DRAFT

Surface Water Master Plan

Prepared for
City of Shoreline
Shoreline, Washington

April 27, 2018

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This is a draft for internal review by City of Shoreline staff. This draft is not intended to be a final representation of the work done or recommendations made by Brown and Caldwell. It should not be relied upon; consult the final report.

Brown AND Caldwell

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List of Abbreviations

§	section
2007 report	*2007 Bioassessment Report, Biological and Habitat Assessment of Shoreline Streams*
2016 Assessment	*2016 Fresh Water Assessment Report—State of Water Quality in Shoreline Streams and Lakes*
AMWP	Asset Management Work Plan
AKART	all known, available, and reasonable treatments
AO	Administrative Order
BC	Brown and Caldwell
BEACH	Beach Environmental Assessment, Communication and Health
B-IBI	Benthic Index of Biotic Integrity
BMP	best management practice
CAC	Community Assistance Contact
CAMP	*Condition Assessment Management Plan*
CCTV	closed-circuit television
CFR	Code of Federal Regulations
CIP	Capital Improvement Plan
CIPP	cured-in-place pipe
City	City of Shoreline
City Council	Shoreline City Council
Cityworks	Azteca Cityworks
CMMS	Computerized Maintenance Management System
CRS	Community Rating System
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DEM	digital elevation model
DO	dissolved oxygen
Ecology	Washington State Department of Ecology
EDM	*Engineering Development Manual*
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ET	evaporation and evapotranspiration
FEMA	Federal Emergency Management Agency
Financial Analysis Report	*Financial Analysis for 2018 Master Plan,* November 2017 (FCS Group 2017) (see Appendix K)
FIRM	flood insurance rate map
FTE	full-time equivalent
Fund	Surface Water Utility Enterprise Fund
GASB	Governmental Accounting Standards Board
GFC	General Facilities Charge
GIS	geographic information system
GMA	Growth Management Act
GO	General Obligation
GSI	green stormwater infrastructure
H&H	hydrologic and hydraulic
HPA	Hydraulic Project Approval
hr	hour(s)
IDDE	illicit discharge detection and elimination
LID	low impact development
LOS	level of service
Master Plan	*Surface Water Master Plan*
MEP	maximum extent practicable
MS4	municipal separate storm sewer system
N/A	not applicable
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NMF	North Maintenance Facility
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
O&M Manual	*City of Shoreline Surface Water Utility Operation and Maintenance Manual*
Phase II Permit	NPDES Phase II Municipal Stormwater Permit
PLC	programmable logic controller
PSLC	Puget Sound LiDAR Consortium
PWTF	Public Works Trust Fund
QA/QC	quality assurance/quality control
RCW	Revised Code of Washington

ROW	right-of-way
R&R	repair and replacement
RSMP	Regional Stormwater Monitoring Program
SCADA	supervisory control and data acquisition
SEPA	State Environmental Policy Act
SFAP	Stormwater Financial Assistance Program
SMC	Shoreline Municipal Code
State	State of Washington
Stormwater Manual	*Stormwater Management Manual for Western Washington*
SWPP	stormwater pollution prevention plan
SWPRRP	Stormwater Pipe Repair and Replacement Project
TMDL	total maximum daily load
UBME	Utility Business Management Evaluation
USC	United States Code
Utility	Surface Water Utility
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQI	Water Quality Index
WRIA	Water Resource Inventory Area
yr	year(s)

Executive Summary

Since incorporating in 1995, the City of Shoreline (City) has strengthened its municipal services over time, including a steady improvement of surface water management. The Surface Water Utility (Utility) and Surface Water Utility Enterprise Fund (Fund) were established in 2006. Shortly thereafter, in 2007, the City became a National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit (Phase II Permit) holder, which allows the City to discharge stormwater to surface waters of the state[1].

The Utility is the City's lead agency for maintaining Phase II Permit compliance, and is responsible for implementing the City's Stormwater Management Program. The Utility is also responsible for maintaining stormwater infrastructure, reducing flooding, and protecting surface water quality. The Utility prepared this 2018 *Surface Water Master Plan* (Master Plan) to guide activities for the next 5 to 10 years and address current challenges in stormwater management. In preparing this Master Plan, the following objectives were achieved:

- Develop updated levels of service (LOSs) for the Utility that align with customer expectations
- Review current policies, programs, and operational activities for the Utility and make recommendations for improvements
- Advance the Asset Management Program to improve stewardship of the surface water system infrastructure, and assure customers that funds are spent responsibly and effectively
- Prepare an operations and maintenance (O&M) manual to establish clear processes and protocols
- Assess the current state of the City's surface water systems
- Create an updated set of proposed capital improvement projects and prepare updated planning-level cost estimates
- Prioritize project and program recommendations for implementation
- Develop management strategies based on selected projects and programs
- Conduct a financial analysis to support funding and rate recommendations

Levels of Service

Functions and services provided by the Utility are shaped by the vision and values of the community, and are driven by State of Washington (State) and federal regulations. Levels of service are common-language statements that describe characteristics or attributes of services provided by the Utility to meet the community's basic needs and expectations. Levels of service should align with overall strategic goals of the organization and support its business drivers. Levels of service help Utility managers focus efforts and resources, communicate service expectations, and reconcile budgetary limitations.

[1] "Surface waters of the state" means all waters defined as "waters of the United States" in 40 CFR 122.2 that are within the boundaries of the state of Washington. This includes lakes, rivers, ponds, streams, inland waters, wetlands, ocean, bays, estuaries, sounds, and inlets. WAC 173-226-030.

As part of this 2018 Master Plan, the Utility has developed updated levels of service. The Utility started by considering the community's vision and values; reviewing the strategic goals of the City; and then engaging in a series of discussions with the public, City staff, and Shoreline City Council (City Council). The final levels of service and associated level-of-service targets are provided in Table ES-1.

Table ES-1. Levels of Service and Level-of-Service Targets for the Utility

Level of Service		Level-of-Service Target
LOS 1: Surface Water Impacts	Manage public health, safety, and environmental risks from impaired water quality, flooding, and failed infrastructure	No verifiable health and safety issues or environmental damage caused by the stormwater services outside of risk tolerance
LOS 2: Equitable Service	Provide consistent, equitable standards of service to the citizens of Shoreline at a reasonable cost, within rates and budget	Meet the levels of service as measured by customer satisfaction and rate and revenue projections
LOS 3: Communication and Outreach	Engage in transparent communication through public education and outreach	Maintain a communication plan to inform the community on Utility goals and progress
LOS 4: Regulatory Compliance	Comply with regulatory requirements for the urban drainage system	Meet or exceed regulatory requirements for NPDES Phase II and federal, State, and local regulations affecting surface water management

The levels of service and level-of-service targets shown in Table ES-1 were used to develop a matrix of performance targets and performance measures, both of which provide a much higher level of detail and specificity. Performance targets were used to develop prioritization criteria for capital improvement projects and programmatic recommendations. By organizing and linking prioritization criteria back to levels of service, the Utility was better able to determine which projects and programs are likely to provide the greatest benefit toward achieving levels of service. The results of the prioritization, in combination with estimated costs, were used to select and assemble projects and programs into solution sets, or *management strategies*.

Identifying Improvement Projects

The Utility prepared six basin plans between 2009 and 2016 for all of the city's drainage basins. The *Thornton Creek Watershed Plan* (completed in 2009) preceded the 2011 recommendation for basin planning because substantial drainage problems existed within the basin that drove a special planning effort. The five other basin plans followed the 2011 Master Plan, with two completed in 2013, two in 2015, and the final plan completed in 2016.

Detailed evaluations that were performed for each of the basin plans generated project and program recommendations to address problems related to flooding, water quality, and aquatic habitat. Recommendations were prioritized within each basin (e.g., high, medium, and low) based on the likelihood of success, number of issues addressed, whether public infrastructure or public safety were protected, and availability of public property to address the need. Recommendations from each of the basin plans have been compiled and now provide a basis for comprehensive planning that accounts for citywide priorities and includes financial planning, funding considerations, and/or potential rate impacts. Projects identified in the basin plans were carried forward and prioritized based on level-of-service targets, and the highest-priority projects were selected for inclusion in management strategies.

Evaluating Utility Programs

Utility programs are coordinated and planned activities with goals designed to help the Utility meet levels of service and address regulatory requirements. Programs involve various work activities including Utility administration, system operation and maintenance, and public involvement and outreach. Programs entail long-term or ongoing work activities that are supported by Utility staff and funded through operations budget. The Utility currently runs 18 programs falling into one of the following three categories:

- **Operational programs** help the Utility meet regulatory requirements, collect and analyze water quality data and asset information, perform routine inspections, and support overall Utility staff and resource management
- **Maintenance programs** include preventive and corrective maintenance including cleaning, repair, rehabilitation, and replacement of damaged or deteriorated Utility assets
- **Public involvement programs** educate and engage Shoreline's residents and ratepayers in surface water management and improving surface water quality

One of the major goals for the development of this Master Plan was to perform a thorough review of current programs and operational activities and their benefit to levels of service, needs identified in the basin plans, anticipated growth, and evolving regulations, and to develop detailed recommendations for improvements. The Utility evaluated the status of each existing program (as of 2017) and compared the program outcomes with level-of-service targets and upcoming regulatory requirements. Each of the evaluations resulted in one of three possible outcomes: (1) maintain the existing program, (2) enhance the existing program, or (3) develop a new program to address potential needs. Nine of the 18 existing programs were identified for enhancements, while 9 new programs were also considered. Each of the programs was carried forward and prioritized based on level-of-service targets, and the highest-priority programs were selected for inclusion in management strategies.

Management Strategies

One of the key objectives of this Master Plan is to prioritize recommended programs and capital improvement projects, and to develop comprehensive management strategies based on those priorities. Programs and projects have considerable cost implications and must be prioritized for implementation over time and to ensure adequate funding. A systematic process was developed, including a spreadsheet tool that applies a consistent set of criteria and procedures for scoring. Figure ES-1 below illustrates the prioritization and management strategy development process.

The Utility developed three alternative management strategies to comprise selected programs and projects. The three management strategies are defined as follows:

- **Minimum:** meet the minimum in terms of existing system needs and anticipated new regulatory requirements
- **Proactive:** minimum management strategy plus new high-priority projects and new/enhanced programs that address high-priority, long-term needs
- **Optimum:** proactive management strategy plus additional recommendations to enhance water quality and aquatic habitat

Program selections were based on prioritization scores, contributions toward meeting levels of service, and needs to address regulatory requirements. Selected programs are assumed to start within the next 6 years, while the remaining programs are deferred. Three programs were considered for inclusion in the 6-year Master Plan but were not included.

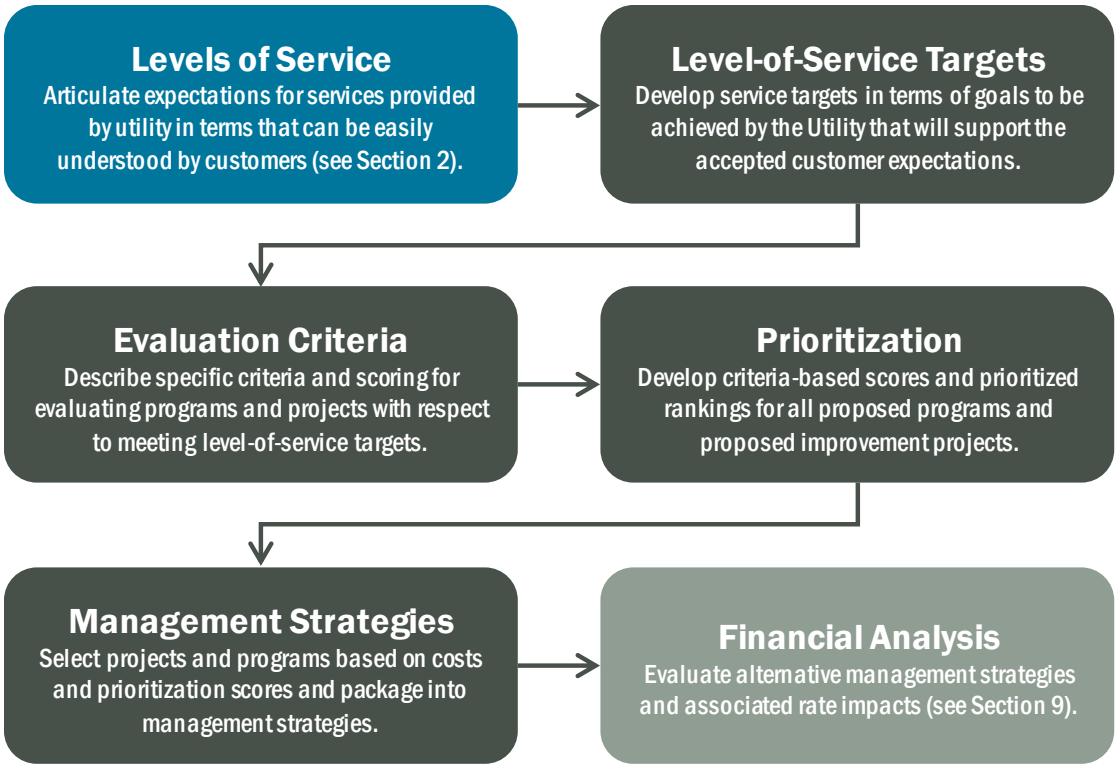


Figure ES-1. Prioritization process for developing management strategies

Projects were selected based primarily on prioritization scores, but with review and consideration for capital costs, project status (some projects have already been initiated), equitable distribution of projects throughout the city, and addressing a variety of project categories. Note that project selection is mostly a reflection of near-term versus long-term scheduling. Projects that were selected for each management strategy are to be included in the 6-year Capital Improvement Plan (CIP), with the remaining projects to be completed over a 20-year planning horizon. In some cases, projects are assumed to be initiated (e.g., planning, design, and permitting phases) during the 6-year planning; however, construction is assumed to be completed in subsequent years. Table ES-2 provides a summary of the number of projects and programs selected for the three management strategies, as well as a qualitative assessment of the benefits to the four levels of service.

Table ES-2. Management Strategy Summary with Cost and Levels of Service Impacts

Management Strategy	Number of Projects and Programs	Total Annual Program Cost, $ million [a]	Total 6-Year Project Cost, $ million [b]	Benefit to Levels of Service			
				Surface Water Impacts	Equitable Service	Communication and Outreach	Regulatory Compliance
Minimum	18 programs 6 projects	4.3	6.2	Low	Medium	Medium	Medium
Proactive [c]	24 programs 26 projects	6.0	11.1	Medium	High	High	High
Optimum	27 programs 30 projects	6.7	16.3	High	High	High	High

a. Includes $3.66 million of current program expenses.

b. Total 6-year project costs based on 2017 dollars.

c. City Council approved the Utility's recommended proactive management strategy based on financial analyses (see Section 9).

The Utility is responsible for funding all program and capital costs. The primary source of funding is a surface water management (SWM) fee assessed to all properties in the city. The fee is billed on King County's property tax statement. Nominal additional revenues are generated through interest earned on reserves and grants. The City controls the SWM fee and the City Council has the authority to adjust the fees as needed to meet financial objectives. A financial analysis was conducted to assess total system costs (capital and non-capital) and assessed funding sources (both current and potential additional funding sources) for each management strategy. Table ES-3 summarizes the annual revenue requirements based on the forecast of revenues, expenditures, fund balances, and fiscal policies that would be needed for each management strategy.

Table ES-3. Management Strategy Financial Analysis Summary

Management Strategy Rate Impact Summary	2017	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 4 2022	Year 5 2023
Minimum							
Proposed increase	N/A	20%	5%	5%	4%	3%	3%
Resulting revenue	$4,488,372	$ 5,391,433	$ 5,666,666	$ 5,955,949	$ 6,200,381	$ 6,392,779	$ 6,591,147
Proactive							
Proposed increase	N/A	27%	15%	10%	10%	5%	5%
Resulting revenue	$4,488,372	$ 5,705,933	$ 6,568,385	$ 7,232,449	$ 7,963,649	$ 8,370,193	$ 8,797,492
Optimum							
Proposed increase	N/A	42%	20%	10%	8%	5%	5%
Resulting revenue	$4,488,372	$ 6,379,862	$ 7,663,490	$ 8,438,269	$ 9,122,444	$ 9,588,145	$ 10,077,620

Source: Table IV-1, City of Shoreline Surface Water Utility; Financial Analysis for 2017 Master Plan, FCS Group (November 2017), Appendix L.

With the greatest number of programs and projects, the optimum strategy has the highest annual revenue requirements and thus the largest rate adjustment of the three scenarios. However, all scenarios require increases in annual revenue to meet new, required expenses as they relate to regulatory requirements and appropriately managing the system. In all three scenarios, an initial, larger, revenue increase is required in 2018 followed by subsequent smaller increases over the next 5 years. This is due to increases in O&M expenses to meet regulatory and basic management requirements for operating the Utility.

These expenses cannot be funded through debt and thus the rate impact cannot be spread out over time. Efforts were made to spread costs and delay projects where possible to mitigate initial rate impacts. The Utility staff recommends the proactive management strategy. This strategy allows the City to not only be compliant with permit requirements but also to attend to desired levels of service and pressing investment needs.

Recommendations for Implementation

Utility staff presented the management strategies and results of the financial analysis to the City Council in August 2017, recommending implementation of the proactive management strategy. The recommendation for the proactive management strategy is based on the expected level of service provided for the associated cost and impact on surface water management fees. The proactive management strategy provides the following:

- Programs that meet current O&M needs and regulatory requirements
- Programs to meet anticipated new regulatory requirements
- High-priority projects and programs that most directly help meet the four levels of service
- Equitable Utility services across the city's drainage basins

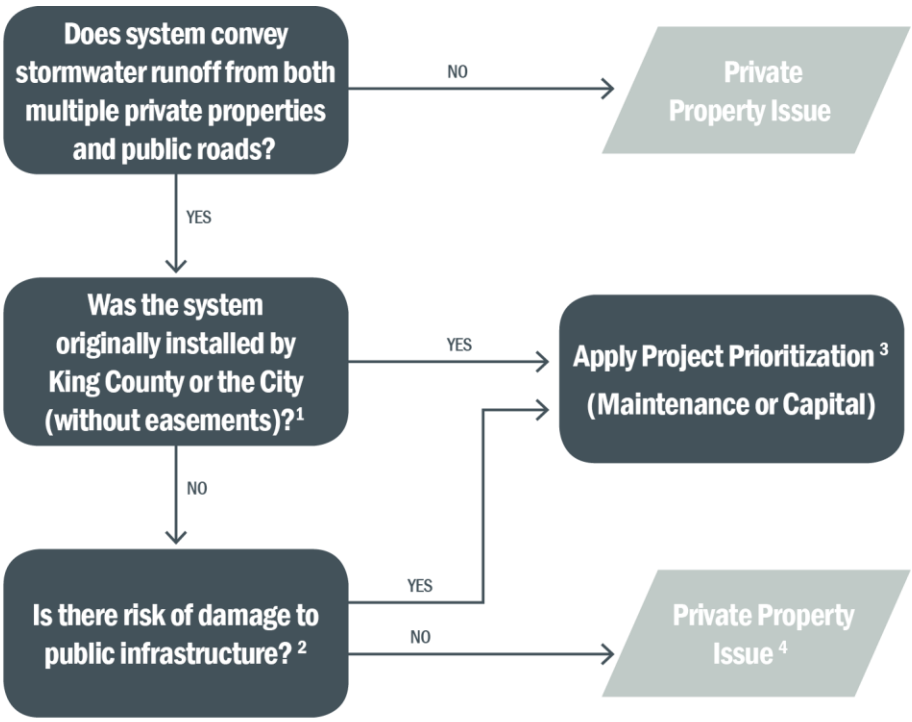
The City Council directed Utility staff to proceed with the proactive management strategy for preparing costs and financial information for the 2018–2023 CIP and 2018 City budget. The following sections summarize the policy recommendations, programs, and projects associated with implementation of the proactive management strategy.

Policy Recommendations

Utility staff conducted policy issue discussions with the City Council on four key policy issues. The following bullets summarize the recommended course of action based on the guidance provided by the City Council:

- **Use of Utility funds outside of the right-of-way (ROW):** The Utility will continue the practice of not expending Utility funds on private property unless City staff determine that the facilities in question are the responsibility of the City or public infrastructure is threatened. Utility staff will follow a "decision requirements" flow chart, shown in Figure ES-2 below. This flow chart shows the criteria Utility staff and the City Attorney will use to identify situations where it is appropriate to use Utility funds outside the ROW.
- **Stormwater Permit:** The Utility will establish a Stormwater Permit that consolidates all the onsite and ROW stormwater review activity into a single permit process covering all ongoing inspections, operations, maintenance, and enforcement of maintenance standards for private drainage systems as required by the Phase II Permit. The Stormwater Permit Program is intended to provide operating budget and staff resources for implementing this recommendation.
- **Surface water management fee-chargeable area:** The Utility will change the chargeable area for surface water fees to be based on hard surfaces. The chargeable area was updated in the surface water management rate table (Shoreline Municipal Code [SMC] 3.01.400) when the City Council approved the 2018 budget.
- **Private facility inspection and maintenance:** The Utility will continue with the current inspection and maintenance program but will embark on a pilot program offering private properties the option to participate in a self-certification program. The Utility estimated an operating budget for the Utility staff to develop the self-certification process over the next 6 years.

The Utility is expected to proceed as described above on each policy issue. Actions required by the Utility have been incorporated into program recommendations where applicable.



Footnotes:

1. In some areas, King County constructed improvements without securing easements. In these cases, there may be a legal justification for the City to secure drainage easements and assume maintenance, particularly if it is a trunk system that serves multiple properties. The City may require that the system be brought up to City standards and that the easement be provided to the City at no cost.
2. Includes flooding or erosion that results in (or could result in future) damage to public roads, infrastructure, or structures.
3. Determine resolution, if possible through a Drainage study/Assessment, then apply project prioritization criteria established in the 2018 Master Plan for prioritization and scheduling. This will include easement acquisition or relocating to the ROW.
4. The City may offer technical guidance.

Figure ES-2. Decision requirements for use of Utility funds outside the ROW

Programs

The proactive management strategy includes 24 programs: 9 existing programs, 9 enhanced programs, and 6 new programs. These programs have been developed to meet current and anticipated NPDES requirements, implement Utility best management practices (BMPs), and reduce the backlog of existing programs. Table ES-4 presents a summary of the proactive management strategy by program category with additional annual operation costs and estimated staffing. Staffing needs were developed by identifying program activities and workload estimates for enhanced and new programs.

Table ES-4. Implemented Program Summary					
Category	Program	Status	Planned Start Year	Operating Cost (Additional to Existing)	Additional Staffing (FTE)
Operation	NPDES Compliance	Enhanced	2020[a]	$32,480	0.13
	Floodplain Management	Existing	Ongoing	-[c]	-[d]
	Administration and Management	Existing	Ongoing	-[c]	-[d]
	Drainage Assessment	Enhanced	2018	$175,640	0.20
	Water Quality Monitoring	Enhanced	2020[a]	$85,470	0.25
	System Inspection	Enhanced	2018	$47,021	0.25
	Condition Assessment	Enhanced	2018	$160,340	0.34
	Private System Inspection	Enhanced	2019[b]	$62,192	0.40
	Stormwater Permit	New	2019[b]	$47,840	0.33
	Asset Management	Enhanced	2018	$69,200	0.25
Maintenance	Street Sweeping	Existing	Ongoing	-[c]	-[d]
	System Maintenance	Existing	Ongoing	-[c]	-[d]
	Small Repairs	Existing	Ongoing	-[c]	-
	SW Pipe Replacement	Enhanced	2019[b]	$651,520	0.52
	Surface Water Small Projects	Enhanced	2018	$400,000	0.16
	Catch Basin R&R	New	2018	$354,100	0.20
	LID Maintenance	New	2018	$53,732	0.10
	Pump Station Maintenance	New	2018	$63,600	0.10
	Utility Crossing Removal	New	2018	$18,400	0.15
Public involvement	Soak-It-Up Rebate	Existing	Ongoing	-[c]	-[d]
	Adopt-a-Drain	Existing	Ongoing	-[c]	-[d]
	Local Source Control	Existing	Ongoing	-[c]	-[d]
	Water Quality Public Outreach	Existing	Ongoing	-[c]	-[d]
	Business Inspection Source Control	New	2020[a]	$86,780	0.10
Average annual O&M effort for infrastructure associated with proactive management strategy				$33,867	0.02
			Total	**$2,342,182**	**3.50**

a. Existing program to continue until enhanced program begins in noted year.

b. Program development begins in 2018; program implementation begins in noted year.

c. Costs for existing programs assumed to be included within existing operation costs.

d. Staffing for existing programs assumed to be covered by existing staff.

Projects

The City Council approved staff's recommendation for the implementation of the proactive management strategy, which includes 25 projects, 21 of which are construction projects and 4 of which are studies or plans. The proactive projects include high-priority construction projects and studies that help meet the level-of-service targets. Projects selected for the 6-year CIP were then examined in closer detail with respect to implementation. Several projects were divided into phases where predesign/feasibility studies were needed or engineering and planning must be done well in advance of construction. Table ES-5 lists the proactive management strategy projects in order of priority with costs in 2017 dollars.

Table ES-5. Proactive Management Strategy Project Summary				
No	6-year CIP status[a]	Project Name	6-Year CIP Cost [b]	Capital Cost [b]
1	DC	25th Ave. NE Flood Reduction and NE 195th St. Culvert Replacement	$2,674,000	$8,226,000
2	P	Master Plan Update	$500,000	$500,000
3	PD	Springdale Ct. NW and Ridgefield Rd. Drainage Improvements	$545,000	$2,058,000
4	PDC	10th Ave. NE Stormwater Improvements	$1,788,000	$1,788,000
5	PD	Heron Creek Culvert Crossing at Springdale Ct. NW	$226,000	$855,000
6	DC	Hidden Lake Dam Removal	$2,097,000	$2,097,000
7	P	25th Ave. NE Ditch Improvements between NE 177th St. and 178th St.	$141,000	$2,538,000
8	PD	Pump Station 26	$320,000	$891,000
9	PD	Pump Station 30 Upgrades	$90,000	$339,000
10	P	6th Ave. NE and NE 200th St. Flood Reduction Project	$22,000	$384,000
11	PDC	Pump Station Misc. Improvements (Linden, Palatine, Pan Terra, 25, Ronald Bog, Serpentine)	$732,000	$732,000
12	C	NE 148th St. Infiltration Facilities	$393,000	$393,000
13	P	Boeing Creek Regional Stormwater Facility	$83,000	$9,440,000
14	P	System Capacity Modeling Study	$300,000	$300,000
15	PDC	NW 195th Pl. and Richmond Beach Dr. Flooding	$747,000	$747,000
16	P	Stabilize NW 16th Pl. Storm Drainage in Reserve M	$28,000	$500,000
17	P	Storm Creek Erosion Management Study	$80,000	$80,000
18	P	Climate Impacts and Resiliency Study	$80,000	$80,000
19	P	Boeing Creek Restoration	$50,000	$7,630,000
20	PD	NW 196th Pl. and 21st Ave. NW Infrastructure Improvements	$83,000	$313,000
21	P	18th Ave. NW and NW 204th St. Drainage System Connection	$15,000	$261,000
22	P	NW 197th Pl. and 15th Ave. NW Flooding	$7,000	$119,000
23	P	Lack of System and Ponding on 20th Ave. NW	$81,000	$1,458,000
24	P	12th Ave. NE Infiltration Pond Retrofits	$38,000	$677,000
25	P	NE 177th St. Drainage Improvements	$9,000	$152,000
			$11,129,000	$51,920,000

a. Implementation status key: P = planning/predesign/study, D = design/permitting, C = construction

b. 2017 dollars. O&M and other life-cycle costs included in financial planning analysis.

Funding

A financial analysis was prepared for capital projects and O&M programs for a 20-year period (2017–2036) and therefore includes financial planning beyond the 6-year period. The Financial Analysis Report (Appendix L) describes the rate increases for the 2018–2023 projected rates and the 2024–2036 revenue requirements. The report also accounts for the associated costs for the debt servicing, reserve funds, and meeting the policy requirements over the planning period. The report then projects the rate increases necessary to support this level of programming. Table ES-6 below provides the results of the projected rate analysis by year.

Table ES-6. Projected Percentage Rate Increases to Meet Proactive Level Program Expenditures							
Rate Increase Summary	2017	2018	2019	2020	2021	2022	2023
Annual rate increases	NA	27.0%	15.0%	10.0%	10.0%	5.0%	5.0%
Single-family annual bill	$ 168.81	$ 214.38	$246.54	$ 271.19	$ 298.31	$ 322.18	$ 328.89
Increase over prior year	NA	$ 45.58	$ 32.16	$ 24.65	$ 27.12	$ 14.92	$ 15.66

Source: Table VI-1; City of Shoreline Surface Water Utility; Financial Analysis for 2017 Master Plan, FCS Group (November 2017) (Appendix L)

Surface water management fee rates are approved annually when the City's annual budget is approved. The rate increases required for the proactive management strategy are implemented for the 6-year planning period through the budget approval.

The analysis shows the need for the rate's highest increase in 2018 with gradually smaller increases in later years. For single-family residences, this reflects an increase in the annual surface water charge from $168.81 in 2017 to $328.89 by 2023. The same percentage increase would apply for every customer type. The current customer rates were adopted on November 20, 2017, when the City Council approved the 2018 budget; these are located in the SMC 3.01.400 Surface Water Management rate table.

Capital improvement estimates show a sustained increase in capital investments from 2024 through 2036. This increase currently results in an average of more than $3 million annually in additional capital expenditures as compared to the current 6-year spending average. Because of sustained above-inflation increases through 2023, current financial forecasts show that the City will require slightly lower rate increases starting in 2024 (of 7 percent) that reduce toward inflationary increases over time despite the higher projected capital expenditures. These forecasts are dependent on the City maintaining its current capital schedule and cost estimates.

It is important that the City revisit the identified rates annually to ensure that the rate projections developed remain adequate. Any significant changes should be incorporated into the financial plan and future rates should be adjusted as needed.

The City should take extra consideration of improved capital cost estimates and scheduling in the 2024–2036 planning period. While the current rate forecast plans for an increase in capital expenditures through this period, changes to costs and schedules will be important to incorporate.

Other financial planning recommendations include the following:

- Adopt rate structure presented for the proactive management strategy
- Revise City "CIP model" to include updated reserve requirements including:
  - 120 days of O&M expenses minimum operating reserve balance
  - 2 percent of assets minimum capital reserve balance
- Review rates and current operational and capital needs annually
- Conduct new financial analysis in 5 years to ensure that projected rates are in line with Utility expenses

Section 1

Introduction

Shoreline, Washington, is a community in northern King County comprising roughly 55,000 residents and covering an area of nearly 12 square miles. Since incorporating in 1995, the City of Shoreline (City) has strengthened its municipal services over time, including a steady improvement of surface water management. The City adopted its first drainage code and established the Surface Water Management Fund in 1995. Operations and maintenance (O&M) work and assessment activities followed in 1997. The Surface Water Utility (Utility) and the Surface Water Utility Enterprise Fund (Fund) were established in 2006. Shortly thereafter, in 2007, the City became a National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Stormwater Permit (Phase II Permit) holder, which allows the City to discharge stormwater to surface waters of the state[2].

The Utility is the City's lead agency for maintaining Phase II Permit compliance, and is responsible for implementing the City's Stormwater Management Program. The Utility is also responsible for maintaining stormwater infrastructure, reducing flooding, and protecting surface water quality. The Utility prepared this 2018 *Surface Water Master Plan* (Master Plan) to guide activities for the next 5 to 10 years and address current challenges in stormwater management.

1.1 History of Planning Efforts

The City's first Master Plan was developed in 2005 to address prevailing needs for flood protection, water quality improvement, and stream habitat protection. The 2005 Master Plan focused on identifying problems and recommending specific structural projects and non-structural programs to address the identified problems. The 2005 Master Plan also included an evaluation of stormwater management activities necessary to comply with the forthcoming 2007 Phase II Permit[3]. The 2005 Master Plan included a financial analysis documenting the need for surface water management fees to support drainage improvements and mandatory compliance with the Phase II Permit.

An updated Master Plan was prepared in 2011 to address the Utility's growing needs, including the new and more stringent requirements anticipated with the 2013 Phase II Permit[4]. As services and regulatory compliance activities became more complex, the Utility required a more sophisticated approach to surface water planning and management. To address this need, the 2011 Master Plan established basic levels of service (LOSs) for the Utility, examined operations and policies, provided recommendations for improvements, and analyzed the rates needed to support the Master Plan. One of the key outcomes from the 2011 Master Plan was a schedule to complete a basin planning effort, which was designed to address stormwater management issues that are unique to each drainage area within the city.

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[2] "Surface waters of the state" means all waters defined as "waters of the United States" in 40 CFR 122.2 that are within the boundaries of the state of Washington. This includes lakes, rivers, ponds, streams, inland waters, wetlands, ocean, bays, estuaries, sounds, and inlets. WAC 173-226-030.

[3] The 2007–2012 Phase II Permit included new requirements for construction site and post-construction runoff control; IDDE, MS4, and O&M program requirements; and public education, outreach, and participation.

[4] The 2013–2018 Phase II Permit was issued in 2012 and became effective in 2013. New requirements in this permit included LID requirements for new development and redevelopment, and additional water quality data collection and documentation of financial contribution to the new RSMP administered by Ecology.

