



SURFACE WATER MASTER PLAN



ADOPTED JULY 11, 2005



**City of Shoreline
Surface Water Master Plan**

Adopted July 11, 2005

City of Shoreline
Shoreline, Washington

Prepared by:



R. W. Beck, Inc.
Seattle, Washington

Acknowledgments

This Surface Water Master Plan was prepared by R. W. Beck, Inc., in coordination with the City of Shoreline. The Surface Water Master Plan supports and implements the City of Shoreline Comprehensive Plan, which was developed concurrently by Berryman & Henigar in coordination with the City of Shoreline.

The Surface Water Master Plan required the expertise of various City staff and consultants. The Plan was prepared and reviewed by the following lead staff:

Project Managers:	Jesus Sanchez, Operations Manager Jerry Shuster, P.E., SWES Coordinator Donna Pacanovsky, P.E., R. W. Beck
Flooding Analysis:	Jesus Sanchez, Operations Manager Jessica Guerrette, P.E., R. W. Beck
Water Quality Analysis:	Andy Loch, Surface Water Quality Specialist Rika Cecil, Environmental Programs Coordinator Donna Pacanovsky, P.E., R. W. Beck
Habitat Analysis:	Rika Cecil, Environmental Programs Coordinator Andy Loch, Surface Water Quality Specialist Donna Pacanovsky, P.E., R. W. Beck Cathie Conolly, Adolfsen Associates
Regulatory Issues:	Jessica Guerrette, P.E., R. W. Beck
Financial Analysis:	Debbie Tarry, Finance Director Patti Rader, Senior Budget Analyst Jesus Sanchez, Operations Manager Jerry Shuster, P.E., SWES Coordinator Art Griffith, P.E., R. W. Beck
Technical Editor:	Todd Crandell, R. W. Beck
Shoreline Planning Commission Surface Water and Environment Workgroup:	Commissioner Carol Doering Commissioner Sidney Kuboi Commissioner David Harris
QA/QC:	Steve Swenson, P.E., R. W. Beck
Additional City Review:	Steve Burkett, City Manager Bob Olander, Deputy City Manager Tim Stewart, PDS Director Paul Haines, Public Works Director Jill Marilley, P.E., City Engineer Andrea Spencer, Senior Planner, PDS
Washington Department of Fish and Wildlife:	Douglas G. Hennick, Area Habitat Biologist

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Executive Summary

While the City of Shoreline is a relatively new city, it has been a community for more than 50 years. The City's surface water system has been installed incrementally over this time, with the majority of its development in the 1960s. It now consists of an established network of storm drains, pipes, and open water courses. These facilities are showing their age and many need repair and improvement. In addition, the City must ensure that new development is implemented in a way that meets regulatory requirements, enhances the City's system, and does not exacerbate existing problems.

This Surface Water Master Plan looks at the City of Shoreline's surface water management program to identify problems, prioritize needs, and develop long-term solutions that are in line with community priorities.

To identify problems, the project team used information from several sources:

- Public comment from two open houses held on September 24 and 25, 2003
- Guidance from the Shoreline Planning Commission's Stormwater and Environment Workgroup
- Goals and policies from 2005 Shoreline Comprehensive Plan
- Review of existing reports and other information provided by the City.

The City assigned priority levels to the problems, and the project team evaluated potential projects and programmatic activities to address these problems. These needs are described in terms of the three main areas of service within the City's surface water program: (1) providing flood protection from stormwater impacts, (2) protecting water quality, and (3) preserving stream habitat for aquatic species.

Chapter 9 of this Surface Water Master Plan includes a financial analysis of the potential projects and programs that the City of Shoreline's surface water management program could provide to its ratepayers, and describes their impacts on rates. The recommended plan in Chapter 9 reflects the needs and priorities of the City and community and balances those against the desire to charge reasonable rates.

Part I: Background and Current Program

Part I of this Surface Water Master Plan describes the City of Shoreline's current surface water management program, its history, and the regulations and policies that have shaped it.

- Chapter 1 Introduction
- Chapter 2 Study Area Characteristics
- Chapter 3 Regulatory Environment
- Chapter 4 Current Program

Chapter 1. Introduction

1.1 Purpose

This Surface Water Master Plan (Plan) was written to guide the City of Shoreline's surface water management program and to identify surface water problems, prioritize needs, and develop long-term solutions that meet regulatory requirements, reflect the community's priorities, and can be funded by the City. Although Shoreline is a relatively new city, it has been an established community for many years. The City's surface water facilities are aging and in need of repair and improvement. In addition, new development must be implemented in a way that meets regulatory requirements, enhances the City's system, and does not exacerbate existing problems.

1.2 History of the City of Shoreline's Drainage Program

Although it became a city in 1995, Shoreline's development history begins with original settlements dating back to the late 1800s. Most of the development in the City took place in the 1940s and 1950s, prior to the implementation of stormwater mitigation regulations in the 1970s. Prior to 1995, the City's drainage facilities were owned and maintained by King County. Drainage facilities in the City consist of a combination of stormwater conveyance pipes, ditches, and stream channels.

Since incorporating in 1995, Shoreline has focused on making the most critical fixes to these systems—many of them through small construction projects that could bring immediate relief to problems residents had been enduring for many years. The City also began performing routine maintenance of storm drainage systems that had not been experienced prior to incorporation. Programs to improve water quality have also been implemented

In its short history, the City of Shoreline has:

- Established a surface water management utility
- Added staff to its Public Works Department to operate, maintain, and administer its surface water management system
- Taken over responsibility for drainage system maintenance from King County
- Developed procedures to contract maintenance services to King County and private entities
- Compiled an inventory of its drainage facilities (in progress)
- Implemented a program to inspect City and privately owned retention/detention facilities
- Planned, designed, and begun construction on two major flood control projects (3rd Ave. NW and Ronald Bog)
- Obtained over \$5 million in low-interest loans for small flood control projects.

- Implemented a program to improve and characterize the water quality of Shoreline's lakes and streams. These activities have included:
 - Implementing a program with King County and privately contracted crews to provide street sweeping on arterials and residential streets
 - Applying to be covered by the Washington State Department of Ecology's general permit for National Pollutant Discharge Elimination Program (NPDES) Phase II municipal stormwater systems
 - Adopting pollution source containment measures
 - Adopting erosion control standards
 - Implementing an environmental education program
 - Working with the community to provide education on herbicide application practices
- Participated in regional committees to address regional environmental issues
- Initiated this Surface Water Master Plan.

This Plan represents the City's desire to comprehensively identify and prioritize its most important drainage needs so that it can continue to improve its system.

1.3 Goals and Policies

The basis for the City's surface water management activities had been established in the 1998 City of Shoreline Comprehensive Plan. The 1998 plan contained policies to accomplish goals that include accommodating growth, promoting compatible development, protecting the natural environment, and making effective and efficient use of public funds. The goals and policies that have driven the current surface water management program are summarized in Chapter 4.

This Surface Water Master Plan was developed in concert with the 2005 City of Shoreline Comprehensive Plan, which was adopted June 13, 2005. Updates to the 1998 surface water-related goals and policies are summarized in Chapters 5, 6, and 7.

1.4 Program Areas

The many activities that make up a surface water management program can be expressed in terms of three basic areas of service. The City's program is intended to (1) provide flood protection from stormwater impacts, (2) protect water quality, and (3) preserve stream habitat.

Flood protection involves preventing flood damage to property and disruption of mobility and critical services. This is accomplished primarily through the planning, design, implementation, and maintenance of channels, pipes, roadside ditches, culverts, detention ponds, and natural and manmade open water courses.

The water quality program area involves preventing pollution through public education and involvement, enforcement, maintenance, and capital projects. This includes monitoring pollutant levels in water bodies throughout the City, addressing sources of pollution, constructing treatment facilities, and maintaining the City's stormwater drainage systems

through street sweeping, catch basin cleaning, and other activities as well as inspections and code enforcement of commercial facilities.

The stream habitat program area involves identifying and preserving existing habitat, identifying high-quality stream habitat in the City, enforcing development standards that prevent development in critical areas such as stream and wetland buffers, providing public education, and coordinating public efforts to protect or enhance habitat.

1.5 Community Input

On September 24 and 25, 2003, two open houses were held in the City of Shoreline to gather public input on the issues to be addressed in the City's update of the Comprehensive Plan and preparation of Surface Water, Parks, and Transportation Master Plans. Public comments relevant to this Surface Water Master Plan are summarized in Appendix A.

In addition, the Shoreline Planning Commission established a Stormwater and Environment Workgroup to guide City staff and the project team during the development of this Plan. The objective of the workgroup was to help ensure that the draft plan was designed with the needs and expectations of the community in mind.

1.6 Priority Levels

The City has assigned priority levels to projects identified in this Plan. These priority levels, which will be used to make decisions on the timing of projects and the expenditure of limited resources, are defined as follows:

- **Priority Level 1:** Projects with Priority Level 1 are deemed critical because they will improve public safety and reduce property damage. The City plans to implement these projects within the next 6 years.
- **Priority Level 2:** Priority Level 2 projects would improve the effectiveness of the City's surface water system. The City plans to implement these projects between years 7 and 20 of the 20-year planning period.
- **Priority Level 3:** These are the lowest priority projects. Projects with Priority Level 3 would provide additional benefits to surface water conditions. These projects will probably not get funded solely with City surface water funds. Based on the recommended plan described in Chapter 9, the City will not be able to implement these projects in the next 20 years. Implementing these projects will likely require additional sources of funding such as grants, developer mitigation fees, or local improvement districts.

More details on priority levels with respect to the three main program areas—flood protection, water quality, and stream habitat—are provided in Chapters 5, 6, and 7, respectively.

Chapter 2. Study Area Characteristics

2.1 Introduction

The study area for the Surface Water Master Plan consists of the incorporated area of the City of Shoreline, Washington. Shoreline is bounded by Puget Sound on the west and by the cities of Edmonds, Woodway, Mountlake Terrace, Lake Forest Park, and Seattle. The study area is 11.74 square miles and contains 3.4 miles of Puget Sound shoreline. Most of the area west of Aurora Avenue drains to Puget Sound via Boeing Creek and smaller creeks, while most of the area east of Aurora drains to Lake Washington through Thornton, McAleer, or Lyon creeks (see Figure 2-1).

2.2 Climate

Shoreline's climate is typical of the mild, mid-latitude coastal climate of the Pacific Northwest, moderated by marine air from the Pacific Ocean. In the summer, temperatures range from the 70s to the 90s during the day and drops to the 60s at night. In the winter, temperatures average in the 40s during the day and 30s at night, with occasional cold spells and temperatures in the low 20s.

Precipitation in the study area is influenced by the moist marine air, which is lifted and cooled by the mountains as it moves inland, causing persistent cloudiness and precipitation and resulting in an average of about 40 inches of precipitation annually. Snowstorms occur rarely, often followed by warming temperatures and rain. The frozen ground is unable to absorb the snowmelt and rainfall, which can cause severe flooding, as during the 1996 holiday storm. Most of the rain falls during the wet season, approximately October to May, usually with low intensity but long duration. While prevailing winds are from the southwest, severe storms occasionally blow in from the north.

2.3 Geology and Soils

Surficial geology develops from geologic activity (glacial advance and retreat for example), while the soil layer is formed as the weather acts upon particular geologic layers. Since the soil layer can be very thin in areas of erosion, the geologic layer is often found at the ground surface and can be mistaken for the soil layer. Thus, the geologic layer, which typically does not infiltrate water as well as soil does, can dominate the infiltration and seepage characteristics of an area.

2.3.1 Geology

Shoreline's surficial geology developed from sedimentation, folding, volcanic activity, and glacial advances and retreats. Glacial activity from 2.5 million to 11,000 years ago caused glacial scour, till and outwash. Till, often referred to as hardpan, is an impermeable layer formed by the glacial compression that contains clay and fine sediment. Till is typically very

dense as a result of having been deposited under the weight of several thousand feet of glacial ice. Outwash consists of rocks and soil deposited by advancing and retreating glaciers.

Till is the predominant geologic unit found in Shoreline. Areas of Esperance sands are found south and east of Ronald Bog and along 175th Street. Esperance sand is highly permeable and easily erodible. Areas of the McAleer and Lyon Creek Basins in eastern Shoreline have significant areas of Esperance sands, transitional beds, and outwash deposits. McAleer Creek has eroded its valley into the recessional deposits and locally into the underlying silt and clay. Boeing Creek and other creeks that drain to Puget Sound in the western part of the City also have large areas of Esperance sands and transitional beds in their valleys. Along the Puget Sound shoreline and at the mouths of the creeks are areas of transitional beds, Whidbey formation, landslide deposits, procession drift, and beach deposits. Recessional outwash deposits are found in the northwest corner of the City.

Till is resistant to infiltration, but sand and gravel layers can be used as locations for infiltration ponds. Caution should be used when locating infiltration ponds to avoid surcharging the groundwater table in areas prone to landslides.

2.3.2 Soils

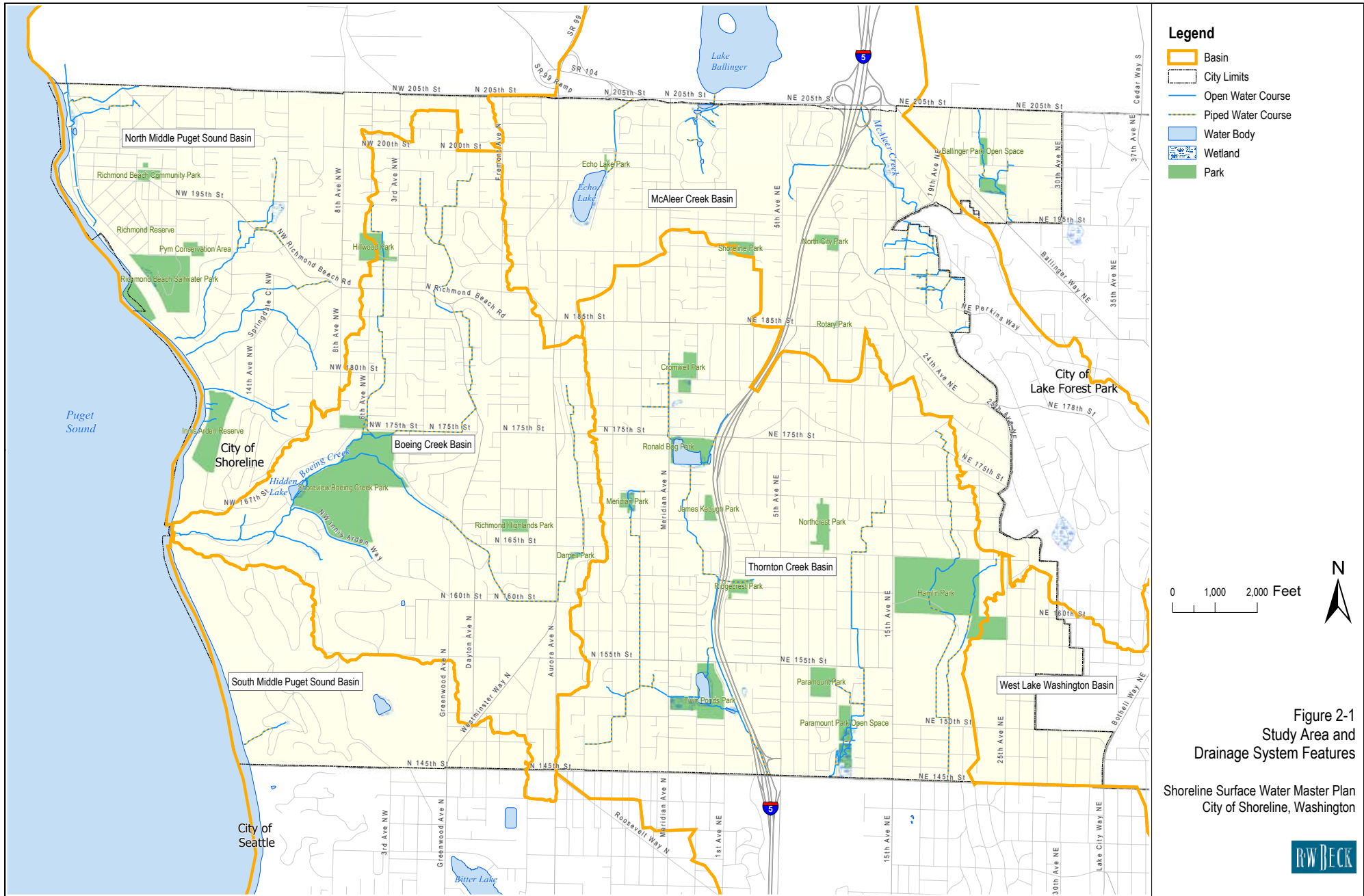
The predominant soil type in most Shoreline basins is Alderwood gravelly sandy loam. Alderwood soils can drain slowly during heavy rains and cause rainfall to pond or run off in sheet flow. Everett gravelly sandy loam and Everett gravelly loamy sand are found in greater proportions in the Middle Puget Sound Basins (North and South) and in the Lyon Creek basin in the eastern edge of the City. Everett soils infiltrate stormwater much better than Alderwood soils, and thus produce less ponding and runoff during heavy rains. Other soil types found in much smaller proportions in the City are: Norma fine sandy loam, Kitsap silt loam, Indianola fine sandy loam, Coastal beach, Carbondale muck, Rifle peat, Mukilteo peat, and Greenwood peat. The muck and peat soils are hydric soils which frequently support wetlands. Peat soils are predominantly located in Twin Ponds and Ronald Bog parks (Tetra Tech/KCM 2004a, 2004b, 2004c, 2004d).

2.4 Drainage System

Figure 2-1 depicts the study area, showing the boundaries of the major drainage basins in the City of Shoreline. The figure also shows the drainage system's major features. The stream systems in Shoreline consist of open water courses (including drainage ditches) and piped water courses.

The City of Shoreline study area contains nine separate drainage basins:

- Boeing Creek Basin
- McAleer Creek Basin
- Thornton Creek Basin
- Lyon Creek Basin
- West Lake Washington Basin
- Middle Puget Sound Basins (north and south)
- Seattle Golf Course Basin (not shown on Figure 2-1)
- Bitter Lake Basin (not shown on Figure 2-1).



- Legend**
- Basin
 - City Limits
 - Open Water Course
 - Piped Water Course
 - Water Body
 - Wetland
 - Park

0 1,000 2,000 Feet



Figure 2-1
Study Area and
Drainage System Features

Shoreline Surface Water Master Plan
City of Shoreline, Washington



The western portions of the City drain to Puget Sound either directly or through Boeing Creek and smaller drainage systems. A small drainage basin, the Seattle Golf Course Basin, has no surface water outlet, but infiltrates to the groundwater below. The rest of the City drains to Lake Washington, primarily through McAleer Creek, Thornton Creek, and Lyon Creek. The features and land use of each drainage basin are discussed in more detail below.

2.4.1 Boeing Creek Basin

The Boeing Creek Basin drains approximately 1,600 acres in the western portion of the City (Figure 2-1). The basin is approximately 90 percent developed, lies primarily west of Aurora Avenue North, and drains to Puget Sound. Land use in the basin is mostly single-family residential; other uses are roads, open space, schools, and commercial/industrial development. A small portion is used for multifamily or high-density housing. Shoreline Community College, Shoreview Park, and Boeing Creek Park each take up large areas within the basin. Commercial areas are mostly along Aurora Avenue North.

Upstream of the intersection of Carlyle Hall Road Northwest and Greenwood Avenue North, the creek's south tributary is contained primarily in pipes that drain a large area including the City's most densely developed commercial areas along Aurora Avenue North. The south tributary then flows in an open water course to the M1 Dam, which forms a detention pond (maximum storage of 14 acre-feet) at the edge of Shoreview Park. Below the M1 Dam the stream flows in a heavily riprapped, steep forested ravine, with numerous cascades (4 to 12 percent gradient) and abundant amounts of large wood that help control the grade of the channel (King County 1994). Inside Shoreview Park, the south tributary meets up with the north tributary to become the Boeing Creek main stem.

The north tributary, including both an eastern and western stem, is almost entirely piped. Stormwater flows in the north tributary are directed through several regional detention ponds. The Crista and Pan Terra ponds are on the eastern stem and service the northeast portion of the area. The western stem follows 6th Avenue NW and drains the northwest portion of the basin. Both stems of the North Tributary drain into the Shoreview (North) Regional Retention/Detention Pond south of the intersection of 6th Avenue NW and NW 175th Street. A high-flow bypass located on 6th Avenue NW near NW 175th Court diverts high flows from the western stem into North Pond, while base flows enter the tributary downstream of North Pond.

From the confluence of the two tributaries, the Boeing Creek main stem descends through forested ravines to Hidden Lake, a small, constructed lake that the City regulates as a storm detention facility. Hidden Lake and its associated wetlands occupy approximately 2.1 acres. Downstream from Hidden Lake, the stream passes through a culvert under NW Innis Arden Way. This section has a steep gradient, and several weirs have been constructed to reduce erosion. The stream flows downhill to a steel-pile dam that acts as a barrier to upstream fish passage. Just upstream of the steel-pile dam, a small tributary enters the main stem. This unnamed tributary begins in a ravine west of the Shorewood Hills community and collects a portion of its stormwater.

From the steel-pile dam, the stream descends 2,300 feet through forest to the mouth. The stream channel below the dam is characterized by steep incised channels with moderate-to-severe erosion of the channel beds and banks. Many sections below the dam have experienced slope failure, and the substrate is generally embedded having been filled in with sediment, providing poor spawning habitat for salmonids (King County 1994). Boeing

Creek enters Puget Sound through a large box culvert under the Burlington Northern Santa Fe (BNSF) railroad track. The lower portion of the stream is tidally influenced at high tides.

Natural watercourses and wetlands are largely absent from the upper basin because of extensive human alteration. The loss of these natural habitat features means the loss of natural runoff storage, infiltration, and flow reduction. The lower portions of the basin still contain streams and wetlands, and the drainage system resembles a more natural pattern. Urbanization of the drainage basin without mitigation to address runoff impacts has led to higher peak flows with resulting increases in erosion and sedimentation. Urbanization has also eliminated or severely impacted fish and wildlife habitat as streams were channelized or diverted into pipes and riparian habitat was removed. These changes have resulted in a loss of total stream length and degradation of the stream sections that remain. Residential development along stream banks has further degraded the natural environment around open channel sections.

2.4.2 Middle Puget Sound Basins

The Middle Puget Sound Basins (north and south) empty into Puget Sound through dozens of small creeks and storm drainage systems (Figure 2-1). The portions of the Puget Sound drainages that lie within the City of Shoreline encompass approximately 1,250 acres north of Boeing Creek and about 30 acres south of Boeing Creek. The two basins are separated by the Boeing Creek Basin. According to a 1997 estimate by Tetra Tech/KCM (KCM 1997), the Middle Puget Sound North Basin is almost 90 percent developed, while the Middle Puget Sound South Basin is approximately 67 percent developed. Current land use is mostly single-family residential, followed by roads. Small areas are developed as multifamily, schools, commercial, and parks and open space (KCM 1997). Commercial areas are primarily along the Richmond Beach Road corridor.

The drainage system of the Middle Puget Sound Basins (North and South) is composed of six major drainage courses that are not hydraulically connected. The only major drainage course in Middle Puget Sound South is Highlands Creek. The drainages in Middle Puget Sound North are: Innis Arden North Creek, Innis Arden South Creek, Storm Creek, Upper Puget Sound North, and Upper Puget Sound South.

Drainage in the Middle Puget Sound Basins begins as urban runoff or as seepage from hillsides (King County 1987). The headwaters of Upper Puget Sound and Storm Creek are located to the north in Snohomish County. All other streams originate from wetlands, hillside seeps, and urban runoff. Each stream drainage is discussed in more detail below.

- **Highlands Creek.** Highlands Creek is entirely within the Highlands development, a gated community within the city limits. From its headwaters upstream of Olympic Drive, the stream flows west, adjacent and through private property, mostly in a pipe. The approximate length of the water course is 1,200 feet, of which 350 feet is an open water course and the rest is piped. Flow seems to originate primarily from groundwater and is relatively constant throughout the year.
- **Innis Arden South Creek.** Innis Arden South begins as three or more branches that extend into ravines with relatively steep side slopes. These branches come together on private property near NW 175th Street. Flows in the upper portion of the creek are intermittent and are strongly affected by stormwater inflow. The stream gradients in this creek range from 4 to 8 percent in the upland areas, with slightly steeper gradients in the bluff region near Puget Sound (King County 1987). Below the confluence of these branches, the creek flows another 1,700 feet before entering

Puget Sound. The lower portion of the creek flows through a private tract called the Coyote Reserve and through Innis Arden Reserve.

- **Innis Arden North Creek.** Innis Arden North Creek begins as a north stem and a south stem. The north stem begins near the intersection of NW Richmond Beach Road and 8th Avenue NW. The north stem flows generally southwest until it joins with the south stem downstream of Springdale Court NW. The south stem begins near the intersection of 10th Avenue NW and NW 180th Street and flows approximately 2,600 feet in a northwest direction until it joins with the north stem. Below the confluence of the stems, the creek flows generally southwest until it reaches Puget Sound. Much of this stream flows through the private Blue Heron Reserve. Innis Arden North Creek drains a larger area than Innis Arden South Creek and experiences larger flows.
- **Storm Creek.** Storm Creek begins upstream of NW 195th Street and flows generally southwest to Puget Sound. Several small unmapped tributaries enter the creek between NW 195th Street and NW Richmond Beach Road. One of the piped tributaries begins as seepage in a wetland area on undeveloped property just west of 12th Avenue NW. The other tributary inlets are likely additional drainages from the wetland area (Tetra Tech/KCM 2004b). To accommodate development, the stream was split in the vicinity of the Meadowbrook Apartment complex and joined again near NW 191st Street. There are continual maintenance issues with the conveyance system in this area as a result of this alteration; flooding is commonplace during heavy rains.

Below NW 191st Street, the creek continues southwest for 3,000 feet through the privately owned Eagle Reserve in Innis Arden before entering Puget Sound. The stream is confined within a very steep ravine between the mouth and 17th Place NW. Severe erosion occurs in the lower sections of Storm Creek through the Eagle Reserve. Bank hardening and several weirs have been constructed to protect private property, a pump station, and a sewer line crossing Storm Creek.

- **Upper Puget Sound.** The Upper Puget Sound drainage is a drainage course locally known as Barnacle Creek. It has a north stem and a south stem that join together before flowing into Puget Sound. This stream flows through highly developed residential areas. The north stem begins upstream of NW 204th Street and flows west through developed areas. A 600-foot section of the stream is piped in this area. After the stream daylights downstream of Richmond Beach Drive NW, the stream enters a wetland area east of the Burlington Northern Santa Fe (BNSF) railroad track and flows generally south. At an undefined location, the north stem joins with the south stem and flows through a culvert and into Puget Sound.

An open water course is present along the BNSF Railroad east of the tracks. The basin characterization report states, "It appears that drainage collects along the east side of the railroad before exiting into Puget Sound through culverts underneath the railroad" (Tetra Tech/KCM 2004b). One open water course begins at approximately NW 194th Place and flows from the south to the north along the east side of the BNSF Railroad and joins Barnacle Creek at the culvert immediately upstream of the BNSF Railroad. This stream is strongly affected by stormwater inflow. The lower section of Barnacle Creek is tidally influenced upstream for a distance of about 20 feet.

The basin characterization report (Tetra Tech/KCM 2004b) describes three additional sections of open water courses that flow to Barnacle Creek. One was mapped from

its culvert outlet near NW 194th Street to the NW 196th Street bridge over the BNSF Railroad. A divide at the bridge separates this first reach from a second reach. The second reach begins at the NW 196th Street bridge (south divide) and ends at the subbasin divide at NW 198th Street (north divide). The last open water course section mapped in the basin characterization study begins in Snohomish County and flows south along the BNSF Railroad to a culvert just north of NW 204th Street. Most of the tributary area for this open water course appears to be in Snohomish County.

2.4.3 Thornton Creek Basin

The Thornton Creek Basin drains approximately 2,418 acres in the southeast quarter of the City of Shoreline (Figure 2-1). The basin is almost completely developed, with only about 3 percent of the basin remaining as vacant or open space. Land use in the basin is primarily single-family residences and roads; commercial areas are the next most prevalent land use type. Institutional uses, including Fircrest, schools, and other public facilities, make up a significant portion of the Thornton Creek Basin. There is a relatively small amount of multifamily use or apartments. A dominant feature in the City of Shoreline portion of the Thornton Creek Basin is Interstate 5, which traverses the basin in a north-south direction. The highway and the extensive residential development result in high proportion of the basin area being categorized as roads.

The Thornton Creek drainage system within the City of Shoreline contains primarily piped and channeled stormwater conveyance. Natural water courses are largely absent from the upper basin because the drainage pattern has been altered by humans to the point where most historical features are difficult to discern. Many wetlands have also been filled. With the loss of these natural habitat features, important areas where stormwater runoff could be naturally stored and infiltrated to reduce peak flows were lost. Peat mining in Ronald Bog and Twin Ponds in the post World War II era and construction of Interstate 5 in the 1960s significantly altered the hydrologic cycle and destroyed much of the natural wetland and riparian habitat.

The piped stormwater conveyance systems that dominate the upper basin and accommodate much of the runoff from this area drain into Thornton Creek or one of its tributaries. Over the years, urbanization of the drainage basin without mitigation to address runoff impacts has increased erosion and sedimentation due to increased peak flows. Urbanization has also eliminated or severely impacted fish and wildlife habitat as former streams were placed in pipes, other streams were channelized and riparian habitat was removed. These changes have resulted in a loss of open water courses and degradation of the remaining sections. Housing development along the stream banks has further degraded the natural environment around the remaining sections of open water courses of Thornton Creek.

Three primary drainage courses comprise the City of Shoreline portion of the Thornton Creek Basin, the Thornton Creek main stem, Littles Creek, and Hamlin Creek.

- **Thornton Creek Main Stem:**

- **Ronald Bog.** The north branch of Thornton Creek's main stem begins near the intersection of 180th Street and Corliss Avenue. This drainage flows through piped water courses into Ronald Bog, a 7.7-acre pond that was previously a peat bog. Outflow from the pond is regulated by a 30-inch-diameter pipe extending over 1,000 feet. This pipe is at a reverse grade and contributes to flooding in the area immediately south of Ronald Bog.

- **Twin Ponds.** South of Ronald Bog, the Thornton Creek main stem flows south approximately one mile to Twin Ponds, another former peat bog. In this area the drainage flows through backyards, ditches and culverts, and through pipes under King County Metro’s bus facility. Throughout this area, the gradient is flat and flooding is common. Downstream of Twin Ponds, the water course passes through a small wetland called Peverly Pond and eventually through a concrete-lined channel into a 1,500-foot-long, 72-inch culvert under Interstate 5, where it emerges as an open channel in the City of Seattle’s Jackson Park Golf Course.
- **Meridian Park Drainage.** The Meridian Park drainage system, which comprises Thornton Creek’s west branch, originates north of Meridian Park, flows as an open water course through the Meridian Park wetland, and runs south to North 152nd Street in a pipe. From there, the drainage flows east and daylights just east of Burke Avenue North at Evergreen School, where it becomes Evergreen Creek. Evergreen Creek flows into the southwest corner of Twin Ponds.
- **Little Creek.** Little Creek flows south along the east side of Interstate 5 to Thornton Creek. The tributary originates as a piped system near NE 174th Street and 14th Avenue NE and collects drainage from mostly residential areas. A retention pond with a pumped overflow at the southwest corner of 170th Street NE and 15th Avenue NE drains to Little Creek. A piped water course carries drainage from Paramount Park to the tributary. The tributary then passes through the Paramount Park Open Space, which has a 6.9-acre wetland system and two open water ponds.
- **Hamlin Creek.** This tributary joins the Thornton Creek main stem near 20th Avenue NE just south of NE 130th Street south of the city limits. The upper drainage consists of east and west stems that join on the Fircrest campus. The drainage for the west stem originates near NE Serpentine Place, south of NE 177th Street; the east stem begins southwest of the intersection of 23rd Avenue NE and NE 165th Street. The drainage in both stems is mostly piped. The west stem flows through Hamlin Park as an intermittent stream discharging to the piped system at the south of the park. The east stem begins with a short section of pipe and continues as an open water course to NE 160th Street. Below NE 160th Street, the system is piped to its confluence with Thornton Creek.

2.4.4 McAleer Creek Basin

Within the City of Shoreline, the McAleer Creek Basin includes the area tributary to Echo Lake (which drains into Lake Ballinger), the area that drains directly into Lake Ballinger, and the area tributary to McAleer Creek itself (Figure 2-1). The portion of this basin within the City totals approximately 1,322 acres. Land use in the McAleer Creek Basin is predominantly residential, although there is a moderately large commercial/industrial section along the Aurora Avenue North corridor. There are small areas of schools, parks, open space, a cemetery, and Echo Lake. Roads make up the largest impervious area in the basin.

Five drainage courses make up the McAleer Creek drainage within the City of Shoreline: the McAleer Creek main stem, the McAleer Creek west tributary, Brookside Creek, Whisper Creek (also called Cedar Brook Creek), and Echo Lake.

- **Main Stem.** The headwaters of McAleer Creek begin in the Hall's Creek and Echo Lake watersheds, both of which drain into Lake Ballinger. McAleer Creek begins at Lake Ballinger's outlet and flows through the City of Mountlake Terrace, the City of Shoreline, and the City of Lake Forest Park. The main stem of McAleer Creek enters the City of Shoreline in the area enclosed by the south cloverleaf off-ramp for Interstate 5 at NE 205th Street and exits the City just downstream of NE 196th Street.

The creek passes beneath NE 205th Street through a 4-by-6-foot box culvert. The creek flows approximately 300 feet in an open water course before entering a culvert beneath the south cloverleaf off-ramp for Interstate 5.

Downstream of the south cloverleaf, the stream flows 24 feet before entering a 72-inch diameter culvert beneath Forest Park Drive NE. Downstream of Forest Park Drive NE, the stream gently meanders approximately 1,500 feet to a 4-by-4-foot box culvert beneath 15th Avenue NE. The west tributary flows into the main stem upstream of 15th Avenue NE.

From there, the creek continues its meander until it reaches the McAleer Creek Regional Detention Pond on the north side of NE 196th Street and approximately 500 feet east of 15th Avenue NE. The pond is controlled with a sluice gate at the upstream end of the dam. The pond's maximum surface area is 1 acre and it extends 550 feet upstream of NE 196th Street in a natural ravine on McAleer Creek.

After exiting the pond, McAleer Creek flows through a 12-by-8-foot box culvert under NE 196th Street, where it leaves the City of Shoreline and enters the City of Lake Forest Park. The channel section in this area transitions gradually from a manicured residential channel to a natural ravine. The main stem of McAleer Creek then flows through Lake Forest Park and empties into Lake Washington.

- **West Tributary.** The west tributary drains the Interstate 5 corridor and west basin south of NE 205th Street. The west tributary follows along the west side of winding 6th Avenue NE as an open water course. It remains open, running east along NE 200th Street, until it enters a culvert just west of Interstate 5. The tributary remains piped for approximately 1,500 feet and daylights just before its confluence with the main stem. The west tributary drainage enters the main stem in an open channel upstream of 15th Avenue NE.
- **Brookside Creek.** Brookside Creek drains into McAleer Creek just downstream of NE 178th Street in the City of Lake Forest Park. At the Brookside Elementary School in Lake Forest Park, the tributary divides into west (Hillside Creek) and south (Brookside Creek) forks. The basin characterization report states that is not evident in the field whether either fork extends into the City of Shoreline (Tetra Tech/KCM 2004d).
- **Whisper Creek.** Whisper Creek (also called Cedar Brook Creek) enters McAleer Creek from the west out of a ravine approximately 200 feet downstream from Perkins Way near NE 185th Street. Segments of the creek lie inside Shoreline's city limits. The total length of the segments in the City is approximately 1,300 feet. Predominantly spring-fed from five major sources within the Shoreline city limits, the tributary potentially offers, for its size, the best continuous clean water source, cover, and substrate in the basin, and contributes to good water quality in the lower main stem of McAleer Creek.

- **Echo Lake Drainage.** Echo Lake is in the western portion of the McAleer Creek Basin. Echo Lake has a year-round open water area of approximately 13 acres. The outlet stream from the lake, beginning at the lake's north end, flows north to Lake Ballinger (outside the City), whose outlet stream is McAleer Creek (which flows back into the City to the east of Interstate 5). The outlet of the lake is piped until passing beneath North 200th Street. North of the street crossing, the drainage is highly confined as it flows through an open water course surrounded by a commercial development to the west and residential neighborhood to the east. The primary inlet to the lake is a pipe entering at the south end that drains an area extending west of Aurora Avenue North.

2.4.5 Lyon Creek Basin

The Lyon Creek Basin extends through Snohomish County as well as the cities of Shoreline, Lake Forest Park, Mountlake Terrace, and Brier (Figure 2-1). The size of the basin within Shoreline's city limits is approximately 184 acres. The most common land use is single-family and multifamily residential, but there is a mix of all other land uses in the area. The commercial uses are clustered along NE Ballinger Way north of 19th Avenue NE. Multifamily is also found along NE Ballinger Way, mostly south of 19th Avenue NE. A large school complex is at the intersection of 25th Avenue NE and NE 200th Street. Bruggers Bog and Ballinger Park are located along 25th and 24th Avenues NE, respectively (KCM 1997).

The only drainage course in this basin within Shoreline is a portion of Ballinger Creek and its associated tributaries, all of which are in the northeast corner of the City. Ballinger Creek, a tributary to Lyon Creek, originates north of the City in Snohomish County. It flows south between 21st and 22nd Avenues NE and enters the Ballinger Creek Condominiums, where it flows alternately through buried culverts and open water courses. The creek flows through a City-owned trash rack just upstream of the Ballinger Creek Condominiums. The creek daylights in Bruggers Bog and flows to the southeast. As it enters Bruggers Bog Park it meets with an unnamed stream flowing from the west. Just upstream of its confluence with Ballinger Creek, this unnamed tributary forks into a north and a south branch. Ballinger Creek flows southeast across Bruggers Bog and picks up flow from two unnamed tributaries flowing in from the east. At the southeast corner of Bruggers Bog Park, Ballinger Creek enters a network of pipes at 25th Avenue NE. The creek daylights on the southeast side of 25th Avenue NE and flows in an open water course prior to leaving the City and flowing under NE Ballinger Way into the City of Lake Forest Park. In the City of Lake Forest Park, the creek flows roughly parallel to NE Ballinger Way and enters Lyon Creek outside the Shoreline city limits near the intersection of NE Ballinger Way and 35th Avenue NE.

2.4.6 Smaller Basins

Small portions of other basins also lie within the Shoreline city limits. However, no specific flood protection, water quality, or stream habitat issues have been identified for these areas. These areas share the general characteristics of nearby basins.

- **West Lake Washington Basin.** Two portions of this basin lie within the City of Shoreline boundary in the southeast part of the City, one about 118 acres and the other about 18 acres (Figure 2-1). This area is adjacent to the Thornton Creek Basin and shares the general geologic, land use, and habitat characteristics of that basin. None of this basin's major water courses lie within the City of Shoreline.

- **Seattle Golf Course Basin.** The Seattle Golf Course Basin lies in the southwest portion of the City (not shown on Figure 2-1). Until recently, this basin was a closed depression that did not have a surface water outlet. Runoff in the basin collected in a 2.1-acre wetland and infiltrated into the groundwater table. The outlet now discharges into Highlands Creek. The basin is approximately 138 acres and is situated almost entirely within the City of Shoreline, with a small proportion in Seattle. The geology of this area is mostly till and land use in the basin consists of recreation.
- **Bitter Lake Basin.** Only 54 acres of this basin lie within the City of Shoreline in the southwest of the City (not shown on Figure 2-1). This area shares the general geologic, land use, and habitat characteristics of the Middle Puget Sound South Basin. None of this basin's major water courses lie within the City of Shoreline.

2.5 Environmental Resources

2.5.1 Vegetation and Wildlife Habitat

Residents characterize the City of Shoreline as a wooded community; this is often cited as a key reason for locating to the area. Large evergreen trees can be seen rising above residential neighborhoods, on hilltops, and even on the periphery of Aurora Avenue. As the City has become more urbanized, the area covered by native ground cover and/or shaded by native trees has been vastly reduced.

Forested open space, wetlands, and native vegetation found on steep slopes and larger residential lots are important resources. Trees help stabilize soils on steep slopes and act as barriers to wind and sound. Plants replenish the soil with nutrients and generate oxygen and clean pollutants from the air. Native vegetation provides habitat for wildlife; the native vegetation found near creeks, lakes, and saltwater areas offer habitats for many migrating and resident birds and other wildlife. Less developed wooded areas and City parks also provide habitats for many birds and mammals. Wetlands and riparian vegetation provide surface water storage and help clean surface water of pollutants and sediment.

Aerial photos show that the community is a mosaic of various types of vegetation. The largest, most contiguous areas of native vegetation in Shoreline are primarily found in City parks, publicly owned open space, privately owned designated open space (such as the Boeing Creek area of The Highlands) and designated sensitive areas (such as steep slopes along the Puget Sound shoreline). These areas provide the highest quality wildlife habitat found in the City. However, areas of less intensive residential development also contain mature trees and other native vegetation that provide secondary wildlife habitat and substantially contribute to the quality of life in the City. Native vegetation in residential areas that may be subdivided or otherwise more intensely developed is at the greatest risk of being lost.

The process of urbanization results in the conversion of wildlife habitat to other uses. The loss of certain types of habitat can have significant, adverse effects on the health of certain species. These types of habitat are referred to as critical wildlife habitats. Critical wildlife habitats include lands important for the protection, management, or public enjoyment of certain wildlife species. These include habitats of species which state or federal agencies have designated as endangered, threatened, sensitive, candidate, or priority species, anadromous fish habitat, waterfowl and raptor nests, heron rookeries, and habitats of local importance that are identified and designated through a wildlife conservation plan.

2.5.1.1 Priority Habitat and Species

The Washington Department of Fish and Wildlife (WDFW) maintains priority habitat and species information for Washington State, including the status of species as threatened or endangered. The City of Shoreline resides within WDFW Region 4. Priority habitats within Region 4 include consolidated marine/estuarine shorelines, cliffs, caves, snags, riparian areas, old-growth/mature forests, and urban open spaces. These areas combined comprise less than 5 percent of the total land area of the City and are primarily found within existing City parks, public open space, designated private open space, and designated sensitive areas. Additional priority habitats and species may occur in areas not currently known to WDFW biologists or in areas for which comprehensive surveys have not been conducted. WDFW's Priority Habitats and Species (PHS) data can only show that a species or habitat type may be present. These data do not show that a species or habitat type is not present. Site-specific surveys may be necessary to rule out the presence of priority species and priority habitats on an individual project site. WDFW has established guidelines that enable local governments to designate and protect species of local importance. These habitats may contain up to 13 species of invertebrates, 62 species of vertebrates, and 20 species of mammals (Shoreline 1998).

