City of Ridgefield

Revised Comprehensive Stormwater Management Plan

December 2018

Submitted to:
City of Ridgefield
230 Pioneer Street
Ridgefield, WA 98642

Prepared By:
Gray & Osborne
701 Dexter Avenue N., Ste 200
Seattle, WA 98109

Revised By:
Otak, Inc.
700 Washington Street, Ste 300
Vancouver, WA 98660

June 2008 - Revised December 2018

Project No. 18240D

Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 • (206) 284-0860

REVISED COMPREHENSIVE STORMWATER MANAGEMENT PLAN

The *Comprehensive Stormwater Management Plan* was prepared in 2008 by Gray & Osborne. The *Revised Comprehensive Stormwater Management Plan* was prepared by Otak and published in 2018. In some chapters, much of Gray & Osborne's original text remains with minor revisions, while in other chapters, Otak has replaced some of the outdated analyses. The following table summarizes the revisions.

Chapter	Revisions
Chapter 1, Introduction	▪ Minor revisions
Chapter 2, Drainage Area Characteristics	▪ Revisions to basin characteristics, such as land cover, precipitation, and storm system statistics to reflect current conditions
Chapter 3, Regulatory Considerations	▪ Revised to reflect current conditions
Chapter 4, Existing Storm Drainage System	▪ Revised to reflect currently identified stormwater problem areas ▪ No revisions to prior hydrologic modeling
Chapter 5, Water Quality Analysis	▪ Revisions to reflect new information
Chapter 6, Stormwater Quantity and Quality Control	▪ No revisions
Chapter 7, Recommendations and Capital Improvement Plan	▪ Completely revised
Chapter 8, Financing Analysis	▪ Revised financial analysis (completed by City staff) ▪ Revisions to reflect current financial analysis

This document is formatted to print double-sided. Some pages are intentionally blank.

TABLE OF CONTENTS

LIST OF TABLES

No. **Table**

LIST OF FIGURES

Note: Each figure is located at the end of the related chapter.

No. **Figure**

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

The City of Ridgefield, which lies in Clark County, is concerned about the control and prevention of flooding, erosion, siltation and the degradation of water quality in Ridgefield due to pollutant loads carried by stormwater. The City also wishes to prepare for the need to obtain coverage under the Western Washington National Pollutant Discharge Elimination System (NPDES) Phase II municipal stormwater permit for discharges from its storm sewer system to local receiving waters. In order to address these needs the City wishes to plan and implement a stormwater management program which will provide and maintain a system of storm drainage facilities and controls designed to protect the property and lives of City residents and maintain and enhance the environment.

The purpose of this Plan is to characterize the drainage basins, identify existing and potential problems, develop alternative solutions for stormwater quantity and quality control, and recommend a stormwater management program and a plan for financing the recommended maintenance and improvement program.

In 2005 the City formed a storm and surface water utility as a means of generating revenue to fund the operation and maintenance of the utility, necessary capital improvements and the stormwater management plan.

In 2008 the City hired Gray & Osborne, Inc. to prepare a Comprehensive Stormwater Management Plan. The Plan described drainage area characteristics, regulatory considerations, and hydrologic/hydraulic modeling results under then-current and future land use conditions. The Plan included recommendations for regulatory updates, administrative and operational activities to implement a stormwater management program, a discussion of funding options, and a recommended capital improvement program (CIP).

As of 2016, the City had implemented some of the recommendations in the 2008 Plan and had completed five of the recommended stormwater capital projects. In 2017, the City hired Otak, Inc. to revise the Plan. The 2018 Revised Comprehensive Stormwater Management Plan includes updates to address changes in regulation, expansion of city boundaries into new basins, and new capital project recommendations based on current conditions.

CHAPTER 2

DRAINAGE AREA CHARACTERISTICS

LOCATION

The current City of Ridgefield corporate limits encompass approximately 7.2 square miles of land located mostly to the west of Interstate Highway 5 (I-5) in Clark County, north of Vancouver, Washington. Lake River borders the city limits to the west with the remaining boundaries abutting rural housing, forest and farmland. Figure 2-1 provides a vicinity map of the area.

DRAINAGE BASINS

The City of Ridgefield was divided into 15 main drainage basins for the 2008 Plan. Topography, natural drainage channels and manmade stormwater conveyance systems defined these drainage basins which were sized between 40 and 725 acres. Although the city limits have expanded since 2008, the drainage basins were not revised for this update to the Plan because City staff are aware of the deficiencies in the storm sewer system through field observations and on-going maintenance work. Drainage basin delineation would support the computation of peak discharges to be used in modeling of the existing stormwater conveyance system. Because the system deficiencies are already known, this exercise was not included in the scope of the update to this plan. Figure 4-1 shows the drainage basins, the basins' corresponding topography, and an approximate boundary of each basin within the areas annexed to the city since 2008.

For hydraulic modeling purposes, selected drainage basins were subdivided into smaller basins. These basins are shown in Figures 4-2 through 4-4 and were delineated based upon topography and existing conveyance systems.

WATERWAYS AND WATERBODIES

Two main waterways exist within the city limits of Ridgefield. The western portion of the City drains toward Lake River which eventually flows into the Columbia River. The central portion of the city drains to Gee Creek. This creek has a drainage basin of approximately 8,700 acres and runs a length of just over 4 miles. The creek flows from the southeast to the northwest, leaves City limits and enters the Ridgefield National Wildlife Refuge, ultimately discharging to the Columbia River.

Small portions of northeast Ridgefield are within the headwater subbasins of Allen Creek and McCormick Creek, which each flow to the East Fork Lewis River.

There are also approximately 61 wetlands identified by the National Wetlands Inventory totaling over 250 acres. Wetlands provide some flood storage and may attenuate peak flows.

GEE CREEK

Most of the city drains to Gee Creek. Gee Creek is a salmon bearing stream, which historically may have had coho salmon, chum salmon, steelhead, and cutthroat trout.

Water quality within the Gee Creek drainage basin is impacted by cumulative effects of upstream development and nonpoint pollution from streets, lawns, and dairy farms. Without mitigation of impacts, urban development in the Gee Creek watershed is expected to further increase peak flows within the creek. Increases in flow due to future development in this already unstable system will most likely degrade remaining instream habitat. As eroded soils are deposited in the lower reach of the creek, gravel beds will be further silted, limiting successful spawning. In conjunction with these impacts, the increased concentration of pollutants present in runoff may limit fish growth and production.

WATER QUALITY

The Washington Department of Ecology (Ecology) publishes a state water quality assessment to describe the surface water conditions of waters of the state. New standards were adopted in 2016.

Gee Creek is listed as a Category 5 polluted water requiring a Total Maximum Daily Load (TMDL) for bacteria (fecal coliform), dissolved oxygen, temperature, and bioassessment. Gee Creek is also listed as a Category 2 water of concern for pH.

The Washington Department of Ecology (DOE) has not developed a Water Quality Improvement Project for Gee Creek to address the bacteria contamination, low levels of dissolved oxygen, high temperatures, and poor bioassessment results.

McCormick Creek is listed as a Category 5 polluted water requiring a TMDL for bacteria to nearly NE 279th Street, just downstream of the Ridgefield city limits. It is also listed as a Category 2 water of concern for temperature, although the reaches of concern are well downstream of the Ridgefield city limits.

Lake River is listed as a Category 5 polluted water requiring a TMDL for temperature and bacteria, as well as for other parameters such as PCB which are not customarily associated with stormwater discharges.

The impacts of stormwater pollution as well as potential sources of stormwater pollution are further addressed in Chapter 5 of this Plan.

TOPOGRAPHY

The western portion of the City slopes to the low lying Lake River which is located at 0 feet Mean Sea Level. From this point, the land slopes upward to form a ridge in the southwest area of the City only to slope easterly again to Gee Creek. East of the creek, the topography slopes upward to a high elevation of approximately 290 feet. Slopes within the city limits approach 35 percent. The topography of the study area is shown in Figure 4-1.

GEOLOGY

The Ridgefield area contains deposits of gravel, sand and silt derived from the Pleistocene Age catastrophic periglacial flooding of the Columbia River. These soil units may be several tens of feet thick and are underlain by semi-indurated gravel and sand of the Pliocene Age Troutdale Formation.

According to the Washington State Department of Natural Resources, both upstream and downstream from Vancouver, at the edge of the Portland basin, there are exposures of Columbia River basalt. Within the basin itself, the basalt units lie more than 1,000 feet below the surface. Starting during the Miocene and continuing through the Pliocene, the basin was filled by sediments of the ancestral Columbia River. Named the Troutdale formation, these deposits can be divided into two general parts: a lower gravel section containing pebbles and cobbles that were derived from the Columbia Basin and the Okanogan Highlands, and an upper section that contains vitric volcanic glass (hyaloclastic) sands. The hyaloclastic sands owe their origin to Cascade Range Simcoe volcanics flowing into the Columbia River, explosively quenching, and then being redeposited downstream in the Portland Basin as sand. A volcanic breccia subunit of the Troutdale formation, representing a lahar, has been mapped near Woodland, Washington.

Deposition of the Troutdale formation was followed by a period of Boring Lava volcanism 2.6 to 1.3 Ma (million years). Centers of extrusive activity have been documented around the margins of the Portland Basin. This volcanism was associated with faulting and structural deformation of the Troutdale formation and further depression of the Portland Basin.

Lastly, as the glacial Lake Missoula catastrophic floods burst out of the Columbia River Gorge 12,700 to 15,300 years ago, the waters ponded in the Portland Basin. Backwaters caused the deposition of well-sorted sand, clay, and gravel.

SOILS

The soils of Clark County were surveyed by the Soil Conservation Service (SCS) in the era between 1950 and 1960. The SCS indicates approximately nine soil types exist within the City of Ridgefield. Soils within the area consist mainly of the Gee series. Gee

soils consist of deep, moderately well drained, rolling and hilly soils on eroded terraces that formed in old alluvium deposited by the Columbia River.

Soils in the northwestern portion of the City consists primarily of Hillsboro silt loam and Sara silt loam soils. The flood plain area adjacent to Gee Creek is comprised of Sauvie silt loam whereas Hillsboro loam and Odne silt loam are found interspersed throughout the eastern industrial area of the City. Figure 2-2 illustrates the soils found within the City.

The SCS classifies soils into Type A (low runoff potential) through Type D (high runoff potential) according to runoff potential. The SCS also provides information pertaining to the physical and chemical properties of the soils in the area, including soil permeability. Permeability is the rate at which stormwater will infiltrate into the soil. Table 2-1 summarizes information of the soil groups and permeability of the soils found in the City of Ridgefield.

TABLE 2-1

Soil Characteristics

Soil	Soil Group	Permeability (in/hr)
Cove Silty Clay Loam	D	<0.06
Gee Silt Loam	B	0.63–2.0
Hillsboro Loam	B	0.63–2.0
Hillsboro Silt Loam	B	0.63–2.0
Odne Silt Loam	B	<0.6
Sara Silt Loam	B	0.63–2.0
Sauvie Silt Loam	B	0.2–0.63
Sauvie Silty Clay Loam	D	0.2–0.63
Washougal Gravelly Loam	B	0.63–2.0

CLIMATE

The climate of the City is heavily influenced by the moderating effects of the Pacific Ocean. The ocean moderates the climate, resulting in mild winters and temperate summers. Precipitation within the area is high in volume in the winter and low in volume during summer. The average annual precipitation based on a nearby weather station in Battle Ground is approximately 51 inches. Approximately 75 percent of the annual precipitation occurs between October and March. The majority of the precipitation falls as rain.

Table 2-2 summarizes the average monthly rainfall for the Ridgefield area based on the rain gage in Battle Ground, WA from years of record 1941 to 2016.

TABLE 2-2

Average Precipitation

Month	Average Precipitation (Inches)
January	7.05
February	5.39
March	5.38
April	3.98
May	3.16
June	2.38
July	0.80
August	1.13
September	2.30
October	4.72
November	7.66
December	8.00
ANNUAL	**50.69**

SENSITIVE AREAS

Sensitive areas should be taken into account when planning for municipal stormwater management. The sensitive areas covered by this Plan include critical wildlife habitat areas, erosion hazard areas, floodplains, wetlands and landslide hazard areas. The figures in Appendix A show sensitive areas in the city.

WATER SUPPLY WELLS

City of Ridgefield municipal water needs are supplied by five wells. Well Nos. 7, 8, 9, and 10 are in Abrams Park, and a well in the Ridgefield Junction area recently came online. To accommodate expected growth, Ridgefield is investigating the development of new sources of groundwater in the coming years. Emergency service can also be provided by an intertie with Clark Public Utilities. The location of the wells is shown in Figure 2-3. Well Nos. 7, 8, 9, and 10 are located in the Troutdale formation which is the primary source of water for many Clark County water systems. The water quality is excellent at these wells and meets all present and anticipated drinking water standards. A Wellhead Protection Plan for all wells was created in the City's 1996 Water System Plan. The susceptibility assessment for the wells was included in the 2005 and 2013 Water System Plan updates prepared by Gray & Osborne.

FLOODPLAINS

The Federal Emergency Management Agency (FEMA) documented areas that are subject to 100- and 500-year floods within the City of Ridgefield. The 100-year flood has been adopted as the base flood for purposes of floodplain management measures. A 100-year flood area is defined as those lands which are subject to a 1 percent or greater chance of flooding in any 1 year. The 500-year flood is employed to indicate additional areas of flood risk in the community.

The Floodways Map in Appendix A delineates the flood plain boundaries within the City of Ridgefield. The 100-year floodplain is delineated along Gee Creek and Lake River.

WETLANDS

Wetlands and riparian corridors perform valuable functions within the ecosystem. Clearing of vegetation, grading, filling, draining, and other activities associated with land development may decrease the ability of the riparian zone to provide drainage, stabilize stream banks, provide wildlife habitat, and filter pollutants from the water. Wetlands receive surface water from surrounding areas and filter pollutants through a combination of physical, chemical and biological processes.

Wetlands also play a major role in flood control. During flooding, rivers and streams overflow their banks and spread out across the flood plain. Wetlands attenuate the peak flows from storm events by storing water during wet periods and discharging this stored water later during drier periods. Wetlands also provide habitat and a source of food for fish and wildlife.

The City of Ridgefield contains more than 250 acres of wetlands delineated by the National Wetlands Inventory. The Wetlands Map in Appendix A shows the approximate location of wetlands within the city limits as identified by the National Wetlands Inventory. The majority of these wetlands are associated with the riparian corridors of streams and tributaries, or the associated flood plains of Gee Creek and Lake River.

HABITAT

Gee Creek and the surrounding lower Columbia River floodplain was one of the first areas in Washington inhabited by European settlers, as early as the 1830s. The area was farmed from that time until present day. Farm roads and later residential streets, highways and freeways cross this 12,000-acre watershed basin, which empties into the Columbia River approximately 0.25 mile upstream of the mouth of the Lewis River in Clark County Washington. The main stem of Gee Creek is approximately 10 miles in length with a number of small tributaries and has been assigned to Water Resource Inventory (WRIA) #27, though it is not a direct tributary to the Lewis River.

Fish species likely to have been present at the time of settlement include coho salmon, *Oncorhynchus kisutch*; chum salmon, *O. keta*, and cutthroat trout, *O. clarki*, which likely spawned throughout this small watershed.

Cutthroat trout are the predominant salmonid in the system at this time. Recent sampling efforts have collected a wide variety of warm water species in Gee Creek, which is due in part to the long-term clearing of the area for agriculture, and later residential and commercial development. A few juvenile Chinook salmon have also been collected during recent sampling efforts. These juveniles were likely spawned upstream on Lake River, the Lewis River or other upstream tributaries to the Columbia and utilize Gee Creek for foraging prior to out-migration. Coho and cutthroat and possibly chum may still spawn in the Gee Creek watershed.

Watershed restoration efforts, most notably riparian planting projects, could improve salmonid spawning and rearing habitat in the coming decades as trees planted in the riparian areas mature. These efforts may partially offset impacts associated with rapid population growth and development in Ridgefield in the coming years.

HYDROLOGY

A flow gage at Abrams Park operated by Clark County measures the discharge of Gee Creek. The gage has a drainage area of 11.6 square miles in Ridgefield and unincorporated Clark County.

Gee Creek is a flashy stream, exhibiting hydrology typical of urbanized and cleared basins. After storms, stream flow rises quickly in response to precipitation and falls quickly. Natural soil conditions, land clearing for agriculture and development, filling of wetlands for agriculture and development, and impervious surfaces resulting from development can contribute to these conditions. Low impact development techniques to promote infiltration, minimize runoff, and reduce flow durations can minimize the hydrologic impacts of new development.

Flooding has not typically been a problem along Gee Creek.

POPULATION TRENDS

Estimates of existing population and Decennial Census data are available from the Washington State Office of Financial Management (OFM). Ridgefield's 1990 population was 1,297 with 455 housing units. The 2010 population was 4,763 with 1,695 housing units. The Office estimates the 2017 population of Ridgefield to be 7,235 people.

The 2016 *City of Ridgefield Comprehensive Plan* includes a population projection of 25,494 by 2035 and estimates a housing unit capacity of 7,392 units within the Urban Growth Area.

Table 2-3 summarizes the population estimates for the years 1980, 1990 and 2000 based on the U.S. census and the forecasted population estimate for the year 2035.

TABLE 2-3

Population Trends

Year	Population (City Only)
1980	1,062
1990	1,297
2000	2,147
2010	4,763
2035	25,494

LAND USE

The City of Ridgefield is currently comprised of approximately 4,600 acres. Land use throughout the City is broken up into several major land use categories; urban residential, employment, mixed use, general commercial, public facilities, and parks/open space.

Figure 2-4 shows the land use designations within the current city limits and the urban growth area for the City of Ridgefield. Figure 2-5 shows the zoning designations within the current city limits and the UGA.

The following bulleted list briefly describes each of the land use districts. For more information regarding land use districts, see Chapter 18 of the City's Municipal Code.

- Low Density Residential – 4, Impervious surfaces are limited to 60% per lot
- Low Density Residential – 6, Impervious surfaces are limited to 60% per lot
- Low Density Residential – 8, Impervious surfaces are limited to 65% per lot
- Medium Density Residential – 16, Impervious surfaces are limited to 75% of net developable acres

EXISTING STORMWATER REGULATIONS AND FINANCIAL CAPABILITIES

The City's primary means of regulating storm drainage is found in Ridgefield Municipal Code (RCC) 13.75 Stormwater Utility and 18.755 Erosion Control. The *City of Ridgefield Engineering Standards for Public Works Construction* adopts the 2005 *Stormwater Management Manual for Western Washington* published by Ecology as the technical manual for stormwater facility design. Departing from the manual, the City allows the use of the Santa Barbara Unit Hydrograph method for facility sizing. Stormwater related operations and maintenance are currently funded through the stormwater utility. The Utility currently charges $16.46 per two months for each equivalent dwelling unit (EDU). For single-family and mobile homes, one EDU is one parcel. For multi-family units, EDUs are calculated as one EDU for the first dwelling unit and 0.5 EDU for each unit thereafter. For most other developed properties, one EDU is equal to 3,500 square feet of impervious surface area. Undeveloped parcels, city street rights-of-way, and Washington State rights-of-way are not charged.

EXISTING STORMWATER CONVEYANCE SYSTEM

The existing stormwater conveyance system for the City consists of a combination of open ditches, hard piped runs, culverts and sheet flow. A summary of the conveyance system inventory is contained in Table 2-4. A base map showing the drainage facilities cataloged in the inventory is contained in the plastic sleeve at the back of this Plan (Appendix B). The base map provides a tool for City staff to use in planning future extensions and facility maintenance.

TABLE 2-4

Stormwater System Inventory

Structure	Quantity
< 3" Pipe	1,350 Feet
4" Pipe	251 Feet
6" Pipe	4,040 Feet
8" Pipe	20,376 Feet
10" Pipe	1,308 Feet
12" Pipe	30,746 Feet
15" Pipe	3,951 Feet
18" Pipe	10,425 Feet
21" Pipe	239 Feet
24" Pipe	8,830 Feet
30" Pipe	1,211 Feet
36" Pipe	1,735 Feet
48" Pipe	68 Feet
120" Pipe	687 Feet
Unknown Pipe Sizes	3,359 Feet
Ditch / Conveyance Swale	15 Miles
StormFilter Vaults	4 Each
Cleanout	40 Each
Drywell	20 Each
Type 1 Catch Basin	802 Each
Type 2 Catch Basin	628 Each
Yard Drain	390 Each
Detention Pond	37 Each
Bioswale	29 Each
Dam	1 Each
Other Structure	37 Each

POINT AND NONPOINT SOURCE POLLUTION

Sources of water pollution are commonly characterized as point or nonpoint pollution. Point sources are typically attributed to the discharge from a single outfall, such as the discharge from an industrial plant. However, the outfall from a stormwater conveyance system is also defined as a point source.

Surface runoff from commercial areas may contribute pollutants which are discharged at the stormwater conveyance system's outfall, a point source. Service stations within the City may contribute oil and grease and heavy metals to stormwater runoff.

Nonpoint sources are generated by a type of land use or activity. Nonpoint sources of pollution in the City may include nutrients and pesticides from residential properties, the City parks and the agricultural areas within the City. Roads and driveways are likely to contribute oil and grease and heavy metals to stormwater runoff.

A more detailed description of potential sources of pollution related to stormwater runoff may be found in Chapter 5 of the Plan.

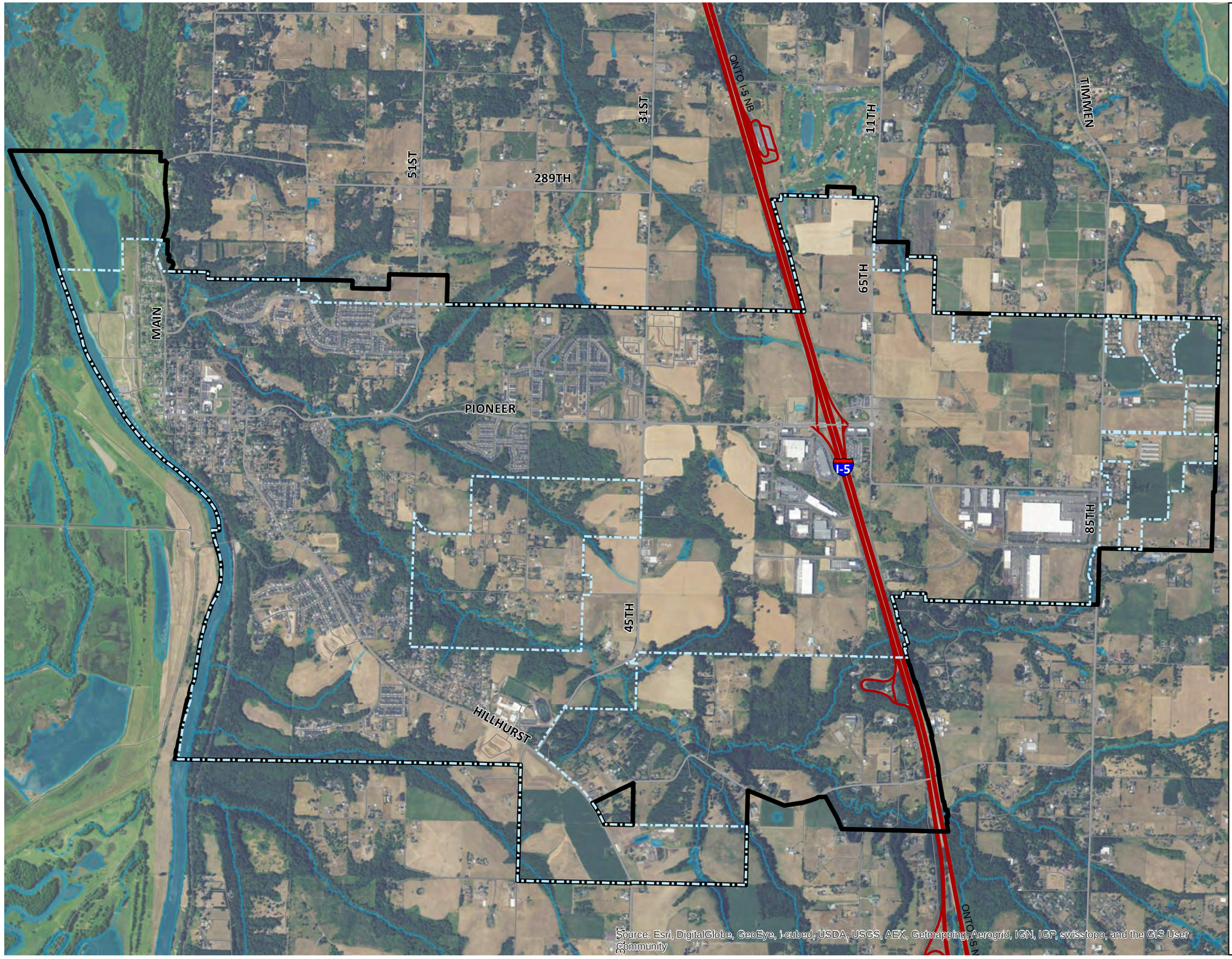
DESIGN CRITERIA

Stormwater planning often involves the design of conveyance, storage and/or treatment facilities adequate for an amount of stormwater runoff predicted from a design storm event. A design storm is defined by the average frequency that the given amount of precipitation is experienced. For example, historical data for the Ridgefield area has established that a total rainfall of 4.0 inches in a 24-hour period is an event which is expected to occur on average once every 100 years. However, although the rainfall for the 100-year storm remains fairly constant, the 100-year storm runoff from a site increases upon development. This is because a larger percentage of the rainfall runs off the impervious surfaces of a developed property to the receiving system rather than infiltrating into the ground.

Another option is to design facilities based on the peak discharge, volume, and duration of runoff predicted by a continuous simulation model based on observed long-term meteorological data. Both the 2005 and the 2014 version of the *Stormwater Management Manual for Western Washington* require use of a continuous simulation model to size facilities.

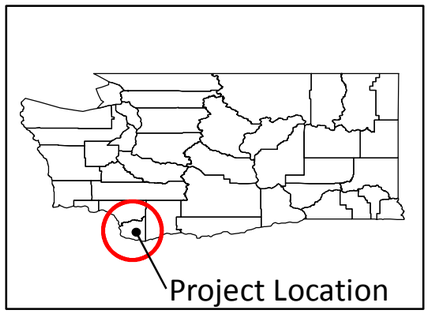
The storm drainage design criteria for the capital projects recommended in this Plan are consistent with the 2014 *Stormwater Management Manual for Western Washington* and the 2014 Washington State Department of Transportation *Highway Runoff Manual*.

The hydraulic modeling completed for the 2008 Plan was performed using the computer software program, SWMM (Surface Water Management Model) in 2008. Conveyance facilities were modeled to determine their capacity to convey runoff resulting from the 25-year storm event identified above using land cover data from 2007. The hydraulic model was not updated for the 2017 update to the Plan, but modeling results for proposed capital improvement projects were evaluated and confirmed.



N

0 0.25 0.5 0.75 Miles



Legend

- City Limit
- UGA Boundary

City of Ridgefield

Comprehensive Stormwater Management Plan

Figure 2-1

Vicinity Map

Otak

RIDGEFIELD WASHINGTON

N

0 0.25 0.5 1 Miles

Legend

- 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
- PuA, Puyallup Fine Sandy Loam, 0 to 3 Percent Slopes
- SlB, Sara Silt Loam, 0 to 8 Percent Slopes
- SlD, Sara Silt Loam, 8 to 20 Percent Slopes
- SlF, 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
- WgB, Washougal Gravelly Loam, 0 to 8 Percent Slopes
- City Limit
- UGA Boundary

City of Ridgefield

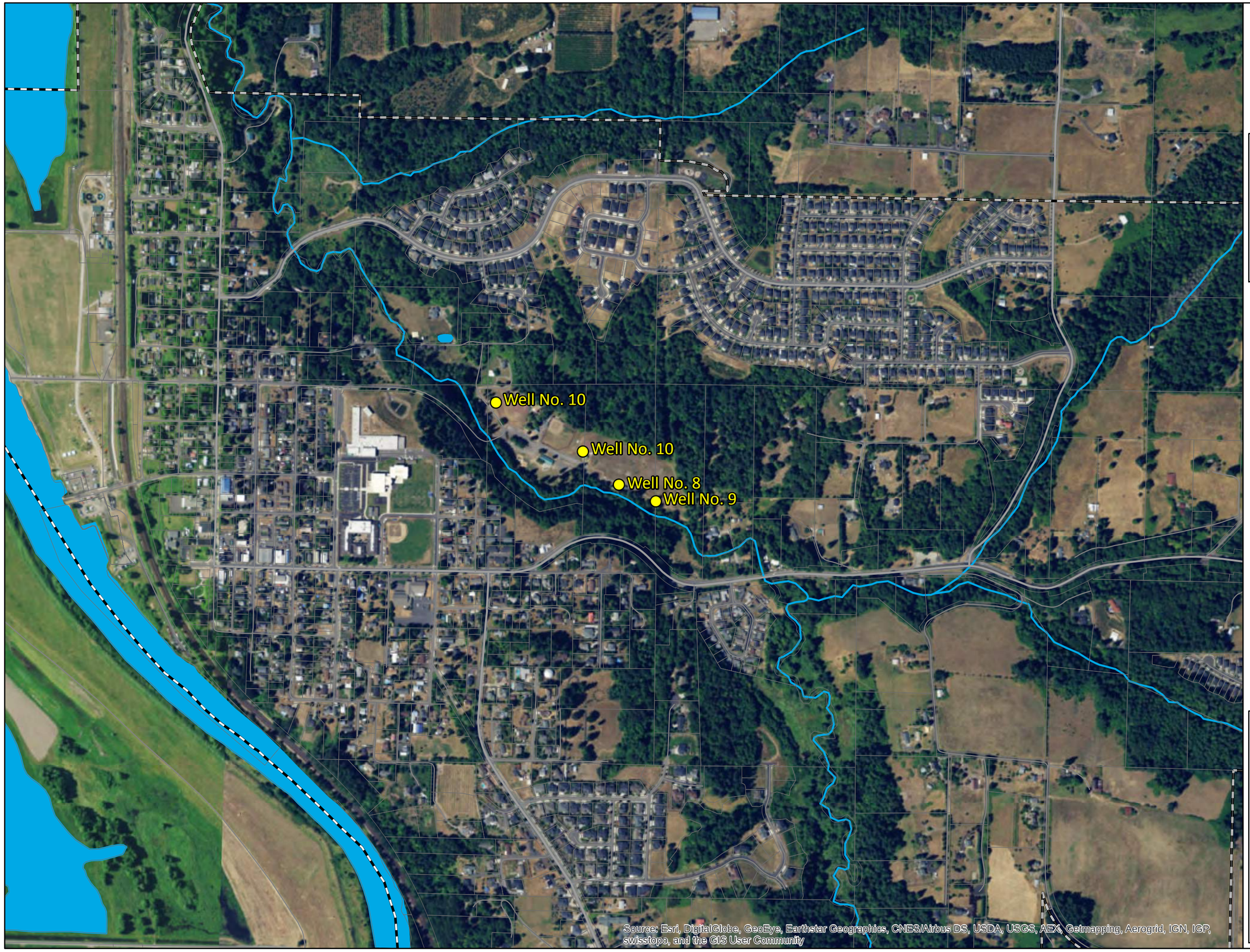
Comprehensive Stormwater Management Plan

Figure 2-2

Soil Map

Otak

CITY OF RIDGEFIELD WASHINGTON



N

0 250 500 1,000

Feet

Legend

- Wells
- Taxlots
- Streams
- Lakes
- City Limit

City of Ridgefield

Comprehensive Stormwater Management Plan

Figure 2-3

Abrams Park Well Field

Otak

CITY OF RIDGEFIELD WASHINGTON

N

0 0.25 0.5 0.75 Miles

Legend

Land Use Designation

- Agriculture
- General Commercial (GC)
- Employment (EM)
- Mixed Use (MU)
- Neighborhood Commercial (NC)
- Parks/Open Space (P/OS)
- Public Facility (PF)
- Rural
- Urban Low Density Residential (UL)
- Urban Medium Density Residential (UM)
- City
- UGA

City of Ridgefield

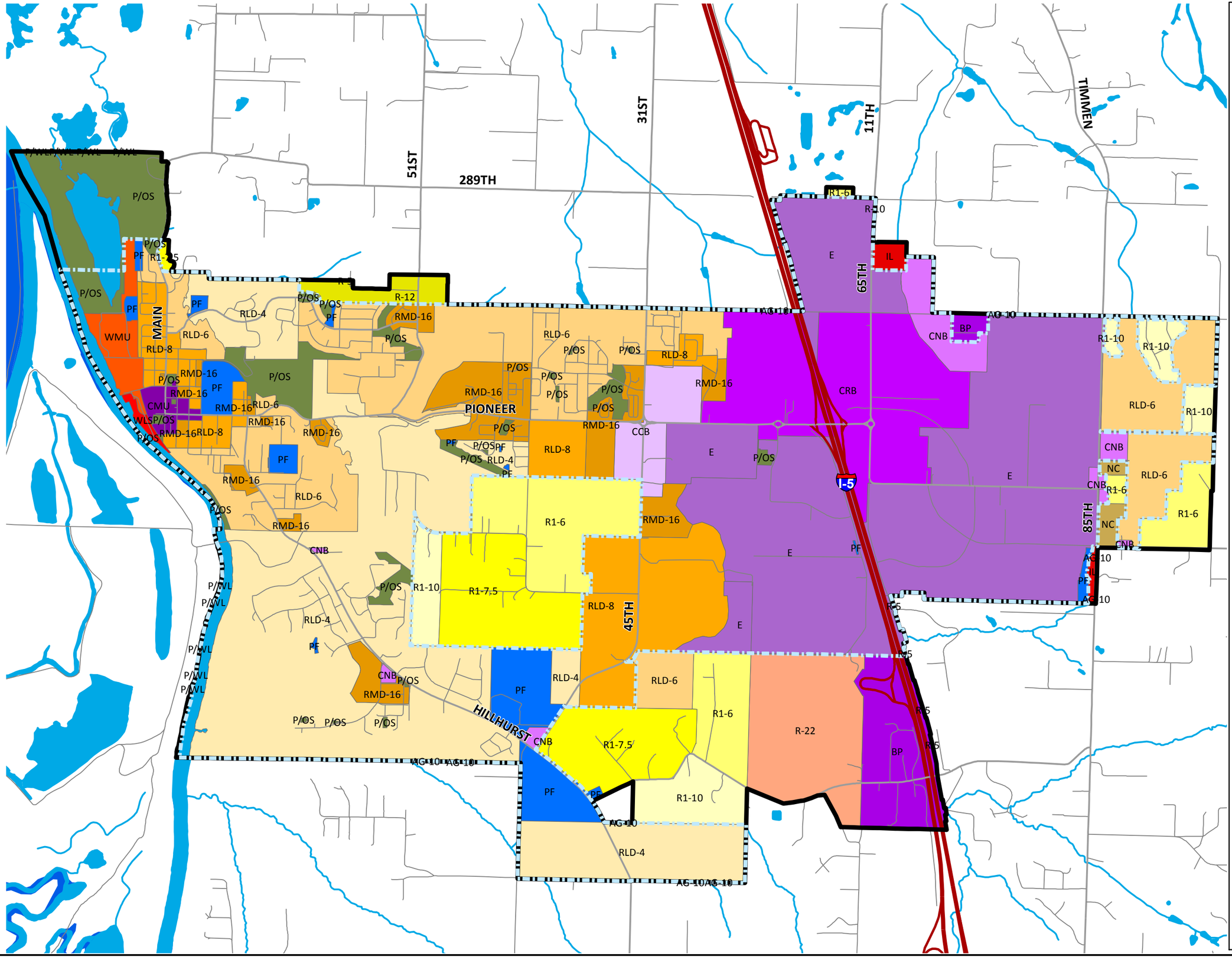
Comprehensive Stormwater Management Plan

Figure 2-4

Land Use Designation Map

Otak

RIDGEFIELD WASHINGTON


N
0
0.25
0.5
0.75
Miles
Agriculture-10 (AG-
Business Park
Central Mixed Use
Commercial Community Business
Commercial Neighborhood Business
Commercial Regional Business
Employment
Light Industrial
Neighborhood Commercial
Parks/Open Space
Parks/Wildlife refuge
Public Facilities
Residential (R-
Residential (R-
Residential Low Density - 4 (RLD-
Residential Low Density - 6 (RLD-
Residential Low Density - 8 (RLD-
Residential Medium Density (RMD-
Rural-10 (R-
Rural-5 (R-
Single Family Residential (R1-
Single Family Residential (R1-
Single Family Residential (R1-
Waterfront Low Scale
Waterfront Mixed Use
City
UGA
MAIN
PIONEER
HILLHURST
289TH
51ST
31ST
11TH
TIMMEN
65TH
45TH
85TH
I-5
City of Ridgefield
Comprehensive Stormwater Management Plan
Figure 2-5
Zoning Designations
Otak
RIDGEFIELD
WASHINGTON

CHAPTER 3

REGULATORY CONSIDERATIONS

INTRODUCTION

Stormwater drainage planning and construction has historically been provided for the purposes of keeping stormwater away from structures and property so that the property can be drained and protected from damage due to stormwater runoff. Local and state governments have installed the majority of existing stormwater facilities to drain roadways. Private property owners have installed facilities to drain their property, which then discharge into public drainage systems that in turn connect with the roadway drainage system. However, over the last 30 years new regulations have required protection of the natural environment from the increasing flows and pollution contained in stormwater runoff. Phase II of this Plan will describe many of the water quality and quantity problems associated with today's urban stormwater runoff.

Through the Clean Water Act and other legislation, the Federal government has delegated to Washington State the authority to implement rules and regulations within the State that meet the goals of the Act. Subsequently, the State has delegated some of this authority to local agencies: cities, counties, and drainage districts. Local agencies are free to enact and enforce rules and policies that are more stringent than those of the State but cannot enact any that are less stringent. Permits may be issued by all three levels of government depending on the type of project and the impacts it may have on the natural drainage systems, which may include streams (intermittent or year-round flows), wetlands, lakes, ponds, rivers, estuaries, marine waters, and groundwater.

The role of federal, State, and local stormwater regulations is to provide minimum standards for the drainage and discharge of stormwater runoff. Specifically, the goal of these regulations is to reduce the damaging effects of increased runoff volumes to the natural environment as the land surface changes, to prevent pollutants from getting into runoff, and to remove the pollutants that become entrained in the runoff.

Because of changing administrations, conditions, and technology, these policies, rules, and regulations are subject to significant change through time.

FEDERAL REGULATIONS

The federal government regulates stormwater through several different programs. Responsibility for implementing the policies of these programs is often delegated to the state and local agencies through various rules, regulations, and permitting policies. The federal government does, however, maintain some of the responsibilities for those activities that are of national interest.

FEDERAL WATER POLLUTION CONTROL ACT (CLEAN WATER ACT)

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972, which set the basic structure for regulating discharges of pollutants to waters of the United States. The Act gave the Environmental Protection Agency (EPA) the authority to set effluent standards on an industry basis (technology-based) and continued the requirements of the original Act to set water quality standards for all contaminants in surface waters. The CWA makes it unlawful for any person to discharge any pollutant from a point source into waters of the United States unless a National Pollutant Discharge Elimination System (NPDES) permit is obtained.

The CWA provides for the delegation by EPA of many permitting, administrative, and enforcement aspects of the law to state governments. In states with the authority to implement CWA programs, EPA still retains oversight responsibilities.

Provisions of the CWA directly apply to the purpose and creation of the nonpoint source management program. Nonpoint pollution is pollution from many diffuse sources. It is caused by runoff from rainfall and snowmelt transporting the pollutants from their source. Under the CWA, stormwater control was established as part of the NPDES permit program (Section 402 of CWA).

Phase I NPDES Stormwater Permits

The EPA set regulations for Phase I stormwater permits in 1991 for large and medium municipalities, as well as, industries and construction sites. The NPDES permit program was originally designed to reduce pollution from point sources such as domestic and industrial wastewater discharges. Section 402 of the Clean Water Act establishes a regulatory program for point sources of pollution but exempts most agricultural activities. Phase I of the program included runoff discharges from specific industrial activities, including construction sites that disturb more than 5 acres of land *(recently reduced to 1 acre),* and runoff discharges operated by local governments with a population over 100,000. Compliance with the Phase I NPDES permit requires that a plan to reduce the discharge of pollutants to the "Maximum Extent Practicable," protect water quality, and satisfy the appropriate water quality requirements of the Clean Water Act be developed and implemented.

Phase II NPDES Stormwater Permits

The EPA issued draft regulations for Phase II NPDES stormwater permits in January 1998 and issued final Phase II regulations on December 8, 1999. The EPA proposes to cover all urban areas, areas with populations greater than 10,000 or located in a federally designated urbanizing area, not initially covered by Phase I regulations under a general Phase II permit. The City of Ridgefield is not located in a federally designated urbanizing area.

The Phase II regulations call for the development of the following stormwater management measures:

- Public Education and Outreach Program,
- Public Involvement and Participation Program,
- Illicit Discharge Detection and Elimination Program,
- Erosion and Sediment Control Program for Construction,
- New Development and Redevelopment Runoff Program, and
- Pollution Prevention (Good Housekeeping) Program.

The stormwater management measures must include quantitative goals and a description of how these goals will be met.

Phase II applies to *regulated small* municipal separate storm sewer systems. The regulatory definition of municipal separate storm sewer system according to 40 CRF 122.26(b)(8) is, "**municipal separate storm sewer**" means a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains):

(i.) "Owned or operated by a State, city, town, borough, county, parish, district, association, or other public body (created by or pursuant to State law)…including special districts under State law such as a sewer district, flood control district or drainage district, or similar entity, or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under section 208 of the Clean Water Act that discharges into waters of the United States.

(ii.) Designed or used for collecting or conveying storm water;

(iii.) Which is not a combined sewer; and

(iv.) Which is not part of a Publicly Owned Treatment Works (POTW) as defined at 40 CFR 122.2."

The NPDES permittee must submit reports to the permitting authority on an annual basis during the first permit term. For subsequent permit terms, reports must be submitted in years 2 and 4 only, unless the NPDES permitting authority request more frequent reports.

The reports must include the following:

- The status of compliance with permit conditions, including an assessment of the appropriateness of the selected BMPs and progress toward achieving the selected measurable goals for each minimum measure;

- Results of any information collected and analyzed, including monitoring data, if any;

- A summary of the stormwater activities planned for the next reporting cycle;

- A change in any identified BMPs or measurable goals for any minimum measure; and

- Notice of relying on another governmental entity to satisfy some of the permit obligations (if applicable).

Phase II NPDES permits for municipal and industrial point and nonpoint source discharges in the State of Washington are issued and administered by Ecology.

Ecology issued a Western Washington Phase II permit on January 17, 2007, which was effective from February 16, 2007 until February 15, 2012. The permit was administratively extended until July 31, 2013. Ecology reissued an updated Western Washington Phase II permit on August 1, 2012 and modified it on January 16, 2015. The permit became effective August 1, 2012 and will expire July 31, 2018. Ecology plans to administratively extend the effective date until July 31, 2019. Ecology will reissue a Western Washington Phase II 2019-2023 permit in 2019.

It is anticipated that Ridgefield's population will reach the 10,000-resident threshold for eligibility for coverage under the Western Washington Phase II permit by the presumed 2023 reissuance of the permit.

ENDANGERED SPECIES ACT

The purpose of the 1972 Endangered Species Act (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 the U.S. Fish and Wildlife Service and the National Marine Fisheries Service 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."

The City of Ridgefield is in the Evolutionary Significant Unit (ESU) of salmonids for the Lower Columbia River Chinook salmon, Lower Columbia River coho, Lower Columbia

River steelhead and Columbia River chum. Each of these species/ESUs have been designated as "threatened" under the ESA.

Distribution
Distribution of threatened salmon and anadromous trout in Ridgefield as documented by WDFW (SalmonScape).

TABLE 3-1
Distribution of Threatened Salmon and Anadromous Trout in Ridgefield

Species	Water Body	Presence
Fall Chinook	Lake River	Documented presence
Coho	Lake River	Documented presence
Coho	Gee Creek	Presumed presence from mouth (downstream of Ridgefield to near I-5. Potential presence in headwater streams above fish passage barriers.
Coho	Small trib to Lake R south of Hillhurst	Presumed presence
Summer Chum	Lake River	Presumed presence
Summer Chum	Gee Creek	Documented presence from mouth to NW Main Ave. Presumed presence from NW Main Ave to above I-5.
Winter Steelhead	Lake River	Documented presence
Winter Steelhead	Gee Creek	Presumed presence from mouth to headwaters above I-5
Winter Steelhead	Small trib to Lake R south of Hillhurst	Presume presence
Summer Steelhead	Lake River	Presumed presence
Summer Steelhead	Gee Creek	Presumed presence from mouth to NW Main Ave. Potential presence from NW Main Ave to headwaters above I-5.

Summer chum are the only threatened species documented in Gee Creek within Ridgefield. Current assessments of species abundance for chum is "very low" (Washington State Recreation and Conservation Office, 2016).

National Oceanic and Atmospheric Administration (NOAA) Fisheries

Under the ESA, NOAA Fisheries is responsible for the protection of marine life, including anadromous salmon such as Lower Columbia River Chinook, Lower Columbia River coho, Lower Columbia River steelhead and Columbia River chum.

Section 7 of the ESA protects threatened and endangered species by focusing on each species' critical habitat. Section 7 requires federal agencies to ensure activities they authorize, fund or carry out are not likely to destroy or damage designated critical habitats. NOAA Fisheries designates critical habitat for threatened and endangered anadromous fish

Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if physical or biological features in the area are essential to conservation and may require special management to protect; and (2) specific areas outside the geographical area occupied by the species if the area is essential for species conservation (ESA Section 3, as quoted in US Department of Commerce, 2005).

In 2005, NOAA Fisheries designated Gee Creek and Lake River waters as critical habitat for Columbia River chum salmon and designated Gee Creek as critical habitat for Lower Columbia steelhead (US Department of Commerce, 2005).

"Take" Prohibition

Once a species is listed as endangered or threatened, the Endangered Species Act makes it illegal for the government or individuals to "take" a listed species. "Take" is defined in Section 9 of the act and includes killing, hunting, trapping, or otherwise "harming" the listed species or habitat the species depends upon. The Federal courts have interpreted the term "take" 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 Endangered Species Act Section 9 "take" prohibition applies to all "persons" including local public entities. State and local governments face twin exposures to the "take" prohibition through their direct conduct and through the exercise of their regulatory authority over activities that may result in a "take." Endangered Species Act listings significantly affect activities that affect salmon and bull trout habitat, such as water use, land use, construction activities, wastewater disposal, and stormwater management.

Threatened species may be protected through a more flexible Section 4(d) rule that describes activities that are likely to result in a "take" and exempts certain activities from "take" liabilities 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 approves some specific existing state and local programs and creates a means for the National Marine Fisheries Service to approve additional programs if they meet certain standards set out in the rule. The 4(d) rule is intended to encourage governments and private citizens to adjust their programs and activities to be "salmon safe."

The United States Fish and Wildlife Service does not differentiate between threatened and endangered species, so a Section 4(d) rule will not contain exceptions to the Section 9 prohibition on "take."

NMFS published a "Citizens 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 and is summarized below.

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 can degrade habitat and injure or kill salmon and steelhead. The 4(d) guide states that with appropriate safeguards, MRCI development can minimize impacts on listed fish. 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. Development will avoid inappropriate areas such as unstable slopes, wetlands, areas of high habitat value, and similarly constrained sites.

2. Stormwater discharge will not impact water quality and quantity and stream flow patterns in the watershed – including peak and base flows in perennial streams.

3. Riparian areas will be adequately protected to maintain Proper Functioning Condition (PFC) so they can provide the biological requirements of the fish, around all rivers, estuaries, streams, lakes, deepwater habitats, and intermittent streams.

4. Stream crossings will be avoided wherever possible and, where crossings must be provided, they will be designed to have minimal impacts.

5. Historic stream meander patterns and channel migration zones will be protected, and hardening stream banks and shorelines will be avoided.

6. Wetlands, wetland buffers and wetland functions will be protected.

7. The capacity of permanent and intermittent streams to pass peak flows will be protected.

8. Landscaping with native vegetation will be encouraged to reduce the need to water and apply herbicides, pesticides, and fertilizer.

9. Erosion and sediment runoff will be prevented during and after construction in order to prevent sedimentation and pollutant discharge to streams, wetlands and other water bodies that support listed fish.

10. Demands on the water supply will be met without affecting the flows salmon need either directly or through groundwater withdrawals.

11. There will be mechanisms for monitoring, enforcing, funding, reporting, and implementing the program.

12. All other State and federal environmental and natural resource laws and permits will be complied with.

In order to minimize liability under the ESA, local governments need to demonstrate that their land use regulations do 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 criteria area ordinances designed to protect critical habitat.

- Amend critical area ordinances to include riparian buffers, vegetative retention, soil retention, maximum road density within a watershed, maximum impervious surface in a watershed and limits on road crossings of streams.

- Amend Growth Management Act (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.

WASHINGTON STATE STORMWATER REGULATIONS

WATER POLLUTION CONTROL ACT

The State of Washington Water Pollution Control Act (Revised Code of Washington 90.48) protects the quality of waters of the state for public health and enjoyment, propagation and protection of fish and wildlife, and industrial development of the state. Ecology is the designated state agency enforcing the law. RCW 90.48 acknowledges the federal regulation of navigable waters through the Clean Water Act, and purports to work in concert with federal efforts.

Ecology enforces the Water Pollution Control Act partly through regulation of Underground Injection Controls to protect groundwater and by issuing state waste discharge permits for discharges of municipal storm sewer systems to surface waters, among other efforts. Ecology combines the state waste discharge permits, enforcing RCW 90.48, with NPDES municipal stormwater permits, enforcing the federal Clean Water Act.

STORMWATER TECHNICAL MANUAL

In 2008, the City of Ridgefield used Ecology's 1992 Stormwater Management Manual for the Puget Sound Basin. The 2008 Comprehensive Stormwater Management Plan recommended adoption of the then-current 2005 Stormwater Management Manual for Western Washington, published by Ecology (2005 Manual). In 2017, the City adopted the 2005 Manual for use in facility design, but it did not adopt the manual's thresholds or requirement to use a continuous simulation hydrology model to size stormwater facilities.

The 2005 Manual guides new development and redevelopment with overall goals of protecting and restoring aquatic species and habitat, water quality and natural hydrology and processes, including achieving no net detrimental change in natural infiltration and surface runoff, particularly for new development sited outside of urban growth areas.

The 2005 Stormwater Manual establishes the minimum requirements for stormwater control and site development requirements for all new development and redevelopment. These manuals outline water quality design criteria, water quality controls, erosion and sediment control practices and site development.

The intent and purpose of the manual is to provide for the following elements:

- Establish criteria for review and analysis of all development,
- Manage stormwater to minimize contact with contaminants,
- Mitigate the impacts of increased runoff due to urbanization,

- Manage runoff from developed property and that being developed, and

- Protect the health, safety, and welfare of the public.

In 2012, Ecology published the 2012 Stormwater Management Manual for Western Washington (2012 Manual). It was updated with minor changes in 2014 (2014 Manual), and the 2014 Manual is the current stormwater technical manual recommended by the state.

The 2014 Manual is substantially similar to the 2005 Manual in most respects except for a new requirement to prioritize and use low impact development (LID) to mitigate, and potentially reverse, the incremental effects of increased runoff due to urbanization on a site-by-site basis. LID uses site planning techniques to minimize runoff and small, distributed vegetated stormwater facilities, such as rain gardens, to infiltrate, disperse, and evaporate runoff close to its source.

The Department of Ecology Stormwater Manuals do not have any independent regulatory authority. The minimum requirements and technical guidance in its manuals only become required through:

- Ordinance and rules established by local governments; and

- Permits and other authorizations issued by local, State and federal authorities.

In the absence of a permit or other regulatory requirement, local jurisdictions may adopt and apply all or a portion of the minimum requirements, thresholds, definitions, Best Management Practices selection processes and BMP design criteria of the manuals through local ordinances.

Table 3-2 lists the differences between the 1992 Manual, which was in use until recently, the 2005 Manual, and the 2014 Manual.

TABLE 3-2

Comparison of 1992, 2005, and 2014 Department of Ecology Stormwater Manuals

	1992 Department of Ecology Manual	2005 Department of Ecology Manual	2014 Manual	Discussion
Thresholds				
New Development	Small Parcel (Meet erosion & sediment control during construction, comply with Small Parcel Req. 1-5, prepare Small Parcel Erosion and Sediment Control Plan) • Creates or adds <5,000 sq ft of new impervious • Land disturbing activity of 1 acre or less	• ≥2,000 sq ft of new imp. area and/or land disturbing activity ≥7,000 sq. ft, meet Min. Reg. 1-5. • <2,000 sq ft of impervious and <7,000 sq. ft land disturbing activity must provide Construction Stormwater Pollution Prevention Plan appropriate for site (Reg. 2).	• ≥2,000 sq ft of new hard area and/or land disturbing activity ≥7,000 sq. ft, meet Min. Reg. 1-5. • <2,000 sq ft of impervious and <7,000 sq. ft land disturbing activity must provide Construction Stormwater Pollution Prevention Plan appropriate for site (Reg. 2).	• Compared to the City's thresholds for triggering stormwater management, both the 2005 Manual and 2014 Manual thresholds I would require more projects to prepare a stormwater site plan, preserve the natural drainage system, provide source control, and provide onsite management. All have to provide Erosion and Sediment Control (same as before).
	Large Parcel (Meet all requirements 1 – 11) • ≥5,000 sq ft of new impervious • Land disturbing activity of >1 acre (If land disturbance <1 acre do not need to meet Requirement 1)	Large Parcel Equivalent (Meet all Requirements 1-10) • ≥5,000 sq ft of new imp. area • Convert 3/4-acre native vegetation to lawn • Convert 2.5 acre of native vegetation to pasture	Large Parcel Equivalent (Meet all Requirements 1-9) • ≥5,000 sq ft of new hard area • Convert 3/4-acre native vegetation to lawn • Convert 2.5 acre of native vegetation to pasture	• Compared to the City's thresholds for triggering stormwater management, Ecology manuals widen the thresholds so more projects need to comply with treatment and flow control requirements.
Continued on next page				

	1992 Department of Ecology Manual	2005 Department of Ecology Manual	2014 Manual	Discussion
Re-development	• ≥5,000 sq ft of new impervious • Requirements 1-11 apply to the portion of the site being redeveloped. Source control Best Management Practices apply to entire site. Stormwater site plan required. • If existing site >1 acre and 50 percent or more impervious or site discharges to a receiving water with documented water quality problem minimum Requirements 1-11 apply to entire site. *Definition: On an already developed site, the creation or addition of impervious surfaces, structural development including construction, installation or expansion of a building or other structural and/or replacement of impervious surface.*	All redevelopment must comply with Min Requirement 2. • If new, replaced, or total of new plus replaced impervious surfaces is ≥2,000 sq. ft. or ≥7,000 sq. ft. of land disturbing activities Min. Requirements 1-5 apply. • If ≥5,000 sq ft of new impervious surface or, converts 3/4-acre native vegetation to lawn, or converts 2.5 acres of native vegetation to pasture Minimum Requirements 1-10 must be applied to the new impervious surface and converted pervious areas. • Applies all requirements (flow control and treatment) to new impervious areas. Replaced impervious areas have to meet these same requirements only if the value of all improvements (including interior improvements) >50 percent cost of the assessment (or replacement) value of the existing site improvements, or if it is a road, if the added area is >50 percent of the impervious surfaces within the project limits.	All redevelopment must comply with Min Requirement 2. • If new, replaced, or total of new plus replaced hard surfaces is ≥2,000 sq. ft. or ≥7,000 sq. ft. of land disturbing activities Min. Requirements 1-5 apply. • If ≥5,000 sq ft of new hard surface or, converts 3/4-acre native vegetation to lawn, or converts 2.5 acres of native vegetation to pasture, then Minimum Requirements 1-10 must be applied to the new hard surface and converted pervious areas. • Applies all requirements (1-9) to new hard areas. Replaced hard areas have to meet these same requirements only if the value of all improvements (including interior improvements) >50 percent cost of the assessment (or replacement) value of the existing site improvements, or if it is a road, if the added area is >50 percent of the impervious surfaces within the project limits.	• More redevelopment projects will require treatment and flow control, especially if replacing existing impervious area. Allows areas to be retrofitted to today's standards. • Cost is now involved so conflicts may exist with this issue (i.e., appraised value of improvements).