The Utility prepared six basin plans between 2009 and 2016 for all of the city's drainage basins. The *Thornton Creek Watershed Plan* (completed in 2009) preceded the 2011 recommendation for basin planning because substantial drainage problems existed within the basin that drove a special planning effort. The five other basin plans followed the 2011 Master Plan, with two completed in 2013, two in 2015, and the final plan completed in 2016. Figure 1-1 shows the areas covered by each of the basin plans. Table 1-1 summarizes the six basin planning documents.

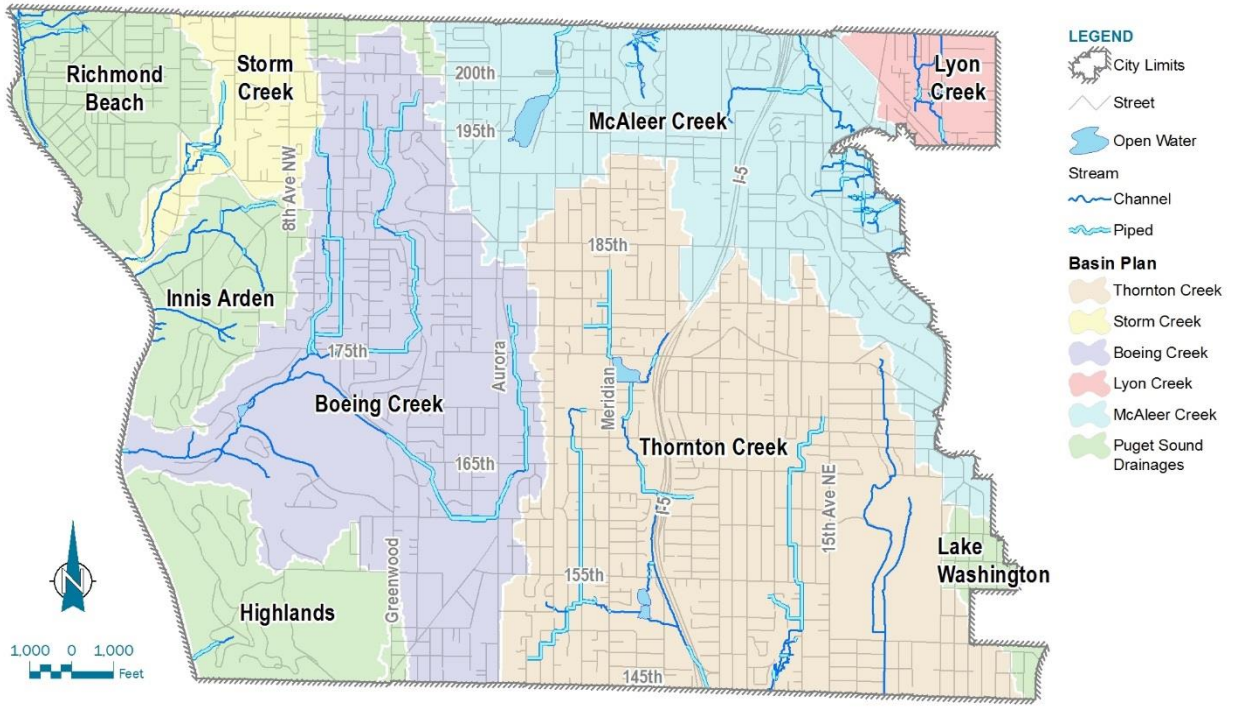

Figure 1-1. Shoreline surface water basins

Table 1-1. Summary of Basin Planning Efforts

Basin Plan Title	Date Completed	Area Covered within the City (acres)	Key Outcomes
Thornton Creek Watershed Plan	November 2009	2,375	• Capital improvement projects [a] • Programmatic measures and studies [a] • Flood hazard mitigation and mapping [b] • Recommendations for development standards [b]
Storm Creek Basin Plan	March 2013	308	• Capital improvement projects • Programmatic measures and studies • Condition assessment for stormwater pipes [a]
Boeing Creek Basin Plan	March 2013	1,769	• Capital improvement projects • Programmatic measures and studies • Condition assessment for stormwater pipes
Lyon Creek Basin Plan	October 2015	178	• Capital improvement projects • Programmatic measures and studies • Condition assessment for stormwater pipes • Risk-based prioritization of pipe repair and replacement (R&R) [a]
McAleer Creek Basin Plan	November 2015	1,370	• Capital improvement projects • Programmatic measures and studies • Condition assessment for stormwater pipes • Risk-based prioritization of pipe R&R
Puget Sound Drainages Basin Plan (including Lake Washington and other small basins)	December 2016	1,402	• Capital improvement projects • Programmatic measures and studies • Condition assessment for stormwater pipes • Risk-based prioritization of pipe R&R

a. Indicates a key outcome included subsequent basin plans.

b. Indicates a difference in key outcomes compared to preceding basin plans.

Detailed evaluations that were performed for each of the basin plans generated project and program recommendations to address problems related to flooding, water quality, and aquatic habitat. Recommendations were prioritized within each basin (e.g., high, medium, and low) based on the likelihood of success, number of issues addressed, whether public infrastructure or public safety were protected, and the availability of public property to address the need. Detailed recommendations from each of the basin plans have been compiled and now provide a basis for comprehensive planning that accounts for citywide priorities and includes financial planning, funding considerations, and/or potential rate impacts.

1.2 Purpose and Objectives

The purpose of this Master Plan is to provide a comprehensive update to the 2011 Master Plan and prioritize the recommendations from the recent basin planning efforts. This Master Plan will guide the Utility for the next 5 to 10 years and addresses emerging issues associated with rapid growth, increasing regulations, and aging infrastructure. In preparing this Master Plan, the following objectives were achieved:

- **Develop updated levels of service for the Utility that align with customer expectations:** The Utility worked closely with customers, Public Works staff, and the Shoreline City Council (City Council) to develop refined language for levels of service. The new levels of service reflect current customer expectations and provide a firm basis for operational decisions and priorities.
- **Review current policies, programs, and operational activities for the Utility and make recommendations for improvements:** Because of recent and anticipated growth and evolving regulations, the Utility worked with Public Works staff and the City Council to develop new policies, as well as recommendations for new and enhanced programs to address current needs. Program recommendations include details regarding costs, additional staffing needs, and performance measures for monitoring program success over time.
- **Advance the Asset Management Program to improve stewardship of the surface water system infrastructure, and assure customers that funds are spent responsibly and effectively:** Asset management ties expenditures to customer service levels, and through increased accountability aims to ensure that all asset decisions reflect the lowest life-cycle cost needed to meet customer expectations at responsible levels of risk. The Utility evaluated its current business practices and developed an Asset Management Work Plan (AMWP) to address gaps and develop near- and long-term actions for improving asset management practices.
- **Prepare an O&M manual to establish clear processes and protocols:** The Utility developed an updated and substantially expanded O&M manual to document the function and frequency of periodic maintenance activities, maximize the use of its Computerized Maintenance Management System (CMMS), and support improvements in asset management practices.
- **Assess the current state of the City's surface water systems:** The Utility synthesized available information from multiple sources, including basin plans, condition assessment data, previous modeling efforts, geospatial databases, and other available documents. In addition, the Utility evaluated water quality treatment options and developed a framework for system-wide capacity modeling.
- **Create an updated set of proposed capital improvement projects and prepare updated planning-level cost estimates:** The Utility developed an updated database of capital improvement projects that were identified through basin planning efforts, pump station condition assessment, the drainage assessment program, and ongoing pipe inspection and condition assessment programs. Project updates included the development of updated project cost estimates using a consistent set of costing assumptions.
- **Prioritize project and program recommendations for implementation:** The Utility established transparent and repeatable processes to prioritize projects and programs based on their potential to support meeting the level-of-service targets. The Utility used the prioritization results to select projects for the 6-year Capital Improvement Plan (CIP) and programs to be implemented over the same time frame.
- **Develop management strategies based on selected projects and programs:** Projects and programs were selected and packaged into management strategies that were evaluated with respect to meeting levels of service and costs to the Utility.

- **Conduct a financial analysis to support funding and rate recommendations:** Implementation of new and revised policies, programs, and projects requires financial planning that provides for implementation of a selected management strategy. The Utility conducted a financial analysis to determine the rates and revenue required to meet the operational, debt service, and capital improvement costs associated with implementation of each of the identified management strategies. The results were used to select a preferred management strategy for the Utility.

1.3 Planning and Review Process

The City retained Brown and Caldwell (BC) to assist with development of the 2018 Master Plan; work began in July 2016. During the process for plan development, the City held two public meetings and obtained input from the City Council. In addition, two Web-based public surveys were conducted to provide input on this Master Plan. More information about these efforts is included in the following paragraphs.

1.3.1 Public Meetings

Obtaining public input is an important way to match customer expectations with the levels of service that are defined for the Utility. A public meeting and open house were held at Shoreline City Hall on September 8, 2016. A total of 23 Shoreline citizens attended and listened to a short presentation on the surface water master planning process and development of levels of service for the Utility. The presentation was followed by many questions from the attendees, ranging from a general discussion on surface water to specific drainage problems experienced by residents. City staff were on hand to answer questions, interact with attendees, and gather feedback.

After the questions portion of the meeting, residents were encouraged to visit each of the two work stations set up within the room. The first work station focused on general surface water topics and planning processes. The second work station exhibited draft levels of service for the Utility and attendees interactively posted stickers indicating, in their view, the priorities of the Utility. Questions, comments, and priority notes from the open house were compiled and used to inform the development of levels of service and level-of-service targets.

A second open house was held at Shoreline City Hall on July 13, 2017. Eight residents attended and listened to a short presentation on the progress of the 2018 Master Plan. The presentation included an overview of project and program recommendations and a brief discussion of three proposed management strategies for the Utility. Work stations were set up within the room and residents were also asked to indicate which of the three stormwater management strategies they preferred by posting stickers on a display board outlining the three options. Figure 1-2 illustrates the basic steps of the 2018 Master Plan development process and the points where open houses were used to solicit feedback from the public.

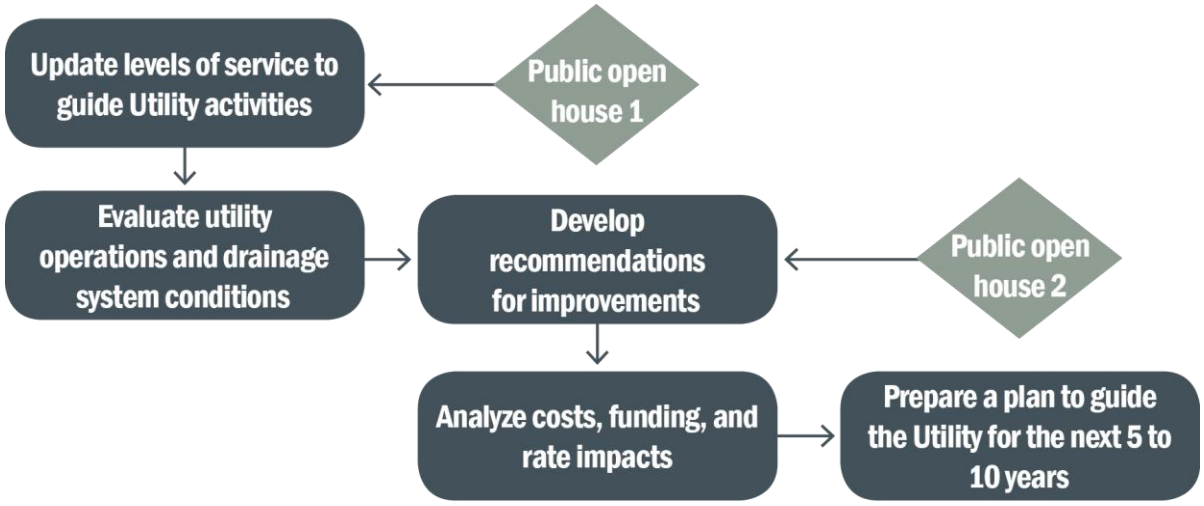

Figure 1-2. Public input was obtained through two open houses held during development of this Master Plan

1.3.2 Public Surveys

Public surveys were conducted in conjunction with each of the two public open houses to solicit direct feedback on levels of service and management strategies for the Utility (Table 1-2). In each case, the Web-based survey was released in advance of the public open house through various channels including Shoreline Alerts, Shoreline Area News, neighborhood associations, and the City's website. Survey questionnaires were also available to the attendees of each public open house. Public survey results are provided in Appendix A.

Table 1-2. Public Survey Activities

Survey Number	Dates of Survey	Number of Responses	Primary Topic
1	September 2–16, 2016	177	Proposed levels of service
2	July 5–16, 2017	129	Proposed management strategies

1.3.3 Reports to City Council

Utility staff provided updates to the City Council at five key points throughout the planning process. Staff reports were prepared in advance of scheduled City Council meetings, and presentations were given during each meeting, followed by questions from council members. These updates were not intended only to inform the City Council of progress on the 2018 Master Plan, but also to provide council members with opportunities to provide feedback and direction throughout the planning process. The following is a summary of the City Council meetings:

- **City Council meeting 1:** On October 10, 2016, the City Council received an introduction to the 2018 Master Plan planning process and reviewed the draft levels of service and level-of-service targets that were to be used in development of the 2018 Master Plan recommendations.
- **City Council meeting 2:** On May 15, 2017, the City Council discussed and provided direction on four key policy issues related to operation of the Utility, the outcomes for which have been incorporated into the program recommendations for the 2018 Master Plan.
- **City Council meeting 3:** On July 17, 2017, the City Council reviewed management strategies, which consisted of different groupings of projects and programs. The City Council also reviewed a summary and provided feedback on the prioritization process and management strategies being evaluated in the financial analysis.

- **City Council meeting 4:** On August 7, 2017, the City Council discussed and provided direction on a preferred management strategy for use in developing rates and financial analysis for the 2018 Master Plan and 2018–2023 rates.
- **City Council meeting 5:** On December 4, 2017, the City Council reviewed the new and enhanced Utility programs scheduled to begin in 2018 along with performance measures that will be used to monitor the success of the programs.

1.3.4 State Environmental Policy Act

The State Environmental Policy Act (SEPA) requires State of Washington (State) and local agencies to consider the likely environmental consequences of a proposal before approving or denying that proposal. This process provides a way to identify possible environmental impacts that may result from governmental decisions. As the lead agency, the City is responsible for identifying and evaluating the potential adverse environmental impacts of this Master Plan. This evaluation will be documented in the form of an environmental checklist and sent to other agencies and the public for their review and comment. See Appendix B for SEPA compliance documentation.

1.4 Organization of the Document

This Master Plan has been written for a variety of audiences ranging from Utility staff to City executives, and is intended to be available to the public and customers of the Utility. The body of this document is divided into the following nine sections:

Section 1. Introduction	Brief discussion of previous planning efforts, list of current planning objectives, and an overview of the planning process.
Section 2. Levels of Service	Summary of Utility services and a discussion on the development of updated levels of service.
Section 3. Drainage Systems	Description of the current conditions of the Utility's stormwater infrastructure and drainage basins.
Section 4. System Evaluation	Summary of technical evaluations, including a conditions assessment and needs for conveyance capacity modeling.
Section 5. Regulatory Compliance	Description of current and future regulations impacting Utility planning and operation.
Section 6. Policies and Procedures	Background on organizational structure and a review of relevant City policies, Shoreline Municipal Code (SMC), and recommendations for policy changes.
Section 7. Utility Programs	Review of current programs and development of recommendations for new and enhanced programs.
Section 8. Management Strategies	Discussion of program and project recommendations, including a summary of the prioritization process and selection of a preferred management strategy.
Section 9. Financial Analysis	Summary of the financial analysis and determination of rates needed to support the selected management strategy.
Section 10. Implementation	Summarizes the costs and staffing needs associated with the preferred management strategy, including the recommended funding plan.

The Master Plan starts with defining levels of service, then evaluates the need for projects and programs to meet those levels of service, and finally makes recommendations for implementing improvements. Section 2 describes the development of updated levels of service for the Utility, providing a basis for subsequent evaluations of system performance, operations, and asset management. Sections 3 and 4 describe and evaluate the condition of the drainage system, including recommendations for improvements from the recent basin planning efforts and condition assessment activities. Section 5 provides an overview of relevant regulations. Sections 6 and 7 discuss Utility policies, procedures, and programs and present recommendations for improvements. Section 8 describes how all recommended improvements were prioritized and selected for alternative management strategies. Section 9 describes the financial analysis used to identify a preferred management strategy for implementation. Section 10 provides additional details regarding implementation of the preferred management strategy. Additional supporting technical information is provided in the appendices.

Section 2

Levels of Service

The Utility is responsible for maintaining stormwater infrastructure and protecting surface water quality in the city of Shoreline. The Utility provides surface water management services within city limits through constructed drainage systems that connect with the streams, wetlands, and lakes of Shoreline's drainage basins, as well as the drainage systems of neighboring jurisdictions. The Utility is the lead agency for compliance with State and federal regulatory requirements relating to surface water resources (e.g., streams and rivers), such as the Phase II Permit.

Functions and services provided by the Utility are shaped by the vision and values of the community, and are driven by State and federal regulations. Levels of service are common-language statements that describe characteristics or attributes of services provided by the Utility to meet the community's basic needs and expectations. Levels of service should align with overall strategic goals of the organization and support its business drivers. Levels of service help Utility managers focus efforts and resources, communicate service expectations, and reconcile budgetary limitations. More specifically, levels of service are used to:

- Provide customers with an understanding of the services offered
- Focus asset management activities on what is needed most
- Measure performance and track progress of the Utility
- Examine the costs and benefits of the services offered
- Assess suitability, affordability, and equity of the services offered

As part of this 2018 Master Plan, the Utility has developed updated levels of service. The Utility started by considering the community's vision and values; reviewing the strategic goals of the City; and then engaging in a series of discussions with the public, City staff, and City Council. The following section summarizes the outcome of this process.

2.1 Community Vision

In 2009, the City Council adopted the *Vision 2029* document (City 2009). *Vision 2029* envisions Shoreline as "a thriving, friendly city where people of all ages, cultures, and economic backgrounds love to live, work, play, and—most of all—call home." The document further describes Shoreline as a:

> … regional and national leader for living sustainably. Everywhere you look there are examples of sustainable, low-impact, climate-friendly practices: cutting edge energy-efficient homes and businesses, vegetated roofs, rain gardens, bioswales along neighborhood streets, green buildings, solar-powered utilities, rainwater harvesting systems, and local food production, to name only a few. Shoreline is also deeply committed to caring for its seashore, protecting and restoring its streams to bring back the salmon, and making sure its children can enjoy the wonder of nature in their own neighborhoods (City 2009).

In support of this vision, the City's Public Works Department seeks to support a sustainable and vibrant community through stewardship of the public infrastructure and natural environment, with a vision for a legacy of enduring quality of services provided for the community and natural

environment through excellent infrastructure and innovative practices. Likewise, the Utility seeks to implement the vision and goals of the community through the services that it provides.

Sustainability. *Vision 2029* outlines a commitment to being a sustainable city in all respects. This emphasis on sustainability includes goals to conserve and protect our environment and natural resources; encourage restoration, environmental education, and stewardship; and apply innovative and environmentally sensitive development practices (City 2009). The City has also prepared an environmental sustainability strategy that underscores the use of green infrastructure, including the following recommendations:

- Promote green building and low impact development (LID) by training select staff, providing outreach information, and revising building and development codes
- Prioritize green streets planning, design, and implementation
- Promote natural solutions to stormwater management in private and public development with both incentives and requirements by revising engineering and development code standards, implementing CIP projects, and through public outreach (City 2008)

The City's commitment to environmental protection, sustainability, and natural solutions is also reflected in the natural environment goals in the *City of Shoreline Comprehensive Plan* (Comprehensive Plan), including the following goals related to surface water (City 2012):

- **Goal NE VI:** Manage the stormwater system through the preservation of natural systems and structural solutions to protect water quality; provide for public safety and services; preserve and enhance fish and wildlife habitat, and critical areas; maintain a hydrologic balance; and prevent property damage from flooding and erosion.
- **Goal NE VII:** Continue to require that natural and onsite solutions, such as infiltration and rain gardens, be proven infeasible before considering engineered solutions, such as detention.
- **Goal NE VIII:** Preserve, protect, and (where feasible) restore wetlands; shorelines; and streams for wildlife, appropriate human use, and the maintenance of hydrological and ecological processes.

Social Equity. *Vision 2029* and the Comprehensive Plan expand the goals for environmental sustainability to incorporate goals for advancing economic development and social equity (i.e., using a triple-bottom-line approach) (City 2009; City 2012). The importance of equity is also reflected in the values of the Public Works Department, honoring diversity and fairly representing all members of the community. The Comprehensive Plan includes the following relevant goals for utilities:

- **Goal U I:** Facilitate; support; and/or provide citywide utility services that are consistent, reliable, and equitable; technologically innovative, environmentally sensitive, and energy efficient; sited with consideration for location and aesthetics; and financially sustainable.
- **Goal U II:** Facilitate the provision of appropriate, reliable utility services, whether through City-owned and operated services, or other providers.

This Master Plan supports the community's vision for sustainability and social equity by providing a financially viable plan for improving surface water management, including recommendations for projects and programs that preserve natural systems, protect water quality, and reduce risks to public safety. Sustainability and equity goals were important considerations in the development of levels of service, as described in the next section.

2.2 Defining Levels of Service

Levels of service provide for a common understanding between the customer (i.e., residents and businesses) and the service provider (i.e., the Utility). When developing levels of service, it is useful to examine various aspects of the services provided by the Utility in terms of what is important to the customer; these often involve health and safety, environmental impacts, quality, reliability, availability, and affordability. Level-of-service statements should articulate intended objectives for delivering services and should be written in a way that can be understood by the end user.

Draft levels of service were developed from the levels of service described in the 2011 Master Plan, the City's Comprehensive Plan, and from the 2015–2017 City Council Work Plan and Goals. Utility staff then participated in several workshops facilitated by BC and FCS Group to develop and refine level-of-service statements. At the same time, level-of-service targets were defined as specific goals for how the Utility would meet the levels of service. The suggested language for levels of service and draft level-of-service targets was presented to the public at an open house on September 8, 2016, and part of a public survey run from September 2–16, 2016. Both the open house and survey were used to obtain feedback from the public and gain a better understanding of the public's priorities.

The draft levels of service, level-of-service targets, and results from the public open house and public survey were presented to the City Council for discussion on October 10, 2016. The City Council agreed with the levels of service and the levels of service did not change throughout the development of the Master Plan. The final levels of service and associated level-of-service targets are provided in Table 2-1.

Table 2-1. Levels of Service and Level-of-Service Targets for the Utility

Level of Service		Level-of-Service Target
LOS 1: Surface Water Impacts	Manage public health, safety, and environmental risks from impaired water quality, flooding, and failed infrastructure	No verifiable health and safety issues or environmental damage caused by the stormwater services outside of risk tolerance
LOS 2: Equitable Service	Provide consistent, equitable standards of service to the citizens of Shoreline at a reasonable cost, within rates and budget	Meet the levels of service as measured by customer satisfaction and rate and revenue projections
LOS 3: Communication and Outreach	Engage in transparent communication through public education and outreach	Maintain a communication plan to inform the community on Utility goals and progress
LOS 4: Regulatory Compliance	Comply with regulatory requirements for the urban drainage system	Meet or exceed regulatory requirements for NPDES Phase II and federal, State, and local regulations affecting surface water management

The levels of service and level-of-service targets shown in Table 2-1 were used to develop a matrix of performance targets and performance measures, both of which provide a much higher level of detail and specificity. Performance targets were used to develop prioritization criteria for capital improvement projects and programmatic recommendations (see Section 8). By organizing and linking prioritization criteria back to levels of service, the Utility was better able to determine which projects and programs are likely to provide the greatest benefit toward achieving levels of service.

Prioritization scoring and estimated costs were used to select and schedule projects and programs for implementation. The resulting group of projects and programs and schedule for implementation is referred to as a management strategy. Section 8 describes the process used to develop the following three alternative management strategies:

- **Minimum:** Meet the minimum in terms of existing system needs and anticipated regulatory requirements. Programs should focus on the fourth level of service, meeting existing and anticipated regulatory requirements. Projects should included those that are currently in progress.
- **Proactive:** Minimum management strategy plus new high-priority projects and new/enhanced programs that address high-priority, long-term needs and benefit all four levels of service. Programs in addition to the minimum should include enhanced existing programs or new programs meeting long-term needs for system inspection and maintenance.
- **Optimum:** Proactive management strategy plus additional recommendations to enhance water quality and aquatic habitat that provide the highest level of service.

The minimum, proactive, and optimum management strategies were analyzed for rate and funding impacts (Section 9), and a preferred management strategy was recommended for implementation after consulting with the City Council (Section 10).

Section 3

Drainage Systems

Shoreline is in the northern portion of King County bounded by Puget Sound to the west, Snohomish County to the north (including the cities of Mountlake Terrace, Edmonds, and the town of Woodway), Lake Forest Park to the east, and the city of Seattle to the south. Shoreline can be divided into seven distinct drainage basins: Thornton, Boeing, Storm, Lyon, and McAleer creeks; Middle Puget Sound; and West Lake Washington. Shoreline surface waters drain to either Lake Washington (Thornton, McAleer, and Lyon creeks, and West Lake Washington drainages) or Puget Sound (Boeing and Storm creeks, and the Middle Puget Sound drainages). Figure 1-1 (see Section 1) is a map of Shoreline's drainage basins. Figures 3-1 through 3-5 show the city drainage basins at a larger scale.

The city is nearly fully developed with about 1 percent of the total land area considered vacant (City 2017). On average, the city's land cover is currently 38 percent impervious. In buildout conditions (i.e., land use matches zoning allowances) imperviousness is estimated to be 50 percent.

Over the past 7 years, the City has completed basin planning for each of the city's drainages. Basin plans for the city's five largest creeks (Thornton, Boeing, Storm, McAleer, and Lyon) were completed first. The *Puget Sound Drainages Basin Plan* (AltaTerra 2016) included information for the city's remaining smaller drainages within the Middle Puget Sound and West Lake Washington basins. All six basin plans provide detailed evaluations of the drainage systems and recommendations for improvements that, when implemented, will help the Utility meet the levels of service defined in Section 2. Projects identified in the basin plans will be carried forward and prioritized based on level-of-service targets, and the highest-priority projects will be selected for inclusion in management strategies (see Section 8).

Table 3-1 presents an inventory summary of the basins' natural and built characteristics based on the basin planning work, the City's GIS and recent water quality evaluations. The sections following the table provide a summary for Shoreline with descriptions of smaller basins included in sections of larger adjacent basins. The summary includes a basin description, water quality data trends, and basin needs as identified in basin plans.

Table 3-1. Summary of Drainage Basins

Basin	In-City Basin Size (acres)	Percent of City Area	Percent Impervious		Geology Soils	Receiving Water Body	Projects Identified
			Existing	Buildout			
Thornton Creek	2,391	32	40	55	Vashon Till with Esperance Sands	Lake Washington via city of Seattle	22
Boeing Creek	1,764	24	40	57	Glacial till	Puget Sound	26
Storm Creek	298	4	38	51 (north) 47 (south)	Till (plateau) with Esperance Sands and lacustrine clay-silt (slopes)	Puget Sound	25
McAleer Creek	1,377	18	41	58	Esperance Sands (east) with glacial till and hardpan (west)	Lake Washington via cities of Mountlake Terrace, and Lake Forest Park	14
Lyon Creek	184	3	42	64	Esperance Sands with small portion of transitional beds along the lower portion of the creek near the city limits	Lake Washington via cities of Mountlake Terrace and Lake Forest Park	9
Middle Puget Sound	1,312	17	33	--	Glacial till (higher elevation) with advanced outwash and transitional beds of silt and clay (lower elevation)	Puget Sound	16
West Lake Washington	119	1	38	58	Alderwood gravelly sandy loam	Lake Washington and small portion to Lake Washington via Seattle	2

3.1 Thornton Creek

The Thornton Creek basin, located east of Aurora Avenue N, drains south through the city of Seattle to Lake Washington. The basin is the largest in the city with 2,391 acres (approximately one third of the 7,402-acre total basin area) within the city limits. See Figure 3-1.

The Thornton Creek basin is almost completely developed with single-family residential and commercial land use. The Thornton Creek basin contains several subareas that have been rezoned for higher density, including the 145th and 185th Street Light Rail Station Subareas. The 185th Street Light Rail Station Subarea spans portions of the Thornton and McAleer Creek basins, with approximately 60 percent of the 559-acre subarea in the Thornton Creek basin. As these areas redevelop, the Utility has the opportunity to mitigate impacts of increased impervious surfaces with stormwater management practices including LID, stormwater treatment, and detention facilities.

The headwaters of Thornton Creek begin within the city just north of Ronald Bog. Currently, a large portion of the former headwaters of Thornton Creek are piped water courses. Relative to all streams in the city, Thornton Creek contains the least amount of natural channel with an estimated 46 percent of the creek conveyed in closed conveyance. Significant features in the basin include the pond and wetland areas of Ronald Bog and Twin Ponds, Meridian wetland, and Thornton and Littles creeks.

The 2009 Thornton Creek (RW Beck 2009) basin plan lists several needs that have been addressed since the plan was published. These projects include capital projects that have alleviated flooding for the Ronald Bog area, flooding of 12th Avenue NE between NE 170th and 175th streets, and infrastructure improvements at N 167th Street and Wallingford Avenue N.

Needs reported in the 2009 plan that are currently relevant include:

- Basin-wide pipe inspection, condition assessment, and pipe repair and replacement (R&R)
- Localized flooding appears to be related to hydraulic constrictions in the system
- Wetland and buffer areas along the east edge of Ronald Bog Park lack a diverse native plant assemblage and habitat structures
- Portions of Hamlin Creek lack habitat in-stream structure, native vegetation, and canopy cover
- Water quality is of moderate concern because of fecal coliform

While the flooding issues associated with the Ronald Bog area have been addressed, a handful of localized flooding issues remain. These issues include areas with little or no formal drainage and retrofit opportunities for Littles Creek and existing infiltration ponds. Water quality and aquatic habitat remain key issues in the Thornton Creek basin. Approximately 46 percent of the creek channel is in pipes, and the open-channel portions have limited riparian habitat. Notable losses in aquatic habitat include enclosed portions of Hamlin Creek, wetland areas near Ronald Bog, and the coarse sediment-starved portions of Thornton Creek streambed. The Utility has proposed a public outreach program to address Thornton Creek basin resident behavior and activity.

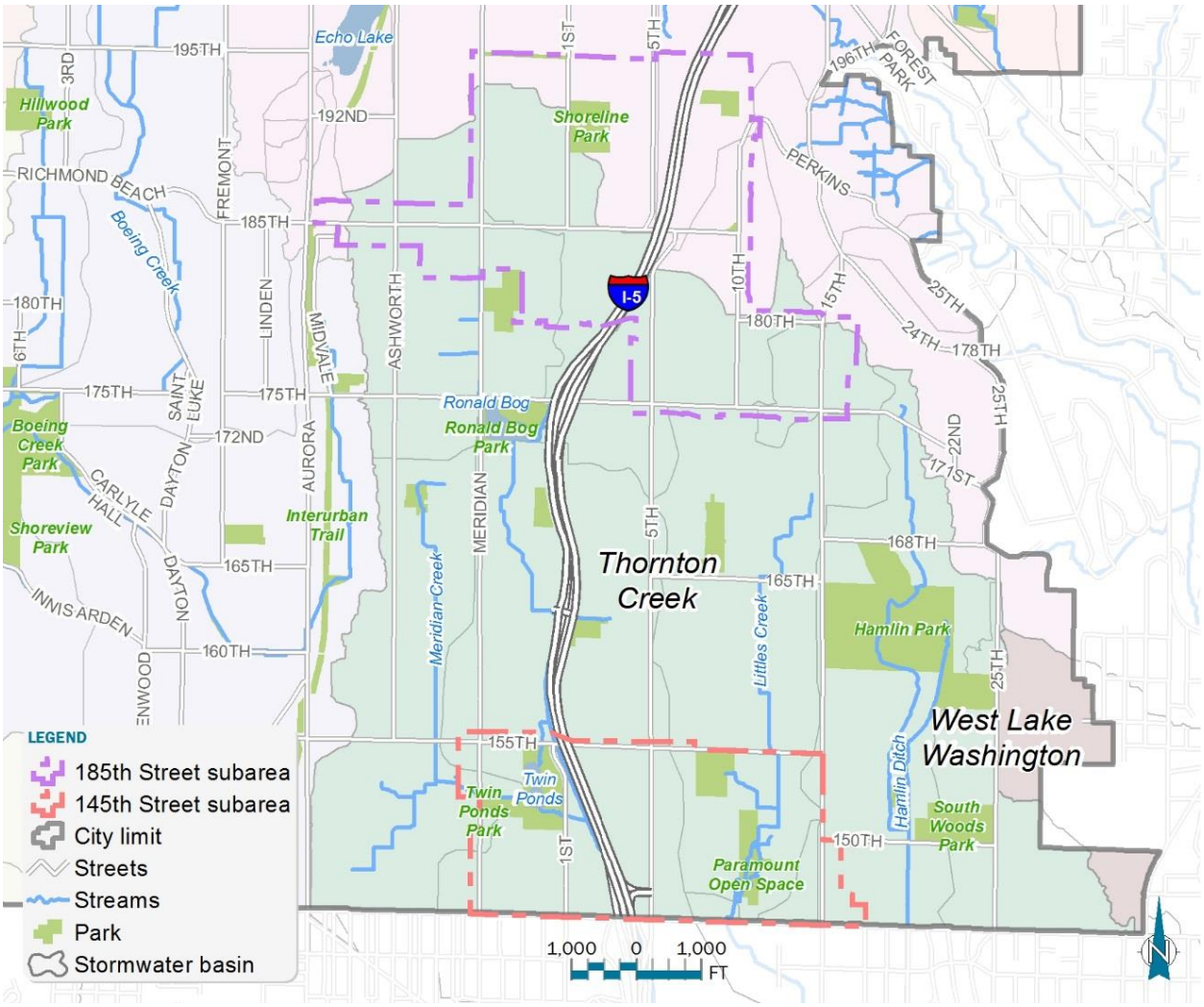

Figure 3-1. Thornton Creek/West Lake Washington basins

3.2 Boeing Creek

The Boeing Creek basin, the second-largest basin in the city, encompasses approximately 1,740 acres and is contained almost entirely inside the city limits. Most of the basin lies west of Aurora Avenue N and drains to Puget Sound. Land use in the basin is single-family residential with a smaller portion of commercial/industrial development along Aurora Avenue N. Focused areas of redevelopment include the Town Center subarea and the Aurora Square Community Renewal Area, both along Aurora Avenue N. See Figure 3-2.

