington

Reclaimed Water Use/Facility	Distance (Feet)			
	Class A	**Class B**	**Class C**	**Class D**
Minimum Distance to Potable Water Well:				
Spray or Surface Irrigation	50	50	100	300
Unlined Storage Pond or Impoundment	500	500	500	1,000
Lined Storage Pond or Impoundment	100	100	100	200
Pipeline	50	100	100	300
Minimum Distance from Irrigation Areas to Public Areas	0	50	50	100

OPERATIONAL AND RELIABILITY REQUIREMENTS

Under the reuse standards, there are a number of operational and reliability requirements for a water reclamation plant. Several key requirements are summarized below.

- Minimum Class III Operator.
- Critical equipment and process failures must be signaled by an alarm.
- Emergency storage and disposal facilities in the event of equipment failure or the intermittent production of effluent that does not meet the reclaimed water standards. It is possible that approval would be granted to dispose of effluent that does not meet specifications directly to the Lake River Creek.
- Operating records provided to DOH as well as Ecology.
- No bypass of untreated or partially treated water.
- Either a stand-by power supply or long-term disposal or storage facilities for untreated wastewater.

CURRENT WATER SYSTEM

The City of Ridgefield's *2005 Draft Comprehensive Water System Plan Update* (referred to hereafter as the Water Plan) evaluated the City's projected future water demands based on projected growth in population and employment. The Water Plan identified a need for the City to develop additional water rights in the long-term, over the next 20-year planning cycle. There is not an immediate need for the City to develop additional water rights; the 5-year planning period developed in the Water Plan did not establish the need for the City to develop additional water rights. The City has inchoate water rights that it intends to reestablish for use in the next 5 years. The Water Plan identified that the potential population growth will surpass the current City of Ridgefield's public water supply capacity in the long term. Growth projections indicate that the City's water rights will be exceeded in the year 2011. As a result, the City will be forced to adopt conservation measures. The Plan suggests the City develop an additional water source as a means to meet the future water demands of the City, reinforcing the value of an additional water supply such as reclaimed water for the City of Ridgefield.

The City of Ridgefield currently does not have sufficient water rights to provide service to customers within the Urban Growth Area for the next 20 years (*City of Ridgefield Water System Comprehensive Plan*, April 2005 by Gray & Osborne). However, the City is in the process of resolving this shortfall by entering into a long-term agreement with Clark Public Utilities (CPU) to purchase water for servicing the Ridgefield UGA. This agreement can supply sufficient water to serve the UGA through buildout projections.

POTENTIAL FOR RECLAIMED WATER

The existing wastewater treatment plant is located on the east edge of Lake River. Potential uses for reclaimed water near the existing treatment plant include the irrigation of public lands near the WWTP; including parks and play fields or lawns at the elementary school, jetting of sanitary, and storm sewers and possible commercial/industrial use at the Port of Ridgefield properties immediately to the west of the existing treatment plant. The existing treatment plant and future expansions can provide a high quality effluent that is suitable for use as a feed source for reclaimed water. The addition of a side stream polishing process to generate a source of reclaimed water is feasible at this location. The amount of reclaimed water that could be made available in this location could, therefore, be driven by demand. However, this location is not advantageous in terms of elevation. The ground rises steeply to the east of the plant and any reclaimed water for consumption in that direction would need to be pumped to reach a significant non-residential consumer.

The City of Ridgefield is planning for commercial and industrial growth to occur in the portion of the Urban Growth Area (UGA) located immediately to the east and west of Interstate 5. As noted in Chapter 3, this area is referred to as the Junction area and another reclaimed water option is to place a satellite reclaimed water treatment plant in this area. The potential uses for reclaimed water in this area will include the irrigation of public lands near the satellite plant, including parks and play fields, roadside planting strips for the commercial areas, jetting of sanitary and storm sewers and possible commercial/industrial use at properties located around the junction of I-5 and Pioneer Street. This area will generate an estimated average dry weather flow of 0.4 mgd of wastewater (0.8 mgd at maximum month flow) at projected 2024 flows. To the extent that there is sufficient demand for reclaimed water in this area, some of the wastewater in this area could be treated at a satellite plant to generate reclaimed water. Locating a satellite plant in this area would reduce the amount of pumping and piping infrastructure necessary to get reclaimed water to potential customers. Flows in excess of the potential reclaimed water demand would be directed to the existing WWTP. Biosolids from the plant would also be discharged to the existing WWTP or hauled directly to the Salmon Creek WWTP.

Injection of treated effluent into the groundwater is not considered in this chapter due to the expense of the reverse osmosis treatment that could be required. Also the irrigation of residential areas is not considered, because residential areas in Washington State are generally not watered with reclaimed water due to cost, and permitting requirements.

RECLAIMED WATER FOR THE JUNCTION AREA

Based on current zoning and land use limitations, the commercial/industrial acreage expected to be developed in this area is estimated to be 1,035 acres. Assuming that 20 percent of this area will require irrigation, an area of 207 acres could be irrigated. Irrigation demands were estimated from the net irrigation requirements listed in the Washington State Irrigation Guide for turf grass at the Battle Ground station. The annual net irrigation demand is 13.7 inches/year, with an irrigation season from mid-May to the end of September (4.5 months/year). The irrigation demand varies during the irrigation season, with the peak irrigation demand in July (5.04 inches).

The total irrigation demand in the irrigation season is estimated to be 77.9 million gallons. This is the potential demand when the area is fully built out. It is assumed that the irrigation will be performed 6 days per week, 6 hours per day (night). The maximum month (July) irrigation demand will be 1,188,000 gpd (3,300 gpm for 6 hours). This irrigation demand exceeds the projected wastewater production rate in the Junction (average dry weather flow of 400,000 gpd). Therefore, the supply of reclaimed water for irrigation will be limited to the rate of wastewater production. 400,000 gpd of reclaimed water would irrigate 70 acres of landscaping.

Wastewater in excess of the irrigation demand (during the non-irrigation season and the periods of low irrigation demand in the spring and fall) would be directed to the Lake River Wastewater Treatment Plant (WWTP). An alternative means of effluent disposal for the wastewater produced in the Junction area during the non-irrigation season was evaluated. Based on the current value of approximately $400,000 per acre for land in the UGA, groundwater infiltration of reclaimed water through surface spreading could be a major cost issue. The costs of installing a groundwater infiltration system for use during the non-irrigation season could be prohibitive due to the high cost of land. No other effluent disposal opportunity is available on the east side of I-5. The cost of groundwater infiltration will be evaluated if after a preliminary evaluation the cost of reclaimed water production appears competitive.

If a satellite plant were constructed for the Junction area, it would need to be built in the third expansion phase of the system. This phase is currently planned for 2017 when sufficient wastewater flows would be generated to justify the use of a satellite plant and sufficient demand for reclaimed water would be available. If the City wished to keep this option open, it would also be necessary to ensure that all irrigation systems in the possible service area were installed using the Pantone 522 "purple pipe" required for the distribution of reclaimed water. This coloration requirement will add $0.03 per foot to the costs of an irrigation system. Other requirements such as identification tape and a 10-foot horizontal separation and 18-inch vertical separation from potable water systems would also be required. The costs of the separation requirements would be determined by the specific limitations of each development. These irrigation systems could then be operated using potable water until reclaimed water becomes available. The costs of the distribution system and the operation of such a system would be the responsibility of the City.

RECLAIMED WATER FOR THE LAKE RIVER AREA

The existing wastewater treatment plant is located at the lowest part of the community. In this location, any reclaimed water to be made available to the east of the treatment plant would have to be pumped up to an elevation of over 90 feet to reach the downtown residential community and over 200 feet in elevation to reach the commercial/industrial locations that might provide the irrigation demand for reclaimed water.

The Port of Ridgefield owns property to the north, west, and south of the Lake River wastewater treatment plant. The total amount of property owned by the Port is 40 acres. Port plans call for this area to be converted from its current industrial uses into a mixed-use commercial and possibly residential area.

Estimating that 20 percent of this area might require irrigation during the irrigation season, the peak month irrigation demand would be 46,000 gpd, applied during a 6 hour period at 130 gpm. In this location, effluent disposal of unneeded water during the non-irrigation season would be through the outfall to Lake River or the Columbia River.

Although the Port could use this amount of reclaimed water in the future, the opportunities for reclaimed water use in this location remain unavailable until the Port has completed the Pacific Wood Treatment cleanup action. The on-site contamination that is being removed will prevent the Port from converting its properties to commercial or residential uses until the cleanup is completed in 2015 or later.

CONCEPTUAL DESIGN AND COST ESTIMATE

The City's non-potable water demands are estimated at approximately 40 percent of the total demand. Non-potable water demand is significantly from irrigation demands; however, non-potable demands other than for irrigation purposes could provide a use for year-round production of reclaimed water. Given the fact that it would likely cost more to produce reclaimed water year-round rather than part of the year, as for irrigation purposes during the dry weather months, the preliminary evaluation of the feasibility of reclaimed water production was done on the alternative to irrigate for 4.5 months of the year. Furthermore, the use of reclaimed water for non-potable uses would require additional infrastructure, which would also increase additional costs for the production of reclaimed water. If the cost to produce reclaimed water for irrigation appears competitive after a preliminary evaluation, then year-round production of reclaimed water will be evaluated.

The Satellite reclaimed water system will require treatment, storage, and distribution components. The system will only operate during the irrigation season; during the non-irrigation season, all wastewater will flow to the main WWTP. Table 10-4 provides the design criteria for the satellite water reclamation facility. The following section briefly describes each component of the process and provides a cost estimate.