This report discusses salmonids and certain forage fish that are priority species and are known to occur in City of Shoreline stream systems. More information on other species, including birds, shellfish, and marine fish, is included in the 2005 Shoreline Comprehensive Plan.

Salmonids

The *Salmonid Habitat Limiting Factors: Water Resources Inventory Area (WRIA) 8 Final Report* (Kerwin 2001) identifies the known presence of salmon in local streams. Boeing Creek has documented salmonid use including chinook salmon (listed as threatened under the ESA), chum salmon, coho (federal candidate species), sea run cutthroat trout, and resident cutthroat trout. It is likely that many of the fish are products of the "Fish in the Classroom" program (Daley Design 2004). Coho are listed by the WRIA 8 report as occurring in Boeing Creek (Kerwin 2001).

McAleer Creek has documented salmonid use including chinook salmon, coho salmon, and sockeye salmon, and resident cutthroat trout (Daley Design 2004). Most use occurs outside the City limits, but coho salmon and resident cutthroat trout have been observed in portions of McAleer Creek within the City limits.

WDFW's Area Habitat Biologist identified an adult steelhead in Thornton Creek upstream of Twin Ponds and NE 155th Street on February 4, 2004. In addition, according to the Thornton Creek Alliance (2004), "...a biologist with Washington Trout had previously identified a chinook juvenile upstream of Twin Ponds, and...Aegis and City biologists have identified coho and sockeye juveniles in the vicinity of Peverly Pond."

Highlands Creek contains no salmonids. All other streams in the City are likely to contain resident cutthroat trout in some portions of the stream (Tetra Tech/KCM 2004b; Daley Design 2004).

Nearshore habitat is an important environment for juvenile salmonids, where the shallow water depth obstructs the presence of larger, predator species (Kerwin 2001). All shoreline segments within the City's shoreline jurisdiction are known or expected to contain juvenile salmonids including bull trout (federally listed), chinook, chum, coho, cutthroat, pink, and sockeye, based on the knowledge of species life histories (King County 2001).

Forage Fish

Forage fish include species that as adults breed prolifically and are small enough to be prey for larger species. They are often non-game fish. Four primary sources were referenced in compiling information on potential forage fish spawning areas within the City's shoreline jurisdiction: Marine Resource Species (MRS) data maintained by WDFW (2003), the *Water Resources Inventory Area (WRIA) 8 Final Report* (Kerwin 2001), *Fish Utilization in the City of Shoreline Streams* (Daley Design 2004), and the *Reconnaissance Assessment of the State of the Nearshore Environment* (King County 2001).

The five forage fish species most likely to occur in the City's shoreline jurisdiction include surf smelt, sand lance, Pacific herring, longfin smelt, and eulachon (Kerwin 2001, King County 2001). The mouth of Boeing Creek has been identified as an important area for the feeding, migration, and spawning and rearing of all five of these forage fish species (Daley Design 2004).

2.5.2 Water Resources and Shorelines

2.5.2.1 Wetlands

Wetlands perform valuable functions that include storm and floodwater storage, water quality improvement, groundwater exchange, stream base flow augmentation, and biological habitat support. Chapter 20.80, Critical Areas, of the Shoreline Municipal Code (SMC) establishes development standards, construction techniques, and permitted uses in critical areas and/or their buffers (i.e., geologic hazard areas, fish and wildlife conservation areas, wetlands, flood hazard areas, aquifer recharge areas, and stream areas) to protect these areas from adverse impacts (for more information, see Chapter 3 and Appendix B). Designated critical areas are found throughout the City's jurisdiction, particularly wetlands and streams, flood hazard areas, and geologic hazard areas.

The characterization of wetlands is based on the recent inventory and classification of existing wetlands in the City of Shoreline that was completed by Tetra Tech/KCM in October and November 2001. The wetland inventory identified significant unmapped wetlands and classified both previously known and unknown wetlands within the City's boundaries. No wetland delineations were conducted as part of that study. Wetlands were classified according to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979).

The inventory identified 24 previously unmapped areas as potential wetlands: nine in the Boeing Creek watershed, six in the Middle Puget Sound watersheds (North and South), two in the McAleer Creek watershed, and seven in the Thornton Creek watershed. Of the 24 unmapped areas, four were found to be wetlands. In addition, 17 previously mapped wetland areas were verified for size, location, and classification (Tetra Tech/KCM 2004a, 2004b, 2004c, 2004d).

These wetlands range from the large estuarine system (a mixture of salt and fresh waters) adjacent to Puget Sound, to lakes and small excavated ponds. With the exception of the Puget Sound estuarine system, all wetlands in the City are palustrine systems (freshwater). The largest palustrine system, at approximately 6.9 acres, is in the Paramount Park Open Space within the Thornton Creek Basin. Other large wetlands include Meridian Avenue (in Twin Ponds Park), Twin Ponds, Seattle Golf Course, Hidden Lake, and ponds within Ronald Bog Park. Most wetlands in the City are relatively isolated systems and are surrounded by development.

Under the current Shoreline Municipal Code (SMC 20.80.320), wetlands are designated Type I, Type II, Type III, Type IV, or artificial. Development restrictions, including minimum buffers, vary by type. Type I wetlands receive the highest level of protection. All wetlands, regardless of size, are regulated under the Shoreline Municipal Code, whether or not they are mapped. When a development is proposed on a site with known or suspected wetlands, a wetland evaluation is required to verify and classify wetlands and delineate boundaries and buffer areas.

All of the documented wetlands within the City have experienced some level of disturbance as a result of development and human activity. Most of the disturbances have included major alterations such as wetland excavation or water impoundment. Disturbances in many wetland systems appear to be ongoing. Most of the wetland areas occur within parks and receive constant use by people. Trash and altered and trampled buffer areas were documented problems in many areas.

2.6 References

The following sources were used to develop this chapter:

- Daley Design. 2004. "Fish Utilization in City of Shoreline Streams," Appendix C to *City of Shoreline Stream and Wetland Inventory and Assessment*. Prepared for Tetra Tech/KCM, Inc., by Daley Design, Bainbridge, WA. May 2004.
- KCM. September 1997. *City of Shoreline Stormwater Study for GMA Comprehensive Plan/EIS*. Prepared for the City of Shoreline by KCM, Inc., Seattle, WA. Cited in Tetra Tech/KCM 2004b and Tetra Tech/KCM 2004d.
- Kerwin, J. 2001. *Salmonid Habitat Limiting Factors: Water Resources Inventory Area (WRIA) 8 Final Report*. Washington State Conservation Commission, Olympia, WA.
- King County. 1987. *Reconnaissance Report No. 21: Middle Puget Sound Basin*. Prepared by King County Department of Public Works Surface Water Management Division, Seattle, WA. Cited in Tetra Tech/KCM 2004b.
- King County. 1994. *Boeing Creek Tributary 0019 special study*. Prepared by King County Department of Public Works Surface Water Management Division, Seattle, WA. November 7, 1994. Cited in Tetra Tech/KCM 2004a.
- King County. 2001. *Reconnaissance Assessment of the State of the Nearshore Report: Including Vashon and Maury Islands (WRIAs 8 and 9)*. Prepared by King County Department of Natural Resources, Seattle, WA.
- Seattle Public Utilities. 2000. *Thornton Creek Watershed Characterization Report*. Cited in Tetra Tech/KCM 2004c.
- Shoreline. 1998. *City of Shoreline Comprehensive Plan*. Adopted November 23, 1998.
- Tetra Tech/KCM. 2004. *City of Shoreline Stream and Wetland Inventory and Assessment*. Prepared for City of Shoreline by Tetra Tech/KCM, Inc., Seattle, WA. May 2004. The following basin characterization reports, published as separate volumes as part of this project, were used extensively for this chapter.
 - Tetra Tech/KCM. 2004a. *Boeing Creek Basin Characterization Report*.

- Tetra Tech/KCM. 2004b. *Middle Puget Sound, Seattle Golf Club and Bitter Lake Basins Characterization Report.*
- Tetra Tech/KCM. 2004c. *Thornton Creek and West Lake Washington Basins Characterization Report.*
- Tetra Tech/KCM. 2004d. *McAleer Creek and Lyon Creek Basins Characterization Report.*
- Thornton Creek Alliance. 2004. Letter to City of Shoreline, June 9, 2004.
- WDFW (Washington State Department of Fish and Wildlife). 2003. Priority Habitats and Species (PHS), “StreamNet,” and Marine Resources Species (MRS) databases. Olympia, WA.

Chapter 3. Regulatory Issues

The City of Shoreline's surface water program must comply with a number of state and federal regulations that are pertinent to stormwater. A detailed review of the existing city, state, and federal policies, regulations, and ordinances relevant to stormwater management is presented in Appendix B. Table 3-1 presents a summary of these policies, regulations, and ordinances and shows how they apply to the City of Shoreline. The table also lists the current status of the City's stormwater management program and recommended actions to bring the City of Shoreline into compliance with the regulations. As these recommendations show, code enforcement should be one of the City's main priorities.

By implementing its own policies, regulations, and ordinances, the City is succeeding in complying with the regulations as well as meeting local needs. The table is divided into six sections that represent key activities of the City's stormwater program. The key activities listed on the table are:

- development of needed regulations and standards
- operations and maintenance
- public education
- program funding
- interlocal coordination
- implementation.

The table is organized to show how the different state and federal regulations relate to these key activities.

**Table 3-1
Surface Water Program Requirements**

Stormwater Program Activity	Requirements				City Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program ^a	NPDES Phase II Final Federal Rule ^b	Endangered Species Act 4(d) Rule ^c	Other Regulatory Programs		
<p>A. Develop Needed Regulations:</p> <p>A.1. Develop Stormwater Design and Construction Standards for New Development and Redevelopment</p>	<ul style="list-style-type: none"> Adopt a Stormwater Management Ordinance that includes minimum requirements defined by the Department of Ecology (Ecology) for new development and redevelopment. In a Stormwater Management Ordinance, either: (1) adopt a Technical Manual equivalent to Ecology's <i>Stormwater Management Manual for the Puget Sound Basin</i> (the Ecology Manual) that contains the minimum requirements, or (2) refer to a Technical Manual as guidance only to be used to meet Ecology's minimum requirements. In the latter case, the minimum requirements must be contained in the ordinance.^d The Stormwater Management Ordinance and/or Technical Manual must include thresholds and definitions of new development, redevelopment, land disturbing activities, and existing conditions that are substantially equivalent to Ecology's minimum requirements. The Stormwater Management Ordinance must include or adopt a Technical Manual that presents best management practices (BMPs) that are equivalent to those contained in the Ecology Manual. Include a BMP selection and site planning process equivalent to the process in the Ecology Manual. Include an exceptions or variance process in the Stormwater Management Ordinance and/or Technical Manual that is similar in content to that contained in the Ecology Manual. Incorporate provisions for stormwater management into local growth management regulatory actions implemented under the Growth Management Act. 	<p>The requirements listed here are based on the Final Federal Rule and are subject to change once the Department of Ecology issues the final General Permit for the state.</p> <p>Construction Site Stormwater Runoff Control Design and Construction Standard Requirements are as follows:</p> <ul style="list-style-type: none"> The owner or operator of a regulated small municipal separate storm sewer system (MS4) must develop, implement, and enforce a program to reduce nonpoint source pollution from construction sites of more than 1 acre. A regulatory mechanism must be used to control erosion and sediment to the maximum extent practicable and allowable under state, tribal, or local law. Existing erosion and sediment control ordinances may suffice, if approved by the National Pollutant Discharge Elimination System (NPDES) permitting authority. Procedures must be included for site inspection and enforcement of control measures. Procedures must be implemented to obtain input from the public. Water quality impacts must be addressed through site plan review processes. Construction site operators must control wastes generated on-site. <p>Post-Construction Stormwater Management in New Development and Redevelopment Design and Construction Standard Requirements are as follows:</p> <ul style="list-style-type: none"> Owners or operators of regulated small MS4s must develop, implement, and enforce a program that addresses stormwater runoff from new development and redevelopment projects that result in land disturbances of at least 1 acre and that discharge to their MS4. Appropriate structural and non-structural BMPs must be used. 	<p>The 4(d) Rule provides a list of activities that have a high risk of resulting in a "take" of the listed threatened or endangered salmonids. The following list includes items that could be included in design standards that would prohibit activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids. Design standards should prohibit:</p> <ul style="list-style-type: none"> Construction of structures like culverts, berms, or dams that eliminate or impede a listed species' ability to migrate or gain access to habitat. Removal, addition, or alteration of rocks, soil, gravel, vegetation, or other physical structures that are essential to the integrity and function of a listed species' habitat. Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns. Construction of dams or water diversion structures with inadequate fish screens or passage facilities. Construction of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat. Operations that substantially disturb soil and increase the amount of sediment entering streams. 		<p>Under Chapter 13.10 of the Shoreline Municipal Code (SMC), the City has adopted Title 9, Surface Water Management, of the King County Code and the 1998 <i>King County Surface Water Design Manual</i> (KCSWDM), including an addendum to modify its requirements to fit the City's needs. The addendum, titled "City of Shoreline Surface Water Design Manual," is published in the City's June 2000 Engineering Development Guide. The City has also adopted by reference "Volume IV: Source Control BMPs" of Ecology's 2001 <i>Stormwater Management Manual for Western Washington</i>.</p> <p>The City has completed and submitted an NPDES Phase II MS4 permit application to Ecology.</p> <p>The City's NPDES Phase II permit application references Ecology's 1992 "Urban Land Use BMPs, Volume IV" for source control measures, and not the latest Ecology guidance on source control BMPs.</p>	<p>The 1998 KCSWDM does not meet the minimum requirements defined by Ecology's Basic and Comprehensive Program under the Puget Sound Plan for drainage review thresholds, flow control requirements, water quality requirements, erosion and sediment control, and other special requirements. King County has revised the KCSWDM to make it consistent with Ecology's requirements. The City should adopt the new 2005 KCSWDM. In addition, the City should update its Surface Water Design Manual to directly reference Ecology's latest "Volume IV: Source Control BMPs" in lieu of Ecology's 1992 "Urban Land Use BMPs, Volume IV" and to reference the 2005 King County Surface Water Design Manual.</p> <p>The City will reduce its liability under Section 9 of the Endangered Species Act (ESA) by reducing impacts to water quality, preventing further degradation to habitat, and increasing overall regulatory compliance. The projects and programs developed under this Surface Water Master Plan will accomplish these goals.</p> <p>The City may also rely on local projects that have federal permitting or funding to obtain an incidental take statement (ITS) from the Section 7 ESA consultation process with other federal agencies. Entities complying with the terms and conditions of an ITS are protected from ESA "take" liability.</p>

Stormwater Program Activity	Requirements				City Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program ^a	NPDES Phase II Final Federal Rule ^b	Endangered Species Act 4(d) Rule ^c	Other Regulatory Programs		
A.1. Develop Stormwater Design and Construction Standards for New Development and Redevelopment (cont'd)		<ul style="list-style-type: none"> Controls must ensure that water quality impacts are minimized. Adequate long-term operation and maintenance of BMPs connected to a regulated MS4 must be addressed. The goal, at a minimum, should be to maintain pre-development runoff conditions. EPA encourages the use of preventive measures, including non-structural BMPs, which are usually thought to be more cost-effective. 		NPDES Industrial Storm Water Permit — Operators of industrial facilities that discharge stormwater to an MS4 or directly into waters of the United States require authorization under an NPDES Industrial Storm Water Permit.	The City does not own or operate any facilities that require an industrial permit.	No action required.
A.2. Regulations to Prevent Illicit Discharges	<ul style="list-style-type: none"> Through an ongoing assessment program, identify and rank significant pollutant sources and determine their relationship to the drainage system and water bodies. Investigate and take corrective actions for problem storm drains, including sampling. Implement a water quality response program to investigate sources of pollutants, spills, fish kills, illegal hookups, dumping, and other water quality problems. These investigations should be used to support compliance/enforcement efforts. 	<p>To prevent illicit discharges, the following Detection and Elimination activities are required:</p> <ul style="list-style-type: none"> The owner or operator of a regulated small MS4 must demonstrate awareness of their system, using maps or other existing documents. They also must develop a storm sewer system map that shows all outfalls, and the location/name of all waters of the United States that receive discharges. A Phase II community must effectively prohibit illicit discharges into the separate storm sewer system. Appropriate enforcement procedures must be implemented. A Phase II community must develop and implement a plan to detect and address illicit discharges (including illegal dumping) to the system. Public employees, businesses, and the general public must be informed of the hazards associated with illegal discharges and improper disposal of waste. 	<p>The following list includes items that could be included in City regulations that would prevent activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids.</p> <ul style="list-style-type: none"> Standards shall prohibit discharge of pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water (including sewage water) into a listed species' habitat. Standards shall prohibit release of non-indigenous or artificially propagated species into a listed species' habitat or into areas where they may gain access to that habitat. 		<p>Chapter 20.60.120 SMC prohibits illicit discharges into its storm sewer system. The City investigates illicit discharges identified by customer reports and by routine City field operations.</p> <p>The City presently monitors water quality and habitat in several locations.</p> <p>The City has a partial inventory (approximately 98 percent complete) of its storm sewer system, but it does not include information on water quality.</p>	<p>No action required.</p> <p>The City is not currently required to perform water quality monitoring by regulation, but the City chooses to continue to do so to collect data, identify problem areas, and to prepare for what is likely to be required in Ecology's Phase II General Permit.</p> <p>The City should complete the inventory of the drainage infrastructure system.</p>

Stormwater Program Activity	Requirements				City Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program ^a	NPDES Phase II Final Federal Rule ^b	Endangered Species Act 4(d) Rule ^c	Other Regulatory Programs		
A.3. Other Regulations				<p>State Growth Management Act (GMA) requires permits for activities in environmentally "critical areas" and for activities that would affect "critical areas."</p> <p>State Shoreline Management Act requires permits for activities along shorelines of the state.</p> <p>State Hydraulic Project Approval (HPA) — The Washington Department of Fish and Wildlife issues Hydraulic Project Approvals for construction activities that affect streams.</p> <p>State Aquatic Land Leases - The Washington State Department of Natural Resources (DNR) negotiates leases and other authorizations for use of state-owned aquatic lands.</p> <p>State Floodplain Regulations — The National Flood Insurance Program has requirements for state and local governments to administer development in floodplains in order to continue participating in the federal flood insurance program. The Federal Emergency Management Agency (FEMA) administers the federal program and this authority is given to the Ecology in Washington State. The state, in turn, requires jurisdictions within the state that want to participate in the National Flood Insurance Program to implement their own regulations for development in flood plains that comply with the state and federal requirements.</p>	<p>The City has these regulations in place. Critical Areas regulations (Chapter 20.80 SMC) provide protection measures, including buffers, for critical areas. The City has prepared and is considering adoption of draft updates to its critical areas regulations in accordance with the GMA.</p> <p>Chapter 16.10 SMC adopts Title 25 of the King County Code by reference as the interim shoreline management regulations. Updates to the shoreline master program and related regulations are currently underway.</p> <p>The City does not issue these permits. They are issued by the Washington Department of Fish and Wildlife.</p> <p>The City does not issue these permits. They are issued by the Department of Natural Resources.</p> <p>The City requires compliance with the state Flood Control Act in its Storm Drain Utility Ordinance. The City also regulates activities and development in floodplains through Chapter 16.12 SMC, Flood Damage Prevention, and Chapter 20.80 SMC, Subchapter 5, Flood Hazard Areas.</p>	<p>The City is in the process of completing the updates and adopting an updated ordinance.</p> <p>The City is in the process of completing the updates and adopting an updated ordinance.</p> <p>Action is required to obtain this permit when the City engages in construction activities that need to obtain an HPA.</p> <p>Action is required to obtain a lease when the City engages in activities that require the use of aquatic lands (usually for a storm drain outfall).</p> <p>No action is required.</p>

Stormwater Program Activity	Requirements				City Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program ^a	NPDES Phase II Final Federal Rule ^b	Endangered Species Act 4(d) Rule ^c	Other Regulatory Programs		
A.3. Other Regulations (cont'd)				<p>Section 404 of the Clean Water Act requires a permit for activities classified by the U.S. Army Corps of Engineers as fill in wetlands. At the federal level, the Corps of Engineers regulates the discharge of dredged or fill material into waters of the United States, including wetlands.</p> <p>Section 303 of the Clean Water Act, TMDL Plans — The federal Clean Water Act requires NPDES-authorized states, such as Washington, to list water quality-impaired water bodies on the 303(d) list and to prepare total maximum daily load (TMDL) plans for water bodies that do not meet state water quality standards. These plans set total maximum limits on point and nonpoint source pollutants that can be discharged to each water body without exceeding state water quality standards. Local entities are responsible for implementing programs to address the water quality problems.</p>	<p>Section 404 permits are issued by the Corps of Engineers and not the City. However, the City's Critical Areas ordinance regulates development in and near wetlands in support of this federal program (Chapter 20.80 SMC, Subchapter 4).</p> <p>Lyon, McAleer, and Thornton Creeks are listed as water quality-impaired water bodies on the 303(d) list for fecal coliform. TMDLs have not been established.</p>	<p>No action is required.</p> <p>No state-sponsored TMDL plans are currently in place or are being developed. Until such time as the state completes these plans, no action is required.</p>
<p>B. Maintenance & Operations</p> <p>B.1. Maintenance of Public Facilities</p> <p>B.2. Maintenance of Private Facilities</p>	<ul style="list-style-type: none"> Develop and enforce an operation and maintenance program and ordinance for new and existing public and private stormwater systems. 	<p>Develop a Pollution Prevention/Good Housekeeping program for Municipal Operations that accomplishes the following:</p> <ul style="list-style-type: none"> Owners or operators of small MS4s must develop and implement a cost-effective operation and maintenance program as well as an employee training program with the goal of preventing or reducing pollutant runoff resulting from municipal operations. 	<p>The following list of items should be included in a maintenance plan to prevent activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmon. Maintenance plan shall prohibit:</p> <ul style="list-style-type: none"> Maintenance of structures like culverts, berms, or dams if maintenance eliminates or impedes a listed species' ability to migrate or gain access to habitat. Removing, poisoning, or contaminating plants, fish, wildlife, or other biota that the listed species requires for feeding, sheltering, or other essential behavioral patterns. Removal, addition, or alteration of rocks, soil, gravel, vegetation, or other physical structures that are essential to the integrity and function of a listed species' habitat. Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns. Operation of dams or water 		<p>The City's drainage facility maintenance program includes the adopted Chapter 9.4.120 from the King County Code, as well as Chapter 13.10 SMC, which includes requirements for annual inspection of commercial facilities.</p> <p>The program also includes annual inspection and maintenance of public retention systems as well as scheduled vactoring of public conveyance systems.</p> <p>The City also has an ordinance in place that requires commercial (private) property owners to maintain private systems.</p>	<p>The City has reviewed its adopted maintenance program to determine whether it meets the requirements of the federal NPDES rule as well as the anticipated Ecology General Permit. This review was conducted as part of this plan and is described in Chapter 8.</p>

Stormwater Program Activity	Requirements				City Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program ^a	NPDES Phase II Final Federal Rule ^b	Endangered Species Act 4(d) Rule ^c	Other Regulatory Programs		
			diversion structures with inadequate fish screens or passage facilities. <ul style="list-style-type: none"> Maintenance or operation of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat. 			
C. Public Education	<ul style="list-style-type: none"> Implement education programs to inform citizens and businesses about stormwater and its effects on water quality, flooding, and fish and wildlife habitat, and to discourage dumping of waste material or pollutants into storm drains. Develop and implement a stormwater public education program aimed at residents, businesses, and industries in the urban area. 	Develop a Public Education and Outreach Program on Stormwater Impacts that accomplishes the following: <ul style="list-style-type: none"> A public education program must be implemented to distribute educational materials to the community. The community should be made aware about the impacts of stormwater discharges to water bodies and the steps needed to decrease stormwater pollution. Municipalities are encouraged to work with their state and Phase I communities to develop an education/outreach program more efficiently. Involve public participation by accomplishing the following: <ul style="list-style-type: none"> The public must be involved in developing the municipality's stormwater program by following state, tribal, and local public notice requirements. All economic and ethnic groups should be included. Examples of public involvement/ participation that should be considered include public hearings, citizen advisory boards, and working citizen volunteers. 			The City currently conducts limited public education of citizens and businesses on stormwater quality.	The City should continue to review its public education and public involvement program to determine whether it meets the requirements of the federal NPDES rule as well as the anticipated Ecology General Permit.
D. Program Funding	<ul style="list-style-type: none"> Assure adequate local funding for the stormwater program through surface water utilities, sewer charges, fees, or other revenue-generating sources. 				The City currently funds its stormwater program through its Storm Drain Utility.	The City has evaluated the adequacy of existing rate revenues to fund a program that complies with applicable regulations. This review was conducted as part of this plan and is described in Chapter 9.

Stormwater Program Activity	Requirements				City Status	Plan of Action
	Ecology's Basic and Comprehensive Stormwater Program ^a	NPDES Phase II Final Federal Rule ^b	Endangered Species Act 4(d) Rule ^c	Other Regulatory Programs		
E. Interlocal Coordination	<ul style="list-style-type: none"> Complete local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees. 				The City of Shoreline participates in Regional Water Quality, King County Interagency Regional Analysis, Regional Funding Advisory Committees, Cedar/Lake WA and Central Puget Sound Watershed Forums, WRIA 8 Steering Committee, Thornton Creek Watershed Management Committee, WRIA 8 Regional Salmon Issues, Regional Road Maintenance, and WRIA 8 Public Outreach.	No action required.
F. Implementation	<ul style="list-style-type: none"> Implement inspection, compliance, and enforcement measures. Prepare an implementation schedule for the comprehensive stormwater program. 				The City currently performs inspection and enforcement to a limited extent. One of the City's main priorities is for the Stormwater Environmental Services Division to have more authority to participate in the permit and review process. The City would also like to have investigative authority for commercial facilities. This would include having one staff person in each department who is responsible for determining what to investigate, to investigate problems, and to monitor commercial properties on an annual basis.	The City has adopted a Comprehensive Plan that includes code enforcement and investigative activities. The City should consider City inspection of private residential facilities in addition to its current activities.

a. Ecology's Basic program requirements were originally defined in the 1994 Puget Sound Water Quality Management Plan. Basic program requirements are from a list of Ecology equivalency review criteria in *Guidance for Local Governments when Submitting Manuals and Associated Ordinances for Equivalency Review* (Ecology 1994) and from *Stormwater Program Guidance Manual for the Puget Sound Basin* (Ecology 1992). Comprehensive program requirements are from *Stormwater Program Guidance Manual for the Puget Sound Basin* (Ecology 1992). **Many of these requirements will likely be incorporated into Ecology's final NPDES Phase II stormwater general permit.**

b. Final Federal Rule and all other applicable state regulations will be the basis for the Phase II NPDES General Permit to be issued by Ecology, which is the NPDES Permitting Authority in Washington State. Ecology's final general permit has not yet been issued and may differ from the Final Federal Rule. As mentioned in note a., Ecology's regulations will most likely contain many of the same requirements as those in Ecology's Basic and Comprehensive Stormwater Programs.

c. Requirements summarized from *A Citizen's Guide to the 4(d) Rule for Threatened Salmon and Steelhead on the West Coast*, prepared by the National Marine Fisheries Service, Northwest and Southwest Regions, June 20, 2000.

d. Ecology indicates the following advantages and disadvantages in the different approaches (Ecology 1994):

If the entire manual (either Ecology's manual or one written by a local government) is incorporated into the ordinance by reference, all the information contained in the manual becomes part of the local government code.

The advantage of this method is that there are no questions about what is and is not an enforceable part of the local government code. One disadvantage is that if a local government wishes to change something in the manual, the ordinance may have to undergo revision as well. Additionally, the Plan requires that the ordinance and/or the manual adopted be revised within a year following any Ecology update of the technical manual.

If only parts of the manual (or only the Minimum Requirements themselves) are adopted in an ordinance, those parts are then enforceable. The other parts of the manual serve as additional guidance. If this method is chosen, only revisions to those parts of the manual adopted in the ordinance require revision of the ordinance. Updates can easily be made to the parts of the manual not adopted in the ordinance.

Chapter 4. Current Program

4.1 Introduction

The City of Shoreline’s surface water management (SWM) program carries out the policy direction set in the City’s Comprehensive Plan, as well as directions expressed by City staff and the public. The City’s 1998 Comprehensive Plan contained adopted goals and policies that expressed the community’s desires related to surface water management. These goals and policies, plus the need to meet regulatory requirements, have resulted in the services that the City currently provides to ratepayers in three program areas: flood protection, water quality, and stream habitat.

To provide background on how 1998 Comprehensive Plan goals and policies have provided direction to the City’s current program, Tables 4-1, 4-2, and 4-3 summarize this information according to the three program areas. The 2005 Comprehensive Plan includes revisions to some of these policies, and the goals and policies that shape the recommended (future) SWM program are described in Chapters 5, 6, and 7.

**Table 4-1
Flood Protection–Related Goals and Policies
from the 1998 Comprehensive Plan**

1998 Comprehensive Plan Goals and Policies	Direction Given to Surface Water Management Program
Goal EN V Policies U14, U15, EN63, EN36, EN42, EN44, and EN46	<ul style="list-style-type: none"> ▪ Manage the storm and surface water system through a combination of engineered solutions and the preservation of natural systems in order to provide for public safety, prevent property damage, protect water quality, preserve and enhance fish habitat, and maintain a hydrologic balance. ▪ Resolve existing flooding problems and prevent new ones. ▪ Develop surface water facilities that protect water quality, enhance public safety, preserve and enhance habitat, and protect critical areas. ▪ Review new development so that it does not aggravate existing flooding problems. ▪ Manage larger development projects to retrofit existing paved areas with new controls that help alleviate downstream flooding problems. ▪ Promote low-impact new development that reduces runoff from the site and helps to alleviate downstream flooding. This includes protecting natural flood storage areas. ▪ Identify the City as the responsible party for maintaining stormwater systems in City right-of-way to prevent flooding. ▪ Identify private property owners as the responsible party responsible for maintenance of their own systems to prevent flooding on their land. ▪ Design and construct flood protection projects to solve existing flooding problems, but also to provide multiple benefits to the extent possible that meet goals, policies, and community needs expressed for habitat and surface water quality.

**Table 4-2
Water Quality–Related Goals and Policies
from the 1998 Comprehensive Plan**

1998 Comprehensive Plan Goals and Policies	Direction Given to Surface Water Management Program
Goal EN V Policies EN36, EN37, EN38, EN39, EN40, EN41, EN43, EN44, EN45, EN46, EN58, and EN62	<ul style="list-style-type: none"> ▪ Manage the storm and surface water system through a combination of engineered solutions and the preservation of natural systems in order to provide for public safety, prevent property damage, protect water quality, preserve and enhance fish habitat, and maintain a hydrologic balance. ▪ Maintain surface water quality as defined by federal and state standards. ▪ Restore water quality of runoff from properties to predevelopment levels for new development and redevelopment. ▪ Rehabilitate degraded surface water by reducing nonpoint source pollution, controlling erosion, and improving the stormwater system. ▪ Actively pursue state and federal grants to improve surface water management and water quality ▪ Support the use of appropriate landscaping, swales, retention facilities, and treatment facilities to enhance water quality and the percolation of water at natural rates near its source to limit soil instability or damage to roadways or other improvements. ▪ Sweep streets to reduce pollutants entering the stormwater drainage system ▪ Educate citizens about proper waste disposal. Prevent direct disposal into storm drains. ▪ Promote practices that prevent pollutants from entering the stormwater system as a result of lawn and garden maintenance, car cleaning or maintenance, and roof cleaning or maintenance. ▪ Maintain and enhance natural drainage systems. ▪ Identify the City as the responsible party for maintaining stormwater systems in City right-of-way to prevent flooding. ▪ Identify private property owners as the responsible party responsible for maintenance of their own systems to prevent flooding on their land. ▪ Cooperate with other jurisdictions and agencies to improve regional surface water management, protect water quality, and resolve related interjurisdictional concerns. ▪ Design and construct water quality projects to solve existing water quality problems, but also to provide multiple benefits to the extent possible that meet goals, policies, and community needs expressed for flood protection and habitat. ▪ Pursue funding to conduct baseline monitoring and improvement of water quality in lakes and streams in the City. ▪ Protect water quality through regulation and educational outreach. ▪ Adhere to state and federal environmental standards in all City-funded projects.

**Table 4-3
Stream Habitat–Related Goals and Policies
from the 1998 Comprehensive Plan**

<p>1998 Comprehensive Plan Goals and Policies</p>	<p>Direction Given to Surface Water Management Program</p>
<p>Goals EN V and EN VI Policies EN29, EN46, EN47, EN57, EN59, EN60, EN61, EN63, EN65, EN66, and EN67</p>	<ul style="list-style-type: none"> ▪ Manage the storm and surface water system through a combination of engineered solutions and the preservation of natural systems in order to provide for public safety, prevent property damage, protect water quality, preserve and enhance fish habitat, and maintain a hydrologic balance. ▪ Preserve, protect, or restore wetlands, shorelines, surface water, and groundwater for wildlife, appropriate human use, and the maintenance of hydrological and ecological processes. ▪ Actively participate in regional species protection efforts, including salmon habitat protection and restoration. ▪ Preserve wetlands and aquatic and riparian habitats in a natural state and maintain appropriate buffers around these areas. ▪ Study issues related to Hidden Lake and develop a management plan for the lake. ▪ Avoid filling or permanently altering streams. Place a higher priority on projects that allow streams to return to natural channel migration patterns. Give preference to channel stabilization over culverting. ▪ Promote citizen involvement and seek community consensus on attempts to restore surface water features which have been altered. Restoration efforts may include the daylighting of streams which have been diverted into underground pipes or culverts. ▪ Identify, prioritize, and eliminate barriers to fish passage. Work with citizen volunteers, state and federal agencies, and tribal governments in these efforts. ▪ Protect natural flood storage areas. ▪ Use the state Shoreline Management Act to guide protection efforts for shorelines of statewide significance and for other water features that do not qualify for state regulation. ▪ Cooperate with adjacent county and local governments, regional governments, state agencies, and tribal governments to develop and implement Watershed Action Plans and other types of basin plans for basins that lie within or partially within Shoreline’s boundaries. ▪ Expand public access to Shoreline’s natural features, including the Puget Sound shoreline. Seek consensus of local communities and neighborhoods when private property owners might be negatively affected by this action. ▪ Design and construct habitat projects to solve existing habitat problems, but also to provide additional benefits to the extent possible that meet goals, policies, and community needs expressed for flood protection and surface water quality.

4.2 Existing Surface Water Management Responsibilities (Current Activities)

This section describes the City's current surface water management program, including both operation and maintenance (O&M) and capital improvements. In general, the City's current SWM activities fulfill the policy direction summarized in Tables 4-1, 4-2, and 4-3. This section begins with an inventory of drainage facilities, followed by a description of SWM activities.

4.2.1 Inventory of Drainage Facilities

Shoreline's drainage system consists of facilities to convey and treat stormwater prior to its discharge into receiving waters that include local streams and Puget Sound. The following paragraphs describe drainage system components.

- **Stormwater Pipe.** The city's stormwater pipes range in diameter from eight inches to five feet, and convey stormwater to outfalls into receiving waters such as Boeing Creek or Puget Sound. Some stormwater pipes have storage or water quality treatment structures built into the system. Maintenance requirements include cleaning lines, making minor repairs, and removing roots, sand, gravel, and other debris from the pipe.
- **Culverts.** Culverts are short sections of pipe used to convey stormwater, generally either under or adjacent to roads. Culvert pipes are usually concrete or corrugated metal. Inspections and minor cleaning are conducted throughout the year. Maintenance activities include inspection, repairs, and removal of sediment, debris, and vegetation.
- **Catch basins.** Catch basins are underground sumps which are typically in-line between catch basin inlets and the piped storm drain system. In Shoreline, some stormwater pipes discharge directly into catch basins. The sump at the bottom of the catch basin is used to capture sediment and other debris from incoming stormwater. A trapped outlet prevents most floating debris and oil from leaving the catch basin. Maintenance includes regular inspection, removal of sediment and debris, and repairs.
- **Ditches.** Ditches are constructed earth trenches, lined with vegetation or concrete, that convey stormwater in areas not served by piped systems. Ditch maintenance includes removal of debris, mowing, and periodic reshaping.
- **Biofiltration swales.** Biofiltration swales are grass-lined, flat-bottomed ditches. The shape, slope, width, and length of the swale are designed to provide water quality treatment. Routine maintenance includes inspection, mowing, debris removal, and occasional removal of built-up sediments. Grass must be mowed frequently.
- **Retention/detention ponds and underground storage facilities.** Retention/detention ponds and underground storage facilities (such as vaults and pipes) store stormwater. The purpose of these facilities is to temporarily store stormwater so that it can be released at a controlled rate to nearby receiving water bodies or into the ground. Routine maintenance includes inspection, sediment removal, and grass cutting for ponds.
- **Oil/water separators.** Oil/water separators are generally underground vaults designed to trap sediments, oil, and floatable materials. Some oil/water separators

contain oil-absorbing booms. Routine maintenance includes inspection; removal of oil, sediment, and floating debris; and replacement of oil booms.

Table 4-4 summarizes the estimated quantity of drainage system infrastructure in the City of Shoreline.

**Table 4-4
Drainage System Infrastructure**

Drainage System Component	Estimated Quantity	Unit
Stormwater Pipe	500,000 (95)	LF (miles)
Catch Basins	5,500	Each
Ditches	180,000 (34)	LF (miles)
Outfalls (to open water courses)	60	Each
Outfalls (to Puget Sound)	unknown	Each
Retention and Detention Facilities (maintained by the City)	95	Each
Retention and Detention Facilities (privately maintained)	219	Each
Lift Stations	2	Each

4.2.2 Current Operation and Maintenance Program

4.2.2.1 Maintenance Activities

Maintenance activities are those directly related to the physical maintenance of the drainage system, and do not include programmatic activities. Currently, the City relies on King County, private contractors, and City crews to complete these maintenance activities.

Each year, the City reviews service level needs and available resources. In recent years, the City has been transferring services previously provided by King County to private contractors in those cases where it is more cost effective. The City’s future evaluations will consider partnerships with other agencies and in-house delivery of services, for continued stabilization or reduction of costs.

Appendix C contains a list of maintenance activities and identifies the current roles of City crews, King County, and private contractors in completing these activities.

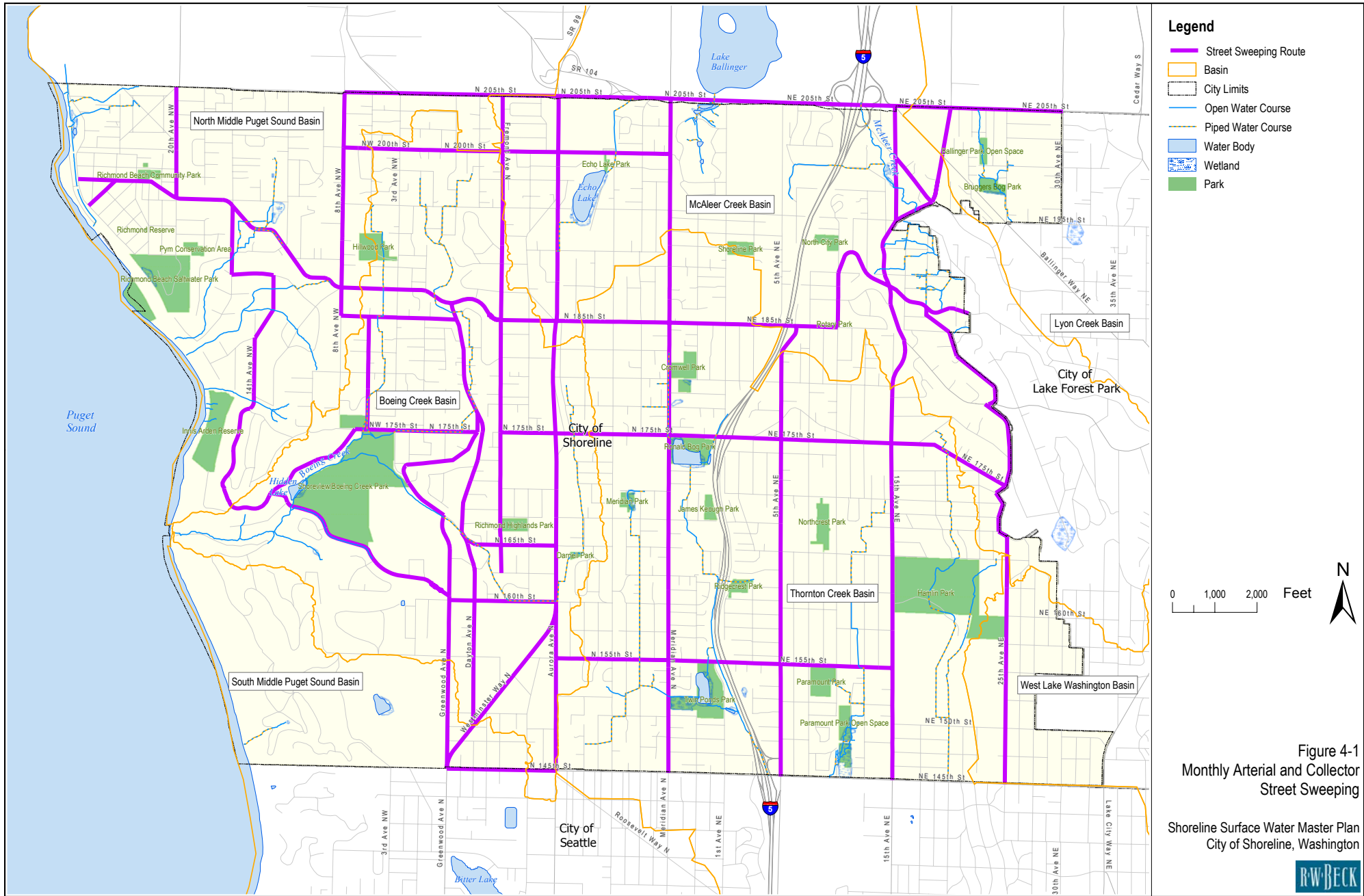
In general, maintenance is contracted if specialized equipment is required. The City does not own street sweepers, and as a result, it contracts out street sweeping services. Similarly, the City does not own vacor trucks, and it contracts out catch basin cleaning that requires vacor trucks. The City often prefers to use King County for emergency repairs because of the County’s responsiveness.