The upper portions of the creek are piped because of previous and historical development. The lower 1.55 miles of the lower Boeing Creek main stem is open channel. This portion is located below Carlyle Hall Road.

The Boeing Creek basin has three dams managed by the Utility. The M1-dam and North Dam provide flood control on the south and north branches of upper Boeing Creek, respectively. Hidden Lake Dam, located on the main stem downstream of the north fork and south fork confluence, was originally constructed to build a fishing pond in the early 20th century. Hidden Lake has required ongoing sedimentation dredging and has been identified as a fish barrier along Boeing Creek. The City decided to stop dredging the lake in 2014 and begin a phased approach to remove Hidden Lake Dam and restore Boeing Creek at the Hidden Lake site.

The Boeing Creek basin plan (Windward 2013) identified erosion and water quality (presence of fecal coliform bacteria) as two of the primary surface water-related issues in the Boeing Creek basin. The plan also identified infrastructure needs including pipe R&R based on condition assessment, as well as stormwater management facilities to mitigate runoff impacts. The following issues identified in the basin plan associated with the built surface water system and infrastructure remain relevant today:

- Approximately 7 percent of the pipes inspected were recommended for repair.
- Multiple impassable fish barriers limit upstream access for anadromous fish, and potentially limit movement of resident fish confined to the upper reaches of Boeing Creek.
- Stormwater management facilities to mitigate runoff from developed areas are limited primarily to large, in-stream facilities at the heads of the open channel sections of Boeing Creek. Management of stormwater closer to the source could improve conditions and augment the functionality of these facilities.
- Glacial outwash geology in areas of steeper slopes is very erodible. Geologic conditions, combined with excessive stormwater inputs from upstream development, have contributed to major hillslope and channel instability issues in and adjacent to Boeing Creek.
- Sediment input from hillslope and bank erosion is deposited in low-gradient reaches, causing aggradation of sedimentation in spawning gravels, as well as maintenance issues in Hidden Lake.
- Low Benthic Index of Biotic Integrity (B-IBI) scores in Boeing Creek indicate poor aquatic habitat conditions
- Localized flooding appears to be related primarily to clogged culverts and ditches, rather than hydraulic constrictions in the system.
- Water quantity is of concern in the Boeing Creek basin, as evidenced by the Washington State Department of Ecology's (Ecology's) recent decision to close the basin to further appropriation of surface water and groundwater. Several applications for new water rights have been denied.

With the exception of localized areas lacking formal drainage or experiencing flooding, most of the surface water needs for Boeing Creek are associated with the open-channel portions of the basin. A key need to improve the natural function of the lower portion of the stream is to allow fish passage

through a creek restoration project. Areas in the upper portions of the basin with flooding and/or highly erosive runoff rates should be addressed prior to, or simultaneously with, a lower creek restoration project. One potential near-term project is the removal of the Hidden Lake Dam (see Figure 3-2). Removing the dam would not only eliminate a fish barrier, the sediment deposited behind the dam will no longer need to be dredged. A long-term project in the upper basin of the Boeing Creek south fork is a regional stormwater facility for planned redevelopment in the Aurora Square Community Renewal Area between 160th and 145th streets, west of Aurora Avenue N. This project will help to control erosive flows and provide some water quality benefits.

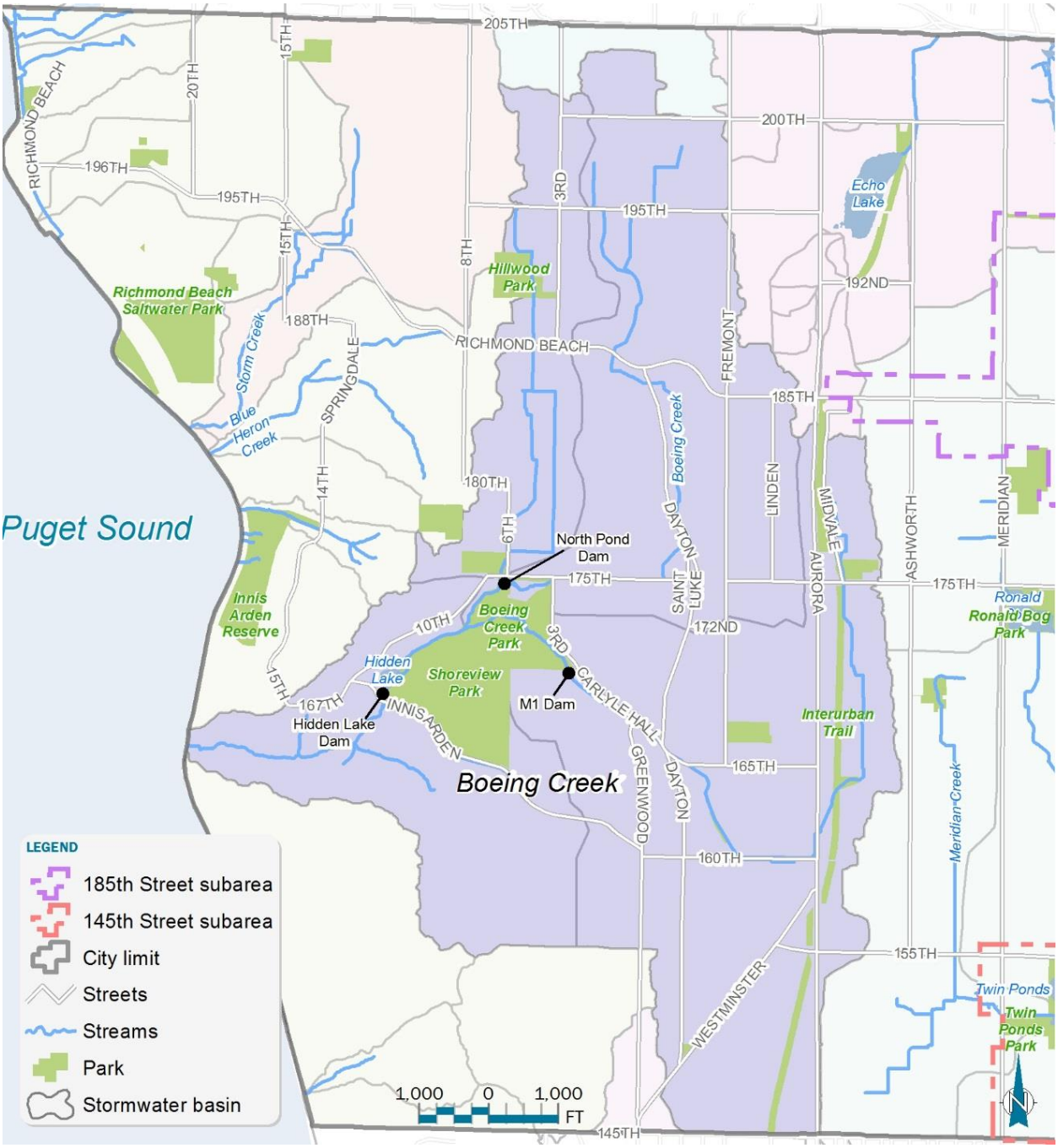

Figure 3-2. Boeing Creek basin

3.3 Storm Creek

As a small creek within the larger Middle Puget Sound regional drainage basin, Storm Creek (unlike Boeing Creek) is typically not distinguished from other small Middle Puget Sound drainages by other governmental entities such as King County and Washington State. However, localized flooding and streambank erosion within this small basin led the City to create a Storm Creek Basin Plan separate from the later Puget Sound Drainages Basin Plan. Because of this basin planning decision, the Storm Creek basin is often listed alongside the larger basins in the city. Approximately 298 acres of the Storm Creek basin are located within Shoreline city limits. The remaining portion, 176 acres, is located within the city of Edmonds. The basin lies west of Aurora Avenue N and drains to Puget Sound. Land use in the basin is single-family residential with a small portion of retail business along Richmond Beach Road. See Figure 3-3.

The upper portions of the creek are piped because of previous and historical development. The lower 1 mile of the Storm Creek main stem is open channel. This portion begins near 15th Avenue NW and NW 190th Street near the Innis Arden Club House. Notable surface water features in the Storm Creek basin include the three wetlands (Syre 1 and 2, and Eagle Reserve).

The Storm Creek basin (Windward 2013) provides the following issues associated with the built surface water system and infrastructure:

- Approximately 8 percent of the pipes inspected are recommended for repair.
- Stormwater management facilities to mitigate runoff from developed areas are not present in the Storm Creek basin.
- Geology of the Puget Sound-facing bluffs and in other areas with steeper slopes is very erodible and has contributed to channel down-cutting in Eagle Reserve.
- Water quality is of moderate concern, primarily because of fecal coliform bacteria and nutrients.
- Localized flooding appears to be related primarily to clogged culverts and ditches, rather than hydraulic constrictions in the system.

Channel erosion in the lower reaches of Storm Creek and high runoff rates generated from developed impervious surfaces remain the primary concerns in the Storm Creek basin. The 2013 basin plan outlined several high-priority projects to address these concerns. These projects include a study to evaluate runoff reductions using alternatives such as out-of-basin transfers and deep-well injection. Another potential project is to convert roadside ditches within the basin into infiltrating bioswales, which would not only reduce runoff rates, but also improve the quality of the stormwater discharged to the creek.

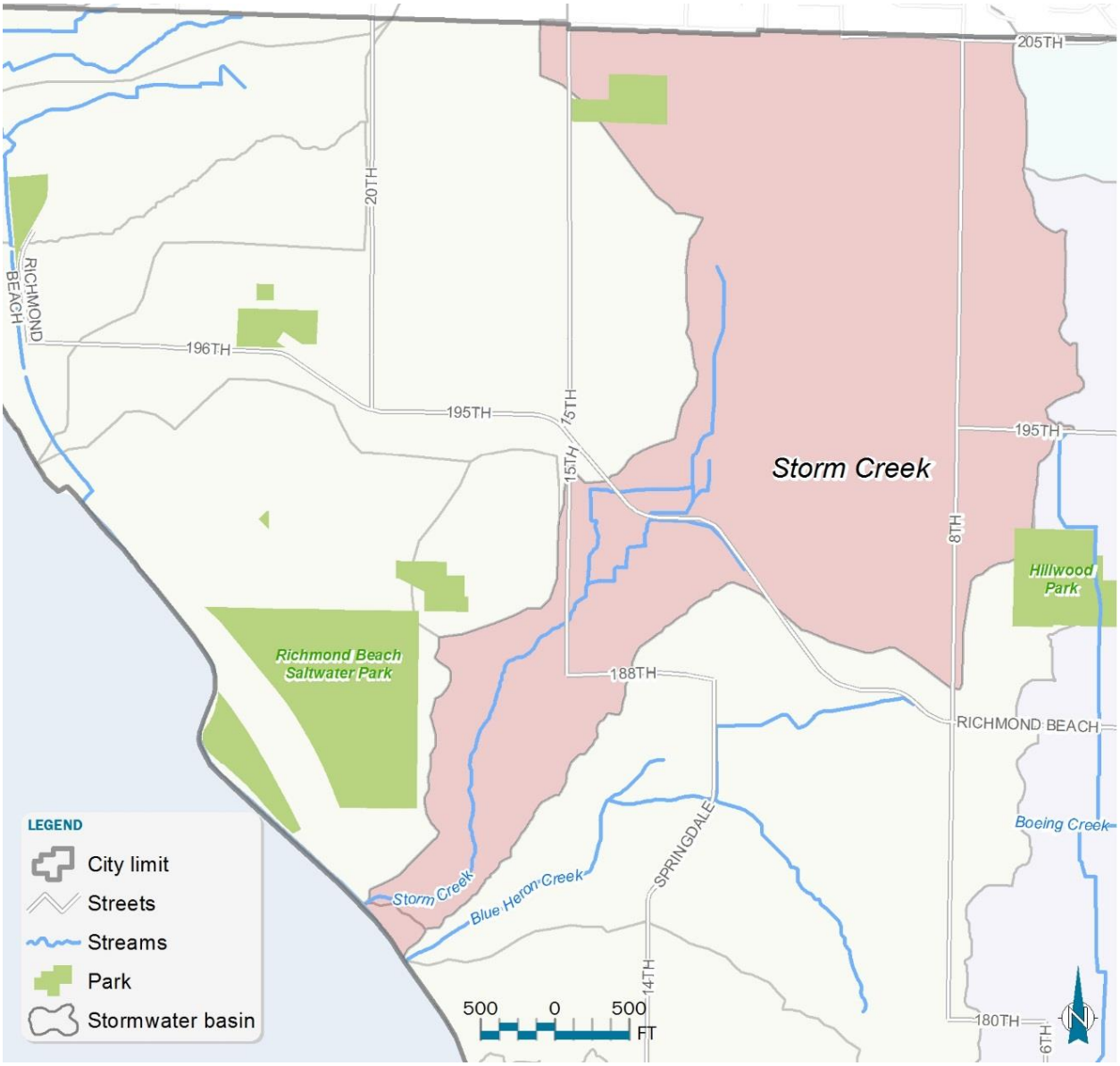

Figure 3-3. Storm Creek basin

3.4 McAleer Creek Basin

The portion of the McAleer Creek basin located in the northeast section of Shoreline city limits represents 1,377 acres of the drainage basin's 5,300-acre total. See Figure 3-4.

The McAleer Creek basin land use is predominantly residential with commercial industrial development along Aurora Avenue, Ballinger Way, NE 205th Street, and Interstate 5. The 185th Street Light Rail Station Subarea spans portions of the Thornton and McAleer creek basins, with approximately 40 percent of the 559-acre subarea in McAleer Creek basin.

The reach of McAleer Creek located within the city is roughly 4,000 feet long. Much of the city's McAleer Creek basin is composed of headwater areas to tributary systems. One of the headwaters originates south of Echo Lake, within the city of Shoreline, and flows north to Echo Lake. Echo Lake then drains north toward Lake Ballinger. Several other streams, the largest being Halls Creek located on the north end of Lake Ballinger in the city of Lynnwood, feed Lake Ballinger. McAleer Creek flows east out of Lake Ballinger, and is joined by the Cedar Brook Creek tributary at the boundary with the city of Lake Forest Park. It flows through the Nile Golf Course and the city of Lake Forest Park to Lake Washington. Other notable water features include the two lakes, Echo (13.5 acres) in the city of Shoreline and Ballinger (101.4 acres), which is located in the cities of Mountlake Terrace and Edmonds. One stormwater detention control structure located on the main stem of McAleer Creek at NE 196th Street, was designed to reduce downstream peak flows and alleviate past flooding. (SAIC 2011).

The entire main stem of McAleer Creek within the city of Shoreline up to Interstate 5 is used by anadromous fish. Little is known about the anadromous use of the various tributaries.

McAleer Creek is on the State 303(d) list for fecal coliform bacteria, dissolved oxygen (DO), water temperature, and low B-IBI scores. Washington State Department of Ecology (Ecology) has established a total maximum daily load (TMDL) to limit phosphorus discharges to Lake Ballinger, which receives drainage from a portion of Shoreline (McAleer Creek flows out of Lake Ballinger). Portions of McAleer Creek in Lake Forest Park downstream of Shoreline city limits are listed for several 303(d) parameters (DO and fecal coliform).

The McAleer Creek basin plan (AltaTerra 2015b) provides the following issues associated with the built surface water system and infrastructure:

- Approximately 6 percent of the pipes inspected are recommended for repair or replacement.
- Persistent erosion and/or flooding problem drainage areas are located at:
  - 6th Avenue NE and 200th Avenue NE west of Interstate 5
  - NE 192nd Street between 15th Avenue NE and 18th Avenue NE
  - 25th Avenue NE near 177th Street
  - NE 177th Street near 22nd Place NE
- Groundwater seepage (associated with some of the problem drainage areas above)

The highest-priority surface water issues in the McAleer Creek basin are improvements to the existing drainage system to address deficient systems, limited capacities, and/or erosion problems within the existing system. Green stormwater infrastructure projects such as bioretention swales are considered feasible and viable solutions for both water quality treatment and reduction of runoff rates. However, in some areas steep roadway ditches that exhibit erosion will require more structural solutions.

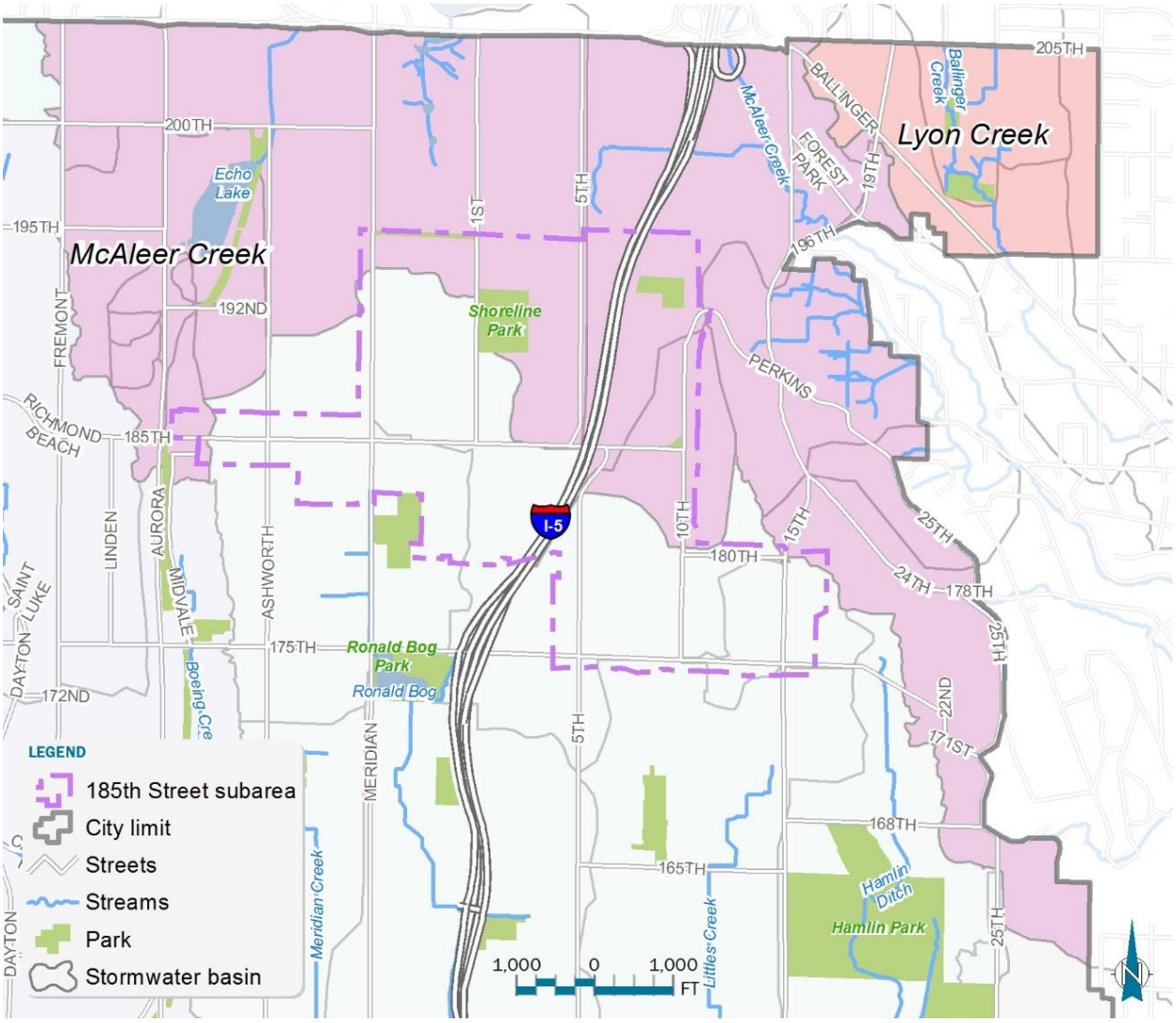

Figure 3-4. McAleer and Lyon creek basins

3.5 Lyon Creek

The Lyon Creek watershed comprises approximately 2,500 acres and lies within five municipal jurisdictions with most of the basin located in the cities of Mountlake Terrace, Brier, and Lake Forest Park. The size of the basin within Shoreline's city limits is approximately 184 acres. See Figure 3-4.

Ballinger Creek is the tributary of Lyon Creek that flows southeast through the city of Shoreline and into Lake Forest Park before discharging into Lake Washington. The portion that flows through Shoreline has a length of 2,200 feet. Notable surface water features associated with Ballinger Creek include the wetland areas of Ballinger Open Space and Brugger's Bog, which provide some natural stream buffer.

The predominant land use is single-family and multifamily residential, but there are clusters of nonresidential development including commercial development, a large school complex, and the City's North Maintenance Facility (NMF). A major current City project within the basin is the 25th Avenue NE Flood Reduction Project. The goal of the project is to reduce the flooding of Ballinger Creek near Brugger's Bog and along 25th Avenue NE. The project is in the predesign stage with several proposed improvements: daylighting Ballinger Creek along 25th Avenue NE, creating floodplain storage at the City's NMF site, and replacing the NE 195th Street culvert (within the city of Lake Forest Park, requiring coordination with Lake Forest Park).

Since 2001, the City has performed water quality monitoring on the 2,200-foot-long section of Ballinger Creek within the city. The monitoring results indicate that water quality parameters DO, water temperature, and turbidity may be improving. Results for pH showed no apparent trend (AltaTerra 2015a).

The Lyon Creek basin plan (AltaTerra 2015a) provided the following issues associated with the built surface water system and infrastructure:

- Approximately 6 percent of the pipes inspected were recommended for repair or replacement.
- Few stormwater management facilities are present in Shoreline or upstream in Mountlake Terrace to mitigate runoff from developed areas.
- Several undersized culverts are not able to convey surface water flows and contribute to frequent flooding along 25th Avenue NE.
- Because of topography, geology, and other drainage conditions, some developments built at lower elevations within the basin experience high groundwater conditions and/or localized flooding in basements and other depressions.

The primary surface water issue in the Lyon Creek basin is the flooding that occurs along 25th Avenue NE between Brugger's Bog Park and NE 195th Street. A capital improvement project to address flooding in this area is currently in the predesign stage, including several of the proposed improvements discussed above.

3.6 Middle Puget Sound

Middle Puget Sound Basin drainages within the city consist of four geographically distinct drainage areas (with each of these areas, except the Edmonds Way drainage, comprising multiple smaller hydraulically separate drainages) that discharge into Puget Sound (see Figure 3-5):

- **Middle Puget Sound-Richmond Beach drainages:** 434 acres northwest of Storm Creek basin, including Barnacle Creek
- **Middle Puget Sound-Innis Arden drainages:** 387 acres south of Storm Creek and north of Boeing Creek basins, including Heron and Coyote creeks
- **Middle Puget Sound-Highlands/Seattle Golf Club drainages:** 430 acres south of Boeing Creek basin
- **Middle Puget Sound-Edmonds Way drainage:** 61 acres along the city's northern boundary between 8th Avenue NW and Fremont Avenue N

The City does not manage surface water in the Middle Puget Sound-Highlands/Seattle Golf Club drainages as they are located within the private Highlands community and private Seattle Golf Club, and do not contain any City stormwater infrastructure.

Current land use in these drainages is mostly single-family residential. Small areas are developed as multifamily, schools, commercial, and parks and open space.

Drainage in these areas typically begins as urban runoff or as seepage from hillsides. The headwaters of North Barnacle Creek in the Middle Puget Sound-Richmond Beach drainage is located beyond city limits in the cities of Woodway and Edmonds. The handful of other small streams within these drainages originate from wetlands, hillside seeps, and urban runoff within the city of Shoreline (SAIC 2011).

The *Puget Sound Drainages Basin Plan* (AltaTerra 2016) provides the following issues associated with the built surface water system and infrastructure:

- Approximately 13 percent of the pipes inspected are recommended for repair or replacement
- Persistent drainage problems and flooding at Springdale Court NW and NW Ridgefield Road in the Middle Puget Sound-Innis Arden drainage
- Groundwater seepage in the following Middle Puget Sound-Innis Arden drainages:
  - Heron Creek
  - Coyote Creek area
- Ditch filling by some homeowners
- Lack of stormwater system or downstream connections

The 61-acre Middle Puget Sound-Edmonds Way drainage is adjacent to the northern portion of the Boeing Creek basin and drains to Puget Sound through the city of Edmonds. See Figure 3-5. Basin land use is residential and does not contain any wetlands or creeks. The City maintains pipes, ditches, and connecting structures located in the basins' right-of-way (ROW). The drainage concerns in this area are localized flooding because of clogged conveyance. The basin was evaluated in the *Puget Sound Drainages Basin Plan* (AltaTerra 2016) and no projects were identified.

The Utility identified 10 high-priority drainage problem areas in the Middle Puget Sound-Richmond Beach and Middle Puget Sound-Innis Arden drainages. More than half of the problem areas were related to a lack of formal drainage or lack of connectivity in the drainage system. In some cases, the ditches serving these locations have been filled by residents. Other drainage problems such as flooding and erosion are a result of existing infrastructure (ditches, pipes, and catch basins) needing to be repaired or replaced because of insufficient capacity or poor condition.

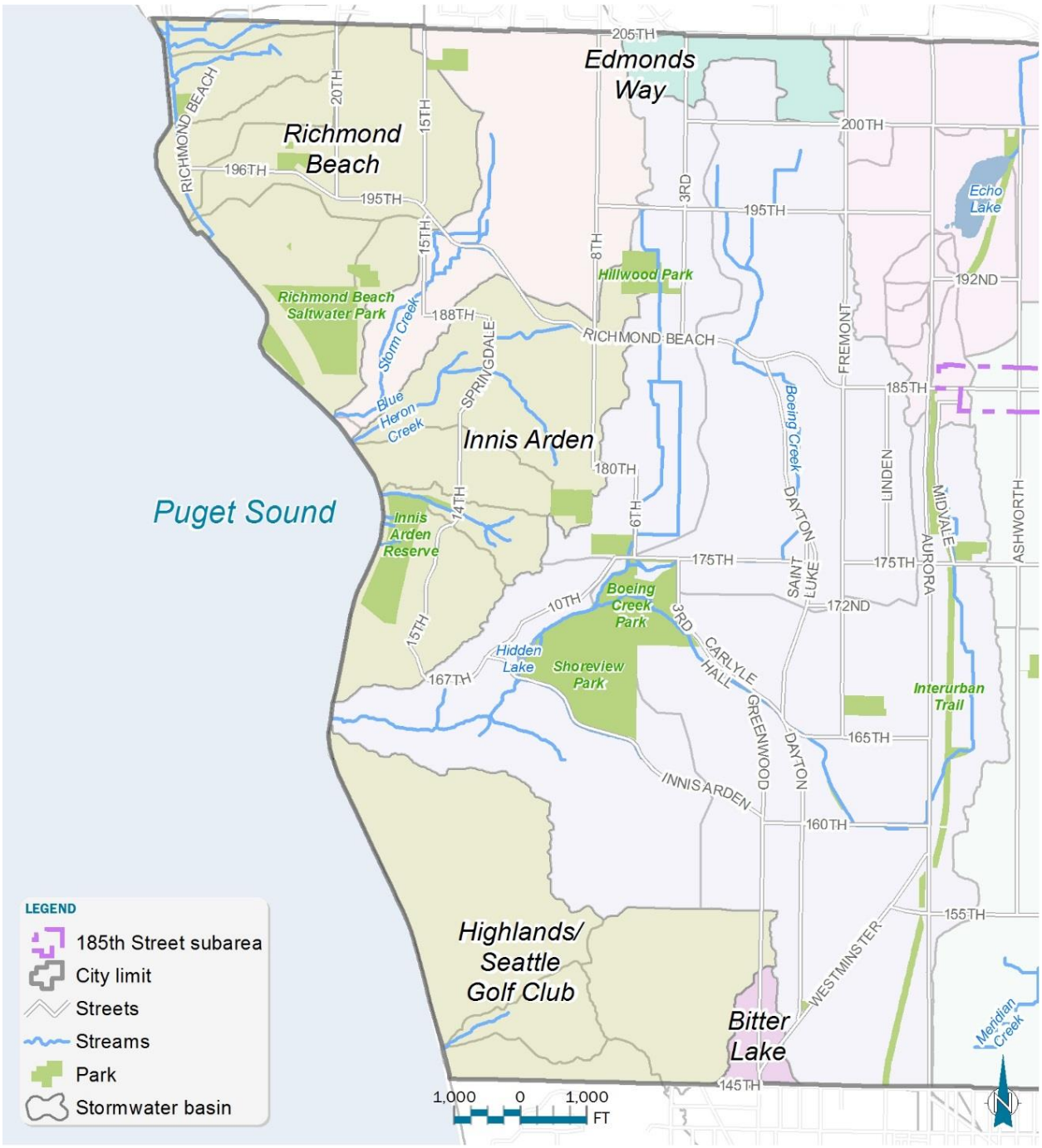

Figure 3-5. Middle Puget Sound drainages and Bitter Lake drainage to West Lake Washington

3.7 West Lake Washington

The city contains West Lake Washington basin drainages in three locations: two are located in the southeast corner of the city; the third is roughly 3 miles west of the other two located along the southern city boundary in the vicinity of Greenwood Avenue N and N 145th Street. No portion of this basin within the city of Shoreline contains streams.

The two eastern drainages of the West Lake Washington basin comprise approximately 90 acres (of a larger 450-acre drainage) and drain eastward to Lake Washington (see Figure 3-1). These two drainages flow to Lake Washington through the city of Lake Forest Park. Land use within these drainages is mostly residential, with small areas of commercial use along Bothell Way. Drainage occurs as overland flow or through drainage ditches, roadway culverts, and storm sewers. No wetlands were identified in the basin (SAIC 2011).

The city's third drainage within the West Lake Washington basin is the 29-acre Bitter Lake drainage (see Figure 3-5). This basin drains southward to the city of Seattle's Densmore basin, which discharges to Lake Washington far to the southeast. Land use within these drainages is mostly residential, with small areas of commercial use along Westminster Way N and N 145th Street. The City maintains pipes, ditches, and connecting structures located in the basins' ROW.

The West Lake Washington basin drainages in the city were reviewed as part of the *Puget Sound Drainages Basin Plan* (AltaTerra 2016). The basin plan noted current stormwater-related issues including high groundwater seepage in lower levels of private residences and a lack of stormwater system and downstream connections for the eastern drainages. No issues were noted for the Bitter Lake drainage.

Section 4

System Evaluation

This section summarizes evaluations of surface water systems, including a summary of condition assessment activities, and discussions regarding conveyance system capacity, water quality, and aquatic habitat conditions. Evaluations such as those described in this section are conducted to characterize surface water conditions, and identify system deficiencies and/or gaps in performance related to the Utility's desired levels of service.

4.1 Condition Assessment

Stormwater infrastructure can deteriorate over time; it is important to know the structural condition of Utility assets to minimize the potential for failures. Structural condition assessment activities can identify problems and enable timely maintenance, repair, or replacement. The City's Condition Assessment Program involves a combination of inspection techniques and the conversion of the observed or recorded data into assessment knowledge. This knowledge is then used to prioritize and schedule maintenance, repair, rehabilitation, and/or replacement activities.

Following the 2011 Master Plan, in parallel with subsequent basin planning efforts, the Utility initiated a program to inspect and assess approximately 134 miles of stormwater pipes owned and maintained by the City. The Utility also initiated a catch basin condition assessment program to address Phase II Permit maintenance standard requirements for catch basins and inlets. Over a 3-year period starting in 2014, the Utility inspected and assessed all 7,461 catch basins to achieve compliance with the Phase II Permit.

As part of the development of this Master Plan, the Utility prepared a *Condition Assessment Management Plan* (CAMP) to document, improve, and plan for continual asset condition assessment (see Appendix C). With the development of the CAMP, the Utility improved and refined the documented condition assessment methodologies for pipes, catch basins, and manholes. In addition, new methodologies were developed for ditches and LID facilities (e.g., bioretention, swales, and permeable pavement). Below is a summary of condition assessment work.