TABLE 10-4

Design Criteria for Satellite WRF (for 2025)

Parameter	Design Criteria
Maximum Month Flow (gal/day)	400,000
Maximum Day Flow (gal/day)	400,000
Peak Hour Flow (gal/day)(1)	1,160,000
Maximum Month BOD5 Loading (lbs/day)	834
Maximum Month TSS Loading (lbs/day)	834

(1) Peak hour flow = maximum month flow x diurnal peaking factor (2.9).

Reclaimed water for the Lake River area may be most economically produced by a sidestream process at the existing Lake River WWTP. Production of Class A reclaimed water would be compatible with the MBR process alternative for the WWTP expansion. An irrigation pump station with an ultraviolet disinfection system would be constructed to supply reclaimed water from the Lake River WWTP.

TREATMENT SYSTEM

The Class A reclaimed water standards require continuous oxidation, coagulation filtration and disinfection of the wastewater.

The preferred alternative for construction of the satellite water reclamation facility is a membrane bioreactor (MBR) activated sludge process. The MBR process produces a very high quality effluent in a small footprint. In an MBR, secondary effluent is separated from the activated sludge solids by filtration through membranes submerged in the aeration basin, instead of separated by gravity in secondary clarifiers. The membrane filters produce a higher quality than typical tertiary filters, such as sand or cloth disc filters. Therefore, secondary clarifiers and tertiary filters are not required for MBR systems, and the facility footprint is smaller than for a reclaimed water facility using conventional activated sludge. Waste activated sludge is removed directly from the aeration basin, and will be stored in a solids holding tank. Solids will be discharged to the Lake River WWTP or hauled to the Salmon Creek WWTP for further treatment.

Influent Pump Station

The satellite water reuse facility will draw influent from the main sewer trunk line that conveys wastewater from the Junction area to the main WWTP. An influent pump station wet well will be located adjacent to a trunk line manhole, set at an elevation 10 feet lower than the manhole. Four submersible pumps (three duty, one standby) will pump wastewater from the wet well to the satellite reuse facility, each with a capacity of 270 gpm @ 35 feet TDH.

Headworks

The headworks will consist of an influent flow meter, sampler, mechanical fine screens, and a grit removal system. MBR processes require at least 3-mm fine screening to protect the membrane cassettes. Two mechanical fine screens (band screen or rotary drum) will be placed in two parallel channels, each sized for the maximum hydraulic flow of 1.16 mgd (one duty, one standby). A bypass bar screen will not be provided because its operation, even temporarily, could allow material into the MBR basin that may damage the membrane cassettes. The grit removal system will consist of an aerated grit chamber, a grit slurry pump, grit hydrocyclone, and classifier. Grit will be collected in a dumpster, while degritted slurry is returned to the grit chamber.

Membrane Bioreactor

In this particular process, solids in the aeration basin would be separated from the liquid by an in-basin membrane unit. The membrane microfilter system evaluated in this section is produced by Kubota, and marketed in the US by Enviroquip, Inc. Other membrane systems are available that may be used for the satellite WRF. In the Kubota system, membrane cassettes containing large numbers of flat-plate membranes (with nominal 0.4 μm pores) are placed directly into the aeration basin to provide clarification and filtration. Air is added through coarse-bubble diffusers mounted directly below the membrane cassettes to scour the membrane surfaces. The flow of air upward along the membranes promotes flow of mixed liquor upward across the membrane surfaces. Permeate (membrane effluent) passes through the membrane walls into the interior of the flat-plate membrane in a cross-flow pattern, with the driving force provided by either the elevation difference between the aeration basin water depth and the elevation of the downstream processes, or by permeate suction pumps.

In-place cleaning of the membranes with chlorine solution should be performed every 6 months, by injecting a chemical cleaning solution into the permeate lines and allowing the solution to soak in the interior of the membrane. Chemical solution tanks and feed pumps are provided. In addition, the manufacturer suggests periodically relaxing the membranes, by closing the permeate valves while continuing to scour the membranes with air, for 1 minute per 10 minutes of operation.

Operation of the aeration basin is not controlled by the gravity settling characteristics of the mixed liquor (as measured by the SVI). Therefore, the mixed liquor concentration can be maintained at three to four times the typical concentrations used in activated sludge processes. For this MBR, it is recommended to operate at a mixed liquor suspended solids (MLSS) concentration of 10,000 mg/L. Due to the high MLSS concentration, longer solids retention times (SRT) can be maintained in a tank with a short hydraulic retention time (HRT). The SRT is controlled by the rate that excess sludge is removed from the reactor. To remove excess sludge, the basins are equipped with waste activated sludge (WAS) pumps that transfer the sludge to the aerobic digestion system. Reducing the WAS removal rate will lengthen the SRT and increase the MLSS concentration. Membrane bioreactors have operated at concentrations up to 20,000 mg/L, without a negative long-term effect on membrane life.

Internal recycle pumps will transfer mixed liquor from the MBR tanks to the pre-aeration tanks, to keep the influent wastewater in contact with the activated sludge. Coarse bubble aeration diffusers will provide process air in the pre-aeration tanks. The MBR tanks are aerated by diffusers mounted to the bottom of the membrane cassettes. Two MBR tanks are provided in parallel; one tank may be taken off-line for maintenance or repair independently. In addition, redundant membrane cassettes will be provided in each tank to allow a cassette to be taken offline while providing treatment of the design flow.

Membrane permeate would flow by gravity or through permeate pumps to the UV disinfection facility. Permeate lines are equipped with pressure gauges and effluent magnetic flow meters.

Kubota membranes have a standard warranty of 5 years; replacement is recommended after 8 to 10 years. Extended warrantees are available, in which for a fixed annual fee the manufacturer will replace membranes as needed to maintain the design flux rate and performance.

Coagulation and Filtration

The Class A reclaimed water standards require continuous oxidation, coagulation filtration and disinfection of the wastewater. The MBR process will not produce higher quality effluent (in terms of BOD, TSS and turbidity) with the addition of coagulation or flocculation processes. Without coagulation they produce reclaimed water with higher quality than reclaimed water from conventional tertiary processes. The Washington State Departments of Ecology and Health have indicated that they would accept the MBR process without coagulation in a water reclamation application on a case-by-case basis. Therefore, coagulation facilities are not included in this evaluation.

Filtration is provided by the membrane microfilters in the MBR process.

UV Disinfection

Numerous UV disinfection systems that meet the Class A disinfection criteria have been installed in Washington State. Pilot testing has demonstrated that microfiltration membranes are capable of physically removing most bacteria, generally meeting the Class A disinfection standard (2.2 total coliform/100 mL) prior to disinfection. Pilot testing has demonstrated that virus removal is highly variable, and has been measured at less than 1-log (90 percent) removal in some pilot tests (City of San Diego, Point Loma Wastewater Treatment Plant). This is because viruses are generally smaller than the pore size of the microfilter.

The Washington State Department of Ecology has indicated that in lieu of specific state guidelines for UV disinfection, generally accepted engineering criteria should be used to design UV systems, such as the California Title 22 standards and the National Water Research Institute (NWRI) guidelines. Title 22 standards require that a combined 5-log removal (99.999 percent) of MS2 phage (a virus) be provided in the filtration and disinfection processes. Because virus removal in microfilters is not reliable, the UV system will be designed for 5-log removal of MS2. Recognizing the reduction in bacterial concentration, the NWRI standards require a minimum UV dose of 80 mJ/cm^2 for membrane filtered effluents, with an assumed transmittance of 65 percent.

The UV disinfection system will be designed to disinfect the maximum day design flow with one reactor out of service. Low-pressure, high-intensity UV lamps will be used. A single channel with three UV reactors in series will be provided, with the third reactor providing redundancy. With the design conditions listed above, low-pressure, high-intensity UV lamps are capable of disinfecting 12 gpm per lamp, per Trojan Technologies. Based on this, 24 lamps will be provided, eight lamps per reactor. A fixed finger weir will control the level in the channel.

Alarms and Telemetry

The use of reclaimed water for irrigation in open access areas demands a higher level of quality control than normal WWTP operations. An alarm system will be installed to notify staff if MBR or disinfection systems fail, or if the reclaimed water quality falls below an acceptable level. At this point, the reclaimed water production will cease and effluent will be discharged to the trunk sewer for treatment at the Lake River WWTP.

Bypass Storage

The water reclamation and reuse standards require a storage basin for effluent that does not meet the reclaimed water standards, if alternate disposal is not available. In case the water quality standards are not met, the facility will automatically shut down and divert the water in to the trunk sewer, for treatment at the Lake River WWTP and discharge per the City's NPDES permit. Therefore a bypass storage basin is not required.

Solids Handling

Mixed liquor must be wasted from the aeration basin to maintain a constant MLSS concentration and sludge age in the activated sludge system. The waste activated sludge (WAS) will be pumped into a sludge storage tank. The tank will provide capacity to store and aerate 5-days production of sludge. Stored sludge will be drained into the sewer trunk line, for conveyance to the Lake River WWTP for further treatment. Sludge will be returned to the sewer during period of moderately high flow, to ensure that the sludge is well-mixed with sewage and does not settle out or clog the sewer pipes.

IRRIGATION STORAGE AND DISTRIBUTION

Irrigation of public access areas, such as landscaped areas, must be performed at the time when risk of public contact is least (night time). Assuming a 6-hour irrigation period (11:00 p.m. to 5:00 a.m.), the peak irrigation demand is 1,110 gpm (400,000 gpd/6 hr). Instead of producing reclaimed water at this rate, it is more cost-effective to operate the reclaimed water facility 24 hours per day at a lower rate, and provide irrigation distribution storage. Approximately 400,000 gallons of storage will be required for equalization, located at the satellite WRF. A covered concrete tank (dimensions 60 feet by 60 feet and 15 feet deep) will be sufficient for irrigation storage.

Three irrigation supply pumps (two duty, one standby) will be provided to transfer reclaimed water from the storage basin to the irrigation systems. They will be sized for 555 gpm at 70 psi to produce sufficient pressure for irrigation. The motor horsepower will be approximately 20 hp each.