The following six maintenance activities have required the majority of expense and effort to date:

- **Vactoring.** Vactoring of catch basins is required to keep debris out of the drainage pipes and to provide a water quality benefit by removing settleable pollutants from stormwater. Currently, there are approximately 5,500 catch basins in the City. With current funding, the City anticipates cleaning approximately 4,300 catch basins (approximately 80 percent of the total) each year. The City has received a bid of approximately \$25 per catch basin from private contractors for this service, and expects to continue shifting the responsibility of catch basin cleaning to private contractors in the future.
- **Ditch Reshaping.** Ditch reshaping is periodically required to maintain the proper conveyance of stormwater in the ditch. The City allots three weeks of crew time throughout the year to ditch reshaping, and expects to complete an estimated 7,500 lineal feet (LF) each year. This is equivalent to reshaping the City's ditches on an approximately 25-year cycle.
- **Shoulder Reconstruction.** Shoulder reconstruction is occasionally required to ensure proper drainage from streets. Generally, shoulder reconstruction involves regrading the slope of the shoulder toward the ditch, followed by placement of a thin gravel layer to cover muddy areas. City staff report that shoulder reconstruction is currently done on an approximately 10-year cycle. The unit cost for shoulder reconstruction is approximately \$1 to \$2 per LF. Shoulder reconstruction is funded by both the City's SWM Fund and the Street Fund. This is because shoulder reconstruction promotes proper drainage as well as proper use of the street and shoulder areas for traffic.
- **Maintenance of Retention and Detention Facilities.** The City contracts with King County for maintenance of these facilities. In 2004, the City is budgeting approximately \$80,000 for maintenance of these facilities. A specific inventory of maintenance activities is not yet available (see discussion of the City's maintenance management system later in this section).
- **Street Sweeping.** The City contracts with King County and with private companies for street sweeping services. As of 2004, street sweeping is planned on the following schedule:
 - Arterials and collectors: monthly. (See Figure 4-1 for a map of arterial and collector street sweeping routes.)
 - Residential streets: three times per year.
 - City-owned parking lots: six times per year.

Street sweeping unit costs budgeted for 2004 range between \$50 and \$60 per lane mile. Street sweeping is funded by both the City's SWM Fund and the Street Fund because street sweeping improves water quality as well as use of the street for traffic.

- **Dredging of Hidden Lake.** This is done biennially by a private contractor.



- Legend**
- Street Sweeping Route
 - Basin
 - City Limits
 - Open Water Course
 - Piped Water Course
 - Water Body
 - Wetland
 - Park

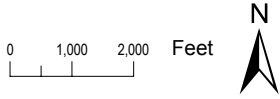


Figure 4-1
 Monthly Arterial and Collector
 Street Sweeping
 Shoreline Surface Water Master Plan
 City of Shoreline, Washington



Dams are another type of facility that requires maintenance. There are eight dams located in the City. Two of these are privately owned and maintained, and the remaining six are owned and maintained by the City. Maintenance activities involve vegetation management occupying a two-person crew for two to three weeks per year, plus groundwater monitoring at the North Pond dam due to recent dam modifications.

Three of the City’s dams are regulated by the Washington State Department of Ecology and have operating permits. Prior to the City’s incorporation, the permits were held by King County. Although King County no longer owns the dams, the County is still the permittee under its National Pollutant Discharge Elimination Program (NPDES) Phase I permit. The City anticipates working with King County to resolve any permitting issues for the City’s dams.

Table 4-5 summarizes 2004 budgeted maintenance expenditures broken down by task as available.

**Table 4-5
Budgeted 2004 Maintenance Expenditures**

Maintenance Activity	2004 Budgeted Expenditure
Catch Basin Cleaning	\$131,960
Street Sweeping ^a	71,522
All Other Activities ^b	384,263
Total	\$587,745

^a Does not include the cost of street sweeping funded by the City’s Street Fund, which in 2004 is budgeted to be \$76,108.
^b Does not include shoulder reconstruction funded by the City’s Street Fund

In 1999, City staff developed a series of unit cost estimates for many maintenance tasks performed by City crews. These unit cost estimates have been useful to the City in the areas of estimating maintenance costs and workload planning. The City intends to review these unit cost estimates after full implementation of its new maintenance management system, and to make changes based on several years’ worth of actual maintenance records.

4.2.2.2 Programmatic Activities

In addition to maintaining the drainage system, City staff are currently involved in a number of programmatic activities shown in Table 4-6. Many of these activities focus on working with Shoreline’s residents and businesses to prevent stormwater pollution and to improve water quality. Other programmatic activities focus on working with entities outside the City on regional watershed planning and regulatory compliance activities. Not shown in Table 4-6 (but included in Appendix C) are activities funded from the City’s Waste Management Fund.

The estimated SWM staffing for programmatic activities is 1.7 regular FTEs (full-time equivalents) plus two part-time interns who combine for 1.0 FTE. SWM staff do not specifically record their time spent on each programmatic activity, so the values shown in Table 4-6 are estimates intended to convey an approximate level of effort for each activity. The majority of programmatic activities provide a water quality benefit, with some activities providing flood protection or habitat benefits. Programmatic activities include enforcement of Shoreline’s municipal code through inspection and source control activities.

**Table 4-6
SWM Programmatic Activities**

Activity^a	Description of Current Efforts	Benefit	Current FTEs
No-Spray Zone Project	Training and materials to teach right-of-way plant eradication. This project is currently being done in the Richmond Beach area in response to a neighborhood request.	Improves water quality by reducing runoff containing pesticides and herbicides.	0.05
Clean Car Wash Program	Present efforts are limited and are incidental to other activities listed in this table.	Improves water quality by reducing discharge of soaps, metals, and turbidity.	0.0
Natural Lawn and Garden Care	Coordinate an annual event containing incentive tools and products; coordinate three annual training workshops for residents. Funded 75% by a grant using City funds as local match.	Improves water quality by reducing runoff containing pesticides and herbicides.	0.25
Storm Drain Stenciling Program	Support for use of stencil kit loaned to residents; provide resource and training support for teachers. Most storm drain stenciling is currently done by student volunteers.	Improves water quality by reducing illegal dumping to the drainage system.	0.1
Community Involvement Restoration Program	Co-lead Earth Day activities in Boeing Creek Park; train teachers and lead student groups in watershed analysis and restoration; educate/train residents to improve lake and stream water quality.	Provides public education on a variety of issues related to surface water management.	0.05
Compost Facility Program	Coordinate compost O&M; maintain records; write reports.	Improves water quality by offering residents alternatives for natural lawn and garden care.	0.2 ^b
Regional Road Maintenance/ESA/NPDES Program	Train staff; participate in Regional Forum; maintain road maintenance best management practices (BMP) records; submit quarterly reports.	Improves water quality by reducing discharge of pollutants through road maintenance; ensures continued regulatory compliance.	0.1
Water Quality Monitoring	Collect field measurements of parameters such as dissolved oxygen, pH, TDS, salinity, turbidity, and temperature.	Characterizes water quality of Shoreline's open water courses and helps identify pollutant sources.	0.4
Regional Committee Participation	WRIA 8 activities (forum, steering committee, and public outreach).	Ensures the City participates in and is informed of ongoing regional planning and regulatory compliance efforts.	0.1
Surface Water Monitoring and Source Control Program	Investigate water quality complaints, spill response, and provide public outreach on various source control issues.	Improves water quality by reducing discharge of pollutants.	0.4
Retention and Detention (R/D) Facility Inspection	Inspect City-maintained facilities to define required maintenance activities. Inspect privately maintained facilities to enforce maintenance requirements. Average one inspection per year. Conduct follow-up inspections to verify maintenance activities.	Improves flood protection by ensuring proper O&M of R/D facilities; improves water quality by ensuring proper O&M of treatment aspects of R/D facilities.	1.0 ^c
Total			2.7

^a Activities listed are those completed by SWM program staff and do not include finance department activities such as SWM account maintenance and billing.

^b The City has included this activity as part of its BMPs in its NPDES municipal stormwater permit application. The 0.2 FTE funded from the SWM program does not include the actual O&M of the facility, which is completed by City roads crews and funded by the City's Street Fund.

^c Currently, two interns, each working 1,040 hours per year, complete retention/detention facility inspections.

The City considers its recycling program and its solid waste management program, both funded from its Waste Management Fund, to be BMPs related to its future NPDES Phase II municipal stormwater permit. Recycling activities include annual coordination of two general recycling events and a Christmas tree recycling program, maintaining the ongoing battery recycling program, writing grant applications, and grant administration. Solid waste management program activities include hazardous waste/recycling events and outreach, monitoring customer satisfaction, and solid waste disposal contract re-negotiation. The combined staffing for these programs is approximately 0.6 regular FTE and 1.0 intern FTE.

The City reviews planned drainage facilities proposed by developers according to the requirements of its municipal code. This review is done to meet regulatory requirements and to ensure consistency with policy direction established in the City's Comprehensive Plan.

4.2.2.3 Support Activities

Support services to the SWM program are provided by a number of different City departments, and include budget and financial management, policy development and leadership, administrative support, vehicle maintenance, building maintenance, accounting, purchasing, and human resources. The City's Community Response Team receives feedback from residents for all City services, including surface water management. King County provides billing support services.

4.2.2.4 O&M Expenditures for Each Program Area

Tables 4-7 and 4-8 show an estimate of a division of 2004 budgeted O&M expenditures among the flood protection, water quality, and habitat program areas. These tables also include support expenditures, which are not directly attributed to one of the three program areas.

**Table 4-7
Approximate Functionalization of SWM O&M Expenses**

O&M Activity	Flood Protection	Water Quality	Stream Habitat	Support
Maintenance				
Street Sweeping	50%	50%		
Catch Basin Cleaning	50%	50%		
Other Maintenance	100%			
Programmatic				
R/D Facility Inspection	50%	50%		
WRIA Activities		50%	50%	
ESA, Biological Evaluations			100%	
Billing				100%
Other Programmatic		100%		
General Fund Cost Allocation				100%

**Table 4-8
Estimated 2004 O&M Expenditures
for SWM Program Areas**

Program Area	2004 Budgeted Expenditure^a	Percent of Total
Flood Protection	\$500,000	36%
Water Quality	407,000	30%
Stream Habitat	28,000	2%
Subtotal	\$928,000	
Support	\$ 436,000	32%
Total	\$1,371,000	100%

^a Data taken from line items in the City's 2004 Proposed Budget, using the functionalization percentages shown in Table 4-8.

4.2.3 Capital Improvement Activities

Since incorporation and establishment of the City's Surface Water Management Utility, drainage system capital improvements have been limited. More focus was provided to ensuring continuity of maintenance service as the drainage system was transferred from King County to the City. As the SWM program has matured, increasing focus is being provided to capital improvements. Currently, the City is in the design phase of two large flood protection improvements serving the 3rd Avenue NW and Ronald Bog areas.

One consequence of not spending a large amount of SWM funds on capital improvements is that the City SWM and SWM Capital Funds have accumulated significant capital reserves to help meet flood protection, water quality, and stream habitat priority levels described in Chapters 5, 6, and 7. Use of these reserves is discussed in the financial analysis contained in Chapter 9.

4.2.4 Funding of SWM Activities

This section is a brief description of the funding sources for SWM activities. Chapter 9 of this report is a financial analysis which explores funding issues in more detail.

Stormwater service fees are the primary funding source for the City's surface water management activities. Some maintenance tasks, such as street sweeping and shoulder reconstruction, are partially funded from the City's Street Fund because street sweeping serves both street maintenance and drainage system maintenance functions.

Part II: Problem Identification and Solution Development

Part II of this Surface Water Master Plan describes potential changes to the City's surface water management program to address known problems and meet regulatory requirements. The chapters in Part II look at known flooding, water quality, and stream habitat problems, and the prioritization and estimated costs of projects and programs to address these problems. Operations and maintenance, which provides services related to all three program areas, is also discussed.

- Chapter 5 Flood Protection
- Chapter 6 Water Quality
- Chapter 7 Stream Habitat
- Chapter 8 Operations and Maintenance

Chapter 5. Flood Protection

5.1 Introduction

This chapter includes a summary of the surface water system flooding problems within the City of Shoreline. The chapter describes the process that was used to identify these problems and lists the various problems that were identified. Conceptual project solutions and planning-level cost estimates that were developed as part of this Plan in response to the identified problems are also summarized. In many cases, more detailed designs or cost estimates have already been developed in previous studies; these items are included in this chapter as well.

The implementation of these project activities, which will provide flood protection from drainage impacts identified in this chapter, is focused on first improving public safety and reducing property damage, then improving the effectiveness of the City's surface water system, and, lastly, providing additional benefits to surface water conditions. The City has defined three priority levels that reflect these three objectives. These priority levels were established based on internal discussions at the City and with input from the public and from the Shoreline Planning Commission's Stormwater and Environment Workgroup. Policy LU106 directs the City to give priority to implementation of projects and programs that meet the criteria of these priority levels. Table 5-1 provides a summary of all of the City's flood protection-related policies.

5.2 Identified Flooding Problems

5.2.1 Background

As described in Chapter 4, the surface water system in the City of Shoreline includes pipe systems, open water courses, ditches, culverts, and detention facilities. The City has performed maintenance and constructed small capital projects in the years since the City was incorporated. As a result, many large and small flooding problems have been alleviated. The City's policy typically has been to address major trunk drainage system problems first, and then address localized problems that affect fewer people and cause little or no property damage. The City initiated a major drainage projects program to solve problems associated with the trunk system, and a Surface Water Small Projects Program to solve localized problems with projects that would cost up to \$50,000 to complete. In 2002, the Small Projects Program was suspended because the projects that remained on the small projects list exceeded the available resources and funding and really needed to be addressed by the major drainage projects program.

5.2.2 Data Review and Identification of Problems

In order to identify current flooding problems in the City of Shoreline, several steps were completed. First, all available drainage studies, basin plans, and other related reports were reviewed. The City's drainage complaints database was reviewed at the beginning of the development of this Plan and once again after the October 2003 storm, which was a major and infrequent event. For complaints that were listed as "complete" in the database, it was assumed that the problem had been resolved. From this review, a preliminary list of flooding

problems was developed and presented to City staff. This list included current problems and problems intended to be addressed by projects that remained on the small projects list after the suspension of that program. City staff confirmed which of the problems still exist and also added some others to the list. Most of the problems involve localized flooding due to the lack of a collection system or to an undersized system.

**Table 5-1
Flood Protection–Related Goals and Policies
from the 2005 Comprehensive Plan**

2005 Comprehensive Plan Goals and Policies	Direction Given to Surface Water Management Program
Goal LU XVII Policies LU105, LU137, LU131, LU139, LU145, LU147, LU149, and LU106	<ul style="list-style-type: none"> ▪ Manage the storm and surface water system through a combination of engineered solutions, the preservation of natural systems, and public education in order to provide for public safety; prevent property damage; protect water quality; preserve and enhance fish habitat and critical areas; and maintain a hydrologic balance. ▪ Resolve existing flooding problems and prevent new ones. ▪ Ensure adequate surface water services to provide defined levels of service to new and future development. ▪ Develop surface water facilities that protect water quality, enhance public safety, prevent erosion, preserve and enhance habitat, and protect critical areas. ▪ Manage new development so that it does not aggravate existing flooding problems. ▪ Manage larger development projects to retrofit existing paved areas with new controls that help alleviate downstream flooding problems. ▪ Promote low-impact new development that reduces runoff from the site and helps to alleviate downstream flooding. This includes protecting natural flood storage areas. ▪ Identify the City as the responsible party for maintaining stormwater systems in City right-of-way to prevent flooding. ▪ Identify private property owners as the responsible party responsible for maintenance of their own systems to prevent flooding on their land. ▪ Design and construct flood protection projects to solve existing flooding problems, but also to provide additional benefits to the extent possible that meet goals, policies, and community needs expressed for habitat and surface water quality. ▪ Prioritize the resolution of flooding problems such that problems which frequently cause property/structure damage or pose a public safety risk have the highest priority.

The problems that were identified through the data review process are summarized on Table 5-2. The table summarizes each problem by providing its approximate location, the basin in which the problem is located, a description of the problem, and a reference to the source of the information. The approximate location of each problem is shown on Figure 5-1.

Most of the identified flooding problems result from inadequate capacity of the existing drainage system, lack of a formal drainage system, and/or lack of adequate detention to mitigate for development. A variety of types of flooding problems were identified.

- Some of the problems identified cause flooding on major roadways and erosion on major water courses. During large storm events, it is desirable to prevent flooding of principal, minor, and collector arterial roadways to provide emergency vehicles access, to allow traffic to move safely at posted speeds, to prevent traffic jams, and to protect the public's mobility.
- Some cause flooding of and damage to structures, including commercial buildings and private homes.
- Finally, some cause flooding of private yards, driveways, and residential streets, as well as erosion along water courses.

Some flooding problems occur where the public storm drain system is constructed across private property and buildings, residential streets, and/or yards experience flooding. To resolve this type of problem, the City would first need to obtain easements from property owners to maintain or upgrade the system. Specific problems of this type are shown on Table 5-2. In addition, problem 17 on Table 5-2 is intended to account for additional problems of this type that may be identified in the future.

Nuisance-type flooding, which would include areas where ponding occurs on the roadway shoulders, does not pose a public safety risk and would not impede the public's mobility. The public may be inconvenienced in areas where the roadway shoulders are used for parking, but this is not seen as a high priority for the City. This Plan does not address nuisance flooding problems.

As shown on Table 5-2, there are several areas in the City where homes are frequently flooded and it is important to the City and the public that these problems be addressed. Two main flooding problem areas that the City has identified and already begun working to solve are the Ronald Bog subbasin in the Thornton Creek Basin and the 3rd Avenue NW subbasin in the Boeing Creek Basin (see Figure 2-1). Residents of the Ronald Bog subbasin have experienced frequent flooding of arterials, streets, yards, and homes. Over 20 residents between 3rd and 6th Avenues NW have also experienced frequent flooding during moderate storms. The various problems in these two areas are summarized as problems 1 through 5 and problems 11 and 12. The City's efforts to develop solutions for these problem areas are discussed in Section 5.2 of this chapter.

**Table 5-2
Flood Protection Problems**

Problem ID	Basin	Problem Area	Problem Description	Reference
1	Boeing Creek – 3rd Ave Drainage Subbasin	3rd Ave NW and NW 185th St	Yard and driveway flooding is experienced annually at at least 5 properties south of NW 185th St, 3 properties along the north side of NW 185th St, and at least 1 property upstream of NW 185th St (all near 3rd Ave NW). One of these properties on NW 185th St also experiences garage flooding.	Shoreline 2004b; Shoreline 1998; R. W. Beck field visit; Surface Water Database; City staff
2	Thornton Creek	NE 175th St and 10th Ave NE	NE 175th St used to overtop annually near the intersection with 10th Ave NE. King County installed a detention pipe downstream of the intersection, but the result has been the flooding of adjacent properties, including structures, yards, and driveways. Specifically, a property owner on 11th Ave NE just downstream of the NE 175th St and 10th Ave NE intersection experiences structure, yard, and driveway flooding many times per year.	Tetra Tech/KCM 2004c; R. W. Beck field visit; Northwest Engineering Company 1986; Otak 2001e; City staff; Customer Request
3	Thornton Creek	12th Ave NE and 11th Ave NE between NE 175th St and NE 170th St	Flooding occurs along 11th and 12th Ave NE between NE 175th St and NE 170th St where there is no formal drainage system. An old creek bed between properties conveys flows, but there are no pipes. The roadway elevation is significantly higher than many of the properties, which results in yard and structure flooding.	City staff; R. W. Beck field visit
4	Thornton Creek	Ronald Bog – Corliss Ave N at N 172nd St	The outflow pipe has inadequate capacity, is at reverse grade, and is in poor condition. This contributes to the flooding of as many as 5 downstream properties. Up to 20 homes have had damage in major storm events. Ronald Bog, Twin Ponds, and Peverly Pond do not provide adequate storage volumes to prevent downstream flooding during high-flow events.	City staff; Shoreline 2004b; Tetra Tech/KCM 2004c; Rasmussen & Huse 1987; R. W. Beck field visit; Otak 2001e

**Table 5-2
Flood Protection Problems**

Problem ID	Basin	Problem Area	Problem Description	Reference
5	Thornton Creek	N 175th St/N 178th St at Serpentine Place near 5th Ave NE	The neighborhood west of 5th Ave N and north of Serpentine Place drains to a closed depression on the 2nd Place cul-de-sac where Pump Station No. 25 is located. Stormwater is pumped to an elevation 20 feet above the pump to discharge to the system on 5th Ave N, which then connects to the system on NE 175th St. During high-flow events, the 5th Ave N system overflows and water flows back down 5th Ave N and N 178th St to the low point at the pump station. Structure flooding is frequent, as is yard and driveway flooding. Additionally, the pump is old and is often submerged. Under these conditions the pump cannot operate because it is not a submersible pump.	Shoreline 1998; Rasmussen & Huse 1987; Rasmussen & Huse 1986; Otak 2001e; City staff
6	Boeing Creek	Midvale Ave N and N 178th St (problems extend from N 180th St to N 183rd St as well)	Flooding of apartment complex parking area and building near Midvale Ave N and N 178th St, and extending from N 180th St to N 183rd St as well. There is an existing detention facility underground in this area, but it may not have sufficient volume to store flood waters.	Shoreline 1998; City staff
7	Boeing Creek	N 165th St and Stone Ave N	Three to five homes along N 165th St near Darnell Park and the intersection with Stone Ave N experience structure, yard, and driveway flooding. The N 165th St roadway also floods. The system has insufficient capacity. Flow is conveyed across N 165th St through a 24-inch-diameter pipe (including two 90-degree bends) which discharges to Darnell Park. The park acts as a detention facility during some flow events, but does not have a large storage volume. The discharge pipe from the park is 18 inches in diameter and water	Brown and Caldwell 1979; Tetra Tech/KCM 2004a; Otak 2001c; Private property owner; City staff

**Table 5-2
Flood Protection Problems**

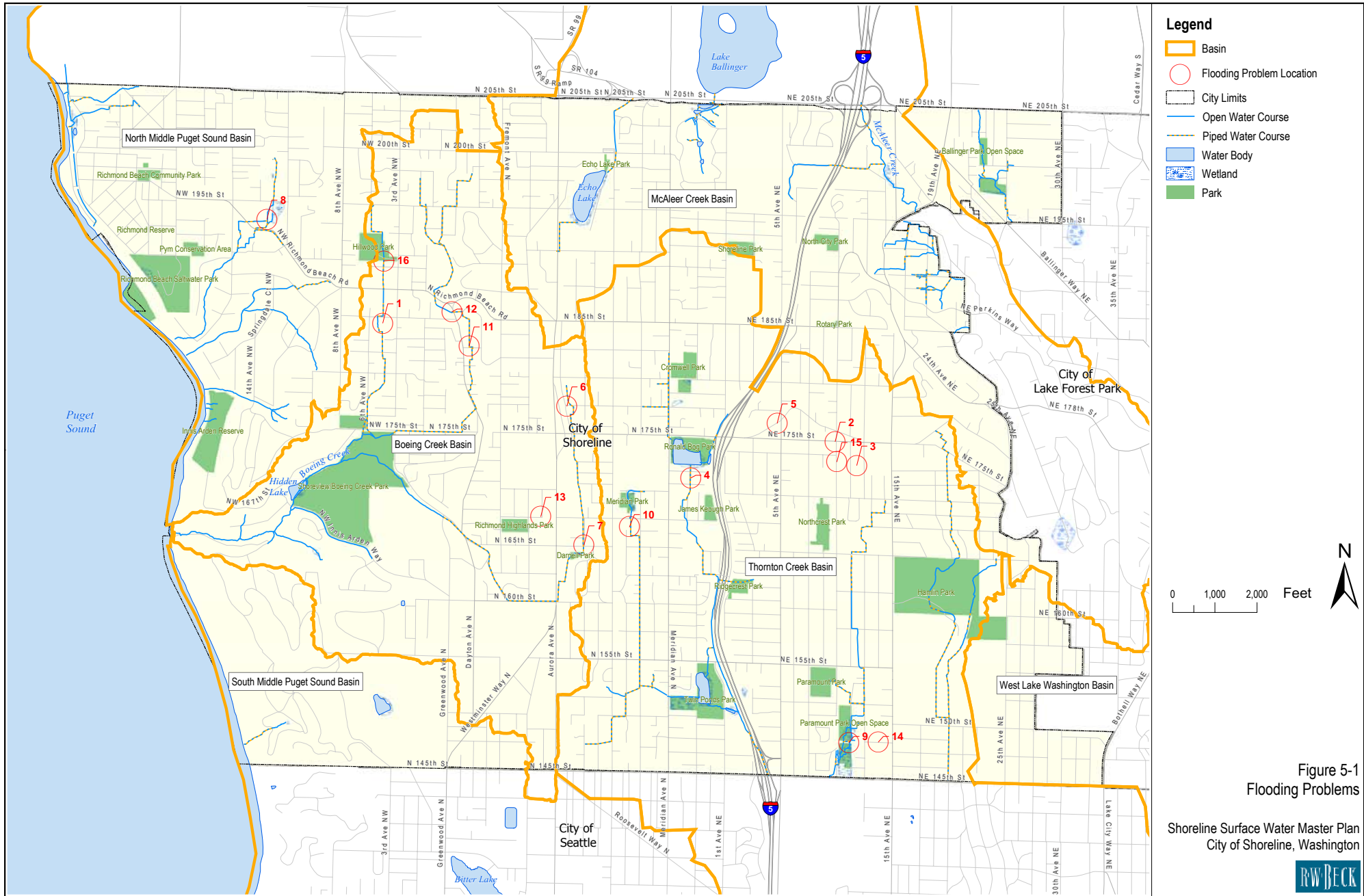
Problem ID	Basin	Problem Area	Problem Description	Reference
			backs up behind this pipe, through the park, and up to the property owners. Limited modeling and hydraulic calculations have been performed for the City. At one time, this project was part of the Small Projects Program, but the scope became too large for that program.	
8	North Middle Puget Sound	NW Richmond Beach Rd near NW 191st St (Storm Creek)	Flooding of apartment units and parking lot on NW Richmond Beach Rd near NW 191st St. Channel overtopping south of Richmond Beach Rd as well. Primarily caused by plugged pipes and inadequate conveyance capacity.	Foley 1993; Tetra Tech/KCM 2004b; City staff
9	Thornton Creek	12th Ave NE (near NE 148th St); also up to NE 155th St and NE 162nd St	Multiple properties experience yard flooding and one property experiences basement flooding on 12th Ave NE near NE 148th St and also up to NE 155th St and NE 162nd St. The problem results from an undersized open channel and pipe system. City staff indicate the system is old and not performing optimally. This problem is primarily a private property issue, but there are multiple flooding problems further upstream and this area is at the downstream end of the drainage basin.	Shoreline 1998; Otak 2001d; City staff
10	Thornton Creek	N 167th St to N 165th St between Wallingford Ave N and Ashworth Ave N	Flooding results from lack of drainage system in the vicinity of N 167th St to N 165th St between Wallingford Ave N and Ashworth Ave N. Wetland area in Meridian Park is partially drained through piping to just south of N 167th St between Wallingford Ave N and Ashworth Ave N. Piping ends on property at end of private road, causing structure, yard, and driveway flooding of two homes and other properties on west side of Wallingford Ave N to N 165th St.	City staff

**Table 5-2
Flood Protection Problems**

Problem ID	Basin	Problem Area	Problem Description	Reference
11	Boeing Creek – Dayton Ave Drainage Subbasin	Dayton Ave and N 183rd St	Structure, roadway, and private property flooding in the vicinity of Dayton Ave and N 183rd St.	Shoreline 1998
12	Boeing Creek – Dayton Ave Drainage Subbasin	Downstream of Pan Terra Pond	Structure, roadway, and private property flooding downstream of Pan Terra Pond.	Tetra Tech/KCM 2004a
13	Boeing Creek	N 167th St – Also general flooding around N 167th St and Whitman Ave N	Flooding of yards and driveways at several single-family homes and two apartment complexes, as well as residential roadways on N 167th St and in the general vicinity of N 167th St and Whitman Ave N. A large drainage area flows along N 167th St to the intersection with Whitman Ave N and then south between properties bordering Aurora Ave N and Linden Ave N. An existing ditch that has been filled in by a property owner causes flooding by preventing the water from draining. There is an enforcement issue here that was referred to Planning and Development Services (PADS). PADS required pipe work as condition of building permit. This was supposed to have been done last year but nothing has been done to date and property owner now has a used car lot on property.	Surface Water Database; City staff
14	Thornton Creek	NE 148th St	Flooding in roadway shoulder and front yard area of apartment complex on NE 148th St, apparently due to an infiltration system failure.	Otak 2001a; City staff

**Table 5-2
Flood Protection Problems**

Problem ID	Basin	Problem Area	Problem Description	Reference
15	Thornton Creek	Ridgecrest at 10th Ave NE near NE 174th St	Flooding of structures, yards, and streets resulting from limited capacity of existing drainage system. Approximately 3 to 4 homes are affected on 10th Ave NE near NE 174th St.	City staff
16	Boeing Creek	Hillwood Park near 3rd Ave NW	Homes on 3rd Ave NW flood during high-flow events. The City currently uses sump pumps to redirect overflow into Hillwood Park, but a more permanent solution is desired.	City staff
17	Various	Various	Public storm drains constructed across private property cause yard and residential roadway flooding. These problems may not have been specifically identified yet.	City staff



5.3 Proposed Flood Protection Projects and Programs

5.3.1 Priority Levels

Consistent with existing and proposed goals and policies, three priority levels for flood protection have been identified by the City in order to prioritize flood protection projects presented in this Plan. This chapter describes the three priority levels and the projects for each priority level which provide solutions to flooding problems identified in the previous section, along with estimated project costs. The project descriptions and benefits are also summarized. Related programs and program costs are discussed in Chapter 8, and more detailed cost estimates for projects and programs are provided in Appendix D. As discussed in Section 1.5 of this Plan, these projects and programs will be phased over time in accordance with their priority level.

5.3.2 Project Development and Cost Estimates

5.3.2.1 Project Development

Project solutions were developed for the problems summarized on Table 5-2. The City then assigned each project to a priority level. The projects for Priority Levels 1, 2, and 3 are listed on Tables 5-3, 5-4, and 5-5, respectively. This section describes how projects were developed. Projects related to two main flooding areas—Ronald Bog subbasin and 3rd Avenue NW subbasin—were developed as part of previous study or design efforts. All solutions developed for these two priority areas were incorporated into this Plan without further analysis.

Conceptual project solutions were developed for other problems based on previous studies, a brief field reconnaissance, and other information provided by the City (including GIS information showing a current inventory of the existing storm drain system as well as drainage basin delineations and topographic information). The development of a conceptual project solution began with a review of the area around the problem to determine if land was available to locate a detention pond, or whether there was an opportunity to enlarge an existing pond. If neither of these options would be possible, it was assumed that the City preferred not to construct detention vaults and therefore, a conveyance improvement was assumed. Typically, these projects included upsizing an existing piping system or adding a new pipe system where one currently does not exist. Pipe sizes were assumed based on the sizes of adjacent or existing pipe systems. In addition, it was assumed that a downstream analysis would be completed prior to implementation of any conveyance improvement project to confirm that the project solution would not increase downstream flows significantly, thereby causing or exacerbating downstream flooding problems. The tables note any previous evaluation or study that was done for problems or projects. In a few cases, the City requested certain projects be added to the lists, and these are later in this chapter.

No hydrologic analysis, hydraulic analysis, survey, or technical engineering analysis was performed when developing any of these conceptual solutions. It was beyond the scope of work of this Plan to complete detailed modeling analysis. Therefore, the first step in implementing these solutions will be to do the necessary engineering in order to confirm all assumptions and confirm any preliminary design information. In general, these projects will require hydrologic modeling to determine frequency of flood events and hydraulic modeling to evaluate the extent and frequency of flooding under existing and future conditions. This will provide an assessment of the capacity and operation of the existing systems. Hydraulic

models can be used to conduct part of the downstream analysis, as well as to size improvements based on the level of protection that can be achieved.

It is recommended that all projects be designed to provide 100-year storm event level of protection. However, it is recognized that in some locations, it may be cost-prohibitive or physically impossible to provide this degree of protection. The City will determine the level of protection to be provided on a case-by-case basis for each project.

Projects have been developed (either for this Plan or in previous studies) for all of the problems listed on Table 5-2 with one exception. Problem 14 on NE 148th Street has been evaluated in great detail by the City and it has been concluded that little can be done to solve this flooding problem. The City should consider this project if any improvements are constructed along 15th Avenue NE in the future. If so, it may be possible to lower the catch basins on 15th Avenue NE so that the drainage from this property can be picked up. In addition, it may be possible to pipe the drainage to the south through other properties until it can be connected to an existing system at a lower elevation. It is not recommended that the City study this problem at this time because improvements here would be very costly and would benefit only one property owner.

5.3.2.2 Cost Estimates

Planning-level cost estimates are provided for new projects developed for this Surface Water Master Plan. These costs are shown in Tables 5-3, 5-4, and 5-5 and details on these cost estimates are included in Appendix D. The tables in this chapter also present cost estimates (adjusted to 2004 dollars) published in prior studies for projects where the solutions were already developed by others. In addition, some cost estimates shown in the tables were provided by the City with no further backup, and some costs were developed as part of the Parks and Transportation Master Plans, as noted.

The cost estimates prepared for this Plan include an item for preliminary engineering, which is intended to include the necessary study, modeling and analysis, downstream analysis, and survey that would be required prior to design. The status of existing easements and the need for new easements was not determined for this Plan. Assumptions about costs for easements are shown in the detailed cost estimates in Appendix D.

Costs are also allocated to each priority level for flood protection maintenance activities. These program activities are discussed in Chapter 8 and include maintenance of new conveyance and detention facilities, catch basin cleaning, periodic inspections, vegetation management and minor repairs, and additional ditch reshaping. The maintenance costs for priority levels 1 and 2 also include an allocation for maintaining public storm drains that are constructed across private property. The assumptions for determining the maintenance costs for this undefined inventory are discussed in Chapter 8 as well.

5.3.3 Flood Protection Priority Level 1: Critical Projects and Programs

Flood protection Priority Level 1 includes projects that are deemed critical because they will improve public safety and reduce property damage. The City plans to implement these projects within the next six years. Most of the projects at this priority level are projects for which funding already exists and/or the design has already been started. Achieving this priority level would largely prevent or minimize structure damage and flooding of principal, minor, and collector arterials and would promote public safety and mobility.

5.3.3.1 Priority Level 1 Projects

Table 5-3 presents summaries of the Priority Level 1 projects. Projects F-1 and F-2a through f were developed as part of previous study or design efforts, as noted on the table,

to address problems 1 through 5 and problems 11 and 12 (see Table 5-2). Conceptual project solutions F-3 and F-4 were developed as part of this Surface Water Master Plan to address problems 6 and 7, respectively.

The City has decided to proceed with one early action project in the Ronald Bog subbasin and one project in the 3rd Avenue NW subbasin in order to provide some flood protection to the public quickly. These projects are listed in Table 5-3 as the 3rd Avenue NW drainage improvements (project F-1) and the Serpentine Place storm drainage improvements (project F-2f). As of November 1, 2004, design of project F-1 is completed and construction will begin by the end of the year; and construction of project F-2f is nearly completed. Projects F-2a through e are expected to be completed within the next six years.

The rest of the projects included under Priority Level 1 are included at the City's request as they are projects that the City is currently funding or otherwise developing. The City has added the Hillwood Park emergency bypass project (project F-9), which is intended to provide additional conveyance capacity and detention during high-flow events to address problem 16. The City has also added the Ridgecrest Drainage at 10th Avenue NE project (project F-13), which involves acquiring property and building a water quality/detention pond to solve flooding problems in the neighborhood (problem 15).

The SWM CIP Formulation category, shown on Table 5-3 as project F-14, includes an annual budget set aside by the City to perform initial engineering conceptualization as capital projects rise in their priority level and imminent implementation. Also included is a Surface Water Small Projects category (project F-15), which includes an annual budget to respond to calls from residents and businesses reporting local infrastructure failure, and any occurrences of flooding and/or property damage. These two lines (projects F-14 and F-15) are also included in Priority Levels 2 and 3 because these are budget items intended to fund unspecified projects over the 20-year period and beyond.

Finally, Table 5-3 includes categories for parks projects (project F-16) and for transportation projects (project F-17) that are intended to cover the stormwater components of miscellaneous parks projects and transportation projects categorized under Priority Level 1. This includes instances in which the City may use drainage funds to pay for the drainage elements of parks or transportation projects. In addition, any new drainage systems constructed as a component of transportation projects would need to be maintained under the surface water management program, as discussed in Chapter 8. In some cases, it is possible that a transportation project would be constructed that includes a drainage component, but for which no drainage funding is used for construction. These systems would still need to be maintained under the surface water management program. Chapter 8 discusses this issue in relation to the Aurora Corridor project. For more information on projects F-16 and F-17, please refer to the Parks and Transportation Master Plans.

5.3.3.2 Cost Estimates for Priority Level 1 Projects

Table 5-3 presents cost estimates (adjusted to 2004 dollars) that were published in prior studies for the Ronald Bog and 3rd Avenue NW projects. Planning-level cost estimates were developed as part of this Surface Water Master Plan for projects F-3 and F-4, and more information on these estimates is provided in Appendix D. The costs for projects F-13 through F-15 were provided by the City and no further backup is provided. Costs for projects F-16 and F-17 were developed as part of the Parks and Transportation Master Plans.

5.3.4 Flood Protection Priority Level 2: Improve Effectiveness of the Surface Water System

Flood protection Priority Level 2 includes projects that would improve the effectiveness of the City's surface water system. The City plans to implement these projects between years 7 and 20 of the 20-year planning period. In general, most of the projects in this priority level would prevent or minimize flooding and damage in structures, yards, driveways, and on residential streets, as well as further increasing public mobility by ensuring that residential roads are passable during flood events.

5.3.4.1 Priority Level 2 Projects

Table 5-4 presents summaries of the Priority Level 2 projects. Conceptual project solutions F-6a/b, F-7, and F-8 were developed as part of this Surface Water Master Plan to address problems 9, 10, and 13, respectively, from Table 5-2.

Also included on this table are projects F-18 and F-19, which include the stormwater components of miscellaneous parks and transportation projects, respectively, that are categorized under Priority Level 2. Please refer to the Parks and Transportation Master Plans for details on specific projects.

5.3.4.2 Cost Estimates for Priority Level 2 Projects

Table 5-4 presents planning-level cost estimates developed as part of this Surface Water Master Plan for projects F-6a/b, F-7, and F-8. More information on these estimates can be found in Appendix D. Costs for projects F-18 and F-19 were developed as part of the Parks and Transportation Master Plans.

5.3.5 Flood Protection Priority Level 3: Provide Additional Flood Protection Benefits

Flood protection Priority Level 3 includes projects that are deemed the lowest priority by the City. These projects would provide additional benefits to surface water conditions. In general, most of the projects in this priority level would prevent or minimize flooding and damage in yards, driveways, and on residential streets. Based on the recommended plan described in Chapter 9, the City will not be able to implement these projects in the next 20 years. Implementing these projects will likely require additional sources of funding such as grants, developer mitigation fees, or local improvement districts.

5.3.5.1 Priority Level 3 Projects

Table 5-5 presents summaries of the Priority Level 3 projects. Conceptual project solution F-5 was developed as part of this Surface Water Master Plan to address problem 8 from Table 5-2. Table 5-5 also includes projects F-20 and F-21, which include the stormwater components of miscellaneous parks and transportation projects, respectively, that are categorized under Priority Level 3. Please refer to the Parks and Transportation Master Plans for details on specific projects.

5.3.5.2 Cost Estimates for Priority Level 3 Projects

Table 5-5 presents planning-level cost estimate developed as part of this Surface Water Master Plan for project F-5. More information on this estimate can be found in Appendix D. Costs for projects F-20 and F-21 were developed as part of the Parks and Transportation Master Plans.

