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Surface Water MASTERPLAN

NOVEMBER 2014

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City of Kirkland

Surface Water MASTERPLAN

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November 2014

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1. INTRODUCTION AND BACKGROUND

Kirkland is a thriving 18 square mile city of 84,000 people. Located on the eastern shore of Lake Washington, the City has a strong connection to the water and natural environment. The City's Surface Water Utility (Utility) is a steward of these resources with goals to manage surface and stormwater such that:

- Flooding is reduced
- Water quality is improved
- Infrastructure is protected and maintained
- Aquatic habitat conditions are improved

Appropriate management of surface water in the City of Kirkland achieves multiple goals, all of which improve the quality of life for Kirkland citizens. The Surface Water Master Plan improves safety, reduces risk to public and private property, and enhances our natural environment. Improved safety is achieved by reduced flooding. Properly sizing and maintaining the City's stormwater conveyance system keeps water from ponding on the streets and sidewalks, creating safer conditions for motorists, bicyclists, and pedestrians. Reduced flooding also means a reduction in the risk of damage to property and business operations. The Plan also benefits groundwater management, which can contribute to reduced risk of landslides. Improved water quality and fish passage in the City's waterways, ponds, and lakes provides for enhanced recreation opportunities, including fishing, swimming, and enjoying the beauties of nature in our City. Management of the urban forest insures that Kirkland will remain a green and livable community for many years to come. The last Surface Water Master Plan was completed in 2005. Since then, the Utility has:

- Constructed over 20 capital projects to address flooding, water quality and habitat problems
- Continued to inspect, clean and maintain an aging and growing public stormwater system,
- Expanded education and stewardship to encourage behaviors that protect water resources,
- Adopted design regulations to mitigate impacts of new development
- Conducted watershed planning to identify stormwater facilities to mitigate existing development
- Provided spill response, training, investigation, and outreach to reduce stormwater pollution
- Complied with State and Federal water quality, flood protection, and endangered species regulations
- Developed the Urban Forestry Strategic Management Plan

An updated Surface Water Master Plan is needed to reflect (1) the addition of public stormwater infrastructure with the annexation of Finn Hill, Juanita and Kingsgate in 2011, (2) a re-issued NPDES Phase II Municipal Separated Stormwater (MS4) Permit (Permit), and (3) the need to integrate stormwater programs and projects into current City goals and interests. This plan presents a detailed review of these elements, an inventory of the City's surface and stormwater assets, an overview of existing programs, and prioritized capital project and programmatic recommendations. A brief discussion of financial considerations for plan implementation is included in anticipation of the City Council's rate and budget discussions that will occur following plan adoption. Utility performance measures that align with City Council goals and citizen expectations are presented to track progress and accountability. Proposed programs and projects are cross-referenced in this summary by project or program number as shown in the body of the Plan.

Program and capital project recommendations are presented below according to the major goals expected to be achieved.

2. FLOODING

Flooding has impacts to Kirkland's economy and public safety. Flood reduction (frequency and severity) and flood preparedness is the top priority for the Utility.

2.A Flooding Programs

Construction of flood reduction projects is supported by programs that include maintenance, education, and planning efforts to assist residents by:

- Repairing and rehabilitating pipes and structures to maximize system capacity
- Clearing debris and obstructions from known trouble spots to prevent flooding (Creek and culvert watch list)

- Providing education and outreach to help residents prepare for and respond to flooding
- Investigating or providing referrals or technical assistance for citizen flooding reports or drainage inquiries
- Participating in the King County Flood Control District to manage flooding with regional economic impacts
- Conducting water level monitoring in the Totem Lake area to evaluate effectiveness of flood control and provide early warning to residents of potential flooding

Table E-1 Supplemental Flood Reduction Programs

Recommended Program	Description	Benefits
CW-3: Expand Fall Street Sweeping	Overtime pay for maintenance workers to conduct additional street sweeping in the fall when it is most needed	• Reduced flooding from clogged catch basins and ditches • Use of existing staff to augment current program
CW-12: Beaver Management Policy	Evaluate the need for a formal policy of how and when to manage beavers that impact public facilities or large numbers of private parcels and how to fund ongoing costs for beaver management	• Consistent protocol for managing beavers that cause flooding of infrastructure or private property
CW-30: Juanita Creek Floodplain Mapping	Evaluate the need for and consequences of mapping the Juanita Creek floodplain, including a base cost for obtaining a FEMA map revision	• A map of the Juanita Creek floodplain would provide clarity for development review staff as to limitations on development within the floodplain and compensatory mitigation for floodplain impacts. However, a floodplain map could affect private property owners' ability to obtain flood insurance and increase the cost of that insurance.
CW-34: Leaf Pick-up Evaluation	Evaluation of fall leaf pick-up programs used by other jurisdictions and potential for Kirkland to implement a similar program	• Understanding of the pros and cons of leaf pick-up programs as they relate to Kirkland
CW-38: Neighborhood Drainage Assistance	Evaluate the current neighborhood drainage assistance program and develop criteria for providing assistance	• Clarity for when and how neighborhood drainage assistance and how this program should be communicated to the public

Supplemental programs are recommended to further reduce localized flooding (CW-3, CW-12, CW-34), map floodplains (CW-30), and clarify when City assistance is appropriate to address private property impacts (CW-38). Cleaning and inspection of the stormwater system is also a flood reduction measure, keeping pipes clean to provide adequate capacity when necessary. This is a secondary benefit of maintaining infrastructure for system longevity and functionality (discussed below).

2.B Flooding Capital Projects

Street and private property flooding in the Totem Lake area is the largest flooding problem in Kirkland. Several projects have been completed, and more are underway to reduce the frequency and severity of this problem. One additional Totem Lake area flood-reduction capital project (JC-04) is recommended in this Plan. Other capital projects are proposed to address flooding problems in the 2011 annexation area (DE-01, JC-06, JC-07 and JC-08), South Rose Hill (RED-01) and a regional flooding problem at the I-405/NE 116th Street interchange (FO-2). Table E-2 lists recommended flood-reduction capital projects.

Table E-2 Flood Reduction Capital Projects

ID	Project	Primary Goal	Preliminary cost in 2014 dollars
FO-02	Regional detention in Forbes Creek basin	Flood Reduction	$10,000,000
DE-01	Sediment removal in channel	Flood Reduction	$136,000
JC-07	Goat Hill stabilize eroding channel	Flood Reduction	$299,000
JC-08	Goat Hill increase pipe conveyance capacity	Flood Reduction	$490,000
RED-01	Underground injection control well (infiltration facility)	Flood Reduction	$65,000
JC-06	Goat Hill route flow away from open channel	Flood Reduction	$521,000
JC-04	Flow diversion	Flood Reduction	$266,000
TOTAL	**Flood Reduction Capital Projects**		**$11,777,000**

■ 3. WATER QUALITY

Swimmable and fishable waters is the goal of water quality efforts. The Utility supports water quality improvement through educational efforts to reduce pollutants from being discharged into surface water, collecting field measurements to monitor water quality in lakes and streams, constructing capital projects to reduce erosion and sedimentation in streams, and complying with the NPDES Phase II Municipal Stormwater Permit.

3.A Phase II NPDES Permit

The Permit became effective on August 1, 2013, and will expire on July 31, 2018. It authorizes the City to discharge stormwater from its public system into Lake Washington and other Kirkland lakes and streams that are considered Waters of the State provided that actions are taken to reduce the discharge of pollutants in stormwater. The Permit requires actions in the following stormwater management areas:

- Public education and outreach
- Public involvement
- Illicit discharge detection and elimination (pollution source control including connections that could convey non-stormwater and instances of dumping)
- Control of runoff from new development and redevelopment and construction sites
- Municipal maintenance and operations (stormwater management at City facilities)
- Monitoring and effectiveness studies

Several major changes in the reissued Permit require program additions for compliance (CW-6, CW-7, CW-8). These are listed in Table E-3. Table E-3 also includes programs that are recommended to assist with Permit implementation (CW-9, CW-11, CW-19). For example, the Permit requires adoption of certain storm drainage design regulations, and programs are recommended to provide education and tools to reduce the impacts of this change on the development community.

*Table E-3. Recommended **Permit-driven** Water Quality Program Additions*

ID	Why?	Benefit of Recommendation
CW-6: Development Review NPDES Analysis	• Permit reduced size threshold for surface water regulatory development review from 1 acre to 2,000 square feet (0.046 acre).	• Plan for how to complete timely review given that the number of permits to be reviewed will increase • Understanding of how NPDES Permit changes may affect resource needs so that adequate time can be budgeted and fees can be recovered, if necessary.
CW-7: LID Code Review	• Permit requires that municipal codes be reviewed and opportunities be identified for incorporating LID principles and best management practices (BMPs) into development code, rules, standards, and other enforceable documents.	• Permit compliance • As City staff go through the process of reviewing and revising codes to incorporate LID, they will be in a better position to relay requirements and develop tools for the Kirkland development community
CW-8: LID Implementation and Surface Water Manual Adoption	• Permit requires adoption of a new Surface Water Design Manual that is equivalent to the 2012 Ecology Manual. Updates codes and policies to match manual and to implement LID.	• Permit compliance
CW-9: Stormwater Facility Inspection	• Additional staff to be shared with Wastewater will allow O&M staff to better inspect facilities that require such inspection after large storm events in the annexation area	• More resources will help ensure that time-critical inspections are completed
CW-11: Spill Response Vehicle	• Service truck dedicated to spill response	• Service truck equipped with proper supplies and gear will be able to respond to emergency spills more quickly, reducing the potential for water quality issues in surface water system
CW-19: Develop LID Feasibility Tools	• Permit requires development projects to use low impact development (LID) facilities or performance standards. Develop tools for evaluating feasibility and implementing LID at the site level	• Development of tools for use by City staff and the development community will provide a framework for consistent interpretation of criteria that can be used to determine when LID BMPs are not feasible • Maps areas where LID is infeasible otherwisealreadocumented (for instance, steep slopes)

The Permit requires screening for illicit discharges. The City may accomplish illicit discharge screening through TV inspection of pipes, which is already being done as part of an overall asset management strategy. The pace of TV pipe inspection needs to be increased if this approach is to be used to meet the Permit requirement of 12% of the system screened per year. A new TV inspection truck and associated staff is recommended to accomplish this and other asset management goals described below.

3.B Supplemental Water Quality Programs (not Permit Driven)

To meet its goal of improving water quality, the Utility conducts a variety of maintenance and outreach programs and other measures to protect and improve Kirkland's water resources. Some of these actions are a continuation of requirements from the City's first Permit and others are designed to monitor or prevent future water quality problems, including:

- Conducting stormwater infrastructure cleaning (catch basins and pipes) to reduce delivery of pollutants to streams and lakes (continuation of Permit requirements)
- Inspecting private drainage facilities to ensure adequate maintenance and functionality (continuation of Permit requirements)
- Educating residents about their role in protecting water quality (continuation of Permit requirements)
- Responding to reports of water quality problems, investigation, and follow up with education, cleanup or enforcement actions (continuation of Permit requirements)
- Sponsoring volunteer monitoring of Forbes Lake to measure chemical health and evaluate whether actions are necessary to protect or improve water quality
- Conducting pollution prevention visits to businesses to assist in their pollution prevention efforts

To continue and expand Utility water quality focused efforts, including those listed above, several supplemental programs are recommended (Table E-4), which focus on improving the water in streams and lakes by identifying, quantifying and eliminating sources of bacteria and other pollutants (CW-16, CW-17), and by preparing to provide water quality treatment for runoff from existing development (CW-18, CW-31, CW-33).

Table E-4. Supplemental Water Quality Programs

Recommended Supplemental Water Quality Programs	Description	Benefits
CW-16: Proactively Avoid Total Maximum Daily Load (TMDL)	Implement a program to reduce pollutants of concern in Kirkland's 303(d) listed streams, including Juanita and Forbes creeks, and monitor progress	• Implementing a program before it is required by the State will save costs in the long run, and accelerate water quality improvements
CW-17: City-Specific Water Quality Monitoring	Expand lake monitoring program to include Totem Lake, and coordinate with King County to collect water quality index parameters in select stream locations to monitor water quality trends	• Monitoring data will provide a baseline for understanding the effects of retrofit and other projects to improve water quality conditions in Kirkland's lakes and streams
CW-18: Watershed Planning for Retrofit	Evaluate opportunities for stormwater retrofit on a watershed basis, develop a plan to construct regional facilities, and opportunistically treat public stormwater in public/private facilities	• Identification of specific projects would facilitate better decision making as opportunities for grant funding or add-ons to other planned projects occur
CW-31: Map Area of Treatment for Existing Stormwater Facilities	One time project to develop a map of area treated for flow or water quality.	• Helps identify areas that currently don't have treatment in order to effectively identify opportunities for retrofit
CW-33: Retrofit Opportunities	One-time project to review development projects for potential retrofit opportunities	• Allows an opportunity to identify large-scale development projects currently in the works that would be good candidates for retrofit, ahead of future requirements that will not take effect until 2017
CW-36: Scoop Law Evaluation	Pet Waste Pickup Laws	• Raises awareness of the need to properly dispose of pet waste

Redevelopment projects, which will constitute most development activity in the business districts of the City, will be required to provide stormwater facilities to mitigate the impacts of existing impervious surfaces. In addition, it is anticipated that the City will eventually be required to treat runoff from public streets. Planning for stormwater retrofits that provide regional facilities and that partner with private properties and private development projects may be a way to reduce the economic burden for all parties. A grant project is currently underway to study the retrofit needs and opportunities in the Totem Lake area, one of the City's most important economic development zones. Additional projects like this will help to position the City to receive grant funding for construction of retrofit projects.

3.C Water Quality Capital Projects

Capital projects to address water quality are aimed at leveraging resources by retrofitting public roads with water quality treatment where none currently exists (CH-03), constructing water quality treatment in coordination with transportation projects (FO-13), reducing erosion and sedimentation in stream channels (CA-01, JC-01, EC-01), and managing channel down-cutting in Forbes Creek (FO-07).

Table E-5. Water Quality Capital Projects and Cost

ID	Project	Primary goal	Preliminary cost
CH-03	Rain garden and bioretention retrofit	Water quality	$85,000
FO-07	Channel grade control	Water quality	$165,000
CA-01	Erosion control measures	Water quality	$550,000
FO-13	Pilot LID water quality project associated with planned transportation project	Water quality	$65,000
JC-01	Sediment removal	Water quality	$194,000
EC-01	Ravine stabilization	Water quality	$830,000
TOTAL	Water Quality Capital Projects		$1,889,000

■ 4. INFRASTRUCTURE

The Utility is responsible for operations and maintenance of stormwater infrastructure in order to achieve optimal performance and extend the useful life of the City's assets. Many of the programs and projects recommended in this Plan support infrastructure protection and maintenance.

4.A Infrastructure Programs

The Utility's Operation and Maintenance (O&M) Group provides protection and maintenance of the City's stormwater infrastructure, including

- Inspection and cleaning of catch basins, pipes, vaults, ponds, tanks and other stormwater treatment facilities
- Maintenance of drainage ditches
- Repair and rehabilitation of pipes and structures
- Vegetation management for stormwater ponds and other above-ground facilities

Staff and equipment for the Operation and Maintenance Group constitutes the majority of the current operating budget for the Utility.

4.A.1 Annexation and New Facilities

Annexation and acquisition of the Cross Kirkland Corridor resulted in a significant increase in the number of stormwater conveyance and treatment facilities including:

- 61% increase (98 miles) in the length of pipe,
- 129% increase (31 facilities) in number of open stormwater ponds
- 126% increase (21 miles) in the length of ditches and swales

Although staff and equipment were added when annexation occurred based on ratios of area and population, mapping of assets and several years of experience with the area have revealed additional needs.

An updated geologic map for the annexation area is needed to develop stormwater facility designs that are protective of steep slopes and landslide hazards. Such a map can also be used to assist developers in determining what types of low impact stormwater facilities may be feasible at a given site. This work will be done in concert with update of the Geologic Hazards portion of the Zoning Code (Chapter 85), and will begin in late 2015 or early 2016. The geologic map for pre-annexation Kirkland was updated as a recommendation of the 2005 Surface Water Master Plan.

Maintenance of ditches takes a different and more intensive type of work than cleaning pipes, including four crew members instead of 2 and a backhoe and service truck instead of an eductor truck. The addition of a crew and equipment for ditching (CW-4) is the most costly and most-needed recommendation in this plan. Specialized maintenance equipment is needed to clean structures on Goat Hill because the roads are too steep to be accessible to traditional equipment (CW-5). An additional service truck and equipment are recommended to improve the efficiency of maintenance activities (CW-10). There is a backlog of rehabilitation needs in the annexation area, and a project is recommended to address those needs using temporary staffing (CW-32).

The number of low impact development (LID) stormwater facilities, such as rain gardens and permeable pavement, is increasing in the city as such facilities are now required as stormwater mitigation for development. Maintenance of these facilities requires landscaping and horticulture skills as well as traditional utility worker skills in construction. Additional funds for training and labor associated with LID facilities (CW-2) will ensure that they are an aesthetic asset to the community as well as providing a stormwater function.

Streams are part of the stormwater system in Kirkland, and maintenance of facilities that are in-line with streams requires permits and approvals from the City, the State Department of Fish and Wildlife and in some cases, the US Army Corps of Engineers. Permitting associated with maintenance activities has become increasingly complex and additional staff and/or consulting time is recommended (CW-23) to ensure that permits are obtained in a timely manner.

4.A.2 Aging Infrastructure and Asset Management

Repair and replacement of aging and failing infrastructure is important to prevent catastrophic failures that may cause flooding or public safety hazards such as sinkholes in streets. TV inspection of underground systems is vital to maintain an accurate condition rating that is needed to prioritize repair and replacement. A pipe TV inspection program was started in 2006 with 1 camera truck that is currently shared with the Wastewater Utility. To date, approximately 20% of publicly-owned stormwater pipes have been TV inspected and rated. Condition rating information shows that 20% of the pipes inspected were in need of repair (condition rated as "poor" or "fair"). Inspection data should be updated on an approximate 10 year cycle to ensure pipes have not deteriorated to a point where repair or replacement is necessary. In order to collect data usable for asset management purposes, as well as to conduct screening for illicit discharges (see above) it is recommended that the City fund a new TV inspection truck and associated staff (CW-1). The cost of these items would be shared with the Wastewater Utility.

Table E-6. Recommended Infrastructure Programs and Equipment

Recommended Infrastructure Program Addition	Description	Benefits
CW-1: TV Inspection of Pipes	Two additional staff and an additional CCTV inspection truck to be shared between Wastewater and Surface Water	• Ability to meet the pavement overlay schedule, while still conducting other important O&M functions • Additional CCTV truck will help accelerate the pipe inspection program, which is useful for better understanding condition of the system and potential replacement needs • Pipe inspection can be used to meet NPDES requirements for IDDE
CW-2: LID Maintenance	Additional grounds crew laborers, training, and equipment to maintain LID sites as they become more prevalent	• Staff with skills in landscape maintenance will be better able to maintain LID facilities

Table E-6. Recommended Infrastructure Programs and Equipment Cont.

Recommended Infrastructure Program Addition	Description	Benefits
CW-4: Ditch Maintenance	Hire additional staff, and acquire an additional multi-purpose dump truck, backhoe, and trailer in future years to effectively maintain Kirkland's ditches	• Maintained ditches are better able to convey water and reduce flooding, contribute to better water quality, and result in fewer citizen complaints • Contract workers will help O&M staff catch up with ditch cleaning, particularly in the annexation area where there are a greater number of open ditches • Eventual staff and equipment purchases will allow for better and more consistent long-term ditch maintenance
CW-5: Maintenance on Goat Hill	Rent equipment so that City staff can access Goat Hill and conduct necessary infrastructure maintenance	• Appropriately sized equipment will allow for more frequent infrastructure maintenance that may help alleviate ongoing erosion problems on Goat Hill
CW-10: Service Truck	Additional service truck to haul heavy gear, including a small crane	• Additional equipment will help staff fulfill NPDES requirements and manage increased workload associated with annexation area
CW-15: Utility Rate Study	Conduct a rate study to assess short-term and long-term program revenue needs and evaluate partitioning of funds between operations and capital projects	• An evaluation of revenue needs in order to support program operation will facilitate decisions on how and when to implement projects based on City priorities
CW-20: Incorporation of LID into City Capital Projects	Develop a preliminary policy to support capital project engineers in the use of LID on City projects	• Demonstration to the community that the City leads by example and follows a protocol that is encouraged of developers
CW-22: Operations and Maintenance CIP Consultation	Time for O&M staff to coordinate more effectively with capital projects engineers to design projects with long-term maintenance in mind	• Timely coordination during the project design phase will result in better projects and less O&M time and money once the project is constructed
CW-23: Environmental Permitting for Maintenance	Time for City staff or a consultant to obtain environmental permits for maintenance projects, and follow up on reporting requirements once permits are obtained	• Dedicated staff time will result in better permit planning and coordination of work efforts that require environmental permits, particularly in the annexation area where infrastructure maintenance could have impacts to natural resources • Dedicated staff will result in more consistency in identification of when permits are required and how they are obtained
CW-25: Evaluation of Stream Deltas in Lake Washington	Evaluate whether a policy is needed to direct the Surface Water Utility in decisions related to if or when it would conduct dredging to maintain functionality of marinas or boat launches	• A policy, if needed, would provide clarity for whether the City views potential dredging projects as a public benefit and whether City funds should be used for such activities
CW-27: Climate Change Evaluation	Evaluate potential future effects of climate change and develop a policy that addresses future infrastructure needs, planning, and adaptive management	• Consideration of potential climate impacts will facilitate better project designs and implementation, especially for those projects or infrastructure that have an anticipated project life cycle that extends into predicted climate change scenario time frames (50 to 100 years)
CW-28: Streamside Restoration Maintenance	Evaluation of responsibility for maintaining stream capital projects, and funding to increase maintenance on stream restoration sites	• Clarity of responsibility, including time frames, easements, and maintenance obligations • Streamside maintenance protects investment in clearing and planting of native vegetation. Long-term health of streamside areas improves water quality and habitat
CW-32: Stormwater System Rehabilitation Catch-up	Temporary maintenance workers (6-month time frame) and equipment rental to conduct system rehabilitation	• Reduce system rehabilitation backlog

Table E-6. Recommended Infrastructure Programs and Equipment Cont.

Recommended Infrastructure Program Addition	Description	Benefits
CW-39 Residential Stormwater Audit Program	The Stormwater Audit Pilot Program, currently under way via King Conservation District and NPDES Municipal Stormwater Capacity grants, seeks to work with homeowners to identify simple and low-cost ways that they can absorb and filter more stormwater on their property.	• Evaluation of this program will help determine if future funding should be sought through grant funding or if the Utility should allocate funds for future implementation
CW-40 Neighborhood Rain Garden Program	The Neighborhood Rain Garden Program identifies a neighborhood champion who recruits six to eight neighbors who will have rain gardens constructed in their front yards. Following construction of the gardens by a City contractor, neighbors gather to plant vegetation in each of the gardens. This program helps to reduce volume of runoff to the stormwater system.	• Depending on the success of this program, the City may consider expansion and re-allocation of City resources for funds and staff to support this program

4.A.3 Utility Programs that Promote Protection of Infrastructure

Indirectly there are a number of other programs recommended in this Plan that will help protect infrastructure and extend the useful life of the City's assets (Table E-6). Evaluation of the Utility rate structure and potential incentives and rebates (such as a "Treebate" program) can help to encourage residents to manage stormwater on their property rather than relying on the capacity of the public system (CW-14, CW-15). Increased consultation between the Capital Projects Group and the Operations and Maintenance Groups (CW-22), as well as development of a policy for incorporating LID into city projects (CW-20) will help with successful construction and maintenance of LID facilities that use soils and vegetation to slow stormwater, thus reducing capacity needs for the public system. Review of big picture issues such as the interaction between climate change and Utility activities (CW-27) would help to position the Utility to respond to changing conditions.

Table E-7. List of Recommended Capital Infrastructure Projects

ID	Project	Primary goal	Preliminary cost
CH-04	Groundwater seepage and road stability	Infrastructure	$126,000
CH-01	Undersized pipe to be replaced	Infrastructure	$219,000
CW-INF-02	Pipe repair and replacement	Infrastructure	$3,025,000
CW-INF-01	Pipe repair and replacement	Infrastructure	$769,000
JC-05	NE 141st Street/111th Avenue NE culvert replacement	Infrastructure	$765,000
MB-01	Replace stormwater pipes	Infrastructure	$680,000
HAS-01	Pipe replacement, improved hydraulics	Infrastructure	$2,369,000
JC-02	Infrastructure/conveyance	Infrastructure	$874,000
TOTAL	**Infrastructure Capital Projects**		**$8,827,000**

4.B Infrastructure Capital Projects

Capital projects to support stormwater infrastructure include pipe repair and replacement projects identified through TV inspection or failures, and projects that protect other City assets such as roads. Table E-7 lists the capital infrastructure projects recommended in this Plan.

■ 5. HABITAT

The Utility, having primary responsibility for surface and stormwater management in Kirkland, also is largely responsible for aquatic habitat conditions because they are dependent on one another. The Utility has a goal of improving overall aquatic habitat conditions and protecting those natural resources that are already in good condition and provide valuable benefits to the Utility, particularly flood reduction and water quality improvement.

5.A Habitat Programs

The Utility manages and conducts the following activities in support of habitat improvement:

- Education and outreach to streamside property owners
- Salmon watch program
- Benthic Index of Biotic Integrity (B-IBI) monitoring (measures the number and diversity of bugs in different stream as an indicator of water quality and habitat conditions)
- Participation in Water Resource Inventory Area (WRIA) 8 (Cedar/Lake Washington/Lake Sammamish) Salmon Recovery Council to plan for restoration and de-listing of Chinook Salmon populations as threatened species under the Federal Endangered Species Act

Table E-8. Recommended List of Supplemental Habitat Programs

Habitat Programs	Description	Benefits
CW-13: Address Prioritized Fish Passage Barriers	Implement a fish barrier removal program and conduct an internal informational campaign	• Systematic removal of priority fish barriers addresses regional and tribal fish passage concerns • Opportunities for incorporating fish barrier removal on City-led or permitted projects will not be missed
CW-21: Stream Habitat and Fish Monitoring	Perform habitat surveys on three stream channel reaches and annual fish surveys to monitor habitat quality and fish population trends	• Monitoring data will provide a baseline for understanding the effects of retrofit and other projects to improve aquatic habitat conditions that support fish populations in Kirkland's streams
CW-24: Property Acquisition Priority Map	Develop a map (for internal use) of priority parcels for acquisition based on Utility goals	• Identification of desirable properties for acquisition would facilitate decision making as properties become available for transfer
CW-26: Urban Forestry and Tree Inventory	Update citywide public right-of-way tree inventory, develop the framework for a treebate program	• Previously completed tree inventory has not been maintained and does not contain the level of detail needed for effective management • Updated tree inventory would allow for a better understanding of the type, location, and age of trees that provide surface water and stormwater environmental functions (temperature moderation, water uptake, detritus, food sources for bugs, etc.) in public right-of-way • Treebate program would provide funds for residents to plant new trees that provide surface water functions on private property • Cost-sharing with other departments that utilize urban forester for benefits beyond surface water • Eco-benefits analysis
CW-29: Noxious Weeds and Invasive Plants	Review noxious weed programs implemented by other jurisdictions and develop a Kirkland-specific program to be implemented across departments, and use volunteers to the extent feasible	• Citywide control of noxious weeds will benefit the Surface Water Utility through decreased time spent on control of noxious weeds at surface water facilities, and better success rates for stream and wetland restoration projects • A noxious weed program will be very important as LID facilities are constructed throughout the city, as these facilities are typically vegetated and compost-amended soils provide an excellent growing medium for all plants including noxious weeds that get imported to the site in one manner or another
CW-35: Private Streambank Stabilization Program	Evaluate the existing private streambank stabilization program and provide recommendations for future continuation and project criteria	• The program will be more effective with clarity on how and when funds should be used
CW-37: Volunteer Involvement	Evaluate the use of volunteers for surface water program activities and recommend whether the program should be expanded, diminished, or abandoned based on benefits and costs	• The results of this evaluation will help utilize volunteers more effectively

Recommended program additions are intended to ensure that the City continues to make progress on removal of fish passage barriers (CW-13), to protect trees and streamside habitat through inventory acquisition, monitoring and management (CW-21, CW-24, CW-26, CW-29), and to clarify the criteria and goals for habitat-related volunteer projects and construction projects (CW-35, CW-37).

5.B Habitat Capital Projects

A habitat inventory was conducted for the 2005 Surface Water Master Plan Update. New natural resources, including several stream channels were added with the 2011 annexation, and surveyed for overall condition and habitat issues for this Plan. Champagne Creek and Denny Creek, the two largest streams in the annexation area exhibit physical conditions that were likely caused by a combination of high stormwater flows that contributed to bank erosion, landslides, and subsequent sedimentation that results in poor habitat conditions for fish. Information from review of streams in pre-annexation Kirkland collected during the 2005 Surface Water Master Plan and the Juanita Creek Retrofit Project remains valid: high stream flows from stormwater runoff impacts water quality and fish habitat. Capital projects have been built, and programs developed as a result of the previous plan continue, though progress is challenging to measure given the long timeframe required to measure noticeable changes in these systems. This plan includes a prioritized list of capital projects to continue making progress on stream and habitat issues.

Table E-9. Recommended Habitat Capital Projects

ID	Project	Primary goal	Preliminary cost
CDE-01	Culvert replacement to improve fish passage	Habitat	$615,000
F0-08	Forbes Creek/BNSF Fish Passage Improvements	Habitat	$424,000
CH-02	Channel reconstruction	Habitat	$690,000
FO-05	Culvert replacement	Habitat	$1,058,000
EC-02	Everest Park channel and riparian restoration	Habitat	$1,096,000
FO-01	Fish passage	Habitat	$333,000
CJC-9	Culvert replacement to improve fish passage	Habitat	$613,000
JC-03	Juanita Creek floodplain creation	Habitat	$533,000
TOTAL	Habitat Capital Projects		$5,362,000

Public culverts (pipes that carry streams beneath public roadways or other structures) were inventoried and ranked according to whether they present a barrier to fish passage. There are five publicly-owned culverts that represent significant barriers to fish passage. Addressing fish passage barriers through culvert alteration or replacement would open new areas of physical habitat for fish, though this must be combined with flow control and water quality improvements to fully restore fish habitat.

Stream habitat conditions in urban areas is largely determined by stormwater flow (and control of those flows) and by water quality. Physical habitat is an important element, and must be managed in conjunction with these two elements. It is recommended that fish passage barrier removal projects be constructed, and that physical habitat projects be prioritized to take place after flow control and water quality retrofits are in place upstream of the proposed in-stream habitat projects. Table E-9 lists recommended habitat-related capital projects.

■ 6. POLICY ISSUES AND RECOMMENDATIONS

The Plan outlines a number of policy decisions that require input from City Council, including how or whether or not the Utility should conduct certain activities and how and when stormwater rates should be used or divided amongst programs. The policy questions and discussion items in this Plan are summarized below.

6.A Property Acquisition

The Utility does not currently set aside CIP funds for property acquisition and there has not been a formal policy regarding property acquisition specifically for the purpose of preserving natural resources that influence the quality and quantity of stormwater runoff.

Preservation of wetlands and stream corridors is the least expensive and most efficient way to control the quantity and quality of stormwater runoff. Although sensitive area regulations in Kirkland's Zoning Code control development in these areas, reasonable use provisions still allow impacts. Thus there are instances where City ownership of property can help to prevent impacts to these crucial areas.

Although there are no regulatory requirements for the Utility or the City to use property acquisition as a surface water management technique, property acquisition is justifiable in instances where acquisition reduces or eliminates the need for stormwater treatment or flow control facilities. Acquisition prevents creation of new impervious surfaces, and thus protects the existing stormwater system.

The Parks Department has historically been the primary City entity that acquired and managed property. Acquisitions within Parks are driven by the desired level of service, which is often focused on active parks and additions to existing natural areas parks. The surface water benefits of acquisition are certainly considered but are not the main interest in Parks acquisitions.

The following could constitute a policy for acquisition:

- Review City land base to identify stream corridors and wetlands that have potential for development
- Acquire lands that are directly linked to surface waters (study on programmatic side or in CIP) as opportunities arise
- Conduct restoration of acquired areas through capital programs and programmatic actions
- Coordinate with the Parks Department on acquisition of upland forested areas that contribute to watershed health

The City Council could choose either to create an opportunity fund within the CIP for acquisition, or to draw from reserves for occasional purchases. Funds would also need to be budgeted for maintenance of acquired areas to reduce City liability and/or to enhance their features and benefits.

6.B Water Quality Policies

The current policy for water quality CIP projects includes:

- Retrofit existing public infrastructure for water quality treatment by adding treatment facilities to transportation projects above and beyond what is required as mitigation for the project (be opportunistic)
- Conduct watershed-scale planning for retrofit of existing public streets in order to position the City to take advantage of grants for construction of retrofit projects

Several state and federal laws require that Kirkland take action to improve water quality. Currently, none of these laws specifically require capital projects to improve the quality of stormwater, but these are likely coming in the future. The Permit currently requires agencies to prioritize retrofit projects and may in the near future require construction of these projects. The Puget Sound Partnership has noted that stormwater is the largest source of pollutants to Puget Sound, and thus state interest and grant funding for water quality retrofit projects has increased. In addition, water quality is one of the factors that heavily influence fish habitat.

Input on current policy for water quality treatment CIPs would provide clarity for the long-term strategy for retrofitting Kirkland with current stormwater treatment facilities.

6.C Beaver Activity

Crews respond to citizen complaints about beaver activity, and provide assistance when water impounded by beaver dams impacts a public facility. The City may wish to consider formalizing policy direction as to when property flooding due to beavers constitutes a public benefit, and whether hand removal of dams should be conducted where the City has obtained a Hydraulic Project Approval (HPA) from the Washington Department of Fish and Wildlife (WDFW).

6.D Stream Deltas in Lake Washington

Shoreline conditions are linked with upstream hydrologic conditions, as stream channels deliver water and sediment to Lake Washington. Whereas the Utility's goals are mostly environment- and infrastructure-oriented, the Shoreline Management Program requires consideration of recreational uses, such as boat launches and marinas. Sometimes local sediment deposition in these areas can temporarily limit accessibility for recreational functions that require deeper marinas to accommodate boats. The City may wish to consider ways to either warn boaters of hazards near stormwater outfalls, or remove those hazards by either dredging or extending stormwater outfalls. King County Water and Land Resources Wastewater Division will be contributing funds toward conducting a bathymetric survey of the stormwater outfall near the boat launch at Marina Park to determine the magnitude of sediment buildup and potential impacts on boat launch operations.

6.E Neighborhood Drainage Assistance Program

The Neighborhood Drainage Assistance Program (SD-0081) was created during the development of the 2013–18 CIP to assist with problems for which the City is not liable but for which a fix would be relatively inexpensive and would benefit several property owners. The program is funded at $50,000 every second (odd) year. Frequently projects constructed under this program cost less than $50,000 and can be constructed by City maintenance crews. It is recommended that staff refine and bring to Council criteria for use of these funds.

6.F Capital Program Policy Direction

In addition to capital projects recommended in this Plan, the Utility supports transportation-oriented projects through the allocation of funds for the surface water portion of those projects. This money is used for installation or replacement of pipes, catch basins, and flow-control and water quality treatment facilities associated with transportation projects. Currently, $950,000 annually has been transferred to this fund; however, only about $500,000 per year has been spent, resulting in accumulation of reserves. It is recommended that the funding be more closely matched with the anticipated transportation CIP needs. Review of the transfer amount during development of the 6-year Capital Improvement Program is recommended to more efficiently allocate surface water funds.

■ 7. PROGRAMS SUMMARY

Recommended program additions are described above according to the particular Utility goal that is met by implementation of the program. Table E-10 provides a full list of recommended programs with funding requirements and priority (required vs. augmentation of an existing program) of the recommended program additions.

Table E-11 presents a summary of programs by goal. The largest percentage of recommended costs are due to infrastructure needs (68%), and the lowest percentage are due to flooding needs (3%). This is because infrastructure requires a high level of on-going maintenance (with associated staff and equipment) while flooding is primarily addressed through capital projects. The highest cost programs in the plan are TV Inspection (CW-1) and Ditch Maintenance (CW-4), which are both associated with the infrastructure goal.

Table E-12 presents a summary of projects by priority (required or augmented). Items are placed in the required priority based on the fact that they are needed for meeting basic maintenance standards, and/or because they are associated with requirements in the Permit. Items in the required category constitute 65% of total recommended costs.

■ 8. CAPITAL PROJECT SUMMARY

A full summary of capital projects recommended in this Plan is listed in is Table E-13 and Figure E-1. Table E-14 presents a summary of project costs by goal. The largest proportion of funding (42%) is dedicated to flood reduction projects, though the majority of this cost is due to one large project. The next largest proportion (32%) is dedicated to infrastructure projects, followed by habitat (19%), and then by water quality (7%). It is recommended that the project list be constructed within 10 years as shown in Figure E-2, with the exception of the regional detention project recommended to resolve flooding issues at the interchange of I-405 and NE 116th Street (project FO-02), which is recommended for future construction once a funding strategy is evaluated and identified. Due to the size of the project, it is assumed that revenue bond financing or buildup of cash reserves may be necessary in order to mitigate potential rate increases.

■ 9. RESOURCES NEEDS AND FUNDING

Program and project recommendations in this Plan must be supported by adequate resources in order to be successful. Staffing and budget were considered in development of the Plan

9.A Staffing Needs for Plan Implementation

The Utility currently supports 28.04 full-time equivalent staff (FTEs). Implementation of programs and projects recommended in this Plan results in the need for 6.5 additional FTEs in the Operation and Maintenance Group and 1 FTE in the Engineering, Stewardship and Environmental Group. Table E-15 lists the specific staffing needs and the programmatic elements of the Plan that require additional staff.

9.B Financial Considerations

Current Utility revenue is approximately $8.5 million and is supplemented by other funding sources including:

- King Conservation District: approximately $55,000 per year, often shared with the Green Kirkland Partnership
- King County Flood Control District Sub-Regional Opportunity Fund: approximately $238,000 per year that in 2014 will be dedicated to Totem Lake flood reduction projects,

Table E-10. Programmatic Recommendations and Costs (continued)

ID	Name	Program priority: Required	Program priority: Augmentation	Staffing needs	Average Annual cost ($1,000s)	One-time costs ($1,000s)	Primary Goal
CW-1	TV Inspection of Pipes	✓		✓	$152.0		Infrastructure
CW-2	LID Maintenance	✓		✓	$11.0		Infrastructure
CW-3	Street Sweeping	✓			$25.0		Flooding
CW-4	Ditch Maintenance	✓		✓	$355.0		Infrastructure
CW-5	Maintenance on Goat Hill: Equipment Rental	✓			$3.0		Infrastructure
CW-6	Development Review Evaluation	✓				$4.0	WQ-Permit
CW-7	LID Code Review	✓				$45.0	WQ-Permit
CW-8	LID Implementation and Manual Adoption	✓			$18.0		WQ-Permit
CW-9	Stormwater Facility Inspection	✓		✓	$40.0		WQ-Permit
CW-19	Develop LID Feasibility Tools	✓				$68.0	WQ-Permit
Subtotal Required Strategies					**$604.00**	**$117.0**	
CW-10	Service Truck		✓		$36.0		Infrastructure
CW-11	Spill Response Truck		✓		$29.0		WQ-Permit
CW-12	Beaver Management Policy		✓		$5.0		Flooding
CW-13	Address Prioritized Fish Passage Barriers		✓		$1.0		Habitat
CW-14	Evaluation of Incentives and Rebate Programs		✓		$1.4		Infrastructure
CW-15	Utility Rate Study		✓			$36.0	Infrastructure
CW-16	Proactively Avoid TMDL		✓		$26.0		Water Quality
CW-17	City-specific Water Quality Monitoring		✓		$9.7		Water Quality
CW-18	Watershed Planning		✓			$44.0	Water Quality
CW-20	Incorporation of LID into City Capital Projects		✓			$2.7	Infrastructure
CW-21	Stream Habitat and Fish Monitoring		✓		$48.0		Habitat
CW-22	O&M CIP Consultation		✓		$1.3		Infrastructure
CW-23	Environmental Permitting for Maintenance		✓		$18.0		Infrastructure
CW-24	Property Acquisition Policy and Priority Areas		✓			$37.0	Habitat
CW-25	Evaluation of Stream Deltas in Lake Washington		✓			$7.0	Infrastructure
CW-26	Urban Forestry and Tree Inventory		✓		$10.0		Habitat
CW-27	Climate Change Evaluation		✓			$55.0	Infrastructure
CW-28	Streamside Restoration Maintenance		✓		$30.0		Infrastructure
CW-29	Noxious Weeds and Invasive Plants		✓		$4.0		Infrastructure
CW-30	Juanita Creek Floodplain Mapping		✓			$11.0	Flooding
CW-31	Map Areas of Treatment for Existing Stormwater Facilities		✓		$65.1		Water Quality
CW-32	Stormwater System Rehabilitation Catch-up		✓		$24.0		Infrastructure
CW-33	Retrofit Opportunities		✓			$6.0	Water Quality
CW-34	Leaf Pick-up Program		✓			$11.0	Flooding
CW-35	Private Streambank Stabilization Program		✓			$5.7	Habitat
CW-36	Scoop Law Evaluation		✓			$6.5	Water Quality
CW-37	Volunteer Involvement		✓			$4.3	Habitat
CW-38	Neighborhood Drainage Assistance		✓			$4.2	Flooding
CW-39	Residential Stormwater Audit Program		✓	✓	$0		Infrastructure
CW-40	Neighborhood Rain Garden Program		✓	✓	$0		Infrastructure
Subtotal Required Programs					**$564.0**	**$117.0**	
Total: All Programs					**$912.5**	**$347.4**	

Table E-11. Summary of Programmatic Recommendations by Goal

Program Goal	Number of Programs	On-Going Average Annual Cost ($1,000s)	One-Time Cost ($1,000s)	Total Cost Over 10 Years ($1,000s)*
Flood Reduction	5	$30.0	$26.2	$326.2
Water Quality - Permit	6	$87.0	$117.0	$987.0
Water Quality	6	$100.8	$56.5	$1,064.5
Infrastructure	17	$635.7	$100.7	$6,457.7
Habitat	6	$59.0	$47.0	$637.0
TOTAL	**40**	**$912.5**	**$347.4**	**$9,472.4**

* Total Cost Over 10 Years = (Average Annual Cost X 10) + One-Time Costs

Table E-12. Summary of Programmatic Recommendations by Priority

Priority	Number of Programs	Cost of Programs ($1000s)		Total Cost Over 10 Years ($1000s)*
		On-Going Average Annual Cost	One-Time Cost	
Required	10	$604.0	$117.0	$6,157.0
Augmented	30	$308.5	$230.4	$3,315.4
Total	**40**	**$912.5**	**$347.4**	**$9,472.4**

* Total Cost Over 10 Years = (Average Annual Cost X 10) + One-Time Costs

- Washington State Department of Ecology NPDES Municipal Capacity Grants: $120,000 for 2014-2015 for NPDES Permit implementation and water quality retrofit planning (future allocations are likely)
- One-time grants for both capital construction and studies. To provide just a few examples, the City was awarded $739,236 for the stormwater portion of the Park Lane project in 2012, and was awarded $247,100 for the Totem Lake/Juanita Creek Basin Stormwater Retrofit Conceptual Design project in 2013.

The 2014 rate for a single-family residence is $15.60 per month. Commercial and multi-family surface water charges are based on the number of "equivalent services units" (ESU) of impervious surface on the property, where one ESU equals 2,600 square feet. Single-family residences pay a flat fee, or 1 ESU. There is currently a total of about 45,500 ESU of impervious surface in billing records.

The potential rate impacts of the Plan's recommendations were an important consideration in development of the Plan with the goal of minimizing the need for rate increases over the ten-year life of the Plan. Costs for programs and projects presented in the Plan are estimated in 2014 dollars.

Table E- 13 Recommended Capital Projects

ID	Project	Primary goal	Preliminary cost
FO-02	Regional detention in Forbes Creek basin	Flooding	$10,000,000
DE-01	Sediment removal in channel	Flooding	$136,000
JC-07	Goat Hill stabilize eroding channel	Flooding	$299,000
JC-08	Goat Hill increase pipe conveyance capacity	Flooding	$490,000
RED-01	Underground injection control well (infiltration facility)	Flooding	$65,000
JC-06	Goat Hill route flow away from open channel	Flooding	$521,000
JC-04	Flow diversion	Flooding	$266,000
CH-03	Rain garden and bioretention retrofit	Water quality	$85,000
FO-07	Channel grade control	Water quality	$165,000
CA-1	Erosion control measures	Water quality	$550,000
FO-13	Pilot LID water quality project associated with planned transportation project	Water quality	$65,000
JC-01	Sediment removal	Water quality	$194,000
EC-01	Ravine stabilization	Water quality	$830,000
CDE-01	Culvert replacement to improve fish passage	Habitat	$615,000
F0-08	Forbes Creek/BNSF Fish Passage Improvements	Habitat	$424,000
CH-02	Channel reconstruction	Habitat	$690,000
FO-05	Culvert replacement	Habitat	$1,058,000
EC-02	Everest Park channel and riparian restoration	Habitat	$1,096,000
FO-01	Fish passage	Habitat	$333,000
CJC-9	Culvert replacement to improve fish passage	Habitat	$613,000
JC-03	Juanita Creek floodplain creation	Habitat	$533,000
CH-04	Groundwater seepage and road stability	Infrastructure	$126,000
CH-01	Undersized pipe to be replaced	Infrastructure	$219,000
CW-INF-02	Pipe repair and replacement	Infrastructure	$3,025,000
CW-INF-01	Pipe repair and replacement	Infrastructure	$769,000
JC-05	NE 141st Street/111th Avenue NE culvert replacement	Infrastructure	$765,000
MB-01	Replace stormwater pipes	Infrastructure	$680,000
HAS-01	Pipe replacement, improved hydraulics	Infrastructure	$2,369,000
JC-02	Infrastructure/conveyance	Infrastructure	$874,000
Total cost			**$27,855,000**

Table E- 14 Summary of Recommended Capital Projects

Program Goal	Number of Projects	Cost of Projects in 2014 Dollars
Flood Reduction	7	$11,777,000
Water Quality	6	$1,889,000
Infrastructure	8	$8,827,000
Habitat	8	$5,362,000
TOTAL	29	$27,855,000

A financial analysis was conducted by an outside consultant. The financial analysis incorporates factors including estimated inflation rates, the need to maintain sufficient reserves, options for smoothing potential rate increases, and shifting or reduction of set annual allocations (such as the funding of the surface water portion of transportation projects). A Utility Rate recommendation for the coming biennium will be presented later, however, the financial analysis indicates that the Plan recommendations can be implemented alongside existing programs and projects over a 10-year timeframe with moderate additions to current Utility revenue.

