Four

Recommended Utility Goals And Strategies

IV.A Surface Water Utility Goals

The Surface Water Utility has three basic goals: flood reduction, water quality improvement, and aquatic habitat protection and restoration. The purpose of this chapter is to recommend approaches to meet those goals, while balancing regulatory requirements, available budget to carry out Surface Water Utility programs, and the City's overall vision for clean water, healthy natural systems, and community stewardship. Specific program recommendations are presented in Chapter V.

The recommended approaches presented in this chapter will help to focus efforts, as a combination of several programs may be needed to achieve the Surface Water Utility's goals (Figure IV.1). For example, to reduce an instance of street flooding, it may be necessary to combine reconstruction of a pipe system (capital improvement program), education of citizens regarding leaf litter disposal (education and outreach program), and increased maintenance of catch basins (maintenance and operations program). There may also be regulatory requirements that will affect several approaches (policy analysis and regulatory compliance program).

Potential approaches to each of the three goals range from (1) the minimum level of service to comply with surface water regulations and protect public safety to (2) the highest possible level of service that would proactively protect public safety and restore resources to pre-development conditions. The recommended approach for each goal is to provide a high level of service that combines achievable programs and projects to meet the minimum requirements, and make progress toward achieving improvements that address community concerns and the City's vision. Table IV.1 describes the three levels of service. Figure IV.2 conceptually shows the cost relative to the level of service required to maintain, improve and restore conditions in Kirkland's watersheds.