4.1.1 Pipes

The Utility has completed initial pipe condition assessments for all of the city's drainage basins except the Thornton Creek basin. The Thornton Creek Basin Plan was completed prior to the recommendation for pipe condition assessment in the 2011 Master Plan, so a pipe condition assessment was not completed at the time of the basin planning effort. Pipe inspections and condition assessment within the Thornton Creek basin began in 2017 and is anticipated to be completed in 2020. Approximately one third of the Utility's pipe network is located within the Thornton Creek basin.

Substantial portions of pipe networks in already-assessed basins were not completed because of issues caused by debris or structural blockages, utility crossing conflicts, improper and poor fitting connections, or because access points are located outside the ROW or easements. To address these issues and continue assessing pipe condition, the following ongoing pipe maintenance and inspection programs are recommended:

- **Condition Assessment Program** is an ongoing inspection program identified in the Basin Plans and in the CAMP (included in Appendix C). The program inspects pipes under two conditions: (1) routine pipe inspections, which occur on a 20-year inspection cycle, and (2) pipes that were not inspected or had an incomplete inspection because of access constraints. The Condition Assessment Program is described in Section 7.1.8.
- **Utility Crossing Removal Program** provides resources for coordinating with other utilities to remove their lines and repair storm drains that have been damaged because of crossings. The Utility Crossing Removal Program is described in Section 7.2.9.
- **Improper Connection Repair Program** fixes non-standard or improperly installed stormwater drains not included in other capital improvement projects by adding properly designed structures. The Improper Connection Removal Program is described in Section 7.2.10.

Based on the results of the inspection and condition assessment efforts to date, the Utility has projected that nearly 800 sections of pipes will require repair or replacement over the next 20 years with an average of 40 sections of pipe replaced per year. The goal is to repair or replace the failing pipes prior to the beginning of the next 20-year inspection cycle. Prior to 2018, the Utility had allocated sufficient resources to repair or replace 20 sections of pipe per year with the Stormwater Pipe Repair and Replacement Program (SWPRRP). This current rate would result in near failing sections of pipe not being repaired or replaced for up to 30 years. The Utility recommends an enhanced version of this program to repair and replace pipe no later than 20 years from the condition assessment and prior to scheduled re-inspection. The enhanced SWPRRP is described in Section 7.2.4.

4.1.2 Manholes and Catch Basins

The Utility's Phase II Permit requires periodic inspection and maintenance of catch basins and manholes. The City owns and maintains 7,461 catch basins and 736 manholes. Between 2014 and 2017, the Utility inspected all known catch basins and approximately 37 percent of the manholes.

Approximately 90 percent of the inspected catch basics were in good condition and another 8 percent were in fair condition. The remaining 2 percent received a poor condition assessment score and were identified for minor repair or replacement. Catch basins in good condition have no structural issues with the walls or bottom of the basin, no large holes in the basin cover, and no cracks in the grout connecting the pipes to the basin. Catch basins in poor condition have severe structural issues with the walls or bottom of the basin, large holes in the basin cover, and large cracks in the grout connecting the pipes and basin. A catch basin in fair condition shows moderate deficits in one or more areas. Catch basins in fair condition may be inspected more frequently.

Beginning in 2018, the Utility will inspect catch basins every other year and perform necessary maintenance within 6 months of inspection or within 2 years for CIP rehabilitation costing less than $25,000. With the increased frequency of inspection, the Utility estimates that the number of catch basins needing repair will increase to 3 percent per year and 1 percent per year will need to be replaced. To remain compliant with the 6-month maintenance time frames, the Utility recommends additional resources for a Catch Basin Repair and Replacement Program. See Section 7.2.6 for more details on this program.

All inspected manholes were assessed as being in good condition. Manholes will continue to be inspected annually through the Utility's ongoing System Inspection Program (see Section 7.1.7). Manholes that are part of the Condition Assessment Program are inspected when pipes are inspected. All accessible manholes within the Puget Sound and Lake Washington drainage basins were inspected as part of the *Puget Sound Drainages Basin Plan* project in 2016. The Utility

recommends including the inspection of manholes in the enhanced Condition Assessment Program; see Section 7.1.8.

4.1.3 Ditches

The City owns and maintains approximately 24 miles of ditches. The Utility completed a full circuit of ditch inspection and maintenance between 2008 and 2013. Beginning in 2014, ditches were re-inspected every 3 years, with approximately one third of the ditches maintained if needed per year. Ditches are inspected in early summer and maintenance is typically performed within 1 month of inspection.

Condition assessment scoring based on inspection results between 2014 and 2017 indicated that approximately 28 percent of ditches were in poor condition, requiring maintenance. Ditches in poor condition show signs of contamination and/or erosion, and excessive sediment and vegetation, which can prevent the flow of water to the ditch from the roadway or in the ditch channel. The Utility recommends continuing with the current ditch inspection and maintenance efforts included in the existing System Inspection Program and System Maintenance Program; see Sections 7.1.7 and 7.2.2, respectively.

4.1.4 Low Impact Development Facilities

The Utility-owned and operated LID facilities are inspected on an annual basis to meet the requirements of the Phase II Permit. Inspection data are analyzed after the inspections are completed. Following inspection, corrective work orders are created based on specific failure possibilities. LID facilities include permeable pavement, bioretention, and swales.

Based on annual inspection information, approximately 70 percent of permeable pavement installations received a poor condition assessment. Approximately 86 percent of bioretention facilities and 19 percent of swales received a poor condition rating. To maintain compliance with the Phase II Permit, the Utility must complete necessary maintenance of all surface water assets including LID facilities within 1 year of inspection. The Utility recommends additional resources to perform the required cleaning, structural repair, or structural replacement of LID facilities in the LID Maintenance Program. This new program would also enhance the existing vegetation management effort the Utility implements for its biofiltration facilities. See Section 7.2.7 for more details on this program.

4.1.5 Pump Stations

The Utility's eight pump stations received an extensive condition and capacity inspection and assessment in 2016 (Kennedy/Jenks 2016). The condition assessment resulted in a list of recommended pump station improvements, and is summarized in Table 4-1. Two of the pump stations were recommended for replacement. The recommendations for the remaining pump stations include adding supervisory control and data acquisition (SCADA) instrumentation, redundant pumps, and site access and safety. The Utility recommends including the three projects to the 6-year projects that are outlined in the 2016 report, namely replacement of pump stations 26 and 30, and the upgrade of the remaining pump stations, as recommended. These projects are listed in Section 8 which includes a project prioritization summary. Details on project costs are included in Appendix D-5. In addition to pump station upgrades, the Utility recommends the allocation of resources for an ongoing Pump Station Maintenance Program. See Section 7.2.8 for more details about this program.

Table 4-1. Recommended Pump Station Improvements	
Pump Station	**Condition Summary and Upgrade Recommendation**
Linden Avenue	Upgrade electrical components, add SCADA, provide signs and bollards, purchase redundant pump, and improve wetwell access
Palatine	Upgrade electrical components, add SCADA, provide signs, purchase redundant pump, and improve wetwell access
Pan Terra	Add SCADA, add pressure gauges, improve hatches, and provide guardrail
25	Upgrade/revise PLC program, improve hatches, and provide guardrail
26	Demolish and rebuild station and reuse existing wetwell
30	Demolish and rebuild station, reuse existing wetwell, provide site improvements around wetwell, and upgrade power service
Ronald Bog	Add SCADA, add pressure gauges, and provide bollards
Serpentine	Add SCADA, add pressure gauges, improve hatches, and provide grading improvement

Source: Kennedy/Jenks 2016 report.

4.2 Conveyance Capacity

As part of the Condition Assessment topic, the Utility reviewed the adequacy of existing data to build new hydrologic and hydraulic (H&H) models. Data for the principal conveyance elements and network connectivity appear to be generally complete; however, there are gaps in key attributes such as pipe size, pipe materials, and invert elevations.

The Utility recommends a phased and prioritized approach to H&H modeling, focusing on data collection and then on model development. Data collection activities can be performed prior to model development and can also provide near-term benefits to asset management and O&M activities. For example, cross-referencing under-capacity pipes with condition assessment results would identify which structurally deficient pipes need to be upsized during replacement. Model development should be performed according to priorities, tailored to specific needs, and refined over time. The Utility recommends allocating resources to develop a System Capacity Modeling Study for inclusion in the 6-year CIP. This study would provide new and updated modeling analyses to forecast future system demands, identify capacity deficiencies, and evaluate improvement projects. This project is listed in the Section 8 project prioritization summary. Details on the project are included in Appendix D-5.

4.2.1 Subbasin Priorities

The Utility created new subbasin delineations prior to determining subbasin priorities. These delineations were developed by first performing automated delineations using a digital elevation model (DEM) obtained from the Puget Sound Light Detecting and Ranging (LiDAR) Consortium (PSLC 2006). Automated delineations were then adjusted where stormwater infrastructure crossed subbasin boundaries. New subbasin identifiers were assigned and a numbering system sequenced from upstream to downstream was used Figure 4-1 shows the subbasins and the direction of stormwater discharge at each subbasin outlet.

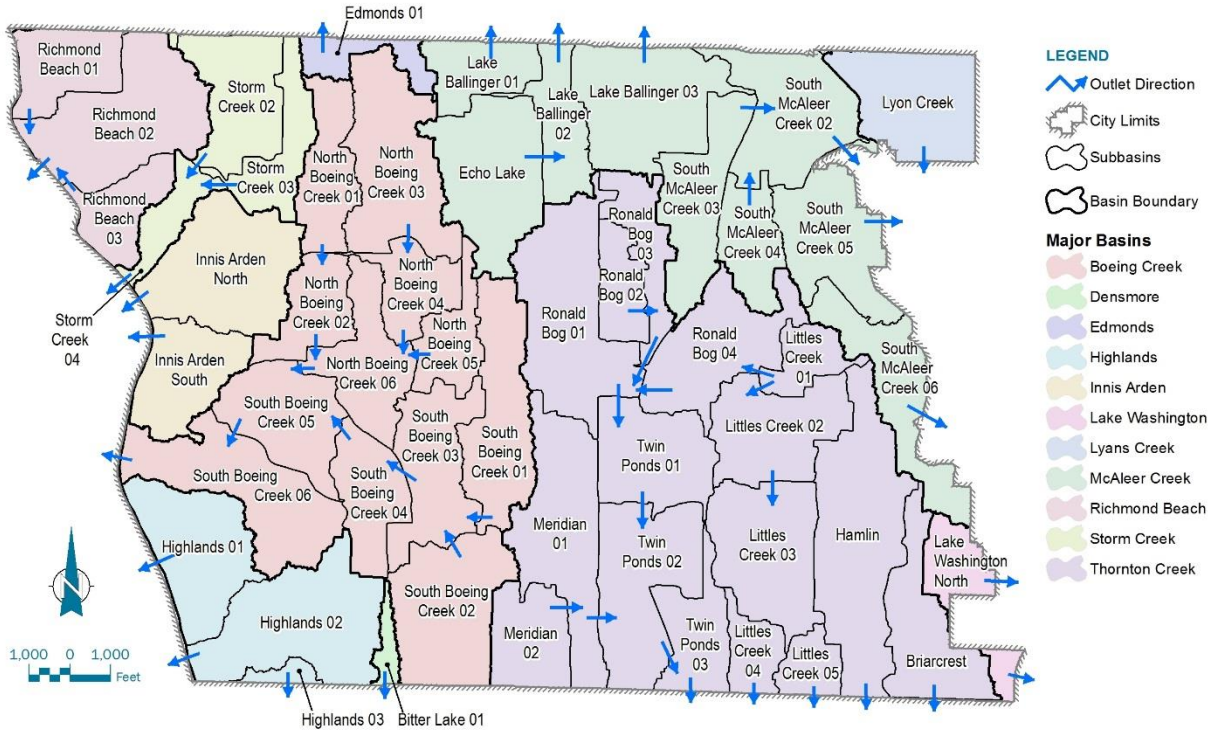

Figure 4-1. Newly delineated subbasins and connectivity

Data collection and modeling efforts should progress in phases as shown in Figure 4-2, which is based on a prioritization scoring system, where the higher score indicates a higher priority. Prioritization accounts for the following factors:

- Known capacity problems or localized flooding
- Existence of a subarea plan where significant growth is expected
- Potential increase in impervious area due to development
- Discharge to a TMDL receiving water or “waters of concern”
- Geotechnical constraints to stormwater infiltration
- Infrastructure data needs

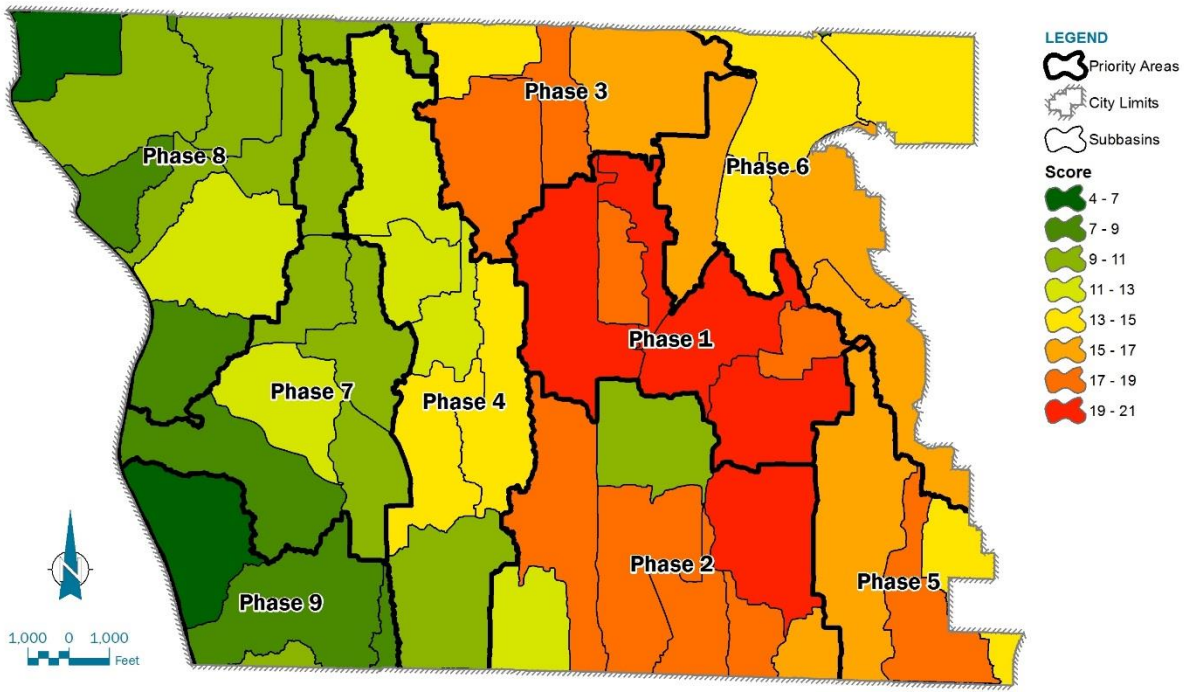

Figure 4-2. Subbasin priority scores and groupings for phased data collection and model development activities

4.2.2 Data Collection

One of the first steps in conducting H&H modeling will be to collect the requisite data. While some pipe and cross-section data are available along major streams and drainage ways, additional data need to be collected to develop more comprehensive drainage system models. Meteorological data—primarily precipitation—as well as spatial data, such as land cover and soil types, are needed to model runoff and inflows to the conveyance network. Table 4-2 provides a general summary of the data needs for H&H modeling.

Table 4-2. Typical Data Needs for H&H Modeling	
Types of Inputs	**Typical Data Needs**
Meteorological data	• Precipitation records, design storms, and/or intensity-duration-frequency statistics • Evaporation and evapotranspiration (ET) records, or meteorological inputs to calculate ET
Spatial data	• Topography: contours, digital elevations models, or terrain surfacing • Impervious areas and, if possible, classification of areas into categories such as roadways, parking lots, sidewalks, etc. • Pervious areas and, if possible, vegetative cover categories such as wetlands, woodlands, grasslands, etc. • Soil characteristics related to infiltration and storage capacities, hydrologic soil groups, general classifications • Land use and zoning • Parcel boundaries
System data	• Pipes: diameter, upstream invert elevation, downstream invert elevation, depth below grade, depth below rim, length, and pipe material • Manholes: type, size, depth, rim elevation • Ponds, vaults, and other storage facilities: dimensions, stage-storage curve, stage-discharge curve, invert elevations for inlets and outlets • Special structures (flow diversions, splitters, weirs, pump stations, gates, and other hydraulic controls): dimensions, floor elevations, hydraulic control elevations, inlet/outlet capacities, storage curves, and operating rules • Open channels and ditches: surveyed cross-sections, slope, culvert dimensions, culvert material, bridge dimensions, roadway elevations, and invert elevations for all structures
Calibration data	• Continuous flow/discharge measurements • Peak flow/discharge measurements • Water levels/flow depths • Historical anecdotal information

4.2.3 Model Development and Analyses Framework

As data are collected, H&H modeling can be performed to address specific projects or study needs. BC recommends beginning with the top priority (Phase 1) subbasins and developing a tailored modeling plan that focuses on the specific needs to be addressed in those subbasins. Developing the modeling plan should involve the following basic steps:

1. **Clarify the problem(s):** Defining and analyzing a problem occurs at several levels. The aim is to translate the problem understanding from the planner or policymaker to the modeler to ensure that the modeling effort answers the appropriate questions and provides useful results to inform decisions. The modeling team should craft a problem description and carefully analyze the nuances of the problem to understand the domain, characteristic time scale, spatial scale, and relevant physical processes.
2. **Define the objectives:** Building on the problem definition, the goals of the modeling effort should be established and then articulated through specific modeling objectives. There are often goals and objectives for the overarching plan (e.g., the 2018 Master Plan)—and, while these are related, they are not the same as modeling objectives. This is where the understanding of the problem and the questions at hand are transformed into specific actions that will yield specific results. For example, the modeler should determine which scenarios will be simulated and how those will be defined in model space. Such translations are potentially great sources of misunderstanding and should therefore receive careful and deliberate attention.
3. **Specify requirements:** As a modeling approach is developed, the modeling team can identify project-specific requirements for achieving the modeling objectives. Requirements should address the quality of the calibration and subsequent results, expertise needed to carry out the analyses, time constraints and deadlines for major milestones, communications and reporting

protocols, quality assurance/quality control (QA/QC) procedures, and data management practices.

Appendix E is a technical memorandum titled *Approach to Performing Hydrologic and Hydraulic Modeling Analyses,* developed as part of the 2018 Master Plan work, which describes this process and includes a modeling plan for the Phase 1 subbasins as shown in Figure 4-2 above. As model development activities continue for subbasins in subsequent phases, the modeling plan can be revisited and improved to address new objectives and apply lessons learned from previous phases.

4.3 Water Quality

Stormwater pollution from the City's municipal separate storm sewer system (MS4) is regulated by the Phase II Permit, which requires treatment and flow control for stormwater discharges from new development and redevelopment projects that exceed certain thresholds. New development projects that add 5,000 square feet of new hard surfaces, or that convert 0.75 acre of vegetation to lawn or landscaping, typically must treat runoff and control flow rates from the new and replaced hard surfaces or lawn/landscaped areas. Redevelopment projects that exceed these criteria typically must treat and control pollution and flows from the new hard surfaces and converted pervious areas. Redevelopment projects must also treat the replaced hard surfaces if the valuation of the proposed improvements exceeds 50 percent of the valuation of the existing site improvements.

The Phase II Permit requires application of LID principles and LID best management practices (BMPs) (also known as green stormwater infrastructure [GSI]) to make LID the preferred and most commonly used approach to site development. Examples of LID BMPs or GSI include bioretention, rain gardens, permeable pavement, vegetated roofs, downspout controls, and dispersion. Other types of stormwater BMPs, such as wet ponds or media filters, can be implemented to meet permit requirements for new development and redevelopment projects where LID opportunities are limited by site conditions.

In certain situations, regional facilities may be used instead of onsite BMPs to meet permit requirements for multiple new development or redevelopment projects within a catchment area. However, the regional facility must be operational before the new development or redevelopment activity occurs and the permittee must demonstrate that the regional facility will fulfill the new development and redevelopment requirements, such that onsite treatment is not needed.

4.3.1 Watersheds Affected by Total Maximum Daily Loads

Although the current Phase II Permit (2013–2018) does not explicitly require treatment or flow control for runoff from existing development, it does require compliance with TMDLs established for water bodies that receive municipal stormwater runoff. Phase II permittees whose stormwater drains to TMDL water bodies might need to implement regional projects, distributed BMPs, and/or GSI to reduce stormwater pollutant loads from existing development.

McAleer Creek is the only water body within Shoreline on the current 303(d) list, and several watersheds within the city contribute flow to downstream 303(d)-listed water bodies. Figure 4-3 shows the areas potentially affected by TMDLs for 303(d)-listed water bodies.

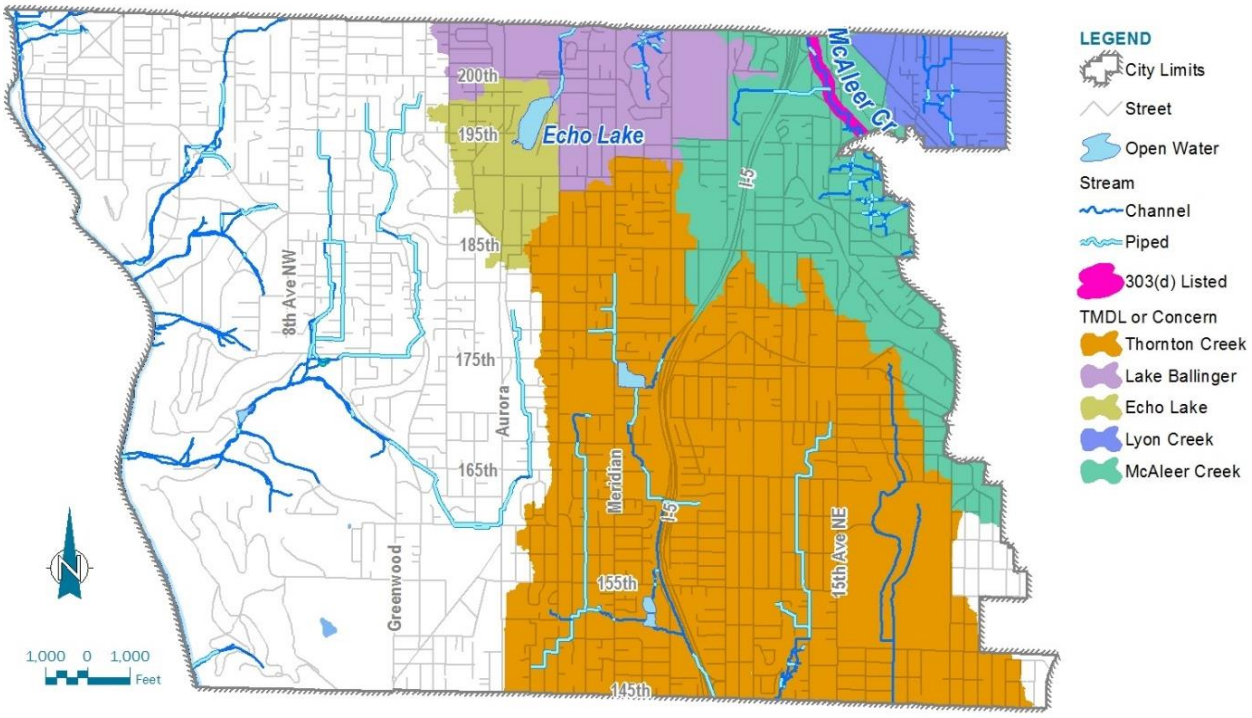

Figure 4-3. Areas potentially affected by TMDL or "waters of concern"

McAleer Creek is on the 303(d) list for fecal coliform bacteria, DO, water temperature, and low B-IBI scores. Ecology has established a TMDL to limit phosphorus discharges to Lake Ballinger, which receives drainage from a portion of the city. Reaches of Thornton Creek downstream of Shoreline are on the 303(d) list for bacteria, DO, and water temperature. Echo Lake is listed as a water body of concern because of elevated fecal coliform bacteria concentrations.

TMDL requirements are enforced through NPDES permits for MS4 and wastewater discharge to affected water bodies. A TMDL could require treatment or removal of stormwater pollution from existing developed areas that drain to the impaired water bodies. The next Phase II Permit will include an appendix listing all TMDL requirements for each permittee. Future TMDLs could affect stormwater treatment requirements for the highlighted areas on Figure 4-3.

4.3.2 Stormwater Treatment Options

Regional facilities, GSI, and/or distributed BMPs may be used to meet Phase II Permit requirements for new development and redevelopment, as well as future TMDL requirements. The Utility prepared a set of pros and cons comparing regional facilities and distributed BMPs and a rough cost comparison for subbasins around the city. This analysis is included in Appendix F.

The cost comparison indicated that regional facilities may be less expensive than distributed BMPs in most subbasins, especially if infiltration can be achieved at the regional facility site. Allowable infiltration capacity is clearly the most important factor in determining the cost feasibility of a project. A study completed by KPG for the City in 2015 looked at the feasibility of a regional facility for the Aurora Square Community Renewal Area (KPG 2014) and found that the cost to manage 1 acre of impervious surface with distributed/onsite facilities with no infiltration is more than nine times the cost compared to a regional facility with infiltration. Another key factor regarding cost-effectiveness is that regional facilities tend to have smaller unit costs (both capital and O&M) as the size of the facility (and treated area) increases because of economies of scale. Regional facilities could also be

used to help meet other City objectives such as encouraging redevelopment and economic growth, creation of green space, or other community amenities.

Regional facilities can be more challenging to implement than GSI or distributed BMPs for several reasons:

- Feasibility and cost for a regional facility depend, to a large extent, on the availability, ownership, size, and suitability of a site.
- Regional facilities are generally larger and more capital-intensive to build when compared to distributed BMPs. It is difficult to break up regional facilities into phases if capital funding is limited.
- Regional facilities that are intended to meet Phase II Permit requirements for new development or redevelopment must be built *before* the development takes place. The jurisdiction or developer must make an upfront investment to build the regional facility.

For these reasons, financing can often be more challenging than the technical issues associated with regional stormwater facilities.

In summary, the optimum treatment approach for a given situation will vary depending on site constraints and opportunities, regulatory requirements, stakeholder interests, and other social issues. Regional facilities and distributed BMPs can both be feasible, cost-effective solutions in the right circumstances. Focused studies like the one performed for Aurora Square can be conducted to evaluate site constraints and opportunities for specific areas of the city. Furthermore, given the importance of infiltration capacity, site investigations may be warranted even at the planning stage.

4.3.3 Stream and Lake Water Quality Summary

The Utility has monitored water quality in the city's key streams and lakes since 2002. The water quality data collected from 2002–2009 were described in the *2009 Fresh Water Assessment Report—State of Water Quality in Shoreline Streams, Lakes and Wetlands* (City 2010). The *2016 Fresh Water Assessment Report—State of Water Quality in Shoreline Streams and Lakes* (City 2017d) describes the water quality data collected from 2010–2015. These reports summarize water quality data for Thornton, Littles, McAleer, Cedar Brook, Storm, and Boeing creeks, as well as Hidden and Echo lakes. The monitoring included DO, water temperature, pH, and turbidity. These parameters must remain within certain limits to support fish and other aquatic organisms. The monitoring also included measurement of fecal coliform bacteria in water samples. The fecal coliform results were compared to State water quality criteria for protection of recreational users of the water bodies.

The City also used the monitoring results to calculate Water Quality Index (WQI) scores for each monitoring location. The WQI is intended to serve as a general indicator of overall water quality. It is calculated based on monitoring results for DO, pH, total phosphorus, total nitrogen, turbidity, total suspended solids, temperature, and fecal coliform bacteria, using the King County method. WQI scores can range from 1 to 100, with the higher number indicating higher water quality. The City's 2009 report calculated WQI scores based on 2007–2009 monitoring data, while the 2016 report used data collected from 2009–2015. The WQI scores were then sorted into three categories: (1) low concern (score 80 and above), (2) moderate concern (score between 40 and 80), and (3) high concern (score below 40).

Overall, the water quality in the city's streams and lakes is typical of urban water bodies in the Puget Sound lowlands. The following bullets summarize the City's water assessment for each drainage basin:

- The Thornton Creek basin includes monitoring locations on Thornton and Littles creeks. DO and fecal coliform often did not meet water quality criteria. Both the 2009 and 2016 reports note that both Thornton and Littles creeks are in the "high concern" category based on their WQI scores (City 2010, 2017d).
- The Boeing Creek basin includes stream monitoring locations on the north and south forks of Boeing Creek, and Hidden Lake. For the north fork, the 2009 report notes excursions from the DO criterion, while the 2016 report mentions excursions for DO and fecal coliform. For the south Boeing Creek location, the 2009 report notes excursions for DO and the 2016 report notes excursions for fecal coliform. Both branches of Boeing Creek are in the "moderate concern" category based on their WQI scores. Monitoring results presented in both the 2009 and 2016 reports indicate an excursion from the water quality standard for fecal coliform bacteria from Hidden Lake (City 2010, 2017d).
- The Storm Creek basin includes one monitoring location on Storm Creek. The 2009 report notes excursions for DO and fecal coliform and the 2016 report notes excursions for DO, pH, turbidity, and fecal coliform. Storm Creek is predominantly in the "highest concern" category based on its WQI scores (City 2010, 2017d).
- The McAleer Creek basin includes monitoring locations McAleer and Cedar Brook creeks and Echo Lake. For both creeks, the 2009 and 2016 reports cite excursions for DO, turbidity, and fecal coliform. Both the 2009 and 2016 reports note that both McAleer and Cedar Brook creeks are in the "moderate concern" category based on their WQI scores. Monitoring results presented in both the 2009 and 2016 reports for Hidden Lake indicated consistent excursions for all water quality parameters (City 2010, 2017d).
- The Lyon Creek basin includes one monitoring location on Ballinger Creek within the city. Water quality results for Ballinger Creek are included in the Lyon Creek Basin Plan for monitoring occurring during 2002–2013. A WQI score was not completed but the results were compared to the State water quality criteria. The monitoring results indicate that water quality parameters DO, water temperature, and turbidity may be improving. Results for pH showed no apparent trend (AltaTerra 2015a).
- The Middle Puget Sound basin includes one marine monitoring location at Richmond Beach. King County collects weekly samples at Richmond Beach Saltwater Park during the swimming season (approximately 14 weeks). The samples are analyzed for fecal indicator bacteria to confirm that the water is safe for recreational uses. King County's 2017 Beach Environmental Assessment, Communication and Health (BEACH) Program annual report indicates that Richmond Beach Saltwater Park met the swimming standards during all periods sampled (Ecology 2018).

4.4 Aquatic Habitat

The Utility conducted biological and habitat evaluations in its *2007 Bioassessment Report, Biological and Habitat Assessment of Shoreline Streams* (2007 report) (Watershed Company 2009). The 2007 report found that urbanization impacts were the likely cause of low B-IBI scores observed at all five stream locations included in the study (Thornton, McAleer, Lower Boeing, Upper Boeing, and Storm creeks). The 2007 report noted that "streams with larger forested riparian buffers tended to have relatively higher quality physical habitat than streams with narrower riparian buffer" and "silt and sand were generally a dominant substrate type in many of the survey areas." The silt and sand substrates negatively affect the macroinvertebrate community and the successful spawning habitat for fish species (Watershed Company 2009).

The City's 2016 Water Quality Assessment Report (City 2017d) included the following recommendations to improve aquatic habitat conditions in the city:

- Conduct riparian vegetation surveys to assess presence of non-native species and replace with appropriate native vegetation. This action will help to reduce streambank erosion, reduce turbidity, and improve in-stream habitat. This effort is included in the Aquatic Habitat Improvement Program (see Section 7.3.7).
- Perform fish surveys on Boeing, Storm, McAleer, and Thornton creeks. A fish survey will help establish a baseline condition and can be used to measure future changes. Fish surveys can be performed programmatically or as part of a related project. For the 2018 Master Plan, the fish surveys are recommended as a part of a project.
- Install temperature loggers at priority stream sites for continuous temperature recording.
- Consider climate change in future studies, plans, ongoing maintenance, and infrastructure design. Climate change could cause current conditions to decline if not mitigated (City 2017d). This effort is included in the *Climate Impacts and Resiliency Study*. Details on the study are included in Appendix D-5 of the Master Plan.

Section 5

Regulatory Compliance

The Utility must establish and maintain programs that comply with State and federal regulations pertaining to surface water, including natural water bodies and the MS4. The City achieves compliance by incorporating these requirements into its own policies, regulations, and ordinances. Compliance with stormwater regulations is an important responsibility of the Utility (see LOS 4, Regulatory Compliance, Table 2-1).

This section summarizes the federal and State regulations and programs that drive the Utility's work. Other City regulations including the Shoreline Municipal Code (SMC) are briefly described in Section 6.2.4. The City designed these regulations in accordance with federal and State requirements.

The primary regulatory driver for the Utility work is the Phase II Permit issued by Ecology. The Phase II Permit which allows the Utility to discharge stormwater runoff from the City's municipal drainage system into Washington State waters as long as the Utility implements programs to protect water quality by reducing the discharge of nonpoint source pollutants to the maximum extent practicable (MEP) through application of Phase II Permit-specified BMPs.