Figure E-1 Recommended Capital Improvement Projects

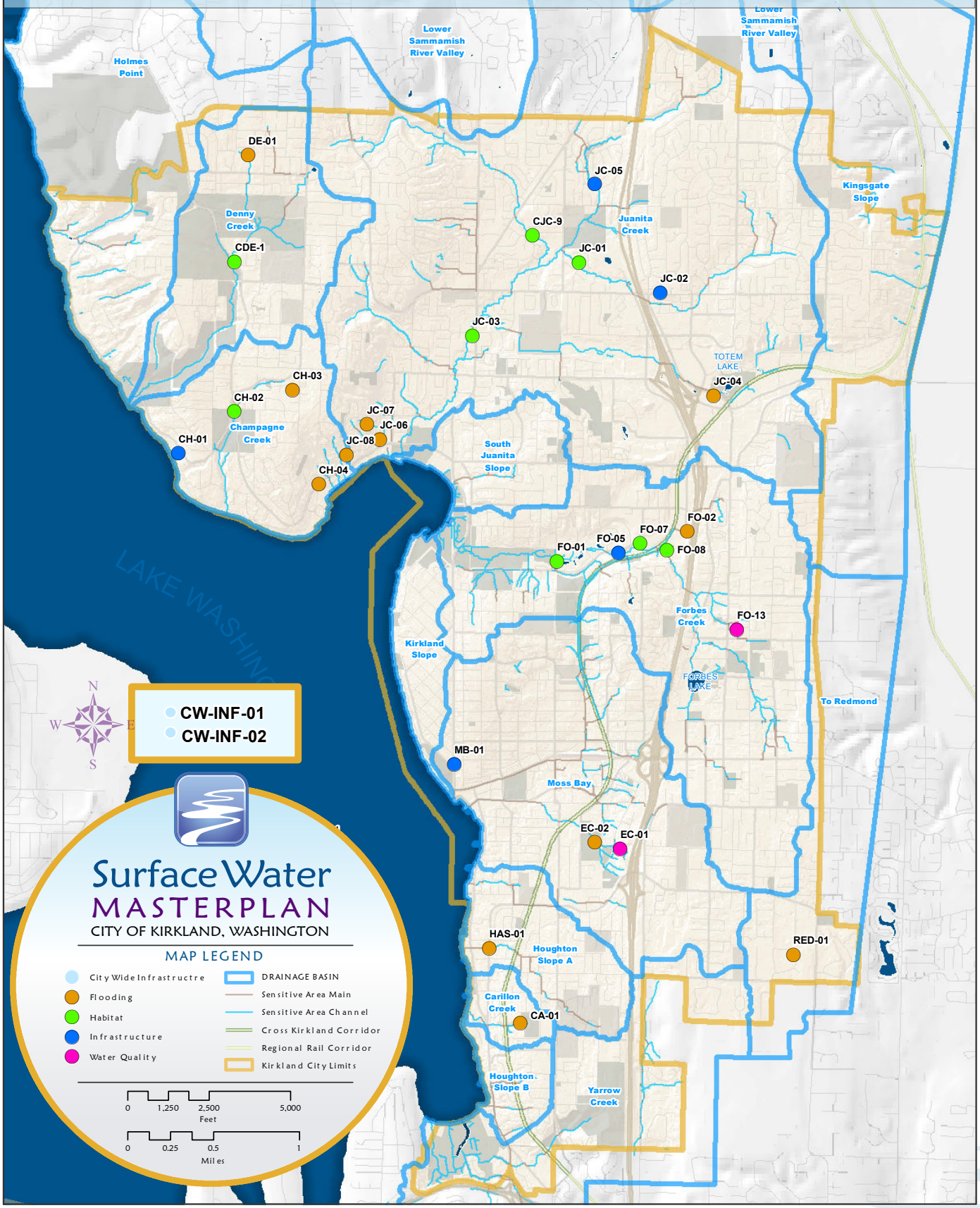
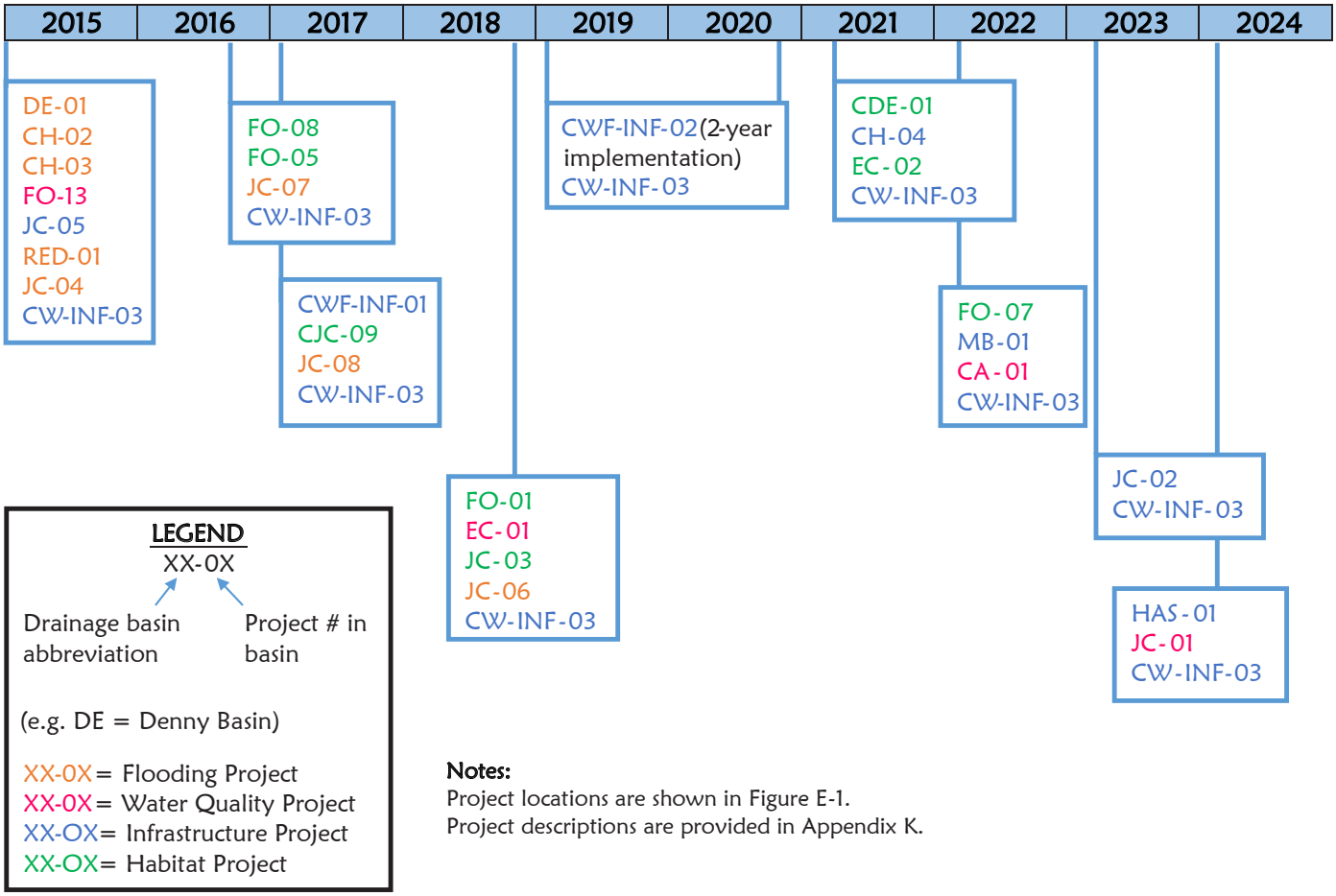


Figure E-2 Suggested schedule for capital project construction



Notes:
Project locations are shown in Figure E-1.
Project descriptions are provided in Appendix K.

Table E-15 Summary of Staffing Needs

Position	Staffing (FTE)	Programmatic element
Required		
Senior Maintenance Worker	0.5	TV Inspection of Pipes (CW-1)
Utility Worker	0.5	TV Inspection of Pipes (CW-1)
Senior Maintenance Worker	1.0	Ditch Maintenance (CW-4)
Utility Person (3)	3.0	Ditch Maintenance (CW-4)
Senior Maintenance Worker	0.5	Stormwater Facility Inspection (CW-9)
Subtotal	**5.5**	
Augmented		
Surface Water Engineer	1.0	Various infrastructure, water quality and habitat-related programs (CW-6-8, CW-12-14, CW-16-25CW-27, CW-31, CW-33-36, CW-38-40)
Subtotal	**1.0**	
Grand total	**6.5**	

10. PERFORMANCE MEASURES

Performance measures are presented as a way to help the Utility accountable to the City Council and to the citizens of Kirkland. Following on the City Council's approach to measuring and reporting progress for City-wide goals, proposed Utility performance measurements that specifically address Utility goals and relevant elements of City-wide goals were developed. Many of these items are already tracked as part of required reporting on the NPDES Phase II Permit. Performance measures include implementation (how much and when), effectiveness (how well), and community metrics (value to the residents) for each of the Utility's four goals. For overall performance, it is recommended that one implementation measure and one effectiveness measure be tracked for each Utility goal:

Flooding

- Flood reduction projects constructed within 5 years of problem identification (implementation)
- Number of flood-related road closures. Goal: 0 for up to a 50-year event (effectiveness)

Water Quality

- Compliance with NPDES Phase II Permit. Goal: 100% compliance (implementation)
- Number of stream reaches on the Department of Ecology's list of water-quality-impaired waters (the 303(d) list): Goal = 0 (effectiveness)

Infrastructure

- Percentage of pipes TV inspected per year. Goal: 10% of total length per year inspected and/or cleaned (implementation)
- Number of calls regarding infrastructure-related flooding. Goal: trend downwards (effectiveness)

Habitat

- Area retrofit with stormwater treatment and flow control facilities. Goal: develop percentage upon completion of map showing areas already treated (implementation)
- Benthic Index of Biotic Integrity (BIBI) Improvement. Goal: bring all Kirkland stream reaches up to fair (BIBI of 35) condition in 20 years (effectiveness)

The following performance measures can be used in the Environmental portion of the City's Annual Performance Report:

- **Compliance with NPDES Phase II Permit (goal is 100% compliance).** Achievement of this goal indicates that the City is taking important steps to protect and improve water quality.
- **Percent of impervious surface for which flow control and water quality treatment is provided.** This indicates how much stormwater in Kirkland is cleaned and slowed. Treatment includes both constructed facilities and dispersion of stormwater into the ground.

11. SUMMARY

This Surface Water Master Plan presents an overview of accomplishments since the last Plan was completed in 2005, as well as constraints and opportunities that shape this Plan. The programs and projects recommended are aimed at achieving Utility goals of flood reduction, water quality improvement, infrastructure protection, and habitat improvement using cost-effective strategies.

Flood reduction needs consist of minor program additions, and a list of flood reduction capital projects that is dominated by one large project (regional detention in the Forbes Creek basin) for which Council may wish to explore alternatives to financing via current rates. Water quality improvement needs are driven by the NPDES Phase II Municipal Stormwater Permit and the need to clean up streams that are on the State listed of impaired waters, and are aimed at controlling pollutants at their source, and at treating stormwater runoff from existing development including city streets. The largest proportion of the cost of the recommendations stems from infrastructure needs, including TV inspection of pipes and ditch maintenance as well as capital projects to repair and replace aging stormwater systems. Habitat needs include removing fish passage barriers, restoring streamside vegetation, and reconstructing stream channels.

Program recommendations are divided into two categories: required to meet basic maintenance standards and/or regulations, and augmented to meet community interests and prepare the Utility for the future. The cost of programs in the required category over 10 years in 2014 dollars is $6.1 million, and the cost of required plus augmented programs over 10 years is approximately $9.1 million.

The total cost of recommended capital projects is approximately $27.9 million in 2014 dollars, with $10 million of this due to one project that would address regional flooding. It is recommended that the list of projects be constructed within 10 years.

Implementation of the Plan would result in addition of 6.5 full-time equivalent staff (FTE) to a current staff total of 28.04 FTE. Current annual Utility revenue is approximately $8.5 million, and the 2014 Utility rate is $15.60 per month for a single-family residence. Financial analysis of the recommendations suggests that they can be accommodated alongside existing efforts with a relatively low rate increase.

This Draft Plan will be presented to the City Council and the public for consideration in early fall of 2014. A final Plan will then be developed based on Council and public comment, and Council adoption is anticipated in fall of 2014. Following adoption, reports on Plan implementation and program performance will be presented to Council once each year. Surface Water Utility rates and budget to support Plan implementation will be developed via separate processes. Implementation of this Plan will result in measurable progress on Utility goals that serve community interests.

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H B-IBI Data
I Operation and Maintenance Standard Operating Procedures
J Stormwater Retrofit Memorandum
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L Programmatic Project Summaries and Estimated Costs
M Prioritization and Ranking Criteria and Prioritization Spreadsheet
N Financial Analysis Memorandum
O Public Comment

Abbreviations

AC ..... Asbestos concrete
APWA ..... American Public Works Association
B-IBI ..... Benthic Index of Biologic Integrity
BMP ..... Best management practice
CAP ..... Corrugated aluminum pipe
CCTV ..... Closed-circuit television
CESCL ..... Certified Erosion Control and Sediment Lead
CIP ..... Capital Improvement Program
City ..... City of Kirkland
CKC ..... Cross Kirkland Corridor
Climate Plan ..... Kirkland Climate Protection Plan (2009)
CONC ..... Concrete
CPE ..... Corrugated polyethylene
CSGP ..... Construction Stormwater General Permit
DI ..... Ductile iron
Ecology ..... Washington State Department of Ecology
Ecology Manual ..... Stormwater Management Manual for Western Washington
ESA ..... Endangered Species Act
ESE ..... Engineering, Stewardship, and Education
FEMA ..... Federal Emergency Management Agency
FHNA ..... Finn Hill Neighborhood Alliance
FTE ..... Full-time equivalent

Abbreviations

GCP	Galvanized corrugated pipe
GIS	Geographic Information System
GMA	Growth Management Act
HPA	Hydraulic Project Approval
IDDE	Illicit discharge detection and elimination
IRAC	Interagency Resource for Achieving Cooperation
ISGP	Industrial Stormwater General Permit
IT	Information Technology
KC	King County
KMC	Kirkland Municipal Code
LCPE	Lined corrugated polyethylene
LID	Low-impact development
MIT	Muckleshoot Indian Tribe
MMIS	Maintenance management and information system
MS4	Municipal Separated Storm Sewer System
N/A	Not applicable
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PARIS	Permit Reporting and Information System
Permit	NPDES MS4 Permit
Plan	Surface Water Master Plan
PVC	Polyvinyl chloride
RCP	Reinforced concrete pipe
RCW	Revised Code of Washington
RSMP	Regional Stormwater Management Program
SEPA	State Environmental Policy Act
SHB	Senate House Bill
SMA	Shoreline Management Act of 1971
SOP	Standard operating procedures
STORM	Stormwater Outreach for Regional Municipalities
SWPE	Solid-wall polyethylene
SWPPP	Stormwater pollution prevention plan
TMDL	Total maximum daily load
USGS	United States Geological Survey
Utility	Surface Water Utility
WAC	Washington Administrative Code
WRIA	Water Resource Inventory Area

section 1

Introduction

1.A Why A Surface Water Master Plan?

Appropriate management of surface water in the City of Kirkland achieves multiple goals, all of which improve the quality of life for Kirkland citizens. The Surface Water Master Plan improves safety, reduces risk to public and private property, and enhances our natural environment. Improved safety is achieved by reduced flooding. Properly sizing and maintaining the City's stormwater conveyance system keeps water from ponding on the streets and sidewalks, creating safer conditions for motorists, bicyclists, and pedestrians. Reduced flooding also means a reduction in the risk of damage to property and business operations. The Plan also benefits groundwater management, which can contribute to reduced risk of landslides. Improved water quality and fish passage in the City's waterways, ponds, and lakes provides for enhanced recreation opportunities, including fishing, swimming, and enjoying the beauties of nature in our City. Management of the urban forest insures that Kirkland will remain a green and livable community for many years to come. The Surface Water Master Plan (Plan) outlines priorities and needs of surface water related work activities that take place in the city of Kirkland. It is a tool for City of Kirkland (City) staff to guide City Surface Water Utility (Utility) work programs, while effectively managing resources, complying with regulations, and coordinating with internal and external entities that have responsibilities for different aspects of surface water and stormwater management. City code (Kirkland Municipal Code [KMC] 15.52.030, Comprehensive Drainage and Storm Sewer Plan) requires that a Plan be developed by the City and adopted by the Kirkland City Council.

Surface Water and Stormwater: Are they the same thing?

Surface water is used to refer to all water at the surface of the landscape—streams, lakes, ditches, springs, and stormwater.

Stormwater is more specific—it is water that runs off the landscape during or directly after rain or snow events. In urban areas like Kirkland, paving and other development have changed the amount and rate of stormwater runoff and pollutant delivery, which has led to problems with flooding, water quality, and aquatic habitat in our streams and lakes.

1.B Plan Overview

This plan sets the course for the next 10 years of Utility Operation. The first 5 sections of the plan present the "why" behind the recommendations; community and regulatory drivers, challenges and opportunities facing stormwater management efforts in general, current conditions of the natural and built stormwater system, and current programs and budget. The final sections of the plan present the "what"; programs and projects and their associated costs, and recommendations for prioritizing and funding the recommended actions. Taken as a whole, the plan presents both a compendium of current knowledge about stormwater in Kirkland, and a roadmap to lead the Utility confidently into the future.

1.B.1 Evolution of Surface Water Management in Kirkland

Kirkland's Surface Water Utility was formed in 1998 (Figure 1-1), following completion of the City's first Surface Water Master Plan in 1994. In the ensuing years, regional and national changes have occurred in the way surface water and stormwater are managed, with a clearer recognition of impacts to natural resources and aquatic species. The 1999 listing of Puget Sound Chinook salmon as a threatened species under the Endangered Species Act (ESA) resulted in widespread regional surface water management changes in order to prevent the further decline of the species, and to promote salmon population recovery.

The last Surface Water Master Plan update was completed in 2005. Since then, many of the programs and projects in that Plan have been implemented. In addition, significant changes have occurred: The size of the city has increased through annexation of the Finn Hill/Juanita/Kingsgate area, the City's

Figure 1-1 Significant Events in Surface Water Management in the City of Kirkland

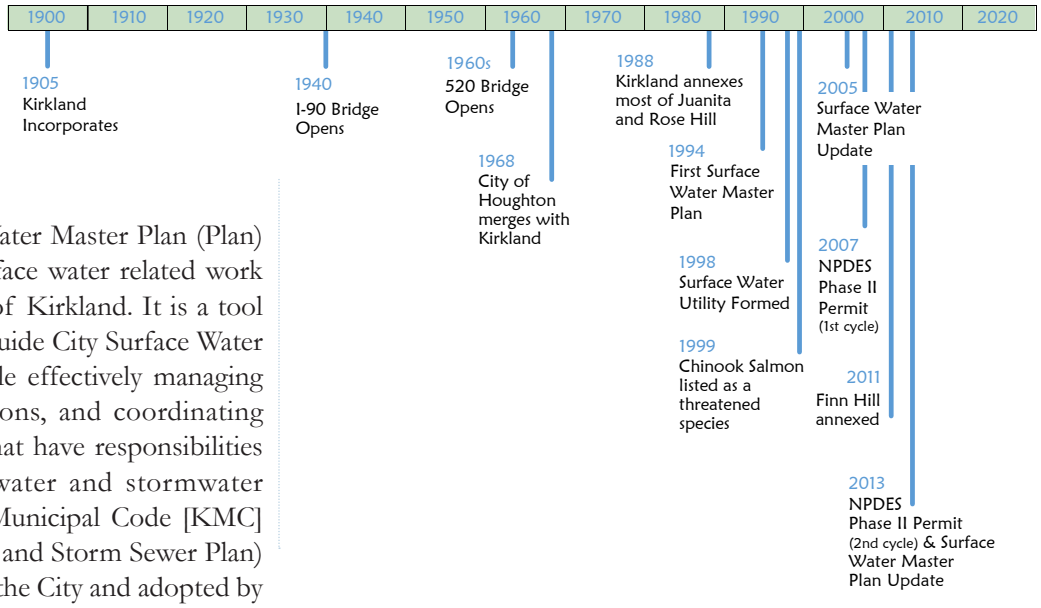
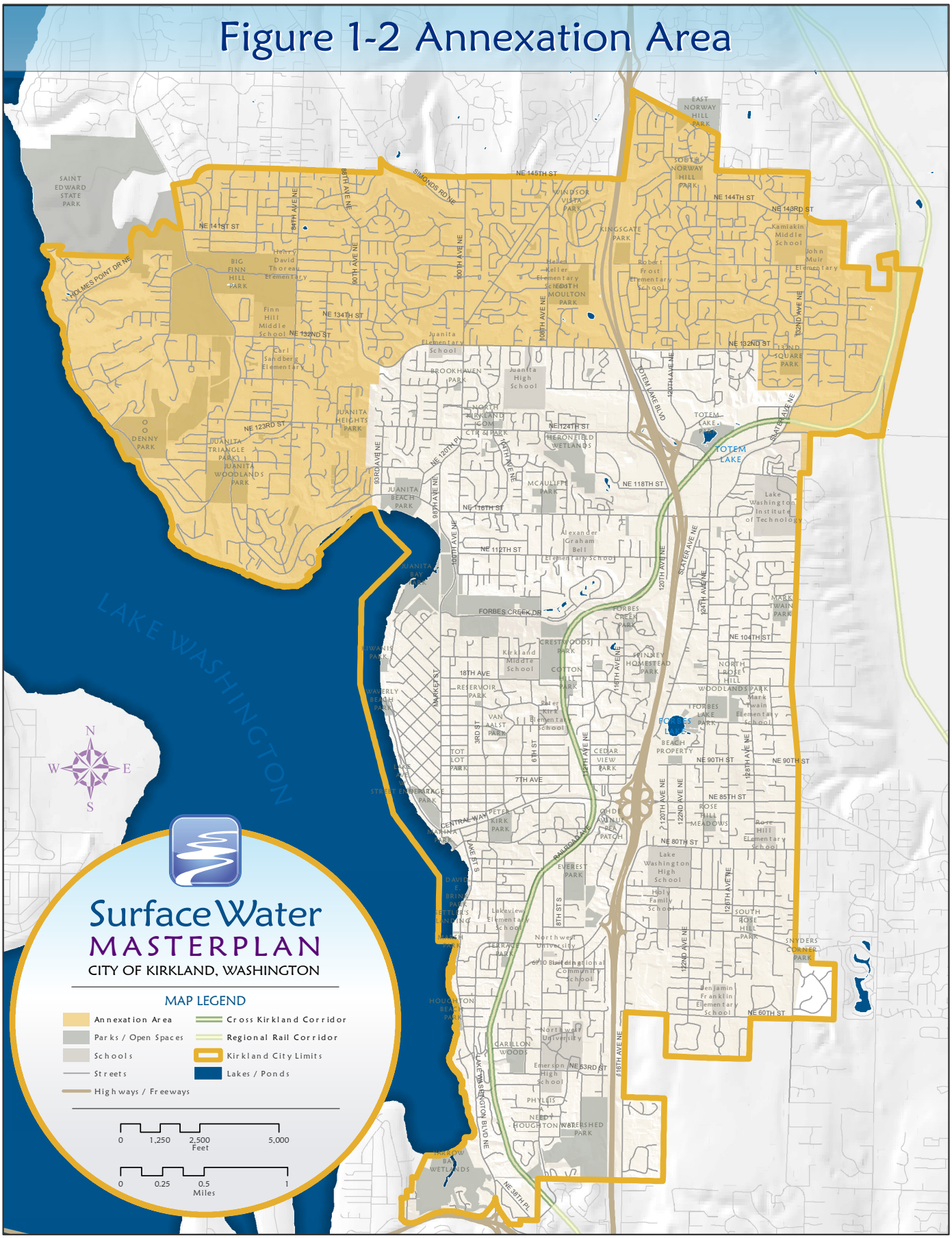


Figure 1-2 Annexation Area



National Pollutant Discharge Elimination System (NPDES) Phase II Municipal Separated Storm Sewer System (MS4) Permit (Permit) was reissued on August 1, 2013, and overall thinking about surface water management has shifted to an emphasis on low-impact development (LID).

1.B.2 Plan Drivers

This Surface Water Master Plan update has several drivers, including annexation of new land and the NPDES Phase II MS4 Permit. These drivers are explained briefly below.

1.B.2.a Annexation

The annexation area (Figure 1-2) represented a 40% increase in the area and a 35% increase in the population of Kirkland. The new area contains large amounts of stormwater infrastructure, and represents a different mix of infrastructure types from what were represented in the city before 2011. Several significant streams including Denny Creek, Champagne Creek, and Holmes Point Creek are in the City's jurisdiction, and habitat and water quality needs must be evaluated. The Plan compiles issues and problems from the first 3 years of Utility operations in this area, and identifies strategies for addressing specific habitat and infrastructure problems in the annexation area over the next 10 years.

1.B.2.b NPDES Phase II MS4 Permit

The Phase II NPDES Municipal Stormwater Permit requires that local jurisdictions with a population of less than 100,000, such as Kirkland, must conduct activities that address the following elements in order to discharge stormwater from their MS4 to Waters of the United States:

What is a Stormwater System and what's in it?

The stormwater system consists of pipes and ditches to convey water, catch-basins to collect the water from the surface (i.e., on roads, parking lots), and stormwater treatment facilities (e.g., detention ponds, vaults, swales) that control the quantity and quality of the water discharged to streams, lakes and the ground.

- Public involvement on surface water projects (e.g., restoration, catch-basin stenciling)
- Public education on surface water issues (e.g., water quality, spill prevention)
- Illicit discharge detection and elimination (IDDE) to ensure that non-stormwater (e.g., chemicals, wash water from cleaning equipment) is not put into the stormwater system
- Control of runoff from new development, redevelopment, and construction sites
- Municipal operations and housekeeping (e.g., cleaning the stormwater system pipes and catch basins, ensuring stormwater facilities function as intended)
- Reporting and monitoring to support the above elements

In Washington, the State Department of Ecology (Ecology) issued the first Permit in 2007 to Kirkland and similarly sized cities. Ecology issued a subsequent Permit that became effective on September 1, 2013, and remains valid through August 2018 (Western Washington Phase II 2013–2018 Stormwater Permit).

The new Permit results in the following changes for Kirkland developers and the Utility:

What is Low Impact Development?

Low Impact Development (LID) is a stormwater and land use management strategy that strives to mimic hydrologic processes (i.e., infiltration into the ground, evaporation and transpiration by plants, and storage in wetlands, floodplains and the ground) that would have occurred in a natural landscape.

- There will be an increase in the number of development proposals requiring design review
- Development projects must install stormwater facilities that allow as much stormwater as possible to soak into the ground
- Requires that municipal codes be reviewed and opportunities be identified for incorporating LID principles and best management practices (BMPs) into development code, rules, standards, and other enforceable documents
- Increases the required inspection frequency for publicly owned catch basins from once every permit cycle (5 years) to once every 2 years
- The City will pay into a regional monitoring fund rather than conduct individual Permit-required water quality monitoring

The majority of existing Utility programs are focused on compliance with the NPDES Phase II Permit, and these new Permit requirements will require additional staff and resources to maintain compliance.

1.C Surface Water Utility Goals

The overarching goals of the Surface Water Utility are to manage surface water and stormwater in Kirkland such that:

- Flooding is reduced
- Water quality is improved
- Infrastructure is protected and maintained
- Aquatic habitat conditions are improved
- The public is educated on ways to protect water quality and the environment

1.C.1 Relation to City Council Goals

These goals fit with broader City Council goals that articulate the service priorities in Kirkland. The City Council goals that are related to the Surface Water Utility's work efforts include the following:

1.C.1.a Neighborhoods

City Council Goal: Achieve active neighborhood participation and a high degree of satisfaction with neighborhood character, services, and infrastructure

Surface Water Utility Role: Public involvement and education is a key component of stormwater management in Kirkland, and City stormwater staff actively solicit feedback and provide opportunities for neighborhood participation.

1.C.1.b Public Safety

City Council Goal: Provide for public safety through a community-based approach that focuses on prevention of problems and a timely response

Surface Water Utility Role: Through active maintenance and repair of stormwater infrastructure and preparation for and response to extreme weather events or accidental spills, City stormwater staff work to protect the public from flooding and pollutants in the stormwater system.

1.C.1.c Parks, Open Spaces, and Recreational Services

City Council Goal: Provide and maintain natural areas and recreational facilities and opportunities that enhance the health and well-being of the community.

Surface Water Utility Role: Through development review and local and regional stormwater regulations, City stormwater staff enforce regulations that protect water quality and aquatic habitat in the City's parks and open spaces.

1.C.1.d Financial Stability

City Council Goal: Provide a sustainable level of core services that are funded from predictable revenue

Surface Water Utility Role: Stormwater management is funded through stormwater fees paid by residents and businesses. City Stormwater staff use those funds responsibly to provide core stormwater services that benefit the public.

1.C.1.e Environment

City Council Goal: Protect and enhance our natural environment for current residents and future generations

O.O. Denny Park in newly annexed Finn Hill neighborhood

Surface Water Utility Role: Manage surface water and stormwater such that it doesn't negatively impact the City's aquatic natural resources, and provide educational opportunities for residents and school-age children to teach them how they can protect and enhance the natural environment through choices they make.

1.C.1.f Economic Development

City Council Goal: Attract, retain, and grow a diverse and stable economic base that supports City revenues, needed goods and services, and jobs for residents

Surface Water Utility Role: Work with developers and City planning staff to identify regional stormwater facilities or other stormwater management techniques that protect the environment and provide predictable services for developers that are reinvigorating parts of Kirkland.

1.C.1.g Dependable Infrastructure

City Council Goal: Maintain levels of service commensurate with growing community requirements at optimum life-cycle costs

Surface Water Utility Role: In conjunction with stormwater operations and maintenance, maintain stormwater infrastructure and ensure that new infrastructure is built to appropriate standards.

1.D Surface Water Utility Responsibilities

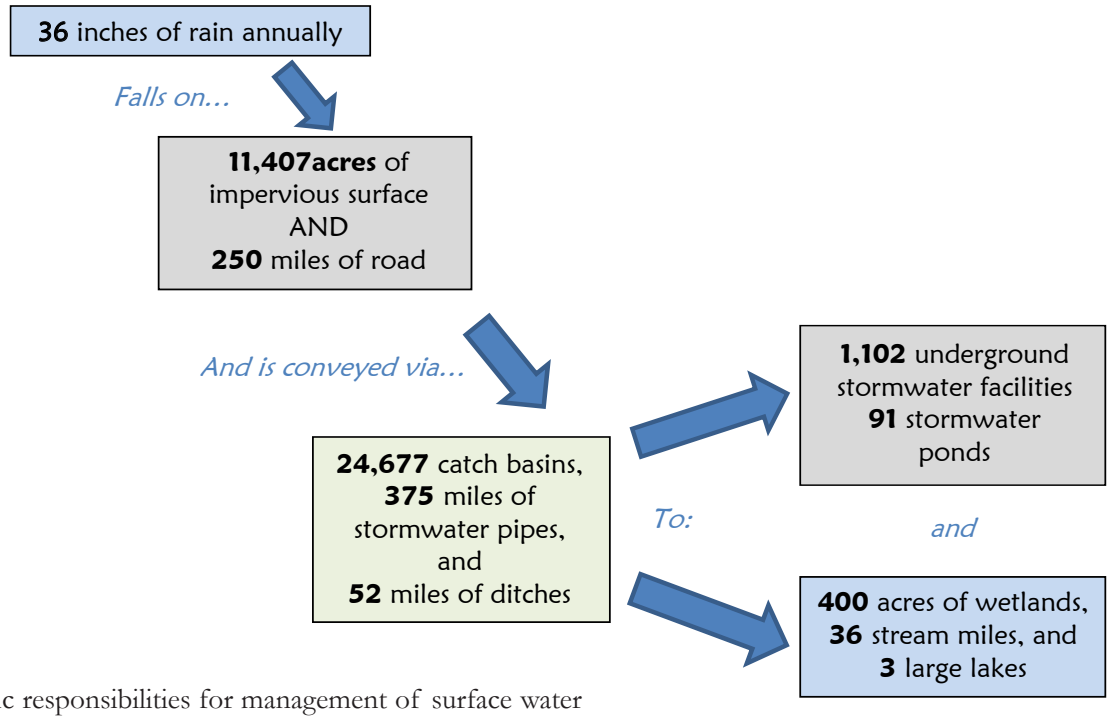
The conveyance system that transports stormwater runoff consists of private and public infrastructure, which can complicate maintenance obligations and responsibilities, however, the Surface Water Utility's responsibilities relate to public stormwater runoff and its effects on public infrastructure and natural resources (Figure 1-3). Stormwater runoff has implications for flooding, water quality, and aquatic habitat, and requires operations and maintenance of conveyance infrastructure and protection of property and receiving waters.

1.D.1 Operations and Maintenance

The Operations and Maintenance (O&M) Group provides the following types of services:

- Support surface water Geographic Information System (GIS) mapping and documentation of maintenance activities via Kirkland's maintenance management information system (MMIS)
- Support new technologies developed in surface water cleaning equipment and operating procedures
- Maintain field staff documents such as the spill response manual and standard operating procedures (SOP) document

Figure 1-3. Simplified schematic of stormwater runoff



Specific responsibilities for management of surface water and stormwater in Kirkland are described below and summarized in Table 1-1.

Table 1-1. Summary of surface water utility programs and functions funded by stormwater

Operating Program Area	Functions
Maintenance and Operation of Public System	Cleaning (pipes, ditches, catch basins, ponds, etc.)
	Inspection
	Flood response
	Repair and maintenance
	Spill response
	Street sweeping (75% of total cost of program)
	Tree pruning and management in public right-of-way
Engineering, Stewardship, and Education (formerly Customer Service)	Education, outreach, and public involvement
	Development review (costs partially recouped by permit fees)
	Engineering/environmental permitting support
	Regulatory compliance coordination
	Pollution source control
	Watershed/utility planning
	Urban forestry (funded; staff in Planning Department)
Capital improvement	Surface water portion of transportation projects
	Surface water capital projects (general, neighborhood drainage, streambank stabilization, replacement of aging/failing infrastructure)

- Provide annual training opportunities to maintain certifications including pesticide applicators licenses, sediment controls certification (Certified Erosion Control and Sediment Lead [CECSL]), and confined space and shoring certifications
- Work with contractors to remove beaver populations damming surface water conveyance systems
- Communicate with regulatory agencies regarding permit applications, notifications of start and end work, and spill notifications as required

1.D.2 Engineering, Stewardship and Education

The Engineering, Stewardship, and Education (ESE) Group provides the following types of services:

- Review stormwater components of development proposals; City staff review more than 100 development permits each year to ensure that new construction has modern stormwater controls that comply with current regulations
- Respond to customer inquiries regarding drainage and water quality issues; City staff address several hundred drainage complaints each year
- Inspect private stormwater facilities to ensure they are properly maintained and are functioning as designed
- Manage and conduct surface water studies and keep current on innovative stormwater treatment technologies and approaches
- Implement IDDE program so that the public is aware of what can and can't go into the stormwater system and that improper or polluting discharges are stopped
- Educate Kirkland businesses and residents about surface water and stormwater
- Coordinate with other City programs that relate to surface water and stormwater (Green Team, Code Enforcement, Climate Collaborative)
- Comply with state and federal mandates (ESA and NPDES Phase II Permit)

1.D.3 Capital Improvement

Staff in the ESE Group support capital improvement through the following types of services:

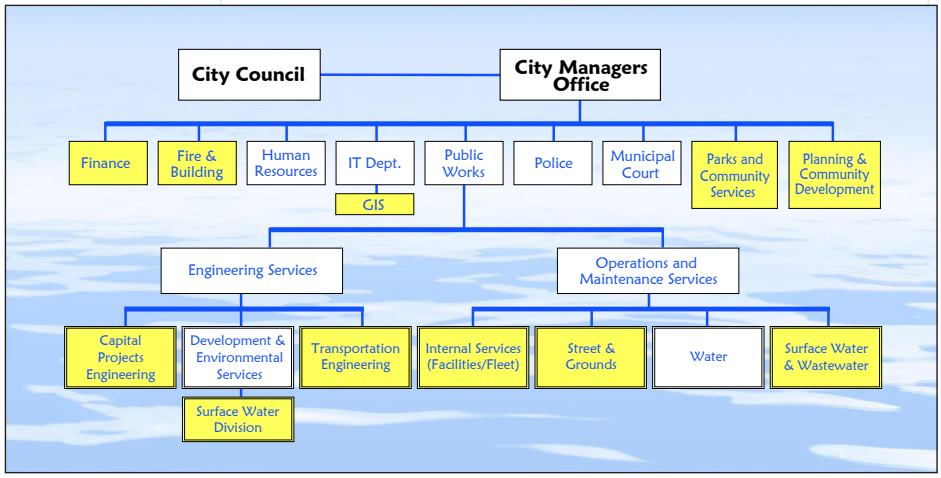
- Identify surface water and stormwater related capital projects to solve flooding, erosion, water quality and habitat degradation problems
- Assist Capital Improvement Program (CIP) with implementation of stormwater capital projects
- Seek grants when opportunities arise to help offset costs of capital surface water systems upgrades

1.E Surface Water Utility Work Related to Other City Departments

The Surface Water Utility is housed within Public Works, within the Development and Environmental Services section in Engineering Services (Figure 1-4), and the Surface Water and Wastewater Group within the Operations and Maintenance Section. Below are some examples of the relationship of Surface Water Utility activities to those of other work groups within Public Works and other City work groups and departments.

- **Capital Projects Engineering** manages design and construction of surface water capital projects.
- **Transportation Engineering** conducts planning for motorized and non-motorized transportation projects, including green infrastructure where appropriate.
- **Parks and Community Services** maintains vegetated stormwater facilities and Green Kirkland Partnership works to restore natural areas in parks, many of which encompass stream corridors, and helps to maintain compliance with the NPDES Phase II Permit by minimizing pollution from park maintenance and management activities.
- **Finance** conducts accounting and financial planning. The finance deparment is also responsible for collection of surface water fees that are paid with County property taxes.
- **Planning and Community Development** plans for land use and development in the city, and manages the Urban Forestry Program, both of which affect surface water resources.

Figure 1-4. Organizational relationship to Surface water utility



- **The Surface Water Utility** coordinates with Fire and Building for public-safety issues related to stormwater and pollutant spills.
- **Information Technology (IT)/GIS** provides system mapping and analysis services that are used to track activities, trace sources of pollutants, and conduct watershed planning.

Surface Water Utility staff participate in outside organizations and coordinate with other jurisdictions on a regional basis to leverage collective resources and share the knowledge available for surface water and stormwater management. Some examples of groups and organizations that the Utility participates in are listed below:

- Water Resource Inventory Area (WRIA) 8 Salmon Recovery Council (the Cedar River/Lake Washington Watershed)
- King County Flood Control District
- IRAC: Interagency Resource for Achieving Cooperation
- King County (KC) ROADMAP
- American Public Works Association (APWA) Washington Chapter, Stormwater Committee
- Ecology NPDES Permit Coordinators Group
- STORM: Stormwater Outreach for Regional Municipalities
- King Conservation District

1.F Accomplishments since 2005 Plan Update

Kirkland has accomplished a number of noteworthy advances in stormwater management since 2005, when this Plan was last updated. Accomplishments are described in the following paragraphs.

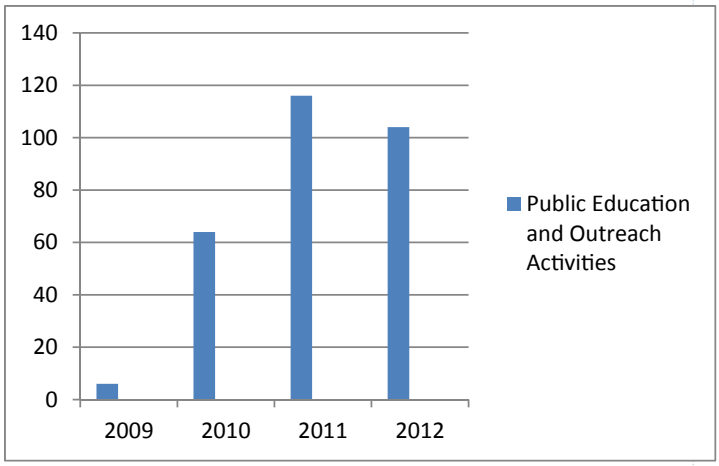
1.F.1 Public Education and Outreach

Control of the source of pollutants is more effective and less expensive than removing pollutants from stormwater, and education is one of the best tools for achieving source control. A stormwater education and outreach specialist was hired at 0.5 full-time equivalent (FTE) in 2007 and became full-time on surface water issues in 2010. As a result, the number of public education and outreach events and activities has increased substantially since tracking began in 2009 (Figure 1-5). The number of education and outreach events vary on a given year depending on the type and size of activities conducted. Activities range from Natural Yard Care seminars, which encourage reductions in pesticide use and lawn watering, to the Neighborhood Rain Garden Program, which constructs demonstration rain gardens in the front yards of existing single-family residences in order to educate others about the beauty and benefits of these stormwater features, to participation in regional awareness efforts through the Puget Sound Starts Here campaign. Surveys, focus groups, and interviews are used to measure the effectiveness of these programs, and have shown that awareness and beneficial behavioral changes have increased in response to this work.

1.F.2 Water Quality Hotline Calls and Illicit Discharge and Detection

As required by the NPDES Phase II Permit, a hotline was established to report spills and potential illicit discharges. Since tracking began in 2009, the number of calls received and illicit discharges detected and subsequently inspected has increased (Figure 1-6) due to increased awareness and reporting, as opposed to an increased incidence of spills and dumping. With the hiring of a Water Quality Program Coordinator in 2011, the Utility has been able to increase staff training and readiness/response for identification and cleanup of water quality problems. Ecology staff have

Figure 1-5. Total number of reported education and outreach events by year



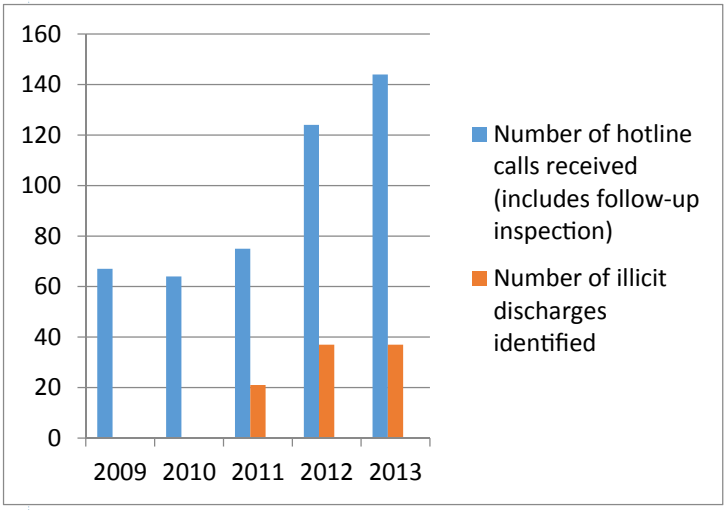
recognized Kirkland for recent excellence in training and readiness regarding spills and dumping. In addition, a recent contract with Ecology will fund pollution prevention visits to 125 businesses in 2014–15. Staff from a local nonprofit will visit with businesses to collaborate on ways to increase business efficiency while reducing discharge of pollutants.

1.F.3 Stormwater Regulation Updates

In order to meet the requirements of the NPDES Permit and to maintain membership in the National Flood Insurance Program (NFIP), since 2005 the City Council has adopted the following regulations:

- Updates to water quality regulations of KMC Chapter 15.52 to meet NPDES Permit requirements in 2009 (Ordinance 4200). Updates included further detail on what constitutes an illicit discharge, and adoption of the source control requirements of Ecology's 2005 Stormwater Management Manual for Western Washington (Ecology Manual).
- 2009 King County Surface Water Design Manual and City of Kirkland Addendum to the 2009 King County Surface Water Design Manual, effective January 1, 2010 (Ordinance 4214). These new design regulations require increased use of LID and stricter flow control requirements for redevelopment sites, among other changes.
- Alterations to KMC Chapter 21.56 to incorporate new NFIP requirements (Ordinance 4367).
- Added Chapter 114 (in an effort led by the Green Building Team from the Planning Department) to the Kirkland Zoning Code to provide a 10% density bonus for development projects that use LID stormwater techniques such as tree retention and reduced creation of impervious surfaces.

Figure 1-6. Number of hotline calls and illicit discharges identified and inspected



1.F.4 Development Review

The Development staff reviewed 350 site plans in 2013 and inspected nearly 600 sites during construction (Figure 1-7). The number of construction sites inspected is generally higher than the number of stormwater site plans reviewed because all construction sites must be inspected, but not all development projects require a stormwater site plan. The number of reviews has steadily increased since 2009 as the economy has recovered from the 2008–10 recession. With adoption of the 2009 King County Surface Water Design Manual as required by the NPDES Permit, the amount and complexity of review increased, meaning that the hours required per site plan increased.

The bright side of this is that new regulations encourage and require use of LID and staff now put substantial effort into working with the development community to evaluate new LID facility types and to assist developers in using LID in their projects. This will reduce the long-term impacts of development and associated stormwater runoff in our community—it is a form of preventive medicine for our watersheds.

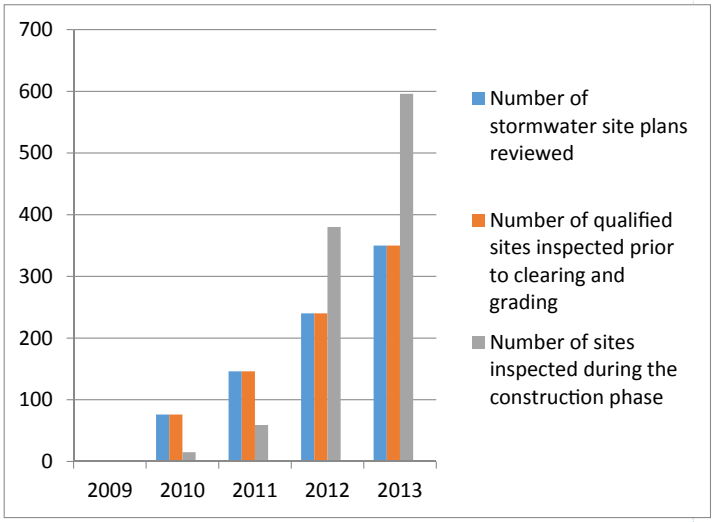
1.F.5 Stormwater System Inspection, Operations, and Maintenance

The O&M Group has conducted the following activities over the last 2 years:

- Purchased an additional eductor truck (a truck that vacuums liquid and solides from catch basins and pipes) for the maintenance and repairs needed for the newly annexed public system
- Conducted ditch cleaning on the newly purchased Cross Kirkland Corridor (CKC) (rail corridor)
- Cleaned and inspected 8,672 catch basins (2012–13)
- Planted vegetation that requires less maintenance in stormwater ponds to reduce mowing
- Rehabilitated 378 catch basins (2012–13)
- Closed-circuit television (CCTV)-inspected 114,916 linear feet of storm line (2012–13) to identify conditions of buried pipes that are otherwise not visible

Figures 1-8 and 1-9 show the actual percentage of maintenance performed on the publicly owned surface water conveyance system in 2012 and 2013, respectively.

Figure 1-7. Number of stormwater site plans reviewed and sites inspected during clearing and grading and construction phases.



1.F.6 Capital Projects Constructed

Several capital projects were constructed or are in the process of being constructed (Figure 1-10). The Totem Lake area has been front and center, and progress is being made toward reducing long-standing flooding issues in this vital area slated for economic renewal. The twin culverts that form the outlet of the lake have been replaced, the channel east of I-405 has been deepened and widened, and a project is in design to restore the stream channel through the wetlands on the west side of I-405 (projects SD-0059 and SD-0075). Other priority projects completed by the Utility since 2005 include:

Flood reduction projects

- Cochran Springs Creek flood reduction (SD-0065): Constructed a berm along Cochran Springs Creek to reduce parking lot flooding of an adjacent business park. The business park has subsequently completed a stream restoration project at its cost and the City will be constructing a new culvert under Lake Washington Boulevard to reduce flooding and improve maintenance access.