Continued on next page

Flow Control (Water Quantity)				
Flow Control Threshold	• Flow control required only for situations where stormwater runoff is discharged directly or indirectly to a stream. • Flow control to match existing hydroperiod if flow discharges directly or indirectly through a conveyance system to a wetland. • May be required if downstream analysis (1/4 mile minimum) indicates impact if flows not controlled. • ≥5,000 sq ft new impervious area • Land disturbing activity of greater than 1 acre	• All projects ≥10,000 sq. ft. of new impervious conversion of 3/4 acre native vegetation to lawn and/or conversion of 2.5 acres native vegetation to pasture, or • Projects that cause an increase of 0.1 cfs in the 100-year flow frequency from a threshold discharge area, and that • Discharge directly, or indirectly through a conveyance system into a fresh water, except for certain water bodies, or wetland must provide flow control to reduce impacts of increased stormwater runoff. *Requirement: Match developed discharge durations to predeveloped durations for the range from 50 percent of the 2-year peak flow up to the full 50-year peak flow* • *Note: Off-site analysis and mitigation included as optional guidance only.*	• All projects ≥10,000 sq. ft. of new impervious conversion of 3/4 acre native vegetation to lawn and/or conversion of 2.5 acres native vegetation to pasture, or • Projects that cause an increase of 0.1 cfs in the 100-year flow frequency from a threshold discharge area, and that • Discharge directly, or indirectly through a conveyance system into a fresh water, except for certain water bodies, or wetland must provide flow control to reduce impacts of increased stormwater runoff. *Requirement: Match developed discharge durations to predeveloped durations for the range from 50 percent of the 2-year peak flow up to the full 50-year peak flow* • *Note: Off-site analysis and mitigation included as optional guidance only.*	• More projects required to provide flow control. • Need to specifically include need for off-site analysis and mitigation in adopting regulation. • Some smaller projects may not need to provide detention. • More facilities incorporated with land conversions
Detention – Performance Standard and Modeling	• Meet 50 percent of predeveloped (today's) conditions for 2-year **peak** flow (for stream bank erosion control) • Meet 100 percent of predeveloped (today's) conditions for 10-year **peak** flow • Meet 100 percent of predeveloped (today's) conditions for 100-year **peak** flow • Peak flow matching using the Santa Barbara Urban Hydrograph (SBUH)	• Meet predeveloped (**forested** unless proven as historically pasture) discharge **durations** for 50 percent of 2-year flow through 100 percent 50-year flow. • Required to use a continuous simulation hydrology model to compute and match predeveloped and post developed flow durations and volumes	• Meet predeveloped (**forested** unless proven as historically pasture) discharge **durations** for 50 percent of 2-year flow through 100 percent 50-year flow. • Required to use a continuous simulation hydrology model to compute and match predeveloped and post developed flow durations and volumes	• Use of duration versus use of previous condition peak flow. • Requirement of modeling duration means using continuous runoff models. DOE has created a free model to use called Western Washington Hydrology Model. • Modeling durations more accurately reflects local storms compared to previous method of matching peaks. • Ridgefield does not require use of a continuous simulation hydrology model to model and size flow control facilities. Ridgefield allows use of the Santa Barbara Unit Hydrograph for sizing facilities.
Detention - Infiltration	• Requires 3 ft from bottom depth to bedrock, water table or impermeable layer • Correction factor of 2 used to size flow control infiltration facility	• Requires 5 ft from depth to bedrock, water table or impermeable layer • Correction factors of 2 to 4 for various soil types used for flow control infiltration facility	• Requires 5 ft from depth to bedrock, water table or impermeable layer • Correction factors of 2 to 4 for various soil types used for flow control infiltration facility	• Greater insurance of less impact to groundwater. • May decrease applicability of infiltration systems for certain project sites • Potentially larger systems due to greater correction factors. • Potentially longer lasting systems with greater correction factors.

Continued on next page

Flow Control Credits	None	• Roof runoff infiltrated – roof area removed from calculating size of detention system. • Roof runoff dispersed area (and meets lot size and flow path requirements) – roof area modeled as grassed surface instead of impervious. • Porous pavers and permeable interlocking concrete assumed to be 85 percent impervious and 15 percent lawn. • Vegetated roofs, rainwater harvesting, reverse slope sidewalks, minimal excavation foundations, rain gardens	• With the release of WWHM 2012, bioretention and permeable pavement are represented directly in the model • Full dispersion, roof runoff full infiltration, or rainwater harvesting – areas managed are removed from calculating size of detention system. • Runoff dispersed area (and meets lot size and flow path requirements) – area modeled as 50% impervious/50% landscape instead of impervious. • Lawn/Landscape areas with amended soils matching requirements of Post-Construction Soil Quality and Depth – area modeled as pasture instead of lawn • Tree retention/tree planting – flow control credits are offered as a reduction in the amount of impervious surfaces based on the type, size, and location of tree relative to impervious surfaces • Reverse slope sidewalks – area modeled as lawn/landscape over the underlying soil type • Minimal excavation foundations – flow control credits are offered based on location of dispersion device, preparation of the surface, and other factors	• Potentially smaller flow control and/or conveyance facilities required.
Water Quality				
Treatment – Thresholds	• ≥5,000 sq ft of new impervious	• ≥5,000 sq ft of effective pollution generating impervious surface • ≥3/4 acres pollution generating pervious surface in a threshold discharge area (i.e., collection basin) exists	• ≥5,000 sq ft of effective pollution generating impervious surface • ≥3/4 acres pollution generating pervious surface in a threshold discharge area (i.e., collection basin) exists	• Refined definition of impervious surface may result in fewer projects needing treatment (for example, if roof runoff does not require treatment), may be offset by need to treat some pollution generating pervious surfaces. • Targets treatment of pollution sources. • No credit for alternative pavement.
Continued on next page				

Levels of Treatment	None	*Four Water Quality Menus:* • Oil Control – for "high use" sites • Phosphorus – based on local authority but DOE recommends 303d listed bodies • Enhanced – for industrial, commercial, multi-family, and arterials/highways that discharge to fish bearing streams • Basic – all other sites that meet threshold of ≥5,000 sq ft of pollution generating impervious surface or ≥3/4 acres pollution generating pervious surface	*Four Water Quality Menus:* • Oil Control – for "high use" sites • Phosphorus – based on local authority but DOE recommends 303d listed bodies • Enhanced – for industrial, commercial, multi-family, and arterials/highways that discharge to fish bearing streams • Basic – all other sites that meet threshold of ≥5,000 sq ft of pollution generating impervious surface or ≥3/4 acres pollution generating pervious surface	• Better coverage of pollutant sources • More complex than previous manual • City would have to decide locations that would require Phosphorus menu.
Treatment - Sizing	• Design for volume from 6-month storm (64 percent of 2-year)	• Design for volume from 6-month storm (72 percent of 2-year) • Design for flow rate that treats 91 percent of annual average runoff for flow based facilities (i.e. bioswales)	• Design for volume from 6-month storm (72 percent of 2-year) • Design for flow rate that treats 91 percent of annual average runoff for flow based facilities (i.e. bioswales)	• Requires treatment of higher design flows which theoretically, are more representative of flows needed to be captured for treatment purposes
Emerging Technologies	N/A	• Added section on emerging technologies that DOE is in the process of reviewing and approving. Includes media filters, amended sand filters, catch basin inserts, high efficiency street sweepers	• Emerging technologies are allowed when approved by Ecology. These include media filters, amended sand filters, catch basin inserts, high efficiency street sweepers	• Greater flexibility in achieving treatment and quantity goals • May provide more economically feasible Best Management Practices options • City staff/inspector needs knowledge of these items
Low Impact Development (On-Site Stormwater Management)				
LID Site Planning	N/A	N/A	• Requires all development and redevelopment sites to use LID site planning to reduce impervious surfaces, preserve permeable soils, and manage runoff on-site.	• Separate flow control or treatment facilities are not necessary if these measures are used to fully disperse, treat, and/or infiltrate on site (full dispersion).
On-site Stormwater Management Thresholds	N/A	• ≥2,000 sq ft of new impervious area and/or land disturbing activity ≥7,000 sq. ft, must use on-site stormwater management BMPs to the maximum extent practicable without causing flooding impacts.	• ≥2,000 sq ft of new hard area and/or land disturbing activity ≥7,000 sq. ft, must use on-site stormwater management BMPs, either selected from a list or selected and modeled to meet the LID Performance Standard, to the extent feasible without causing flooding or erosion impacts.	• In the 2005 Manual, use of on-site stormwater management BMPs is effectively *optional* because the definition of "maximum extent practicable" is not established for the particular context. • In the 2014 Manual, use of on-site stormwater management BMPs is effectively *required* for most development sites because of a prescriptive procedure to determine feasibility.
Continued on next page				

LID – Performance Standard	N/A	• None. • Credits to reduce the size of flow control facilities are allowed (see Flow Control section, above).	The LID Performance Standard is an optional way to meet Minimum Requirement #5 (On-Site Stormwater Management) for projects within the Urban Growth Boundary. The other option is selection of BMPs from a prescriptive list. The LID Performance Standard requires post-development runoff to match predeveloped (**forested** unless proven as historically pasture) discharge durations for 8 percent of 2-year flow through 50 percent 50-year flow.	• The LID Performance Standard is difficult to meet without using infiltration. • The prescriptive list option is challenging to understand and administer.

The Minimum Requirements recommended in the 1992 Manual, the 2005, and the 2014 Manuals are described in Table 3-3.

TABLE 3-3

Department of Ecology 1992, 2005, and 2014 Stormwater Manual Minimum Requirements*

1992 Manual	2005 Manual	2014 Manual
Small Parcel Requirements (<5,000 sq. ft. impervious surface and/or <1 acre land disturbing activity) comply with the following: 1. Construction Access Route 2. Stabilization of Denuded Areas 3. Protection of Adjacent Properties 4. Maintenance 5. Other Best Management Practices (as necessary to mitigate effects of increased runoff)	**Equivalent Small Parcel Requirement**. Projects that add or replace <2,000 sq ft of impervious surface or disturb <7,000 sq ft of land must consider the following elements of Minimum Requirement #2, Construction Stormwater Pollution Prevention, and develop controls for all elements that pertain to the site. 1. Mark Clearing Limits 2. Establish Construction Access 3. Control Flow Rates 4. Install Sediment Controls 5. Stabilize Soils 6. Protect Slopes 7. Protect Drain Inlets 8. Stabilize Channels and Outlets 9. Control Pollutants 10. Control De-watering 11. Maintain Best Management Practices 12. Manage the Project	**Equivalent Small Parcel Requirement**. Projects that add or replace <2,000 sq ft of impervious surface or disturb <7,000 sq ft of land must consider the following elements of Minimum Requirement #2, Construction Stormwater Pollution Prevention, and develop controls for all elements that pertain to the site. 1. Mark Clearing Limits 2. Establish Construction Access 3. Control Flow Rates 4. Install Sediment Controls 5. Stabilize Soils 6. Protect Slopes 7. Protect Drain Inlets 8. Stabilize Channels and Outlets 9. Control Pollutants 10. Control De-watering 11. Maintain Best Management Practices 12. Manage the Project 13. Protect LID BMPs
Large Parcel Requirements (≥5,000 sq ft impervious surface and/or ≥1 acre land disturbing activity) prepare a stormwater site plan and comply with Minimum Requirements 1 through 11: 1. Erosion and Sediment Control a. Stabilization and Sediment Trapping b. Delineate Clearing and Easement Limits c. Timing and Stabilization of Sediment Trapping Measures d. Cut and Fill Slopes e. Controlling Off-site Erosion f. Stabilization of Temporary Conveyance Channels and Outlets g. Storm Drain Inlet Protection h. Underground Utility Construction i. Construction Access Routes j. Removal of Temporary Best Management Practices k. Dewatering Construction Sites l. Control of Pollutants Other Than Sediment on Construction Sites m. Maintenance n. Financial Liability 2. Preservation of Natural Drainage Systems 3. Source Control of Pollution	**New Development** (≥2,000 sq ft, new, replaced or new plus replaced impervious surface area or ≥7,000 sq ft land disturbing activity) comply with Minimum Requirements #1 through #5: 1. Preparation of Stormwater Site Plans 2. Construction Stormwater Pollution Prevention (Items 1 to 12 listed above) 3. Source Control of Pollution 4. Preservation of Natural Drainage System and Outfalls 5. On-site Stormwater Management **New Development** (≥5,000 sq ft new impervious surface, or converts ≥3/4 acre native vegetation to lawn or landscaped areas, or ≥2.5 acres native vegetation to pasture) apply Minimum Requirements #1 through #5 (described above) and Minimum Requirements #6 through #10. 6. Runoff Treatment (requires on-site Best Management Practices is <3/4 acre pollution generating impervious surface or <5,000 sq ft of pollution generating impervious surface and treatment facilities if ≥3/4 acres pollution generating pervious surface or ≥5,000 sq ft pollution generating impervious surface.)	**New Development** (≥2,000 sq ft, new, replaced or new plus replaced hard surface area or ≥7,000 sq ft land disturbing activity) comply with Minimum Requirements #1 through #5: 1. Preparation of Stormwater Site Plans 2. Construction Stormwater Pollution Prevention (Items 1 to 13 listed above) 3. Source Control of Pollution 4. Preservation of Natural Drainage System and Outfalls 5. On-site Stormwater Management **New Development** (≥5,000 sq ft new hard surface, or converts ≥3/4 acre native vegetation to lawn or landscaped areas, or ≥2.5 acres native vegetation to pasture) apply Minimum Requirements #1 through #5 (described above) and Minimum Requirements #6 through #9. 6. Runoff Treatment (requires on-site Best Management Practices is <3/4 acre pollution generating impervious surface or <5,000 sq ft of pollution generating impervious surface and treatment facilities if ≥3/4 acres pollution generating pervious surface or ≥5,000 sq ft pollution generating impervious surface.)

4. Runoff Treatment Best Management Practices 5. Streambank Erosion Control 6. Wetlands 7. Water Quality Sensitive Areas 8. Off-site Analysis and Mitigation 9. Basin Planning 10. Operation and Maintenance 11. Financial Liability	1. Flow Control (on-site controls unless project ≥10,000 sq ft of impervious surface in a threshold discharge area, or convert ≥3/4 acre native vegetation to lawn or landscaped area or convert ≥2 acres native vegetation to pasture or increase runoff by ≥0.1 cfs for 100 year event) 2. Wetlands Protection 3. Basin/Watershed Planning 4. Operation and Maintenance	7. Flow Control if a project has ≥10,000 sq ft of impervious surface in a threshold discharge area or converts ≥3/4 acre vegetation to lawn or landscaped area or converts ≥2.5 acres native vegetation to pasture, or increases runoff by ≥0.1 cfs for the 100 year event. 8. Wetlands Protection 9. Operation and Maintenance
Redevelopment (≥5,000 sq ft) apply Minimum Requirement 1 through 11 to the portion of the site being redeveloped and source controls to entire site including adjacent parcels if part of the project. A stormwater site plan must be prepared.	**Redevelopment** (<2,000 sq ft new plus replaced impervious surface and <7,000 sq ft land disturbing activities) comply with Equivalent Small Parcel Requirements.	**Redevelopment** (<2,000 sq ft new plus replaced hard surface and <7,000 sq ft land disturbing activities) comply with Equivalent Small Parcel Requirements.
Redevelopment (≥5,000 sq ft and/or any of the following: • Existing site greater than 1 acre with more than 50 percent impervious surface, • Site discharges to a receiving water with a documented water quality problem, then prepare Stormwater Site Plan that includes a schedule for implementing Minimum Requirements 1 through 11 for the <u>entire</u> site including adjacent parcels if part of the project.	**Redevelopment** (≥2,000 sq ft, new, replaced, or new plus replaced impervious surface area, or ≥7,000 sq ft land disturbing activity, or converts ≥3/4 acre of native vegetation to lawn or landscaped area, or converts ≥2.5 acres native vegetation to pasture) apply Minimum Requirements #1 through #5 to the new impervious surfaces and the converted vegetation areas.	**Redevelopment** (≥2,000 sq ft, new, replaced or new plus replaced hard surface area, or ≥7,000 sq ft land disturbing activity, or converts ≥3/4 acre of vegetation to lawn or landscaped area, or converts ≥2.5 acres native vegetation to pasture) apply Minimum Requirements #1 through #5 to the new hard surfaces and converted vegetation areas.
	Redevelopment (≥5,000 sf new impervious surface AND add 50% value to existing site & interior improvements), apply Minimum Requirements #1 through #10 to the new and replaced impervious surfaces.	**Redevelopment** (≥5,000 sf new, replaced, or new plus replaced hard surface <u>AND</u> add 50% value to existing site & interior improvements), apply all Minimum Requirements (#1 through #9) to the new and replaced hard surfaces and converted vegetation areas.
	Optional Guidance: 1. Financial Liability 2. Off-Site Analysis and Mitigation	**Optional Guidance:** 1. Financial Liability 2. Off-Site Analysis and Mitigation
* Minimum Requirements and thresholds are summarized in this table. Exact requirements, thresholds, and exemptions are found in the respective manuals.		

The provisions of either the 2005 Manual or the 2014 Manual that may be of particular interest to City of Ridgefield include the lower threshold for additional storm control requirements, which would increase the number of projects required to meet water quality treatment requirements. The flow control requirements in both manuals are more restrictive than the 1992 Manual because of the requirement to use flow durations in Ecology's hydrologic model. This requirement results in detention facilities that are significantly larger than what would be required under the 1992 guidelines. However, Ecology raised the threshold that requires developments to provide flow control to sites that create 10,000 sf of effective impervious surfaces in a threshold discharge area.

The Washington State Legislature created an Independent Science Panel (ISP) in 1998 to provide scientific review and oversight and help ensure that sound science is used in Washington's salmon, steelhead, and trout recovery efforts. One of the items the ISP panel reviewed was Ecology's 2005 Manual. The ISP concluded that the 2005 Manual did a credible job in developing the guidelines and standards presented in the manual using the information available. The panel indicated that implementation of the provisions in the 2005 Manual should help prevent further degradation of stream channels associated with stormwater.

STATE OF WASHINGTON SHORELINE MANAGEMENT ACT

In 2004, Ecology adopted new Shoreline Master Program guidelines, updating the regulations for the first time since 1972. The City of Ridgefield last updated the Shoreline Master Plan in 2012. Shorelands subject to the Shoreline Master Program in Ridgefield include Lake River and Gee Creek where it enters Ridgefield just south of Pioneer Street upstream to the city limits.

The Plan addresses the areas of shoreline use, economic development, public access, transportation, recreation, natural conservation and historical/cultural preservation. It assigns shoreline area categories based on use and public input. Goals and objectives were the identified to provide a management basis for each area. The goals related to stormwater management include the following:

- Restoration efforts (of shorelines) should include retrofitting existing stormwater control facilities to improve water quality.
- New development should be located in such a manner as to not require shoreline stabilization measures.
- All shoreline development should be located, designed, and constructed to prevent flood damage and to the extent possible be located outside of shoreline jurisdiction.
- Encourage the location, construction, operation, and maintenance of shoreline uses, developments, and activities to be focused on maintaining or improving the quality and quantity of surface and ground water over the long term.

- Minimize, through effective education, site planning, and best management practices, the inadvertent release of chemicals, activities that cause erosion, stormwater runoff, and faulty on-site sewage systems that could contaminate or cause adverse effects on water quality.
- Encourage the maintenance and restoration of appropriate vegetative buffers along surface waters to improve water temperature and reduce the adverse effects of erosion and runoff.

WASHINGTON STATE SALMON RECOVERY STRATEGY

In 1998, Governor Locke issued a Draft Salmon Recovery plan and created the Governor's Office Salmon Recovery Office in response to the listing of Puget Sound Chinook salmon as "threatened" and the potential for other listings in the Columbia River. The Lower Columbia Fish Recovery Board (LCFRB) is the lead entity for salmon recovery in Clark County and the lower Columbia River basin. LCFRB's 2010 Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan is an integrated plan for the lower Columbia that combines ESA recovery planning for listed salmon, steelhead, and trout; fish & wildlife planning for several subbasins of the Northwest Power and Conservation Council; watershed planning pursuant to RCW 90.82; and Habitat protection and restoration pursuant to the Washington Salmon Recovery Act (RCW 77.85). The plan is not a regulatory document, and it relies on voluntary measures and greater enforcement and monitoring of existing regulations.

Currently the Office collects data and releases reports regarding recovery efforts and successes. The *State of Salmon in Watersheds 2016* report lists the lower Columbia River chum, fall Chinook salmon, and spring Chinook salmon as not making progress. It lists the lower Columbia River coho and steelhead as showing signs of progress.

Lower Columbia Fish Recovery Board (LCFRB)

Gee Creek is included in the LCFRBs 2010 WA Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan for the East Fork Lewis River. Removal of culverts on Gee Creek is included in the eighth prioritized measure for the subbasin. Ridgefield is called out in Action #EF Lew 11 to help implement, along with Ecology and other partners, the prescriptions of WRIA 27/28 Watershed Planning Unit regarding instream flows in the Vancouver Lake Lowlands.

Measure #1 – Protect stream corridor structure and functions. Along with other local jurisdictions, Ridgefield is identified as a key program partner to prevent further stream corridor degradation through control of land-use conversions and development through local comprehensive planning. The plan states that planning must provide "adequate and consistent protections across jurisdictions."

Measure #2 – Protect hillslope processes. Along with other local jurisdictions, Ridgefield is identified to protect hillslope processes through comprehensive planning, zoning, and stormwater regulations of agricultural practices.

Measure #3 – Restore degraded hillslope processes on forest, agricultural, and developed lands. Along with other local jurisdictions and federal agencies, Ridgefield is identified to restore degraded hillslope processes through comprehensive planning.

Measure #7 – Provide for adequate instream flows during critical periods. Ridgefield, Battleground, DOE, and CPU are identified to expand the Water Supply Program to protect instream flows in Gee Creek and the Vancouver Lake Lowlands.

RIDGEFIELD STORMWATER MANAGEMENT PROGRAM

Local jurisdictions are typically responsible for implementing and enforcing regulations passed down from the State and Federal governments and for enacting additional policies, procedures and regulations based on local conditions and desires of the citizens.

RIDGEFIELD COMPREHENSIVE PLAN

Ridgefield last updated its Comprehensive Plan in 2016. The Comp Plan establishes goals and policies that are implemented by City actions. The Plan Elements include goals and policies related to stormwater management.

Public Facilities Element

The Public Facilities element of the Plan (Element 7) includes a Stormwater Management component (7.6). The City's goal is to maintain or improve surface and groundwater quality by managing stormwater and to safely pass floodwaters and drainage in a manner that improves the community and the environment. Ridgefield's future direction for stormwater management is to continue to encourage Low Impact Development and to effect a smooth transition to complying with Clean Water Act NPDES Phase II permitting requirements over time as the City approaches a population of 10,000, which would make it a candidate for NPDES permit coverage.

Stormwater management policies are shown in Table 3-4.

TABLE 3-4
2016 Comprehensive Plan Stormwater Management Policies

Policy	Name	Summary
PF-ST-1	Stormwater Management	Manage stormwater safely; maintain and improve receiving water quality; protect and enhance fish and wildlife habitat; promote recreation; and enhance community aesthetics.

Policy	Name	Summary
PF-ST-2	New Construction	New development and construction shall control impacts of runoff; use source control and treatment best management practices (BMPs); prioritize infiltration; protect stream channels and wetlands; control erosion and sedimentation; be encouraged to use LID.
PF-ST-3	Regional Consistency	Implement policy provisions of PF-ST-2 using effective published standards in use in western Washington or Clark County.
PF-ST-4	State Permitting Transition	Prepare for a smooth transition to NPDES Phase II municipal storm sewer system permitting by updating local regulations, evaluating existing facilities and funding, and educating the development community about the benefits and requirements of new regulations.
PF-ST-5	Groundwater Protection	Develop groundwater protection mechanisms which protect well heads, reduce the risk of groundwater contamination, and encourage groundwater conservation.

Environment Element

The Environment Element is not exclusively stormwater-focused, but the city's stormwater program and stormwater policies respond to several Environmental Element policies.

Environmental policies with a stormwater nexus are shown in Table 3-5.

TABLE 3-5
2016 Comprehensive Plan Environmental Policies with Stormwater Nexus

Policy	Name	Stormwater Nexus
EN-1	Environmental protection	Use of stormwater management techniques in a locally appropriate Stormwater Technical Manual can help protect, sustain, and provide for healthy and diverse aquatic ecosystems by protecting water quality and by reducing or eliminating hydromodification.
EN-6	Endangered Species	Use of stormwater management techniques in a locally appropriate Stormwater Technical Manual can help protect habitat for threatened salmonids by protecting water quality and by reducing or eliminating hydromodification.

Policy	Name	Stormwater Nexus
EN-7	Water Quality and Quantity	Emphasis on infiltration with appropriate treatment as a stormwater management technique can help protect and enhance surface and groundwater quality and contribute to groundwater recharge.
EN-10	Trees and Other Vegetation	LID site planning techniques for development and redevelopment can conserve tree and plant cover.

STORMWATER ORDINANCE

The 2004 City of Ridgefield Ordinance 840 adopted standards to minimize erosion from land development and land-disturbing activities. This ordinance is codified as Ridgefield Municipal Code Chapter 18.755, Erosion Control. Generally, these standards require best management practices to prevent and control erosion and sedimentation in accordance with the 1992 Puget Sound Manual, Volume II.

ENGINEERING STANDARDS FOR PUBLIC WORKS CONSTRUCTION

Volume I, Design and Planning, of the City's 2017 *Engineering Standards for Public Works Construction* requires use of the *2005 Stormwater Management Manual for Western Washington*, as amended in the standards, for design of water quality and water quantity control facilities.

Currently, Ridgefield modifies the *2005 Stormwater Management Manual for Western Washington*'s thresholds for providing water quantity and water quality facilities as follows, in Volume 1, Section 3.04, Water Quantity and Quality Standards:

> The provisions of this section apply to all development or redevelopment that:
>
> 1. Results in 5,000 square feet or more of new effective impervious surface within an urban area, or has more than 7,000 square feet of land disturbing activities, or converts ¾ acres or more of native vegetation to lawn or landscaped areas, or converts 2.5 acres or more native vegetation to pasture;
>
> 2. Results in the addition or replacement of more than 1,000 square feet of effective impervious surface for any of the development activities requiring oil/water separators;
>
> 3. For the portion of a redevelopment site that is redeveloped, if the redevelopment results in 10,000 square feet or more of replaced effective impervious surface.

The *Engineering Standards for Public Works Construction* also allows Low Impact Development (LID) concepts and techniques generally following the *2005 Low Impact Development Technical Guidance Manual for Puget Sound*.

ILLICIT DISCHARGE ORDINANCE

The City has not adopted an ordinance to prohibit the discharge of non-stormwater substances into the public storm sewer system, nor to prohibit illicit connections such as floor drains and other connections.

CHAPTER 4

EXISTING STORM DRAINAGE SYSTEM

2017 SYSTEM INVESTIGATION

Gray & Osborne, Inc. completed hydrologic and hydraulic modeling to characterize the City's drainage basins and storm sewer conveyance pipe system in support of the 2008 Plan. The methodology for the 2017 plan revision does not include modeling, although existing model information was reviewed for individual capital improvement projects. The historic model information remains valuable and is presented here for context and background.

For this revision, the project team met with City staff to review the changes to the existing system since the 2008 Plan (completed Capital Improvement Projects) and identify the highest priority problem and opportunity areas throughout the City's stormwater system. The priority areas were generally selected based the following criteria:

- Frequency of maintenance work needed to alleviate nuisance flooding,
- Difficulty in accessing stormwater facilities to perform maintenance,
- Opportunity for water quality improvements,
- Lack of public easement need to access stormwater facilities, and
- Stormwater facilities that are in disrepair or failing.

City staff identified twelve significant problematic areas in terms of stormwater. These areas are shown in the Capital Improvement Project (CIP) description sheets in Chapter 7. The projects are summarized below in Table 4-1. When a project was analyzed during the hydrologic and hydraulic modeling completed in 2008 by Gray and Osborne, that basin identification is included in the table. When a project is newly added with this 2017 plan revision, a basin identifier has not been included.

TABLE 4-1
Identified Stormwater Problem Areas

Name	Problem/Opportunity Summary
Division Street Outfall	Existing drainage basin discharges untreated runoff directly to Gee Creek.
Hillhurst Swale	Runoff from the right-of-way discharges to a swale located on private property. Currently, there is no maintenance easement. The swale overflow structure clogs frequently and discharges uncontrolled stormwater down a hill to the adjacent development.
South 56th Place	Existing catch basins, one on each side of the road, are located at a sag in the road vertical alignment and the catch basins clog frequently.
Old Pioneer Way (Basin L9)	Stormwater from Northridge Drive flows (via sheet flow) across Old Pioneer Way onto a privately owned grass field located to the north of Old Pioneer Way. Additionally, there is a single catch basin at the terminus of Old Pioneer Way that is insufficient to collect the runoff.
South Riverview Drive	There is a slight sag in the vertical alignment of South Riverview Drive. Currently, there are no catch basins at the sag and the area experiences nuisance flooding.
North Pioneer Canyon Drive, East Culvert	The existing culvert that conveys surface flow across North Pioneer Canyon Drive includes a vertical trash rack on the inlet of the culvert. The rack clogs frequently and is difficult to access for maintenance.
Viewport Swale	Existing swale is no longer functioning and is overgrown with invasive weeds and existing drywells do not provide enough infiltration capacity, causing nuisance flooding.
North Simons Street (Basin L8)	Nuisance flooding is occurring at the corner of North Simons Street and North 9th Street. The existing catch basins are located in a vegetated shoulder area and the grates clog frequently with debris and sediment. Additionally, the conveyance pipe is undersized.
Gee Creek Loop (Basin L6)	Conveyance channel discharges down a steep slope to a non-standard catch basin that connects to a city main through a pipe located behind homes on Gee Creek Loop. The structure clogs regularly, and the structure and piping are difficult to access for maintenance.
Lake River Outfall	There is an existing culvert that conveys stormwater underneath the railroad tracks from downtown through the site to Lake River. There is a large piece of undeveloped private property located adjacent to the conveyance ditch that has been identified as a good opportunity for construction of a stormwater treatment facility.
Abrams Park (Basin L7)	Nuisance flooding in baseball field due to overgrown ditch, undersized piping, and non-standard inlet structures.

The remainder of this chapter is the Gray & Osborne, Inc. hydrologic and hydraulic modeling completed in support of the 2008 Plan. This information has not been reviewed to identify changes to the system since the analysis was completed in 2008 and is presented here in its original form for context and background.

EXISTING STORMWATER CONVEYANCE SYSTEM

The existing City stormwater conveyance system consists of a combination of open ditches, pipes, culverts and sheet flow. An inventory of the storm drainage conveyance system (in accordance with the City's base map) was shown in Table 2-4. A large format copy of the base map is in Appendix B.

HYDROLOGIC MODEL

Hydrologic analysis of the City of Ridgefield was performed using the Department of Ecology's Western Washington Hydraulic Model (WWHM) software program. The model is capable of modeling existing basin conditions as well as modifications to reflect future anticipated land use.

Hydrologic analysis addresses the relatively short-term movement of water over the land resulting from precipitation. The purpose of a hydrologic model is to determine the flow of stormwater runoff over a period of time passing a specified point. The information generated in the hydrologic model is presented in the form of a hydrograph, a standard plot of runoff (cubic feet per second, cfs) versus time (hours) for a given design storm event. Hydrograph analysis utilizes the standard plot of runoff versus time for a given design storm allowing the key characteristics of runoff such as peak flow, volume and phasing to be considered in the design of drainage facilities. The physical characteristics of the site and the design storm determine the magnitude, volume and duration of the hydrograph.

The first step to hydrologic modeling involves basin delineation. Basin boundaries were established using topographical maps and the inventory of the existing storm drainage system. With this information, regional basins were delineated throughout the City and modeled under current and future land use conditions (see Figure 4-1). Specific localized basins pinpointing problematic stormwater areas were also delineated and modeled under current and future land use conditions. These basins are shown in Figures 4-2 through 4-4. Basin characteristics were checked by field observation, Soil Conservation Service Soil Surveys, and additional information provided by the City.

With the basins delineated, various parameters were input into the WWHM model in order to calculate the basin flow rate. The input parameters used in the WWHM model include soil information and the amount of pervious and impervious area located within the basin. The WWHM software program then takes these parameters and combines them with over 40 years of rainfall data to produce hydrographs displaying flow rates

represented for a number of storm events ranging from the 6-month storm to the 100-year storm event for each particular basin.

The input parameters used in the WWHM modeling analysis are as follows:

SOILS

The soils modeled for the Ridgefield area included till and outwash soils although the soils were predominantly outwash soils.

PERVIOUS/IMPERVIOUS AREAS

The pervious and impervious areas for the delineated basins were determined from 2008 land use data available through Clark County's geographical information system (GIS) data. Future land use was obtained from maps included within the City's 2004 Comprehensive Plan. Current and Future land use maps are included in Appendix A of this Plan. Table 4-2 presents the percentage amount of impervious area estimated for each type of land use within the region whereas Tables 4-3 and 4-4 display the estimated current and future pervious and impervious area based on the information presented in Table 4-2 that was input into the basin models for each soil type.

TABLE 4-2

Estimated Percent Impervious Based on Land Use

Existing Land Use Condition	% Impervious	Existing Land Use Condition	% Impervious
Auto Body Shop	90%	Outdoor Court Sport Facilities	90%
Banks and Credit Unions	90%	Parking Lot: Paved, for Adjoining Building	90%
Cemeteries	20%	Parks with and including Playgrounds, Ball Fields, and Picnic Areas	35%
Churches, Synagogues, Temples, Sunday School Buildings	90%	Pleasure Boat Launching Facilities, e.g. ramps, hoists	90%
Communication Buildings and Related Structures	90%	Prime Developable Ground	0%
Community Center	90%	Private – Preschools, Nurseries and Daycare Centers	80%
Convalescent or Nursing Home	90%	Private Streets	90%
Convenience Store – w/ pumps & tanks	90%	Public – Primary and Elementary Schools	80%
Dedicated Unimproved Streets	80%	Railroad Operations	90%
Designated, Developed, and Preserved Unique Geological, Topological Features	80%	Railroad Right-of-Way	80%
Distribution Warehouse	90%	Restaurants, Cafes	90%
Dry Cleaners, Laundries (single tenant – free-standing building)	90%	Retirement Residences and ALFs (Assisted Living Facilities)	90%
Farm Buildings for Equipment	20%	Rock Quarry, Crushing, Sand and Gravel Pits	90%

Existing Land Use Condition	% Impervious	Existing Land Use Condition	% Impervious
Fire Station or Related Facility	90%	RV Parks and Trailer Courts	80%
Government Offices and Courts (exclusively the function of the government)	90%	School Administration and Service Operations	90%
Impervious Roads	90%	Service Repair Shop	90%
Impervious Roads/Water	90%	Sewage Related Building or Structure	80%
Large Grocery Store	90%	Single-family Residence on Commercial Land	42%
Libraries and Cultural Arts Buildings	90%	Single-family Unit not Sharing Structure with Other Uses	42%
Manufacturing Buildings (250-279)	90%	Single-family Unit not Sharing Structure with Other Uses	42%
Marinas	90%	Small Retail Building (<10,000 sq ft)	90%
Manufacturing – Chemicals	90%	Storage Warehouse	90%
Manufacturing – Fabricated Metal Products	90%	Surfaced Streets with Curbs and Gutters	90%
Manufacturing – Lumber and Wood Products	80%	Taverns and Bars, Dine, Drink, and Dance Establishments	90%
Manufacturing – Rubber and Plastic Products	90%	Tires (includes retread tires), Batteries, Parts and Accessories Dealers	90%
Miscellaneous Building with Office Functionality	90%	Two Family Units Partly or Entirely Over and Under (townhouse)	60%
Mobile Home Converted to Real Property	42%	Unidentified Buildings or Use	80%
Multi-family Units above One Another (most apartment houses)	80%	Unused Land Timbered	0%
Multi-family Units not Elsewhere Classified	80%	Unused or Vacant Land – No Improvements	0%
Neighborhood Strip Center with No Anchor	90%	Unused Platted Land	0%
Non-residential Structure Used as Two-family Housing Unit	60%	Warehouse Buildings 201-209	90%
Office Building: Leasing Class B and C	90%	Water Towers & Reservoirs	60%
One or More Mobile Homes not Affixed to the Land	42%	Wedding Chapels, Dance Halls, Ballrooms	90%
Future Land Use Condition			
Agriculture	15%	MDR 16	90%
Commercial	90%	Neighborhood Commercial	90%
Downtown Mixed Use	85%	Open Space	0%
Industrial Park	90%	Planned Commercial	90%
LDR 5	62%	Public Facility	90%
LDR 7.5	52%	Rural 5	15%
LDR 8.5	48%	Urban	90%
Master Planned Business Park	90%	Water Front Mixed Use	90%

TABLE 4-3

Regional Basin Model Input
(Current Land Use)

Basin ID	Total Basin Area (ac)	Till Soils		Outwash Soils	
		Pervious Area (ac)	Impervious Area (ac)	Pervious Area (ac)	Impervious Area (ac)
R1	725.9	4.0	2.7	289.6	429.6
R2	174.9	0.1	0.0	141.8	33.0
R3	248.8	3.5	0.0	169.9	75.4
R4	53.7	0.0	0.0	31.3	22.4
R5	212.5	9.0	0.0	190.2	13.3
R6	245.2	11.5	0.2	172.9	60.5
R7	450.9	0.0	0.0	298.8	152.1
R8	194.8	0.0	0.0	128.5	66.3
R9	667.1	19.9	17.0	404.6	225.5
R10	291.9	1.9	1.4	171.5	117.0
R11	296.3	0.8	0.0	224.0	71.5
R12	368.9	0.0	0.0	313.6	55.4
R13	157.9	16.9	4.9	90.3	45.8
R14	42.2	0.0	0.0	26.8	15.3
R15	212.1	0.0	0.0	129.4	82.6

TABLE 4-4

Regional Basin Model Input
(Future Land Use)

Basin ID	Total Basin Area (ac)	Till Soils		Outwash Soils	
		Pervious Area (ac)	Impervious Area (ac)	Pervious Area (ac)	Impervious Area (ac)
R1	725.9	5.1	1.6	270.5	448.8
R2	174.9	0.1	0.0	98.4	76.4
R3	248.8	1.5	2.0	135.5	109.7
R4	53.7	0.0	0.0	13.0	40.7
R5	212.5	4.9	4.5	99.0	104.1
R6	245.2	7.4	7.0	95.2	135.6
R7	450.9	0.0	0.0	199.9	251.0
R8	194.8	0.0	0.0	72.5	122.2
R9	667.1	6.6	29.9	132.6	498.0
R10	291.9	0.6	3.1	28.8	259.6
R11	296.3	0.1	0.7	62.2	233.3
R12	368.9	0.0	0.0	36.9	332.0
R13	157.9	2.0	17.6	13.8	124.4
R14	42.2	0.0	0.0	4.2	38.0
R15	212.1	0.5	4.7	20.7	186.2

Tables 4-5 and 4-6 present the amount of current and future pervious and impervious area input into the localized basin models depicting problematic stormwater areas.

TABLE 4-5

Localized Basin Model Input
(Current Land Use)

Basin ID	Total Basin Area (ac)	Outwash Soils	
		Pervious Area (ac)	Impervious Area (ac)
L1	1.83	0.87	0.96
L2	9.43	3.35	6.08
L3	1.91	0.65	1.26
L4	2.06	0.77	1.28
L5	3.36	1.69	1.67
L6	14.05	11.33	2.72
L7	22.37	17.59	4.78
L8	1.47	0.62	0.85
L9	4.88	2.73	2.15
L10	50.1	31.5	18.7

TABLE 4-6

Localized Basin Model Input
(Future Land Use)

Basin ID	Total Basin Area (ac)	Outwash Soils	
		Pervious Area (ac)	Impervious Area (ac)
L1	1.83	0.87	0.96
L2	9.43	3.02	6.41
L3	1.91	0.31	1.60
L4	2.06	0.57	1.49
L5	3.36	1.17	2.20
L6	14.05	3.82	10.22
L7	22.37	15.34	7.03
L8	1.47	0.56	0.91
L9	4.88	2.34	2.54
L10	50.1	26.8	23.3

HYDROLOGIC MODEL RESULTS

The results of the hydrologic analysis are shown in Tables 4-7 and 4-8. For each of the regional and localized basins, the 2-, 10-, 25- and 100-year peak flow rates were calculated by the WWHM model under both the current and future land use scenarios.

TABLE 4-7

Hydrologic Modeling Results for the Regional Basins
(in cfs)

Basin	Current Land Use				Future Land Use			
	2-Year	10-Year	25-Year	100-Year	2-Year	10-Year	25-Year	100-Year
R1	93.0	138.2	163.7	205.2	96.9	143.9	170.4	213.7
R2	7.1	10.9	13.1	16.9	16.4	24.5	29.1	36.6
R3	16.3	24.6	29.5	37.7	24.1	35.9	42.6	53.5
R4	4.8	7.2	8.6	10.9	8.7	12.9	15.3	19.2
R5	2.9	5.0	6.4	8.8	23.5	35.0	41.5	52.2
R6	13.3	20.4	24.6	31.6	30.8	45.9	54.4	68.3
R7	32.6	49.2	58.8	75.0	53.9	80.2	95.0	119.2
R8	14.2	21.4	25.6	32.7	26.2	39.0	46.1	57.8
R9	32.6	49.2	58.8	75.0	113.5	168.2	199.0	249.1
R10	25.4	38.2	45.7	58.1	56.4	83.4	98.6	123.4
R11	15.4	23.4	28.1	36.0	50.2	74.4	88.0	110.2
R12	12.0	18.5	22.4	29.0	71.2	105.4	124.6	155.9
R13	11.3	17.3	20.8	26.8	30.5	45.2	53.4	66.9
R14	3.3	4.9	5.9	7.5	8.2	12.1	14.3	17.8
R15	17.7	26.6	31.8	40.5	41.0	60.6	71.7	89.7

TABLE 4-8

Hydrologic Modeling Results for the Localized Basins
(in cfs)

Basin	Current Land Use				Future Land Use			
	2-Year	10-Year	25-Year	100-Year	2-Year	10-Year	25-Year	100-Year
L1	0.21	0.31	0.36	0.46	0.21	0.31	0.36	0.46
L2	1.31	1.94	2.29	2.88	1.38	2.04	2.42	3.03
L3	0.27	0.40	0.48	0.60	0.34	0.51	0.60	0.75
L4	0.27	0.41	0.48	0.61	0.32	0.47	0.56	0.70
L5	0.36	0.53	0.63	0.80	0.47	0.70	0.83	1.04
L6	0.59	0.90	1.08	1.39	2.19	3.25	3.85	4.82
L7	1.03	1.57	1.89	2.42	1.51	2.28	2.73	3.48
L8	0.18	0.27	0.32	0.40	0.20	0.29	0.34	0.43
L9	0.46	0.69	0.82	1.03	0.55	0.81	0.96	1.21
L10	4.0	6.03	7.21	9.18	5.01	7.47	8.86	11.12

As shown in Tables 4-7 and 4-8, the future land use scenario will generate higher peak flows due to an increase in impervious area.

HYDRAULIC MODEL

The hydraulic model involved routing the 25-year storm through existing and future conveyance pipes. After modeling the various storm events in WWHM, it was determined that the 100-year storm could only be achieved statistically within the WWHM model. Even with 40 years of historical rainfall data, it was apparent that the highest rated (or largest peak) flow in the model was less than the 50-year storm event and that no 100-year storm had been present in the 40 years of data available. Therefore, only hydrographs from the 25-year storm event were extracted and used for the hydraulic model. It should be noted that it is standard practice to design conveyance systems for the 25-year storm event. After the 25-year storm hydrographs were extracted from WWHM and then input into the hydraulic model, the XP-SWMM program was used to route the hydrographs through each basin's conveyance system to identify inadequacies in the existing system under current and future land use conditions.

This information is then used to locate and size necessary improvements. The conveyance system facilities that were indicated to be inadequately sized for the 25-year storm event are discussed in the remainder of this chapter. The recommended system improvements with corresponding cost estimates will be discussed in Phase II of the Comprehensive Stormwater Management Plan.

HYDRAULIC MODEL RESULTS

The following paragraphs describe the model results for each identified problem area (Basins L1-L10). Due to a lack of survey information, the slopes and inverts of the pipes were conservatively estimated. Rim elevations were also estimated using the topographical contours shown in Figure 4-1. In general, the identified basins have insufficient infrastructure to properly convey stormwater away from the area. Therefore, the hydraulic models discussed below represent pipes that are both currently existing and/or future pipes to be installed to alleviate currently experienced flooding problems.

Drainage Basin No. L1 Model Results

Drainage Basin No. L1 drains to the north along South 8th Avenue. It currently consists of a 6-inch pipe collecting runoff along South 8th Court which, in accordance with the City's base map, is joined with a 12-inch pipe paralleling South 8th Street. This 12-inch pipe connects to an 8-inch pipe which then discharges to a ditch along the east side of South 8th Street. In a field visit conducted on October 19, 2006, it appeared that the two catch basins located at the downstream end of South 8th Court were out of the main flow path for the road. It was also uncertain as to how effective the next downstream catch basin along South 8th Street would be in capturing runoff for the area. Maintenance of the catch basin filters may also help alleviate flooding in this area. Assuming that all

three catch basins are effective in capturing regional flow, the model revealed that the 6- and 8-inch pipes are inadequate to convey the 25-year storm. The segment designation, existing capacity and modeled runoff for system segments with deficient capacity for the current and future land use conditions are shown in Table 4-9.

TABLE 4-9

Drainage Basin No. L1 System Deficiencies

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
6-inch Pipe	0.16	0.37	0.37
8-inch Pipe	0.36	0.37	0.37

With the assumed slopes and rim elevations for this basin, the model revealed surcharging of the pipes, but no flooding was experienced at the ground level.

Drainage Basin No. L2 Model Results

Drainage Basin No. L2 is one of the larger localized basins. It encompasses runoff surrounding North 3rd Avenue and North 4th Avenue from Division Street to NW Simons Street. According to staff, flooding is currently seen near the intersection of North 4th Avenue and Division Street. Although flooding is currently experienced there, the model did not show any deficiencies with the pipe conveyance system under existing land use conditions. However, capacity problems were present within the model under the future land use scenario during a 25-year storm event. The segment designation, existing capacity and modeled runoff of system segments with deficient capacity for the future land use conditions are shown in Table 4-10.

TABLE 4-10

Drainage Basin No. L2 System Deficiencies

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
10-inch Pipe along North 4th Avenue	0.64	0.62	1.81
12-inch crossing Division Street	1.05	0.98	2.36

With an assumed slope of 0.1 percent for these pipes and with assumed rim elevations for the catch basins, the model revealed surcharging of the pipes and flooding along North 4th

Avenue. Flooding under the future land use scenario equated to approximately 5,130 cubic feet along North 4th Avenue under the 25-year storm event.

Drainage Basin No. L3 Model Results

Drainage Basin No. L3 is adjacent to Basin L2 and includes the strip of land located between North 4th Place and North 5th Avenue between Division Street and NW Mill Street. Drainage currently flows westerly from North 5th Avenue to North 4th Place into three dry wells spaced along North 4th Place. According to City staff, these dry wells are inadequately sized, resulting in flooding along this street.

For hydraulic modeling purposes, we modeled a 12-inch pipe that would collect runoff from this basin and direct it to Division Street. These pipes would need to be surveyed to ensure that topographically, it would be feasible to connect this system with the current 12-inch system located near North 4th Avenue and Division Street. Assuming this is possible, the model revealed that a 12-inch pipe would be adequate to convey the flow away from North 4th Place. A 12-inch pipe is the minimum pipe size recommended for this system due to maintenance purposes. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-11.

TABLE 4-11

Drainage Basin No. L3 Recommended 12-inch Pipe System

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
12-inch Pipe to North 4th Avenue/Division Street	1.04	0.48	0.61

With an assumed slope of 0.1 percent for this pipe and with assumed rim elevations for the catch basins, the model revealed no surcharging or flooding of the pipes and catch basins.

Drainage Basin No. L4 Model Results

Drainage Basin No. L4 involves the buildings located between North 3rd Avenue and North Main Avenue and between Pioneer Street and NW Simons Street. City staff indicated that roof drains from the buildings within this block discharge runoff to the alley located behind the buildings and floods this area out. To remedy this situation, it is recommended that a 12-inch pipe and associated catch basins be placed along the alleyway.

For hydraulic modeling purposes, we modeled a 12-inch pipe that would collect runoff along the alley and would then connect to an existing 12-inch pipe located near the intersection of NW Simons Street and North Main Avenue. As with Basin L3, the existing pipes would need to be surveyed to ensure that it would be feasible to connect to the existing system. With the assumption that the connection is possible, the model revealed that a 12-inch pipe would be adequate to convey the flow. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-12.

TABLE 4-12

Drainage Basin No. L4 Recommended 12-inch Pipe System

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
12-inch Pipe to North Main Avenue/NW Simons Street	1.04	0.49	0.57

With an assumed slope of 0.1 percent for this recommended 12-inch pipe and with assumed rim elevations for the catch basins, the model revealed no surcharging or flooding of the pipes and catch basins.

Drainage Basin No. L5 Model Results

Drainage Basin No. L5 lies south of the downtown portion of the city along Sargent Street in between South 4th Avenue and South 5th Avenue. Currently, flooding is experienced in the ditch between the two houses located along the north side of Sargent Street. To alleviate this situation, it is recommended that a 12-inch pipe and associated catch basins be installed along the current ditch which discharges to pipes located east of the intersection of South Robert Street and South 4th Avenue.

For hydraulic modeling purposes, we modeled a 12-inch pipe that would collect runoff in between the houses and would then connect to the existing pipe system in South Shobert Street. Prior to design, this area should be surveyed to ensure that it would be feasible to connect to the existing system. With the assumption that the connection is possible, the model revealed that a 12-inch pipe would be adequate to convey the flow. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-13.

TABLE 4-13

Drainage Basin No. L5 Recommended 12-inch Pipe System

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
12-inch Pipe to South Shobert Street	1.33	0.65	0.85

With an assumed slope of 0.1 percent for this recommended 12-inch pipe and with assumed rim elevations for the catch basins, the model revealed no surcharging or flooding of the pipes and catch basins.

Drainage Basin No. L6 Model Results

Drainage Basin No. L6 is south of Pioneer Street and encompasses a large area of currently forested land. Flooding is experienced in the non-standard manhole located behind a home off of South Gee Creek Loop Road. Further investigation should be given to installing a new structure at this location with a possible interior baffle to dissipate flows coming from the steep hillside located upstream. The base map depicts a ditch flowing to the manhole. Due to the possible erosion hazard with this steep slope, a 12-inch pipe was modeled to replace this ditch at an estimated slope of 12.5 percent.

The hydraulic model of the 12-inch pipe revealed that it would be adequate to convey the flow from the forested area. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-14.

TABLE 4-14

Drainage Basin No. L6 Recommended 12-inch Pipe System

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
12-inch Pipe to manhole near South Gee Creek Loop Road	11.70	1.06	3.99

With an assumed slope of 12.5 percent for this pipe and with assumed rim elevations for the catch basins, the model revealed no surcharging or flooding of the pipes and catch basins.

Drainage Basin No. L7 Model Results

Drainage Basin No. L7 collects runoff from a large area north of Abrams Park. Staff indicated that the area near the park's eastern ball fields flood on a recurrent basis. This is possibly due to the large amount of runoff entering a 12-inch pipe that crosses under the existing ball field. Prior to this 12-inch pipe, sizeable ditches collect water from the hillside located north of the baseball fields. These ditches have bases that are approximately 3 feet wide and are approximately 2.5 feet deep with estimated 2:1 side slopes. Upstream of the forested hillside, lies a large housing development that collects a sizeable amount of runoff which discharges from a 24-inch diameter pipe at the top of the hill. Once the discharge flows down the hill, into the ditches, and through the 12-inch pipe located under the ball field, runoff enters a ditch approximately 75 feet in length which then enters a 12-inch pipe and eventually discharges into Gee Creek.

Assuming that proper maintenance is conducted on the inlets and outlets of these pipes and that the ditches are not overgrown, the model revealed that both the 12-inch pipe under the ball field and the downstream 12-inch pipe near Gee Creek are undersized for the 25-year storm. However, no flooding was experienced at the ground level. Again, the inverts and slopes of these pipes were estimated. Any design to remedy the situation should include a survey of the area to adequately reflect the existing situation. The segment designation, existing capacity and modeled runoff for system segments with deficient capacity for the current and future land use conditions are shown in Table 4-15.