FIGURE IV. 1 Surface Water Relationship Between Utility Goals and Programs

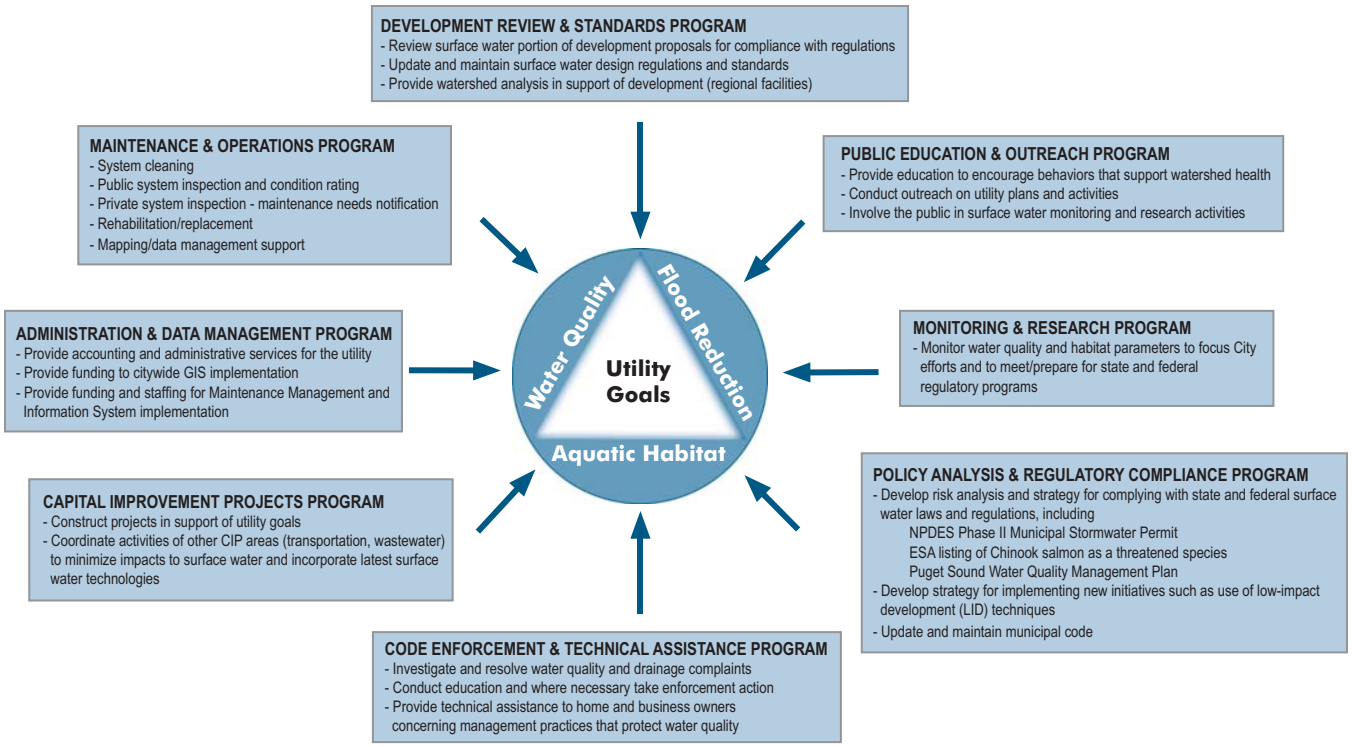
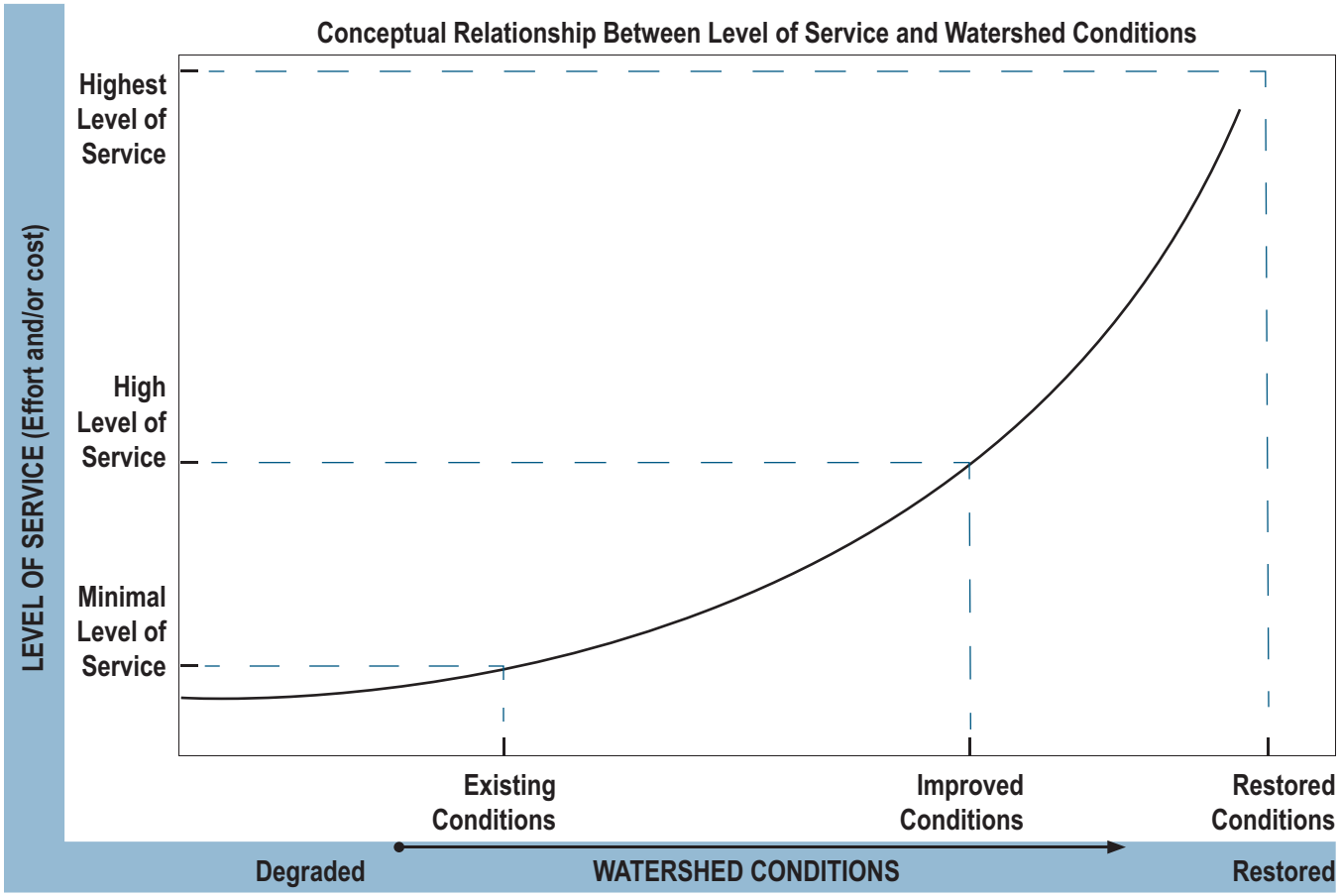


TABLE IV. 1 Levels of Service Descriptions for Utility Goals

Utility Goal	Basic	High	Highest
Flooding	React to flooding problems and address only those that the City is required to fix.	Reduce the frequency and severity of major flooding so that it only occurs during major (> 100 year) storm events	Reduce the frequency and severity of major flooding so that it only occurs during the most extreme (>>100 year) storm events.
Water Quality	Maintain current water quality through programs and projects that control sources of pollutants and treat runoff from new and redeveloping properties	Provide moderate water quality improvement by enhancing the basic level of service with projects and programs that have a high benefit-cost ratio	Provide water quality improvement such that water quality standards are consistently met in all streams and lakes
Aquatic Habitat	Maintain Current aquatic habitat condtions, understanding that this may lead to continued decline of fish populations	Improve aquatic habitat conditions to sustain existing fish populations	Improve aquatic habitat conditions to sustain fish populations at historic levels

Table format and concept per the City of Olympia Storm and Surface Water Plan, September, 2003.