Approximately 18,300 lf of 8-inch pipe will be required to distribute the reclaimed water throughout the Junction area. At a unit cost of $80/lf (independent trench), the reclaimed water piping is estimated to cost $1,464,000.

ECONOMIC FEASIBILITY OF REUSE

Production of reclaimed water for irrigation is considered economically feasible if the cost of producing reclaimed water is less than or equal to the cost of purchasing water. The costs of proceeding with an alternative discharge location can also be part of the economic considerations if generating reclaimed water precludes the need for a new outfall. In this section, the economic feasibility of reuse will be evaluated by computing the per-gallon cost of reclaimed water production to the current price of water in Ridgefield. If unit costs change, this feasibility study will need to be re-evaluated.

Water Reclamation Facility and Distribution System Capital Cost

Estimated project costs for the water reclamation facility and the irrigation distribution system are provided in Tables 10-5 and 10-6, respectively. The cost estimate for the water reclamation facility includes pumping, piping, instrumentation, electrical, structures, and all equipment required to ensure reliable operation. The equipment cost estimates include installation costs. From experience with previous projects, general piping system, valves and appurtenances were estimated to be 12 percent of the subtotal (this value is lower than for the Lake River WWTP because significant piping is provided in the MBR equipment package). Electrical and controls equipment, including conduits, pullboxes, motor control centers, computer control systems and alarms, were estimated to be 15 percent of the subtotal. From experience with previous projects, mobilization/demobilization was estimated at 10 percent of the subtotal and sitework at 5 percent of the subtotal. Painting was estimated at three percent of the subtotal and miscellaneous metals at two percent of the subtotal. The estimate includes 7.9 percent for sales tax, 25 percent for contingencies, and 25 percent for administration, fiscal, legal, and engineering.

The cost estimate for the irrigation water distribution system included the irrigation storage basin and the irrigation pump station, with added proportional costs for mechanical, electrical, site work, painting and miscellaneous metals. The estimated cost for reclaimed water piping is also included. The estimate includes 7.9 percent for sales tax, 25 percent for contingencies, and 25 percent for administration, fiscal, legal, and engineering.

TABLE 10-5

Estimated Project Cost for Satellite WRF

Item	Quantity		Unit Price	Total Price
Mobilization/Demobilization	1	LS	$ 295,000	$ 295,000
Influent Pump Station	1	LS	$ 100,000	$ 100,000
Headworks (incl. fine screens, grit removal)	1	LS	$ 117,000	$ 117,000
MBR concrete tanks	1	LS	$ 152,000	$ 152,000
MBR equipment	1	LS	$1,300,000	$1,300,000
Sludge Holding tank	1	LS	$ 36,000	$ 36,000
Class "A" UV Disinfection System	1	LS	$ 64,000	$ 64,000
Effluent flow meter and sampler	1	LS	$ 10,000	$ 10,000
Standby Generator	1	LS	$ 76,000	$ 76,000

Subtotal	$2,150,000
Site Work (5% of subtotal)	$ 108,000
Piping (12% of subtotal)	$ 258,000
Alarms/electrical (15% of subtotal)	$ 323,000
Painting (3% of subtotal)	$ 65,000
Misc. metals (2% of subtotal)	$ 43,000
Subtotal	$2,947,000
Contingency (25%)	$ 737,000
Sales Tax (7.9%)	$ 292,000
Total Construction Cost	**$3,976,000**
Engineering and Administrative Costs (25%)	$ 994,000
Total Estimated Project Cost	**$4,970,000**

TABLE 10-6

Estimated Project Cost for Reclaimed Water Distribution System

Item	Quantity	Unit Price	Total Price
Mobilization/Demobilization	1 LS	$235,000	$ 235,000
Irrigation Storage Basin (400,000 gal)	1 LS	$290,000	$ 290,000
Irrigation Supply Pumping Station	1 LS	$110,000	$ 110,000
Subtotal			$ 635,000
Site Work (5% of subtotal)			$ 32,000
Piping (15% of subtotal)			$ 96,000
Alarms/electrical (15% of subtotal)			$ 96,000
Painting (3% of subtotal)			$ 20,000
Misc. metals (2% of subtotal)			$ 13,000
Irrigation Supply Piping	18,300 LF	$ 80	$1,464,000

Subtotal $2,356,000
Contingency (25%) .... $ 589,000
Sales Tax (7.9%) .... $ 233,000
Total Construction Cost $3,178,000
Engineering and Administrative Costs (25%) .... $ 795,000
Total Estimated Project Cost $3,973,000

Operation and Maintenance Cost Estimate

The annual operation and maintenance cost estimate is provided in Table 10-7. The estimates are based on information from the City of Ridgefield and experience from other water reclamation facilities in the State. It is estimated that the Satellite WRF and distribution system will add 1 FTE to the City's labor requirement. Annual equipment maintenance costs are estimated as three percent of the initial equipment capital cost. In addition, UV lamps will need to be replaced, with an average replacement rate of 40 percent per year. The membrane cartridges must be periodically replaced, with an average life of eight to 10 years. The cost of an extended warranty, which includes replacement of membranes as needed, was quoted at $25,000 per year. The membranes will also require sodium hypochlorite, and possibly oxalic acid, as cleaning chemicals.

TABLE 10-7

Estimated Annual Operations and Maintenance Cost for Satellite WRF

Item	Annual Quantity	Unit Price	Annual Cost
Labor (1 FTE for 4.5 months)	2,080 hr	$28	$ 59,000
Electricity	303,000 kWh	$0.069	$ 21,000
Membrane extended warranty	1 LS		$ 25,000
Maintenance	1 LS		$ 11,000
Membrane cleaning chemical	3,340 LBS	$0.10	$ 400
UV Lamp Replacement	4 EA	$157	$ 700
Miscellaneous	1 LS		$ 10,000

Subtotal $127,100
Contingency (15%) .... $ 19,065
Total Annual Costs $146,200

Comparison to Potable Water Costs

The total annualized cost for the available alternatives to the City of Ridgefield to address the need for additional water rights are presented in Table 10-8; the total annualized cost includes both operating and capital costs and was used in calculating the cost of reclaimed water for a comparison to current and possible future Ridgefield water costs. The alternatives include:

1. Reclaimed water production,
2. Development of additional water rights,
3. Purchase water rights from the County, and
4. Adopt a conservation-based water rate structure.

The annualized debt service is based on a 20-year, 1.5 percent PWTF loan for the capital cost would be $521,000. Combined with annual O&M Costs of $146,200, the annual cost to provide reclaimed water would be $667,165. The cost of reclaimed water would be $25.33 per 1,000 gallons.

TABLE 10-8

Comparison of Reclaimed Water and Potable Water Costs (1)

	Reclaimed Water Production	Development of Additional Water Rights	Purchase Water Rights from the County	Conservation Based Water Rate Structure
Capital Cost	$8,943,000	NA(2)	NA(2)	NA(3)
Annual O&M Cost (2005)	$ 146,200	NA(2)	NA(2)	NA(3)
Net Present Value (2005)	$9,222,500	$4,593,000(4)	$4,044,000(4)	NA(3)
Cost of Water ($/1000 gal) (2005)	$25.33(6)	NA(3)	NA(3)	$8.57(5)

(1) Discount rate = 4.5%, interest rate = 1.5%, and inflation rate = 3%.
(2) Varies by year over the twenty year period; presented in Tables 8-3, 8-4, and 8-5 in the *City of Ridgefield Water System Plan Update* (Gray & Osborne, 2005).
(3) Not applicable, not calculated, not used in the comparison.
(4) From Table 8-6, *City of Ridgefield Water System Plan Update* (Gray & Osborne, 2005) for the production of 632 million gallons over 20 years.
(5) Assumes a very large monthly use of 64,328 gallons, which is selected because it is in the third tier of a conservation based water rate structure. The first tier is based on the existing City of Ridgefield water rate (including a monthly base charge); the second and third tiers were based on the conservation based water rate structure for the City of Seattle.
(6) Cost of water based on 2005 annual O&M cost and debt payment on capital cost for 26,000,000 gallons of reclaimed water produced per year.

Developing Additional Water Rights and Purchasing Additional Water Rights

The two alternatives for obtaining additional water rights presented in the *City of Ridgefield Water System Plan Update* (Gray & Osborne, 2005) (Water Plan) include 1) the City can develop its own additional water rights or 2) the City can purchase water from Clark County Public Utilities. The net present value of both alternatives for the production of 632 million gallons over 20 years is presented in Table 8-6 of the Water Plan. The net present value is used for a comparison between the cost of reclaimed water and the two alternatives presented in the Water Plan.

The net present value of developing the City's own additional water rights is less than half the net present value of producing reclaimed water. The net present value of purchasing water rights from Clark County Public Utilities is also less than half the net present value of producing reclaimed water. Furthermore, the net present value presented in Table 10-8 for reclaimed water production would produce approximately 26.3 million gallons of water per year. The net present value for the alternatives presented in the Water Plan listed in Table 10-8 would produce approximately 31 million gallons per year

(632 million gallons over 20 years). The cost for either alternative, developing additional water rights or purchasing water from the County, is significantly less than the cost to produce reclaimed water at this time.

The net present value of the alternative to purchase water from the County assumes no annual price increase of the County charges; however, if the price is increased 5 percent annually the net present value of the alternative would still be less than the net present value for the production of reclaimed water.

The net present value, presented in Table 10-8, for each of the three alternatives, reclaimed water production, developing additional water rights, and purchasing water rights from the County, assumes a project life of 20 years. Presumably most of the infrastructure established will last longer than twenty years nonetheless, for this preliminary cost comparison, the use of a 20-year service life is appropriate.