TABLE 4-15

Drainage Basin No. L7 System Deficiencies

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
12-inch Pipe Under Ball Field	1.04	1.86	2.73
12-inch Pipe to Gee Creek	1.04	1.86	2.73

Drainage Basin No. L8 Model Results

Drainage Basin No. L8 involves the homes located along the west side of North 9th Avenue in between North Simons Street and Pioneer Street. It is our understanding that the northwest corner of the intersection of North 9th Avenue and North Simons Street has flooded in the past. The existing system consists of a 6-inch pipe crossing the south side of the intersection which then connects to a 6-inch pipe that runs parallel to North Simons Street to the east, down the hill towards Gee Creek.

The hydraulic model revealed that the existing 6-inch pipe crossing the intersection is insufficient in a 25-year storm. It is recommended that the 6-inch pipe be replaced with a

12-inch pipe. As with the other areas, a survey would be needed to ensure that the estimated pipe capacity is correct and that a 12-inch pipe will be adequately sized for this basin. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-16.

TABLE 4-16

Drainage Basin No. L8 System Deficiencies

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
Existing 6-inch pipe crossing	0.16	0.33	0.84

With an assumed slope of 0.1 percent for this pipe and with assumed rim elevations for the catch basins, the model revealed surcharging of the pipes but no flooding of the catch basins during a 25-year storm. An accurate survey may reveal hydraulic modeling results that show historical surface flooding in the field.

Drainage Basin No. L9 Model Results

Drainage Basin No. L9 exists south of old Pioneer Way, encompassing Northridge Drive and the area west of South 13th Court. Currently, flooding is experienced by the houses just north of Pioneer Way, at the north end of Northridge Drive. To alleviate this situation, it is recommended that a 12-inch pipe and associated catch basins be installed along Old Pioneer Way to the existing system. This system includes a 6-inch pipe near the intersection of Old Pioneer Way and South 13th Court. The existing 6-inch pipe then connects to a 12-inch pipe that runs down the hill toward Pioneer Street.

For hydraulic modeling purposes, we modeled a 12-inch pipe that would collect runoff along the east end of Pioneer Way. The model revealed that a 12-inch pipe would be adequate to convey the flow to the existing system without creating any deficiencies. With an assumed slope of 8.8 percent for this pipe and with assumed rim elevations for the catch basins (estimated from topographical maps), the model revealed no surcharging or flooding of the pipes and catch basins. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-17.

TABLE 4-17

Drainage Basin No. L9 Recommended 12-inch Pipe System

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
New 12-inch Pipe	9.8	0.84	0.99
Existing 6-inch Pipe	1.7	0.84	0.99
Existing 12-inch Pipe	14.4	0.84	0.99

Drainage Basin No. L10 Model Results

Drainage Basin No. L10 surrounds the L6 and L9 basins. It is bounded by Pioneer Street to the north and the cemetery to the south. Drainage flows northeasterly toward Pioneer Street where it enters a ditch with a bottom width of approximately 11 feet and a depth of 1.5 feet. The flow then enters an 18-inch pipe and discharges to another ditch along the south side of Pioneer Street. This ditch has a bottom width of approximately 2 feet, vertical sides, and a depth of nearly 1 foot. The capacity of the two ditches has been expressed as a concern.

The ditches and 18-inch pipe need to be surveyed to obtain accurate slope information. For hydraulic modeling purposes, we estimated a slope of approximately 7.9 percent for the westerly ditch, 4.3 percent for the 18-inch pipe and 4.7 percent for the easterly ditch. With these assumed slopes, the model revealed sufficient capacity in both the westerly and easterly ditch. The 18-inch pipe was sufficient as well. Any previous flooding in these areas may have been due to maintenance related problems. The segment designation, existing capacity and modeled runoff for the system under both current and future land use conditions is shown in Table 4-18.

TABLE 4-18

Drainage Basin No. L10 System Capacities

Segment	Existing Capacity (cfs)	Current Land Use 25-year Storm (cfs)	Future Land Use 25-year Storm (cfs)
West Ditch along Pioneer Street	703.9	7.21	8.86
18-inch Pipe on South Side of Pioneer Street	21.8	7.21	8.86
East Ditch along Pioneer Street	29.1	7.21	8.86

N

0 1,000 2,000 4,000 Feet

R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15

TEE CREEK

GEE CREEK

LEGEND:

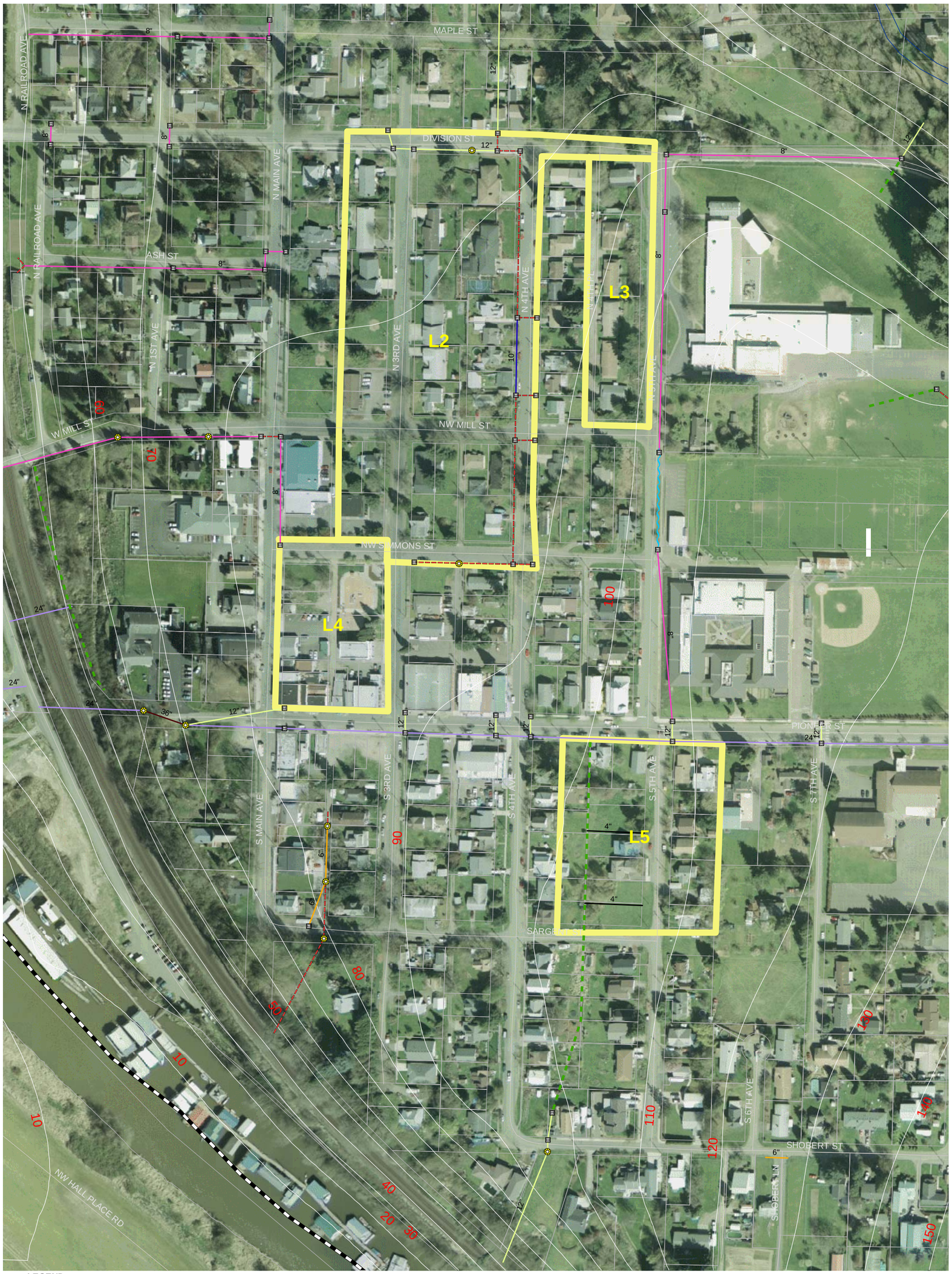
- STORM BASINS
- 10 FOOT USGS CONTOURS
- PARCELS

CITY OF RIDGEFIELD

STORMWATER MANAGEMENT
COMPREHENSIVE PLAN
FIGURE 4-1
REGIONAL BASINS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:/Ridgefield/06488/Figures/Fig 4-1 Regional Basins.mxd



LEGEND:

STORM PIPES: SIZE
- UNKNOWN
- 4"
- 6"
- 8"
- 10"
- 12"
- 15"
- 18"
- 21"
- 24"
- 30"
- 36"
- 48"
- 120"

STORM STRUCTURES: TYPE
- UNKNOWN
- C.B. STORMFILTER
- C.O.
- DRYWELL
- TYPE 1
- TYPE 2
- CITY LIMITS
- STORM FACILITIES

STORM DITCH LINE TYPE
- DAM
- DITCH
- SWALE
- COUNTY DITCH
- PARCELS
- RIVERS
- CIP basins

N

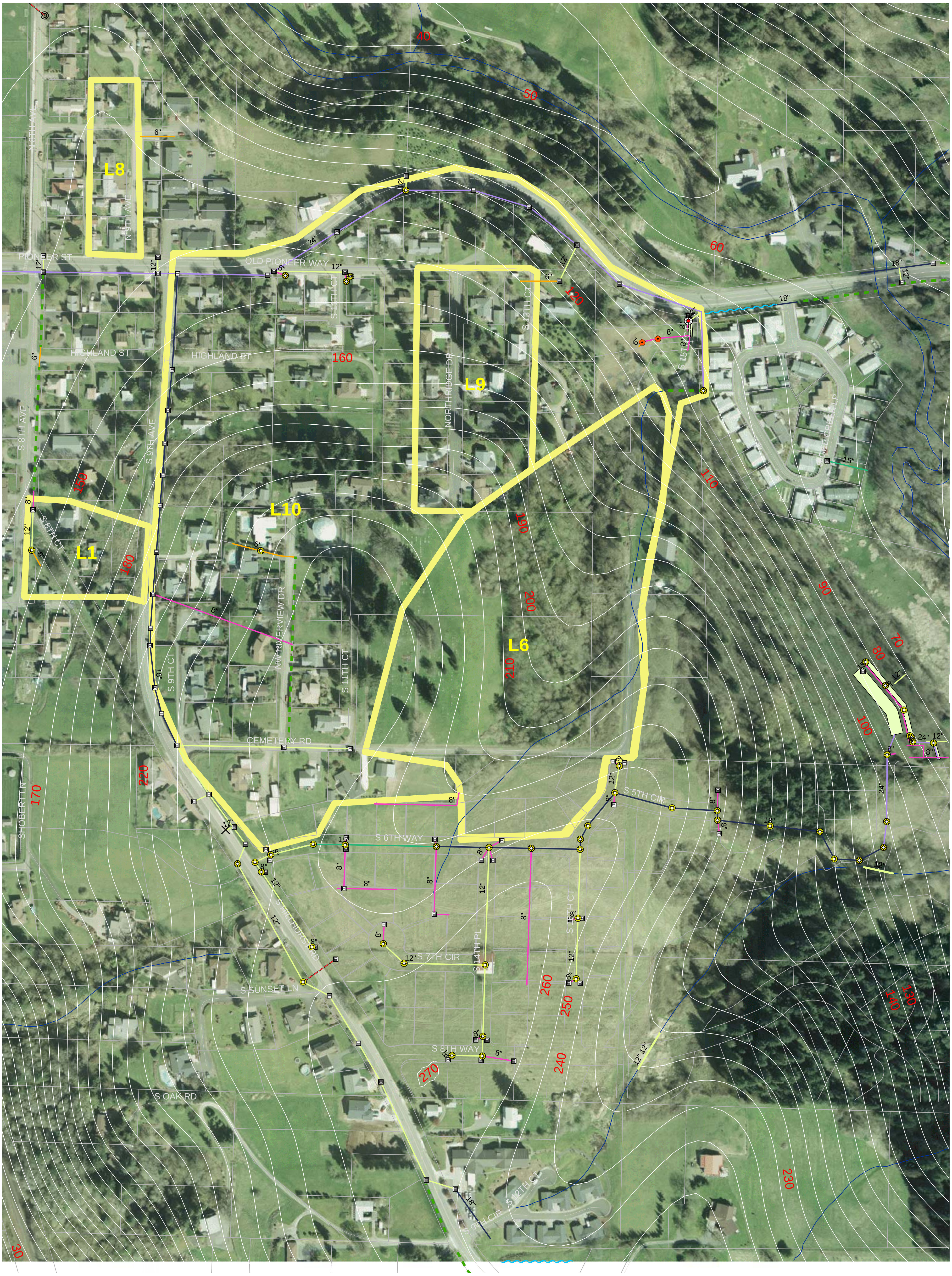
0 100 200 400 Feet

CITY OF RIDGEFIELD

STORMWATER MANAGEMENT
COMPREHENSIVE PLAN
FIGURE 4-2
LOCALIZED BASINS
(L2, L3, L4, L5)

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:/Ridgefield/06488/Figures/Fig 4-1 Local Downtown Basins.mxd



LEGEND:

STORM PIPES: SIZE	STORM STRUCTURES: TYPE	STORM DITCH LINE TYPE
UNKNOWN	UNKNOWN	DAM
4"	C.B. STORMFILTER	DITCH
6"	C.O.	SWALE
8"	DRYWELL	COUNTY DITCH
10"	TYPE 1	CIP basins
12"	TYPE 2	PARCELS
15"	CITY LIMITS	RIVERS
18"	STORM FACILITIES	
21"	10 FOOT USGS CONTOURS	
24"		
30"		
36"		
48"		
120"		

N

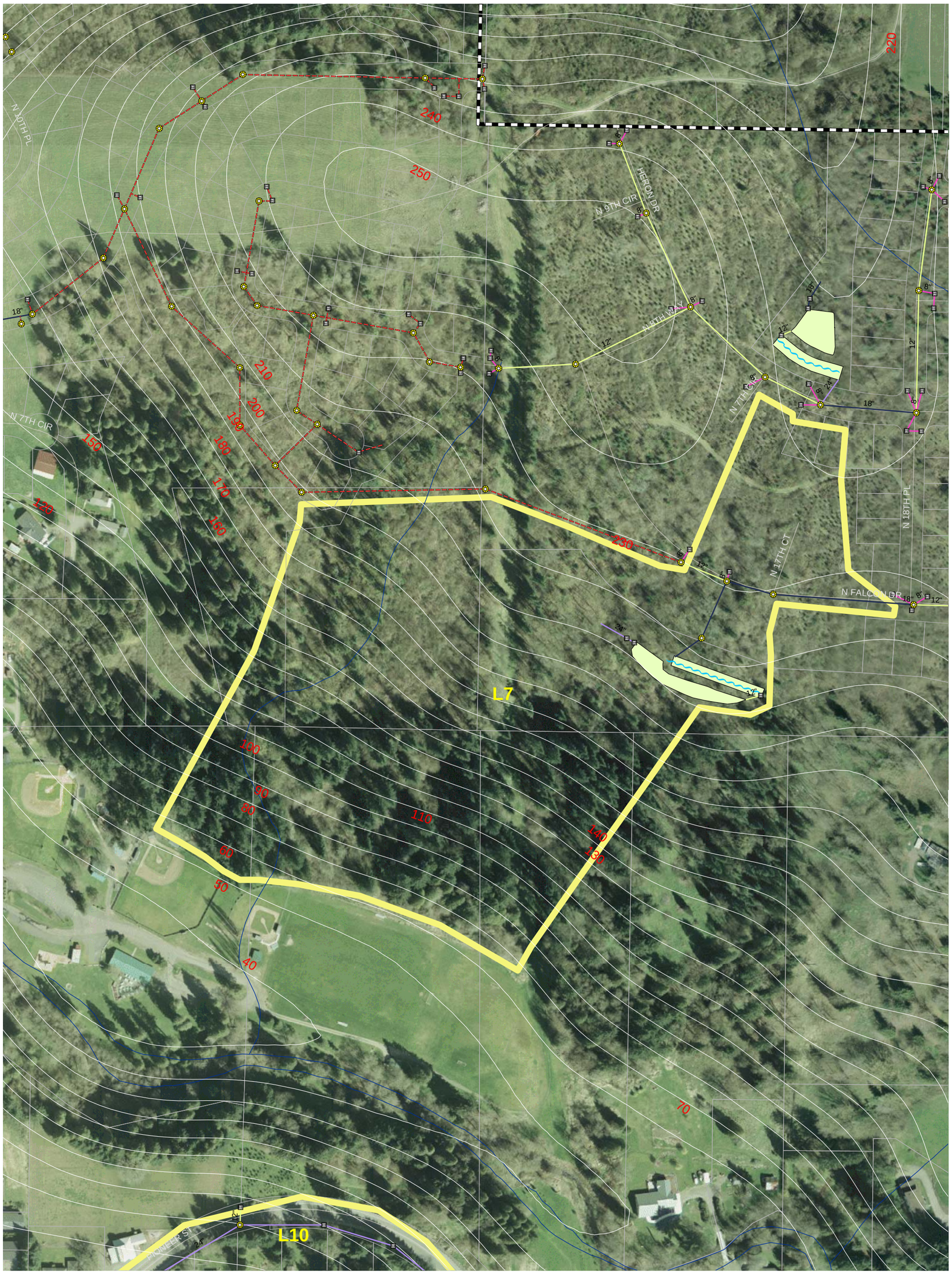
0 100 200 400 Feet

CITY OF RIDGEFIELD

STORMWATER MANAGEMENT
COMPREHENSIVE PLAN
FIGURE 4-3
LOCALIZED BASINS
(L1, L6, L8, L9, L10)

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:/Ridgefield/06488/Figures/Fig 4-1 Local East Basins.mxd



LEGEND:

STORM PIPES: SIZE
- UNKNOWN
- 4"
- 6"
- 8"
- 10"
- 12"
- 15"
- 18"
- 21"
- 24"
- 30"
- 36"
- 48"
- 120"

STORM STRUCTURES: TYPE
- UNKNOWN
- C.B. STORMFILTER
- C.O.
- DRYWELL
- TYPE 1
- TYPE 2
- CITY LIMITS
- STORM FACILITIES
- 10 FOOT USGS CONTOURS

STORM DITCH LINE TYPE
- DAM
- DITCH
- SWALE
- COUNTY DITCH
- CIP basins
- PARCELS
- RIVERS

N

0 100 200 400 Feet

CITY OF RIDGEFIELD

STORMWATER MANAGEMENT
COMPREHENSIVE PLAN
FIGURE 4-4
LOCALIZED BASINS
(L7)

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:/Ridgefield/0648B/Figures/Fig 4-1 Local Abrams Basins.mxd

CHAPTER 5

WATER QUALITY ANALYSIS

INTRODUCTION

The City of Ridgefield lies amongst a rolling region of hills, just above Lake River. Stormwater from the region generally flows centrally to Gee Creek. The western portion of the City flows directly toward Lake River. The northeastern portion of Ridgefield is in the headwater subbasins of McCormick Creek and Allen Creek, which both flow to the East Fork Lewis River.

Ridgefield's surface water features are a significant part of its natural beauty and rich heritage. Fish and wildlife habitat, clean water and aesthetic appeal are benefits of the surface water resources, which must be managed wisely to protect their value. Without proper management, urban runoff may cause the degradation of surface water resources.

In terms of aquatic life, fish species likely to have been present at the time of settlement include coho salmon, *Oncorhynchus kisutch*; chum salmon, *O. keta*, and cutthroat trout, *O. clarki clarki*, which likely spawned throughout this small watershed. Cutthroat trout are the predominant salmonid in the system at this time.

Recent sampling efforts have collected wide variety of warm water species in Gee Creek, which is due, in part, to the long-term clearing of the area for agriculture, and later residential and commercial development (Gee Creek Watershed Restoration Background Report, July 2006). A few juvenile Chinook salmon have also been collected during recent sampling efforts. These juveniles were likely spawned upstream on Lake River, the Lewis River or other upstream tributaries to the Columbia and utilize Gee Creek for foraging prior to out-migration. Coho and cutthroat and possibly chum may still spawn in the Gee Creek watershed. Watershed restoration efforts, most notably riparian planting projects, may improve salmonid spawning and rearing habitat in the coming decades as trees planted in the riparian areas mature. These efforts may partially offset impacts associated with rapid population growth and development in Ridgefield in the coming years.

As rain falls and runs off of urban surfaces, pollutants associated with the urban environment are transported to natural surface waters where they may damage aquatic organisms and reduce the aesthetic value of the water body. Nationwide, approximately 30 percent of water quality problems have been attributed to stormwater runoff. Many sources of stormwater pollution are uncontrolled. Sources of nonpoint pollution are numerous, varied and hard to detect, but their cumulative effect on water quality and habitats can be significant. Compared to most communities nationwide, Ridgefield contains areas that are relatively undeveloped and the City's stormwater is unlikely to carry significant concentrations of metals and polyaromatic hydrocarbons (PAHs)

normally associated with urban runoff. However, due to livestock and pets, bacterial concentrations may be similar if not higher in rural areas, such as Ridgefield, than in highly urbanized areas.

RELATIONSHIP OF STORMWATER RUNOFF TO WATER QUALITY

Pollutants discharged in stormwater are largely uncontrolled. In the Puget Sound area, stormwater has been estimated to contribute about 7 percent of the total flow from all point and nonpoint sources entering surface waters but about 60 percent of the total lead, 30 percent of the total zinc, and nearly all of the total fecal coliform bacteria. Research in western Washington has shown that the concentrations of many pollutants found in stormwater from residential, commercial, and industrial areas exceed water quality criteria.

The National Water Quality Inventory, 1986 Report to Congress (EPA, 1986), also concluded that diffuse sources of water pollution, including runoff from urban areas, are the leading cause of water quality impairment.

The Nationwide Urban Runoff Program (NURP) (EPA, 1983), included extensive field monitoring throughout the United States to characterize urban runoff flows and pollutant concentrations. According to this study nonpoint pollution includes: heavy metals (especially copper, lead and zinc); organic priority pollutants; coliform bacteria; nutrients; oxygen demanding substances; and total suspended solids (TSS).

The effects of the pollutants on receiving waters are site-specific; however, the following generalities can be assumed:

- Urban runoff produces frequent exceedances of ambient water quality criteria for heavy metals on freshwater aquatic life. Metals content in Ridgefield stormwater should be lower than most cities, due to the low population and relatively low traffic volumes.

- Although a significant number of problem situations could result from heavy metals in urban runoff, levels of freshwater aquatic life impairment (suggested by the magnitude and frequency of ambient criteria exceedances) were not observed.

- Copper, lead and zinc appear to pose a significant threat to aquatic life uses in some areas of the country. Copper is suggested to be the most significant of the three.

- Organic priority pollutants in urban runoff generally do not pose a general threat to freshwater aquatic life.

- The physical aspects of urban runoff, e.g., erosion and scour, can be significant causes of habitat disruption and can affect the type of fishery present.

- Sediment contamination due to the build-up of priority pollutants can be attributed wholly or in part to urban runoff.

- Coliform bacteria may be present at high levels in urban runoff and may be expected to exceed EPA water quality criteria during and immediately after storm events in most rivers and streams. Coliform bacteria discharges in urban runoff have a significant negative impact on the recreational uses of lakes.

- Domestic water supply systems with intakes located on streams in close proximity to urban runoff discharges are encouraged to check for priority pollutants which have been detected in urban runoff, particularly those in the organic category.

- Nutrients in urban runoff may accelerate eutrophication problems and severely limit recreational uses, especially in lakes. However, NURP's lake projects indicate that the degree of beneficial use impairment varies widely, as does the significance of the urban runoff component.

- Adverse effects of urban runoff in marine waters are highly specific to the local situation. Though estuaries and embayments were studied to a very limited extent in NURP, they were not believed to be generally threatened by urban runoff. Coliform bacteria present in urban runoff are the primary pollutants of concern, causing direct impacts on shellfish harvesting and beach closures.

- Groundwater aquifers that received deliberate recharge of urban runoff do not appear to be imminently threatened by this practice at the two locations where they were investigated.

The conclusions reached by the NURP study indicate that sedimentation, erosion and bacterial pollution are the pollutants of most concern in stormwater runoff. The Bellevue, Washington NURP project concluded that habitat changes associated with streambed scour and sedimentation produced by urbanization were more significant than pollutant concentrations. The results of these two studies illustrate the importance of controlling both stormwater quality and quantity.

SOURCES OF POLLUTANTS IN STORMWATER RUNOFF

The major types of stormwater pollution sources in the Ridgefield area are related to urban development, agricultural activities, and transportation-related activities. Other

important sources of nonpoint pollution may include illicit connections to the storm drain system, on-site sewage systems and improper waste storage and disposal practices.

The following sources of nonpoint pollution may occur in the City.

- Lack of preventive maintenance of stormwater facilities.
- Bacterial loading from garbage storage at groceries and restaurants.
- Pollutant wash-off from car and truck parking areas.
- Dumping of used motor oil into the City's storm drainage system
- Nutrient loading due to excessive fertilizer usage.
- Bacterial contamination from pet wastes that are not "scooped."

Urban Development

Commercial development in the City includes restaurants, mini-marts, auto repair shop, a lumber yard and miscellaneous smaller business. Potential sources of pollution from these developments include oil and grease, suspended solids and metals from the parking lots, bacterial loads and garbage from improper waste storage from residential and business sites, and fertilizers, pesticides and herbicides from landscaping and farming activities.

Other contaminants that may be associated with businesses in Ridgefield include toxic organic compounds such as pesticides and PAHs. Volatile organic compounds such as solvents may also be present in urban runoff and are typically associated with spills and improper waste disposal activities. Improper chemical storage and waste disposal practices are common sources of contaminates migrating off site from commercial and industrial establishments. The improper use of garbage dumpsters, such as exposing the contents to rain or depositing garbage on the ground rather than in the dumpster, are potential sources of stormwater pollution.

Throughout the City, undeveloped land is being converted to residential and commercial use. The construction-related activities of land clearing and site preparation are potential sources of stormwater pollution. Areas that have been cleared of vegetation are more prone to erosion and can significantly increase sediment loading to nearby water bodies. Sediments can be deposited in natural and constructed channels, thereby reducing the hydraulic capacity. The efficiency and capacity of associated stormwater control structures such as culverts, pipes, and detention facilities are also affected by the deposition of sediment.

The amount of stormwater runoff usually increases during construction activities as vegetative cover is removed. Leaf interception and infiltration provide a natural detention benefit while plant roots generally improve the water holding capacity of soil. When vegetation is removed from an area, the total runoff volume and peak runoff rate increases, which can erode stream banks and accelerate channel scouring. Erosion and scouring can damage property, destroy riparian habitat and degrade water quality.

In addition to soil erosion, other pollutants can also be generated by building activities. Pesticides, fertilizers, petroleum products, cleaning solvents, paints, asphalt by-products, acids, salts and solid wastes are potential sources of stormwater pollution if improperly handled on a construction site.

The impact of increased development on stormwater pollution does not stop after construction. The volume of stormwater runoff and peak discharge rate increases as a direct result of the increase in the amount of impervious area. The duration of high flows also increases, even when runoff is detained in traditional flow control facilities that are designed to match peak flows. Higher flow rates and longer durations of high flows accelerate bank erosion and scour in the receiving systems, which result in an increase in sediment deposition downstream. Higher flow rates can also cause localized flooding where the carrying capacity of natural streams and piped conveyance systems is exceeded. The pollutant load of stormwater in residential areas also increases as development increases. The potential pollutant sources in residential areas include fertilizers, pesticides and herbicides from landscaping activities, biological loads from pet wastes, waste oil disposal from vehicle maintenance activities, improper disposal of household and yard wastes and illegal connections of sanitary sewers to the storm sewer system.

Urban development can severely impact wetlands in several ways. Development often includes the filling in of wetlands. When increased stormwater flows due to development are directed to a wetland area the hydrologic regime of the wetland may be altered which may lead to the destruction of the wetland. Nutrient pollution from urban development may impact wetlands by promoting the growth of nuisance plants and pesticide, herbicide or fertilizer pollution from urban development may destroy wetland plants. Organic pollution from urban development may increase the oxygen demand in wetlands that may contribute to destruction of existing ecosystems.

Roadways

Stormwater runoff from highways, City arterials, and residential streets can contain elevated concentrations of metals, suspended solids, and organic compounds such as petroleum hydrocarbons. Runoff from roadways and parking areas is likely to be contributing metals, such as cadmium and lead, to stormwater runoff. These contaminants are produced by dryfall from vehicle emissions, vehicle wear and tear, and chemical products used in vehicles. Studies have shown that pollutant loading is directly related to the amount of vehicle traffic during a storm event (Horner and Mar, 1982). Major highways with high vehicle use can be significant sources of nonpoint pollutant loading. Sanding in the winter further contributes sediment to the drainage system. Major thoroughfares in the City include State Route 501, 45th Avenue, Union Ridge Parkway, Hillhurst Road, and others.

Domestic Activities

Nonpoint pollution from domestic activities in the City consists primarily of pet waste and domestic gardens. Pet wastes are likely the most significant source of nonpoint pollution from residential activities. Runoff laden with animal wastes, fertilizers, pesticides or herbicides can all contribute to nonpoint pollution.

IMPACTS ON SURFACE WATERS

The following discussion focuses on the criteria used to evaluate water quality contaminants, and sources most common in runoff. Water quality problems in the Ridgefield area are identified further in this Chapter. Appropriate strategies for addressing problem areas and reducing adverse impacts are discussed in Chapter 6.

Stormwater runoff constitutes the primary transport mechanism for nonpoint pollution. Pollution problems associated with land utilization and development encompass the common use of potential pollutants such as pesticides, fertilizers, petroleum products, and solid waste. A further problem stemming from residential, commercial, and industrial land uses is the increase in peak rate, volume, and duration of runoff because of the higher percentage of impervious area. Pollutants accumulate in surficial soils and on paved surfaces from vehicular emissions, atmospheric deposition, spills, leaks, improper waste storage/disposal practices, and fertilizer/pesticide application. They are then washed off the land surface during storm events and transported via stormwater runoff to nearby water bodies or infiltrated to shallow groundwater.

These types of nonpoint pollution are seldom attributed to an individual source and their intermittent nature makes them difficult to identify and control. Parameters that define nonpoint pollution are discussed below in terms of state standards and potential sources.

Parameters of Concern

Water quality parameters impacted by stormwater comprise a long list and are classified in many ways. Typical categories include sediment, nutrients, and metals; oxygen demanding and inert material; particulate and dissolved; chemical, biological, and physical; toxic and nontoxic; and organic and inorganic. Many specific pollutants are incorporated into one classification if their effects on receiving water are similar. Receiving water can assimilate a limited quantity of each, but there are thresholds beyond which the measured amount becomes a pollutant and results in an undesirable impact.

Human health considerations for fresh water can be monitored through the analysis of conventional water column parameters, nutrients, and oil and grease. The following section provides a brief description of contaminants, likely sources, and potential environmental effects.

Dissolved Oxygen

Dissolved oxygen (DO) is necessary in water to maintain a robust ecosystem. Fish kills and reductions in aesthetic values have resulted from low-DO conditions. During the oxidation of organic matter by biological activities, oxygen from water is used. Low DO problems result when the rate of uptake by oxygen-demanding material exceeds the rate of replenishment. Maintenance of adequate DO levels is especially important during summer when low stream flows and high temperatures make oxygen less available to aquatic life. DO concentrations may also become critical when wastes that require oxygen for decomposition enter the water. Dissolved oxygen concentrations vary between day and night and between seasons and stream site. These natural variations are caused by differences in such things as light intensity, nutrient levels and hydrogeologic conditions. Natural variation can also be caused by water sources. Some groundwater or water draining from bogs and marshes will have lower DO concentrations.

pH

Chemical and biological systems of natural water are impacted by pH. Similar to DO, pH responds to natural environmental factors. Changes in pH affect the degree of dissociation of weak acids and bases, which affect the toxicity, reactivity, and solubility of many compounds. Diurnal variations in pH occur as a result of changes in production and respiration rates and different water sources such as groundwater or water draining wetlands. A high pH condition has the potential to adversely impact salmonids.

Temperature

Temperature extremes affect stream productivity and eventually may result in loss of aquatic life. Temperature also affects stream chemistry, specifically the solubility of oxygen, carbon dioxide and metals. Temperature varies diurnally and seasonally. High temperatures, in particular, have the potential to adversely impact salmonids.

Turbidity

Turbidity is a measure of the clarity of water. Turbidity is not a measurement of mass or concentration; it is a water quality attribute. Therefore, it cannot be used as a quantitative measure to calculate loadings but is used qualitatively to compare against a standard. Turbidity increases in response to physical factors such as runoff, proximity to exposed erodible soils, and stream flow.

Nutrients

Nutrients are chemicals that stimulate the growth of algae and water plants. Typical sources include detergents, fertilizers, septic system effluent, manure, etc. The primary nutrients of concern are **nitrogen** and **phosphorous**. Forms of nitrogen include ammonia, nitrite, and nitrate, which are components of fertilizers, septic system effluent, and manure. The typical nutrient concentrations in stormwater runoff are often more than sufficient to stimulate the growth of algae and plant species. The increased algal activity will initially raise DO levels. Once decomposition of dead algae begins, DO levels drop, surface algal scums form, and water discoloration and odors may occur.

Nitrogen and phosphorus are the principal nutrients for algae and other plants in fresh water ecosystems including wetlands, streams, and lakes. Phosphorus is often the controlling nutrient for algae growth in fresh waters. A large input from nonpoint sources can result in algal blooms that can affect recreational use and reduce the overall quality of receiving waters. Nitrogen is also an important parameter for waters used as drinking water supplies as it can cause oxygen deficiencies in small children.

Pathogens/Bacteria
Pathogens/bacteria commonly refer to fecal coliform bacteria, which are found in the intestinal tracts of warm-blooded animals, including humans. Concentrations of fecal coliform bacteria in surface waters have historically been used as an indicator of waterborne pathogenic bacteria or viruses. Therefore, fecal coliform bacteria concentrations are used as indicators of potential public health concerns. High levels can indicate failing septic systems, poor livestock management practices, poorly operated wastewater treatment systems, poor source control of pet wastes in the municipal storm sewers, and other point or nonpoint sources.

Bacterial quality is one measure of water's ability to provide beneficial uses. The potential sources of nonpoint coliform pollution include:

- On-site septic systems,
- Urban stormwater runoff,
- Livestock, and
- Pets and wildlife.

High Oil and Grease
High oil and grease concentrations are associated with urban and industrial stormwater runoff. In addition to representing a water quality problem, they can also serve as indicators of a wide array of hydrocarbon compounds that can be toxic to aquatic life at low concentrations. Typically, oil and grease concentrations are low in receiving waters and are usually associated with runoff events.

Total Suspended Solids
Total suspended solids originate from erosion of urban and agricultural soils and stream channel erosion. Sediments washed off paved surfaces are transported by runoff and discharged to receiving waters. Land-clearing activities associated with urban development as well as poor livestock and crop management can accelerate soil erosion and increase sediment transport to receiving waters. The conversion of land from forest to urban uses increases impervious surfaces and accelerates stormwater runoff. The total volume and peak rate of stormwater is increased due to an increase in impervious surfaces and can cause scouring in stream channels, thereby increasing the suspended solids loading in the stream.

Metals
Metals commonly found in stormwater runoff from road surfaces and parking areas include lead, zinc, copper, chromium, arsenic, cadmium, and nickel. Other potential sources of metals originate from commercial car washes, auto repair facilities, and industrial operations. Most metals are adsorbed onto suspended solids present in the runoff and are probably not toxic to aquatic life.

Toxic Organic Compounds
Toxic organic compounds include a variety of contaminants such as pesticides, petroleum hydrocarbons, and volatile organic compounds (VOCs). Potential nonpoint sources of these contaminants include urban and agricultural runoff, hazardous substance spills, improper disposal of waste products, and industrial discharges. Compounds that are most frequently found in runoff include phosphates, PAHs, VOCs, and some pesticides. The availability of toxic organic compounds to aquatic life is difficult to determine because of their adsorption to particulate matter. Particulate-bound contaminants are usually flushed out of the receiving system during high stormwater flows.

Organic Material
Organic material is an integral component of topsoil. The organic content of soil is primarily produced by microorganisms during the degradation of dead plant and animal material. The microbial degradation of organic matter in aerobic systems results in the consumption of oxygen. Waters high in organic matter may experience depressed oxygen concentrations.

WATER QUALITY STANDARDS

Water quality standards for surface water in Washington State are established in Chapter 173-201A Washington Administrative Code. Standard criteria allow for comparison of the data of interest to a safe or desired concentration or level. Management practices that violate established standards are subject to further investigation and ultimately appropriate corrective measures.

The Department of Ecology has responsibility for managing the State's water resources. The State adopted revised water quality standards in 2016.

Water quality standards are set by the State to achieve designated uses of a water body. Use categories include aquatic life uses, recreational uses, water supply uses, and miscellaneous uses.

Water quality standards have been assigned to each specific use category, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, and deleterious substances.

The surface waters of Ridgefield, including Lake River, McCormick Creek, and the small un-named system between Flume Creek and Gee Creek that drains to Lake River, have

not been given designated uses in 173-201A WAC. Gee Creek and Allen Creek also have not been given designated uses in 173-201A, but their designated uses are set by their statuses as feeder streams to lakes.

As unlisted surface waters with no other required protections, Lake River, McCormick Creek, and the small un-named system between Flume Creek and Gee Creek that drains to Lake River are to be protected for the following designated uses:

- Salmonid spawning, rearing, and migration;
- Primary contact recreation;
- Domestic, industrial, and agricultural water supply;
- Stock watering;
- Wildlife habitat;
- Harvesting;
- Commerce and navigation;
- Boating; and
- Aesthetic values.

As feeder streams to lakes, Gee Creek and Allen Creek are to be protected additionally for the designated uses of core summer salmonid habitat and extraordinary primary contact recreation.

The most stringent water quality standard for each parameter based on these designated uses is listed in Table 5-1.

As development in Ridgefield increases, there may be greater impacts on water quality in Lake River associated with storm sewers. There has been no known direct water quality testing for specific parameters on the stormwater discharges in water bodies throughout Ridgefield. The Wastewater Treatment Plant generally meets the discharge effluent limitations contained in the City's NPDES permit.

In addition to the water quality parameters listed in Table 5-1, concentrations of toxic substances, such as organic compounds and metals, must not exceed standards specified in Washington Administrative Code 173-201A-240. These standards are based on the U.S. Environmental Protection Agency Quality Criteria for Water (1986), which are derived from federal water quality criteria based on aquatic toxicology.

The Washington Administrative Code defines both acute and chronic criteria for toxic substances. Acute toxicity criteria are based on death percentages of test organisms within 24 hours. Chronic toxicity criteria are defined as the concentration that causes long-term adverse effects on an organism's functions.

Water quality criteria for nutrients are not defined in federal or state regulations for surface water. However, because of their influence on algal growth in surface waters, nitrogen and phosphorus are the nutrients of greatest interest in stormwater runoff. Phosphorous is often the limiting nutrient for growth of plants in freshwater systems.

Phosphorous enrichment can, therefore, result in the excessive algal blooms and associated nuisance conditions in streams and lakes. The general threshold for eutrophic conditions in lakes is 20 µg/L total phosphorous. Criteria for defining eutrophic thresholds in streams do not exist. However, soluble phosphorous in the range of 15 to 25 µg/L promotes nuisance conditions in streams.

TABLE 5-1

Designated Uses and Water Quality Standards for Ridgefield Streams and Lake River (WAC 173-201A)

Parameter	Lake River et. al.	Gee Creek / Allen Creek
Fecal Coliform	Primary contact recreation – Fecal coliform organisms shall not exceed a geometric mean value of 100 colonies/100 ml, with not more than 10 percent of samples exceeding 200 colonies/100 ml.	Extraordinary primary contact recreation – Fecal coliform organisms shall not exceed a geometric mean value of 50 colonies/100 ml, with not more than 10 percent of samples exceeding 100 colonies/100 ml.
Dissolved Oxygen	Salmonid spawning, rearing, and migration – Dissolved oxygen shall exceed 8.0 mg/L.	Core summer salmonid habitat – Dissolved oxygen shall exceed 9.5 mg/L.
Total Dissolved Gas	Salmonid spawning, rearing, and migration – Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.	Core summer salmonid habitat – Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.
Temperature	Salmonid spawning, rearing, and migration – The 7-day average of daily maximum temperatures (7-DADMax) shall not exceed 17.5 degrees C.	Core summer salmonid habitat – The 7-day average of daily maximum temperatures (7-DADMax) shall not exceed 16 degrees C.
pH	Salmonid spawning, rearing, and migration – pH shall be within the range of 6.5 to 8.5 with a human-caused variation within a range of less than 0.5 unit.	Core summer salmonid habitat – pH shall be within the range of 6.5 to 8.5 with a human-caused variation within a range of less than 0.2 unit.
Turbidity	Salmonid spawning, rearing, and migration – Turbidity shall not exceed 5 NTU over background turbidity when the background is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background is more than 50 NTU.	Core summer salmonid habitat – Turbidity shall not exceed 5 NTU over background turbidity when the background is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background is more than 50 NTU.

Parameter	Lake River et. al.	Gee Creek / Allen Creek
Toxic, Radioactive, or Deleterious Materials	All freshwater uses – Toxic, radioactive, or deleterious material concentrations must be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health (see WAC 173-201A-240, toxic substances, and 173-201A-250, radioactive substances).	
Aesthetic Values	All freshwater uses – Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.	

Groundwater standards in the state of Washington are listed in Chapter 173-200 WAC. The standards establish criteria for maximum contaminant concentrations in terms of primary and secondary contaminants and radionuclides based on human health-based criteria. Special protection area can be designated because of wellheads and recharge areas that are vulnerable to pollution because of hydrogeologic characteristics and sole source aquifer status by federal designation. A Wellhead Protection Plan has been created for each of the City's wells.

The general impacts of nonpoint sources on beneficial uses that are likely to be of concern to water bodies in or adjacent to the City of Ridgefield are indicated in Table 5-2.

TABLE 5-2

General Impact of Nonpoint Sources Likely to be of Concern in Ridgefield

Body	Key Pollutants	Affect on Water	Affected Uses
Streams	Sediment/suspended solids	Turbidity deposition in stream pools and wetlands	Loss of flood control capacity, loss of aquatic habitat, fishing, loss of wetland cleaning ability, visual pollution
	Hydraulic erosion	Stream bank loss sediment deposit downstream	Damage of private and public property, loss of aquatic habitat
	Bacteria/viruses	Contamination	Swimming
Groundwater	Nitrates	Loss of use as a drinking water supply	Drinking water supply

Body	Key Pollutants	Affect on Water	Affected Uses
	Toxic organics	Cancer, related diseases	Drinking water supply
	Bacteria/viruses	Contamination	Drinking water supply

STATE WATER QUALITY ASSESSMENTS

The federal government defines water quality impaired water bodies as the following:

> "....any (water body) segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards even after the application of the technology based effluent limitations required by 301(b) and 306 of the Clean Water Act"
> (40 CFR 130.2(i)).

The same federal regulations require that Ecology assess waters to determine attainment with surface water quality standards. Ecology is also required to perform a total maximum daily load (TMDL) evaluation for surface waters that are found to be impaired. The basic goal of the TMDL procedure is to bring water bodies back into compliance with standards by limiting pollutant loading based on the characteristics of the water bodies, rather than by the limits capable from the usual source treatment processes.

Ecology maintains a list of water quality impaired water bodies in the state. This list is known as the Section 303(d) List. In general, water quality problems in the vicinity of Ridgefield include summer high temperatures, low dissolved oxygen, and high fecal coliform bacteria levels in the streams. Ecology's Clean Water Act Section 303(d) List includes the following information regarding Gee Creek and Lake River in Ridgefield.

Gee Creek

In 1995, Ecology published water quality data on Gee Creek. The water was sampled from the bridge in Abrams Park. The data was then scored on a level between 1 and 100, where 40 to 80 represents moderate water quality and above 80 represents data that met State water quality criteria and was considered as an indication of a water body in good condition. The 1995 data revealed that dissolved oxygen, pH, turbidity and suspended solids scored above 80 indicating the creek was in good condition with regards to these constituents. Temperature and fecal coliform data fell within the moderate water quality range whereas nitrogen and total phosphorus data fell within the poor water quality range. The creek received a water quality index of 43 which designated it as "moderate" in terms of overall water quality.

Bacteria (Fecal Coliform)
Gee Creek is listed on the 2016 Section 303(d) List for bacteria. The basis of this listing is data collected by Clark County since 2003 at Abrams Park and at Main Street in

Ridgefield and data collected by Ecology in 1994 and 1995. Gee Creek exceeded the geometric mean criterion in water years 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, and 2002 and exceeded the percent criterion in water years 2010, 2009, 2008, 2007, 2006, 2005, 2004, 2003, and 2002. This pattern shows a consistent problem with bacteria in the creek.

In the 2004, 2008, and 2012 assessments, Gee Creek was also listed on the Section 303(d) List for bacteria. It was not included on the 1996 or 1998 Section 303(d) Lists.

At the writing of this Plan, there have been no efforts to begin the TMDL process for Gee Creek.

Dissolved Oxygen
Gee Creek downstream of Pioneer Street is listed on the 2016 Section 303(d) List for dissolved oxygen. The basis of the listing is unpublished data collected by Clark County at Abrams Park. Several years of sampling from 2002 to 2006 were used. Using the year 2006 as an example, two of four samples did not meet the minimum dissolved oxygen concentration (9.5 mg/L). In the vicinity of Carty Road and I-5, Gee Creek is listed as a Category 2 water of concern for dissolved oxygen.

In the 2012 and 2008 assessments, Gee Creek was listed as a Category 3 water with insufficient data for a determination for dissolved oxygen. Prior assessments did not list Gee Creek for dissolved oxygen.

Temperature
Gee Creek is listed on the 2016 Section 303(d) List for temperature. The basis of the listing is unpublished data collected by Clark County at Abrams Park. Using the year 2007 as an example, the 7-DADMax exceeded the maximum temperature (16 degrees C) on 97 of 150 days.

Ecology's 2004, 2008, and 2012 assessments listed Gee Creek as a Category 2 water of concern for temperature. The 1996 and 1998 303(d) Lists did not include Gee Creek for temperature.

Bioassessment
Bioassessment is a measure of biological integrity of a surface water body.

Gee Creek is listed on the 2016 Section 303(d) List for bioassessment. The basis of the listing is data collected by Clark County and the resultant calculated Benthic Index of Biotic Integrity (B-IBI) score, which indicates that biological integrity in Gee Creek is degraded. A B-IBI score of 27 or above (out of 50) indicates non-degraded biological integrity.

In the 2004, 2008, and 2012 assessments, Gee Creek was listed as a Category 3 water with insufficient data for bioassessment, and it was not included on the 1996 or 1998 Section 303(d) Lists.

pH
Gee Creek is listed as a Category 2 water of concern for pH. The basis of the classification is unpublished data collected by Clark County. In 2006, 25 percent of samples showed an excursion of the pH criteria.

Lake River
Temperature and Bacteria
The portion of Lake River that passes Ridgefield is listed on the 2016 Section 303(d) List for temperature and bacteria. The basis of the listings are data collected by Ecology in the 1990s.

McCormick Creek
A small portion of Ridgefield drains to McCormick Creek in the East Fork Lewis River watershed.

Downstream of its headwaters in Ridgefield, in unincorporated Clark County, McCormick Creek is listed on the 2016 Section 303(d) List for bacteria. This basis of the listing is data collected by Ecology in 2005, 2006, and 2007 as part of the East Fork Lewis River TMDL study for bacteria and temperature. Impairment was determined by exceedance of the geometric mean criterion in water years 2007 and 2005 and by exceedance of the percentage criterion in water years 2007, 2006, and 2005.

Further downstream, McCormick Creek is listed as a Category 2 water of concern for temperature.

Development of the East Fork Lewis River TMDL was on hold for a number of years. In 2017, Ecology began collecting bacteria data again and expects to publish a Source Assessment Report in 2018.

The City of Ridgefield has not been identified as a stakeholder in the coordinated cleanup effort for the East Fork Lewis River watershed.

CHAPTER 6[1]

STORMWATER QUANTITY AND QUALITY CONTROL

The following sections discuss general considerations for the control of stormwater pollution from the sources identified in Chapter 5 and present some specific recommendations for the City of Ridgefield.

GENERAL CONSIDERATIONS IN URBAN STORMWATER QUANTITY AND QUALITY CONTROL

Each issue discussed in the previous chapter for stormwater quality problems represents a classic stormwater quantity or quality management problem. Stormwater management solutions to alleviate the stormwater problem areas must incorporate sound engineering. They must also comply with the City's regulations. It is recommended that the City implement and enforce a stormwater management program designed to reduce the discharge of pollutants to the maximum extent practicable (MEP), to protect water quality and to satisfy the appropriate water quality requirements of the Clean Water Act.

Effective stormwater management is often achieved from a management systems approach, as opposed to an approach that focuses on individual practices. BMPs can be structural or nonstructural facilities or programs that can be implemented to achieve protection of water quality. Once pollutants are present in a water body, or after a receiving water body's physical structure and habitat have been altered, it is much more difficult and expensive to restore it to an undegraded condition. Implementation of a management system that emphasizes prevention of receiving water degradation is recommended.

As the consequences of uncontrolled urban runoff have become more widely recognized and better understood, and as more alternatives for control and treatment of runoff have become available, stormwater management has become more complex. Several general issues have been identified to provide a framework for review of methods employed by the City of Ridgefield to implement its stormwater management program. These issues are briefly discussed in the following paragraphs and include:

- Stormwater quality versus quantity control,
- Construction phase versus long-term site operation phase,
- Structural versus nonstructural controls,
- Source control versus downstream treatment, and
- Special sensitive area considerations.

[1] Chapter 6 discusses general principles and techniques, and it was not updated for the 2018 plan revision.

STORMWATER QUALITY VERSUS QUANTITY CONTROL

Stormwater management has traditionally been concerned with control of runoff quantities for the purpose of flood prevention. Accordingly, most regulations and engineering design procedures address this concern. The quality of stormwater runoff has become an added concern as the regulatory community has recognized that water quality goals often cannot be realized through control of point sources of water pollution alone.

The design of quantity and quality control begins with the same basic task: predict the amount of runoff resulting under various conditions. In the case of quantity control, the objective is to release storm runoff at a rate that does not exceed stream channel capacity (which may not be the same as matching predevelopment hydrologic conditions for a given site). Excessive flow rates and volume of stormwater can also cause water quality concerns through erosion and bank cutting. For quality control the objective is to provide sufficient holding time for the effective gravity settling or biochemical removal of pollutants. Because storage may benefit both quantity and quality of runoff, some of the same storage strategies, if correctly applied, can advance both goals. This discussion will emphasize the achievement of dual stormwater quantity and quality control goals wherever possible.

CONSTRUCTION PHASE VERSUS LONG-TERM SITE OPERATION PHASE

In general, the types of potential water quality problems associated with construction differ from those associated with the operation of a developed site. Therefore, these project stages should be treated separately in stormwater management planning. At the same time, there should be an awareness that some stormwater management measures installed for the construction phase can be converted to permanent service, once construction is complete.

STRUCTURAL VERSUS NONSTRUCTURAL CONTROLS

Control of water pollution relies to a large extent on structural treatment devices. Structural stormwater treatment infrastructure includes grass swales, oil/water separators, and wet ponds. Structural stormwater quality and quantity controls are difficult and costly to retrofit into existing development. Nonstructural stormwater quality controls can be employed in new and existing developments. Nonstructural approaches may include enhanced maintenance programs, regulations, public involvement, land use controls and other measures. The most effective stormwater quality programs utilize a mix of structural and nonstructural alternatives.

SOURCE CONTROL VERSUS DOWNSTREAM TREATMENT

While the distinction is not perfect, source controls generally prevent pollutants from coming into contact with stormwater and they are located at the site of pollutant

generation. Downstream treatment infrastructure is typically removed from the source. Source control measures (such as enclosing or covering a pollutant source) are usually applied at multiple locations, while a downstream treatment measure (such as an artificial wetland) often receives drainage from more than one source. In the extreme case, a single downstream treatment structure (such as a regional detention pond) can receive and treat runoff from several subbasins.

CONTROL OF ACUTE VERSUS CHRONIC IMPACTS

Acute impacts are defined as the impact caused by a one-time event. For example, if antifreeze were poured into a catch basin near a creek, a fish kill might result.

Chronic impacts are defined as a constant impact caused by an ongoing event or situation. For example, gradual removal of vegetation and increases in impervious areas associated with road building and development increase runoff rates and reduce groundwater recharge, resulting in erosion and siltation of streams and loss of fish and wildlife habitat.

Different strategies may be required to address acute and chronic stormwater impacts. Methods used to reduce acute and chronic impacts often overlap. The most successful stormwater quality management programs utilize an integrated approach.

SPECIAL SENSITIVE AREA CONSIDERATIONS

Areas particularly susceptible to adverse impacts from urban runoff include:

- Stream corridors, especially those with valuable fish habitat;
- Floodplains;
- Wetlands;
- Steep slopes, and
- Groundwater aquifers and their recharge areas.

Special considerations in stormwater management apply to these areas. These considerations will be brought into the discussion as appropriate.

STORMWATER QUANTITY AND QUALITY CONTROL: STRUCTURAL ALTERNATIVES

Stormwater management alternatives for the control of the quantity of stormwater runoff and the quality of the runoff are not mutually exclusive. The outdated method of designing stormwater conveyance systems that relied on curbs and gutters to transport stormwater directly into pipes that discharged the stormwater directly into a stream, river, or lake provided little stormwater quantity control and no stormwater quality control. As stormwater management techniques evolve, it has become apparent that many stormwater management tools designed to address quantity issues also aid in improving stormwater

quality. In the remainder of this chapter stormwater management alternatives designed to limit the quantity of stormwater runoff and improve runoff quality will be discussed.

The incorporation of runoff quality controls into urban landscape may be difficult due to space and economic restraints. However, if the design is developed with the following concepts in mind, a good water quality management system will result:

- Design runoff quality controls to capture small storms.
- Design to maximize sediment removal and removal of other pollutants will generally be good.
- The most effective method for reducing urban runoff pollution is to minimize directly connected impervious area (DCIA).
- Infiltration devices are most efficient but are most difficult to maintain, and should not be used on sites with poor soil conditions.
- Dry detention is easiest to design and operate, but efficiency can be low.
- Wet detention is more difficult to design but more efficient than dry detention, and often more aesthetic.