FIGURE IV. 2 Conceptual Costs and Benefits of Achieving Utility Goals



The section for each Surface Water Utility goal includes a review of minimum requirements, as well as the highest level of service that would protect public safety and restore resources to historic conditions. The recommended approach for achieving success toward meeting each goal was generally determined based on an analysis of success factors for different strategies that could be implemented. The success factors included (1) effectiveness, (2) feasibility, (2) cost and (3) likelihood of success. The strategies with the greatest possible effectiveness, feasibility and likelihood of success relative to the cost of implementation were chosen for inclusion in this plan. Additionally, the strategies were evaluated with regard to these basic principles:

1. Protect first – it is far less expensive to protect and preserve than to restore and treat.
2. Optimize and manage infrastructure – use our constructed facilities to meet multiple objectives (e.g., combine water quality treatment with the existing pipe system).
3. Balance public and private responsibility – the City should set an example in care and management of public facilities, while at the same time requiring private development projects to meet standards for surface water management.
4. Involve the community and influence behavior – stewardship, education, and resulting behavior changes will be necessary to protect and preserve our watersheds.
5. Explore and encourage innovative solutions – be willing to responsibly experiment to develop better (less expensive and more efficient) ways to protect and restore watersheds while protecting public health and safety.
6. Measure performance and adapt programs as needed – surface water management is a relatively new field; we must constantly evaluate and adjust our actions to achieve the best possible outcomes.

Tables IV.2, IV.3, and IV.4 list flooding, water quality and habitat problems in the city, possible solutions and success factors on the following pages.

Table IV.2- Flooding Problems and Potential Utility Solutions

Type of Flooding Problem	Potential Solutions	Under what circumstances could this solution be used?	Which Utility programs are involved?	Specific recommended Utility program elements	How is solution implemented?	How Effective is the solution?	How feasible is it?	How much does it cost?	What is the likelihood of success?
New Impervious Surface	Provide incentives to minimize creation of new impervious surfaces	New Development citywide (private and public)	Policy Analysis and Regulatory Compliance	**Low impact development (LID) study**	Kirkland Municipal Code and Surface Water Design Manual	Moderate	High	Low	High
			Development and Review		Surface Water Design Manual and Kirkland pre-approved plans	High	High	Moderate	High
	Regulate minimization and management of runoff from new development and redevelopment projects	New development and redevelopment citywide	Development and Review	Review new development plans for compliance with existing regulations. **Adopt new surface water design regulations.**	CIP Plan and Utility Programs	Moderate	Moderate	High	Moderate
	Provide regional facilities for use by development projects	New development	CIP	**Regional detention facility CIP project**					
Existing Impervious Surface	Provide regional facilities to retrofit previously developed impervious surfaces	Redevelopment projects citywide	CIP	**Regional detention facility CIP project**	CIP Plan	High	Moderate	Moderate	High
				Public Private partnerships	Utility Programs	Moderate	Low	Moderate	Low
				Surface water portion of transportation improvement projects					
	Remove impervious surfaces	Redevelopment projects citywide	CIP	**Identify LID pilot project as part of LID study**					
			Code Enforcement and Technical Assistance						
			Public Education and Outreach						
Deteriorating or inadequate conveyance systems	Replace Infrastructure	Transportation CIP projects, facility upgrades	Maintenance and Operations	**Condition rating system**	Maintenance work program	High	High	Low	High
			CIP	**Street overlay program infrastructure upgrade**	CIP Plan and Maintenance work program	High	High	Moderate	High
	Abandon infrastructure, replace with low impact management structures or techniques	Facility upgrades, transportation projects	Maintenance and Operations		Maintenance work program	Moderate	Low	Moderate	Low
			CIP		CIP Plan and Utility programs				

Table IV.2- Flooding Problems and Potential Utility Solutions *cont.*									
Type of Flooding Problem	**Potential Solutions**	**Under what circumstances could this solution be used?**	**Which Utility programs are involved?**	**Specific recommended Utility program elements**	**How is solution implemented?**	**How Effective is the solution?**	**How feasible is it?**	**How much does it cost?**	**What is the likelihood of success?**
Inadequate maintenance of conveyance systems	Increase maintenance frequency and timing (i.e., inspect during storm events)	Citywide following major rain or snow storms	Maintenance and Operations	**Increase between storm inspection frequency**	Maintenance work program	High	High	Low	High
	Decrease impact of sediment and debris on system		CIP	**Construct CIP projects that specifically reduce sedimentation problems**					
	Educate residents on local maintenance needs/assistance	Citywide outreach in fall	Public Education and Outreach	**Increase public education and outreach regarding removal of leaf debris in fall through utility bill inserts or public access TV ads**	CIP plans	High	High	Low	High
					Utility Programs	High	High	Low	High
New structures in flood prone areas	Regulate to preserve wetlands, streams and their buffers, and to preserve flood storage capacity and floodplain connectivity	Zoning code review	Outside scope of Utility- coordinate through zoning code review		Kirkland Zoning Code	High	High	Moderate	Moderate
Existing structures in flood prone areas	Move structures away from streams or wetlands	Properties adjacent to streams and wetlands	CIP	Not applicable at this time	CIP Plan	Moderate	Low	High	Moderate

Table format and concept per the City of Olympia Storm and Surface Water Plan, September, 2003.