**Table 5-3
Flood Protection Priority Level 1 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost^a
Projects						
F-1	Boeing Creek	3rd Ave NW Drainage Improvements	Construction of new conveyance system down 3rd Ave NW and construction of pump station at Dayton Ave N and NW 185th St near Pan Terra Pond, which will collect runoff from north of NW Richmond Beach Rd and pump it back to the 3rd Ave NW system.	Promotes public safety and mobility by alleviating roadway flooding. Reduces property damage by alleviating structure flooding. Also reduces yard, driveway, and residential roadway flooding.	1, 11, 12	\$3,670,451
F-2a	Thornton Creek	Thornton Creek Corridor (Ronald Bog Improvements) ^b	Construction of a new conveyance system or stream channel between Ronald Bog and the 170th Street right-of-way (would remove and replace existing 60-inch-diameter storm drain pipe). Would also likely upgrade existing open channel between the 170th Street right-of-way and NE 167th Street. The preliminary plans for this project were taken from "Ronald Bog Drainage Improvements, Phase 1: Thornton Creek Tributary Flood Reduction Study," (prepared by Otak, Inc., December 7, 2001). Since completion of this study the City has completed several capital and maintenance projects in the Ronald Bog/Thornton Creek drainage basin which necessitate a re-evaluation of the alternatives for the corridor between the outlet from Ronald Bog and N. 167th Street, including additional modeling of the basin.	Reduces property damage by alleviating structure flooding. Also reduces yard, driveway, and residential roadway flooding. Would also provide water quality and habitat benefit in the currently daylighted portion of the channel including downstream in the Twin Ponds area.	4	\$1,227,000
F-2b	Thornton Creek	Ronald Bog Park (Ronald Bog Improvements) ^b	Regrade existing wetland to enhance wetland and increase flood storage.	Detains flows to mitigate for development and reduces local flooding of multiple structures, yards, driveways, and roadways to reduce property damage and promote public mobility. Increases wetland habitat.	4	\$288,380
F-2c	Thornton Creek	Cromwell Park Wetland (Ronald Bog Improvements) ^b	Expand wetland in Cromwell Park to enhance wetland and increase flood storage.	Provides detention of flows to mitigate for other related projects and reduces local flooding of multiple structures, yards, driveways, and roadways to reduce property damage and promote public mobility. Increases wetland habitat.	NA	\$222,427
F-2d	Thornton Creek	Cromwell Park Pond (Ronald Bog Improvements) ^b	Modify detention at Cromwell Park by creating additional detention pond storage and creating an athletic field that provides overflow flood storage.	Provides detention of flows to mitigate for other related projects and reduces local flooding of multiple structures, yards, driveways, and roadways to reduce property damage and promote public mobility.	NA	\$243,607

**Table 5-3
Flood Protection Priority Level 1 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost^a
F-2e	Thornton Creek	Pump Station No. 25 (Ronald Bog Improvements) ^b	Replace pump and force main to provide additional pumping capacity.	Promotes public safety and mobility by alleviating roadway flooding. Reduces property damage by alleviating structure, yard, driveway, and roadway flooding.	5	\$142,855
F-2f	Thornton Creek	Serpentine Place Storm Drainage Improvements (Ronald Bog Improvements) ^b	Construction for this project is nearly complete as of Nov. 1, 2004. This is a revised version of the solution recommended in a previous study (Otak 2001e). The project includes 2,500 feet of 16-inch to 24-inch storm drainage piping and structures on Serpentine Place from NE 175th St to 5th Ave NE, on 10th Ave NE from NE 175th St to approximately 600 feet north of 175th, and on NE 175th St from 10th Ave NE to 12th Ave NE. The project also includes a new pump station on 5th Ave NE and NE 178th St that will collect the overflow from existing Pump Station No. 25 and pump it back into the system that flows to the new line on Serpentine Place.	Promotes public safety and mobility and reduces property damage. City staff expect this piece of the Ronald Bog project to reduce the existing flooding of 5 homes, 9 yards, and the roadways at the NE 175th St and 10th Ave NE intersection and at the 5th Ave NE and NE 180th St intersection at the 2-year and 25-year events. With these improvements in place, only 4 yards would flood and homes and roadways would not flood during the 2-year event. With the improvements in place, 3 homes, 7 yards, and the two roadway intersections would still flood. At some point, the City may consider buying homes that experience flooding as part of the Ronald Bog Improvements work. These improvements are also expected to provide relief to flooding on 11th and 12th Aves NE.	2,3,5	\$656,170
F-3	Boeing Creek	Midvale Ave N Drainage	It is assumed that no land is available for a detention pond. Therefore, the proposed solution involves a conveyance upgrade. The cost estimate assumes that 770 linear feet of existing pipe will be upsized to 18-inch-diameter (390 LF) and 24-inch-diameter (390 LF) corrugated polyethylene pipe from N 178th St down to N 175th St adjacent to Midvale Ave N. This pipe would be installed across several private properties.	Provides increased conveyance capacity to reduce local flooding of property and roadways to mitigate for development. Promotes public safety and mobility and reduces property damage.	6	\$415,000

**Table 5-3
Flood Protection Priority Level 1 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost^a
F-4	Boeing Creek	Darnell Park Neighborhood Drainage	<p>The proposed solution in this area incorporates three recommendations from a previous study (Otak 2001c) that were recommended for further study. This problem was studied as part of the Small Projects Program, but was determined to be out of the scope of that program. The first recommendation in the proposed solution assumes that the pipe downstream of Darnell Park would be upsized to 24 inches in diameter and a flow-control device would be installed to limit downstream flows. The second recommendation in the proposed project includes excavating Darnell Pond by approximately 3 feet to increase the storage capacity and water quality potential. This could provide approximately 1700 cubic yards of storage. The third recommendation is to replace and upsize the pipe system under N 165th St near Stone Ave N to a 36-inch-diameter corrugated polyethylene pipe, and to lower the discharge elevation into the pond. This work would be constructed partially on private property.</p> <p>(If any part of these recommendations are determined to be infeasible based on further study, there may still be a possibility to purchase undeveloped property near Stone Ave N and N 167th St for a detention facility.)</p>	Provides increased detention and conveyance capacity to promote public safety and mobility and reduce property damage by alleviating structure, yard, driveway, and residential roadway flooding. Water quality benefits for this project could also benefit the Aurora Corridor Project.	7	\$749,000
F-9	Boeing Creek	Hillwood Park Emergency Bypass	Construction of a new conveyance system along 3rd Ave NW that will serve as an emergency overflow bypass during high-flow events and direct flow into Hillwood Park. This project also includes excavation of a section of Hillwood Park to provide detention.	Provides increased detention and conveyance capacity to reduce property damage by alleviating structure, yard, driveway, and residential roadway flooding.	16	\$250,000
F-13	Thornton Creek	Ridgecrest Drainage at 10th Ave NE	Property acquisition and water quality/detention pond design and construction.	Detains flows to mitigate for development and reduces local flooding of multiple structures, yards, driveways, and roadways to reduce property damage and promote public mobility. Provides water quality benefits.	15	\$600,000
F-14 ^c	Various	SWM CIP Formulation (years 1–6)	As CIPs rise in their level of priority and imminent implementation, this funding provides for initial engineering conceptualization.	Benefits will be specific to each project.	Various (including 17)	\$240,000
F-15 ^c	Various	Surface Water Small Projects (years 1–6)	Provides funding for small community projects that become a high priority as localized infrastructure fails, causing flooding and property damage. Projects will be developed in response to problems reported by residents and businesses.	Benefits will be specific to each project.	Various (including 17)	\$900,000

**Table 5-3
Flood Protection Priority Level 1 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost^a
F-16	Various	Park Projects – Priority Level 1	Stormwater components of miscellaneous parks projects. Details of the projects to be determined during design of parks projects. See Parks Master Plan for additional information.	Benefits will be specific to each project.	Various	\$100,000
F-17	Various	Transportation Projects – Priority Level 1	Stormwater components of miscellaneous transportation projects. Details of the projects to be determined during design of transportation projects. See Transportation Master Plan for additional information.	Benefits will be specific to each project.	Various	\$2,080,000
Total Capital Project Costs						\$11,784,890
Programs						
See Chapter 8.						

- a. Cost estimate provided from another source for project F-1 was adjusted according to ENR Construction Cost Index in order to present the cost in 2004 dollars. The ENR index for June 2003 was 6694 and for January 2004 is 6825, so the cost was multiplied by a factor of 1.0196. Costs for F-2 were likewise adjusted. The ENR index for December 2001 was 6390. These costs were multiplied by a factor of 1.0681.
- b. Ronald Bog Improvements are summarized from *Ronald Bog Drainage Improvements, Phase I - Thornton Creek Tributary Flood Reduction Study*, prepared by Otak, Inc., December 2001. Cost estimates presented on this table are the high-end estimates from the report adjusted as noted. (With the exception of Serpentine Place Storm Drainage Improvements, which is under construction.)
- c. Cost is the total cost over the 6-year period.

**Table 5-4
Flood Protection Priority Level 2 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost
Projects						
F-6a	Thornton Creek	Ridgecrest Drainage at 12th Ave NE	Two alternatives are presented in this table for this problem area. It is assumed that the solution to this problem will only address the local issue and will not address a basinwide solution in the area. The first solution is based on the high-flow bypass option presented in a previous study (Otak 2001a). Several alternatives were briefly presented in the Otak study as part of the Surface Water Small Projects Program, but this project was later determined to be out of the scope of that program. It is assumed that this solution would include the installation of 820 linear feet of 24-inch-diameter corrugated polyethylene pipe to serve as a high-flow bypass from the flooded property downstream to the existing surface water management facility in the park. This pipe would be installed across several private properties along NE 150th Court and then adjacent to 12th Ave NE.	Provides increased conveyance capacity for high flows to mitigate for development. Promotes public safety and mobility and reduces property damage.	9	\$436,000
F-6b	Thornton Creek	Ridgecrest Drainage at 12th Ave NE (Alternative 2 cost is not included in total)	The second proposed alternative for this problem involves purchasing the flooded property on 12th Ave NE. This solution could include creation of a water quality pond. There is not enough headroom to create a detention facility on this site.	Eliminates property and building flooding problem. Provides water quality benefits.	9	\$325,000
F-7	Thornton Creek	N 167th St and Wallingford Ave N Drainage	This solution assumes replacement of 750 linear feet of existing pipe with 18-inch-diameter corrugated polyethylene pipe. This pipe would be installed across several private properties adjacent to Wallingford Ave N from N 167th St to N 165th St.	Provides increased conveyance capacity for high flows to mitigate for development. Promotes public safety and mobility and reduces property damage.	10	\$326,000
F-8	Boeing Creek	N 167th St and Whitman Ave N Drainage	City staff generally consider this problem to be a private property issue. A remedy to the problem may include following up on code enforcement under the Small Projects Program. However, for planning purposes, it is assumed that the City would install 780 linear feet of 12-inch-diameter (630 LF) and 18-inch-diameter (150 LF) corrugated polyethylene pipe. This pipe would be installed across several private properties from N 167th St to N 165th St.	Provides increased conveyance capacity of flows to reduce yard, driveway, and residential roadway flooding.	13	\$242,000
F-14 ^a	Various	SWM CIP Formulation (years 7–12)	As CIPs rise in their level of priority and imminent implementation, this funding provides for initial engineering conceptualization.	Benefits will be specific to each project.	Various (including 17)	\$240,000

**Table 5-4
Flood Protection Priority Level 2 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost
F-15 ^a	Various	Surface Water Small Projects (years 7–12)	Funding for small community projects that become a high priority as localized infrastructure fails, causing flooding and property damage. Projects will be developed in response to problems reported by residents and businesses.	Benefits will be specific to each project.	Various (including 17)	\$900,000
F-18	Various	Park Projects – Priority Level 2	Stormwater components of miscellaneous parks projects. Details of the projects to be determined during design of parks projects. See Parks Master Plan for additional information.	Benefits will be specific to each project.	Various	\$350,000
F-19	Various	Transportation Projects – Priority Level 2	Stormwater components of miscellaneous transportation projects. Details of the projects to be determined during design of transportation projects. See Transportation Master Plan for additional information.	Benefits will be specific to each project.	Various	\$5,950,000
Total Capital Project Costs						\$8,444,000

Programs

See Chapter 8.

a. Cost is the total cost allocated for miscellaneous projects over years 7 to 20 of the 20-year planning period.

**Table 5-5
Flood Protection Priority Level 3 Projects and Programs**

ID	Basin	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost
Projects						
F-5	North Middle Puget Sound	Meadowbrook Neighborhood Drainage	According to the City, this problem is primarily a private property issue at the apartment complex. However, for planning purposes, it is assumed that the City would construct a bypass pipeline along NW Richmond Beach Rd and then south down 15th Ave NW as suggested in a previous study (Foley 1993). The cost estimate includes costs for 1850 linear feet of 36-inch-diameter pipe to serve as a high-flow bypass. This solution is conservative, as it assumes that downstream channel upgrades (a less costly fix) would not be sufficient to handle any flow increases resulting from conveyance improvements made on the private property in the future. It is also assumed that the City would not further evaluate the possibility of buying the O'Neil property, which is located upstream of the problem area, as was recommended in the 1993 study, due to the steep slope of the property and its proximity to a wetland.	Provides increased conveyance capacity for high flows to mitigate for development. Promotes public safety and mobility and reduces property damage.	8	\$1,257,000
F-14 ^a	Various	SWM CIP Formulation (years 13–20)	As CIPs rise in their level of priority and imminent implementation, this funding provides for initial engineering conceptualization.	Benefits will be specific to each project.	Various (including 17)	\$320,000
F-15 ^a	Various	Surface Water Small Projects (Years 13–20)	Funding for small community projects that become a high priority as localized infrastructure fails, causing flooding and property damage. Projects will be developed in response to problems reported by residents and businesses.	Benefits will be specific to each project.	Various (including 17)	\$1,200,000
F-20	Various	Park Projects – Priority Level 3	Stormwater components of miscellaneous parks projects. Details of the projects to be determined during design of parks projects. See Parks Master Plan for additional information.	Benefits will be specific to each project.	Various	\$170,000
F-21	Various	Transportation Projects – Priority Level 3	Stormwater components of miscellaneous transportation projects. Details of the projects to be determined during design of transportation projects. See Transportation Master Plan for additional information.	Benefits will be specific to each project.	Various	\$2,650,000
Total Capital Project Costs						\$5,597,000
Programs						
See Chapter 8.						

a. Cost is the total cost allocated for miscellaneous projects beyond the 20-year planning period.

5.4 References

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Chapter 6. Water Quality

6.1 Introduction

The water quality assessment that was performed for this Surface Water Master Plan represents a limited evaluation of the existing water quality within the City of Shoreline. This evaluation is based on the 1998 Shoreline Comprehensive Plan, input from public meetings and the planning commission work group and interviews with City staff. This input emphasizes resolution of water quality problems in the City based on a system that requires the City to first meet regulatory requirements and then to take steps to improve degraded waters. Policy LU140 directs the City to “maintain surface water quality as defined by federal and state standards and [to] rehabilitate degraded surface water through reduction of non-point source pollution, erosion control, and the development of stormwater system improvements.” Policy LU151 directs the City to take a “leadership role in protecting water quality through regulation, educational outreach, and by adhering to state and federal environmental standards in all City funded projects.” A summary of surface water quality policies is provided in Table 6-1.

A discussion of surface water quality problems typically found in urbanized areas is presented in this chapter. No field reconnaissance was conducted as part of this assessment. This assessment identifies surface water quality improvement programs and projects the City plans to implement in the 20-year planning period.

6.2 Identified Water Quality Problems

6.2.1 Surface Waters

Portions of Thornton Creek, Lyon Creek, and McAleer Creek are listed on the Washington Department of Ecology’s (Ecology’s) section 303(d) list of impaired and threatened water bodies for fecal coliforms. Impaired waters are those not meeting state water quality standards. Water bodies on Ecology’s 303(d) list are selected for further studies referred to as total maximum daily load (TMDL) determinations. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. Section 303 of the federal Clean Water Act establishes the water quality standards and TMDL programs. Water quality standards identify the uses for each water body (for example, drinking water supply, swimming, and fishing) and the scientific criteria to support those uses.

A TMDL study includes a problem formulation and an analysis of how to control the discharge of particular pollutants to surface waters. TMDL studies have not yet been completed by Ecology for these three listed waters as of the date of this Surface Water Master Plan. The City should keep abreast of any new TMDL plans for these waters and determine if the plans require specific actions that affect the City.

**Table 6-1
Water Quality–Related Goals and Policies
from the 2005 Comprehensive Plan**

2005 Comprehensive Plan Goals and Policies	Direction Given to Surface Water Management Program
Goal LU XVII Policies LU140, LU141, LU142, LU143, LU144, LU146, LU147, LU148, LU149, LU150, LU151, and LU135	<ul style="list-style-type: none"> ▪ Manage the storm and surface water system through a combination of engineered solutions, the preservation of natural systems, and public education in order to provide for public safety; prevent property damage; protect water quality; preserve and enhance fish habitat and critical areas; and maintain a hydrologic balance. ▪ Maintain surface water quality as defined by federal and state standards. ▪ Rehabilitate degraded surface water by reducing nonpoint source pollution, controlling erosion, and improving the stormwater system. ▪ Actively pursue state and federal grants to improve surface water management and water quality ▪ Support the use of appropriate landscaping, swales, “green street” improvements, retention facilities, and treatment facilities to enhance water quality and the percolation of water at natural rates near its source to limit soil instability or damage to roadways or other improvements. ▪ Sweep streets to reduce pollutants entering the stormwater drainage system ▪ Educate citizens about proper waste disposal. Prevent direct disposal into storm drains. ▪ Promote practices that prevent pollutants from entering the stormwater system as a result of lawn and garden maintenance, car cleaning or maintenance, and roof cleaning or maintenance. ▪ Maintain and enhance natural drainage systems. ▪ Identify the City as the responsible party for maintaining stormwater systems in City right-of-way to prevent flooding. ▪ Identify private property owners as the responsible party responsible for maintenance of their own systems to prevent flooding on their land. ▪ Cooperate with other jurisdictions and agencies to improve regional surface water management, protect water quality, and resolve related inter-jurisdictional concerns. ▪ Design and construct water quality projects to solve existing water quality problems, but also to provide additional benefits to the extent possible that meet goals, policies, and community needs expressed for flood protection and habitat. ▪ Pursue funding to conduct baseline monitoring and improvement of water quality in lakes and streams in the City. ▪ Protect surface and ground water quality through regulation and educational outreach. ▪ Adhere to state and federal environmental standards in all City-funded projects. ▪ Work with neighboring communities to improve water quality and stream habitat in basins that share interjurisdictional boundaries.

The City is currently on the state's list of proposed jurisdictions that need to obtain a National Pollutant Discharge Elimination System (NPDES) Phase II stormwater permit. The City will need to obtain coverage under a NPDES Phase II stormwater general permit. As discussed in Chapter 3, the final general permit for Phase II permittees has not yet been issued by Ecology, so the specific requirements are unknown, but the City has already submitted its application in accordance with the deadline stipulated in the Federal Rule. Based on minimum requirements in the Federal Rule, it can be assumed that the City will need to have programs in place to requiring pre- and post-construction best management practices (BMPs), provide public involvement and education, and provide maintenance of stormwater facilities. Also, enforcement of TMDLs through the NPDES Phase II program for improved nonpoint source pollution prevention would most likely be required.

Urbanization has resulted in modifications to area creeks and this has led to erosion, increased temperature, and other water quality problems. Much of the City's system conveys untreated runoff from roadways and other developed areas directly to water bodies, allowing sediment, oil and grease, and other roadway pollutants to drain directly to Hidden Lake, Twin Ponds, Echo Lake, Lake Washington, and Puget Sound. Cost estimates for projects and programs to improve water quality are given in Tables 6-2, 6-3, and 6-4 later in this chapter.

6.2.2 General Water Quality Problems

Urban development can lead to a wide range of water quality problems resulting from a variety of common development activities. Water quality problems in the vicinity of Shoreline are typical of problems encountered in other urban areas. Surface water in the City generally flows overland, collecting in small roadside ditches and traveling to storm drain inlets, streams, or other waterways, which lead to Puget Sound or Lake Washington. The quantity of runoff from rainfall, flooding, the erosion of soils and stream channels, and the transport of nonpoint source pollutants all are factors in the decline of water quality in an urban watershed. Nonpoint source pollution is pollution that is generated on the land surface over a large area that then washes off into the storm drainage system during storm events. Examples of nonpoint source pollutants include chemical contamination from automobiles and machinery operation (e.g., oil, grease, hydraulic fluids, and heavy metals), erosion and sediment transport from disturbed soils (sediment and nutrient loading), and nutrient and biological pollution from domestic pets (e.g., phosphorus and fecal coliform bacteria).

Although provisions for water quality treatment and protection facilities are now required as part of new developments, much of the existing development in the City occurred before stormwater treatment requirements were established. Thus, runoff from most of the existing developed areas in the City receives little or no treatment before it reaches the nearest waterway.

General water quality problems have been divided into the following five categories, each of which is discussed in detail below, followed by water quality improvement projects and programs.

- Nonpoint source pollution from impervious surfaces
- Nonexistent or inadequate stormwater treatment facilities
- Erosion and sediment transport from disturbed areas
- Pollutant inputs from residences
- Accidental or intentional discharge of chemical contaminants.

6.2.2.1 Nonpoint Source Pollution from Impervious Surfaces

Development and urbanization inevitably result in increased impervious surface areas. At a minimum, impervious surfaces result in increased rates and volumes of stormwater runoff, resulting in the potential for increased erosion and scour in downstream waterways. In urban settings, impervious areas also provide a medium for the deposition and transport of common urban pollutants. Roadways collect tire fragments, oil and grease, heavy metals, sand and grit, and other contaminants generated from vehicular traffic. Parking lots and driveways also collect concentrated amounts of these pollutants as vehicles drip and deposit various automotive chemicals directly onto parking lot surfaces. Inevitably, stormwater runoff across roadways and parking lots entrains these pollutants and transports them to downstream receiving waters. To prevent water quality degradation, it is important that runoff from impervious surfaces receives some form of water quality treatment to remove pollutants to the maximum extent possible.

Most existing impervious areas within the City are contributing to cumulative water quality problems in the area. Runoff from all but the most recent developments receives little or no water quality treatment before being routed to downstream waters. Thus, pollutants deposited in these impervious areas can be entrained by stormwater and transported to the receiving water systems without any treatment to remove the contaminants. In addition, because water quality treatment does not remove 100 percent of all pollutants, even treated runoff from impervious surfaces carries some level of pollutant loads to receiving waters. As the City continues to redevelop, new water quality treatment facilities or other methods of preventing water quality degradation will be installed as a condition of many redevelopment projects. The new water quality treatment facilities will have a positive impact on surface waters, although the degree to which any specific water body water quality will be improved will depend on the timing, size, and number of redevelopment projects in a basin.

Water Quality Improvements

Effective methods of reducing the water quality impacts associated with impervious surfaces include implementing new and redevelopment standards that require water quality treatment, constructing water quality treatment and detention systems where possible, and implementing source control best management practices. Impervious surfaces are a necessary component of development, and many of the water quality problems associated with them can be mitigated with structural treatment measures and source controls to prevent pollutants from coming into contact with surface waters. The City is required to implement flow control and water quality treatment measures in accordance with the 1998 *King County Surface Water Design Manual* for any new or redevelopment projects to adequately manage stormwater from their sites to reduce impacts in downstream systems.

Public education also helps to control stormwater pollution. Efforts to improve public awareness of existing problems may help to reduce the deposition of pollutants on impervious surfaces and reduce impacts on receiving waters. For example, improving public awareness of the detrimental effects of allowing automotive fluids to be deposited onto roadways and parking lots could help to reduce impacts on streams and rivers.

Maintenance of stormwater facilities is important for improving water quality. For example, the City's regular maintenance of catch basins is an effective means of reducing stormwater pollution because it removes pollutants from these structures before they accumulate to the point that they get washed into receiving waters. Maintaining water quality treatment and detention systems also keeps them functioning properly. Maintenance of the City's system to improve water quality is discussed in Chapter 8 of this plan. The City also institutes a program requiring private drainage systems to be maintained. In accordance with the Puget

Sound Water Quality Management Plan and NPDES Phase II requirements, jurisdictions will be responsible for maintenance of the overall storm drain system. Since the City does not maintain all privately owned facilities itself, it implements a program requiring private property owners to maintain private facilities. The City has an inspection and enforcement program to ensure that facilities get maintained on a regular basis.

The City should stay abreast of current technological advances that might reduce the adverse effects of impervious surfaces. For example, studies have been conducted on the feasibility of constructing semi-pervious parking lot surfaces. These semi-pervious surfaces are more porous than concrete or asphalt and allow precipitation to infiltrate through them, thereby reducing runoff and pollutant transport. In addition, a variety of urban planning and design techniques are currently being explored that reduce the area of impervious surfaces in new developments, such as reduced street widths, landscaped cul-de-sacs, and placement of sidewalks on only one side of the street. Whenever feasible, these and other advances should be evaluated and included in development proposals that come before the City.

6.2.2.2 Nonexistent or Inadequate Stormwater Treatment Facilities

As noted earlier, many areas within the City of Shoreline were developed prior to the establishment of significant stormwater treatment requirements. These areas include roadways, parking lots, commercial areas, residential areas, and industrial areas constructed before stormwater treatment facilities were required. These areas typically generate pollutants that can adversely affect downstream receiving waters. Runoff from these areas is not treated, and any contaminants present in the runoff are transported directly downstream.

The lack of stormwater treatment systems in existing urban areas is one of the main contributors to surface water quality problems within the City. The most common occurrence is roadway and parking lot runoff that is collected in catch basins and conveyed directly to receiving waters without water quality treatment. The majority of the existing developed areas convey stormwater runoff in this manner, thereby generating a pollutant load on downstream waters.

Water Quality Improvements

One approach to improving water quality is to retrofit the existing stormwater systems to include water quality treatment measures. Although retrofitting existing systems is costly and therefore may not be the preferred course of action, new development in the City will present opportunities to retrofit existing drainage systems to protect water quality as part of larger development projects. As part of the mitigation requirements for new developments, the City requires developers to improve stormwater management systems where they are needed. The City is also requiring redevelopment projects to retrofit existing systems so they are now equipped with treatment systems.

BMPs that could be used to retrofit existing water quality controls include oil/water separators, oversized catch basins, wetponds, modifications to roadside ditches to provide water quality treatment, and construction of biofiltration swales and vegetative filter strips. For example, parking areas that currently have no water quality treatment facilities could incorporate oil/water separators. Roadways that receive sand and grit applications in the winter months should be fitted with oversized catch basins to help prevent these materials from being washed downstream. Roadside slopes and ditches could be retrofitted with vegetative filter strips and ditches could be reconstructed, similar to the City of Seattle's "SEA Street" project, to provide treatment for runoff that currently receives little or no

treatment. These individual improvements are generally minor but cumulatively would result in significant improvements compared to existing conditions.

These types of structural BMPs could be implemented on a case-by-case basis where City staff observe an opportunity to improve water quality. For systems within the public right-of-way, the improvements could be made using the system replacement budget identified in the proposed operation and maintenance (O&M) budget. This is further discussed in Chapter 8. For systems on private property, the City can work with the property owner first on a voluntary basis. If the water quality problem is very severe, the City can take additional steps to require improvements.

Future developments are not expected to cause significant long-term impacts on water quality in the area. In following the water quality requirements outlined in the *King County Surface Water Design Manual* (KCSWDM), many of the problems associated with new (or redeveloped) impervious surfaces will be addressed for new developments or redevelopment. Thus, the City should focus on addressing water quality problems associated with older roadways and existing developments. Nonetheless, allocating additional funds and personnel for enhanced maintenance of stormwater systems and ensuring that stormwater treatment systems are functioning properly would help to improve water quality in the City. This is discussed in more detail in Chapter 8.

6.2.2.3 Erosion and Sediment Transport from Disturbed Areas

Another common source of water quality impairment can be the erosion and transport of sediment from disturbed land. Excessive sediment loads can cause a variety of water quality and habitat problems, including turbidity violations, temperature increases, increased pollutant loads (i.e., pollutants bound to the sediments), and shifts in stream substrate composition with the potential for habitat impairment or losses. The primary cause of sediment transport is the disturbance of soils, usually for construction purposes, without effective measures to limit and control erosion of these disturbed soils.

The majority of the City is zoned for single-family residential use and has already been developed. The remaining area will probably be developed in the near future. Every new development is accompanied by temporary land disturbance that can cause erosion and lead to water quality pollution. Each time land is disturbed to provide for new development, the threat of erosion and sediment transport is introduced. Disturbed land can be exposed to wind and rain that can easily erode unprotected soils. Disturbed soils that are not properly covered and stabilized can result in significant sediment loads reaching downstream waters. Without the incorporation of settling basins, soil covering, filtration systems, or other measures to control the transport of these materials along the conveyance system, much of the eroded soil reaches downstream receiving waters, contributing to water quality and habitat impairment. Proper soil stabilization, combined with measures to limit the off-site transport of any eroded material, will greatly reduce the potential for erosion and water quality problems. In addition, construction activities can also generate other pollutants such as chemicals from fertilizers and pesticides, petroleum products, construction chemicals, and various solid wastes.

Water Quality Improvements

The best solution for erosion and sediment transport problems is to enforce the City's erosion control standards and BMPs. The City has adopted the temporary erosion and sediment control requirements as contained in the KCSWDM and this program could be improved by also informing and educating area contractors about the erosion control requirements. The enforcement of these standards is crucial. City staff should continue to review all stormwater pollution prevention plans and temporary sedimentation and erosion

control plans that are submitted with development applications, to ensure adequate water quality protection. In addition, the City needs to ensure that erosion control facilities are frequently inspected and that developers are held responsible for any failure to adhere to the approved plans.

6.2.2.4 Pollutant Inputs from Residences

Residential parcels are likely a significant source of water quality impairment within the waterways of the City of Shoreline. Many small sources can cumulatively contribute significant amounts of pollutants, including nutrients, oils and greases, sediments, organics, metals, pathogens, and bacteria. The main concerns associated with residential land result from chemical inputs from overfertilization, misuse of pesticides, domestic pet wastes, car washing, spills or improper disposal of hazardous wastes, and construction-related soil disturbance.

Many residential properties use fertilizers and pesticides in landscaping. When used properly, these chemicals should not contribute to significant water quality problems. However, problems can arise when excess chemicals that are not taken up by plants or pests are entrained into stormwater runoff and transported to downstream waters. These chemicals can be directly hazardous to aquatic organisms or may exacerbate existing water quality problems. Additional water quality problems can result from a lack of attention to domestic pet wastes on residential property. Pet wastes that are allowed to concentrate near a stormwater conveyance system or natural waterway can add bacteria and nutrients to runoff, thereby contributing to water quality degradation.

Residential additions or other property modifications that result in areas of disturbed ground can also result in considerable erosion and sediment transport to downstream waters. Small developments or landscaping on individual properties can often result in significant ground disturbance, sometimes for extended periods of time. During periods of frequent or heavy rainfall, any exposed soils can easily be eroded by stormwater runoff and transported to downstream waters. Many residents are not aware of the potential impacts and do little to control erosion-related problems. These problems are of particular concern in the Shoreline area because several of the open channel stream and creek systems pass directly through residential properties where water quality is easily affected by activities on adjacent properties.

Older, dense residential areas provide little roadside area for biofiltration in ditches, and the minimal filter strips or buffer widths provide little biofiltration between yards and drainage ways.

Water Quality Improvements

Perhaps the best way to reduce water quality problems associated with private residences is to educate homeowners about water quality degradation and encourage source control of stormwater pollution. For example, providing information on the environmental hazards associated with pesticides, fertilizers, and hazardous wastes would help to limit overapplication (and application preceding storm events) of chemicals used in landscaping activities. Information should also be provided on certified waste collection facilities where hazardous waste from these products can be disposed of. Providing information on the wise use of pesticides and herbicides or alternative methods of pest control would also help to reduce their use. Implementation of an Integrated Pest Management Plan (IPMP) rather than using chemical treatment should be encouraged. Any efforts to inform property owners about how they can help to improve water quality just by altering their own land use practices would be beneficial.

The City's current activities do include community outreach programs to educate and inform on ways to reduce water quality problems. These include a clean car wash program, a natural lawn and garden care program, a storm drain stenciling program, and community involvement restoration programs. Much of this information is disseminated in the form of flyers, city meetings, newspaper articles, and workshops. Homeowners and developers are encouraged to incorporate soil amendments such as compost into the top soil layer when creating lawn areas. These soil amendments in a lawn will increase runoff infiltration and reduce overland runoff. These lawns not only promote better surface water quality, but also reduce watering needs, reduce flooding, and recharge the groundwater system.

In addition, the City also makes efforts to ensure that catch basins in existing and new residential areas are labeled with warnings such as "Do not dump—drains to surface waters" where appropriate.

Encouraging property owners to plant native vegetation along drainage ways through private property and reduce the physical disturbances to these systems would help to improve water quality. The use of recommended BMPs would reduce stormwater exposure.

The City's solid waste collection service provides the surface water group support in educating City residents on the effects of and ways to prevent hazardous waste spills and information on where to recycle or properly dispose of hazardous material.

6.2.2.5 Accidental or Intentional Discharge of Chemical Contaminants

As with most urbanized areas, the threat of accidental or intentional spills of chemicals in storm drainage systems increases with increasing human activity. Automobile use and repair, construction work, auto service stations, small manufacturing businesses, and chemical storage areas all present some risk of spills or contamination. Whether the discharge is intentional or accidental, the end result is generally the same: materials spilled on land can easily and readily be transported to a stormwater conveyance system and ultimately to a stream. Under the best-case scenario, any environmentally hazardous spills would be promptly and properly cleaned up, with minimal impacts on water quality. However, if cleanup equipment and procedures are lacking, the contaminants will likely find their way to a storm drain and ultimately to receiving waters. Chemical contaminants are also sometimes directly discharged to a storm drain or ditch illegally.

Because there are no records of illegal dumping, it is difficult to determine how significant this problem might be in Shoreline. It is likely that household and commercial hazardous wastes are dumped into storm drains, ditches, or backyards, where they contribute to nonpoint pollution by directly entering the drainage ways, streams, and groundwater. The City also sponsors a spring and fall cleanup program to collect batteries, transmission fluid, and computer monitors as a deterrent to illegal dumping activities.

Ideally, the affected stormwater system would include a spill containment mechanism (e.g., oil/water separator), and most of the spill would not be carried downstream. However, the more common situation throughout most urbanized areas, including Shoreline, is that stormwater conveyance systems do not include spill containment measures or water quality treatment systems. As a consequence, spills flow directly to receiving waters without treatment. The impacts are highly dependent on the type and volume of chemical spilled, but clearly there is a potential for severe water quality impacts to occur. Although no records of significant spills of this nature have been recorded in Shoreline, other urbanized stream systems have been impacted by fuel spills. Therefore, measures to avoid these types of impacts should be considered.

Water Quality Improvements

The best methods to limit or prevent this type of pollution are prevention, structural barriers, and public education. New development that has areas prone to hazardous material spills (e.g., gas stations, auto repair lots, and industrial areas) are required to have spill containment mechanisms in place that are able to prevent a spill from reaching a storm drain. For existing development that does not have appropriate stormwater controls or programs, they can be achieved one of three ways. First, if an area is redeveloping, water quality capital facilities should be required as a part of the redevelopment. Second, if there is an observed water quality problem, the City can enforce proper BMPs. The City can also enforce its discharges policy. Third, the City can encourage property owners' voluntary compliance.

Structural or capital measures could greatly reduce the risk of surface water contamination. The preferred means of accomplishing this is to install some type of oil/water separator facility into the on-site drainage system. This could be as simple as an inverted elbow added to a catch basin, or a more elaborate oil/water separation system for larger sites. In either case, the end result is that most of the oil and similar chemicals that drain to catch basins are separated from the water by gravity and are not allowed to drain to the receiving water. The chemicals can then be removed from the catch basin before they reach the downstream receiving waters.

Education regarding the water quality impacts of chemical contaminants and the ease with which these pollutants can enter a creek or stream would also help to significantly reduce water quality pollution. Citizens and businesses alike should be made clearly aware of the connection between the storm drains and nearby waterways. Likewise, they should be informed about the cumulative impacts a city can have on a waterway, from numerous seemingly insignificant chemical inputs to storm drains. The City should encourage a neighborhood watch mentality to help enforce regulations regarding any illegal chemical dumping to storm drains. Clear labels on individual drains reading "Do not dump—drains to surface waters" would also help to prevent illegal dumping. The City has stenciled some of its catch basins and it is recommended that it stencil all other catch basins in the City.

6.3 Proposed Water Quality Projects and Programs

As explained in this chapter, the City has policies in place to improve surface water quality and will implement some new policies with the 2005 Comprehensive Plan. The City has and will continue to implement these policies through a number of projects and programs. To prioritize these activities, the City has identified three priority levels that it has assigned to projects or programs that maintain or improve water quality. As discussed in Section 1.5 of this Plan, these activities will be phased in over time in accordance with their priority level.

Ecology's upcoming NPDES Phase II stormwater general permit will likely include numerical water quality benchmarks. It is expected that over time the City's stormwater discharges will need to meet these benchmark requirements, so it will be beneficial to the City to incorporate water quality treatment into other capital projects where possible and also to construct stand-alone water quality projects to benefit receiving waters. Projects that are not required by current regulations are planned to be implemented over the 20-year period in anticipation of these new regulations.

In addition to regulatory agencies, the citizens of Shoreline have expressed a desire for clean surface waters. This Plan is intended to respond to regulatory requirements and also to meet the public's expectations of improved water quality.

This section provides a summary of projects and programs for the three priority levels. Tables 6-2, 6-3, and 6-4 list the projects and programs for each priority level, along with estimated project costs. Program costs are discussed in Chapter 8, and more detailed project cost estimates are provided in Appendix D.

It should be noted that detailed field studies were not performed as part of this master planning process. However, the consultants obtained information from individuals involved in the City's stream and wetland inventory and assessment and other City staff who have performed detailed field reconnaissance. The recommended projects and costs presented here are based on this information.

6.3.1 Water Quality Priority Level 1: Critical Projects and Programs

Water quality Priority Level 1 includes critical activities that need to be implemented to meet minimum regulatory requirements, particularly for the NPDES Phase II municipal stormwater permit. These activities are expected to be implemented within the next six years. Priority Level 1 primarily consists of programs and maintenance activities (see Table 6-2). Maintenance activities include catch basin cleaning, street sweeping, and maintenance of retention/detention facilities.

The City's current programmatic activities include programs to minimize the use of pesticides and fertilizers; community involvement and public education activities; inspection, monitoring, and enforcement activities; water quality monitoring; source control activities; and participation in regional committees.

The City has also identified four Priority Level 1 water quality capital projects that would be constructed in coordination with flood protection projects to improve water quality. Each of these projects would either add a wetpond to a proposed detention pond project or add water quality treatment facilities to proposed conveyance system upgrades. The wetpond projects include addition of wetpond elements to proposed detention facilities in Darnell Park (WQ-2), Cromwell Park (WQ-3), and in the Ridgecrest Neighborhood in the vicinity of 10th Avenue NE (WQ-4). Water quality features (which may consist of bioswales or oil/water separators) are proposed for the Third Avenue flood protection project (WQ-1). Further discussion of these flood protection projects is provided in Chapter 5.

A wetpond contains a permanent pool of water to settle out fine sediment and pollutants, and to allow biologic activity to occur that metabolizes nutrients and organic pollutants. Because this enhancement simply requires overexcavation of the detention pond, the additional cost is significantly less than if the water quality pond were constructed as a stand-alone treatment facility. The additional cost to add a wetpond feature to a detention pond can largely be attributed to the costs associated with the additional labor and disposal of the additional excavated materials. No additional cost would typically be required for land acquisition or inlet and outlet structures.

Incorporation of water quality features into detention facilities specifically addresses the policy that requires the City to consider providing multiple benefits when designing stormwater facilities.

Summaries of Priority Level 1 projects, along with planning-level cost estimates, are provided in Table 6-2.

6.3.2 Water Quality Priority Level 2: Enhance the Ability of the System to Improve Water Quality

Water quality Priority Level 2 includes both project and programmatic activities that would enhance the ability of the City's surface water system to improve water quality. Water Quality Priority Level 2 projects (WQ-5) include funding for miscellaneous stand-alone water quality projects such as vault treatment systems, engineering studies, wetponds, or additional biofiltration swales that will be implemented between years 7 and 20 of the 20-year planning period.

Because these miscellaneous stand-alone water quality projects have not been specifically identified, the City would need to conduct future studies to identify sites and types of stand-alone water quality structures that would most benefit the City's surface waters. Stand-alone water quality projects would be best located in high-traffic areas that are currently discharging untreated runoff to surface waters. For example, a park-and-ride lot that drains untreated runoff directly to a lake or creek would be a good candidate site for a water quality structure.

Planning-level cost estimates for Priority Level 2 projects are provided in Table 6-3. Priority Level 2 also includes funds to increase programmatic activities (costs for these additional activities are described in Chapter 8).

6.3.3 Water Quality Priority Level 3: Provide Additional Water Quality Benefits

Water quality Priority Level 3 includes both project and programmatic activities that would provide additional benefits to surface water quality. Water quality Priority Level 3 projects (WQ-5) include funding for additional miscellaneous stand-alone water quality projects such as water quality ponds, vaults, or biofiltration swales. Planning-level cost estimates for Priority Level 3 projects are provided in Table 6-4.

Based on the recommended plan described in Chapter 9, the City will not be able to implement Priority Level 3 projects in the next 20 years. Implementing these projects will likely require additional sources of funding such as grants, developer mitigation fees, or local improvement districts.

Priority Level 3 does include funds to increase programmatic activities (costs for these additional activities are described in Chapter 8). These activities are expected to be implemented between years 13 and 20 of the 20-year planning period.

6.4 References

The following sources were used to develop this chapter:

- KCM. 1997. *City of Shoreline Stormwater Study for GMA Comprehensive Plan/EIS*. Prepared for the City of Shoreline by KCM, Inc., Seattle, WA. Cited in Tetra Tech/KCM 2004b and Tetra Tech/KCM 2004d.
- King County. 1998. *King County Surface Water Design Manual*. Prepared by King County Department of Natural Resources, Seattle, WA. September 1998.
- King County. 2004. *King County Surface Water Design Manual 2004 Update – Key Changes Proposed*. Prepared by King County Department of Natural Resources, Seattle, WA. 2003.

- Otak. 2001. *Ronald Bog Drainage Improvements, Phase 1: Thornton Creek Tributary Flood Reduction Study*. Prepared for City of Shoreline by Otak, Inc., Kirkland, WA. December 7, 2001
- Shoreline. 1998. *City of Shoreline Comprehensive Plan*. Adopted November 23, 1998.
- Shoreline. 2003. *Proposed 2004–2009 Capital Improvement Plan*. Prepared by City of Shoreline, WA. June 2003.
- TCWMC (Thornton Creek Watershed Management Committee). 2003. *Thornton Creek Watershed Action Plan Draft*. Prepared for TCWMC with assistance from Seattle Public Utilities. Seattle, WA. May 2003.

**Table 6-2
Water Quality Priority Level 1 Projects and Programs**

ID	Title	Description	Benefits Provided	Estimated Cost
Projects				
WQ-1	Third Ave Water Quality Facilities	Provide treatment via bioswales, oil/water separators, or other water quality features for Third Ave drainage system.	Improvement of water quality.	\$100,000
WQ-2	Wetpond addition to Darnell Park Detention Pond	Provide wetpond volume for water quality treatment by overexcavating proposed detention pond constructed to minimize flooding in the vicinity of N 165th St and Stone Ave N.	Wetpond will provide some level of treatment to surface water collected from road prior to discharge into Boeing Creek.	\$96,000
WQ-3	Wetpond addition to detention pond in the Ridgecrest neighborhood in vicinity of 10th Ave NE	Provide wetpond volume for water quality treatment by overexcavating proposed detention pond constructed to minimize flooding in the Ridgecrest Neighborhood in the vicinity of 10th Ave NE.	Wetpond will provide some level of treatment to surface water collected from road prior to discharge into Thornton Creek.	\$96,000
WQ-4	Wetpond addition to Cromwell Park Detention Pond	Provide wetpond volume for water quality treatment by overexcavating proposed 0.5-acre detention pond to be constructed to alleviate flooding in the Thornton Creek Basin in the vicinity of Ronald Bog.	Wetpond will provide some level of treatment to surface water collected from road prior to discharge into Thornton Creek.	\$96,000
Total Capital Project Costs				\$388,000
Programs				
	Operation and Maintenance (O&M)	O&M such as catch basin cleaning and street sweeping to remove pollutants before they are allowed to enter surface waters.	Reduces the amount of pollutants entering surface waters by removing them from catch basins and road surfaces before they can get washed into the drainage system.	See Chapter 8
	No-Spray Zone Project	Training and materials to teach right-of-way plant eradication. This project is currently being done in the Richmond Beach area in response to a neighborhood request.	Improves water quality by reducing runoff containing pesticides and herbicides.	See Chapter 8
	Clean Car Wash Program	Efforts are currently limited and are incidental to other activities listed in this table.	Improves water quality by reducing discharge of soaps and metals and by reducing turbidity.	See Chapter 8
	Natural Lawn and Garden Care	Coordinate an annual event containing incentive tools and products; coordinate three annual training workshops for residents. Funded 75% by grant using City funds as local match.	Improves water quality by reducing runoff containing pesticides and herbicides.	See Chapter 8
	Storm Drain Stenciling Program	Support for use of stencil kit loaned to residents. Provide resource and training support for teachers. Most storm drain stenciling is currently done by student volunteers.	Improves water quality by reducing illegal dumping to the drainage system.	See Chapter 8
	Community Involvement Restoration Program	Co-lead Earth Day activities in Boeing Creek Park; train teachers and lead student groups in watershed analysis and restoration; educate/train residents to improve lake and stream water quality.	Provides public education on a variety of issues related to surface water management.	See Chapter 8
	Compost Facility	Coordinate compost O&M; maintain records; write reports.	Improves water quality by offering residents alternatives for natural lawn and garden care.	See Chapter 8
	Regional Road Maintenance/ESA/NPDES Program	Train staff; participate in Regional Forum; maintain road maintenance BMP records; submit quarterly reports.	Improves water quality by reducing discharge of pollutants through road maintenance; ensures continued regulatory compliance.	See Chapter 8

**Table 6-2
Water Quality Priority Level 1 Projects and Programs**

ID	Title	Description	Benefits Provided	Estimated Cost
	Water Quality Monitoring	Collect field measurements of parameters such as dissolved oxygen, pH, TSS, salinity, turbidity, and temperature.	Characterizes water quality of Shoreline's water courses and helps identify pollutant sources.	See Chapter 8
	Participation in Regional Committees	WRIA 8 activities (forum, steering committee, and public outreach).	Ensures the City participates in and is informed of ongoing regional planning and regulatory compliance efforts.	See Chapter 8
	Surface Water Monitoring and Source Control Program	Investigate water quality complaints; provide spill response; provide public outreach on various source control issues.	Improves water quality by reducing discharge of pollutants.	See Chapter 8
	Retention and Detention (R/D) Facility Inspection	Inspect City-maintained facilities to define required maintenance activities. Inspect privately maintained facilities to enforce maintenance requirements.	Improves flood protection by ensuring proper O&M of R/D facilities; improves water quality by ensuring proper O&M of treatment aspects of R/D facilities.	See Chapter 8

**Table 6-3
Water Quality Priority Level 2 Projects and Programs**

ID	Title	Description	Benefits Provided	Estimated Cost
Projects				
WQ-5 ^a	Miscellaneous Priority 2 Water Quality Projects	May include such stand-alone projects as vault treatment systems, engineering studies, wetponds, and construction of biofiltration swales.	Improves water quality in surface waters in the City based on the location of the projects identified with additional engineering.	\$2,020,000
Total Capital Project Costs				\$2,020,000
Programs				
See Chapter 8.				

a. Cost is the total cost allocated for miscellaneous projects over years 7 to 20 of the 20-year planning period.