Site controls can minimize the quantity of stormwater released as well as provide water quality benefits. Site controls are generally those controls that attempt to reduce runoff rate and volume at or near the point where the rainfall hits the ground surface. The following types of site controls are common:

- Low-impact development,
- Storage and regulated release,
- Minimization of directly connected impervious area,
- Swales and filter strips,
- Porous pavement and parking blocks, and
- Infiltration devices, such as trenches and basins.

LOW-IMPACT DEVELOPMENT

Low-impact development is one method for controlling stormwater on a site. The primary goal of low-impact development methods is to mimic the predevelopment site hydrology by using site design techniques that store, infiltrate, evaporate, and detain runoff. Use of these techniques helps to reduce off-site runoff and ensure adequate groundwater recharge. The *Puget Sound Water Quality Management Plan* recommends that low-impact development include the following:

- Maintain the predeveloped, undisturbed stormwater flows and water quality;

- Retain native vegetation and soils to intercept, evaporate, and transpire stormwater on the site (rather than using traditional ponds and conveyances);

- Emphasize a higher standard of soil quality in disturbed soils (by using compost and other methods) to improve infiltration, reduce runoff, and protect water quality;

- Cluster development and roads on the site and retain natural features that promote infiltration; and

- Reduce impervious surface area and use permeable surfaces instead.

Management practices often used to achieve low-impact development goals include bioretention facilities, dry wells, filter/buffer strips, grass swales, rain barrels, cisterns, and/or infiltration trenches. Low-impact development is an efficient method for decreasing the amount of runoff associated with developing a site. Maintenance in low-impact developments is critical and should be addressed prior to implementation. The 2005 *Low Impact Development Technical Guidance Manual for Puget Sound* by the Puget Sound Action Team/WSU Pierce County Extension is a manual being adopted by a number of jurisdictions to aid in the design of low-impact development techniques. Included in this manual is a list of available techniques, appropriate design standards, and maintenance recommendations.

STORAGE AND REGULATED RELEASE

Storage and regulated release of stormwater has been implemented in the City of Ridgefield in the form of sedimentation and detention ponds, pipes, and ditches. In addition, detention also occurs in the form of ponding in yards, pastures, vacant lots, and ditches. Storage and regulated release of stormwater requires the installation of detention systems to insure that the rate of stormwater runoff leaving the site in the postdevelopment condition is no greater than the predevelopment rate for the same design storm event. This method of stormwater control minimizes downstream impact on the existing conveyance system.

Wet and dry detention systems are used for runoff quantity control. If wet detention systems are properly sized, they can also serve as effective runoff quality control devices.

Wet Detention Basins

A wet detention basin consists of:

- A permanent water pool,
- An overlying zone with capacity to temporarily store the design runoff volume for release at the allowed peak discharge rate, and
- A shallow littoral zone (the biological filter), which serves to treat the permanent volume between storm events.

The permanent water pool volume and the vegetated littoral zone are important for water quality enhancement. If properly designed and maintained, wet detention ponds can provide effective flood and water quality protection, and ancillary benefits, such as enhanced aesthetics and wildlife habitat.

The removal of stormwater pollutants in a wet detention system is accomplished by a number of physical, chemical, and biological processes. Gravity settling removes particles through the physical process of sedimentation. Chemical flocculation occurs when heavier sediment particles coalesce with smaller, lighter particles to form still larger particles. Biological removal of dissolved stormwater pollutants includes uptake by aquatic plants and metabolism by phytoplankton and microorganisms that inhabit the bottom sediments.

Dry Detention Basins

Dry detention basins are the most common type of detention basin used for peak flow attenuation. Dry detention systems perform very poorly as treatment devices for runoff (Lansing, Michigan Nurp Study, 1999). This is primarily due to short residence time and the fact that these basins do not remove any dissolved pollutants.

Design, sizing and maintenance criteria for detention facilities can be found in Chapter 3, Volume III of the 2005 Ecology *Stormwater Management Manual for Western Washington.*

DIRECTLY CONNECTED IMPERVIOUS AREA

Directly connected impervious area (DCIA) is defined as the impermeable area that drains directly to the improved drainage system, i.e., paved gutter, improved ditch, or pipe. Minimization of DCIA is an effective method of runoff quantity and quality control because it reduces the flow into the improved drainage system and maximizes the opportunity for rainfall to infiltrate. Figure 6-1 illustrates the difference between an area where the DCIA is extensive and one where DCIA has been minimized. The residential lot on the north side of the street has all impervious areas on the lot draining directly to the gutter. This drainage plan does not provide the opportunity for water falling on the impervious surfaces to infiltrate into the ground. The system is laid out so that the rain falling on the impervious areas is quickly concentrated and drained to the gutter. The result is a greatly increased peak runoff rate and runoff volume compared to the

predevelopment condition. The pollutants contained in the runoff from the rooftop, driveway, sidewalk, and street are collected in the gutter and must be dealt with downstream.

In contrast, the drainage layout for the lot on the south side of the street has been designed to minimize DCIA. All impervious areas drain to a pervious area before they reach the grassed swale that serves as the primary conveyance facility for runoff from the lot. The roof runoff drains to the lawn and sheet-flows across it, the driveway is sloped to drain to the lawn instead of the street, and the sidewalk and the street sheet-flow across a grass filter strip before reaching the grassed swale. All of these techniques combine to promote infiltration and reduce the runoff rate. This approach to drainage system layout, which emphasizes peak-flow reduction and pollutant capture, is called **stormwater management**, in contrast with the north lot design, which is simply a drainage plan.

The majority of residences in Ridgefield, particularly the older homes, have been constructed with minimal DCIA. Commercial development and more recent housing developments tend to exhibit greater DCIA. Future development in the Ridgefield area should attempt to minimize DCIA and instead, exhibit low-impact development designs where possible.

SWALES AND FILTER STRIPS

Swales, or grassed waterways, and filter strips are among the oldest stormwater control measures. They have been used alongside streets and highways, and to contain, filter, and convey agricultural runoff for many years. A swale is a shallow trench that has the following characteristics:

- Side slopes flatter than 3 feet horizontally to 1 foot vertically;
- Contiguous areas of standing or flowing water only following rainfall; and
- Lined with vegetation suitable for soil stabilization, stormwater treatment, and nutrient uptake.

A filter strip is a vegetated strip of land across which stormwater flows prior to entering adjacent receiving waters. Filter strips receive runoff from streets, parking lots, rooftops, etc.

For small storms, both swales and filter strips remove pollutants from stormwater by reducing the velocity which increases the settling and filtering of solids out of the water as it travels over the grassed area. In addition, depending on the underlying soil conditions swales and filter strips may allow infiltration into the underlying soil. Vegetation in the filter strip or swale may also function as a fixed media to support growth of microorganisms that can break down dilute concentrations of organics

including oil residues. Heavy metals are typically trapped in the upper regions of the soil column.

In general, the higher the flow rate through a swale or across a filter strip, the lower the efficiency. Thus, low velocity and shallow depth are key design criteria. A swale designed with a shallow bottom slope and check dams will perform more efficiently than one without check dams. Raised driveway culverts can be effective as swale check dams. For maximum efficiency of pollutant removal during small storms, a trapezoidal swale with a large bottom width is desirable. This will maximize surface area to provide stormwater contact with the vegetation and soil.

Design equations for swales and filter strips can be found in Chapter 9, Volume V of the 2005 Ecology *Stormwater Management Manual for Western Washington*. Maintenance of these devices is critical to maintain aesthetics, hydraulic efficiency, and treatment capacity.

PARKING BLOCKS

Parking blocks are a very effective site control device. Parking blocks are hollow concrete blocks similar to the masonry blocks used in construction. In commercial parking lots, private driveways and parking areas, the use of parking blocks in the less frequently used areas may reduce runoff quantity, flow rates, and pollution. Parking blocks should only be used in less heavily traveled areas. The traffic lanes should be paved in the normal fashion. Parking blocks are put in place in rows, with soil surrounding each one. Appropriate vegetation is planted to fill the voids in the blocks. Runoff is reduced if the underlying soils allow infiltration in the planted areas. The quality of the runoff may be better than the runoff from a typical parking lot because the vegetation matrix retains the pollutants.

INFILTRATION DEVICES

Infiltration devices are stormwater quantity and quality control measures that completely capture runoff from the design storm and allow it to infiltrate into the ground. The 2005 Ecology *Stormwater Management Manual for Western Washington* provides design and sizing guidance in Chapter 7 of Volume V (Runoff Treatment BMPs). Infiltration systems provide groundwater recharge and pollutant removal. Infiltration systems can be integrated into a site's landscaped and open areas. If the system is designed properly, infiltration devices can serve larger developments.

Infiltration devices should be used only in situations where the captured volume of water can infiltrate into the ground before the next storm and where soils, slope, and cover will not promote sloughing and mass wasting (landslides). The applicability of infiltration systems in the Ridgefield area may be limited due to high groundwater and the underlying soil conditions. Infiltration systems in this area may only be used if tests reveal that sufficient permeability exists within the soil.

STORMWATER QUANTITY AND QUALITY CONTROL: NONSTRUCTURAL ALTERNATIVES

Management of a stormwater system can be improved by strengthening various areas of City administration. The administrative issues, also termed nonstructural controls, include a wide variety of measures.

Nonstructural stormwater management alternatives include:

- Source control measures,
- Maintenance programs,
- Staff training,
- Changes to the municipal codes or regulations,
- Enforcement actions for noncompliance with stormwater regulations, and
- Public education.

SOURCE CONTROL MEASURES

Source control measures are designed to minimize or eliminate contact of pollutants with stormwater at the site of origin. Regulation of development, such as requiring the enclosure of a pollutant source, physically segregating the pollutant source to prevent runon of uncontaminated water and direct connection of pollutant sources to the sanitary sewer are forms of source control. A requirement for erosion and sedimentation control during construction is a source control method for reducing pollutant load to receiving waters. Source control methods also include education of the public to prevent disposal of yard wastes, household chemicals, and motor oil into drainage facilities. Source control measures that City staff can implement include pet waste ordinances, pollution prevention/good housekeeping programs for municipal operations, an education program to inform the general public and businesses on the water quality impacts of outdoor washing of automobiles, or an education program to inform businesses of the proper way to store waste materials to prevent pollution carried by stormwater.

The 2005 Ecology *Stormwater Management Manual for Western Washington* lists many types of BMPs specific to the operation being conducted such as activities for boat yards, commercial composting areas, landscaping, roadside ditches, manufacturing activities, mobile fueling of vehicles, and scrap yards among others. The Manual also provides BMPs to apply to all commercial and industrial establishments. These include the following:

- Formation of a Pollution Prevention Team: One or more individuals should be assigned responsibility for stormwater pollution control. Regular meetings should be held and should address schedules for

maintenance, inspections, operation and maintenance and emergency situations.

- Good Housekeeping: The business should contain and clean up solid and liquid pollutant leaks and spills; sweep paved areas regularly; clean oils, debris sludge, etc.; repair or replace all substantially cracked or damaged paved secondary containment high-intensity parking and any other drainage areas; and repair leaking connections, pipes, hoses, valves, etc., which can contaminate stormwater.

- Preventative Maintenance: Prevent discharge of unpermitted liquid or solid wastes to ground or surface water; do not connect floor drains to storm drains, clean oily parts within a building; do not pave over contaminated soil; construct impervious areas that are compatible with the materials handled; use drip pans; and store liquids in containers.

- Spill Prevention and Cleanup: Immediately stop, contain, and clean up spills; have spill containment kit readily accessible; notify Ecology if spill has reached storm sewer or groundwater; do not flush absorbent materials or other spill cleanup materials to a storm drain.

- Employee Training: Train all employees that work in pollutant source areas; use Ecology's "Guidance Manual for Preparing/Updating a stormwater Pollution Prevention Plan for Industrial Facilities.

- Inspections: Conduct quarterly visual inspections; verify descriptions of pollutant sources, pollutant control BMPs; update site map; include observations of presence of floating materials, suspended solids, grease, etc.; conduct annual dry weather inspection for illicit connections to storm drain.

- Record Keeping: Retain reports for 3 years on implementation of Stormwater Pollution Prevention Plan (SWPPP) and any reports on spills.

The source control BMPs are found in Volume IV of the 2005 Ecology *Stormwater Management Manual for Western Washington.*

MAINTENANCE PROGRAMS

The objective of a stormwater maintenance program is to assure the reliability and dependability of the stormwater system. A complete maintenance program includes more than the following physical tasks of cleaning catch basins, pipes, and open ditches, maintaining the vegetation in biological treatment structures and the proper disposal of debris from the maintenance activities.

Maintenance programs also involve management items such as completing and maintaining a facilities inventory and maintenance schedule, maintaining cost and manpower information to assist in the budget process, and maintaining a log of citizen drainage complaints and corrective actions.

In order to perform maintenance at the appropriate time, a budget, staff, and priority schedule needs to be established. Certain types of maintenance are more important than others. It is important that catch basins and conveyance facilities be inspected before the wet season to assure that debris has not blocked a channel or taken up capacity in a manhole. Street sweeping in the fall is important because leaves block catch basin grates which could result in overland flow across private property or flooding of roadways. The City has numerous amounts of filter fabric in their catch basins. These need to be inspected to ensure that debris and vegetation is not blocking water from entering the catch basin. In addition, it should be noted that a loss of vegetative cover in treatment swales and filter strips during summer drought conditions can result in reduced effectiveness during the "first flush" of autumn storms.

Reports and record keeping are important feedback mechanisms that enable management to compare actual versus planned costs, production and efficiency. Reports provide a database for improved budgeting and resource allocation. Records and reports should include man hours, equipment hours, materials used, and the unit of work completed.

Maintenance control establishes accountability for specific results within a specific time frame and budget. The maintenance program needs a control hierarchy to establish a chain of command to complete the work.

Appendix C includes a proposed manual for operating and maintaining stormwater facilities. This appendix also includes a table describing a maintenance schedule to conduct such procedures. Within the manual, potential problems and the necessary corrective actions for typical stormwater treatment, detention, and conveyance facilities are noted. Of course, as these facilities are maintained the need may arise for maintenance at a level more (or less) than these typical values. It should also be noted that at the time of facility installation, the City should request a manual describing specific maintenance necessary for the facility. This, coupled with a routine schedule, will help ensure proper maintenance of the facility.

One item of critical importance is the City's diligence in inspecting privately owned and maintained facilities. It is recommended that the City perform inspections and issue notices of inspections to those private parties not maintaining their facilities. To facilitate maintenance of the stormwater system, it is recommended that the City seek easements for those portions of the system that lie outside of the right-of-way.

A sample of the various stormwater facilities that require maintenance are described below:

- **Streets:** Streets with concrete curb and gutter or thickened edges are part of the stormwater conveyance system. All streets accumulate vehicular emission particles, silt, leaves and other debris and pollutants that could enter the stormwater conveyance system. Street sweeping (not washing) is an important maintenance item to reduce pollution in the receiving waters and to reduce the potential for blockage of the conveyance system. Street sweeping is recommended two times per year, especially towards the fall, after the leaves have fallen.

- **Catch Basins:** Catch basins in the City include ones with and without sumps. Sumps are important features that allow the deposition of particulate matter carried in stormwater. When sumps become filled to 60 percent of their volume, the efficiency of silt removal diminishes significantly. Catch basins should be inspected annually. Once a maintenance-tracking program is in place, the City will be able to develop a history on particular areas to determine which basins require more frequent attention. Catch basins are normally cleaned with a vactor truck that removes the sediment from the basin. This sediment must be disposed of properly into an appropriate disposal site. For the purposes of this plan, catch basin cleaning is estimated to be required an average of once a year with the recommended inspection of all City catch basins within 5 years.

- **Storm Sewer Pipes:** Pipes in the City mostly vary in size from 12-inch to 48-inch diameter. Pipe types include concrete, clay, corrugated metal and PVC. All pipes should be inspected and cleaned as needed. A vacuum system is recommended for cleaning. If pipe flushing is used, adequate downstream siltation control must be in place.

- **Open Ditches:** Some roads in the City of Ridgefield are drained by means of roadside ditches. Ditches and swales can provide biofiltration if vegetation is allowed to remain within the channel and on the sides. The primary pollutant removal mechanism of a bioswale (or ditch) involves filtration by grass blades, which enhance sedimentation, as well as trapping and adhesion of pollutants to the grass and thatch. To be most effective, the vegetation within the ditch should be cut down to a height between 2 and 6 inches. Swales can be cleaned by the use of a horizontal auger. Ditches should be inspected every 9 months and maintained if necessary, preferably during the summer months to allow vegetation to grow back before the rainy season. The edges of the ditches should be mowed four times a year.

- **Detention Systems:** When a detention system is installed the City should request a manual regarding specific maintenance requirements for the facilities. At a minimum, detention systems should be monitored annually

for sediment accumulation. Removal of accumulated sediment is anticipated to be required once every 5 years.

- **Oil/Water Separators:** Oil/water separators must be maintained in order to be effective. If deposited material is not removed on a periodic basis; it may be flushed downstream by winter storms. Inspection of oil/water separators should be scheduled periodically for pollutants and annually for cracks and other structural damage. Maintenance cleaning should be scheduled annually and more frequently if required.

All components of the stormwater system should be inspected per the schedule in Appendix C. Additional inspections may be warranted in problem areas and in areas where land development is occurring, due to the potential for erosion and sedimentation. Routine maintenance should be performed on all components based on these inspections. In general, most jurisdictions do not provide an appropriate level of maintenance for all portions of their system. Maintenance is often reactive, rather than proactive.

Several benefits can be realized by maintaining all portions of the stormwater system. Better treatment and flow control can be achieved with a well-maintained system. The public recognizes a well-run maintenance program. If the system is well maintained it is easier to identify problems and resolve complaints. Flooding, icing of roadways, and damage to the system are minimized if the system is well maintained.

MANAGEMENT OF MAINTENANCE RESIDUALS

The Department of Ecology developed a guidance document (recommendations for Management of Street Wastes, Appendix IV-G, 2005 *Stormwater Management Manual for Western Washington*) that address waste generated from stormwater maintenance activities such as street sweeping and the cleaning of catch basins and other stormwater conveyance and treatment facilities.

Street wastes include liquid and solid wastes collected during maintenance of catch basins, detention/retention ponds and ditches and similar stormwater treatment and conveyance structures and solid wastes collected during street and parking lot sweeping. Ecology states that sampling to date has shown that material collected from routine maintenance of streets and stormwater facilities does not classify as dangerous waste. However, if the waste originates from spills or illegal dumping, the waste material could classify as dangerous waste. The owner of the stormwater facility or collector of street waste is considered the waste generator and is responsible for determining whether or not the waste should be classified as dangerous waste.

Street waste from normal street and highway maintenance is solid waste and is regulated by the Solid Waste Management Act (Chapter 70.95 RCW) and under Minimum Functional Standards for Solid Waste Handling (Chapter 173-304 WAC). Local health departments have primary jurisdiction over solid waste management. Street wastes do

not typically qualify as clean soil that can be reused as soil due to the presence of total petroleum hydrocarbons (TPH) and PAHs. If reuse of street wastes is allowed, the appropriate reuse sites are commercial or industrial areas or other sites where public exposure is limited or prevented.

Ecology has the following recommendations for handling street wastes that do not exceed recommended values for metals, TPH, PAH and other constituents (Table G.4, Appendix G, Volume IV, 2005 Manual).

Street Waste Solids

Street waste solids can be handled by one of the following methods:

- Street sweepings that consist primarily of leaves, pine needles and branches, and grass cuttings from mowing grassy swales can be composted. Litter and other foreign material must be removed prior to composting. Screened trash is solid waste and must be disposed of at an appropriate solid waste handling facility.

- Coarse sand screened from street sweeping after recent road sanding, may be reused for street sanding, providing there is not obvious contamination from spills.

- Roadside ditch cleanings, not contaminated by a spill or other release and not associated with a stormwater treatment system such as a bioswale, may be screened to remove litter and separated into soil and vegetative matter (leaves, grass, needles, branches, etc.). The solids from these activities are not generally regulated as solid waste. If the ditching material may be contaminated it must be stored, tested, and handled in the same manner as other street waste solids.

- Construction street wastes – solids collect from sweeping or in stormwater treatment systems at active construction sites – may be placed back onto the site that generated it, or managed by another method provided it has not been contaminated as a result of a spill.

- Screen street waste soils may be used as feedstock materials for topsoil operations if the street waste has very low levels of contamination.

- Fill in parks, play fields, golf courses, and other recreational settings, where direct exposure by the public is limited or prevented. This can be accomplished by covering the fill with sod, grass, or other capping material to reduce the risk of soil being ingested.

- Fill in commercial and industrial areas, including soil or top dressing for use at industrial sites, roadway medians, airport infields and similar sites where there is limited direct human contact with the soil, and the soils will be stabilized with vegetation or other means.

- Top dressing on roadway slopes, road or parking lot construction material and road subgrade, parking lot subgrade or other road fill.

- Recycling through incorporation into a manufactured product, such as Portland cement, prefab concrete, or asphalt. The facility operator should be consulted to determine conditions of acceptance.

- Other end use as approved by the local health department.

- Disposal at an appropriate solid waste handling facility.

If the street waste exceed the suggested maximum values for TPH, PAH, and other constituents (Table G.4, Appendix G, Volume IV, 2005 Manual), the following disposal methods can be applied:

- Treatment at a permitted contaminated soil treatment facility.

- Recycling through incorporation into a manufactured product, such as Portland cement, prefab concrete, or asphalt.

- Other end use as approved by the local health department.

- Disposal at an appropriate solid waste handling facility.

Street Waste Liquids

The primary objective of street sweeping or maintenance programs is to collect solids. Street waste liquids usually contain high amounts of suspended solids and adsorbed materials. Discharges of street waste liquids to sanitary sewer or storm sewer generally must be approved by the entity responsible for operation and maintenance of the system. Ecology recommends the following disposal options, in order of preference, for catch basin decant liquid and water removed from stormwater treatment facilities:

- Discharge of catch basin decant liquids to municipal sanitary sewer connected to a publicly owned treatment works is the preferred disposal option. However, this requires the approval of the sewer authority. Ideally, the liquids would be disposed of at a decant station that provides settling. State and local regulation generally prohibit discharge of stormwater runoff into sanitary sewers, to avoid hydraulic overloads and treatment performance problems. The volume of stormwater discharged

from catch basins and small stormwater treatment facilities is generally not sufficient to be a problem, provided the discharge point is properly selected and designed.

- Stormwater removed from catch basins and stormwater treatment wetvaults, ponds, or oversized catch basins may be returned to the storm sewer system if other practical means are not reasonably available and pretreatment is provided by discharge back into the pond, vault, or catch basin.

STAFF TRAINING

A fundamental part of a stormwater program is training for City personnel on how to address stormwater issues. The City should ensure that the City staff is well trained on how to inspect and maintain the stormwater system. At a minimum, staff should be educated on how to maintain catch basins, detention ponds and control structures, bioswales/ditches, and any other best management practices implemented within the City. Staff shall also be knowledgeable in identifying pollutant sources and in understanding pollutant control measures, spill response procedures, illicit discharges/connections, and environmentally acceptable material handling practices. Ecology's "Stormwater Pollution Prevention Planning for Industrial Facilities" (WQ-R-93-015, 9/93) may be used as a training reference. The Utilities Supervisor may be designated as responsible for setting up training for new employees regarding these issues. Renewal training for all employees on a biannual basis is recommended.

Personnel must be trained to spot and respond to sediment and erosion control issues so they can properly investigate and advise contractors regarding construction problem areas. Staff members should be certified through the "Construction Site Erosion and Sediment Control Certification Course" offered through out the year by the Associated General Contractors of Washington Education Foundation or an approved equivalent. Equivalent certification programs include:

- WSDOT certification in Construction Site Erosion and Sediment Control, and

- Certified Professional in Erosion and Sediment Control (CPESC) offered by the International Erosion Control Association (IECA).

Erosion and sediment control certification for staff members should be renewed every 3 years.

CHANGES TO MUNICIPAL CODES AND REGULATIONS

The federal, state and local rules, regulations and guidelines that govern stormwater have been discussed in Chapter 2 and Appendix A of this document.

In order to consolidate the various regulations and policy directives, the City should revise their stormwater code. The City has tentatively decided to wait to revise the stormwater code until Clark County revises their Stormwater Technical Manual to be equivalent to the 2005 Department of Ecology (DOE) *Stormwater Management Manual for Western Washington*. Adoption of this manual is intended to provide the City with a comprehensive technical support document for implementing erosion and sedimentation control facilities on development sites, allow establishment of technical requirements for BMPs, and provide design criteria for structural stormwater management facilities.

ENFORCEMENT

City staffing levels must be sufficient to monitor construction activity, respond to surface water complaints, and provide periodic inspection of private stormwater treatment facilities such as oil/water separators and detention facilities. Existing staff should document the hours spent on site inspections, together with the frequency of inspection of construction sites and private stormwater facilities. From these records and the records of time spent responding to complaints, an understanding of the adequacy of the current staffing level can be gained.

PUBLIC INVOLVEMENT AND EDUCATION

An important element of a stormwater management plan is public involvement and education. The involvement of the public is necessary to insure the overall success of the stormwater management plan. For the public to be motivated to participate in stormwater management it must first be made aware of the existing surface water problems, what role the public has in causing surface water problems and what can be done about them. One recommendation to address this issue is to implement a public education program that informs residents and businesses about the causes and prevention of stormwater pollution.

The general public should be made aware of how their normal activities affect stormwater quality and quantity. Most citizens believe that stormwater management is someone else's problem. In order to educate the public it is necessary to identify those subjects that have local relevance and then design a program that addresses those issues. Public education programs in the Ridgefield area may focus on the following issues:

- Voluntary ditch maintenance,
- Catch basin stenciling,
- Oil recycling center,
- Newsletter articles,
- Citizen hotline, and
- Neighborhood compost bin.

Voluntary Ditch Maintenance

A voluntary drainage ditch maintenance program should be established that encourages property owners to mow and otherwise maintain the drainage ditches adjacent to their properties. Local groups, clubs, and service organizations can be recruited to provide maintenance for drainage features, which have a more community-wide significance. The City could provide a clearinghouse for coordination of stormwater volunteer maintenance activities. The goal of the program is to insure that drainage ditches are maintained in a condition, which insures that they will be able to carry their full design capacity of stormwater when needed. The City may wish to consider an ordinance that requires property owners to maintain the ditches adjacent to their property. Such an ordinance would be similar to the City's sidewalk maintenance ordinance.

Catch Basin Stenciling

A program that encourages citizens and local service groups to stencil catch basins is needed to discourage the dumping of oil or other harmful substances and to inform citizens that materials dumped in the catch basins end up in waterbodies. The goal of this program could be to have 100 percent coverage of all catch basins stenciled.

Many, if not most, people are unaware that storm drains usually discharge into nearby surface waters. By stenciling all catch basins within the City with an appropriate warning, citizens will be made aware that anything dumped into a catch basin will soon enter Tee or Gee Creeks and eventually Lake River.

Oil Recycling Center

This program could encourage a local business to become a drop-off point for recycling of waste oil. The general public must be made aware of the location and hours for the local recycling station and the procedures for disposing of waste oil at the station.

The goal of this program will be to provide a suitable destination for waste oil. This will serve to provide alternatives to other practices that have been used in the past, such as dumping of waste oil down storm drains. An effort should be made to coordinate the establishment of the waste oil-recycling center with other nearby jurisdictions.

Newsletter or Utility Bill Inserts

A community newsletter or inserts included with utility bills that addresses stormwater issues should be published. The newsletter or inserts could include articles containing relevant information of local interest to help citizens eliminate or minimize stormwater quantity or quality problems.

The goal of this program would be to place issues concerning activities affecting the watershed before citizens in a timely manner. Issues to be addressed could include:

- Composting,
- Fertilization practices,
- Hazard household waste disposal,
- Waste oil recycling,
- Pesticide use,
- Ditch maintenance,
- Sensitive area protection,
- Waterfowl feeding (adverse effects),
- Wetlands protection/maintenance, and
- Citizen hotline.

Citizen Hotline

The City could establish and publish a phone number for use by citizens to report activities that could cause water quality problems. It would also be used for reporting surface water quality problems and illicit discharges/connections.

The goal of this program would be to reduce stormwater water quality impacts and to assure that appropriate education or enforcement actions are undertaken.

Neighborhood Compost Bin

A neighborhood compost bin could provide a site for disposal of yard wastes for residents without sufficient space for a residential compost bin or for those whose properties are unsuitable for such use. The City will maintain and manage the compost bin and use the resulting compost in the City parks and public places.

The goal of this program is to insure that all yard wastes are disposed of in an environmentally sound manner. Side benefits of this program include the reduction of the quantity of yard wastes sent to landfills and provision of a source of landscaping material for the City.

CHAPTER 7

RECOMMENDATIONS AND CAPITAL IMPROVEMENT PLAN

INTRODUCTION

Recommendations for the City of Ridgefield's stormwater program and Capital Improvement Plan (CIP) are presented in this chapter. The recommended stormwater program includes operational activities, regulations, and structural and nonstructural elements to control the quality and quantity of stormwater runoff.

The CIP has been prepared to reduce stormwater system problems related to the following:

- Frequency of maintenance work needed to alleviate nuisance flooding,
- Difficulty in accessing stormwater facilities to perform maintenance,
- Water quality improvements,
- Lack of public easement need to access stormwater facilities, and
- Stormwater facilities that are in disrepair or failing.

In order for the facilities to operate properly, it is essential that appropriate operations and maintenance schedules are developed. Facilities maintenance and preferred management strategies are detailed in this chapter. Best Management Practices (BMPs) for runoff treatment and source control are also provided.

REGULATORY RECOMMENDATIONS

RECOMMENDED STORMWATER TECHNICAL MANUAL

The City recently implemented the recommendation of the 2008 *Comprehensive Stormwater Management Plan* to adopt the *2005 Stormwater Management Manual for Western Washington* for its improved standards for water quantity and quality control and for its supportive yet flexible approach to on-site stormwater management (LID).

Currently, Ridgefield modifies the *2005 Stormwater Management Manual for Western Washington*'s thresholds for providing water quantity and water quality facilities as follows:

The provisions of this section apply to all development or redevelopment that:

1. Results in 5,000 square feet or more of new effective impervious surface within an urban area, or has more than 7,000 square feet of land disturbing

activities, or converts ¾ acres or more of native vegetation to lawn or landscaped areas, or converts 2.5 acres or more native vegetation to pasture;

2. Results in the addition or replacement of more than 1,000 square feet of effective impervious surface for any of the development activities requiring oil/water separators;

3. For the portion of a redevelopment site that is redeveloped, if the redevelopment results in 10,000 square feet or more of replaced effective impervious surface.

RECOMMENDED LID DESIGN MANUAL

The City recommends the use of the *2005 Low Impact Development Technical Guidance Manual for Puget Sound*, published by the Puget Sound Action Team/WSU Pierce County Extension, for design of optional LID best management practices.

It is recommended that references in the City's Engineering Standards and municipal codes by replaced with the updated version of this manual, the *2012 Low Impact Development Technical Guidance Manual for Puget Sound*, published by the Puget Sound Partnership/WSU Puyallup Research & Extension Center.

STORMWATER ORDINANCES

It is recommended that the City revise Ordinance 840 to rename Ridgefield Municipal Code Chapter 17.55 from "Erosion Control" to "Stormwater and Erosion Control" and incorporate requirements to use water quality and water quantity controls at the thresholds described in the *2017 Engineering Standards for Public Works Construction.,* In addition, it is recommended the City adopt an ordinance prohibiting non-stormwater illicit discharges and illicit connections to the municipal storm sewer system.

FACILITY MAINTENANCE

Maintenance Program

Regular maintenance of drainage facilities is an effective means of reducing stormwater quantity and quality impacts. Improperly maintained stormwater facilities cause water quality degradation, frequent flooding, interruption of essential emergency services, and costly rehabilitation. The City of Ridgefield is responsible for maintenance of public facilities within City right-of-way. Most of the City's maintenance work to date has been reactive. Facilities in the City which require maintenance include the following:

- Catch basins,
- Control structures,

- Stormwater pipes,
- Culverts,
- Open ditches,
- Detention basins,
- Retention basins
- Bioretention facilities, and
- Water quality facilities.

Appendix C outlines a recommended inspection frequency for the drainage facilities in the City. The City is using the maintenance standards in the *2005 Stormwater Management Manual for Western Washington*.

Maintenance activities are categorized as routine, preventive, planned, remedial, mandatory and emergency.

Routine maintenance tasks include ditching, cleaning, repair and/or replacement, placement of rock and other erosion control measures and technical assistance for drainage complaints/service requests.

Preventive maintenance includes cleaning catch basins, inlets and culverts in areas of repeated problems. This is required maintenance because the facilities are inside the City's right-of-way.

Planned maintenance is scheduled maintenance based on the life cycle of the facility.

Remedial maintenance replaces a facility without upgrading it to current standards. It is usually a low-cost repair.

Mandatory maintenance means maintenance required by local ordinance, liability, or state/federal statute.

Emergency maintenance is difficult to budget for, because it is nearly impossible to predict the type and amount of flood damage that may occur in any given year. Emergency response to stormwater drainage system problems is provided to private properties as a service. Property owners are then billed for the work.

In 2017 the City added 1.0 FTE in the Stormwater Program to address inspection and maintenance needs.

Private Drainage Facilities

Private drainage systems in the City of Ridgefield include perforated pipes in drain rock, catch basins, detention systems, orifices, manholes, oil/water separators, LID facilities, and pipes and open channels located outside the road right-of-way. The property owner is responsible for maintenance of the facilities on the property. In 2017, the City

implemented a private facility inspection program to ensure private systems that discharge to the City's storm sewer system or to ground are properly maintained.

Preferred Management Strategy

The management strategy for the City of Ridgefield should be to clean inlets and maintain stormwater facilities as indicated in Appendix C. Funding for this preventative maintenance should come from the Stormwater Utility.

Management of Maintenance Residuals

The Department of Ecology recognized that the lack of accepted procedures and locations for the disposal of waste from maintenance activities is one of the greatest problems confronting stormwater operation and maintenance programs. Disposal of the liquid and solid waste material from vactor trucks is a concern because of the potential contamination of surface or groundwater. DOE has developed the Minimum Functional Standards for Solid Waste Facilities, WAC 173-304. This law may be an appropriate mechanism for addressing vactor waste.

The following procedures are suggested as means of handling stormwater maintenance residuals:

- Any standing water removed during the maintenance operations from catch basins, detention tanks and oil/water separators must be disposed to a sanitary sewer at a location approved by the City.

- Vegetation removed from open ditches or detention ponds during maintenance operations should be disposed of in the same manner as yard wastes.

- Waste sediments and oils from the cleaning of catch basins, detention tanks, pipe, culverts, and oil/water separators must be disposed of in accordance with the Washington Department of Ecology requirements.

Maintenance of Natural Systems

Natural systems include ditches, swales, and wetlands. Maintenance requirements for ditches and swales are shown in Appendix C.

Maintenance of a natural system may require a permit from one of several agencies including a hydraulic project approval (HPA) from the Washington Department of Fish and Wildlife, a water quality certification from the Department of Ecology, and/or a wetland permit from the U.S. Army Corps of Engineers.

CAPITAL IMPROVEMENT PROGRAM RECOMMENDATIONS

The Capital Improvement Projects have been developed to a preliminary level of design commensurate with determining feasibility and planning level implementation and construction costs. To implement the CIPs, additional design tasks will need to be completed. These additional design tasks include but are not limited to survey, hydrologic/hydraulic analysis, natural resources analysis, and geotechnical analysis. At least two of the projects will require the purchase of property or temporary/permanent easements to construct and maintain the future facilities.

The project team has developed CIP information sheets to provide detail on the preliminary design. The CIP information sheets include the following items:

- Statement of existing problem,
- Proposed improvements,
- Implementation and construction cost estimate,
- Site photos, and
- Site map showing existing and proposed features.

The estimated project costs are divided into implementation costs and construction costs. Implementation covers project tasks related to design, permitting, and property acquisition (when needed). City project administration costs have been included in the implementation costs and account for the project management work needed to bring the project to completion. The implementation costs were calculated as a percentage of construction costs, which is detailed in the cost estimate tables included in each CIP information sheet. The construction costs include the construction items needed to build the project and a 35% contingency, which accounts for items not considered at this preliminary level of design.

As described previously, several CIPs that were listed in the 2008 Plan have not yet been implemented and have been included in the current list. The modeling efforts that were completed in the 2008 Plan have been reviewed and pertinent conclusions and recommendations have been included in the proposed improvements described on the CIP information sheets.

Additional modeling has not been included in the scope of this update to the 2008 Plan. For new CIPs, the project team has generally reviewed the hydrology and hydraulics of the project to assess feasibility and the size of facilities to estimate planning level costs. These reviews will need to be formalized and expanded on by the design team during the implementation phase.

Table 7-1 includes the recommended capital improvement projects listed in order of priority including the Estimated Total Project Cost. The locations of each capital improvement project can be found on Figure 7-1.

A set of detailed project fact sheets is presented in Appendix D.

TABLE 7-1

Capital Improvement Projects

Project ID	Project Name	Estimated Total Project Cost
1	Division Street Outfall	$355,000
2	Hillhurst Swale	$197,100
3	South 56th Place	$38,500
4	Old Pioneer Way	$230,500
5	South Riverview Drive	$238,340
6	North Pioneer Canyon Drive, East Culvert	$60,000
7	Viewport Swale	$166,500
8	North Simmons St	$165,000
9	Gee Creek Loop	$253,500
10	Lake River Outfall	$484,325
11	Abrams Park	$162,000

PROGRAMMATIC RECOMMENDATIONS

In preparation for the potential need by the City to obtain coverage under the Western Washington Phase II municipal stormwater permit in 2023, Otak, Inc. performed a regulatory requirements analysis to identify gaps between the current City stormwater management program and potential permit requirements.

It is assumed that permit requirements will become more protective of surface water quality and hydrology between the current 2013-2018 permit and a permit anticipated in 2023. It is also assumed that new permittees in any permit cycle will be given a longer compliance schedule and reduced performance standards compared to continuing permittees.

The regulatory requirements analysis is presented in Appendix D.

In general, it is recommended that the City take the following actions to protect the quality of the surface water features in Ridgefield:

- Continue using the *2005 Stormwater Management Manual for Western Washington* as the stormwater technical manual for development and new development sites;

- Continue modest investments in public education related to stormwater;

- Update erosion and sediment control standards consistent with the *2005 Stormwater Management Manual for Western Washington*;

- Continue to enforce erosion and sediment control standards and stormwater control standards through a program of site plan review and site inspections;

- Continue to update its stormwater system base map and inventory on a regular basis;

- Adopt an ordinance to prohibit non-stormwater illicit discharges and illicit connections to the storm sewer system;

- Keep records of inspection frequency, inspection findings, and maintenance tasks for its public facility inspection and maintenance program for drainage and stormwater facilities;

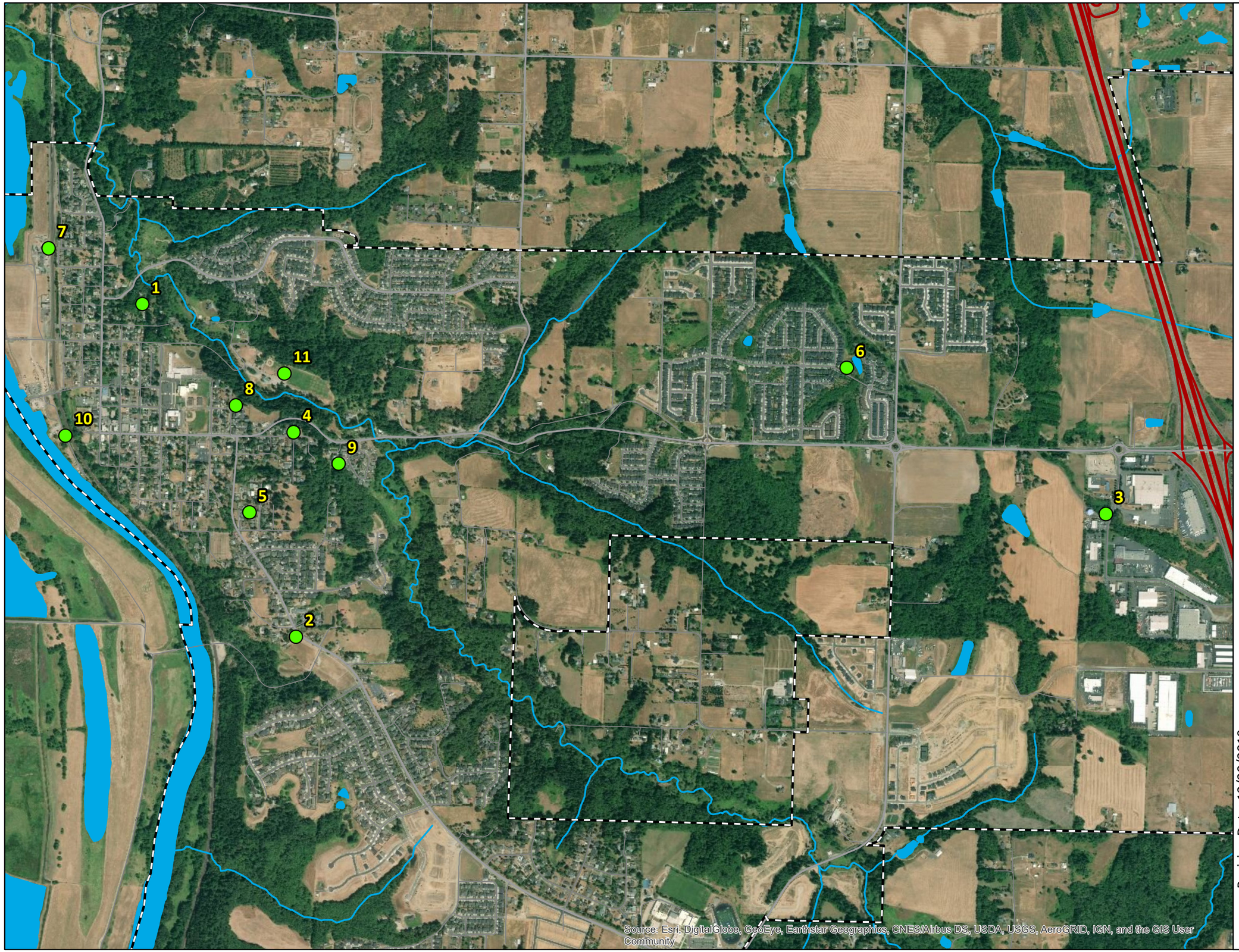
- Keep records of inspection frequency, inspection findings, and technical assistance or enforcement for its private facility inspection and maintenance program for drainage and stormwater facilities;

- Standardize and implement procedures for the detection and elimination of illicit discharges and illicit connections to the storm sewer system; and

- Develop a program for following good housekeeping procedures at municipal facilities.

In order to ensure that maintenance will be provided on a regular basis throughout the entire City, it is highly recommended that the City obtain easements for those portions of the municipal stormwater system that exist on private property.

The Capital Improvement Projects list should be reviewed and updated every 3 years and the Comprehensive Plan should be updated approximately every 5 years.



N

0 0.25 0.5 Miles

Legend

- Capital Improvement Projects
- Streams
- Lakes
- City Limit

CIP 1: Division Street Outfall
CIP 2: Hillhurst Senior Living Swale
CIP 3: South 56th Place
CIP 4: Old Pioneer Way
CIP 5: South Riverview Drive
CIP 6: N. Pioneer Canyon Dr. East
CIP 7: Viewport Swale
CIP 8: North Simons Street
CIP 9: Gee Creek Loop Road
CIP 10: Lake River Outfall
CIP 11: Abrams Park

Revision Date: 12/30/2019

City of Ridgefield

Comprehensive Stormwater Management Plan
Figure 7-1, Revised
Recommended Capital Improvement Projects

Otak

City of Ridgefield Washington

CHAPTER 8

FINANCING ANALYSIS

INTRODUCTION

This chapter discusses methods of providing financing for the stormwater system operation and maintenance program and capital improvement projects, which were recommended in Chapter 7, Recommendations and Capital Improvement Plan.

Funding for the capital improvements listed in Chapter 7 is an essential requirement for the implementation of the recommendations. The financial resources available to the City for the implementation of stormwater capital improvement projects include stormwater utility service charges, general facility charges, grant and loan funds, debt financing, and improvement districts.

STORMWATER UTILITY

The City of Ridgefield created a Stormwater Utility in 2005. At that time, the City Council found the level of funding for storm drainage and surface water control to be inadequate to meet current and future requirements to protect private and public property from damage caused by urban stormwater runoff.

RMC 13.75 authorizes stormwater service charges, general facility charges, stormwater system development charges, inspection, permitting, and application fees to fund the stormwater program.

The current Stormwater Utility rate is $17.50 per two months for a single-family residence (or equivalent dwelling unit (EDU)). RMC 13.75 designates EDU calculations for other types of properties. The City does not currently collect a general facility charge or a system development charge for stormwater.

PROGRAM COSTS

CAPITAL IMPROVEMENT EXPENSES

The recommended capital improvements for the stormwater utility are detailed in Chapter 7. The list of projects, recommended schedule for implementation, project costs in year 2017 dollars, and project costs adjusted for annual inflation for the scheduled construction year are shown in Table 8-1. Project costs in Table 8-1 are inflated using the Construction Cost Index published by *Engineering News-Record*.

OPERATING EXPENSES

Future stormwater utility operation and maintenance expenses are estimated in 2017 dollars using input from staff, previous maintenance expenditures, and estimates for additional operation and maintenance items.

Program costs are inflated using a variety of escalation factors. The analysis assumes no additional program staffing through 2027.

Cash operating expenses in 2018 are $532,007.

See Table 8-2 for a summary of the program costs and fund balances.

TABLE 8-1
Capital Improvement Project Programming 2018 to 2027

ID	Project Name	2017 Cost	2018*	2019*	2020*	2021*	2022*	2023*	2024*	2025*	2026*	2027*
1	Division Street Outfall	$355,000	$ 365,650									
2	Hillhurst Swale	$197,100		$ 209,103								
3	South 56th Place	$38,500			$ 42,070							
4	Old Pioneer Way	$230,500			$ 251,874							
5	South Riverview Drive	$238,340						$ 284,590				
6	North Pioneer Canyon Drive, East Culvert	$60,000				$ 67,531						
7	Viewport Swale	$166,500				$ 187,397						
8	North Simmons St	$165,000					$ 191,280					
9	Gee Creek Loop	$253,500							$ 311,773			
10	Lake River Outfall	$484,325								$ 613,528		
11	Abrams Park	$162,000										$ 217,714
TOTAL			**$ 365,650**	**$ 209,103**	**$ 293,944**	**$ 254,928**	**$ 191,280**	**$ 284,590**	**$ 311,773**	**$ 613,528**	**$ 0**	**$ 217,714**
* Project costs are shown in inflated dollars for the year of construction												

TABLE 8-2
Financial Analysis Summary

Revenue Requirement	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenues @ Existing Rates										
Rate Revenues Under Existing Rates	$ 593,128	$ 641,883	$ 694,261	$ 750,426	$ 810,611	$ 875,622	$ 945,847	$ 1,021,703	$ 1,103,644	$ 1,192,156
SDC Revenue Towards Debt Service	-	-	-	-	-	-	-	-	-	-
Non-Rate Revenues	6,213	5,722	5,730	5,739	5,750	5,759	5,770	5,782	5,795	5,809
Total Revenues	**$ 599,341**	**$ 647,605**	**$ 699,991**	**$ 756,166**	**$ 816,361**	**$ 881,381**	**$ 951,617**	**$ 1,027,486**	**$ 1,109,439**	**$ 1,197,965**
Expenses										
Cash Operating Expenses	$ 532,007	$ 555,005	$ 579,543	$ 610,179	$ 633,809	$ 663,850	$ 696,062	$ 730,638	$ 767,791	$ 807,753
Existing Debt Service	-	-	-	-	-	-	-	-	-	-
New Debt Service	-	-	46,856	46,075	45,294	44,513	43,732	42,951	42,170	41,389
Rate Funded Capital	-	32,094	35,754	39,806	44,289	49,276	54,825	60,998	67,867	75,509
Total Expenses	**$ 532,007**	**$ 587,099**	**$ 662,153**	**$ 696,060**	**$ 723,392**	**$ 757,639**	**$ 794,619**	**$ 834,588**	**$ 877,828**	**$ 924,652**
Net Surplus (Deficiency)	**$ 67,334**	**$ 60,506**	**$ 37,837**	**$ 60,105**	**$ 92,969**	**$ 123,742**	**$ 156,998**	**$ 192,898**	**$ 231,611**	**$ 273,313**
Additions to Meet Coverage	-	-	-	-	-	-	-	-	-	-
Total Surplus (Deficiency)	**$ 67,334**	**$ 60,506**	**$ 37,837**	**$ 60,105**	**$ 92,969**	**$ 123,742**	**$ 156,998**	**$ 192,898**	**$ 231,611**	**$ 273,313**
Annual Rate Increase	**0.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**
Cumulative Rate Increase	**0.00%**	**3.00%**	**6.09%**	**9.27%**	**12.55%**	**15.93%**	**19.41%**	**22.99%**	**26.68%**	**30.48%**
Rate Revenues After Rate Increase	$ 593,128	$ 661,140	$ 736,541	$ 820,011	$ 912,349	$ 1,015,085	$ 1,129,390	$ 1,256,566	$ 1,398,063	$ 1,555,494
Incremental Rate Revenues (Compared with 2015)	$ -	$ 19,256	$ 42,280	$ 69,585	$ 101,739	$ 139,464	$ 183,544	$ 234,863	$ 294,419	$ 363,337
Additional Taxes from Rate Increase	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow After Rate Increase	**67,334**	**79,762**	**80,118**	**129,690**	**194,708**	**263,206**	**340,542**	**427,761**	**526,030**	**636,650**

Fund Balance	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
OPERATING FUND										
Ending Balance	**$ 131,180**	**$ 136,850**	**$ 142,901**	**$ 150,455**	**$ 156,282**	**$ 163,689**	**$ 171,632**	**$ 180,157**	**$ 189,318**	**$ 199,172**
Minimum Target Balance	*$ 131,180*	*$ 136,850*	*$ 142,901*	*$ 150,455*	*$ 156,282*	*$ 163,689*	*$ 171,632*	*$ 180,157*	*$ 189,318*	*$ 199,172*
CAPITAL FUND										
Ending Balance	**$ 129,981**	**$ 27,258**	**$ 567,919**	**$ 575,784**	**$ 718,537**	**$ 840,097**	**$ 917,006**	**$ 935,085**	**$ 1,521,222**	**$ 2,008,093**
Minimum Target Balance	*$ 60,082*	*$ 62,173*	*$ 65,113*	*$ 67,662*	*$ 69,575*	*$ 72,421*	*$ 75,538*	*$ 81,674*	*$ 81,674*	*$ 83,851*

Notes:	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Debt-to-Net Assets Ratio	0.00	0.00	0.09	0.08	0.07	0.06	0.06	0.05	0.04	0.04
Capital grant proceeds consist of the following:										
Grant for Division St. Project (from budget)	$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Grants for 2020-2023	-	-	100,000	100,000	100,000	100,000	-	-	-	-
Grant for 2025	-	-	-	-	-	-	-	150,000	-	-
Capital loan proceeds consist of the following:										
Loan for 2020	$ -	$ -	$ 624,742	$ -	$ -	$ -	$ -	$ -	$ -	$ -

REVENUE SOURCES

The following sections present information about typical sources of revenue for stormwater utilities in Washington state.

STORMWATER UTILITY FEE

The rate basis is a method by which the revenue required to maintain the stormwater system is recovered from utility customers. The most common rate basis for stormwater utilities is contribution of runoff, reflecting the belief that those who cause the problem are most served by the maintenance services provided. Contribution of runoff is often measured by the amount of "impervious" surface area on a property. Impervious surface area is defined as hard surface that retards or prevents the absorption of water into the ground. Examples include rooftops, paved parking lots, sidewalks and patios.

Stormwater utility fee revenue may be used for any expense of the utility, including operating expenses and capital outlay.

Typically, single-family residential stormwater customers are charged for one EDU each. For commercial and industrial development, charges are based on the amount of impervious surface area.

The City of Ridgefield defines an EDU for non-residential parcels not used in conjunction with a farming business as 3,500 square feet of impervious surface. By the end of 2018, the City expects to have 6,088 EDUs. By the end of 2027, the City expects to have 12,237 EDUs as a result of new growth and annexations.

CAPITAL IMPROVEMENT FINANCING

The City plans to fund the capital program through a combination of stormwater utility rates, grants, and loans.

GRANTS
Grants for stormwater capital improvements are available through the Stormwater Financial Assistance Program (SFAP) and occasionally through the Centennial Clean Water Fund (CCWF) and the Clean Water State Revolving Fund (SRF), each administered by the Department of Ecology. Generally, these grant programs are focused on improvements to water quality or protection of receiving water hydrology and are less likely to award funding to projects that focus on increasing stormwater conveyance capacity or preventing localized flooding from the storm sewer.

A local source of grant funds is the Clark County Clean Water Restoration Fund, administered by the Lower Columbia Fish Recovery Board, which funds projects that address water quality problems and habitat degradation associated with stormwater runoff

in several Clark County watersheds. Approximately $500,000 is available annually through 2020. The maximum grant award is $150,000. The City anticipates receiving a grant from this program in 2019 to fund the Division Street Outfall project.

The Aquatic Lands Enhancement Account (ALEA), administered by the Washington Recreation and Conservation Office, was established in 1984 to provide grants to cities, towns, counties, and port districts for preservation or improvement of wetlands, natural systems, waterfront redevelopment plus some aquatic-land related planning. The maximum grant is $100,000 and the project must be associated with state-owned aquatic lands. A storm project that redirects or treats runoff and thus improves state-owned aquatic lands could be an eligible project under this program.

LOANS

The Public Works Board is state-authorized to loan money to local jurisdictions for infrastructure capital improvements for domestic water systems, sanitary sewer systems, storm sewer systems, streets, bridges, and solid waste facilities. The Board offers two competitive loan programs for planned improvements: The Pre-Construction Loan Program and the Construction Loan Program. Pre-Construction loans are limited to $1 million per jurisdiction per biennium and stipulate a loan term of 5 years. Interest rates are below market rate and are set based on the financial stability of the applicant using an affordability index or a debt service coverage ratio. The legislature has not funded the Construction Loan Program recently, but funds may become available in the 2019-2021 state biennium.