[1] The National Flood Insurance Program is a program of the federal government's Federal Emergency Management Agency (FEMA) that allows residents and businesses to purchase low-cost flood insurance and provides flood relief in communities where local government has taken certain steps to regulate floodplain development and to reduce the potential for flood damage to existing structures.

Table IV.3- Water Quality Problems and Potential Utility Solutions *cont.*

Type of Water Quality Problem	Potential Solutions	Under what circumstances could this solution be used?	Which Utility programs are involved?	Related program elements recommended in plan	How is solution implemented?	How Effective is the solution?	How feasible is it?	How much does it cost?	What is the likelihood of success?
Runoff from new impervious surfaces	Use low impact development techniques that minimize creation of impervious surfaces	New Development citywide (private and public)	Policy Analysis and Regulatory Compliance	**Low impact development study**	Kirkland Municipal Code and Surface Water Design Manual	Moderate-High	High	Low	High
			Development and Review						
	Treat runoff from new impervious surfaces	New development and redevelopment citywide	Development and Review	Review development proposals for compliance with existing regulations.	Surface Water Design Manual and Kirkland pre-approved plans	Moderate	High	Low cost to public (cost to developers is high)	Moderate
Discharge of pollutants from point sources	Replace failing septic systems with sewer connections	Areas with high density of septic systems near streams with elevated fecal coliforms	Public Education and Outreach	**Coordinate with Sewer Utility to prioritize residential conversion from septics to sewer system**	Wastewater Utility programs and Kirkland Municipal Code	Moderate	Moderate	Low cost to public (cost to homeowners is high)	Moderate
			Code Enforcement and Technical Assistance						
			Monitoring and Research						
	Require cleaning and maintenance of private drainage facilities	Citywide	Code Enforcement and Technical Assistance	Inspect and require maintenance of private drainage facilities	Kirkland Municipal Code and Utility Programs	Moderate-High	High	Low	Moderate
	Eliminate non-stormwater connections to drainage system	Citywide	Public Education and Outreach	**Dry weather sampling plan**	Kirkland Municipal Code and Utility Programs	High	High	Low	High
			Code Enforcement and Technical Assistance						
	Educate public regarding methods for proper waste disposal to reduce spills and dumping	Citywide	Public Education and Outreach	**Adopt King County Stormwater Pollution Control Manual**	Kirkland Municipal Code and Utility Programs	Moderate	High	Low	High
			Code Enforcement and Technical Assistance	**Centralize spill response and incident documentation**		Low	Moderate	Low	Moderate
				Conduct routine water quality business audits		High	High	Moderate	High

Table IV.3- Water Quality Problems and Potential Utility Solutions *cont.*

Type of Water Quality Problem	Potential Solutions	Under what circumstances could this solution be used?	Which Utility programs are involved?	Related program elements recommended in plan	How is solution implemented?	How Effective is the solution?	How feasible is it?	How much does it cost?	What is the likelihood of success?
Runoff from existing impervious surfaces	Reduce existing impervious surfaces	Citywide	Development and Review	**Low impact development study**	CIP Plan, Surface Water Design Manual and Utility Programs	Low	Moderate	Moderate	Low
			CIP						
			Maintenance and Operations						
	Disconnect existing impervious surface from drainage system (i.e., drain impervious surfaces to soils that can treat/infiltrate water)	City redevelopment projects, such as transportation improvement and private redevelopment	Monitoring and Research	**Improved soils map**	CIP Plan	Moderate-High	Low	Low	Low
			Maintenance and Operations						
			CIP						
	Sweep and clean streets to reduce sediment wash off	Citywide	Maintenance and Operations	**Street washing study**	Utility programs	High	High	Low	High
	Clean sediment from pipes and catch basins	Citywide	Maintenance and Operations	Increased inspection and maintenance	Utility programs	High	High	Moderate	High
	Treat runoff from existing impervious surfaces	Redevelopment projects and known pollution "hot'spots"	Monitoring and Research, and CIP	**Evaluate and rank sources of pollutants**	CIP Plan and Utility programs	High	Moderate	Moderate	High
				Retrofit facilities to provide water quality treatment		High	Low	High	Moderate

Table IV.3- Water Quality Problems and Potential Utility Solutions *cont.*

Type of Water Quality Problem	Potential Solutions	Under what circumstances could this solution be used?	Which Utility programs are involved?	Related program elements recommended in plan	How is solution implemented?	How Effective is the solution?	How feasible is it?	How much does it cost?	What is the likelihood of success?
Discharge of pollutants from nonpoint sources	Encourage management practices for the City, residents, and businesses that protect water quality:	Citywide	Public Education and Outreach, and Code Enforcement and Technical Assistance	**"Green" landscaper certification program**	Kirkland Municipal Code, Wastewater and Surface Water Utility programs, Transportation program	Moderate	High	Low	Moderate
	Minimize use of chemicals in landscaping (fertilizers, pesticides, herbicides)			**Multifamily outreach program**		Moderate	High	Low	Moderate
	Minimize contamination from pet waste			**Audit of City Practices and Properties**		High	High	Moderate	High
	Contain wastewater from washing and cleaning operations			Continue existing eduction and outreach programs					
	Store materials such that they do not contact rainwater or stormwater			**Adopt King County Stormwater Pollution Control Manual**					
	Prevent and cleanup spills								
	Conduct proper maintenance of septic systems								
	Yard-scale treatment facilities??								
	Reduce vehicle use								

Table format and concept per the City of Olympia Storm and Surface Water Plan, September, 2003.