**Table 6-4
Water Quality Priority Level 3 Projects and Programs**

ID	Title	Description	Benefits Provided	Estimated Cost
Projects				
WQ-6 ^a	Miscellaneous Priority 3 Water Quality Projects	May include such stand-alone projects as vault treatment systems, engineering studies, wetponds, and construction of biofiltration swales.	Improves water quality in surface waters in the City based on the location of the projects identified with additional engineering.	\$4,040,000
Total Capital Project Costs				\$4,040,000
Programs				
See Chapter 8.				

a. Cost is the total cost allocated for miscellaneous projects beyond the 20-year planning period.

Chapter 7. Stream Habitat

7.1 Introduction

This chapter provides an analysis of stream habitat as it relates to flood protection, water quality, and surface water management within the City of Shoreline. This evaluation is based on a review of information contained in the City of Shoreline 1998 Comprehensive Plan and the *City of Shoreline Stream and Wetland Inventory and Assessment* (Tetra Tech/KCM 2004). No field reconnaissance was conducted as part of this assessment. Chapter 2 includes a characterization of the City's existing vegetation and wildlife habitat.

This chapter is organized into two areas—identified problems and recommended projects and programs. The analysis focuses on the existing aquatic environment within the City and identifies surface water problems that affect aquatic habitat. This is followed by a description of proposed projects and programs that will help the City to protect and improve stream habitat. This chapter also describes the priority levels that have been assigned to recommended activities to indicate the order in which the City plans to implement them.

7.2 Identified Problems

The following problems affecting fisheries habitat and preventing fish access to upper reaches of stream systems were identified in the *City of Shoreline Stream and Wetland Inventory and Assessment* (Tetra Tech/KCM 2004). The problems are of four types: anadromous fish year-round access, fish passage for non-anadromous fish, erosion and sedimentation to streams, and control of invasive species. Each of these types of problems contributes to the degradation of fisheries resources and their habitat.

Based on discussions with City staff and with input from the planning commission work group and the public, emphasis for resolving habitat problems in the City is based on a system that first prioritizes protecting and preserving existing habitat, then focuses on problems that impact locations where anadromous fish are present by enhancing and expanding their existing habitat, and lastly addresses those problems that impact locations where other types of fish species are present by enhancing and expanding their existing habitat. Several policies are the primary drivers for defining habitat problems. Policy LU116 directs the City to preserve wetlands and aquatic and riparian habitats in a natural state and to maintain appropriate buffers around shorelines, wetlands, lakes, creeks, and streams to protect native vegetation, water quality, habitat for fish and wildlife, and hydrologic function. Policy LU130 directs the City to “work with citizen volunteers, state and federal agencies, and Indian tribes to identify, prioritize, and eliminate barriers and other impediments to anadromous fish spawning and rearing habitat.” For example, City residents have provided many hours of volunteer time to improve stream habitat and water quality throughout the City, including improvements within Twin Ponds Park and Paramount Park. Policy LU114 directs the City to “participate in regional species protection efforts, including salmon habitat and restoration.” Policy LU129 defines how solutions to stream habitat problems should be prioritized. Policy LU129 states that solutions to habitat problems related to the City's storm drainage system should focus on those types of activities that first protect and preserve existing habitat, then enhance and expand habitat in areas where wild anadromous fish are present, and lastly, enhance and expand habitat in areas where other wild fish are present. LU135 prompts the City to establish an interjurisdictional stewardship committee to use as a forum for working with neighboring communities to improve water quality and stream habitat in basins that share interjurisdictional boundaries. Table 7-1 provides a listing of stream habitat policies.

**Table 7-1
Stream Habitat–Related Goals and Policies
from the 2005 Comprehensive Plan**

2005 Comprehensive Plan Goals and Policies	Direction Given to Surface Water Management Program
Goals LU XVII and LU XVIII Policies LU114, LU149, LU116, LU126, LU127, LU128, LU130, LU131, LU133, LU134, LU136, LU129, and LU135	<ul style="list-style-type: none"> ▪ Manage the storm and surface water system through a combination of engineered solutions, the preservation of natural systems, and public education in order to provide for public safety; prevent property damage; protect water quality; preserve and enhance fish habitat and critical areas; and maintain a hydrologic balance. ▪ Preserve, protect, or restore wetlands, shorelines, surface water, and ground water for wildlife, appropriate human use, and the maintenance of hydrological and ecological processes. ▪ Actively participate in regional species protection efforts, including salmon habitat protection and restoration. ▪ Preserve aquatic and riparian habitats in a natural state and maintain appropriate buffers around these areas. ▪ Develop a basin stewardship program to prevent negative impacts to stream habitat and identify opportunities for restoration. ▪ Avoid permanently altering streams except in certain types of projects. Require that any stream alteration result in a net improvement to habitat and encourage streams to return to natural channel migration patterns where feasible. Give preference to channel stabilization over culverting. ▪ Promote citizen involvement and seek community consensus on attempts to restore surface water features which have been altered. Restoration efforts may include the daylighting of streams which have been diverted into underground pipes or culverts. ▪ Identify, prioritize, and eliminate barriers to fish passage. Work with citizen volunteers, state and federal agencies, and Indian tribes in these efforts. ▪ Preserve and protect natural flood storage areas. ▪ Use the state Shoreline Management Act to guide protection efforts for shorelines of statewide significance and for other water features that do not qualify for state regulation. ▪ Work with citizen and watershed groups and cooperate with adjacent county and local governments, regional governments, state agencies, and Indian tribes to develop and implement watershed action plans and other types of basin plans for basins that lie within or partially within Shoreline’s boundaries. ▪ Provide additional public access to Shoreline’s natural features, including the Puget Sound shoreline. Seek consensus of local communities and neighborhoods when private property owners might be negatively affected by this action. ▪ Design and construct habitat projects to solve existing habitat problems, but also to provide multiple benefits to the extent possible that meet goals, policies, and community needs expressed for flood protection and surface water quality. ▪ Implement activities that, in the following order of priority, (1) protect and preserve existing habitat, (2) enhance and expand habitat in areas where wild anadromous fish are present, and (3) enhance and expand habitat in areas where other wild fish are present. ▪ Work with neighboring communities to improve water quality and stream habitat in basins that share interjurisdictional boundaries.

Specific habitat problems for fisheries resources were identified for four streams within the City: Boeing Creek, Thornton Creek, McAleer Creek, and Storm Creek. Although non-anadromous fish are present in several other water courses within the City, these four streams have the best habitat available and/or potential for fish habitat within the City. The “City of Shoreline Stream Inventory and Assessment” (Tetra Tech/KCM 2004e) contains the following recommendations for habitat improvements:

Taking the results directly from the USBEM [Urban Streams Baseline Evaluations Method], the foremost option for recovery within the Shoreline area is enhancement of the BC1 [Boeing Creek reach 1], BC8, and TC14 [Thornton Creek reach 14] reaches. In these areas, there are several site-specific enhancement options to address poor or fair conditions and improve the overall habitat conditions.

The report indicates that these are the only reaches that received a “fair” rating overall. It further states: “All fair reaches would benefit from planting of native riparian vegetation and underplanting of native conifers and deciduous trees, as well as eradication of invasive plants, such as Himalayan blackberry and Japanese knotweed.” (Tetra Tech/KCM 2004e)

Table 7-2 identifies the habitat problems and their location on the identified water courses.

Boeing Creek (reaches 1 and 1a), Thornton Creek (reaches TC1 through TC7), and McAleer Creek (as far upstream as Lake Ballinger) have anadromous fish access at this time. All other stream reaches have non-anadromous fish (usually cutthroat trout). Some reaches have juvenile salmon that were outplanted by school groups; however, this is not indicative that they are habitat for anadromous fish, as the adults cannot return there due to blockages. Some of the blockages are only at low or high flow, so some fish will get through. The steel pile dam (which defines the end of Boeing Creek reach 1 and the start of reach 2 is a total anadromous fish blockage.

7.3 Proposed Stream Habitat Projects and Programs

The City has policies in place to protect and improve stream habitat (Table 7-1). The City has and will continue to implement these policies through a number of programs and capital projects. Stream habitat projects and programs focus on protecting and preserving existing habitat to maintain the current level of function of the system, enhancing known and potential habitat for salmonid fish species, and, lastly, focusing on lower priority problems to enhance habitat for other fisheries resources.

To prioritize all of the proposed activities, the City has identified three priority levels that it has assigned to projects or programs that protect or improve stream habitat. As discussed in Section 1.5 of this Surface Water Master Plan, these activities will be phased in over time in accordance with priority level.

The citizens of Shoreline have expressed a desire for improved stream habitat. This Plan is intended to respond to regulatory requirements and also to meet the public’s expectations that the City protect and enhance stream habitat.

This section describes the projects and programs included in each priority level. Tables 7-3, 7-4, and 7-5 list the projects and programs by priority level for specific habitat programs and capital projects for the problems identified in Table 7-2 and for other activities identified by the City. These tables also provide estimated costs for conceptual projects. Program costs

are discussed in Chapter 8, and more detailed project cost estimates are provided in Appendix D.

It should be noted that detailed field studies were not performed as part of this master planning process. However, the consultants obtained information from individuals involved in the City’s stream and wetland inventory and assessment and other City staff who have performed detailed field reconnaissance. The recommended projects and costs presented here are based on this information. In addition, because the problems identified in Table 7-2 do not identify every potential habitat problem in the City, the City will undertake additional engineering and reconnaissance to identify project solutions for additional habitat projects throughout the City.

**Table 7-2
Stream Habitat Problems**

Problem ID	Problem Location	Problem Description	Reference
1	Thornton Creek – Reach 14 (Maintenance to remove invasive species)	Invasive plant species are invading the restoration project in Paramount Park.	Tetra Tech/KCM 2004e
2	Boeing Creek – Reach 1 (Bank Stabilization)	High stormwater flows are causing erosion and sedimentation to the stream.	Tetra Tech/KCM 2004e
3	Boeing Creek – Reach 8 (Bank Stabilization)	High stormwater flows are causing erosion and sedimentation to the stream. Also, erosion in this area is a significant contributor to sediment in Hidden Lake.	Tetra Tech/KCM 2004e; Pers. Comm., Jesus Sanchez, Rika Cecil, Andy Loch, City of Shoreline, February 2004
4	McAleer Creek – Reach 1 (Fish Passage Blockage)	48-inch box culvert beneath 15th Avenue NE may be a fish barrier at times.	Tetra Tech/KCM 2004e; Pers. Comm., Andy Loch, City of Shoreline, December 2003
5	Thornton Creek – Reach 7 (Fish Passage Blockage)	In Twin Ponds Park, a hanging culvert located north of the north pond is a fish barrier. Also, a culvert passing beneath a pedestrian trail likely prevents juvenile fish passage due to its jumping height of 20 inches and the high downstream flow velocity.	Tetra Tech/KCM 2004e
6	Storm Creek – Reach 1 (Substrate Improvement)	Concrete streambed constructed over pipeline provides poor substrate for fish.	Tetra Tech/KCM 2004e

Problem ID	Problem Location	Problem Description	Reference
7	Thornton Creek – Reach 3	The culvert beneath 1st Avenue NE may be a low-flow fish blockage.	Tetra Tech/KCM 2004e
8	Thornton Creek – Reach 12	A previous study (Otak 2001) identified a piped section that has settled and caused flooding problems and backed up flow to Ronald Bog. The long outlet pipe and associated catch basin may prevent fish passage. This problem will be covered under the Ronald Bog project described in Chapter 5.	Otak 2001 (referenced in Tetra Tech/KCM 2004)
9	Ballinger Creek – Reach 2	Three concrete culverts convey Ballinger Creek at the north end of Bruggers Bog Park; the jumping height is a minimum of 30 inches, and is a fish blockage.	Tetra Tech/KCM 2004e

7.3.1 Stream Habitat Priority Level 1: Critical Projects and Programs

For stream habitat Priority Level 1, the primary implementation activities would include meeting regulatory requirements, monitoring, enforcement, removal of invasive plants, and other actions that would enhance habitat in streams with salmonid fish species. Capital projects include stabilizing the streambank on sections of Boeing Creek, plus funding for other miscellaneous projects to enhance stream habitat. Because these miscellaneous projects have not been specifically identified, the City would need to conduct future studies to identify sites and to engineer projects that would most benefit the City's stream habitat.

Table 7-3 provides summaries of Priority Level 1 projects and programs. These projects include streambank restoration work on Boeing Creek (H-1 and H-2), implementation of a stream rehabilitation and habitat enhancement program (H-3) and acquisition of stormwater right-of-way (H-4). Projects H-3 and H-4 are also included in Priorities 2 and 3 because they include funds that will be spent for unspecified projects over the 20-year planning period. Table 7-3 gives planning-level cost estimates for capital projects; program costs are discussed in Chapter 8. These projects and programs are expected to be implemented within the next 6 years.

7.3.2 Stream Habitat Priority Level 2: Enhance and Expand Habitat in Areas Where Wild Anadromous Fish Are Present

Stream habitat Priority Level 2 includes both programs and projects that would further focus on enhancement of habitat in streams with salmonid fish species. Projects in this priority level include a culvert replacement on McAleer Creek (H-5), funding for miscellaneous stream habitat projects such as bank stabilization (H-6), and funds for projects H-3 and H-4 as discussed under Priority Level 1.

Table 7-4 provides summaries of Priority Level 2 projects along with planning-level cost estimates. Priority Level 2 also includes funds to increase programmatic activities (costs for

these additional activities are described in Chapter 8). These projects and programs are expected to be implemented between years 7 and 20 of the 20-year planning period.

7.3.3 Stream Habitat Priority Level 3: Provide Additional Benefits to Stream Habitat

Stream habitat Priority Level 3 includes both project and programmatic activities that would provide additional benefits to stream habitat such as enhancing sections of streams with potential habitat immediately upstream of existing reaches with salmonid fish. Priority Level 3 activities may also focus on stream reaches with habitat for non-salmonid fish, thereby providing additional benefit to the overall surface water system. Project activities include miscellaneous stream habitat projects such as bank stabilization (H-7), and funds for projects H-3 and H-4 as discussed under Priority Level 1. Summaries of Priority Level 3 projects, along with planning-level cost estimates, are provided in Table 7-5.

Based on the recommended plan described in Chapter 9, the City will not be able to implement Priority Level 3 projects in the next 20 years. Implementing these projects will likely require additional sources of funding such as grants, developer mitigation fees, or local improvement districts.

Priority Level 3 does include funds to increase programmatic activities (costs for these additional activities are described in Chapter 8). These activities are expected to be implemented between years 13 and 20 of the 20-year planning period.

**Table 7-3
Stream Habitat Priority Level 1 Projects and Programs**

ID	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost
Projects					
H-1	Boeing Creek Reach 1 – Streambank Restoration	Stabilize streambanks, improve creek buffer vegetation, and introduce woody debris into the lower reach of Boeing Creek, an area that provides viable salmonid habitat.	Increases and improves habitat for salmonids.	2	\$2,417,000
H-2	Boeing Creek Reach 8 – Streambank Restoration	Stabilize streambanks, improve creek buffer vegetation, and introduce woody debris into the upper reach of Boeing Creek, an area that provides viable salmonid habitat.	Increases and improves habitat for salmonids. Decreases sediment loading to Hidden Lake. The City identifies this problem as the largest sediment contributor to Hidden Lake.	3	\$1,179,000
H-3 ^a	Stream Rehabilitation/Habitat Enhancement Program (years 1–6)	Miscellaneous projects to enhance stream habitat.	Improves stream habitat.	Various	\$300,000
H-4 ^a	Advanced Surface Water Right-of-Way Acquisition (years 1–6)	Miscellaneous projects to acquire surface water systems on private property.	Improves habitat, reduces erosion, improves water quality.	Various	\$120,000
Total Capital Project Costs					\$4,016,000
Programs					
	Water Resource Inventory Area (WRIA) Coordination	Coordination with other jurisdictions in WRIA 8.	Watershed-level approach to fisheries issues.	Regulatory	See Chapter 8
	Consultant Services	Consultant services related to ESA compliance and biological resource issues in the City.	Aids in compliance with federal ESA and state Growth Management Act; provides for protection of anadromous fish habitat.	Regulatory	See Chapter 8
	Meet Regulatory Requirements	Conduct review of plans to ensure that design standards are being met.	Prevents encroachment into sensitive areas.	Regulatory	See Chapter 8
	Thornton Creek Reach 14 – Maintenance to Remove Invasive Species	Invasive plant species are invading the restoration project in Paramount Park. Includes five years of maintenance and monitoring. After five years, funds can be used to address invasive plant species in other priority areas.	Increases the success of the restoration project through greater survival of native species.	1	See Chapter 8

a. Cost is the total cost over the 6-year period.

**Table 7-4
Stream Habitat Priority Level 2 Projects and Programs**

ID	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost
Projects					
H-3 ^a	Stream Rehabilitation/ Habitat Enhancement Program (years 7–12)	Miscellaneous projects to enhance stream habitat.	Improves stream habitat.	Various	\$300,000
H-4 ^a	Advanced Surface Water Right-of-Way Acquisition (years 7–12)	Miscellaneous projects to acquire surface water systems on private property.	Improves habitat, reduces erosion, improves water quality.	Various	\$120,000
H-5	McAleer Creek – Culvert Replacement	Replace 48-inch box culvert beneath 15th Ave NE with a fish-passable culvert.	Improves passage for salmonids at various flows.	4	\$78,000
H-6	Miscellaneous Priority 2 Stream Habitat Enhancement Projects	May include such projects as bank stabilization.	Improves habitat, reduces erosion, improves water quality.	Various	\$1,029,000
Total Capital Project Costs					\$1,527,000
Programs					
See Chapter 8.					

a. Cost is the total cost allocated for miscellaneous projects over years 7 to 20 of the 20-year planning period.

**Table 7-5
Stream Habitat Priority Level 3 Projects and Programs**

ID	Title	Description	Benefits Provided	Problems Addressed	Estimated Cost
Projects					
H-3 ^a	Stream Rehabilitation/ Habitat Enhancement Program (years 13–20)	Miscellaneous projects to enhance stream habitat.	Improves stream habitat.	Various	\$400,000
H-4 ^a	Advanced Surface Water Right-of-Way Acquisition (years 13–20)	Miscellaneous projects to acquire surface water systems on private property.	Improves habitat, reduces erosion, improves water quality.	Various	\$160,000
H-7	Miscellaneous Priority 3 Stream Habitat Enhancement Projects	May include such projects as bank stabilization.	Improves habitat, reduces erosion, improves water quality.	Various	\$2,058,000
Total Capital Project Costs					\$2,618,000
Programs					
See Chapter 8.					

a. Cost is the total cost allocated for miscellaneous projects beyond the 20-year planning period.

7.4 References

The following sources were used to develop this chapter:

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Chapter 8. Operation and Maintenance

This chapter describes the City of Shoreline’s operation and maintenance (O&M) program needs that support the flood protection, water quality, and stream habitat priority level alternatives presented in Chapters 5, 6, and 7, respectively. This chapter also includes a discussion of drainage infrastructure repair and replacement. A description of the City’s current O&M program is contained in Chapter 4.

The following sections describe the projected O&M needs associated with each priority level alternative. Additional detail is found in Appendix E. All O&M costs in this chapter are in 2004 dollars.

8.1 Flood Protection O&M Needs

Table 8-1 summarizes projected O&M needs for the flood protection priority level alternatives. Over the next 20 years, as new drainage infrastructure is built, it will require maintenance. Maintenance costs for new capital improvements are a large component of projected O&M expense increases.

Drainage and surface water infrastructure currently owned and maintained by the City is located in the publicly owned right-of-way. There are, however, drainage and surface water systems that were installed to follow predevelopment drainage paths that are not located in the public right-of-way but instead on private property. These systems located on private property are critical elements of the city’s drainage system, but the City has limited access for maintenance or inspection. The City may choose to spend additional funds to assume maintenance responsibility of these systems.

Over the next six years, the number of privately maintained retention and detention structures is expected to increase, and the City will devote additional resources to inspection of these structures. To improve the effectiveness of the drainage system, expanded ditch reshaping and shoulder reconstruction efforts are also proposed.

**Table 8-1
Projected Flood Protection O&M Needs**

Flood Protection Priority Level Alternative	O&M Activities	Estimated Annual Financial Impact (2004\$)
Priority Level 1: improves public safety and reduces property damage	Current activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities ▪ O&M of systems on private property ▪ Additional ditch reshaping ▪ Additional inspection/source control 	Current O&M expenditures plus \$126,500 per year
Priority Level 2: improves the effectiveness of the City’s surface water system	Priority Level 1 activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities ▪ O&M of additional systems on private property ▪ Additional shoulder reconstruction 	Priority Level 1 O&M expenditures plus \$44,500 per year
Priority Level 3: provides additional benefits to surface water conditions	No additional Priority Level 3 activities	Same as Priority Level 2 O&M expenditures

8.2 Water Quality O&M Needs

Table 8-2 summarizes projected new water quality O&M needs. Priority Level 1 needs, totaling a projected \$157,000 per year, are primarily due to O&M needs for new capital projects and the anticipated requirements of the City's National Pollutant Discharge Elimination System (NPDES) Phase II permit.

Expansion of the City's street sweeping program is proposed in Priority Level 3, which provides water quality benefits by removing pollutants prior to reaching Shoreline's surface waters. Priority Level 3 includes expanded water quality monitoring of Shoreline's creeks and lakes.

Within the next year, the Washington State Department of Ecology (Ecology) is expected to issue an NPDES Phase II General Permit, which would be applicable to Shoreline. After the permit requirements are finalized, the City intends to review projected O&M needs to be consistent with permit requirements.

**Table 8-2
Projected Water Quality O&M Needs**

Water Quality Priority Level Alternative	O&M Activities	Estimated Annual Financial Impact (2004\$)
Priority Level 1: deemed critical to meet minimum regulatory requirements	Current activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities ▪ Additional catch basin cleaning ▪ Additional retention/detention facility inspection ▪ Additional source control efforts ▪ Expand programs: clean car wash, no-spray zone, community involvement restoration, natural lawn and garden care ▪ Additional water quality monitoring 	Current O&M expenditures plus \$157,000 per year
Priority Level 2: enhances the ability of the City's surface water system to improve water quality	Priority Level 1 activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities 	Priority Level 1 O&M expenditures plus \$8,000 per year
Priority Level 3: provides additional benefits to surface water quality	Priority Level 2 activities, plus: <ul style="list-style-type: none"> ▪ More frequent street sweeping ▪ Use of regenerative air street sweepers ▪ Additional water quality O&M activities 	Priority Level 2 O&M expenditures plus \$169,500 per year

8.3 Stream Habitat O&M Needs

Table 8-3 summarizes projected stream habitat O&M needs. Increases in O&M expenditures throughout the 20-year planning period are primarily due to maintenance of new facilities (such as culverts for fish passage), additional maintenance in targeted areas such as Paramount Park, and coordination of additional community/volunteer restoration projects.

**Table 8-3
Projected Stream Habitat O&M Needs**

Stream Habitat Priority Level Alternative	O&M Activities	Estimated Annual Financial Impact (2004\$)
Priority Level 1: protects and preserves existing habitat	Current activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities ▪ Additional maintenance in Paramount Park 	Current O&M expenditures plus \$18,000 per year
Priority Level 2: enhances and expands habitat in areas where wild anadromous fish are present	Priority Level 1 activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities ▪ Additional volunteer restoration projects, invasive plant species removal, and public education 	Priority Level 1 O&M expenditures plus \$25,000 per year
Priority Level 3: enhances and expands habitat in areas where other wild fish are present	Priority Level 2 activities, plus: <ul style="list-style-type: none"> ▪ Additional volunteer restoration projects, invasive plant species removal, and public education 	Priority Level 2 O&M expenditures plus \$26,000 per year

8.4 O&M Needs from Parks and Transportation Projects

As part of other concurrent planning efforts, the City has developed projected parks and transportation improvements over the 20-year planning period. Many of these improvements include upgrading the storm drainage system, including the installation of new storm drainage facilities (see Section 9-2 for a more detailed explanation). These new facilities must be maintained, and Table 8-4 summarizes the estimated O&M impacts. These O&M costs were allocated by priority level to coincide with the timing of the construction of those parks and transportation projects.

**Table 8-4
Projected O&M Needs from SWM Facilities
in Parks and Transportation Projects**

Parks and Transportation Projects	O&M Activities	Estimated Annual Financial Impact
Priority Level 1	O&M of new capital facilities	Additional \$9,000 per year
Priority Level 2	Priority Level 1 activities, plus: <ul style="list-style-type: none"> ▪ O&M of new capital facilities 	Priority Level 1 O&M expenditures plus \$24,000 per year
Priority Level 3	No additional Priority Level 3 activities	Same as Priority Level 2 O&M expenditures

8.5 General Fund Cost Allocation Impact

Each year, some surface water utility funds are transferred to the City's General Fund to pay for a variety of support activities. Some of the support activities funded by the General Fund include other City departments such as human resources, the customer response team, the City attorney's office, the City manager's office, and the City Council. The General Fund also funds some public works department staff such as the public works director, the public works administrative manager, and portions of various other public works department positions.

The City has developed a detailed methodology to calculate the General Fund Cost Allocation for each City department. The methodology is based on items such as the square feet of office space (for facilities expenses) and the number of FTEs (for the human resources department).

As the content and staffing of the surface water management program change, so does the General Fund Cost Allocation. For financial planning purposes, 25 percent is added to each new annual O&M expenditure for the General Fund Cost Allocation. The estimated costs shown in Tables 8-1 through 8-4 include this additional General Fund Cost Allocation.

8.6 Repair and Replacement

The majority of the City's current drainage system has been installed incrementally over the past 60 years. Portions of the drainage system are nearing their useful life, and will require replacement in the near future.

Currently, repair and replacement of relatively short sections of the drainage system are typically done via the City's Small Works Program on an as-needed basis.

A comprehensive long-term repair and replacement program has not been developed because the condition of the underground drainage infrastructure has not been fully evaluated. Over the next six years, the City intends to complete a condition assessment of drainage infrastructure. This condition assessment will enable the City to develop a long-term repair and replacement program. For financial planning purposes, an annual repair and replacement expenditure of \$150,000 (in 2004 dollars) is projected. These dollars will initially be used for a condition assessment to develop the long-term repair and replacement program. The results of the condition assessment will help prioritize R&R projects that will be funded at the \$150,000 per year level. There will continue to be a Small Works Program to fix ongoing system problems at \$150,000 per year. The Small Works Program is funded through the Capital Improvement Projects.

8.7 Summary

Table 8-5 summarizes the proposed new O&M expenditures resulting from implementation of Priority Level 1, 2, and 3 projects and programs.

**Table 8-5
Summary of Projected New O&M Expenditures**

Program Area	New O&M Expenditures (\$/Year, 2004\$)		
	Priority Level 1 (Years 1–6)	Priority Level 2 ^a (Years 7–12)	Priority Level 3 ^b (Years 13–20)
Flood Protection	\$126,500	\$171,000	\$171,000
Water Quality	157,000	165,000	334,500
Stream Habitat	18,000	43,000	69,000
SWM Facilities in new Parks and Transportation Projects	9,000	33,000	33,000
Total	\$310,500	\$412,000	\$607,500

^a The estimated new O&M expenditure for Priority Level 2 is \$412,000 per year, which includes the \$310,500 new O&M expenditure associated with Priority Level 1 plus an additional \$101,500.

^b The estimated new O&M expenditure for Priority Level 3 is \$607,500 per year, which includes the \$412,000 new O&M expenditure associated with Priority Level 2 plus an additional \$195,500.

Part III: Recommended Plan and Financial Analysis

Part III of this Surface Water Master Plan presents a financial analysis of the potential projects and programs that the City of Shoreline's surface water management program could provide to its ratepayers, and describes their impacts on rates. The recommended plan presented in Part III reflects the needs and priorities of the City and community and balances those against the desire to charge reasonable rates.

Chapter 9 Recommended Plan and Financial Analysis

Chapter 9. Recommended Plan and Financial Analysis

9.1 Introduction

This chapter includes a summary of the recommended plan for the City's surface water management (SWM) program. This recommended plan was developed as a result of:

- Listening to the community regarding its flood protection, water quality, and stream habitat priorities
- Working with City staff to obtain the best available technical analysis of the City's surface water management infrastructure, maintenance procedures, program activities, and anticipated regulatory requirements
- Evaluating the financial impacts

The recommended plan includes funding for repair and replacement (R&R) of aging infrastructure, operation and maintenance (O&M) of the system, and new capital improvement projects (CIP). The plan was developed through an iterative process, as described in Appendix G. Following the recommended plan is a financial analysis that consists of:

- A description of Shoreline's existing SWM fee schedule
- The results of a long-range financial projection for the City's SWM program, including the possible financial impacts of implementing the recommended plan
- A SWM fee comparison with 11 other local jurisdictions

Appendix F contains more detailed financial information.

9.2 Recommended Plan

Table 9-1 shows the recommended capital spending plan. The proposed SWM fee structure described later in this Chapter will fund all of the Priority Level 1 capital improvements described in Chapters 5, 6, and 7 between 2005 and 2010. The proposed SWM fee structure will also fund all of the Priority Level 2 capital improvements between 2011 and 2024 but will not fund any of the Priority Level 3 capital improvements. A more detailed list of capital improvements is included in Appendix F.

**Table 9-1
Recommended SWM Capital Spending (2004 dollars, in millions)**

Type of Improvement	Priority Level 1 (2005–2010)	Priority Level 2 (2011–2024)	Priority Level 3 (Not Affordable)	Total	Reference
Flood Protection	\$9.604	\$1.244	\$0.0	\$10.848	Chapter 5 SWMP
Water Quality	0.388	2.020	0.0	2.408	Chapter 6 SWMP
Stream Habitat	4.016	1.527	0.0	5.543	Chapter 7 SWMP
SWM Facilities: Transportation Projects ^a	2.083	5.950	0.0	8.033	See Below
SWM Facilities: Parks Projects ^a	0.100	0.350	0.0	0.450	See Below
Total	\$16.192	\$11.091	\$0.0	\$27.283	

^a Costs for transportation and parks projects come from the Transportation and Parks Master Plans, respectively. These costs are allocated by priority level to coincide with planned construction of projects during the time periods shown on this table.

The redevelopment of Shoreline’s parks and improvement of roads will provide an opportunity (in some cases) to fix the aging and sometimes failed storm drainage infrastructure within the City. In Shoreline, surface water is classified as a utility. Other utilities such as water, sewer, and power generally find it to be cost-effective to perform necessary upgrades when a major Parks or Transportation project is undertaken. This is a cost-effective way of upgrading the City’s vital infrastructures by providing multiple beneficiaries for a single capital improvement project. This programmatic approach allows funding to be available at the time a Parks or Transportation project is scheduled without disrupting other surface water priorities.

Surface water dollars will only be used to fund flood protection, water quality, and habitat issues associated with future Parks and Transportation projects. For flood protection, these dollars would generally be used to replace or upgrade pipes, catch basins, manholes, and other drainage infrastructure. For water quality, surface water dollars could be used to purchase oil/water separators or sediment traps to keep pollutants out of the City’s surface water bodies. In the case of parks projects, surface water dollars may be used toward wetland restoration if it provides a water quality benefit. In some cases, surface water dollars may allow the City to go above and beyond the water quality requirements in place at the time of the project to provide a higher level of water quality protection. Surface water dollars would go towards replacing a road culvert that is currently a potential fish migration barrier with one that is not.

For planning purposes, the SWM program is being assigned 10 percent of the cost of pedestrian projects, 20 percent of the cost of road and intersection projects, and 10 percent of the cost of parks projects.

O&M needs for the City’s SWM program will continue to include activities that preserve the system’s flood conveyance function, such as cleaning catch basins, maintaining ditches, and sweeping streets. Upcoming stormwater regulations, in the form of the general NPDES Phase II Municipal Stormwater Permit (NPDES stormwater permit), are expected to significantly impact the City’s O&M activities and O&M expenditures. Additional emphasis will be placed on programs to improve water quality, and on increasing inspection and pollutant source control activities. Additional repair of gravel shoulders, additional ditch maintenance, and changes to street sweeping practices are also anticipated.

As the City’s SWM infrastructure ages, planning for its repair and replacement will become more critical. The recommended plan includes a condition assessment of SWM infrastructure and annual spending for repairs and replacements.

Figure 9-1 shows a proposed implementation schedule for the 20-year planning period. Priority Level 1 capital projects would be constructed over the six-year period from 2005 to 2010, and new O&M expenses would be phased in over this same period. Priority Level 2 capital projects would be completed between years 7 and 20 of the 20-year planning period. Priority Level 2 O&M activities would be phased in between years 7 and 12, and Priority Level 3 O&M activities would be phased in between years 13 and 20. After the NPDES stormwater permit is issued by Ecology, the City will re-evaluate its O&M activities and define necessary changes to ensure consistency with the permit.

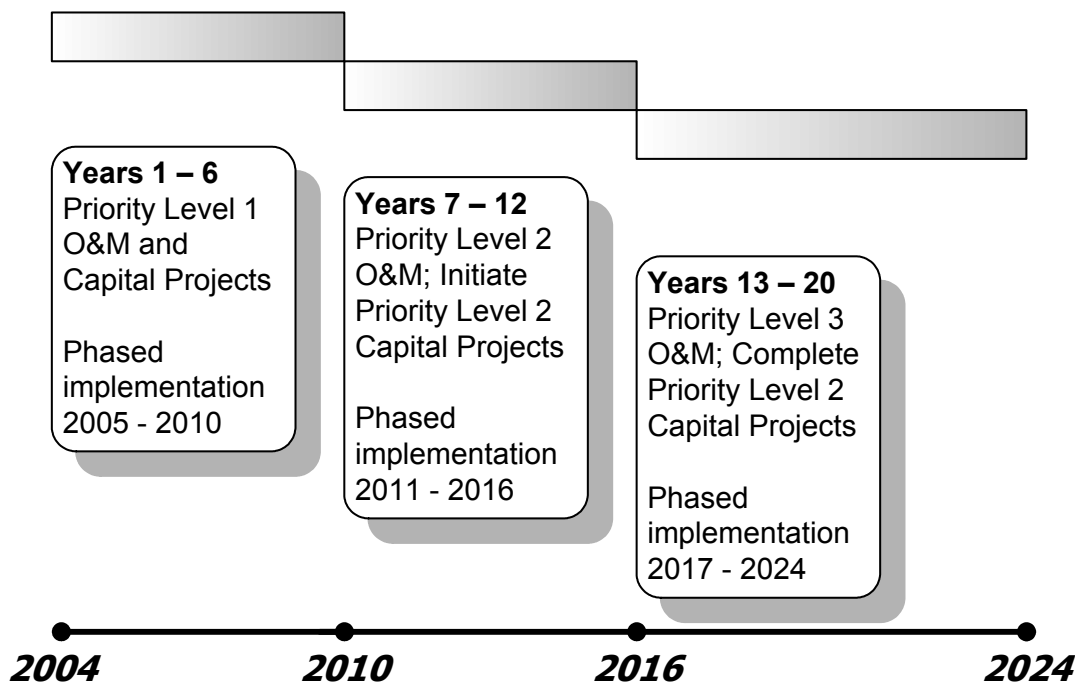


Figure 9-1. SWM Program Implementation Schedule

9.3 Financial Analysis

9.3.1 Existing Fee Schedule

In 2003, the Shoreline City Council adopted the SWM fee schedule shown in Table 9-2. The SWM fee for single-family residences in the City is \$102 per parcel per year. Multifamily and commercial users are charged an annual fee on a per-acre basis that depends on the percentage of impervious surface.

**Table 9-2
2003 Surface Water Management Fees**

Category	Percent Impervious Surface	Annual Fee
Single-Family Residences		\$102/parcel
Other Customers		
Very Light	Less than or equal to 10%	\$102/parcel
Light	10% to 20%	\$238/acre
Moderate	20% to 45%	\$493/acre
Moderately Heavy	45% to 65%	\$952/acre
Heavy	65% to 85%	\$1,207/acre
Very Heavy	85% to 100%	\$1,581/acre

Exemptions and discounts are available for several categories of customers. Homes occupied by low-income disabled and low-income senior citizens can qualify for an exemption. Discounts are available for parcels with officially designated open space.

A SWM fee discount is available to property owners that maintain an on-site retention/detention facility. The rate discount is a one category deduction. For example, a parcel with a retention/detention facility classified as “moderate” would be charged the “light” rate. The SWM fees shown in Table 9-2 do not apply to the City’s rights-of-way.

Figure 9-2 compares Shoreline’s SWM fees with those of 11 other local SWM utilities. The example annual bill is for a single-family residence.

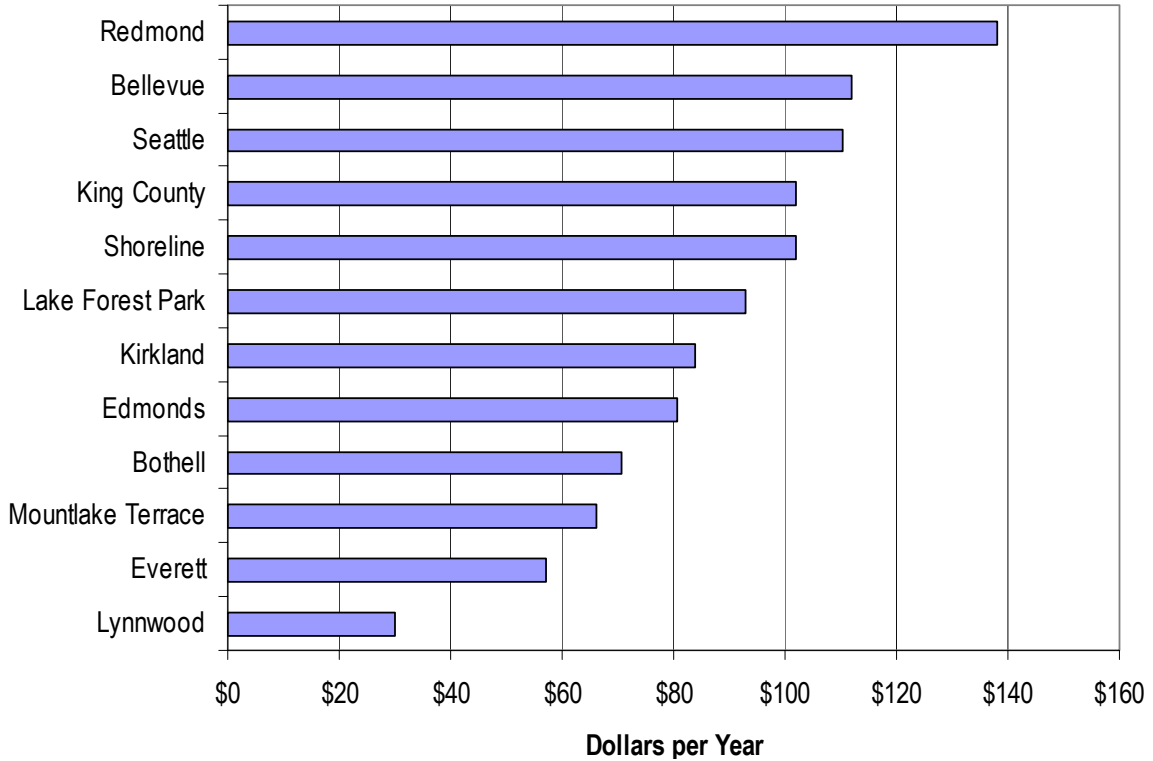


Figure 9-2. Single-Family Residential SWM Fee Comparison

9.3.2 Equivalent Service Units

The equivalent service unit (ESU) concept provides a way to consider the entire drainage system in terms of an equivalent number of single-family residences. In this financial analysis, an ESU is defined as a single-family residence and the number of ESUs is determined in terms of the amount of revenue collected through SWM fees. For 2004, the City has budgeted total revenue from SWM fees to be \$2,492,192. The estimated number of ESUs is 24,000, calculated by dividing the SWM fee revenues by the single-family residential SWM fee (\$102 per parcel per year).

Use of ESUs is a way to quickly approximate the financial impacts of proposed expenditures. A \$1 per year per ESU SWM fee increase would fund an annual expenditure of \$24,000.

9.3.3 Long-Range Financial Projection

This section provides a long-range financial projection of SWM fees for a 20-year period. The financial projection is based on a number of assumptions, which are described below. The assumptions represent the best data currently available, and should be expected to change over time. The projected SWM fees are intended to show the financial consequences of implementing the recommended plan over a 20-year period. The projected SWM fees do not represent a commitment by the City to adopt the fees; the City regularly evaluates the financial condition of its SWM utility to make policy decisions regarding services to be provided and the required level of SWM fees.

A spreadsheet-based financial planning model was developed for the City’s SWM program. Revenues, consisting primarily of SWM fees, were projected, as were O&M and capital

expenditures. SWM fee revenues were projected to provide revenues sufficient to cover expenses and meet the City's financial policy targets, which are also described below.

Capital Spending Assumptions

- 20-year total, in 2004 Dollars, of \$27,283,000, as shown in Table 9-1 and Appendix F
- Capital project costs in future years are adjusted for inflation at 2.5 percent per year
- Repair and replacement funding of \$150,000 per year (in 2004 dollars)

Capital Funding Assumptions

- Repair/replacement is funded through SWM fees
- Future debt is issued at a 5.0% interest rate, with levelized principal and interest payments over a 20-year period
- No debt service coverage ratio criterion is included in this analysis

O&M Spending Assumptions

- O&M spending consists of current expenditures (from 2004 budget) plus phase-in of new O&M expenditures. Chapter 8 contains a summary of projected new O&M expenditures.
- New O&M expenditures are phased in over the period represented by each priority level
- Most other O&M spending increases at 3 percent per year (growth plus inflation)
- New expenditures include the additional General Fund Cost Allocation, estimated to be 25 percent of the new O&M expenditure

Other Assumptions

- 2.5 percent annual inflation
- 0.5 percent annual system growth
- Financial policy target: minimum SWM Fund balance is 10 percent of operating revenues
- Financial policy target: minimum SWM Capital Fund balance is >\$0
- Fund balances and debt reserve balances earn 3 percent interest

9.3.4 Projected SWM Fees

Figure 9-3 shows the 20-year projection of SWM fees for a single-family residence and the relative distribution of spending among repair/replacement, capital improvements, and O&M.