DEBT FINANCING

Two forms of debt financing are available for capital improvements including general obligation (G.O.) bonds and revenue bonds. General obligation bonds are backed by the "full faith and credit of the City" and are paid for through property tax levies. These bonds require voter approval before they can be implemented. A less common means of financing capital improvements associated with stormwater projects is through the use of revenue bonds. The City, like other municipalities, is capable of issuing tax-exempt bonds. The principal and interest of such bonds are repaid from revenue generated from a water, sewer, or stormwater utility. This type of funding may be offered without voter approval. However, in order to qualify to sell revenue bonds, the City must establish that its net operating income, gross income less expenses, is equal to or greater than its debt coverage factor (typically 1.3 to 1.4) times the annual principal and interest due for all outstanding bonded indebtedness. Essentially, utility rates have to be set high enough to ensure revenue bond repayment.

The City does not anticipate debt financing under this plan.

DEVELOPER FEES

The City may require improvements for service to a property within new plats or commercial improvements to be financed by the developer. The developer, for example,

is usually required to construct detention facilities in accordance with City standards or pay into a fund for construction of an off-site facility to service multiple properties. The alternative approach allows the City to develop facilities in a planned and cost-effective manner. However, several developments are generally required before the City has available funds to construct a regional facility. The City has little control over the scheduling of such facilities unless alternative funding sources such as service charge revenues are utilized on a short-term basis to fund initial construction and are then repaid as developer fees are collected.

The City does not anticipate collecting developer fees under this plan.

IMPROVEMENT DISTRICTS AND SPECIAL ASSESSMENTS

Levying of special assessments on benefited properties has been used throughout the state for stormwater improvements. Projects funded through special assessments must have an identifiable benefit to the properties included in the assessment area, and charges for each parcel must be consistent with the relative benefit to each property. In Washington, municipalities can establish a local improvement district (LID) or utility local improvement district (ULID). These approaches require an assessment against benefited property owners within the district boundaries. In order to establish the district and implement this approach, a minimum percentage of property owners within the proposed district must vote their approval.

The use of LIDs to fund stormwater projects is complicated by the difficulty in quantifying benefits for individual property owners. For water and sewer improvements, for example, the benefits are generally easy to identify. With drainage improvements, however, upstream or hillside properties, which could contribute significantly to runoff, may benefit little from improvements because of their protected location. One result may be to narrowly establish the boundaries of the LID, which may be counterproductive to comprehensive stormwater management. Another problem with LIDs is that they place heavy administrative burdens on City staff to maintain the improvements in the district.

The City does not anticipate use of special assessments of LIDs under this plan.

RECOMMENDATIONS

The City's stormwater utility financial policies include continuing to omit a system development charge and allocating 5% of annual rate revenues to a repair and restoration fund.

A stormwater rate analysis shows that a 3% annual increase in the Stormwater Utility rate is needed to fund operation and maintenance of the storm sewer system, fund a portion of the stormwater CIP, and maintain minimum fund balances. The fund the remainder of the CIP, grants and loans will be required.

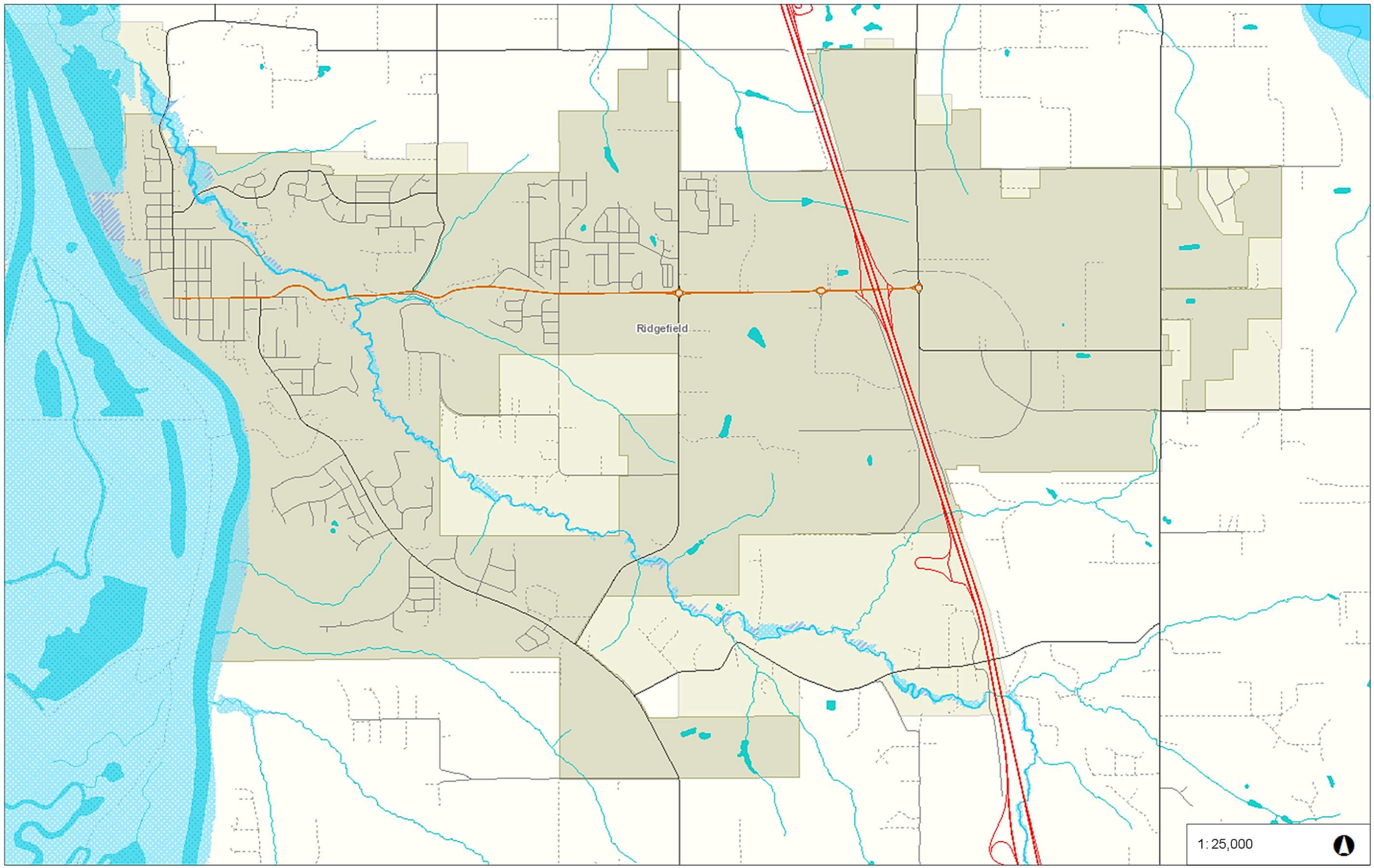
The City should increase stormwater utility rates beginning in 2019, secure grant funding, and obtain low-interest loans to operate the stormwater program and complete the planned CIP over a ten-year period.

The complete stormwater rate analysis is presented in Appendix E.

Appendix A

Sensitive Areas

Ridgefield Urban Growth Area Floodways Map



Legend

Flood Zone Designation
- Floodway
- Floodway Fringe
- 500 Year Flood Area
- Area Not Studied

Cities Boundaries

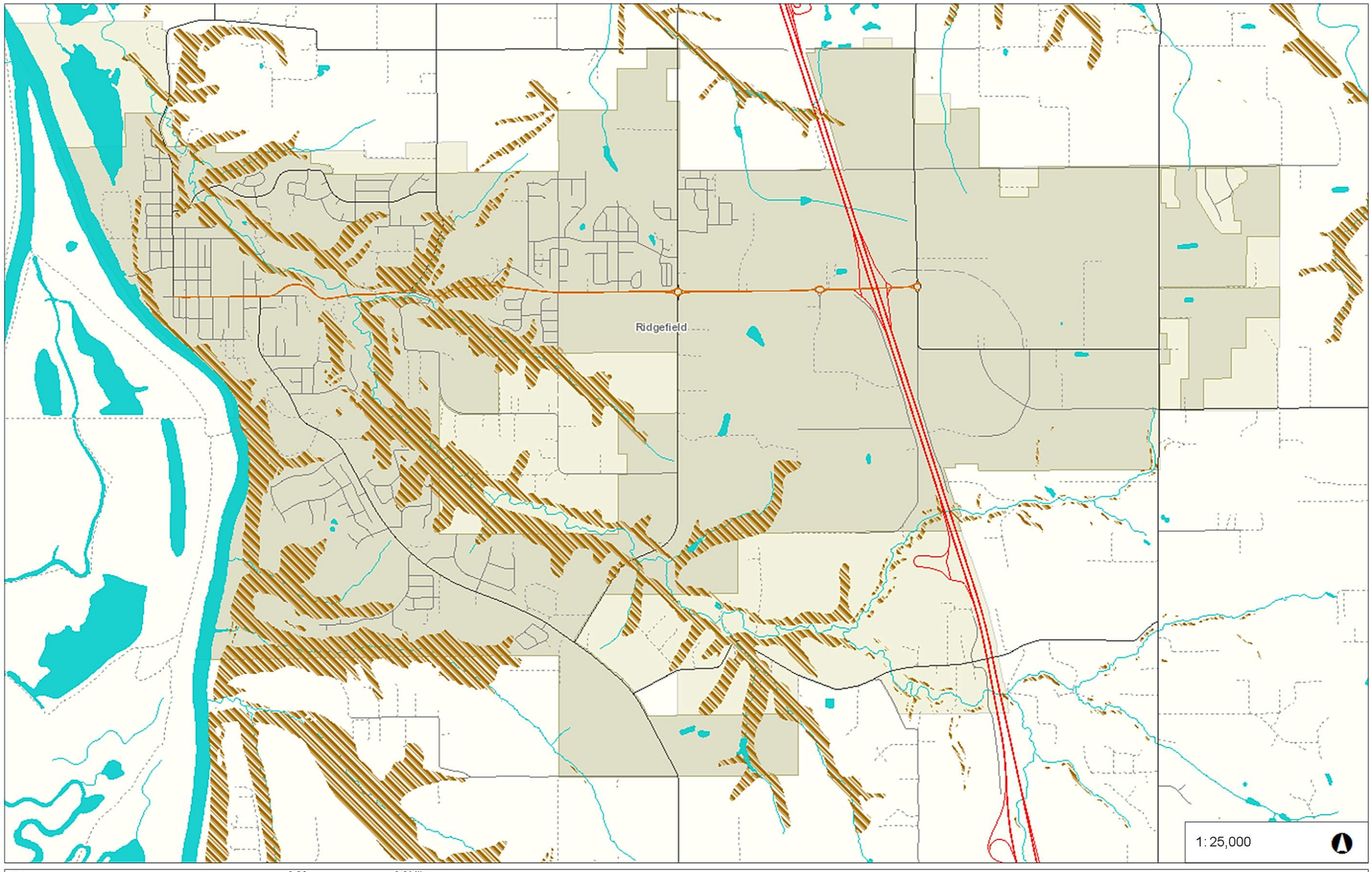
Urban Growth Boundaries

Notes:

0.8 0 0.39 0.8 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Ridgefield Urban Growth Area Severe Erosion Potential Map



Legend

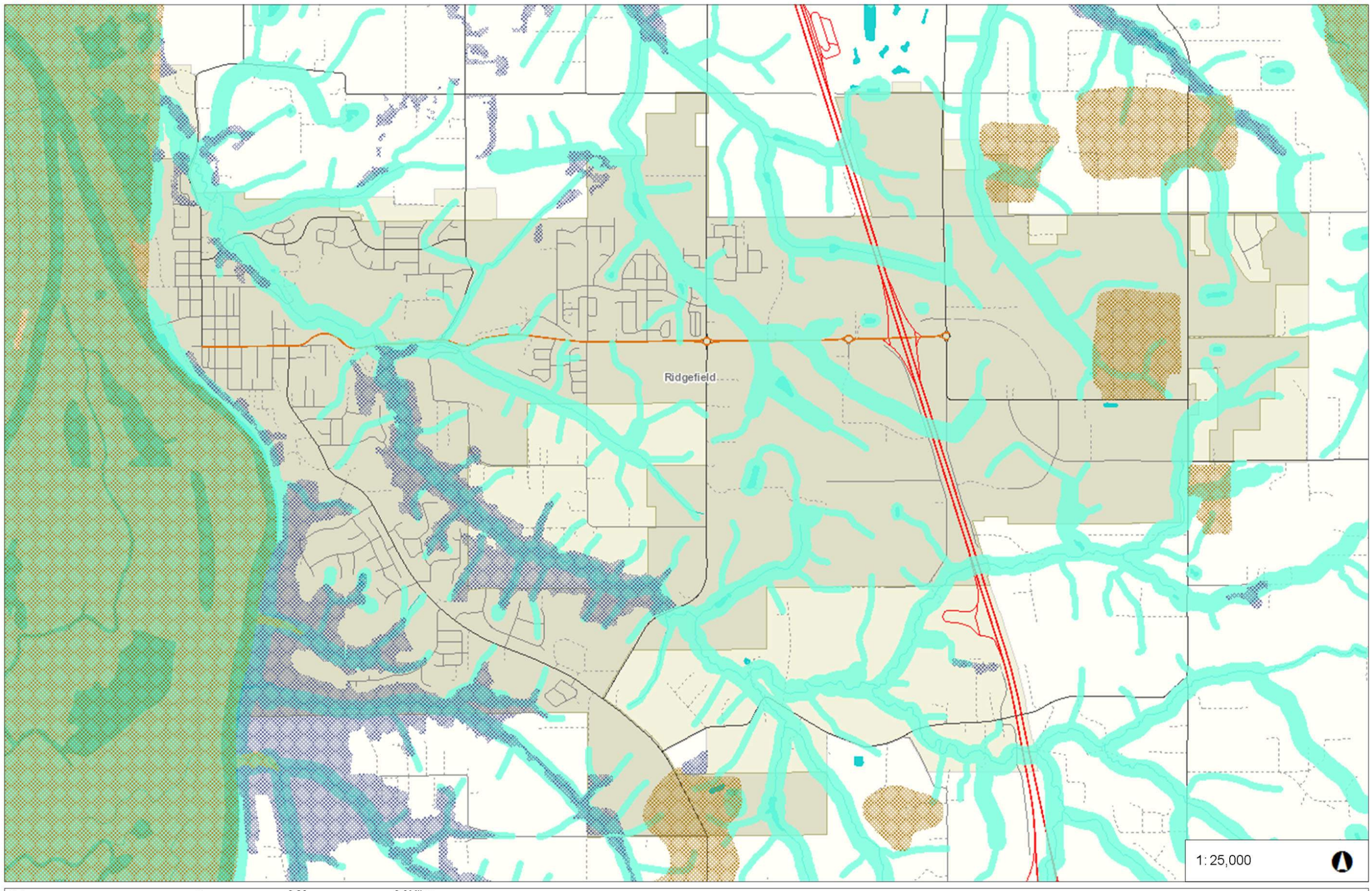
- Severe Erosion Hazard
- Cities Boundaries
- Urban Growth Boundaries

Notes:

0.8 0 0.39 0.8 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Ridgefield Urban Growth Area Priority Habitat Map



Legend

Priority Habitat and Species
- Non-riparian Habitat Conservation
- Species Areas
- Riparian Habitat Conservation Area

Cities Boundaries

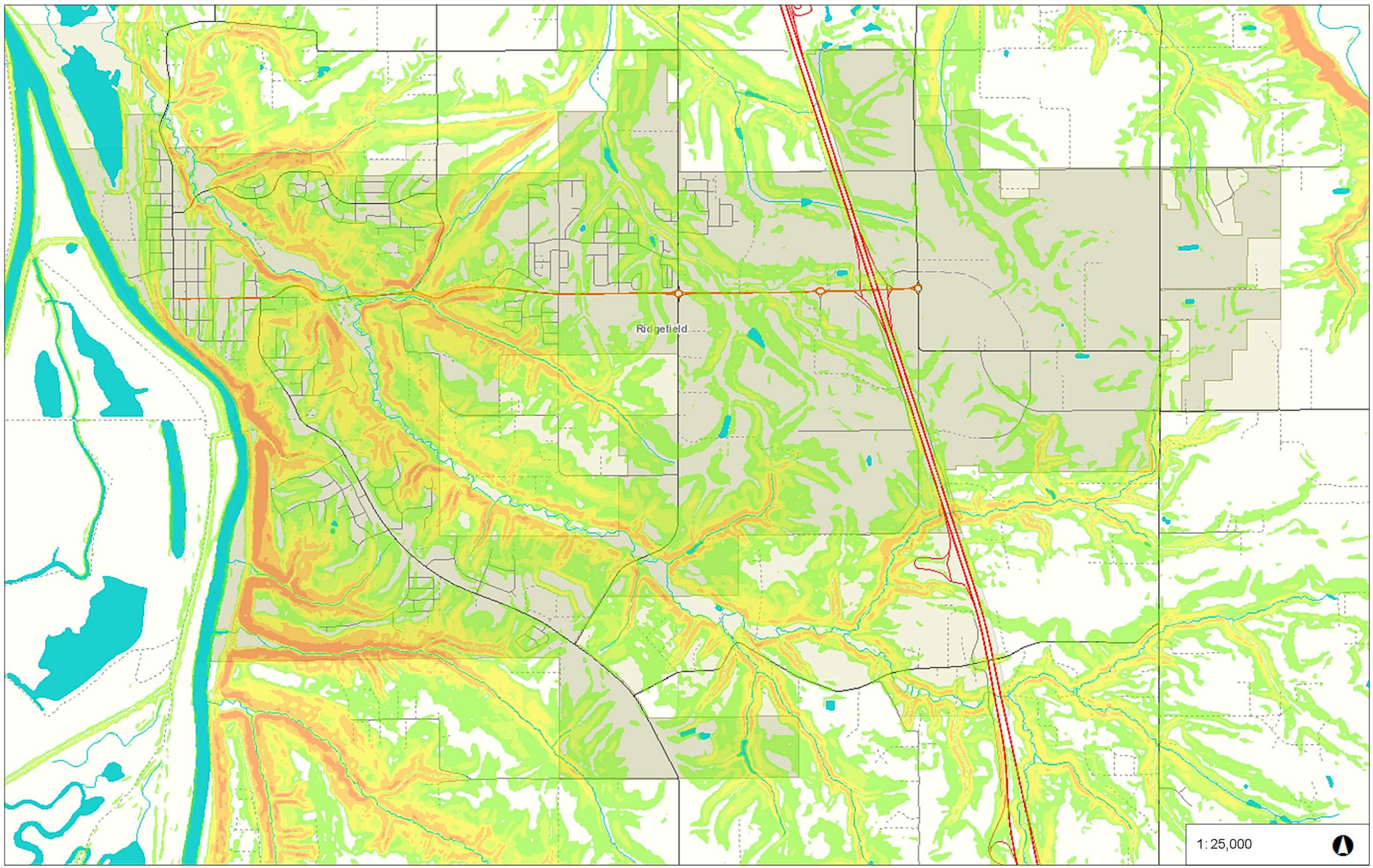
Urban Growth Boundaries

Notes:

0.8 0 0.39 0.8 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Ridgefield Urban Growth Area Slopes Map



Legend

Slopes
- less than 5 Percent
- 5-10 Percent
- 10-15 Percent
- 15-25 Percent
- 25-40 Percent
- 40 - 100 Percent

Cities Boundaries

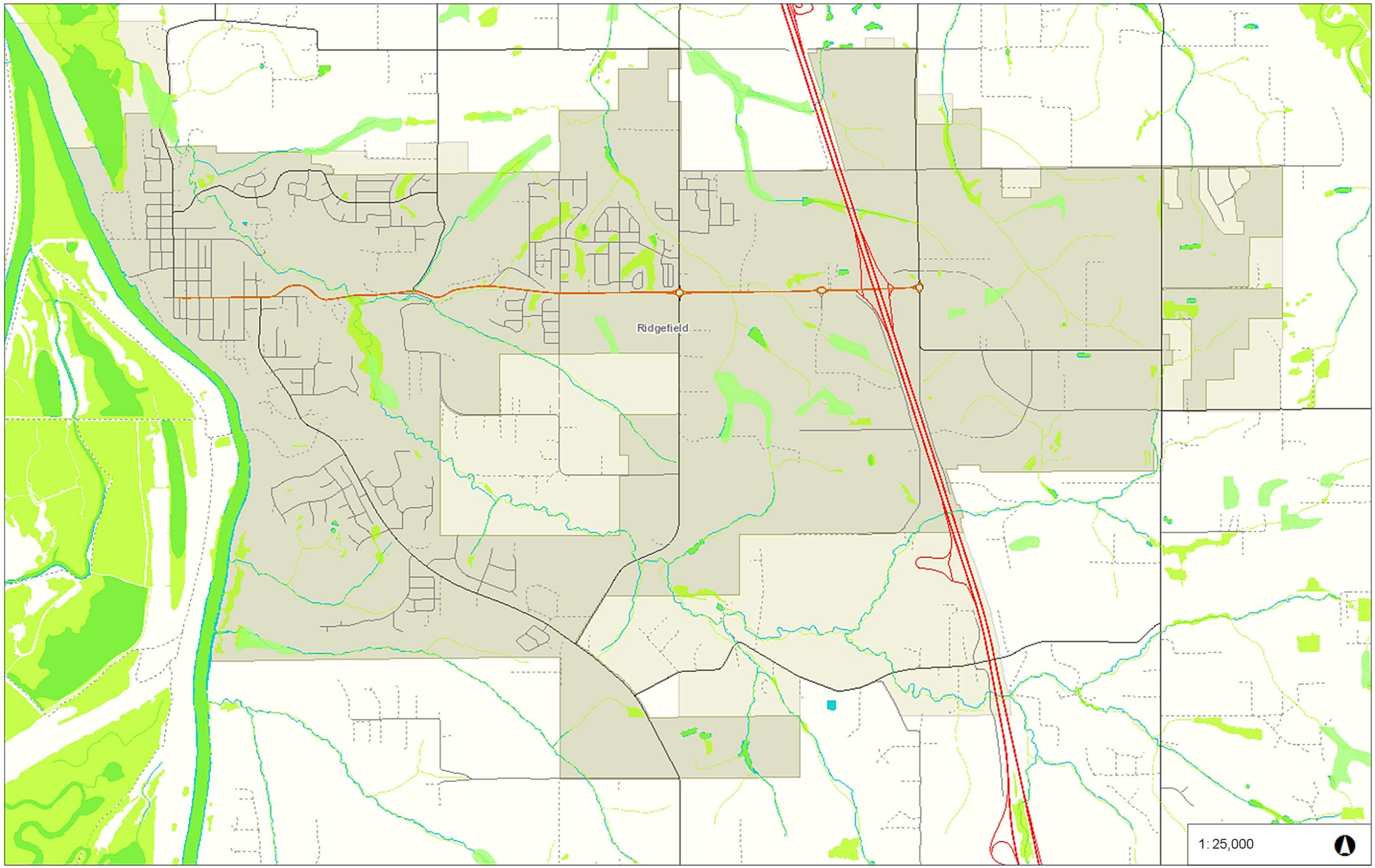
Urban Growth Boundaries

Notes:

0.8 0 0.39 0.8 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Ridgefield Urban Growth Area Wetlands Map



Legend

- High Quality Wetland
- NWI Wetland
- Cities Boundaries
- Urban Growth Boundaries

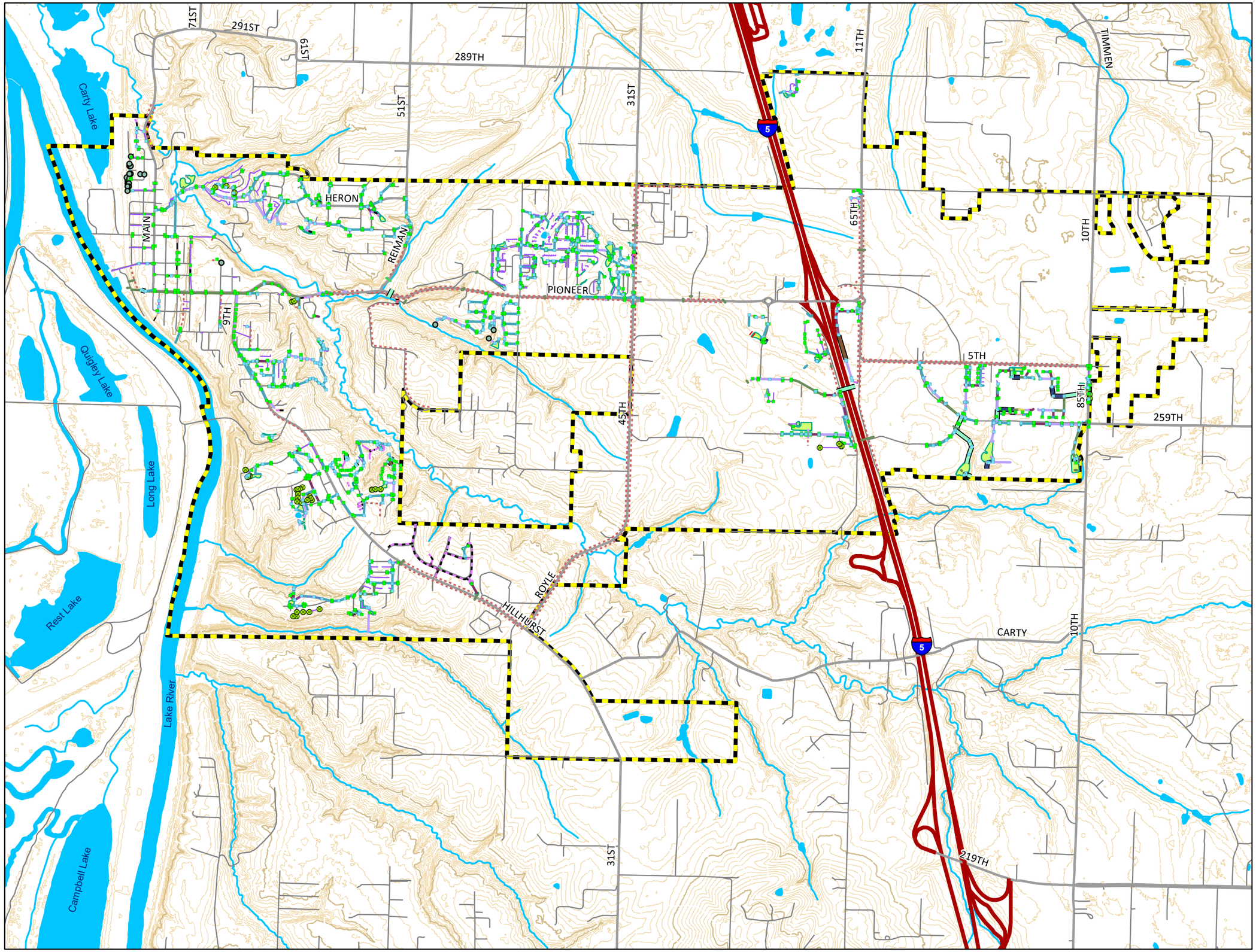
Notes:

0.8 0 0.39 0.8 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Clark County, WA. GIS - http://gis.clark.wa.gov

Appendix B

Stormwater Base Map



N

0 0.25 0.5 0.75 Miles

Legend

STORM FEATURE
- Clean Out
- Drywell
- Type 1 Catch Basin
- Type 2 Catch Basin

PIPE SIZE
- UNKNOWN
- 3"- 8"
- 10"
- 12"
- 15"
- 18"
- 21"
- 24"
- 30"
- 36"
- 48"
- 120"

DITCH TYPE
- DAM
- DITCH
- SWALE

STORM FACILITIES

City Limit

100' Contour

10' Contour

City of Ridgefield

Comprehensive Stormwater Management Plan

Stormwater System Map

Otak

CITY OF RIDGEFIELD WASHINGTON

Appendix C

Water Quality Best Management Practices for Operation and Maintenance of Publicly-Owned Property

WATER QUALITY
BEST MANAGEMENT PRACTICES FOR OPERATION AND MAINTENANCE OF PUBLICLY-OWNED PROPERTY

2017

Table of Contents

Chapter 1. Activities That Require Water Quality BMPs

Introduction

Water quality protection is now a consideration for all activities performed by the City. Many activities, such as road construction have specific water resource protections in City code. Other activities, such as storm sewer maintenance, have not been required to meet specific water quality requirements.

This manual contains procedures for implementing water quality protection practices, referred to as best management practices or BMPs, to eliminate or reduce pollution from the City's outdoor maintenance and operational activities.

Purpose

This manual is intended to meet specific needs of the City of Ridgefield. The goal is to provide standard water quality and vegetation management practices for each activity maintenance crews perform.

Scope

Water quality protection practices are addressed here. These include two main categories:

- Practices to eliminate or reduce the pollution caused by operation and maintenance activities such as ditch cleaning or road repairs and
- Practices to assure that water quality BMPs such as swales and treatment ponds are maintained to make sure they are performing as intended.

Habitat preservation practices are largely avoiding or minimizing vegetation removal and the use of chemical controls, and promoting native vegetation where feasible.

Practices in this manual are subject to updates as more detailed storm sewer and road maintenance standards are developed.

Method for Creating this Manual

This manual was modeled after Clark County's *Water Quality Best Management Practices for Operation and Maintenance of Publicly-Owned Property.* Other manuals were reviewed during the creation of Clark County's manual. Notable examples include the ODOT Water Quality and Habitat Guide (June 1997), City of Portland Parks Department Policies and Procedures for Pest Management, the King County Road Maintenance BMP Manual (September 1998), and the *2005 Stormwater Management Manual for Western Washington*. This manual draws on these manuals to present lists of best management practices for numerous operation and maintenance activities. King County's manual lists and describes in detail, BMPs that might apply to thirteen broad categories of activity. The ODOT Guide lists in general language, the BMPs that should be applied to each of 92 specific tasks. To suit the City's needs, this manual combines some of the ODOT tasks and adds activities that ODOT does not include, such as maintaining storm sewer facilities and park land.

Best management practices are compiled from several manuals, programs, or guides. They are:

- Clark County NPDES stormwater management program (April, 1999)
- Clark County Public Works internal assessments of activities affected by the ESA (spring 1999)
- ODOT (June 1997) Maintenance BMPs for Water Quality and Habitat
- AWQA (June 1998) Oregon Toolbox
- King County (September 1998) Appendix A, Private Facilities Maintenance Requirements
- City of Portland, Parks and Recreation Bureau, April 1999, Waterways Pest Management Policy
- Washington Department of Ecology (February 2005) Stormwater Management Manual for Western Washington
- WDOT (February 1995) Highway Runoff Manual
- Tri-County ESA 4(d) stormwater proposal maintenance standards (April 2000)

Manual Layout

The manual lists activities to operate storm sewers, maintain roads, operate shops and maintenance yards, and perform park and landscape maintenance.

For each activity, this manual:

- Briefly describes the activity which needs BMPs.
- Lists the water quality and non-water quality outcomes from the activity. In many cases there is added description of the desired outcome for the activity.
- Lists the BMPs to meet the water quality protection requirements.

Activities

Activities are the actions that road and storm sewer maintenance crews take in the routine performance of their jobs. Some activities such as catch basin cleaning are water quality best management practices. Others, such as ditch maintenance require best management practices. The activities are listed in the table of contents.

Activities covered by this manual may include small capital projects and overlays, but any project with work in a habitat buffer or stream channel is a larger project that requires permitting and specific BMPs beyond those included here.

Outcomes

Each activity meets desired outcomes, which are listed for each activity. There are two sets of outcomes for each activity:

- Water Quality Outcomes
- Infrastructure Maintenance Outcomes

This manual provides practices to reach the water quality outcomes and infrastructure maintenance requirements specific to water quality or habitat protection.

The Water Quality Outcomes are:

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants

The Infrastructure Maintenance Outcomes are:

O5 Protect public safety and health
O6 Prevent catastrophic infrastructure failures
O7 Maintain or restore the intended infrastructure function
O8 Prevent or reduce flooding
O9 Protect infrastructure
O10 Meet public expectations for aesthetics

Practices

Practices are the best management practices necessary to meet the water quality outcomes for each activity. Practices were compiled from other agencies' manuals, the NPDES stormwater management program, or from regulatory requirements.

The practices listed for each activity may be more thoroughly described in separate chapters about BMPs or in other agencies' manuals. The source manuals are also a good reference for specific BMPs. For example, the King County manual is a good source for sediment and erosion control and the Ecology Stormwater Manual (February 2005) is the most complete source for all stormwater BMPs.

Where to Find More Information on Best Management Practices

This manual provides a quick reference of the specific categories of BMPs that apply to Operations activities. It does not provide detailed description of each BMP. The supervisor or crew chief is referred to the source manuals for descriptions and diagrams of BMPs.

Further Work

The manual also includes areas where much further work will be required. These include:

- Training in the use of BMPs
- Developing a habitat conservation plan
- More detailed description of BMPs
- Updates of this manual
- Developing an integrated pest management plan
- Developing comprehensive road maintenance standards

Chapter 2. Stormwater Facility Operation and Maintenance

Stormwater facility maintenance is activities that care for the City's storm sewer system. They include all of the pipes, catch basins, drywells, manholes, swales, retention/detention ponds, oil/water separators, etc. in urbanized areas and some subdivisions in rural areas. Storm sewer maintenance does not include roadside ditch maintenance, which is described as a road maintenance activity.

Stormwater facility operation and maintenance includes inspection and maintenance. The inspection schedule is shown below. The City uses maintenance standards in the *2005 Stormwater Management Manual for Western Washington*. The maintenance standards are not repeated in this manual.

The City is using an adaptive management approach to inspecting and maintaining its drainage and stormwater facilities. The following inspection frequencies may be modified over time as maintenance records reveal patterns.

	Six Months	Annual	When Associated Facility is Being Maintained
Catch Basins and Inlets		■	
Stormwater Treatment Facilities (e.g. biofiltration swales)	■		
Proprietary Filtration Systems (e.g. StormFilters)	■		
Flow Control Facilities (e.g. detention ponds / infiltration ponds)	■		
LID Facilities (e.g. bioretention, permeable pavement)	■		
Oil/Water Separators		■	
Flow Control Structures	■		
Storm Pipes			■
Debris Grates / Trash Racks			■
Energy Dissipaters			■
Fences, Gates, and Signs			■
Access Roads			■

Special Facilities Maintenance Requirements

Manufactured stormwater facilities such as leaf compost filters and oil/water separators often have maintenance requirements and manuals specified or written by the manufacturer. Also, larger or more complex stormwater facilities may include specifications for maintenance and vegetation management that provide specific detail above this manual.

Manufacturer or Designer's Maintenance Manuals

Where the Public Works Director determines that manuals or plans provide equal or greater level of maintenance and water quality protection, they shall be followed by the owner. These individual maintenance plans, specifications, or manuals must be approved by the Public Works Director. Review of the manuals and plans should include an engineer, senior maintenance staff and, if available, the manual preparer.

One of a Kind Facilities

The director may require development and implementation of a site-specific maintenance plan for complex or unusual facilities. The plan is required when the general provisions of this manual do not provide sufficient detail for inspection, maintenance, vegetation management, and repair practices to operate the facility.

Chapter 3. Road Operation and Maintenance

Road maintenance activities include just routine maintenance activities on roads, roadsides and bridges or stream culverts. It includes activities such as sweeping, roadside vegetation management, ditch cleaning, clearing debris from culverts and de-icing.

The overall goal of water quality BMPs for road O and M is to make sure that:

- Systems that control pollutants, such as vegetation in roadside ditches are preserved
- Work on roads does not become a source of pollutants such as sediment.
- Activities near sensitive areas such as stream buffers and wetland buffers follow habitat protection procedures
- Sources of pollutants to roadside ditches are identified and removed.

Activity: Street Sweeping (vacuum pickup)

Street sweeping is performed largely for aesthetics and to remove sand and litter sediment from streets and curb gutters. Street sweeping is a water quality BMP. Water quality practices for street sweeping focus on sediment disposal.

Outcomes

O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health
O10 Meet public expectations for aesthetics

Practices

Subdivision streets, arterial roads and collector roads should be swept once per year. Sweeping schedules may be revised following monitoring of the program. The City may coordinate with the County for this operation.

Materials storage BMPs from the Stormwater Pollution Control Manual will be used for sweepings.

Sweepings are disposed as provided for by the Washington Department of Ecology and Health District requirements. Sweepings are screened to separate litter and trash (disposed as solid waste), then used as reclamation fill in permitted gravel pits.

Activity: Sweeping (non pick up)

This sweeping brushes debris off the road surface onto road shoulders and into the ditch sides.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health
O10 Meet public expectations for aesthetics

Practices

Do not sweep debris into wet ditches (storm or base flow) or into streams, ponds, or wetlands. Sweep debris into vegetated areas of shoulder or ditch.

Vacuum sweepers are used on bridges, and within 250 feet of water bodies, streams and wetlands.

Activity: Roadside Mowing

Mowing maintains sight distances, promotes grass growth and controls unwanted vegetation. It can include mowing of grass, brush and shrubbery.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O10 Meet public expectations for aesthetics

Practices

Perform mowing to the extent needed to control unwanted vegetation. Natural vegetation is left in place to the extent possible, considering safety issues for visibility and the need to maintain ditch flow capacity.

Minimize mowing to the backslope to include areas where noxious weeds or unwanted vegetation need to be controlled.

Roadside ditches are stormwater conveyances, and are in effect, water body buffers where pesticides and fertilizer are not normally used. See Activity: Vegetation and Pest Management in Stormwater Control Facilities for details.

In Habitat Conservation Areas where roads abut natural vegetation (not cultivated fields, lawns and pastures), mowing is restricted to the road shoulder and for control of patches of blackberries or other noxious or nuisance vegetation.

Activity: Roadside Chemical Vegetation Control

Weed control is performed to control noxious weeds on city right-of-way and to kill vegetation along the edge of pavement along arterial roads and major collectors, within pavement cracks, and on landscaped medians. This activity does not include maintaining stormwater swales or other vegetated stormwater facilities.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O10 Meet public expectations for aesthetics

Practices

Chemical controls are used where it is not practical to control by mechanical removal or cultural controls.

Herbicide is sprayed to either the top of the ditch or two feet from the edge of pavement (whichever is less) to control vegetation.

Never spray herbicides into water. Many roadside ditches carry water during dry periods and can be recognized by the presence of water and wetland plants such as cattails. Do not spray herbicide in these ditches.

Within 250 feet of a water body or wetland, or within a designated Habitat Conservation Areas, follow the practices of Activity: Vegetation and Pest Management in Stormwater Control Facilities or avoid chemical applications within 100 feet of a water body.

Activity: Roadside Brush and Tree Clearing

This includes mechanical, hand removal, and spot herbicide spraying of undesirable shrubs, bushes and trees along roads.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O9 Protect infrastructure
O10 Meet public expectations for aesthetics

Practices

Limit brush removal to the shoulder and ditch. Only remove brush and trees or branches to provide sight distance and maintain ditch flow capacity.

Do not remove native shrubs or trees within Habitat Conservation Areas, wetland buffers, or along drainage ditches that have dry weather flow unless it poses a hazard or is a nuisance or noxious weed. These ditches often have wetland plants such as cattails in them. Consult with the area supervisor before removing trees or brush within 250 feet of a stream. A habitat biologist should be consulted before removing trees in an Habitat Conservation Area. For drainage ditches, follow the practices of Activity: Vegetation and Pest Management in Stormwater Control Facilities. For other roadside areas with natural vegetation, follow vegetation management activity: Vegetation Management in Less-Managed Areas.

Only trees that pose a danger of falling onto roadways or structures may be removed within Habitat Conservation Areas. Removed trees are replaced with the same type of trees that cover an equal area as the canopy of the removed tree. Tree replacement is within the same basin.

If practical, hand remove weeds such as black berry vines, nightshade and scotch broom while keeping other bushes and trees.

If there is a water body or ditch with water flow during dry weather, only clear bushes when sight distance is an issue, and after checking with the area supervisor.

Cover bared soils with an erosion prevention cover BMP. Vegetate bare soils.

Activity: Brush and Tree Clearing Near Bridges

This includes hand removal of undesirable shrubs, bushes and trees along bridge approaches and under bridges. Bridges over water bodies are always in Habitat Conservation Areas.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure
O10 Meet public expectations for aesthetics

Practices

Limit brush removal to area between the edge of pavement to the back side of the ditch or to a location that provides adequate sight distance.

If practical, hand remove weeds such as black berry vines, nightshade and scotch broom while keeping other bushes and trees.

Only trees that pose a danger of falling onto roadways or structures may be removed within Habitat Conservation Areas. Do not remove native shrubs or trees within Habitat Conservation Buffers, wetland buffers, or along drainage ditches that have summer base flow. Consult with the area supervisor before removing trees or brush within 250 feet of a stream. A habitat biologist should be consulted before removing trees in an Habitat Conservation Area.

Removed shrubs and trees will be replaced as directed by a Habitat Conservation Plan or to replace an area equal to the vegetation area and tree canopy removed. Trees are replaced within the same basin.

Cover exposed soil with an erosion prevention cover BMP. Vegetate bare soils.

Within 250 feet of a water body or wetland, follow the practices of Activity: Vegetation and Pest Management in Stormwater Control Facilities

Activity: Bridge Channel Debris Removal

This activity involves removing any debris that has accumulated against or around a bridge in a stream channel where normal to high water flows occur. See Activity: Brush and Tree Clearing Near Bridges for information on managing vegetation on streamside areas. The main concerns for debris removal are preventing a hazard to the bridge while protecting stream habit.

Any work that may modify a stream bed or stream bank requires consultation with Engineering staff and consultation with the Washington Department of Fish and Wildlife.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O5 Protect public safety and health
O6 Prevent catastrophic infrastructure failures
O9 Protect infrastructure

Practices

Follow the Habitat Preservation Ordinance and Wetland Protection Ordinance requirements and obtain the needed permits before constructing access routes in stream buffers, wetlands or wetland buffers.

Only remove debris from channel and stream bank areas. Where no downstream obstructions exist, dislodge debris and turn it to flow downstream through the bridge. Only cut apart wood debris when necessary to clear it.

Do not remove any debris outside of the structure, stream channel or stream bank.

Follow source controls for petroleum and hydraulic fluid leaks.

Use ground cover BMPs for any bare soil and vegetate any bare areas with approved cover vegetation.

Consult with the Washington Department of Fish and Wildlife if any work involves modifications to the stream bank or channel. If an emergency exists, contact the Department of Fish and Wildlife for verbal approval.

Activity: Roadside Ditch Cleaning and Reshaping

This activity includes machine or hand cleaning of ditches, reshaping ditches to promote drainage, and managing any removed materials. This practice does not include ditches that have water flowing in them See the stormwater facility O and M standards for Dry Drainage Ditches.

Protecting water quality dictates minimizing vegetation removal and preventing erosion.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O7 Maintain or restore the intended infrastructure function
O8 Prevent or reduce flooding
O9 Protect infrastructure

Practices

Use mowing as the first method to reduce capacity loss. If mowing is insufficient, use ditch cleaning methods.

Where practical, perform work during dry weather.

Only clean areas where there is a flow restriction.

Never remove more vegetation than is absolutely needed. Leave untouched sections at least 200 feet long (where feasible) to act as sediment trapping filters between cleaned sections.

Remove small amounts of sediment by hand when performing routine maintenance.

Use sediment-trapping BMPs at the lower end of each excavated area to keep it from washing out of the work area or entering water bodies.

If there are problems with steep gradient or flowing water, use a stabilization BMP such as a silt mat on the ditch bottom.

Cover bare soils with a cover BMP. Vegetate bare soils. During summer, seeding may not be feasible. Hydroseed unvegetated soils in early fall to assure growth before rainy weather begins in October.

Transport sediment to the appropriate permitted site, grading project, or gravel pit reclamation project.

Avoid work within 250 feet of a stream, wetland or Habitat Conservation Area. If work is required to solve a drainage problem in a Habitat Conservation Area, use ground cover matting to stabilize the area and sediment trapping BMPs.

Activity: Culvert and Inlet Cleaning

This activity includes cleaning sediment and debris from culverts, inlets and other drainage structures less than 6 feet in diameter. These structures are in dry drainage ditches that do not contain water during dry weather. Cleaning is performed to restore drainage capacity using flushing equipment or hand tool.

If there is any question about whether the inlet is in a storm drain or a natural or altered stream, consult with the Washington Department of Fish and Wildlife.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O7 Maintain or restore the intended infrastructure function
O8 Prevent or reduce flooding
O9 Protect infrastructure

Practices

Other than to address a threat to public safety or property due to flooding, perform work during the dry season.

Minimize soil disturbance. Never remove more vegetation than is absolutely needed.

Use sediment controls to trap any sediment and prevent sediment from entering storm sewer and water bodies. Sediment trapping BMPs are used to the extent practical during emergencies.

Cover bare soils with a cover BMP. Vegetate bare soils. During summer, seeding may not be feasible. Unvegetated soil will be hydro-seeded in early fall to assure growth before rainy weather begins in October.

If there are problems with steep gradient or flowing water, use a stabilization BMP such as a silt mat on the ditch bottom.

Transport sediment to the appropriate permitted site, grading project, or gravel pit reclamation project.

Avoid work within 250 feet of a stream, wetland or Habitat Conservation Area. If work is required to solve a drainage problem in a Habitat Conservation Area, use ground cover matting to stabilize the area and sediment trapping BMPs.

Activity: Minor Culvert Repair (not in a stream)

This activity is the replacement or repair of culverts and inlets less than 6 feet in diameter. It applies only to structures that are in ditches built specifically for drainage and do not carry water during dry weather.

If there is any question about whether the ditch is a storm drain or a natural or altered stream, consult with the Washington Department of Fish and Wildlife.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O7 Maintain or restore the intended infrastructure function
O8 Prevent or reduce flooding
O9 Protect infrastructure

Practices

Other than to address a threat to public safety or property due to flooding, perform work during the dry season.

Minimize soil disturbance. Never remove more vegetation than is absolutely needed.

Use sediment controls to trap any sediment and prevent sediment from entering storm sewer and water bodies. Sediment trapping BMPs are used to the extent practical during emergencies.

If there are problems with steep gradient or flowing water, use a stabilization BMP such as a silt mat on the ditch bottom.

Cover bare soils with a cover BMP. Vegetate bare soils. During summer, seeding may not be feasible. Unvegetated soil will be hydro-seeded in early fall to assure growth before rainy weather begins in October.

Transport sediment to the appropriate permitted site, grading project, or gravel pit reclamation project.

Avoid work within 250 feet of a stream, wetland or Habitat Conservation Area. If work is required to solve a drainage problem in a Habitat Conservation Area, use ground cover matting to stabilize the area and sediment trapping BMPs.

Activity: Major Culvert Repair (At a Stream Crossing)

This activity is the replacement or repair of culverts and inlets greater than 6 feet in diameter or bridging a stream or ditch with flowing water during dry weather. If there is any question about whether the ditch is a storm drain or a stream consult with a supervisor, crew chief or Washington Department of Fish and Wildlife.

Practices

These projects are designed by engineering staff and must meet all regulatory requirements. Follow practices specified by engineering staff and permit conditions.

Activity: Erosion Repair

This activity includes the clean up and repair caused by erosion or minor soil failures. It involves reshaping the slope using material on site, importing fill material and removing material.

This activity does not include larger slide or stream erosion projects, which are overseen by an engineer who specifies the BMPs.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O6 Prevent catastrophic infrastructure failures
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure

Practices

Unless work is to address a threat to public safety or property, perform work during dry weather.

Never remove more vegetation than is absolutely necessary to complete the job.

Use sediment-trapping BMPs at the lower end of each excavated area. Trap sediment that is generated by work to keep it from entering water bodies.

Cover bare soils with a cover BMP. Vegetate bare soils.

Transport sediment to the appropriate permitted site, grading project, or gravel pit reclamation project.

Avoid work within 250 feet of a stream, wetland or Habitat Conservation Area. If work is required to solve a drainage problem in a Habitat Conservation Area, use ground cover matting to stabilize the area and sediment trapping BMPs.

Activity: Emergency Slide/Washout Repair

This activity is emergency actions that must be immediately taken to avoid an imminent threat to public health or safety, or to prevent an imminent threat of serious environmental degradation (Section 197-11-880 WAC).

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O5 Protect public safety and health
O6 Prevent catastrophic infrastructure failures
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure

Practices

Install sediment control BMPs.

Use BMPs to avoid or minimize additional impacts to streams and wetlands.

If possible, divert water around the work area with temporary measures such as sandbags.

Transport sediment to the appropriate permitted site, grading project, or gravel pit reclamation project.

Install cover BMPs on bare soil and vegetate the area.

Where required, emergency permits will be obtained from appropriate agencies. Possible permits include:

- Grading
- SEPA
- Shoreline
- State HPA
- Flood Plain

Activity: Bridge Deck Cleaning and Maintenance

These are minor activities to care for bridge decks such as patching and cleaning sediment. Consultation with Washington Department of Fish and Wildlife is required if the work will impact a stream.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure

Practices

Block drains during pressure washing or cleaning to route water off the deck and prevent material from entering water bodies.

Collect and properly dispose of debris. Use screening on the ground or in a catch basin to filter out particles for disposal as solid waste.

Sweep up debris at the end of each workday.

Properly dispose of any removed material according to standard procedures.

Activity: Bridge Structure Maintenance

This activity includes a variety of activities that may be part of routine bridge maintenance. They include washing, scraping, and painting. If activities are part of a project, the project engineer will specify BMPs after consultation with Washington Department of Fish and Wildlife.

Bridges are almost always in Habitat Conservation Areas where clearing must be limited.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure
O10 Meet public expectations for aesthetics

Practices

Block drains during washing or cleaning to route water off the deck to prevent debris, paint chips and paint from entering surface water. Sweep up debris at the end of each workday.

Collect debris and properly dispose of it. Use screening on the ground or in a catch basin to filter out particles for disposal as solid waste or hazardous material.

Use netting or other material to catch material dislodged from beneath (King County BMP 3.4.6 or 3.4.8).

Properly dispose of any removed material according to standard procedures.

Most bridges are constructed of concrete and have little or no surfaces that have been covered by lead-based paint. If paint is being removed and there is a chance that it is lead based, paint chips are tested for lead content and use lead control and safety practices if lead, cadmium or chromium is found. Contact the safety officer for information on control and safety practices.

Have spill control and cleanup materials on site.

When applying paint, use paints that minimize environmental risk. Roll paint when feasible.

Minimize disturbing vegetation to trimming branches. If vegetation or trees must be removed to complete the project, replace the vegetation and tree with an equal type and area covered at the site or another within the same basin.

Activity: Chemical Road De-Icer Use

This is a practice of using a chemical to prevent or retard ice formation on roads and structures. The primary purpose is to protect public safety.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health

Practices

Limit de-icer use to areas where traffic hazards occur. Apply the current Washington Department of Transportation approved material.

List sites where de-icer is required. Use de-icer as specified in manufacturer's instructions. Follow materials storage and transfer BMPs in the DOE Manual or City Code.

Activity: Sanding for Ice

Sand is used to provide traction in certain areas where snow and ice cause safety problems.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health

Practices

Recover and reuse sand by using pick-up sweepers in urban areas, within 250 feet of lakes, ponds and streams, and on bridges.

In rural areas, and not near a water body, sweep sand onto vegetated shoulders.

Properly store sand and use containment or covering BMPs specified in the DOE Manual or adopted City Code.

Activity: Snow Removal

This activity is snow removal from roads, shoulders, and bridges using various snowplowing devices. Plowed snow can include sediment and debris from roads and shoulders.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function

Practices

Minimize the amount of sediment and debris entering water bodies. When moving snow and ice, avoid pushing or casting snow directly into a water body.

Consider the influence that plowed or cast snow has on roadside vegetation. Minimize crushing or disturbance of roadside shrubs and trees within Habitat Conservation Areas.

Reduce speed, change plow angle or use other methods to protect water bodies and sensitive habitat areas.

Activity: Road Surface Maintenance

This activity includes surface repairs and paving jobs. Tasks include using asphaltic concrete, midland pavement, and other materials for patching potholes, filling cracks, paving shoulders, and overlaying roads. If the job cuts or places concrete, see the concrete work activity BMPs.

The major concern is rainfall runoff carrying oils from the work area and particles of material being washed or swept into storm drains or water bodies.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure

Practices

If resurfacing work is performed under contract, specify BMP performance under inspection/contract administration.

Prevent debris, oils, cleaning agents, and sediment from entering waterways. If feasible block inlets and drains.

Avoid work in wet weather. This will reduce the problems of containing sediment or oil laden runoff from the job.

Carry spill control kit.

If the work is creating sediment or other pollutants that can be washed from the work area, protect storm drains. Use the following practices as feasible.

- Cover storm sewer inlets, catch basins and open manholes to prevent or block sediment-bearing water.
- If runoff contains oil and grease use sandbags, booms, or other absorbent products to trap oil at inlets or in drainage ditches. Use catch basin inserts with oil trapping material.
- If runoff contains sediment, use gravel-filled filter bags or other appropriate products to build berms around inlets. Gravel-filled bags are more stable that chip-filled bags.
- At stream crossings, trap materials using screens or another form of containment. Use containment BMPs to protect roadside ditches during wet weather.

Avoid using water to clean up work sites. Sweep or vacuum dust and debris from the repair job. Do not wash materials into storm sewers.

Properly contain and dispose of any residue from cleaning tools. Use heat to clean equipment where possible, avoiding solvents. If vehicles and equipment are left at the site overnight, use drip pans to contain leaks.

Minimize vehicle and equipment cleaning at the site. If cleaning is performed, dispose of cleaning residue in a sanitary sewer or into a grassy area or small temporary infiltration pit.

Place cold mix and material stockpiles away from drainageways. Cover or contain stock piles to prevent material or residues from washing off.

Recycle asphalt and fill material when possible.

Activity: Concrete Work

This activity is the installation, cutting, or repair of concrete facilities such as road surfaces, curb and gutter, sidewalks, and drainage structures.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function

Practices

When necessary, place storm drain covers or containment devices over all drain inlets or discharge points at the beginning of each workday. Remove all accumulated material at the end of each workday. Properly dispose of the material.

Dispose of concrete where it will not wash into a water body, ditch or storm drain. Collect slurry from exposed aggregate washing, grinding water, and any truck washout and dispose of it properly. It is acceptable to dig a hole to hold any slurry or rinse water.

Use curing and form release materials that minimize pollutant discharge.

Do not use water to wash down the area.

Activity: Shoulder Blading

This activity is blading and shaping of unpaved shoulders to correct ruts, sediment accumulation, excessive plant material accumulation, and to maintain drainage from the pavement to the ditch. It usually involves work on relatively flat gravel shoulders.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function

Practices

Try to limit this work to dry weather.

Minimize vegetation removal. If soils are disturbed beyond the top of the ditch or on a slope, apply erosion prevention BMPs and vegetate the bare areas.

Avoid or minimize vegetation removal within Habitat Conservation Areas, and wetland buffers. Consider avoiding shoulder blading.