Table IV.4- Aquatic Habitat Problems and Potential Utility Solutions									
Type of Flooding Problem	**Potential Solutions**	**Under what circumstances could this solution be used?**	**Which Utility programs are involved?**	**Specific recommended Utility program elements**	**How is solution implemented?**	**How Effective is the solution?**	**How feasible is it?**	**How much does it cost?**	**What is the likelihood of success?**
Increased frequency and duration of high stream flows in winter, reduced baseflow in summer	Intercept runoff from impervious surfaces for use in other non-potable uses	Fish-bearing watersheds (such as Juanita or Forbes creeks)	Development Review and Standards		Surface Water Design Manual and CIP Plan	Moderate	Low-moderate	Moderate-High	Moderate
	Provide High flow bypass structures to route water around high quality habitat areas					Moderate	Moderate	Moderate	Moderate
	Preserve forest cover and vegetation			**Coordinate with Planning Department regarding stream buffer preservation and incentives for removing existing encroachments**					
	Provide regional facilities for use by development and redevelopment projects, in addition to providing retrofit for past unmitigated flows	New development, redevelopment and areas to be retrofit	CIP	**Regional detention facility CIP project**	CIP Plan and Utility Programs	High	Moderate	High	High

Table IV.4- Aquatic Habitat Problems and Potential Utility Solutions *cont.*

Type of Flooding Problem	Potential Solutions	Under what circumstances could this solution be used?	Which Utility programs are involved?	Specific recommended Utility program elements	How is solution implemented?	How Effective is the solution?	How feasible is it?	How much does it cost?	What is the likelihood of success?
Inadequate quality and amount of riparian corridor	Preserve riparian corridors through acquisition, development restrictions and incentives to remove existing encroachments	Citywide	CIP, Development Review and Standards, Public Education and Outreach, Policy Analysis and Regulatory Compliance, and Maintenance and Operations	**Construct CIP projects that improve riparian corridors**	Coordination with Parks and Planning Departments, Kirkland Municipal Code, Utility programs	High	Moderate	Moderate	High
				Coordinate with Parks to purchase high-quality riparian areas or develop conservation easements		High	Moderate	High	High
				Partner with private landowners to restore aquatic habitat		High	Moderate	High	High
				Coordinate with Planning Department regarding stream buffer width and incentives for removing existing encroachments		High	Moderate	High	High

Table IV.4- Aquatic Habitat Problems and Potential Utility Solutions *cont.*

Type of Flooding Problem	Potential Solutions	Under what circumstances could this solution be used?	Which Utility programs are involved?	Specific recommended Utility program elements	How is solution implemented?	How Effective is the solution?	How feasible is it?	How much does it cost?	What is the likelihood of success?
Inadequate physical habitat features in streams	Retrofit culverts to provide/ enhance fish passage	Emphasis on fish-bearing watersheds (such as Juanita and Forbes creeks)	CIP, Maintenance and Operations, and Public Education and Outreach	**CIP Projects that replace culverts that are fish barriers**	Utility Programs	Moderate	Moderate	Low	Moderate
				Condition rating and identification of problems					
	Stabilize eroding streambanks			**Private streambank program**					
	Install instream habitat structures			**CIP projects that restore complexity through installation of instream structures**	CIP Plan	High	High	Moderate	High
	Manage and eliminate invasive species, and enhance native vegetation cover		Maintenance and Operations and Public Education and Outreach	Implement invasive species removal program	Maintenance work program	High	High	Low	High
					CIP	High	Moderate	Moderate	High
					CIP Plan and Utility Programs	Moderate	Moderate	Moderate	Moderate

Table format and concept per the City of Olympia Storm and Surface Water Plan, September, 2003.

IV.B Flood Reduction

Minimum Level of Service

Flood reduction is a top priority for the Surface Water Utility, because of concern for public safety and property protection rather than regulatory requirements. Flood reduction as it relates to public safety concerns and property damage is a local goal rather than a state or federally regulated activity. The City is a member of the National Flood Insurance Program, a federal program to reduce flood damage, but there are only very small areas of 100-year floodplain mapped within the city that would be regulated under this program. At a minimum, the City resolves flooding problems as necessary to protect the public.