This graph indicates that approximately 35 percent of the current SWM fee pays for capital projects and repair and replacement. Over time, the O&M component increases due to inflation, added O&M activities associated with the completed capital improvements, and the costs to comply with assumed new regulatory requirements (i.e., NPDES Phase II).

The capital project component reflects cash-financed capital improvements and debt service payments on debt-financed capital improvements. Repair and replacement projects are cash-funded without issuance of debt. The projected amount of capital improvements funded by debt from 2004 through 2024 is approximately 70%. The assumed sources of this funding are revenue bond proceeds and loans from the Public Works Trust Fund.

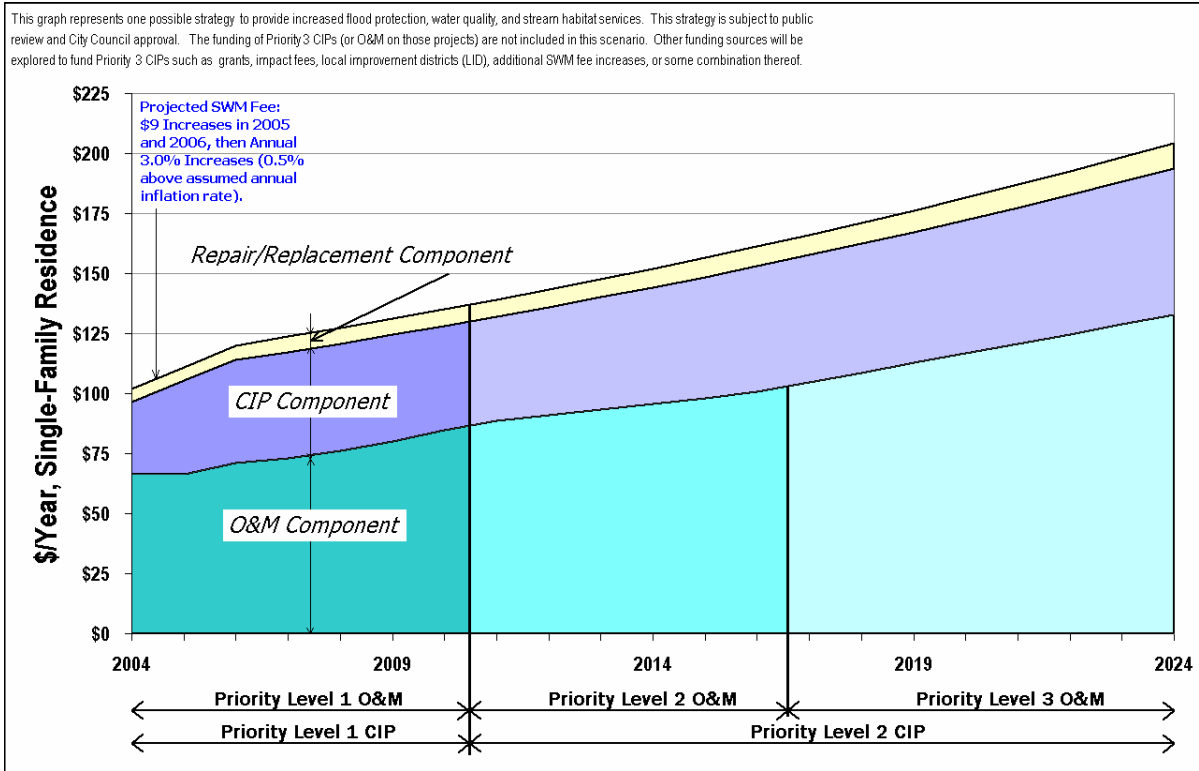


Figure 9-3. 20-Year Projection of Single-Family Residential SWM Fees

The ability of the SWM program to finance capital improvements depends in part on the level of SWM fees. If SWM fees higher than those described above were implemented, then additional capital improvements could be funded. Conversely, if SWM fees are not raised to the levels described above, fewer capital improvements could be funded.

The following additional factors could also facilitate completion of a greater amount of capital improvements:

- Receipt of additional low interest rate loans (the recommended plan assumes loans would be obtained with a 5.0 percent interest rate)
- Loans with longer payback periods (the recommended plan assumes a 20-year payback period)
- Receipt of grants (the recommended plan assumes no grant funding is received, though the City will continue to seek grant funding)
- Use of other, non-SWM funding sources such as impact fees, local improvement districts (LIDs) or partnering with other government and non-government entities on projects (the recommended plan assumes no additional funding sources)

A major factor affecting the SWM program is the contents of the upcoming NPDES Phase II stormwater general permit. If final permit requirements are less extensive than what has been anticipated in this plan, then the City could choose either to (1) defer projected SWM fee increases, or (2) construct additional capital improvements.

Appendices

- A Summary of Public Comments
- B Background Information on Regulatory Issues
- C Background Information on Current SWM Program
- D Project Cost Estimates
- E Operation and Maintenance Supporting Information
- F Financial Analysis Supporting Information
- G Changes in the Recommended Plan and the Financial Analysis from the Public Review Draft

Appendix A. Summary of Public Comments

City of Shoreline Master Plan and Comprehensive Plan Update

Summary of Open House Public Comments Surface Water and Critical Areas

On September 24 and 25, 2003, two open houses were held in the City of Shoreline to gather public input on the issues to be addressed in the City's update of the comprehensive plan and preparation of transportation, surface water, and parks/recreation/open space master plans. The following is a summary of public comments received at those open houses on surface water and critical areas.

Thornton Creek:

- Stop further development of Thornton Creek.
- Day-light the Thornton Creek drainage.
- Protect Thornton Creek. The *Thornton Creek Basin Characterization Report* does not indicate the full extent of wetlands existing from NE 155th south along the edge of I-5. The report misidentifies the watercourse draining into the north end of Twin Ponds as a natural watercourse and does not identify the natural watercourse that extends from behind the church at NE 155th south along the base of I-5 to Peverton Pond [Peverly Pond], which is described as an artificial watercourse.
- Remove the concrete bed in Thornton Creek along I-5.

Stream Protection:

- Compromise on buffers, if the resource is adequately protected.
- Day-light streams.
- Add more than minimal buffers. Buffers should be sufficient to prevent damage to the resource.
- Do not use streams as ditches.

Tree Protection:

- Protect trees.
- Advocate for tree retention by providing education and technical assistance to the public.
- Consider using trees for stabilization on steep slopes.
- Add more trees.
- It takes 100 years to grow one tree. They clean the air.
- Protect healthy trees by preventing cuts.
- Retain tree to help with surface water problems. Trees take up a lot of water!

Educational Programs:

- Adopt and enforce a regulation to prevent motor oil and paint from entering storm drains. This starts with education.
- Promote natural yard care.
- Restrict chemical and fertilizer use on lawns, and commercial yard spraying in residential neighborhoods.



- Implement an aggressive public education program to promote environmentally sound lawn and garden care. Work with the neighborhood groups in putting together informational sessions at their regular meetings.

Critical Area Protection:

- Enforce the City's critical area ordinances.
- Do not place picnic tables in critical areas, such as Twin Ponds.
- Increase native plant populations in wetlands to reduce erosion and water temperatures, and to increase habitat values.
- Keep the native habitat that is close to streams.
- Renew the storm drainage signs.
- Complete an environmental assessment of Shoreline – and protect its resources. The City is attacking the environment (i.e. Aegis, Thornton Creek, and stalled inventory of environmental resources).
- Remove off leash areas to protect the natural environment.
- Maintain 100-foot setbacks in critical areas.
- Improve water quality at Echo Lake, which has a high phosphorous content. Residents along the lake are very concerned about the water quality. They notice oil sheens after rain.
- Monitor closely the new development at the south end of Echo Lake to avoid environmental impacts.

Flooding Concerns:

- Address flooding that occurs along NE 11th and NE 175th.
- Proceed with original plan to open up the creek, as Ronald Bog endures flooding.
- Address flooding that occurs in the 1700 block, specifically NE 177th. There is a lake on the south side of street, and a runoff stream on the north side.
- Address flooding that occurs at NE 11th and NE 175th. Pump excess water because the dip on 10th fills up rapidly with heavy rain and floods the surrounding area. Present construction plans do not provide an adequate outlet for pond water.

Drainage Concerns:

- Implement a storm drainage project for 15th, between 10th NE and 12th NE. Only include sidewalks, if trees remain and no front yards are reduced along 175th.
- Implement a basin plan for Hamlin Creek in coordination with Seattle. High flows result in flooding and erosion, and prevent re-naturalization of the creek in a ditch along 20th.
- Remove invasive plant species in favor of native plants to slow flows.
- Add complexity and storage.
- Do more detention on Hamlin Creek in Fircrest.
- Take Hamlin Creek out of the pipe.
- Address sidewalks in front of new in-fill that disrupts, diverts, and creates water flow problems (see 163rd and Linden). One, lot-long gutter, does not make an improvement.
- Address problem with water in crawl spaces on the west side of Corliss between 185th and 190th.

- Address drainage concern along Meridian Avenue at Ronald Bog.
- Address land sinking at Corliss between 175th and 178th.
- Address drainage problems associated with large, grass play areas. They can stay boggy for long periods.
- Address drainage concern at Ronald Bog Park.
- Bring to landowner's attention trees that pose a hazard to drainage pipes.
- Address water problem that occurs at 32nd Avenue NE between 145th and 149th Avenue NE. The duplexes and apartments being built on 32nd are contributors.
- Increase water filtration of streams that feed Twin Ponds to decrease pollution. The green belts surrounding unearthened streams slow water down and provide a better filtration system.

Runoff Concerns:

- Address runoff from Linden to 184th. The area southeast of the fire station floods in heavy rain.
- Address sediment and oil runoff from the Shoreline Park and Ride that feeds directly into Echo Lake causing pollution. Work trucks hose down at the park and ride and the water goes directly into the drain.

Appendix B. Background Information on Regulatory Issues

Appendix B.

Background Information on Regulatory Issues

B.1 Introduction

This appendix includes a detailed review of the existing city, state, and federal policies, regulations, and ordinances relevant to surface water management in the City of Shoreline.

B.2 Relevant City Policies, Ordinances, and Regulations

This section provides an overview of the City of Shoreline's policies, ordinances, and regulations relevant to stormwater management. The City's regulations are set forth in the Shoreline Municipal Code (SMC), which includes several chapters related to environmental requirements. The City's Comprehensive Plan is also summarized.

B.2.1 Shoreline Municipal Code

B.2.1.1 Chapter 13.10 SMC — Surface Water Management Code

This chapter adopts Title 9, Surface Water Management, of the King County Code (KCC) by reference as the interim surface water management code, with amendments, in accordance with the Revised Code of Washington (RCW) 35.21.180, 35A.11.020, and 35A.21.160. This chapter also adopts all administrative rules and enforcement remedies that exist regarding Title 9 and any other relevant laws, rules, or regulations that are referenced in Title 9.

KCC Title 9 includes the surface water runoff policies that apply to the entire county. It includes drainage review requirements for new construction, insurance requirements, and types of drainage facilities maintained and not maintained by the County. Title 9 notes that the *King County Surface Water Design Manual* is to be referred to for additional details.

KCC Title 9 also establishes the surface water management fund and the corresponding rules and regulations for the County including definitions, rates, system development charges, billing and collection, charges for new construction, collection and penalties with respect to bill payment, and rate adjustments. The City of Shoreline obtains its storm drain utility funding from the surface water management fund that is managed by the County in accordance with an interlocal agreement.

B.2.1.2 Chapter 16.10 SMC — Shoreline Management Plan

This chapter adopts KCC Title 25 by reference as the City's interim shoreline management regulations and satisfies the requirements of the Shoreline Management Act of 1971 and

RCW 35.21.180, 35A.11.020, 35A.21.160, and 90.58.280. The Shoreline Management Plan (SMP) sets forth environmental designations intended to provide a uniform basis for applying policies to varying shoreline uses. This chapter also adopts by reference all administrative rules in effect regarding shoreline management that have been adopted in accordance with Chapter 2.98 KCC, Rules of County Agencies, or KCC Title 23, Code Compliance.

The SMP needs to be updated to comply with the new shoreline master program guidelines that the Washington State Department of Ecology (Ecology) adopted in December 2003. The City is required to update its shoreline master program by 2009

The general purpose of the City's shoreline master program is to encourage uses appropriate to the desired character of that environment and at the same time to place standards and restrictions on development and use activities so that they do not disrupt or destroy the character of that environment. The SMP defines what types of land uses are permitted in the various shoreline areas and defines setbacks for development.

The City has developed a strategy to update its shoreline master program prior to the 2009 deadline. This strategy includes completing the necessary updates to the program and adopting a new ordinance. The SMP is considered an element of the City of Shoreline's Comprehensive Plan and the regulations on activities that are included in the SMP supplement the City's building, zoning, and municipal codes.

B.2.1.3 Chapter 16.12 SMC — Flood Damage Prevention

This chapter, along with the regulations in SMC 20.80.360 through 20.80.410, satisfies the requirements of the National Flood Insurance Program and maintains the City as an eligible community for federal flood insurance benefits. These sections reference the Flood Insurance Rate Maps (FIRMs) for King County and incorporated areas which identify the special flood hazard areas. Special flood hazard areas are those areas subject to a one percent or greater chance of flooding in any given year as shown in the FIRM maps, which are compiled by the Federal Insurance Administration in its report, *The Flood Insurance Study for King County, Washington* (May 16, 1995, as amended). These sections summarize development standards intended to prevent flood damage. For information on relevant state regulations, see "State Floodplain Regulations" later in this appendix.

B.2.1.4 SMC Title 20 — Development Code

This title is the Unified Development Code for the City of Shoreline, Washington. The purpose of the Unified Development Code is essentially to guide the development of the City in a way that is consistent with the goals and policies of the Comprehensive Plan. The purpose is also to promote environmental protection. Several sections of this title that apply specifically to the stormwater management program are summarized in the following paragraphs.

SMC 20.30.490 through 20.30.700 — Environmental Procedures Ordinance

These sections, which make up Subchapter 8 of Chapter 20.30 SMC, were adopted under the State Environmental Policy Act (SEPA) (RCW 43.21C.120), and the SEPA Rules (WAC 197-11-904). These sections contain the City's SEPA procedures and policies to be used in conjunction with the SEPA Rules (Chapter 197-11 WAC).

Chapter 20.80 SMC — Critical Areas

This chapter was developed to comply with the requirements of the Growth Management Act (GMA), which was passed by the Washington State Legislature in 1990. The GMA is discussed in greater detail later in this appendix; however, a brief summary as it relates to the SMC is given here.

The GMA requires the fastest-growing counties in the state (including King County and the municipalities within King County) to develop local comprehensive land use plans and development regulations. It also requires that municipalities classify, designate, and develop regulations to protect certain critical areas prior to the completion of comprehensive land use plans. These critical areas include:

- Fish and Wildlife Habitat Conservation Areas
- Wetlands
- Aquifer recharge areas
- Geologically hazardous areas
- Flood hazard areas.

The intent of the critical areas designation is to require municipalities to provide regulatory protection of these critical areas prior to the development and adoption of comprehensive land use plans that meet the standards of the GMA. In this way, the conservation of critical areas can be accomplished while more detailed studies and discussions occur during the development of comprehensive plans that will ultimately determine a long-term approach to critical area protection.

Chapter 20.80 SMC includes critical environmental area protection goals; definition of regulated activities; standards and criteria for alteration or development of critical areas; rating system for streams and wetlands; required buffer areas for streams and wetlands; allowed development activities in streams, wetlands, and buffers; and mitigation performance standards and requirements.

The City has prepared and is considering adoption of draft updates to its critical areas regulations in accordance with the GMA.

B.2.2 Shoreline Comprehensive Plan

The 1998 City of Shoreline Comprehensive Plan and EIS (Shoreline 1998) were developed and adopted in Chapter 16.05 SMC to meet the requirements of the Growth Management Act as expressed in Chapter 36.70A RCW and the State Environmental Policy Act as expressed in Chapter 43.21C RCW. The plan contains several elements, including environmental protection, housing economic development, community facilities and services, land use, transportation, and utilities. The City's Comprehensive Plan is currently being revised. Goals and policies related to surface water are discussed in Chapters 5, 6, and 7.

B.3 Relevant State Regulations and Programs

B.3.1 Puget Sound Water Quality Action Team and Work Plan (Puget Sound Plan Requirements)

The Puget Sound Water Quality Protection Act, passed during the 1996 Legislative session, creates a new approach to water quality protection in the Puget Sound Basin. A 17-member Puget Sound Action Team and 12-member Puget Sound Council now lead water quality protection efforts in the Puget Sound Basin. The Action Team assumed responsibility for implementing the 1994 Puget Sound Water Quality Management Plan, which had previously been the responsibility of the Puget Sound Water Quality Authority (PSWQA). The Action Team, with guidance from the Puget Sound Council, must also develop biennial work plans that identify both state and local actions necessary to correct regional water quality problems. It is the policy of the state to implement the 1994 Puget Sound Water Quality Management Plan to the maximum extent possible.

B.3.1.1 Puget Sound Water Quality Management Plan

The *Puget Sound Water Quality Management Plan* (Puget Sound Plan) establishes a comprehensive plan to protect and improve water quality and aquatic resources in Puget Sound. The PSWQA was directed to identify water quality problems and corresponding pollution sources affecting marine life and human health, and to develop effective pollution control and management programs that could be implemented in a comprehensive multi-jurisdictional manner throughout the Puget Sound Basin.

The 1994 Puget Sound Plan incorporated and built on the Authority's 1991, 1989, and 1987 management plans. The *Puget Sound Water Quality Management Plan* is also the Puget Sound Comprehensive Conservation and Management Plan (CCMP) for the Puget Sound Estuary Program, as authorized by the federal Clean Water Act.

As noted above, the Puget Sound Action Team replaced the PSWQA during the 1996 Legislative session. While the PSWQA no longer exists, the intent of the Puget Sound Action Team is to guide the implementation of the many elements of the 1994 Puget Sound Plan (and subsequent plans). A number of programs regarding stormwater management were included in the 1994 plan. State authority to require jurisdictions to implement the provisions contained within the 1994 Puget Sound Plan is inherent in the 1996 Puget Sound Water Quality Protection Act, discussed previously. These programs are described in the following subsections.

B.3.1.2 Development Standards and Operations and Maintenance Programs for all Municipalities

The provisions within the 1994 Puget Sound Plan for achieving the program's goal of controlling pollution from stormwater is to implement best management practices (BMPs), assess their effectiveness, and, as necessary, require further water quality controls that may include treatment. This includes a requirement for jurisdictions to adopt a stormwater management ordinance (or ordinances) with minimum standards for new development and redevelopment. The ordinances are to be substantially equivalent to Ecology's model ordinances.

These ordinances shall address, at a minimum: (1) the control of water quality and quantity impacts from new development and redevelopment sites; (2) the use of source control best

management practices and treatment best management practices; (3) the effective treatment, using best management practices, of the 6-month design storm for proposed development; (4) the use of infiltration, with appropriate precautions, as the first consideration in stormwater management; (5) the protection of stream channels and wetlands; (6) erosion and sedimentation control for new construction and redevelopment projects; and (7) local enforcement of these stormwater controls.

In addition, each municipality shall also develop and enforce operation and maintenance programs and ordinances for new and existing public and private stormwater systems. Each municipality shall maintain records of new public and private storm drainage systems and appurtenances.

The 1994 plan also requires that in conjunction with the runoff control ordinances for new development and redevelopment, each jurisdiction shall adopt a stormwater management technical manual containing state-approved BMPs. A local government may adopt Ecology's technical manual or prepare its own technical manual as long as it has technical standards equivalent to those included in Ecology's manual.

Education programs to inform citizens about stormwater and its effects on water quality, flooding, and fish-wildlife habitat, and to discourage dumping of waste material or pollutants into storm drains, are also included in the Education and Public Involvement Program and the Household Hazardous Waste Program sections of the 1994 plan.

Each municipality that adopts a comprehensive land use plan and development regulations under the provisions of Chapter 36-70A RCW (the Growth Management Act), shall incorporate the goals of the local stormwater program into the goals of the comprehensive plan and shall incorporate the stormwater management ordinances into the development regulations.

Consistent with the Growth Management Act, each local jurisdiction in the Puget Sound Basin is expected to cooperate with neighboring jurisdictions in growth management, stormwater planning, and stormwater basin planning.

Ecology will monitor compliance with these requirements, reviewing the status of municipality operation and maintenance and runoff control programs every two years to ensure consistent and adequate implementation. Ecology's oversight role shall pertain only to compliance with the objectives of the plan's stormwater program and appropriate rules and statutes and technical suggestions to improve implementation. This should ensure maximum flexibility and creativity for local governments to resolve site-specific stormwater problems in accordance with their land use and other local policies.

B.3.1.3 Comprehensive Urban Stormwater Programs

Each municipality must develop and implement a comprehensive stormwater management program in order to:

- Control erosion and manage the quantity and the quality of stormwater runoff from public and private activities
- Protect and enhance water quality, and achieve water quality and sediment quality standards
- Reduce the discharge of pollutants to the maximum extent practicable within the constraints of federal and state laws
- Protect beneficial uses, as described in Chapter 173-201 WAC

- Achieve the four items above in a manner that makes efficient use of limited resources to address the most critical problems first.

Each urban stormwater program shall seek to control the quality and quantity of runoff from public facilities and industrial, commercial, and residential areas, including streets and roads. Each program shall cover both new and existing development. Early action by urbanized areas that are prepared to implement stormwater control programs is encouraged. Emphasis shall be placed on controlling stormwater through source controls and BMPs. Where local programs are not effectively solving stormwater problems, Ecology shall ensure compliance through its oversight role. Each municipality shall have the flexibility to design its own program, but the content, priorities, and deadlines for compliance shall be subject to review by Ecology for consistency with the Puget Sound Plan.

In some cases, significant stormwater problems may be originating in urbanized areas outside of a local jurisdiction. In those situations, the sequencing of areas for urban stormwater programs may be modified to address problems in shared watersheds. The neighboring jurisdictions will develop local coordination mechanisms to cooperatively resolve the identified problems. Where joint programs are not developed, Ecology shall ensure consistency in programs through its oversight role.

At a minimum, each urban stormwater program shall include:

- Identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies through an ongoing assessment program
- Investigations and corrective actions of problem storm drains
- Programs for operation and maintenance of storm drains, detention systems, ditches, and culverts
- A water quality response program, to investigate sources of pollutants, and respond to citizen complaints or emergencies such as spills, fish kills, illegal hookups, dumping and other water quality problems. These investigations should be used to support compliance/enforcement efforts
- Assurance of adequate local funding for the stormwater program through surface water utilities, sewer charges, fees, or other revenue-generating sources
- Local coordination arrangements such as interlocal agreements, joint programs, consistent standards, or regional boards or committees
- Ordinances requiring implementation of stormwater controls for new development and redevelopment
- A stormwater public education program aimed at residents, businesses and industries in the urban area
- Inspection, compliance, and enforcement measures
- An implementation schedule
- If, after implementation of the control measures listed in the points above, there are still discharges that cause significant environmental problems, retrofitting of existing development and/or treatment of discharges from new and existing development may be required.

Stormwater quality in public stormwater systems in commercial and industrial areas shall have a high priority in the municipal programs. Ecology shall determine, in compliance with

U.S. Environmental Protection Agency (EPA) regulations and in consultation with local governments, the appropriate approach to controlling stormwater discharges from industrial and commercial facilities that are not currently required to have stormwater National Pollutant Discharge Elimination System (NPDES) or point source discharge permits. Stormwater controls are included in NPDES permits for discharges of stormwater from commercial and industrial point source facilities, which are addressed in the Industrial Discharges Program.

Ecology shall have oversight responsibilities for the urban stormwater programs. Ecology shall review each urban stormwater program every two years to ensure consistent and adequate implementation and report to the Action Team.

B.3.1.4 Local Government Stormwater Assistance Service

The intent of the 1994 Puget Sound Plan and subsequent Puget Sound Water Quality Work Plans is to provide technical assistance to local governments through staff who have hands-on experience with (1) the design and implementation of stormwater programs at the local level, (2) current BMPs for stormwater, and (3) local basin characteristics. Ecology shall assist the municipality with current stormwater expertise to establish a technical assistance service.

This service will support the exchange of technical information and assistance on stormwater among local governments, will train Ecology and local government staff in current practices and real world application and problems in stormwater technology, and will operate as an integral part of the state technical assistance program. The service will have the goal of acting as an in-the-field branch of Ecology's technical assistance program.

B.3.1.5 Guidance and Model Ordinances

Ecology will prepare and update guidance and model ordinances for stormwater programs for all municipalities and for comprehensive urban stormwater programs. All municipalities will adopt stormwater programs that include minimum requirements for new development and redevelopment set by the plan and in guidance developed by Ecology.

The guidance shall include:

- Procedures for developing local programs, including procedures for review and approval of programs
- Minimum requirements for runoff controls and system maintenance required in local ordinances
- Minimum requirements for control of private sector maintenance of private drainage systems
- Minimum requirements for operation and maintenance programs, including record keeping requirements for drainage systems and facilities
- Methods for assuring practical and appropriate disposal procedures for decant water, solid, and other substances from drainage system cleanout and maintenance. Methods shall address catch basins, oil/water separators, pipelines, swells, detention/retention basins, and other appropriate drainage elements.

Additionally, the guidance for the comprehensive urban stormwater programs will include:

- Procedures for identification and ranking of significant pollutant sources and their relationship to the drainage system and water bodies

- Procedures for source tracing investigations, including sampling of problem storm drains
- Procedures for investigations, implementation of spill-control measures, enforcement, and remedial actions
- Methods for assuring adequate local funding for the urban stormwater program
- Provisions for agreements with neighboring jurisdictions when stormwater and watersheds do not follow jurisdictional boundaries
- Requirements for public education programs
- Requirements for retrofitting and/or treatment measures, if necessary
- Procedures for inspection, compliance, and enforcement measures
- Requirements for implementation schedules
- Methods to coordinate stormwater management with other watershed habitat protection and growth management activities.

The guidance will lay out acceptable approaches to control stormwater from new development and redevelopment, such as water quality policies for use in SEPA, NPDES, and other permit decisions; density controls to limit development in sensitive areas; development standards to limit the amount of impervious surfaces; regional detention ponds; oil separators or other treatment facilities; grading and drainage ordinances; erosion control programs; buffers next to waterways; preservation of wetlands; and other appropriate elements.

B.3.2 Hydraulic Project Approval

The Washington Department of Fish and Wildlife (WDFW) requires a Hydraulic Project Approval (HPA) for construction activities that use, divert, obstruct, or change the natural flow or bed of any waters of the state (RCW 75.20.100). The purpose of the requirements, which are administered through the HPA permit process, is to protect fish habitat in stream channels, to prevent erosion, and to protect freshwater and nearshore marine aquatic life. Any construction activity such as channel widening or culvert improvements within the ordinary high water mark of any stream would fall under the HPA permit requirements. In some instances, WDFW is also extending its permitting authority to include developments creating new impervious surfaces in excess of 5,000 square feet even if the project does not include work within the ordinary high water mark. The rationale for extending its permit authority is that such a project will affect the hydrologic regime of downstream stream habitats.

B.3.3 Growth Management Act

Enacted on July 1, 1990, the Growth Management Act is intended to manage growth in Washington's fastest-growing counties through the adoption of local comprehensive land use plans and development regulations. A 1995 GMA amendment requires all counties and cities in Washington to include the best available science in developing policies and development regulations to protect the functions and values of critical areas. For more information on the City of Shoreline's critical areas ordinance, see the discussion of "Chapter 20.80 SMC — Critical Areas" earlier in this appendix.

B.3.4 State Floodplain Regulations

Chapter 86.16 RCW establishes statewide authority through regulations promulgated by Ecology for coordinating the floodplain management regulation elements of the National Flood Insurance Program (NFIP). Under Chapter 173-158 WAC, Ecology requires local governments to adopt and administer regulatory programs compliant with the minimum standards of the NFIP. Ecology provides technical assistance to local governments for identifying the location of the 100-year (base) floodplain.

Ecology also establishes land management criteria in the base floodplain area by adopting the federal standards and definitions contained in 44 CFR Parts 59 and 60 as minimum state standards. In addition to adopting the federal standards, the state regulations provide for additional regulation of residential development in the floodplain.

A Flood Insurance Study and associated Flood Insurance Rate Maps for King County were published in May 1995 and adopted by the City (see the discussion of “Chapter 16.12 SMC — Flood Damage Prevention” earlier in this appendix).

B.4 Relevant Federal Regulations and Programs

B.4.1 National Pollutant Discharge Elimination System

B.4.1.1 Federal Stormwater Management Policy

In 1990, the federal government adopted the NPDES Phase I Rule, which addressed priority sources of pollutant runoff, including stormwater pollution from medium and large Municipal Separate Storm Sewer Systems (MS4s), industrial sources, and construction sites disturbing at least five acres.

In 1999, the federal government adopted the NPDES Phase II Rule, which primarily regulates smaller MS4s not covered under Phase I that are part of urbanized areas, plus construction activities of between one and five acres. The City of Shoreline will be required to obtain a permit under the Phase II Rule. This rule is designed to comply with the requirements of the Clean Water Act (CWA) to further protect our nation’s streams, rivers, and beaches from polluted stormwater runoff.

B.4.1.2 NPDES Phase II Objectives

The EPA’s objectives in developing the Phase II regulations include:

- Providing a comprehensive stormwater program that designates and controls additional sources of stormwater discharges to protect water quality, pursuant to CWA Section 402 (p)(6)
- Addressing discharges of stormwater from activities not addressed by Phase I, including:
 - All construction site activities involving clearing, grading, and excavating land equal to or greater than one acre (including projects that are comprised of several sites of less than one acre each)
 - “Light” industrial activities not exposed to stormwater (light industrial activities exposed to stormwater are covered under Phase I)

- MS4s located in urbanized areas not covered under Phase I
- Municipally owned industrial facilities that were addressed under Phase I but granted an extension under ISTEA (Intermodal Surface Transportation Efficiency Act)
- Facilitating and promoting watershed planning as a framework for implementing water quality programs wherever possible.

EPA aims to achieve these objectives by balancing nationwide automatic designation and locally based designation. EPA will designate, on a nationwide basis, that the NPDES Phase II rule is applicable to the following:

- Stormwater discharges from small MS4s located in urbanized areas
- Construction activities that result in land disturbance equal to or greater than one acre.

EPA believes that these designation criteria address the main sources of stormwater pollution causing significant degradation of surface waters. Permitting authorities (Ecology, in Washington State) may designate additional Phase II permittees, such as additional small MS4s and categories of individual sources of stormwater discharges that are problematic in specific communities.

B.4.1.3 NPDES Phase II Permitting Authority for the State of Washington

The State of Washington is authorized to administer the federal NPDES program and Ecology is the state agency with responsibility for the following:

- Issuing NPDES permits
- Issuing the menu of appropriate BMPs in cases of general permits
- Supporting local programs by:
 - Overseeing programs
 - Ensuring municipalities have adequate legal authority
 - Providing technical assistance
- Providing waivers for some or all permit requirements.

Ecology has stated that it will issue one general permit for all Phase II permittees that will describe permit conditions for all small MS4s in order for them to be in compliance with the federal NPDES Phase II Rule. According to the federal rule, each Phase II permittee is required to submit a notice of intent (NOI) to be covered under the general permit as well as the permit application by March 10, 2003. In Washington, these two documents are combined into a single permit application.

According to the federal rule, the NPDES permitting authority (Ecology) was supposed to issue a final general permit by December 8, 2002. Ecology is expected to issue a final general permit within the next year. The expiration date of the first permit term for the general permit will be five years after its issuance.

The federal rule specifies that the regulated MS4 programs, described in this case in Ecology's general permit, must be developed and implemented within the first five-year permit term.

B.4.1.4 Stormwater Management Requirements under NPDES Phase II

Stormwater Management Requirements for entities affected by the NPDES Phase II Rule are as follows:

- **For MS4s:** The EPA requires, under the Phase II regulation, that all owners/operators of small MS4s reduce the discharge of pollutants from a regulated system to the “maximum extent practicable” to protect water quality (Federal Register Vol. 63, p. 1574). At a minimum, jurisdictions regulated under Phase II must:
 - Specify BMPs for six minimum control measures and implement them to the “maximum extent practicable”
 - Identify measurable goals for control measures
 - Show an implementation schedule of activities or frequency of activities
 - Define the entity responsible for implementation.
- **For Construction and Other Activities:** Construction activities that disturb one to five acres must also be regulated under an NPDES Phase II permit. The NPDES permitting authority may also require that other facilities and industrial and construction activities, as well as small MS4s outside urbanized areas, be designated on a case-by-case or categorical basis.

Each of these requirements is discussed in more detail in the subsections that follow.

B.4.1.5 BMPs for Six Minimum Control Measures

Municipal stormwater management programs must specify best management practices for the following six minimum control measures:

- (1) Public Education and Outreach Minimum Control Measure
 - A public education program must be implemented to distribute educational materials to the community.
 - The community should be made aware about the impacts of stormwater discharges to water bodies and the steps needed to reduce stormwater pollution.
 - Municipalities are encouraged to work with other governmental entities and civic, environmental, and industrial organizations to develop an education/outreach program more efficiently.
- (2) Public Participation/Involvement Minimum Control Measure
 - The public must be involved in developing the municipality’s stormwater program by following applicable state, tribal, and local public notice requirements.
 - All economic and ethnic groups should be included.
 - Examples of public involvement/participation that should be considered include public hearings, citizen advisory boards, and working with citizen volunteers.

- (3) Illicit Discharge Detection and Elimination Minimum Control Measure
 - The goal of this control measure is for the Phase II MS4 permittee to demonstrate awareness of its system, using maps or other existing documents.
 - The permittee also must develop a storm sewer system map that shows all outfalls, and the location/name of all waters of the United States that receive discharges.
 - A Phase II MS4 permittee must effectively prohibit illicit discharges into the separate storm sewer system.
 - Appropriate enforcement procedures must be implemented.
 - A Phase II MS4 permittee must develop and implement a plan to detect and address illicit discharges (including illegal dumping) to the system.
 - Public employees, businesses, and the public must be informed of the hazards associated with illegal discharges and improper disposal of waste.
- (4) Construction Site Runoff Control Minimum Control Measure
 - Phase II MS4 permittees must develop, implement, and enforce a program to reduce nonpoint source pollution from construction sites with a land disturbance of more than one acre.
 - A regulatory mechanism must be used to control erosion and sediment from applicable construction sites to the maximum extent practicable and allowable under state, tribal, or local law.
 - Existing erosion and sediment control ordinances may suffice, if approved by the NPDES permitting authority.
- (5) Post-Construction Runoff Control Minimum Control Measure
 - Phase II MS4 permittee must develop, implement, and enforce a program that addresses stormwater runoff from new development and redevelopment projects that result in land disturbances of at least an acre and that discharge to their MS4.
 - Appropriate structural and non-structural BMPs must be used.
 - Controls must ensure that water quality impacts are minimized.
 - Adequate long-term operation and maintenance of BMPs connected to a regulated MS4 must be addressed.
 - The goal, at a minimum, should be to maintain pre-development runoff conditions.
 - EPA encourages the use of preventive measures, including non-structural BMPs, which are usually thought to be more cost-effective.
- (6) Pollution Prevention/Good Housekeeping Minimum Control Measure
 - Phase II MS4 permittees must develop and implement cost-effective operation and maintenance, as well as training programs, with the goal of preventing or reducing pollutant runoff from municipal operations.

B.4.1.6 Measurable Goals for Control Measures

The requirement allowing each permittee to identify its own measurable goals for each control measure is unique to Phase II. Communities regulated under Phase I were subject to more prescriptive compliance requirements. Examples of measurable goals include:

- Inspecting or repairing a certain number of drain inlets each year
- Conducting street-sweeping operations a certain number of times each year
- Inspecting municipal right-of-ways to identify illicit discharges
- Conducting a certain number of training classes for municipal operations each year
- Reporting the help of a certain number of volunteers each year to perform water quality monitoring or education/outreach activities.

B.4.1.7 Implementation Schedule of Activities or Frequency of Activities

Regulated communities must show an implementation schedule of activities or frequency of activities that will be done as part of the stormwater management program. An example might include the following entries:

Sweep City streets	X times per year
Vacuum storm drain inlets	Y times per year
Conduct classroom stormwater education	Z times per year
Implement Household Hazardous Waste Program	by a certain date

B.4.1.8 Entity Responsible for Implementation

Regulated communities must also indicate who is responsible for the stormwater management program. There must be one entity or person responsible for the entire program.

The Phase II regulations are amenable to creative implementation strategies, as they encourage communities to take a watershed or cooperative approach. Communities may also be covered under a neighboring Phase I community, or allow another entity, such as a county, to implement certain minimum control measures or portions of minimum control measures. The regulated entity, however, is still responsible for complying with the requirements of the permit.

B.4.1.9 Phase II Permitting Process

Phase II Small MS4

A general permit will most likely be issued by Ecology to cover Phase II MS4s in Washington, although the timeframe is currently unknown. Permittees will need to submit a permit application to Ecology to be covered under a general permit. As part of this application, an applicant may be required to identify and submit the following information:

- The BMPs that will be implemented
- The measurable goals for the minimum control measures
- The month and year in which each BMP will be started and completed or the frequency of action if it is ongoing

- The person(s) responsible for implementing or coordinating the stormwater management program.

Phase II Regulated Construction Site

Under the Phase I program, for land-disturbing activities greater than five acres, a notice of intent was required for coverage under a general construction permit. For the Phase II Rule, EPA is not specifying NOI requirements for construction sites of between one and five acres applying for coverage under a general permit. While EPA recognizes the benefit of NOIs—which allow for better outreach and dissemination of information—federal regulators are sensitive to the burden being placed on the regulated community and on the NPDES regulators. Therefore, it is up to Ecology, as the NPDES permitting authority, to determine whether it will require NOI submission for construction sites disturbing less than five acres. Ecology is currently revising its construction stormwater general permit and is expected to require an NOI for sites disturbing one to five acres. Ecology has not announced a date on which the permit will be reissued. The NOI (also known as construction stormwater general permit) for construction projects disturbing greater than five acres can be used to obtain coverage for smaller projects in the interim.

Phase II Industrial Stormwater Permit

Industrial sites requiring permits, as determined by standard industrial classification (SIC) codes, are required to obtain an NPDES permit for industrial activities. The deadline for permit applications was January 30, 2003; however, the City of Shoreline does not currently own or maintain any facilities that would require an industrial stormwater permit.

B.4.1.10 NPDES Phase II Ongoing Requirements

Under the Phase II rule, regulated communities must conduct periodic evaluations and assessments of their stormwater management practices, maintain records, and prepare required reports. These requirements are summarized in Table B-1.

**Table B-1
Minimum Reporting Requirements**

Evaluation and Assessment Requirements	Recordkeeping Requirements	Reporting Requirements
<ul style="list-style-type: none"> ▪ Evaluate program compliance ▪ Evaluate the appropriateness of identified BMPs ▪ Evaluate progress toward achieving measurable goals ▪ The NPDES permitting authority may determine monitoring requirements appropriate to your watershed. EPA encourages participation in a group monitoring project. 	<ul style="list-style-type: none"> ▪ Keep records required by the NPDES permitting authority for at least three years ▪ Submit the records when requested by the permitting authority ▪ Make records and stormwater management plan accessible to the public during regular working hours <ul style="list-style-type: none"> ○ A reasonable copying fee may be charged ○ Advance notice of up to two days for copying may be requested 	<ul style="list-style-type: none"> ▪ Submit annual reports to the permitting authority for the first permit term ▪ In subsequent terms, submit reports in years two and four or more frequently as required ▪ Reports should include: <ul style="list-style-type: none"> ○ Status of permit condition compliance ○ Appropriateness of identified BMPs ○ Progress toward achieving measurable goals for each measure ○ Results of data collected and analyzed during the reporting period ○ A summary of the activities that will take place during the next reporting period ○ Any changes in measurable goals

B.4.2 Endangered Species Act

This section contains background on the ESA and the sections of the ESA that are relevant to surface water management activities. This is followed by discussions of that relate the ESA to the City of Shoreline and describe current actions by local and regional governments to respond to ESA requirements.

B.4.2.1 Background

When evaluating the City’s stormwater program, it is important to be aware of how the ESA (as it relates to fish species) can impact the City’s activities. Puget Sound and its tributary

streams in the vicinity of the City of Shoreline provide habitat, or may provide habitat, for aquatic species listed as threatened or endangered under the Endangered Species Act of 1973. The ESA prohibits killing or harming an endangered species in any way, including significant modification of critical habitat for that species. The ESA requires federal agencies to develop programs to conserve endangered and threatened species and assist in species recovery. Under the ESA, a species likely to become extinct in the foreseeable future is categorized as “endangered,” while one likely to become endangered unless action is taken is categorized as “threatened.”

The ESA is jointly administered by the Secretaries of the Department of Commerce (DOC) and the Department of the Interior (DOI) (16 USC 1532 [15]). The National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries), an agency under the DOC, is responsible for marine species including anadromous fish, some sea turtles, and marine mammals. (Until recently, NOAA Fisheries was known as the National Marine Fisheries Service, or NMFS.) The U.S. Fish and Wildlife Service (USFWS), an agency under the DOI, is responsible for terrestrial species and resident aquatic species.

Although the ESA is a federal statute, its implementation can affect local jurisdictions and their citizens in several ways. A listing can potentially affect a wide variety of activities including, but not limited to, stormwater management practices, infrastructure improvements, land use planning, maintenance of existing facilities, and private development proposals.

The body of federal legislation that is commonly termed the “Endangered Species Act” is comprised of 11 sections, six of which are commonly referenced in relation to regulatory actions. These are:

- Section 4: Determination of Endangered and Threatened Species
- Section 6: Cooperation with States
- Section 7: Interagency Cooperation
- Section 9: Prohibited Acts
- Section 10: Exceptions
- Section 11: Penalties and Enforcement.

The following sections describe these six sections of the ESA.

Section 4: The 4(d) Rulemaking Process

In June 2000, the NMFS adopted a rule prohibiting the “take” (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, or collect; or to attempt any of these things) of 14 groups of salmon and steelhead listed as threatened under the ESA. NMFS adopted the take rule under Section 4(d) of the ESA. This rule prohibits anyone from taking a listed salmon or steelhead, except in cases where the take is associated with an approved program. The 4(d) rule approves some specific existing state and local programs, and creates a means for NOAA Fisheries to approve additional programs if they meet certain standards set out in the rule. The 4(d) rule for salmon took effect in January 2001. The 4(d) rule for steelhead took effect in September 2000.