Conservation Based Water Rate Structure

The City of Ridgefield rate structure provides some incentive for conservative water use. If the City were to provide a greater incentive to conserve water by adopting an aggressive conservation based water rate structure the cost of water to the rate payer would increase with an increase in water use. For example, the City of Seattle has adopted a three-tier conservation based water rate structure. A modified version of the City of Seattle's rate structure was used to evaluate the impact of a conservation based water rate charge and would be equal to the existing water base charge for up to 7,480 gallons (1,000 cubic feet) ($36.58 per 1,000 cubic feet). The second tier was established for up to 19,448 gallons (2,600 cubic feet) at $3.35 per 748 gallons (100 cubic feet). The third tier was established at any quantity greater than 26,928 gallons (3,600 cubic feet) per month. The conservation based water rate structure presented in this Chapter was established to allow for a reasonable comparison with the existing City of Ridgefield water rates. The first tier includes the base rate as is done for the existing water rate structure. The cost was evaluated for a use of 64,328 cubic feet per month; the quantity was chosen so that the impact of the third tier could be evaluated. It was estimated that the water rate would be approximately $8.58/1,000 gallons per month. The conservation based water rate structure presented here was established for preliminary evaluation purposes, the City would have to develop its own value for reach tier if the City decides to establish a conservation based water rate structure similar to the City of Seattle.

The reclaimed water facility would provide an estimated 26.3 million gallons of reclaimed water per year. The cost of reclaimed water per 1,000 gallons is at least two orders of magnitude greater than the cost for the City to develop additional water rights and for the City to purchase water from the County. The cost of producing reclaimed water for part of the year does not appear to be cost competitive; therefore, a further evaluation using reclaimed water year round was not evaluated at this time. The costs presented in the Water Plan and in Table 10-8 are subject to changes in the market price of water and must be reevaluated should reclaimed water production be considered at a later date. It has not been established yet whether the City will be granted the rights from Washington State Department of Ecology or whether the County will have enough water for the City to purchase; nonetheless, at this time the production of reclaimed water does not appear to be cost-effective. It may be the case that in the future, reclaimed water will be the only alternative.

CHAPTER 11

FINANCIAL ANALYSIS

This chapter describes how the City can finance the wastewater system improvements outlined in the previous chapters of this plan. The potential funding sources, financial status of the wastewater utility, the funding required to pay for the scheduled improvements, and the impact of wastewater improvements on wastewater rates are presented herein.

FINANCIAL STATUS OF EXISTING WASTEWATER UTILITY

CURRENT WASTEWATER RATES

Wastewater rates and charges for the City are specified in the Ridgefield Municipal Code (RMC) 13.11.010. Monthly wastewater rates consist of a base charge that is dependent on the size of the water meter. All customers located outside of the city limits pay a 50 percent surcharge on their total bill. Table 11-1 lists the City's current schedule of rates and charges.

TABLE 11-1

Monthly Wastewater Service Charges(1)

Customer Type and Meter Size	Monthly Base Charge(2) (3)
Residential: All sizes	$ 39.19(4)
Commercial: 1-inch and smaller	$ 28.13
Commercial: 1-1/2 inch	$ 40.59
Commercial: 2-inch	$ 61.05
Commercial: 3-inch	$108.81
Commercial: 4-inch	$179.13
Commercial: 6-inch	$364.01
Commercial: 8-inch	$553.21
Non Metered Customer	$ 39.19 per EDU(5)
Customer Type	**Volume Charge(2)(3)**
Residential	None
Non-residential	$3.11/ccf

(1) Source: Ridgefield Municipal Code sections 13.11.010
(2) Customers outside the City's corporate limits also pay a surcharge of 50 percent.
(3) Customers with a septic tank and low pressure sewer also pay a surcharge of 50 percent.
(4) A senior discount of 25 percent may be granted to customers over 60 years of age and within the City limits.
(5) EDU = Equivalent Dwelling Unit

CURRENT CONNECTION FEES

The City has increased its System Development Charge (SDC) from $4,000 to $6,950 per EDU. This increase is based on a SDC review performed in 2005.

HISTORICAL EXPENSES

The City operates a combined water and sewer utility operating fund. The Water Sewer Fund (No. 401) segregates expenses into several categories: salaries and benefits, administration, maintenance/repairs, and Public Works. The Water Sewer System Development Fund (No. 402) itemizes all capital expenses to the combined utility. Table 11-2 provides the historical wastewater utility operating expenses for the years 2001-2004.

TABLE 11-2

Historical Wastewater Utility Operating Expenses

Operating Expenditures	2001	2002	2003	2004
Salaries & Benefits				
Salaries	143,720	138,621	159,574	191,679
Overtime			4,18	3,790
Health Care			25,428	27,086
Benefits	37,463	34,269	20,121	36,517
Subtotal Salaries & Benefits	**181,183**	**172,890**	**209,312**	**259,072**
Administration				
Uniforms/Cleaning	1,506	1,908	2,177	2,516
Supplies	20,245	11,660	10,914	11,031
Fuel Consumed	1,208	938	2,148	2,125
Small Tools/Minor Repair	519	458	1,644	1,190
Professional Services/Sludge Hauling	11,261	14,913	19,680	31,380
Lab – Clark Co		57	140	1,670
Professional Services Legal				52
Cellular	88	120	544	395
Telephone/Telemetry/Technical	3,308	3,689	3,452	5,905
Pager	16		145	145
Postage	980	344	1,286	615
Travel Seminars	566	875	1,456	2,145
Advertising	217	535	65	1,370
Rentals/Leases – Pitney/Office	746	907	1,281	1,400
Utilities	16,955	31,459	29,883	32,890
Inter-Department & Administration	43,146	46,799	69,792	76,414

TABLE 11-2 – (continued)

Historical Wastewater Utility Operating Expenses

Operating Expenditures	2001	2002	2003	2004
Inter-Department & Administration (Audit)	122	2,500	101	
Excise Tax[(1)]				
Subtotal Administration	**100,883**	**117,162**	**144,708**	**171,243**
Maintenance/Repair				
Standby Clarifier	4,261	27,960		1,440
Computer Repair/Maintenance		323	300	440
Treatment Facility Plant Maintenance		53,411	34,121	28,210
Vehicle Maintenance			7,892	2,415
UV Light Maintenance			3,526	1,560
Miscellaneous Repair & Maintenance		4,15	709	22,763
Miscellaneous/Dues/Permits	2,765	2,976	3,396	3,068
Subtotal Maintenance/Repair	**7,026**	**88,655**	**49,944**	**59,896**
Public Works				
Office Equipment/Copier			39	245
Office Furnishings			191	100
Custodial Services				60
Telephone/Communications			520	165
Office Space Rent			1,250	1,155
Electricity/Heat			17	115
Water/Sewer				35
Miscellaneous			109	
Subtotal Public Works	**0**	**0**	**2,126**	**1,875**
Total O&M Expenses	**290,100**	**379,700**	**407,100**	**492,100**

(1) Historical excise taxes are unknown.

HISTORICAL REVENUES

The wastewater utility records revenues in two accounts, the Water Sewer Fund and the Water Sewer System Development Fund. Wastewater utility revenues for the years 2001 through 2004 are shown in Table 11-3.

TABLE 11-3

Historical Wastewater Utility Operating Revenues

Operating Revenues	2001	2002	2003	2004
Sewer Revenue	252,128	264,164	354,149	367,200
Miscellaneous	423	1,084	9,712	5
Total Revenues	252,511	265,248	363,861	367,205

SUMMARY OF CURRENT FINANCIAL STATUS

Comparing water system operating expenses (Table 11-2) and revenues (Table 11-3), the wastewater utility generated negative net operating revenue in 2001, 2002, 2003, and 2004. In 2004, the wastewater portion of the utility generated a total net operating revenue of approximately negative $124,895 ($367,205 - $492,100). The negative net revenue was paid by reserve funds.

PROJECTED EXPENSES, REVENUES, AND RESERVES

GROWTH

Projected growth in wastewater demand is required to estimate expenses associated with providing sewer services (supplies and utilities) and to estimate future revenues.
Table 3-3 in this Plan projects a 16.6 percent average increase in water usage for the next 6-years planning period. This growth rates are used in the financial analysis section of this chapter.

FUTURE EXPENSES

Tables 11-4 summarize projected wastewater utility operating and expenses for the years 2005 through 2010. Future expenses have been projected based on a review of the historical expenses from 2001 through 2004 and the potential impact of inflation and growth on each expense. Historical expenses that appear stable or have been growing are projected using 2004 expenses, while historical expenses that show significant variation from year to year are projected using the average expenses from 2001 through 2004. All projected expenses, except debt, capitalized expenditures, salaries and benefits, have been adjusted for an estimate of 2.2 percent annual inflation. Salary and benefit costs have been increased by a cost of living adjustment of 3.0 percent per year. Professional services, insurance, and repairs and maintenance expenses have been increased annually for the projected average annual growth in customers of 3.0 percent. The Washington State excise tax (5.029 percent) is applied to all wastewater revenue, also discussed in the next section.