Highest Level of Service

As mentioned above, flood reduction is a top priority for the Surface Water Utility. Public safety and property protection are the reasons why we have constructed drainage systems, and maintenance and operation of these systems is one of the most visible and valued functions of the utility. The highest level of service for flood reduction is to prevent problems by addressing existing flooding and taking proactive steps to prevent future flooding during very large storm events. This would largely eliminate public safety and property damage related to smaller storm events (along with associated potential financial liability) and may help to reduce the magnitude of problems caused by larger (greater than 100-year) storm events. Such an approach would be costly, as it would require for example increasing the size of the public drainage pipes to the point that they would contain even the largest and rarest storm events, rather than tolerating some street flooding for such events.

Flooding is also an ecological concern when flows from small storm events consistently cause erosion and loss of complexity in stream channels. Preserving the connection between stream channels and adjacent floodplains can help to route flood flows and reduce habitat damage caused by smaller events. Although damage is always expected from large storm events (in undisturbed systems, 100-year storms cause major damage), controlling damage from smaller events can help to restore and protect streams. Strategies for aquatic habitat protection aspects of flooding, including control of high flows, will be discussed in the Aquatic Habitat section below (Section IV.D).

Surface Water Programs and Recommended Approach

Surface Water Utility Flood Reduction Accomplishments Since 1994

- Eliminated most major flooding problems.
- Mapped surface water infrastructure.
- Implemented a program to inspect and clear flooding "hot spots" during storm events

The City made great strides in the last decade to reduce major flooding problems. As a result, the Surface Water Utility's existing approach is to provide the basic services needed to meet existing regulatory requirements and keep the public safe, including (1) routine cleaning of the existing conveyance system, (2) infrastructure repair, and (3) response to drainage complaints and upgrading facilities as necessary. To address potential surface water volume increases from new development and redevelopment, and to prevent failures as infrastructure ages, it is recommended that the City adopt a more proactive approach to flood reduction. Table IV.2 presents an overview of the types of flooding problems in Kirkland, potential solutions, utility programs involved, and an analysis of the feasibility of the various solutions. This analysis forms the basis for the recommended approach.

The following are new recommended program elements to augment the Surface Water Utility's existing efforts to reduce flooding. All of the elements listed below have the dual benefit of leading toward the protection of aquatic habitat resources. They are discussed in more detail in the program sections (Sections V.A. through V.G.) in Chapter V.

Maintenance and Operations

- Develop a condition rating system and continue periodic video inspection to prioritize maintenance, rehabilitation, and CIP projects.
- Increase between-storm inspections and maintenance to reduce debris-related flooding.

Capital Improvement

- Construct a regional detention facility to provide flow control for anticipated future development and past unregulated (from a surface water standpoint) development.

- Conduct hydraulic modeling during pipe replacement projects to determine appropriate sizing to accommodate existing and future storm flows.
- Rehabilitate infrastructure in conjunction with transportation improvement projects, such as the street overlay program.

Development Review and Standards

- Partner with other City departments and private landowners to coordinate construction of facilities designed to alleviate existing and future flooding.

Public Education and Outreach

- Provide education and outreach to residents and businesses to enlist their help in clearing leaves from catch basin grates during the fall to alleviate debris-related flooding.

Monitoring and Research

- Research opportunities for incentives, pilot projects, and regulations that will encourage use of low-impact development (LID) techniques to reduce the amount of existing impervious surfaces (through redevelopment) and prevent creation of new impervious surfaces.
- Evaluate existing drainage problems in the vicinity of Totem Lake Boulevard.

IV.C Water Quality Improvement

Minimum Level of Service

The City is required to address water quality problems by the federal Clean Water Act, the federal Endangered Species Act, and the state Water Quality Protection Act (see Chapter II, Section C for details). Regulations under these laws delegate responsibility for water quality protection and improvement to the City through various mechanisms, including permit programs and the threat of citizen lawsuits. In most cases, regulations require municipalities to take steps to address water quality problems through direct and indirect City actions such as the following:

- Construction, maintenance, and operation of and in City facilities, including streets, buildings, and parks and open spaces.
- Coordination with other jurisdictions within a watershed on water quality issues.
- City response to spills, dumping, and chronic low-level pollution (including maintenance of private drainage facilities).
- Education and outreach programs on pollution prevention.
- Design standards for surface water facilities at new and redeveloping sites, including erosion control.
- Land use regulations (zoning).

Analysis of specific City compliance with water quality regulations is contained in the Policy Analysis and Regulatory Compliance section in Chapter V (Section V.F).

Regulations are effort-oriented rather than prescriptive or performance-oriented. In other words, if we are trying as a community to improve conditions in our watersheds, and we have specific programs and codes in place, we are in compliance with the regulations. This is because water quality improvement needs vary greatly between jurisdictions, and water quality outcomes are often hard to measure in the short term (for example, it takes many years of discontinued pesticide use to clear pesticides from aquatic habitats). Monitoring of progress will be required, but it remains to be seen what this will entail.

Highest Level of Service

High-quality water in streams and lakes is important to quality of life for both people and aquatic organisms. Although we do not draw drinking water from our local waterways, these resources provide a variety of other benefits, including swimming, fishing, boating, and passive recreation. Kirkland places a high value on these activities, and many people expressed interest in preserving and improving water quality during the public outreach survey (Appendix A).