Water quality improvement projects

- **Hourglass Pond rehabilitation (SD-0058):** Removed sediment and re-graded this pond, which is designed to improve the quality of water in the "Kingsgate" tributary of Juanita Creek.
- **Infrastructure improvement projects Annual infrastructure replacement:** Multiple projects have been completed using this fund that was created out of a recommendation in the 2005 Surface Water Master Plan, including the following:

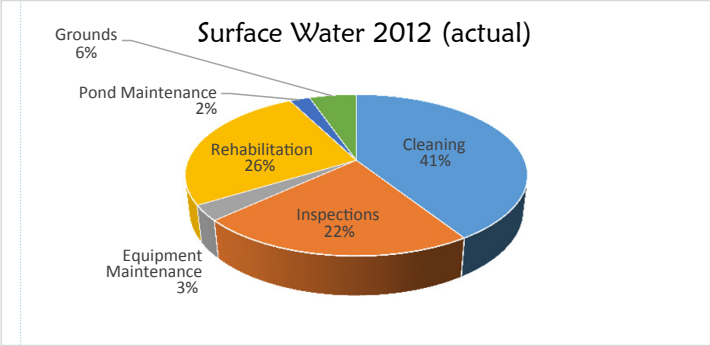


Figure 1-8. Percent of maintenance time spent on various maintenance functions for publicly owned surface water infrastructure in 2012

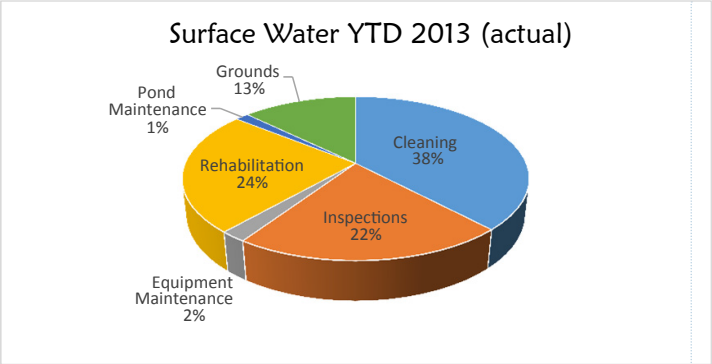


Figure 1-9. Percent of maintenance time spent on various maintenance functions for publicly owned surface water infrastructure in 2013

  - **North of NE 124th Street, west of 98th Avenue NE (various locations) (SD-1247):** Slip-lined or replaced pipes that carry the "Billy Creek" tributary into the mainstem of Juanita Creek.

Habitat improvement projects

- **Juanita Beach Park channel restoration (SD-0057):** Removed garbage, re-graded, created an off-channel rearing area, and replanted native vegetation in the portion of Juanita Creek that is north of Juanita Drive in Juanita Beach Park. This project is a good example of how surface water projects can also serve to improve conditions and recreational and interpretive opportunities in the City's park system.
- **Private streambank stabilization on Juanita Creek at approximately NE 122nd Street (SD-0060):** Stabilized a steep bank that was eroding on private property and delivering fine sediment to Juanita Creek. This eroding streambank was identified as the greatest habitat threat to Juanita Creek in the 2005 Surface Water Master Plan. The Utility paid for the project that was done in cooperation with the property owner, because of the public benefit to Juanita Creek.

In addition, the Surface Water Utility has provided approximately $500,000 per year toward the stormwater portion of the following transportation projects:

- **NE 85th Street:** Funded the design and installation of stormwater structures to serve the improved roadway.
- **124th Avenue NE/NE 124th Street Intersection Improvements:** The Utility funded both the stormwater portion of the project, and addition of water quality treatment to serve an upstream area of public right-of-way.
- **NE 120th Street Extension:** Funded design and installation of detention to serve this new roadway.
- **Park Lane:** Provided matching dollars for an Ecology grant to install LID stormwater features as part of reconstruction of this street in the heart of downtown Kirkland.

1.F.7 Urban Forestry

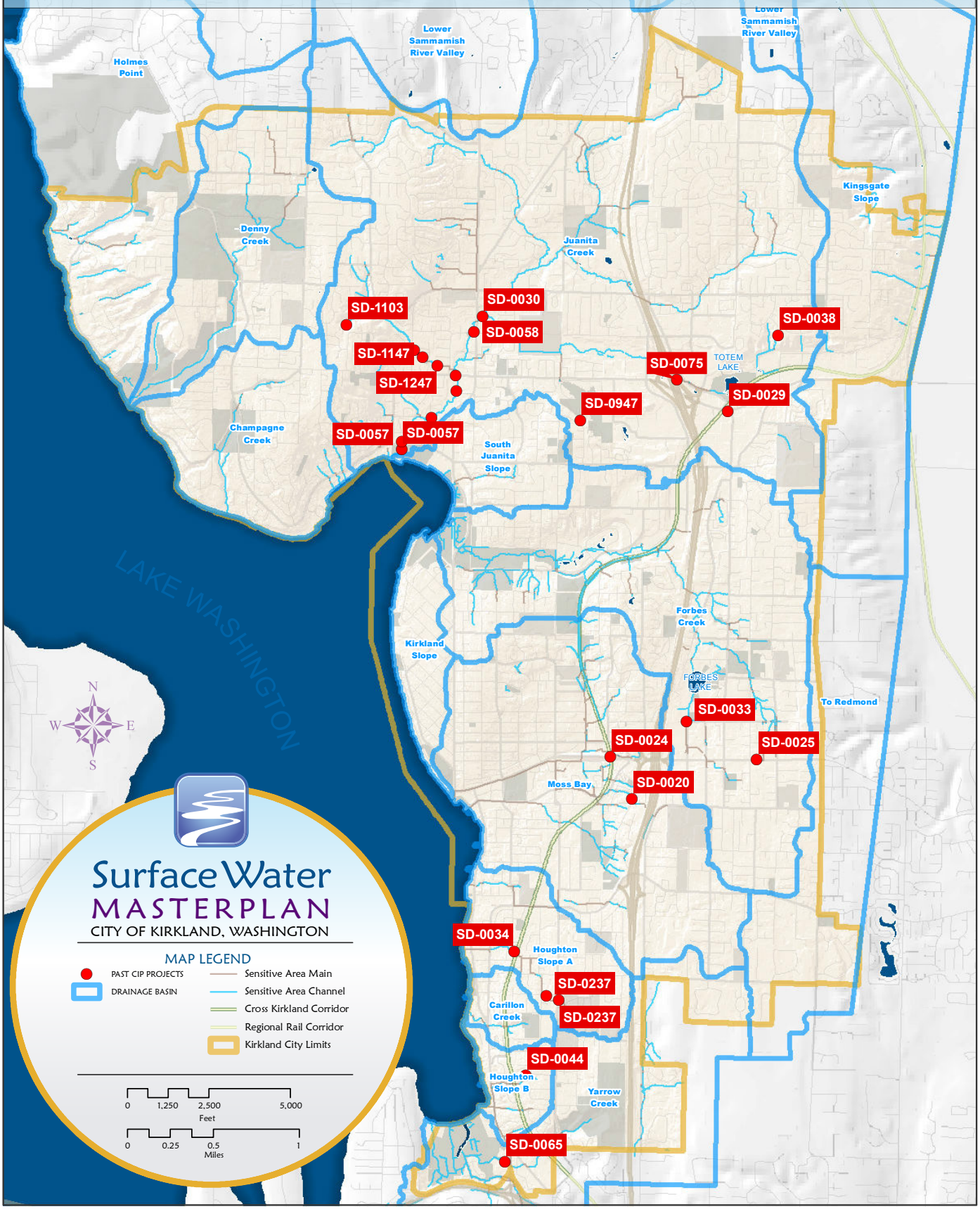
Management of the urban tree canopy has progressed through the following urban forestry efforts:

- Comprehensive tree regulations adopted by the City Council in 2005 as Chapter 95 of the Kirkland Zoning Code established a permit process and standards for the protection and replacement of trees on private and public property.
- Canopy analysis completed in 2011 showed that the City overall has 40.7% canopy cover, and has therefore met the 40% canopy cover goal included in the Comprehensive Plan, mostly because of high forest cover in the annexation area.
- The Urban Forest Strategic Management Plan was adopted by the City Council in 2013. This plan was developed to establish the protocols, outcomes, and services related to Kirkland's urban forest over a long time horizon. Specifically, the plan focuses on urban forest quality by identifying challenges to better urban forest management, providing a sustainable framework for efficient and consistent urban forest management, and reflecting the values of the community as a whole.

Juanita Creek stabilization project (SD0060) under construction

The growing recognition that trees and urban forests play a crucial role in surface water management has also led to the availability of tools to quantify the stormwater impacts of protecting and restoring trees.

Figure 1-10 Captial Projects Constructed Since 2005



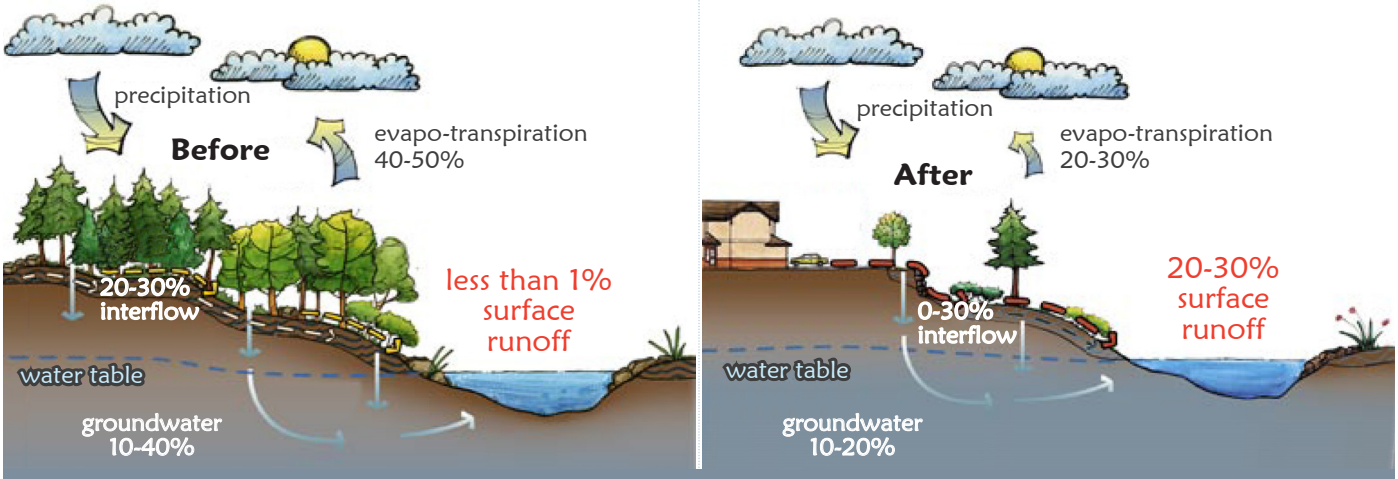
section 2

Challenges and Opportunities

2.A Complexity of Stormwater

Surface water and stormwater runoff is ubiquitous—when and where there is precipitation, there is surface water runoff, particularly in urban environments where a reduction of trees and vegetation and increase in hard surfaces occurs (Figure 2-1). The conveyance system that transports this runoff consists of private and public infrastructure, which can add to the complexity of maintenance obligations and responsibilities. Additionally, the conveyance system is a mix of pipes, ditches, and natural water bodies, including streams, wetlands, and lakes. What is collected and conveyed during runoff events ultimately ends up in downstream receiving waters, and depending on the quantities of flow, and the quality of the runoff, natural resources and aquatic habitat can be negatively impacted.

Figure 2-1. Schematic of surface water runoff and effects of urbanization.



Before development almost all rainfall is taken up by plants, evaporates or infiltrates through the ground. After conventional development, surface runoff increases significantly while evaporation and infiltration into the ground decrease.

2.B Existing Development

Stormwater regulations have evolved over the years and now place an equal emphasis on water quality and aquatic habitat protection as they do on flood control. Developments within Kirkland have provided varied levels of stormwater treatment depending on the date of construction. Figure 2-2 shows the year that city parcels were developed, as a surrogate for areas of the city that likely do not have any water quality or flow control treatment (those parcels developed prior to 1976). Figure 2-3 shows the general ages of public stormwater treatment facilities. As regulations have changed, the standards of treatment have too, and older facilities probably aren't providing the highest level of treatment because of the standard for which they were built, or current functionality could be diminished as a result of age or past maintenance. There are opportunities to lessen stormwater impacts through retrofit of older communities, which can occur as aging infrastructure is repaired, replaced, or expanded.

> Surface water and stormwater runoff is challenging to manage because of a number of factors, including the general nature of stormwater. It's everywhere, it's chaotic, and it changes with land use patterns and climate variability.

2.C Aging Infrastructure

As infrastructure ages, whether it is stormwater treatment facilities or underground piping, the need for increased maintenance or replacement can be expected. The City conducts stormwater facility inspection on a regular schedule, and also conducts video inspection of buried stormwater pipes. These activities are useful in alerting staff to the maintenance and replacement needs of the City's stormwater infrastructure; however, only 14% of the City's entire stormwater pipes have been video-inspected to date. The video inspection program is discussed in Section 4. There may be an opportunity to pair infrastructure replacement projects that control flow and provide water quality treatment.

Figure 2-2 Year Parcel Developed

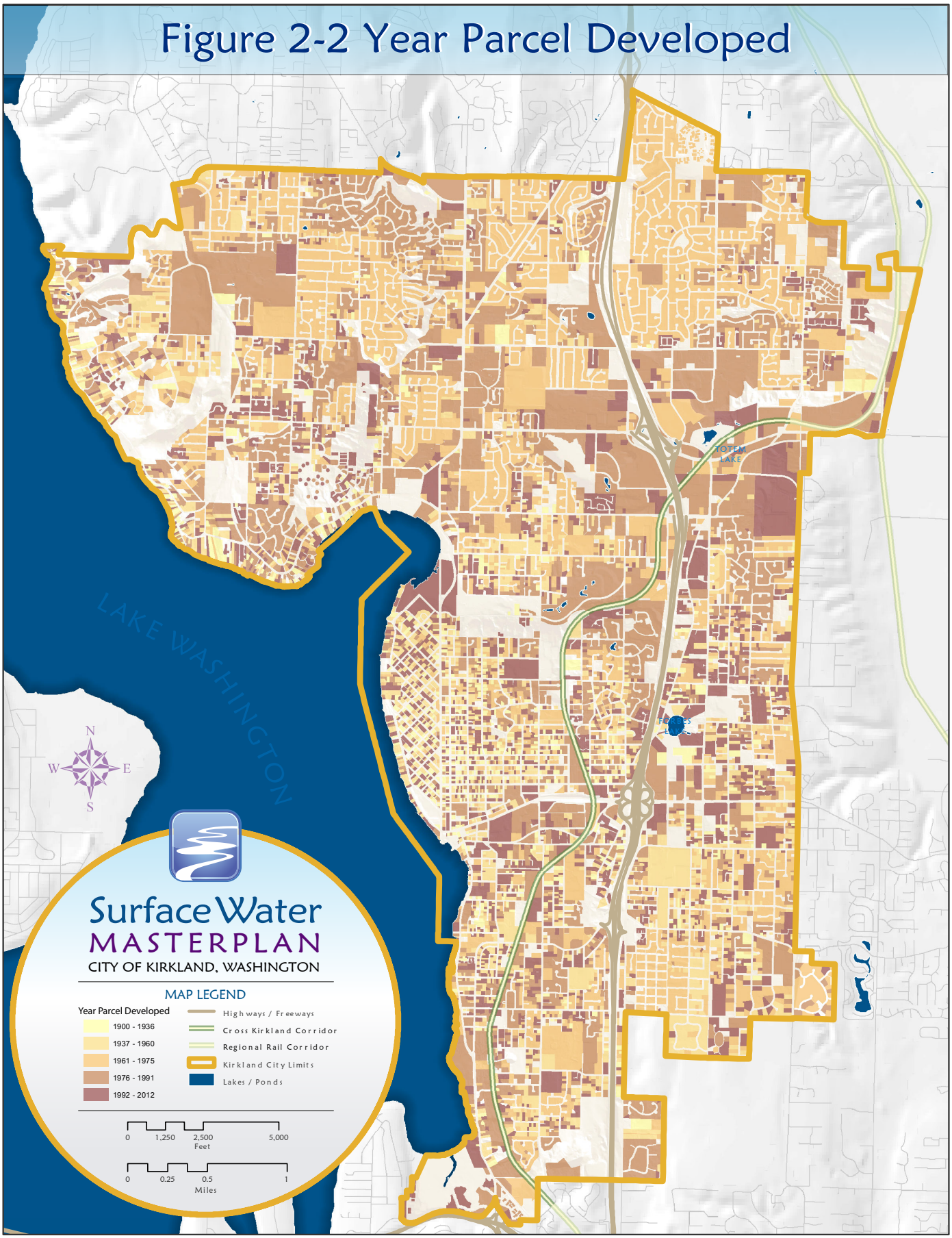
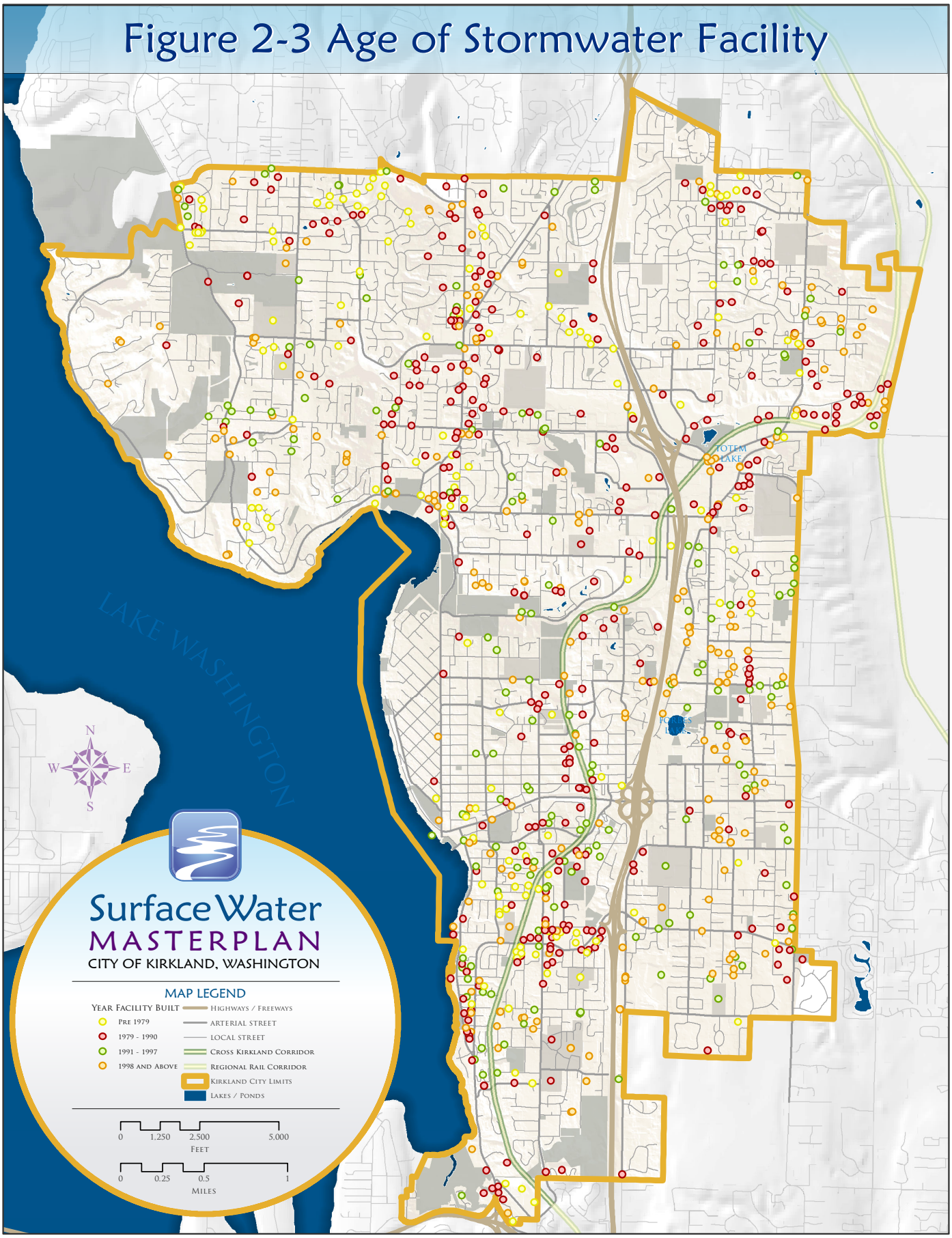


Figure 2-3 Age of Stormwater Facility



2.D Redevelopment/Major Initiatives

A lot of development and redevelopment is occurring in Kirkland, with opportunities to upgrade stormwater infrastructure and improve aquatic habitat in conjunction with major projects. Figure 2-4 shows parcels that will likely be redeveloped in the next few decades, as well as current redevelopment initiatives such as the CKC and the Totem Lake Mall redevelopment. Appendix A contains the results of a redevelopment analysis that was used to create Figure 2-4.

The Cross Kirkland Corridor (CKC) is a major focus of the City. This 5.5-mile-long portion of the Eastside Rail Corridor will provide connectivity to schools, parks, neighborhoods, and businesses and enhance the livability of Kirkland. Surface water and stormwater opportunities associated with the trail construction are being considered and implemented as the project progresses. Grant funding provided by Ecology in 2014–15 will result in conceptual designs for up to three water quality treatment retrofit projects along the corridor by fall 2014. Ecology has indicated that grant funds are forthcoming for construction of retrofit projects, and that those with developed conceptual designs will be well-placed to receive those funds.

The City has spent considerable resources to alleviate flooding on Totem Lake Parkway. Completed stormwater projects appear to be working, and the City is currently identifying stormwater retrofit opportunities in the Totem Lake Sub-basin via a grant project funded through Ecology and the National Estuary Program. The Totem Lake Mall will be redeveloped, and with the redevelopment come opportunities for stormwater improvements.

Although dispersed throughout the city, the largest acreage of redevelopment will likely be single-family residential lots—whether it's large lots being divided into smaller parcels, or older, smaller homes being replaced with new

modern and typically larger construction. Allowable lot coverage in the Zoning Code has a large impact on the amount of new impervious surface that is created through redevelopment. New stormwater regulations will factor into modifications at the lot scale, resulting in citywide improvements. The City recently conducted a development capacity analysis that shows the potential for development and redevelopment (Appendix A).

2.E Outside Influences

Other factors influence the management of surface water and stormwater in Kirkland that are beyond the City's control. Climate change and invasive species are just two such factors. The City's Climate Protection Action Plan (Kirkland 2009) notes steps that the City is taking to try to limit its contribution to climate change, but it is also important to be prepared to respond to climate change as it impacts city functions and activities. The City is also investigating steps that can be taken to limit the introduction of invasive species into Kirkland's water bodies, but we also must be aware of the need to respond if and when such species arrive.

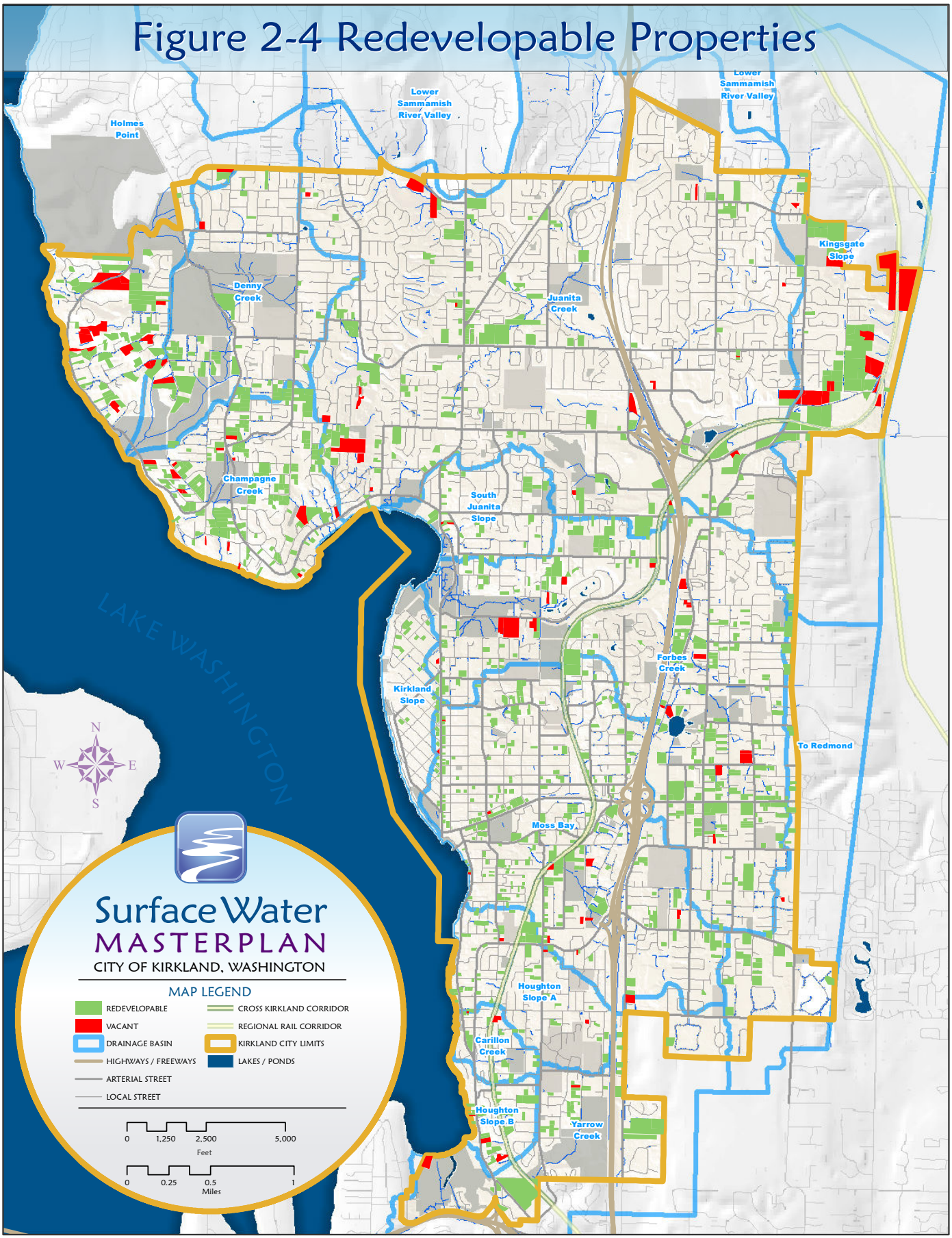
2.E.1 Climate Protection

The City Council signed the U.S. Conference of Mayors Climate Protection Agreement in 2005 and adopted staff-recommended greenhouse gas reduction targets in 2007 (Resolution R-4659). Since then, the City has taken important steps to reduce its impacts on climate change via the 2009 Kirkland Climate Protection Plan (Climate Plan) (Kirkland, 2009). The Climate Plan includes 12 recommended actions ranging from inventory of city and community emissions to land use policies and use of clean alternative energy sources in City operations.

> *"Wet will get wetter, and dry drier.... since warm air, carries more water"*
> —Haiku, Gregory Johnson
> (Sightline Institute, December 16, 2013)

Predicted climate changes that could affect Kirkland are related to the predicted increase in the frequency and intensity of precipitation events. In the Pacific Northwest, heavy rainfall events are projected to become more severe (Snover et al., 2013). This could lead to increased periods of flooding in lowland areas. Factors that influence flooding in Kirkland include the availability of wetlands and constructed ponds to store water, and the size of stormwater conveyance pipes. Stormwater infrastructure designed to convey a certain size storm event may not be adequate if more frequent high-intensity, or longer-duration, storms become commonplace. Additionally, unstable slopes may experience more frequent slope failures due to prolonged saturated conditions. As the City upgrades its piped infrastructure and replaces culverts, there are opportunities to upsize systems to accommodate predicted future flow increases.

Figure 2-4 Redevelopable Properties



2.E.2 Invasive Species, Noxious Weeds, and Beavers

Non-native fish and invertebrate species pose a threat to native fish populations because they out-compete them for food or physical habitat. The New Zealand mud snail is the most recent example of such a species. The City has surveyed its streams for the New Zealand mud snail, and has not yet found evidence that it has spread to Kirkland. This species is of concern because it can quickly cover river and lakebed habitat, thus out-competing native aquatic snails and insects, and leading to implications for fish and other species that rely on these insects for their food source. A few streams that drain to Lake Washington, including Kelsey Creek in Bellevue and Thornton Creek in Seattle, are known to have New Zealand mud snails. Measures such as decontamination of equipment when moving between streams, and requiring contractors to use gravel or other materials from water bodies that are known to be free of mud snails, have been implemented to try to prevent spread of this species to Kirkland. Regional and state forums have been convened to research the impacts of this species on salmon recovery and to experiment with ways to stop its spread.

Noxious weeds crowd out native vegetation that provides food and shelter for native animal species ranging from invertebrates in stream channel bottoms to mammals that typically live near streams. Effective elimination of noxious species such as Japanese knot weed, Himalayan blackberry, and Policeman's helmet requires control of seeds, roots, and shoots of plants via hand removal and/or focused application of pesticides. If even a small patch of the weed remains, it will quickly rebound and spread along a stream channel. Kirkland's planning department provides a list of

prohibited plants to permit applicants and the King County Noxious Weed program occasionally conducts free workshops on noxious weed control for Kirkland residents. These are some of the ways that Kirkland educates residents about noxious weeds and helps prevent the spread of invasive plants.

Kirkland is home to a large and active beaver population. Beavers are a native species that was largely eliminated from the area by farming practices in the early 20th century, but is now rebounding. Beavers build dams that create ponds that help to reduce flooding in downstream areas, provide fish habitat, and allow sediment to settle out of water as it passes through. However, people have now developed many low-lying areas that were historically beaver habitat, and conflicts between people and beavers in Kirkland are becoming more common. Beavers impact roadway culverts, stormwater facility outlets, and local streams and wetlands,

New Zealand Mud Snails, courtesy of USGS

causing flooding and sometimes infrastructure damage. Potential solutions to beaver problems include providing sufficient habitat where flooding does not cause problems (i.e., preserving wetlands), live trapping, and management of beaver dams through either periodic removal or installation of devices that lower or maintain water levels behind the dams.

2.F Modern Stormwater Strategies

There has been a recent shift in regional stormwater management approaches, including a greater emphasis on "green" infrastructure utilizing vegetation, infiltration, and solutions that work within the environmental context of the surrounding landscape. This new stormwater management approach is not without complexities, but it presents an opportunity to have greener communities that support healthy streams. Siting, connection to existing stormwater infrastructure, and maintenance and operation of green infrastructure presents different challenges and opportunities for City staff. Permit-driven O&M requirements have also resulted in a workload shift for City operations crews, with a greater focus on inspection and maintenance of existing infrastructure. There are more opportunities for stormwater infrastructure to provide multiple benefits, particularly with the use of "green" infrastructure that provides aesthetic, cooling, and air quality benefits.

Siting, connection to existing stormwater infrastructure, and maintenance and operation of green infrastructure presents different challenges and opportunities for City staff. Permit-driven operations and maintenance requirements have also resulted in a workload shift for City operations crews, with a greater focus on inspection and maintenance of existing infrastructure. There are more opportunities for stormwater infrastructure to provide multiple benefits, particularly with the use of "green" infrastructure that provides aesthetic, cooling, and air quality benefits.

2.F.1 Low-Impact Development (LID)

LID stormwater management techniques and facilities are becoming the preferred and commonly used stormwater management strategy in the region, and NPDES municipal permits require consideration of these techniques unless deemed infeasible for a variety of reasons.

The following are examples of LID techniques:

- Reduce the amount of impervious surface created by clustering houses and shortening and narrowing roadways
- Retain native vegetation, especially trees, to intercept and transpire rain water
- Use LID stormwater facilities to slow and treat runoff

The following are examples of LID stormwater facilities:

- Bioretention (often known as rain gardens)
- Infiltration ponds or trenches
- Cisterns that capture rain water for reuse
- Pervious pavement
- Tree planting

LID and green infrastructure provide excellent benefits to Kirkland and the ecological conditions of local water bodies. Infiltrated water returns flow to local groundwater aquifers that provide summer baseflow and cooler water to streams. Infiltration also slows the water delivery to the creeks during smaller, more frequent storm events, which studies are finding to be the most detrimental to the ecological condition of the creek. The soil and vegetated matter through which stormwater is filtered generally removes pollutants that otherwise might be transported to local receiving waters. Aesthetically, LID facilities blend in well with the environment and can also provide pocket habitats for birds and other urban wildlife. LID and green infrastructure are not without risk, however. Thoughtful application of these techniques will be required, particularly

in areas of geologic hazards that could be exacerbated by saturated soil conditions as a result of infiltration.

Example of a bioretention cell

Some of the challenges associated with LID facilities are the shift in the type of inspection and maintenance, as well as the skills and tools needed for implementation. LID facilities such as green roofs, cisterns, and rain gardens are typically small and are spread throughout the landscape, so inspection may take more time than with centralized detention or treatment facilities. Because these facilities are usually vegetated with a variety of plants and growing conditions, they cannot be mowed like traditional detention ponds, bioswales, or other grass-based stormwater features, and require knowledge of plant type (weeds vs. desirable vegetation), growing habit, and pruning needs. There are also choices to be made about landscape maintenance standards that include aesthetics as well as stormwater function. This is similar to maintenance of detention ponds; ponds are mowed several times a year for aesthetics rather than for a stormwater function. Whereas traditional facilities typically do not suffer for lack of water, certain types of green infrastructure may need to be irrigated to maintain plant growth and prevent die-off in periods of low rainfall or drought.

LID is still in its experimental stage. Cities and counties around the region are trying new and different ways to reduce the impacts of impervious surfaces using LID, and we are all learning together how to improve stormwater management and provide the additional benefits of open space, trees, and more vegetation. LID is a necessary part of successful stormwater management that needs to be integrated with existing infrastructure and current maintenance practices.

section 3

Community and Regulatory Framework

Surface water management in the city of Kirkland is guided by the vision and goals of the City Council (described in Section 1), as well as input from citizens through requests, calls about specific drainage and surface water issues, and input solicited during this Plan development process. Regulatory drivers are also a significant component of the Surface Water Utility's work program. This section describes the community involvement process and outcomes in the development of this Plan, and the regulatory framework that drives the Surface Water Utility's work. In addition to the public involvement process described below, comments on the draft Plan were solicited from the public, the Muckleshoot Indian Tribe, and the Kirkland City Council.

3.A Public and Internal Stakeholder Process

Public and internal stakeholder outreach events were conducted for this Surface Water Master Plan update. Table 3-1 lists the events held in conjunction with this Plan update. A description of the events is below and public and stakeholder involvement and outreach event materials are included in Appendix B.

Table 3-1. List of Public Outreach Events

Event Date	Description	Audience	Purpose
March 4, 2013	Internal stakeholder meeting	City representatives	Raise internal awareness of Surface Water Master Plan update and solicit early input
May 1, 2013	Public meeting	General public	Raise external awareness of Surface Water Master Plan update and solicit early input
June 8, 2013	Community planning day	General public	Present information about Plan update
October 19, 2013	Community planning day	General public	Present draft list of capital improvement projects
April 26, 2014	Community planning day	General public	Present draft list of programs and projects, request input on priorities

3.A.1 Internal Stakeholder Meeting

An internal stakeholder meeting was held with 12 City representatives, primarily from the Surface Water Utility of the Public Works Department, bus also represented by Planning, IT/GIS, Parks, and the City Manager's Office (Neighborhoods Department). The objectives of the meeting were to:

- Raise awareness within the City of the Surface Water Master Plan update
- Inform City staff about the contents of the Surface Water Master Plan and the objectives for the update
- Clearly communicate project schedule, anticipated impacts, and opportunities for engagement
- Discuss problems, potential solutions, and performance measures
- Answer questions and take comments
- Gather input from City staff regarding the successes and challenges associated with the existing Plan

Input was gathered as to what is working well within the Utility and what needs improvement, and draft performance measures were developed.

3.A.2 Public Meeting

A public meeting was held at the Finn Hill Middle School to inform the public of the Plan update, and solicit input regarding surface water and stormwater issues and what is important to the residents of Kirkland.

The objectives of the meeting were to:

- Raise public awareness of the Surface Water Master Plan update
- Explain the elements of the current Surface Water Master Plan and the objectives for the update, with display boards and project representatives on hand to answer questions
- Discuss problems and potential solutions
- Clearly communicate project schedule, anticipated impacts, and opportunities for engagement and feedback

The 13 attendees at this meeting expressed concerns regarding the impact of new development, particularly in newly annexed areas, and informed the City of their awareness of site-specific drainage issues.

3.A.3 Community Planning Days

The Surface Water Utility participated in citywide community planning days on June 8 and October 19, 2013, and April 26, 2014. These planning events were used as an opportunity to present information on the Surface Water Master Plan update and gather comments. A summary of comments compiled from the community planning day events is presented in Appendix B.

3.A.4 Coordination with Finn Hill Neighborhood Alliance

Prior to initiation of this Plan, the Finn Hill Neighborhood Alliance (FHNA) produced a Finn Hill/Holmes Point-specific Surface Water Plan focusing on their neighborhood (Finn Hill Neighborhood Alliance, 2013). The FHNA plan included general issues, suggestions for capital projects, and drainage and water quality problems specific to certain properties. A copy of the FHNA plan and a table of how specific surface water issues have already been addressed by the City is included in Appendix C.

3.B New Revisions to Existing Regulations, Permits, and/or Agreements

The Surface Water Utility must comply with a variety of local, state, and federal regulations and permits, some of which are directly applicable to the work the Utility does, and others that are more tangential. Table 3-2 provides a summary of applicable regulations and permits. Regulations and permits that have been subject to recent revisions or planned future changes are highlighted and described in more detail below.

3.B.1 NPDES Phase II Permit

A number of substantive new requirements in Ecology's NPDES Phase II MS4 Permit are to be phased in over the 5-year Permit cycle (Figure 3-1). The City is meeting its current NPDES Permit obligations, including O&M components, public education and outreach, IDDE, and administration of surface water code and standards equivalent to the 2005 Ecology Manual. Some of these program elements are described in Section 1. A gap analysis of the NPDES requirements relative to Kirkland's current program is provided in Appendix D. The primary changes are:

Figure 3-1 NPDES Phase II Permit Timeline of New Requirements

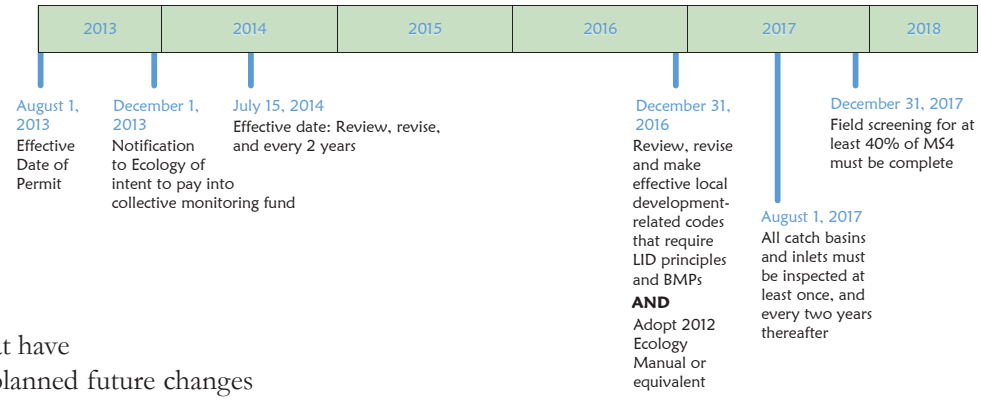


Table 3-2. Summary of Applicable Regulations and Permits

Law	Program	Intent	Relevance to Kirkland Surface Water Program
Clean Water Act / Federal	NPDES MS4 Permit	Eliminate discharge of pollutants to nation's water, and achieve water quality that supports beneficial uses (fishable and swimmable)	NPDES Permit delegates Kirkland with the responsibility for water quality leaving the City's system. New NPDES Permit in effect as of August 1, 2013, with a phased implementation schedule for new requirements.
	King County NPDES Municipal Wastewater Permit	Manage wastewater treatment facilities to minimize impacts to surface water	City must conduct cleaning and grease inspections of the sanitary sewer system (i.e. must have a Capacity Management Operations and Maintenance Program) with the goal of reducing sewer overflows.
	Other NPDES permits (Industrial, Sand and Gravel, Boatyard, etc.)	Eliminate discharge of pollutants from industrial activities	Requires entities in Kirkland that conduct certain pollutant-generating activities to obtain a permit and implement a plan to eliminate or minimize discharge of pollutants to receiving waters.
	Water quality standards (303(d) list)	Protect and restore beneficial uses of state waters including fishing and swimming	Requires Ecology to develop a total maximum daily load (TMDL) for each pollutant in water bodies at levels greater than the water quality standards. Kirkland has several stream reaches on the state's 303(d) list that may require a TMDL.
	Sections 401 and 404	Protect water quality during construction in waterways	Requires a permit for activities that discharge or dredge fill material to or from Waters of the United States.

Table 3-2. Summary of Applicable Regulations and Permits (cont.)

Law	Program	Intent	Relevance to Kirkland Surface Water Program
Tribal Agreements and Related Case Law / Fedaral	"Culvert Case"—March 29, 2013 District Court rules that the State of Washington must replace culverts that impede the passage of fish to their spawning grounds.	Protect fish populations in traditional fishing grounds of Indian tribes.	Muckleshoot Indian Tribe is party to SEPA review of development proposals and programs. **March 29, 2013, U.S. District Court ruling could lead to future implications for counties and cities whose culverts impede fish passage.**
National Flood Insurance Act, Flood Disaster Protection Act / Federal	National Flood Insurance Program (NFIP)	Reduce property damage and public safety threats from flooding.	City enacts restrictions/requirements on development in floodplain and residents get reduced flood insurance rates in return. **The National Marine Fisheries Service (NMFS) issued a Biological Opinion requiring changes to the NFIP to comply with ESA.**
Endangered Species Act (ESA)/Federal	Listing of Chinook salmon as a threatened species	Prevent further decline of Chinook salmon populations through prohibition on "take" of the fish or their habitat.	City participates in Water Resources Inventory Area (WRIA) 8 Salmon Conservation Planning. Chinook salmon are present in Lake Washington. The intent of this work is to recover and eventually de-list the species, as opposed to merely prohibiting take, leading to greater certainty for all.
	WRIA 8 Chinook Salmon Conservation Plan	Restore and protect habitat for Chinook Salmon for healthy, harvestable salmon populations	City Council adopted WRIA 8 Plan via Resolution R-4510 in 2005.
State Environmental Policy Act (SEPA)/State	City of Kirkland reviews proposals and issues SEPA determinations	Identify and require mitigation for the environmental impacts or proposals and programs	SEPA is used to address impacts that are not covered in other City requirements.
Shoreline Management Act / State	City of Kirkland Shoreline Master Plan	Protect use and functions (economic, ecological, and aesthetic) of shoreline areas. Implemented by KMC Chapter 21.	Shoreline Master Program was updated in 2006. The City's 2010 Shoreline Restoration Plan component of the Shoreline Master Program for the City of Kirkland (The Watershed Company, 2010) outlines restoration priorities that are complementary or the purview of the Surface Water Utility.
Hydraulic Code / State	Revised Code of Washington	Set requirements for placement of culverts and other hydraulic devices that may impact fish use.	Project proposing work within the wetted perimeter of a stream must obtain a Hydraulic Project Approval (HPA).
Growth Management Act / State	City Comprehensive Plan, City zoning and critical areas regulations	Regulate land use to meet growth targets while providing necessary services and protecting sensitive environmental resources	City of Kirkland Comprehensive Plan and supporting municipal code sections.
Puget Sound Partnership / State	Action Agenda	Protect habitat and economic resources (fish, shellfish) in Puget Sound	Action agenda includes a specific list of components to address water quality and quantity in Puget Sound. Many requirements overlap with NPDES requirements.

- **Monitoring:** The Phase II permit includes monitoring and assessment requirements that allow permittees to conduct individual monitoring or pay into a Regional Stormwater Management Program (RSMP) fund that collects (1) status and trends monitoring data, (2) stormwater program effectiveness studies, and (3) source identification and diagnostic monitoring. Kirkland has opted to pay into the regional monitoring fund per City Council Resolution 5018, passed on November 19, 2013.
- **LID:** The Phase II Permit requires permittees to adopt LID site-scale standards and update development-related codes that require use of LID principles and facilities, in addition to adopting the 2012 Ecology Manual or an equivalent manual that emphasizes the incorporation of LID standards and has a new LID performance standard for flow control for projects as small as adding or replacing 2,000 square feet (0.046 acre) of impervious area. Use of pervious materials is required for sidewalks and local roads (regardless of whether they are publicly or privately owned) up to a certain traffic volume.
- **Operations and maintenance:** The Phase II Permit has new inspection and maintenance frequencies, increasing catch basin inspections from once a Permit cycle to every 2 years. As an alternative, the City can choose to clean the entire MS4 including pipes and ditches once in the 5-year Permit cycle.
- **Threshold for sites requiring flow control:** The Phase II Permit lowers the threshold for controlling runoff from new development, redevelopment, and construction.
- **Illicit discharge detection and elimination:** The Phase II Permit requires 40% of the MS4 to be field-screened by December 31, 2017, and 12% of the MS4 to be screened each year thereafter.

These changes will mean a shift in how the City permits development projects and inspects and maintains the stormwater system. Because the changes are required by regionally based permits, most cities and counties are making similar changes to their programs and collectively going through the process. The City is active in regional stormwater groups and continued participation and collaboration will inform Kirkland's program adaptations.

3.B.2 Fish Passage Barrier and Tribal Treaty Rights

In March 2013, the U.S. District Court ruled that Washington State is not fulfilling obligations to remove barriers that impede fish movement and thus is violating Tribal treaty fishing rights. This has become known as the "culvert case," and requires the State to accelerate its program to upgrade and replace State-owned culverts. The ruling is under appeal, but nonetheless many jurisdictions around the state are assessing their culverts in anticipation of future rulings that would apply at a local level. Section 4.B.4 contains a review of the fish passage status of publicly owned culverts in Kirkland.

In March 2014, the Washington State Senate passed Senate House Bill (SHB) 2251 that, if approved by the governor, will require all fish barrier removal projects sponsored by local governments to use a streamlined permit review process in Revised Code of Washington (RCW) 77.55.181. The bill also establishes a fish barrier removal board to coordinate efforts to identify and prioritize fish barrier removals. As part of this Plan, publicly owned culverts on streams that are suspected to be capable of supporting fish habitat were assessed for fish passage. Results of the culvert assessment are included in Section 4 and Appendix E.

3.B.3 Floodplain Management

The federal government created the NFIP in 1968 as a way to offer flood damage assistance in exchange for city regulation of development to prevent future damage within the Federal Emergency Management Agency (FEMA) mapped 100-year floodplains. This program focuses on public health, safety, and welfare by protecting all new and substantially improved buildings. It has proved to reduce flood damage by 80% when compared to buildings not designed to meet development standards for construction within floodplains. In exchange for the City regulating development in floodplains, property owners within the city obtain the ability to purchase flood insurance at substantially reduced rates regardless of whether their property is located in a floodplain.

Juanita Creek

A study was conducted by the National Marine Fisheries Service (NMFS—now known as National Oceanic and Atmospheric Administration [NOAA] Fisheries) on how floodplain development affects aquatic habitat. NMFS issued a Biological Opinion that required changes to the NFIP in order to meet the requirements of the federal ESA as well as protect buildings from flood damage. In order to remain in compliance with the NFIP, in 2012, the City Council adopted changes to KMC Chapter 21.56 via Ordinance 4367. Ecology notified the City in late 2012 that the City's regulations fully comply with the NFIP and Washington floodplain management regulations.

There are 18 private property owners of the 35 total tax parcels (the remaining 17 are owned by the City) that are located within the FEMA mapped 100-year floodplain within Kirkland. Under current requirements in KMC 21.56, each property applying for a development permit will need to demonstrate how the proposed project is consistent with requirements in the Biological Opinion.

As there is significant overlap between City sensitive areas protection requirements in Chapter 90 of the Kirkland Zoning Code and the Biological Opinion requirements, it is likely that development requirements will be similar to what is required today because the delineated wetlands in the city of Kirkland often exceed the limits of the FEMA mapped 100-year floodplains. For example, Chapter 90 of the Kirkland Zoning Code currently requires that any development within a wetland or wetland buffer must demonstrate that it will not adversely affect water quality, fish, wildlife, or their habitat, and that mitigation is provided for any impacts on the wetland or its buffer. Under the Biological Opinion, a biological assessment is required to show that the project will not adversely affect water quality, water quantity, fish, wildlife, or their habitat.

The only additional requirements under the Biological Opinion would be to look at flood volumes and velocities to ensure that it will not increase runoff to the stream.