TABLE 11-4

Projected Wastewater Utility Operating Expenses

Operating Expenditures	2005	2006	2007	2008	2009	2010
Salaries and Benefits						
Salaries	196,500	201,400	206,400	211,600	216,900	222,300
Overtime	3,900	4,000	4,100	4,200	4,300	4,400
Health Care	27,900	28,800	29,600	30,500	31,400	32,400
Benefits	37,600	38,700	39,900	41,100	42,300	43,600
Subtotal Salaries and Benefits	**265,900**	**272,900**	**280,000**	**287,400**	**294,900**	**302,700**
Administration						
Uniforms/Cleaning	2,600	2,600	2,700	2,700	2,800	2,800
Supplies	13,800	14,100	14,400	14,700	15,100	15,400
Fuel Consumed	2,100	2,200	2,200	2,300	2,300	2,400
Small Tools/Minor Repair	1,200	1,300	1,300	1,300	1,300	1,400
Professional Services/Sludge Hauling	32,100	32,800	33,500	34,300	35,000	35,800
Lab Clark Co.	1,700	1,800	1,800	1,900	1,900	1,900
Professional Services Legal	100	100	100	100	100	100
Cellular	400	400	400	400	400	500
Telephone/Telemetry/Tech	6,000	6,200	6,300	6,400	6,600	6,700
Pager	100	100	100	100	100	100
Postage	600	600	600	700	700	700
Travel Seminars	2,100	2,200	2,200	2,300	2,300	2,400
Advertising	1,400	1,500	1,500	1,500	1,600	1,600
Rentals/Leases – Pitney/Office	1,400	1,500	1,500	1,500	1,600	1,600
Utilities	40,300	49,300	60,400	73,900	90,500	110,800
Inter Department and Administration	78,100	79,800	81,600	83,300	85,200	87,100
Inter-Department and Administration (Audit)		2,600		2,700		2,800
Excise Tax	17,200	20,700	24,800	29,800	35,800	43,000
Subtotal Administration	**201,200**	**219,800**	**235,400**	**259,900**	**283,300**	**317,100**
Maintenance/Repair						
Standby Clarifier	8,600	8,800	9,000	9,200	9,400	9,600
Computer – Repair/Maintenance	400	400	400	400	400	500
Treatment Facility Plant/Maintenance	39,400	40,300	41,200	42,100	43,000	44,000
Vehicle Maintenance	5,300	5,400	5,600	5,700	5,800	5,900
UV Light Maintenance	2,600	2,600	2,700	2,700	2,800	2,800
Miscellaneous Repair/Maintenance	9,400	9,600	9,800	10,000	10,300	10,500
Miscellaneous/Dues/Permits	3,200	3,200	3,300	3,400	3,500	3,500
New WWTP Costs (Sludge/Pump/LAB)				115,600	118,200	120,800
T-7 Pump Station			19,200	19,600	20,100	20,500

TABLE 11-4 – (continued)

Projected Wastewater Utility Operating Expenses

Operating Expenditures	2005	2006	2007	2008	2009	2010
45th Avenue Pump Station			19,200	19,600	20,100	20,500
279th Street Pump Station					20,100	20,500
Basin 1 Pump Station		18,800	19,200	19,600	20,100	20,500
Subtotal Maintenance/Repair	**68,900**	**89,100**	**129,600**	**247,900**	**273,800**	**279,600**
112 N. Main Suite B						
Office Equipment/Copier	200	200	200	200	200	200
Office Furnishings	200	200	200	200	200	200
Custodial Services	100	100	100	100	100	100
Telephone/Communications	500	500	500	500	600	600
Office Space Rent	1,300	1,400	1,400	1,400	1,400	1,500
Electricity/Heat	100	100	100	100	100	100
Miscellaneous	100	100	100	100	100	100
Subtotal 112 N Main Suite B	**2,500**	**2,600**	**2,600**	**2,600**	**2,700**	**2,800**
Total O&M Expenses	**538,500**	**584,400**	**647,600**	**797,800**	**854,700**	**902,200**

Table 11-5 shows the scheduled debt payments for the wastewater utility. The proposed wastewater treatment plant and collection system improvements will be debt financed.

TABLE 11-5

Projected Wastewater Utility Debt Expenses

Debt Payments	2005	2006	2007	2008	2009	2010
DOE SRF Loan WWTP	226,100	226,100	226,100	226,100	226,100	226,100
New Debt - T-7 Pump Station & FM			102,100	102,100	102,100	102,100
New Debt - WWTP Phase 1				185,000	185,000	185,000
New Debt - WWTP Phase 2					757,200	757,200
Total Debt Payments	**226,100**	**226,100**	**328,200**	**513,200**	**1,270,400**	**1,270,400**

Table 11-6 shows the capital improvement projects recommended to occur in the next 6 years as identified in this Plan. The cost of each project has been inflated by 2.2 percent from 2005 dollars to the year in which it occurs.

TABLE 11-6

Projected Wastewater Utility Capital Expenses

Capital Expenses	2005	2006	2007	2008	2009	2010
T-7 Pump Station and Force Main	1,031,000	1,031,000				
T-21						1,916,600
T-20						313,300
T-17W	384,500	384,500	384,500	384,500		
T-18		302,500				
T-17E						
T-9W						
T-16W						691,300
T-16E	182,300	182,300	182,300	182,300	182,300	182,300
T-9E		331,200	331,200			
T-10					1,375,700	
T-11				573,200		
T-23						
T-12E				1,414,400		
T-12WB				1,030,100		
T-15				1,013,000		
T-12W				900,900		
T-12WA	177,700	177,700	177,700	177,700	177,700	177,700
T-8	834,500	834,500				
45th Avenue Pump Station and Force Main		1,122,200				
279th Street Pump Station and Force Main				495,300		
Basin 1 Pump Station and Force Main	735,000					
WWTP Outfall Permitting	90,000	90,000	90,000			
WWTP Phase 1		1,868,200	1,868,200			
WWTP Phase 2A			7,646,700	7,646,700		
WWTP Phase 2B						
Transfer to Operations	320,800	278,100	336,900	544,300	1,204,900	1,068,000
Total Capital Expenses	**3,755,800**	**6,602,200**	**11,017,500**	**14,362,400**	**2,940,600**	**4,349,200**

FUTURE REVENUES

Future operating revenues are shown in Table 11-7. Investment interest revenue is based on mid-year wastewater fund balances and the current return rate in the Local Government Investment Pool of 1.1 percent. Revenues also include a 3 percent annual increase per the City's current policy. All other revenues have been adjusted for the effects of 2.2 percent annual inflation.

TABLE 11-7

Projected Wastewater Operating Fund Revenues

Operating Revenue	2005	2006	2007	2008	2009	2010
Sewer Revenue	441,000	529,600	636,100	763,900	917,400	1,101,800
Miscellaneous	2,800	2,800	2,800	2,800	2,800	2,800
Total Operating Revenue	**443,800**	**532,400**	**638,900**	**766,700**	**920,200**	**1,104,600**

Projected capital revenues are shown in Table 11-8. Many projects will be partially funded by contributions in aid of construction (CIAC) from developers, grants, or loans.

TABLE 11-8

Projected Capital Revenues

Capital Revenues	2005	2006	2007	2008	2009	2010
Connection Charges	1,098,100	1,278,800	1,487,300	1,737,500	2,022,500	2,363,000
New Loan - T-7 Pump Station and FM	1,752,700					
New Loan - WWTP Phase 1		3,175,900				
New Loan - WWTP Phase 2A			12,999,300			
New CIAC - T-21						1,916,600
New CIAC - T-17W	153,800					
New CIAC - T-18		30,300				
New CIAC - T-17E						
New CIAC - T-9W						
New CIAC - T-16W						622,200
New CIAC - T-16E	1,094,000					
New CIAC - T-9E		331,200				
New CIAC - T-10					687,900	
New CIAC - T-11				573,200		
New CIAC - T-23						
New CIAC - T-12WB				1,030,100		
New CIAC - T-15				1,013,000		
New CIAC - T-12W				180,200		
New CIAC - T-12WA	1,066,000					
New CIAC - T-8	1,251,800					
New CIAC - 45th Avenue PS and FM		561,100				
New CIAC - 279th Street PS and FM				371,500		
New CIAC - Basin 1 PS and FM	735,000					
Interest Earnings from Cash	28,800	41,100	54,000	21,400		
Total Capital Revenues	**7,180,200**	**5,418,400**	**14,540,600**	**4,926,900**	**2,710,400**	**4,901,800**

Table 11-9 illustrates the potential operating cash flows projected through the year 2010. This includes operations revenue and expenses and debt expenses.

TABLE 11-9

Projected Wastewater Operating Cash Flows

Operating Fund	2005	2006	2007	2008	2009	2010
Operating Revenues	443,800	532,400	638,900	766,700	920,200	1,104,600
Operating Expenses	(538,500)	(584,400)	(647,600)	(797,800)	(854,700)	(902,200)
Net Operating Revenue	**(94,700)**	**(52,000)**	**(8,700)**	**(31,100)**	**65,500**	**202,400**

Future capital improvement fund revenues are shown in Table 11-10.

TABLE 11-10

Projected Wastewater Capital Fund Revenues

Capital Fund	2005	2006	2007	2008	2009	2010
Capital Revenues	7,180,200	5,418,400	14,540,600	4,926,900	2,710,400	4,901,800
Capital Expenses	(3,755,800)	(6,602,200)	(11,017,500)	(14,362,400)	(2,940,600)	(4,349,200)
Total Debt	(226,100)	(226,100)	(328,200)	(513,200)	(1,270,400)	(1,270,400)
Total Capital Revenue	**3,198,300**	**(1,409,900)**	**3,194,900**	**(9,948,700)**	**(1,500,600)**	**(717,800)**

AVAILABLE CAPITAL PROJECT FUNDING SOURCES

This section describes several funding sources available to the City without reference to any specific project:

Grants: USDA Rural Development (RD)

Loans: Public Works Trust Fund
USDA Rural Development (RD)
Community Economic Revitalization Board
State Revolving Fund (SRF) and Centennial Clean Water Act

Bonds: Revenue Bonds

Other: Local Improvement Districts
Developer Financing
General Facilities Charges

USDA RURAL DEVELOPMENT

USDA Rural Development (RD) has a loan program that, under certain conditions, includes a limited grant program. Grant determination is based on a formula that incorporates existing utility debt service and existing utility service rates.