Cool, clean water is essential for the survival of salmon and other aquatic species. Preservation of fish populations, a community value, requires that we take steps to protect and improve the quality of water in our streams and lakes.

The highest level of service for water quality would include taking all possible steps to restore water quality to historic levels. Within the Surface Water Utility, this would include retrofitting of existing impervious surfaces for water quality treatment, removing or disconnecting drainage from impervious surfaces, increasing surveillance and code enforcement, and cultivation of a highly aware and involved citizenry. Full water quality restoration would likely also include actions that are currently beyond the scope of the Surface Water Utility, such as increased stream buffer widths, reduced allowances for lot coverage, and reduction of parking requirements for development projects.

Surface Water Programs and Recommended Approach

The protection and improvement of water quality is a community value. The recommended approach for improving water quality reflects the need to preserve waters for both human and fish use. Also, to reduce legal and financial liability, it is recommended that water quality improvement exceeds the requirements of state and federal regulations.

Many of the City's current programs address existing surface water quality regulations. Areas that will need augmentation to meet future regulations include prioritization and treatment of water quality hot spots, continued review and update of City maintenance practices and frequencies, and incorporation of low-impact development techniques. In addition, the City will need to document and monitor the success of existing efforts, as discussed in Chapter V.

Specific Water Quality Improvement Accomplishments Since 1994

- Adopted an ordinance to prohibit illicit discharges (spills and dumping), require use of pollution prevention practices, require maintenance of private drainage facilities, and require pre- and post-development control of stormwater runoff.
- Established a water quality monitoring program.
- Implemented a volunteer program to conduct water quality monitoring, planting of native vegetation, and other activities.
- Increased frequency of system cleaning, resulting in removal of an average of 200 cubic yards of sediment per year
- Conducted regional water quality related outreach programs in Kirkland, including "Natural Yard Care" and "Horses for Clean Water."
- Distributed educational brochures regarding pollution prevention, car washing practices, and leaf blower use.
- Conducted storm drain stenciling with community groups.

Table IV.3 lists water quality problems in Kirkland, Surface Water Utility programs involved, and potential solutions. Some tools for addressing water quality, such as land use, are beyond the scope of the utility (i.e., the Surface Water Utility can regulate treatment of water quality from new impervious surfaces but cannot regulate creation of new impervious surfaces). In this case, utility staff will coordinate with other departments to effect positive changes for water quality.

The recommended approach for improving water quality in the city includes the following new program elements to augment existing water quality efforts already implemented by the surface water utility. The water quality program elements listed below also benefit aquatic species and their associated habitat. These elements will not be repeated in the aquatic habitat section (Section IV.D.3). These elements are discussed in more detail in the program sections (Sections V.A. through V.G.) in Chapter V.

Maintenance and Operations

- Increase between-storm inspection and maintenance frequencies to reduce accumulation of debris and pollutants in stormwater infrastructure.

Capital Improvement

- Rehabilitate stormwater infrastructure in conjunction with transportation improvement projects to provide water quality treatment.
- Construct capital improvement program projects identified to reduce erosion and provide other water quality benefits.
- Continue the private streambank stabilization program, established in 2004.

Public Education and Outreach

- Develop a "green" landscaper certification program.
- Conduct outreach to multi-family housing residents to adopt natural landscaping techniques and develop a streamside demonstration garden to be used as a resource by other multi-family complexes.

Code Enforcement and Technical Assistance

- Conduct routine water quality audits of Kirkland businesses.
- Adopt the 2005 King County Stormwater Pollution Control Manual.

Policy Analysis and Regulatory Compliance

- Implement a plan to address the West Nile Virus.
- Conduct a low-impact development study.
- Conduct a water quality audit of City property and practices.
- Identify requirements for compliance with the pending NPDES Phase II permit.

Monitoring and Research

- Develop an improved soils map of Kirkland to assist developers and the City in designing better water quality facilities.
- Conduct a study of street washing techniques.
- Evaluate and rank water quality pollutants to better focus treatment efforts.

IV.D Aquatic Habitat Protection and Restoration

Minimum Level of Service

State and federal regulations and tribal treaties require the City to preserve and protect existing fish habitat, as detailed in Chapter II, Table II.1. Kirkland's fish populations may not be significant on a regional scale, but allowing these populations to disappear by allowing existing habitat to decline is not a viable option under existing regulations. We are asked to find ways to protect and restore fish habitat in an urban setting—not an easy task, but one that will result in an improved environment for people as we change development to accommodate fish habitat.

The presence of healthy fish habitat is an integrated measure of watershed health. Fish require clean water, complex stream channels that contain a variety of hydraulic conditions, and good riparian vegetation. Regulations to protect these attributes are far-reaching but inexact; decline is tied to a suite of factors, and it is difficult to regulate overall watershed health without disallowing watershed use and development. Regulations balance the need for people to live and work in fish-bearing watersheds with the requirement to protect physical habitat features.