3.C Other Related Regulations

In addition to directly related regulations, such as NPDES and the Clean Water Act, the Growth Management Act (GMA) (Chapter 36.70A RCW) and the Shoreline Management Act of 1971 (SMA) (Chapter 90.58 RCW) have significant overlap with surface water and stormwater management programs. The GMA requires jurisdictions within urban growth areas, such as Kirkland, to conduct comprehensive city planning, and develop policies and regulations that protect the functions and values of critical areas (Chapter 36.70A.172 RCW). The SMA requires local governments to develop shoreline management programs

that protect the public interest associated with shorelines of the state while, at the same time, recognizing and protecting private property rights consistent with the public interest.

3.C.1 Growth Management Act and Comprehensive Plan Update (Kirkland 2035 Project)

The City is in the process of updating its Comprehensive Plan, and in doing so Kirkland is utilizing "smart growth" principles (http://www.kirklandwa.gov/Assets/Kirkland+2035/K2035+Comp+Plan+Smart+Growth+Principals.pdf) including the following:

1. Mix land uses together
2. Take advantage of compact building design
3. Create a range of housing opportunities and choices
4. Create walkable neighborhoods
5. Foster distinctive, attractive communities with a strong sense of place
6. Preserve open space, farmland, natural beauty, and critical environmental areas
7. Strengthen and direct development toward existing communities
8. Provide a variety of transportation choices
9. Make development decisions predictable, fair, and cost-effective
10. Encourage community and stakeholder collaboration in development decisions

The GMA requires Kirkland to accommodate growth, which is in conflict with the need to manage stormwater effectively. This conflict is currently being examined at the state level by the Department of Commerce. The GMA also requires the City to manage its sensitive natural resources.

3.C.2 Critical Areas

Critical areas include: (a) wetlands, (b) areas with a critical recharging effect on aquifers used for potable water, (c) fish and wildlife habitat conservation areas, (d) frequently flooded areas, and (e) geologically hazardous areas. These critical areas are often explicitly linked to the built and natural surface water and stormwater system. The city's wetlands, streams, and open spaces provide beneficial surface water functions, and stormwater regulations are designed to protect these important functions. Additionally, some of the city's most problematic areas from a surface water and stormwater O&M standpoint are located in or adjacent to geologically hazardous areas, such as steep slopes. These areas are prone to erosion and landslides, especially when the earth becomes saturated from prolonged or heavy rain events (see further discussion of geologic hazards in Section 4). Stormwater systems that are constructed on steep slopes are sometimes difficult to maintain because the road network that serves these locations is difficult for large vehicles and equipment to access. One such location in Kirkland is the Goat Hill area north of Juanita Bay. Figure 3-2 shows Kirkland's mapped critical areas in relation to its surface water and stormwater system.

3.C.3 Shoreline Management Act

Kirkland is a waterfront city. The shoreline of Lake Washington is one of the city's most popular and valuable public features. The City's Shoreline Management Program and associated shoreline environment designations (Figure 3-3) was updated in 2010 with restoration priorities identified in 2010. Many of the priorities require involvement and cooperation of the Surface Water Utility, as they involve managing surface water in the context of shoreline beneficial uses. Shorelines covered under the City's Shoreline Master Program include the entire shoreline of Lake Washington within Kirkland and the Forbes Creek and Yarrow Creek wetlands located near the mouths of Forbes Creek in Juanita Bay and Yarrow Creek in Yarrow Bay. Other streams and lakes in Kirkland are below the size regulated via the City's Shoreline Master Program, though they are still regulated under critical areas regulations contained in Chapter 90 of the Zoning Code.

The 2010 Shoreline Restoration Plan (The Watershed Company and City of Kirkland, 2010), outlined the following three goals that also pertain to surface water and stormwater management:

- **Goal 1:** Maintain, restore, or enhance watershed processes, including sediment, water, wood, light, and nutrient delivery, movement, and loss.
- **Goal 2:** Maintain or enhance fish and wildlife habitat during all life stages and maintain functional corridors linking these habitats.
- **Goal 3:** Contribute to conservation and recovery of Chinook salmon and other anadromous fish, focusing on preserving, protecting, and restoring habitat with the intent to recover listed species, including sustainable, genetically diverse, harvestable populations of naturally spawning Chinook salmon.

The plan recommended continued participation in the WRIA 8 regional group, and support of the WRIA 8 action items, including "Protect and restore water quality in tributaries and along shoreline. Restore Coho runs in smaller

tributaries as control mechanism to reduce the cutthroat population. Reconnect and enhance small creek mouths as juvenile rearing areas."

3.C.4 City Land Use Codes and Requirements

Land use and activities conducted in Kirkland directly affect surface water and stormwater management through the creation of impervious surfaces and pollution-generating activities. The City's development code is designed to ensure that development is carried out in locations and methods that are safe, do not negatively impact public resources, and fit in within the overall context of the city's neighborhoods. Surface water management design standards are included in KMC Chapter 15. The following Kirkland Zoning Code sections also impact surface water:

- **Chapter 85:** Geologically Hazardous Areas
- **Chapter 95:** Tree Management and Required Landscaping
- **Chapter 105:** Parking Areas, Vehicle and Pedestrian Access, and Related Improvements
- **Chapter 110:** Required Public Improvements
- **Chapter 114:** Low Impact Development

Some of the codes will need to be reviewed as part of the LID Code Review, discussed in Section 5. In 2006, the City took part in a Puget Sound Partnership grant project to identify and develop potential modifications to codes that impact surface water. Here is a link to the results of that study: http://www.psparchives.com/our_work/stormwater/lid/lid_regs.htm#2006

Chapter 114 was developed to incorporate suggestions of the grant project. This chapter grants density bonuses and other incentives in exchange for maintaining open space and using LID stormwater facilities.

Chapter 95 focuses on tree management, including tree retention, tree protection, required landscaping, and tree and landscape maintenance. Trees play an important role in surface water and stormwater management through reducing stormwater runoff (interception of rainfall), enhancing water quality (pollutant filtering), prevention of soil erosion, and providing wildlife habitat and shade to aquatic resources. City staff includes an Urban Forester position that is funded by the Surface Water Utility in part because of the role that trees have in the management of surface water and stormwater runoff. For example, this position is responsible for drafting the City's Urban Tree Canopy Assessment, which analyzed tree canopy cover within each drainage basin.

3.C.5 Transportation Standards

Most of the City's public stormwater infrastructure is located within road right-of-way, and the transportation network accounts for approximately 35% of the impervious surfaces in Kirkland. Additionally, pollutants from roadway runoff contribute to water quality issues in the city's water bodies. The transportation design standards affect the amount and quality of stormwater runoff that is conveyed and/or treated. Non-motorized transportation planning and design also involves coordination with surface water and stormwater management, as hard surfaces such as trails and sidewalks contribute flow to the surface water system. Opportunities for surface water improvements are incorporated into regional trail projects in Kirkland, such as the CKC. Additionally, the City has adopted street standards in the zoning code ("skinny streets") that reduce the required widths of streets, which reduces creation of impervious surface. Transportation projects present an opportunity for partnership to create green infrastructure and to provide treatment alongside other street improvements.

Figure 3-2 Critical Areas

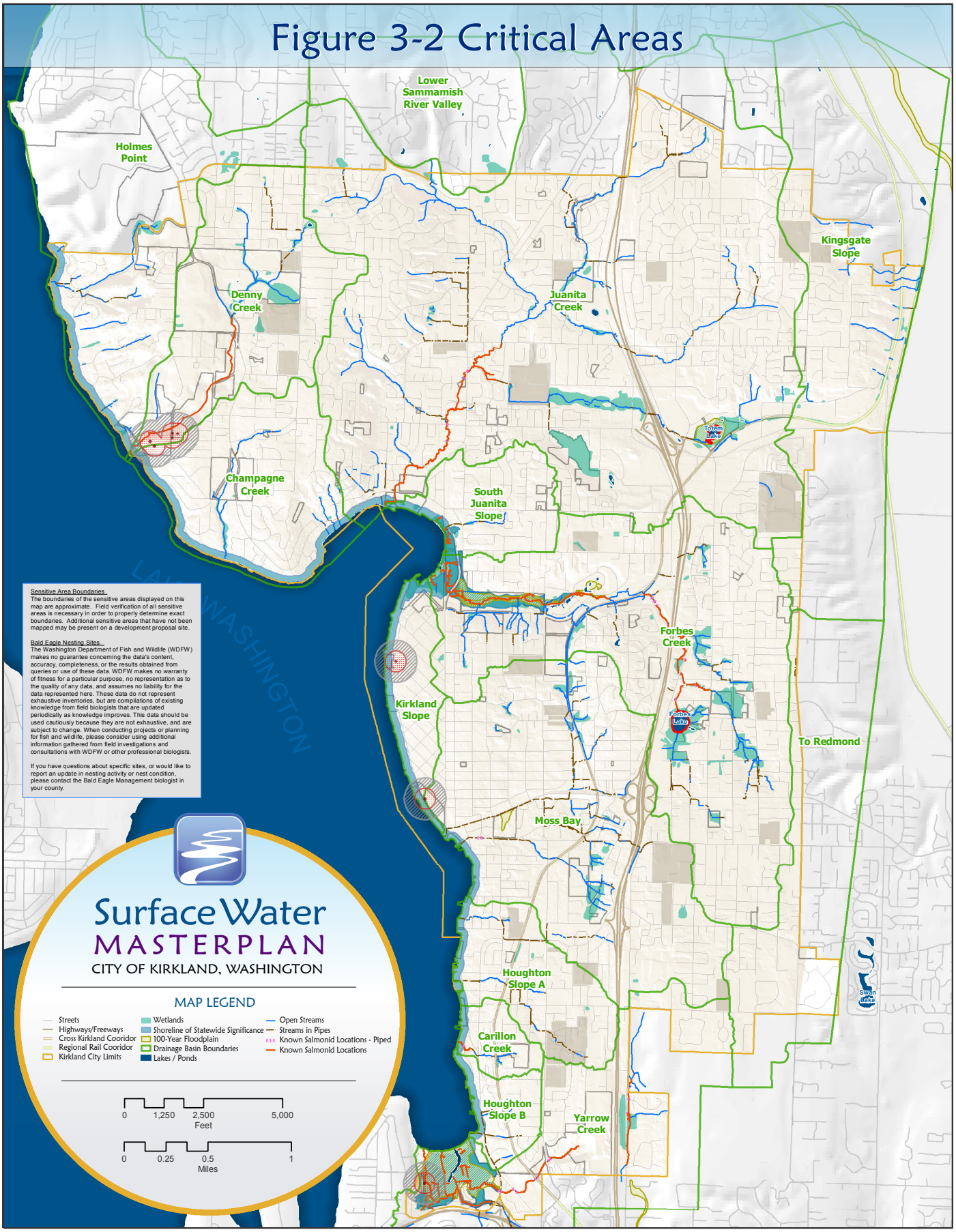
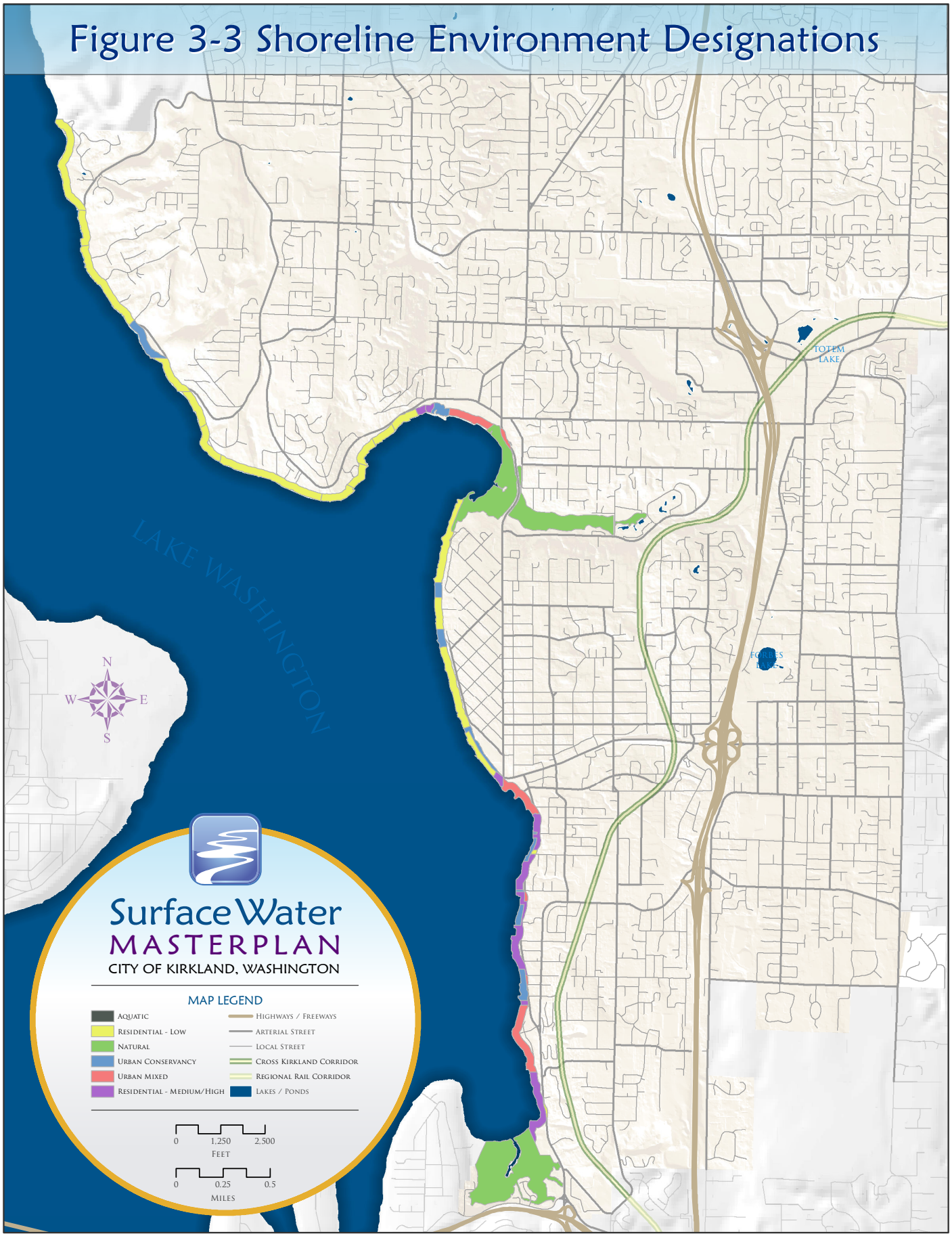


Figure 3-3 Shoreline Environment Designations



section 4

Surface and Stormwater Inventory & Condition of Resources

Section 4 describes conditions of the City's surface water and stormwater system, including built infrastructure and natural resources. Issues are noted relative to their impact on flooding, water quality, aquatic habitat, and infrastructure. Recommended projects and strategies to address issues discussed below are summarized in Section 6.

4.A Surface Water and Stormwater Infrastructure

Kirkland's surface water and stormwater system consists of conveyance and stormwater treatment (water quality and flow control) facilities, and receiving water bodies. The built and natural systems that make up the surface water and stormwater system are owned by both public and private entities. Ownership changes the strategies that the Utility uses to provide the public benefits of flood reduction, improved water quality, and improved aquatic habitat. For example, publicly owned stormwater flow control facilities are maintained by City crews, while privately owned stormwater flow control facilities are inspected by City crews and owners are required to perform maintenance according to City Code.

Annexation, acquisition of the CKC, and development projects have increased the citywide inventory of public and private stormwater assets by greater than 120% for some of the system elements. The increase in public facilities puts greater demand on city resources, resulting in additional maintenance of city-owned facilities and a greater number of inspections for privately owned facilities.

4.A.1 Drainage Basins

There are 15 drainage basins within the city of Kirkland. Most of these basins drain directly to Lake Washington; however, a few drain to the east or north to the Sammamish River, which then flows to Lake Washington through the cities of Redmond, Bothell, and Kenmore. On a regional scale, Kirkland lies within the Cedar River/Lake Washington Watershed, also referred to as Water Resource Inventory Area (WRIA) 8.

The current conditions described in this section are discussed in terms of characteristics within each drainage basin. Summaries of specific drainage basin characteristics are included in Appendix F.

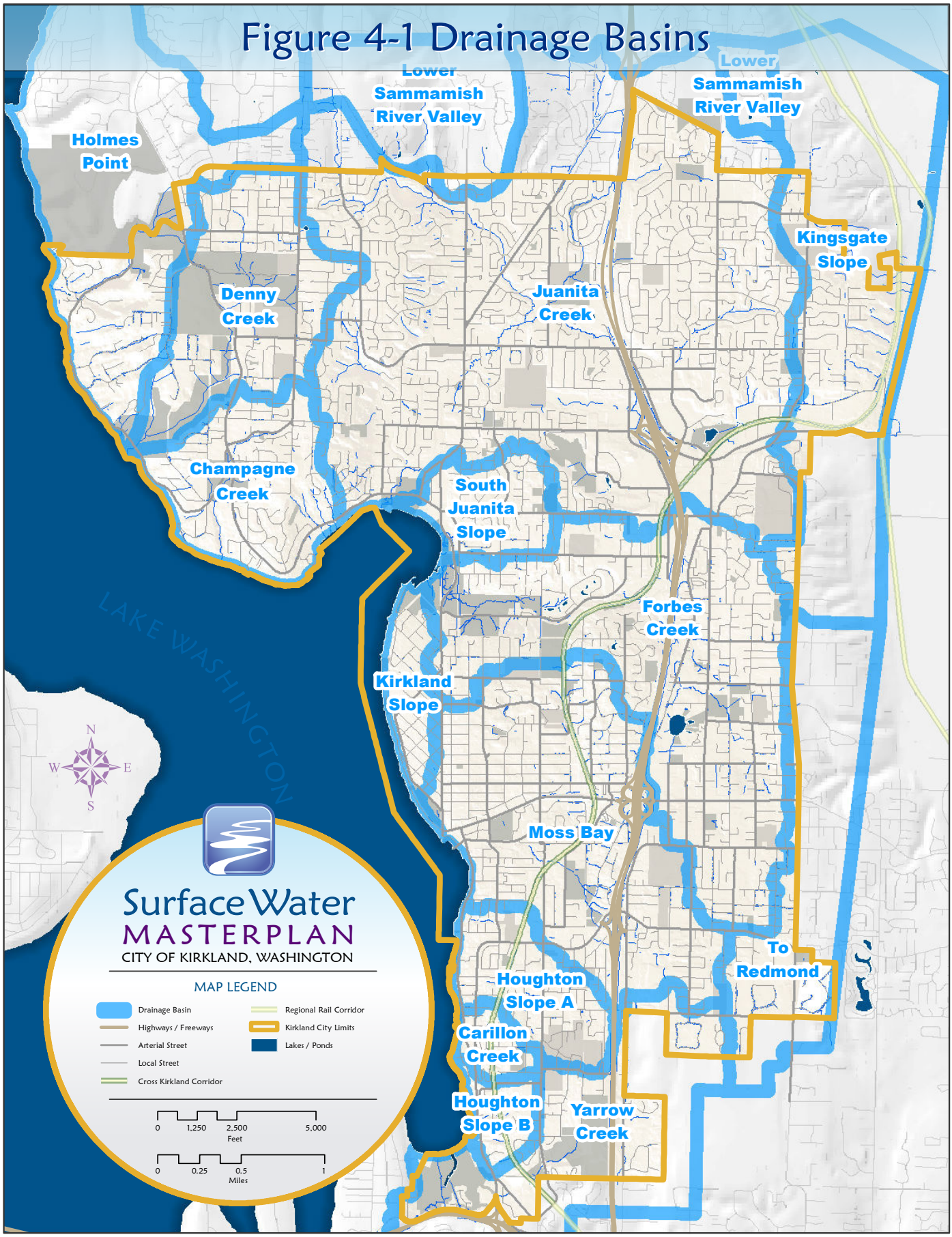
Table 4-1. Total stormwater system inventory (public and private ownership)

System element	Number or length in 2014		Citywide Total in 2014	Public assets added with annexation and CKC acquisition (i.e. since 2011)	% Increase in public assets since 2011
	Public ownership	Private ownership	Total		
Catch basins, manholes, and cleanouts	15,690	8,977	24,667	5947	61%
Stormwater facilities (tanks, vaults, pipes, stormfilters)	554	548	1,102	150	37%
Detention ponds	~55	~36	91	31	129%
Ditches and swales	37.6	14.7	52.3	21.0 miles	126%
Pipes	257.4	117.1	374.5	98.0 miles	61%
Public streets	250.1 miles	Not applicable	250.1	85.1 miles	52%

Total public street mileage added since 2005. The majority were added with annexation; however, some were added through development projects.

Table 4-2. Drainage basins, sizes, and impervious surfaces as of 2012

Basin	Acres	Percent of City	Existing impervious % of basin
Carillon Creek	106	1	38
Champagne Creek	625	5	30
Denny Creek	804	7	24
Forbes Creek	1,837	16	37
Holmes Point	457	4	22
Houghton Slope A	376	3	46
Houghton Slope B	134	1	41
Juanita Creek	3,623	32	43
Kingsgate Slope	564	5	30
Kirkland Slope	208	2	39
Lower Sammamish River Valley	24	<1	41
Moss Bay	1,487	13	46
South Juanita Slope	287	3	44
To Redmond	303	3	38
Yarrow Creek	573	5	21
Total	11,407		



Stormwater infrastructure is discussed by basin because the characteristics of the built system have a direct impact on the water quality and habitat quality of the open channels in that basin. For example, drainage basins that have a high percentage of the conveyance in pipes versus open channels are less likely to have high-quality fish habitat.

4.A.2 Conveyance

Stormwater is conveyed from its point of origin on the land surface to Lake Washington through constructed infrastructure (pipes and ditches) and natural stream channels that generally follow the topography confined within drainage basins. Impervious surfaces within those drainage basins influence how much water enters the conveyance systems. A list of Kirkland's drainage basins, sizes, and percent impervious surfaces is provided in Table 4-2 and shown on Figure 4-1.

4.A.2.a Pipes

Pipe sizes vary according to the drainage area and amount of flow they receive, but pipes are usually larger at lower points in the basin as the volume of water collected from upstream areas is routed through fewer pipes. For example, in the Moss Bay drainage basin, pipe diameters in the upper region vary from 8 to 12 inches and combine into one 72-inch-diameter pipe down Central Way to discharge into Lake Washington. The pipe materials also vary, although most pipes in Kirkland are constructed of corrugated aluminum pipe (CAP), concrete, or solid-wall polyethylene (SWPE). The stormwater conveyance pipes are not all owned by the City of Kirkland. Stormwater pipes on private property connect to pipes owned by the City or to local streams and waterways under the City's jurisdiction.

Table 4-3 summarizes the total lengths and materials of stormwater publicly maintained pipes in Kirkland. Kirkland owns and maintains the majority of pipes within the city as a whole (over 60%) as most pipes are located beneath city streets and city right-of-way.

Table 4-3. Summary of types of publicly owned pipes and lengths by drainage basin

Basin	Pipe material (miles) (see Table 4-5 for pipe abbreviations)							Total Length (miles)
	CAP	Concrete	Ductile Iron	Other	PVC	RCP	SWPE	
Carillon Creek	0.37	1.00	0.05	0.00	0.41	0.27	0.55	2.65
Champagne Creek	3.18	4.27	0.17	0.45	1.70	0.22	3.73	13.73
Denny Creek	3.12	7.36	0.24	0.07	0.60	0.24	2.78	14.42
Forbes Creek	12.58	13.95	1.49	0.69	4.26	1.37	12.07	46.42
Holmes Point	1.58	2.26	0.02	0.28	0.73	0.23	1.07	6.17
Houghton Slope A	0.78	5.71	0.14	0.00	1.20	0.87	0.93	9.63
Houghton Slope B	0.67	0.74	0.01	0.03	0.22	0.74	0.17	2.57
Juanita Creek	26.20	41.47	0.73	1.58	2.34	1.45	11.94	85.72
Kingsgate Slope	2.23	3.40	0.15	0.33	1.42	0.61	5.11	13.24
Kirkland Slope	0.39	3.75	0.11	0.01	1.33	0.37	0.74	6.69
Lower Sammamish River Valley	0.22	0.24	0.01	0.00	0.00	0.00	0.32	0.79
Moss Bay	6.93	17.41	0.91	0.61	5.62	4.49	8.42	44.39
South Juanita Slope	2.67	2.94	0.12	0.26	0.73	0.41	1.22	8.35
To Redmond	2.94	2.09	0.19	0.06	0.37	0.19	2.29	8.13
Yarrow Creek	2.51	2.68	0.05	0.04	0.51	0.70	1.10	7.59
Total length (miles)	66.38	109.27	4.40	4.42	21.44	12.15	52.44	270.51

Since 2007, about 20% of the City's stormwater pipes have been inspected using CCTV camera equipment that the City owns. Almost 52% of the pipes inspected were classified as being in good or excellent condition.

Figure 4-2 shows the locations of those pipes that have been video-inspected since April 2009, and the condition of the pipes based on the inspection. Table 4-4 summarizes the condition of the pipes that have been inspected and Table 4-5 summarizes the condition ratings according to pipe material. The data do not indicate that certain pipe materials are more likely to result in poor or fair pipe condition ratings; however, certain pipe materials such as CAP are known to require more frequent maintenance or replacement, based on staff experience.

Figure 4-2 Storm Pipe Condition Since April 2009

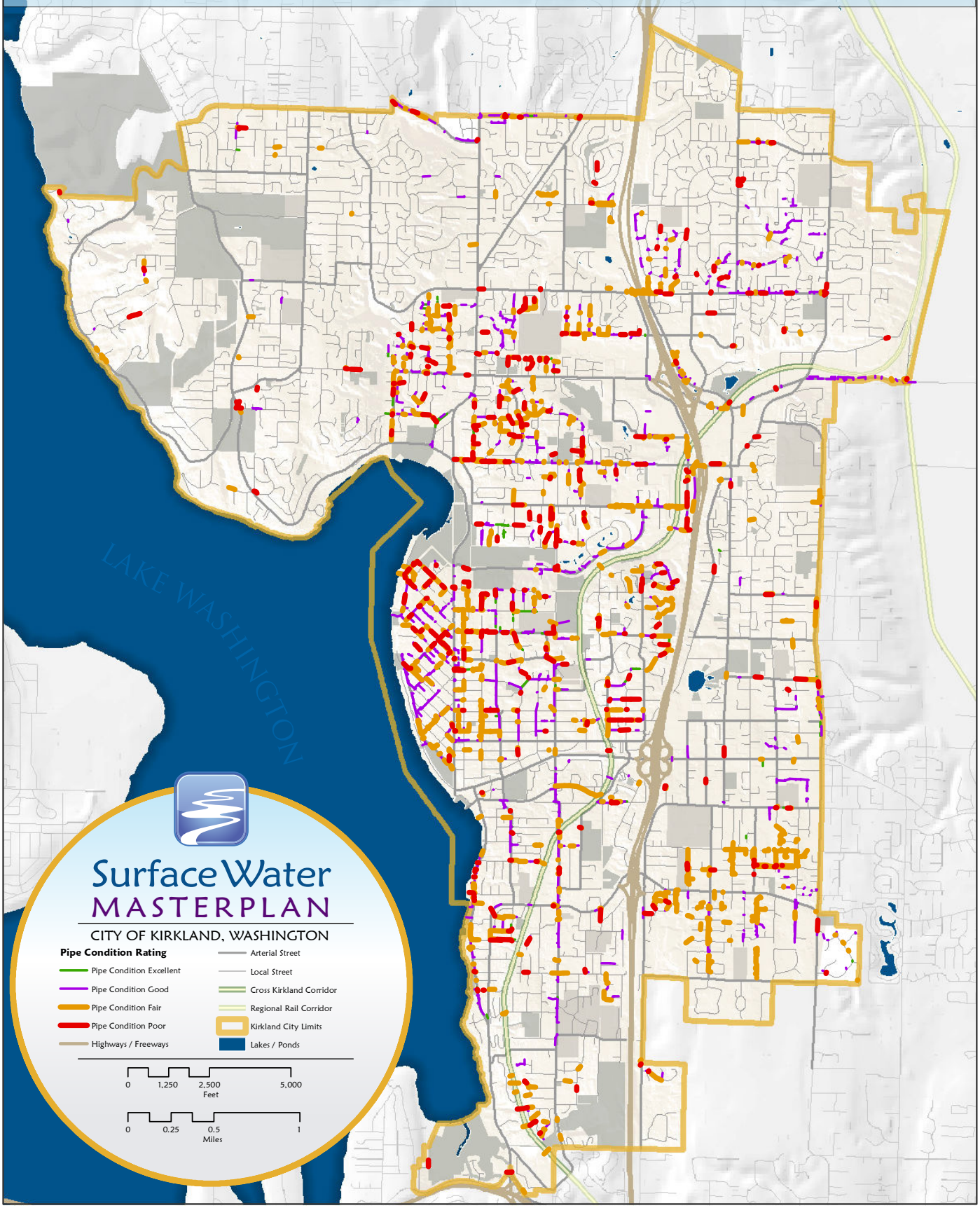


Table 4-4. Summary of pipes CCTV inspected and condition ratings by drainage basin

Basin	Condition of pipe (in miles)				Percent of City pipe CCTV inspected	City pipe cleaned (in miles)	Percent of City pipe cleaned	Percent of City pipe CCTV inspected/ cleaned per basin
	Excellent	Fair	Good	Poor				
Carillon Creek	0.03	0.22	0.06	0.01	12.34%	1.19	42.16%	54.50 %
Champagne Creek	0.00	0.06	0.08	0.11	1.85%	0.39	2.86%	4.71 %
Denny Creek	0.01	0.16	0.08	0.04	2.10%	0.57	3.97%	6.07 %
Forbes Creek	0.59	4.55	4.21	2.07	24.61%	13.01	28.03%	52.64 %
Holmes Point	0.00	0.05	0.09	0.08	3.53%	0.36	5.89%	9.42 %
Houghton Slope A	0.09	1.44	0.93	0.40	29.67%	2.70	28.02%	57.69 %
Houghton Slope B	0.00	0.17	0.30	0.11	22.11%	1.55	60.39%	82.49 %
Juanita Creek	0.54	7.51	4.52	2.22	17.26%	8.82	10.29%	27.54 %
Kingsgate Slope	0.01	0.81	0.17	0.05	7.85%	0.89	6.69%	14.54 %
Kirkland Slope	0.12	2.88	1.40	0.59	74.38%	0.47	7.01%	81.39 %
Lower Sammamish River Valley	0.00	0.29	0.03	0.02	42.54%	0.00	0.00%	42.58 %
Moss Bay	0.50	5.69	4.31	1.31	26.61%	12.05	27.14%	53.74 %
South Juanita Slope	0.06	1.17	1.23	0.68	37.60%	2.55	30.52%	68.12 %
To Redmond	0.16	0.96	0.84	0.12	25.58%	3.58	43.98%	69.57 %
Yarrow Creek	0.00	0.23	0.32	0.11	8.70%	2.88	37.96%	46.67 %
Grand Total	2.11	26.19	18.57	7.92	20.25 %	50.94	18.83 %	39.08 %

Table 4-5. Summary of pipe material inspected relative to condition rating

Pipe Material	Condition				Total length (miles)
	Excellent	Fair	Good	Poor	
AC: asbestos concrete	0.00	0.02	0.07	0.00	0.09
CAP: corrugated aluminum pipe	0.05	5.51	4.75	2.67	12.98
CONC: concrete	0.50	12.99	9.78	3.93	27.2
CPE: corrugated polyethylene	0.00	0.01	0.00	0.04	0.05
DI: ductile iron	0.24	0.47	0.22	0.04	0.97
GCP: galvanized corrugated pipe	0.00	0.01	0.05	0.03	0.09
LCPE: lined corrugated polyethylene	0.00	0.01	0.04	0.04	0.09
N/A: not applicable (misc. pipe type)	0.00	0.01	0.04	0.04	0.09
PVC: polyvinyl chloride	0.60	1.34	1.14	0.42	3.50
RCP: reinforced concrete pipe	0.00	1.69	0.86	0.09	2.64
SWPE: solid wall polyethylene	0.72	4.13	1.62	0.62	7.09
Total (miles)	2.11	26.19	18.57	7.92	54.79

In addition to CCTV work, pipes are viewed by crews as they are routinely cleaned. This work does not assign condition ratings, and may not as thoroughly inspect joints or identify structural defects, but does give a larger view of the portion of the system that is viewed by staff in a given period of time. Cleaning and CCTV are coordinated to provide maximum coverage of the public system.

4.A.2.b Open Channels

Open channels, including natural stream channels, make up the rest of the City's surface water and stormwater conveyance system.

Figure 4-3 shows the locations where City-owned stormwater outfalls (the built infrastructure, including pipes and constructed conveyance systems) discharge to receiving waters, either streams or Lake Washington. The outfalls are used to identify surface water and stormwater pathways and determine sources of pollutants through upstream source tracing.

A little over half of the open conveyance system (~45 miles) are ditches, and most of the stream channels are part of the Juanita Creek drainage basin, which is also the largest basin in the city. With the annexation of the Finn Hill/Juanita/Kingsgate area, Kirkland gained more jurisdictional area within Juanita Creek, and also added the Holmes Point Creek, Denny Creek, and Champagne Creek drainage basins, all of which have natural stream channels that were walked and assessed as part of this Surface Water Master Plan update. Stream channel conditions are summarized below in the Natural Resources section. Table 4-6 summarizes the lengths and types of open channels and streams in each drainage basin.

Table 4-6. Summary of channel types and lengths by drainage basin

Basin	Channel Type (miles)			Total Length (miles)
	Ditch	Stream	Treatment Swale	
Carillon Creek	0.52	0.22	0.101	0.75
Champagne Creek	2.85	1.71	0.82	5.38
Denny Creek	4.05	3.19	0.21	7.45
Forbes Creek	6.30	4.73	0.75	11.78
Holmes Point	2.73	1.56	0.16	4.45
Houghton Slope A	0.42	0.38	0.03	0.83
Houghton Slope B	0.70	0.17	0	0.87
Juanita Creek	4.62	10.42	0.58	15.62
Kingsgate Slope	3.43	1.02	0.60	5.05
Kirkland Slope	0.26	0.0	0.0	0.26
Lower Sammamish River Valley	0.03	0.0	0.0	0.03
Moss Bay	3.51	3.33	0.31	7.51
South Juanita Slope	0.62	0.08	0.07	0.77
To Redmond	2.28	0.0	0.01	2.29
Yarrow Creek	1.74	1.12	0.01	2.87
Total (miles)	44.80	36.09	6.94	87.83

4.A.3 Stormwater Flow Control and Water Quality Treatment Facilities

Similar to stormwater conveyance systems, stormwater treatment facilities are both publicly and privately owned and maintained. More than 1,100 stormwater treatment facilities, including tanks, vaults, swales, ponds, and other stormwater BMPs, are located in Kirkland. Over half of these facilities are either privately owned, or owned by another government agency. Table 4-7 provides a summary of the number of publicly and privately owned stormwater treatment facilities in Kirkland, as well as the average facility density relative to impervious surface coverage in the basin. Facility density gives a very general idea of how much of the impervious area of a basin is treated prior to discharge,though this does not take into account the area treated by an individual facility or the size of that facility (older facilities may treat a larger area to a lesser degree than new facilities; ages of facilities are noted in Figure 2-3). Stormwater facilities categorized by public and private ownership are shown in Figure 4-4.

In general, stormwater facilities that serve public streets and single-family residential neighborhoods are publicly maintained, whereas commercial and multifamily development stormwater facilities are generally privately maintained.

4.B Natural Resources

Natural resources and open spaces, such as the streams, wetlands, and lakes, are an integral part of Kirkland's surface water and stormwater system. Protection of these natural resources is one of the primary reasons for current stormwater regulations, and preservation of these resources is generally more effective than restoration after degradation has already occurred. With the annexation of the Finn Hill neighborhood, Kirkland gained three new stream systems—Champagne Creek, Denny Creek, and Holmes Point Creek—as well as additional upstream areas of the Juanita Creek basin. The 1998 habitat inventory of Kirkland's stream systems conducted by The Watershed Company was updated in 2005 as part of the last Surface Water Master Plan. The Juanita Creek system has also been extensively characterized and has been the focus of regional stormwater retrofit grants; therefore, the newly annexed areas of Juanita Creek and streams inventoried in 2005 were not evaluated again for this Plan update.

Figure 4-3 City Owned Outfalls

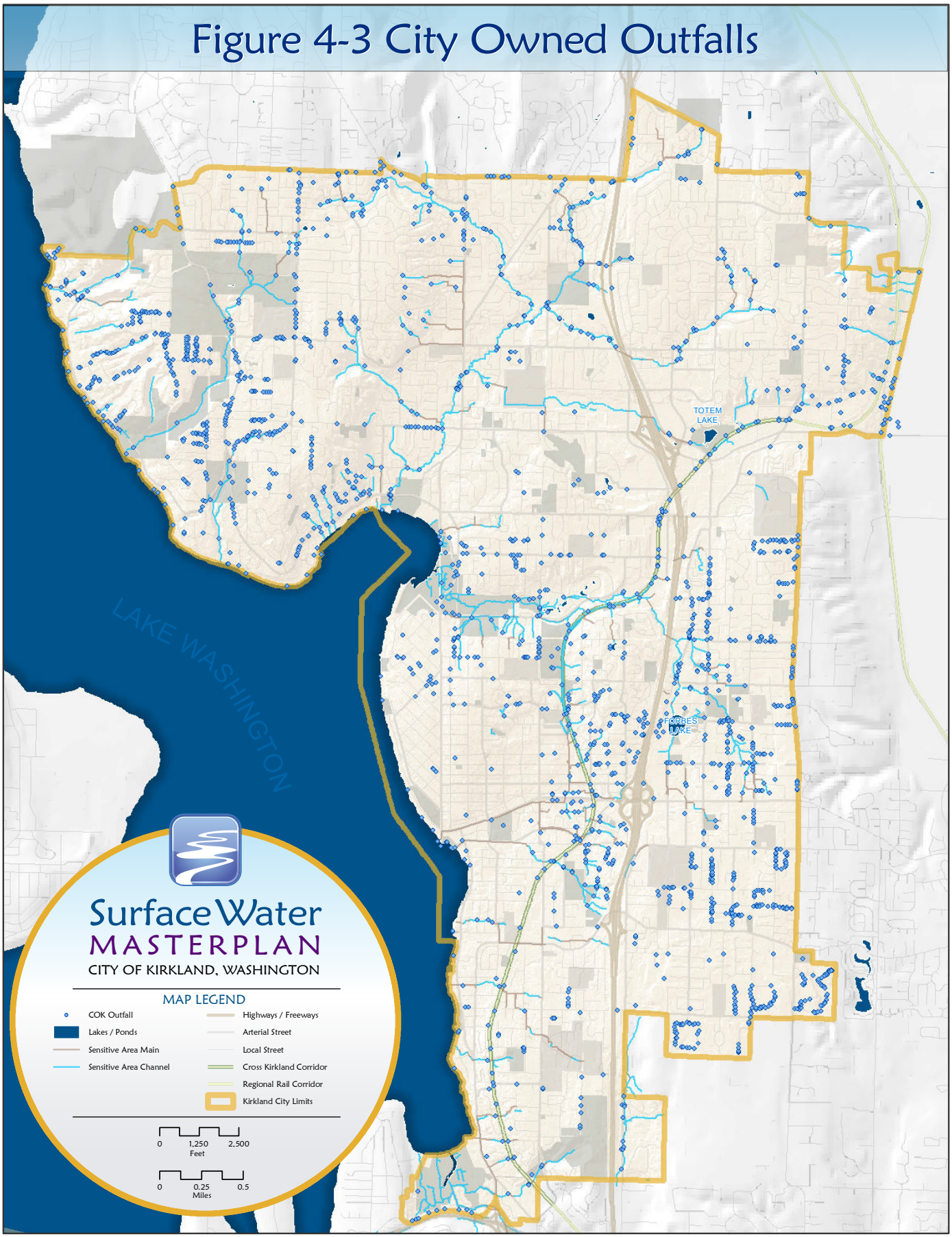


Figure 4-4 Public and Private Stormwater Facilities

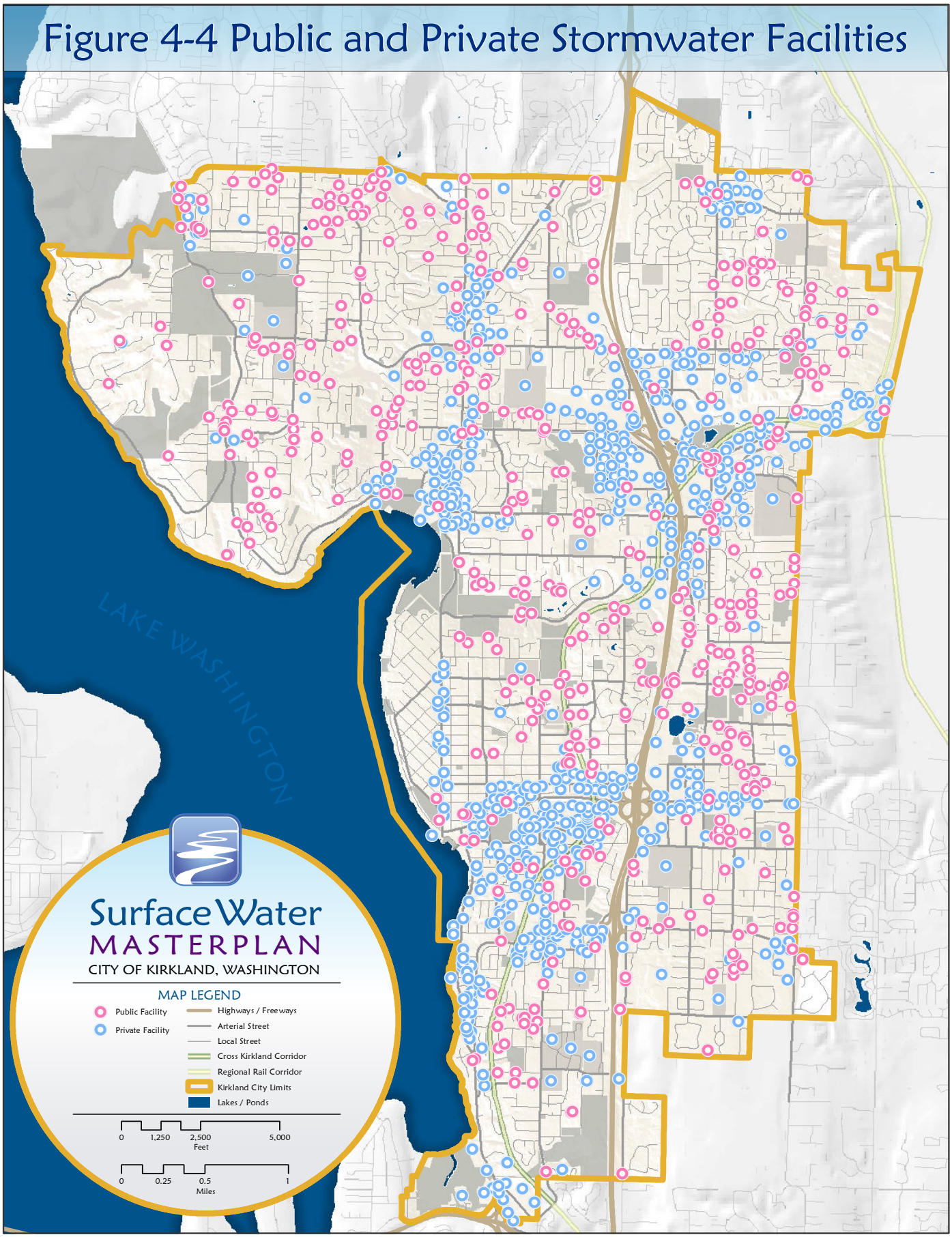


Table 4-7. Summary of public and private stormwater facilities by drainage basin

Basin	Number of Public Facilities	Number of Private Facilities	Number of municipal facilities*	Total Number of Facilities	Facility Density (number of facilities per acre impervious)*
Carillon Creek	8	5	0	13	0.32
Champagne Creek	39	6	0	45	0.24
Denny Creek	33	10	4 (KC)	47	0.24
Forbes Creek	147	82	2 (WA)	231	0.34
Holmes Point	8	6	1 (MUN)	14	0.14
Houghton Slope A	17	39	0	56	0.32
Houghton Slope B	2	2	0	4	0.07
Juanita Creek	174	200	31 (MUN) 2 (WA)	407	0.26
Kingsgate Slope	33	31	0	64	0.32
Kirkland Slope	0	2	0	2	0.02
Lower Sammamish River Valley	2	2	5 (MUN)	9	0.91
Moss Bay	80	167	0	247	0.36
South Juanita Slope	12	23	0	35	0.28
To Redmond	20	19	0	29	0.20
Yarrow Creek	5	21	2 (KC)	28	0.15
Grand Total	580	603	47	1,230	0.28

KC = King County, MUN= Other Municipality, WA = State of Washington Facility density does not account for size of facility or area treated, but gives a general idea of overall treatment in the basin.*

Habitat concerns in other stream systems have been addressed through capital projects and programs, and the overall concerns of stormwater flow control and water quality treatment remain. Champagne, Denny, and Holmes Point creeks were walked during this planning effort. Field notes and photos of the field investigations are included in Appendix G, and conditions are summarized below.

Juanita Bay Park

4.B.1 Annexation Area Streams

Stream walks were conducted to evaluate general physical and biological conditions of the mainstem channels within the annexation area. A summary of concerns with channel characteristics is provided below in Table 4-8 and details are provided in Appendix G. Overall, Champagne Creek had the most concerns with erosion and downcutting, likely caused by high stormwater flows.

Denny Creek has a long segment that is subject to landslide hazards but is in relatively good condition with regard to fish habitat, though the culvert at Juanita Drive is a complete barrier to fish passage. The lower reach of Holmes Point Creek has significant barriers to fish passage and has an armored channel with little streamside vegetation.

Table 4-8. Summary of annexation Area Stream Issues Observed

Stream	Reach	Issues observed
Champagne Creek	Lower	Extreme channel incision downstream of Juanita Drive in the Juanita Woodlands open space and sediment deposition near the mouth
	Upper	Very narrow riparian corridor, ditch-like conditions
Denny Creek	Lower	Narrow riparian corridor through O.O. Denny Park, previous channel stabilization efforts
	Lower Ravine	Bank erosion and landslide evidence on adjacent slopes, stream channel restoration in the vicinity of the Stone Bridge, and major gully entering the stream channel from the north
	Upper Ravine	Slope failures are common, lots of large wood and boulders create hydraulic and aquatic habitat diversity
	Upper	Juanita Drive culvert is a complete barrier to fish movement
Holmes Point Creek	Lower	Fish passage barriers, no riparian corridor, armored channel
	Middle	Erosion, bank, and hill slope instability; good riparian corridor; potential for fish habitat
	Upper	Old water diversion structures in channel

4.B.2 Mapped Floodplains

Four drainage basins within Kirkland have mapped 100-year floodplains: Forbes Creek, Juanita Creek, Yarrow Creek, and Moss Bay. Figure 4-5 shows the floodplains, and Table 4-9 summarizes the acreage mapped as floodplain in Kirkland. Most are associated with large wetland complexes such as at Yarrow Bay, Totem Lake, and Forbes Creek near the mouth at Juanita Bay. The Moss Bay floodplain is in the Peter Kirk ball fields. No other floodplains have been mapped; FEMA has not provided funding for this work as there has not been large-scale loss of property as has occurred on other urban creeks such as Thornton Creek in Seattle. There are areas that flood, particularly along Juanita Creek, and the City may wish to consider the pros and cons of expanding floodplain mapping to raise awareness and improve flood preparedness. As was discussed in Section 3, 35 tax parcels are located within the mapped FEMA 100-year floodplain. A small number of parcels in the Forbes Creek basin are located within the mapped FEMA floodway, which is the channel area that must be analyzed for changes in flood elevations as part of land development. Most of these parcels are publicly owned.