In addition to the 4(d) rule, the ESA provides a variety of tools for saving species threatened with extinction. Under Section 7 of the ESA, no federal agency may fund, permit, or carry out any activity that will jeopardize their continued existence. Projects

that require a federal permit or have federal funding must go through a “consultation” with NOAA Fisheries (for salmon and steelhead) or the USFWS (for bull trout). This “consultation” is to make sure that the project will adequately limit any impacts and qualify for an “incidental” take of listed species. Another tool, under Section 10 of the ESA, allows NOAA Fisheries to issue incidental take permits for specific activities such as research that usually do not apply to a municipality.

Under Section 4(d), the ESA requires that activities of state and local governments, tribes, and private citizens be controlled so they do not lead to extinction of listed species. To comply with this, NOAA Fisheries has established protective rules for threatened species. The rules need not prohibit all “take,” however. The 4(d) rule can “limit” the situations to which the take prohibitions apply. But NOAA Fisheries offers 4(d) “limits” only for those programs or activities that will not impair properly functioning habitat of listed species. In accordance with this provision, NOAA Fisheries has established 13 general categories of programs that can qualify for 4(d) limits on the take prohibitions. NOAA Fisheries will evaluate programs under these 13 categories that wish to be granted a 4(d) limit on take prohibitions. Limit No. 10, Routine Road Maintenance, is a category under which a municipal program could be evaluated by NOAA Fisheries for a 4(d) limit on take prohibitions. Limit No. 12, Municipal, Residential, Commercial, and Industrial Development and Redevelopment (MRCI), is another category under which a municipal program could be evaluated by NOAA Fisheries for a 4(d) limit on take prohibitions. The Tri-County effort described below has obtained NOAA Fisheries approval of road maintenance and is working to obtain NOAA Fisheries approval of MRCI programs so that any jurisdiction that adopts these programs would then be eligible for the 4(d) limit on take prohibition.

The ESA does not directly require jurisdictions to change their practices to conform to the take limits described in the final rule. The take limits provide a way for jurisdictions to make sure an activity or program does not violate the take prohibitions. Without this assurance, jurisdictions would risk ESA penalties when an activity in question is determined to result in a take of a listed fish.

The 4(d) rule also provides a list of activities that have a high risk of resulting in a “take” of the listed threatened or endangered salmonids. The following list includes items that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids. City design standards should prohibit:

- Construction of structures like culverts, berms, or dams that eliminate or impede a listed species’ ability to migrate or gain access to habitat
- Removal, addition, or alteration of rocks, soil, gravel, vegetation, or other physical structures that are essential to the integrity and function of a listed species’ habitat
- Removal of water or otherwise altering streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns
- Construction of dams or water diversion structures with inadequate fish screens or passage facilities
- Construction of inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species’ habitat

- Operations that substantially disturb soil and increase the amount of sediment going into streams.

The following list includes items that should be included in the City's regulations so that these activities that the 4(d) rule has determined are likely to result in injury or harm to listed salmonids would be illegal.

- Discharge of pollutants, such as oil, toxic chemicals, radioactivity, carcinogens, mutagens, teratogens, or organic nutrient-laden water (including sewage water) into a listed species' habitat is prohibited.
- The release of non-indigenous or artificially propagated species into a listed species' habitat or into areas where they may gain access to that habitat is prohibited.

The 4(d) rule has determined that the following maintenance-related items are likely to result in injury or harm to listed salmon. The City's maintenance program should not:

- Maintain structures like culverts, berms, or dams if maintenance eliminates or impedes a listed species' ability to migrate or gain access to habitat
- Remove, poison, or contaminate plants, fish, wildlife, or other biota that the listed species requires for feeding, sheltering, or other essential behavioral patterns
- Remove, add, or alter rocks, soil, gravel, vegetation, or other physical structures that are essential to the integrity and function of a listed species' habitat
- Remove water or otherwise alter streamflow in a manner that significantly impairs spawning, migration, feeding, or other essential behavioral patterns
- Operate dams or water diversion structures with inadequate fish screens or passage facilities
- Maintain or operate inadequate bridges, roads, or trails on stream banks or unstable hill slopes adjacent to or above a listed species' habitat.

Chinook salmon in Puget Sound were federally listed as threatened species by the National Marine Fisheries Service in March 1999. Bull trout in Puget Sound and coastal waters were listed as threatened species by the U.S. Fish and Wildlife Service in October 1999, and coho salmon are currently candidate species in the Puget Sound.

Section 6: Cooperation with States

Although Section 6 is titled "Cooperation with States," the law only requires agencies to "cooperate to the maximum extent practicable" with the states. Such cooperation includes "consultation with the states concerned before acquiring any land or water, or interests therein, for the purpose of conserving any endangered species or threatened species" (16 USC 1535[a]). The ESA does not require the federal government to delegate any authority to state or local governments concerning the conservation or recovery of listed species, although provisions for this are made in Section 10 of the ESA (described later in this section).

Section 7: Federal Responsibilities

Section 7 requires the federal government and its agencies to conserve listed species and to ensure that any projects or actions it authorizes, funds, or implements are not likely to jeopardize listed species or destroy or adversely modify their critical habitat. Under Section 7, the federal agency with permit or funding authority must review a project to determine if the project “may affect” a listed species (50 CFR 402.07). If a project is determined to affect a listed species, the federal agency must consult with the USFWS or NOAA Fisheries (or both), depending on the species (50 CFR Section 402.14). An informal or “conference” process is required if a project may affect a proposed species (50 CFR 402.13). Section 7 requires the preparation of a Biological Assessment (BA) (also termed Biological Evaluation, or BE) for projects with a federal link or “nexus” to determine what, if any, effects the project or action may have on a listed species (50 CFR 402.12). A BA/BE may also be required for species that are proposed for listing, but are not yet formally listed. At this time, coho is a candidate species in the Puget Sound region.

The purpose of a BA/BE is to review the biological requirements of a listed species to determine potential effects of the project or action on those species (50 CFR 402.12). After the consultation process is complete, the USFWS or NOAA Fisheries will issue a Biological Opinion (BO) (50 CFR 402.15). The BO will determine if the project or action would result in “jeopardy” or the destruction or modification of critical habitat (50 CFR 402.14[h][3]). If a project or action is determined to affect a species that has been proposed for listing, the federal lead agency must complete an informal consultation with either the USFWS or NOAA Fisheries, but the results of the subsequent conference is non-binding.

Section 7 consultation is only required for projects that may lead to construction. If a local construction project has a federal nexus, either through federal funding or a requirement for a federal permit, review of that action will be necessary under Section 7. Common federal permits or actions requiring review under Section 7 include:

- National Environmental Policy Act (NEPA) reviews for proposed construction projects
- Corps of Engineers Clean Water Act Section 10 and Section 404 permits
- Funding for construction projects derived from a federal source.

Funding does not have to be in the form of a direct grant from a federal agency. Many types of grant programs are administered by state or local agencies, but these programs often include full or partial federal funding. Such programs include urban development block grants, clean water programs, and most forms of transportation funding.

Section 9: Prohibition of “Take”

Under Section 9 of the ESA, individuals and groups within U.S. jurisdiction are specifically prohibited from “taking” or otherwise harming a listed species (16 USC 1538 [a][1][b]). “Take” means to “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct,” any fish, wildlife, or plant that has been listed as threatened or endangered (16 USC 1532 [19]).

Subsequent interpretation and clarification by federal courts and agencies have expanded “harm” to include indirect actions which may result in the death or injury of

protected species including significant habitat modification which may impair “essential behavior patterns, including breeding, feeding, or sheltering” (50 CFR 17.3).

Whereas the Section 7 process, as stated in the law (16 USC 1536) and implementing regulation (50 CFR 402), includes specific instructions and requirements for review by federal agencies, Section 9 simply states “with respect to any endangered species of fish or wildlife listed pursuant to [Section 4 of the ESA] it is unlawful for any person subject to the jurisdiction of the United States to take any such species within the United States or the territorial sea of the United States” (16 USC 1538[a][1][b]). While Section 9 arguably includes a much broader range of prohibited actions by simply prohibiting take, unlike Section 7, the language of Section 9 does not include a parallel process by which take is evaluated and adjudicated. To deal in part with the ambiguity, the 4(d) rulemaking process often includes criteria that NOAA Fisheries or USFWS will use in determining what constitutes “take.”

Section 10: State and Local Involvement

Although the ESA does not require the federal government to impart any authority to state or local governments or private parties concerning the conservation or recovery of listed species, the recent policy of federal agencies has been to provide state and local governments and large private landowners the opportunity to develop and implement their own protection and conservation measures. These are accomplished through voluntary, although legally binding, agreements provided for under Section 10 of the ESA (16 USC 1530). The types of agreements allowed under Section 10 include Candidate Conservation Agreements, Safe Harbor Agreements, and Habitat Conservation Plans (HCPs). These plans can provide specific legal protection for actions not included as exemptions under 4(d) rules, but these agreements require a significant amount of coordination and legal efforts to implement.

Section 11: Third-Party Lawsuits

Section 11 of the ESA specifically enables “citizen suits” for the purpose of: (1) enjoining a person or agency alleged in violation of any provision in the ESA; (2) compelling federal agencies to list a specific species; and (3) compelling the government to enforce protective measures upon the listing of a species (16 USC 1540 [g][1]). In addition, Section 11 provides specific penalties for violations of the ESA including civil fines and criminal judgments (16 USC 1540 [a] and (16 USC 1540 [b], respectively).

B.4.2.2 ESA as It Relates to Shoreline

A technical memorandum titled “Technical Memorandum: Selected Summary of Best Available Science in Support of City of Shoreline Critical Areas Update” (Adolfson 2003) contains a description of ESA-regulated species occurring or having the potential to occur in the vicinity of the City of Shoreline, as indicated in ESA Section 4. This document states:

*Boeing Creek has documented salmonid use including Chinook salmon (*Oncorhynchus tshawytscha*), a listed Federal Threatened species; chum salmon (*O. keta*); coho salmon, also a listed Federal Candidate species, (*O. kisutch*); and sea run cutthroat trout (*Salmo clarki*).*

McAleer Creek has documented anadromous salmonid use including chinook salmon (LFPSF [2001]), coho salmon, and sockeye salmon (O. nerka) [Tetra Tech/KCM, 2003e]. Most use occurs outside the City limits, but coho salmon and resident cutthroat trout have been observed in portions of McAleer Creek within the City limits.

Chinook salmon, coho salmon, and sockeye salmon have been documented in Thornton Creek outside of the City limits (WDFW 1998). Resident cutthroat trout are common throughout the Thornton Creek system [Tetra Tech/KCM, 2003e].

Many of the City's smaller streams are likely to contain resident cutthroat trout.

B.4.2.3 County and Local Efforts to Respond to ESA

At the time when ESA listings of threatened fish species occurred, it was recognized by all levels of government that planning and regulatory activities in the region needed to be re-evaluated. In addition, development and business interests began to inquire as to how this listing would affect them. To prepare a response to the listings that would attempt to consider all public and private needs in a coordinated fashion, several different planning and analysis efforts were begun. The following section presents a brief description of ESA response activities that are currently underway and could affect stormwater planning in the City of Shoreline.

Even before the NMFS formally proposed that wild native chinook salmon in the Puget Sound Basin be listed as threatened under the Endangered Species Act, King County and other jurisdictions had begun to evaluate what they might do individually and together to address the reasons for salmon decline. The process of evaluating the current health and viability of chinook in each watershed began with compilation of data describing habitat conditions, population distribution, and abundance. Along with these fisheries assessments, two other efforts were begun. An analysis was initiated of the actions each government body regularly undertakes, funds, or permits others to undertake, which could affect potentially listed salmon species and their habitat. An inventory was also begun to identify all the projects currently underway, and those expected to begin soon, that included federal funding, since the proposed listing initiated additional federal agency consultation and review requirements that were not previously needed.

Shortly after the proposal to list chinook salmon, the executives of King, Pierce, and Snohomish Counties began drawing regional interests together. They formed an inclusive steering committee to work together to identify a strategy for the region to recover salmon populations. This strategy would have the broad goal of recovering salmon stocks to numbers adequate to sustain the population and to provide harvestable salmon for Native American tribes pursuant to their individual treaty rights.

Soon all jurisdictions within the Puget Sound Basin, the area affected by the potential listings, began to communicate on this issue. However, a smaller group composed of King, Pierce, and Snohomish Counties determined to work closely together in a Tri-County Effort (TCE) to meet their salmon conservation and recovery goals.

The participants in the TCE described above have set out a strategy for action. The goals of the TCE are to prepare for long-term recovery of listed species and to develop a response to ESA listing actions. The strategy used to accomplish this was to:

- Create watershed-based efforts called WRIA (Water Resource Inventory Area) Salmon Conservation Plans for each river system in these three counties
- Use the umbrella TCE to address policy issues that affect multiple watersheds.

The Strategy for Action can be described as five basic tasks:

- Identify long-term recovery objectives and steps toward achieving them.
- Inventory, at individual jurisdictional levels, all activities potentially affecting salmon.
- Undertake watershed assessments including determination of the watershed-specific factors for decline.
- Develop Draft WRIA Salmon Conservation Plans.
- Obtain NOAA Fisheries approval of the proposed Road Maintenance (accomplished) and MRCI programs.

This strategy is designed to coordinate the various jurisdictions' efforts to collect and characterize the information necessary to create responses that will fit in a framework appropriate for the whole region. The TCE received NMFS (NOAA Fisheries) approval of Regional Road Maintenance ESA Program Guidelines in 2002 and the TCE is working to obtain the agency's approval of a proposed MRCI program, described above, so that any jurisdiction that adopts the program would then be eligible for the 4(d) rule limit on take prohibition.

**Appendix C.
Background Information on
Current SWM Program**

Appendix C.

Background Information on Current SWM Program

C.1 Maintenance Activities

Maintenance contracts with King County and private contractors are renewed on an annual basis. Each year, City staff review current maintenance costs and decide on the appropriate tasks to be performed by King County and private contractors. In recent years, the City has increased the amount of catch basin and street sweeping done by private contractors because the private contractors could provide these services for less cost than King County. Table C-1 identifies the current roles of city crews, King County, and private contractors in completing maintenance activities

**Table C-1
Maintenance Activities**

Maintenance Activity	King County	Private Contractors	City Crews
Clean Drainage System: Equipment	√	√	
Clean Drainage System: Hand			√
Clean Catch Basins/Manholes	√	√	√
Repair and Replace Catch Basins			√
Replace Catch Basin Grates			√
Replace/Install Drainage Pipe			√
Culvert Cleaning by Hand			√
Ditch Reshaping			√
Hand Ditching			√
Construct Swales and Berms			√
Maintenance of Retention/Detention Facilities	√		
Pump Station Maintenance	√		
Shoulder Reconstruction			√
Extend Pavement Edges	√		√
Street Sweeping	√	√	
Erosion Control—Riprap			√
Debris Removal			√
Silt Removal			√
Complaint Investigation			√
Emergency Repairs	√		√

C.2 SWM Program Organization

C.2.1 City of Shoreline Organization

This section describes the organizational structure of the City's surface water management (SWM) program. Figure C-1 shows the City's organizational structure. Shoreline is governed by an elected seven-member City Council. The City Council is assisted by several commissions, boards, and advisory committees. One of these, the Planning Commission, is helping review surface water management policy decisions.

The majority of surface water management activities are completed within the Public Works Department, which reports to the Deputy City Manager. Other City departments also support SWM activities, including the Finance Department, Customer Response Team, Human Resources Department, and Planning and Development Services.

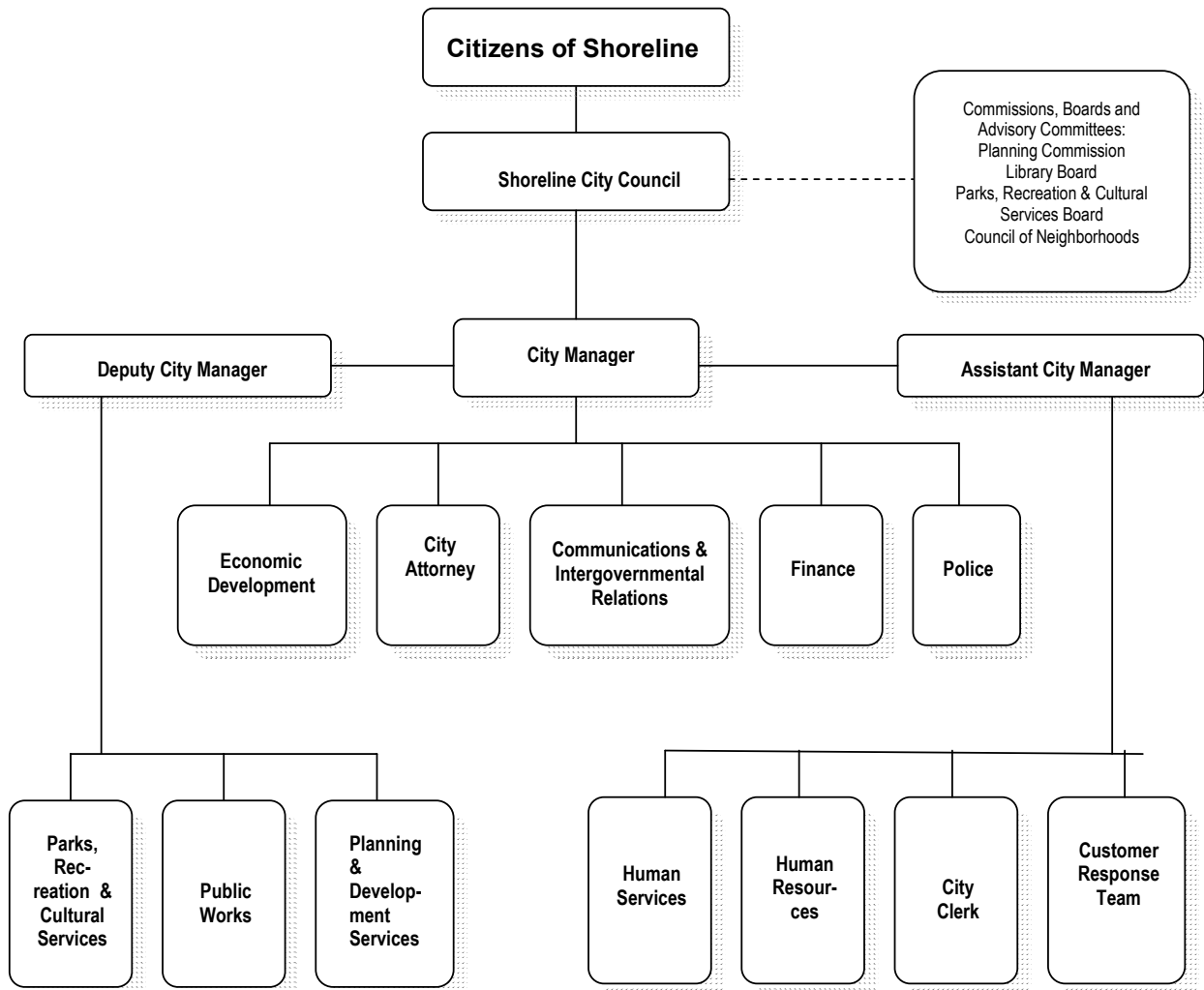


Figure C-1. City of Shoreline Organizational Chart

C.2.2 Public Works Department

The Public Works Department has established the following mission statement:

“Public Works: What are we doing to make a difference? Public Works employees are guided by the principles of integrity, respect and partnerships combined with innovation, hard work and customer responsiveness. We, as a team are dedicated to maintaining and improving our City’s infrastructure through positive and proactive leadership, education, planning and the delivery of quality projects on time, on target and on budget while being strong stewards of the environment, public safety, and fiscal resources. Public Works Employees strive to be known for getting it done...and done well.”

There are seven identified Public Works Department programs. The activities of each program are shown in Table C-1, along with the number of full-time equivalents in the City’s 2004 budget. The surface water management program is one of the seven department programs, and 5.72 FTEs are currently devoted to SWM program activities. Other department programs (such as the right-of-way program and the CIP and engineering services program) also are responsible for surface water management activities. Table C-2 also describes, in general terms, how SWM activities are funded. SWM program activities are funded by SWM fees. SWM fees also pay the majority of capital improvement costs, which include construction inspection and CIP and engineering services. Administrative and facilities support are funded by the General Fund. However, through the City’s General Fund Cost Allocation, the SWM Fund transfers funds each year to the General Fund. The majority of plan review is funded by permit fees.

Surface water management activity: a general term meaning any City activity that affects surface water.
SWM program activity: an activity of the surface water management program, one of seven programs that comprise the City’s public works department.

**Table C-2
Public Works Department Programs and Activities**

Department Program	Program Activities	FTEs (2004 Budget)	SWM Activities?	Funding of SWM Activities
Administration	<ul style="list-style-type: none"> ■ Budget and financial management ■ Policy development and leadership ■ Administrative support and report 	2.1	Support	General Fund; SWM fees pay for transfer to General Fund
Surface Water Management (SWM)	<ul style="list-style-type: none"> ■ Inspection and operation of stormwater facilities ■ Ambient water quality monitoring of streams and investigation of illicit discharges to the stormwater system ■ Surface water drainage systems maintenance ■ Environmental education 	5.72	All SWM	SWM fees
Street Operations	<ul style="list-style-type: none"> ■ Street maintenance ■ Street drainage systems maintenance ■ Right-of-way vegetation management ■ Traffic management 	7.98	Partially SWM	Street Fund
Traffic Services	<ul style="list-style-type: none"> ■ Pedestrian and traffic improvements 	2.5	No	Street Fund
Facilities	<ul style="list-style-type: none"> ■ Building operations and maintenance ■ Vehicle operations and maintenance ■ Capital project management support 	2.45	No	General Fund; SWM fees pay for transfer to General Fund
Recycling	<ul style="list-style-type: none"> ■ Community/school education and outreach ■ Community recycling events ■ Hazardous waste recycling 	0.35	Partially SWM	Waste Management Fund
Right-of-Way Program	<ul style="list-style-type: none"> ■ Construction inspection ■ Plan review 	1.5	Partially SWM	Permit fees and SWM fees
CIP and Engineering Services	<ul style="list-style-type: none"> ■ CIP project development and management ■ Non-CIP engineering services 	13.0	Partially SWM	SWM fees through SWM Capital Fund

Appendix D.

Project Cost Estimates

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Midvale Ave N Drainage (F-3)**

BY: JLG

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING		AC	\$5,000.00	\$ -
2	REMOVE PAVEMENT	513	SY	\$25.00	\$ 12,833
3	REMOVE PIPE	770	LF	\$20.00	\$ 15,400
4	REMOVE CATCH BASIN	9	EA	\$325.00	\$ 2,925
5	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$40.00	\$ -
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	390	LF	\$55.00	\$ 21,450
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	390	LF	\$70.00	\$ 27,300
8	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$110.00	\$ -
9	CATCH BASIN TYPE 1	9	EA	\$1,420.00	\$ 12,780
10	PAVEMENT, ASPHALT CONCRETE CL B	120	TON	\$85.00	\$ 10,200
11	FLOW CONTROL STRUCTURE, 48-INCH		EA	\$4,240.00	\$ -
12	EROSION CONTROL, HYDROSEEDING		SF	\$0.20	\$ -
13	CHAIN LINK FENCE		LF	\$15.00	\$ -
14	ACCESS ROAD (15' WIDE, 6" GRAVEL DEPTH)		LF	\$20.00	\$ -
15	ROADSIDE PLANTING/LANDSCAPING	120	SY	\$30.00	\$ 3,600
16	UTILITY RELOCATIONS	1	LS	\$5,000.00	\$ 5,000
17	TEMPORARY FLOW BYPASS	1	LS	\$5,000.00	\$ 5,000
Subtotal					\$ 116,488
	DEWATERING	10%			\$ 11,649
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 11,649
	TRAFFIC CONTROL	10%	(See Note 4)		\$ 11,649
Subtotal					\$ 151,435
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 15,143
	CONTINGENCY	40%			\$ 60,574
Construction Subtotal (Rounded)					\$ 227,000
	STATE SALES TAX	8.9%			\$ 20,203
	PRELIMINARY & DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 79,450
	CONSTRUCTION MANAGEMENT	20%			\$ 45,400
	PERMITTING	10%			\$ 22,700
Project Subtotal (Rounded)					\$ 395,000
	LAND ACQUISITION (see note 5)	0	AC	\$0	\$ -
	CONTINGENCY	30%			\$ -
	EASEMENT CONTINGENCY	4	PARCEL	\$5,000	\$ 20,000
2004 Dollars					
Total Estimated Project Cost (Rounded)					\$ 415,000

Notes:

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- The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Darnell Park Neighborhood Drainage (F-4)**

BY: JLG

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING	0.2	AC	\$5,000.00	\$ 1,000
2	REMOVE PAVEMENT	430	SY	\$25.00	\$ 10,750
3	REMOVE PIPE	880	LF	\$20.00	\$ 17,600
4	REMOVE CATCH BASIN	5	EA	\$325.00	\$ 1,625
5	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$40.00	\$ -
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$55.00	\$ -
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	700	LF	\$70.00	\$ 49,000
8	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	180	LF	\$110.00	\$ 19,800
9	CATCH BASIN TYPE 2	5	EA	\$3,120.00	\$ 15,600
10	EXPAND POND BY 3 FOOT DEPTH (COMMON EXCAVATION)	1700	CY	\$20.00	\$ 34,000
11	PAVEMENT, ASPHALT CONCRETE CL B	100	TON	\$85.00	\$ 8,500
12	FLOW CONTROL STRUCTURE, 48-INCH	1	EA	\$ 4,240.00	\$ 4,240
13	EROSION CONTROL, HYDROSEEDING	1500	SF	\$0.20	\$ 300
14	CHAIN LINK FENCE		LF	\$15.00	\$ -
15	ACCESS ROAD (15' WIDE, 6" GRAVEL DEPTH)	50	LF	\$20.00	\$ 1,000
16	ROADSIDE PLANTING/LANDSCAPING	1000	SY	\$30.00	\$ 30,000
17	UTILITY RELOCATIONS	1	LS	\$10,000.00	\$ 10,000
18	TEMPORARY FLOW BYPASS	1	LS	\$5,000.00	\$ 5,000
				Subtotal	\$ 208,415
	DEWATERING	10%		\$	20,842
	EROSION & SEDIMENTATION CONTROL	15%	(See Note 3)	\$	31,262
	TRAFFIC CONTROL	10%	(See Note 4)	\$	20,842
				Subtotal	\$ 281,360
	MOBILIZATION (GENERAL REQUIREMENT)	10%		\$	28,136
	CONTINGENCY	40%		\$	112,544
				Construction Subtotal (Rounded)	\$ 422,000
	STATE SALES TAX	8.9%		\$	37,558
	PRELIMINARY & DESIGN ENGINEERING/LEGAL/ADMIN	35%		\$	147,700
	CONSTRUCTION MANAGEMENT	20%		\$	84,400
	PERMITTING	10%		\$	42,200
				Project Subtotal (Rounded)	\$ 734,000
	LAND ACQUISITION (see note 5)	0	AC	\$0	\$ -
	CONTINGENCY	30%		\$	-
	EASEMENT CONTINGENCY	3	PARCEL	\$5,000	\$ 15,000
2004 Dollars				Total Estimated Project Cost (Rounded)	\$ 749,000

Notes:

- The above cost opinion is in 2004 dollars and does not include future escalation, financing, or O&M costs.
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- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Meadowbrook Neighborhood Drainage (F-5)**

BY: JLG

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING		AC	\$5,000.00	\$ -
2	REMOVE PAVEMENT	1300	SY	\$25.00	\$ 32,500
3	REMOVE PIPE	1000	LF	\$20.00	\$ 20,000
4	REMOVE CATCH BASIN	10	EA	\$325.00	\$ 3,250
5	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$40.00	\$ -
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$55.00	\$ -
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$70.00	\$ -
8	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	1850	LF	\$110.00	\$ 203,500
9	CATCH BASIN TYPE 2	12	EA	\$3,120.00	\$ 37,440
10	EXPAND POND BY 3 FOOT DEPTH (COMMON EXCAVATION)		CY	\$20.00	\$ -
11	PAVEMENT, ASPHALT CONCRETE CL B	400	TON	\$85.00	\$ 34,000
12	FLOW CONTROL STRUCTURE, 48-INCH		EA	\$ 4,240.00	\$ -
13	EROSION CONTROL, HYDROSEEDING		SF	\$0.20	\$ -
14	CHAIN LINK FENCE		LF	\$15.00	\$ -
15	ACCESS ROAD (15' WIDE, 6" GRAVEL DEPTH)		LF	\$20.00	\$ -
16	ROADSIDE PLANTING/LANDSCAPING	400	SY	\$30.00	\$ 12,000
17	UTILITY RELOCATIONS	1	LS	\$20,000.00	\$ 20,000
18	TEMPORARY FLOW BYPASS	1	LS	\$8,000.00	\$ 8,000
Subtotal					\$ 370,690
	DEWATERING	10%			\$ 37,069
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 37,069
	TRAFFIC CONTROL	10%	(See Note 4)		\$ 37,069
Subtotal					\$ 481,897
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 48,190
	CONTINGENCY	40%			\$ 192,759
Construction Subtotal (Rounded)					\$ 723,000
	STATE SALES TAX	8.9%			\$ 64,347
	PRELIMINARY & DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 253,050
	CONSTRUCTION MANAGEMENT	20%			\$ 144,600
	PERMITTING	10%			\$ 72,300
Project Subtotal (Rounded)					\$ 1,257,000
	LAND ACQUISITION (see note 5)	0	AC	\$0	\$ -
	CONTINGENCY	30%			\$ -
	EASEMENT CONTINGENCY		PARCEL	\$5,000	\$ -
2004 Dollars					
Total Estimated Project Cost (Rounded)					\$ 1,257,000

Notes:

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- The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Ridgecrest Drainage at 12th Avenue NE (F-6a)**

BY: JLG

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING	0.3	AC	\$5,000.00	\$ 1,500
2	REMOVE PAVEMENT	400	SY	\$25.00	\$ 10,000
3	REMOVE PIPE	600	LF	\$20.00	\$ 12,000
4	REMOVE CATCH BASIN	1	EA	\$325.00	\$ 325
5	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$40.00	\$ -
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$55.00	\$ -
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	820	LF	\$70.00	\$ 57,400
8	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$110.00	\$ -
9	CATCH BASIN TYPE 2	8	EA	\$3,120.00	\$ 24,960
10	EXPAND POND BY 3 FOOT DEPTH (COMMON EXCAVATION)		CY	\$20.00	\$ -
11	PAVEMENT, ASPHALT CONCRETE CL B	100	TON	\$85.00	\$ 8,500
12	FLOW CONTROL STRUCTURE, 48-INCH		EA	\$ 4,240.00	\$ -
13	EROSION CONTROL, HYDROSEEDING		SF	\$0.20	\$ -
14	CHAIN LINK FENCE		LF	\$15.00	\$ -
15	ACCESS ROAD (15' WIDE, 6" GRAVEL DEPTH)		LF	\$20.00	\$ -
16	ROADSIDE PLANTING/LANDSCAPING	50	SY	\$30.00	\$ 1,500
17	UTILITY RELOCATIONS	1	LS	\$4,000.00	\$ 4,000
18	TEMPORARY FLOW BYPASS	1	LS	\$4,000.00	\$ 4,000
Subtotal					\$ 124,185
	DEWATERING	10%			\$ 12,419
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 12,419
	TRAFFIC CONTROL	10%	(See Note 4)		\$ 12,419
Subtotal					\$ 161,441
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 16,144
	CONTINGENCY	40%			\$ 64,576
Construction Subtotal (Rounded)					\$ 242,000
	STATE SALES TAX	8.9%			\$ 21,538
	PRELIMINARY & DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 84,700
	CONSTRUCTION MANAGEMENT	20%			\$ 48,400
	PERMITTING	10%			\$ 24,200
Project Subtotal (Rounded)					\$ 421,000
	LAND ACQUISITION (see note 5)	0	AC	\$0	\$ -
	CONTINGENCY	30%			\$ -
	EASEMENT CONTINGENCY	3	PARCEL	\$5,000	\$ 15,000
2004 Dollars					
Total Estimated Project Cost (Rounded)					\$ 436,000

Notes:

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- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **N 167th St and Wallingford Ave N (F-7)**

BY: JLG

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING	0.2	AC	\$5,000.00	\$ 1,000
2	REMOVE PAVEMENT	350	SY	\$25.00	\$ 8,750
3	REMOVE PIPE	500	LF	\$20.00	\$ 10,000
4	REMOVE CATCH BASIN	4	EA	\$325.00	\$ 1,300
5	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$40.00	\$ -
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	750	LF	\$55.00	\$ 41,250
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$70.00	\$ -
8	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$110.00	\$ -
9	CATCH BASIN TYPE 1	6	EA	\$1,420.00	\$ 8,520
10	EXPAND POND BY 3 FOOT DEPTH (COMMON EXCAVATION)		CY	\$20.00	\$ -
11	PAVEMENT, ASPHALT CONCRETE CL B	110	TON	\$85.00	\$ 9,350
12	FLOW CONTROL STRUCTURE, 48-INCH		EA	\$ 4,240.00	\$ -
13	EROSION CONTROL, HYDROSEEDING		SF	\$0.20	\$ -
14	CHAIN LINK FENCE		LF	\$15.00	\$ -
15	ACCESS ROAD (15' WIDE, 6" GRAVEL DEPTH)		LF	\$20.00	\$ -
16	ROADSIDE PLANTING/LANDSCAPING	75	SY	\$30.00	\$ 2,250
17	UTILITY RELOCATIONS	1	LS	\$4,000.00	\$ 4,000
18	TEMPORARY FLOW BYPASS	1	LS	\$4,000.00	\$ 4,000
				Subtotal	\$ 90,420
	DEWATERING	10%			\$ 9,042
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 9,042
	TRAFFIC CONTROL	10%	(See Note 4)		\$ 9,042
				Subtotal	\$ 117,546
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 11,755
	CONTINGENCY	40%			\$ 47,018
				Construction Subtotal (Rounded)	\$ 176,000
	STATE SALES TAX	8.9%			\$ 15,664
	PRELIMINARY & DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 61,600
	CONSTRUCTION MANAGEMENT	20%			\$ 35,200
	PERMITTING	10%			\$ 17,600
				Project Subtotal (Rounded)	\$ 306,000
	LAND ACQUISITION (see note 5)	0	AC	\$0	\$ -
	CONTINGENCY	30%			\$ -
	EASEMENT CONTINGENCY	4	PARCEL	\$5,000	\$ 20,000
2004 Dollars				Total Estimated Project Cost (Rounded)	\$ 326,000

Notes:

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- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **N 167th St and Whitman Ave N Drainage (F-8)**

BY: JLG

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CLEARING AND GRUBBING	0.2	AC	\$5,000.00	\$ 1,000
2	REMOVE PAVEMENT	150	SY	\$25.00	\$ 3,750
3	REMOVE PIPE	150	LF	\$20.00	\$ 3,000
4	REMOVE CATCH BASIN	4	EA	\$325.00	\$ 1,300
5	12" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	630	LF	\$40.00	\$ 25,200
6	18" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE	150	LF	\$55.00	\$ 8,250
7	24" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$70.00	\$ -
8	36" DIA. SMOOTH INTERIOR WALL CORRUGATED POLYETHYLENE		LF	\$110.00	\$ -
9	CATCH BASIN TYPE 1	6	EA	\$1,420.00	\$ 8,520
10	EXPAND POND BY 3 FOOT DEPTH (COMMON EXCAVATION)		CY	\$20.00	\$ -
11	PAVEMENT, ASPHALT CONCRETE CL B	40	TON	\$85.00	\$ 3,400
12	FLOW CONTROL STRUCTURE, 48-INCH		EA	\$ 4,240.00	\$ -
13	EROSION CONTROL, HYDROSEEDING		SF	\$0.20	\$ -
14	CHAIN LINK FENCE		LF	\$15.00	\$ -
15	ACCESS ROAD (15' WIDE, 6" GRAVEL DEPTH)		LF	\$20.00	\$ -
16	ROADSIDE PLANTING/LANDSCAPING	50	SY	\$30.00	\$ 1,500
17	UTILITY RELOCATIONS	1	LS	\$4,000.00	\$ 4,000
18	TEMPORARY FLOW BYPASS	1	LS	\$4,000.00	\$ 4,000
				Subtotal	\$ 63,920
	DEWATERING	10%			\$ 6,392
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 6,392
	TRAFFIC CONTROL	10%	(See Note 4)		\$ 6,392
				Subtotal	\$ 83,096
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 8,310
	CONTINGENCY	40%			\$ 33,238
				Construction Subtotal (Rounded)	\$ 125,000
	STATE SALES TAX	8.9%			\$ 11,125
	PRELIMINARY & DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 43,750
	CONSTRUCTION MANAGEMENT	20%			\$ 25,000
	PERMITTING	10%			\$ 12,500
				Project Subtotal (Rounded)	\$ 217,000
	LAND ACQUISITION (see note 5)	0	AC	\$0	\$ -
	CONTINGENCY	30%			\$ -
	EASEMENT CONTINGENCY	5	PARCEL	\$5,000	\$ 25,000
2004 Dollars				Total Estimated Project Cost (Rounded)	\$ 242,000

Notes:

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- The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Cromwell Park Wetpond (WQ-3)**

BY: **DLP**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	
1	COMMON EXCAVATION {QTY >= 1000}	1,000	CY	\$ 16.00	\$ 16,000	
2	WETPOND EMERGENT VEGETATION	8,000	SF	\$ 2.00	\$ 16,000	
					Subtotal	\$ 32,000
	DEWATERING	0%			\$ -	
	EROSION & SEDIMENTATION CONTROL	0%			\$ -	
	TRAFFIC CONTROL	0%	(See Note 4)		\$ -	
					Subtotal	\$ 32,000
	CONTINGENCY	40%			\$ 12,800	
	MOBILIZATION (GENERAL REQUIREMENT)	0%			\$ -	
					Construction Subtotal (Rounded)	\$ 45,000
	STATE SALES TAX	8.9%			\$ 4,005	
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	85%		\$ -	\$ 38,250	
	CONSTRUCTION MANAGEMENT	20%			\$ 9,000	
	PERMITTING	0%			\$ -	
					Project Subtotal (Rounded)	\$ 96,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -	
	CONTINGENCY	30%			\$ -	
2004 Dollars					Total Estimated Project Cost (Rounded)	\$ 96,000

Notes:

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- The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Darnell Park WQ Wetpond (WQ-2)**

BY: **DLP**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	COMMON EXCAVATION {QTY >= 1000}	1,000	CY	\$ 16.00	\$ 16,000
2	WETPOND EMERGENT VEGETATION	8,000	SF	\$ 2.00	\$ 16,000
					Subtotal \$ 32,000
	DEWATERING	0%			\$ -
	EROSION & SEDIMENTATION CONTROL	0%			\$ -
	TRAFFIC CONTROL	0%	(See Note 4)		\$ -
					Subtotal \$ 32,000
	CONTINGENCY	40%			\$ 12,800
	MOBILIZATION (GENERAL REQUIREMENT)	0%			\$ -
					Construction Subtotal (Rounded) \$ 45,000
	STATE SALES TAX	8.9%			\$ 4,005
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	85%		\$ -	\$ 38,250
	CONSTRUCTION MANAGEMENT	20%			\$ 9,000
	PERMITTING	0%			\$ -
					Project Subtotal (Rounded) \$ 96,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -
	CONTINGENCY	30%			\$ -
2004 Dollars					Total Estimated Project Cost (Rounded) \$ 96,000

Notes:

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2. The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Ridgecrest at 10th Ave WQ Wetpond (WQ-4)**

BY: **DLP**

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT	
1	COMMON EXCAVATION {QTY >= 1000}	1,000	CY	\$ 16.00	\$ 16,000	
2	WETPOND EMERGENT VEGETATION	8,000	SF	\$ 2.00	\$ 16,000	
					Subtotal	\$ 32,000
	DEWATERING	0%			\$ -	
	EROSION & SEDIMENTATION CONTROL	0%			\$ -	
	TRAFFIC CONTROL	0%	(See Note 4)		\$ -	
					Subtotal	\$ 32,000
	CONTINGENCY	40%			\$ 12,800	
	MOBILIZATION (GENERAL REQUIREMENT)	0%			\$ -	
					Construction Subtotal (Rounded)	\$ 45,000
	STATE SALES TAX	8.9%			\$ 4,005	
	PRMLINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	85%		\$ -	\$ 38,250	
	CONSTRUCTION MANAGEMENT	20%			\$ 9,000	
	PERMITTING	0%			\$ -	
					Project Subtotal (Rounded)	\$ 96,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -	
	CONTINGENCY	30%			\$ -	
2004 Dollars					Total Estimated Project Cost (Rounded)	\$ 96,000

Notes:

1. The above cost opinion is in 2004 dollars and does not include future escalation, financing, or O&M costs.
2. The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **Miscellaneous WATER QUALITY Projects (WQ-5 and WQ-6)**

BY: DLP

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	PARK AND RIDE VAULT (assume 1acre site basic wq treatment plus appurtneance:	1	LS	\$240,000.00	\$ 175,000
2	ENGINEERING IDENTIFYING OTHER PROJECTS	1	LS	\$80,000.00	\$ 80,000
3	STANDALONE WETPOND (PROPERTY ACQUISITION PROJECT)				\$ -
3a	COMMON EXCAVATION {QTY >= 1000}	500	CY	\$ 16.00	\$ 8,000
3b	WETPOND EMERGENT VEGETATION	1,300	SF	\$ 2.00	\$ 2,600
3c	ROADSIDE PLANTING/LANDSCAPING	1,500	SF	\$ 30.00	\$ 45,000
3d	REINF. CONC. PIPE 18-INCH	200	LF	\$80.00	\$ 16,000
5	O/W SEPARATOR AT OUTFALLS (15 out of 60 total outfalls)	15	EA	\$100,000.00	\$ 1,500,000
	Subtotal				\$ 1,826,600
	DEWATERING	5%			\$ 91,330
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 182,660
	TRAFFIC CONTROL	5%	(See Note 4)		\$ 91,330
	Subtotal				\$ 2,191,920
	CONTINGENCY	40%			\$ 876,768
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 219,192
	Construction Subtotal (Rounded)				\$ 3,288,000
	STATE SALES TAX	8.9%			\$ 292,632
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 1,150,800
	CONSTRUCTION MANAGEMENT	20%			\$ 657,600
	PERMITTING	5%			\$ 164,400
	Project Subtotal (Rounded)				\$ 5,553,000
	LAND ACQUISITION (see note 5)	1	PARCEL	\$ 390,000.00	\$ 390,000
	CONTINGENCY	30%			\$ 117,000
2004 Dollars	Total Estimated Project Cost (Rounded)				\$ 6,060,000
	WQ-5	1/3	Priority Level 2	\$ 2,020,000	
	WQ-6	2/3	Priority Level 3	\$ 4,040,000	

Notes:

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PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: BOEING CREEK REACH 1 - STREAMBANK RESTORATION (H-1)

BY: DLP

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	BANK STABILIZATION	1000	LF	\$700.00	\$ 700,000
2	BOEING CREEK REACH 1 RIPARIAN REVEGETATION	0.75	AC	\$ 3,200.00	\$ 2,400
3	LARGE WOODY DEBRIS	2	EA	\$500.00	\$ 1,000
				Subtotal	\$ 703,400
	DEWATERING	5%			\$ 35,170
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 70,340
	TRAFFIC CONTROL	5%	(See Note 4)		\$ 35,170
				Subtotal	\$ 844,080
	CONTINGENCY	40%			\$ 337,632
	MOBILIZATION (GENERAL REQUIREMENT)	20%			\$ 168,816
				Construction Subtotal (Rounded)	\$ 1,351,000
	STATE SALES TAX	8.9%			\$ 120,239
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 472,850
	CONSTRUCTION MANAGEMENT	15%			\$ 202,650
	PERMITTING	20%			\$ 270,200
				Project Subtotal (Rounded)	\$ 2,417,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -
	CONTINGENCY	30%			\$ -
2004 Dollars				Total Estimated Project Cost (Rounded)	\$ 2,417,000

Notes:

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2. The order-of-magnitude cost opinion has been prepared with information provided by the City. Little or no field reconnaissance may have been conducted. Final costs will depend on actual labor and material costs, site conditions, and other variable factors. As a result, the final project costs will vary from those presented above. Because of these factors, funding needs for individual projects must be scrutinized prior to establishing the final project budgets.
3. Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
4. Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
5. Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **BOEING CREEK REACH 8 - STREAMBANK RESTORATION (H-2)**

BY: DLP

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	BANK STABILIZATION	500	LF	\$700.00	\$ 350,000
2	BOEING CREEK REACH 1 RIPARIAN REVEGETATION	0.5	AC	\$ 3,200.00	\$ 1,600
3	LARGE WOODY DEBRIS	5	EA	\$850.00	\$ 4,250
Subtotal					\$ 355,850
	DEWATERING	5%			\$ 17,793
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 35,585
	TRAFFIC CONTROL	5%	(See Note 4)		\$ 17,793
Subtotal					\$ 427,020
	CONTINGENCY	40%			\$ 170,808
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 42,702
Construction Subtotal (Rounded)					\$ 641,000
	STATE SALES TAX	8.9%			\$ 57,049
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 224,350
	CONSTRUCTION MANAGEMENT	20%			\$ 128,200
	PERMITTING	20%			\$ 128,200
Project Subtotal (Rounded)					\$ 1,179,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -
	CONTINGENCY	30%			\$ -
2004 Dollars	Total Estimated Project Cost (Rounded)				\$ 1,179,000

Notes:

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- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **McALEER - CULVERT REPLACEMENT (H-5)**

BY: DLP

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	CORRUGATED METAL PIPE ARCH 64"X 43" (EQUIV. DIA 54")	50	LF	\$125.00	\$ 6,250
2	REMOVE CULVERT	50	LF	\$13.00	\$ 650
3	ROAD RESTORATION	200	SY	\$ 33.00	\$ 6,600
4	RIPARIAN REVEGETATION	0.5	AC	\$ 3,200.00	\$ 1,600
2	STREAM GRAVEL	100	TN	\$40.00	\$ 4,000
					\$ -
				Subtotal	\$ 19,100
	DEWATERING	5%			\$ 955
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 1,910
	TRAFFIC CONTROL	5%	(See Note 4)		\$ 955
				Subtotal	\$ 22,920
	CONTINGENCY	40%			\$ 9,168
	MOBILIZATION (GENERAL REQUIREMENT)	10%			\$ 2,292
				Construction Subtotal (Rounded)	\$ 34,000
	STATE SALES TAX	8.9%			\$ 3,026
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	85%			\$ 28,900
	CONSTRUCTION MANAGEMENT	20%			\$ 6,800
	PERMITTING	15%			\$ 5,100
				Project Subtotal (Rounded)	\$ 78,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -
	CONTINGENCY	30%			\$ -
2004 Dollars				Total Estimated Project Cost (Rounded)	\$ 78,000

Notes:

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- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

PLANNING LEVEL CONSTRUCTION COST OPINION

PROJECT ID:

TITLE: **MISCELLANEOUS STREAM HABITAT PROJECTS (H-6 & H-7)**

BY: DLP

ITEM NO.	BID ITEM	QUANTITY	UNIT	UNIT PRICE	AMOUNT
1	STREAM STABILIZATION (for all fish)	1	LS	\$356,000.00	\$ 356,000
2	CULVERT REPLACEMENT	1	EA	\$20,000.00	\$ 20,000
3	ENGINEERING INVESTIGATION	1	EA	\$100,000.00	\$ 100,000
4	STREAM STABILIZATION (for all fish)	1	LS	\$356,000.00	\$ 356,000
5	CULVERT REPLACEMENT	1	EA	\$20,000.00	\$ 20,000
6	ENGINEERING INVESTIGATION	1	EA	\$100,000.00	\$ 100,000
Subtotal					\$ 952,000
	DEWATERING	5%			\$ 47,600
	EROSION & SEDIMENTATION CONTROL	10%	(See Note 3)		\$ 95,200
	TRAFFIC CONTROL	5%	(See Note 4)		\$ 47,600
Subtotal					\$ 1,142,400
	CONTINGENCY	40%			\$ 456,960
	MOBILIZATION (GENERAL REQUIREMENT)	20%			\$ 228,480
Construction Subtotal (Rounded)					\$ 1,828,000
	STATE SALES TAX	8.9%			\$ 162,692
	PRLIMINARY ENGINEERING/DESIGN ENGINEERING/LEGAL/ADMIN	35%			\$ 639,800
	CONSTRUCTION MANAGEMENT	20%			\$ 365,600
	PERMITTING	5%			\$ 91,400
Project Subtotal (Rounded)					\$ 3,087,000
	LAND ACQUISITION (see note 5)	0	AC	\$ -	\$ -
	CONTINGENCY	30%			\$ -
2004 Dollars					Total Estimated Project Cost (Rounded) \$ 3,087,000
	H-6	1/3	Priority Level 2	\$	1,029,000
	H-7	2/3	Priority Level 3	\$	2,058,000

Notes:

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- Increase percentage markup if work is in or immediately adjacent to flowing or standing water, steep slope, and/or other erosion-prone conditions.
- Increase percentage markup if work is in or immediately adjacent to secondary, arterial, or other high-volume road or temporarily closes a roadway.
- Land acquisition unit costs include administrative costs and condemnation.