Activity: Shoulder Rebuilding

This activity is an expansion from shoulder blading that involves adding material to the shoulder, reshaping, and compacting aggregate. It may also include removing material. Shoulders are generally cleared and mowed areas vegetated with grass and brush and are not specifically subject to requirements of the Habitat Conservation Ordinance.

If work will take place between the road and stream, and increases the size of the should or impacts vegetation or a stream channel, consult with an engineer to determine if permits are required.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O4 Preserve native plants
O7 Maintain or restore the intended infrastructure function
O9 Protect infrastructure

Practices

Use erosion controls and prevent sediment and debris from entering water bodies and wetlands. Apply sediment control BMPs at the outside edges of the work area.

Minimize vegetation removal. Avoid or minimize vegetation removal within Habitat Conservation Areas and wetland buffers.

Where possible, create a grassy vegetated slope area between the road and ditch bottom when rebuilding a shoulder.

Activity: Pavement Marking

This activity includes striping roadway surfaces and applying other markings such as hot plastic material to define special traffic control features such as crosswalks, and application of special markers using adhesives.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health

Practices

As current paint stocks are consumed, water based or low VOC paints replace them.

Prevent paint from entering storm sewers and water bodies. Use over-spray control.

Store paint in spill proof containers or covered areas. Clean up spills during storage and handling.

When cleaning up, use methods that properly contain and dispose of unused paint, cleaning materials, and other spent materials.

When removing markings, prevent debris from entering water bodies. Clean up debris from grinding or power washing and dispose of it according to standard procedures.

Avoid using water to clean pavement and do not wash debris into storm sewers or ditches. Protect inlets, manholes and roadside ditches during any washing activities.

Activity: Sign Installation and Repair

This activity is the routine replacement, installation, repair, straightening and cleaning of signs.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function

Practices

Prevent disturbed soil from entering storm sewer or surface water bodies. Seed bare soils.

Avoid discharging cleaners to storm sewers or surface water by making sure they run into vegetated areas or limiting the amount used.

Clean up any materials or debris left by the work.

Attempt to avoid placing signs in areas where there are shrubs and trees that will have to be removed and periodically cleared to keep the sign visible.

Activity: Traffic Signal Maintenance

This activity is the routine repair and preventative maintenance of traffic signals and luminaires, including lamps, poles and bases.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function

Practices

Prevent disturbed soil from entering storm sewer or surface water bodies. Use sediment trapping or cover BMPs and seed bare soils.

Avoid discharging cleaners to storm sewers or surface water by making sure they run into vegetated areas or limiting the amount used.

Clean up any materials or debris left by the work.

Activity: Maintenance of Posts, Guardrails, Concrete Barriers and Other Road Features

This activity is the routine repair and replacement of guardrails and similar features. It can include straightening and minor excavation.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O3 Minimize vegetation removal
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O10 Meet public expectations for aesthetics

Practices

Prevent disturbed soil from entering storm sewer or surface water bodies.

Minimize the area of soil disturbance.

If soil is disturbed, use sediment trapping and cover BMPs. Seed disturbed soils if the area will sustain vegetation.

Prevent pollutants such as paint and debris from entering storm sewer or surface water bodies.

If power washing, avoid discharging water and debris directly to storm sewers or surface water by trapping with gravel-filled bags and blocking inlets. If sand blasting, contain and sweep up residues and dispose of them following standard procedures.

Carry a spill response kit.

Chapter 4. Spill and Hazardous Materials Response

Spill or hazardous materials response applies to any activity. It includes finding abandoned containers on city right-of-way or drainage structures; spills to roads, ditches or storm structures; and clean up and vehicle accidents.

The following procedures are subject to change as training, equipment, and staff changes occur.

Spill/Incident Response while in the office or while in the field

Purpose/Intent: This policy ensures that all Public Works employees understand notification procedures for calls or field discovery of chemicals spills (specifically, chemical spills into the City stormwater sewer system, as well as into surface and groundwater), abandoned chemical containers or garbage or trash.

Individual divisions and sections that have field staff that investigate, collect or clean up materials must have proper training and procedures in place.

This policy applies to all Public Works employees. All employees are responsible to ensure compliance with this policy.

Policy Provisions

1.0 Spills and Leaking Containers

When an employee receives call or discovers a chemical spill into the City Stormwater System (roads, roadside ditches, retention/detention ponds, drywells, and catch basins), and/or into surface water or groundwater (e.g., via drywell, etc.), the employee shall immediately take the following information from the caller:

- Caller's name, telephone number, address, and where they can be reached later that day;
- The address of the spill;
- The physical location of the spill;
- Nature of the spill (material and quantity); and
- License plates numbers, names of individuals, company names/logos on vehicles, if available.

Notification and tracking procedure

1. **Call 911 (Emergency Services) and report the call and information**
2. Call the Washington Department of Ecology Spill Response at 800-424-8802
3. Call the U.S. Coast Guard National Response Center at 800-424-8802
4. Notify Public Works at (360) 887-3897 that a call has been report to 911 and to the Washington Department of Ecology Spill Response.

2.0 Abandoned Non-leaking Chemical Containers

Calls about contained material such as paint cans or barrels, calls should go to:

1. Public Works at (360) 887-3897. Operations will evaluate the situation and complete the notification and reporting procedure.

3.0 Trash and Garbage

Calls about garbage and trash should go to:

1. Public Works at (360) 887-3897. Operations will evaluate the situation and complete the notification and reporting procedure.

Activity: Accident Clean Up

This activity involves clean up of debris and spilled automotive fluids at accident scenes. Larger spills are discussed in the Spill Response Activity.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function

Practices

Follow city procedures for spill cleanup. Each maintenance vehicle has spill response instructions. Contact the Public Works safety officer for more information.

Activity: Spill Response (illicit dumping or chemical spill)

This is in response to a spill on a city-owned road or a spill impacting a storm sewer owned or operated by the City.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health
O6 Prevent catastrophic infrastructure failures
O7 Maintain or restore the intended infrastructure function

Practices

Follow practices defined in the spill reporting or response plan and policies. Each maintenance vehicle has spill response instructions. Contact the Public Works safety officer for more information.

Activity: Abandoned Container Response

This is response to discovery of abandoned waste containers on roads or other facilities owned or operated by the City.

Outcomes

O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O5 Protect public safety and health

Practices

Follow practices defined in the abandoned materials policy. Each maintenance vehicle has instructions on responding to abandoned containers. Contact the Public Works safety officer for more information.

Chapter 5. Facilities Operation

Facilities operation includes a variety of activities such materials stockpiling, fuel storage, fueling stations, vehicle repair, and equipment storage.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources

Practices

The City follows best management practices in Volume IV of the *2005 Stormwater Management Manual for Western Washington.*

Chapter 6. Vegetation Management Goals, Vegetation Management Areas, and General BMPs

Vegetation management activities listed here are performed by grounds maintenance crews who care for parks, natural areas and landscaped areas. Roadside vegetation management is covered in Chapter 3, Road Operation and Maintenance.

Chapter 7, Description of Vegetation and Pest Management Practices provides specific practices for each vegetation management activity in this chapter.

Vegetation management practices are adapted, with minor modifications for format and local practices, from City of Portland Parks Pest Management Policy (April 1999).

General Goals and Philosophy

The City recognizes the special importance of the rivers, streams, wetlands, ponds, and stormwater treatment facilities that fall under our stewardship. The sensitive nature of such habitats, their plant and animal communities, and their direct link with other waterways require that we establish specific policies to ensure their health. These sets of practices for vegetation management, pesticide use and fertilizer use establish guidelines and limitations regarding maintenance for waterways and adjacent lands.

All landscape management decisions for controlling unwanted vegetation, diseases, and pests will follow Integrated Pest Management (IPM) principles and decision-making rationale. These are

- Proper planning and management decisions begin the IPM process.
- Cultural methods of vegetation and pest control are preferred and are first employed.
- Mechanical means of vegetation and pest control are next in line of preference, and are utilized where feasible.
- Biological methods of vegetation and pest control are considered before chemical means, where they are feasible.
- Botanical and synthetic pesticides are used only when no other feasible methods exist.

Main Categories of Vegetation Management Areas

Vegetation management practices vary for areas having different management objectives. The standards here apply to all areas, but more strict controls are placed on areas where code or policy dictate that native vegetation be preserved and in areas near water bodies. These are identified for each activity. There are special management areas for pesticide and fertilizer use in 25 foot setbacks from water bodies and in stormwater control facilities. Special clearing requirements may apply in areas defined by the City's Code.

All Areas

Practices for vegetation management apply as minimum standards for all areas. More restrictive standards and practices for protected habitat and water body setbacks are listed in each activity.

Habitat Conservation Areas

Few wetlands or wetlands buffers are mapped because very few wetlands are accurately mapped. Consult wetland maps or check with technical staff regarding the potential area and buffers for a wetland. Separate practices are established for vegetation management and pest control near water bodies and inside city Habitat Conservation Areas which include protections for existing trees and shrubs and special set backs from water bodies for controls on pesticide and fertilizer use. Vegetation management practice for specific activities or types of area such as intensively managed parks or natural areas are listed in Chapter 7, Vegetation Management Activities.

Descriptions and Examples of Types of Vegetation Management Areas and Activities

The City has grouped landscape management activities by the condition and use of the area. These can include areas inside Habitat Conservation Areas, areas in water body set backs for pesticide and fertilizer use, and areas remote from Habitat Conservation Areas (HCA) or water bodies.

Park landscapes near waterways, lakes and ponds are divided into four classifications, ranging from intensively managed high-use areas to intact natural areas. The classifications describe their current features, as well as define the differing objectives and maintenance rationales of their care. Along with these landscapes, there are activities for maintaining storm sewer facilities and constructed wetlands.

Features and Objectives in Highly-Managed Areas

These are areas where there is exceptionally high traffic and can include areas where there are special standards for vegetation maintenance.

Examples: Klineline Pond, Tri-Mountain fairways, Lewisville Park, Vancouver Lake Park, Leverich Park, Daybreak Park, Marine Park, Frenchmans Bar, and Waterfront Park.

Features of Highly Managed Areas:

Ornamental landscape
Public access and activity
High public use
Mowing of turf, sometimes to edge of waterway
May have facilities adjacent to water
May have highly modified stream banks
Often limited plantings in water body buffers

Objectives for Highly Managed Areas

Healthy plants and turf
Maintain ability to handle high use
May have high expectation for aesthetics in general
Minimize need for chemical intervention
Control invasive plants
Safe access

No bare soil areas
Low tolerance for weeds

Features and Objectives in Less-Managed Areas

Less-managed areas can include a wide variety of areas where there is a lower level of vegetation management due to public access or the area is within a water body buffer. General examples are road shoulders, less used or natural areas in developed parks, and unused land where seasonal or less frequent vegetation management occurs.

Features of Less Managed Areas:

There is a mix of native and non-native plants
Water bodies are have adjacent areas of predominantly native plants
Some impacts from use and park development apparent in water body buffers
Managed landscapes may be nearby
Stream bank erosion may be occurring due to use

Objectives for Less Managed Areas:

Maintain healthy plants in HCAs or water body buffers
Minimize need for chemical intervention
Control invasive plants where feasible
Minimize impact on water body buffers
No bare soil areas
Tolerance for natural appearance and weeds

Features and Objectives in Impacted Natural Areas

Impacted natural areas are generally in parks and undeveloped land. These areas may or may not be in Habitat Conservation Areas or water body set backs.

Features of Impacted Areas:

Very limited impact to native vegetation
Stream banks are buffered with predominately native plants
There are observable limited impacts from use and park development
Managed landscapes are not nearby

Objectives for Impacted Areas:

Maintain healthy plant community
Minimize need for chemical intervention
Lower tolerance of invasive plants, non- natives
Minimize any impacts on buffer
No bare soil areas are allowed

Features and Objectives in Intact Natural Areas

Intact natural areas are rare and exceptional places where there is intact and self-sustaining native vegetation.

Features of Intact Natural Areas:

Very limited visitor impact
Native plant communities exist
No nearby developed park areas

Objectives for Intact Natural Areas:

Maintain healthy plant community
No tolerance of invasive plants, non-natives
Minimize any impacts from activities

Features and Objectives in Stormwater Facilities

Stormwater facilities are constructed features that control or treat stormwater. The most common types of facility are swales, ponds and treatment wetlands. Many include vegetation for treatment, habitat or aesthetics. Specific maintenance requirements are included in activities for storm sewer maintenance.

Features of Stormwater Facilities:
There is a mix of native and non-native plants
Generally not used by the public
Include areas managed to promote design function, such as turf in swales
Managed landscapes may be nearby

Objectives for Intermediate Areas: Maintain
healthy plant communities Minimize
need for chemical intervention Control
invasive plants where feasible No bare
soil areas are allowed
Tolerance for natural appearance and weeds

Features and Objectives in Constructed Wetlands

Constructed wetlands refer to wetlands built to replace lost wetlands or as a habitat feature. They are not stormwater facilities and are considered natural surface water bodies. Constructed wetlands have specific plans for establishing and maintaining vegetation which should be consulted and followed in addition to the requirements in this manual.

Features of Constructed Wetlands:

Limited public access
Plants may or may not be well established depending on age and condition

Objectives for Constructed Wetlands:

Maintain healthy plant communities
Minimize need for chemical intervention
Low tolerance of invasive plants, non- natives
Bare soil areas are not allowed

Mulching

Mulches and other ground coverings are useful during the installation and restoration of landscapes as well as their ongoing maintenance. Mulches meet a variety of needs. They suppress weeds, help to retain moisture around plants, reduce possible erosion, and provide visual enhancement.

Always consider the possible impacts when using mulches, which may include:

- Inadvertent introduction of non-native weeds and diseases to the site.
- Leaching of substances such as tannins from the mulch into nearby waterways.
- Migration of mulch material into waterways.
- Nutrient leaching into waterways.

The most serious problems are probably introduction of weeds and diseases. Routine maintenance in waterway buffers should minimize the use of mulches. Mulching is best used as a part of restoration activity. Mulching in areas that are below typical high water lines is discouraged in any buffer areas.

It is permissible to plant cover crops to control erosion in buffer zones. Cover crops should never introduce any persistent non-native plant species.

Use Low-Volume Directed-Pesticide Application Equipment

Pesticide delivery will be by hand with directed, low volume, single wand sprayers, wiping, daubing and painting equipment, injections systems, or drop spreaders. Typically, application is performed using backpack sprayers, but may also include using the same hand application methods with larger tanks. These delivery methods have low volume applications and low pressure spraying which minimizes the formation of fine mists that might drift off target. It also helps make sure that pesticides will reach targeted plants or targeted soil surfaces.

Minimize Pesticide Drift

Managing drift is of particular importance when surface waters are nearby. Application equipment used in the application shall employ all necessary methods to limit drift. Nozzle size, pressure regulation, droplet size, and height of spray wand, are all techniques that can be modified to reduce unwanted drift of pesticides.

Spray applications are not to be allowed in a water body set back area when:

- wind speed is above 8 mph
- wind direction or activity would carry pesticides toward, or deposit them upon open water

Use Acceptable Pesticides

To minimize possible aquatic impacts, only a limited group of pesticides are allowed in buffer areas. Only the pesticides specifically listed in the following tables may be used as specified in each activity. Generally, restrictions fall into two groups: general use outside of water body set backs and within 25 foot water body set backs. This selection of pesticides considers any possible effects on aquatic life as well as pesticide tendencies to move in the environment.

This list of pesticides may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Materials allowed in Buffer Areas in Certain Circumstances (see individual activities):

Post emergent herbicides:
Glyphosate products: Roundup Pro, Rodeo
Triclopyr products: Garlon 3A (or other amine formulations only, not Garlon 4)
Surfactant (i.e. R-11)

Pre-emergent herbicides:
Oryzalin (Surflan)
Napropamide (Devrinol)

Materials Allowed in for Use in Aquatic Habitats under Certain Circumstances:

Aquatic labeled only:
Glyphosate (Rodeo)
Approved surfactant (R-11 or equivalent)
Aquashade (acid blue 9, acid yellow 23)

The following matrix gives specific guidelines for pesticide and fertilizer use in 25-foot water-body set backs that have varying levels of management. Pesticide and fertilizer use also depends on whether the activity is routine maintenance or restoration and construction projects.

See the requirements for each maintenance activity in Chapter 7 for specifics in each area.

Use of pesticides and fertilizers within 25-foot water body set backs

Chemical used	Maintenance Activity	Intensively Managed Areas	Less Intensively Managed Areas/Stormwater Facilities	Impacted areas and Constructed Wetlands	Intact Natural Areas
Pre-emergent herbicide use possible?	Routine Maintenance	Only in shrub beds above high water line	Not Allowed	Not Allowed	Not Allowed
	During Construction or Restoration	Only in shrub beds above high water line	Not Allowed	Not Allowed	Not Allowed
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray	Spot spray and broadcast spray	Spot spray and broadcast spray	*Spot spray for target list weeds only**
	During Construction or Restoration	Spot spray and broadcast spray	Spot spray and broadcast spray	Spot spray and broadcast spray	*Spot spray and broadcast spray for non-natives**
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. Spot spray	Cut and treat stems. *Spot spray to establish monocots**	Cut and treat stems. Spot spray	Not Allowed
	During Construction or Restoration	Cut and treat stems. *Broadcast spray**	Cut and treat stems. *Spot spray/broadcast to establish monocots**	Cut and treat stems. *Broadcast spray**	Not Allowed
Fertilizer Used:					
Slow release fertilizer use possible?	Routine Maintenance	Directed applications to shrub beds if no flooding possible	Not Allowed	Not Allowed	Not Allowed
	During Construction or Restoration	Directed applications if no flooding possible	Directed applications if no flooding possible	Directed applications if no flooding possible	Directed applications if no flooding possible

** Requires approval of Manager, or Wetland Ecologist*

Materials Available for Tree Injections

If a pest or disease threatens the health of *important and valuable trees* within a Habitat Conservation Area or 25-foot water body set back, there may be a need to treat them. Instances of this occurring are rare however. The intent and limit of this exception to the approved buffer area pesticide list is to allow only the insecticides or fungicides necessary to combat direct threats to the health of valuable trees. In these special cases, the use of injected pesticides may be employed, with the following limitations:

- The pesticide applied must be delivered by methods that inject or otherwise distribute the material entirely within interior tree tissues.
- Pesticides will not be injected into the soil surrounding the tree. Tree surfaces will not be sprayed or treated with pesticides, with the exception of approved fungicides and biological agents.

Following These BMPs in All Other Areas:

Water body setbacks have the most restrictive controls on pesticide and fertilizer use. Generally, the standards for outside setbacks are quite similar. See each individual vegetation management activity for specific requirements.

Keep Good Records of Pesticide Use (Record Keeping Requirements)

Regular application record keeping requirements are required for all pesticide applications. Records shall include:

- Applicator name and license number;
- Date and the time intervals of the application;
- Location of application;
- Temperature and wind conditions;
- Materials and concentrations used; and
- Amount applied, coverage rate, and equipment used.

Have a State Applicators' Licenses

All personnel who apply pesticides to City lands must be Washington Department of Agriculture licensed applicators or have a license recognized by the Washington Department of Agriculture. Only licensed personnel who have received an additional aquatics license certification may apply pesticides to aquatic sites.

Chapter 7. Vegetation Management Activities

This section describes specific vegetation management activities and the best management practices to follow.

Refer to Chapter 6 for description of the types of areas and description of the practices required by this chapter.

Activity: Maintaining Shrub Beds in Highly Managed Areas

This activity is caring for shrubs and plants in high-use areas such as day use parks, road medians, landscaped areas along roads, and public building landscapes. Due to their use as public areas and surroundings to public buildings, there is a low tolerance for weeds in these areas. Maintenance includes pruning, plant replacement, flower planting, plant removal, weeding and bark dust or mulch placement, litter removal, edging and irrigation system operation.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O10 Meet public expectations for aesthetics

Practices

The main goal in maintaining these areas is sustaining the appearance of the planting bed. This is largely through weed control, pruning, and mulching.

Vegetation is trimmed to keep clear "sight distances" and to keep signs visible. Trees and shrubbery are trimmed to allow street sweepers clear access to curbs.

Do not remove native shrubs or trees within stream buffers, wetland buffers, or along drainage ditches that have base flow. Consult with the area supervisor before removing trees or brush within 250 feet of a stream.

When applying bark dust or mulch, make sure that it is placed in a manner that prevents it from washing into storm sewers, ditches or streams. Bare spots are minimized by the use of mulch or appropriate cover plants to prevent erosion. Cover bare soils with an erosion prevention cover BMP. Vegetate bare soils.

Minimize the use of mulches within 25 feet of a waterbody.

Hand remove weeds such as black berry vines, nightshade, scotch broom, English ivy, and holly, while keeping other bushes and trees. Chemical intervention is minimized.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in Chapter 6.

Follow chemical use listed in the attached table. This list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Use of Pesticides and Fertilizers in for Shrub Beds in Highly-Managed Areas

Chemical used	**Maintenance Activity**	**Allowed Uses**
Pre-emergent herbicide use possible?	Routine Maintenance	Only in shrub beds above high water line
	During Construction or Restoration	Only in shrub beds above high water line
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and Broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. Spot spray
	During Construction or Restoration	Cut and treat stems. *Broadcast spray**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Directed applications to shrub beds if no flooding possible
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager or Wetland Ecologist*

Activity: Landscaped Turf Maintenance (Highly-Managed Areas)

This activity is caring for turf in landscaped areas such as parks, road medians, and around buildings. It includes mowing, fertilizing, herbicide use, sweeping, raking, top dressing, aerating, edging, debris removal, and irrigation.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O10 Meet public expectations for aesthetics

Practices

The main goal in maintaining these areas is maintaining appearance and vigorous turf growth for high-traffic areas. This includes having healthy turf and plants, minimizing weeds and bare spots, and providing safe access to the water.

Bare spots are minimized by seeding turf.

Mower clippings are left on the ground unless they are so thick that they cover the turf. Minimize the use of mulches within 25 feet of a water body.

Chemical intervention is minimized. This includes spot spraying for weeds and minimizing insecticides and fungicides. Fertilizer use is limited to that needed to sustain intended use.

Follow chemical use listed in the attached table. Outside of the 25-foot water body set back, fertilizers are applied to sustain turf growth. Lime is applied once per year. This list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in Chapter 6.

Where feasible, turf areas will be fitted with computerized irrigation systems to better maintain turf during the summer. Better irrigation will allow more frequent mowing and better control irrigation runoff.

Turf Management in Near Lakes and Ponds

Several parks have intensively maintained turf extending to the edge of water bodies. In these areas, special management measures are used as much as feasible considering the management objectives. Special measures include more frequent, low rate fertilizer application or temperature release fertilizer and computerized irrigation systems that prevent over watering and fertilizer runoff.

Use of Pesticides and Fertilizers for Turf Management (Highly Managed Areas)

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Only in shrub beds above high water line
	During Construction or Restoration	Only in shrub beds above high water line
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. Spot spray
	During Construction or Restoration	Cut and treat stems. *Broadcast spray**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Directed applications to if no flooding possible
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager or Wetland Ecologist*

Activity: Maintaining Roadsides and Lower Use Areas of Parks

This activity is lower intensity management of plants along roads and lower use areas of parks, or other low use landscapes. There is a higher tolerance for weeds in these areas than in day-use parks and landscaped areas around public buildings.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants
O5 Protect public safety and health
O7 Maintain or restore the intended infrastructure function
O10 Meet public expectations for aesthetics

Practices

The main goal in maintaining these areas is maintaining appearance with a minimum amount of work and chemical intervention. This largely includes controlling weeds.

Consider hardiness and drought tolerance when selecting plants.

Do not remove native shrubs or trees within stream buffers, wetland buffers, or along drainage ditches that have base flow. Consult with the area supervisor before removing trees or brush within 250 feet of a stream.

If there is a water body or ditch with water flow during dry weather, only remove desirable shrubs or bushes when sight distance is an issue, and after checking with the area supervisor.

When applying mulches or bark dust, make sure that it will not wash off into storm sewer, ditches or streams. Bare spots are minimized by the use of mulch or appropriate cover plants to prevent erosion. Cover bare soils with an erosion prevention cover BMP. Vegetate bare soils.

Hand remove weeds such as black berry vines, nightshade, scotch broom, English ivy, and holly, while keeping other bushes and trees. Chemical intervention is minimized.

The attached list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Use of Pesticides and Fertilizers in Lower Use Areas and Roadside Plantings

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Only in shrub beds above high water line
	During Construction or Restoration	Only in shrub beds above high water line
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. Spot spray
	During Construction or Restoration	Cut and treat stems. *Broadcast spray**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Directed applications to shrub beds if no flooding possible
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager or Wetland Ecologist*

Activity: Vegetation and Pest Management in Less-Managed Areas

These are areas in parks or other lands that are less actively managed than turf or shrub beds. These areas may include degraded or modified natural areas or unused land that is maintained periodically or seasonally. In Habitat Conservation Areas, these land areas are maintained for the purpose of establishing natural vegetation. There is a tolerance for natural appearance and weeds. There may be some use such as water access by the public, but that is not the primary use of the area.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants
O7 Maintain or restore the intended infrastructure function

Practices

Practices in these less-managed areas focus on establishing and maintaining healthy native plantings. This includes controlling invasive plants where feasible, minimizing the human impact on the buffer, and planting cover on bare soils.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in the following section.

Within natural areas, limit the use of mulches to covering bare soils while establishing plantings.

Pesticide and fertilizer should be avoided within 25 feet of a water body.

The attached list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Use of Pesticides and Fertilizers in Less-Managed Areas

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Not Allowed
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and Broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. Spot spray
	During Construction or Restoration	Cut and treat stems. *Broadcast spray**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager or Wetland Ecologist*

Activity: Vegetation and Pest Management in Impacted Natural Areas

Impacted natural areas are predominately native plants and limited influence from public use and park development. The main objective is to maintain and improve the healthy plant community. Impacted areas have a lower tolerance for invasive or non-native plants.

Outcomes

O4 Preserve native plants
O7 Maintain or restore the intended infrastructure function

Practices

Practices in these areas focus on establishing and maintaining healthy native plantings. This includes more vigorously controlling invasive plants and the human impact on the buffer. It also includes covering for bare soils with native plants.

Limit mulch use to covering bare soil while establishing plantings.

Pesticide and fertilizer use is minimized and is avoided if possible within 25 feet of a water body.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in Chapter 6. The attached list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Use of Pesticides and Fertilizers in Impacted Natural Areas

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Not Allowed
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and Broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. *Spot spray to establish monocots**
	During Construction or Restoration	Cut and treat stems. *Spot spray/broadcast to establish monocots**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Directed applications if no flooding possible

**Requires approval of Parks Manager or Wetland Ecologist*

Activity: Vegetation and Pest Management in Intact Natural Areas

Intact natural areas are separate from developed parks and have very limited public access. They have established native plant communities. The objective is to maintain the healthy plant buffer and provide wildlife habitat. There is no tolerance for invasive or non-native plants. There is little public access to these areas other than trails.

Outcomes

O4 Preserve native plants
O7 Maintain or restore the intended infrastructure function

Practices

Practices in these areas focus on maintaining healthy native plantings. This includes vigorously controlling invasive plants and human impact on the buffer.

Avoid the use of mulches.

Pesticide and fertilizer use is minimized or not allowed.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in Chapter 6. The attached list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Use of Pesticides and Fertilizers in Intact Natural Areas of Habitat Buffers

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Not Allowed
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. *Spot spray to establish monocots**
	During Construction or Restoration	Cut and treat stems. *Spot spray/broadcast to establish monocots**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager*

Activity: Vegetation and Pest Management in Stormwater Control Facilities

Stormwater control facilities include biofiltration treatment swales, treatment wetlands, treatment ponds, detention ponds, open channels, and infiltration basins. Stormwater control facilities discharge to surface water or groundwater either directly or through pipes or ditches. Many facilities are built to remove pollutants from stormwater.

Generally, vegetation should be maintained to blend into surrounding areas. Stormwater facilities can provide habitat for aquatic life and birds. Promoting natural vegetation where feasible improves habitat. Swales often blend into intensively managed landscapes. Pond perimeters can include natural vegetation.

The use of pesticides and, in most cases fertilizer, is not compatible with the task of pollutant removal or the direct connection of stormwater facilities to streams and groundwater.

Features of Stormwater Facilities:

- There is a mix of native and non-native plants
- Generally not used by the public
- Include areas managed to promote design function, such as turf in swales
- Managed landscapes may be nearby
- May be used by fish and wildlife

Objectives for Stormwater Facilities:

- Maintain healthy plant communities
- Avoid or minimize need for chemical intervention
- Control invasive plants where feasible
- No bare soil areas are allowed
- Tolerance for natural appearance and weeds

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants
O7 Maintain or restore the intended infrastructure function
O8 Prevent or reduce flooding
O10 Meet public expectations for aesthetics

Practices

Pest management practices in stormwater facilities mirror the less-managed park areas. The focus is establishing and maintaining healthy, low-maintenance native or landscape plantings and sustaining the design function of vegetated filters such as biofiltration swales. This

includes controlling invasive plants where feasible, minimizing the human impact on the buffer, and planting cover on bare soils.

In some cases, the original plantings may not be appropriate for the actual condition at a facility. One example is a frequently flooded swale that cannot support normal turf. In cases like this, replace turf with appropriate plants if the underlying drainage problem cannot be fixed.

Consider the use of soil amendments such as compost before using fertilizer.

Limit mulch use to covering bare soil while establishing plantings.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in Chapter 6. The attached list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Chemical use should be avoided within 25 feet of any area that holds or conveys surface water or stormwater. This includes the base of a biofiltration swale.

Stormwater treatment and control facilities, including wetlands, intercept storm water run-off before it enters surface water or groundwater. There are no provisions for herbicide use below the high water line of these facilities.

Trees or shrubs that block access roads may be trimmed (or removed if within the access road) at the time of when access is required for maintenance by heavy equipment.

Trees that pose a risk to stormwater structures due to root growth may be removed and replaced by smaller shrubs.

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Not Allowed
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and Broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. Spot spray
	During Construction or Restoration	Cut and treat stems. *Broadcast spray**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager or Wetland Ecologist*

Activity: Vegetation and Pest Management in Constructed Wetland Areas

The City may build wetlands to mitigate for wetlands lost during road construction or other public works. These are not stormwater facilities, but compensation for wetlands taken during construction projects. This activity applies only to parts of wetlands that are not subject to inundation during the growing season. Operations or Parks crews use no chemical controls in wetland water bodies.

Noxious weed controls may include herbicide use in wetlands.

Constructed wetlands progress from little or no natural vegetation to an ideal state where they are self-sustaining natural areas. As water bodies, wetlands connect to streams and groundwater. Wetlands also host insects, fish, amphibians, and birds that are sensitive to horticultural chemicals. Because of this, chemical use should be minimized in wetland buffers. Wetland management has a low tolerance for invasive or non-native plants.

Outcomes

O1 Minimize sediment and pollutant discharges from the work area
O2 Prevent city roads, drainage systems, facilities and property from becoming pollutant sources
O3 Minimize vegetation removal
O4 Preserve native plants
O7 Maintain or restore the intended infrastructure function

Practices

Practices in these areas focus on establishing and maintaining healthy native plantings. This includes more vigorously controlling invasive plants and the human impact on the buffer. It also includes covering for bare soils.

Consider the use of soil amendments such as compost before using fertilizer.

Limit mulch use to covering bare soil while establishing plantings.

Chemical intervention is minimized and is avoided if possible within 25 feet of a water body.

Follow BMPs for pesticide and fertilizer application, storage, disposal and record keeping as outlined in Chapter 6. The attached list of pesticides and fertilizers may be revised to include or drop compounds. Reasons for changes include the potential for plants to become tolerant or build resistance to specific compounds, addition of a new compound to state approved pesticides, or federal or state removal of a pesticide.

Chemical used	Maintenance Activity	Allowed Uses
Pre-emergent herbicide use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Not Allowed
Glyphosate use possible?	Routine Maintenance	Spot spray and broadcast spray
	During Construction or Restoration	Spot spray and broadcast spray
Triclopyr use possible?	Routine Maintenance	Cut and treat stems. *Spot spray to establish monocots**
	During Construction or Restoration	Cut and treat stems. *Spot spray/broadcast to establish monocots**
Fertilizer Used:	**Maintenance Activity**	**Allowed Uses**
Slow release fertilizer use possible?	Routine Maintenance	Not Allowed
	During Construction or Restoration	Directed applications if no flooding possible

** Requires approval of Parks Manager or Wetland Ecologist*

Activity: Weed Control within Water Bodies

Specific practices are allowed in water bodies such as streams, ponds and wetlands. Chemical controls are allowed only in extreme cases where there is a threat of near complete habitat loss due to an invasive weed.

Weed control within natural water bodies requires an authorization under the State Hydraulic Code. Activities such as dredging require approval from the Washington Department of Fish and Wildlife. Mechanical harvesting is allowed without consultation with Washington Department of Fish and Wildlife if practices in their publication *#APD-1-98, Aquatic Plants and Fish* are followed.

Within Streams

In the rare need for control of noxious weeds and invasive non-native plants within a stream itself, mechanical and biological means will be utilized.

Within Pond and Lake Areas

Weed control is by mechanical removal. There are special requirements for disposal of aquatic weeds to prevent spreading seeds. The Parks Manager will determine the proper disposal methods.

Biological controls are used in some situations.

If an emergency situation arises where habitat is endangered by non-native invasive submerged weeds in ponds and lakes, the Manager may approve the use of an aquatic use approved herbicide for control as a last resort.

Herbicide use is only allowed where there is no direct outflow of the treated water to streams or waterways. The herbicide utilized shall be of very low toxicity to aquatic organisms, and be applied in such a way that there are no appreciable negative effects on the health of the aquatic environment.

Within Wetlands Areas

There are no provisions for the use of herbicides in open water areas in wetlands or constructed wetlands. Aquatic use approved herbicides may be used during establishment of constructed wetlands. The City may control noxious weeds in some cases.

Within Stormwater Ponds, Swale Treatment Areas and Treatment Wetlands

Stormwater treatment and control facilities, including wetlands, intercept storm water run-off before it enters surface water or groundwater. There are no provisions for herbicide use below the high water line of these facilities. The City may control noxious weeds in some cases.

Chapter 8. Training

Training is an essential component to successful water quality BMP use. Simple diagrams and descriptions will not be adequate to demonstrate the use of many BMPs in the field. Training should include field demonstrations, videos, slide shows, and reference cards or field manuals.

Initiation Training

Training for new employees should include the basic do's and don'ts. Why things like dirt are a pollutant that we control during routine operations. What is absolutely not allowed, such as dumping excavated material into streams, washing debris into storm drains and streams, and so forth.

This training should set the base for added training about implementing BMPs.

BMP Training

Staff should be provided with basic manuals that include diagrams and descriptions of the practices to meet standards for water quality.

Crew chiefs and employees under their supervision should have training in BMP use for the activities they perform. Specific training, classroom and field, in the use of the BMP should lead to more successful implementation than simply providing a written manual.

Procedure Cards/Sheets

Cards can be made for each activity and the required BMPs. These can go to each vehicle as needed.

Every vehicle should have a card, describing spill and abandoned container response.

Water Quality Kits for Trucks

Each vehicle should be equipped with a water quality kit that contains:
Lightweight cover materials for exposed materials and eroding areas.
Seed mix for planting bare areas.
Sediment barriers for storm sewer inlets.
Absorbent for small spills.
Drip pans for leaky vehicles.

Map/Track Problem Areas

Problem areas where erosion, sediment accumulation in ditches or other water quality problems occur should be mapped so that they can be systematically tracked and solutions documented.

Map Habitat Areas/Streams/Wetlands

Create wall maps and atlases that show the extent and type of Habitat Conservation Areas, known wetlands, and streams that require special consideration under City code.

The purpose of the maps is to raise awareness of the extent of these areas as well as simply show where they are.

Appendix D

Recommendations

Appendix D-1

Capital Project Fact Sheets

Project ID:	**CIP 1**	**General Location: North Heron Drive & Maple Street**
Project Name:	**Division Street Outfall**	**Project Priority Rank: 1**

Problem Summary

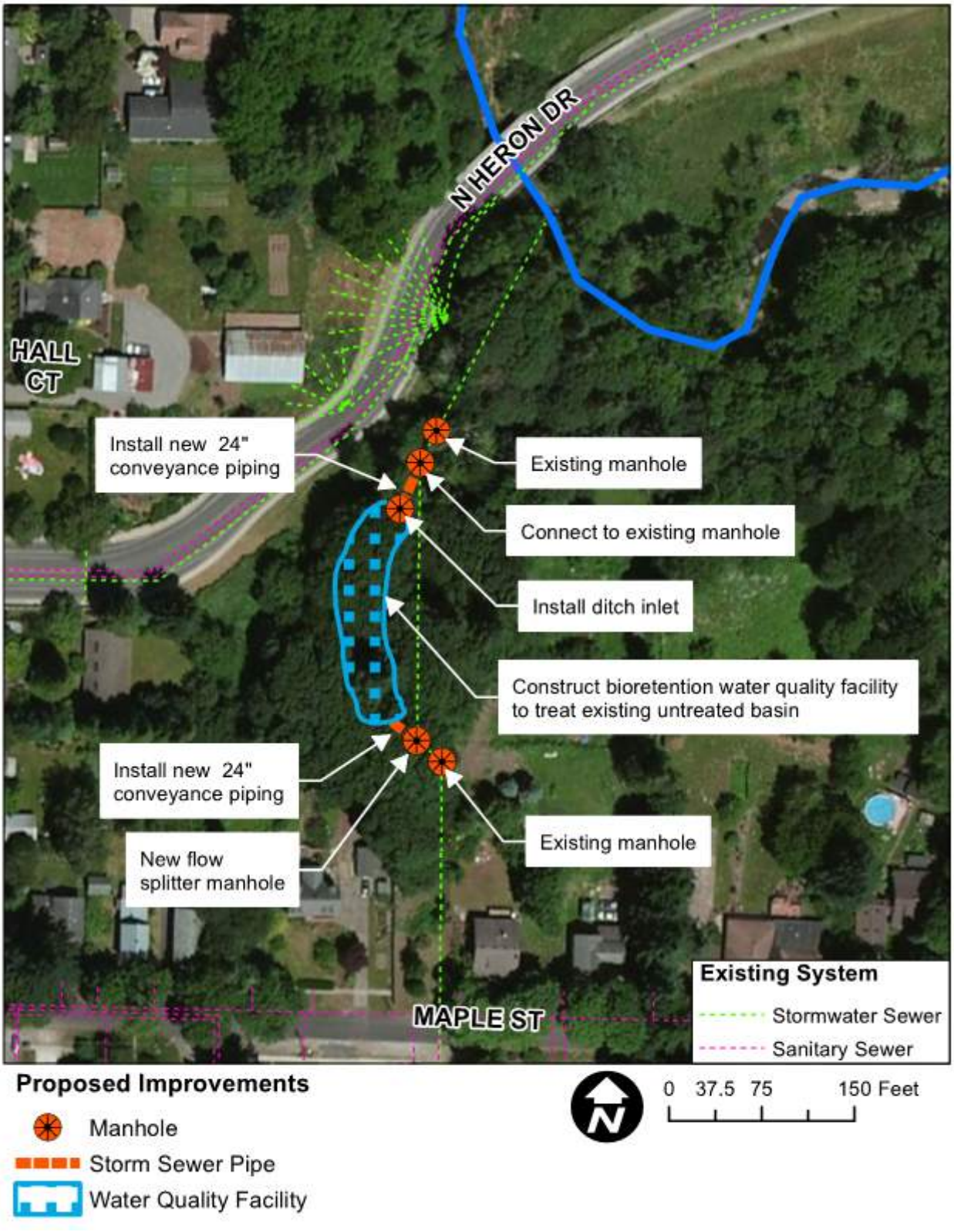
The City of Ridgefield recently completed a project to better convey runoff from Maple Street down to Gee Creek. The conveyance project was routed through a largely undeveloped property along North Heron Drive. The City has an agreement with the current owner to allow for the future purchase of the property. There is an opportunity for the City to use this property as a regional water quality treatment facility, as the upstream basin does not currently have water quality treatment. Based on findings during the previous project referenced above, it is understood that existing wetlands are not present on the site. The following are the identified deficiencies of the existing system:

- No water quality treatment for the existing developed basin.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Construct a bioretention water quality facility to provide water quality treatment for the existing untreated basin.
- Replace existing manhole with a flow splitter manhole on the existing stormwater main that will direct water quality storm flows to the new stormwater facility while allowing higher flows to remain in the existing pipe and bypass the facility.
- Construct a ditch inlet and connect to the existing manhole to allow overflows from the water quality facility to discharge to Gee Creek through the existing outfall.


N HERON DR
HALL CT
Install new 24" conveyance piping
Existing manhole
Connect to existing manhole
Install ditch inlet
Construct bioretention water quality facility to treat existing untreated basin
Install new 24" conveyance piping
New flow splitter manhole
Existing manhole
MAPLE ST
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Storm Sewer Pipe
Water Quality Facility
N
0 37.5 75 150 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$30,000
Design (12% of construction total)*				$30,000
Permitting				$3,000
Land Acquisition (Easement/ROW)				$50,000
			Total Implementation	**$113,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$17,000
Erosion & Sed. Control	1	LS	$3,000	$3,000
Excavation	900	CY	$25	$22,500
Ditch Inlets	1	EA	$3,000	$3,000
Flow Splitter Manhole	1	EA	$6,000	$6,000
24-in Storm Sewer Pipe	60	FT	$250	$15,000
Water Quality Media	450	CY	$50	$22,500
Biodegradable Geotextile	8,000	SF	$5	$40,000
Planting	10,000	SF	$5	$50,000
			Construction Subtotal	**$179,000**
Planning Level Contingency (@ 35% of Const.)*				$63,000
			Construction Total	**$242,000**
Total Project Cost				**$355,000**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Existing site for proposed stormwater facility – looking south

Existing site for proposed stormwater facility – looking north

Project ID:	**CIP 2**	**General Location: S. Hillhurst Road & S. 9th Circle**
Project Name:	**Hillhurst Swale**	**Project Priority Rank: 2**

Problem Summary

There is an existing conveyance ditch collecting roadway runoff on the north side of South Hillhurst Road. This runoff is routed to an existing stormwater swale, which is located on private property. The stormwater runoff is then routed through a private pond located on a parcel owned by The Recovery Village.

The swale was constructed under a handshake agreement with a former property owner, but the city does not have any documentation of the agreement and there is no public easement for access the swale for maintenance. The property owner would prefer to remove the swale and otherwise utilize this portion of the property.

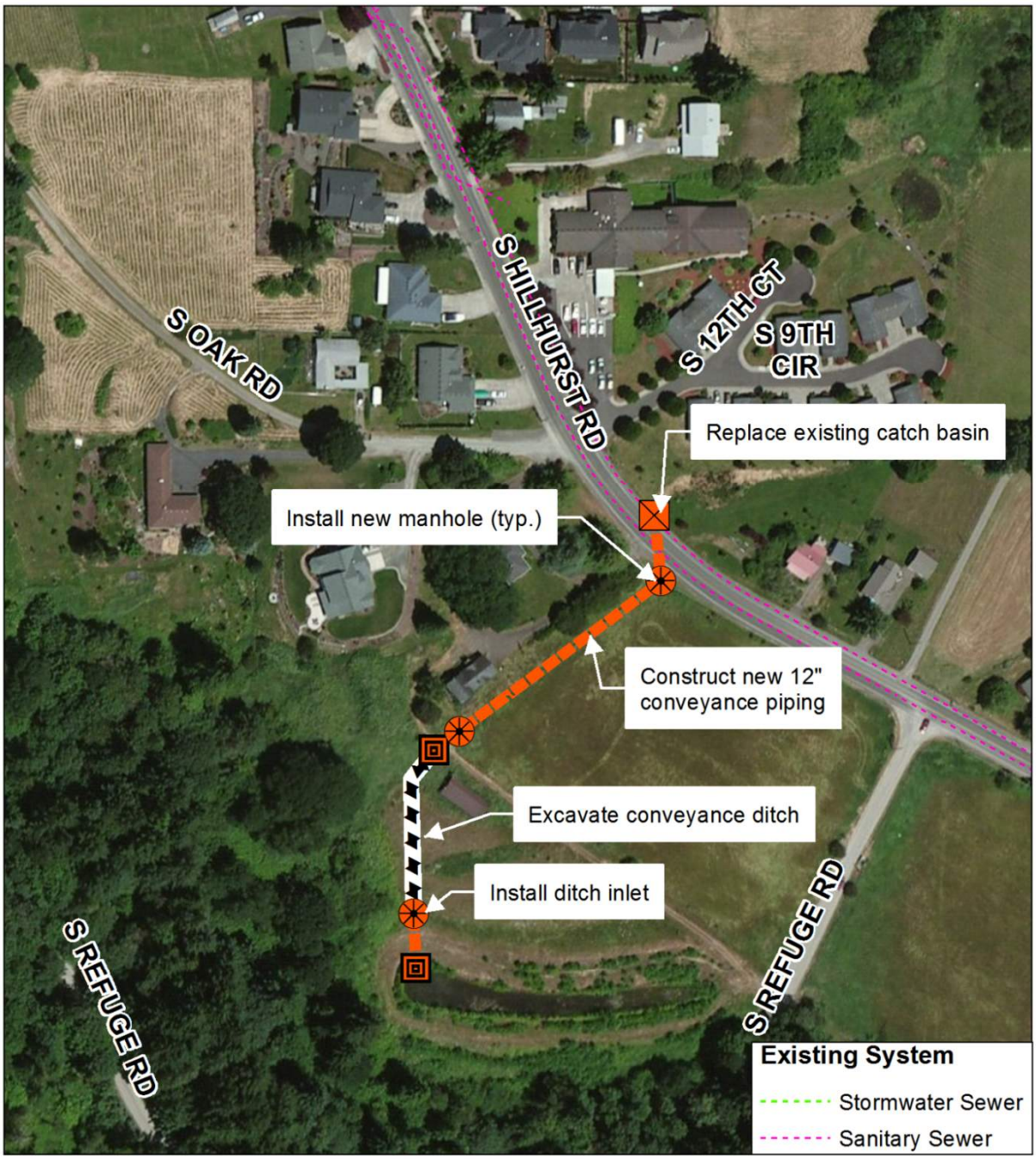
The following are the identified deficiencies of the existing system:

- The City does not have an easement for the stormwater swale or pond.
- Stormwater runoff from the right-of-way discharges through privately owned facilities.
- The catch basin that is the overflow structure for the swale is potentially a safety hazard due to frequent clogging and its location at the top of a relatively steep slope adjacent to The Recovery Village facilities.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Replace the existing catch basin with a new catch basin.
- Abandon the existing stormwater piping and bioswale.
- Construct a new stormwater pipe along the western edge of the City owned property located south of South Hillhurst Road. Review of GIS topography of the site, indicates that a pipe will work better than a ditch from South Hillhurst Road to the access road in the middle of the property.
- Construct a new ditch to convey the runoff from the pipe down the existing slope to the existing stormwater pond.
- Construct a new ditch inlet and outfall to the existing pond.
- It is assumed that retrofitting the pond will not be necessary. City staff has indicated that the existing pond was design to handle runoff from a large development that was never constructed. The existing pond has the additional capacity needed to manage the runoff from this relatively small area of right-of-way pavement.


S OAK RD
S HILLHURST RD
S 12TH CT
S 9TH CIR
Replace existing catch basin
Install new manhole (typ.)
Construct new 12" conveyance piping
Excavate conveyance ditch
Install ditch inlet
S REFUGE RD
S REFUGE RD
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Outfall Scour Protection
Standard Catch Basin
Storm Sewer Pipe
Open Channel Excavation
N
0 55 110 220 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$19,000
Design (15% of construction total)*				$23,000
Permitting				$3,000
			Total Implementation	**$45,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$11,000
Erosion & Sed. Control	1	LS	$3,000	$3,000
Excavation	60	CY	$25	$1,500
Catch Basin	1	EA	$2,000	$2,000
Ditch Erosion Protection	1	LS	$2,000	$2,000
Ditch Inlet	1	EA	$3,000	$3,000
Manhole	2	EA	$4,000	$8,000
12-in Storm Sewer Pipe	460	FT	$160	$73,600
Outfall Scour Protection	2	EA	$2,000	$4,000
Pavement Restoration	500	SF	$8	$4,000
			Construction Subtotal	**$112,100**
Planning Level Contingency (@ 35% of Const.)*				$40,000
			Construction Total	**$152,100**
Total Project Cost				**$197,100**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Catch basin collecting ditch flow north of S. Hillhurst Road

Existing stormwater facility looking north from south side of South Hillhurst Road

Project ID:	**CIP 3**	**General Location: South 56th Place south of South 1st Circle**
Project Name:	**South 56th Place**	**Project Priority Rank: 3**

Problem Summary

The existing stormwater system consists of two existing catch basins, one on either side of the street, at the low point in South 56th Place. The catch basins clog frequently. Ponding in the roadway can be severe enough to overtop the adjacent sidewalk and runs overland to the existing surface water and regional pond.

The following are the identified deficiencies of the existing system:

- The existing single catch basins at the low point in South 56th Place clog frequently and cause a maintenance and nuisance flooding problem.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Remove the existing catch basins and replace with new paired catch basins at the low point in South 56th Place on both sides of the road to alleviate ponding problems. The paired catch basin configuration is typical at low points along a roadway gutter and will help to reduce nuisance flooding.


S 56TH PL
Replace existing catch basins and install new adjacent catch basins on both sides of the street
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Standard Catch Basin
N
0 37.5 75 150 Feet

Cost Estimate

Implementation

Implementation Items	*Amount*
Survey (12% construction total)*	$4,000
Design (30% of construction total)*	$8,000
Permitting	$0
Total Implementation	**$12,000**

Construction

Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$2,000
Erosion & Sed. Control	1	LS	$1,500	$1,500
Asphalt Removal	1	LS	$5,000	$5,000
Catch Basins	4	EA	$2,000	$8,000
12-in Storm Sewer Pipe	20	FT	$150	$3,000
Construction Subtotal				**$19,500**
Planning Level Contingency (@ 35% of Const.)*				$7,000
Construction Total				**$26,500**
Total Project Cost				**$38,500**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Reduced storage capacity in existing stormwater pond

Existing catch basin on S. 56th Pl.

Project ID:	**CIP 4**	**General Location: Old Pioneer Way & Northridge Drive**
Project Name:	**Old Pioneer Way**	**Project Priority Rank: 4**

Problem Summary

Currently, there is a large volume of stormwater runoff flowing down Northridge Drive, which is located on a fairly steep slope. Northridge Drive has not been improved with curb, gutter, or catch basins. Currently, stormwater from Northridge Drive flows (via sheet flow) across Old Pioneer Way onto a privately owned grass field located to the north of Old Pioneer Way. There is currently a single catch basin located at the eastern terminus of Old Pioneer Way, which connects to the east to a storm conveyance pipe located on Pioneer Street.

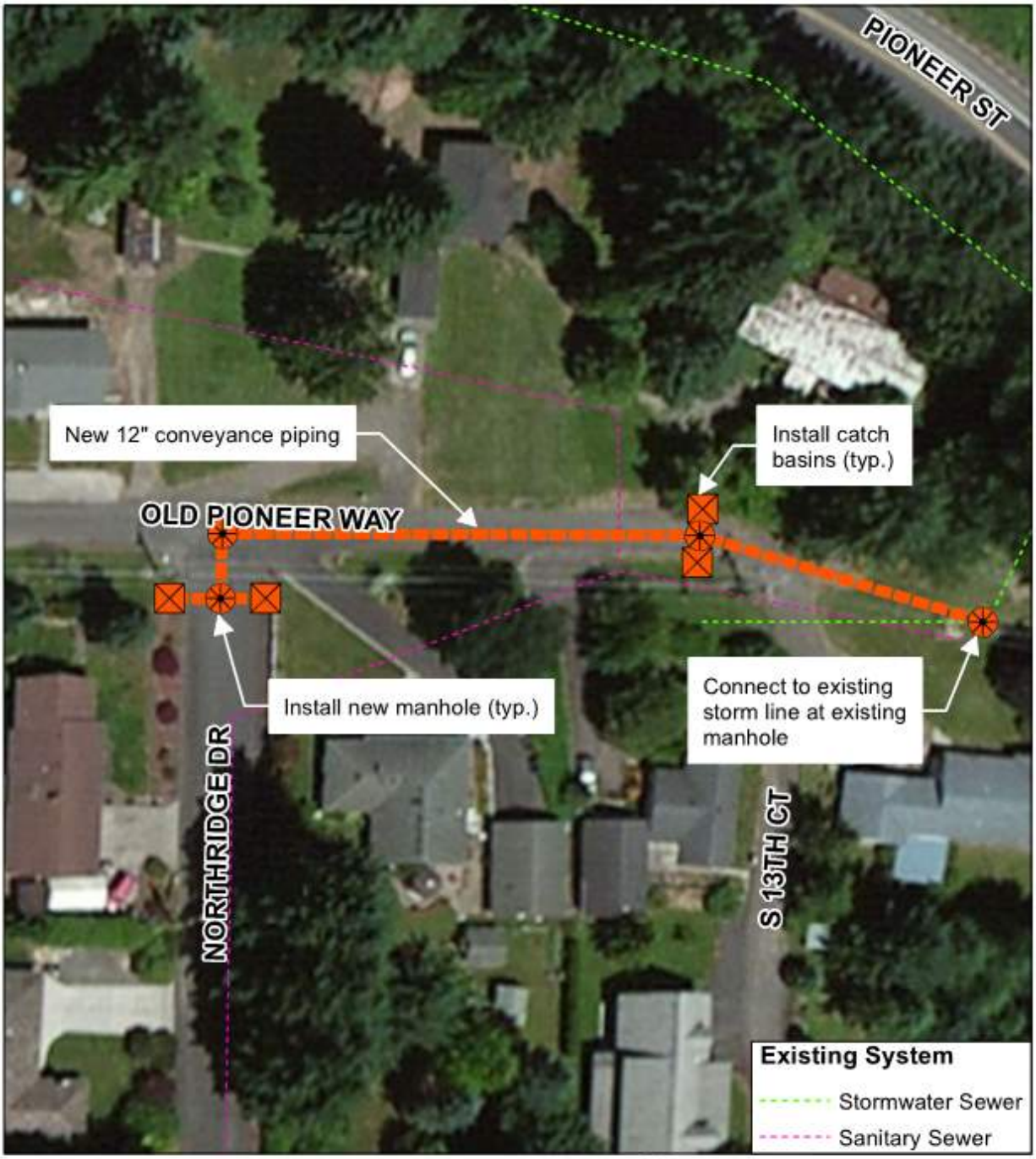
The following are the identified deficiencies of the existing system:

- No catch basins located along Northridge Drive resulting in sheet flow across Old Pioneer Way onto private property.
- One nonstandard catch basin along Old Pioneer Way is insufficient to intercept runoff.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Construct new catch basins along Northridge Drive to collect stormwater and prevent flow across Old Pioneer Way.
- Remove existing nonstandard catch basin on Old Pioneer Way and abandon any existing piping.
- Construct standard catch basins on both sides of the eastern terminus of Old Pioneer Way to prevent flow onto private property. Currently, the City requires stormwater structures to comply with Washington Department of Transportation (WSDOT) requirements.
- Connect improvements along Northridge Drive and Old Pioneer Way to the existing storm line located in Pioneer Street through an existing manhole.