Table 4-9. Summary of mapped floodplain acreage in Kirkland

Basin	Mapped Floodplain (acres)		Total (acres)
	100-Year	Floodway	
Forbes Creek	15.90	8.26	24.16
Juanita Creek	12.84	0.00	12.84
Moss Bay	2.54	0.00	2.54
Yarrow Creek	62.66	0.00	62.66
Grand Total (acres)	93.94	8.26	102.20

4.B.3 Wetlands

Kirkland has more than 400 acres of mapped wetlands (Figure 4-6 and Table 4-10), with over 120 individual wetland areas and 9 wetlands that are larger than 8 acres (Table 4-11). Wetlands are an important component of the surface water system, providing ecological values in the form of water quality filtering, flow attenuation, and refuge for wildlife. Stormwater regulations require preservation of flow patterns, so that wetland hydroperiods are not significantly impacted. Many wetland areas face development pressure, either because the properties surrounding them contain upland areas, or because they can be developed under the reasonable use provisions of Chapter 90 of the Kirkland Zoning Code. Acquisition of key wetland areas may provide significant protection for streams at a relatively low cost.

Expanded **floodplain mapping** may be beneficial to increasing flood awareness and preparedness, but could also result in higher insurance rates for property owners within these areas. The City should consider the benefits and consequences of additional floodplain mapping.

Figure 4-5 Mapped FEMA Floodplains

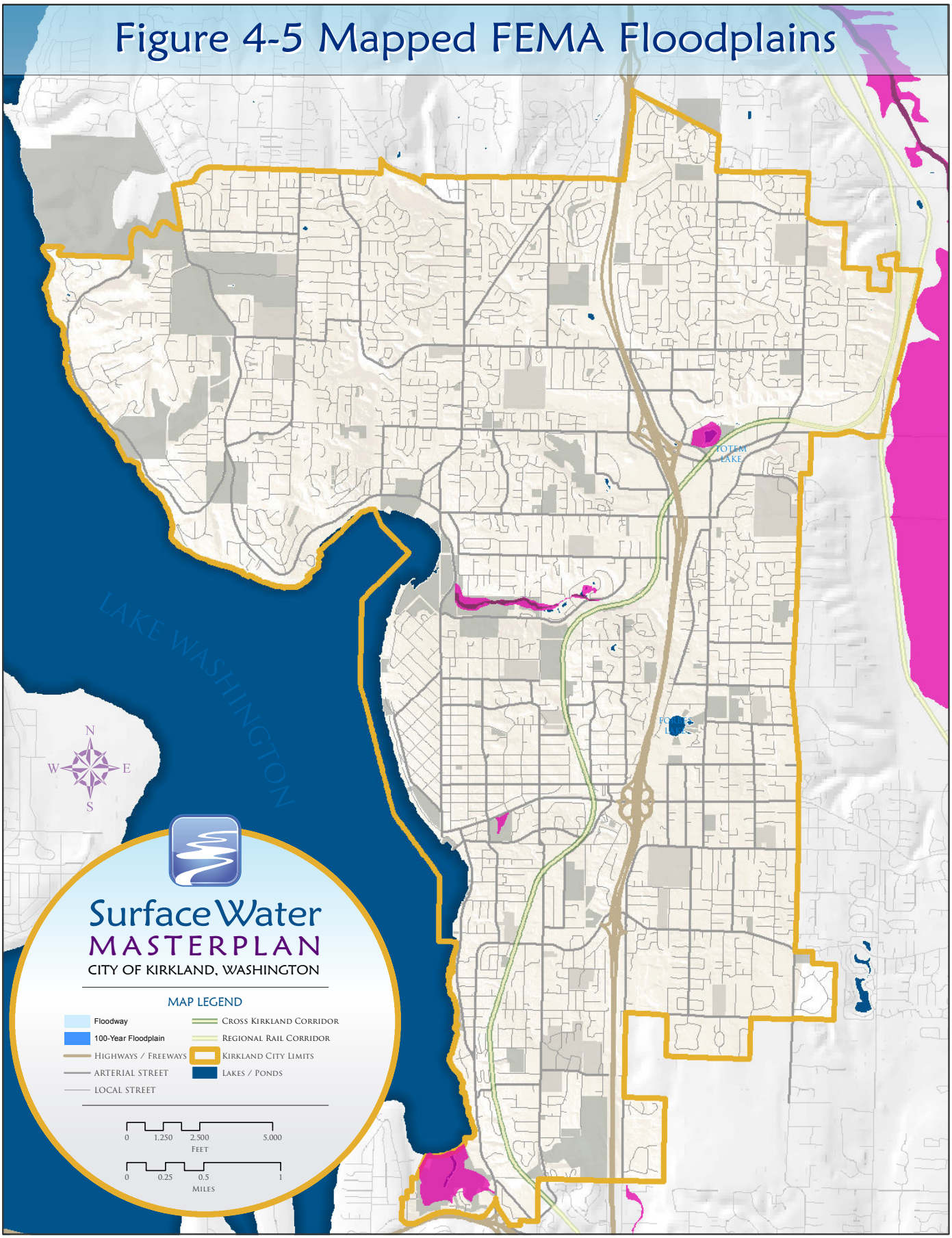


Figure 4-6 Wetlands

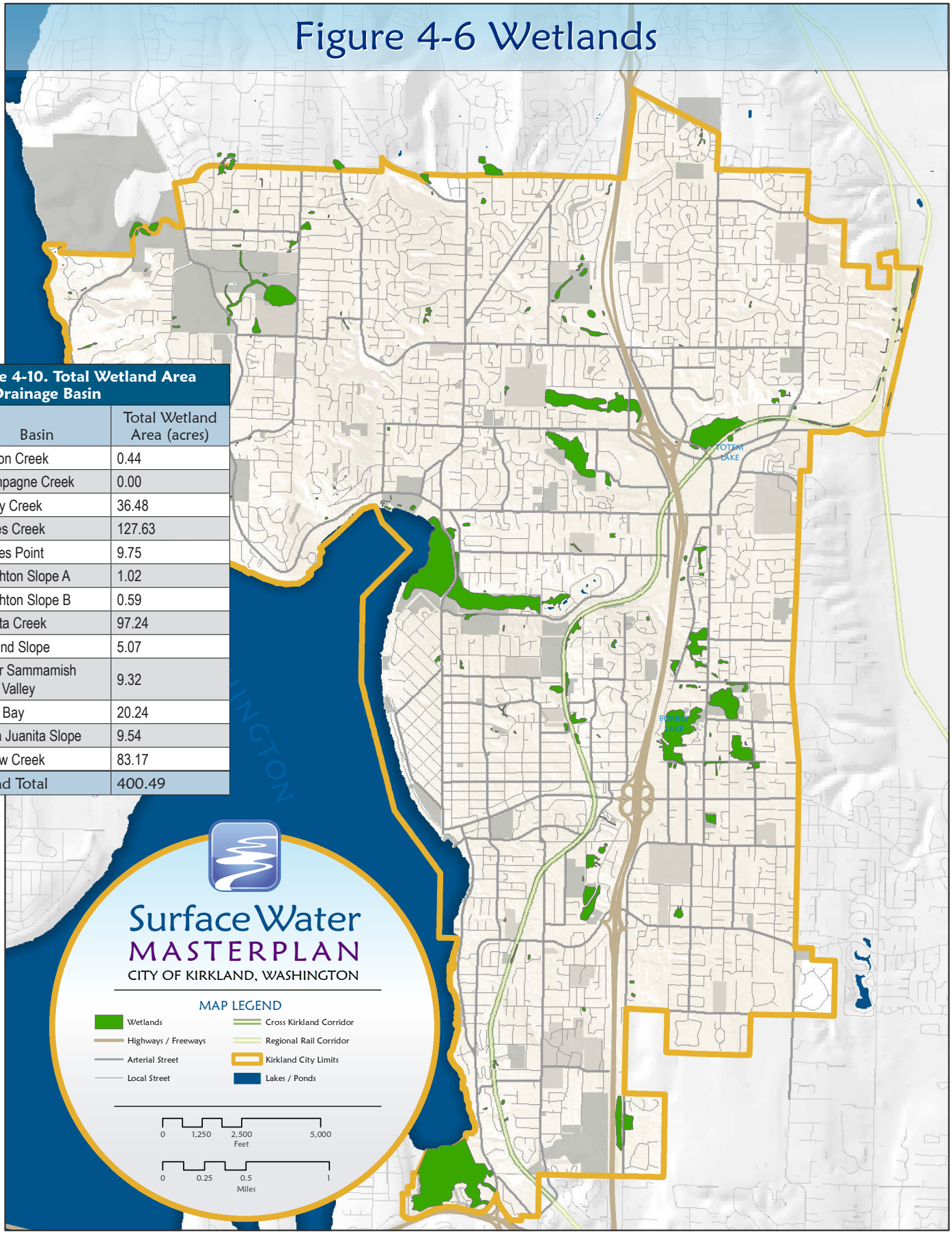


Table 4-10. Total Wetland Area by Drainage Basin

Basin	Total Wetland Area (acres)
Carillon Creek	0.44
Champagne Creek	0.00
Denny Creek	36.48
Forbes Creek	127.63
Holmes Point	9.75
Houghton Slope A	1.02
Houghton Slope B	0.59
Juanita Creek	97.24
Kirkland Slope	5.07
Lower Sammamish River Valley	9.32
Moss Bay	20.24
South Juanita Slope	9.54
Yarrow Creek	83.17
Grand Total	400.49

4.B.4 Culverts and Fish Passage

An evaluation of fish passage was conducted in 2013 at culvert crossings where the city's streams are classified as "fish bearing" or Type F according to the Forest Practices Act stream typing protocol, Washington Administrative Code (WAC) 222-16-013. The slope, layout, length, and entrance/exit conditions all can impact whether adult and juvenile fish can pass through a given culvert. Ratings were assigned for each culvert based on the degree to which that culvert is a barrier to fish passage, with 1 being fully passable and 4 being a total passage barrier. Culverts that were identified as being barriers to fish movement were prioritized for improvements based on the following criteria, with 1 being the highest priority to address:

Priority 1

Those fish passage barriers that:

- Are located on a fish-bearing or potentially fish-bearing stream segment
- Are rated as a full (4) or partial (3) barrier
- Independently restore access to a high or moderate amount of good-quality habitat
- Can be accomplished at a relatively low to moderate cost

Priority 2

Same as priority 1 except must be implemented in conjunction with one or more other projects to be effective, restores access to only a fairly limited amount of habitat, is comparatively expensive, and/or is infeasible for some other reason.

Priority 3

Would be given a priority rating of 1 or 2, except is rated only as a hindrance (2) to upstream migration. As noted above, such culverts should eventually be replaced and brought up to standard, but such replacement is not urgent and the culvert is not precluding access significantly in the meantime.

Priority 4

These are culvert crossings located either along non-fish-bearing stream segments with little or no habitat potential or that are already fully passable (rating of 1). These are noted as having a low priority for replacement.

Sixty-two culverts were evaluated for fish passage barriers, and five of those culverts were assigned a priority rating of 1 for replacement.

Table 4-11. List of the City's Largest Wetlands

Basin	Wetland Name	Area (acres)
Forbes Creek	FORBES 1*	65.45
	FORBES 14	13.00
	FORBES 17	26.22
	FORBES 19	8.12
Juanita Creek	JUANITA 10	20.35
	JUANITA 4	25.20
	JUANITA 6	18.56
Moss Bay	URBAN 11	8.08
Yarrow Creek	YARROW 1**	73.50

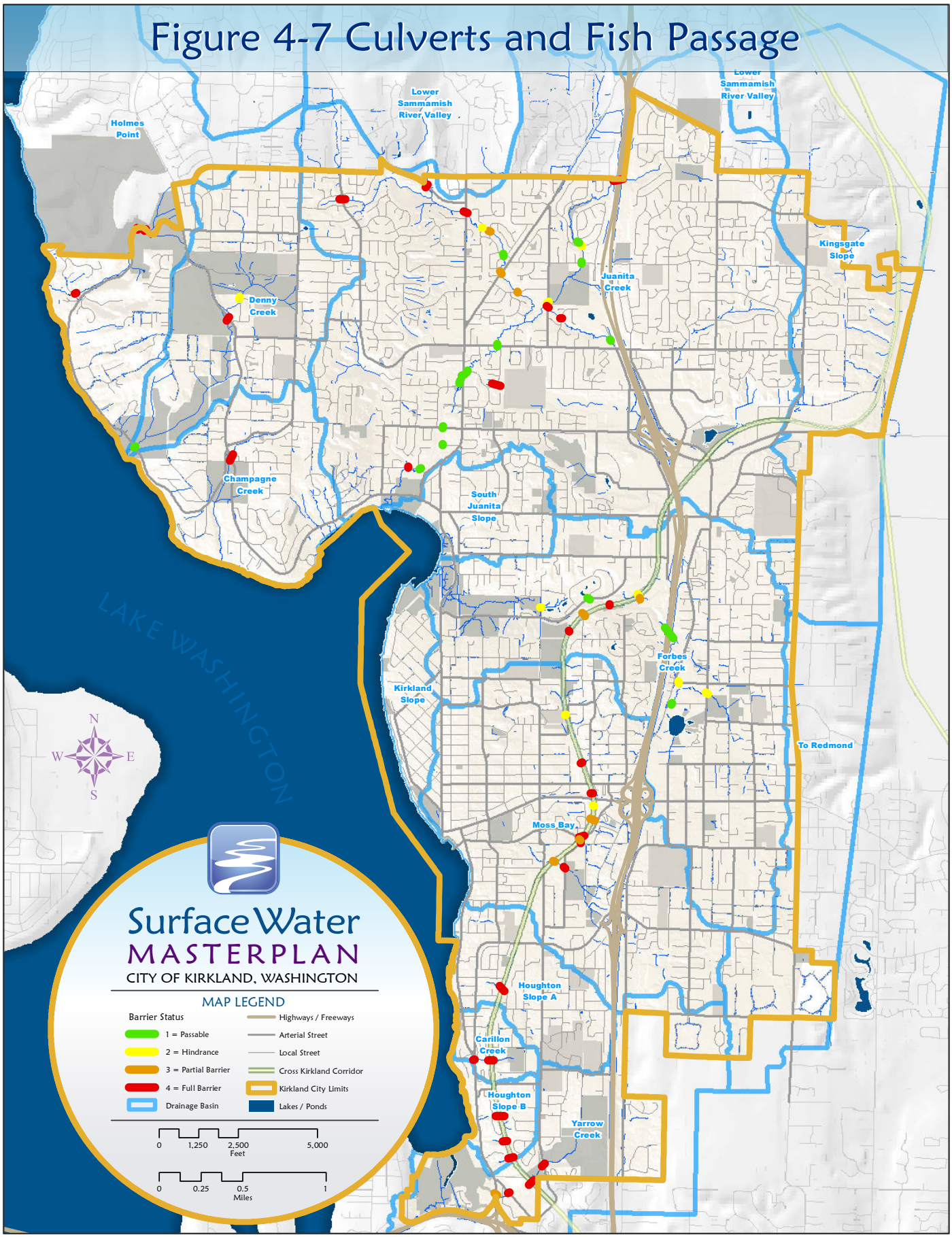
* Also in South Juanita Slope and Kirkland Slope basins
** Also in Houghton Slope B basin

Figure 4-7 shows the culvert priorities for replacement. Table 4-12 lists the number of culverts evaluated in each basin and the number rated as priority 1 through 4 for fish passage. The full results of the culvert analysis are provided in Appendix E.

Table 4-12. Number of culverts evaluated and priority for upgrade

Basin	Number of culverts evaluated	Priority for upgrade			
		1 (highest)	2	3	4 (lowest)
Carillon Creek	2	0	0	0	2
Champagne Creek	1	0	0	0	1
Denny Creek	3	1	0	1	1
Forbes Creek	11	0	1	4	6
Holmes Point	3	0	1	0	2
Houghton Slope A	1	0	1	0	0
Houghton Slope B	3	0	0	0	3
Juanita Creek	25	3	6	3	13
Kingsgate Slope	0	0	0	0	0
Kirkland Slope	0	0	0	0	0
Lower Sammamish River Valley	0	0	0	0	0
Moss Bay	9	0	0	1	8
South Juanita Slope	0	0	0	0	0
To Redmond	0	0	0	0	0
Yarrow Creek	4	1	3	0	0
Total (miles)	**62**	**5**	**12**	**9**	**36**

Figure 4-7 Culverts and Fish Passage



4.B.5 Shorelines

The City's Shoreline Management Program, implemented by the Planning and Community Development Department, shares some common environmental goals with the Surface Water Utility. Shoreline conditions are linked with upstream hydrologic conditions, as stream channels deliver water and sediment to Lake Washington. Whereas the Surface Water Utility's goals are mostly environment- and infrastructure-oriented, the Shoreline Management Program requires consideration of recreational uses, such as boat launches and marinas. Sometimes local sediment deposition in these areas can temporarily limit accessibility for recreational functions that require deeper marinas to accommodate boats. The City may wish to consider ways to either warn boaters of hazards near stormwater outfalls, or remove those hazards by either dredging or extending stormwater outfalls. King County Water and Land Resources Wastewater Division will be contributing funds toward conducting a bathymetric survey of the stormwater outfall near the boat launch at Marina Park to determine the magnitude of sediment buildup and potential impacts on boat launch operations.

Sediment deposition along Kirkland shorelines sometimes affects boat access to marinas. The City should consider whether it is in the public interest or the City's responsibility to mitigate sediment deposition in these areas.

4.B.6 Aquatic Life

Aquatic life in Kirkland's streams is measured through reports of fish counts when projects require fish removal and stream dewatering, and through annual surveys of the Benthic Index of Biologic Integrity (B-IBI). The City has been collecting B-IBI data at 13 locations since 2005 (Figure 4-8). The data generally show B-IBI scores that are typically indicative of poor water quality; however, in many cases, not enough organisms have been collected to be statistically valid. Collection methods are being updated to ensure that a minimum of 500 organisms are collected from each site so that statistics are valid. B-IBI data are included in Appendix H.

4.C Geologic Conditions

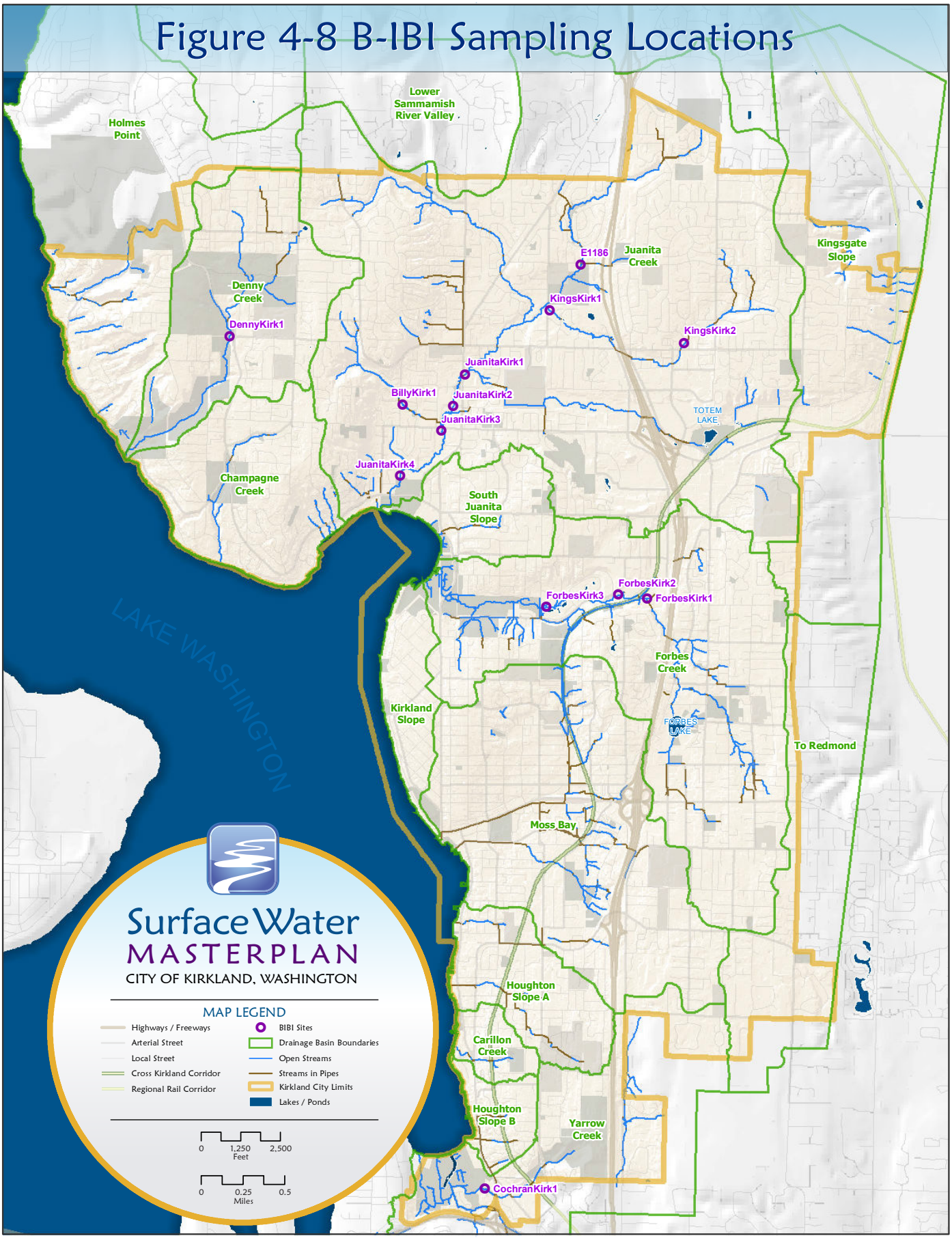
Geologic conditions partially determine landslide risk, infiltration potential, and development complexity or feasibility. This general overview of geologic conditions in Kirkland provides the context for discussion of landslides and infiltration potential, both of which are closely linked to surface water management.

Surface geology was mapped in 1983 by the United States Geological Survey (Minard, USGS 1983) for Kirkland, including the newly annexed area. A more detailed geologic map was developed for Kirkland in 2010 (Troost and Wisher, 2010), to help identify areas that can readily infiltrate water, however, the 2010 effort did not include the annexation area. In general, Kirkland's geology is composed of glacial till (material compressed by glaciers, also known as hard pan) and outwash (material washed off of advancing or meltingglaciers), and lakebed deposits associated with the periods between glaciers. The till is typically present at the higher elevations of the city, and is underlain by advance outwash. The advance outwash is generally comprised of sand that is is easily eroded by running water, and it can move down hillsides as a result of gravity, falling trees, or failures associated with saturated conditions. Clay and silt is typically below the sand and impedes the downward movement of water, resulting in seepage. Hill slope failures are often present in the advance outwash above the silt and clay. Advance outwash is present in the steep ravines in the annexation area, and hill slope failures were observed in theseareas in Denny Creek, and Holmes Point Creek during stream reconnaissance (described above and in Appendix G).

Recessional glacial deposits (deposits laid down as the glaciers melted) are present in the low-lying valleys in Kirkland, including the Totem Lake and Juanita Creek areas. In much of Kirkland the recessional deposits are lakebed deposits of silt and clay with some sand and peat that resulted from deposition in glacial lakes.

Great heron at juanita bay

Figure 4-8 B-IBI Sampling Locations



4.C.1 Landslides

Figure 4-9 shows high and medium potential for landslide hazards. In general, landslide hazards are defined by steep slopes and by conditions where water is likely to build up at the interface between layers of sand and silt. The Denny Creek and Holmes Point Creek ravines are classified as high landslide hazard areas, as are steep slopes flanking the Forbes Creek valley, west of I-405, and in the vicinity of the CKC trail north of NE 85th Street. Other landslide hazards are present in the city, generally associated with steep terrain and/or erosive geologic conditions. Surface water and stormwater drainage in the vicinity of landslide hazard areas needs to be routed away from steep slopes to avoid exacerbating potentially unstable conditions. The City's zoning code (Chapter 85, Geologically Hazardous Areas) addresses erosion, landslide, and seismic hazards and requires additional analysis for development in these areas. Landslides contribute material to the City's stormwater infrastructure, filling catch basins and pipes with sediment, resulting in increased maintenance needs. Managing surface water and stormwater in order to minimize hill slope instability will improve stormwater conveyance system functionality and public safety.

Citywide review of codes pertaining to geologic hazards, and of current and potential responses to landslide hazards and landslides, is under way in light of the **Oso, Washington**, mudslide that occurred in March 2014.

Citywide review of codes pertaining to geologic hazards, and of current and potential responses to landslide hazards and landslides, is under way in light of the Oso, Washington, mudslide that occurred in March 2014.

4.C.2 Infiltration

In the 2010 geologic mapping, an infiltration potential map (Figure 4-10) was developed for the City, exclusive of the annexation area. Identification of broad areas that may be appropriate and conducive to shallow infiltration is an important first step for determining where LID infiltrative techniques may be appropriate stormwater BMPs. Based on the data in Figure 4-10, approximately 59% of Kirkland (prior to 2011 annexation) has high or medium potential for infiltration. Additional criteria, including location relative to landslide hazards, depth to groundwater, and slopes, will need to be considered when determining LID feasibility or infeasibility, but the infiltration potential map is a good first step.

4D Water Quality

Past monitoring efforts have shown that water quality in Kirkland's streams is typical of that found in other urban areas. King County collects data sufficient to report the Water Quality Index (WQI) for Juanita Creek and Forbes Creek. The WQI is a limited set of chemical parameters that give an overall idea of water quality. In 2013, the WQI for Juanita Creek was 57, which is considered "moderate," and the index for Forbes Creek was 34, which is considered poor (http://green.kingcounty.gov/WLR/Waterres/StreamsData/WQIReport.aspx?Locator=0446). King County is considering increasing the amount of water quality data collected for Juanita and Forbes creeks as part its wastewater treatment program.

Volunteers collect water quality samples in Forbes Lake, and King County analyzes samples and data via a contract with Kirkland. Data are displayed on the King County Web site (http://green2.kingcounty.gov/SmallLakes/LakePage.aspx?SiteID=61). These data show that the general health of the lake remains steady. Other water quality monitoring has been conducted by King County and individual industrial permit holders that reside within Kirkland.

King County, under contract with the Parks Department, conducts monitoring of fecal coliform bacteria at the Houghton, Juanita Beach, and Waverly swimming areas, and these data are reported on the King County Web site (http://green.kingcounty.gov/swimbeach/). High concentrations of fecal coliform bacteria can indicate hazardous conditions for swimmers, and when necessary beaches are closed until bacteria concentrations return to acceptable levels. Juanita Beach has experienced the most closures over the last 5 years.

Public Works volunteer placing water quality placard on storm drain

Figure 4-9 Potential for Landslides

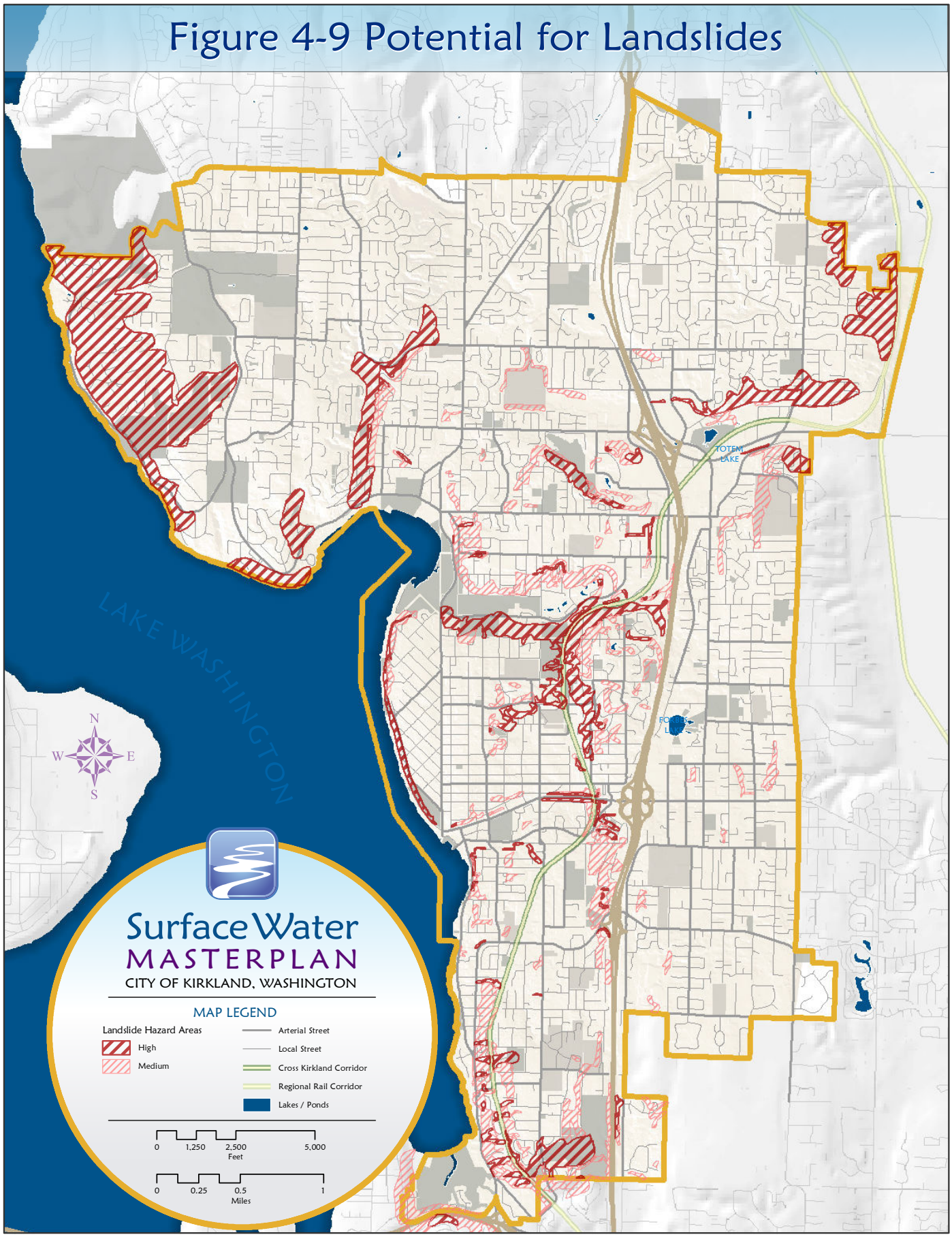
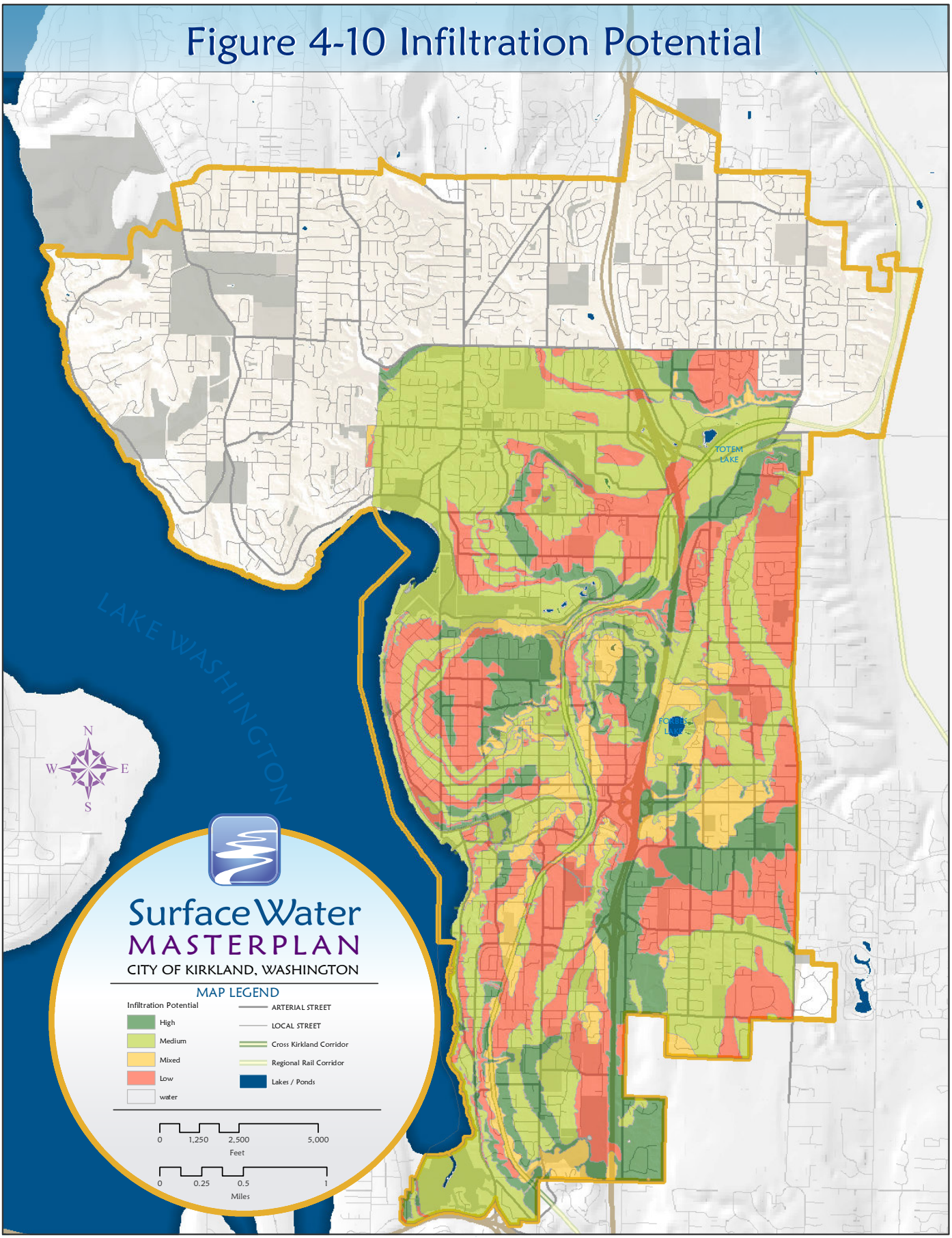


Figure 4-10 Infiltration Potential



The State of Washington maintains a list of water quality status of water bodies in Washington to meet federal requirements of Sections 303(d) and 305(b) of the Clean Water Act. Water quality is assessed to determine attainment of State surface water quality standards (WAC 173-201A) and sediment management standards (WAC 173-204). The Ecology 303(d) list and private NPDES permit holders that conduct water quality monitoring are discussed below.

Ecology 303(d) List

The State's most recent water quality assessment was conducted in 2012. The water bodies are classified into categories ranging from 1 to 5, based on data collected by government agencies:

- Category 1 waters meet tested standards for water quality.
- Category 2 indicates waters of concern.
- Category 3 indicates insufficient data.
- Category 4 are waters that are of concern that do not require a TMDL cleanup plan because one is already in place, another pollution control program is in place, or a TMDL is not appropriate for the type of impairment (i.e., dams, low flow).
- Category 5 waters require a cleanup plan such as a TMDL, which identifies by how much pollutants need to be reduced to achieve surface water quality standards.

Three of Kirkland's streams (Juanita, Forbes, and Yarrow creeks) and Lake Washington are on the 2012 Ecology 303(d) list for impaired water quality. Table 4-13 lists the stream reach, pollutant, and category of impairment. Bacteria is a common constituent of concern in all of the water bodies that are on the 303(d) list in Kirkland, and it is the one constituent that has been on the list the longest (since 1996). Common sources of bacteria are fecal matter from wildlife, domestic pets, and sewage.

Table 4-13. Summary of stream reaches on 2012 Ecology 303(d) list

Stream	Category	On the List Since	Type of Impairment						
			Temperature	Mercury	Bacteria	pH	Dissolved Oxygen	Nitrogen Ammonia	Other
Forbes-Creek near Juanita Bay	1	2004				✓		✓	
	5	1996			✓				
	5	2004	✓				✓		
	2	2004		✓					
Juanita Creek near the NE 132nd crossing, approximately 1.5 miles upstream of Lake Washington	5	1996			✓				
	5	2004	✓				✓		
	2	2004				✓			
Yarrow Bay Creek downstream of SR520	5	2004			✓		✓		
Lake Washington: Juanita Bay	5	1996			✓				
	4C	2004							✓*
Lake Washington: Moss Bay	5	1996			✓				
	2	2004							✓**
Lake Washington: Yarrow Bay	2	2004						✓	
	5	2004			✓				

** Invasive species (milfoil).*
*** Sediment bio-assay.*

4.D.2 Other NPDES Permit Holders within Kirkland

The Ecology Permit Reporting and Information System (PARIS) database was reviewed for a list of NPDES permit holders within Kirkland. In addition to the City's Phase II NPDES MS4 permit, there are three businesses with coverage under the State's Industrial Stormwater GeneralPermit (ISGP) because their activities are exposed to stormwater and/or they are classified as businesses with a high potential for stormwater pollution, and 28 sites that have active Construction Stormwater General Permits (CSGP). Industrial permit holders are responsible to Ecology for meeting permit requirements, and the City of Kirkland does not have responsibility for industrial permit holders; however, this information does help to inform business outreach conducted by the Surface Water Utility, and monitoring data collected by these entities can be used to assess general water quality of discharges leaving these sites.

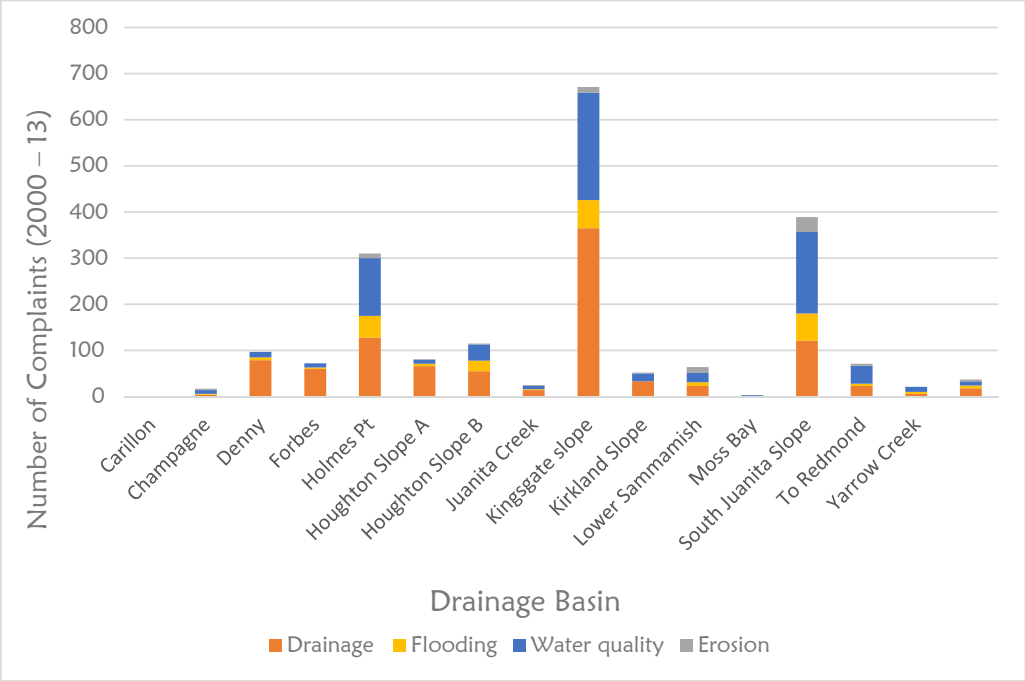
4.E Drainage and Water Quality Complaints

Drainage complaints reach the Surface Water Utility through a phone call, in-person visit, or e-mail to the front counter or individuals within the Utility. Complaints are logged into the Energov permit management software, or are referred directly to the O&M Group where they are entered into the Hansen MMIS software. An initial assessment is made about the urgency of the problem and who should respond. O&M staff handle pollutant spills or flooding problems in the right-of-way. Surface Water Utility engineers provide technical assistance, if required, or the Utility Water Quality Specialist follows up with educational materials for source control, or water quality related issues. If the problem relates to a code violation, staff will typically work with the individual to correct the situation, and will follow up to ensure that a remedy has been implemented. As a last resort, code enforcement will be employed. If the problem requires construction of a capital project, it is referred to the CIP Group for inclusion in the Surface Water CIP.

Drainage complaints from 2000–12 were reviewed to get a general sense of the types of complaints, the areas where they occur, and the seasonality of the calls. After annexation in 2011, King County supplied the City with drainage complaints dating back to 1973. Staff refer to these data when conducting new investigations in the annexation area.

The most drainage complaints occurred in the Juanita Creek basin (the largest basin), followed by the Moss Bay and Forbes Creek basins (Figure 4-11). The complaints were broken down into four categories: drainage, flooding, erosion, and water quality. Most calls were about drainage and water quality issues (Figure 4-11), and the greatest number of calls in a single month were received in December (Figure 4-12). There is not a clear pattern of seasonal calls when looking at the data as a whole. However, flooding calls occur most often in the winter months and the total number of calls has steadily risen over the years (Figure 4-13), peaking in 2007 when an extreme precipitation event occurred in December.

Figure 4-11. Types of drainage complaints by basin (2000–12)



4.F Finn Hill Neighborhood Alliance Surface Water Concerns

Shortly following annexation in 2011, the FHNA compiled citizen complaints, review of data, and field visits into Surface Water Management and Drainage Concerns in the Finn Hill/Holmes Point Neighborhood (FHNA, 2012). This document contains a variety of type and size of concerns, ranging from simple drainage complaints that have since been addressed by Utility staff, to suggestions for large capital projects and long-term programs. City staff are grateful for this assistance in identifying citizen interests and environmental problems. The primary concerns captured in the FHNA plan are water quality associated with Juanita Drive, infrastructure repair and replacement, fish habitat and flooding issues associated with Denny Creek, and stormwater BMPs in new development. The full document and responses to the concerns raised are included in Appendix C.

Figure 4-12. Number of drainage complaints by month (2000–12)

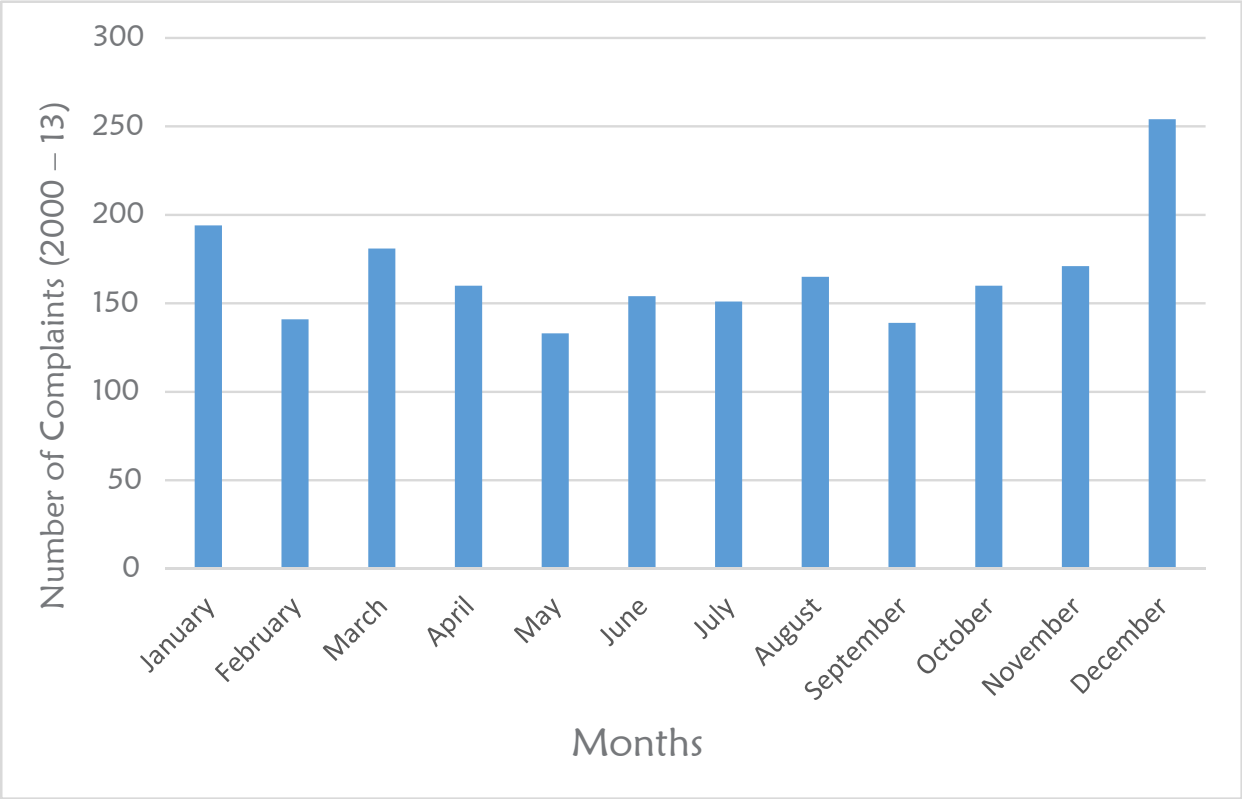
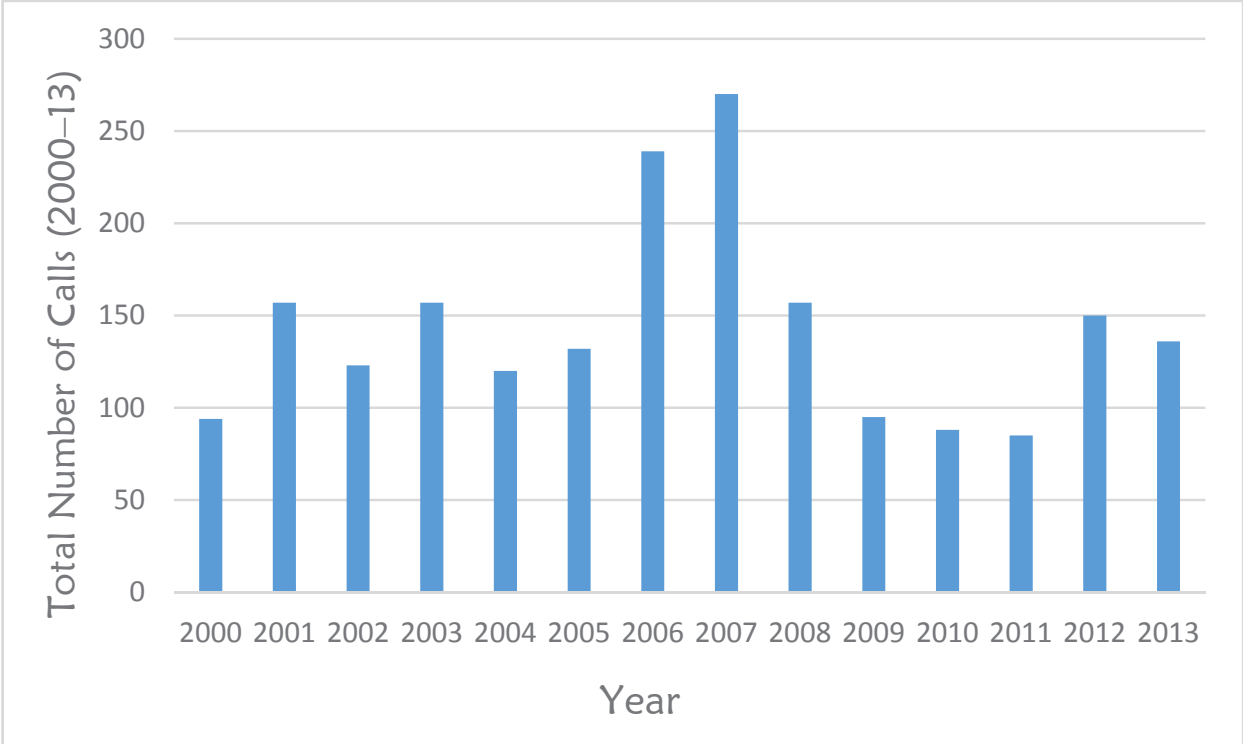


Figure 4-13. Total number of calls received by year (2000–13)



section 5

Current Program Overview and Challenges

The Surface Water Utility staff are currently organized into two work groups: O&M and ESE (formerly called Customer Service). The Capital Projects Group within the Public Works Department also provides management of the design and construction of surface water capital projects funded by the Utility. This section provides an overview of current work programs staffing and costs. The challenges these three groups are facing in terms of staffing, resources, or policy direction are described. This information is the basis for the programmatic and project recommendations detailed in Section 6.