In addition, RD has a loan program for needy communities that cannot obtain funding by commercial means through the sale of revenue bonds. The loan program provides long-term 30- to 40-year loans at interest rates that are based on federal rates and vary with the commercial market. Interest rates currently range from 4.5 percent to 5.25 percent and require a 1.1 debt coverage payment to a capital reserve. However it is unlikely that Ridgefield will qualify for this funding program under the current regulations.

PUBLIC WORKS TRUST FUND

The Public Works Trust Fund (PWTF) is a revolving loan fund designed to help local governments finance needed public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by legislative action, offers loans substantially below market rates, payable over periods ranging up to 20 years.

Interest rates are 0.5 percent, 1.0 percent, or 2.0 percent, with the lower interest rates providing an incentive for a higher financial share. For the local community to qualify a 2.0 percent loan must provide a minimum of 5 percent of the project’s costs. A 10 percent local share qualifies the applicant for a 1.0- percent interest rate and a 15 percent local share qualifies for a 0.5 percent loan. The useful life of the project determines the loan term, with a maximum term of 20 years.

To be eligible, an applicant must be a local government such as a City, Town, County, or special purpose utility district, and have a long-term plan for financing its public work needs. If the applicant is a Town, City, or County, it must adopt the 1/4 percent real estate excise tax dedicated to capital purposes. Eligible public works systems include streets and roads, bridges, storm sewers, sanitary sewers, and domestic water. Loans are presently offered only for purposes of repair, replacement, rehabilitation, reconstruction or improvement of existing service users. A recent change has now made projects intended to meet reasonable growth (as detailed in a 20-year growth management plan) eligible for PWTF funding.

The funding program operates on an annual cycle for construction funds, with a May application date. The program also accepts pre-construction applications on a monthly basis.

STATE REVOLVING FUND/CENTENNIAL CLEAN WATER ACT FUND

The Department of Ecology administers the State Revolving Fund (SRF) and Centennial Clean Water Act programs that provide low interest loans for water pollution control projects. Currently, Ecology is offering 20-year loans at 1.5 percent interest rates, and 5-year loans at 0.5 percent interest rates. The primary program requirements are to have an approved facilities plan for treatment works and to demonstrate the ability to repay the loan through a dedicated funding source. The loans can be used to finance sewer system replacement for the elimination of excessive infiltration and inflow and for the construction of facilities with reserve capacities to accommodate flows corresponding to the 20-year projected growth in the service area. Land acquisition is not eligible for SRF funding.

COMMUNITY ECONOMIC REVITALIZATION BOARD (CERB)

This low interest loan and grant program is managed by the Department of Trade and Economic Development. Funding is available for infrastructure that supports projects, which will result in specific private developments or expansions in manufacturing, and businesses that support the trading of goods and services outside the state's border. Funding is not available to support retail shopping developments or acquisition of real property. The projects must create or retain jobs. The average is one job per $3,000 of CERB financing. The interest rate fluctuates with the state bond rate.

REVENUE BONDS

A common source of funds for construction of major utility improvements is the sale of revenue bonds. The tax-free bonds would be issued by the City of Ridgefield, and repaid and backed by sewer service rate revenue. In order to market revenue bonds, the issuer must typically show that its net wastewater utility operating income (gross income less expenses) is equal to or greater than a factor, typically 1.2 - 1.4, times the annual debt service on all par debt issued. This 1.4 factor is commonly referred to as the debt coverage factor and is applicable to revenue bonds sold on the commercial market. The required debt coverage factor may be specified in previous revenue bond ordinances. If not, it will be determined at the time of bond issue.

UTILITY LOCAL IMPROVEMENT DISTRICTS

Another potential source of funds for improvements comes through the formation of Utility Local Improvement Districts (ULIDs) involving an assessment made against properties benefited by the improvements. ULID bonds are further guaranteed by the revenues and are financed by issuance of revenue bonds.

ULID financing is frequently applied to sewer system extensions into areas previously not served. Typically, ULIDs are formed by a municipality at the written request (by petition) of the property owner within a specific area of the municipality. Upon receipt of a sufficient number of signatures on petitions, the local improvement area is defined. Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the sewer system improvements.

There are several benefits to a municipality in selecting ULID financing. The assessment places a lien on the property and must be paid in full upon sale of the property. Further, property owners may pay the assessment immediately upon receipt reducing the costs financed by the ULID. The advantages of ULID financing, as opposed to rate financing, to the property owner include:

1. The ability to avoid interest costs by early payment of assessments.

2. Low-income senior citizens may be able to defer assessment payments until the property is sold.

3. Some Community Development Block Grant funds are available to property owners with incomes near or below the poverty level. Funds are available only to reduce assessments.

The major disadvantage to the ULID process is that there are significant costs associated with a ULID process (can be 30 percent of the amount of funds needing to be raised). Also, it may be politically difficult to approve the formation of the ULID. The ULID process may be stopped if owners of 40 percent of the property, within the ULID boundary, protest its formation.

DEVELOPER FINANCING

Developers may fund the construction of extensions of the sewer system to property within new plats. The developer extensions are turned over to the wastewater system for operation and maintenance when completed.

It may be necessary, in some cases, to require the developer to construct facilities outside of the plat limits to provide service to the plat and/or larger pipelines for the ultimate development of the sewer system. The municipality may, by policy, reimburse the developer through direct outlay, latecomer charges, or reimbursement agreements for the additional cost of facilities, including increased size of pipelines over those required to serve the property under development. Construction of any pipe in commercial or industrial areas that is larger than the size required to service the development may also be considered as an oversized line possibly eligible for compensation. Developer reimbursement (latecomer) agreements provide up to 15 years or more for developers to receive payment from other connections made to the developer-financed improvements.

SYSTEM DEVELOPMENT CHARGES

The City of Ridgefield has System Development Charges (SDCs) to finance improvements of general benefit to the wastewater system, which are required to service future growth. System Development Charges are generally established as one-time charges assessed against new sewer customers as a way to recover a part of the cost of additional system capacity constructed for their use.

The charge is deposited in a construction fund to construct such facilities. The intent is that all new system customers will pay an equitable share for existing and planned facilities of general benefit. Typical items of construction financed by the system development charge are wastewater treatment facilities, pump stations, interceptors, and other general improvements that benefit the entire system.

CONCLUSION AND RECOMMENDATIONS

The City of Ridgefield is currently planning a large number of major wastewater system improvements. These improvements will impose additional capital costs and derivative operational and maintenance costs on the City. Costs are also increasing due to regulatory requirements and general inflation.

The City has taken steps to ensure that the wastewater revenues are capable of meeting these additional costs. These steps include the completion of a 2005 update of the System Development Charges (SDCs) for the wastewater system (Appendix R) as well as providing for an annual 3 percent increase in sewer rates.

Based on the growth rates used in this General Sewer/Wastewater Facility Plan and the City's Comprehensive Plan, the income from sewer SDCs and sewer rates is not sufficient to cover all of the costs identified in this Plan. However, the City has recently seen higher growth than these plans projected. Although this growth has not been sustained for a long enough period to justify changing the projections in this Plan, it has been assessed in the financial models and, if sustained, will provide increased revenues to accomplish the projects identified in this Plan. If growth does slow, the capital improvement projects will be delayed accordingly, thus postponing the capital costs. The ability to access some of water system funds through an inter fund loan will also enable the City to meet cash flow requirements for the wastewater system. Another requirement for accomplishing the projects identified in this Plan is accessing the PWTF and SRF programs for low interest loans.

The existing rates are not fully funding the operating revenues required for the existing facilities. However, this shortfall is projected to be eliminated by 2009. The City may wish to consider a rate increase that covers the shortfall until that time.

The City should also undertake a periodic review of both the rates and SDCs to ensure that these income sources remain current with costs. A review period of 6 years would enable the wastewater and water utilities to conduct these reviews simultaneously and within the same time period as required for Water System Plan updates.

ADDENDUM TO CHAPTER 11

The following table summarizes the revised financial analysis. Conclusions and recommendations for this plan remain essentially unchanged in the revision. Based on the growth rates used in the General Sewer/Wastewater Facility Plan and the City's Comprehensive Plan, the income from sewer SDCs and sewer rates, is not sufficient to cover all of the costs identified in this Plan. However, the City has recently seen higher growth than these plans projected. Although this growth has not been sustained for a long enough period to justify changing the projections in this plan, it has been assessed in the financial models and, if sustained, will provide increased revenues to accomplish the projects identified in this Plan. If growth does slow, the capital improvement projects will be delayed accordingly, thus postponing the capital costs. The ability to access some of the water system funds through an inter fund loan will also enable the City to meet cash flow requirements for the wastewater system. Another requirement for accomplishing the projects identified in this Plan is accessing the PWTF and SRF programs for low interest loans.

The existing rates are not fully funding the operating revenues required for the existing facilities. However, this shortfall is projected to be eliminated by 2009. The City may wish to consider a rate increase that covers the shortfall until that time.

The City should also undertake a periodic review of both the rates and SDCs to ensure that these income sources remain current with costs. A review period of 6 years would enable the wastewater and water utilities to conduct these reviews simultaneously and within the same time period as required for Water System Plan updates.