Appendix E.
Operation and Maintenance
Supporting Information

Appendix E.

Operation and Maintenance

Supporting Information

The information in this appendix supplements the summary of Operation and maintenance (O&M) needs described in Chapter 8 of this master plan. O&M needs for the surface water management (SWM) program have been developed based on a review of the City's existing program, a review of existing needs identified by City staff, and the priority level alternatives for the flood protection, water quality, and stream habitat program areas. All O&M costs in this appendix are in 2004 dollars.

The O&M costs in the following sections are direct O&M costs, and do not include the City's General Fund Cost Allocation. The General Fund Cost Allocation is shown in Table E-2 at the end of this appendix.

E.1 Flood Protection O&M Needs: Additional Detail

Priority Level 1

Additional O&M Costs for Future Capital Improvements

Capital improvements, particularly those that add infrastructure, require additional maintenance effort and expenditure. The O&M activities associated with future capital improvements are expected to be as follows:

- **3rd Avenue NW Drainage Improvements.** O&M activities include maintenance of new conveyance facilities. The annual new O&M expenditure is estimated to be \$5,000.
- **Ronald Bog Drainage Improvements.** New O&M activities include maintenance of detention improvements and new conveyance facilities. The annual new O&M expenditure is estimated to be \$5,000, which would include any required additional maintenance in the wetland facilities and daylighted water course.
- **Other Flood Protection Improvements.** New conveyance, retention, and detention facilities will require maintenance, including such activities as catch basin cleaning, catch basin inlet cleaning, periodic inspections, vegetation management, and minor repairs. The unit cost is based on the City's existing maintenance costs (excluding street sweeping) divided by its estimated drainage pipe inventory. For the flood protection Priority Level 1 capital projects, the estimated additional O&M cost is \$29,000 per year. Throughout this analysis, the annual O&M cost for new facilities is estimated to be 0.3 percent of the project cost. This factor was estimated based on the City's current costs for contracted maintenance services and vactoring divided by an estimated replacement cost for the City's approximately 500,000 lineal feet (LF) of piped drainage system.

Acquiring Maintenance Responsibility for Systems on Private Property

Drainage and surface water infrastructure currently owned and maintained by the City is located in the publicly owned right-of-way. Some drainage and surface water systems, however, were built to

follow predevelopment drainage paths that are not located in the public right-of-way but instead on private property. Public water moving through private facilities creates service level and risk concerns.

These systems located on private property are critical elements of Shoreline’s drainage system, but the City has limited access for maintenance or inspection. Often, maintenance of these systems is inadequate, contributing to flooding problems. Acquiring maintenance access to these systems will help meet the City’s overall flood protection goals.

Estimated maintenance of these systems related to areas of structural flooding, not including any needed capital upgrades, is expected to cost \$17,500 per year. The maintenance cost is based on maintaining an additional 17,500 LF of conveyance infrastructure and an annual unit cost of \$1 per LF for maintenance.

Additional Ditch Reshaping

City staff indicate that the City’s roads and street crews should spend five weeks per year on ditch reshaping instead of the three weeks that is currently budgeted. Five weeks of crew time is expected to result in reshaping ditches on an approximately 15-year cycle. The annual financial impact is approximately \$14,000.

Additional Retention/Detention Facility Inspection

The City is responsible for inspecting all retention/detention facilities. Approximately two-thirds of these facilities serve commercial development and are privately maintained. Residential retention/detention facilities are generally maintained by the City, as are regional facilities. A projected inventory of retention/detention facilities was developed by City staff and is shown in Table E-1. The number of facilities is projected to increase from the current 314 to over 500 by 2010 as a result of new development and redevelopment in the City.

**Table E-1
Projected Retention/Detention Facility Inventory**

Year	Regional and Residential (City-Maintained)	Commercial (Privately Maintained)	Total
2003	95	219	314
2004	100	229	329
2005	110	249	359
2006	120	269	389
2007	130	289	419
2008	140	309	449
2009	150	329	479
2010	160	349	509

Currently, inspections are done on an annual basis and are completed by two interns who combine for 1.0 full-time equivalent (FTE). City staff report that the required staffing level to adequately document inspections is 1.0 FTE plus one half-time intern support. The City intends to reprioritize efforts of existing staff to meet this staffing need. By 2010, since the projected number of facilities is expected to increase by over 60 percent, it is anticipated that an additional 1.0 FTE would be required. The additional expenditure for this FTE is \$60,000, to be phased in incrementally through 2010 as the number of facilities increases. For planning purposes, 50 percent of this expenditure is

considered flood protection and 50 percent is associated with water quality. The expenditure associated with flood protection Priority Level 1 is \$30,000 per year.

Priority Level 2

Priority Level 2 includes all Priority Level 1 activities plus the following additional activities.

Additional O&M Costs for Future Capital Improvements

For flood protection Priority Level 2 capital projects (see Table 5-3 in the master plan), the estimated new O&M cost is \$4,000 per year.

Acquiring Maintenance Responsibility for Systems on Private Property

Continuing from Priority Level 1, the City will expand its maintenance responsibility for drainage infrastructure on private property. Annual maintenance expenditures are an estimated \$17,500 above those include in Priority Level 1.

Additional Shoulder Reconstruction

City staff indicate that shoulder reconstruction should occur on an approximately 8-year cycle, compared to the current 10-year cycle. The annual financial impact is approximately \$14,000.

Priority Level 3

Priority Level 3 activities are the same as Priority Level 2 activities.

E.2 Water Quality O&M Needs: Additional Detail

Priority Level 1

Additional O&M Costs for Future Capital Improvements

Aurora Avenue improvements are being completed in three phases, and each phase is expected to contain oil/water separators, sediment traps, and one new detention facility. The estimated annual O&M cost for facilities to be completed within the next six years is \$15,000 per year.

Additional Catch Basin Cleaning

Although the Washington State Department of Ecology (Ecology) has not yet issued an NPDES Phase II municipal stormwater general permit (see Chapter 3), it is anticipated that this permit could require annual catch basin cleaning. This would represent increasing the frequency of catch basin cleaning by approximately 25 percent. The estimated annual financial impact, based on a unit cost of \$25 per catch basin, is approximately \$30,000. Because the 2004 budget for contracted maintenance services includes a larger dollar amount than anticipated to deliver the current services, this increase in catch basin cleaning can be funded within the dollar amount specified in the 2004 budget.

Additional Retention/Detention Facility Inspection

As described in Section E.1, additional retention/detention facility inspection is anticipated as the number of facilities increases. For planning purposes, 50 percent of this new expenditure is related to water quality, corresponding to an additional annual expenditure of \$30,000.

Water Quality Monitoring

An additional \$20,000 expenditure for water quality monitoring activities is proposed, which will allow for a water quality survey every five years, and other annual water quality monitoring activities.

Additional FTE for Programmatic Activities

Within the next year Ecology is expected to issue the NPDES Phase II municipal stormwater general permit, which will apply to the City of Shoreline. The requirements of the final permit are not yet known, and this master plan incorporates anticipated permit requirements. It is anticipated that this permit may require hiring of an additional FTE for programmatic activities. City staff have identified needs including 0.20 FTE to expand the clean car-wash program, 0.25 FTE to expand no-spray zone activities, 0.4 FTE to expand the community involvement restoration program, and the balance to expand the natural lawn and garden care program. The estimated cost for this additional FTE is \$60,000 per year.

Combined, these programmatic activities will improve the water quality in Shoreline's surface water by reducing the discharge of pollutants. These activities will also foster community knowledge and involvement in activities that benefit Shoreline's surface waters.

Expanding the clean car-wash program would allow the City to provide support for a vacu-broom to be loaned to the community, provide outreach to community and youth fundraising groups, and develop and distribute educational materials. Expanding the no-spray project would allow City staff to expand this project citywide. Expanding the community involvement restoration and the natural lawn and garden care programs will allow City staff to provide more outreach and education, and to facilitate greater volunteer efforts.

Priority Level 2

Priority Level 2 includes all Priority Level 1 activities plus the following additional activities.

Additional O&M Costs for New Capital Improvements

For water quality Priority Level 2 capital projects, the estimated new O&M cost is \$6,000 per year.

Priority Level 3

Priority Level 3 includes all Priority Level 2 activities plus the following additional activities.

Additional O&M Costs for New Capital Improvements

For water quality Priority Level 3 capital projects, the estimated new O&M cost is \$8,000 per year.

Increased Frequency of Street Sweeping

City staff indicate that a meeting a targeted street sweeping frequency would require approximately 25 percent more sweeping than current levels (as described in Chapter 4). The estimated financial impact would be approximately \$37,500 per year.

Use of Regenerative Air Street Sweepers

The majority of street sweepers used in Shoreline are mechanical broom sweepers. Additional water quality benefits could be obtained by use of regenerative air sweepers (or other types of high-efficiency sweepers) because these sweepers can pick up smaller particulates. Prior to using regenerative air sweepers, several items need further evaluation, including (1) the amount of water quality benefit in Shoreline, (2) whether regenerative air sweepers should be used on all streets or only on those with curb/gutter drainage systems, and (3) the ability of regenerative air sweepers to pick up heavier debris that can be picked up by mechanical broom sweepers. This last consideration will define whether regenerative air sweepers could be used instead of mechanical broom sweepers, or whether they would follow behind mechanical broom sweepers. The estimated annual financial

impact is \$60,000, based on the assumptions that (1) regenerative air sweepers would be used only on the estimated 25 percent of Shoreline's streets with curb/gutter drainage systems, (2) regenerative air sweepers would follow behind mechanical broom sweepers, (3) the City's current street sweeping frequencies (described in Chapter 4) would remain unchanged, and (4) the unit cost for a regenerative air sweeper would be 50 percent higher than that of a mechanical broom sweeper.

Additional O&M Activities

Associated with water quality Priority Level 3 is a 10 percent increase in all water quality maintenance activities.

E.3 Stream Habitat O&M Needs: Additional Detail

Priority Level 1

Additional O&M Costs for New Capital Improvements

For stream habitat Priority Level 1 capital projects, the estimated new O&M cost is \$12,000 per year.

Thornton Creek Reach 14

Maintenance of the restoration area in Paramount Park is needed to remove invasive plant species. The estimated annual cost of this maintenance is \$2,000.

Priority Level 2

Priority Level 2 includes all Priority Level 1 activities plus the following additional activities.

Additional O&M Costs for New Capital Improvements

For stream habitat Priority Level 2 projects, the estimated new O&M cost is \$5,000 per year.

Additional Programmatic Activities

An additional \$15,000 per year expenditure is included to organize volunteer groups for habitat restoration projects, to provide public education and involvement, to organize a network of volunteer stream stewards, and to perform additional invasive plant species removal.

Priority Level 3

Priority Level 3 includes all Priority Level 2 activities plus the following additional activities.

Additional Programmatic Activities

An additional \$21,000 per year expenditure is included to organize volunteer groups for habitat restoration projects, to provide public education and involvement, to organize a network of volunteer stream stewards, and to perform additional invasive plant species removal.

E.4 Summary of All New O&M Needs

Table E-2 shows a summary of anticipated new O&M activities for each priority level, including the direct O&M expenditure and the General Fund Cost Allocation impact. The financial analysis in Chapter 9 contains additional information regarding the impacts to SWM fees and how these activities could be phased in over the 20-year planning period.

Table E-2
Projected Annual O&M Needs (in 2004 dollars)

New Annual O&M Expenditure	Direct O&M Cost	General Fund Cost Allocation Impact ¹	Total (2004\$)	Notes
Priority Level 1 (Years 1 - 6)				
Flood Protection				
O&M from Ongoing Capital Projects	\$10,000	\$3,000	\$13,000	2
O&M from Other New Capital Projects	29,000	7,000	36,000	3
O&M of Systems on Private Property	17,500	4,000	21,500	4
Ditch Reshaping	14,000	4,000	18,000	5
Inspection/Source Control	30,000	8,000	38,000	6
Subtotal, Flood Protection	\$100,500	\$26,000	\$126,500	
Water Quality				
O&M from Ongoing Capital Projects	14,000	4,000	18,000	7
O&M from Other New Capital Projects	1,000	0	1,000	3
WQ Monitoring Program	20,000	5,000	25,000	12
Catch Basin Cleaning	0	0	0	8
Inspection/Source Control	30,000	8,000	38,000	6
Programmatic	60,000	15,000	75,000	9
Subtotal, Water Quality	\$125,000	\$32,000	\$157,000	
Stream Habitat				
Additional O&M Activities	\$2,000	\$1,000	\$3,000	
O&M from New Capital Projects	12,000	3,000	15,000	3
Subtotal, Stream Habitat	\$14,000	\$4,000	\$18,000	
Parks and Transportation Projects				
O&M from New Capital Projects	\$7,000	\$2,000	\$9,000	3
Total Priority Level 1	\$246,500	\$64,000	\$310,500	
Priority Level 2 (Years 7 - 12)				
Flood Protection				
Priority Level 1	\$100,500	\$26,000	\$126,500	
O&M from New Capital Projects	4,000	1,000	5,000	3
O&M of Systems on Private Property	17,500	4,000	21,500	4
Shoulder Reconstruction	14,000	4,000	18,000	10
Subtotal, Flood Protection	\$136,000	\$35,000	\$171,000	
Water Quality				
Priority Level 1	\$125,000	\$32,000	\$157,000	
O&M from New Capital Projects	6,000	2,000	8,000	3
Use of Regenerative Air Street Sweepers	0	0	0	11
Subtotal, Water Quality	\$131,000	\$34,000	\$165,000	
Stream Habitat				
Priority Level 1	\$14,000	\$4,000	\$18,000	
Additional O&M Activities	15,000	4,000	19,000	11
O&M from New Capital Projects	5,000	1,000	6,000	3
Subtotal, Stream Habitat	\$34,000	\$9,000	\$43,000	
Parks and Transportation Projects				
Priority Level 1	\$7,000	\$2,000	\$9,000	
New O&M from New Capital Projects	19,000	5,000	24,000	3
Subtotal, Parks and Transportation Projects	\$26,000	\$7,000	\$33,000	
Total Priority Level 2	\$320,000	\$83,000	\$412,000	

Table E-2 (continued)
Projected Annual O&M Needs (2004 Dollars)

New Annual O&M Expenditure	Direct O&M Cost	General Fund Cost Allocation Impact ¹	Total (2004\$)	Notes
Priority Level 3 (Years 13 - 20)				
Flood Protection				
Priority Level 2	\$136,000	\$35,000	\$171,000	
O&M from New Capital Projects	0	0	0	3
Subtotal, Flood Protection	\$136,000	\$35,000	\$171,000	
Water Quality				
Priority Level 2	\$131,000	\$34,000	\$165,000	
O&M from New Capital Projects	0	0	0	3
Street Sweeping (additional service)	37,500	9,000	46,500	11
Use of Regenerative Air Street Sweepers	60,000	15,000	75,000	11
Resume Water Quality Monitoring	0	0	0	11
Water Quality Monitoring in Lakes	0	0	0	11
Additional WQ O&M activities	38,000	10,000	48,000	11
Subtotal, Water Quality	\$266,500	\$68,000	\$334,500	
Stream Habitat				
Priority Level 2	\$34,000	\$9,000	\$43,000	
Additional O&M Activities	21,000	5,000	26,000	11
O&M from New Capital Projects	0	0	0	3
Subtotal, Stream Habitat	\$55,000	\$14,000	\$69,000	
Parks and Transportation Projects				
Priority Level 2	\$26,000	\$7,000	\$33,000	
New O&M from New Capital Projects	0	0	0	3
Subtotal, Parks and Transportation Projects	\$26,000	\$7,000	\$33,000	
Total Priority Level 3	\$483,500	\$124,000	\$607,500	

Notes:

- (1) The General Fund Cost Allocation impact is estimated at 25% of the direct O&M cost.
- (2) Ronald Bog: \$5K, and Aurora Avenue Phase 1, \$5K.
- (3) The annual O&M expenditure for new capital projects is an estimated 0.3 percent of the capital investment. This was estimated based on the City's current costs for catch basin cleaning and contracted King County maintenance, divided by the estimated investment (in today's dollars) of drainage pipe (equal to 500,000 LF of pipe at \$150 per LF). Repair/replacement expenditures excluded from this calculation.
- (4) Based on acquisition of 35,000 LF of piped conveyance systems at a maintenance cost of \$1/LF/year.
- (5) Based on two additional crew weeks of effort each year.
- (6) Based on one new FTE, due to increased number of facilities. 50% flood protection, 50% water quality.
- (7) \$14K for Aurora Avenue Phase 1.
- (8) The 2004 budget has unallocated funds for contracted maintenance services that cover the projected costs of additional catch basin cleaning.
- (9) Anticipated requirement of the General MS4 NPDES Phase 2 Permit.
- (10) Based on an eight-year cycle of shoulder maintenance.
- (11) See text above for explanations of these costs. Priority Level 3 additional service is estimated to be a 25% increase compared with current (2004) levels.
- (12) Annual \$20,000 expenditure for water quality monitoring covers a "state of the waters" report every five years at an estimated cost of \$60,000 and ongoing monitoring of \$8,000/year.

Appendix F. Financial Analysis Supporting Information

Appendix F. Financial Analysis Supporting Information

F.1 Introduction

This appendix provides information that supplements Chapter 9 of the master plan.

F.2 Past and Present Financial Status

The City accounts for surface water management (SWM) revenues and expenditures in the following two funds:

- **Surface Water Management Fund** – Drainage system operating expenses are recorded in this fund and the primary revenue source is the storm drainage fees paid by Shoreline property owners. A portion of the funds are transferred to the Surface Water Capital Fund for drainage improvement projects. As of January 1, 2003, the City reported a fund balance of \$2,370,539 in the Surface Water Management Fund. The projected fund balance for January 1, 2004 is \$1,972,470.
- **Surface Water Capital Fund** – The Surface Water Capital Fund receives funds from the Surface Water Management Fund and dedicated grant sources for capital purposes. These funds are used for surface water drainage and stream rehabilitation projects. As of January 1, 2003, the City reported a fund balance of \$2,468,014 in the Surface Water Capital Fund. The projected fund balance for January 1, 2004 is \$3,605,642.

Tables F-1 and F-2 summarize revenues and expenses for the Surface Water Management Fund and Surface Water Capital Fund in 2001 and 2002. These summaries of historical data were obtained from the City of Shoreline 2004 Proposed Budget.

Table F-1
Surface Water Management Fund, 2001–2002

	2001	2002
Sources of Funds		
Beginning Fund Balance	\$2,720,300	\$2,314,525
Intergovernmental Revenue	61,600	3,197
Charges for Goods and Services	2,055,702	2,084,661
Miscellaneous Revenues	88,637	41,922
Total Sources of Funds	\$4,926,239	\$4,444,306
Uses of Funds		
Salary and Benefits	\$429,419	\$503,163
Supplies	39,733	43,050
Other Services & Charges	296,478	249,938
Intergovernmental Services	434,804	497,931
Capital Outlays	44,655	22,755
Debt Service	0	2,481
Interfund Payments for Service ^a	1,366,626	754,449
Total Expenditures	\$2,611,715	\$2,073,767
Ending Fund Balance	\$2,314,525	\$2,370,539

^a Part of the Interfund Payments is a transfer to the Surface Water Capital Fund. The remainder is the City's General Fund Cost Allocation.

**Table F-2
Surface Water Capital Fund, 2001–2002**

	2001	2002
Sources of Funds		
Beginning Fund Balance	\$1,712,792	\$2,371,430
Transfers In	641,411	90,716
Other Financing Sources	239,629	156,190
Miscellaneous Revenues	99,538	55,015
Total Sources of Funds	\$2,693,370	\$2,673,351
Uses of Funds		
Salary and Benefits	\$44,369	\$21,104
Supplies	62	1,587
Other Services & Charges	272,190	128,037
Intergovernmental Services	5,319	37,527
Capital Outlays	0	17,082
Interfund Payments for Service	0	0
Total Expenditures	\$321,940	\$205,337
Ending Fund Balance	\$2,371,430	\$2,468,014

The City has completed limited capital improvements in 2001 and 2002. Currently, the City is completing two large capital improvements to improve drainage in the 3rd Ave NW and Ronald Bog areas.

The City has obtained two Public Works Trust Fund (PWTF) loans for the Ronald Bog and 3rd Avenue NW projects that began being drawn in 2002. The City expects to complete these projects by 2006.

F.3 Projected Capital Expenditures

Table F-3 shows projected capital expenditures for the 20-year planning period, not including projected repair and replacement expenditures, which are described in Chapter 8. A notation of “RB” in Table F-3 indicates the project is part of the Ronald Bog improvements. The total capital expenditure, in 2004 dollars, over the 20-year period is an estimated \$41,334,000. Over 40 percent of this capital expenditure is in the first six years. Approximately 30 percent of the capital expenditure is in the middle six years of the 20-year planning period, and the remaining 30 percent of projected capital expenditures are in the final eight years of the 20-year planning period.

**Table F-3
Projected Capital Expenditures**

	<u>Estimated Cost (\$M, 2004\$)</u>
Priority Level 1 (Years 1 - 6)	
Flood Protection	
SWM CIP Formulation (\$40K/yr for 6 years)	\$0.240
3rd Avenue NW Drainage Improvements	3.670
Ronald Bog Park (RB)	0.288
Pump Station 25 (RB)	0.143
Serpentine SD Improvements (RB)	0.656
Midvale Ave N Drainage	0.415
Darnell Park Neighborhood Drainage	0.749
Ridgecrest Drainage at 10th Ave NE	0.600
Cromwell Park Wetland (RB)	0.222
Cromwell Park Pond (RB)	0.244
Thornton Creek Corridor (RB)	1.227
Hillwood Park Stormwater Detention Pond	0.250
Small Works Projects (\$150K/yr for 6 years)	0.900
Water Quality	
Third Ave Oil-Water Separator/Other WQ Improvements	0.100
Darnell Park Wetpond	0.096
Cromwell Park Wetpond	0.096
Ridgecrest Drainage at 10th Ave NE Wetpond	0.096
Stream Habitat	
Stream Rehab/Habitat Enhancement Pgm (50K/yr for 6 years)	0.300
Advanced Stormwater R/W Acquisition (20K/yr for 6 years)	0.120
Boeing R1 Bank Stabilization	2.417
Boeing R8 Bank Stabilization	1.179
SWM Facilities: Parks	
One Project	0.100
SWM Facilities: Transportation	
15 Pedestrian Projects (SWM cost = 10% of total cost)	1.780
Five Road/Intersection Projects (SWM cost = 20% of total cost)	0.303
Total Priority Level 1	\$16.192
Priority Level 2 (Years 7 - 20)	
Flood Protection	
SWM CIP Formulation (\$40K/yr for 6 years)	\$0.240
Ridgecrest Drainage at 12th Ave NE	0.436
N 167 & Wallingford Ave N Drainage	0.326
N 167 & Whitman Ave N Drainage	0.242
Water Quality	
Misc WQ Projects Priority Level 2	2.020
Stream Habitat	
Stream Rehab/Habitat Enhancement Pgm (50K/yr for 6 years)	0.300
Advanced Stormwater R/W Acquisition (20K/yr for 6 years)	0.120
McAlear Culvert Replacement	0.078
Misc Habitat Projects Priority Level 2	1.029
SWM Facilities: Parks	
Two Projects	0.350
SWM Facilities: Transportation	
27 Pedestrian Projects (SWM cost = 10% of total cost)	3.570
Nine Road/Intersection Projects (SWM cost = 20% of total cost)	2.380
Total Priority Level 2	\$11.091
Priority Level 3 (At This Time, Not Funded Within 20-Year Planning Period)	
Flood Protection	
SWM CIP Formulation (\$40K/yr for 8 years)	\$0.320
Ballinger Neighborhood Drainage	1.257
Water Quality	
Misc WQ Projects Priority Level 3	4.040
Stream Habitat	
Stream Rehab/Habitat Enhancement Pgm (50K/yr for 8 years)	0.400
Advanced Stormwater R/W Acquisition (20K/yr for 8 years)	0.160
Misc Habitat Projects Priority Level 3	2.058
Parks	
One Project	0.170
Transportation	
11 Pedestrian Projects (SWM cost = 10% of total cost)	1.380
Four Road/Intersection Projects (SWM cost = 20% of total cost)	1.266
Total Priority Level 3	\$11.051

F.4 Existing Debt Service

The City has two PWTF loans for the 3rd Avenue NW improvements and the Ronald Bog improvements. These loans are at favorable interest rates (1.5 percent or less) and will be repaid over a 20-year period. The City has not fully drawn the available PWTF loan funds, but expects to do so in the future as construction of the two projects proceeds. Projected loan draw and repayment information is summarized below.

3rd Avenue NW Project

Total PWTF loan: \$1,959,000

Combined principal and interest payment on full draw: approximately \$110,000 per year

2004 payment: per 2004 budget

2005 payment: through 12/04, approximately 20% of loan will have been drawn, so 2005 payment is 20% of \$110,000

2006 payment: through 12/05, 100% of loan will have been drawn, so 2006 payment is 100% of \$110,000

2007 until repayment: approximately \$110,000 per year

Ronald Bog Project

Total PWTF loan: \$4,055,500

Combined principal and interest payment on full draw: approximately \$230,000 per year

2004 payment: per 2004 budget

2005 payment: through 12/04, approximately 25% of loan will have been drawn, so 2005 payment is 25% of \$230,000

2006 payment: through 12/05, approximately 70% of loan will have been drawn, so 2006 payment is 70% of \$230,000

2007 payment: through 12/06, 100% of loan will have been drawn, so 2007 payment is 100% of \$230,000

2008 until repayment: approximately \$230,000 per year

F.5 Six-Year Projected Revenues and Expenditures

Table F-4 shows the projected revenues and expenditures for the City's SWM Fund for 2004 through 2010. SWM fees are the primary source of SWM Fund revenues. Miscellaneous revenues are primarily interest income on fund reserves. All O&M expenditures and debt service payments are made from the SWM Fund, including the City's General Fund Cost Allocation. Table F-4 shows the existing PWTF loan debt service payments, as well as projected debt service payments from future debt issues. Also shown in Table F-4 is a transfer to the SWM Capital Fund.

Table F-4
SWM Fund Projected Revenues and Expenditures

Sources of Funds	2004	2005	2006	2007	2008	2009	2010	
Beginning Fund Balance	\$1,972,470	\$2,386,856	\$3,280,300	\$4,328,242	\$4,049,864	\$1,869,778	\$447,722	
Charges for Goods and Services								
Current Rates	% Increase	2,492,192	2,505,000	2,518,000	2,531,000	2,544,000	2,557,000	2,570,000
2005 Rate Increase	8.88%		222,444	223,598	224,753	225,907	227,062	228,216
2006 Rate Increase	8.11%			222,344	223,492	224,639	225,787	226,935
2007 Rate Increase	3.00%				89,377	89,836	90,295	90,755
2008 Rate Increase	3.00%					92,531	93,004	93,477
2009 Rate Increase	3.00%						95,794	96,281
2010 Rate Increase	3.00%							99,170
Miscellaneous Revenues	45,000	160,000	206,000	184,000	123,000	57,000	19,000	
Total Sources of Funds	\$4,509,662	\$5,274,300	\$6,450,242	\$7,580,864	\$7,349,778	\$5,215,722	\$3,871,556	
Uses of Funds								
Salary and Benefits	\$417,452	\$430,000	\$443,000	\$456,000	\$470,000	\$484,000	\$499,000	
Supplies	43,200	45,000	46,000	47,000	48,000	49,000	50,000	
Other Services and Charges	202,679	209,000	215,000	221,000	228,000	235,000	242,000	
Intergovernmental Services	289,790	299,000	308,000	317,000	327,000	337,000	347,000	
PWTF Loan Debt Service	51,785	183,000	271,000	340,000	340,000	340,000	340,000	
New Debt Service	0	0	0	0	0	0	96,853	
General Fund Cost Allocation	413,028	423,000	434,000	445,000	456,000	467,000	479,000	
Transfer to SWM Capital Fund	700,000	400,000	400,000	1,600,000	3,400,000	2,500,000	1,100,000	
Other Interfund Charges	4,872	5,000	5,000	5,000	5,000	5,000	5,000	
New O&M Expenses								
Priority Level 1 (1)				100,000	206,000	351,000	360,000	
Total Expenditures	\$2,122,806	\$1,994,000	\$2,122,000	\$3,531,000	\$5,480,000	\$4,768,000	\$3,518,853	
Ending Fund Balance	\$2,386,856	\$3,280,300	\$4,328,242	\$4,049,864	\$1,869,778	\$447,722	\$352,703	
Exceed Minimum Balance Criterion?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Note 1: New O&M expenses are phased in between 2007 and 2012

Table F-5 shows the sources and uses of funds for the SWM Capital Fund. The projected sources of revenue are a transfer from the SWM Fund, and loan proceeds from the PWTF loan and future revenue bond issues. SWM Capital Fund expenditures include surface water engineering, General Fund Cost Allocation for capital-related expenditures, repair and replacement expenditures, and capital project expenditures.

At the end of the six-year planning period, the SWM Fund and the SWM Capital Fund are projected to maintain reserve balances that exceed the financial policy targets. These reserve balances are maintained for use later in the 20-year planning period.

Table F-5
SWM Capital Fund Projected Revenues and Expenditures

Sources of Funds	2004	2005	2006	2007	2008	2009	2010
Beginning Balance	\$3,605,642	\$2,934,175	\$3,600,510	\$1,804,598	\$53,598	\$18,598	\$67,148
Transfer from SWM Fund	700,000	400,000	400,000	1,600,000	3,400,000	2,500,000	1,100,000
PWTF Loan Draws	258,358	3,455,335	1,073,088	0	0	0	0
Revenue Bond Proceeds	0	0	0	0	0	1,068,550	2,504,000
Total Sources of Funds	\$4,564,000	\$6,789,510	\$5,073,598	\$3,404,598	\$3,453,598	\$3,587,148	\$3,671,148
Uses of Funds	2004	2005	2006	2007	2008	2009	2010
Surface Water Engineering	147,825	152,000	156,000	160,000	164,000	168,000	172,000
General Fund Cost Allocation	114,000	117,000	120,000	123,000	126,000	129,000	132,000
Repair and Replacement (4)	0	154,000	158,000	162,000	166,000	170,000	174,000
Priority Level 1 Capital Projects (5)		2,766,000	2,835,000	2,906,000	2,979,000	3,053,000	3,130,000
Other 2004 Capital Expenditures (9)	1,368,000						
Total	\$1,629,825	\$3,189,000	\$3,269,000	\$3,351,000	\$3,435,000	\$3,520,000	\$3,608,000
Ending Fund Balance	\$2,934,175	\$3,600,510	\$1,804,598	\$53,598	\$18,598	\$67,148	\$63,148

Notes:

Notes 1, 2, 3, and 6-8 refer to the 20-year financial projection, which is not shown in detail in this Appendix.

Note 4: Projected repair/replacement expenditures are \$150,000/year in 2004 dollars.

Note 5: Priority Level 1 capital expenditures are distributed equally (in 2004 dollars) over the six-year period.

Note 9: \$25K stream rehab/habitat enhancement; \$40K CIP project formulation; \$175K surface water small projects; \$297K Ronald Bog; \$702K 3rd Ave NW; \$20K ROW Acquisition; \$109 SW Master Plan. Source: 2004 Budget

**Appendix G.
Changes in the Recommended
Plan and the Financial Analysis
from the Public Review Draft**

Appendix G. Changes in the Recommended Plan and the Financial Analysis from the Public Review Draft

G.1 Introduction

This appendix provides information that supplements Chapter 9 of the master plan.

G.2 Previous Proposal in the Public Review Draft

In April 2004, the City produced the public review draft of the surface water master plan (SWMP). This public review draft contained a financial projection fully funding the R&R, O&M, and CIP expenditures by increasing the SWM fee accordingly. The costs of the R&R, O&M, and CIPs were based on a set of draft assumptions. Figure 10-1 shows the projected SWM fee structure contained in the public review draft. This figure is the same as Figure 9-3 in the public review draft but is not the same as Figure 9-3 in the final version of the SWMP.

Changes in the Recommended Plan and the Financial Analysis from the Public Review Draft

This graph represents one of several possible strategies to provide increased flood protection, water quality, and stream habitat services; this strategy is subject to City Council and public review. Analysis includes 2.5% annual inflation.

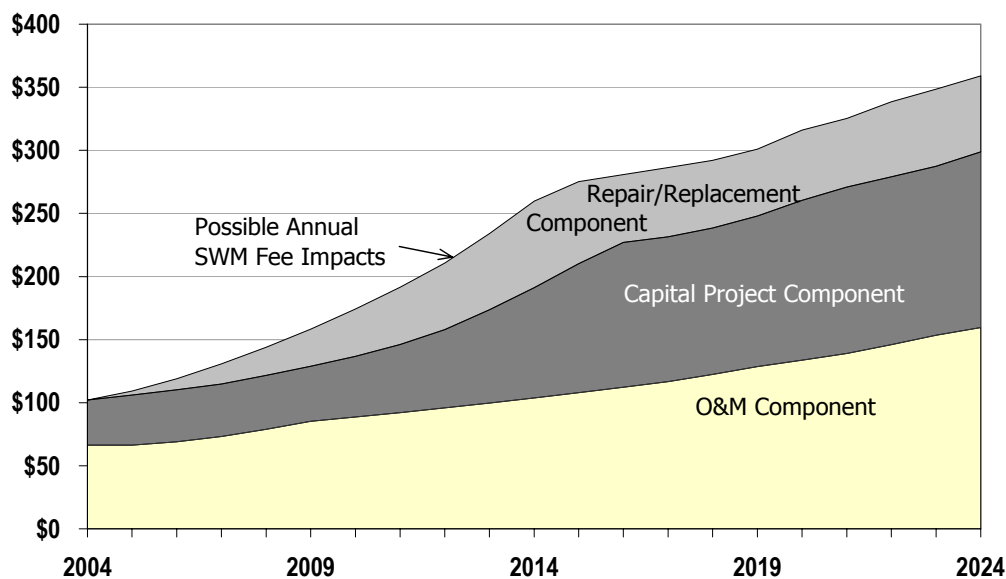


Figure G-1. April 2004 Public Review Draft 20-Year Projection of SWM Fees

G.3 Changes to the Public Review Draft Financial Assumptions

This section describes the changes made to the cost and funding assumptions in the public review draft that form the basis for the recommended plan

G.3.1 Changes in R&R and O&M Spending Assumptions from Public Review Draft

Figure G-1 shows the projected SWM fee for a single-family residence exceeding \$350/year in inflation-adjusted dollars by 2024 to fully fund all the R&R, O&M, and CIPs in the public review draft. As a result of these large projected increases in SWM fees, City staff reviewed the R&R and O&M spending assumptions in the draft SWMP and recommended changes to them. No changes were made in the cost of the CIPs from those in the public review draft. (Note that all assumptions will be revisited in five to seven years when this SWMP is revised.)

G.3.1.1 Repair and Replacement

In the public review draft R&R spending was based on the estimated value of the drainage infrastructure without specific reference to the condition of existing infrastructure.

R&R assumptions were refined based on actual expenditures plus the need to perform a system-wide condition assessment. This refined set of assumptions resulted in a substantial reduction in projected R&R spending. This refined level of R&R spending will cover the necessary fixes to keep the current system functioning while providing a rational basis for prioritizing R&R expenditures in years 7 through 20.

G.3.1.2 Operation and Maintenance

O&M assumptions were refined in the following areas:

- Type and frequency of street sweeping practices. Initiation of street sweeping using regenerative air street sweepers was delayed from year 7 to year 14. The frequency of street sweeping, previously projected to be double the current amount, was revised to be 125 percent of the current amount.
- Change in water quality sampling frequency and intensity. Projected spending on water quality monitoring will remain higher than current spending levels, but implementation of new monitoring initiatives has been scaled back and/or delayed.
- Change in the number of private stormwater systems added to the City's O&M program. This implies the city will be less aggressive in obtaining maintenance access to stormwater conveyance facilities that are currently located on private property.

These refinements reduced projected O&M spending compared with that projected in the public review draft. These refinements also were developed, based on the best available information, to predict the required actions to comply with current and future (assumed) environmental requirements.

G.3.2 Changes in Funding Assumptions from Public Review Draft

The resulting SWM fee increases in the public review draft, necessary to fully fund all the CIPs and the assumed R&R and O&M spending, was determined by City staff to be unrealistic. In this recommended plan, a SWM fee structure that supports the majority of the priority CIPs was developed using the following assumptions:

- Current SWM fee for a single-family residence: \$102 per year
- SWM fee increase in 2005: 8.9 percent, resulting in an annual SWM fee of \$111 for a single-family residence
- SWM fee increase in 2006: 8.1 percent, resulting in an annual SWM fee of \$120 for a single-family residence
- In subsequent years, SWM fees would increase 3.0 percent annually, or 0.5 percent above the annual inflation rate used in this financial analysis.