What is a Capital Project?
A long-term investment made in order to build upon, add, or improve on a capital-intensive project. A capital project is any undertaking that requires the use of notable amounts of capital (for Kirkland this is defined as >$50,000), both financial and labor, to undertake and complete. Capital projects are often defined by their large scale and high cost relative to other investments requiring less planning and resources. *Source: Investopedia.com*

5.A Current Utility Functions and Positions

The Surface Water Utility provides the general functions as shown in Table 5-1 (this table repeated from Section 1). These functions will be used to organize the discussion of current programs.

Currently 27.54 FTE are funded by the Utility as detailed in Table 5-2. The majority of positions are in O&M (60%). Positions listed as fractions of FTEs provide support to multiple functions within the department. In addition, the Utility funds a 0.5 FTE Planner in the budget to support planning associated with surface and stormwater management. The CIP Group staff are supported by the Utility in that they charge their time to individual surface water capital projects.

Table 5-1. Surface Water Utility programs and functions

Operating program area	Overview of functions
Operations and Maintenance of public system	Cleaning (pipes, ditches, catch basins, ponds, etc.)
	Public system inspection
	Flood response
	Repair and maintenance
	Spill response
	Street sweeping (75% of total cost of program)
	Tree pruning and management in public right-of-way
Engineering, Stewardship, and Education (formerly Customer Service)	Education and public involvement
	Development review (costs reimbursed by permit fees)
	Engineering/environmental permitting support for City activities
	Regulatory compliance coordination
	Pollution source control
	Monitoring

Table 5-2. Surface Water Utility staffing by work group

Work group	Classification	Positions
Operations and Maintenance		
	Maintenance Center Superintendent	0.00 (proposed at 0.25 for 2015–16 Budget)
	Stormwater/Sewer Division Manager	0.50
	Leadperson	1.80
	Field Arborist	1.0
	Senior Maintenance Person	6.00
	Yard Maintenance and Inventory	0.15
	Utility Craftperson	0.15
	Utilityperson	8.40
	Groundsperson	0.40
	Public Works Office Specialist	0.75
	Utility Data Entry Clerk	0.34
	Total	19.49
Engineering, Stewardship, and Education		
	Development Engineering Manager	0.25
	Surface Water Engineering Supervisor	1.00
	Senior Surface Water Engineer	1.00
	Surface Water Utility Engineer	1.00
	Water Quality Programs Coordinator	1.00
	Urban Forester (supervised by Planning Department)	0.50
	Water Quality Inspector	1.00
	Surface Water Engineering Analyst	1.00
	Education and Outreach Specialist	1.00
	Permit Technician	0.2
	Senior Accounting Associate	0.10
	Planner	0.50
	Total	8.05
	Total	**28.04**

Table 5-3. Summary of Surface Water Utility Operations and Maintenance tasks

Function	Task	Staff resources	Equipment	Budgeted labor hours	Season
Cleaning	Manhole, catch basin, and storm conveyance vault cleaning	Senior maintenance worker, utility worker, flaggers, as needed	Eductor truck, backup truck	2,350	Year round
	Storm pipe cleaning	Senior maintenance worker, utility worker, flaggers, as needed	Eductor truck, backup truck	900	Year round
	Catch basin and culvert hand cleaning	Senior maintenance worker, utility worker	Service truck	130	Year round
	Retention/ detention pond inspection, maintenance and repair	Senior maintenance worker, utility worker (2)	Dump truck, service truck	1,050	Summer
	Culvert survey and pipe root cutting	Equipment operator, utility worker, flaggers (2)	Eductor truck, backup truck with arrow	250	Summer
	Maintain storm treatment cartridge vaults	Senior maintenance worker, utility workers (3)	Eductor truck, service trucks (2)	250	Summer
	Ditch cleaning and ditch/stream erosion protection	Senior maintenance worker, utility worker (2)	Dump truck, equipment trailer, service truck, excavator	600	Summer
Inspection	Storm pipe video inspection and video inspection equipment repairs	Senior maintenance worker, utility worker	CCTV truck	1,500	Spring and summer ahead of pavement overlay and during dry weather
	Catch basin sediment inspection	Crew member	Service truck	100	Summer and fall
	Underground retention/ detention inspection and maintenance	Senior maintenance worker, utility workers (3)	Eductor truck, service truck (2)	700	Summer
Flood response	Inspect and maintain major culvert and creek crossings (47 locations)	Senior maintenance worker, utility worker	Service truck	1,150	As needed, but typically fall
Repair and maintenance	Catch basin, manhole, and pipe rehabilitation and replacement	Senior maintenance worker, utility workers (3)	Dump truck, service truck, mini excavator with breaker, mini excavator trailer	5,200	Year round
	Installation of new storm catch basins, manholes, pipes, or culverts	Senior maintenance worker, utility workers (2), flaggers (2)	Dump truck, equipment trailer, jackhammer and compressor, trackhoe, service truck, backup truck with arrow, backhoe	350	Year round

Table 5-3. Summary of Surface Water Utility Operations and Maintenance tasks (continued)

Function	Task	Staff resources	Equipment	Budgeted labor hours	Season
Spill response	Spill response	Senior maintenance worker,utility worker, eductor crew, flaggers (2)	Eductor truck, sweeper truck, backup track with arrow	100	Year round
All functions: customer service	Storm system investigation to resolve conflicts for planning, development, and engineering	Senior maintenance worker	Service truck	900	Year round
	Service requests	Senior maintenance worker, utility worker	Service truck	190	Year round

5.B Operations and Maintenance

The O&M Group charges work to the specific tasks shown in Table 5-3, and the first column of this table assigns these tasks to the broader categories in Table 5-1 above. The number of hours budgeted for each task in 2013–14 is shown. An SOP including staff resources, equipment, and time standard (average productivity) has been developed for each of these tasks, and these are included in Appendix I. The section below describes tasks or programs that are facing challenges with resources or staffing.

Street sweeping, tree pruning, and management in the public right-of-way are funded by the Utility but are managed by the Streets Group within the O&M Group of Public Works.

5.B.1 Cleaning

Maintenance crews clean all elements of the publicly owned and operated stormwater system. Cleaning is done to respond to citizen reports of flooding, on a geographic basis (clean the whole system from north to south), and to meet NPDES Phase II Permit requirements. This work also protects water quality and minimizes transport of sediment through the system (which can contribute to delta formation at outfalls in Lake Washington).

5.B.1.a Stormwater Facilities and Structures

Catch basins, manholes, vaults, tanks, and ponds that collect sediment and debris require removal of that material in order for the structure or facility to function properly. The City's three eductor trucks are used to vacuum material from these facilities. As the trucks are filled, the material is transported to the City's decant facility for liquid and solids management. Table 5-4 provides an overview of the number and type of facilities (i.e., flow control and water quality treatment structures as opposed to catch basins) noted by watershed.

The number of public facilities increased with annexation, resulting in more material facilities to clean, and more material being removed from these structures. The current decant facility is being upgraded to accommodate the additional material.

- **Current System Cleaning Protocol**

Cleaning in Kirkland is comprehensive, in that when a catch basin is cleaned, the pipes flowing into that basin are inspected and, if needed, are cleaned at the same time. This prevents buildup of "legacy loads" in pipes that increase the need for catch basin cleaning. Using this approach, crews were, up until annexation in 2011, cleaning the whole city system in approximately 5 years. As we move forward, there is additional length of pipe to clean due to annexation, and much of that pipe has a "legacy load" of sediment due to different cleaning practices and frequencies used by King County.

- **New NPDES Phase II Permit Requirements**

The NPDES Phase II Permit that became effective on August 1, 2013, requires increased frequency of catch basin inspection (see further discussion of inspections below). Instead of inspecting catch basins once every 5 years, they now must all be inspected once by August 1, 2017, and once every 2 years thereafter. If inspection determines that cleaning is needed, that work must be completed within 6 months of inspection in order to maintain Permit compliance. This will likely result in an increased need for cleaning.

Catch basins tend to fill to a certain level, then excess material washes downstream; the time period in which a given catch basin fills is variable, but cannot be determined until the inspection frequency is higher than the time period in which the catch basin fills up. The magnitude of the need for increased cleaning will need to be determined once statistics have been gathered from the first complete round of catch basin inspections.

- **Future Cleaning Alternatives**

An alternative is available in the Permit, which is to clean the entire system including pipes and ditches within the 5-year Permit cycle, but the City has chosen to use a hybrid approach of inspecting catch basins every 2 years and continuing to clean on a geographic basis (areas of the City are systematically cleaned together---both catch basins and pipes), rather than conducting inspection and catch basin cleaning simultaneously as was done in the past This method is more cost-effective because resources are spent on the areas in need, rather than the entire catch basin system that may or may not need cleaning. Additionally, the geographic cleaning eventually reaches all areas of the City and results in better removal of material because it targets both catch basins and pipes.

Kirkland maintains catch basins and other stormwater structures to preserve system functionality, improve water quality, and meet NPDES permit compliance. With annexation, the number of structures needing maintenance has increased and alternatives for meeting the cleaning objectives are being evaluated.

5.B.1.b Ditches

Ditch maintenance is necessary to prevent flooding and protect water quality. Almost 40 miles of publicly maintained stormwater ditches are located in Kirkland, a number that increased dramatically with the annexation area and acquisition of the CKC. The stormwater system in the 2011 annexation area contains a higher percentage of open ditches than other neighborhoods and they are generally in need of maintenance to bring them up to Kirkland standards. Current staff and equipment resources are insufficient to meet this need alongside other responsibilities.

Ditches are part of the open-channel conveyance system and, because they are connected to stream channels, these systems sometimes provide access and habitat for fish. In these situations, environmental considerations and appropriate permits are necessary to conduct ditch cleaning. Engineering staff have to date assisted with applying for and managing these permits, but, as the number and complexity has increased, this has strained staff resources.

5.B.1.c Stormwater Ponds

The number of ponds increased by approximately 40% with annexation. Ponds require regular mowing and installation and repair of fencing in addition to regular cleaning. Currently mowing is performed by the Grounds crew of the Streets Division. Re-grading or cleaning of structures associated with ponds is performed by the O&M Group. Fencing has been installed and repaired under contract. Staffing increases associated with annexation are thus far sufficient to meet the need for this work.

Ditch along Cross Kirkland Corridor

5.B.2 Inspection

The O&M Group inspects the public stormwater system to proactively identify repair needs, investigate flooding concerns, identify and remove illicit connections (pipes that could convey something other than stormwater), and meet NPDES Phase II Permit requirements. This work prioritizes cleaning and repair work, prevents public safety issues that could be caused by pipe collapses, and prevents flooding and water quality problems. The condition of each type of structure or facility is compared to maintenance standards in the *2009 King County Surface Water Design Manual* (King County 2009), which was adopted by Kirkland effective January 1, 2010.

5.B.2.a Pipe Conditions

Inspection of pipes is conducted via a truck-mounted CCTV camera. Currently this equipment is shared with the Wastewater Group. Pipes are prioritized for inspection by the annual pavement overlay program, by citizen reports of problems, and by geographic area. The pipe segments are rated on a 4-point scale that ranges from poor (needs immediate attention) to excellent (requires follow-up in 10 years). With the available resources, only 20% of the total stormwater pipe system has been inspected since 2006 (see Section 4 for a summary of inspection data). At the current frequency of inspection it will take several decades to make one pass through the entire system, a timeframe beyond which useable information should be obtained. The standard for pipe inspection is approximately every 10 years, so that the Utility has time to schedule repair and replacement. CCTV inspection is one of the only ways to know the conditions of buried infrastructure (prior to failure).

5.B.2.b Illicit Discharge Detection and Elimination

Under the NPDES Phase II Permit effective in 2013, the City must inspect the public system for illicit connections and sources of pollution. In the previous NPDES Phase II Permit, this was accomplished by inspection of stormwater outfalls during dry weather. Although this method is allowed in the new NPDES Phase II Permit, CCTV inspection of pipes is also allowed to be counted toward this inspection requirement. Staff have found that CCTV inspection has led to identification of far more illicit connections than dry weather outfall inspection, so they recommend this approach. The Permit requirement is to conduct screening for illicit discharges on 40% of the public stormwater system by December 31, 2017, and 12% per year thereafter (Ecology gives flexibility as to how the overall system size is evaluated—by watershed area, by length of pipe, or by some other method). An additional camera truck and staff could be used to help to meet this requirement.

The City should consider whether a policy should be formalized to **manage beavers** and in what circumstances.

5.B.2.c Catch Basins

The required frequency of inspection of catch basins increased in the NPDES Phase II Permit (which came into effect on August 1, 2013) from once every 5 years to once by August 1, 2017, and once every 2 years thereafter. As noted in Section 5.B.1, Cleaning, inspection is now being separated from cleaning work, and will therefore require additional staff resources. The need for inspection staff may be somewhat offset by reduced need for cleaning work (the eductor truck crew will no longer inspect and clean at the same time), but the impact of this change has yet to be quantified.

Table 5-4. Types of facilities that require cleaning

	Public facility type							
	Storm filters	Pipes	Ponds	Swales	Tanks	Vaults	Other	Total
Citywide	28	5	55	38	396	85	2	609

5.B.2.d Public Stormwater Treatment Facilities

Public flow control and water quality treatment facilities must be inspected once per year to meet NPDES Phase II Permit requirements. There are currently about 609 public facilities, (554 underground facilities and approximately 55 ponds), with more being added with development projects each year. In addition, a select set of these facilities must be inspected for damage and cleaning needs following each storm event that is equal to or greater than a 10-year, 24-hour rainfall event (see Section 5.B.3, Flood Response, below). This requirement has remained the same in the new NPDES Phase II Permit and the City is in compliance.

5.B.3 Flood Response

Storm crews are first responders during large precipitation events. When large events are predicted, crews prepare by checking trouble spots (see description below), clearing debris, and setting work schedules to allow for 24-hour response. During events, crews are dispatched geographically to check trouble spots and respond to citizen calls. Office staff arrange to provide telephone coverage in order to respond more quickly to citizen reports of flooding.

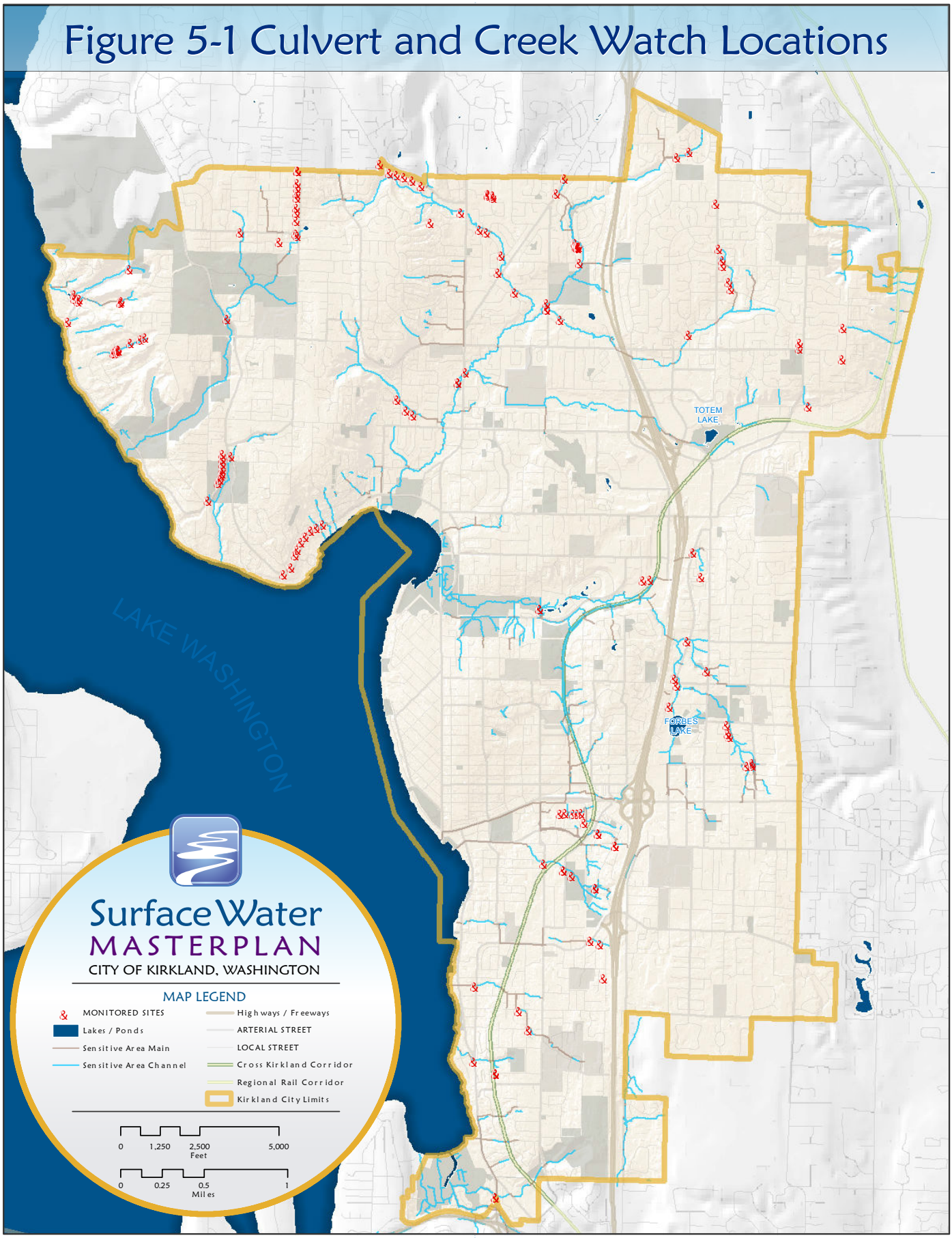
5.B.3.a Creek and Culvert Watch List

Creeks and culverts that have flooded during storm events, or have been problematic for a number of reasons (erosion, etc.), are on a watch list for more frequent inspection and maintenance and follow-up inspection after large storm events (Figure 5-1). Several watch areas are associated with Goat Hill, an area that is difficult for standard-size maintenance equipment to reach because of the narrow, steep grade of the public roads. Storm response workload has increased significantly with annexation, leaving fewer staff hours for other activities. The unpredictable nature of storm events makes it difficult to recommend staffing based on these events and this may have an impact on productivity during a year with large storm events.

5.B.3.b Beaver Activity

Crews respond to citizen complaints about beaver activity, and provide assistance when water impounded by beaver dams impacts a public facility. The City may wish to consider formalizing policy direction as to when property flooding due to beavers constitutes a public hazrd, and whether hand removal of dams should be conducted where the City has obtained permits from the Washington Department of Fish and Wildlife (WDFW).

Figure 5-1 Culvert and Creek Watch Locations



5.B.4 Repair and Maintenance

The O&M Group performs rehabilitation, repair, and installation of infrastructure for small projects. Work can range from repair of a single failing catch basin to installation of new pipe sections to solve a flooding problem. Work is identified through routine inspections (see Section 5.B.2), CCTV inspection, or citizen inquiries. Projects that have construction costs greater than $50,000 and those involving special trades are placed on the Surface

Water CIP and design and construction is managed by the Capital Project Engineering Group. Construction costs of $50,000 is the minimum for being considered a Capital Improvement Project according to the City's accounting principles.

The O&M Group works with the Streets and CIP groups in order to coordinate pavement overlay or rehabilitation with necessary surface water infrastructure repairs. CCTV inspection is performed (see Section 5.B.2) and any necessary surface water infrastructure repairs are completed prior to the pavement overlay so that interruption to the transportation network is minimized and the integrity of the pavement is maintained. The street preservation program, which includes the pavement overlay program, doubled in 2012 with the passage of the 2012 Streets Levy. This has doubled the need for stormwater rehabilitation and repair work associated with pavement overlay. Currently this work is being given priority while other work, such as inspection and cleaning, is on hold. New NPDES Phase II Permit requirements will make it more difficult to accommodate the pavement overlay while maintaining Permit compliance or addressing other priorities such as flooding and water quality.

> The 2012 Streets Levy has doubled the Surface Water O&M Group's workload of inspecting and completing stormwater infrastructure repairs ahead of pavement overlay.

As CCTV pipe inspection increases, it is likely that further repair and rehabilitation needs will be identified. It is preferable to identify and fix problems before they cause public safety or flooding concerns, but this will require additional staff and resources.

Jet Set Fast Patch is a catch basin grouting product that was used in rehabilitation of many stormwater structures in the downtown area in the late 1990s/early 2000s. This product was defective and has swelled and fallen out in many places where it was used, creating the need to re-grout or replace those catch basins, a task that can take up to a full day of crew time. To date approximately 1,000 catch basins have been re-grouted; staff estimate that 20–30 more are found and re-grouted each year.

There is a backlog of work needed to bring facilities in the annexation area up to current maintenance standards. Inventory and mapping of the system in that area has revealed significant repair needs ranging from buried structures (over 100 identified prior to annexation), to ditches that need to be re-dug (see ditch cleaning discussion in Section 5.B.1.b), to detention ponds that need to be completely re-graded in order to restore their function. This creates a large, though perhaps temporary, increase in the need for repair and rehabilitation work.

5.B.5 Spill Response

KMC Chapter 15.52 prohibits discharge of anything other than stormwater to the public stormwater system. Reports of water quality problems including spills and dumping are received from citizens (via telephone or Web-based complaint forms) and other City staff (Police, Fire, Parks, Building, Planning and Community Development, and Public Works crews). Crews respond in coordination with staff from the ESE Group. If the responsible party cannot be found, or cannot clean up material that is an imminent threat to the environment, surface water crews conduct cleanup operations. This work requires specialized training and protective equipment. As awareness of water quality problems caused by dumping has risen through training of City staff and education of the public, the number of spill-response requests has increased (see Drainage and Water Quality Complaints, Section 4.E).

Spills that are beyond the capabilities of the Stormwater Group are referred to Ecology and/or to the National Response Program within the U.S. Environmental Protection Agency. Staff from the ESE Group conduct follow-up to recover costs from any responsible party and to conduct education or enforcement actions.

5.B.6 Maintenance Activities Managed by Others

The Surface Water Utility financially supports surface water and stormwater maintenance that is accomplished through other divisions or departments. Below is a description of these programs.

5.B.6.a Street Sweeping

The Surface Water Utility contributes funds for street sweeping, which is conducted by the Street Maintenance Group. Currently, street sweeping occurs between 6:30 a.m. and 3:00 p.m. and it takes more than 32 business days for the three street sweepers to sweep all of the city's roads. The need for street sweeping intensifies in the fall because of the amount of debris and leaves on the road. The Surface Water Utility funds sweeping because of localized flooding that can result from leaves blocking catch basins. Street sweeping can be done for water quality improvement, but this would require new or different equipment, including high-efficiency specialized street sweepers.

5.B.6.b Tree Pruning and Management in the Public Right-of-Way

The Utility funds management of trees in the public right-of-way in order to maintain and improve the vital stormwater functions of trees, which include absorbing and cleaning stormwater.

5.B.6.c Low-Impact Development BMP Maintenance

Maintenance of LID stormwater facilities in the public right-of-way, especially rain gardens, is a new and growing task for the O&M Group. Current surface water design regulations require at least minimal use of LID, and updated surface water design regulations will require almost exclusive use of LID beginning in 2017. Maintenance of rain gardens requires knowledge and skills in horticulture, as opposed to the construction and equipment operation skills of a Utility Person. In 2009 the Utility began funding a Groundsperson within the Streets Group to assist with this maintenance. As the number of LID facilities increases, the need for maintenance will increase and lead to an increased need for horticulture and landscape staffing. When the number of LID facilities grows to require enough work for a full-time position, it may make sense to bring this function under the supervision of the Stormwater O&M Group.

The City should consider how to manage and maintain pervious sidewalks as they get installed. Should responsibility remain with private property owners, or should the City take on the responsibility, or discourage the use of pervious pavement on sidewalks.

Pervious pavement also requires different maintenance skills from what have historically been needed. O&M staff have not typically been required to maintain sidewalks. Additionally, street sweeping will be needed for the new pervious public roads that will be built. This will involve sweeping the entire road width rather than just the edges and gutters, which is the current practice.While homeowners maintain traditional sidewalks, pervious sidewalks need to be specially vacuumed to maintain functionality. This may require educating homeowners in the maintenance of pervious sidewalks, or a shift in responsibility to the City.

Photo of pollutants entering stormwater catch basin

5.C Engineering, Stewardship, and Education

The ESE Group provides functions as noted in Table 5-1. Current programs and challenges are described below.

5.C.1 Education, Stewardship, and Public Involvement

Education and stewardship activities conducted by the Utility strive to encourage behaviors that:

- Support good water quality
- Enhance flood preparedness and prevention
- Healthy stream systems

Water quality is affected by everyday choices that each of us make, from how to wash our cars, to whether we plant trees in our yard, to how we manage runoff from our business activities. It is much simpler and less costly to prevent stormwater pollution than it is to clean up stormwater once it has become polluted. Flood preparedness and prevention is an important part of the overall flood response picture. As most of the property along streams in Kirkland is privately owned, stewardship of riparian areas on those properties is a key ingredient in the health of stream systems.

5.C.1.a NDPES Permit Compliance

The NPDES Phase II Permit requires that jurisdictions provide education and outreach on stormwater, but it also allows significant flexibility in the topics and behaviors that must be addressed, with the expectation that local jurisdictions will be most able to identify what has the most impact on their community. Kirkland determines these priorities through local and regional surveys and through review of pollutants and activities in the community. Education programs are provided largely by consultants with expertise working with the target age group or topic. For example, Nature Vision is a nonprofit consultant that provides stormwater education programs for elementary and middle school students that aligns with the curriculum needs of the Lake Washington School District. Stormwater staff also partner with Solid Waste staff at the City to provide sustainability education programs and the Reuse Recycle Conserve newsletter, thus leveraging resources between groups. The NDPES Phase II Permit in 2013 did not significantly increase the public education and outreach requirements.

5.C.1.b Volunteer Habitat Restoration Opportunities

Volunteer stream habitat restoration projects provide an experiential education opportunity while also providing labor for removal of invasive species and planting in the riparian areas of the City's parks. Ongoing responsibility for maintenance of restoration sites needs to be better defined. Currently the ESE Group has been funding this work through contracts with EarthCorps, but there may be other options for completing this work such as funding a Groundsperson within the Streets Group or the Parks Department (Green Kirkland restoration staff).

Water quality is affected by everyday choices each of us make:

- Car washing
- Fixing our leaky vehicles
- Cleaning up after our pets
- Limiting pesticide use

Education, stewardship, and public involvement target these type of behaviors and more.

5.C.1.c Private Property Stewardship

Stewardship of private properties containing streams will be a priority for education and outreach over the next several years. In the past this work has happened largely through grants. Effective control of invasive species such as Japanese knotweed requires participation by all owners adjacent to a stream channel. Future activities will be part of a basin-wide invasive species control and removal program, prioritized based on property owner willingness to provide maintenance of restored areas, as well as the expected habitat improvement that would accrue from the work.

5.C.1.d Low-Impact Development BMPs

In addition to being one of the topics noted as needing focus in the NPDES Phase II Permit, studies such as the Juanita Creek Retrofit Study (King County, 2012) show that providing LID to serve existing single-family homes will be necessary to achieve water quality and flow control goals that support healthy streams. LID stormwater facilities represent a fundamental shift from traditional stormwater facilities; they are distributed throughout the landscape and are often in residential yards. Promoting the cultural shift necessary for property owners to accommodate and maintain LID facilities such as rain gardens, pervious pavement, disconnected roof downspouts, and cisterns takes significant education and outreach efforts.

Kirkland's LID education and outreach programs focus both on promoting awareness of LID, and on beginning the arduous process of encouraging homeowners to voluntarily install LID facilities on their property. Below is a description of two such LID education programs.

- **Neighborhood Rain Garden Program**

  The Neighborhood Rain Garden Program identifies a neighborhood champion who recruits six to eight neighbors to have rain gardens constructed in their front yards. Following construction of the gardens by a City contractor, neighbors gather to plant vegetation in each of the gardens. The program has dual benefits of education and stormwater volume reduction. Because the gardens are in front yards and have interpretive signage, they serve as a demonstration for others interested in learning more about rain gardens. As the gardens allow water from pavement and rooftops to soak into the ground rather than running into the City stormwater system, they reduce the volume of stormwater runoff.

- **Residential Stormwater Audit Pilot Program**

  The Stormwater Audit Pilot Program, funded in part by King Conservation District and NPDES Municipal Stormwater Capacity grants, seeks to work with homeowners to identify simple and low-cost ways that they can absorb and filter more stormwater on their property. Rebates and incentives will be offered to encourage homeowners to install the identified measures, which could include disconnecting roof downspouts from the stormwater system, installing cisterns, amending soils with compost, or installing rain gardens.

As part of an overall LID and stormwater retrofit strategy, ways to increase the scale and scope of these programs should be considered in order to promote awareness and achieve stormwater retrofit goals. To be successful, these programs require large amounts of time to coordinate with each individual homeowner to make sure that the proposed facilities provide an amenity as well as a stormwater function. The current education staffing level (1 FTE) cannot support expansion of these programs. One option would be to set aside CIP funding for construction and to partner this with additional education and outreach consultants with LID expertise. When CIP funding is used on private property to obtain the retrofit benefits, the City establishes contracts with the private parties clarifying their maintenance responsibilities for the installed facilities and required reimbursement to the City should the facility be removed.

5.C.2 Development Review

Surface Water Utility staff review the stormwater components of permit applications; develop new surface water design regulations and present them to Council; and develop methods, tools, and policies for increasing implementation of LID in the city. As the ESE Group is with the Development and Environmental Services Group, there is close coordination on surface water and general development issues.

The Utility is 100% reimbursed for surface water application review by permit fees. In 2013, the total reimbursement amount was equal to approximately the cost of a 0.5 FTE position. Depending on the level of development activity in any given year, surface water staff may review over 100 applications. The typical review takes 4 to 8 hours, and, increasingly, reviews have been taking more time due to inadequate submittals (not enough detail, or missing information) and the complexity of projects (properties that have wetlands, geologic hazards, or other constraints).

Surface Water Utility staff review over 100 development applications every year.

Additionally, applicants have been requesting pre-submittal meetings and assistance prior to starting the application process. The variable workload makes it challenging to accommodate this task alongside other surface water activities, but provides a valuable resource for meeting review time frames. Development review has strict timelines, which results in this work taking precedence over other work that is important but that may have more flexible deadlines. The complexity and thus the time required for review will increase with new stormwater design requirements that must be adopted in December 2016 per the NPDES Phase II Permit, which may increase the magnitude of this challenge.

City staff look for opportunities to use Utility funds to partner with private development projects to achieve additional detention and/or water quality treatment for the public benefit. As an example, the utility paid for a portion of the enlargement of the private detention pond serving Northstar School; now the pond detains and treats runoff from the public road along with runoff from the school property. These partnerships are cost-effective and help retrofit areas without detention or treatment.

5.C.2.a NPDES-Driven Changes

The NPDES Phase II Permit includes tasks that will require both one-time and ongoing work by development review staff. Below is a description of permit changes that will require additional staff and resources over the next several years.

- **New Thresholds**

The NPDES Phase II Permit includes new requirements that will affect development review time for City staff on an ongoing basis. The 1-acre threshold for sites requiring construction stormwater pollution prevention plans (SWPPPs) was eliminated so that all new developments and redevelopment projects require a construction SWPPP. Additionally, LID requirements including a hydrologic performance standard will be required of all new developments and redevelopments that result in new or replaced hard surfaces 2,000 square feet (0.046 acre) or greater. These changes could increase the number of permit applications requiring review, as well as the amount of time needed for the review.

- **New Stormwater Design Regulations**

Adoption of a new stormwater design manual is required by the NPDES Phase II Permit. This is a one-time task but a large one that will limit staff availability for other surface water tasks over the next 2 years. The new regulations will increase the cost and complexity of stormwater facilities that are required as part of development projects. Education and outreach to the development community and investigation of ways to lessen the economic impacts of the new regulations will be integral to adoption of the new stormwater manual.

Kirkland currently uses the 2009 King County Surface Water Design Manual, and the County is in the process of updating its manual to be equivalent to the 2012 Ecology Manual. The Permit deadline for adopting a manual equivalent to the 2012 Ecology Manual is December 31, 2016. City staff will need to learn the new requirements and develop tools to effectively support the development community in implementation of the requirements.

Education and outreach to the development community and investigation of ways to lessen the economic impacts of the new regulations will be integral to adoption of a new stormwater manual.

- **LID Feasibility**

The NPDES Phase II Permit has several elements related to LID that will require one-time and ongoing actions by the City for compliance. The following is excerpted from the Permit:

  - **S5.4.f**—Low impact development code-related requirements
  - "No later than December 31, 2016, Permittees shall review, revise and make effective their local development-related codes, rules, standards, or other enforceable documents to incorporate and require LID principles and LID BMPs……..."

- "The intent of the revisions shall be to make LID the preferred and commonly used approach to site development. The revisions shall be designed to minimize impervious surfaces, native vegetation loss, and stormwater runoff in all types of development situations. Permittees shall conduct a similar review and revision process, and consider the range of issues, outlined in the following document: Integrating LID into Local Codes: A Guidebook for Local Governments (Puget Sound Partnership, 2012)."

Minimum Requirement 5: On-site Stormwater Management is an LID hydrologic performance standard in the NPDES Permit. This standard must be met, unless proved to be infeasible due to site conditions.

In order to comply with this Permit requirement, the City will need to conduct a review of all development-related codes and make modifications, as necessary, by December 2016. This review will require significant time and resources from the Planning and Community Development Department and will need to go before the Planning Commission as well as the City Council. A 0.5 FTE Planner is currently funded by the Utility, and this person will assist with planning aspects of this work.

- **LID Use for Onsite Stormwater Management**

One of the major permit changes with respect to LID is the modification of Minimum Requirement 5: On-site Stormwater Management. The LID hydrologic performance standard and applicable LID BMPs must be used to meet this requirement unless proved to be infeasible. City staff and developers will need to get acquainted with methods and acceptable approaches to determining infeasibility. For those areas of the city that are clearly not feasible for infiltrative stormwater techniques (e.g., steep slopes, wetlands), maps or other tools should be developed to clarify areas for which additional study must be conducted. This would help in the permit review process by providing more clarity to developers and City permit reviewers. Site-specific geologic conditions will need to be evaluated on an individual development basis, but infiltration potential maps (i.e., low, medium, and high) could guide developers in the initial project planning phases. At the time of writing this Plan, the use of infiltrative LID facilities in relationship to certain environmental conditions is being evaluated because of potential pollutant export from facilities (either to groundwater used for domestic purposes or to surface water bodies). Pending further information and guidance from Ecology, water quality considerations may also need to be evaluated when determining LID feasibility.

5.C.3 Engineering and Environmental Permitting Support

This category of work includes engineering analysis to support the O&M Group and the CIP Group, writing and negotiating permits for maintenance activities that take place in streams and wetlands, and monitoring streams and wetland mitigation areas to meet Permit requirements for surface water and transportation capital projects.

As the O&M Group replaces failing pipes, there are cases where it may be necessary to use a different size or material of pipe or to set the pipe at a different slope. Engineering staff conduct hydraulic analyses to check whether such proposed actions will provide equal or greater capacity for the system. Staff also conduct small-scale hydrologic and hydraulic analysis to assist with capital projects or to investigate the impact of development proposals on watersheds. In addition, small professional services contracts are managed by engineering staff to determine the feasibility of partnering with developers on regional flow control projects or adding water quality treatment to transportation projects. As Planning staff work with property owners on tree removal permits, they often will consult with engineering staff on the interaction between tree removal and stream health.

ESE staff provide engineering and permitting support to the O&M Group, Planning, and CIP Engineering. They also are the liaison to outside natural resources regulatory agencies.

Stream channels are part of the surface and stormwate system and provide conveyance. In some instances, maintenance of these channels is necessary to prevent flooding. Streams are under the jurisdiction of the Washington State Department of Fish and Wildlife (WDFW) and permits are required for any work in stream channels. Permit negotiations and applications have become increasingly complex and time-consuming. Staff have provided this service but may need to consider adding funding for consultants to assist with this work in order to accommodate the overall surface water workload.

When a transportation capital project impacts wetlands, mitigation is required by local, state, and federal regulations. Frequently, the mitigation sites must be monitored for 5 years following construction to ensure plant survival and adequate coverage. ESE staff provide this service and bill the appropriate capital project for its cost. Stream projects are also monitored to determine whether restoration strategies were successful and to glean information for use in future projects.

5.C.4 Regulatory Compliance Coordination

The ESE Group provides coordination and oversight of compliance with the NPDES Phase II Permit. Staff work with other groups and departments to develop compliance strategies and to produce required documents and reports, including the NPDES Stormwater Management Program Document and the Annual Compliance Report. This workload is greater at the beginning of the Permit cycle, when staff are developing strategies and working to ensure that all affected departments understand the new requirements.

Other recent regulatory efforts have included updates of the Kirkland Municipal Code to maintain membership in the NFIP, and to maintain staff support for City Council members who participate in the WRIA 8 Salmon Recovery Council. Future efforts are expected to include a similar level of work and may include items such as re-authorization of the King Conservation District fee and program and tracking of the work program and funding of the King County Flood Control District.

5.C.5 Pollution Source Control

The NPDES Phase II Permit requires that jurisdictions provide the following program elements to find and eliminate sources of pollution (Permit section S5.C.3):

- Mapping of the public stormwater system
- Municipal Code that prohibits non-stormwater discharges to the public stormwater system
- Program to detect, identify, and eliminate non-stormwater discharges into the public stormwater system

These programs include screening of the public system for non-stormwater discharges, tools for the public to report problems, training for staff and education for the public, and spill and complaint response.

In addition, a separate section of the Permit (S5.C.4) requires that privately owned flow control and water quality facilities built during the term of the Permit be inspected to ensure that they are clean and functional. Table 5-6 notes private facilities by watershed. Functional and well-maintained private facilities help to reduce maintenance needs in the public stormwater system and protect water quality. The majority of the facilities in the city were built before the Permit, so inspection is conducted once every 2 years. The minority of facilities, those that were built during the Permit term, are inspected annually. If 4 years of inspections show that this inspection frequency is not necessary, Kirkland can petition Ecology to change the inspection frequency for these facilities to once every 2 years to be consistent with the majority of private facilities. ESE staff provide source control programs that meet and exceed Permit requirements, which changed little between the previous and current versions of the Permit. Upon annexation, a Water Quality Program Coordinator position was established that allowed for increases in training and source control activities. A $98,000 contract between Ecology and the City for 2014–15 is also providing funding to work with businesses on pollution prevention practices. It is anticipated that Ecology will continue to provide this level of funding in future years.

Table 5-6. List of private facilities inspected by drainage basin

Basin	Inspected every year	Inspected in even years	Inspected in odd years	Total number
Carillon Creek		11	1	12
Champagne Creek		1	2	3
Denny Creek		8	6	14
Forbes Creek	1	32	42	75
Holmes Point		2	6	8
Houghton Slope A		31	11	42
Houghton Slope B		4		4
Juanita Creek	13	43	191	247
Kingsgate Slope		12	19	31
Kirkland Slope			2	2
Lower Sammamish River Valley			1	1
Moss Bay	4	141	48	193
South Juanita Slope	5	7	28	40
To Redmond	1	7	5	13
Yarrow Creek	1	16	1	18

Note: Total number of sites shown in this table may differ from number of private facilities shown in tables elsewhere because some sites have only pipes (i.e., not facilities) that are inspected due to past flooding or water quality issues.

5.C.6 Monitoring

Monitoring of watershed conditions supports program development throughout the Utility. Current monitoring efforts include physical, chemical, and biological parameters that indicate hydraulic conditions, overall watershed health, and the presence or absence of individual pollutants.

5.C.6.a Totem Lake Water Level Monitoring

Water level monitoring is conducted in the Totem Lake area to support design of the Totem Lake Flood Relief projects. This work will be continued at least through construction of the next phase of flood relief projects (approximately 2016), and may be a necessary element of managing beaver populations in the Totem Lake system (water level changes can indicate that beavers have built new dams).

Water quality monitoring with dog and trainer

5.C.6.b Benthic Index of Biotic Integrity

The B-IBI is used to estimate overall stream health. Benthic invertebrates are collected, counted, and categorized according to species, and the results give an overall indication of stream health based on the numbers and tolerance to poor water quality for the types of organisms collected. This work is relatively inexpensive and is a good measure of overall surface water management efforts by the community, of which City actions are only one part. Recently staff determined that data collected through 2013 were not statistically rigorous due to the small number of organisms collected. Methods will be updated beginning in 2014 to ensure that future data are statistically valid.

5.C.6.c Fecal Coliform Bacteria in Juanita Creek

Staff have spent significant time and effort tracking down sources of fecal coliform bacteria in the Juanita Creek system, which is listed on Ecology's 303(d) list for fecal coliform bacteria (see Section 4 for more detail). Field surveys, laboratory analysis of water samples, and specially trained dogs have all been used to narrow the locations of bacteria sources, which may include human (leaking sewer pipes, malfunctioning septic systems, or encampments near the creek) and animal (geese, raccoons, rats) sources. In addition to protecting public health, this work will assist in developing solutions to bring this creek into compliance with state water quality standards.

Ecology 303(d) Listing

In response to 303(d) listing of streams as being polluted (i.e., not in compliance with state water quality standards), Ecology must, under court order, issue TMDL plans for each watershed and each pollutant. Ecology is in the process of renegotiating the time frame for issuing cleanup plans, but streams draining into Lake Washington are a high priority. The TMDL process assigns responsibility for portions of the pollutant load to each responsible party within a watershed.

This process can be time-consuming, and with a watershed like Juanita Creek that has high fecal coliform bacteria levels, the City may end up being named as the largest responsible party because most stormwater reaches the creek via the public system, and stormwater is the largest single source of bacteria. Given this probability, staff have been concentrating on finding and eliminating sources of bacteria in the Juanita watershed. This "straight to implementation" approach has been approved by Ecology although the City has not formalized an agreement with Ecology. This would bypass the need tospend time and resources developing the TMDL. The recent canine bacteria source-tracking work has yielded good results. Laboratory testing for human DNA in water samples also shows promise as a method of finding and eliminating sources of human bacteria. Continuation of this work will protect public health while complying with the intent of Ecology's TMDL program, which is to clean up streams and lakes.

5.C.6.d Volunteer Lake Monitoring Program

Kirkland currently has a contract with King County to include Forbes Lake in the Volunteer Lake Monitoring Program. A lakeside property owner volunteers to collect water samples for which King County staff conducts laboratory analysis. King County staff provide analysis of laboratory results in an annual report. Given the City focus on Totem Lake, it may be beneficial to conduct a similar level of monitoring for that lake.

Lake Water Quality Monitoring

5.C.6.e NPDES Regional Monitoring

To comply with the NPDES Phase II Permit, Kirkland has chosen to join the regional monitoring effort at an annual cost of approximately $35,000 beginning in August 2014. This approach is vastly less expensive than hiring staff and purchasing resources to conduct stormwater monitoring as required in the NPDES Phase II Permit. Staff will continue to participate in groups that advise and manage the regional monitoring efforts to ensure that Kirkland's interests and needs are represented.

With the exception of regional monitoring described above, other types of monitoring conducted by Kirkland are not required by permits or regulations. However, this work is useful for informing and focusing future Utility efforts that provide value to the community.

5.C.7 Watershed and Utility Planning

Watershed and Utility planning services are provided by ESE staff and by consultants managed by these staff. Work is prioritized based on the availability of grant funding, potential to positively impact economic development, and potential for large amounts of development or redevelopment in a given watershed.

5.C.7.a Totem Lake Retrofit

The Totem Lake area is a large focus of City economic development efforts. Projects to solve the flooding problems that have impacted businesses and roadways in the area have taken place through the Surface Water CIP (see discussion below). In addition, an Ecology/National Estuary Program grant is under way to study stormwater retrofit of the Totem Lake portion of Juanita Creek. Current stormwater design regulations require that redeveloping sites provide stormwater facilities to match forested conditions. This is a large economic and physical burden for redevelopment projects. Regional facilities to serve redeveloping properties would reduce that burden significantly while still providing improvements in stormwater management. The grant will result in predesign reports for three retrofit facilities. Ecology has indicated that grant funds for construction of stormwater retrofit projects are forthcoming. This illustrates the benefits of watershed planning—the City is well-placed to apply for funds to construct large projects that would otherwise need to be funded via the Surface Water Utility.

Totem Lake Park Master Plan

5.C.7.b Cross Kirkland Corridor

The CKC presents an opportunity for stormwater projects that provide other benefits such as green space and wildlife habitat in addition to water quality treatment; about a third of the area of the city drains through the CKC before flowing into Lake Washington. Planning for stormwater facilities on the CKC would position the City to take advantage of grant opportunities or partnerships with development projects. Ecology grant funds of $120,000 are currently being used to develop conceptual designs for such facilities.

Cross Kirkland Corridor

5.C.7.c Redevelopment

The analysis of properties likely to develop or redevelop **(Appendix A)** indicates that most new development will occur in the annexation area, and that most redevelopment will occur in the downtown core and in areas targeted for economic improvement, such as Totem Lake. These areas should be considered as the next priorities for watershed planning.

5.C.7.d Fiscal Planning

Fiscal planning for the Utility is performed as part of this Surface Water Master Plan and annually as part of City Council discussion and decision on Utility rates. ESE staff coordinate with Financial Planning staff in Public Works and Finance to complete this work in a timely manner.

5.C.8 Urban Forestry

Trees provide important environmental functions, which benefit both surface water and stormwater runoff in the urban landscape. These benefits include stabilization of slopes and soils to prevent erosion, interception of rainfall that would otherwise run off the land surface, uptake of shallow groundwater, nutrient input for aquatic organisms, and temperature regulation in stream channels through shade.

The Urban Forest Strategic Management Plan adopted by the City Council in 2013 by Resolution R-4986 (City of Kirkland, 2013) details recommended actions to guide the City's actions toward a sustainable, healthy urban forest resource over a long-term horizon. One of the top recommendations in this plan is to update the public tree inventory. This will provide crucial information about the current number and conditions of publicly owned and managed trees in the public right-of-way (including the CKC), and in parks and open spaces. There currently is a $50,000 King Conservation District grant that will be used to fund inventory of trees in parks. Using the inventory data, the City can derive the value of surface water mitigated by public trees, another priority established in the Urban Forest Strategic Management Plan (City of Kirkland, 2013). No funding is currently programmed for inventory of trees in the public right-of-way.

The Surface Water Utility currently supports the half-time Urban Forester position to manage trees on public and private property, and to implement the Urban Forest Strategic Management Plan adopted by the City Council in 2013. The Urban Forester also supports maintenance staff in the pruning and management of trees in the public right-of-way.

5.D Capital Improvement Project Implementation

There are two types of surface water capital projects: projects that mitigate for existing surface water problems (flooding, water quality, habitat, and infrastructure), and projects that provide the required stormwater elements of transportation projects. This Surface Water Master Plan identifies the former type of projects. Transportation projects for which stormwater funding will be needed are identified in the Transportation Master Plan, which will be finalized in summer 2015. The following is a discussion of

staffing resources required to construct surface water CIP projects, an overview of current priorities for surface water capital projects, and details on current partitions that exist within the CIP Fund.

5.D.1 CIP Project Implementation

Utility staff identify and prioritize capital projects and develop cost estimates. This information is then used by the CIP Group to develop the surface water portion of the Citywide CIP. Design and construction of individual projects is managed by CIP Group staff. The availability of sufficient CIP Group staff time, as well as permit time frames and construction impacts, would need to be factored into any change in the magnitude of the Surface Water CIP.

5.D.2 CIP Priorities

This section details overall priorities for the Surface Water CIP as a whole and strategies for achieving goals in each of the individual project areas of flooding, water quality, habitat, and infrastructure. This information supports the prioritization of identified projects that is presented in Section 6.

The overall prioritized list of capital projects presented in Section 6 is based on a review of existing problems and opportunities, based on the following priorities:

- Flood mitigation: Minimize impacts to the public and infrastructure.
- Water quality: Construct retrofits based on opportunity to construct alongside transportation projects, and conduct watershed planning to prepare for stormwater retrofit grant opportunities.
- Habitat: Guarantee progress on fish passage barrier removal to satisfy The Muckleshoot Indian Tribe, plan for flow and water quality retrofits to prepare for grant opportunities.
- Infrastructure: Construct projects that coordinate with the pavement overlay program, and develop an asset management program to better prioritize replacement.
- Acquisition: Review riparian and wetland properties in the City to identify opportunities for acquisition. Subsequent to that study, create an opportunity fund within the CIP to be ready for acquisition opportunities as they arise.