5.1 Federal Requirements

The Utility directly or indirectly adheres to the requirements of the following five federal government-based requirements:

- **National Environmental Policy Act (NEPA):** requires documentation of environmental impact of projects with federal permits
- **Clean Water Act (CWA):** requires permits and adherence to permit requirements to maintain or improve water quality
- **Endangered Species Act (ESA):** requires O&M practices conducive to habitat conservation
- **National Flood Insurance Program (NFIP):** requires flood-prone cities to adopt and enforce ordinances that meet or exceed Federal Emergency Management Agency (FEMA) requirements to reduce the risk of flooding
- **Governmental Accounting Standards Board (GASB):** requires the City to adhere to requirements of established governmental accounting and financial reporting

The requirements from these federal and nationally based regulations and their impact on the Utility operations and management are presented below.

5.1.1 National Environmental Policy Act (43 CFR 1500–1508)

Passed in 1970, NEPA requires that all proposed activities (such as surface water capital projects) with federal funding or needing federal permits prepare documentation that describes the environmental impacts of proposed actions, and perform public outreach and review opportunities. The documentation includes disclosure to the public of the following information: the federal-related actions and a mechanism for public input, preparation of environmental impact statements, and presentation of alternatives and mitigation for major project components that might impact the environment.

5.1.2 Clean Water Act (33 USC 1252 [a])

The CWA is the 1972 amendment to the 1948 Federal Water Pollution Control Act. The main purpose of the CWA is to achieve the goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. To achieve that goal, the CWA directs the U.S. Environmental Protection Agency (EPA) to administer programs to (1) regulate the discharge of pollutants (e.g., through permits), and (2) implement water quality standards. The relevant portions of these two programs are summarized below.

In 1999, EPA adopted rules to implement Phase II of the MS4 Program, which applied to smaller communities. These smaller communities were identified as those located in urbanized areas as defined by the U.S. Census. The Phase II Permit is described in Section 5.2.1, Phase II Permit (CWA 402-NPDES).

5.1.3 Wetland-Related Permits (CWA §404)

Section 404 of the CWA regulates water body filling, particularly wetland areas, with a permit program. The U.S. Army Corps of Engineers administers the permit program to ensure no net loss of wetland areas. Under this permit program, capital projects that impact wetlands would need to include alternatives to avoid, minimize, or compensate for any wetland loss. In cases where a wetland area is impacted, the permit program regulates wetland replacement through a mitigation process.

5.1.4 Endangered Species Act

The National Oceanic and Atmospheric Administration (NOAA) listed Puget Sound Chinook salmon (*Oncorhynchus tshawytscha)* and Puget Sound Steelhead as threatened species under the ESA on March 24, 1999, and May 11, 2007, respectively. Both species' threatened status was confirmed on April 14, 2014. The ESA provides for both the conservation and protection of plant and animal species that face the threat of extinction, as well as for the supporting ecosystems. To prevent further decline of the species and to encourage restoration, the ESA prohibits "take" of listed animals, which includes significantly modifying its habitat. The ESA requires that a plan be developed and implemented to address recovery of the species.

Shoreline is located within Water Resource Inventory Area (WRIA) 8 (Lake Washington, Cedar/Sammamish Watershed and Water) and participates in this group's Chinook salmon conservation planning efforts for streams discharging to Lake Washington and Puget Sound (WRIA 8 2017). The City continues to protect Chinook salmon with a range of BMPs and public education. The only water body with documented Chinook presence is McAleer Creek. Steelhead trout also have a documented presence in McAleer Creek.

NOAA listed the southern resident population of killer whales (*Orcinus orca*) as endangered species under the ESA on November 18, 2005, and updated status on April 14, 2014. The southern resident population of killer whales spends summers and fall in Puget Sound, which is considered critical habitat. Urban surface runoff has been identified as one of several sources of pollution that degrades water quality and can affect killer whales through bioaccumulation of contaminants in prey (Industrial Economics 2006). Boeing and Storm creeks, and the Middle Puget Sound drainages discharge to the Puget Sound. Activities such as road maintenance, culvert replacement, surface water asset O&M, and land use regulations can impact aquatic habitat. These activities can be subject to the requirements of the ESA.

5.1.5 Governmental Accounting Standards Board Statement 34

The City needs an accurate inventory of its stormwater infrastructure to comply with GASB 34 requirements. Financial reporting by public utilities must adhere to requirements set by the GASB, which is the agency responsible for developing standards of State and local governmental accounting and financial reporting. Most prominent is GASB Statement 34, "Basic Financial Statements—and Management's Discussion and Analysis—for State and Local Governments," which was issued in June 1999. The main objective of Statement 34 requirements is to develop financial reports that are more comprehensive and easier to understand by the public. Statement 34 consists of several components, which can be seen in full in paragraphs 3 through 166 of the GASB publications (GASB 2017).

5.2 State Requirements

State regulatory requirements and federal requirements administered by the State that are relevant to the Utility are described below. Two sections of the federal CWA administered by the State through Ecology protect water quality include the Phase II Permit (CWA 402-NPDES) and TMDL Listing (CWA 303(d)). For convenience, the federal and State requirement for flood protection and mitigation are described together below. Other State requirements, such as the planning requirements associated with the Growth Management Act (GMA) and permitting requirements outlined in the Hydraulic Code, are also discussed.

5.2.1 Phase II Permit (CWA 402-NPDES)

Shoreline is a Phase II permitted community and received its first Phase II Permit from Ecology in 2007. The 2007 Phase II Permit was updated and reissued to Phase II Permit holders in August 2012 with an effective date of August 2013. In January 2014, some modifications were made to the City's Phase II Permit and Ecology issued an errata sheet in 2015.

5.2.1.1 Current Phase II Permit (effective 2013–2018, with extension to 2019)

The Phase II Permit allows municipalities to discharge stormwater runoff from their municipal drainage systems into Washington State water bodies (e.g., streams, rivers, lakes, and wetlands) under conditions specified in the Phase II Permit. Municipalities must implement programs to protect water quality by reducing the discharge of pollutants to the MEP and by applying all known, available, and reasonable treatments (AKART). Stormwater pollution reduction is accomplished through the application of structural and non-structural BMPs. The stormwater management activities specified in the Phase II Permit are documented in a *Stormwater Management Program Plan* and broken out by the following program components (City 2017e):

- *Stormwater Management Program* administration
- Public education and outreach
- Public involvement and participation
- Illicit discharge detection and elimination (IDDE)
- Control of runoff from new development, redevelopment, and construction sites
- Municipal O&M
- Monitoring and assessment

The Phase II Permit also requires compliance with established TMDLs as described in Section 5.2.2.

On March 31 of each year, the Phase II Permit requires the City to submit a report to Ecology on the status of compliance with the Phase II Permit. The City must also submit a stormwater management program plan each year that describes the activities for the coming year. Implementation of specific Phase II Permit conditions are staggered throughout the 5-year Phase II Permit term.

In the 2013 Phase II Permit, there were changes and updates from the 2007 Phase II Permit. Two significant changes were as follows:

- LID requirements were included for new development and redevelopment to mimic natural drainage processes. Existing standards were changed to apply to sites smaller than 1 acre.
- A Regional Stormwater Monitoring Program (RSMP) was included covering collection of water quality, habitat, and biota monitoring information; program effectiveness tracking; a source identification information repository; publicly accessible monitoring data; and identification of Ecology as the program administrator for the 2013–2018 Phase II Permit term, with funding from each permittee.

5.2.1.2 Future Phase II Permit (2019–23)

The 2013–2018 Phase II Permit was extended 1 year. Ecology plans to issue a new Phase II Permit in 2019. Ecology held public meetings in 2017 and presented preliminary draft language for the new Phase II Permit, which includes the following:

- **Business Inspection Source Control Program:** To continue reduction of illicit discharges and build on existing public outreach and education efforts of Ecology's Local Source Control Partnership, the new Phase II Permit may require a source control program for the existing Development Program, similar to what is currently required of Phase I Permit holders (e.g., City of Seattle, King County). The new source control program would require updates to SMC as well as additional resources to manage the program and perform inspections.
- **Illicit discharge tracking and documentation:** The previous Phase II Permit provided guidance for tracking and documenting illicit discharges. To better review illicit discharge information, Ecology will require Phase II Permit holders to document incidents and submit a file with an annual report containing the information in the manner Ecology prescribes. This will require Phase II Permit holders to use the Ecology system to document the illicit discharge incidents or to develop a data programming tool to convert the data collected in the City's system into the Ecology prescribed format.
- **Minor updates to mapping and water quality monitoring:** The new Phase II Permit will include minor modifications to the continuing mapping and monitoring requirements. For mapping, Phase II Permit holders will be required to record size and material attributes for all known MS4 outfalls. For the Utility, this requirement is partially met with 80 percent of the mapped outfalls with size and material attribute information complete. For water quality monitoring, the new Phase II Permit is asking for more detail in annual report summary responses and changes in payment time for regional status and trend monitoring.
- **Language clarification:** Although not resulting in substantive or actionable changes, the new Phase II Permit will include language clarification and provide overall clarity to the "Controlling Runoff from New Development, Redevelopment and Construction Sites" and "Public Education and Outreach" sections.
- **Update to education and outreach requirements**: The new permit will include "actionable changes," to the education and outreach requirement including, a new evaluation of an existing program, implementing either changes to that program or a new program altogether, and correlating outreach efforts to actual water quality data, which has not been done previously.

- **Long-term MS4 planning:** Ecology is proposing a watershed-scale planning requirement for both Phase I and Phase II Permit holders. The planning effort would require permit holders to prioritize subbasins based on the needs of local receiving waters and prepare plans with targeted capital projects and BMPs that directly contribute to preventing and reducing impacts to receiving waters.
- **Stormwater Management Manual for Western Washington update:** Ecology is updating the 2014 *Stormwater Management Manual for Western Washington* (Stormwater Manual) to enhance usability and improve overall clarity.

5.2.2 Total Maximum Daily Load Listing (CWA 303(d))

Ecology performs a statewide Water Quality Assessment every 2 to 4 years to identify water bodies that do not meet the State water quality standards. Water bodies that do not meet standards are placed on the CWA 303(d) list. Ecology develops TMDLs for the water bodies on the 303(d) list to bring them into compliance with water quality standards. TMDLs typically apply to the watershed areas that contribute flow to the 303(d)-listed reaches.

McAleer Creek is the only water body within Shoreline on the current 303(d) list. Echo Lake is listed as a water body of concern, which means there are indications of a water quality problem, but not an ongoing impairment. Other watersheds within the city contribute flow outside of Shoreline city limits to downstream water quality impaired water bodies. For example, the Thornton Creek watershed contributes flows to 303(d) reaches of Thornton Creek outside of Shoreline. Similarly, portions of the city's McAleer Creek watershed contribute flow to the TMDL-listed Lake Ballinger located in the cities of Mountlake Terrace and Edmonds.

TMDLs for water bodies downstream of Shoreline could trigger pollutant load reduction requirements for stormwater discharges in Shoreline. TMDL requirements will become a special condition of the next Phase II Permit after the TMDL has been developed by Ecology and approved by EPA. The TMDL could require treatment or removal of stormwater runoff from existing developed areas that drain to the affected water bodies. Thus, TMDLs could affect future stormwater treatment or removal of stormwater runoff from existing developed areas that drain to the affected water bodies. See Appendix F, for more details on 303(d) and TMDL information.

5.2.3 National Flood Insurance Program and Floodplain Management (RCW 86.16)

In 1968, the U.S. Congress created the NFIP to provide financial protection to property owners from flood damage. The NFIP offers flood insurance to homeowners, renters, and business owners if their community participates in the NFIP. Participating communities agree to adopt and enforce ordinances that meet or exceed FEMA requirements to reduce the risk of flooding (see FloodSmart.gov for details about the program). The City is a participating community in FEMA's NFIP. To participate in the program, the City adopted and enforces a floodplain management ordinance that regulates development, SMC 13.12 Floodplain Management.

The City updated SMC 13.12 in 2017 to meet FEMA recommendations developed during a Community Assistance Contact (CAC) assessment. The updates were administrative in nature and provided consistency with updated FEMA regulations. The updates ensured that the City remained in compliance with FEMA regulations, and maintained its eligibility for the NFIP. The current FEMA flood insurance rate maps (FIRMs) affect properties along the Puget Sound shoreline, Boeing Creek, and the north fork of Thornton Creek.

Revised Code of Washington (RCW) Chapter 86.16, "Floodplain Management," establishes statewide authority for floodplain management as provided through the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Ecology is identified as the responsible State agency

to carry out this program. Under Washington Administrative Code (WAC) Chapter 173-158, Ecology requires local governments to adopt and administer regulatory programs compliant with the minimum standards of the NFIP. Ecology provides technical assistance to local governments for both identifying the location of the 100-year (base) floodplain and administering their floodplain management ordinances.

The City currently does not participate in FEMA's Community Rating System (CRS). The CRS is an incentive program that encourages communities to adopt floodplain management activities exceeding the minimum NFIP requirements. Participants receive discounts on flood insurance.

5.2.4 Growth Management Act (RCW Chapter 36.70A)

The Washington State Legislature enacted the GMA in 1990 to address rapid population growth and concerns with suburban sprawl, environmental protection, quality of life, and related issues.

The GMA provides a framework for regional coordination of land development. Under the GMA, local comprehensive plans, such as the Comprehensive Plan, must include the following elements: land use, housing, capital facilities, utilities, transportation, economic development, parks and recreation, and, for counties, a rural element. City master planning documents, such as the 2018 Master Plan, are coordinated with the City's comprehensive planning process through an annual Comprehensive Plan amendment process. During this amendment process, the Master Plan and capital projects therein are integrated with the capital facilities element of the Comprehensive Plan.

5.2.5 Hydraulic Project Approval (State Hydraulic Code RCW 77.55)

The Washington Department of Fish and Wildlife (WDFW) requires a Hydraulic Project Approval (HPA) for construction activities that use, divert, obstruct, or change the natural flow or bed of any waters of the state. The purpose of the requirement is to protect fish habitat in stream channels, prevent erosion, and protect freshwater and nearshore marine aquatic life. Construction activity such as bridge painting, channel improvements, stream restoration, or culvert replacements within the ordinary high water mark of any stream would typically require an HPA. Flood-damage repair and prevention activities may be permitted as a 5-year plan, avoiding the need to permit each individual activity. WDFW generally may require modifications to plans and specifications that avoid or mitigate project impacts on fish ecology. Possible modifications include, and are not limited to, the following:

- Making a culvert fish passable
- Providing large woody debris in a stream channel
- Moving grading limits outside the ordinary high water mark
- Specifying construction practices that prevent entry of construction equipment and/or materials into the watercourse
- Specifying bed material, construction methods, the construction period, riparian vegetation, and any required mitigation

If it is more cost-effective, the applicant may be permitted to perform offsite mitigation, provided that it will generate equal or greater biological functions and values as compared to onsite mitigation.

Table 5-1 provides a summary list of the federal and State regulations and programs relevant to the Utility's responsibilities.

Table 5-1. Federal and State Regulations and Programs Relevant to the Utility's Responsibilities		
Title	**Regulation or Program**	**Application to the City**
Federal		
NEPA	Regulation	All projects with federal funding or needing federal permits are required to submit a NEPA review to describe environmental ramifications, disclose federal actions, provide a mechanism for public input, prepare an environmental impact statement, and consider alternatives and mitigation for actions.
CWA	Regulation	Originally passed in 1972 to address point sources of pollution and to restore the chemical, physical, and biological integrity of the nation's water (33 USC 1251 [a]). Several sections are administered by Ecology through permission of EPA including §303(d), §401, and §402-NPDES as described in RCW 90.48.260. These sections of the CWA are described in the State and Regional subsection of this table. Different sections of the CWA require permits and adherence to permit requirements to maintain or improve water quality.
CWA §404 wetlands	Regulation	Permit program for capital projects that is administered by the U.S. Army Corps of Engineers to ensure no net loss of wetland areas. Permits are obtained when work occurs in or near a designated wetland area. The City's designated wetlands are mapped in the City's GIS.
ESA	Regulation	Stormwater capital improvement projects that involve federal permitting or funding could require consultation with federal agencies under §7 of the ESA. ESA consultation could increase project timelines and costs. For the Utility, ESA-regulated activities require O&M practices conducive to habitat conservation.
GASB Statement 34	Program	Requires the City to adhere to established governmental accounting and financial reporting such as accurate inventory of the City's stormwater infrastructure.
State and Regional		
SEPA	Regulation	Each capital improvement project requires SEPA review prior to implementation, unless that project qualifies as exempt. May increase project costs and schedules. Planning documents that outline proposed capital projects and programs such as the Master Plan require programmatic SEPA review to evaluate cumulative impacts.
CWA §303(d) TMDL listings [a]	Regulation	TMDLs could lead to more stringent stormwater quality controls in future NPDES permits. The City does not currently have any TMDLs. The City has one water body with a 303(d) listing, McAleer Creek.
CWA §401 water quality certification [a]	Regulation	Individual projects that require §404 permit (projects with the federal connection) or other federal permits would also require a §401 certification from Ecology. A §401 certification could include requirements for site-specific mitigation measures, which could affect capital improvement project design and costs.
CWA §402 MS4 NPDES permit [a]	Regulation	Includes requirements focused on stormwater quality management in the city. The Phase II Permit requires the reduction of pollutant loads to the MEP. Washington State may establish TMDLs for water bodies that violate the standards. TMDLs can become Phase II Permit requirements.
NFIP and floodplain management [b]	Regulation	Washington State's RCW 86.16, "Floodplain Management," establishes statewide authority for floodplain management as provided through the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Provides guidance and regulations for City's Floodplain Development Permit and participation in NFIP.
GMA and *City of Shoreline Comprehensive Plan*	Regulation	The GMA is a significant driver for land use and permitting decisions. The 2012 *City of Shoreline Comprehensive Plan* (as amended) is required by the GMA, and includes language preventing adverse surface water impacts from land development (City 2012).
State hydraulic code	Regulation	Projects that involve work in waters of the state such as streams and culverts that convey stream flow require an HPA permit. HPA permitting and mitigation measures could affect project costs.
Archaeological and cultural coordination	Regulation	If capital improvement projects are near known or suspected archaeological sites, they must coordinate with the Department of Archaeology and Historic Preservation, local Indian tribes, and King County Historic Preservation.

a. *Portions of the CWA are delegated to Ecology entities for administration.*

b. *The NFIP is a federal program administered by FEMA, but is presented here with Washington State-administered floodplain management requirements.*

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Section 6

Policies and Procedures

Utility services are provided by City staff who perform administrative activities, operations, maintenance, public involvement, and capital improvement planning in accordance with established policies and procedures. This section describes the organizational structure of the staff supporting the Utility, provides background on existing policies and procedures, and summarizes policy discussions and recommended policy changes evaluated as part of the master planning process.

6.1 Staff Organization

The Utility is part of the City's Public Works Department. Utility staff are located primarily under the Surface Water Utility; however, shared staff also fall under Street Operations and Engineering. Additional staffing funds may be allocated to other City departments, such as Administrative Services or Planning and Community Development, but this varies from year to year depending on the needs of the Utility. Figure 6-1 provides an organizational chart for Utility personnel with the full-time equivalent (FTE) allocations for 2017.

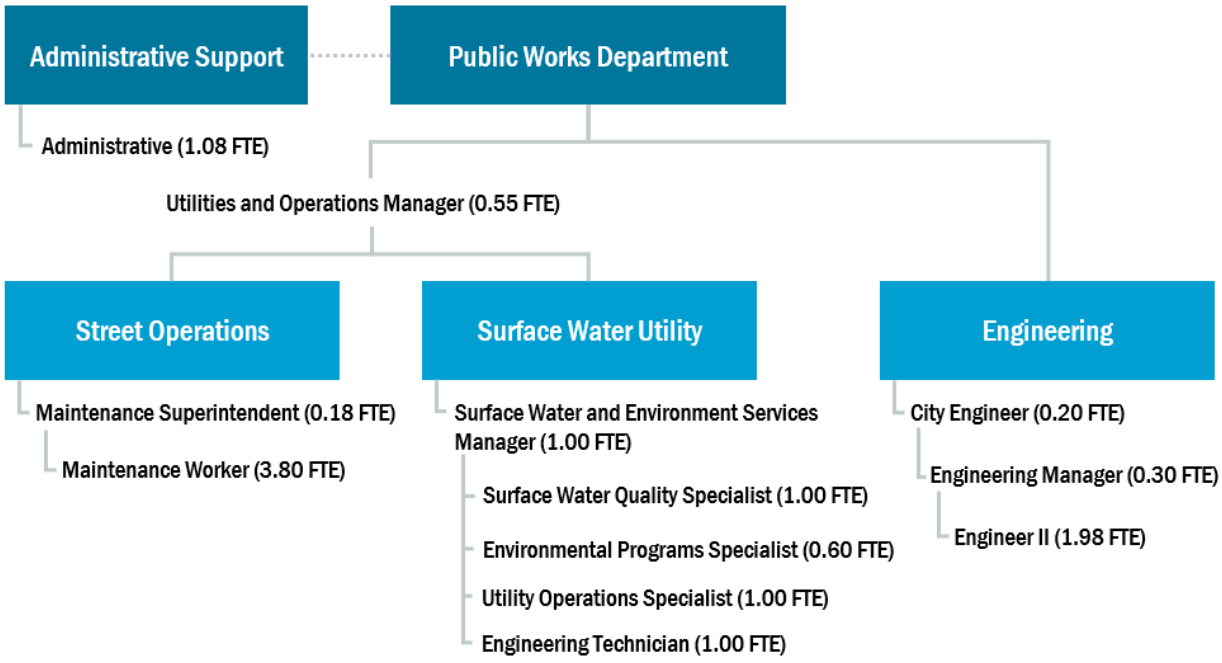


Figure 6-1. Organization of personnel contributing to Utility with FTE allocations for 2017

6.2 Existing Policies and Procedures

The Surface Water and Environmental Services Manager, Utilities and Operations Manager, Public Works Director, and City Manager work collectively to establish policies and procedures for the Utility, many of which are approved by the City Council through municipal ordinances or as part of the annual budgeting process. Policies and procedures are developed as staff recommendations, and are approved through a process that potentially involves three levels of City administration: Public Works Department, City Manager's Office, and the City Council. For example, policies that result in changes to municipal code or that affect the City's annual budget require the Public Works Director to coordinate with the City Manager's Office to prepare recommendations for the City Council. In contrast, minor updates to the *Engineering Development Manual* (EDM) or Administrative Orders (AOs) interpreting existing code are simply approved at a departmental level by the Public Works Director.

The following sections summarize key policies and procedures for the Utility.

6.2.1 O&M Manual

As part of the development of this Master Plan, the Utility prepared the *City of Shoreline Surface Water Utility Operation and Maintenance Manual* (O&M Manual), which contains the latest policies and procedures for operating and maintaining the City's surface water infrastructure (see Appendix G). The updated O&M Manual documents the policies and procedures that improve asset management and comply with regulatory requirements. Key updates include:

- Process details for O&M procedures in accordance with the Phase II Permit and asset management BMPs
- O&M work flow process relative to the Computerized Maintenance Management System (CMMS)
- Inspection and maintenance guidance for the various types of publicly owned surface water assets
- References to other O&M activities such as severe weather response, IDDE procedures, and private facility inspection

6.2.2 Engineering Development Manual

The 2016 Shoreline EDM is a guide for public and private development within the city. The EDM is a supplement to the city code and provides minimum engineering criteria and specifications. The Public Works Director is given authority to create and update the EDM through SMC 20.70.020, Engineering and Utilities Development Standard. The EDM is updated on an ongoing basis and typically re-published every other year.

The EDM manual includes four divisions:

- **Division 1:** Administration contains information related to permits
- **Division 2:** Right-of-way presents standards and other information related to development within the ROW
- **Division 3:** Surface Water contains surface water policies, as well as design standards that apply to public and private development
- **Division 4:** Construction and Inspection provides the basics regarding construction and inspection in the City ROW

Division 3 of the EDM consolidates City policy, procedures, and BMPs guidance for development related to surface water. Table 6-1 summarizes the nine chapters of Division 3.

Table 6-1. Summary of EDM Division 3 Surface Water Standards and Policies

Chapter	Relevance to Utility
18. Surface Water Standards	Provides references to standards documents including the 2012 Stormwater Manual, as amended in December 2014 and the King County *Surface Water Design Manual* (Stormwater Manual)
19. Stormwater Manual Modifications	Lists modifications to the requirements of the Stormwater Manual especially where the Stormwater Manual notes an item is optional or up to the jurisdiction
20. General Requirements	Provides additional requirements to documents listed in Chapter 18, Surface Water Standards
21. Infiltration	Provides additional information about infiltration for LID and relative to City-specific development permits
22. Surface Water Project Classification	Includes guidance and descriptions about the four development project classifications to help with following the requirements of the Stormwater Manual and City development permits
23. Site Development Plan	Provides reference to site development discussion in the Stormwater Manual and additional City-specific guidance on BMPs for site design
25. Stormwater Pollution Prevention Plan	Provides reference to stormwater pollution prevention plans (SWPPPs) and additional City-specific requirements for preparing a SWPPP
26. Flood Control	Lists areas within the city that are identified as floodplain areas and provides reference to SMC
27. Conveyance System	Lists design specifications for pipe, drop structures, wall crossing, and ditch modifications

The EDM incorporates or provides references to AOs, which are code interpretations issued by department directors. Currently one AO is related to surface water activities, AO 000019 121300. This AO states that a detention pond can be placed in all land use zones. Unlike parking, detention is not a function of land use, but a function of impervious surface and drainage area.

6.2.3 Budget and Capital Improvement Plan

An annual City budget and the 6-year CIP recommendations are prepared as part of an overall budget process and are approved by the City Council annually. There are also budget amendments and budget carryover processes that occur during the year.

Financial policies associated with the City's annual budgeting process are included in the appendices of the annual *Capital Improvement Plan* (City 2017b). These policies were considered during the CIP cost development and rate structure analysis of this Master Plan:

- **Fund reserve:** The City shall maintain an operating reserve within the Fund in an amount equal to or greater than 20 percent of budgeted operating revenues.
- **CIP O&M costs:** CIP projects, as approved by the City Council, shall have a funding plan for O&M costs identified in the project description. These costs will be included in the City's long-term financial planning.

6.2.4 Shoreline Municipal Code

SMC Chapter 13.10, Surface Water Utility, establishes the requirements for the Utility. The City Council adopts amendments to the SMC on an ongoing basis as recommendations are provided by the City Manager's office and department directors. Compliance with Phase II Permit regulations is a common driver for code amendments related to the Utility. For example, the City adopted SMC language to promote and not inhibit the use of LID to maintain compliance with the 2013 Phase II

Permit requirements. Code amendments are also needed when surface water management fees change. Utility staff recommended new surface water management fees for 2018 to fund the recommended projects and programs identified in the 2018 Master Plan. The City Council updated the surface water management rate table, SMC 3.01.400 with the adoption of the 2018 annual budget and CIP. This section of code also included language changes relative to chargeable area as discussed in Section 6.3.3.

Table 6-2 presents a summary of the current SMC relevant to the Utility and its level-of-service goals.

Table 6-2. Summary of Shoreline Municipal Code Relevant to Utility

Code	Relevance to Utility
3.01.400 Surface Water Management Rate Table	Presents the current surface water management rate table, rate credits and adjustment, and Soak It Up program rebate rate.
3.35.080 Surface Water Utility Enterprise Fund	Establishes the Surface Water Utility Enterprise Fund and restrictions of its use.
13.10 Surface Water Utility	Establishes the Utility and its goals, and provides guidance and requirements for water quality pursuant to federal (NPDES Permit) and State (Chapter 90.48 RCW) requirements including prohibited discharges, inspections, investigations, and illicit discharges. Includes guidance for facility design and construction, construction inspection, and record drawings and certification.
13.12 Floodplain Management	Outlines the City's approach, standards, and adherence to State and federal guidance for floodplain management to protect public health, safety, and welfare relative to flooding.
20.30 Subchapter 9. Code Enforcement	Declares public nuisance and enforcement. Includes code enforcement procedures for SMC. Outlines enforcement procedures relevant to violations outlined in other sections of SMC such as the pollution of public waters, commercial facility maintenance, floodplain management, and public nuisances as defined by the RCW. Outlines the escalation of enforcement for code violations as declared in SMC 20.30.740. Relevant to the inspection and maintenance enforcement of privately owned stormwater facilities, detection and elimination of illicit discharges, and floodplain management.
20.70 Engineering and Utilities Development Standard	Establishes the engineering regulations and standards including naming the EDM as the City standard for surface water asset design and maintenance.
20.70.140 Dedication of Stormwater Facilities	Outlines maintenance responsibilities for stormwater facilities within and outside of the public ROW, including processes for accepting or releasing facility dedication. Relevant to the inspection and maintenance enforcement of privately owned stormwater facilities.
20.70.330 Surface Water Facilities	Establishes that stormwater facilities must meet requirements outlined in SMC 13.10, Surface Water Utility, and SMC 20.30.440, Installation of Improvements. Relevant to the inspection and maintenance enforcement of privately owned stormwater facilities.
20.80 Critical Areas: 20.80.260–300 Fish and Wildlife Habitat 20.80.310–350 Wetlands 20.80.360–380 Flood Hazard 20.80.420–450 Aquifer Recharge	Includes critical area ordinances for fish and wildlife habitat, wetlands, flood hazard areas, and aquifer recharge areas that include designating and rating, mapping and delineation, development standards, or alteration. Critical area information is considered for CIP planning and cost estimates.
20.200 Shoreline Master Plan	Requires a master plan as specified by the Shoreline Protection Act. Outlines regulations relevant to shoreline protection including no net loss of ecologic function of the city's shorelines. Considered for surface water CIP and cost estimates.
20.230 SMP Shoreline Policies and Regulations	Includes surface water policies and regulations associated with shoreline areas for surface water in general and for stormwater management facilities.

6.2.5 City of Shoreline Comprehensive Plan

The Comprehensive Plan, the City's long-range planning document for the next 20 years, was originally adopted shortly after the City incorporated in 1995. A major review and revision to the Comprehensive Plan was completed in December 2012. While the Comprehensive Plan is a long-range planning document, it may be amended annually by the City Council via ordinance. Shoreline citizens and the City recommend amendments to the Comprehensive Plan's polices and goals, maps, and supporting analyses. City-initiated amendments occur as the City develops and adopts its various master planning documents (e.g., parks, transportation, and surface water) or as new planning issues and goals emerge. The Comprehensive Plan contains many policies relevant to the Utility. Utility staff reviewed the Comprehensive Plan goals and identified a subset of goals relevant to the Utility and the 2018 Master Plan, see Table 6-3.

Table 6-3. Shoreline Comprehensive Plan Goals Relevant to Utility

Comprehensive Plan Section	Policy and Goals Relevant to Utility
Land use, residential	LU41: Through redevelopment opportunities in station areas, promote restoration of adjacent streams, creeks, and other environmentally sensitive areas; improve public access to these areas; and provide public education about the functions and values of adjacent natural areas.
Land use, light rail station areas	LU69: Design, locate, and construct surface water facilities to: • Promote water quality • Enhance public safety • Preserve and enhance natural habitat • Protect critical areas • Reasonably minimize significant, individual, and cumulative adverse impacts to the environment
Land use, water quality, and drainage	LU70: Pursue state and federal grants to improve surface water management and water quality.
	LU71: Protect water quality through the continuation and possible expansion of City programs, regulations, and pilot projects.
	LU72: Protect water quality by educating citizens about proper waste disposal and eliminating pollutants that enter the stormwater system.
	LU73: Maintain and enhance natural drainage systems to protect water quality, reduce public costs, protect property, and prevent environmental degradation.
	LU74: Collaborate with Ecology and neighboring jurisdictions, including participation in regional forums and committees, to improve regional surface water management, enhance water quality, and resolve related interjurisdictional concerns.
	LU75: Where feasible, stormwater facilities like retention and detention ponds should be designed to provide supplemental benefits, such as wildlife habitat, water quality treatment, and passive recreation.
	LU76: Pursue obtaining access rights, such as easements or ownership, to lands needed to maintain, repair, or improve portions of the public drainage system that are located on private property, and for which the City does not currently have legal access.
Community design	CD28. Use the Green Street standards in the Master Street Plan to provide an enhanced streetscape, including street trees, landscaping, natural surface water management techniques, lighting, pathways, crosswalks, pedestrian and bicycle facilities, decorative paving, signs, seasonal displays, and public art.
Transportation	T10. Use LID techniques or other elements of complete or Green Street, except when determined to be infeasible. Explore opportunities to expand the use of natural stormwater treatment in the ROW through partnerships with public and private property owners.