Residential Sewer Monthly Bill	$38.40	$39.60	$40.80	$42.00	$43.30	$44.60	$45.90	$47.30	$48.70	$50.20	$51.70	$53.30	$54.90	$56.50	$58.20	$59.90	$61.70	$63.60
% Rate Increase	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Unified System Accounts	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
OPERATIONAL SUMMARY																		
(+) Total Operating Revenues	638,900	766,700	920,200	1,104,600	1,260,300	1,437,900	1,640,500	1,871,900	2,135,900	2,437,100	2,780,900	3,173,300	3,621,200	4,132,200	4,715,400	5,381,000	6,140,700	7,007,600
(-) Total Operation & Maintenance	(647,600)	(797,800)	(854,700)	(902,200)	(941,200)	(990,100)	(1,038,200)	(1,097,700)	(1,158,000)	(1,230,800)	(1,306,600)	(1,398,200)	(1,494,400)	(1,610,500)	(1,734,500)	(1,882,400)	(2,044,100)	(2,235,000)
(-) Total Debt	(328,200)	(346,800)	(346,800)	(939,100)	(939,100)	(939,100)	(1,094,600)	(1,094,600)	(1,094,600)	(1,094,600)	(1,094,600)	(1,148,900)	(1,148,900)	(1,148,900)	(1,148,900)	(1,035,900)	(922,800)	(922,800)
NET REVENUE	**(336,900)**	**(377,900)**	**(281,300)**	**(736,700)**	**(620,000)**	**(491,300)**	**(492,300)**	**(320,400)**	**(116,700)**	**111,700**	**379,700**	**626,200**	**977,900**	**1,372,800**	**1,832,000**	**2,462,700**	**3,173,800**	**3,849,800**
CAPITAL SUMMARY																		
Start of Year Cash	864,200	(749,500)	(2,393,300)	(1,699,900)	(816,000)	(7,650,700)	(19,626,600)	(17,922,700)	(16,482,300)	(13,902,400)	(10,802,200)	(13,632,800)	(9,337,000)	(4,293,300)	1,590,100	8,474,600	16,607,500	26,146,300
(+) Connection Charges & Interest Inc.	1,487,900	1,737,500	2,022,500	2,363,000	1,793,100	1,987,700	2,196,200	2,439,500	2,696,600	2,988,500	3,315,200	3,669,600	4,065,800	4,510,600	5,052,500	5,670,200	6,365,000	7,145,200
(+) Transfer from Operations	0	0	0	0	0	0	0	0	0	111,700	379,700	626,200	977,900	1,372,800	1,832,000	2,462,700	3,173,800	3,849,800
(+) Total Loan Funds	0	0	7,572,500	0	2,669,200	0	0	0	0	0	932,200	0	0	0	0	0	0	0
(+) Total CIAC Funds	0	3,168,000	687,900	2,538,800	3,683,300	1,135,100	0	678,700	0	0	1,864,400	0	0	0	0	0	0	0
(-) Total Capital Expenses	(2,764,700)	(6,171,400)	(9,308,200)	(3,281,200)	(14,360,300)	(14,607,400)	0	(1,357,400)	0	0	(9,322,100)	0	0	0	0	0	0	0
(-) Transfer to Operations	(336,900)	(377,900)	(281,300)	(736,700)	(620,000)	(491,300)	(492,300)	(320,400)	(116,700)	0	0	0	0	0	0	0	0	0
NET CAPITAL REVENUE	**(1,613,700)**	**(1,643,800)**	**693,400**	**883,900**	**(6,834,700)**	**(11,975,900)**	**1,703,900**	**1,440,400**	**2,579,900**	**3,100,200**	**(2,830,600)**	**4,295,800**	**5,043,700**	**5,883,400**	**6,884,500**	**8,132,900**	**9,538,800**	**10,995,000**
End of Year Cash	(749,500)	(2,393,300)	(1,699,900)	(816,000)	(7,650,700)	(19,626,600)	(17,922,700)	(16,482,300)	(13,902,400)	(10,802,200)	(13,632,800)	(9,337,000)	(4,293,300)	1,590,100	8,474,600	16,607,500	26,146,300	37,141,300
OPERATING REVENUES																		
SEWER REVENUE	636,100	763,900	917,400	1,101,800	1,257,500	1,435,100	1,637,700	1,869,100	2,133,100	2,434,300	2,778,100	3,170,500	3,618,400	4,129,400	4,712,600	5,378,200	6,137,900	7,004,800
MISCELLANEOUS	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800	2,800
TOTAL REVENUES	**638,900**	**766,700**	**920,200**	**1,104,600**	**1,260,300**	**1,437,900**	**1,640,500**	**1,871,900**	**2,135,900**	**2,437,100**	**2,780,900**	**3,173,300**	**3,621,200**	**4,132,200**	**4,715,400**	**5,381,000**	**6,140,700**	**7,007,600**
OPERATING EXPENDITURES																		
SALARIES & BENEFITS																		
SALARIES	206,400	211,600	216,900	222,300	227,900	233,600	239,400	245,400	251,500	257,800	264,300	270,900	277,600	284,600	291,700	299,000	306,500	314,100
OVERTIME	4,100	4,200	4,300	4,400	4,500	4,600	4,700	4,900	5,000	5,100	5,200	5,400	5,500	5,600	5,800	5,900	6,100	6,200
HEALTH CARE	29,600	30,500	31,400	32,400	33,300	34,300	35,400	36,400	37,500	38,600	39,800	41,000	42,200	43,500	44,800	46,100	47,500	48,900
BENEFITS	39,900	41,100	42,300	43,600	44,900	46,200	47,600	49,100	50,500	52,000	53,600	55,200	56,900	58,600	60,300	62,100	64,000	65,900
SUBTOTAL SALARIES & BENEFITS	**280,000**	**287,400**	**294,900**	**302,700**	**310,600**	**318,700**	**327,100**	**335,800**	**344,500**	**353,500**	**362,900**	**372,500**	**382,200**	**392,300**	**402,600**	**413,100**	**424,100**	**435,100**
ADMININSTRATION																		
UNIFORMS/CLEANING	2,700	2,700	2,800	2,800	2,900	3,000	3,000	3,100	3,200	3,200	3,300	3,400	3,500	3,500	3,600	3,700	3,800	3,900
SUPPLIES	14,400	14,700	15,100	15,400	15,700	16,100	16,400	16,800	17,200	17,500	17,900	18,300	18,700	19,100	19,500	20,000	20,400	20,900
FUEL CONSUMED	2,200	2,300	2,300	2,400	2,400	2,500	2,600	2,600	2,700	2,700	2,800	2,800	2,900	3,000	3,000	3,100	3,200	3,200
SMALL TOOLS/MINOR REPAIR	1,300	1,300	1,300	1,400	1,400	1,400	1,500	1,500	1,500	1,600	1,600	1,600	1,700	1,700	1,700	1,800	1,800	1,900
PROF SERVICES/SLUDGE HAULIN(	33,500	34,300	35,000	35,800	36,600	37,400	38,200	39,000	39,900	40,800	41,700	42,600	43,500	44,500	45,500	46,500	47,500	48,500
LAB - CLARK CO	1,800	1,900	1,900	1,900	2,000	2,000	2,100	2,100	2,200	2,200	2,300	2,300	2,400	2,400	2,500	2,500	2,600	2,600
PROF SERVICES LEGAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	200	200
CELLULAR	400	400	400	500	500	500	500	500	500	500	500	500	600	600	600	600	600	600
TELPHONE/TELEMETRY/TECH	6,300	6,400	6,600	6,700	6,900	7,000	7,200	7,300	7,500	7,700	7,800	8,000	8,200	8,400	8,500	8,700	8,900	9,100
PAGER	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	200	200
POSTAGE	600	700	700	700	700	700	700	700	800	800	800	800	800	800	900	900	900	900
TRAVEL SEMINARS	2,200	2,300	2,300	2,400	2,400	2,500	2,600	2,600	2,700	2,700	2,800	2,800	2,900	3,000	3,000	3,100	3,200	3,200
ADVERTISING	1,500	1,500	1,600	1,600	1,600	1,700	1,700	1,700	1,800	1,800	1,900	1,900	1,900	2,000	2,000	2,100	2,100	2,200
RENTALS/LEASES - PITNEY/OFFIC	1,500	1,500	1,600	1,600	1,600	1,700	1,700	1,700	1,800	1,800	1,900	1,900	1,900	2,000	2,000	2,100	2,100	2,200
UTILITIES	60,400	73,900	90,500	110,800	128,900	150,000	174,500	203,000	236,100	274,700	319,600	371,800	432,600	503,300	585,500	681,200	792,500	922,000
INTER-DEPT & ADMINISTRATION	81,600	83,300	85,200	87,100	89,000	90,900	92,900	95,000	97,100	99,200	101,400	103,600	105,900	108,200	110,600	113,000	115,500	118,100
INTER-DEPT & ADMINISTRATION (/	0	2,700	0	2,800	0	3,000	0	3,100	0	3,200	0	3,400	0	3,500	0	3,700	0	3,900
EXCISE TAX	24,800	29,800	35,800	43,000	49,000	56,000	63,900	72,900	83,200	94,900	108,300	123,600	141,100	161,000	183,800	209,700	239,400	273,200
SUBTOTAL ADMININSTRATION	**235,400**	**259,900**	**283,300**	**317,100**	**341,800**	**376,600**	**409,700**	**453,800**	**498,400**	**555,500**	**614,800**	**689,500**	**768,800**	**867,200**	**972,900**	**1,102,900**	**1,244,900**	**1,416,800**
MAINTENANCE/REPAIR																		
STANDBY CLARIFIER	9,000	9,200	9,400	9,600	9,800	10,000	10,200	10,400	10,700	10,900	11,100	11,400	11,600	11,900	12,200	12,400	12,700	13,000
COMPUTER -REPAIR/MAINT	400	400	400	500	500	500	500	500	500	500	500	500	600	600	600	600	600	600
TREATMENT FACILITY PLANT MAII	41,200	42,100	43,000	44,000	45,000	45,900	47,000	48,000	49,000	50,100	51,200	52,300	53,500	54,700	55,900	57,100	58,400	59,600
VEHICLE MAINTENANCE	5,600	5,700	5,800	5,900	6,100	6,200	6,300	6,500	6,600	6,800	6,900	7,100	7,200	7,400	7,500	7,700	7,900	8,000
UV LIGHT MAINTENANCE	2,700	2,700	2,800	2,800	2,900	3,000	3,000	3,100	3,200	3,200	3,300	3,400	3,500	3,500	3,600	3,700	3,800	3,900
MISC REPAIR & MAINTENANCE	9,800	10,000	10,300	10,500	10,700	10,900	11,200	11,400	11,700	11,900	12,200	12,500	12,800	13,000	13,300	13,600	13,900	14,200
MISC/DUES/PERMITS	3,300	3,400	3,500	3,500	3,600	3,700	3,800	3,900	3,900	4,000	4,100	4,200	4,300	4,400	4,500	4,600	4,700	4,800
New WWTP Costs (sludge/pump/LAE	0	115,600	118,200	120,800	123,400	126,200	128,900	131,800	134,700	137,600	140,700	143,800	146,900	150,100	153,500	156,800	160,300	163,800