The following sections describe the general approach to identifying the most significant projects in each goal area.

5.D.2.a Flood Mitigation

Flood reduction is one of the main goals of the Utility and was one of the main drivers for forming it in 1998. Flood reduction projects are not required per state or federal requirements but are integral to public safety. Kirkland is a member of the King County Flood Control District, which provides approximately $256,000 per year to Kirkland for local flood reduction and stormwater efforts.

Currently, the City's Comprehensive Plan (Table U.1) notes that the level of service for the City stormwater system is to:

> "Convey, detain and treat stormwater runoff in a manner that provides adequate drainage for the appropriate storm to ensure safety, welfare, and convenience in developed areas while protecting the hydrologic regime and quality of water and fish/wildlife habitat in streams, lakes and wetland."

The level of service for flooding is often discussed in terms of conveyance capacity of the public stormwater system. Current surface water design regulations require that new development provide stormwater conveyance sufficient to completely contain the 25-year peak flow and to appropriately route up to the 100-year peak flow. Older regulations required conveyance of the 10-year peak flow. As calculations used in design are quite conservative, even this lower level of conveyance capacity serves to contain stormwater in all but the most extreme events.

Flooding problems in Kirkland are currently addressed through capital projects when the solution will do one or more of the following:

- Protects public infrastructure and safety from recurrent and severe flooding
- Impacts enough people and is inexpensive enough to be handled as a neighborhood drainage project
- Reduces O&M costs

Totem Lake is the largest flooding issue that Kirkland has faced. Projects constructed in 2011–13 have reduced water levels, and future projects anticipated to be complete by 2016 will further reduce water levels and thus flood risk.

5.D.2.b Water Quality

Several state and federal laws require that Kirkland take action to improve water quality. Currently, none of these laws specifically require capital projects to improve the quality of stormwater, but these are likely coming in the future. The Phase I NPDES Stormwater Permit, which applies to jurisdictions with greater than 100,000 population, currently requires agencies to prioritize retrofit projects and may in the near future require construction of these projects. The Puget Sound Partnership has noted that stormwater is the largest source of pollutants to Puget Sound, and thus state interest in and grant funding for water quality retrofit projects has increased. In addition, water quality is one of the factors that heavily influence fish habitat as noted above.

Current policy for water quality CIP projects is as follows:

- Retrofit existing public infrastructure for water quality treatment by adding treatment facilities to transportation projects above and beyond what is required as mitigation for the project (be opportunistic)
- Conduct watershed-scale planning for retrofit of existing public streets in order to position the City to take advantage of grants for construction of retrofit projects

Table 5-7. Summary of retrofit strategy

Current level of treatment	Parcel condition	
	(Re-)Development potential Existing density less than allowed under current zoning	**Built-out*** Existing density greater than or equal to current zoning
Untreated	Install new facilities • Regional facilities • Partnering opportunity • Rely on developers to provide treatment • Focus on treatment of right-of-way	Install new facilities • Focus on treatment of right-of-way
Old treatment (Pre-1990)**	Retrofit old facilities • Modify pond size and/or control structure • Install new facilities • Regional facilities • Partnering opportunity • Rely on developers to provide treatment • Focus on treatment of right-of-way	Retrofit old facilities • Modify pond size and/or control structure • Install new facilities • Focus on treatment of right-of-way
Treatment (1990–current)	No retrofit of old facilities; assumes adequate treatment is provided by facilities designed after 1990.	

* Properties may still redevelop but will not increase % impervious compared to existing condition.
** Definition of old treatment can be adjusted based on manual year (i.e., pre-1998, or 2005)

A retrofit strategy was developed as part of this Plan that included identification of potential areas that should be targeted for retrofit. The retrofit memorandum is included in Appendix J.

Table 5-7 above summarizes the proposed strategy for retrofitting untreated areas, areas with outdated treatment facilities, and lastly those with more current stormwater treatment facilities.

5.D.2.c Aquatic Habitat

Fish require habitat with good water quality, a flow regime that mimics forested conditions, and physical habitat. All three elements are required to be in balance and/or at healthy levels in order for fish populations to survive and thrive. The B-IBI provides a snapshot of habitat conditions in a given stream at a given time (see Section 5.C.6, Monitoring). At present, Kirkland's streams are all rated as "poor" or "very poor" quality based on B-IBI sampling. The main physical habitat problems are the following: fish passage barriers, high and "flashy" flows that have caused channel simplification (lack of pools and riffles) and disconnection from the floodplain, and lack of large woody debris.

Fish habitat improvement is not explicitly required by state or federal regulations. At the same time, the following factors should influence the City's decision as to whether and how to conduct habitat improvement projects:

- Chinook salmon was listed as a threatened species under the ESA, which prohibits any action that could be seen as "taking" Chinook salmon. The ESA does not specifically require recovery of the species, but as long as the listing remains, the risk of liability under ESA is real. In response to the listing, governments in WRIA 8 gathered together to develop a plan for recovering the species and eventually removing the listing. The WRIA 8 Chinook Salmon Conservation Plan includes specific actions that local governments must take to contribute to regional recovery of the species. The City Council adopted the WRIA 8 plan in 2005.

Habitat improvement at Juanita Creek

- Muckleshoot Indian Tribe Treaty Fishing Rights: The MIT has fishing rights in this area as guaranteed under federal treaties. MIT has sued the Washington State Department of Transportation (WSDOT) over the presence of fish-passage barriers that are owned by state roads, and the State has developed a plan for fish-passage barrier removal. In addition to the threat of lawsuits, MIT has comment/review authority over actions involving Kirkland streams. The City has tried to accommodate MIT concerns through providing early review opportunities on projects that will either restore or impact streams and

  providing opportunity to comment on prioritization of culverts for fish passage improvements that is part of this Plan (Appendix E).
- Ancillary benefits of habitat improvement to Kirkland's residents: open space, aesthetics, etc.

Approach for Future Habitat Projects

The Surface Water Utility is the only entity in the City with the authority and funding to directly construct habitat improvement projects and this work is part of its core mission. The need for fish habitat projects stems directly from creation of impervious surfaces in our watersheds.

The following is the recommended approach to habitat improvement capital projects:

- Evaluate City-owned culverts for fish passage status.
- Prioritize City-owned fish-passage barriers for removal, and make progress on construction of projects that remove those barriers.
- Address flow via stormwater retrofit projects and projects to route flows to protect stream channels (high flow bypass), combined with control of development/redevelopment as a programmatic element (high flow bypass pipes and upstream detention where/if appropriate). Seek out opportunities to address flow on a regional basis to reduce costs and impacts to development.
- Address water quality as noted in Section 4.D, Water Quality.
- Address instream fish habitat where projects align with fish passage barrier removal. Address physical habitat projects via capital projects once flows and water quality are more closely controlled (i.e., not at present). Continue to work on programmatic elements that place habitat elements in streams via volunteer and grant programs.
- Address riparian habitat through acquisitions and restoration of riparian habitat (see Section 5.D.2.e, Property Acquisition).
- Provide on-going public education and stewardship opportunities associated with habitat improvement projects.

5.D.2.d Infrastructure

The City stormwater system consists of pipes, catch basins, ditches, and other stormwater facilities that require periodic repair and replacement. Many repairs and replacements are beyond the scope of O&M programs because of cost or complexity, so they must be addressed via the CIP. Currently there are two line items in the CIP for infrastructure:

- Replacement of Aging and Failing Infrastructure
- Annual Infrastructure Replacement

Replacement of Aging and Failing Infrastructure

The Replacement of Aging and Failing Infrastructure Fund was created to allow the Utility to respond quickly to infrastructure problems that emerge between iterations of the CIP. Examples of this type of work include replacement of a leaking pipe on a steep hillside to reduce an immediate risk of slope failure, installation of measures to stabilize portions of the drainage system on Goat Hill, and replacement of a failed pipe that was threatening the stability of a nearby road.

Annual Infrastructure Replacement

Priorities for the Annual Infrastructure Replacement Fund are driven largely by CCTV inspection of pipes. Replacement projects are prioritized based on whether they can or should be completed prior to pavement overlay (i.e., are driven by the overlay), whether the work can be accomplished by maintenance crews (as opposed to becoming a CIP project), and on the condition and consequences of failure of the asset. Prioritization is done informally by experienced staff. Assets are inventoried and mapped, but this system is not yet used for formal condition rating or asset management. Further discussion of asset management is provided in Section 5.E.1. In this plan, individual CIP projects are identified that are beyond the available resources of the maintenance crew, and that will use this annual CIP funding amount. In other words, the line item will not appear as a project because the funding is being scheduled into particular infrastructure replacement projects.

The City Council may also wish to consider coordinating repair/replacement work associated with the pavement overlay program into one annual CIP project, similar to or even as part of the overlay project itself. Costs should be compared to that of increased maintenance staffing to accomplish this work. Surface Water O&M staff may still need to perform inspection work to determine repair/replacement needs prior to the overlay.

5.D.2.e Property Acquisition

The Utility does not currently set aside CIP funds for property acquisition and there has not been a formal policy regarding property acquisition specifically for the purpose of preserving natural resources that influence the quality and quantity of stormwater runoff.

Preservation of wetlands and stream corridors is the least expensive and most efficient way to control the quantity and quality of stormwater runoff. Although sensitive area regulations in Kirkland's Zoning Code control development in these areas, reasonable use provisions still allow impacts. Thus there are instances where City ownership of property can help to prevent impacts to these crucial areas. There are no regulatory requirements for the Surface Water Utility or the City to use property acquisition as a surface water management technique.

Property acquisition is justifiable in instances where acquisition reduces or eliminates the need for stormwater treatment or flow control facilities. Acquisition prevents creation of new impervious surfaces, and thus protects the existing stormwater system.

The Parks Department has historically been the main City entity that acquiresand manages property. Acquisitions within Parks are driven by the desired level of service, which is often focused on active parks and addition to existing natural areas parks. The surface water benefits of acquisition are certainly considered but are not the main interest in Parks acquisitions.

The following could constitute a policy for acquisition:

- Review City land base to identify stream corridors and wetlands that have potential for development
- Acquire lands that are directly linked to surface waters (study on programmatic side or in CIP) as opportunities arise
- Conduct restoration of acquired areas through capital programs and programmatic actions
- Coordinate with the Parks Department on acquisition of upland forested areas that contribute to watershed health

The City Council could choose either to create an opportunity fund within the CIP for acquisition, or to draw from reserves for occasional purchases (though reserves will likely be less available in the future). Funds would also need to be budgeted for maintenance of acquired areas to reduce City liability and/or to enhance their features and benefits.

5.D.2.f Stormwater Portion of Transportation Projects

Although the stormwater needs associated with Transportation projects are identified via the Transportation Master Plan, the Surface Water Utility maintains the following general guidelines for this work:

- Use LID as feasible for new infrastructure: With adoption of a new stormwater design manual by December 31, 2016, use of LID including use of pervious sidewalks and low-volume streets, will be required.

- Look for opportunities to provide additional benefits such as tree cover and green spaces through the use of "green" infrastructure such as rain gardens and pervious pavement.
- Look for opportunities to coordinate transportation projects with retrofits that serve upstream or off right-of-way areas (see discussion in Section 5.D.2.b, Water Quality).

5.D.3 Current Division of CIP Funds

Total Surface Water CIP expenditures of $2.54 million per year are currently partitioned into the following areas:

- Surface Water Funding for Transportation Projects ($950,000 per year)
- Other projects, partitioned as follows ($1.59 million per year on average for 2013–18):
  - Streambank stabilization projects ($350,000 per year)
  - Neighborhood drainage assistance projects ($50,000 per year)
  - Replacement of aging/failing infrastructure ($200,000 per year)
  - Annual infrastructure replacement ($350,000 per year on average)
  - Other projects (remainder, or about $100,000–150,000 per year)

The many general line items exist within the CIP because there was concern it would be challenging to weigh different project types against each other. For example, small-scale streambank stabilization projects would not be prioritized over flooding problems, and thus may never get addressed. The benefits and limitations of the current partitions are discussed in Section 6.

5.E Utility-Wide Challenges and Opportunities

There are a number of opportunities for the City to position itself for successful management of the surface and stormwater system into the future, some of which are discussed below.

5.E.1 Asset Management

Inventory and maintenance work on Kirkland's stormwater assets is currently done using the Hansen MMIS. Efforts are under way to upgrade this software, which could be used in the future to prioritize infrastructure replacement based on likelihood and criticality of failure as well as current condition.

5.E.2 Climate Change

Climate change may result in higher intensity storm events (more rain in a shorter period of time) that could result in more flooding and potentially at different times of the year. Additionally, snowpack levels are expected to change, and could result in drinking water shortages for communities such as Kirkland that rely on surface water sources of potable water. The following are examples of actions that could help the Utility to support overall City climate change goals:

To prepare to respond to climate change:

- Increase the required size of conveyance pipes that are provided with new development so that the stormwater system can handle more intense storm events
- Increase the size of wetland buffers in order to provide more space for storage of stormwater
- Investigate which areas may pond water during large storm events, and take steps to prepare residents and businesses by elevating structures, re-routing water, or flood-proofing critical infrastructure
- Investigating rainwater harvesting could assist in providing a reliable water supply if snowpack can no longer provide a reliable source of water

To limit the impact of Utility activities on climate change:

- Reduce the frequency of mowing of ponds or investigate the use of electric mowers in order to reduce greenhouse gas emissions from this activity
- Reduce greenhouse gas emissions associated with surface water capital construction projects by using alternative or recycled materials and/or by sourcing materials locally
- Investigate alternatives for disposal of decant solids that do not require trucking materials long distances to landfills

Investigation of the costs and benefits of these items would help to determine whether they should be part of overall City climate change response.

section 6

Surface Water Program Recommendations

6.A Capital Projects

Capital projects were identified according to the process shown in Figure 6-1.

Previously identified capital projects, including unfunded projects on the CIP list, recommended projects from the 2005 Surface Water Master Plan update, and projects identified by the FHNA, were reviewed for current status. Projects were removed from the CIP or not included in the list of recommended projects in this planning cycle for one or more of the following reasons:

- Issue has been solved or project has been constructed
- Issue is on private property
- Problem is being addressed in conjunction with a different project

The remaining projects were updated or revised, if needed.

6.A.1 Capital Projects Recommended for Funding

New issues and capital projects were identified through a review of video inspection data, field assessment in the annexation area, culvert evaluations, and problems identified by City staff knowledgeable about the surface water and stormwater system as well as from the public during public meetings and open houses. Conceptual design alternatives and cost estimates were developed for those projects determined to be the most critical in the opinion of City staff. These projects were then prioritized according to several critieria including project need to address a particular problem such as flooding, environmental considerations, fiscal considerations (one-time and on-going costs of construction and maintenance), and consistency with City and community goals. Prioritization criteria and ranking is discussed in Section 7.

The projects recommended for funding in this Plan cycle are shown in Figure 6-2. Costs shown in Table 6-1 are in 2014 dollars. Inflation factors are applied as projects are scheduled, so costs may be different for a particular project as noted in Section 8.

WHAT IS A CAPITAL PROJECT?

A long-term investment made in order to build upon, add, or improve on a capital-intensive project. A capital project is any undertaking that requires the use of notable amounts of capital (for Kirkland this is defined as >$50,000), both financial and labor, to undertake and complete. Capital projects are often defined by their large scale and high cost relative to other investments requiring less planning and resources.

Source: Investopedia.com

Figure 6-1. Capital Project Identification Process

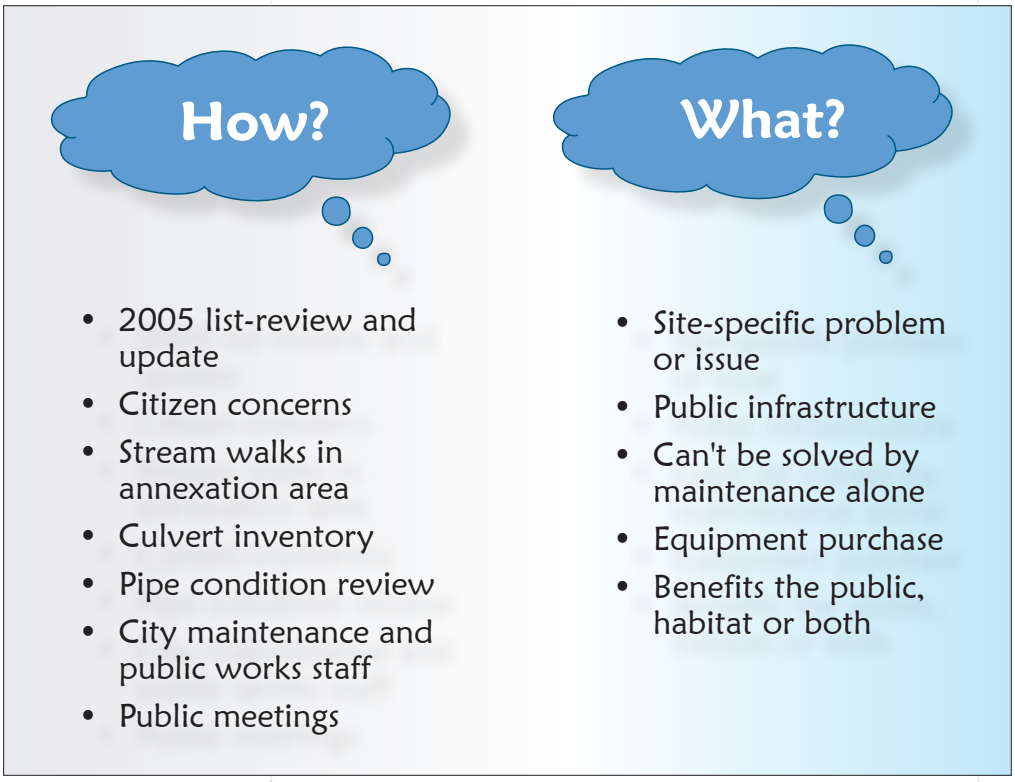


Figure 6-2 Locations of New Capital Projects

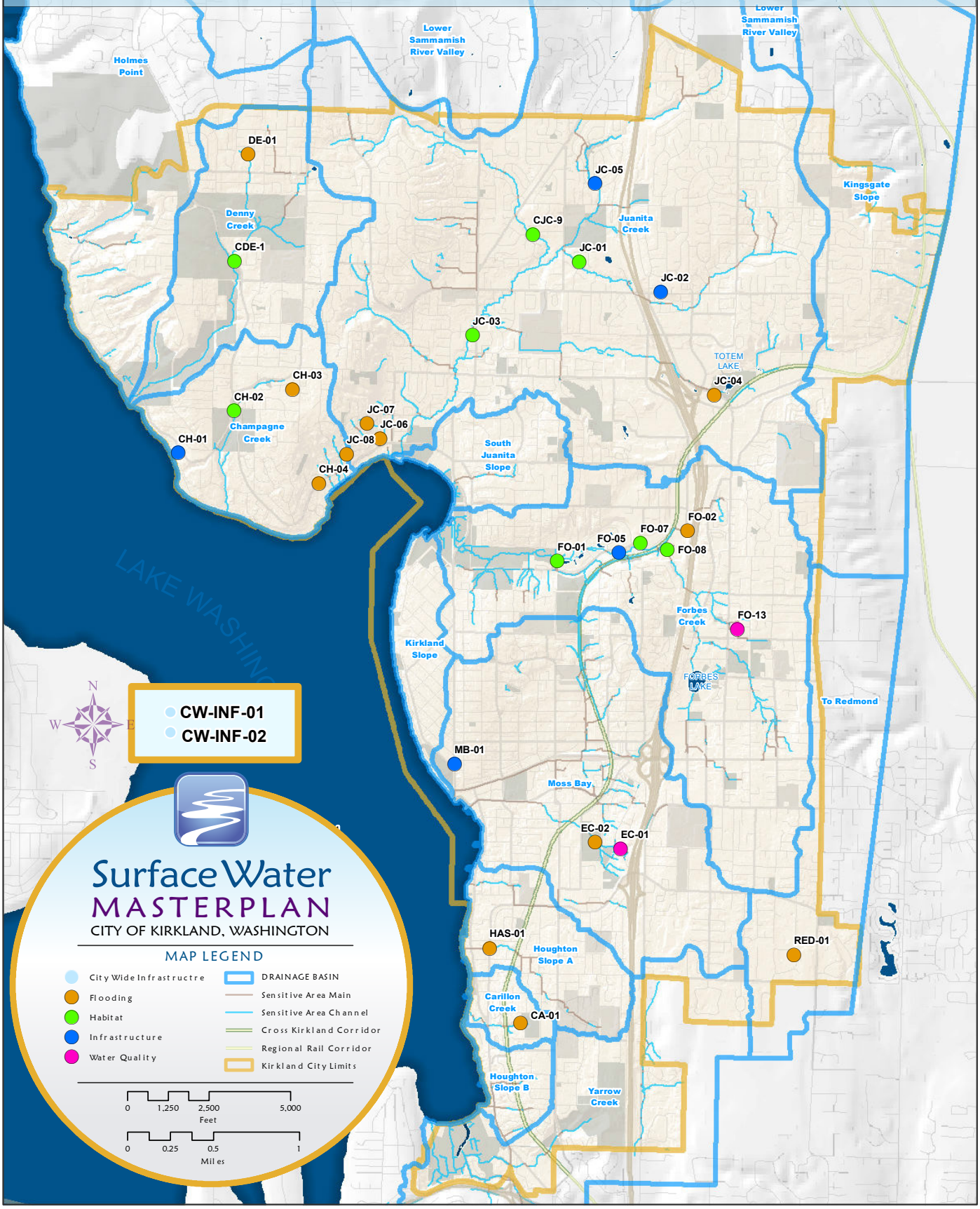


Table 6-1. Summary of recommended capital projects

ID	2013–18 CIP	Basin	Location	Project type	Description	Order of magnitude cost ($k) 2014 dollars
CA-1	SD-0045	Carillon Creek	Carillon Woods	Water Quality	Erosion control measures	$550*
CH-01		Champagne Creek	11553 Holmes Point Drive	Infrastructure	Undersized pipe to be replaced	$219
CH-02		Champagne Creek	Downstream of Juanita Drive in Juanita Woods	Habitat	Channel reconstruction	$690
CH-03		Champagne Creek	80th Avenue NE and 122nd Place	Water quality	Rain garden and bioretention retrofit	$85
CH-04		Champagne Creek	8547 NE Juanita Drive	Infrastructure	Groundwater seepage and road stability	$126
CW-INF-01		Citywide	Various: 14 poorly rated pipes located along arterials	Infrastructure	Pipe repair and replacement	$769
CW-INF-02		Citywide	Various: 70 poorly rated pipes in the rest of the city	Infrastructure	Pipe repair and replacement	$3,025
DE-01		Denny Creek	7718 NE 141st (Inglewood Presbyterian Church)	Flooding	Sediment removal in channel	$136
CDE-01		Denny Creek	Denny Creek at Juanita Drive	Habitat	Culvert replacement to improve fish passage	$615
EC-01	SD-0063	Everest Creek	Slater Avenue at Alexander Street	Water quality	Ravine stabilization	$830*
EC-02	SD-0061	Everest Creek	Everest Park	Habitat	Everest Park Channel and riparian restoration	$1,096*
FO-01	SD-0049	Forbes Creek	108th Avenue NE	Habitat	Fish passage	$333*
FO-02	SD-0046	Forbes Creek	Near NE 116th Street	Flooding	Regional detention in Forbes Creek basin	$10,000*
FO-05	SD-0051	Forbes Creek	KC Metro Access Road	Habitat	Culvert replacement	$1,058*
FO-07	SD-0053	Forbes Creek	Coors Pond	Water quality	Channel grade control	$165*
F0-08	SD-0054	Forbes Creek	Forbes Creek crossing under CKC	Habitat	Forbes Creek/BNSF Fish Passage Improvements	$424*
FO-13		Forbes Creek	Rose Hill Retrofit	Water quality	Pilot LID project associated with planned transportation project	$65

Table 6-1. Summary of recommended capital projects (continued)

ID	2013–18 CIP	Basin	Location	Project type	Description	Order of magnitude cost ($k) 2014 dollars
HAS-01		Houghton Slope A	62nd and Lakeview Drive	Infrastructure	Pipe replacement, improved hydraulics	$2,369
JC-01		Juanita Creek	109th Avenue NE, north of NE 134th Street (Weaver's Pond)	Water quality	Sediment removal	$194
CJC-9		Juanita Creek	NW tributary at 137th Street	Habitat	Culvert replacement to improve fish passage	$613*
JC-02		Juanita Creek	NE 132nd Street between I-405 and 124th Avenue NE	Infrastructure	Infrastructure/ conveyance	$874
JC-03		Juanita Creek	SW corner of intersection of 100th Avenue NE and NE 128th Street	Habitat	Juanita Creek floodplain creation	$533
JC-04		Juanita Creek	12204 NE 124th Street (north side of Totem Lake Boulevard) Comfort Inn Pond	Flooding	Flow diversion	$266
JC-05		Juanita Creek	NE 141st Street and 111th Avenue NE	Infrastructure	Culvert replacement	$765
JC-06		Juanita Creek	Goat Hill	Flooding	Re-route flow	$521*
JC-07		Juanita Creek	Goat Hill	Flooding	Stabilize eroding channel	$299*
JC-08		Juanita Creek	Goat Hill	Flooding	Increase conveyance capacity	$490*
MB-01		Moss Bay	Market Street from 4th to 6th Street	Infrastructure	Replace stormwater pipes	$680
RED-01	SD-0068	Redmond	128th Avenue NE and NE 60th Street to NE 64th Street drainage (Silver Spurs)	Flooding	Underground injection control well (infiltration facility)	$65

* Cost is based on estimate calculated for 2013–18 CIP during previous or separate budgeting process.

Conceptual designs and preliminary cost estimates are provided in Appendix K.

6.A.2 Capital Projects for Future Consideration

Several identified problems are of less immediate concern but should be noted for future consideration if extra funding, grant money, or companion projects become available in the future. These projects are listed in Table 6-2; however, conceptual designs and preliminary cost estimates were not prepared. Fish passage barrier removals identified during the culvert assessment are not included in Table 6-2; rather, a list of prioritized culverts for fish passage barrier removal is provided in Appendix E.

6.A.3 Capital Project Fund Divisions

Some types of surface water and stormwater issues are common and known to occur with some regularity, even if the exact locations or needs cannot be predicted ahead of time. The Surface Water Utility has created separate capital project funds for these types of projects, including Annual Streambank Stabilization, Aging Infrastructure Replacement, Neighborhood Drainage Assistance, and Annual Infrastructure Replacement. The separate capital project funds allow support Utility priorities for flood reduction, water quality improvement, infrastructure protection and improvement, and habitat improvement.

Table 6-2. Summary of recommended capital projects for future consideration

ID	Basin	Location	Project type	Description
CCH-1	Champagne Creek	Juanita Drive at NE 112nd Street	Undersized culvert	Whiskey Creek culvert replacement
DE-02	Denny Creek	Lake Washington	Habitat	Deposition at mouth is a potential fish passage issue
HP-01	Holmes Point Creek	6060 NE 135th Street	Fish passage	Removal of large private dam in conjunction with other fish passage projects downstream, and habitat projects upstream
HP-02	Holmes Point Creek	Water diversion downstream of St. Edwards Park	Habitat	Stream restoration in vicinity of water diversion structure

The Aging Infrastructure Replacement and Annual Infrastructure Replacement funds are specifically designed to protect and maintain infrastructure and allows the Utility flexibility in how general infrastructure projects get scheduled. For instance, this Plan has identified two city-wide infrastructure projects to repair and replace poorly rated pipes. These projects can be broken up into smaller pieces and accomplished through these infrastructure funds, rather than scheduling the entire program for a given year.

These divisions assist in developing the CIP; it is easier to balance among funds with known annual amounts rather than to develop a list of projects each year that exactly matches the available funding. The specific funds and recommendations for continuation are discussed below.

6.A.3.a Annual Streambank Stabilization

The Annual Streambank Stabilization Program (SD-8888) was created in 2001 to respond to instances where erosion of streambanks on private property posed a threat either to the public stormwater system or to aquatic habitat. Erosion affects conveyance in natural systems, aquatic habitat conditions, and maintenance at culvert crossings. This fund helps make incremental progress toward flood reduction, water quality, infrastructure protection and habitat goals on private property even when such a project would not typically rank high enough for consideration against large flooding problems or other immediate problems. An average amount of $224,000 per year has been used for projects such as the following:

NW University Creek (SD-0037): Stream channel was reconstructed to reduce flooding occurring at the point where this system enters a pipe near 106th Avenue NE and NE 58th Street. Streambank stabilization was an alternative to a much more expensive and disruptive high-flow bypass pipe.

Totem Lake Hillside Stabilization (SD-0066): A subdivision constructed in the 1970s allowed stormwater to discharge at the top of a steep and erosive privately owned slope. Water eroded material to create a deep gully and deposited it in a City right-of-way at the base of the slope, which was causing flooding of what is now the Nintendo building. The project constructed a high-flow bypass beneath a new creek channel.

Juanita Creek/NE 122nd Stabilization (SD-0060): Juanita Creek was cutting into a steep hillside composed of fine sediment. A biologist conducting field work for the 2005 Surface Water Master Plan identified this slope as the highest-priority threat to aquatic habitat in Juanita Creek. The slope was stabilized using bio-engineering techniques, and rocks and rootwads were placed to better route the channel through the area.

This type of important work needs to continue, but the this fund may no longer be necessary because the goals of habitat protection and infrastructure protection and replacement are now built into the CIP in other ways. It is now understood that projects may be built on private property in order to serve a public benefit. For habitat protection, the focus needs to shift to controlling the high flows that cause erosion and streambank instability, and to creating floodplain areas where channels can migrate without running into structures. Infrastructure problems involving streams can be funded via the main body of the CIP. If the fund is left in place, the goal for use of the funds should be reevaluated.

Recommendation: Study the streambank stabilization fund within the Surface Water CIP and return to the City Council with a recommendation to keep or remove this segregation.

6.A.3.b Annual Replacement of Aging and Failing Infrastructure

The Aging Infrastructure Replacement Program (SD-0047) was created as a recommendation of the 2005 Surface Water Master Plan. This program allows for critical infrastructure identified via citizen complaints or inspections to be addressed quickly, rather than needing to wait to schedule these projects into the CIP, which can take 1 to 2 years. Funds of $200,000 per year are spent on projects such as the following:

69th Avenue NE/NE 130th Place Pipe Replacement (SD-1347): Replacement of a leaking pipe that routes public stormwater down an extremely steep and unstable hillside. The pipe was discovered during construction on private property (there were no recorded easements and the pipe was not mapped in King County records). The construction of a new pipe will reduce City liability and the risk of slope failure.

Heronfield Wetland Pipe Replacement (SD-0066): A failed pipe was causing severe erosion, sending material into the Heronfield Wetland Park and endangering the stability of NE 120th Street. The pipe was replaced with an improved drainage system and the slope was stabilized to protect the roadway.

It is recommended that this line item continue to be included in the CIP.

6.A.3.c Annual Infrastructure Replacement

Annual Infrastructure Replacement (SD-9999) was created as a recommendation of the 2005 Surface Water Master Plan. This program provides for ongoing infrastructure replacement needs at $350,000 per year that are identified via CCTV inspection. Currently 14% of the City's stormwater pipes have been inspected. It is likely that more pipes will

be identified for replacement as they are assessed, and that pipe replacement on the order of magnitude recommended in this Plan will need to continue into the future. In this Plan, individual projects scheduled to use this funding are noted in Sections 6 and 7 and, thus, the line item itself may not appear in the CIP in a given year. Capital projects CW-INF-01 and CW-INF-02 are infrastructure projects recommended in this Plan (Table 6-1) that could be accomplished with this fund.

6.A.3.d Neighborhood Drainage Assistance

The Neighborhood Drainage Assistance Program (SD-0081) was created during the development of the 2013–18 CIP to assist with problems for which the City is not liable but for which a fix would be relatively inexpensive.. The program is funded at $50,000 every second (odd) year. Frequently projects constructed under this program cost less than $50,000 and can be constructed by City maintenance crews. To assist with implementation of this program, staff recommend the following:

- Develop criteria for the type and scope of project that can be constructed using these funds
- Examine whether O&M crew have sufficient capacity to construct this type of project, or whether the CIP Group needs to manage design and construction via small works contracts
- Examine whether these projects should be capitalized, as they sometimes result in infrastructure that will be privately maintained
- Develop criteria for how private beneficiaries contribute

This program has great potential to help citizens facing small but vexing flooding problems, and thus may serve to increase customer satisfaction with Utility services.

6.A.4 Capital Program Policy Direction

In addition to the Surface Water Program's portion of the CIP—projects that address primarily surface water and stormwater issues—the Surface Water Program also supports transportation-oriented projects through the allocation of funds for the surface water portion of those projects. This money is used for installation or replacement of pipes, catch basins, and flow-control and water quality treatment facilities associated with transportation projects.

Currently, $950,000 annually has been transferred to this fund; however, only about $500,000 per year has been spent, resulting in accumulation of reserves. The $950,000 was based on an estimated rate of construction for transportation capital projects that was larger than what actually occurred, and on estimates of the percentage of project costs attributable to stormwater infrastructure that

were somewhat higher than actual percentages. It is recommended that the funding be reduced to $500,000 per year or an amount that is commensurate with the anticipated transportation CIP needs. Review of this amount may be necessary once new stormwater design regulations are adopted in 2016, as requirements for use of LID stormwater facilities may increase costs associated with the stormwater portion of transportation projects. Further discussion of this fiscal change is included in Section 8.

6.B Programmatic Strategies

Programmatic strategies are those projects that are typically citywide and deal with issues that are broader in scope and not associated with a particular site or problem. These include regulatory compliance strategies, O&M needs, policies, monitoring and assessment, studies to track progress and make better informed decisions, and tools to position the Surface Water Utility for successful operations now and into the future.

Programmatic strategies were identified through a review of regulatory requirements, stakeholder and public input, discussions with City staff, and anticipated future issues as discussed in Sections 3 and 5. Programmatic project sheets and estimated one-time and annual costs are provided in Appendix L, and summarized in Table 6-3. Acknowledging that many of the programmatic strategies are multi-purpose, Table 6-3 lists the various elements anticipated to be addressed by each strategy.

Cost estimates for programmatic projects are in Sections 7 and 8, and include one-time and ongoing funding needs and staff resources.

Table 6-3. List of recommended programmatic strategies

		Purpose							
ID	**Name**	O&M	Water quality	Flooding	Policy	NPDES	Education and outreach	Development and permitting	Natural resources
CW-1	TV Inspection of PIpes	✓				✓			
CW-2	LID Maintenance	✓				✓			
CW-3	Street Sweeping	✓		✓					
CW-4	Ditch Maintenance	✓	✓	✓					
CW-5	Maintenance on Goat Hill: Equipment Rental	✓							
CW-6	Development Review Evaluation				✓	✓		✓	
CW-7	LID Code Review				✓	✓		✓	
CW-8	LID Implementation and Manual Adoption		✓		✓	✓		✓	
CW-9	Stormwater Facility Inspection	✓		✓		✓			
CW-10	Service Truck	✓				✓			
CW-11	Spill Response Truck	✓	✓			✓			
CW-12	Beaver Management Policy				✓		✓		
CW-13	Address Prioritized Fish Passage Barriers				✓				✓
CW-14	Evaluation of Incentives and Rebate Programs				✓				
CW-15	Utility Rate Study				✓				
CW-16	Proactively Avoid TMDL		✓		✓				
CW-17	City-specific Water Quality Monitoring		✓						
CW-18	Watershed Planning				✓		✓	✓	
CW-19	Develop LID Feasibility Tools					✓	✓	✓	

Table 6-3. List of recommended programmatic strategies (continued)

ID	Name	Purpose							
		O&M	Water quality	Flooding	Policy	NPDES	Education and outreach	Development and permitting	Natural resources
CW-20	Incorporation of LID into City Capital Projects				✓	✓			
CW-21	Stream Habitat and Fish Monitoring						✓		✓
CW-22	O&M CIP Consultation	✓			✓				
CW-23	Environmental Permitting for Maintenance	✓							
CW-24	Property Acquisition Policy and Priority Areas				✓				✓
CW-25	Evaluation of Stream Deltas in Lake Washington				✓				
CW-26	Urban Forestry and Tree Inventory				✓			✓	
CW-27	Climate Change Evaluation	✓		✓	✓				
CW-28	Streamside Restoration Maintenance	✓			✓			✓	✓
CW-29	Noxious Weeds and Invasive Plants				✓		✓		✓
CW-30	Juanita Creek Floodplain Mapping			✓	✓			✓	
CW-31	Map Areas of Treatment for Existing Stormwater Facilities		✓			✓		✓	
CW-32	Stormwater System Rehabilitation Catch-up	✓							
CW-33	Retrofit Opportunities						✓	✓	
CW-34	Leaf Pick-up Program	✓			✓		✓		
CW-35	Private Streambank Stabilization Program		✓		✓				✓
CW-36	Scoop Law Evaluation		✓		✓				
CW-37	Volunteer Involvement				✓		✓		✓
CW-38	Neighborhood Drainage Assistance				✓		✓		
CW-39	Residential Stormwater Audit		✓				✓		✓
CW-40	Neighborhood Rain Garden Program		✓				✓		✓

6.B.1 Operations and Maintenance

The nature of the work conducted by the O&M Group is equipment- and labor-centric, requiring a work force that has the right tools, an appropriately sized staff, and the skills needed to keep the surface water and stormwater infrastructure functioning in a manner that is protective of the public and the environment. Several programmatic recommendations are put forth to meet O&M staff needs and better serve the community. As noted in Section 5, the primary drivers for the O&M needs are:

- **Annexation:** With annexation, the workload has increased and the area served has some different needs, such as a higher percentage of roadside ditches and stormwater ponds requiring City maintenance. The length of ditches increased by 126% and the number of stormwater ponds increased by 129% as a result of annexation. Although staff were added with annexation, workload exceeds available staffing.
- **2012 Streets Levy:** The street preservation program doubled in 2012 with passage of this levy, increasing time spent investigating and repairing stormwater infrastructure ahead of pavement overlay.
- **Regulatory requirements:** The NPDES Phase II Permit requires increased maintenance frequency, as well as implementation of citywide LID BMPs that have different maintenance requirements.

Table 6-4. List of operations and maintenance related programmatic strategies

Project	Description	Anticipated outcomes and benefits
CW-1: TV Inspection of Pipes	Two additional staff and an additional CCTV inspection truck to be shared between Wastewater and Surface Water	• Ability to meet the pavement overlay schedule, while still conducting other important O&M functions • Additional CCTV truck will help accelerate the pipe inspection program, which is useful for better understanding condition of the system and potential replacement needs • Pipe inspection can be used to meet NPDES requirements for IDDE
CW-2: LID Maintenance	Additional grounds crew laborers, training, and equipment to maintain LID sites as they become more prevalent	• Staff with skills in landscape maintenance will be better able to maintain LID facilities
CW-3: Expand Fall Street Sweeping	Overtime pay for maintenance workers to conduct additional street sweeping in the fall when it is most needed	• Reduced flooding from clogged catch basins and ditches • Use of existing staff to augment current program
CW-4: Ditch Maintenance	Hire additional staff, and acquire an additional multi-purpose dump truck, backhoe, and trailer in future years to effectively maintain Kirkland's ditches	• Maintained ditches are better able to convey water and reduce flooding, contribute to better water quality, and result in fewer citizen complaints • Contract workers will help O&M staff catch up with ditch cleaning, particularly in the annexation area where there are a greater number of open ditches • Eventual staff and equipment purchases will allow for better and more consistent long-term ditch maintenance

Table 6-4. List of operations and maintenance related programmatic strategies (continued)

Project	Description	Anticipated outcomes and benefits
CW-5: Maintenance on Goat Hill	Rent equipment so that City staff can access Goat Hill and conduct necessary infrastructure maintenance	• Appropriately sized equipment will allow for more frequent infrastructure maintenance that may help alleviate ongoing erosion problems on Goat Hill
CW-9: Stormwater Facility Inspection	Additional staff to be shared with Wastewater will allow O&M staff to better inspect facilities that require such inspection after large storm events in the annexation area	• More resources will help ensure that time-critical inspections are completed
CW-10: Service Truck	Additional service truck to haul heavy gear, including a small crane	• Additional equipment will help staff fulfill NPDES requirements and manage increased workload associated with annexation area
CW-11: Spill Response Vehicle	Service truck dedicated to spill response	• Service truck equipped with proper supplies and gear will be able to respond to emergency spills more quickly, reducing the potential for water quality issues in surface water system
CW-22: Operations and Maintenance CIP Consultation	Time for O&M staff to coordinate more effectively with capital projects engineers to design projects with long-term maintenance in mind	• Timely coordination during the project design phase will result in better projects and less O&M time and money once the project is constructed
CW-23: Environmental Permitting for Maintenance	Time for City staff or a consultant to obtain environmental permits for maintenance projects, and follow up on reporting requirements once permits are obtained	• Dedicated staff time will result in better permit planning and coordination of work efforts that require environmental permits, particularly in the annexation area where infrastructure maintenance could have impacts to natural resources • Dedicated staff will result in more consistency in identification of when permits are required and how they are obtained
CW-28: Streamside Restoration Maintenance	Evaluation of responsibility for maintaining stream capital projects, and funding to increase maintenance on stream restoration sites	• Clarity of responsibility, including time frames, easements, and maintenance obligations
CW-32: Stormwater System Rehabilitation Catch-up	Temporary maintenance workers (6-month time frame) and equipment rental to conduct system rehabilitation	• Reduce system rehabilitation backlog
CW-34: Leaf Pick-up Evaluation	Evaluation of fall leaf pick-up programs used by other jurisdictions and potential for Kirkland to implement a similar program	• Understanding of the pros and cons of leaf pick-up programs as they relate to Kirkland

6.B.2 Engineering, Stewardship, and Education

The Engineering, Stewardship, and Education Group is the group responsible for all aspects of surface and stormwater management outside of the operation and maintenance of stormwater infrastructure. The diverse staff in this group conducts education and outreach, development review, regulatory compliance activities, and watershed and Utility planning.

6.B.2.a Education and Outreach

The Surface Water Utility provides a wide variety of opportunities for citizen involvement as well as programs, information, and tools to help the community do its part to protect local water bodies. Some of the programmatic projects recommended in this Plan have an education and outreach component, but there are no specific recommendations for changes to the current education and outreach program. Regulatory compliance projects described above will have an education and outreach component, as there will be changes to codes, standards, and development permit requirements that will need to be communicated to the community at large. Additionally, new or revised policies (described below) that affect the community will require education and outreach.

6.B.2.b Development Review

Review of surface water and stormwater elements of development permit applications is one of the primary responsibilities of the Surface Water Utility. The workload varies depending on the level of development activity and the general economic climate in the region. New NPDES requirements will increase the review time for most permit applications, and the programmatic projects aimed at permit compliance (described above) will help in the development review process. Permit fees cover a portion of the staff time needed to conduct the reviews; however, the current schedule of charges might need to be revisited based on anticipated changes driven by the NPDES permit. Table 6-5 describes programmatic projects recommended to address future development review.

City Council may wish to consider revisiting the current schedule of permit fees to account for anticipated increases in staff review time as a result of NPDES permit changes.

Table 6-5. Recommended development-oriented programmatic strategies

Project	Description	Anticipated outcomes and benefits
CW-6: Development Review NPDES Analysis	Evaluate previous permit application review data with regard to future requirements to predict future needs, including staff resources	• Understanding of how NPDES Permit changes may affect resource needs so that adequate time can be budgeted and fees can be recovered, if necessary.
CW-30: Juanita Creek Floodplain Mapping	Evaluate the need for and consequences of mapping the Juanita Creek floodplain, including a base cost for obtaining a FEMA map revision	• A map of the Juanita Creek floodplain would provide clarity for development review staff as to limitations on development within the floodplain and compensatory mitigation for floodplain impacts. However, a floodplain map could affect private property owners' ability to obtain flood insurance and increase the cost of that insurance.

6.B.2.c Environmental Stewardship

The City's surface water and stormwater system is intimately connected to the environment and the City's natural resources. One of the Surface Water Utility's primary responsibilities is to conduct its activities in a manner that is consistent with the City'senvironmental values and to carry out projects that contribute to improved environmental conditions. Table 6-6 (next page) describes programmatic projects recommended in support of this mission.

Table 6-6. Recommended programmatic strategies related to environmental stewardship

Project	Description	Anticipated outcomes and benefits
CW-13: Address Prioritized Fish Passage Barriers	Implement a fish barrier removal program and conduct an internal informational campaign	• Systematic removal of priority fish barriers addresses regional and tribal fish passage concerns • Opportunities for incorporating fish barrier removal on City-led or permitted projects will not be missed
CW-16: Proactively Avoid Total Maximum Daily Load (TMDL)	Implement a program to reduce pollutants of concern in Kirkland's 303(d) listed streams and monitor progress	• Implementing a program before it is required by the State will save costs in the long run, and accelerate water quality improvements
CW-17: City-Specific Water Quality Monitoring	Expand lake monitoring program to include Totem Lake, and coordinate with King County to collect water quality index parameters in select stream locations to monitor water quality trends	• Monitoring data will provide a baseline for understanding the effects of retrofit and other projects to improve water quality conditions in Kirkland's lakes and streams
CW-21: Stream Habitat and Fish Monitoring	Perform habitat surveys on three stream channel reaches and annual fish surveys to monitor habitat quality and fish population trends	• Monitoring data will provide a baseline for understanding the effects of retrofit and other projects to improve aquatic habitat conditions that support fish populations in Kirkland's streams
CW-24: Property Acquisition Priority Map	Evaluate and develop a map for internal use of undeveloped properties that provide unique or valuable ecologic functions and for which property acquisition by the City may support Surface Water Utility and City goals for environmental stewardship	• Identification of desirable properties for acquisition would facilitate decision making as properties become available for transfer
CW-26: Urban Forestry and Tree Inventory	Update citywide public right-of-way tree inventory, develop the framework for a treebate program	• Previously completed tree inventory has not been maintained and does not contain the level of detail needed for effective management • Updated tree inventory would allow for a better understanding of the type, location, and age of trees that provide surface water and stormwater environmental functions (temperature moderation, water uptake, detritus, food sources for bugs, etc.) in public right-of-way • Treebate program would provide funds for residents to plant new trees that provide surface water functions on private property • Cost-sharing with other departments that utilize urban forester for benefits beyond surface water • Eco-benefits analysis

Table 6-6. Recommended programmatic strategies related to environmental stewardship (continued)

Project	Description	Anticipated outcomes and benefits
CW-29: Noxious Weeds and Invasive Plants	Review noxious weed programs implemented by other jurisdictions and either develop a Kirkland-specific program to be implemented across departments, and use volunteers to the extent feasible or use King County's noxious weed program.	• Citywide control of noxious weeds will benefit the Surface Water Utility through decreased time spent on control of noxious weeds at surface water facilities, and better success rates for stream and wetland restoration projects • A noxious weed program will be very important as LID facilities are constructed throughout the city, as these facilities are typically vegetated and compost-amended soils provide an excellent growing medium for all plants including noxious weeds that get imported to the site in one manner or another
CW-36: Scoop Law Evaluation	Evaluate poop scoop laws in other jurisdictions, and make a recommendation to City Council if is determined that a poop scoop law in Kirkland would help minimize water quality problems that result from dog waste	• Determination of whether a law would be effective and whether the costs of implementation would be outweighed by the water quality and social benefits
CW-39 Residential Stormwater Audit Program	The Stormwater Audit Pilot Program, currently under way via King Conservation District and NPDES Municipal Stormwater Capacity grants, seeks to work with property owners to identify simple and low-cost ways that they can absorb and filter more stormwater on their property.	• Evaluation of this program will help determine if future funding should be sought through grant funding or if the Utility should allocate funds for future implementation
CW-40 Neighborhood Rain Garden Program	The Neighborhood Rain Garden Program identifies a neighborhood champion who recruits six to eight neighbors who will have rain gardens constructed in their front yards. Following construction of the gardens by a City contractor, neighbors gather to plant vegetation in each of the gardens. This program helps to reduce volume of runoff to the stormwater system.	• Depending on the success of this program, the City may consider expansion and re-allocation of City resources for funds and staff to support this program

6.B.2.d Regulatory Compliance

As discussed previously, much of the surface water and stormwater program operations are guided by regulatory requirements aimed at protecting the public and the environment.