Table 6-3. Shoreline Comprehensive Plan Goals Relevant to Utility	
Comprehensive Plan Section	**Policy and Goals Relevant to Utility**
Natural environment, geological, and flood hazards	NE11. Mitigate drainage, erosion, siltation, and landslide impacts, while encouraging native vegetation.
	NE14. Inform landowners about site development, drainage, and yard maintenance practices that affect slope stability and water quality.
	NE16. Prioritize the resolution of flooding problems based on public safety risk, property damage, and flooding frequency.
	NE17. Promote public education and encourage preparation in areas that are potentially susceptible to geological and flood hazards.
Natural environment, wetlands, and habitat protection	NE23. Participate in regional species protection efforts, including salmon habitat enhancement and restoration.
	NE24. Preserve critical wildlife habitat, including those identified as priority species or priority habitats by WDFW, through regulation, acquisition, incentives, and other techniques. Habitats and species of local importance will also be protected in this manner.
	NE25. Strive to achieve a level of no net loss of wetland function, area, and value within each drainage basin.
	NE26. Restore existing degraded wetlands where feasible.
	NE27. Focus on wetland and habitat restoration efforts that will result in the greatest benefit for areas identified by the City as priority for restoration.
Natural environment, streams, and water resources	NE28. Support and promote basin stewardship programs to prevent adverse surface water impacts, and to identify opportunities for watershed improvements.
	NE29. Stream alterations, other than habitat improvements, should occur only when it is the only means feasible, and should be the minimum necessary.
	NE30. Identify and prioritize potential stream enhancement projects through surface water basin planning and its public participation process. Enhancement efforts may include daylighting of streams that have been diverted into underground pipes or culverts, removal of anadromous fish barriers, or other options to restore aquatic environments to a natural state.
	NE31. Work with citizen volunteers, State and federal agencies, and Indian tribes to identify, prioritize, and eliminate physical barriers and other impediments to anadromous fish spawning and rearing habitat.
	NE32. Preserve and protect natural surface water storage sites, such as wetlands, aquifers, streams, and water bodies that help regulate surface flows and recharge groundwater.
	NE33. Conserve and protect groundwater resources.
	NE34. Provide additional public access to Shoreline's natural features, including the Puget Sound shoreline. The City will attempt to reach community and neighborhood agreement on any proposal to improve access to natural features where the proposal has the potential to negatively impact private property owners.
	NE35. Educate the public on BMPs regarding the use of pesticides and fertilizers to prevent chemical runoff and the pollution of water bodies.
Capital facilities	CF9. Improvements necessary to provide critical City services such as police, surface water, and transportation at designated service levels concurrent with growth shall have funding priority for City funds over improvements that are needed to provide capital facilities.
	CF10. Consider all available funding and financing mechanisms, such as utility rates, bonds, impact fees, grants, and local improvement districts for funding capital facilities.
	CF11. Evaluate proposed public capital facility projects to identify net costs and benefits, including impacts on transportation, stormwater, parks, and other public services. Assign greater funding priority to those projects that provide a higher net benefit and provide multiple functions to the community over projects that provide single or fewer functions.
	CF16. Promote water reuse and water conservation opportunities that diminish impacts on water, wastewater, and surface water systems, and promote conservation or improvement of natural systems.

Table 6-3. Shoreline Comprehensive Plan Goals Relevant to Utility	
Comprehensive Plan Section	Policy and Goals Relevant to Utility
Capital facilities, mitigation, and efficiency	CF17. Encourage the use of ecologically sound site design in ways that enhance provision of utility services.
	CF18. Support local efforts to minimize inflow and infiltration, and reduce excessive discharge of surface water into wastewater systems.
	CF25. Evaluate and establish designated levels of service to meet the needs of existing and anticipated development.
	CF26. Plan accordingly so that capital facility improvements needed to meet established level of service standards can be provided by the City or the responsible service providers.
	CF27. Identify deficiencies in capital facilities based on adopted levels of service and facility life cycles, and determine the means and timing for correcting these deficiencies.
	CF31. The City establishes the following levels of service as the minimum thresholds necessary to adequately serve development, as well as the minimum thresholds to which the City will strive to provide for existing development: surface water, consistent with the levels of service recommended in the most recently adopted Master Plan.
Utilities	U3. Encourage and assist the timely provision of the full range of utilities within Shoreline to serve existing businesses, including home businesses, and promote economic development.
	U4. Support the timely expansion, maintenance, operation, and replacement of utility infrastructure to meet anticipated demand for growth identified in the land use element.
	U5. Coordinate with other jurisdictions and governmental entities in the planning and implementation of multi-jurisdictional utility facility additions and improvements.

6.3 Recommended Policies and Procedures

As a part of the development of this Master Plan update, the Utility examined current policies and procedures considering the newly defined levels of service and potential improvements to Utility programs. Utility staff prepared policy issue discussions to receive City Council guidance. Based on guidance from the City Council, the Utility then prepared policy, code, and program recommendations for inclusion in the 2018 Master Plan. The following four topics were presented to the City Council:

- Use of Utility funds outside of the ROW
- Stormwater Permit
- Surface water management fee-chargeable area
- Private facility inspection and maintenance

Issues associated with each of the four topic areas are discussed below and include an evaluation of the status quo condition and alternatives with pros and cons. The outcome of the issues discussions based on City Council guidance and reference to implementation in the 2018 Master Plan is also noted.

6.3.1 Use of Utility Funds Outside the Right-of-Way

The Utility often receives requests to perform work on drainage systems that cross through private property. These requests may come from the affected property owner or a group of property owners, or others being impacted by the drainage system. The decision to use Utility funds on private property is based on the determination that the drainage facilities in question are clearly the responsibility of the City, or instances when public infrastructure, such as a road, is threatened if action is not taken. With technical guidance from Utility staff, the City Attorney makes the determination of City responsibility on a case-by-case basis with final determination made by the City Attorney's Office.

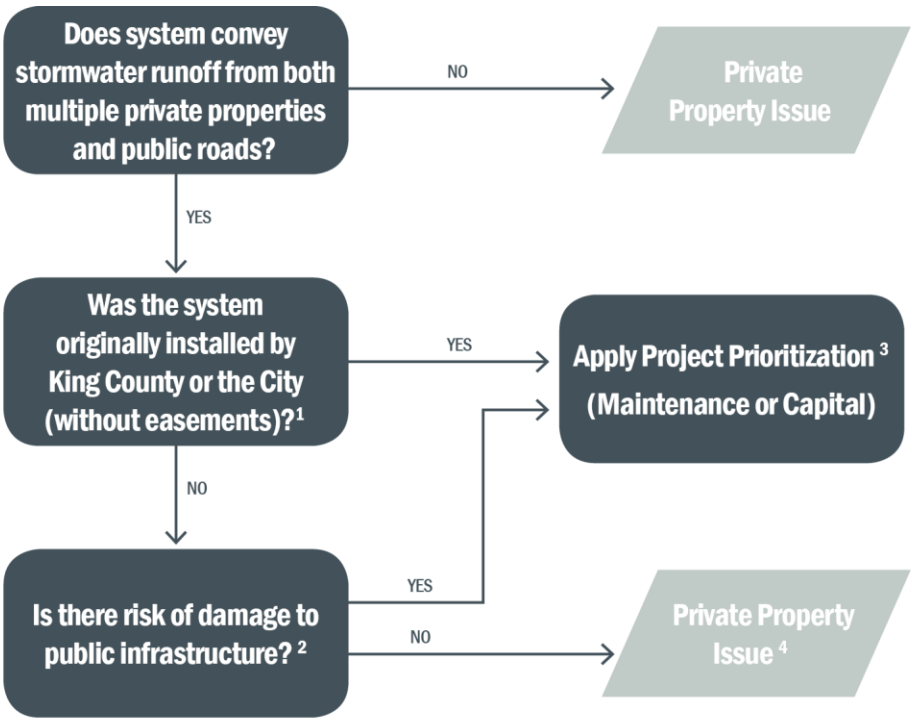
Two policy alternatives and their pros and cons were considered, as described in Table 6-4.

Table 6-4. Use of Utility Funds Outside the ROW Policy Alternatives and Pros/Cons

Policy Alternative	Pros	Cons
Alternative 1: Status quo: public infrastructure preservation • Continue the practice of not expending Utility funds on private property unless City staff determine that the facilities in question are the responsibility of the City or public infrastructure is threatened.	• Limits City involvement with private systems • Legally defendable • Requires the lowest funding level of the two alternative approaches considered • Provides clear policy direction	• May not satisfy some property owners who want the City to take certain actions • Would not allow City action in situations where there is only a water quality or environmental enhancement opportunity
Alternative 2: Identify critical private property infrastructure • City acquires easements or purchases properties containing critical stormwater infrastructure. City operates and maintains these facilities. • Create a program to develop and maintain inventory of drainage and water quality infrastructure on private property deemed critical to protect public infrastructure and provide public benefits (e.g., water quality and environmental enhancements)	• Provides a program for identifying and acquiring easement or ownership of critical drainage infrastructure on private property • Provides a method to consider public requests for City maintenance of private drainage systems where a broader public interest than preservation of public infrastructure may be present • Ensures a minimum level of maintenance for critical facilities added to the City's maintenance program	• Requires establishment of, and funding for, a new program to inventory and prioritize critical drainage infrastructure for easement or ownership acquisition and ongoing maintenance

The City Council agreed with the staff's recommended Alternative 1: Status quo: public infrastructure preservation. Staff refined a "decision requirements" flow chart developed in the 2011 Master Plan, shown in Figure 6-2. This flow chart shows the criteria Utility staff and the City Attorney will use to identify situations where it is appropriate to use Utility funds outside the ROW.

Establishing a clear and transparent process for use of Utility funds outside of the ROW helps the Utility provide consistent and equitable service to customers (see LOS 2, Equitable Service, Table 2-1).



Footnotes:

1. In some areas, King County constructed improvements without securing easements. In these cases, there may be a legal justification for the City to secure drainage easements and assume maintenance, particularly if it is a trunk system that serves multiple properties. The City may require that the system be brought up to City standards and that the easement be provided to the City at no cost.
2. Includes flooding or erosion that results in (or could result in future) damage to public roads, infrastructure, or structures.
3. Determine resolution, if possible through a Drainage study/Assessment, then apply project prioritization criteria established in the 2018 Master Plan for prioritization and scheduling. This will include easement acquisition or relocating to the ROW.
4. The City may offer technical guidance.

Figure 6-2. Decision requirements for use of Utility funds outside the ROW

6.3.2 Stormwater Permit

The Utility operates an MS4 that has connections from private onsite systems. However, there is no single standard process for permitting onsite stormwater systems and connections to the MS4. The City instead has multiple permitting processes for property owners to gain approval and implementation of onsite stormwater infrastructure and connection to the MS4. As permits are processed, the City's recorded actions related to onsite stormwater infrastructure and MS4 connections are filed in different locations. The result is that permit information related to stormwater is in several locations, and is difficult for Utility staff to review and access effectively and efficiently.

Two policy alternatives and their pros and cons were considered, as summarized in Table 6-5.

Table 6-5. Stormwater Permit Policy Alternatives and Pros/Cons		
Policy Alternative	**Pros**	**Cons**
Alternative 1: Status quo: use existing permit process Continue to rely on the current process that involves coordinating with up to four permitting processes where recorded actions related to onsite stormwater infrastructure and MS4 connections are located and managed in different permit records	• No new permit is required	• Significant interdepartmental coordination • Increased risk of not meeting regulations and maintenance standards • Information and approvals of stormwater management facilities reside in different documents • Responsibility remains dispersed among departments
Alternative 2: Establish a City stormwater permit Consolidate all the onsite and ROW stormwater review activity into a single permit and develop a process to manage ongoing inspections, operations, maintenance, and enforcement of maintenance standards for private drainage systems as required by the Phase II Permit	• Improved coordination with other permitting processes for stormwater management • Facilitate a comprehensive review, approval, implementation, and improved maintenance tracking of surface water management infrastructure	• New stormwater permit process and fee

The City Council agreed with staff's recommendation for Alternative 2: Establish a City Stormwater Permit. The Utility estimated an operating budget for Utility staff to develop the Stormwater Permit in 2018 and implement it in 2019. Details on the Stormwater Permit program are presented in Section 7.1.9.

Establishing a City Stormwater Permit provides the Utility with a consistent process to enforce standards that reduce risks to public health, safety, and the environment (see LOS 1, Surface Water Impacts, Table 2-1). In addition, a consistent permitting process provides a clearer line of communication with customers (see LOS 3, Communication and Outreach, Table 2-1).

6.3.3 Surface Water Management Fee Chargeable Area

Surface water management fees are currently based on impervious surface[5]. To comply with the Phase II Permit, the City requires that properties implement LID practices that reduce the amount of impervious surface area. In 2016, the SMC was updated to include LID language that included changing references from "impervious surface" to "hard surface" as defined by Ecology. The reference change had one exception: the term "impervious surface" is still used to define rate categories in the Surface Water Management rate table as presented in SMC 3.01.400.

Based on the current definition of impervious surface, permeable pavements and vegetated roofs would not be chargeable areas for surface water management fees; however, these surfaces are included in the "hard surfaces" definition. The City's level of service for stormwater conveyance requires the same downstream capacity and costs for both impervious and hard surfaces because the system must provide conveyance in the event of permeable surface system overload during storm events and/or permeable surface system failure. Inspections and oversight of onsite stormwater systems will remain the same with either definition.

[5] Impervious surface means a non-vegetated surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development, and causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, roof tops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled, macadam, or other surfaces which similarly impede the natural infiltration of stormwater.

Two policy alternatives and their pros and cons were considered, as summarized in Table 6-6.

Table 6-6. Surface Water Management Fee Chargeable Area Policy Alternatives and Pros/Cons

Policy Alternative	Pros	Cons
Alternative 1: Status quo: maintain existing surface water management fees based on impervious surface Chargeable area will be based on the current definition of impervious surface	No SMC amendment required	• Possible revenue loss for development that reduces impervious surfaces through the use of permeable pavements or other permeable surface treatments • Potentially cause confusion among ratepayers with the terms "hard surface" and "impervious surface" used by Ecology
Alternative 2: Use hard surfaces for surface water management fees Replace the term "impervious surface" with "hard surface" for purposes of calculating surface water management fees in SMC 3.01.400	Ensures a consistent revenue stream as hard surfaces replace impervious surfaces and eliminates confusion among ratepayers with Ecology's use of terms "hard surface" and "impervious surface"	• Requires an amendment to SMC 3.01.400 • Requires developing and maintaining an inventory and tracking process for managing the changes in hard surfaces

The City Council agreed with staff's recommendation for Alternative 2: Use Hard Surfaces for Surface Water Management Fees, which would change the chargeable area for surface water fees to be based on hard surface. The chargeable area was updated in the surface water management rate table (SMC 3.01.400) when the City Council approved the 2018 budget.

Updating the surface water management fee definition will help meet LOS 2, Equitable Service, in Table 2-1 by ensuring a consistent revenue stream as hard surfaces replace impervious surfaces, and by reducing confusion among ratepayers related to inconsistent use of Ecology terminology.

6.3.4 Private Facility Inspection and Maintenance Program

The Phase II Permit requires annual inspections and appropriate maintenance of all permanent stormwater BMPs/facilities that were constructed on private properties since 2007 and discharge to the MS4. The Phase II Permit assigns responsibility for the enforcement of proper maintenance activity to the City.

During the investigation of Utility O&M programs, Utility staff identified the need to change the Private Facility Inspection and Maintenance Program because of changes in rate credits and an anticipated increase in private facilities. Staff made the recommendation to transition the program from relying only on enforcement code for maintenance to include a private facility owner self-certification program similar to what is implemented by King County. The City Council requested additional information on the recommended approach before approval.

Two policy alternatives and their pros and cons were considered, as described in Table 6-7.

Table 6-7. Private Facility Inspection and Maintenance Enforcement Policy Alternatives and Pros/Cons

Policy Alternative	Pros	Cons
Alternative 1: Status quo: use current inspection, notification, and enforcement mechanisms Continue to use SMC authority to oversee required Utility private drainage system inspection and enforcement activities	• Does not require creation of new municipal code for surface water maintenance enforcement • Generally accepted municipal business practice	Process may take longer than the allowed time for repairs as specified by the Phase II Permit and may result in an NPDES violation
Alternative 2: Establish a self-certification process Create a program for new systems and establish a process for property owners to conduct inspect and self-certify that the stormwater system is maintained and operating correctly	• Anticipated to result in less staff time for inspection, verifying maintenance actions, and code enforcement • Provides public education opportunities	• Requires new code to establish self-certification • Relies on property owners and their agents to assess proper functioning of stormwater systems • Requires incentive for existing systems to join • Could increase risk of permit noncompliance and/or third-party lawsuits

The City Council directed Utility staff to provide more information on Alternative 2: Establish a Self-Certification Process including more details on the participation and cost implications, and to report back to the City Council with findings. To gather more information on the recommended approach, Staff will embark on a pilot program offering the private properties the option to participate in the self-certification program with the use of qualified personnel as defined in the Phase II Permit. The Utility estimated an operating budget for the Utility staff to develop the self-certification process over the next 6 years. Details on the Private Facility Inspection and Maintenance Program are presented in Section 7.1.9.

The addition of a self-certification process to the existing private facility inspection and maintenance program promotes costs savings by reducing Utility staff time for inspections (see LOS 3, Equitable Service, in Table 2-1).

Section 7

Utility Programs

Utility programs are coordinated and planned activities with goals designed to help the Utility meet levels of service and address regulatory requirements. Programs involve various work activities including Utility administration, system operation and maintenance, and public involvement and outreach. Programs entail long-term or ongoing work activities that are supported by Utility staff and funded through operations budget. Short-term work activities that are funded through the City's CIP are generally referred to as projects, rather than programs[6]. Project recommendations are discussed in later sections.

The Utility currently runs 18 programs falling into one of three categories:

- **Operational programs** help the Utility meet regulatory requirements, collect and analyze water quality data and asset information, perform routine inspections, and support overall Utility staff and resource management
- **Maintenance programs** include preventive and corrective maintenance including cleaning, repair, rehabilitation, and replacement of damaged or deteriorated Utility assets
- **Public involvement programs** educate and engage Shoreline's residents and ratepayers in surface water management and improving surface water quality

One of the major goals for the development of this Master Plan was to perform a thorough review of current programs and operational activities and their benefit to levels of service (see Section 2), needs identified in the basin plans, anticipated growth, and evolving regulations, and to develop detailed recommendations for improvements. The Utility evaluated the status of each existing program (as of 2017) and compared the program outcomes with level-of-service targets and upcoming regulatory requirements. Each of the evaluations resulted in one of three possible outcomes: (1) maintain the existing program, (2) enhance the existing program, or (3) develop a new program to address potential needs. Nine of the 18 existing programs were identified for enhancements, while 9 new programs were considered for recommendation.

Table 7-1 lists the 27 programs considered for recommendation and implementation. Prior to recommendation, programs were prioritized and, based on this prioritization, were grouped according to three alternative management strategies (see Section 2 for level-of-service discussion). Ultimately one management strategy is recommended for implementation in the Master Plan. As a result, not all programs are recommended for implementation in the Master Plan. Additional details for all considered programs, including staffing needs and estimated implementation costs, are provided in Appendix D-1. Prioritization and selection of programs for implementation is described in Section 8.

[6] Some ongoing programs, such as Pipe Repair and Replacement, are funded as capital improvements; but generally, programs are funded through operations and projects are funded through the CIP.

Table 7-1. Summary of Considered [a] Improvements for Utility Programs			
Program Category	Existing Programs		New Programs
	Maintain	Enhance	
Operation	• Administration and Management • Floodplain Management	• NPDES Compliance • Drainage Assessment • Water Quality Monitoring • Asset Management • System Inspection • Condition Assessment • Private Facility Inspection and Maintenance	• Stormwater Permit
Maintenance	• Street Sweeping • System Maintenance • Small Repairs	• Stormwater Pipe Repair and Replacement [b] • Surface Water Small Projects [b]	• Catch Basin Repair and Replacement • LID Maintenance • Pump Station Maintenance • Utility Crossing Removal • Improper Connection Repair
Public Involvement	• Soak It Up Rebate • Adopt-a-Drain • Local Source Control • Water Quality Public Outreach		• Business Inspection Source Control • Thornton Creek Stewardship • Aquatic Habitat Improvement

a. *Programs listed here were considered for inclusion in management strategies. Ultimately, not all considered programs were recommended for implementation; see Section 8 for the list of recommended programs and Section 10 for the selected management strategy.*

b. *These programs are funded as R&R capital projects in the City's annual budget.*

7.1 Operational Programs

Operational programs cover a broad range of work activities that administer surface water management practices, comply with regulatory requirements, sustainably manage assets, and support overall Utility staff and resource management.

7.1.1 Administration and Management (Existing)

Administration and management activities include workload management, budgeting, and policy development by Utility staff. These efforts also require coordination with, and support from, other City departments and their divisions, including the following:

- **Administrative services:** budget and financial administration, administrative support, accounting, purchasing, and GIS
- **Planning and Community Development:** development review and inspection, code enforcement
- **Engineering Division of Public Works Department:** engineering services
- **Operations and Streets Division of Public Works Department:** vehicle and equipment maintenance

Administration and management of the Utility is recommended to continue with the same basic responsibilities and administrative practices, though some activities may expand to accommodate additional staff and internal resources. This program helps the Utility meet all four levels of service (see levels of service defined in Table 2-1) by providing for the general management of the Utility and administration of the other programs described in this Section.

7.1.2 Floodplain Management (Existing)

The Utility manages the City's participation in FEMA's NFIP. FEMA NFIP regulatory compliance includes implementation of SMC Chapter 134.12, "Floodplain Management," which includes administration of floodplain development permits and review. Enforcing floodplain regulations helps the City meet the minimum requirements for a Community to participate in the NFIP (relates to LOS 4, Regulatory Compliance, see Table 2-1); see Section 5.2.3 for more details on the regulatory requirements for floodplain management and the NFIP. Sound floodplain management also more generally helps the City reduce the potential impacts of flooding events (relates to LOS 1, Surface Water Impacts, in Table 2-1). There are no recommendations for this program. The Utility should continue to work to keep the City in compliance with requirements for participation in the NFIP.

7.1.3 NPDES Compliance (Enhanced)

Public Works is the lead organization responsible for administration and interdepartmental coordination of the Phase II Permit compliance. While all City staff are responsible for response and reporting related to IDDE and spill response, Utility staff perform administrative duties to remain compliant including coordinating Phase II Permit-required training, preparing the annual report, tracking permit requirements, and communicating Phase II Permit needs to other City departments and with Ecology and neighboring jurisdictions (relates to LOS 4, Regulatory Compliance, see Table 2-1). The Utility addresses other NPDES requirements (e.g., public outreach and involvement, pollution prevention with O&M, and water quality monitoring) through other Utility programs described below. The NPDES requirement to control runoff from development is managed through the Department of Planning and Community Development.

The current NPDES Compliance Program is recommended for enhancement to address the anticipated new requirements of the next Phase II Permit, which Ecology plans to issue in 2019. Ecology has indicated that the 2019 Phase II Permit will include a new Business Inspection Source Control Program, updated water quality monitoring and reporting, IDDE tracking and reporting, and new watershed-scale planning. See Section 5.2.1 for more details about the Phase II Permit.

7.1.4 Drainage Assessment (Enhanced)

Utility staff investigate, evaluate, and prioritize drainage issues identified through basin planning, customer service requests, and staff field observations. This work identifies capacity deficiencies, addresses public safety hazards, and reduces risk of erosion and water quality impairment (relates to LOS 1, Surface Water Impacts, see Table 2-1). Prior to 2017, the Utility had an informal Drainage Assessment Program and because of limited resources a backlog of unaddressed drainage complaints has accumulated. Funding secured in 2017 allowed the Utility to begin to address the backlog of about 75 drainage assessment requests. Continued funding is needed to address the approximately 20 new drainage assessment requests that arise in a typical year.

The Drainage Assessment program is recommended for enhancement as an ongoing program to complete drainage assessments to address the backlog and maintain levels of service. As the drainage assessment work is completed and construction-based solutions are identified in an ongoing program, the additional resources will be allocated for the maintenance, repair, and replacement programs such as the Surface Water Small Projects Program; see Section 7.2.5. This enhanced program supports the Utility's Asset Management program, O&M of existing and planned assets, and Utility financial planning (relates to LOS 2, Equitable Service, see Table 2-1).

7.1.5 Water Quality Monitoring (Enhanced)

The Utility conducts a Water Quality Monitoring Program to fulfill several objectives, including the following:

- Support the City's *Vision 2029* goals for conserving and protecting environmental and natural resources
- Beach sampling at Echo Lake and Hidden Lake to protect human health as part of the King County Swimming Beach Monitoring Program
- Lake sampling as a part of the King County Lake Stewardship Program
- Water quality level-of-service goals of the 2011 and 2018 Master Plan

Under this program, staff collect water quality samples from six streams and two lakes within the city. The monitoring, which began in 2002, helps the Utility monitor the condition of the city's surface waters (relates to LOS 1, Surface Water Impacts, see Table 2-1). The results are documented in two water quality assessment summary reports (City 2010; City 2017d). The reports evaluate water quality relative to the applicable State water quality standards (WAC 173-201A). See section 4.3.3 for additional details about the water quality monitoring program and water body assessments.

The monitoring program is managed by full-time Utility staff, but relies on seasonal staff to assist with data collection and evaluation. Seasonal staff turnover rates are higher than permanent staff turnover rates, resulting in greater staff training needs and performance inefficiencies.

This program is recommended for enhancement to add staff resources to improve program efficiencies for sampling, analysis, and reporting.

7.1.6 Asset Management (Enhanced)

The Utility's existing Asset Management Program was established following adoption of the Master Plan in December 2011. Since then, a substantial amount of asset information has become available through condition assessment and basin planning efforts. In 2013, the City implemented Azteca Cityworks (Cityworks), a GIS-integrated CMMS designed to improve asset condition tracking and continued maintenance of City infrastructure. Cityworks uses a geographic-based asset inventory to facilitate the work flow process, enabling the Utility to plan and manage required maintenance more efficiently. Implementation of the Cityworks software platform required a significant reconfiguration of the City's GIS data and additional data capture, inspections, and work orders. All service requests, work orders on assets, and inspections are now recorded in the Cityworks system.

A key objective of the Master Plan work is to advance the asset management program. The Utility performed a formal evaluation on its portion of the citywide asset management program with a Utility Business Management Evaluation (UBME). The UBME helped identify areas of improvement needed to meet the Utility's level of service and to be on par with the management practices of similar-sized utilities. The UBME results and recommended actions to enhance the asset management program are documented in an Asset Management Work Plan (AMWP), which included near- and long-term actions. The AMWP is included in Appendix H.

This program is recommended to enhance the existing asset management program with activities outlined in the AMWP. In addition to the actions outlined in the AMWP, BC and FCS Group developed the following three guidance documents to assist with the enhancement of the asset management program:

- **Asset plan template:** outlines key information to help manage the asset over the asset's life cycle including introduction and overview; description of assets covered by the plan, service

levels, future demand, life-cycle management, and financial considerations; and action plan (see Appendix I)

- **Asset management process and framework:** describes the process and key elements of the asset management framework including Utility goals, levels of service, asset knowledge, people and processes, asset decisions, and risk mitigation (see Appendix J)
- ***Condition Assessment Management Plan* (CAMP):** provides an asset management-based condition assessment approach and condition assessment results for eight of the Utility's currently inspected infrastructure assets (see Appendix C)

The enhanced Asset Management program will help continue the cost-effective planning and management of Utility assets, sound financial planning, and efficient operations (relates to LOS 2, Equitable Service, see Table 2-1).

7.1.7 System Inspection (Enhanced)

The Utility inspection program provides information for cleaning, repairs, and condition assessment, and is the backbone program for City surface water asset maintenance and management. The Utility inspects stormwater assets and facilities through three inspection programs: system inspection, private (commercial) facility inspection, and pipe inspections. More details about all inspection programs are available in the City's *Surface Water O&M Manual* included in Appendix G.

The system inspection program consists of the following types of inspections:

- ROW inspections include catch basins, ditches, and ditch-adjacent pipe (driveway culverts) networks that transfer surface water from ROW pavement. Each catch basin is inspected on a 2-year cycle while each ditch is inspected every third year.
- Regional facility inspections involve visual checks of stormwater facilities, site access, and safety features associated with a regional site owned and operated by the City. Inspections are conducted annually.
- Residential facility inspections involve visual checks of stormwater infrastructure on a biennial cycle. Half of the facilities are inspected in even years and the other half are inspected in odd years.
- Park facility inspections involve annual inspection of stormwater quality and flow control facilities in City-owned parks. Parks that have water quality and/or flow control infrastructures are inspected annually.
- City facility inspections involve the inspection of stormwater facilities on City-owned and City-maintained properties outside of parks.

Enhancements recommended for the System Inspection Program are a result of 2013 Phase II Permit requirements. To remain compliant, the Utility is required to increase catch basin inspection frequency, from at least once by August 1, 2017, to once every 2 years starting in 2018. Also, as redevelopment occurs within the City ROW, the City will own and operate more water quality BMPs. To meet the increasing needs of catch basin inspection and maintenance, the Utility should allocate additional staffing, material, and equipment resources for the System Inspection Program.

The program reduces incidents of flooding, erosion, and water quality impairment through systematic and scheduled inspections (relates to LOS 1, Surface Water Impacts, see Table 2-1). The program helps meet LOS 2, Equitable Service, by supporting the Asset Management program's goal of cost-effective planning and management of Utility assets, sound financial planning, and efficient operations. The program addresses O&M regulatory requirements of the Phase II Permit, which helps to meet LOS 4, Regulatory Compliance.

7.1.8 Condition Assessment (Enhanced)

Condition assessment provides a standardized inspection and scoring system to evaluate assets for repair, replacement, or re-inspection. The Condition Assessment program provides information necessary for risk-based asset management decision making. The program also identifies conditions that, if left unaddressed, may contribute to flooding, erosion, or water quality impairment (relates to LOS 1, Surface Water Impacts, see Table 2-1). The program helps meet LOS 2, Equitable Service, by supporting the goals of the Asset Management program including system preservation, O&M activities, and efficient financial planning.

Pipe condition assessment includes the inspection of pipes through closed-circuit television (CCTV) and handheld recording devices on a basin-wide scale. The general inspection cycle for stormwater is on a 20-year frequency, which is within the range of industry best management practices. Pipe inspections and condition assessments were performed between 2012 and 2016 as part of basin plan development. About two-thirds of the pipes have been inspected within the basin planning areas with a completed condition assessment. The remaining one-third of those pipes either have an incomplete inspection or were not inspected because of debris or structural blockage. Pipes with a condition assessment score were evaluated and prioritized in the SWPRRP (relates to Section 7.2.4).

In 2017, a condition assessment project began in the Thornton Creek basin. This project will complete the system-wide evaluations recommended in the 2011 Master Plan. Section 4.1 provides details about the pipe condition assessment evaluation for pipes inspected prior to 2017.

The enhancement for the Condition Assessment program is that it become an annually funded program. An ongoing program will help the Utility meet the recommended 20-year inspection frequency and complete the inspection of pipes whose inspections were incomplete or that were not inspected because of debris or blockages.

7.1.9 Private Facility Inspection and Maintenance (Enhanced)

The NPDES Permit requires annual inspections and maintenance, if needed, of all permanent stormwater BMPs/facilities constructed on private properties. The permit further assigns responsibility for enforcement of proper maintenance activity to the City. Privately owned stormwater assets are maintained by the owner. Until January 1, 2017, the Utility offered a Surface Water Management fee discount for any parcel that maintained its stormwater facilities.

With the anticipated growth in the City, the majority of new development and redevelopment projects will have to construct permanent stormwater BMPs/facilities. Over time, virtually all properties will have the potential to come under the inspection requirement. In July 2015, the City's planning-level redevelopment rate was estimated at 1.5 to 2.5 percent, suggesting that within a 50-year planning horizon, virtually all properties within the City of Shoreline could require annual drainage inspections.

The anticipated increase in the number of inspections and associated enforcement actions will be supported by the enhanced private inspection and maintenance enforcement program. This program is recommended to hold property owners accountable for their storm drainage system. Staff also recommends creating a process in which property owners conduct inspections and "self-certify" that the surface water system is maintained and operating correctly. The self-certification process would limit inspections to spot checks, properties where inspection is required, and those facilities that have repeatedly failed inspections.

The program provides the Utility opportunities for public outreach helping to meet the goals of LOS 3, Communication and Outreach (see Table 2-1). By documenting the inspection and maintenance of private facilities, the program helps meet the goals of LOS 4, Regulatory Compliance.

7.1.10 Stormwater Permit (New)

The City Council approved a Utility staff recommendation to develop a City stormwater permit for private development (see Section 6.3.2 for issue discussion with City Council). The new City stormwater permit will provide a mechanism for Utility staff to review proposed stormwater infrastructure designs, collect hard surface area information, manage and record maintenance covenants, update GIS, and inspect surface water infrastructure (relates to LOS 2, Equitable Service, see Table 2-1). In conjunction with the EDM and existing development permits, the stormwater permit will serve as the City's standard framework for regulating and tracking onsite stormwater systems and connections to the MS4.

Like other City development-related permits, the stormwater permit may gather surface water management chargeable area, defined as impervious surface until 2017 and now defined as hard surface. Hard surface areas are used to estimate sizing for surface water infrastructure and are also used to develop surface water management fees according to SMC 3.01.400. A 2017 evaluation of the existing Utility billing, permit review and tracking process revealed gaps in the City's methods for updating and tracking the surface water management chargeable area (see Appendix K for Utility billing evaluation). The evaluation recommended that chargeable area be collected on one permit and that the permit differentiate hard surface data (used for Utility billing) and hardscape data (used for land use code).

7.2 Maintenance Programs

Maintenance programs are routine maintenance activities including cleaning, repair, rehabilitation, and replacement of Utility assets.