Failure to protect fish habitat in Kirkland to the standards set by state and federal agencies would have financial and economic ramifications for the City and, more importantly, would contribute to the loss of salmon, a culturally and economically important species for the Pacific Northwest.

Highest Level of Service

Aside from regulatory requirements, habitat restoration is a community value. Kirkland citizens have expressed a desire to maintain fish populations in our community. Unfortunately, most of our watersheds are severely degraded. If no action is taken, habitat decline will continue, leading to the eventual loss of salmon populations.

When setting restoration goals, it is relevant to consider the level of effort required to achieve the goal. Full restoration of historic populations, the highest level of service, in a given watershed, for example, could require drastic reduction in the density of land use, removal of stream crossings, reconstruction of in-stream habitat, and changes in management practices by residents. With the current requirements of the Growth Management Act to accommodate growth, this level of effort is not realistic.

Surface Water Programs and Recommended Approach

Streams that currently support fish populations do so despite extensive human modification of the watershed, which has significantly degraded the quality of available habitat. It may be more realistic to restore watershed conditions to the point that they can sustainably support existing fish populations. This is still a high level of effort—there is a tipping point with habitat that Kirkland's watersheds have passed. Bringing conditions back to support even the small existing fish populations will take significant time and effort. Fortunately, efforts to restore aquatic habitat often provide side benefits for people, such as improved water quality at swimming beaches and open space for passive recreation.

Specific factors that influence aquatic habitat in the city have included changes in watershed hydrology, degradation of water quality, and removal of physical habitat features. Tools for addressing these problems are listed in Table IV.4. Water quality degradation was addressed in the previous section, and proposed solutions will not be repeated here.

Restoration of aquatic habitat requires a fundamental shift in the way that we view our streams. In the recent past, streams were valued for providing efficient removal of stormwater (i.e., for their role in flood reduction). The ideal stream was a trapezoidal channel devoid of debris that received runoff from a highly efficient pipe drainage system. To support aquatic life, we need to reintroduce complexity into our streams. Large woody debris, soft sloping banks (as opposed to banks armored with rockeries), and highly vegetated riparian areas are required to support fish populations. The challenge in designing aquatic habitat restoration projects is to restore watershed hydrology and provide that complexity while preserving the flood reduction capabilities of stream channels. Restoration of watershed hydrology also is needed to reduce the need for large flood capacity.

Aquatic habitat restoration would be most cost-effective if we focus our efforts on high-quality basins that already have salmonid populations. Many of Kirkland's watersheds are steep, short, low-flow channels that likely did not support historic fish populations (see Table III.2). Thus, it is recommended that we focus restoration efforts on primary basins that currently support fish populations: Juanita Creek, Forbes Creek, and Yarrow Creek.

Surface Water Utility Aquatic Habitat Restoration Accomplishments Since 1994

- Implemented "Salmon Watcher" program to monitor salmon populations in Kirkland streams.
- Participated in WRIA 8 activities related to salmon recovery plans.
- Conducted habitat assessment of Juanita and Forbes Creeks to fofocus habitat restoration efforts
- Constructed three projects on Juanita Creek that included fish passage and fish habitat improvements

Protection of habitat is easier and less expensive than habitat restoration. It is recommended that the City seek opportunities to preserve existing habitat. Acquisition of much of the Forbes Creek Valley is a stunning example of this idea; the wetlands and stream channel now support populations of both salmonids and other wildlife, including beavers. Restoration of an area of this size would be incalculably expensive, and its success would not be guaranteed.

Restoration of watershed hydrology is a key component of habitat restoration. The frequency and duration of peak stream flows determines channel shape and whether habitat structures persist in that channel (i.e., whether log jams are washed away by high flows). Although it may not be possible in the short term to completely restore watershed hydrology, the City can achieve gains through a combination of modification of watershed hydrology and installation of in-stream structures that are designed to withstand and work with existing high flow regimes.

Habitat restoration elements can often be easily added to CIP projects that are done for other purposes, such as transportation or water/wastewater. The Surface Water Utility could coordinate with the City CIP program to efficiently achieve gains in habitat quality. This is especially true for transportation, where the City Council has already supported use of Surface Water Utility funds to pay for some of the surface water portion of those projects (see CIP program description in Chapter V.B for further details).

In addition to all of the program elements listed under the flood reduction and water quality goals in Sections IV.B.3 and IV.C.3, the following aquatic habitat program elements are also recommended to protect and restore habitat for aquatic species in Kirkland.

Capital Improvement Program

- Construct capital improvement program projects that have directly identified aquatic habitat benefits, increasing in-channel complexity, restoring riparian vegetation, and reducing erosion and sedimentation.

Policy Analysis and Regulatory Compliance

- Coordinate with the City Natural Resources Management Team and Parks Department to protect high-quality habitat and establish conservation easements.
- Identify opportunities for habitat enhancement or restoration associated with City capital improvement projects in other City departments.
- Implement the WRIA 8 Chinook Salmon Conservation Plan.

Monitoring and Research

- Expand normative flow concepts to Forbes Creek