Residential Sewer Monthly Bill	$38.40	$39.60	$40.80	$42.00	$43.30	$44.60	$45.90	$47.30	$48.70	$50.20	$51.70	$53.30	$54.90	$56.50	$58.20	$59.90	$61.70	$63.60
% Rate Increase	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Unified System Accounts	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
T-7 Pump Station	19,200	19,600	20,100	20,500	21,000	21,400	21,900	22,400	22,900	23,400	23,900	24,400	24,900	25,500	26,100	26,600	27,200	27,800
45th Ave Pump Station	19,200	19,600	20,100	20,500	21,000	21,400	21,900	22,400	22,900	23,400	23,900	24,400	24,900	25,500	26,100	26,600	27,200	27,800
279th St. Pump Station	0	0	20,100	20,500	21,000	21,400	21,900	22,400	22,900	23,400	23,900	24,400	24,900	25,500	26,100	26,600	27,200	27,800
Basin 1 Pump Station	19,200	19,600	20,100	20,500	21,000	21,400	21,900	22,400	22,900	23,400	23,900	24,400	24,900	25,500	26,100	26,600	27,200	27,800
SUBTOTAL MAINTENANCE/REPAIR	**129,600**	**247,900**	**273,800**	**279,600**	**286,000**	**292,000**	**298,500**	**305,200**	**311,900**	**318,600**	**325,600**	**332,800**	**340,000**	**347,600**	**355,500**	**362,900**	**371,100**	**379,100**
112 N MAIN SUITE B																		
OFFICE EQUIPMENT/COPIER	200	200	200	200	200	200	200	200	300	300	300	300	300	300	300	300	300	300
OFFICE FURNISHINGS	200	200	200	200	200	200	200	200	300	300	300	300	300	300	300	300	300	300
CUSTODIAL SERVICES	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	200	200
TELEPHONE/COMMUNICATIONS	500	500	600	600	600	600	600	600	600	600	700	700	700	700	700	700	800	800
OFFICE SPACE RENT	1,400	1,400	1,400	1,500	1,500	1,500	1,600	1,600	1,700	1,700	1,700	1,800	1,800	1,800	1,900	1,900	2,000	2,000
ELECTRICTY/HEAT	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	200	200
WATER/SEWER	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MISCELLANEOUS	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	200	200
SUBTOTAL 112 N MAIN SUITE B	**2,600**	**2,600**	**2,700**	**2,800**	**2,800**	**2,800**	**2,900**	**2,900**	**3,200**	**3,200**	**3,300**	**3,400**	**3,400**	**3,400**	**3,500**	**3,500**	**4,000**	**4,000**
TOTAL O&M EXPENSES	**647,600**	**797,800**	**854,700**	**902,200**	**941,200**	**990,100**	**1,038,200**	**1,097,700**	**1,158,000**	**1,230,800**	**1,306,600**	**1,398,200**	**1,494,400**	**1,610,500**	**1,734,500**	**1,882,400**	**2,044,100**	**2,235,000**
DEBT PAYMENTS																		
DOE SRF LOAN WWTP	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	226,100	113,100	0	0
New Debt - T-7 Pump Station & FM	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100	102,100
New Debt - WWTP Phase 1	0	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600	18,600
New Debt - WWTP Phase 2	0	0	0	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300	592,300
New Debt - Columbia River Outfall	0	0	0	0	0	0	52,400	52,400	52,400	52,400	52,400	52,400	52,400	52,400	52,400	52,400	52,400	52,400
New Debt - Alt. No. 1 Phase 3	0	0	0	0	0	0	103,100	103,100	103,100	103,100	103,100	103,100	103,100	103,100	103,100	103,100	103,100	103,100
New Debt - Alt. No. 1 Phase 4	0	0	0	0	0	0	0	0	0	0	0	54,300	54,300	54,300	54,300	54,300	54,300	54,300
TOTAL DEBT PAYMENTS	**328,200**	**346,800**	**346,800**	**939,100**	**939,100**	**939,100**	**1,094,600**	**1,094,600**	**1,094,600**	**1,094,600**	**1,094,600**	**1,148,900**	**1,148,900**	**1,148,900**	**1,148,900**	**1,035,900**	**922,800**	**922,800**
CAPITAL REVENUES																		
Transfer from Operations	0	0	0	0	0	0	0	0	0	111,700	379,700	626,200	977,900	1,372,800	1,832,000	2,462,700	3,173,800	3,849,800
Connection Charges	1,487,300	1,737,500	2,022,500	2,363,000	1,793,100	1,987,700	2,196,200	2,439,500	2,696,600	2,988,500	3,315,200	3,669,600	4,065,800	4,510,600	4,997,100	5,532,200	6,129,900	6,797,100
New Loan - T-7 Pump Station & FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Loan - WWTP Phase 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Loan - WWTP Phase 2	0	0	7,572,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Loan - Columbia River Outfall	0	0	0	0	899,800	0	0	0	0	0	0	0	0	0	0	0	0	0
New Loan - Alt. No. 1 Phase 3	0	0	0	0	1,769,400	0	0	0	0	0	0	0	0	0	0	0	0	0
New Loan - Alt. No. 1 Phase 4	0	0	0	0	0	0	0	0	0	0	932,200	0	0	0	0	0	0	0
New CIAC - T-21	0	0	0	1,916,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-17W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-17E	0	0	0	0	0	1,135,100	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-9W	0	0	0	0	0	0	0	678,700	0	0	0	0	0	0	0	0	0	0
New CIAC - T-16W	0	0	0	622,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-16E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-9E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-10	0	0	687,900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-11	0	573,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-23	0	0	0	0	1,014,100	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-12WB	0	1,030,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-15	0	1,013,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-12W	0	180,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-12WA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - T-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - 45th Ave PS & FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - 279th Street PS & FM	0	371,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - Basin 1 PS & FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - WWTP Phase 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - Columbia River Outfall	0	0	0	0	899,800	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - Alt. No. 1 Phase 3	0	0	0	0	1,769,400	0	0	0	0	0	0	0	0	0	0	0	0	0
New CIAC - Alt. No. 1 Phase 4	0	0	0	0	0	0	0	0	0	0	932,200	0	0	0	0	0	0	0
New CIAC - Alt. No. 1 Phase 4	0	0	0	0	0	0	0	0	0	0	932,200	0	0	0	0	0	0	0

Residential Sewer Monthly Bill	$38.40	$39.60	$40.80	$42.00	$43.30	$44.60	$45.90	$47.30	$48.70	$50.20	$51.70	$53.30	$54.90	$56.50	$58.20	$59.90	$61.70	$63.60
% Rate Increase	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Unified System Accounts	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Interest Earnings from Cash	600	0	0	0	0	0	0	0	0	0	0	0	0	0	55,400	138,000	235,100	348,100
CAPITAL REVENUES TOTAL	**1,487,900**	**4,905,500**	**10,282,900**	**4,901,800**	**4,462,300**	**1,987,700**	**2,196,200**	**2,439,500**	**2,696,600**	**3,100,200**	**4,627,100**	**4,295,800**	**5,043,700**	**5,883,400**	**6,829,100**	**7,994,900**	**9,303,700**	**10,646,900**
CAPITAL EXPENSES																		
T-7 Pump Station & FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-21	0	0	0	1,916,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-20	0	0	0	313,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-17W	384,500	384,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-17E	0	0	0	0	0	1,261,200	0	0	0	0	0	0	0	0	0	0	0	0
T-9W	0	0	0	0	0	0	0	1,357,400	0	0	0	0	0	0	0	0	0	0
T-16W	0	0	0	691,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-16E	182,300	182,300	182,300	182,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-9E	331,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-10	0	0	1,375,700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-11	0	573,200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-23	0	0	0	0	1,014,100	0	0	0	0	0	0	0	0	0	0	0	0	0
T-12E	0	1,414,400	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-12WB	0	1,030,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-15	0	1,013,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-12W	0	900,900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-12WA	177,700	177,700	177,700	177,700	0	0	0	0	0	0	0	0	0	0	0	0	0	0
T-8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45th Ave PS & FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
279th Street PS & FM	0	495,300	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Basin 1 PS & FM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WWTP Outfall Permitting	90,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WWTP Phase 1	1,599,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WWTP Phase 2	0	0	7,572,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Columbia River Outfall	0	0	0	0	4,499,100	4,499,100	0	0	0	0	0	0	0	0	0	0	0	0
Alt. No. 1 Phase 3	0	0	0	0	8,847,100	8,847,100	0	0	0	0	0	0	0	0	0	0	0	0
Alt. No. 1 Phase 4	0	0	0	0	0	0	0	0	0	0	9,322,100	0	0	0	0	0	0	0
Transfer to Operations	336,900	377,900	281,300	736,700	620,000	491,300	492,300	320,400	116,700	0	0	0	0	0	0	0	0	0
CAPITAL EXPENSES TOTAL	**3,101,600**	**6,549,300**	**9,589,500**	**4,017,900**	**14,980,300**	**15,098,700**	**492,300**	**1,677,800**	**116,700**	**0**	**9,322,100**	**0**	**0**	**0**	**0**	**0**	**0**	**0**