7.2.1 Street Sweeping (Existing)

The Street Sweeping program, which is performed by Street Operations staff, includes sweeping arterial and residential streets, bike lanes, and some municipally owned parking lots to reduce the pollutant load from sediments and debris from entering the MS4 as roadway runoff. Pollutant removal helps the Utility maintain O&M-related compliance with the Phase II Permit (relates to LOS 4, Regulatory Compliance, see Table 2-1). Routine street sweeping is performed year-round with higher traffic volume streets being swept as often as monthly and lower volume streets and municipal parking lots swept twice per year. The program also provides seasonal and emergency sweeping services. In addition to providing water quality benefits, street sweeping maintains public safety and reduces airborne pollutants by removing fine particulate matter (relates to LOS 1, Surface Water Impacts, see Table 2-1). The Public Works Department prepared the *Street Sweeping Plan* to communicate to its citizens about the means, methods, frequency, and schedule of the program (City 2016). The Utility should continue to maintain city streets according to the *Street Sweeping Plan*.

7.2.2 System Maintenance (Existing)

System maintenance includes cleaning and minor repair of surface water assets and facilities. LID vegetation maintenance, catch basin cleaning, ditch maintenance, and other stormwater system maintenance are performed by Public Works operation staff and private contractors. Private contractors provide seasonal workforce resources and specialized equipment such as vactor trucks and high-pressure cleaners for collecting and removing sediment from catch basins, jetting and rodding equipment for cleaning and clearing pipe, and truck-mounted augers for ditch cleaning.

The City currently uses goats to help control blackberries and other weedy plants at selected surface water facilities. A goat herder is on site full-time for larger sites and part-time in fully fenced smaller areas.

The Utility should maintain its current efforts for the system maintenance program except where noted below for enhanced and new maintenance programs.

The System Maintenance program addresses problems in system capacity due to the accumulation of sediment and debris and also eliminates potential water quality problems (relates to LOS 1, Surface Water Impacts, see Table 2-1). The program also helps LOS 4, Regulatory Compliance, by addressing the O&M regulatory requirements of the NPDES Permit.

7.2.3 Small Repairs (Existing)

The Small Repairs program addresses minor repairs for assets not included in other repair programs, small projects, or CIP projects. This includes berms, road or shoulder work to resolve a drainage issue, and other small infrastructure repairs or installations typically made by O&M staff or private contractors on an as-needed basis. The Utility should maintain its current efforts for small repairs. The Small Repairs program helps meet LOS 1, Surface Water Impacts (see Table 2-1) by addressing system deficiencies and reducing potential public safety hazards and impairment of water quality and aquatic habitat. The program also helps meet LOS 2, Regulatory Compliance, by supporting the goals of the Asset Management Program.

7.2.4 Stormwater Pipe Repair and Replacement Program (Enhanced)

The City owns and maintains approximately 134 miles of stormwater pipes, and most of those pipes have exceeded their typical service lifespans. Pipes are evaluated in the Condition Assessment Program (Section 7.1.8) and prioritized for repair or replacement in the SWPRRP. The preferred repair method is to install a robust pipe liner (to date the City has used primarily cured-in-place pipe [CIPP] lining for repairs). Open-cut trench pipe replacement is used for pipes that are too deteriorated to repair with CIPP lining. These methods provide optimal value by extending the lifespan of the City's existing stormwater infrastructure.

The existing SWPRRP began following implementation of the system-wide Condition Assessment program. Because of limited resources, the program has resulted in the repair or replacement of only a small percentage of the failing pipes. At the current rate, completing the identified pipe repairs and replacements would take more than 20 years. An expansion of the program to finish repairs within a 20-year period is recommended to align with the City's 20-year inspection cycle. The recommended enhanced SWPRRP will proactively protect public safety, reduce flooding, decrease maintenance demands, and protect critical infrastructure and other public and private property (relates to LOS 1, Surface Water Impacts, and LOS 2, Equitable Service, see Table 2-1).

7.2.5 Surface Water Small Projects Program (Enhanced)

The Surface Water Small Projects (Small Projects) program implements small projects to address localized drainage problems and other small-scale surface-water-related issues. Drainage issues are generally identified through either the City's customer request system or City staff field observations and are evaluated in the Drainage Assessment Program (see Section 7.1.4).

With more surface water small project needs evaluated and identified in the enhanced Drainage Assessment program, the need for additional small drainage construction projects is estimated to double over the 6-year planning period. The Utility should allocate additional resources to the Small Projects program to construct the additional projects and help meet updated levels of service.

The enhanced Small Projects program helps meet LOS 1, Surface Water Impacts, by addressing system deficiencies and reducing potential public safety hazards. The program helps meet LOS 2, Equitable Service, directly by supporting the goals of the Asset Management program including cost-effective planning and management.

7.2.6 Catch Basin Repair and Replacement (New)

The Phase II Permit requires the Utility to perform maintenance on catch basins that do not meet the maintenance standard. The catch basins must be maintained within 6 months of inspection (relates to LOS 4, Regulatory Compliance, see Table 2-1). During the last 3 years, the number of catch basins needing repair or replacement was greater than the Utility resources available to perform the work. In addition, the number of catch basins requiring R&R is anticipated to increase as the Utility increases the frequency of catch basin inspections to remain compliant with the 2013 Phase II Permit O&M requirements. The recommended new catch basin R&R program will help the Utility remain in compliance with the Phase II Permit maintenance requirement.

7.2.7 Low Impact Development Maintenance (New)

The Utility has historically inspected its LID facilities and performed only vegetation maintenance for bioretention and swales. Other maintenance activities such as structural repair, soil replacement, and permeable pavement cleaning have been deferred until required by the Phase II Permit. To remain complaint with the Phase II Permit in 2018, the Utility should maintain all surface water assets to an established maintenance standard as based on inspection results (relates to LOS 4, Regulatory Compliance, see Table 2-1). The recommended LID maintenance program provides the resources necessary to perform cleaning, structural repair, and replacement efforts to achieve the facilities' adopted maintenance standard.

7.2.8 Pump Station Maintenance (New)

The Utility performs nearly weekly checks on the Utility's eight pump stations during the rainy season as part of the Hot Spot inspection program, and monthly in the dry summer months. While the spot inspections confirm that the pump stations are operating during the time of inspection, they do not provide routine or preventive maintenance or provide an overall condition assessment. This recommended program would provide routine maintenance of pump station equipment (e.g., hydraulic, mechanical, and electrical), structure, and facility access.

The new Pump Station Maintenance program will identify potential capacity deficiencies, which will help meet LOS 1, Surface Water Impacts (see Table 2-1) and help meet the cost efficiency goals of the Asset Management program LOS 2, Equitable Service.

7.2.9 Utility Crossing Removal (New)

The pipe inspection and condition assessment effort associated with the basin planning work revealed numerous instances throughout the city where other utility lines and unidentified conduits crossed storm drain pipes. Utility crossings can damage storm drain pipes, reduce flow capacity of pipes, cause obstructions in water flow from debris blockages, and make pipe inspection difficult. This recommended program involves City staff time to coordinate with other utilities to remove their lines and repair the storm drains that have been damaged because of improper crossings. The program would also include inspecting the removal work when complete.

The new Utility Crossing Removal program will identify potential capacity deficiencies caused by utility crossings, which will help meet LOS 1, Surface Water Impacts (see Table 2-1). The program will also help meet the cost efficiency goals of the Asset Management program LOS 2, Equitable Service.

7.2.10 Improper Connection Repair (New)

The pipe inspection and condition assessment effort associated with the Basin Planning work revealed numerous instances throughout the city where storm drains are improperly connected. Improperly installed storm drain connections can lead to separated pipe joints, leaks, erosion, and possibly damage to nearby structures. This recommended program involves fixing non-standard or improperly installed stormwater drains by adding a properly designed structure such as a catch basin or prefabricated tee to connect pipes. The recommended installations represented in this program would be those not included in other CIP projects.

The new Utility Connection Repair program addresses potential capacity deficiencies caused by improperly installed storm drain connections. This program helps meet LOS 1, Surface Water Impacts (see Table 2-1) by removing these deficiencies.

7.3 Public Involvement Programs

The Utility's Public Involvement programs are intended to educate, involve, and engage Shoreline ratepayers regarding surface water issues such as water quality, flood reduction, and expected levels of service. Current and recommended programs are described below.

7.3.1 Soak It Up Low Impact Development Rebate (Existing)

The Soak It Up rebate program helps property owners manage rainwater on their property with rain gardens or native vegetation conservation landscaping. Incentives are provided to qualified applicants as rebates. The program supports the Utility's Phase II Permit public outreach and education requirements. The Utility should continue promoting and growing participation in this rebate program.

The Soak It Up Low Impact Development Rebate program provides opportunities, education, and outreach for LID principles. This program helps meet the LOS 3, Communication and Outreach, and LOS 4, Regulatory Compliance (see Table 2-1).

7.3.2 Adopt-A-Drain (Existing)

This storm drain monitoring program increases awareness of localized flooding, efforts needed to protect fish and habitat from pollutants, and maintenance needs of the City's storm drains. The Adopt-A-Drain program volunteer participants keep drains clear of debris and monitor drains for potential contaminants such as paint, motor oil, or soapy water. Through program participation and promotion, information is also provided to encourage proper disposal of household hazardous waste to avoid surface water contamination. The Utility should continue promoting and growing participation in this volunteer program.

The Adopt-A-Drain program promotes public participation in activities that can reduce capacity deficiencies and erosion problems with low-cost volunteer efforts. The program helps meet LOS 1, Surface Water Impacts, and LOS 3, Communication and Outreach in Table 2-1.

7.3.3 Local Source Control (Existing)

The Local Source Control/Small Business Pollution Prevention program helps business owners develop practical methods to reduce or eliminate non-stormwater pollutant discharges through proper material storage, hazardous waste disposal, spill plans, and other BMPs. Upon completion of a spill plan, a business is eligible for a free spill kit. Training for staff is also provided through this program. This program supports NPDES regulatory compliance and includes targeted inspection and outreach to businesses (relates to LOS 3, Communication and Outreach, and LOS 4, Regulatory

Compliance in Table 2-1). The Utility should continue participating in this program and, where possible, combine efforts with the proposed Business Inspection Source Control Program.

7.3.4 Water Quality Public Outreach (Existing)

This program supports Phase II Permit compliance for community outreach and includes participation in Earth Day events, community and neighborhood events, and a car wash event program. The program also promotes water quality campaigns provided by the Utility and outside water quality organizations. The programs include materials and Web pages reporting spills, car washing, auto leaks, pet waste, and yard care. The Utility should continue performing outreach activities that promote public education, outreach, involvement, and participation requirements of the Phase II Permit (relates to LOS 3, Communication and Outreach, and LOS 4, Regulatory Compliance in Table 2-1).

7.3.5 Business Inspection Source Control (New)

This new program is anticipated to be a separate but complementary program to the Local Source Control program. The program, an anticipated requirement of the 2019 Phase II Permit, will require the Utility to inspect 20 percent of businesses annually to detect potential pollution sources and institute corrective actions as needed. The goal of the program is to reduce illicit discharges and build on existing public outreach and education efforts (relates to LOS 3, Communication and Outreach, and LOS 4, Regulatory Compliance, see Table 2-1). The recommended program is similar to what is currently required of Phase I Permit holders (e.g., City of Seattle, King County) and will require updates to the SMC.

7.3.6 Thornton Creek Stewardship (New)

Thornton Creek is the city's most degraded waterway and could benefit from a watershed-based public involvement and stewardship program. The recommended program would consist of a series of targeted behaviors to improve water quality such as a watershed-specific pet waste program. Through this type of program, City staff would conduct outreach on pet waste and provide an incentive for pet owners to change behavior. The program would survey constituents periodically to track behavior change. Other program elements might include habitat education and volunteer restoration activities.

The Thornton Creek Stewardship program will help meet LOS 1, Surface Water Impacts, and LOS 3, Communication and Outreach (see Table 2-1) by public education and outreach for the water quality needs of Thornton Creek.

7.3.7 Aquatic Habitat Improvement (New)

Riparian zones play a key role in combating adverse water quality impacts associated with nonpoint source pollution and offset the need for costly stormwater and flood protection facilities. This recommended program would conduct vegetation surveys and streamside plantings to improve overall habitat near freshwater systems. Other program activities include removing invasive plant species and replacing plantings with native species to improve functionality of the stream.

The Aquatic Habitat Improvement program will help meet LOS 1, Surface Water Impacts, and LOS 3, Communication and Outreach (see Table 2-1) by providing opportunities for public involvement, outreach, and education with projects that protect or restore aquatic habitat of city water bodies.

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Section 8

Management Strategies

As described in previous sections, recommendations for improving the Utility include new and enhanced programs and capital improvement projects. Programs and projects have considerable cost implications and must be prioritized for implementation over time and to ensure adequate funding. This section summarizes the recommended improvements and describes a detailed prioritization process that is based on meeting levels of service and complying with regulatory requirements. The results of the prioritization, in combination with estimated costs, were used to select and assemble projects and programs into solution sets, or *management strategies*. A financial analysis of each of the management strategies is presented in Section 9.

8.1 Prioritization Process

One of the key objectives of this Master Plan is to prioritize recommended programs and capital improvement projects, and to develop comprehensive management strategies based on those priorities. A systematic process was developed, including a spreadsheet tool that applies a consistent set of criteria and procedures for scoring. Figure 8-1 illustrates the prioritization and management strategy development process.

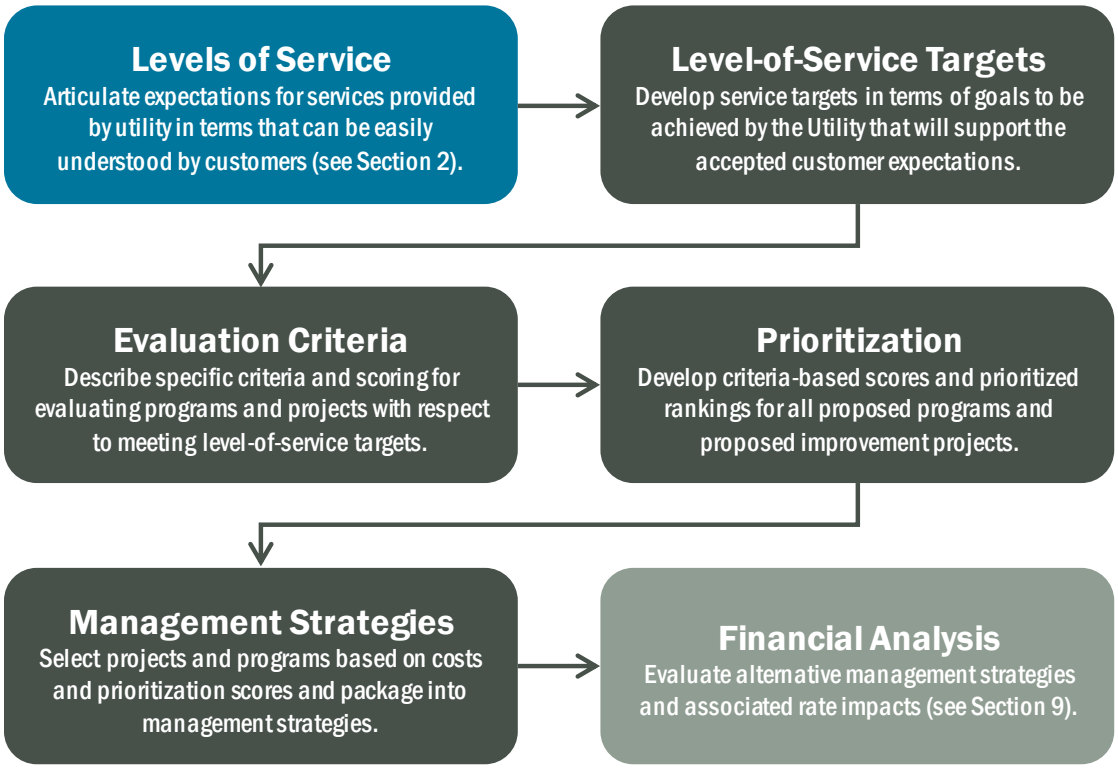

Figure 8-1. Prioritization process for developing management strategies

Levels of service (see Section 2) and associated level-of-service targets are the basis for articulating customer expectations for the services provided by the Utility. Level-of-service targets were refined to reflect key goals relating to flooding and erosion, water quality, aquatic habitat, responsible stewardship of assets, customer service and communications, and regulatory compliance (see Table 8-1). These targets were then carried forward to support project and program prioritization, as well as monitoring/tracking of operational activities.

Table 8-1. Level-of-Service Targets for Program and Project Evaluation

Level of Service	Level-of-Service Targets
1. Manage public health, safety, and environmental risks from impaired water quality, flooding, and failed infrastructure	A. Flooding and Erosion: No verifiable health and safety issues or environmental damage caused by flooding or erosion outside of an accepted risk tolerance B. Water Quality: Improve the quality of stormwater discharged to impaired receiving waters to mitigate environmental damage C. Habitat: Protect aquatic habitat by reducing impacts to ecosystem health and biotic diversity in lakes, streams, and wetlands
2. Provide consistent, equitable standards of service to the citizens of Shoreline at a reasonable cost, within rates and budget	D. Responsible Stewardship: Provide equitable services through cost-effective planning and management of utility assets, sound fiscal planning, and efficient operations
3. Engage in transparent communication through public education and outreach	E. Customer Service and Communications: Provide effective communication, public education, and outreach
4. Comply with regulatory requirements for the urban drainage system	F. Regulatory Compliance: Meet state and federal regulatory requirements for stormwater utilities

Level-of-service targets were further refined into specific evaluation criteria; these differed slightly between programs and projects. Table 8-2 provides an example of the program and project evaluation criteria for Level of Service Target “A. Flooding and Erosion” from above.

Table 8-2. Evaluation Criteria for Flooding and Erosion

Program Evaluation Criteria	Project Evaluation Criteria	
	Measure	Question
A.1 System Capacity Program addresses capacity deficiencies	The capacity of the drainage system to capture, convey, store, and discharge (or infiltrate) runoff should be sufficient to prevent flooding more often than the standard risk tolerance for the affected properties.	a. Does the project improve the capacity of the drainage system? b. What is the scale of the problem addressed by the improvement?
A.2 Hazard Reduction Program addresses an apparent public safety hazard	Urban drainage conditions that cause observed and recurring public safety hazards should be eliminated.	Does the project address an apparent public safety hazard such as severe flooding of inhabited structures or flooding that affects critical facilities?
A.3 Erosion Control Program addresses erosion problems related to public stormwater conveyance	Water conveyed through public infrastructure and/or within the public ROW (i.e., ditches and streams) should not cause erosion that threatens property or infrastructure.	Does the project address an erosion problem due to public stormwater conveyance?

As programs and projects are scored, each criterion receives a score of 0, 1, or 2. Guidance on scoring is provided for each evaluation criterion; in general, a 0 is assigned when there is not relevant benefit, a 1 when there is moderate relevant benefit, and a 2 when there is substantial relevant benefit. The scores are then multiplied by a pre-specified weighting factor. The weighted

scores are then summed to obtain a single prioritization score for each program and project. Details on the evaluation criteria, scores, and weighting factors are provided in Appendix D-2.

After scoring was completed, the programs and projects were ranked from highest to lowest by their total scores and tabulated with other key information such as estimated cost, type, location, and the primary issue addressed (described below). This information was used to select programs and projects and align them with defined management strategies (see Section 8.2).

8.1.1 Program Prioritization and Cost Estimates

As described in Section 7, a total of 27 programs were considered for addressing current and future needs of the Utility, nine of which are a continuation of existing programs, nine are enhanced programs (existing programs with added enhancements), and nine are new programs.

Program costs were developed for all enhanced and new programs. For enhanced programs, the cost estimate consisted of costs only for the enhanced activities within the program. For new programs, costs were based on expenses of similar activities or programs at the Utility. In cases where a similar program did not exist, Utility staff referenced programs from other agency programs or developed estimates based on experience. Costs were also developed for new infrastructure per management strategy to provide anticipated planning-level costs for O&M in the 6-year planning period. Key elements for program costs included Utility staff labor, professional contracts, equipment, and materials. Details on these elements are as follows:

- Utility staff cost and FTE estimates:
  - Staff availability (hr/yr/FTE): 1,768
  - Percent of total program FTE for management, supervision, and administration: 15 percent
  - Program/project management: 1 hr/$1,000 contract
  - Staff loaded rate: $80/hr
- Professional services contracts:
  - Contractor rate: $130/hr
  - Program study: $30,000–$50,000
  - Maintenance work: Varies—based on existing contracts and program
- Equipment:
  - Estimates from Ecology documents and previous studies
  - Included in professional service contracts
- Materials:
  - Estimates from existing operation budget
  - Estimates from professional service contracts and project costs estimates

Table 8-3 lists the 27 programs, general program categories, prioritization scores, and capital cost estimates.

Table 8-3. Program Prioritization Scoring and Cost Summary			
Program	Category	Prioritization Score [c]	Estimated Annual Program Cost [d]
System Inspection (Enhanced)	Operation	1,280	$47,021
Business Inspection Source Control (New)	Public involvement	1,020	$86,780
Street Sweeping (Existing)	Maintenance	975	-[a]
Water Quality Public Outreach (Existing)	Public involvement	950	-[a]
Adopt-a-Drain (Existing)	Public involvement	855	-[a]
System Maintenance (Existing)	Maintenance	825	-[a]
Soak-It-Up Rebate (Existing)	Public involvement	815	-[a]
Local Source Control (Existing)	Public involvement	785	-[a]
Administration and Management (Existing)	Operation	740	-[a]
Catch Basin Repair and Replacement (New)	Maintenance	720	$354,100
Private Facility Inspection/Maintenance (Enhanced)	Operation	580	$62,192
NPDES Compliance (Enhanced)	Operation	560	$32,480
Stormwater Permit (New)	Operation	555	$47,840
Small Repairs (Existing)	Maintenance	525	-[a]
LID Maintenance (New)	Maintenance	525	$53,732
Condition Assessment (Enhanced)	Operation	480	$160,340
SW Pipe Repair and Replacement (Enhanced)	Maintenance	480	$953,600[b]
Surface Water Small Projects (Enhanced)	Maintenance	480	$500,000[b]
Drainage Assessment (Enhanced)	Operation	460	$175,640
Floodplain Management (Existing)	Operation	445	-[a]
Asset Management (Enhanced)	Operation	400	$69,200
Water Quality Monitoring (Enhanced)	Operation	325	$85,470
Utility Crossing Removal (New)	Maintenance	320	$18,400
Pump Station Maintenance (New)	Maintenance	260	$63,600
Improper Connection Repair (New)	Maintenance	220	$60,520
Thornton Creek Stewardship (New)	Public involvement	170	$19,900
Aquatic Habitat Improvement (New)	Public involvement	155	$54,600

a. Costs for existing programs were not estimated; assumed to be included within existing operation costs.

b. Costs of pipe replacement and small projects can be scaled depending on the amount of work to be accomplished each year.

c. Maximum score 1,480.

d. 2017 dollars.

8.1.2 Project Prioritization and Cost Estimates

Since the completion of the basin plans, the Utility has compiled 116 recommended projects with a combined estimated cost of $50 million. One of the tasks of the Master Plan was to assess these projects within the context of the levels of service and consistent priorities for the Utility. A series of three workshops were conducted with staff to screen the projects and develop a transparent and repeatable prioritization process. These workshops are summarized below:

- **Workshop 1:** Staff worked to remove projects that have already been completed or are no longer relevant. Projects that can be addressed programmatically were removed from the list or added to an existing or new program. Project entries that address the same problem were combined.
- **Workshop 2:** Staff worked to develop a formal prioritization process based on the City's level of service, as well as regulatory and operational considerations. During this second workshop, Utility staff established a set of evaluation criteria and project scoring definitions. Following the workshop, BC developed a prioritization tool to implement the prioritization process and performed an initial round of project scoring.
- **Workshop 3:** Staff reviewed the results of the initial scoring and discussed ways to improve and refine the results. Following the workshop, staff worked to revise and refine the scoring and developed a final list of projects for consideration.

The project screening, workshops, and prioritization process resulted in a list of the 40 prioritized projects. Appendix D-6 presents the project prioritization evaluation criteria. The Utility prepared project summaries and planning-level cost estimates for each of the projects, which are provided in Appendix D-5. Quantities and line-item costs were based on information contained in the basin plans. Unit costs were updated to 2017 dollars based on the *Engineering News-Record* costs index. Other key cost assumptions include the following:

- An estimating and construction contingency of 50 percent was applied to the construction subtotal
- An additional 13 percent was added to the construction cost to account for contractor overhead, profit, and mobilization
- Washington State sales tax of 10 percent was applied to the construction subtotal
- An additional 15 percent was included to account for City staff time to support the project
- If a predesign feasibility study was needed to refine the design of the project, an addition cost ranging from 1.5 to 10.0 percent of the project cost was applied
- An additional 20 to 45 percent was applied to the subtotal cost of the above items to account for administration, engineering design, and permitting; the amount varied depending on the size and complexity of the project

Preliminary life-cycle cost estimates were also developed for the projects to assist with estimates of increasing O&M costs due to commissioning of new projects. Where possible, the life-cycle cost estimates include renewal and disposal costs, in addition to annual O&M costs. Cost information was obtained from national and local sources. Where available, estimates from the Utility budget breakdown were used exclusively or given higher weighting when combined with other estimates. Assumptions for life-cycle costs that vary per project type include:

- **Design life:** Life in years as specified in Washington State Department Highway Runoff Manual.
- **Operating, maintenance, and renewal activities:** Operating costs are estimated for pump stations as these are the only surface water assets that are operated. The costs include electricity estimates from the 2016 Utility operating budget summary.
- **Maintenance costs:** Based on regional and national estimates with regional estimates weighted more heavily.
- **Renewal costs:** Based on value for renewal costs per facility.
- **Disposal costs:** For many projects, disposal costs were estimated as an excavation cost based on the estimated dimensions of the project.

Table 8-4 lists the 40 projects, general project categories, prioritization scores, and capital cost estimates.

Table 8-4. Project Prioritization Scoring and Cost Summary				
	Project Name	Category[a]	Prioritization Score	Estimated Cost [b]
1	25th Ave. NE Flood Reduction and NE 195th St. Culvert Replacement	FM	620	$8,226,000
2	Master Plan Update	Study	620	$500,000
3	Springdale Ct. NW and Ridgefield Rd. Drainage Improvements	FM	560	$2,058,000
4	10th Ave. NE Stormwater Improvements	FM	515	$1,788,000
5	Heron Creek Culvert Crossing at Springdale Ct. NW	AM	485	$855,000
6	Hidden Lake Dam Removal	FM	480	$2,097,000
7	25th Ave. NE Ditch Improvements between NE 177th St. and 178th St.	EC	480	$2,538,000
8	Pump Station 26	AM	420	$891,000
9	Pump Station 30 Upgrades	AM	420	$339,000
10	6th Ave. NE and NE 200th St. Flood Reduction Project	FM	360	$384,000
11	Pump Station Improvements: Linden, Palatine, Pan Terra, 25, Ronald Bog, Serpentine	AM	360	$732,000
12	NE 148th St. Infiltration Facilities	FM	355	$393,000
13	Boeing Creek Regional Stormwater Facility	EC	315	$9,440,000
14	Stormwater Upgrades NW 196th St.	AM	310	$146,000
15	System Capacity Modeling Study	Study	300	$300,000
16	NW 195th Pl, and Richmond Beach Dr. Flooding	FM	280	$747,000
17	Stabilize NW 16th Pl. Storm Drainage in Reserve M	EC	260	$500,000
18	Storm Creek Erosion Management Study	EC	250	$80,000
19	Flood Reduction in Linden Avenue Neighborhood	FM	245	$803,000
20	Climate Impacts and Resiliency Study	Study	220	$80,000
21	Culvert Improvements near 14849 12th Ave. NE	FM	205	$347,000
22	Convert Stormwater Conveyance Ditches to Bio-infiltration Facilities	WQ	190	$1,178,000
23	Boeing Creek Restoration	AH	180	$7,630,000
24	NW 196th Pl. and 21st Ave. NW Infrastructure Improvements	FM	175	$313,000
25	Echo Lake Biofiltration Swale	WQ	160	$905,000
26	18th Ave. NW and NW 204th St. Drainage System Connection	FM	150	$261,000
27	NW 197th Pl. and 15th Ave. NW Flooding	FM	150	$119,000
28	Lack of System and Ponding on 20th Ave. NW	FM	150	$1,458,000
29	12th Ave. NE Infiltration Pond Retrofits	FM	140	$677,000
30	NE 177th St. Drainage Improvements	FM	130	$152,000
31	26th Ave. NE Flooding and Lack of System Study	FM	110	$64,000
32	NW 180th St. and 8th Ave. NW Ditch with Unknown Connection	FM	80	$68,000
33	NE 192nd St. Ditch Modifications	EC	60	$202,000
34	Bioretention at N 199th St. and Wallingford Ave. NE	WQ	50	$524,000
35	Bioretention at NE 192nd St. and Burke Ave. NE	WQ	50	$320,000
36	Hamlin Creek Daylighting	AH	50	$1,611,000
37	Thornton Creek Coarse-Grained Sediment Improvements	AH	50	$55,000
38	Enhance Ronald Bog Wetland Fringe Areas	AH	50	$2,826,000
39	Westminster Triangle Bioinfiltration Facility	WQ	45	$163,000
40	NW 194th Pl. and 25th Ave. NW Ditch Erosion	EC	40	$150,000

a. Abbreviations for project categories as follows: AH = Aquatic Habitat Enhancement, AM = Asset Management, EC = Erosion Control, FM = Flood Mitigation, Study = non-structural study funded through capital budget, WQ = Water Quality Improvement

b. 2017 dollars.

8.2 Management Strategies

The Utility developed three alternative management strategies to comprise selected programs and projects. The three management strategies are defined as follows:

- **Minimum:** meet the minimum in terms of existing system needs and anticipated new regulatory requirements
- **Proactive:** minimum management strategy plus new high-priority projects and new/enhanced programs that address high-priority, long-term needs
- **Optimum:** proactive management strategy plus additional recommendations to enhance water quality and aquatic habitat

Program selections were based on prioritization scores, contributions toward meeting levels of service, and needs to address regulatory requirements. Selected programs are assumed to start within the next 6 years, while the remaining programs are deferred. Three programs were considered for inclusion in the 6-year Master Plan but were not included. The list of programs within each management strategy is provided in Appendix D-3.

Projects were selected based primarily on prioritization scores, but with review and consideration for capital costs, project status (some projects have already been initiated), equitable distribution of projects throughout the city, and addressing a variety of project categories. Note that project selection is mostly a reflection of near-term versus long-term scheduling. Projects that were selected for each management strategy are to be included in the 6-year CIP, with the remaining projects to be completed over a 20-year planning horizon. In some cases, projects are assumed to be initiated (e.g., planning, design, and permitting phases) during the 6-year planning; however, construction is assumed to be completed in subsequent years. Table 8-5 provides a summary of the number of projects and programs selected for the three management strategies, as well as a qualitative assessment of the benefits to the four levels of service.

The City Council approved the Utility's recommended proactive management strategy. As noted in Table 8-5, the proactive management strategy includes 24 programs and 26 projects. It will provide a medium benefit to surface water impact level of service and high benefits to equitable service, regulatory compliance, communication, and outreach. In addition to meeting the existing system needs and anticipated new regulatory requirements, the proactive management strategy includes new projects and new/enhanced programs that address high-priority, long-term needs.

Table 8-5. Management Strategy Summary with Cost and Levels of Service Impacts

Management Strategy	Number of Projects and Programs	Total Annual Program Cost, $ million [a]	Total 6-Year Project Cost, $ million [b]	Benefit to Levels of Service			
				Surface Water Impacts	Equitable Service	Communication and Outreach	Regulatory Compliance
Minimum	18 programs 6 projects	4.3	6.2	Low	Medium	Medium	Medium
Proactive [c]	24 programs 26 projects	6.0	11.1	Medium	High	High	High
Optimum	27 programs 30 projects	6.7	16.3	High	High	High	High

a. Includes $3.66 million of current program expenses.

b. Total 6-year project costs based on 2017 dollars.

c. City Council approved the Utility's recommended proactive management strategy based on financial analyses (see Section 9).

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Section 9

Financial Analysis

The purpose of this financial plan is to ensure the viability of the City's surface water management program. This section is a summary of a full report prepared by FCS Group (*Financial Analysis for 2018 Master Plan,* November 2017 [Financial Analysis Report]). The full report can be found in Appendix L.

The financial plan considers the historical financial condition, current and identified future financial and policy obligations, O&M needs, and capital projects as identified in this 2018 Master Plan.

The Utility is responsible for funding all program and capital costs. The primary source of funding is a surface water management (SWM) fee to all properties in the city. The fee is billed on King County's property tax statement. Nominal additional revenues are generated through interest earned on reserves and grants. The City controls the fees and the City Council has the authority to adjust the fees as needed to meet financial objectives.

The financial plan assessed total system costs (capital and non-capital) and assessed funding sources (both current and potential additional funding sources). The report used a 6-year planning period.

9.1 Available Capital Funding Assistance and Financing

Long-term capital funding strategies must be defined to ensure that adequate resources are available to fund the CIP identified in the 2018 Master Plan. In addition to City resources (Utility fees), capital needs may be met from outside sources such as grants, low-interest loans, and bond financing. The following summarizes internal and external resources available for meeting funding requirements.

9.1.1 City Resources

Resources appropriate and available to the City for funding capital needs are limited to rate revenues and accumulated cash (through rates and interest) beyond what is required by the minimum reserve requirements set forth in fiscal policies. The City does not maintain specific capital-related charges such as a General Facilities Charge (GFC) that would provide additional capital resources.