PIONEER ST
New 12" conveyance piping
Install catch basins (typ.)
OLD PIONEER WAY
Install new manhole (typ.)
Connect to existing storm line at existing manhole
NORTHRIDGE DR
S 13TH CT
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Standard Catch Basin
Storm Sewer Pipe
N
0 15 30 60 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$22,000
Design (15% of construction total)*				$28,000
Permitting				$0
			Total Implementation	**$50,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$13,000
Erosion & Sed. Control	1	LS	$1,500	$1,500
Manholes	3	EA	$4,000	$12,000
Catch Basin	4	EA	$2,000	$8,000
12-in Storm Sewer Pipe	380	FT	$150	$57,000
Half Street Pavement Restoration	6,000	SF	$7	$42,000
			Construction Subtotal	**$133,500**
Planning Level Contingency (@ 35% of Const.)*				$47,000
			Construction Total	**$180,500**
Total Project Cost				**$230,500**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Nonstandard catch basin located along Old Pioneer Way

Northridge Drive looking south (no catch basins)

Project ID:	**CIP 5**	**General Location: S. Riverview Dr. and Cemetery Rd.**
Project Name:	**South Riverview Drive**	**Project Priority Rank: 5**

Problem Summary

There is a slight low point in the road at 313 South Riverview Drive. Currently, there are not any catch basins located at the sag and runoff creates a nuisance flooding issue. City reviews of the existing piping indicate that there is a pair of catch basins at the north terminus of South Riverview Drive that discharges runoff through an outfall overland west to South 9th Avenue.

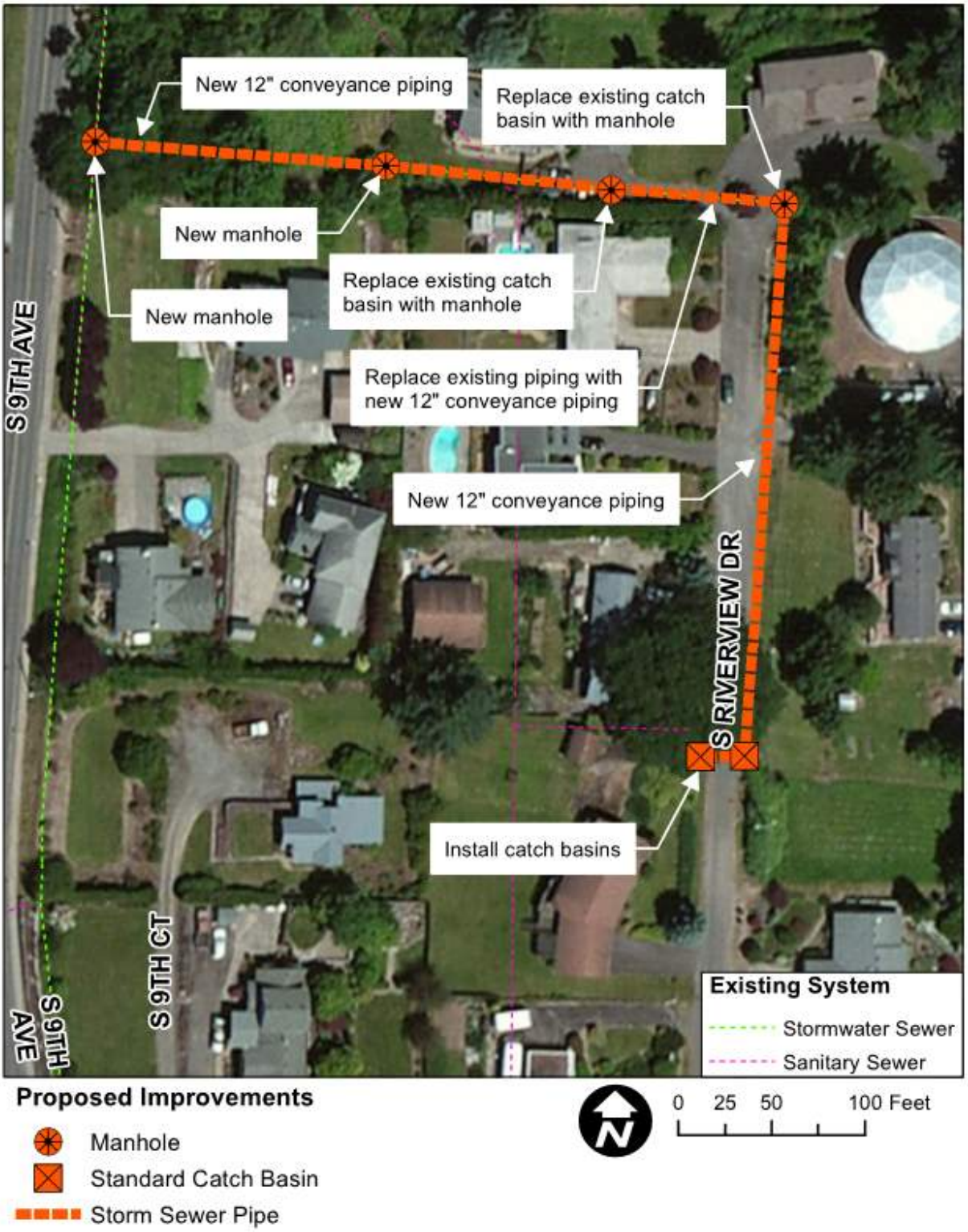
The following are the identified deficiencies of the existing system:

- No catch basins located at the low point in the road at 313 South Riverview Drive.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Construct two new catch basins at the low point on South Riverview Drive, one on either side of the crowned roadway.
- Construct new conveyance piping to the existing catch basins at the north terminus of South Riverview Drive.
- Replace the existing catch basins with grated manholes.
- The elevation of the existing conveyance pipe connected to the existing catch basins is unknown. It is assumed the elevation is not low enough for this new configuration and the pipes need to be replaced at lower elevations.
- Construct new conveyance piping to connect to the existing main in South 9th Ave and make connection with new manhole.


New 12" conveyance piping
Replace existing catch basin with manhole
New manhole
Replace existing catch basin with manhole
New manhole
Replace existing piping with new 12" conveyance piping
New 12" conveyance piping
Install catch basins
S 9TH AVE
S 9TH CT
S 9TH AVE
S RIVERVIEW DR
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Standard Catch Basin
Storm Sewer Pipe
N
0 25 50 100 Feet

Cost Estimate

Implementation

Implementation Items	*Amount*
Survey (12% construction total)*	$20,000
Design (15% of construction total)*	$25,000
Permitting	$3,000
Land Acquisition (Easement/ROW)	$25,000
Total Implementation	**$73,000**

Construction

Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$12,000
Erosion & Sed. Control	1	LS	$1,500	$1,500
Manholes	4	EA	$4,000	$16,000
Catch Basin	2	EA	$2,000	$4,000
12-in Storm Sewer Pipe	682	FT	$120	$81,840
Street Pavement Restoration	1,000	SF	$7	$7,000
Construction Subtotal				**$122,340**
Planning Level Contingency (@ 35% of Const.)*				$43,000
Construction Total				**$165,340**
Total Project Cost				**$238,340**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Existing Low Point – Photo taken from Google Street View

Project ID:	**CIP 6**	**General Location: North Pioneer Canyon Dr., west of N. 43rd Ct.**
Project Name:	**North Pioneer Canyon Drive, East Culvert**	**Project Priority Rank: 6**

Problem Summary

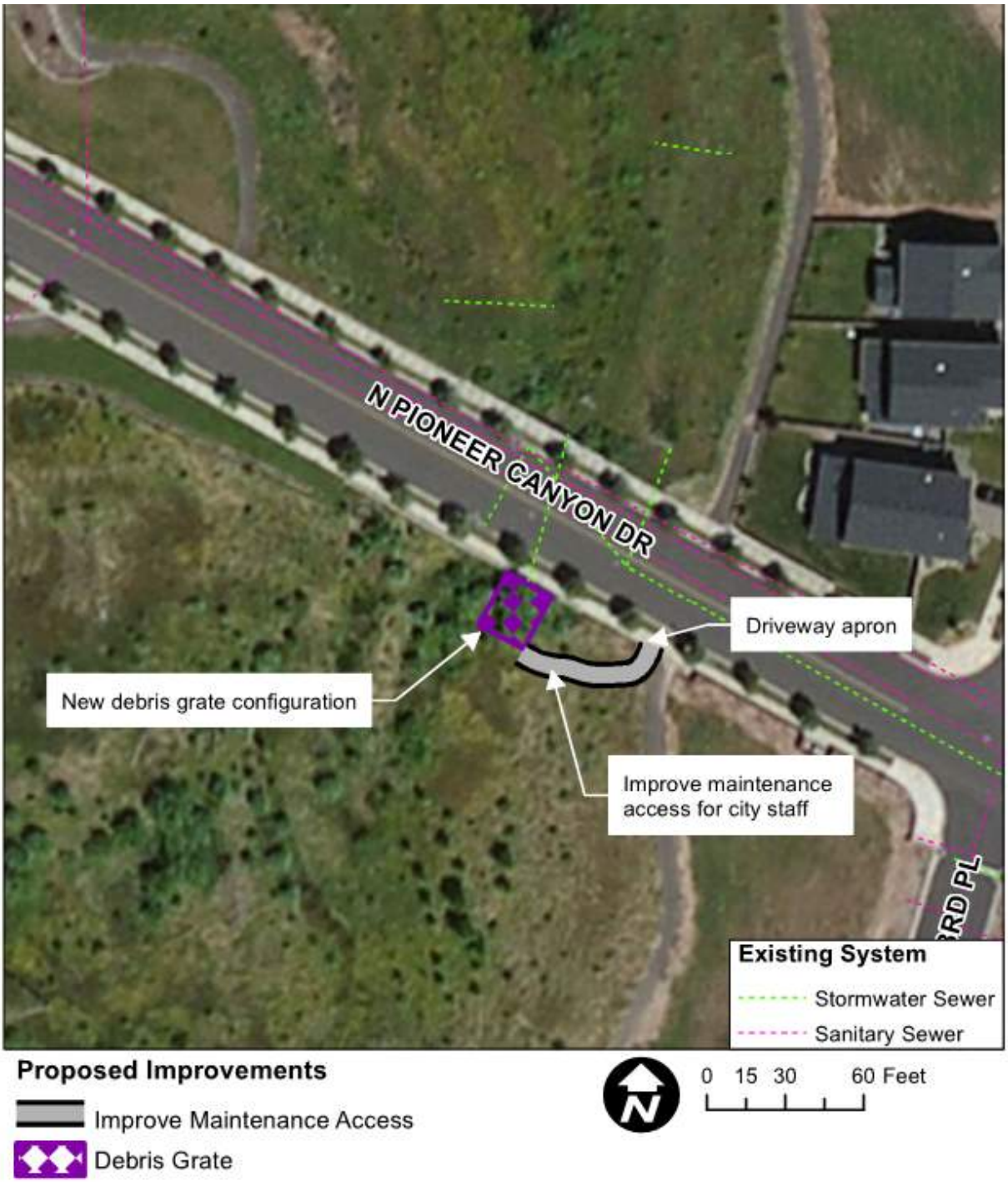
The existing culvert is located at North Pioneer Canyon Drive, west of North 43rd Court. Clogging of the culvert by debris has been an issue. A vertical grate, slightly taller and wider than the diameter of the culvert, has been installed. However, clogging at the inlet has continued to be an issue for city maintenance staff. Additionally, access to the culvert is difficult, especially during storm events. The following are the identified deficiencies of the existing system:

- Existing vertical debris grate does not adequately prevent the existing culvert from clogging during storm events.
- Access to the culvert during storm events is difficult for maintenance staff.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Construct a new custom trash rack configuration for improved debris management to minimize clogging at the inlet of the culvert. Common trash rack configurations include a sloped end piece to make it more difficult for debris to completely cover the inlet.
- Improved access path to the culvert for city maintenance staff to more easily remove debris that does accumulate.


N PIONEER CANYON DR
Driveway apron
New debris grate configuration
Improve maintenance access for city staff
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Improve Maintenance Access
Debris Grate
N
0 15 30 60 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$5,000
Design (30% of construction total)*				$12,000
Permitting				$3,000
Total Implementation				**$20,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$3,000
Erosion & Sed. Control	1	LS	$2,000	$2,000
Excavation	20	CY	$25	$500
Remove Existing Curb	1	LS	$500	$500
Debris Rack	1	EA	$10,000	$10,000
Gravel Access Road	1	LS	$8,000	$8,000
Driveway Apron	1	EA	$5,000	$5,000
Construction Subtotal				**$29,000**
Planning Level Contingency (@ 35% of Const.)*				$11,000
Construction Total				**$40,000**
Total Project Cost				**$60,000**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Difficult access path for maintenance of culvert

Existing debris grate at culvert

Project ID:	**CIP 7**	**General Location: N. Railroad Ave & N. 9th Circle**
Project Name:	**Viewport Swale**	**Project Priority Rank: 7**

Problem Summary

Runoff from the northern portion of the Viewport Subdivision is currently managed by a horseshoe swale that was designed to overflow to a series of shallow drywells connected in series with perforated pipe. The southern areas of the subdivision discharge directly to the drywell/perforated pipe system without being treated by the swale.

The horseshoe shaped swale is currently not functioning properly. A timber wall is damaged and flow can discharge directly to the adjacent railroad ditch. As-built plans for the road improvements show a drywell was constructed in the vegetated area adjacent to the swale. This drywell could not be found in the field, and the rim may have been constructed below grade. Additionally, the swale has become overgrown with invasive weeds that make access to the swale difficult.

The drywells located along North Railroad Avenue are unusually shallow and do not adequately infiltrate stormwater. Stormwater runoff currently ponds on the roadway and eventually sheet flows to the railroad ditch at a low point in the road grade.

The catch basin on the north side of North Cook Street is full of sediment and bypasses flow during frequent storm events.

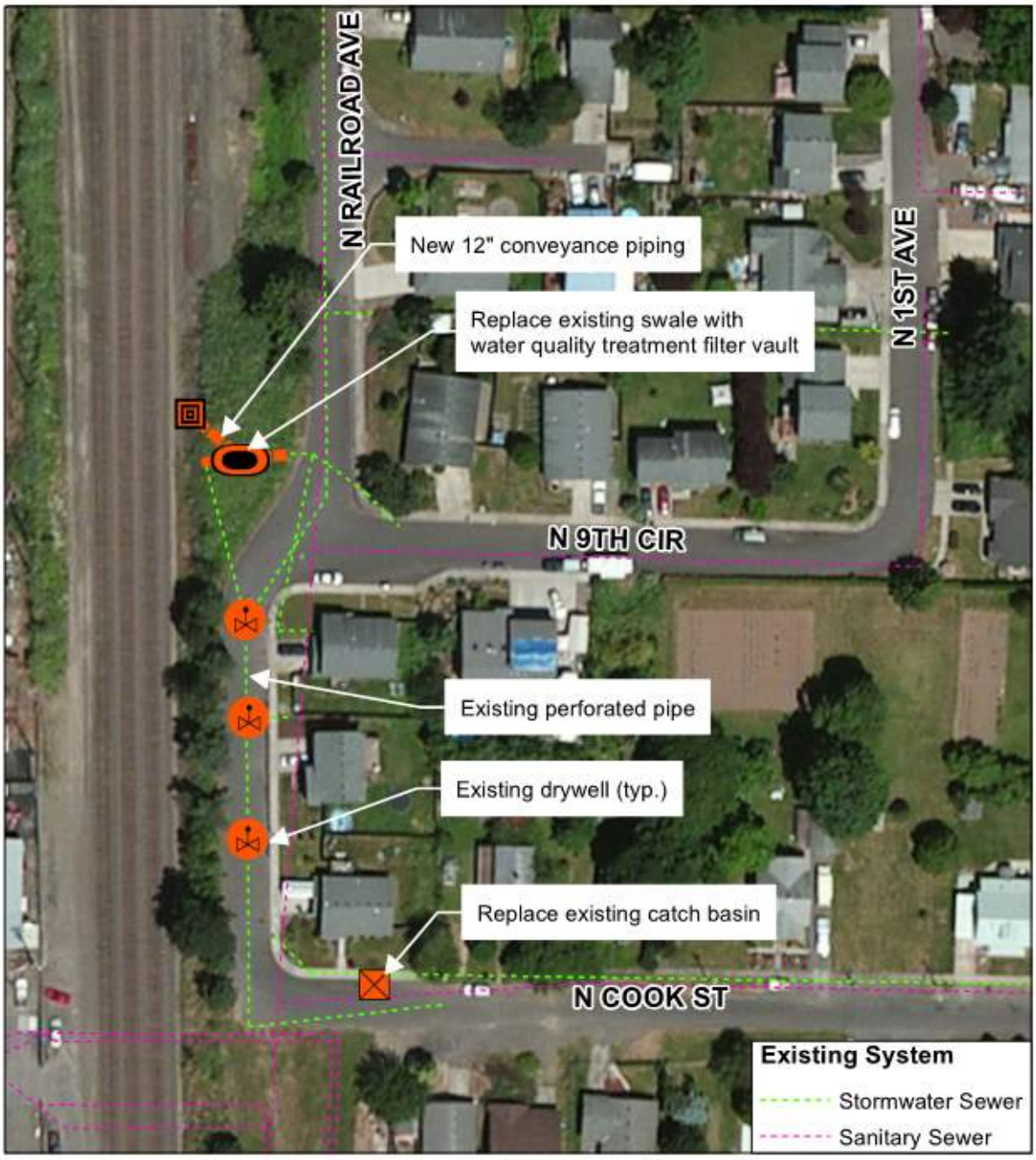
The following are the identified deficiencies of the existing system:

- The existing stormwater swale is no longer functioning and is overgrown with invasive weeds.
- The existing system of shallow drywells and perforated pipe along North Railroad Avenue does not have sufficient infiltration capacity.
- The catch basin along North Cook Street is clogged with sediment.
- As designed, runoff treatment is not being provided for the southern portion of the subdivision.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Install a new water quality filter cartridge structure in the location of the existing swale to provide runoff treatment for both the northern and southern portions of the development. Preliminary calculations show that an 8-ft wide by 16-ft long concrete vault containing approximately 35 cartridges will be needed to provide runoff treatment.
- Install new 12-inch diameter stormwater conveyance piping to connect the new filter vault to the existing system. It is assumed the existing drywells and perforated pipe will remain and provide some infiltration. Overflows will remain in the system (off the roadway) and discharge to the ditch through the new filter vault.
- Install stabilized outfall to the ditch adjacent to the railroad.


N RAILROAD AVE
N 1ST AVE
N 9TH CIR
N COOK ST
New 12" conveyance piping
Replace existing swale with water quality treatment filter vault
Existing perforated pipe
Existing drywell (typ.)
Replace existing catch basin
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Drywell
Outfall Scour Protection
Water Quality Filter Cartridge
Standard Catch Basin
Storm Sewer Pipe
N
0 25 50 100 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$16,000
Design (15% of construction total)*				$20,000
Permitting				$0
			Total Implementation	**$36,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$9,000
Erosion & Sed. Control	1	LS	$2,000	$2,000
Catch Basin	1	EA	$2,000	$2,000
Manholes	1	EA	$4,000	$4,000
12-in Storm Sewer Pipe	50	FT	$150	$7,500
Water Quality Filter Vault	1	LS	$70,000	$70,000
Outfall Scour Protection	1	EA	$2,000	$2,000
			Construction Subtotal	**$96,500**
Planning Level Contingency (@ 35% of Const.)*				$34,000
			Construction Total	**$130,500**
Total Project Cost				**$166,500**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Existing shallow drywell along North Railroad Avenue

Existing stormwater swale

Catch basin full of sediment

Project ID:	**CIP 8**	**General Location: N. 9th Ave. & Simons St.**
Project Name:	**North Simons Street**	**Project Priority Rank: 8**

Problem Summary

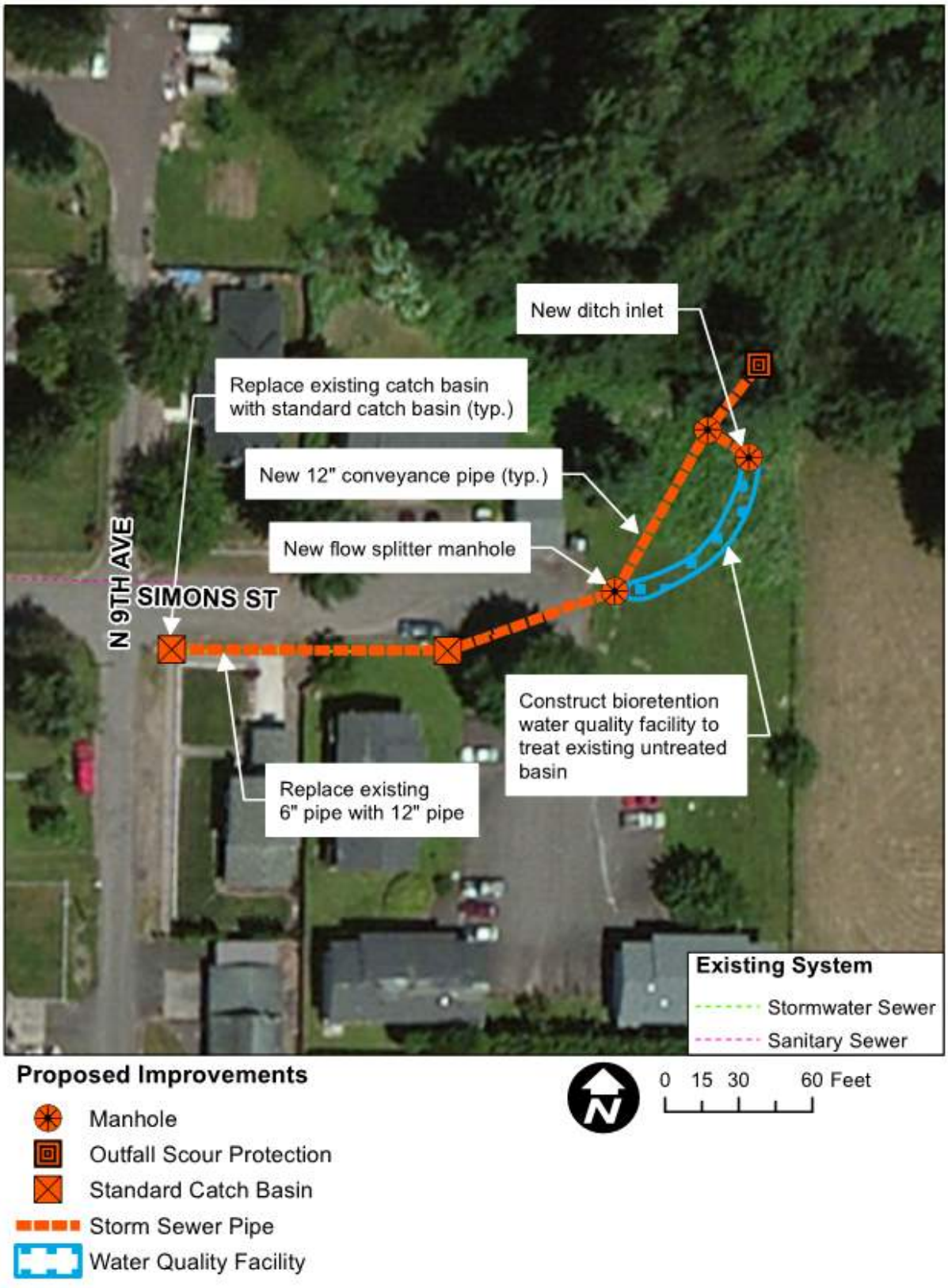
The existing stormwater system consists of two catch basins and 6-inch diameter conveyance pipes that discharge runoff towards Gee Creek. The area suffers from nuisance flooding as a result of the following deficiencies of the existing system:

- The 6-inch diameter conveyance pipes are undersized.
- The existing catch basins are substandard and do not have adequate sumps.
- The catch basins have flat grates and are located in a vegetated area, which leads to frequent clogging of the grates.
- The catch basins collect a substantial amount of sediment.
- It is possible there is a horizontal alignment change through an elbow that could also be contributing to clogging.
- The pipe outfall location is unknown, likely due to an elbow.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Hydraulic modeling completed by Gray and Osborne, Inc. for the previous stormwater master plan shows that the 6-inch diameter pipe should be replaced with 12-inch diameter pipe to increase capacity.
- The existing catch basins should be replaced with standard catch basins. Currently, the City requires stormwater structures to comply with Washington Department of Transportation (WSDOT) requirements.
- The new catch basins should include a sump for sediment collection.
- Install manholes at any horizontal alignment changes between the replaced catch basins and the outfall towards Gee Creek.
- Add outfall protection to prevent erosion.


New ditch inlet
Replace existing catch basin with standard catch basin (typ.)
New 12" conveyance pipe (typ.)
New flow splitter manhole
N 9TH AVE
SIMONS ST
Construct bioretention water quality facility to treat existing untreated basin
Replace existing 6" pipe with 12" pipe
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Outfall Scour Protection
Standard Catch Basin
Storm Sewer Pipe
Water Quality Facility
N
0 15 30 60 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$15,000
Design (20% of construction total)*				$25,000
Permitting				$3,000
			Total Implementation	**$43,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$9,000
Erosion & Sed. Control	1	LS	$3,000	$3,000
Excavation	110	CY	$25	$2,750
Catch Basin	2	EA	$2,000	$4,000
Ditch Inlet	1	EA	$3,000	$3,000
Manholes	2	EA	$4,000	$8,000
12-in Storm Sewer Pipe	320	FT	$150	$48,000
Outfall Scour Protection	1	EA	$2,000	$2,000
Water Quality Media	45	CY	$50	$2,250
Biodegradable Geotextile	800	SF	$5	$4,000
Planting	800	SF	$5	$4,000
			Construction Subtotal	**$90,000**
Planning Level Contingency (@ 35% of Const.)*				$32,000
			Construction Total	**$122,000**
Total Project Cost				**$165,000**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

N. Simons St. looking south – Photo taken from Google

N. Simons St. looking east

Project ID:	**CIP 9**	**General Location: Pioneer St. and S. Gee Creek Loop**
Project Name:	**Gee Creek Loop**	**Project Priority Rank: 9**

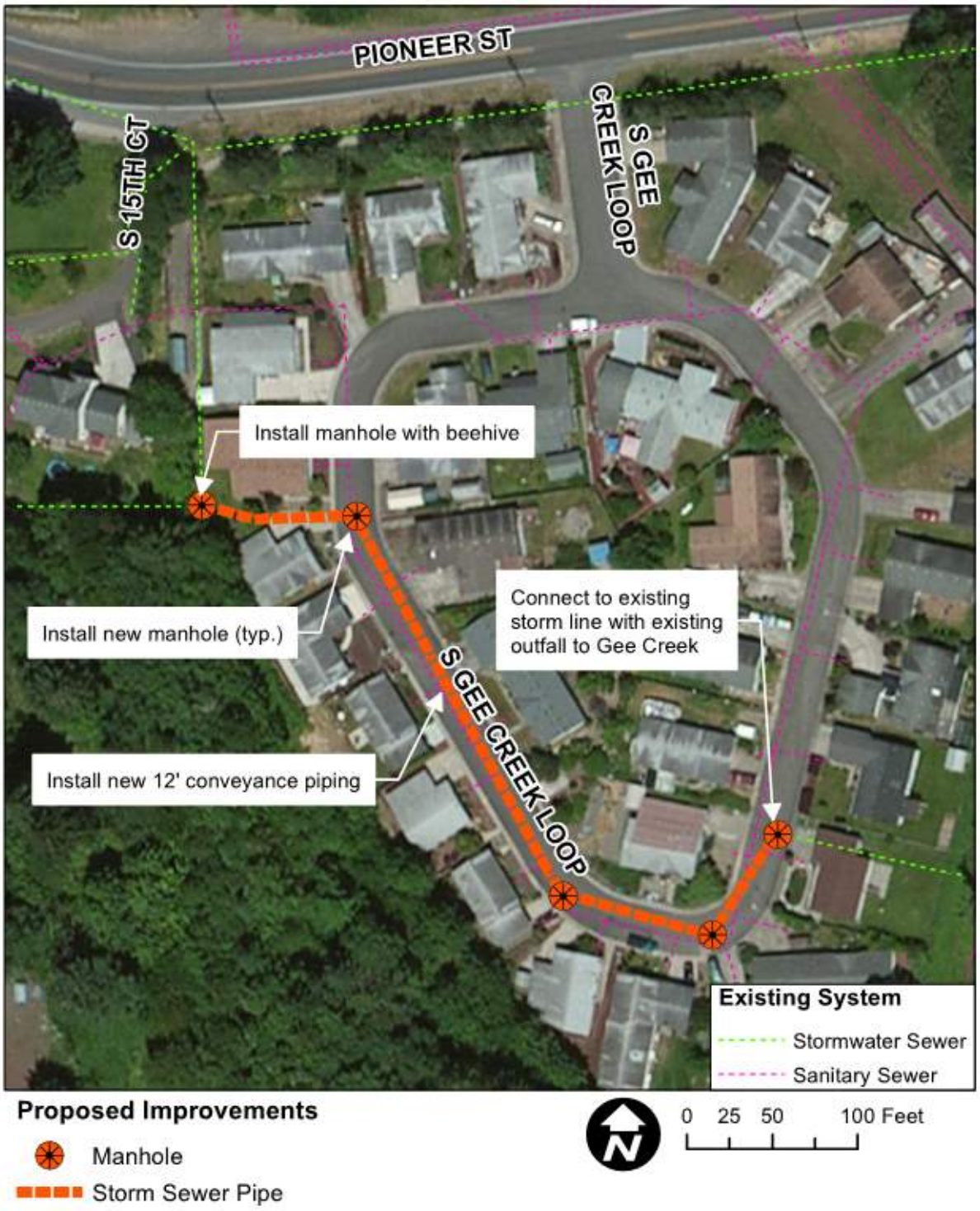
Problem Summary

An existing ditch originates in the backyard of a home located uphill of the Gee Creek Loop development. The ditch flows down a steep slope, in a relatively shallow channel that terminates at a nonstandard catch basin at the base of the slope in the Gee Creek Loop development. The slope is experiencing erosion and the catch basin regularly becomes clogged. The catch basin is located in the backyard of a Gee Creek Loop home and is difficult to access for maintenance. Additionally, the catch basin is connected to a conveyance pipet that is located across several other backyards and discharges to a stormwater main at Pioneer St.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Replace the existing catch basin with a manhole and beehive grate.
- Regrade immediate area to form a slight depression to allow for debris to settle out and increase the available freeboard at the inlet.
- Install new conveyance piping connecting the new beehive manhole to an existing outfall to Gee Creek located on the eastern side of Gee Creek Loop.
- Half-street pavement restoration where the new pipe is constructed.


PIONEER ST
S 15TH CT
S GEE CREEK LOOP
Install manhole with beehive
Install new manhole (typ.)
Connect to existing storm line with existing outfall to Gee Creek
Install new 12' conveyance piping
S GEE CREEK LOOP
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Storm Sewer Pipe
N
0 25 50 100 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$24,000
Design (15% of construction total)*				$30,000
Permitting				$3,000
			Total Implementation	**$57,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$14,000
Erosion & Sed. Control	1	LS	$1,500	$1,500
Manholes	5	EA	$4,000	$20,000
12-in Storm Sewer Pipe	500	FT	$150	$75,000
Half Street Pavement Restoration	5,000	SF	$7	$35,000
			Construction Subtotal	**$145,500**
Planning Level Contingency (@ 35% of Const.)*				$51,000
			Construction Total	**$196,500**
Total Project Cost				**$253,500**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Nonstandard inlet structure

View of conveyance pipe alignment looking east

Project ID:	**CIP 10**	**General Location: Pioneer St. and Mill St.**
Project Name:	**Lake River Outfall**	**Project Priority Rank: 10**

Problem Summary

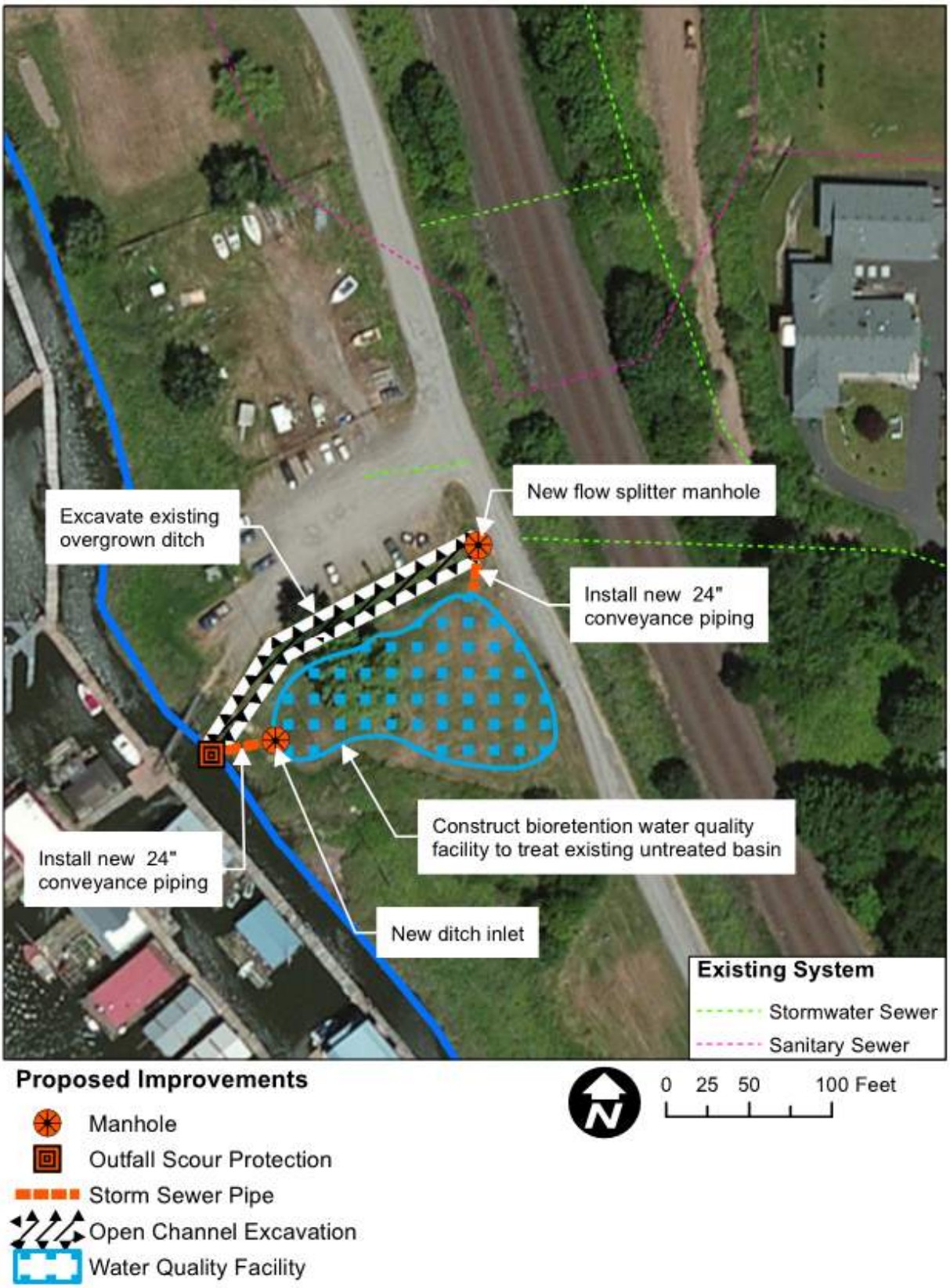
The project site is located south of Mill Street and west of the railroad tracks on a parcel owned by McCuddy's Marina. There is an existing culvert that conveys stormwater underneath the railroad tracks from downtown to the site. An overgrown ditch conveys the stormwater runoff from the culvert to Lake River. There is a large piece of undeveloped private property located adjacent to the conveyance ditch. The following are the identified deficiencies of the existing system:

- There is not any water quality treatment being provided for this downtown subbasin.
- The existing conveyance ditch is overgrown.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Construct a bioretention water quality facility to provide water quality treatment for the existing untreated basin.
- Construct a flow splitter manhole to direct water quality storm events to the new stormwater facility.
- Excavate the existing ditch to provide improved conveyance of stormwater flows.
- Replant the ditch with vegetation that will provide erosion protection and be easy to maintain for conveyance.
- Improve existing ditch outfall to include water quality facility overflows and prevent erosion.


Excavate existing overgrown ditch
New flow splitter manhole
Install new 24" conveyance piping
Construct bioretention water quality facility to treat existing untreated basin
Install new 24" conveyance piping
New ditch inlet
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Outfall Scour Protection
Storm Sewer Pipe
Open Channel Excavation
Water Quality Facility
N
0 25 50 100 Feet

Cost Estimate

Implementation				
Implementation Items				*Amount*
Survey (12% construction total)*				$39,000
Design (12% of construction total)*				$39,000
Permitting				$8,000
Land Acquisition (Easement/ROW)				$80,000
Total Implementation				**$166,000**
Construction				
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$22,000
Erosion & Sed. Control	1	LS	$3,000	$3,000
Excavation	1333	CY	$25	$33,325
Ditch Inlet	1	EA	$3,000	$3,000
Manholes	1	EA	$4,000	$4,000
24-in Storm Sewer Pipe	50	FT	$250	$12,500
Outfall Scour Protection	1	EA	$2,000	$2,000
Ditch Stabilization	1	LS	$2,000	$2,000
Water Quality Media	670	CY	$50	$33,500
Biodegradable Geotextile	12,000	SF	$5	$60,000
Planting	12,000	SF	$5	$60,000
Construction Subtotal				**$235,325**
Planning Level Contingency (@ 35% of Const.)*				$83,000
Construction Total				**$318,325**
Total Project Cost				**$484,325**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Location for proposed water quality facility

Existing overgrown conveyance ditch

Project ID:	**CIP 11**	**General Location: Division St. & Abrams Park Rd.**
Project Name:	**Abrams Park**	**Project Priority Rank: 11**

Problem Summary

The existing stormwater system that conveys runoff through Abrams Park consists of open channels, ditch inlets, and a conveyance pipe. The system conveys runoff from the park and the steep, forested slope north of the park to Gee Creek. Additionally, the stormwater pond (referred to as Falcon Pond) located at the top of the slope, manages runoff from Bellwood Heights and discharges to Gee Creek via the Abrams Park stormwater system.

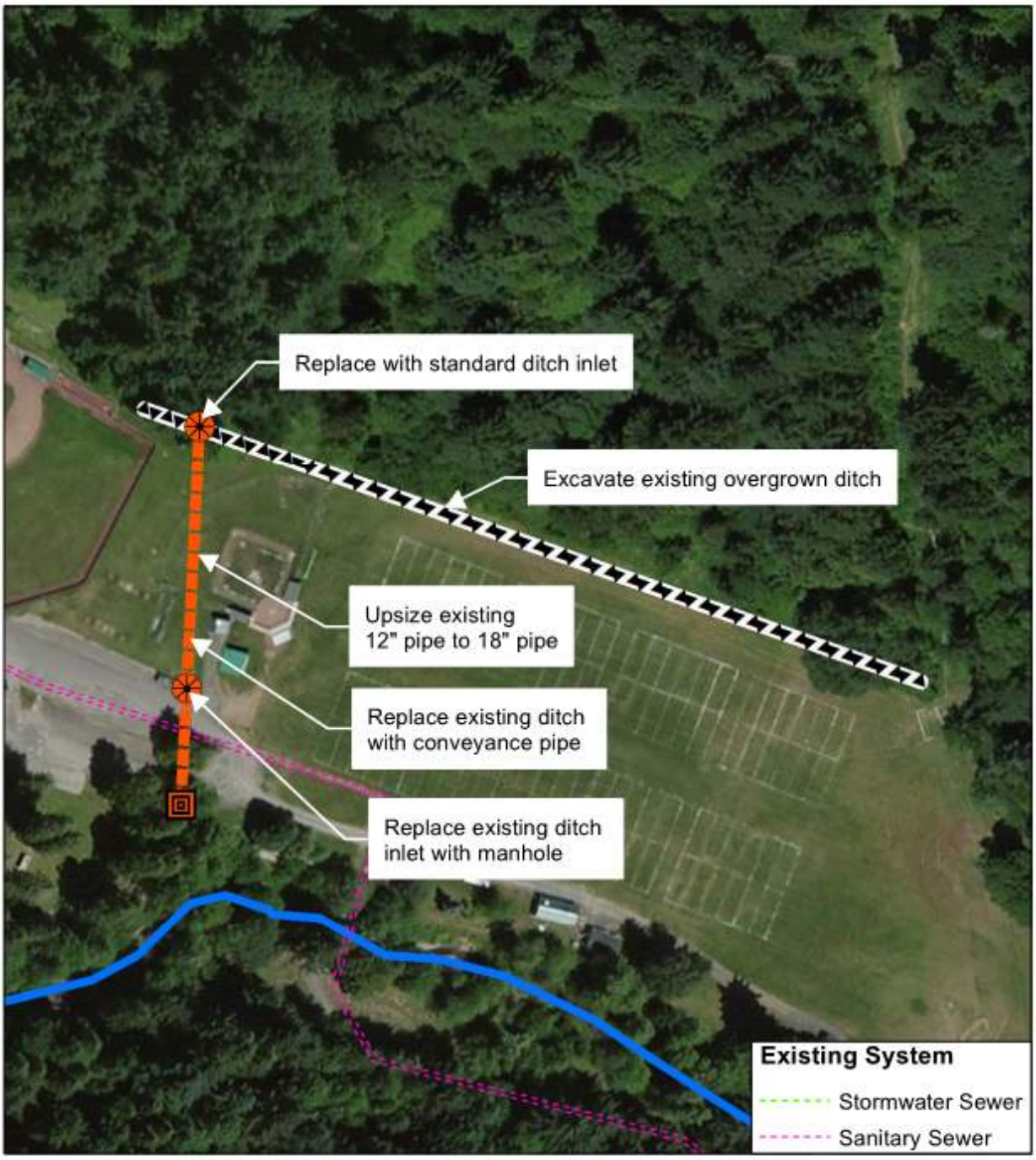
The area suffers from nuisance flooding that is the result of the following deficiencies of the existing system:

- The 12-inch conveyance pipe is undersized.
- There is dense vegetation in the ditch that reduces conveyance capacity.
- The existing ditch inlets are substandard and hydraulically inefficient.

Proposed Improvements

The following improvements are proposed to address the deficiencies of the existing system:

- Hydraulic modeling completed by Gray and Osborne, Inc. for the previous stormwater master plan shows that the 12-inch diameter pipe should be replaced with 18-inch diameter pipe to increase capacity.
- The existing non-standard ditch inlets should be replaced with standard ditch inlets.
- The section of ditch north of the ball field should be excavated to remove overgrown vegetation and excess sediment.
- Replant the ditch north of the ball field with vegetation that will provide erosion protection and be easy to maintain for conveyance.
- The section of ditch south of the ball field should be piped through a new 18-inch pipe to Gee Creek, which would improve conveyance efficiency.
- Pavement restoration where the new pipe crosses the existing parking lot.
- Outfall protection to dissipate hydraulic energy where conveyance pipe daylights at Gee Creek.


Replace with standard ditch inlet
Excavate existing overgrown ditch
Upsize existing 12" pipe to 18" pipe
Replace existing ditch with conveyance pipe
Replace existing ditch inlet with manhole
Existing System
Stormwater Sewer
Sanitary Sewer
Proposed Improvements
Manhole
Outfall Scour Protection
Storm Sewer Pipe
Open Channel Excavation
N
0 40 80 160 Feet

Cost Estimate

Implementation

Implementation Items	*Amount*
Survey (12% construction total)*	$15,000
Design (15% of construction total)*	$19,000
Permitting	$5,000
Total Implementation	**$39,000**

Construction

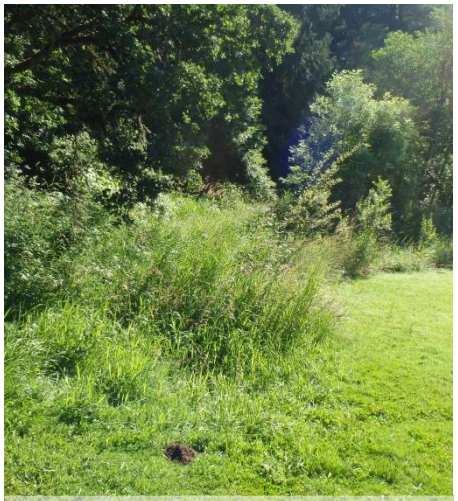
Construction Items	*Qty.*	*Unit*	*Unit Price*	*Amount*
Mobilization (10% of construction items)*				$9,000
Erosion & Sed. Control	1	LS	$2,000	$2,000
Ditch Inlets	1	EA	$3,000	$3,000
Manholes	1	EA	$4,000	$4,000
Outfall Scour Protection	1	EA	$2,000	$2,000
18-in Storm Sewer Pipe	320	FT	$180	$57,600
Parking Lot Pavement Restoration	400	SF	$7	$2,800
Ditch Excavation	160	CY	$35	$5,600
Ditch Stabilization	1	LS	$5,000	$5,000
Construction Subtotal				**$91,000**
Planning Level Contingency (@ 35% of Const.)*				$32,000
Construction Total				**$123,000**
Total Project Cost				**$162,000**

* Amounts calculated on a percentage basis are rounded up to the nearest $1,000

Photos of Existing Project Area

Outfall of 12-inch pipe under ball field

Nonstandard ditch inlet south of ball field



Overgrown ditch

Appendix D-2

Program Analysis

Ridgefield Stormwater Regulatory Requirements Analysis

October 31, 2017

Requirements Summary			Current Program Description	Recommendation
NPDES Phase II Municipal Stormwater Permit				
Sub-Requirement	**Description**	**Status**	**Current Program Description**	**Discussion and Recommendation**
NPDES Phase II Permit Element #S5.C.1, Public Education and Outreach				
Outreach and Education	The Phase II NPDES municipal stormwater permit requires an education and outreach program designed to reduce or eliminate behaviors and practices that cause or contribute to adverse stormwater impacts and encourage the public to participate in stewardship activities. Recent permit requirements have focused on changing behaviors of target audiences, measuring adoption of these behaviors, educating the development and building community about LID, and creating stewardship opportunities.	Potential Future Requirement	The City does not have a formal program, but does engage in occasional outreach to the general public. Ridgefield is also a member of the Stormwater Partners of SW Washington consortium, which offers guidance on stormwater facility maintenance to private parties in Clark County. The 2008 Comprehensive Stormwater Management Plan (CSWMP) recommended a public involvement and education program to engage the general public focusing on the following activities: voluntary ditch maintenance; catch basin stenciling; oil recycling center; newsletter articles; citizen hotline; and neighborhood compost bin.	The City's current program provides a foundation for meeting this requirement in the future, but likely will need to be expanded. Specific future requirements are unknown at this time. It is recommended that the City continue its current outreach activities. Rely on the Stormwater Partners web site and publications as part of an effort to increase participation and improve results of private stormwater facility maintenance by property owners and homeowner associations (see Permit Element S5.C.4).
NPDES Phase II Permit Element #S5.C.2, Public Involvement and Participation				
Public Involvement	Permittees shall provide ongoing opportunities for public involvement and participation through advisory councils, public hearings, watershed committees, participation in developing rate-structures or other similar activities. Each Permittee shall comply with applicable state and local public notice requirements when developing elements of the SWMP. The SWMP must be posted to the City's website each year.	Potential Future Requirement	City Council and the Planning Commission consider changes to ordinances, fees, and plans that impact stormwater management in Ridgefield and offer opportunities for public input. The City posts the current CSWMP, which is updated periodically, on the Stormwater and Wastewater web page on the City's web site.	The City's current program provides a foundation for meeting this requirement in the future, but may need to be expanded. Future requirements are likely to be substantially similar to requirements in the current permit. No change is recommended at this time.
NPDES Phase II Permit Element #S5.C.3, Illicit Discharge Detection and Elimination				
Storm Sewer System Map	New permittees generally must meet a deadline for mapping the storm sewer system within a couple of years. Recent permit requirements have specified mapping outfalls, tributary conveyances to outfalls greater than 24-in diameter, treatment and flow control facilities, and connections to the system (e.g. private system connection to a City pipe). Mapping of the MS4 must then continue on an ongoing basis.	Potential Future Requirement	The City has an electronic storm sewer map in a geographic information system (GIS) which inventories conveyances, catch basins/inlets, and water quality and detention facilities. A separate map shows most outfalls to receiving waters, although no attributes other than location are recorded.	The City's current program provides a foundation for meeting this requirement in the future, but will need to be expanded. Future requirements are likely to be substantially similar to requirements in the current permit. It is recommended the City continue its current activities. To prepare for future requirements, it is recommended the City a) identify and map all outfalls to receiving waters, including attributes such as coordinates and pipe diameter, and b) develop a procedure to document all new connections to the MS4 from private storm sewers as part of the development review process.
Prohibit Illicit Discharges	New permittees generally must prohibit, through ordinance or other regulatory mechanism, non-stormwater, illicit discharges into the Permittee's MS4 to the maximum extent allowable under state and federal law within a couple of years.	Potential Future Requirement	The 2008 CSWMP indicates the City has an ordinance controlling discharges into the storm sewer; however a review of City Codes does not reveal such a prohibition.	Prohibiting illicit discharges and illicit connections to the City's MS4 is good practice, regardless of the City's Phase II permit coverage status. Washington's Water Pollution Control Act (RCW 90.48) prohibits any person or entity from discharging or allowing to be discharged into any water of the state any substance that causes, or tends to cause, pollution of the water (RCW 90.48.080). The City's MS4 outfalls to waters of the state. The City would benefit from establishing clear authority to regulate the types of connections to and the types of materials that can be discharged into its MS4, since the City could become responsible for discharge of polluting substances to waters of the state. An illicit discharge/connection ordinance provides this protection. It is recommended to adopt an ordinance prohibiting illicit connections and illicit discharges to the City's MS4.
Detect and Eliminate Illicit Discharges and Connections	Each Permittee shall implement an ongoing program designed to detect and identify non-stormwater discharges and illicit connections into the Permittee's MS4. Permittees are required to select a field screening method to detect illicit discharge and connections, and must train all City field staff to recognize and report potential discharges (e.g. spills, dumping). New permittees generally are required to screen a percentage of the MS4 by the end of the permit term. Permittees must have a progressive enforcement program to address illicit discharges and connections that are discovered, and must meet timelines for responding to illicit discharges and connections. All illicit connections must be eliminated.	Potential Future Requirement	The City has a tentative plan to begin conducting dry-weather screening of outfalls to detect non-stormwater discharges in 2018.	The City's tentative plan, if implemented, will provide a good foundation for meeting this requirement in the future. To make the best use of this preparatory step, it is recommended that the City select a field screening method approved by Ecology. Two manuals for consideration are the *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments* , Center for Watershed Protection, 2004; or *Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual* , Washington State Department of Ecology, 2013.