NPDES Phase II Permit changes and new requirements were discussed in previous sections. Many of the programmatic strategies are standalone tasks that will help Kirkland implement changes for compliance with the new permit. Regulatory compliance is the primary driver for the recommended programmatic projects described below in Table 6-7 and Appendix L.

Table 6-7. Regulatory compliance-related programmatic strategies

Project	Description	Anticipated outcomes and benefits
CW-7: LID Code Review	Review and revise development-related codes to incorporate and require LID principles and LID BMPs	• The LID code scrub is necessary to comply with the NPDES permit • As City staff go through the process of reviewing and revising codes to incorporate LID, they will be in a better position to relay requirements and develop tools for the Kirkland development community
CW-8: LID Implementation and Surface Water Manual Adoption	Adopt a new Surface Water Design Manual that is equivalent to the 2012 Ecology Manual, update City codes and standards for consistency with the new Manual, and develop a plan for implementation of Manual requirements including citywide implementation of LID	• Manual adoption, LID implementation, and surface water design code and standards updates are necessary to comply with the NPDES Permit
CW-19: Develop LID Feasibility Tools	Develop tools for City staff and development community to use in determining LID infeasibility criteria	• Development of tools for use by City staff and the development community will provide a framework for consistent interpretation of criteria that can be used to determine when LID BMPs are not feasible • Maps that delineate areas in the city that are clearly not feasible for LID BMPs will save development review time and money spent on studies to prove what is otherwise already documented (for instance, steep slopes)

6.B.2.e Watershed and Utility Planning

As the City plans for its future and conducts work designed to accomplish its goals, the Surface Water Utility responsibilities support those goals in many ways, including the items previously discussed.

Planning ahead requires being strategic, and includes consideration of elements that are beyond the City's direct control or require many years to implement. Stormwater retrofit is one such consideration that will happen gradually as the City redevelops but is not yet required. However, the City may benefit from taking a proactive approach toward retrofit for the following reasons:

- Stormwater retrofit may be required in the next NPDES Permit cycle
- Planned retrofit in areas of economic revitalization will support successful development that is beneficial to the City, its resources, and the developer
- Prioritization of stormwater retrofit for those areas of the city that could most benefit will result in fewer surface water problems
- Grants are available for stormwater retrofit projects, particularly those that incorporate LID BMPs

Climate change is one of the other big-picture topics that will likely affect the City's Surface Water Utility but on a time frame outside of this planning cycle. As with stormwater retrofit, the City should proactively evaluate potential program revisions and strategies to manage surface water in a very different climatic environment. Table 6-8 describes the programmatic strategies recommended to address these broader issues.

The City Council and City Manager may wish to consider reorganizing the Utility to have a Utility Manager that is in charge of the entire program and can provide leadership and continuity across the various groups that implement the overall program.

The current organization structure of the Utility presents some challenges for coordination and oversight. Engineering and O&M functions are managed within different sections of Public Works, and central oversight is provided by the Public Works Director. This organization structure developed because when the Utility was formed, there was only one surface water engineering employee and it made sense to have that position as part of the Engineering section. There are now seven employees in the ESE Group, and the need for tight coordination among the different functions of the Utility in order to meet regulatory requirements has increased. Reorganization of the Utility may be considered in a Citywide or department-wide context.

Table 6-8. Recommended programmatic strategies related to Watershed and Utility planning

Project	Description	Anticipated outcomes and benefits
CW-18: Watershed Planning for Retrofit	Evaluate opportunities for stormwater retrofit on a watershed basis, develop a plan to construct regional facilities, and opportunistically treat public stormwater in public/private facilities	• Identification of specific projects would facilitate better decision making as opportunities for grant funding or add-ons to other planned projects occur
CW-27: Climate Change Evaluation	Evaluate potential future effects of climate change and develop a policy that addresses future infrastructure needs, planning, and adaptive management	• Consideration of potential climate impacts will facilitate better project designs and implementation, especially for those projects or infrastructure that have an anticipated project life cycle that extends into predicted climate change scenario time frames (50 to 100 years)
CW-33: Retrofit Opportunities	One-time project to review development projects for potential retrofit opportunities	• Allows an opportunity to identify large-scale development projects currently in the works that would be good candidates for retrofit, ahead of future requirements that will not take effect until 2017

6.B.3 Policies and Administrative Functions

The Surface Water Utility requires administrative functions to conduct its work (including the collection of surface water fees). It also relies on direction from the City Council for implementation of Citywide or Surface Water Utility policies. There are several policy-related issues that warrant special consideration by the City Council. These have been highlighted in the relevant sections of the Plan and are also listed below.

- Expanded floodplain mapping may be beneficial to increasing flood awareness and preparedness, but could also result in higher insurance rates for property owners within these areas. The City should consider the benefits and consequences of additional floodplain mapping. Analysis is proposed in programmatic strategy CW-30 (Table 6-5).

1. Sediment deposition along Kirkland shorelines sometimes affects boat access to marinas. The City should consider whether it is in the public interest or the City's responsibility to mitigate sediment deposition in these areas. Analysis is proposed in programmatic strategy CW-25 (Table 6-9).
2. The City should consider whether a policy should be formalized to manage beavers and in what circumstances. Analysis is proposed in programmatic strategy CW-12 (Table 6-9).
3. The City should consider how to manage and maintain pervious sidewalks as they get installed. Should responsibility remain with private property owners, or should the City take on the responsibility, or discourage the use of pervious pavement on sidewalks. Specific pervious pavement analysis is not recommended in this Plan, but will be evaluated during the LID code review (CW-7) and LID implementation and Manual Adoption (CW-8) programmatic strategies.
4. Consider reducing the amount of Utility funding allocated for transportation capital projects from $950,000 to $500,000 annually to be commensurate with anticipated transportation CIP needs. Analysis of this funding allocation was conducted for this Plan, and a fund reduction is recommended, pending approval by City Council.
5. City Council may wish to consider revisiting the current schedule of permit fees to account for anticipated increases in staff review time as a result of NPDES permit changes. Analysis is proposed in programmatic strategy CW-6 (Table 6-5).
6. The City Council and City Manager may wish to consider reorganizing the Utility to have a Utility Manager that is in charge of the entire program and can provide leadership and continuity across the various groups that implement the surface and stormwater management program. Specific analysis of potential modifications to the Utility organization were not evaluated as part of this Plan, but should be considered by City Council and the City Manager as a way to provide better coordination and efficiency.
7. Construction of high cost projects such as the Forbes Creek regional detention project (FO-02) will require a different funding mechanism. The City should consider costs, benefits and risks associated with implementation and whether evaluation of alternative approaches is warranted.

Specific programmatic strategies that are recommended for new, existing, and modified policies or administrative functions are in Table 6-9 .

Table 6-9 Recommended policy-oriented programmatic strategies

Project	Description	Anticipated outcomes and benefits
CW-12: Beaver Management Policy	Evaluate the need for a formal policy of how and when to manage beavers that impact public facilities or large numbers of private parcels and how to fund ongoing costs for beaver management	• Consistent protocol for managing beavers
CW-14: Evaluate Incentives and Rebate Programs	Evaluate existing incentive and rebate programs for financial impacts and effectiveness at achieving desired results	• Results of evaluation would provide direction for continuation, dismissal, or modifications of existing incentives and rebates
CW-15: Utility Rate Study	Conduct a rate study to assess short-term and long-term program revenue needs and evaluate partitioning of funds between operations and capital projects	• An evaluation of revenue needs in order to support program operation will facilitate decisions on how and when to implement projects based on City priorities
CW-20: Incorporation of LID into City Capital Projects	Develop a preliminary policy to support capital project engineers in the use of LID on City projects	• Demonstration to the community that the City leads by example and follows a protocol that is encouraged of developers
CW-25: Evaluation of Stream Deltas in Lake Washington	Evaluate whether a policy is needed to direct the Surface Water Utility in decisions related to if or when it would conduct dredging to maintain functionality of marinas or boat launches	• A policy, if needed, would provide clarity for whether the City views potential dredging projects as a public benefit and whether City funds should be used for such activities
CW-35: Private Streambank Stabilization Program	Evaluate the existing private streambank stabilization program and provide recommendations for future continuation and project criteria	• The program will be more effective with clarity on how and when funds should be used
CW-37: Volunteer Involvement	Evaluate the use of volunteers for surface water program activities and recommend whether the program should be expanded, diminished, or abandoned based on benefits and costs	• The results of this evaluation will help utilize volunteers more effectively
CW-38: Neighborhood Drainage Assistance	Evaluate the current neighborhood drainage assistance program and develop criteria for providing assistance	• Clarity for when and how neighborhood drainage assistance and how this program should be communicated to the public

section 7

Project and Program Prioritization and Schedule

This section describes alternatives for implementing the projects recommended in Section 6, including both capital projects and programmatic strategies. Costs associated with the recommended projects were modeled against the current revenue forecast to determine whether the existing Surface Water Utility rates could support the recommendations in this Plan or whether a rate increase is necessary. Based on the financial analysis (described in Section 8) and prioritization of the projects based on need and timing, projects were "packaged" into alternatives so that decision makers could choose the package that best represents the goals, vision, and obligations of the City while maintaining surface water rates at a reasonable level for the community.

7.A Capital Projects

City accounting policy states that capital funding should at least equal the annual depreciation amount for surface water infrastructure, which was $1.3 million for 2013, and is either spent through the CIP or placed in reserves. In addition to replacing surface water infrastructure, capital projects also serve to efficiently solve flooding, water quality, and habitat problems and are a vital component of the overall Utility program.

In determining the types of capital projects for prioritization, the following policy statements are recommended:

Flood Mitigation

Prioritize flood mitigation projects first before other types of capital projects. This is essential for the protection of public safety and infrastructure.

Address each of the following categories of projects in terms of scheduling, but provide a greater proportion of funding toward infrastructure per citizen input:

Water Quality

Prioritize stormwater retrofits based on opportunity to coordinate with transportation projects, and conduct watershed planning to prepare for stormwater retrofit grant opportunities.

Habitat

Commit to progress of fish passage barrier removal and plan for flow and water quality retrofits to prepare for grant opportunities.

Infrastructure

Construct projects that coordinate with the pavement overlay program; use information from CCTV inspection of system to prioritize repair and replacement.

Acquisition

Review riparian and wetland properties in the city to identify opportunities for acquisition. Create an opportunity fund within the CIP to be ready for acquisition opportunities as they arise.

In addition to the decision-making criteria described above, other considerations factor into which capital projects get constructed first or the schedule for implementation, such as coordination with other projects and availability of funding within a given year. Capital projects engineering staff manage the design and construction of these projects, in addition to other citywide capital engineering projects. Only a limited number of projects can be effectively constructed each year, particularly when surface water projects must compete for staff resources along with transportation and parks projects. Additionally, the cost of some projects is so large that their implementation would require use of the entire surface water capital budget for several years.

Criteria for ranking individual projects (Appendix M) are used as one piece of information for fitting projects into the above policy framework. Criteria for individual projects are perhaps most useful for deciding whether the project should be addressed at all, based on the cost and benefit. The priorities above, as well as the need to coordinate with other City projects and efforts, were used to prioritize projects for construction.

Capital projects recommended for inclusion in the CIP were ranked based on facility, environmental, fiscal, and community considerations. Ranking gives an indication of how serious the problem is and whether it should be addressed at all within a given priority. Rankings are combined with the overall criteria above and with coordination needs when developing an implementation schedule. A copy of the stormwater project criteria and numeric scoring system is included in Appendix M.

The recommended projects represent the following:

- Projects identified in the newly annexed areas
- Priorities for fish barrier removal
- New projects identified in Kirkland (areas prior to 2011 annexation)
- Projects that have been carried forward from past plans (i.e., already on the 2013–18 Surface Water CIP but have yet to be started)

Table 7-1 lists the recommended capital projects from highest to lowest priority based on cumulative scores for the four criteria; facilities, environment, fiscal, and community considerations.

Table 7-1. List of recommended capital projects in order of priority by goal (project descriptions are in Appendix K)

ID	Project	Primary goal	Preliminary cost	Other considerations for priority and scheduling	Total score
FO-02	Regional detention in Forbes Creek basin	Flooding	$10,000,000	Consider bonding because of high project cost relative to annual Surface Water Utility capital budget	55
DE-01	Sediment removal in channel	Flooding	$136,000	Addresses flooding problem	53
JC-07	Goat Hill stabilize eroding channel	Flooding	$299,000	Addresses flooding problem	44
JC-08	Goat Hill increase pipe conveyance capacity	Flooding	$490,000	Addresses flooding problem	40
RED-01	Underground injection control well (infiltration facility)	Flooding	$65,000	Addresses flooding problem	40
JC-06	Goat Hill route flow away from open channel	Flooding	$521,000	Addresses flooding problem	37
JC-04	Flow diversion	Flooding	$266,000	Addresses flooding problem	30
CH-03	Rain garden and bioretention retrofit	Water quality	$85,000	Strong FHNA support for LID/rain gardens	51
FO-07	Channel grade control	Water quality	$165,000	Construct after flows are better controlled by FO-02	49
CA-1	Erosion control measures	Water quality	$550,000	City vault in Lake Washington Boulevard and private vault/pond at Carillon point fill up with sediment from this area	46
FO-13	Pilot LID water quality project associated with planned transportation project	Water quality	$65,000		42
JC-01	Sediment removal	Water quality	$194,000		42
EC-01	Ravine stabilization	Water quality	$830,000	Combine with project EC-02	41
CDE-01	Culvert replacement to improve fish passage	Habitat	$615,000	Build in coordination with Juanita Drive improvements	63
F0-08	Forbes Creek/ BNSF Fish Passage Improvements	Habitat	$424,000	Coordinate with CKC trail construction	59

Table 7-1. List of recommended capital projects in order of priority by goal (project descriptions are in Appendix K)

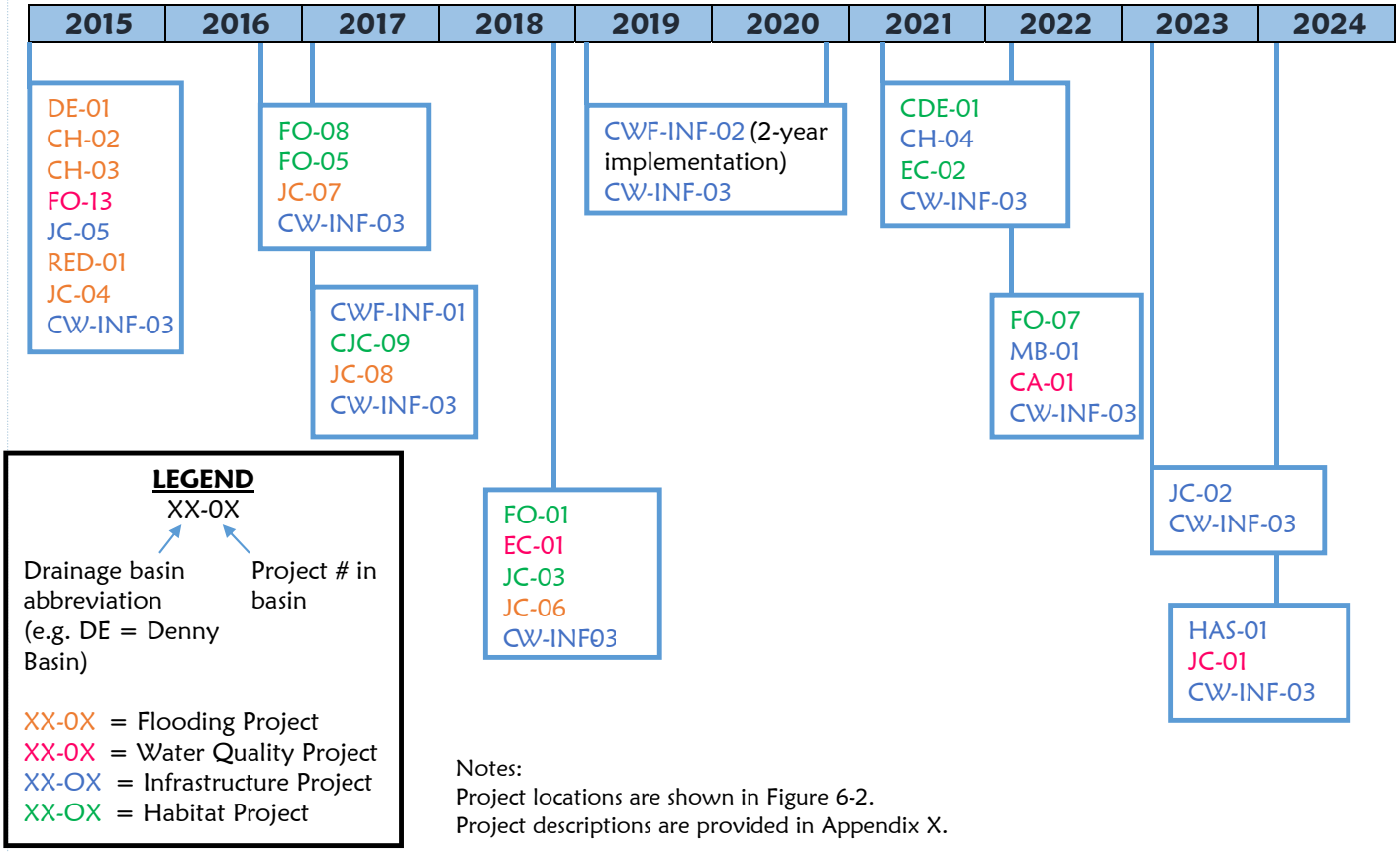
ID	Project	Primary goal	Preliminary cost	Other considerations for priority and scheduling	Total score
CH-02	Channel reconstruction	Habitat	$690,000	In Juanita Woodlands Park: strong community support	53
FO-05	Culvert replacement	Habitat	$1,058,000	May be opportunities for joint funding with King County	43
EC-02	Everest Park channel and riparian restoration	Habitat	$1,096,000	Do following or at same time as EC-01 ravine stabilization	42
FO-01	Fish passage	Habitat	$333,000		42
CJC-9	Culvert replacement to improve fish passage	Habitat	$613,000		37
JC-03	Juanita Creek floodplain creation	Habitat	$533,000		31
CH-04	Groundwater seepage and road stability	Infrastructure	$126,000	Construct as part of Juanita Drive improvements: ice causes safety issue in winter	46
CH-01	Undersized pipe to be replaced	Infrastructure	$219,000	Private property floods, system inaccessible for maintenance	43
CW-INF-02	Pipe repair and replacement	Infrastructure	$3,025,000		43
CW-INF-01	Pipe repair and replacement	Infrastructure	$769,000		40
JC-05	NE 141st Street/111th Avenue NE culvert replacement	Infrastructure	$765,000		40
MB-01	Replace stormwater pipes	Infrastructure	$680,000	Should be done in conjunction with road projects	35
HAS-01	Pipe replacement, improved hydraulics	Infrastructure	$2,369,000	Monitor maintenance fix to evaluate whether project is needed	30
JC-02	Infrastructure/ conveyance	Infrastructure	$874,000		29
		Total cost	**$27,855,000**		

The projects listed in Table 7-1 represent a reasonable mix of projects that could be accomplished over the next 10 years.

The exception to this is the regional detention project in the Forbes Creek basin (FO-02/SD-0046), which was carried forward from the 2005 Plan and is estimated to be $10 million based on a recent flood study conducted in the vicinity of 116th Avenue NE. This project would both solve a flooding problem at the NE 116th Street/I-405 interchange, and improve habitat conditions in downstream reaches of Forbes Creek. While important, the scale ofthis project is so much larger than others identified that it has been set to the side. The City Council may wish to study longer-term and more dispersed alternatives such as installation of rain gardens in the upstream watershed to meet the same goal.

An implementation schedule for projects listed in Table 7-1 is shown in Figure 7-1.

Figure 7- 1 Capital project implementation schedule



Notes:
Project locations are shown in Figure 6-2.
Project descriptions are provided in Appendix X.

For certain high-cost projects, such as the Forbes Creek regional detention project, the City should consider debt as a mechanism to fund construction rather than waiting to accumulate adequate funds through rate revenue. The reasons for this include:

- Potential damage that could occur from waiting to construct the project (i.e., flooding or habitat damage)
- Consideration of ancillary benefits to constructing the project sooner, such as an incentive for development to occur in priority areas for economic revitalization
- Other important projects are delayed as a result of saving for the high-cost project

Whether the City decides to fund high-cost projects in this manner affects the overall scheduling and prioritization of the remaining projects on the capital project list.

7.B Programmatic Strategies

Programmatic additions are grouped into "required" or "augmentation" based on the following:

- Required programmatic strategies have one of more of the following characteristics:
  - Required for NPDES compliance
  - Protects public safety
  - Maintains minimum level of service
  - Project delay would result in negative consequences
- Programmatic strategies that augment existing program management and operations have one or more of the following characteristics:
  - Immediately improves work efficiencies
  - Solves ongoing issues
  - Strong community support
  - Project addresses short-term needs
  - Project addresses long-term strategies and anticipated future conditions

The recommended strategies and associated priorities are shown in Table 7-2 in addition to average annual cost and types of funding needs.

Table 7-2 .List of recommended programmatic strategies by order of priority

ID	Name	Project priority		Staffing needs	Average Annual cost ($1,000s)	One-time costs ($1,000s)	Primary Goal
		Required	Augmentation				
CW-1	TV Inspection of Pipes	✓		✓	$152.0		Infrastructure
CW-2	LID Maintenance	✓		✓	$11.0		Infrastructure
CW-3	Street Sweeping	✓			$25.0		Flooding
CW-4	Ditch Maintenance	✓		✓	$355.0		Infrastructure
CW-5	Maintenance on Goat Hill: Equipment Rental	✓			$3.0		Infrastructure
CW-6	Development Review Evaluation	✓				$4.0	WQ-Permit
CW-7	LID Code Review	✓				$45.0	WQ-Permit
CW-8	LID Implementation and Manual Adoption	✓			$18.0		WQ-Permit
CW-9	Stormwater Facility Inspection	✓		✓	$40.0		WQ-Permit
CW-19	Develop LID Feasibility Tools	✓				$68.0	WQ-Permit
Subtotal Required Strategies					$604.0	$117.0	
CW-10	Service Truck		✓		$36.0		Infrastructure
CW-11	Spill Response Truck		✓		$29.0		WQ-Permit
CW-12	Beaver Management Policy		✓		$5.0		Flooding

Table 7-2 .List of recommended programmatic strategies by order of priority (continued)

ID	Name	Project priority		Staffing needs	Average Annual cost ($1,000s)	One-time costs ($1,000s)	Primary Goal
		Required	Augmentation				
CW-13	Address Prioritized Fish Passage Barriers		✓		$1.0		Habitat
CW-14	Evaluation of Incentives and Rebate Programs		✓		$1.4		Infrastructure
CW-15	Utility Rate Study		✓			$36.0	Infrastructure
CW-16	Proactively Avoid TMDL		✓		$26.0		Water Quality
CW-17	City-specific Water Quality Monitoring		✓		$9.7		Water Quality
CW-18	Watershed Planning		✓			$44.0	Water Quality
CW-20	Incorporation of LID into City Capital Projects		✓			$2.7	Infrastructure
CW-21	Stream Habitat and Fish Monitoring		✓		$48.0		Habitat
CW-22	O&M CIP Consultation		✓		$1.3		Infrastructure
CW-23	Environmental Permitting for Maintenance		✓		$18.0		Infrastructure
CW-24	Property Acquisition Policy and Priority Areas		✓			$37.0	Habitat
CW-25	Evaluation of Stream Deltas in Lake Washington		✓			$7.0	Infrastructure
CW-26	Urban Forestry and Tree Inventory		✓		$10.0		Habitat
CW-27	Climate Change Evaluation		✓			$55.0	Infrastructure
CW-28	Streamside Restoration Maintenance		✓		$30.0		Infrastructure
CW-29	Noxious Weeds and Invasive Plants		✓		$4.0		Infrastructure
CW-30	Juanita Creek Floodplain Mapping		✓			$11.0	Flooding
CW-31	Map Areas of Treatment for Existing Stormwater Facilities		✓		$65.1		Water Quality
CW-32	Stormwater System Rehabilitation Catch-up		✓		$24.0		Infrastructure
CW-33	Retrofit Opportunities		✓			$6.0	Water Quality
CW-34	Leaf Pick-up Program		✓			$11.0	Flooding
CW-35	Private Streambank Stabilization Program		✓			$5.7	Habitat
CW-36	Scoop Law Evaluation		✓			$6.5	Water Quality
CW-37	Volunteer Involvement		✓			$4.3	Habitat
CW-38	Neighborhood Drainage Assistance		✓			$4.2	Flooding
CW-39	Residential Stormwater Audit Program		✓	✓	$0		Infrastructure
CW-40	Neighborhood Rain Garden Program		✓	✓	$0		Infrastructure
Subtotal required strategies					$564.0	$117.0	
Total: all programmatic strategies					$912.5	$347.4	

A discussion of programmatic recommendations relative to current funding is discussed in Section 8.

7.C Staffing Needs

Implementation of the Programmatic recommendations would result in addition of 5.5 FTEs in the O&M Group and 1.0 FTE in the ESE Group beginning in 2015. In addition, the Capital Projects Group may wish to review whether additional staff will be necessary to build the surface water projects recommended by this Plan. Table 7-3 lists the specific programmatic elements that require additional permanent staffing.

Table 7-3. Permanent staffing associated with required and augmented programmatic recommendations

Position		Staffing (FTE)	Programmatic element
Required	Senior Maintenance Worker	0.5	CW-1
	Utility Worker	0.5	CW-1
	Senior Maintenance Worker	1.0	CW-4
	Utility Person (3)	3.0	CW-4
	Senior Maintenance Worker	0.5	CW-9
	Subtotal	5.5	
Augmentation	Surface Water Engineer	1.0	CW-8, CW-12-14, CW-16-25 CW-27, CW-31, CW-33-35, CW-38-40
	Subtotal	1.0	
Grand total		6.5	

section 8

Financial Analysis

Surface Water Utility rates and budget are determined through processes separate from adoption of this Plan. Current Utility revenue is approximately $8.5 million and is supplemented by other funding sources including:

- King Conservation District: approximately $55,000 per year, often shared with the Green Kirkland Partnership
- King County Flood Control District Sub-Regional Opportunity Fund: approximately $238,000 per year that in 2014 will be dedicated to Totem Lake flood reduction projects,
- Washington State Department of Ecology NPDES Municipal Capacity Grants: $120,000 for 2014-2015 for NPDES Permit implementation and water quality retrofit planning (future allocations are likely)
- One-time grants for both capital construction and studies. To provide just a few examples, the City was awarded $739,236 for the stormwater portion of the Park Lane project in 2012, and was awarded $247,100 for the Totem Lake/Juanita Creek Basin Stormwater Retrofit Conceptual Design project in 2013.

The 2014 rate for a single-family residence is $15.60 per month. Commercial and multi-family surface water charges are based on the number of "equivalent services units" (ESU) of impervious surface on the property, where one ESU equals 2,600 square feet. Single-family residences pay a flat fee, or 1 ESU. There is currently a total of about 45,500 ESU of impervious surface in billing records.

The potential rate impacts of the Plan's recommendations was a primary consideration in development of the Plan with the goal of minimizing the need for additional revenue over the ten-year life of the Plan. Costs for programs and projects are presented in the Plan are estimated in 2014 dollars.

A financial analysis of the Surface Water Utility was conducted to assess the overall financial health of the utility and the revenue needed to implement the recommendations of the Surface Water Master Plan. Utility revenue requirements and cash flow projections for the next 10 years (2014–23) were estimated based on prioritized capital improvement projects and programmatic strategies recommended in Section 7, current financial information and capital funding status, and potential funding alternatives

for a large anticipated regional detention project (Project FO-02). Details of the financial analysis are presented in Appendix N.

8.A Fiscal Policies

Kirkland's adopted fiscal policies were assumed to maintain the long-term financial health and performance of the Utility. Key policies assumed in the analysis include (1) system replacement funding, (2) operating and capital contingency reserves, and (3) inclusion of funds for surface water portions of transportation projects.

8.A.1 System Replacement Funding

The purpose of a system reinvestment policy is to establish the practices and funds required to complete the replacement of aging system facilities and ensure sustainability of the system for ongoing operations. A common approach of municipal utilities is to incorporate a replacement funding (or depreciation) policy. Annual depreciation is intended to recognize the consumption of utility assets over their useful lives. Setting aside an amount related to annual depreciation expense through rates provides a funding source for repair and replacement of existing utility plant-in-service. Further, funding a measure of depreciation through rates helps to ensure that existing ratepayers pay for the use of the assets serving them, with the cash flow funding at least a significant portion of the eventual replacement of those assets.

The targeted depreciation amount in 2014 was listed at $1.37 million for the City's Surface Water Utility. The City is currently funding annual depreciation in full, and this analysis assumes that the current practice will continue for the remainder of the study period.

8.A.2 Reserve Levels

Financial reserves are a necessary and appropriate part of prudent utility management practices. The City maintains separate accounting for an Operating Fund (Fund 421) and Capital Fund (Fund 423) in order to distinguish the different "sources" and "uses" for operating and capital needs. Both operating and capital reserves are fully funded based on the City's adopted fiscal policies.

8.A.2.a Operating Reserves

Operating reserves are designed to provide a liquidity cushion to ensure that adequate cash working capital will be maintained to address significant cash balance fluctuations, such as seasonal fluctuations in billings and receipts, unanticipated cash operating expenses, or unexpectedly low revenue collections.

8.A.2.b Capital Contingency Reserves

Capital contingency reserve, or capital funds include grant, load and bond proceeds, and other capital-related revenues.

8.A.3 Surface Water Portion of Transportation Capital Projects

Portions of the surface water conveyance system are constructed in conjunction with City street projects (e.g. gutters and drains). The Utility has paid for the stormwater-related portion of such transportation improvements through an annual set-aside of $950,000 for the Transportation Capital Improvement Program. Based on the 2014–19 transportation improvement plan (estimates provided by the Transportation Division), the average annual capital expenditure for surface water purposes has been $495,000. Current reserve funding available for surface water transportation projects has accumulated to $4.7 million. In order to more closely reflect current annual surface water costs associated with transportation projects, it is recommended that the City base the annual transfer to the Transportation Fund on the 5-year average annual forecast. For purposes of the revenue requirement calculations, it can be assumed that the Surface Water Utility will begin setting aside $500,000 per year for Transportation Projects, starting in 2015. The accumulated balance can be allocated to Surface Water Utility Capital Projects as described in this plan.

8.B Capital Project Funding Strategy

The City currently funds approximately $1.6 million in surface water capital projects per year, not including the transfer for transportation capital projects. Surface water projects are currently funded through a combination of annual depreciation set-aside and a $262,500 annual operating transfer to the surface water Capital Fund. Should the City need additional funds, the Capital Fund balance is used. The capital projects prioritized in Section 7 are assumed to be completed within the next 10 years (2014–23).

In addition to the projects listed in the prioritized CIP, the City has identified the $10 million Regional Detention Project (Forbes Creek Basin) to be completed within the next 10 years. As the prioritized CIP does not anticipate any large capital expenditures in 2020 (except for the transportation transfer), the financial analysis included the Forbes Creek Basin project in 2020. Due to the size of the project, it is assumed that revenue bond financing may be necessary in order to mitigate potential rate increases. As part of the analysis, two scenarios were evaluated to look at potential funding strategies for the Forbes Creek Basin project: (1) funding the project with a combination of both Capital Fund cash and revenue bond proceeds, and (2) funding the project with solely Capital Fund balance, increasing rates to cover the additional operating transfer expenses. Details are presented in Appendix N.

8.C Proposed Operating Program Additions and Associated Rate Adjustments

Based on City staff evaluation, each proposed budget expense has been classified as either a "Required" expense (necessary to maintain the minimal level of service and comply with the NPDES permit conditions) or an "Augmented" expense (enhances the service provided by the surface water utility). Required expenses must be added to future operating budgets. For budgetary analysis, the minimum, or "Required," service level was assumed to consist of the surface water's existing expenses plus the additional operating program expenses deemed "Required." The "Augmented" service level analyzes cost impacts if the City were to include all recommended operating program additions in future operating budgets.

Further, each potential program addition is composed of annual expenses (added to the annual operating budget) and/or one-time "startup" expenses (funded through operating cash reserves). In order to gain an accurate understanding of the Utility's annual revenue requirement, one-time expenses are assumed to be funded through the Operating Fund's cash balance as funding permits. A summary of the proposed operating program expenses associated with each service level is provided in Table 8-1, however, the timing of program implementation will be based on the City Council's review and direction of Surface Water Utility Rates and the biennial budget which will take place following the review of this plan.

Table 8-1. Proposed operating program expenses associated with required and augmented programmatic elements

Proposed Operating Additions	2014	2015	2016	2017	2018	2019	2020
Service Level: Required							
Annual Operating Expenses	-	$555,116	$582,379	$615,083	$633,535	$652,541	$672,118
One-Time Expenses	$49,680	$181,080	$51,580	$457,248	-	-	-
Service Level: Augmented							
Annual Operating expenses	$22,480	$701,313	$782,789	$821,506	$846,151	$871,535	$897,681
One-Time Expenses	$56,040	$632,900	$237,615	$578,048	-	-	-

section 9

Performance Measures

The management of surface water and stormwater in Kirkland is primarily the responsibility of the Surface Water Utility, but requires shared responsibility with other departments and groups within Public Works in order to meet the Surface Water Utility's overall goals of flood reduction, water quality and habitat improvement, and infrastructure functionality. The Surface Water Utility provides core services that are designed to meet these goals, while also complying with regulatory requirements, supporting economic development, and providing exceptional customer service. Core services provided or supported by the Surface Water Utility were described in detail in Section 5 (see Table 5-1) and include:

- Operation and Maintenance of the Public System
- Engineering, Stewardship, and Education
- Capital Improvements

9.A City Council Goals

The Surface Water Utility also has an important role in the overall City Council goals, and the core services provided by the Utility directly support those goals. Table 9-1 shows the relationship between the Surface Water Utility's core services and the Utility's role in supporting City Council goals, including the specific Utility functions.

This section describes specific metrics (actions and results) for which the Surface Water Utility can measure progress toward meeting goals through accomplishment of its work program.

Table 9-1. Relationship between Surface Water Utility work programs and City Council goals

Essential service	City Council goal	How Surface Water Utility supports City Council goal	Specific Utility functions that support goal
Neighborhoods	Achieve active neighborhood participation and a high degree of satisfaction with neighborhood character, services, and infrastructure	Public education and outreach	• Education public involvement • Stewardship opportunities • Pollution source control • Respond to inquiries
Public safety	Provide for public safety through a community-based approach that focuses on prevention of problems and a timely response	Protect public from flooding and pollution	• Flood response • Spill response • Tree management in public right-of-way • Cleaning system • Repair and maintenance
Parks, recreation, and open spaces	Provide and maintain natural areas and recreational facilities and opportunities that enhance the health and well-being of the community	Protect and improve water quality and aquatic habitat	• Watershed/Utility planning • Urban forestry • Monitoring • Surface water capital projects
Financial stability	Provide a sustainable level of core services that are funded from predictable revenue	Use stormwater fees responsibly	• All Utility functions

Table 9-1. Relationship between Surface Water Utility work programs and City Council goals (continued)

Essential service	City Council goal	How Surface Water Utility supports City Council goal	Specific Utility functions that support goal
Environment	Protect and enhance our natural environment for current residents and future generations	Manage surface water and stormwater to protect and enhance natural resources	• Development review • Surface water capital projects • Engineering/environmental permitting support • Regulatory compliance coordination • Operations and maintenance of the stormwater system • Urban forestry management
Economic development	Attract, retain, and grow a diverse and stable economic base that supports City revenues, needed goods and services, and jobs for residents	Provide predictable services to developers	• Development review • Watershed/Utility planning
Dependable infrastructure	Maintain levels of service commensurate with growing community requirements at optimum life-cycle costs	Maintain stormwater infrastructure and ensure that new infrastructure is built to appropriate standards	• Operations and maintenance of stormwater system • Surface water portion of transportation projects • Surface water capital projects

9.B Measuring Performance

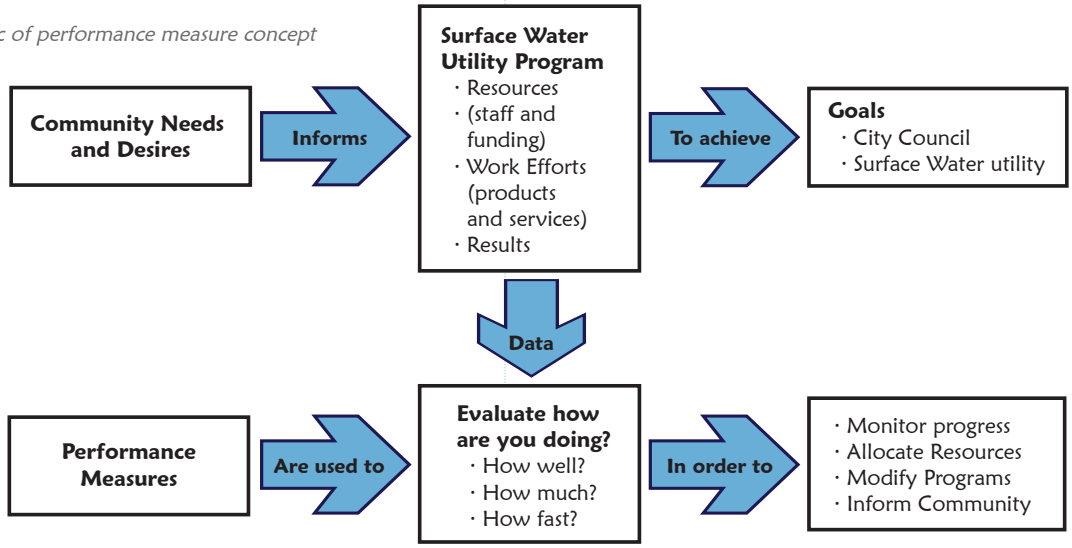
As a municipal organization, the City has the responsibility to manage public facilities for the benefit of the public and community at large. Through the establishment of City Council-defined goals, and Surface Water Utility goals that reflect those of the City Council and the public, the Surface Water Utility has a responsibility to report on progress toward meeting those goals. In addition to reporting progress, performance measures are valuable tools to help define and modify work programs. In general, performance measures are quantifiable measurements of how fast, how much, and how well work program elements are being completed, and how progress is being made toward meeting goals. Figure 9-1 provides a simplified schematic of the performance measure concept.

Surface Water Utility performance measures were discussed during an internal stakeholder meeting in the development of this Plan. During the meeting, participants broke out into smaller work groups to discuss performance metrics for specific program elements. The results of those discussions are incorporated into these recommended performance metrics. Notes from the meeting are included in Appendix B.

9.C Performance Measurements in Common with City Council Goals

As mentioned above, the Surface Water Utility plays an integral role in meeting goals established by the City Council. Several of the measurements used to evaluate progress are common to measurements that would be used to evaluate Surface Water Utility progress.

Figure 9-1. Schematic of performance measure concept



The Kirkland City Council developed performance measures for each of its goals. In general, the performance measurements relate to the following:

What is Kirkland doing to meet the goal?

- Staffing
- Programs

What financial support is being provided to meet the goal?

- Investments
- How effective are the programs and investments?
- How are the programs, investments, and outcomes viewed by the community?

Table 9-2 lists performance measurements being used as indicators of success for City Council goals that could also be used either as a direct measurement of success in achievement of Surface Water Utility goals or as an analogous performance measurement.

Table 9-2. Performance measures used by City Council that are either directly applicable to Surface Water Utility goals or analogous

City Council goal	City Council performance measures
Environment: Protect and enhance our natural environment for current residents and future generations	• Implementation measurements including compliance with NPDES stormwater permits • Effectiveness measurements that include tree canopy coverage and B-IBI population data in Kirkland
Parks and recreation: Provide and maintain natural areas and recreational facilities and opportunities that enhance the health and well-being of the community	• Implementation measurements such as number of volunteers, volunteer hours, and staffing • Financial measurements such as City investments in parks and recreation • Effectiveness measurements that include acres of natural area in restoration • Community measurements that include citizen survey results
Neighborhoods: Achieve active neighborhood participation and a high degree of satisfaction with neighborhood character, services, and infrastructure	• Implementation measurements such as City e-publishing subscriptions, and neighborhood CIP funding • Effectiveness measurements such as volunteer hours in neighborhood projects, attendance at neighborhood City Council meetings, and number of questions submitted from neighborhoods • Community measurements that include citizen survey results
Public safety: Provide for public safety through a community-based approach that focuses on prevention of problems and a timely response	• Implementation measurements such as staff and funding • Effectiveness measurements including response times and ability to contain building fires • Community measurements that include community preparedness and citizen survey results
Financial stability: Provide a sustainable level of core services that are funded from predictable revenue	• Implementation measurements such as obtaining a minimum balance in reserves and maintaining a high credit rating • Effectiveness measurements include a percentage of funding that goes to high-priority projects
Economic development: Attract, retain, and grow a diverse and stable economic base that supports City revenues, needed goods, and services and jobs for residents	• Implementation measurements that include retention of a business development consultant that assists the business community • Effectiveness measurements that include office space vacancy, number of jobs, net new business, visits to online resources, and lodging tax revenue • Community measurements that include results of business and citizen surveys
Dependable infrastructure: Maintain levels of service commensurate with growing community requirements at optimum life-cycle costs	• Implementation measurements that include funding and staff • Effectiveness measurements that include condition assessments and monitoring results • Community measurements that include results of citizen surveys

9.D Proposed Surface Water Utility Performance Measurements

Following on the City Council's approach to measuring and reporting progress for Citywide goals, proposed Surface Water Utility performance measurements that specifically address Surface Water Utility goals and relevant elements of Citywide goals are shown in Tables 9-3 through 9-7. Many of these items are already tracked as part of required reporting on the NPDES Phase II Permit.

The following performance measures can be used in the Environmental portion of the City's Annual Performance Report:

Compliance with NPDES Phase II Permit (goal is 100% compliance). Achievement of this goal indicates that the City is taking important steps to protect and improve water quality.

Percent of impervious surface for which flow control and water quality treatment is provided. This indicates to which stormwater in Kirkland is cleaned and slowed. Treatment includes both constructed facilities and dispersion of stormwater into the ground.

Table 9-3. Performance measures supported by citywide goals

Citywide goal	Surface Water Utility measurements?	How is success defined?
Neighborhoods	Number of individuals attending public outreach events	Higher is better
	Number of opportunities for residents to provide input on stormwater management	Higher is better
	Number of volunteers or community members that participate in education and outreach events	Higher is better
Financial stability	Number of investments completed vs. number of investments planned	Higher is better
	Program funding accomplished through fair rate structure	Rate is comparable to surrounding jurisdictions with an equal or better level of service (rates vs. level of service)
Economic development	Consistent and timely review of surface water portions of development permit applications	Average turnaround time (lower is better)
	Number of projects for which technical assistance is provided	Higher is better
	Area retrofit with stormwater treatment facilities in support of economic revitalization	Higher is better
Environment	See Surface Water Utility performance measures below	
Parks and recreation	See Surface Water Utility performance measures below	
Public safety	See Surface Water Utility performance measures below	
Dependable infrastructure	See Surface Water Utility performance measures below	

Table 9-4. Performance measures in support of infrastructure goal

Surface Water Utility Infrastructure Goal: Protect and maintain the City's surface water and stormwater infrastructure for optimal performance		
How?	**Measurement?**	**How is success defined?**
Implementation	Compliance with NPDES permit	Percent compliance on O&M items
	Percent of private facilities inspected every other year	Average of 50% each year, and 100% in 2 years
	Percent of public stormwater facilities inspected and maintained	95% of inspections required per NPDES Phase II Permit completed if any maintenance is required it is completed within 6 months of the inspection
	Percent of catch basins inspected and maintained	20% each year, until 2017 when it will increase to 50% each year
	Percent of pipe infrastructure inspected	10% per year (revisit based on workload)
	Percent of ditches maintained	20% of total length each year
	Number of pipes rehabilitated ahead of overlay program	No delays in pavement overlay program due to pipe rehabilitation
	Number of drainage complaints due to infrastructure maintenance issues	Lower is better; review number of complaints in comparison to the size of the storm event
Effectiveness	Number of hot spots on watch list for storm events	Lower is better; construct projects where feasible to reduce the need to watch hot spots during storm events
	Number of flooding problems due to infrastructure maintenance issues	Lower is better
	Number of claims paid regarding drainage issues	Lower is better: aim for zero
	Citizen satisfaction survey	Higher is better
Community		Percent of high ratings

Table 9-5. Performance measurements that support water quality goal

Surface Water Utility Water Quality Goal: Protect and enhance water quality for current residents, aquatic life, and future generations		
How?	**Measurement?**	**How is success defined?**
Implementation	NPDES regulatory compliance	100% compliance
	Number of businesses visited for source control outreach	Current goal is 125 in 18 months per current contract with Ecology
	Percent of impervious surface in the city for which flow control and water quality treatment is provided	Higher is better; create map of current conditions, then set annual goal, construct recommended retrofit projects by 2024
	Percent of City system screened for illicit discharges, and number of illicit discharges that are found and eliminated	Screen 40% of MS4 by 2017, 12% per year thereafter
	Number of responses to reports of spills and dumping	Higher response is better: aim for 100% response
Effectiveness	B-IBI scores in Juanita and Forbes creeks	Higher is better and indicative of good water quality; aim to bring Juanita and Forbes from Poor (BIBI 18-26) to Good (BIBI38-44)
	Number of stream reaches on Ecology 303(d) list	Lower is better; avoid TMDLs
	Number of beach closures due to water quality issues	Lower is better; aim for zero
Community	Citizen satisfaction survey	Percent of high ratings

Table 9-6. Performance measurements that support flood reduction goal

Surface Water Utility Flood Reduction Goal: Reduce threats to public infrastructure or private property due to flooding		
How?	**Measurement?**	**How is success defined?**
Implementation	Area retrofit with stormwater flow control treatment facilities that manage flows	Higher is better; create map of current conditions, then set annual goal, construct recommended retrofit projects by 2024
	Number of flood reduction projects completed	Higher % is better: aim to construct flood reduction projects within 5 years of identification of the problem
	Percent of ditches maintained	Higher is better; aim for 20 % per year
	Percent of streets swept during the fall leaf drop	Higher is better; work with Streets Division to develop specific goal
	Number of flooding hot spots still on watch list	Lower is better
	Area of floodplain preserved	Higher is better
Effectiveness	Number of flood-related calls in areas where flood-reduction projects have been implemented	Lower is better
	Number of flood-related road closures	Lower is better
	Number of drainage complaints related to clogged catch basins or ditches	Lower is better
Community	Citizen satisfaction survey	Percent of high ratings

Table 9-7. Performance measurements that support habitat improvement goal

Surface Water Utility Habitat Improvement Goal: Protect and enhance Kirkland's aquatic resources for current residents, aquatic life, and future generations		
How?	**Measurement?**	**How is success defined?**
Implementation	Area retrofit with stormwater treatment facilities that manage flows and water quality	Higher is better; develop map of areas already treated, then set % goal
	Number of fish passage barrier removals and length of habitat opened up	Higher is better; complete projects recommended for inclusion in the CIP by 2024
	Linear feet of stream restoration projects completed	Higher is better
	Acreage of high ecological value properties acquired	Higher is better
	Number of educational events focused on stream habitat and natural resources	Higher is better
	Area of floodplain preserved either via Native Growth Protection easements, or acquired as parks or open space	Higher is better
Effectiveness	B-IBI data	Higher is better and indicative of good quality habitat conditions
	Area classified as open space or natural environment	Higher is better
	Fish population data	Higher is better; aim for sustainable populations of salmon
	General habitat quality	Higher is better; aim for improved conditions as measured during periodic habitat surveys
Community	Citizen satisfaction survey	Percent of high ratings

section 9

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