9.1.2 Outside Resources

Although the City does not have additional internal funding sources, grant, loan, and bond opportunities are available to fund the CIP identified and some programs. These potential sources are described in the following subsections.

9.1.2.1 Grants and Low-Cost Loans

Historically, federal and state grant programs assist local utilities with funding of capital projects. However, these assistance programs have been mostly eliminated, reduced, or replaced by loan programs. Remaining miscellaneous grant programs are generally lightly funded and heavily subscribed. Major funding sources are described below.

Department of Ecology Grants and Loans. Ecology administers an integrated funding program for projects that improve and protect water quality. The funding cycle generally begins on September 1, and applicants must submit the final application by the first week of November. Capital projects include stormwater control and treatment, nonpoint pollution abatement, and stream restoration activities. The amount of available grant and loan funding varies from year to year based on the State's budget appropriation process and the annual federal budget. The sources of funding for water quality projects include the following:

- Centennial Clean Water Fund State Grant Program
- Clean Water Act Section 319 Federal Grant Program
- Clean Water State Revolving Fund (CWSRF) Loan Program
- Stormwater Financial Assistance Program (SFAP)

The City has received SFAP funding in the past and anticipates further funds from this program in 2018.

King County Flood Reduction Grant. King County's Flood Reduction Grants assist cities with local flood reduction projects. Applications are generally due in May and there is no cap on the award amount. Total available funding for 2017 was slightly over $3 million (King County 2017).

Public Works Trust Fund (PWTF). Cities, counties, special-purpose districts, public utility districts, and quasi-municipal governments are eligible to receive loans from the PWTF. Eligible projects include repair, replacement, and construction of infrastructure for domestic water, sanitary sewer, stormwater, solid waste, road, and bridge projects that improve public health and safety, respond to environmental issues, promote economic development, or upgrade system performance. As of August 2017, the PWTF is not funded through 2019 and is not accepting funding requests.

9.1.2.2 Bond Financing

General Obligation (GO) Bonds. GO bonds are bonds secured by the full faith and credit of the issuing agency. With this high level of commitment, GO bonds have relatively low interest rates and few financial restrictions. However, the authority to issue GO bonds is restricted in terms of the amount and use of the funds, as defined by Washington constitution and statute. The amount of debt that can be issued is linked to assessed valuation.

Revenue Bonds. Revenue bonds are commonly used to fund utility capital improvements. The debt is secured by the revenues of the issuing utility. With this limited commitment, revenue bonds typically bear higher interest rates than GO bonds and also require security conditions related to the maintenance of dedicated reserves (a bond reserve) and financial performance (added bond debt service coverage). The City agrees to satisfy these requirements by resolution as a condition of bond sale.

Revenue bonds can be issued in Washington without a public vote. The current financial forecast anticipates issuing revenue bonds to help fund capital projects starting in 2018.

9.2 Financial Forecast

The financial forecast, or revenue requirement analysis, predicts the amount of annual revenue that is needed from user rates to meet the obligations of the Utility. The analysis incorporates operating revenues, O&M expenses, debt service payments, rate-funded capital needs, and any other identified revenues or expenses related to surface water management.

The objective of the financial forecast is to evaluate the sufficiency of the current level of rates to meet expected expenditures and comply with fiscal policies and financial goals of the City. The results determine the amount of revenue needed in a given year to meet that year's expected financial obligations. For this analysis, two revenue sufficiency tests were developed to reflect the

financial goals and constraints of the City: cash needs and debt coverage. To operate successfully with respect to these goals, both tests of revenue sufficiency must be met.

Cash Flow Test. The cash flow test identifies all known cash requirements for the City in each year of the planning period. The requirements include O&M expenses, debt service payments, depreciation funding or directly funded capital outlays, and additions to specified reserve balances. The total annual cash needs of the City are then compared to projected cash revenues using the current rate structure. If revenue shortfalls are identified, the rate increases necessary to make up the shortfalls are established.

Coverage Test. The coverage test is based on a commitment made by the City when issuing revenue bonds or certain other forms of long-term debt. Debt service coverage is expressed as a multiplier of the annual revenue bond debt service payment. For example, a 1.25 coverage factor means revenue must be sufficient to pay O&M expenses, annual revenue bond debt service, plus an additional 25 percent of that annual revenue bond debt service. Targeting a higher coverage factor can help the City achieve a better credit rating and provide lower interest rates for future debt issues.

In determining the annual revenue requirement, both the cash and coverage sufficiency tests must be met and the test with the greatest deficiency drives the level of needed rate increase in any given year.

9.2.1 Current Financial Structure

The City maintains a fund structure and implements financial policies that target management of a financially viable and fiscally responsible stormwater system. The City's fiscal policies and financial assumptions are described below.

Operating Reserves. Operating reserves ensure that adequate cash working capital will be maintained to deal with cash balance fluctuations.

The City's current policy is to maintain a minimum balance of 20 percent of O&M expenses. This equates to 73 days of operating expenses.

We recommend, and the study reflects, an O&M reserve minimum balance of 120 days. This higher level of reserves is consistent with the risk maintained by the City from receiving surface water fees twice per year coinciding with the payment of property taxes. If the City were to move to a monthly billing system this reserve target could be reduced.

Capital Reserves. A capital contingency reserve is an amount of cash set aside in case the Utility must make an unexpected (emergency) capital investment. The reserve is also available for other unanticipated capital needs such as cost overruns. Capital reserves are usually calculated as a percentage of fixed asset cost with industry BMP set at 1 or 2 percent.

This forecast is based on maintaining a minimum balance of at least 2 percent of assets, or approximately $450,000.

System Reinvestment. System reinvestment funding promotes system integrity through reinvestment in the system. Target system reinvestment funding levels are commonly linked to annual depreciation expense as a measure of the decline in asset value associated with routine use of the system. The specific benchmark used to set system reinvestment funding targets is a policy that balances various objectives including managing rate impacts, keeping long-term costs down, and promoting "generational equity" (i.e., not excessively burdening current customers with paying for facilities that will serve a larger group of customers in the future).

Because of the levels of planned capital improvements over the next 6 years, this study does not separately consider the need for additional, dedicated, system reinvestment.

Capital Funding. The City uses a combination of debt proceeds and rate revenue to fund capital projects. The following funding resources are identified as part of the capital funding strategy:

- Accumulated cash reserves over minimum fund balances
- Annual cash from rates available for rate funded capital
- Interest earned from the available fund balance and other miscellaneous capital resources
- Revenue bond proceeds (as necessary)

Debt Management. This financial analysis models a minimum bonded debt coverage test of 1.5. The financial forecast is developed from 2017 and 2018 budget documents. This forecast is supported by key factors and assumptions used to develop a complete portrayal of the Utility's annual financial obligations. A list of the key revenue and expense factors and assumptions used to develop the baseline financial forecast can be found in the Financial Analysis Report (Section III) in Appendix L.

9.3 Management Matrix Analysis

The City considered three management strategies in the financial analysis: minimum, proactive, and optimum. Each management strategy reflects a different suite of programs and projects that allow the City to provide varying levels of service to its customers. These varying programs and projects impact the forecasted operating and capital costs and thus necessary rate increases.

It is important to note that these three strategies are a change from the Utility's current operating scenario. The three management strategies all account for additional operational and capital expenditures that help better align the Utility to its levels of service.

Using management strategies in the financial analysis allows the City to determine the rate impacts of different service levels. Through discussion with the City Council, City staff, and community residents, the proactive strategy was chosen as the recommended management strategy. See a description of the proactive management strategy in Section 8.2.

Management strategies differ on two levels:

- **Programs** are O&M activities that enhance or maintain surface water services. The minimum strategy uses the fewest number of programs and the optimum strategy uses the most. Each strategy builds on the next so there are no programs in the minimum strategy that are not also in the proactive strategy and there are no programs in the proactive strategy missing from the optimum strategy.
- **Projects** are capital investments designed to enhance or maintain surface water services. The three management strategies differ in the number of projects that are assumed to take place in the 6-year planning horizon. Projects not planned in the 6-year planning period are assumed to occur in the next 20 years, between 2024 and 2036.

Minimum. The minimum management strategy is a combination of projects and programs meant to meet the minimum in existing system needs and anticipated new regulatory requirements.

Proactive. The proactive management strategy adds new projects and enhanced programs that address high-priority, long-term needs as well as anticipated new regulatory requirements.

Optimum. The optimum management strategy adds additional priority projects and programs that focus on enhancements to water quality and aquatic habitat.

9.3.1 Management Strategy Results and Summary

Table 9-1 summarizes the annual revenue requirements based on the forecast of revenues, expenditures, fund balances, and fiscal policies that would be needed for each management strategy.

Table 9-1. Management Strategy Financial Analysis Summary

Management Strategy Rate Impact Summary	2017	Year 1 2018	Year 2 2019	Year 3 2020	Year 4 2021	Year 4 2022	Year 5 2023
Minimum							
Proposed increase	N/A	20%	5%	5%	4%	3%	3%
Resulting revenue	$4,488,372	$ 5,391,433	$ 5,666,666	$ 5,955,949	$ 6,200,381	$ 6,392,779	$ 6,591,147
Proactive							
Proposed increase	N/A	27%	15%	10%	10%	5%	5%
Resulting revenue	$4,488,372	$ 5,705,933	$ 6,568,385	$ 7,232,449	$ 7,963,649	$ 8,370,193	$ 8,797,492
Optimum							
Proposed increase	N/A	42%	20%	10%	8%	5%	5%
Resulting revenue	$4,488,372	$ 6,379,862	$ 7,663,490	$ 8,438,269	$ 9,122,444	$ 9,588,145	$ 10,077,620

Source: Table IV-1, City of Shoreline Surface Water Utility; Financial Analysis for 2017 Master Plan, FCS Group (November 2017), Appendix L.

With the greatest number of programs and projects, the optimum strategy has the highest annual revenue requirements and thus the largest rate adjustment of the three scenarios. However, all scenarios require increases in annual revenue to meet new, required expenses as they relate to regulatory requirements and appropriately managing the system.

In all three scenarios, an initial, larger, revenue increase is required in 2018 followed by subsequent smaller increases over the next 5 years. This is due to increases in O&M expenses to meet regulatory and basic management requirements for operating the Utility.

These expenses cannot be funded through debt and thus the rate impact cannot be spread out over time. Efforts were made to spread costs and delay projects where possible to mitigate initial rate impacts.

The Utility staff recommends the proactive management strategy. This strategy allows the City to not only be compliant with permit requirements but also attend to desired levels of service and pressing investment needs. Section 10.5 details the recommended funding plan for the proactive strategy.

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Section 10

Implementation

Utility staff presented the management strategies and the results of the financial analysis to the City Council in August 2017, recommending implementation of the proactive management strategy. The recommendation for the proactive management strategy is based on the expected level of service provided for the associated cost and impact on surface water management fees. The proactive management strategy provides the following:

- Programs that meet current O&M needs and regulatory requirements
- Programs to meet anticipated new regulatory requirements
- High-priority projects and programs that most directly help meet the four levels of service
- Equitable Utility services across the city's drainage basins

The City Council directed Utility staff to proceed with the proactive management strategy for preparing costs and financial information for the 2018–2023 CIP and 2018 City budget. The following sections summarize the policy recommendations, programs, and projects associated with implementation of the proactive management strategy.

10.1 Policy Recommendations

As described in Section 4.3, Utility staff have already conducted policy issue discussions with the City Council on four key policy issues. The following bullets summarize the recommended course of action based on the guidance provided by the City Council:

- **Use of Utility funds outside of the ROW:** The Utility will continue the practice of not expending Utility funds on private property unless City staff determine that the facilities in question are the responsibility of the City or public infrastructure is threatened. Utility staff will follow a "decision requirements" flow chart, shown previously in Figure 6-2. This flow chart shows the criteria Utility staff and the City Attorney will use to identify situations where it is appropriate to use Utility funds outside the ROW.
- **Stormwater Permit:** The Utility will establish a Stormwater Permit that consolidates all the onsite and ROW stormwater review activity into a single permit process covering all ongoing inspections, operations, maintenance, and enforcement of maintenance standards for private drainage systems as required by the Phase II Permit. The Stormwater Permit Program is intended to provide operating budget and staff resources for implementing this recommendation.
- **Surface water management fee-chargeable area:** The Utility will change the chargeable area for surface water fees to be based on hard surfaces. The chargeable area was updated in the surface water management rate table (SMC 3.01.400) when the City Council approved the 2018 budget.
- **Private facility inspection and maintenance:** The Utility will continue with the current inspection and maintenance program but will embark on a pilot program offering private properties the option to participate in a self-certification program. The Utility estimated an operating budget for the Utility staff to develop the self-certification process over the next 6 years.

The Utility is expected to proceed as described above on each policy issue. Actions required by the Utility have been incorporated into program recommendations where applicable.

10.2 Programs

The proactive management strategy includes 24 programs: 9 existing programs, 9 enhanced programs, and 6 new programs. These programs have been developed to meet current and anticipated NPDES requirements, implement Utility BMPs, and reduce the backlog of existing programs. Table 10-1 presents a summary of the proactive management strategy by program category with additional annual operation costs and estimated staffing. Staffing needs were developed by identifying program activities and workload estimates for enhanced and new programs. Staffing needs are included in program costs estimates in Appendix D-1.

Table 10-1. Implemented Program Summary

Category	Program	Status	Planned Start Year	Operating Cost (Additional to Existing)	Additional Staffing (FTE)
Operation	NPDES Compliance	Enhanced	2020[a]	$32,480	0.13
	Floodplain Management	Existing	Ongoing	-[c]	-[d]
	Administration and Management	Existing	Ongoing	-[c]	-[d]
	Drainage Assessment	Enhanced	2018	$175,640	0.20
	Water Quality Monitoring	Enhanced	2020[a]	$85,470	0.25
	System Inspection	Enhanced	2018	$47,021	0.25
	Condition Assessment	Enhanced	2018	$160,340	0.34
	Private System Inspection	Enhanced	2019[b]	$62,192	0.40
	Stormwater Permit	New	2019[b]	$47,840	0.33
	Asset Management	Enhanced	2018	$69,200	0.25
Maintenance	Street Sweeping	Existing	Ongoing	-[c]	-[d]
	System Maintenance	Existing	Ongoing	-[c]	-[d]
	Small Repairs	Existing	Ongoing	-[c]	-
	SW Pipe Replacement	Enhanced	2019[b]	$651,520	0.52
	Surface Water Small Projects	Enhanced	2018	$400,000	0.16
	Catch Basin R&R	New	2018	$354,100	0.20
	LID Maintenance	New	2018	$53,732	0.10
	Pump Station Maintenance	New	2018	$63,600	0.10
	Utility Crossing Removal	New	2018	$18,400	0.15
Public involvement	Soak-It-Up Rebate	Existing	Ongoing	-[c]	-[d]
	Adopt-a-Drain	Existing	Ongoing	-[c]	-[d]
	Local Source Control	Existing	Ongoing	-[c]	-[d]
	Water Quality Public Outreach	Existing	Ongoing	-[c]	-[d]
	Business Inspection Source Control	New	2020[a]	$86,780	0.10
Average annual O&M effort for infrastructure associated with proactive management strategy				$33,867	0.02
			Total	**$2,342,182**	**3.50**

a. Existing program to continue until enhanced program begins in noted year.

b. Program development begins in 2018; program implementation begins in noted year.

c. Costs for existing programs assumed to be included within existing operation costs.

d. Staffing for existing programs assumed to be covered by existing staff.

Three programs were only included in the optimum management strategy and therefore not included in the recommended management strategy. These programs included a group of projects or programmatic work that were considered good candidates for alternate funding such from a grant or as a component of a separate but related capital project. The programs and discussion for funding are as follows:

- **Improper Connection Removal Program:** Identified in the condition assessment efforts of the basin plan work. Improper connections can be addressed when identified as a surface water small project or as part of a separate but related capital project.
- **Thornton Creek Stewardship Program:** Identified in the Thornton Creek Basin Plan because of the creek's poor water quality. The stewardship opportunities identified for this basin can be applied to all basins. Grant funding from Ecology or the Puget Sound Partnership may be available for this public outreach, involvement, and education program.
- **Aquatic Habitat Improvement Program:** Identified in basin planning efforts as a citywide need. Aquatic habitat improvements identified in this program can be addressed when identified as a part of a separate but related capital project. Portions of this program related to public outreach and involvement may be funded through Ecology grants.

10.2.1 Staffing Needs

The Utility staff estimated additional staff resources during the development of proactive management strategy program costs and the annual City budget process. The need for 3.5 additional FTE was identified in the enhancement of Utility programs. These FTE include 1.00 FTE (Public Works Senior Maintenance Worker), 1.00 FTE (Engineering Technician), 1.00 FTE (Engineer I), and 0.2 FTE (Maintenance Worker). The remaining 0.3 FTE to be allocated to the Utility programs was obtained through the redistribution of existing FTE within the Public Works Department. Redistribution of FTE occurs during the annual budget review process, but can also occur as needed. From the development of the 2018 budget, a notable redistribution of the FTE consisted of the addition the development review and construction inspection staff. These staff will help with new Stormwater Permit program.

Figure 10-1 shows an organizational chart for Utility personnel with FTE allocations for 2018.

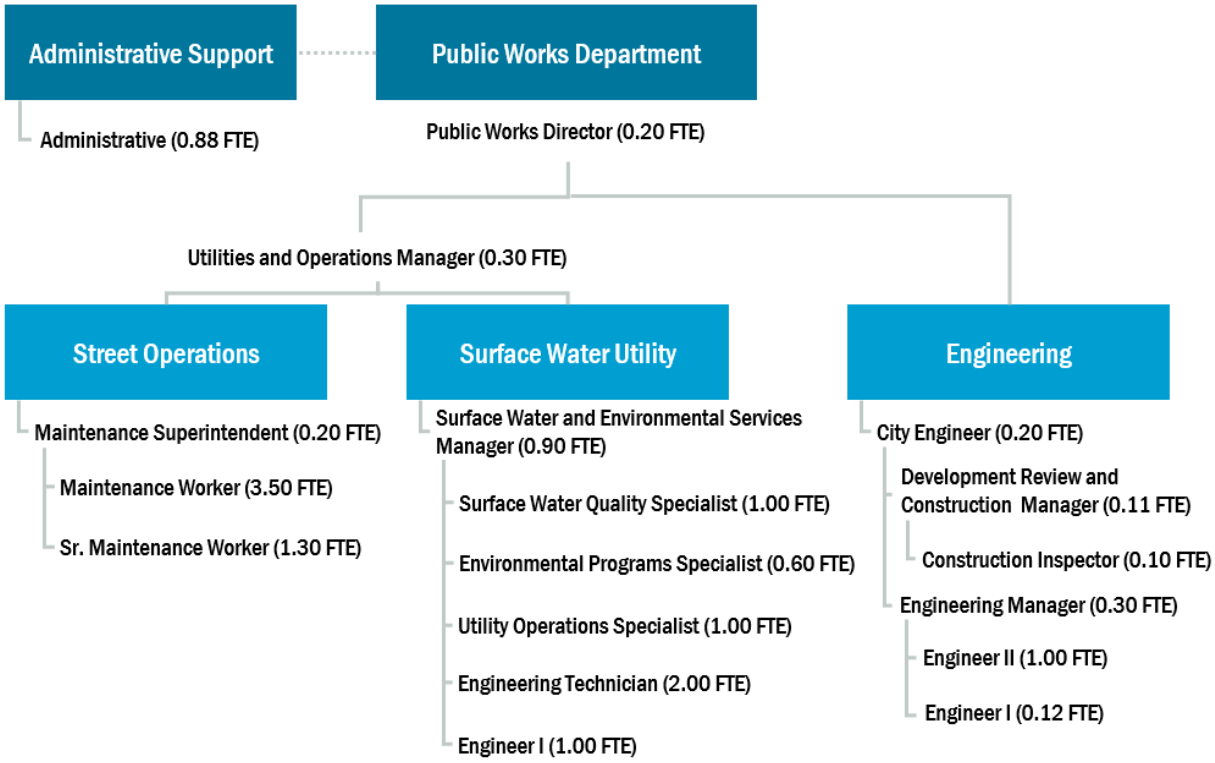

Figure 10-1. Organization of personnel contributing to Utility with FTE allocations for 2018

10.2.2 Monitoring Performance

As the Utility moves forward with implementing the programs included in the proactive management strategy, staff will collect data and monitor the performance of these programs over time. The Utility has assessed each of the programs and described the characteristics of a successful program. Staff identified quantitative performance measures related to the successful implementation of each program. These performance measures were then narrowed down to one per program, and thresholds for success were set according to three possible levels or ratings (see Table 10-2).

Table 10-2. Performance Ratings for Programs

Performance Rating	Definition
Meets expectations	Program meets expectations and is consistent with meeting level-of-service targets.
Needs improvement	Program is active and is being implemented by staff, but still needs improvement to meet expectations of customers or stakeholders.
Below expectations	Program either does not exist or falls short of meeting expectations of customers or stakeholders.

Appendix D-4 provides a comprehensive list of the programs to be implemented for the proactive management strategy along with a description of the performance measure identified for each. An overall assessment of levels of service can be made by combining the ratings of all related programs for a particular level of service. For example, if there are 11 programs that greatly impact level of service 1 (manage public health, safety, and environmental risks from impaired water quality, flooding, and failed infrastructure), we can assess the status of each program and then determine an average rating (see Table 10-3).

Table 10-3. Combined Assessment of Programs Supporting LOS 1, Surface Water Impacts		
Relevant Program	2017 Program Status	Combined Status
Drainage Assessment [a]	Needs improvement	Below Expectations
Water Quality Monitoring [a]	Meets expectations	
Street Sweeping	Meets expectations	
System Maintenance	Needs improvement	
Pipe Condition Assessment Program [a]	Below expectations	
SW Pipe Replacement Program [a]	Below expectations	
System Inspection [a]	Meets expectations	
Catch Basin Repair and Replacement [a]	Below expectations	
LID Maintenance [a]	Below expectations	
Pump Station Maintenance [a]	Below expectations	
Utility Crossing Removal [a]	Below expectations	

a. *Programs that are new or enhanced for the proactive management strategy; these programs may have gaps or may not exist currently, which would lead to a "below expectations" rating in 2017.*

Appendix D-4 provides a complete list of the programs with 2017 program status ratings. Appendix D-4 also shows the anticipated ratings for 2018, once additional programs become active and additional Utility staff are available to ramp up those activities. In addition, Appendix D-4 shows the long-term goals for each program as anticipated for 2023. Table 10-4 shows the overall ratings and planned improvements for how the programs will support the levels of service.

Table 10-4. Levels of Service and Level-of-Service Targets for the Surface Water Utility					
Level of Service		Level-of-Service Target	2017	2018	2023
LOS 1: Surface Water Impacts	Manage public health, safety, and environmental risks from impaired water quality, flooding, and failed infrastructure	No verifiable health and safety issues or environmental damage caused by the stormwater services outside of risk tolerance			
LOS 2: Equitable Service	Provide consistent, equitable standards of service to the citizens of Shoreline at a reasonable cost, within rates and budget	Meet the levels of service as measured by customer satisfaction and rate and revenue projections			
LOS 3: Communication and Outreach	Engage in transparent communication through public education and outreach	Maintain a communication plan to inform the community on utility goals and progress			
LOS 4: Regulatory Compliance	Comply with regulatory requirements for the urban drainage system	Meet or exceed regulatory requirements for NPDES Phase II and federal, state, and local regulations affecting surface water management			
Meets expectations		Needs improvement		Below expectations	

10.3 Projects

The City Council approved staff's recommendation for the implementation of the proactive management strategy, which includes 25 projects, 21 of which are construction projects and 4 of which are studies or plans. The proactive projects include high-priority construction projects and studies that help meet the level-of-service targets. Projects selected for the 6-year CIP were then examined in closer detail with respect to implementation. Several projects were divided into phases where predesign/feasibility studies were needed or engineering and planning must be done well in advance of construction. Table 10-5 lists the proactive management strategy projects in order of priority with costs in 2017 dollars.

Table 10-5. Proactive Management Strategy Project Summary

6-year CIP status[a]	Project Name	6-Year CIP Cost [b]	Capital Cost [b]
DC	25th Ave. NE Flood Reduction and NE 195th St. Culvert Replacement	$2,674,000	$8,226,000
P	Master Plan Update	$500,000	$500,000
PD	Springdale Ct. NW and Ridgefield Rd. Drainage Improvements	$545,000	$2,058,000
PDC	10th Ave. NE Stormwater Improvements	$1,788,000	$1,788,000
PD	Heron Creek Culvert Crossing at Springdale Ct. NW	$226,000	$855,000
DC	Hidden Lake Dam Removal	$2,097,000	$2,097,000
P	25th Ave. NE Ditch Improvements between NE 177th St. and 178th St.	$141,000	$2,538,000
PD	Pump Station 26	$320,000	$891,000
PD	Pump Station 30 Upgrades	$90,000	$339,000
P	6th Ave. NE and NE 200th St. Flood Reduction Project	$22,000	$384,000
PDC	Pump Station Misc. Improvements (Linden, Palatine, Pan Terra, 25, Ronald Bog, Serpentine)	$732,000	$732,000
C	NE 148th St. Infiltration Facilities	$393,000	$393,000
P	Boeing Creek Regional Stormwater Facility	$83,000	$9,440,000
P	System Capacity Modeling Study	$300,000	$300,000
PDC	NW 195th Pl. and Richmond Beach Dr. Flooding	$747,000	$747,000
P	Stabilize NW 16th Pl. Storm Drainage in Reserve M	$28,000	$500,000
P	Storm Creek Erosion Management Study	$80,000	$80,000
P	Climate Impacts and Resiliency Study	$80,000	$80,000
P	Boeing Creek Restoration	$50,000	$7,630,000
PD	NW 196th Pl. and 21st Ave. NW Infrastructure Improvements	$83,000	$313,000
P	18th Ave. NW and NW 204th St. Drainage System Connection	$15,000	$261,000
P	NW 197th Pl. and 15th Ave. NW Flooding	$7,000	$119,000
P	Lack of System and Ponding on 20th Ave. NW	$81,000	$1,458,000
P	12th Ave. NE Infiltration Pond Retrofits	$38,000	$677,000
P	NE 177th St. Drainage Improvements	$9,000	$152,000
		$11,129,000	$51,920,000

a. Implementation status key: P = planning/predesign/study, D = design/permitting, C = construction

b. 2017 dollars. O&M and other life-cycle costs included in financial planning analysis.

10.4 Recommended Funding Plan

The proactive management strategy includes project (capital) and program (non-capital) investments to meet regulatory requirements and address high-priority, long-term needs of the Utility.

Capital. There are more than $22.3 million in identified capital project costs over the 6-year planning horizon assuming a 3 percent annual escalation rate. The specific projects and costs are identified the Financial Analysis Report (see Appendix L).

O&M Program. The proactive strategy O&M expenses (including programs not in the 2017 O&M program) were identified in Table V-3 in the Financial Analysis Report. Annual (escalated) expenses ranged from approximately $4.78 million (2018) to $5.69 million (2023).

10.5 Current and Projected Rates

Surface water management fee rates are approved annually when the City's annual budget is approved. The rate increases required for the proactive management strategy are implemented for the 6-year planning period through the budget approval. The financial analysis was prepared for capital projects and O&M programs for a 20-year period (2017–2036) and therefore includes financial planning beyond the 6-year period. This section describes the rate increases for the 2018–2023 projected rates and the 2024–2036 revenue requirements.

10.5.1 2018–2023 Projected Rates

The Financial Analysis Report accounts for the "proactive level" of capital and O&M program costs over the 6-year planning period. The report also accounts for the associated costs for the debt servicing, reserve funds, and meeting the policy requirements over the planning period. The report then projects the rate increases necessary to support this level of programming. Table 10-6 below (Table VI-1 in the Financial Analysis Report—see Appendix L) provides the results of the projected rate analysis by year.

Table 10-6. Projected Percentage Rate Increases to Meet Proactive Level Program Expenditures

Rate Increase Summary	2017	2018	2019	2020	2021	2022	2023
Annual rate increases	NA	27.0%	15.0%	10.0%	10.0%	5.0%	5.0%
Single-family annual bill	$ 168.81	$ 214.38	$246.54	$ 271.19	$ 298.31	$ 322.18	$ 328.89
Increase over prior year	NA	$ 45.58	$ 32.16	$ 24.65	$ 27.12	$ 14.92	$ 15.66

Source: Table VI-1; City of Shoreline Surface Water Utility; Financial Analysis for 2017 Master Plan, FCS Group (November 2017) (Appendix L)

The analysis shows the need for the rate's highest increase in 2018 with gradually smaller increases in later years. For single-family residences, this reflects an increase in the annual surface water charge from $168.81 in 2017 to $328.89 by 2023. The same percentage increase would apply for every customer type. The current customer rates were adopted on November 20, 2017, when the City Council approved the 2018 budget; these are located in the SMC 3.01.400 Surface Water Management rate table.

Figure 10-2 compares the 2018 Shoreline monthly surface water management fee with 2018 monthly fees of other surface water agencies. The Shoreline monthly fee is considerably lower than that of Seattle and similar to that of other local agencies.

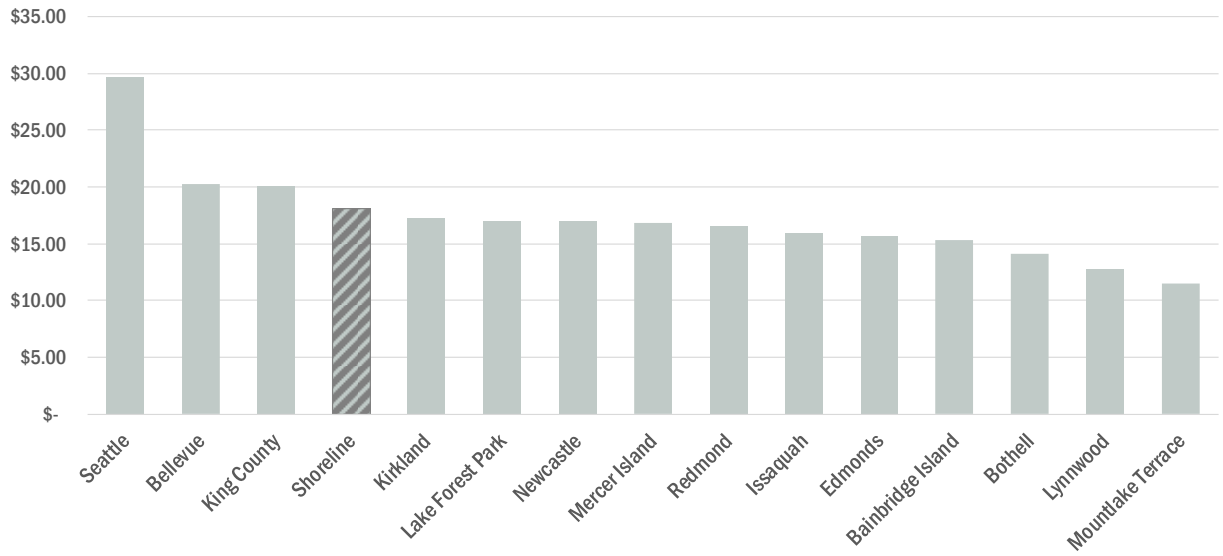

Figure 10-2. Comparison of Shoreline 2018 monthly surface water management fees with other 2018 surface water agencies

10.5.2 2024–2036 Revenue Requirement Discussion

Capital improvement estimates show a sustained increase in capital investments from 2024 through 2036. This increase currently results in an average of more than $3 million annually in additional capital expenditures as compared to the current 6-year spending average. Because of sustained above-inflation increases through 2023, current financial forecasts show that the City will require slightly lower rate increases starting in 2024 (of 7 percent) that reduce toward inflationary increases over time despite the higher projected capital expenditures. These forecasts are dependent on the City maintaining its current capital schedule and cost estimates.

10.6 Conclusion

The City examined three management strategies in the financial analysis. Each analysis considered all funding resource options, the Utility's financial policies and targets, and current operating needs. All strategies were developed such that they, at a minimum, meet Phase II Permit obligations. All management strategies require rate increases. The 2018 rate increase is the most substantial, followed by smaller increases through 2023. These increases are related to higher O&M obligations of new programs.

The proactive strategy adds new, high-priority projects and programs and is the recommended management strategy. The proactive management strategy is recommended because it meets Phase II Permit obligations and funds many high-priority needs but does not require the same level of investment (and rate increases) as the optimum strategy.

It is important that the City revisit the identified rates annually to ensure that the rate projections developed remain adequate. Any significant changes should be incorporated into the financial plan and future rates should be adjusted as needed.

The City should take extra consideration of improved capital cost estimates and scheduling in the 2024–2036 planning period. While the current rate forecast plans for an increase in capital expenditures through this period, changes to costs and schedules will be important to incorporate.

Other financial planning recommendations include the following:

- Adopt rate structure presented for the proactive management strategy
- Revise City "CIP model" to include updated reserve requirements including:
  - 120 days of O&M expenses minimum operating reserve balance
  - 2 percent of assets minimum capital reserve balance
- Review rates and current operational and capital needs annually
- Conduct new financial analysis in 5 years to ensure that projected rates are in line with Utility expenses

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Section 11

Limitations

This document was prepared solely for the City of Shoreline in accordance with professional standards at the time the services were performed and in accordance with the contract between the City of Shoreline and Brown and Caldwell dated July 14, 2016. This document is governed by the specific scope of work authorized by the City of Shoreline; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the City of Shoreline and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Section 12

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