Sub-Requirement	Description	Status	Current Program Description	Discussion and Recommendation
Staff Training and Recordkeeping	Train staff who are responsible for identification, investigation, termination, cleanup, and reporting of illicit discharges, including spills, and illicit connections, to conduct these activities. Follow- up training shall be provided as needed to address changes in procedures, techniques, requirements or staffing. Permittees shall document and maintain records of the training provided and the staff trained. Track and maintain records of activities conducted pursuant to these requirements.	Potential Future Requirement	None.	It is recommended that staff are trained prior to conducting field screening activities. The Washington Stormwater Center offers a series of 14 training videos on the field screening and source tracing methods described in the *Illicit Connection and Illicit Discharge Field Screening and Source Tracing Guidance Manual* , Washington State Department of Ecology, 2013.
Permit Element #S5.C.4, Controlling Runoff from New Development, Redevelopment, and Construction Sites				
Stormwater Runoff Control Ordinance	Permittees are required to regulate construction stormwater discharges and post-construction stormwater discharges into their storm sewer by adopting and enforcing an ordinance and stormwater technical manual that is equivalent to Appendix 1 of the NPDES Phase II municipal stormwater permit. Adopted requirements must apply to construction and development sites that meet certain thresholds of land disturbance and/or new and replaced hard surfaces. Appendix 1 describes nine minimum technical requirements that cities must require on construction and development sites. New permittees generally must reach this goal within a few years.	Potential Future Requirement	The 2004 City of Ridgefield Ordinance 840 adopted standards to minimize erosion from land development and land-disturbing activities. This ordinance is codified as Ridgefield Municipal Code Chapter 18.755, Erosion Control. Generally, these standards require best management practices to prevent and control erosion and sedimentation in accordance with the 1992 Puget Sound Manual, Volume II. Volume I, Design and Planning, of the City's 2017 Engineering Standards for Public Works Construction requires use of the 2005 Stormwater Management Manual for Western Washington (SWMMWW) for design of water quality and water quantity control facilities. The City modifies the requirements of the 2005 SWMMWW by modifying the thresholds of development (e.g. creation of impervious surfaces) that trigger stormwater management requirements and by allowing the use of a peak-flow matching method (Santa Barbara Urban Hydrograph) for use in sizing runoff facilities. [The 2005 SWMMWW requires use of a continuous simulation hydrology model to size facilities to match predevelopment flow durations.] The City allows use of low impact development in accordance with the 2005 Low Impact Development Technical Guidance Manual for Puget Sound.	The most common way to meet this requirement among Phase II permittees is to adopt the current state stormwater manual. In 2017, the current manual is the 2014 Stormwater Management Manual for Western Washington. With its recent adoption of the 2005 SWMMWW for facility design, Ridgefield has made strides toward achieving the state standard. As noted, the City modifies the requirements of the 2005 SWMMWW by modifying the thresholds of development (e.g. creation of impervious surfaces) that trigger stormwater management requirements and by allowing the use of a peak-flow matching method (Santa Barbara Urban Hydrograph) for use in sizing runoff facilities. [The 2005 SWMMWW requires use of a continuous simulation hydrology model to size facilities to match predevelopment flow durations.] The State's 2014 SWMMWW contains an additional requirement to use LID site design techniques and stormwater BMPs that is not required by the 2005 SWMMWW. To prepare for coverage under the Phase II permit, it is recommended the City continue to use the 2005 SWMMWW for facility design. Between now and the anticipated time of permit coverage, it is recommended the City phase in a requirement to use a continuous simulation hydrology model and a flow duration matching method for sizing runoff facilities. The method is required by Clark County and the cities of Battle Ground, Camas, Vancouver, and Washougal. It is recommended the City encourage the use of LID site design and BMPs to reduce effective impervious area in development and redevelopment, thus reducing the size of runoff facilities through modeling credits.
Site Plan Review and Permitting	Enforcement of the above-mentioned ordinance and stormwater technical manual must include a permitting process with site plan review, inspection, and enforcement.	Potential Future Requirement	The Engineering Division reviews development applications that propose 5,000 sf of new impervious surfaces to ensure that standards are applied.	The stormwater plan review processes in place provide a good foundation for meeting future requirements. No changes are recommended at this time.
Long Term Operation and Maintenance	Permittees must have a program with provisions to verify adequate long-term operation and maintenance (O&M) of privately-owned and/or privately-operated stormwater treatment and flow control BMPs/facilities that are permitted and constructed pursuant to the above-mentioned ordinance and stormwater technical manual.	Potential Future Requirement	Appendix C of the 2008 CSWMP establishes and inspection schedule and maintenance standards based on Clark County's standards from the late 1990's. The City does not necessarily follow these standards for inspection and maintenance of private stormwater facilities. As of the writing of this analysis, the Public Works Department has an unwritten plan to verify maintenance of privately-owned stormwater systems that connect to the MS4. The initial goal is to inspect each private facility and to contact and work with homeowner associations as necessary to bring facilities up to maintenance standards. After an initial round is completed, the City's goal is to inspect private facilities every six months to one year. The City has informally begun to use the maintenance standards in the 2005 SWMMWW for this effort. The 2017 Engineering Standards for Public Works Construction requires easement for private stormwater facilities.	The City's plan, if implemented, will provide a good foundation for meeting this requirement in the future and may exceed requirements in some respects. A six-month inspection frequency for treatment or flow control facilities, for example, exceeds required frequencies in the current MS4 permit. A requirement to enclose private stormwater facilities on an easement allows the City access it needs to inspect facilities. To prepare for coverage under the Phase II permit, it is recommended that the City document its private facility inspection program.
Staff Training	Staff who review, inspect, or enforce stormwater technical requirements must be adequately trained to do so.	Potential Future Requirement	Staff are trained on the job. Reviews of stormwater site plans containing engineered facilities are completed by a Professional Engineer. One construction site inspector has obtained a Certified Erosion and Sediment Control Lead (CESCL) certification.	The City's current practices likely meet this potential future requirement and should be continued.

Ridgefield Stormwater Regulatory Requirements Analysis

October 31, 2017

Sub-Requirement	Description	Status	Current Program Description	Discussion and Recommendation
Low Impact Development Requirements	The 2013-2018 Phase II permit required cities to review local development-related codes, rules, standards, or other enforceable documents to incorporate and require LID principles and LID BMPs and to remove barriers to the use of LID principles. The intent of the revisions shall be to make LID the preferred and commonly-used approach to site development. The revisions shall be designed to minimize impervious surfaces, minimize native vegetation loss, and minimize stormwater runoff in all types of development situations.	Potential Future Requirement	The City has not conducted a formal review of codes and standards to identify barriers to and opportunities for LID. The Engineering Standards for Public Works Construction encourage the use of LID in development, and the City has allowed bioretention in the street rights-of-way on a case-by-case basis.	The City's current practices provide a good foundation for meeting this requirement in the future. To further prepare, it is recommended The City routinely incorporate consideration of measures to minimize impervious surfaces, minimize loss of native vegetation, and minimize stormwater runoff whenever the City revises any development-related codes and standards. A review of *Integrating LID into Local Codes: A Guidebook for Local Governments* (Puget Sound Partnership, 2012) will provide ideas as to the types of measures that could be considered.
Watershed-scale Stormwater Planning	In the 2013-2018 Phase II permit, some cities were effectively required to participate in a watershed-scale stormwater planning process implemented by a Phase I permittee County, if a watershed under planning consideration crossed into the boundaries of the Phase II permittee.	Potential Future Requirement	Not applicable.	The likelihood of a similar requirement being included in the next issuance of the Phase II permit is unknown. In the current Phase I permit term, Clark County, a Phase I permittee, chose to plan for the Whipple Creek watershed, which is south of Ridgefield.
NPDES Phase II Permit Element #S5.C.5, Municipal Operations and Maintenance				
Establish Maintenance Standards	Permittees are required to adopt and use maintenance standards for catch basins, treatment facilities, and flow control BMPs/facilities that are as protective, or more protective, of facility function than those specified in the most current state stormwater technical manual. Permittees must meet timelines for maintaining catch basins and facilities ranging from 6 months to 2 years. New permittees generally must adopt and begin using these standards within a few years.	Potential Future Requirement	Appendix C of the 2008 CSWMP establishes maintenance standards based on Clark County's standards from the late 1990s. The City does not necessarily follow these standards for inspection and maintenance of its own stormwater facilities.	It is recommended that the City document its inspection program and select published maintenance standards that have been approved by Ecology in the current or a previous Phase II permit cycle. The 2005 Stormwater Management Manual for Western Washington would meet this recommendation.
Annual Inspections of Treatment and Flow Control Facilities	Permittees must annually inspect all municipally owned or operated permanent stormwater treatment and flow control BMPs/facilities, and take appropriate maintenance actions in accordance with the adopted maintenance standards. With a sufficiently long record of annual inspections that demonstrate that a lesser frequency is needed, maintenance schedules can be reduced. New permittees generally must begin the annual inspection program within a few years. If an inspection indicated maintenance is needed, maintenance must be done within timelines specified above.	Potential Future Requirement	Appendix C of the 2008 CSWMP includes a proposed inspection and maintenance schedule. The City does not necessarily follow the inspection schedule. As of the writing of this analysis, the City has an unwritten plan to inspect its own treatment and flow control facilities annually.	The City's current plan, if implemented, would meet the required inspection frequency of the current Phase II permit.
Spot Checks	Permittees are required to conduct spot checks of potentially damaged permanent stormwater treatment and flow control BMPs/facilities after major storm events.	Potential Future Requirement	The City keeps a list of problem areas and checks them after storms.	The City's current program meets the requirements of the current Phase II permit.
Catch Basin Inspection	Permittees must inspect all catch basins and inlets owned or operated by the Permittee. The specific scheduled performance measure is specified in each permit, but generally requires each one to be inspected at least once during the permit term for new permittees. Generally a schedule of inspection once per two years for continuing permittees is required. Inspections must use adopted maintenance standards. If inspection indicates maintenance is needed, maintenance must be achieved within timelines specified above.	Potential Future Requirement	Appendix C of the 2008 CSWMP includes a proposed inspection schedule and maintenance standards based on Clark County's standards from the late 1990's. The City does not necessarily follow these standards for inspection and maintenance of catch basins. The City has an unwritten plan to inspect its catch basins every year. The City contracts with WSDOT to clean catch basins when needed.	The City's current plan, if implemented, would exceed the required inspection frequency of the current Phase II permit for new permittees. Because regular catch basin cleaning can reduce sedimentation and siltation of downstream conveyances and culverts, which can be more expensive to inspect and clean, it is recommended that the City implement its plan to inspect catch basins every year. It is recommended the City adopt an adaptive management approach and modify the inspection schedule as warranted based on a review of patterns in the maintenance record.
Municipal Maintenance to Reduce Stormwater Impacts	Permittees must implement practices, policies and procedures to reduce stormwater impacts associated with runoff from all lands owned or maintained by the Permittee, including streets and roads. The following (selected) activities and others listed in the permit must be conducted in a manner that reduces stormwater impacts: • Cleaning of pipes, culverts, and ditches • Street cleaning and ROW vegetation management • Road repair and resurfacing, including pavement grinding, and striping • Snow and ice control • Utility installation • Sediment and erosion control • Landscape maintenance and vegetation disposal, including use of fertilizers, pesticides, herbicides • Trash and pet waste management • Building exterior cleaning and maintenance	Potential Future Requirement	Appendix C of the 2008 CSWMP includes a maintenance program for operation and maintenance activities. It includes BMPs for road operation and maintenance and vegetation and pest management. Road operations BMPs are based on several manuals from the region dating from the late 1990s, such as ODOT's manual and King County's manual. Vegetation management BMPs are based on the City of Portland Parks Pest Management Policy of 1999. The City is not necessarily following Appendix C. The City is reducing stormwater impacts of its lands and maintenance management practices as follows: • Sweeping arterial streets twice annually • Sweeping neighborhood streets annually • Using erosion control BMPs for road repair projects • Properly disposing of wastes from street sweeping, ditch maintenance, and drainage system cleaning • Pesticides and herbicides are applied by licensed applicators	The City's current practices likely meet many aspects of this potential future requirement. To prepare for coverage under the permit, it is recommended that the City update its practices in a few years by adopting the latest BMP manuals.

Sub-Requirement	Description	Status	Current Program Description	Discussion and Recommendation
Staff Training	The City must train staff whose primary construction, operations or maintenance job functions may impact stormwater quality. The training program must address the importance of protecting water quality, operation and maintenance standards, inspection procedures, selecting appropriate BMPs, ways to perform their job activities to prevent or minimize impacts to water quality, and procedures for reporting water quality concerns.	Potential Future Requirement	The Public Works Department maintains two operations crews: A Utilities Crew and a Facilities Crew. Between these crews, four employees are certified as licensed applicators.	A common way to meet these requirements is certification as licensed pesticide applicator. Another common way is to obtain training through WSDOT's Local Technical Assistance Program on the ESA 4(d) Regional Road Maintenance Program.
SWPPP for Maintenance Yards	Implement a Stormwater Pollution Prevention Plan (SWPPP) for all heavy equipment maintenance or storage yards, and material storage facilities owned or operated by the Permittee must have and apply a SWPPP.	Potential Future Requirement	The City operates a maintenance yard at 201 Division Street. It does not have a SWPPP for this facility.	It is recommended that the City prepare a SWPPP incorporating, at minimum, spill prevention, response, and reporting procedures.
Record Keeping	Maintain records of inspection and/or repair activities.	Potential Future Requirement	The City maintains handwritten records of inspection and repair activities. The City is implementing an asset management system in the Accela line of products, which will allow tracking of complaints and work orders.	It is recommended the City implement the planned asset management system and use it to track work orders for inspection and maintenance of public stormwater facilities.
NPDES Phase II Permit Elements #S5.A and #S5.B, Program Implementation and Other Administration				
SWMP Plan	Develop a stormwater management programs specifically designed to meet Phase II permit requirements. Prepare written documentation of the SWMP and maintain annual updates. Write the plan to inform the public of the planned SWMP activities for the upcoming calendar year. Include a description of planned activities of the program components in S5.C, planned actions to meet applicable TMDL requirements (NPDES Permit Condition S7), and planned actions to meet NPDES Permit Condition S8, Monitoring.	Potential Future Requirement	The City has published the 2008 CSWMP and is working on a 2017 revision to the Plan.	The 2017 Revised CSWMP Is useful, but would not meet the permit requirement for a documented stormwater management program specifically addressing permit requirements. The City does not need to develop a permit-compliant stormwater management program plan until it obtains coverage under the Phase II permit.
Program Tracking	The SWMP shall include an ongoing program for gathering, tracking, maintaining, and using information to evaluate SWMP development, implementation and permit compliance and to set priorities. Requirements include tracking costs of each component of the SWMP and numbers of inspections, enforcement, and public education activities.	Potential Future Requirement	N/A	When the City obtains coverage under the Phase II permit, it will need to track costs of program implementation by SWMP component. A common way to do this is to use the annual program budget to allocate costs by component.
Coordination Among Permittees	Permittees must coordinate with other adjacent municipal stormwater permittees. Coordination mechanisms should establish roles and responsibilities for the control of pollutants between physically interconnected MS4s and coordination for shared water bodies.	Potential Future Requirement	The City coordinates with permittees in the region on the Stormwater Partners consortium for public outreach.	When the City obtains coverage under the Phase II permit, it may need to implement formal mechanisms with WSDOT and Clark County to establish roles and responsibilities for physically interconnected MS4s.
Permit Application	Apply for NPDES Phase II municipal stormwater permit coverage when the City is eligible.	Potential Future Requirement	N/A	After the City reaches a population threshold that makes it eligible for coverage under the Phase II permit, the City will need to submit a Notice of Intent for Coverage under a National Pollutant Discharge Elimination System (NPDES) Municipal Stormwater Permit to Department of Ecology.
NPDES Phase II Permit Element #8, Monitoring and Assessment				
Monitoring and Assessment	In the 2013-2018 Phase II permit, permittees were given a choice to pay into a collective fund for both status and trends monitoring and effectiveness studies or to conduct specified monitoring and assessments on their own. Most permittees were required to pay into a collective fund to implement the Source Identification Information Repository. Fees were allocated on a sliding scale by population.	Potential Future Requirement	City of Ridgefield cooperates with Clark County by allowing the county to operate a stream gauge on Gee Creek at Abrams Park. The City has no independent monitoring programs.	No change is recommended at this time.
NPDES Phase II Permit Elements #S9.A and #S9.B, Reporting				
Annual Reports	Municipal stormwater permittees must submit an annual report to Department of Ecology by March 31 of each year.	Potential Future Requirement	N/A	No change is recommended at this time.
Maintain Open Public Records	Maintain records of SWMP and permit activities for five years; make records available to the public upon request.	Potential Future Requirement	Washington state law requires cities to maintain open public records.	No change is needed.

Sub-Requirement	Description	Status	Current Program Description	Discussion and Recommendation
NPDES Phase II Anticipated Future Permit Elements				
Source Control for Existing Development	Department of Ecology has indicated that it will include a source control for existing development requirement in the 2019-2024 Western Washington Phase II permit. The Phase I permits have included a source control requirement since Ecology issued the first permits under the Phase I rule in 1995. Generally, source control requires a permittee to reduce discharge of pollutants from areas of existing commercial and residential development that discharge to its storm sewer system. Requirements in the 2013-2018 Phase I permit include application of operational and structural source control BMPs through adoption of an ordinance and BMP manual, inspections, and enforcement.	Potential Future Requirement	N/A	No change is recommended at this time.
TMDL				
Requirement	**Description**	**Status**	**Current Program Description**	**Discussion**
Water Quality Clean-up Plan	When water bodies do not meet designated uses under the Clean Water Act and are designated as polluted waters on the 303(d) list developed by Ecology, then the water body requires a Total Maximum Daily Load. Cities and other entities that discharge to the water body may be required to follow the requirements of a water quality clean-up plan. NPDES municipal stormwater permits include provisions for meeting requirements of TMDL water quality clean-up plans. Ecology develops TMDLs.	Potential Future Requirement	City of Ridgefield has no specific nonpoint source TMDL activities.	Gee Creek, Lake River, and McCormick Creek are listed on Department of Ecology's 303(d) list of waters requiring a TMDL for various parameters including temperature and bacteria. There are no approved TMDLs covering Gee Creek, Lake River, or McCormick Creek. McCormick Creek is part of the East Fork Lewis River watershed, for which Ecology may issue a TMDL within the next few years. No changes are recommended at this time.
Endangered Species Act				
Requirement	**Description**	**Status**	**Current Program Description**	**Discussion**
Threatened Species	The City of Ridgefield is located within the Evolutionary Significant Units (ESUs) of salmonids for the Lower Columbia River Chinook salmon, Lower Columbia River coho, Lower Columbia River steelhead, and Columbia River chum. All of these species/ESUs have been designated as “threatened” under the ESA. In Gee Creek through Ridgefield, WDFW documents the presence of threatened summer chum and presumes the presence of threatened coho and summer steelhead. In a small tributary to Lake River in Ridgefield, WDFW presumes presence of summer chum and winter steelhead. In Lake River, WDFW documents the presence of fall Chinook, coho, and winter steelhead and presumes the presence of summer chum and summer steelhead.	Current	City of Ridgefield protects fish and wildlife habitat conservation areas in its critical areas ordinance, codified in RMC 18.20.110.	As of the writing of this analysis, there are no projected requirements for the stormwater program.
Section 9 "Take" 4(d) Rule	Threatened species may be protected through the Section 4(d) rule that describes activities that are likely to result in a “take” and exempts certain activities from “take” liabilities 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 approves some specific existing state and local programs, and creates a means for the National Marine Fisheries Service to approve additional programs if they meet certain standards set out in the rule. The 4(d) rule is intended to encourage governments and private citizens to adjust their programs and activities to be “salmon safe.” Limit No. 10 - Routine Road Maintenance. The 4(d) rule does not apply take prohibitions to routine road maintenance conducted by employees of a county or city that complies with the ODOT Transportation Maintenance Management System Water Quality and Habitat Guide or a substantially similar program. Limit No. 12 – Municipal, Residential, Commercial and Industrial development and redevelopment (MRCI). The 4(d) rule recognizes that MRCI development and redevelopment can degrade habitat and injure or kill salmon and steelhead. The 4(d) guide states that with appropriate safeguards, MRCI development can minimize impacts on listed fish.		The city has not documented its routine road maintenance practices in a BMP manual, and it adopts and is using an outdated stormwater technical manual (the 1992 Puget Sound Manual), which is no longer meets the standard of "all known, available, and reasonable methods of prevention, control and treatment" or AKART for controlling or abating pollutants associated with a discharge from its storm sewer system. AKART is established in RCW 90.48, the Washington Water Pollution Control Act.	Although not directly impacting the stormwater program, the two limits under the 4(d) Rule can be partially or wholly met by actions also required under the Phase II permit. Permit Element S5.C.5, which requires municipal maintenance activities to reduce impacts on stormwater, can be met partially by adopting a road maintenance BMP manual equivalent to the manual cited in the 4(d) Rule. Adopting the current state stormwater technical manual is likely to be considered one of the best ways to minimize impacts of MRCI development on listed fish.

Appendix E

Stormwater Utility Rate Model

City of Ridgefield
Stormwater Rate and SDC Model
Summary

Revenue Requirement	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Revenues @ Existing Rates										
Rate Revenues Under Existing Rates	$ 593,128	$ 641,883	$ 694,261	$ 750,426	$ 810,611	$ 875,622	$ 945,847	$ 1,021,703	$ 1,103,644	$ 1,192,156
SDC Revenue Towards Debt Service	-	-	-	-	-	-	-	-	-	-
Non-Rate Revenues	6,213	5,722	5,730	5,739	5,750	5,759	5,770	5,782	5,795	5,809
Total Revenues	**$ 599,341**	**$ 647,605**	**$ 699,991**	**$ 756,166**	**$ 816,361**	**$ 881,381**	**$ 951,617**	**$ 1,027,486**	**$ 1,109,439**	**$ 1,197,965**
Expenses										
Cash Operating Expenses	$ 532,007	$ 555,005	$ 579,543	$ 610,179	$ 633,809	$ 663,850	$ 696,062	$ 730,638	$ 767,791	$ 807,753
Existing Debt Service	-	-	-	-	-	-	-	-	-	-
New Debt Service	-	-	46,856	46,075	45,294	44,513	43,732	42,951	42,170	41,389
Rate Funded Capital	-	32,094	35,754	39,806	44,289	49,276	54,825	60,998	67,867	75,509
Total Expenses	**$ 532,007**	**$ 587,099**	**$ 662,153**	**$ 696,060**	**$ 723,392**	**$ 757,639**	**$ 794,619**	**$ 834,588**	**$ 877,828**	**$ 924,652**
Net Surplus (Deficiency)	**$ 67,334**	**$ 60,506**	**$ 37,837**	**$ 60,105**	**$ 92,969**	**$ 123,742**	**$ 156,998**	**$ 192,898**	**$ 231,611**	**$ 273,313**
Additions to Meet Coverage	-	-	-	-	-	-	-	-	-	-
Total Surplus (Deficiency)	**$ 67,334**	**$ 60,506**	**$ 37,837**	**$ 60,105**	**$ 92,969**	**$ 123,742**	**$ 156,998**	**$ 192,898**	**$ 231,611**	**$ 273,313**
Annual Rate Increase	**0.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**
Cumulative Rate Increase	**0.00%**	**3.00%**	**6.09%**	**9.27%**	**12.55%**	**15.93%**	**19.41%**	**22.99%**	**26.68%**	**30.48%**
Rate Revenues After Rate Increase	$ 593,128	$ 661,140	$ 736,541	$ 820,011	$ 912,349	$ 1,015,085	$ 1,129,390	$ 1,256,566	$ 1,398,063	$ 1,555,494
Incremental Rate Revenues (Compared with 2015)	$ -	$ 19,256	$ 42,280	$ 69,585	$ 101,739	$ 139,464	$ 183,544	$ 234,863	$ 294,419	$ 363,337
Additional Taxes from Rate Increase	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow After Rate Increase	**67,334**	**79,762**	**80,118**	**129,690**	**194,708**	**263,206**	**340,542**	**427,761**	**526,030**	**636,650**
Coverage After Rate Increase: w/ SDCs	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

Fund Balance	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
OPERATING FUND										
Ending Balance	**$ 131,180**	**$ 136,850**	**$ 142,901**	**$ 150,455**	**$ 156,282**	**$ 163,689**	**$ 171,632**	**$ 180,157**	**$ 189,318**	**$ 199,172**
Minimum Target Balance	*$ 131,180*	*$ 136,850*	*$ 142,901*	*$ 150,455*	*$ 156,282*	*$ 163,689*	*$ 171,632*	*$ 180,157*	*$ 189,318*	*$ 199,172*
CAPITAL FUND										
Ending Balance	**$ 129,981**	**$ 27,258**	**$ 567,919**	**$ 575,784**	**$ 718,537**	**$ 840,097**	**$ 917,006**	**$ 935,085**	**$ 1,521,222**	**$ 2,008,093**
Minimum Target Balance	*$ 60,082*	*$ 62,173*	*$ 65,113*	*$ 67,662*	*$ 69,575*	*$ 72,421*	*$ 75,538*	*$ 81,674*	*$ 81,674*	*$ 83,851*

City of Ridgefield
Stormwater Rate and SDC Model
Assumptions

Economic & Financial Factors		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Escalation Rates											
General Cost Inflation		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
Construction Cost Inflation		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Labor Cost Inflation		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
Benefit Cost Inflation		10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%	10.00%
General Inflation + Acct. Growth		9.65%	10.38%	10.32%	10.25%	10.18%	10.18%	10.18%	10.18%	10.18%	10.18%
Account Growth		7.50%	8.22%	8.16%	8.09%	8.02%	8.02%	8.02%	8.02%	8.02%	8.02%
No Escalation		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Interfund Admin Svcs Escalation	*Calc'd from O%M	*16.69%*	*5.33%*	*5.43%*	*5.54%*	*5.64%*	*5.75%*	*5.86%*	*5.97%*	*6.09%*	*6.20%*
New Employee Growth Rate		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
[Extra]											
Investment Interest		0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%	0.15%
System Reinvestment Strategy (% of gross receipts)		5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Tax Rates											
State Excise Tax		0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
State B&O Tax		1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Utility Tax	(net effect on utility)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

City of Ridgefield
Stormwater Rate and SDC Model
Assumptions

Accounting Assumptions			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
MINIMUM FUND BALANCE TARGETS												
Operating Fund												
Min. Fund Balance Target (days of O&M expense)			90 days	90 days	90 days	90 days	90 days	90 days	90 days	90 days	90 days	90 days
Max. Fund Balance ($)			90 days	90 days	90 days	90 days	90 days	90 days	90 days	90 days	90 days	90 days
Capital Fund												
Select Minimum Capital Fund Option →		1	**% of Plant Assets**									
#		*2015 Total Assets*										
1	% of Plant Assets	$ 5,642,579	$ 60,082	$ 62,173	$ 65,113	$ 67,662	$ 69,575	$ 72,421	$ 75,538	$ 81,674	$ 81,674	$ 83,851
	% of Total		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
2	User Input		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
RATE FUNDED CAPITAL												
#	***Select Annual Funding Option →***	5	**User Input**									
1	Original Cost Depreciation	$ 102,933	$ 90,710	$ 90,710	$ 90,710	$ 90,710	$ 90,710	$ 78,245	$ 78,245	$ 78,245	$ 78,245	$ 78,245
2	Original Cost Depreciation less Debt Principal Pmts		$ 90,710	$ 90,710	$ 59,473	$ 59,473	$ 59,473	$ 47,008	$ 47,008	$ 47,008	$ 47,008	$ 47,008
3	% of Total Annual CIP		$ 146,260	$ 83,641	$ 117,577	$ 101,971	$ 76,512	$ 113,836	$ 124,709	$ 245,411	$ -	$ 87,086
	% of Total		*40%*	*40%*	*40%*	*40%*	*40%*	*40%*	*40%*	*40%*	*40%*	*40%*
4	% of R&R Annual CIP		$ 365,650	$ 209,103	$ 293,944	$ 254,928	$ 191,280	$ 284,590	$ 311,773	$ 613,528	$ -	$ 217,714
	% of Total		*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*	*100%*
5	User Input		$ -	$ 32,094	$ 35,754	$ 39,806	$ 44,289	$ 49,276	$ 54,825	$ 60,998	$ 67,867	$ 75,509
6	No Rate Funded Capital											

City of Ridgefield
Stormwater Rate and SDC Model
Assumptions

Capital Financing Assumptions		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
SYSTEM DEVELOPMENT CHARGES											
Existing Connection Charge		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Calculated Connection Charge		$ 412	$ 412	$ 412	$ 412	$ 412	$ 412	$ 412	$ 412	$ 412	$ 412
Annual Inflationary Increase											
Selected Connection Charge (inc. inflation)	Existing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total EDUs (end of year)		6,088	6,589	7,126	7,703	8,321	8,988	9,709	10,487	11,329	12,237
Additional EDUs Per Year		425	500	538	577	618	667	721	779	841	909
Total SDC Revenue		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
System Development Charges Towards Debt Service											
Total Annual Debt Service		$ -	$ -	$ 46,856	$ 46,075	$ 45,294	$ 44,513	$ 43,732	$ 42,951	$ 42,170	$ 41,389
Existing Annual Debt Service		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Allowable %: SDCs to Pay for Debt Service											
Allowable SDC Revenue		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Actual %: SDCs to Pay for Debt Service		*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*	*0%*
SDC Revenue Towards Debt Service		**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
OUTSIDE FUNDING SOURCES (USES)											
Capital Grants / Contributions	**Function**										
Grant for Division St. Project (from budget)		$ 100,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Grants for 2020-2023		-	-	100,000	100,000	100,000	100,000	-	-	-	-
Grant for 2025		-	-	-	-	-	-	-	150,000	-	-
[Extra]		-	-	-	-	-	-	-	-	-	-
[Extra]		-	-	-	-	-	-	-	-	-	-
[Extra]		-	-	-	-	-	-	-	-	-	-
Total: Capital Grants / Contributions		**$ 100,000**	**$ -**	**$ 100,000**	**$ 100,000**	**$ 100,000**	**$ 100,000**	**$ -**	**$ 150,000**	**$ -**	**$ -**

City of Ridgefield
Stormwater Rate and SDC Model
Assumptions

REVENUE BONDS										
Term (years)		20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years
Interest Only Payments (years)		0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years
Interest Cost		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Issuance Cost		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
Coverage Requirement (w/ SDCs)	**1.75**									
Coverage Requirement (w/o SDCs)	**1.25**									
Use Reserves to Pay for Last Payment?	**Yes**									
OTHER BONDS										
Term (years)		20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years
Interest Only Payments (years)		0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years
Interest Cost		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
Issuance Cost		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
SRF LOANS										
Term (years)		20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years
Interest Only Payments (years)		0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years
Interest Cost		1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Issuance Cost		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
OTHER LOANS										
Term (years)		20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years	20 years
Interest Only Payments (years)		0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years	0 years
Interest Cost		2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%

City of Ridgefield
Stormwater Rate and SDC Model
Operating Revenue and Expenditure Forecast

Operating Revenues	Forecast Basis	City Update 2017	Budget 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Rate Revenues												
Storm Water (Ops)	*Account Growth*	$ 476,292	$ 593,128	$ 641,883	$ 694,261	$ 750,426	$ 810,611	$ 875,622	$ 945,847	$ 1,021,703	$ 1,103,644	$ 1,192,156
[Extra]	*No Escalation*	-	-	-	-	-	-	-	-	-	-	-
Total Rate Revenue		**$ 476,292**	**$ 593,128**	**$ 641,883**	**$ 694,261**	**$ 750,426**	**$ 810,611**	**$ 875,622**	**$ 945,847**	**$ 1,021,703**	**$ 1,103,644**	**$ 1,192,156**
Non-Rate Revenues												
Late Fees/Penalties	*No Escalation*	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000
Other Revenue	*No Escalation*	2,653	525	525	525	525	525	525	525	525	525	525
[Extra]	*No Escalation*	-	-	-	-	-	-	-	-	-	-	-
Total Non-Rate Revenues		**$ 7,653**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**	**$ 5,525**
TOTAL OPERATING REVENUES		**$ 483,945**	**$ 598,653**	**$ 647,408**	**$ 699,786**	**$ 755,951**	**$ 816,136**	**$ 881,147**	**$ 951,372**	**$ 1,027,228**	**$ 1,109,169**	**$ 1,197,681**

City of Ridgefield
Stormwater Rate and SDC Model
Operating Revenue and Expenditure Forecast

Operating Expenses	Forecast Basis	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
State Excise Tax	*State Excise Tax*	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
State B&O Tax	*State B&O Tax*	7,219	8,972	9,711	10,497	11,339	12,242	13,217	14,271	15,408	16,638	17,965
City Utility Tax	*Utility Tax*	-	-	-	-	-	-	-	-	-	-	-
Personnel												
Salaries	*Labor Cost Inflation*	151,125	178,966	184,335	189,865	195,561	201,428	207,471	213,695	220,106	226,709	233,510
Social Security	*Benefit Cost Inflation*	9,556	11,176	12,294	13,523	14,875	16,363	17,999	19,799	21,779	23,957	26,352
Medicare	*Benefit Cost Inflation*	2,235	2,618	2,880	3,168	3,485	3,833	4,216	4,638	5,102	5,612	6,173
Workers Comp	*Benefit Cost Inflation*	5,656	8,759	9,635	10,598	11,658	12,824	14,106	15,517	17,069	18,776	20,653
State Unemployment	*Benefit Cost Inflation*	309	377	415	456	502	552	607	668	735	808	889
Overtime	*Benefit Cost Inflation*	3,000	3,000	3,300	3,630	3,993	4,392	4,832	5,315	5,846	6,431	7,074
Pension	*Benefit Cost Inflation*	17,932	20,369	22,406	24,646	27,111	29,822	32,804	36,085	39,693	43,663	48,029
Benefits	*Benefit Cost Inflation*	38,716	41,451	45,596	50,156	55,171	60,688	66,757	73,433	80,776	88,854	97,739
Health Care	*Benefit Cost Inflation*	1,190	1,342	1,476	1,624	1,786	1,965	2,161	2,377	2,615	2,877	3,164
Supplies												
Office Supplies	*General Cost Inflation*	500	500	510	520	531	541	552	563	574	586	598
Operational Supplies	*General Cost Inflation*	4,613	4,600	4,692	4,786	4,882	4,979	5,079	5,180	5,284	5,390	5,497
Postage	*General Cost Inflation*	4,655	4,700	4,794	4,890	4,988	5,087	5,189	5,293	5,399	5,507	5,617
Uniforms	*General Cost Inflation*	924	900	918	936	955	974	994	1,014	1,034	1,054	1,076
Statement Mailing	*General Cost Inflation*	3,000	5,000	5,100	5,202	5,306	5,412	5,520	5,631	5,743	5,858	5,975
Fuel	*General Cost Inflation*	2,825	2,800	2,856	2,913	2,971	3,031	3,091	3,153	3,216	3,281	3,346
Small Tools/Equipment	*General Cost Inflation*	5,200	5,200	5,304	5,410	5,518	5,629	5,741	5,856	5,973	6,093	6,214
Training												
Registration	*General Cost Inflation*	1,000	1,000	1,020	1,040	1,061	1,082	1,104	1,126	1,149	1,172	1,195
Travel Expenses	*General Cost Inflation*	500	500	510	520	531	541	552	563	574	586	598
Utilities												
Electricity	*General Cost Inflation*	7,457	7,400	7,548	7,699	7,853	8,010	8,170	8,334	8,500	8,670	8,844
Natural Gas	*General Cost Inflation*	165	210	214	218	223	227	232	236	241	246	251
Water	*General Cost Inflation*	300	300	306	312	318	325	331	338	345	351	359
Storm Water	*General Cost Inflation*	625	500	510	520	531	541	552	563	574	586	598
Communications	*General Cost Inflation*	906	1,950	1,989	2,029	2,069	2,111	2,153	2,196	2,240	2,285	2,330
Sewer	*General Cost Inflation*	351	370	377	385	393	400	409	417	425	434	442
Photocopy Machine	*General Cost Inflation*	226	350	357	364	371	379	386	394	402	410	418

City of Ridgefield
Stormwater Rate and SDC Model
Operating Revenue and Expenditure Forecast

Operations and Maintenance												
Facilities	*General Cost Inflation*	500	500	510	520	531	541	552	563	574	586	598
Dues and Permits	*General Cost Inflation*	-	100	102	104	106	108	110	113	115	117	120
Vehicle/Equip Maintenance	*General Cost Inflation*	3,660	3,600	3,672	3,745	3,820	3,897	3,975	4,054	4,135	4,218	4,302
Advertising	*General Cost Inflation*	4	50	51	52	53	54	55	56	57	59	60
Street Sweeping	*General Cost Inflation*	5,392	5,000	5,100	5,202	5,306	5,412	5,520	5,631	5,743	5,858	5,975
Storm Ditch Maintenance	*General Cost Inflation*	10,000	10,000	10,200	10,404	10,612	10,824	11,041	11,262	11,487	11,717	11,951
Computers	*General Cost Inflation*	-	15,908	16,226	16,551	16,882	17,219	17,564	17,915	18,273	18,639	19,012
Computer Software	*General Cost Inflation*	2,799	2,520	2,570	2,622	2,674	2,728	2,782	2,838	2,895	2,953	3,012
Other Ops and Maintenance	*General Cost Inflation*	5,000	5,500	5,610	5,722	5,837	5,953	6,072	6,194	6,318	6,444	6,573
Services												
Facility Planning	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
Janitorial	*General Cost Inflation*	175	175	179	182	186	189	193	197	201	205	209
Utility Rate Study	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
Storm Plan Update	*General Cost Inflation*	50,000	-	-	-	-	-	-	-	-	-	-
Other Professional Services	*General Cost Inflation*	7,181	7,000	7,140	7,283	7,428	7,577	7,729	7,883	8,041	8,202	8,366
Intergovernmental												
Permits - State Agencies	*General Cost Inflation*	100	100	102	104	106	108	110	113	115	117	120
Maintenance - Clark County	*General Cost Inflation*	5,000	5,000	5,100	5,202	5,306	5,412	5,520	5,631	5,743	5,858	5,975
Excise Tax	*No Escalation*	-	-	-	-	-	-	-	-	-	-	-
Interfund Admin Services	*Interfund Admin Svcs Escalation*	113,273	98,961	104,232	109,892	115,974	122,518	129,564	137,159	145,353	154,200	163,761
Capital Outlays	*No Escalation*	84,064	20,561	20,561	20,561	20,561	20,561	20,561	20,561	20,561	20,561	20,561
Transfers												
Transfer to Utility Capital Fund	*General Cost Inflation*	13,700	-	-	-	-	-	-	-	-	-	-
Transfer to General Capital	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
Transfer to Cap Repair & Replace	*General Cost Inflation*	21,217	24,440	24,929	25,427	25,936	26,455	26,984	27,523	28,074	28,635	29,208
Transfer to Equipment Replacement Reserve	*General Cost Inflation*	23,316	19,282	19,668	20,061	20,462	20,871	21,289	21,715	22,149	22,592	23,044
New Expenditures												
Utility Fund Retirement Payout	*[Calcuated per City staff]*	-	-	-	-	4,416	-	-	-	-	-	-
Additional Staffing - From City	*Labor Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
New Utility Clerk - From City 6-14	*New Employee Growth Rate*	-	-	-	-	-	-	-	-	-	-	-
Desk Set-up - From City 6-14	*General Cost Inflation*	-	-	-	-	-	-	-	-	-	-	-
[Extra]	*No Escalation*	-	-	-	-	-	-	-	-	-	-	-
TOTAL CASH OPERATING EXPENSES		**$ 615,566**	**$ 532,007**	**$ 555,005**	**$ 579,543**	**$ 610,179**	**$ 633,809**	**$ 663,850**	**$ 696,062**	**$ 730,638**	**$ 767,791**	**$ 807,753**

City of Ridgefield
Stormwater Rate and SDC Model
Existing Debt

Existing Debt Service - Summary	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Annual Debt Payments										
Revenue Bonds	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
PWTF Loans	-	-	-	-	-	-	-	-	-	-
Other Loans	-	-	-	-	-	-	-	-	-	-
Total Debt Payments	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Existing Debt Service - Revenue Bonds	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
TOTAL REVENUE BONDS										
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Use of Debt Reserve for Debt Service	-	-	-	-	-	-	-	-	-	-
Annual Debt Reserve Target on Existing Rev	-	-	-	-	-	-	-	-	-	-

Existing Debt Service - PWTF Loans	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
TOTAL PWTF LOANS										
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Existing Debt Service - Other Loans	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
TOTAL OTHER LOANS										
Annual Interest Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payment	-	-	-	-	-	-	-	-	-	-
Total Annual Payment	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

City of Ridgefield

Stormwater Rate and SDC Model

Capital Improvement Program

Project Costs in Year: 2017

ID	Description	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	Useful Life (Years)	Funding Source	Function of Service	% Upgrade/ Expansion	% R&R	$ Upgrade / Expansion	$ R&R
		UNESCALATED COSTS												*FUNDING DETAILS: FOR SDC CALC*				
	Stormwater Master Plan Projects - from 2017														-		$ -	$ -
	Division Street Outfall	355,000										75.00	Balances	Water Quantity	0%	100%	-	355,000
	Hillhurst Swale		197,100									75.00	Balances	Water Quantity	0%	100%	-	197,100
	South 56th Place			38,500								75.00	Balances	Water Quantity	0%	100%	-	38,500
	Old Pioneer Way			230,500								75.00	Balances	Water Quantity	0%	100%	-	230,500
	North Pioneer Drive, East				60,000							75.00	Balances	Water Quantity	0%	100%	-	60,000
	Viewport Swale				166,500							75.00	Balances	Water Quantity	0%	100%	-	166,500
	North Simons Street					165,000						75.00	Balances	Water Quantity	0%	100%	-	165,000
	South Riverview Drive						238,340					75.00	Balances	Water Quantity	0%	100%	-	238,340
	Gee Creek Loop							253,500				75.00	Balances	Water Quantity	0%	100%	-	253,500
	Lake River Outfall								484,325			75.00	Balances	Water Quantity	0%	100%	-	484,325
	Abrams Park										162,000	75.00	Balances	Water Quantity	0%	100%	-	162,000
															-		-	-
															-		-	-
	TOTAL CAPITAL PROJECTS	**$ 355,000**	**$ 197,100**	**$ 269,000**	**$ 226,500**	**$ 165,000**	**$ 238,340**	**$ 253,500**	**$ 484,325**	**$ -**	**$ 162,000**						**$ -**	**$ 2,350,765**

City of Ridgefield
Stormwater Rate and SDC Model
Capital Funding

Capital Project Summary	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Growth Related Project Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Existing Needs Project Costs	365,650	209,103	293,944	254,928	191,280	284,590	311,773	613,528	-	217,714
TOTAL CAPITAL EXPENDITURES	**$ 365,650**	**$ 209,103**	**$ 293,944**	**$ 254,928**	**$ 191,280**	**$ 284,590**	**$ 311,773**	**$ 613,528**	**$ -**	**$ 217,714**

Capital Financing Plan	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Outside Funding Sources: Grants/CIAC	100,000	-	100,000	100,000	100,000	100,000	-	150,000	-	-
Balance/Remained to be Funded	**$ 265,650**	**$ 209,103**	**$ 193,944**	**$ 154,928**	**$ 91,280**	**$ 184,590**	**$ 311,773**	**$ 463,528**	**$ -**	**$ 217,714**
OTHER FUNDING SOURCES										
Rate Funded Capital	$ -	$ 32,094	$ 35,754	$ 39,806	$ 44,289	$ 49,276	$ 54,825	$ 60,998	$ 67,867	$ 75,509
SDC Revenue Towards Capital	-	-	-	-	-	-	-	-	-	-
Revenue Bond Proceeds	-	-	-	-	-	-	-	-	-	-
Other Bonds Proceeds	-	-	-	-	-	-	-	-	-	-
Srf Loans Proceeds	-	-	-	-	-	-	-	-	-	-
Other Loans Proceeds	-	-	624,742	-	-	-	-	-	-	-
Fund Balances	265,650	142,094	-	115,121	46,991	135,314	256,948	402,530	-	142,205
TOTAL CAPITAL RESOURCES	**$ 365,650**	**$ 174,188**	**$ 760,496**	**$ 254,928**	**$ 191,280**	**$ 284,590**	**$ 311,773**	**$ 613,528**	**$ 67,867**	**$ 217,714**
Info: Working Capital Contingency Deficit	-	***(34,916)***	-	-	-	-	-	-	-	-

City of Ridgefield
Stormwater Rate and SDC Model
Capital Funding

New Debt Computations	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
REVENUE BONDS										
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-	-	-	-
Reserve Required	-	-	-	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
OTHER BONDS										
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
SRF LOANS										
Amount to Fund	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Issuance Costs	-	-	-	-	-	-	-	-	-	-
Amount of Debt Issue	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
OTHER LOANS										
Amount to Fund	$ -	$ -	$ 624,742	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Debt Service Summary	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
EXISTING DEBT SERVICE										
Annual Interest Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Annual Principal Payments	-	-	-	-	-	-	-	-	-	-
Total Debt Service Payments	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Revenue Bond Payments Only	-	-	-	-	-	-	-	-	-	-
NEW DEBT SERVICE										
Annual Interest Payments	$ -	$ -	$ 15,619	$ 14,838	$ 14,057	$ 13,276	$ 12,495	$ 11,714	$ 10,933	$ 10,152
Annual Principal Payments	-	-	31,237	31,237	31,237	31,237	31,237	31,237	31,237	31,237
Total Debt Service Payments	$ -	$ -	$ 46,856	$ 46,075	$ 45,294	$ 44,513	$ 43,732	$ 42,951	$ 42,170	$ 41,389
Revenue Bond Payments Only	-	-	-	-	-	-	-	-	-	-
TOTAL DEBT SERVICE PAYMENTS	**$ -**	**$ -**	**$ 46,856**	**$ 46,075**	**$ 45,294**	**$ 44,513**	**$ 43,732**	**$ 42,951**	**$ 42,170**	**$ 41,389**
Total Interest Payments	-	-	15,619	14,838	14,057	13,276	12,495	11,714	10,933	10,152
Total Principal Payments	-	-	31,237	31,237	31,237	31,237	31,237	31,237	31,237	31,237
Total Revenue Bond Payments Only	-	-	-	-	-	-	-	-	-	-
Use of Debt Reserve for Debt Service	-	-	-	-	-	-	-	-	-	-

City of Ridgefield
Stormwater Rate and SDC Model
Revenue Requirement Tests

Cash Flow Test	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
EXPENSES										
Cash Operating Expenses	$ 532,007	$ 555,005	$ 579,543	$ 610,179	$ 633,809	$ 663,850	$ 696,062	$ 730,638	$ 767,791	$ 807,753
Existing Debt Service	-	-	-	-	-	-	-	-	-	-
New Debt Service	-	-	46,856	46,075	45,294	44,513	43,732	42,951	42,170	41,389
Rate Funded Capital	-	32,094	35,754	39,806	44,289	49,276	54,825	60,998	67,867	75,509
Additions Required to Meet Min. Op. Fund Balances	-	-	-	-	-	-	-	-	-	-
Total Expenses	*$ 532,007*	*$ 587,099*	*$ 662,153*	*$ 696,060*	*$ 723,392*	*$ 757,639*	*$ 794,619*	*$ 834,588*	*$ 877,828*	$ 924,652
REVENUES										
Rate Revenue	$ 593,128	$ 641,883	$ 694,261	$ 750,426	$ 810,611	$ 875,622	$ 945,847	$ 1,021,703	$ 1,103,644	$ 1,192,156
SDC Revenue Towards Debt Service	-	-	-	-	-	-	-	-	-	-
Other Non Rate Revenue	5,525	5,525	5,525	5,525	5,525	5,525	5,525	5,525	5,525	5,525
Interest Earnings: Operating & Debt Reserve Funds	688	197	205	214	225	234	245	257	270	284
Total Revenue	*$ 599,341*	*$ 647,605*	*$ 699,991*	*$ 756,166*	*$ 816,361*	*$ 881,381*	*$ 951,617*	*$ 1,027,486*	*$ 1,109,439*	$ 1,197,965
NET CASH FLOW (DEFICIENCY)	**$ 67,334**	**$ 60,506**	**$ 37,837**	**$ 60,105**	**$ 92,969**	**$ 123,742**	**$ 156,998**	**$ 192,898**	**$ 231,611**	**$ 273,313**

Coverage Test - w/ SDCs	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
EXPENSES										
Cash Operating Expenses	$ 532,007	$ 555,005	$ 579,543	$ 610,179	$ 633,809	$ 663,850	$ 696,062	$ 730,638	$ 767,791	$ 807,753
Revenue Bond Debt Service	-	-	-	-	-	-	-	-	-	-
Revenue Bond Coverage Requirement at 1.75	-	-	-	-	-	-	-	-	-	-
Total Expenses	*$ 532,007*	*$ 555,005*	*$ 579,543*	*$ 610,179*	*$ 633,809*	*$ 663,850*	*$ 696,062*	*$ 730,638*	*$ 767,791*	$ 807,753
ALLOWABLE REVENUES										
Rate Revenue	$ 593,128	$ 641,883	$ 694,261	$ 750,426	$ 810,611	$ 875,622	$ 945,847	$ 1,021,703	$ 1,103,644	$ 1,192,156
Other Revenue	5,525	5,525	5,525	5,525	5,525	5,525	5,525	5,525	5,525	5,525
SDC Revenue	-	-	-	-	-	-	-	-	-	-
Interest Earnings - All Funds	688	391	246	1,065	1,088	1,311	1,504	1,631	1,671	2,562
Total Revenue	*$ 599,341*	*$ 647,799*	*$ 700,032*	*$ 757,016*	*$ 817,224*	*$ 882,457*	*$ 952,875*	*$ 1,028,859*	*$ 1,110,840*	$ 1,200,244
Coverage w/ SDCs	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
COVERAGE SURPLUS (DEFICIENCY)	**$ 67,334**	**$ 92,795**	**$ 120,488**	**$ 146,837**	**$ 183,414**	**$ 218,607**	**$ 256,813**	**$ 298,221**	**$ 343,049**	**$ 392,491**

City of Ridgefield
Stormwater Rate and SDC Model
Revenue Requirement Tests

Maximum Revenue Deficiency	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sufficiency Test Driving the Deficiency	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*
Maximum Revenue Deficiency (Surplus)	$ (67,334)	$ (60,506)	$ (37,837)	$ (60,105)	$ (92,969)	$ (123,742)	$ (156,998)	$ (192,898)	$ (231,611)	$ (273,313)
plus: Additional Tax Expense	-	-	-	-	-	-	-	-	-	-
less: Incremental Revenue From Prior Rate Increases	-	-	(20,828)	(45,701)	(75,165)	(109,898)	(150,649)	(198,264)	(253,699)	(318,032)
Net Revenue Deficiency (Surplus)	**$ (67,334)**	**$ (60,506)**	**$ (58,665)**	**$ (105,806)**	**$ (168,135)**	**$ (233,640)**	**$ (307,647)**	**$ (391,162)**	**$ (485,309)**	**$ (591,345)**
Applicable Tax Rates (Excise)	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*	*0.000%*

Rate Increases	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Rate Revenue @ Existing Rates	$ 593,128	$ 641,883	$ 694,261	$ 750,426	$ 810,611	$ 875,622	$ 945,847	$ 1,021,703	$ 1,103,644	$ 1,192,156
Revenues from Prior Rate Increases	-	-	20,828	45,701	75,165	109,898	150,649	198,264	253,699	318,032
Rate Revenue Before Rate Increase (incl. previous increas	593,128	641,883	715,089	796,127	885,776	985,520	1,096,495	1,219,967	1,357,343	1,510,188
Required Annual Rate Increase	-11.35%	-9.43%	-8.20%	-13.29%	-18.98%	-23.71%	-28.06%	-32.06%	-35.75%	-39.16%
Number of Months New Rates Will Be In Effect	12	12	12	12	12	12	12	12	12	12
Info: % Increase to Generate Required Revenue	*-11.35%*	*-9.43%*	*-8.20%*	*-13.29%*	*-18.98%*	*-23.71%*	*-28.06%*	*-32.06%*	*-35.75%*	*-39.16%*
Policy Induced Rate Increases	0.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
ANNUAL RATE INCREASE	**0.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**	**3.00%**
CUMULATIVE RATE INCREASE	**0.00%**	**3.00%**	**6.09%**	**9.27%**	**12.55%**	**15.93%**	**19.41%**	**22.99%**	**26.68%**	**30.48%**

Impacts of Rate Increases	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Sufficiency Test Driving the Deficiency	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*	*Cash*
Rate Revenues After Rate Increase	$ 593,128	$ 661,140	$ 736,541	$ 820,011	$ 912,349	$ 1,015,085	$ 1,129,390	$ 1,256,566	$ 1,398,063	$ 1,555,494
Full Year Rate Revenues After Rate Increase	*593,128*	*661,140*	*736,541*	*820,011*	*912,349*	*1,015,085*	*1,129,390*	*1,256,566*	*1,398,063*	*1,555,494*
Partial Year Adjustment	-	-	-	-	-	-	-	-	-	-
Additional Taxes Due to Rate Increases	-	-	-	-	-	-	-	-	-	-
Net Cash Flow After Rate Increase	**$ 67,334**	**$ 79,762**	**$ 80,118**	**$ 129,690**	**$ 194,708**	**$ 263,206**	**$ 340,542**	**$ 427,761**	**$ 526,030**	**$ 636,650**
Coverage After Rate Increase: w/ SDCs	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**

City of Ridgefield
Stormwater Rate and SDC Model
Fund Activity

Funds	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
OPERATING FUND										
Beginning Balance	$ 459,476	$ 131,180	$ 136,850	$ 142,901	$ 150,455	$ 156,282	$ 163,689	$ 171,632	$ 180,157	$ 189,318
plus: Net Cash Flow after Rate Increase	67,334	79,762	80,118	129,690	194,708	263,206	340,542	427,761	526,030	636,650
less: Transfer of Surplus to Capital Fund	(395,631)	(74,092)	(74,067)	(122,136)	(188,881)	(255,798)	(332,599)	(419,235)	(516,869)	(626,797)
Ending Balance	**$ 131,180**	**$ 136,850**	**$ 142,901**	**$ 150,455**	**$ 156,282**	**$ 163,689**	**$ 171,632**	**$ 180,157**	**$ 189,318**	**$ 199,172**
Minimum Target Balance	*$ 131,180*	*$ 136,850*	*$ 142,901*	*$ 150,455*	*$ 156,282*	*$ 163,689*	*$ 171,632*	*$ 180,157*	*$ 189,318*	*$ 199,172*
Maximum Funds to be Kept as Operating Reserves	*$ 131,180*	*$ 136,850*	*$ 142,901*	*$ 150,455*	*$ 156,282*	*$ 163,689*	*$ 171,632*	*$ 180,157*	*$ 189,318*	*$ 199,172*
Info: # of Days of Cash Operating Expenses	*90*	*90*	*90*	*90*	*90*	*90*	*90*	*90*	*90*	*90*
CAPITAL FUND										
Beginning Balance	$ -	$ 129,981	$ 27,258	$ 567,919	$ 575,784	$ 718,537	$ 840,097	$ 917,006	$ 935,085	$ 1,521,222
plus: Rate Funded Capital	-	32,094	35,754	39,806	44,289	49,276	54,825	60,998	67,867	75,509
plus: Transfers from Operating Fund	395,631	74,092	74,067	122,136	188,881	255,798	332,599	419,235	516,869	626,797
plus: Capital Grants / Contributions	100,000	-	100,000	100,000	100,000	100,000	-	150,000	-	-
plus: SDC Revenue Towards Capital	-	-	-	-	-	-	-	-	-	-
plus: Revenue Bond Proceeds	-	-	-	-	-	-	-	-	-	-
plus: Other Bond Proceeds	-	-	-	-	-	-	-	-	-	-
plus: SRF Loan Proceeds	-	-	-	-	-	-	-	-	-	-
plus: Other Loan Proceeds	-	-	624,742	-	-	-	-	-	-	-
plus: Interest Earnings	-	195	41	851	863	1,076	1,258	1,374	1,401	2,279
Total Funding Sources	**$ 495,631**	**$ 236,361**	**$ 861,862**	**$ 830,712**	**$ 909,817**	**$ 1,124,687**	**$ 1,228,779**	**$ 1,548,614**	**$ 1,521,222**	**$ 2,225,807**
less: Capital Expenditures	(365,650)	(209,103)	(293,944)	(254,928)	(191,280)	(284,590)	(311,773)	(613,528)	-	(217,714)
Ending Capital Fund Balance	**$ 129,981**	**$ 27,258**	**$ 567,919**	**$ 575,784**	**$ 718,537**	**$ 840,097**	**$ 917,006**	**$ 935,085**	**$ 1,521,222**	**$ 2,008,093**
Minimum Target Balance	*$ 60,082*	*$ 62,173*	*$ 65,113*	*$ 67,662*	*$ 69,575*	*$ 72,421*	*$ 75,538*	*$ 81,674*	*$ 81,674*	*$ 83,851*
DEBT RESERVE FUND										
Beginning Balance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
plus: Reserve Funding from New Debt	-	-	-	-	-	-	-	-	-	-
less: Use of Reserves for Debt Service	-	-	-	-	-	-	-	-	-	-
Ending Balance	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Minimum Target Balance	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -