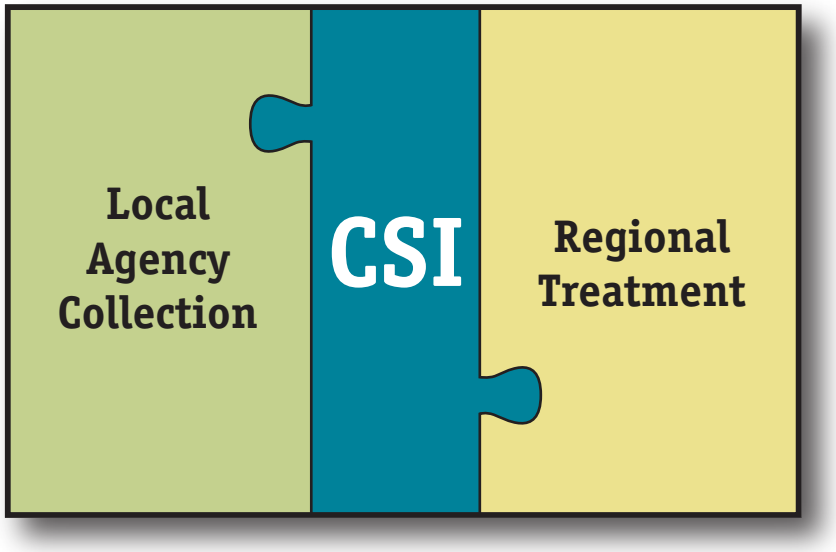
Conveyance System Improvement Program



Program Update

June 2007

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

Conveyance System Improvement Program Update

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Wastewater Treatment Division
Conveyance System Improvement Program
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Table of Contents

List of Tables

List of Figures

Appendices

Chapter 1

Executive Summary

This *Regional Conveyance System Improvement Program Update* implements conveyance policies contained in the Regional Wastewater Services Plan (RWSP), adopted by the King County Council in 1999. The update identifies projects needed for increasing capacity in the conveyance system to accommodate population growth; and, also provides a status on the County's asset management program for replacing or substantially rehabilitating deteriorated portions of the system. It then lays out a schedule and budget for these projects. Component (local) sewer agencies were instrumental in helping to identify conveyance needs, and prioritize projects through their participation on MWPAAC's Engineering and Planning (E&P) Subcommittee and through one-on-one meetings with Wastewater Treatment Division staff.[1] This chapter summarizes the detailed information documented in subsequent chapters of this update. It describes conveyance planning efforts on which this update is based, presents the processes used to identify capacity-related needs and the projects to address these needs, and concludes with next steps for implementing the program and for future conveyance system planning.

1.1 Background on Conveyance Planning

The RWSP contains policies that are intended, in part, to guide the planning, design, and construction of conveyance system improvement (CSI) projects to accommodate increased flows over a 30-year period (through 2030).

King County's regional wastewater system is a large, integrated wastewater conveyance and treatment system. The 34 cities and sewer districts that are component agencies of the system are responsible for collecting wastewater from residences and businesses. King County's over 335 miles of pipes and 62 pump and regulator stations convey this wastewater to 3 secondary treatment plants.

Planning for the regional conveyance system is an ongoing function for King County's Wastewater Treatment Division (WTD). The conveyance program was last updated in 2004 to organize conveyance planning by 10 sub-regional planning basins and to integrate conveyance planning with component agency plans and with other RWSP programs such as infiltration and inflow control and combined sewer overflow (CSO) control.[2]

[1] MWPAAC = Metropolitan Water Pollution Abatement Advisory Committee.

[2] Older pipes are part of a combined sewer system that collects both stormwater and wastewater. The rest of the region is part of a separated sewer system in which separate pipes carry wastewater and stormwater. Separated wastewater sewers also carry groundwater and stormwater, called infiltration and inflow, which enters through leaky pipes, improper storm drain connections, and other means.

The program is being updated now because flow monitoring and modeling information developed for the Regional Infiltration and Inflow (I/I) Control Program allowed for a more accurate analysis of capacity needs within the regional conveyance system.

This *Conveyance System Improvement Program Update* refines the previously identified needs; categorizes these needs based on system age, condition, or capacity; and presents a list of recommended projects and a schedule to address identified needs.

Key Points for the Conveyance Program Update

Adoption of the **RWSP** in 1999 established a uniform design standard for the regional conveyance system. The standard is intended to avoid sanitary sewer overflows by establishing a 20-year peak flow standard system-wide.

Prior to RWSP adoption, the region had no uniform design standard for conveyance facilities. Consequently, **half** of the planned projects identified in this *Conveyance System Improvement Program Update* address capacity needs where flow monitoring and modeling data indicate that the 20-year peak flow cannot currently be conveyed.

1.2 Scope of This Update

The Conveyance System Improvement (CSI) Program is being updated now because significant flow modeling and analysis has been completed since the last update in 2004. Additionally, information provided by the individual component agencies about population and employment growth rates and land use trends that can affect the timing or size of recommended RWSP regional conveyance improvements were used to update the list of needed conveyance projects, implementation schedule, and project cost estimates included in this CSI Program Update.

Unlike previous conveyance plans, this program update extends through 2050. This is the date when the regional wastewater service area is projected to be fully built out and all sewerable portions of the service area are expected to be connected to the wastewater system. Completion of an asset management plan in 2010 for the conveyance system will provide further refinement to capacity related needs in the future.

The CSI project recommendations in this program update focus on facilities in the *separated* portion of the county-owned regional conveyance system. It does not cover planned new facilities, such as Brightwater, nor does it cover component agency systems.[3] However, the development of CSI project scopes, costs, and schedules assumes that Brightwater will begin operating in 2010.

No assumptions were made regarding I/I reduction across the region. As recommended in the Regional I/I Control Program, two or three initial I/I reduction projects will be completed by 2011.[4] Each initial project, if successful, will eliminate the need for an identified CSI project. After completion of these initial projects, recommendations will be made to the King County Council regarding when and where to implement additional cost-effective I/I reduction projects.

[3] The Brightwater System will consist of both a treatment plant and an influent/effluent conveyance system to convey and treat flows from the rapidly growing northern portion of the regional wastewater service area.
[4] The *Executive's Recommended Regional Infiltration and Inflow Control Program* can be found at http://dnr.metrokc.gov/wtd/i-i/library/ExecRec/report.htm.

1.3 Identified Capacity Needs

Before determining capacity needs, peak flow standards that consider both the sizing and timing of facility improvements must be in place for a comparison of flow demands to existing regional conveyance system capacity:

- **Sizing.** What peak flow will a facility convey safely without overflowing? How does that compare to the estimated peak flows?
- **Timing.** What peak flow should be used to decide when the facility will be replaced, upgraded, or expanded? What is the expected life of a facility?

Policy CP-1.1 in the Regional Wastewater Services Plan (RWSP) established the 20-year peak flow as the standard to be used for both sizing and timing of facility improvements for the separated portion of the conveyance system.

A 20-year peak flow event consists of both storm flow (I/I) and base flow (wastewater from homes and businesses). It is projected to occur on average about every 20 years (a 20-year "return period") and on an annual basis, has a 5 percent chance of being exceeded.

This program update identifies portions of the separated portion of the regional conveyance system that will require expansion to provide adequate capacity to convey projected 20-year peak flows through 2050. In the past, census data, available peak flow data, service area growth assumptions, and general experience served as the basis for identifying conveyance capacity needs. For this update, extensive flow and rainfall data was also collected for two years (2000–2002) in support of the Regional I/I Control Program. This allowed for more accurate projections. The process for identifying capacity needs consisted of four main steps:

- Estimating current 20-year peak flow demands on the regional conveyance system to establish a baseline that represents how the system currently performs under peak flow conditions.
- Projecting 20-year peak flows by decade through 2050 for the regional conveyance system using population and employment growth projections.
- Using a hydraulic model of the conveyance system to identify capacity constraints based on when the 20-year peak flows exceed the capacity of existing regional conveyance facilities.
- Verifying and adjusting identified growth assumptions and capacity constraints using updated information from component agencies.

WTD staff met with representatives from component agencies to present identified capacity needs and to obtain updated information about local growth rates and other factors affecting conveyance capacity. The meetings resulted in a more common understanding of the basis for identified regional conveyance needs and incorporation of local conditions into the needs identification process. For example, the area served by the City of Issaquah is expected to be fully built out in 2020, rather than by 2050 assumed for the rest of the service area. The projected dates for needed improvements to the regional conveyance system in the area were adjusted accordingly.

1.4 Projects to Meet Capacity Needs

This conveyance program update identifies 33 CSI projects, in addition to the 8 projects already in design or construction, to meet identified capacity needs through 2050, the projected date that the regional wastewater service area will be fully built out. Project identification was iterative, in which early project lists were reviewed and revised to incorporate information from the local agencies. For each project, the type of improvement (replace existing facilities, parallel existing pipes, or build storage facilities), the size and route, and estimated costs and cost saving measures were identified.

Since adoption of the RWSP in 1999, approximately $327.6 million has been invested in CSI projects. This includes completed projects, acquisitions, and those that are currently in design or construction. Table 1-1 summarizes projected costs for meeting conveyance capacity needs through 2030, the RWSP planning horizon, and 2050, the expected year that the regional wastewater service area will be built out.

Table 1-1. Total Estimated Capital Investment Necessary to Expand the Separated Portion of the Regional Conveyance System

Project Status	Est. Project Cost
Projects Completed Since RWSP Adoption	$92,300,000
Projects Currently in Design	$99,600,000
Projects Currently Under Construction	$105,100,000
Acquisitions	$30,600,000
Currently Invested[a]	$327,600,000
Planned New Conveyance Projects Through 2030[b]	$398,000,000
Estimated Capital Conveyance Costs Through 2030	***$725,600,000***
Planned New Conveyance Projects 2031 Through 2050[b]	$88,600,000
Estimated Capital Conveyance Costs Through 2050	***$814,200,000***

[a] Nominal dollars -- dollars in the actual years spent through 2006
[b] 2006 dollars – the current value of dollars projected to be spent in the future

This Conveyance Program Update identifies 33 additional planned projects with an estimated cost of $486 million that are necessary to address capacity needs through 2050. As mentioned previously, half of these planned projects will address capacity needs where flow monitoring and modeling data indicate that the 20-year peak flow currently cannot be conveyed.

Table 1-2 lists the identified projects, the estimated date when the 20-year peak flow standard has or will be exceeded, and their estimated capital costs. Figure 1-1, which follows the table, shows the locations of the identified projects.

In April 2004, WTD published the first RWSP comprehensive review. The RWSP Update summarized the first four years of RWSP implementation. It included a revised list of projects and cost estimates for non-Brightwater conveyance system improvements through 2030 that was substantially higher than what was contained in the adopted RWSP. The revised list of projects and cost estimates addressed needs identified during large storms in 1996 and 1997, as well as

Table 1-2. Identified Planned Conveyance Projects

Project Name	Year that 20-yr peak capacity is Exceeded	Estimated Range of Project Completion	Estimated Project Cost	Color Key
Heathfield/Sunset Pump Station Replacement and Force Main Upgrade	Before 2000[a]	2010-2013	$51,000,000	**Planned *High Priority* Projects (7 total)**
Bellevue Influent Trunk Parallel	Before 2000	2010-2013	$2,500,000	
[CSI] Sammamish Plateau Diversion	Before 2000	2014-2030	$24,800,000	
Northwest Lake Sammamish Interceptor Parallel	Before 2000	2014-2030	$23,500,000	
Coal Creek Siphon and Trunk Parallel	Before 2000	2014-2030	$7,100,000	
North Mercer and Enatai Interceptor Parallels	Before 2000	2014-2030	$24,900,000	
Lake Hills Trunk Replacement	Before 2000	2014-2030	$15,000,000	
[CSI] Thornton Creek Interceptor Parallel	Before 2000	2014-2030	$7,600,000	**Planned *Medium Priority* Projects (6 total)**
[CSI] Sammamish Plateau Storage	Before 2000[a]	2014-2030	$33,200,000	
Boeing Creek Storage Expansion	Before 2000	2014-2030	$9,100,000	
Algona Pacific Trunk Stage 1	Before 2000	2014-2030	$4,500,000	
Richmond Beach Storage	Before 2000	2014-2030	$14,000,000	
Factoria Pump Station and Trunk Diversion	Before 2000	2014-2030	$10,200,000	
[CSI] Soos Alternative 3A(3) – Pump Station D with Conveyance	Before 2000[b]	2014-2030	$42,000,000	**Planned *Lower Priority* Projects (20 total)**
[CSI] Soos Alternative 3A(3) – Pump Station H with Conveyance	Before 2000[b]	2014-2030	$47,000,000	
[CSI] Soos Alternative 3A(3) – Pump Station B with Conveyance	N/A[c]	2014-2030	$7,900,000	
[CSI] Issaquah Storage	Before 2000[a]	2014-2030	$22,900,000	
Eastgate Parallel Pipe Storage	Before 2000[a]	2014-2030	$23,800,000	
Bryn Mawr Storage	2005	2014-2030	$8,700,000	
Medina Storage	2009	2014-2030	$1,100,000	
Issaquah Creek Highlands Storage	2009[a]	2014-2030	$2,400,000	
South Renton Interceptor Parallel	2011	2014-2030	$3,600,000	
Issaquah Interceptor Section 2 Parallel	2011[a]	2014-2030	$2,800,000	
York Pump Station Modifications	2016	2014-2030	$8,400,000	
Projects within RWSP horizon (2030) Subtotal			***$398,000,000***	

Project Name	Year that 20-yr peak capacity is Exceeded	Estimated Range of Project Completion	Estimated Project Cost	Color Key
[CSI] Swamp Creek – Section 1B Parallel	2017	2031-2050	$9,000,000	**Planned *Lower Priority* Projects (20 total, cont.)**
Garrison Creek Trunk Parallel	2018	2031-2050	$6,000,000	
Juanita Bay Pump Station Force Main Upgrade	2020	2031-2050	$15,000,000	
ULID 1 Contract 4 Parallel	2021	2031-2050	$3,800,000	
Lower North Creek Interceptor Parallel	2024	2031-2050	$11,500,000	
Algona Pacific Trunk Stage 2	2027	2031-2050	$1,400,000	
Auburn Interceptor – Section 3 Parallel Pipe Storage	2028	2031-2050	$31,000,000	
Upper North Creek Parallel	2029	2031-2050	$4,800,000	
Lakeland Hills Pump Station Replacement	2040	2031-2050	$6,000,000	
Projects after RWSP horizon (2030) Subtotal			***$88,600,000***	
Total Planned Projects			**$486,600,000[d]**	

[a] The South Lake Sammamish Planning Basin has seven projects that are all capable of contributing to increased level of service to downstream capacity constraints. The proposed prioritization accounts for the phasing of projects to address capacity constraints over time by including O&M issues along with coincident benefits in the decisions on the preferred course of action.

[b] Initially, Soos Pump Stations D and H were planned to serve existing customers and planned growth for the Black Diamond Service and Soos Creek areas. The Black Diamond Storage Project will delay the need for the pump stations and conveyance lines for 10 to 20 years.

[c] Area not currently served by regional conveyance facilities

[d] Estimated costs in 2006 dollars

modifications to the project list that resulted from basin planning, application of improved cost estimating models, and the addition of new projects to address newly identified needs. The 2004 RWSP Update showed that large portions of the conveyance system cannot convey the 20-year peak flow. However, it is not practical to simultaneously construct all identified CSI projects necessary to bring facilities up to this standard. Such an approach would be extremely expensive and potentially disruptive to system operation. Therefore, the King County Council directed WTD to develop options for phasing or deferring non-Brightwater conveyance facilities anticipated for the 2006-2011 capital improvement plan, and in the 30-year RWSP capital plan (*Ordinance No. 14942 [2] [F], adopted 6/17/04*). In response to this directive, WTD and the component agencies worked collaboratively to identify and analyze alternative cost containment strategies. The alternatives analyzed included approaches to downsizing, phasing, or delaying construction of projects. Through this effort, it was determined that delaying or phasing project construction would be the best method of containing costs over time. Delaying projects did not reduce the overall capacity standard to be achieved, and allowed WTD to focus on the region's most pressing conveyance needs with minimal risk to public health or the environment, or impact to ratepayers. To assist in identifying the most pressing conveyance system needs, WTD and the component agencies developed eight prioritization criteria that address such factors as public health risks, coincident benefits, costs, and rate impacts. These prioritization criteria were submitted to the County Council in a report entitled "Prioritization Guidelines for Phasing Conveyance System Improvement Projects" in October 2004 in response to Ordinance No. 14942 (2) (F).

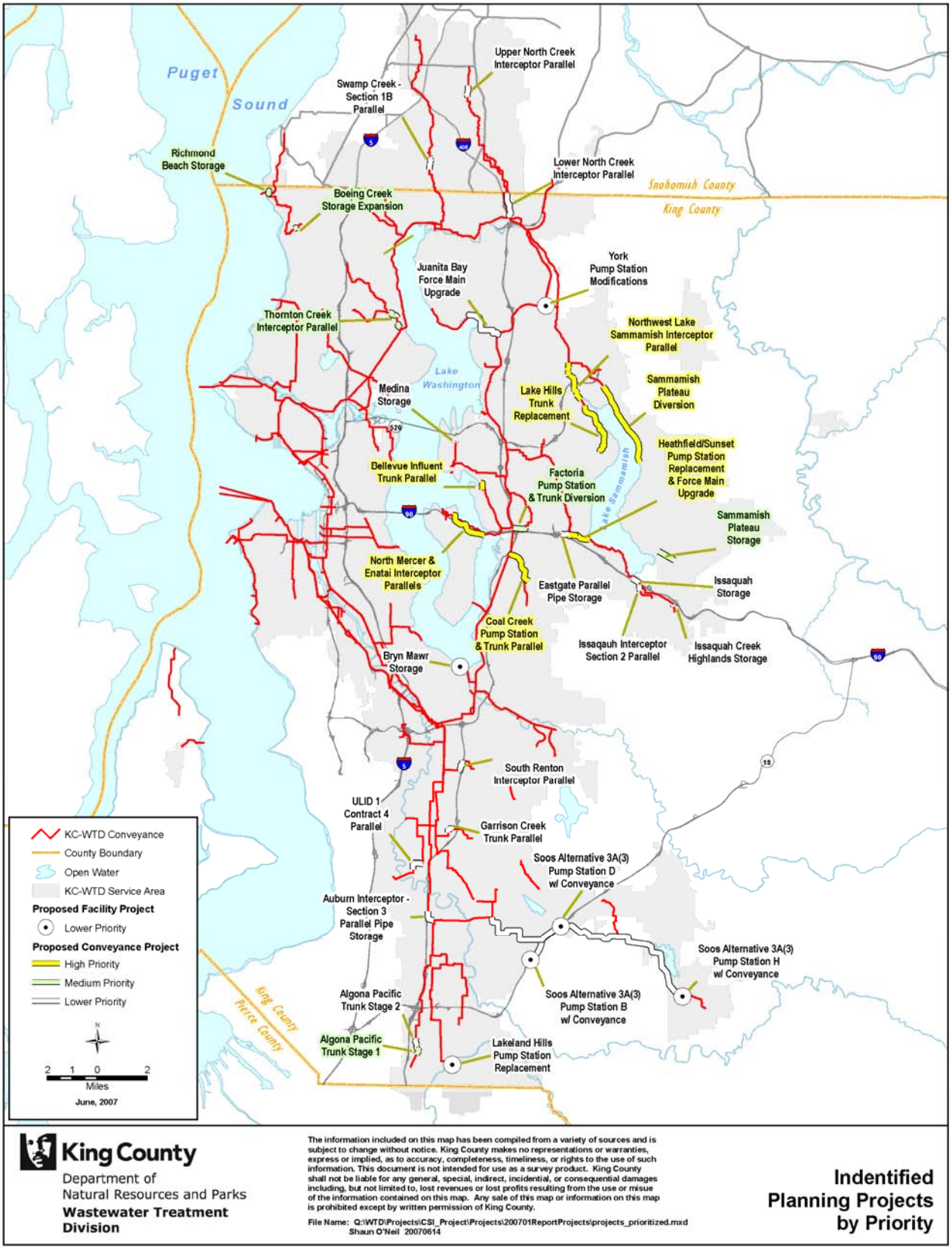

Figure 1-1. Identified Planned Conveyance Projects by Priority

The prioritization criteria were applied to all planned CSI projects identified in this Conveyance System Improvement Program Update in order to rank the projects as High (7 projects), Medium (6 projects), or Lower Priority (20 projects). During the prioritization process, the component agencies put a high priority on minimizing the potential for overflows in the regional conveyance system. In addition, the agencies recommended that prior to initiating project design and construction, WTD conduct additional flow monitoring and field inspection to field-verify capacity needs and the adequacy of projects to meet these needs. Due to the need to field verify projects prior to initiating design and construction, completion dates for projects are only generally identified for most projects. Field verification can have the affect of raising the priority of a project, reducing the priority resulting in delay, or eliminating the need for the project all together. Current field verification data and information on Heathfield/Sunset pump stations and the Bellevue Influent Trunk have resulted in anticipated transfer of these two projects for design and construction with estimated completion between 2010 and 2013. Field verification of needs will ultimately determine the timing and implementation of the remaining planned projects.

It is expected that through implementing both the current and planned capacity-driven CSI projects, the 20-year peak flow standard will be attained over time, and ultimately achieved system-wide by approximately 2045. Completion of these projects should be feasible within projected sewer rate and capacity charge increases through 2030—the last year of the RWSP planning period.

1.5 Areas of Uncertainty

The conveyance system improvement projects listed in Table 1-2 above are based on the best available information about system capacity and future growth. However, the timing, scope, and scale of actual conveyance system projects is subject to change as actual conditions evolve and diverge from projections of growth and capacity demand over time.

Conditions that may change include the physical condition of specific components of the conveyance system that are discovered during project initiation. These conditions may change the scope or scale of a project. For instance, a project planned as installing a parallel pipe may require a full pipe replacement if the existing pipe is found to be in poor condition. Actual population and employment growth, both in terms of total numbers, and density in various portions of the region may also vary greatly from current projections and can change the scale and timing of planned projects.

The effects of climate change on the regional wastewater system are currently under investigation. Climate change may cause more intensive storm events which could increase projections of peak wastewater flows for the system. Currently, precipitation models for our region that account for the affects of climate change are not available. When they become available, they would be incorporated into existing models for projecting peak flows. The updated projections may require revisions to the list of needed conveyance improvement projects for the region.

This CSI Program Update does not account for any reductions in projected peak flow volume due to implementation of the Regional Infiltration and Inflow (I/I) Program. In June 2006, the

King County Council approved implementation of a Regional I/I Control Program. The program will invest in I/I reduction in lieu of investing in larger conveyance system improvements when it is cost-effective to do so. I/I reduction is considered cost-effective when the total estimated CSI project savings is greater than the total estimated cost of I/I reduction. The recommended projects contained in this CSI Program Update provides the required capital cost and projected flow volume estimates for completing cost effectiveness analyses for potential I/I projects. Currently the County is working to implement 2 to 3 initial I/I reduction projects identified as cost effective within the Regional I/I Control Program. After the initial I/I reduction projects are completed, the recommended capital improvements contained in this update will provide the basis for completing benefit-cost analyses for possible future I/I reduction projections.

1.6 Next Steps

The next two capacity-related CSI projects to be implemented are the Heathfield/Sunset Pump Station Replacement and Force Main Upgrade Project and the Bellevue Influent Trunk Parallel Project. Field data collected over the past few months verifies the need for both projects and the project approach outlined in this program update. Design for these projects will begin in 2008. Field verification of identified high and medium priority projects will be conducted over the next two to four years. Depending on the results, it is anticipated that one to two projects per year will move into the design phase beginning in 2011.

Conveyance flow monitoring will need to be updated periodically. The King County Executive recommends that a comprehensive flow monitoring effort is conducted across the regional conveyance system each decade to correspond with new census data to update future flow estimates. Each effort would cost approximately $5 million. However, this represents 1-percent of the total planned capital investment in conveyance system improvements through 2050. The information obtained will help to ensure that information used to plan, design, and build appropriately sized and prioritized conveyance facilities over time remains current. Additionally, the investment in system-wide flow monitoring will provide useful flow information to the component agencies as they update their own plans and capital programs.

New technologies, such as sonar technology, have recently become available for inspecting conveyance system components that could not be thoroughly inspected in the past. WTD's Asset Management Section staff is now employing this new technology and is undertaking an asset management plan that will allow for evaluations of how best to maintain, repair, or replace regional wastewater facilities over time. The more detailed information will be used to update the regional conveyance system program in the future.

Given that actual growth rates and flow volumes vary from projections and that the condition of the conveyance system will change over time, the Executive recommends that conveyance system program be updated every five years starting in 2013 to ensure that the prioritized project list remains current.

Chapter 2

Background

This *Regional Conveyance System Improvement Program Update* implements conveyance policies contained in the Regional Wastewater Services Plan (RWSP), adopted by the King County Council in 1999. Consistent with the 2003 Program Update, this update identifies projects needed for increasing capacity in the conveyance system to accommodate projected peak flows. It lays out a schedule and budget for capacity improvement projects based on a set of eight prioritization criteria that address such factors as public health risks, incidental benefits, costs, and rate impacts[1] . In order to provide a more complete overview of the capital investment necessary to upgrade and maintain the regional conveyance system, this update includes new sections that provide summary information about asset management projects necessary for replacing or substantially rehabilitating deteriorated portions of the system.

This chapter cites relevant RWSP conveyance policies, describes King County's wastewater service area and its regional wastewater system, provides background on the RWSP conveyance planning program and other programs related to conveyance planning, and summarizes the scope of the program update. It concludes with a description of the contents of the remainder of this document.

2.1 RWSP Conveyance Policies

The RWSP contains policies that are intended, in part, to guide the planning, design, and construction of conveyance system improvement (CSI) projects to accommodate increased flows over a 30-year period (through 2030). This program update addresses the following key RWSP conveyance policies:

CP-1: To protect public health and water quality, King County shall plan, design, and construct county wastewater facilities to avoid sanitary sewer overflows.

1. *The twenty-year peak flow storm shall be used as the design standard for the county's separated wastewater System.*

CP-2: King County shall construct the necessary wastewater conveyance facilities, including, but not limited to pipelines, pumps, and regulators, to convey wastewater from component agencies to the treatment plants for treatment and to convey treated effluent to water bodies for discharge. Conveyance facilities shall be constructed during the planning period of the currently adopted RWSP to ensure that all treatment plants can ultimately operate at their rated capacities. No parallel eastside interceptor shall be constructed. No parallel Kenmore interceptor shall be constructed.

[1] These criteria, discussed in Chapter 5, were developed jointly with the local wastewater collection agencies that are members of the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC).

2.2 Wastewater Service Area and System

King County's regional wastewater system serves approximately 1.4 million residents within a 420-square-mile service area encompassing most of King County and smaller portions of Snohomish and Pierce Counties. It is a large, integrated wastewater collection, conveyance, and treatment system operated by King County that serves 34 cities and sewer districts that are "component agencies" of the system. Figure 2-1 illustrates the regional wastewater service area in relation to component agency service areas.

The component agencies own and operate facilities for collecting wastewater from residences and businesses. Their combined facilities include 5,100 miles of collection pipes and numerous pump and regulator stations. King County owns and operates regional facilities necessary for conveying, treating, and discharging flows from component agency systems.

The following components make up King County's regional wastewater system:

- 3 secondary treatment facilities
- 335 miles of regional conveyance pipes
- 42 pump stations
- 19 regulator stations
- 4 combined sewer overflow (CSO) treatment facilities
- 38 CSO outfalls

Wastewater System Components

Secondary treatment plants provide secondary treatment of wastewater before discharging the treated and disinfected effluent to Puget Sound.

Conveyance pipes carry wastewater to the treatment plants.

Pump stations lift wastewater in pipes to higher elevations so that it can continue to flow by gravity.

Regulator stations store wastewater during peak flow events until flows can be safely conveyed by the downstream system.

CSO treatment facilities provide primary treatment and disinfection to combined flows during periods of peak flow following large storm events.

CSO control structures store excess combined flows to prevent overflows into surface waters.

The West Point, South, and Vashon Treatment Plants provide secondary treatment; the CSO treatment facilities (Henderson, Elliot West, Alki, and Carkeek) provide CSO treatment, which is the equivalent to primary treatment. All seven treatment facilities discharge their treated and disinfected effluent to Puget Sound. Two new treatment plants are being constructed: the Brightwater regional treatment plant, scheduled to start operating in 2010, and a smaller local treatment plant in the City of Carnation, scheduled to start operating in 2008.

The county's conveyance system, consisting of pipes, pump stations, and regulator stations, was constructed over many decades. Older pipes, located in most parts of Seattle, are part of a combined sewer system that collects both stormwater and wastewater. Wastewater pipes in the rest of the region, including some portions of north Seattle, are part of a separated sewer system in which separate pipes carry wastewater and stormwater. Figure 2-2 illustrates the structural and functional differences of combined and separated sewer systems.

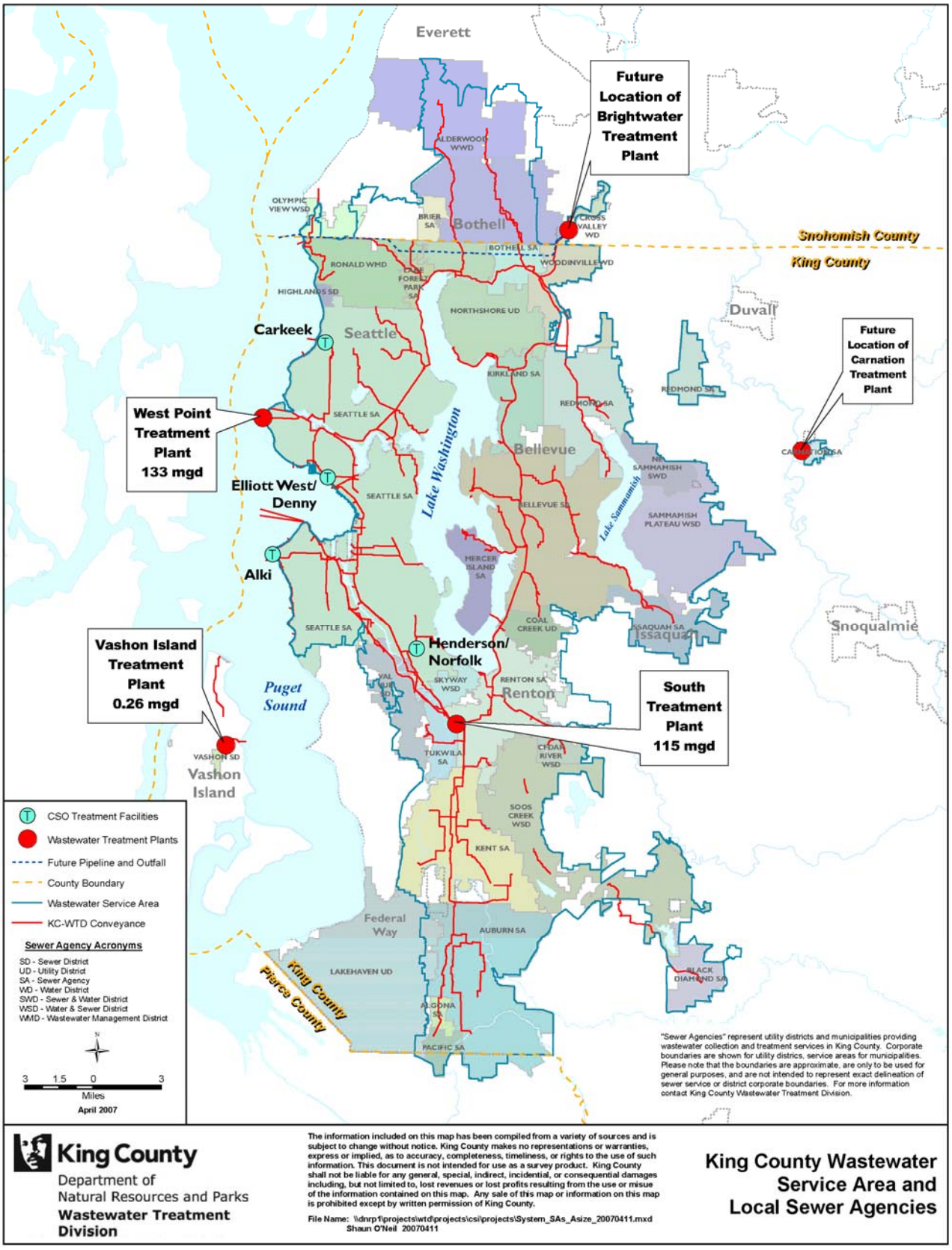

Figure 2-1. Regional Wastewater Service Area and Component Agencies

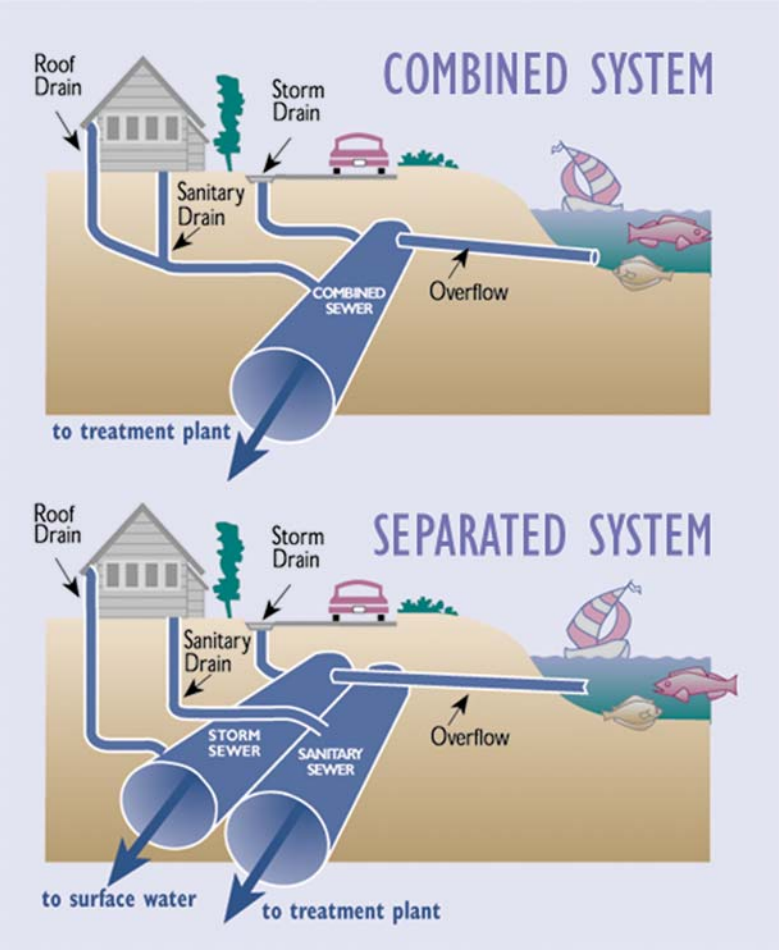

Figure 2-2. Combined and Separated Sewer Systems

2.3 History of Conveyance System Planning

Planning for the regional conveyance system is an ongoing function for King County's Wastewater Treatment Division (WTD). Initial planning began in 1959 when the newly formed Municipality of Metropolitan Seattle (Metro) completed its *Metropolitan Seattle Sewerage and Drainage Survey.* This original plan was largely implemented in the 1960s, 1970s, and early 1980s.

The plan was updated as a part of the Regional Wastewater Services Plan (RWSP) in 1999. The regional conveyance system improvement program that was included as part of the RWSP listed projects, based on information available at that time, for repairing or modifying existing conveyance facilities and for constructing new facilities. The program consisted of three components: (1) conveyance facilities needed to serve a proposed new North Treatment Plant (now called Brightwater), (2) improvements to major conveyance facilities, and (3) improvements to minor pipelines (trunks).

Since adoption of the RWSP, the conveyance planning approach has undergone substantial reorganization, primarily to break down the service area into ten sub-regional planning basins and to integrate conveyance planning with local agency plans and with other RWSP programs such as infiltration and inflow control, CSO control, and water reuse. The conveyance program was updated between 2000 and 2003 using this approach and was documented in the 2004 RWSP comprehensive review. Projects were identified through 2030, the RWSP planning horizon.

The program is now being updated because significant new capacity needs were identified during development of the March 2005 *Regional Needs Assessment* (RNA) conducted for the Regional Infiltration and Inflow (I/I) Control Program. The purpose of the RNA was to identify CSI projects and costs that could serve as a baseline for conducting benefit-cost analyses of potential I/I reduction projects. The RNA identified 63 capital conveyance projects needed through 2050[2]. These capacity related projects included a combination of projects previously identified in the 1999 RWSP and the 2000–2003 CSI programs and additional projects identified based on extensive flow monitoring data and sewered population information obtained during development of the I/I control program.

A technical memorandum, published in December 2005 and updated in March 2007, built on the RNA by re-evaluating capacity needs and reviewing age and facility inspection data on the condition of the conveyance system. The memorandum identifies the portions of the conveyance system that will need to be expanded or replaced over time in order to make the system capable of handling peak flow demands through 2050. It provided a basis for identifying and evaluating alternative approaches to address the identified needs and for seeking input from component agencies in the preparation of this update.

Types of Conveyance Pipes

Gravity sewers allow wastewater to flow passively via gravity. About 90% of the pipes in the regional conveyance system are gravity sewers.

Force mains convey wastewater from pump stations under pressure. About 5% of the pipes in the regional conveyance system are force mains.

Pressure sewers convey wastewater under pressure in pipes that are also under the effect of gravity. About 3% of the pipes in the regional conveyance system are pressure sewers.

Siphons convey wastewater under and across water bodies using gravity siphon effects. These pipes are always full and under pressure. About 2% of the pipes in the regional conveyance system are siphons.

This *Conveyance System Improvement Program Update* further refines the previously identified needs; categorizes these needs based on system age, condition, or capacity; and presents a list of recommended projects and a schedule to address identified needs.

[2] By 2050, the regional wastewater service area is projected to be fully built out and all sewerable portions of the service area will be connected into the wastewater system.

2.4 Related Programs that Affect Conveyance Capacity

This section briefly describes three programs that are related to conveyance system planning:

- the Brightwater System, which will be online in 2010,
- the I/I control program, which is striving to reduce the amount of I/I that enters the separated portion of King County's conveyance system via local agency systems, and
- the CSO control program, which is working to reduce the amount of untreated overflows from the combined portion of the system.

2.4.1 Brightwater System

The Brightwater System will consist of both a treatment plant and an influent/effluent conveyance system (Figure 2-3). The new plant will treat flows from the rapidly growing northern service area that currently goes to the West Point and South plants. The new conveyance system will bring wastewater to the Brightwater plant and convey treated wastewater from the plant to Puget Sound. Figures 2-4 and 2-5 show the regional conveyance system and treatment plant service areas both before and after the Brightwater System is online.

Although this *Regional Conveyance System Improvement Program Update* covers only existing conveyance facilities, it accounts for Brightwater's positive effect on regional conveyance and treatment capacity. The development of CSI project scopes, costs, and improvement schedules in this update assumes that Brightwater will begin operating in 2010.

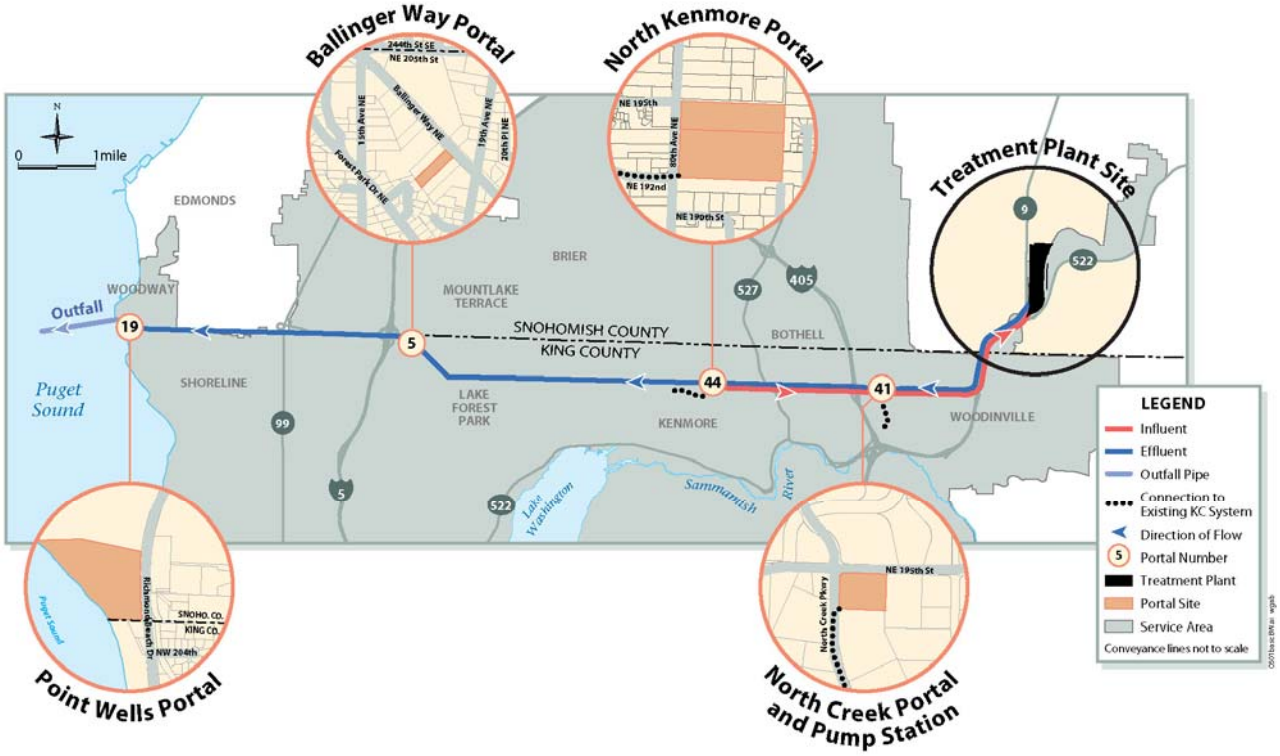

Figure 2-3. Components of the Brightwater System

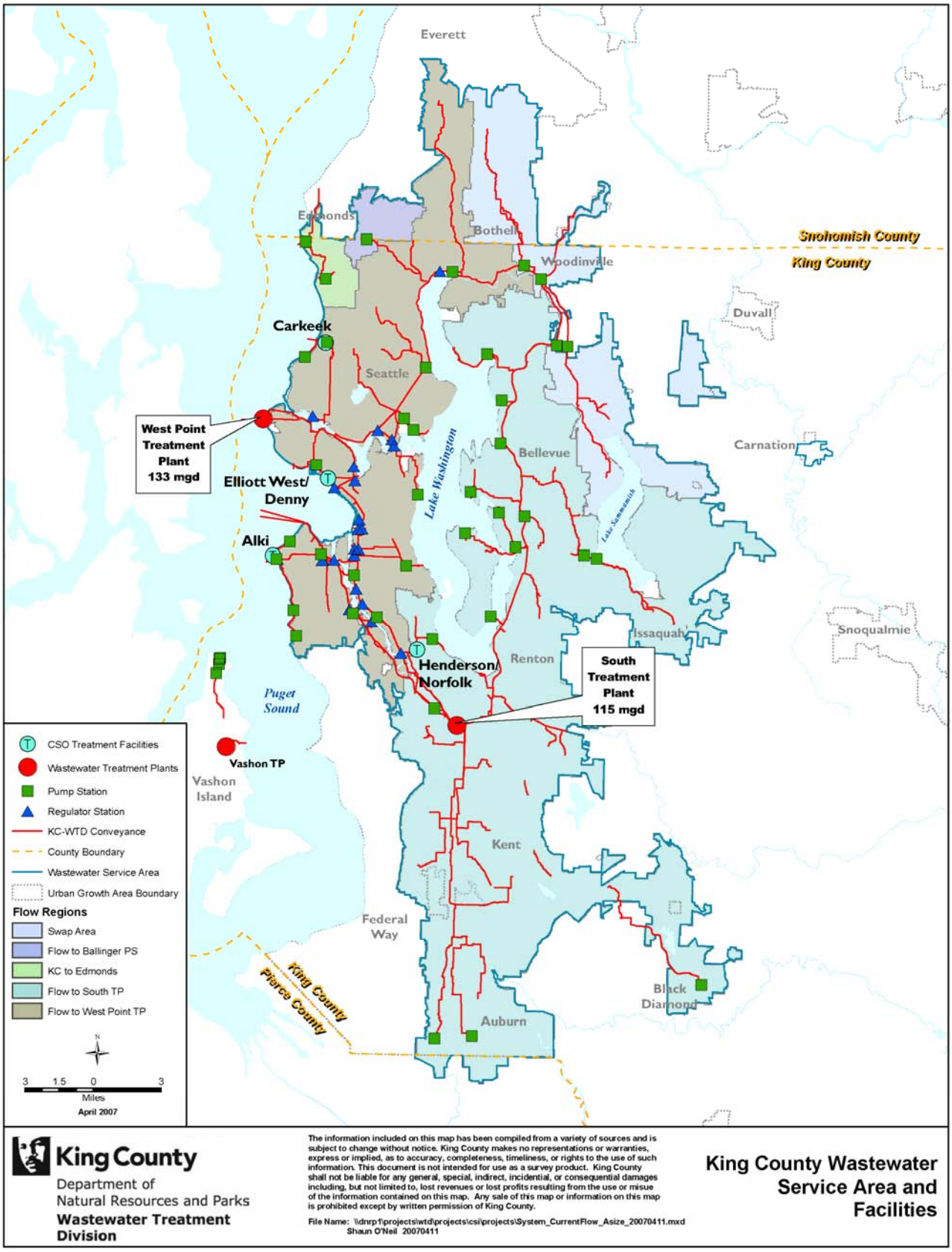

Figure 2-4. Existing Treatment Plant Service Areas

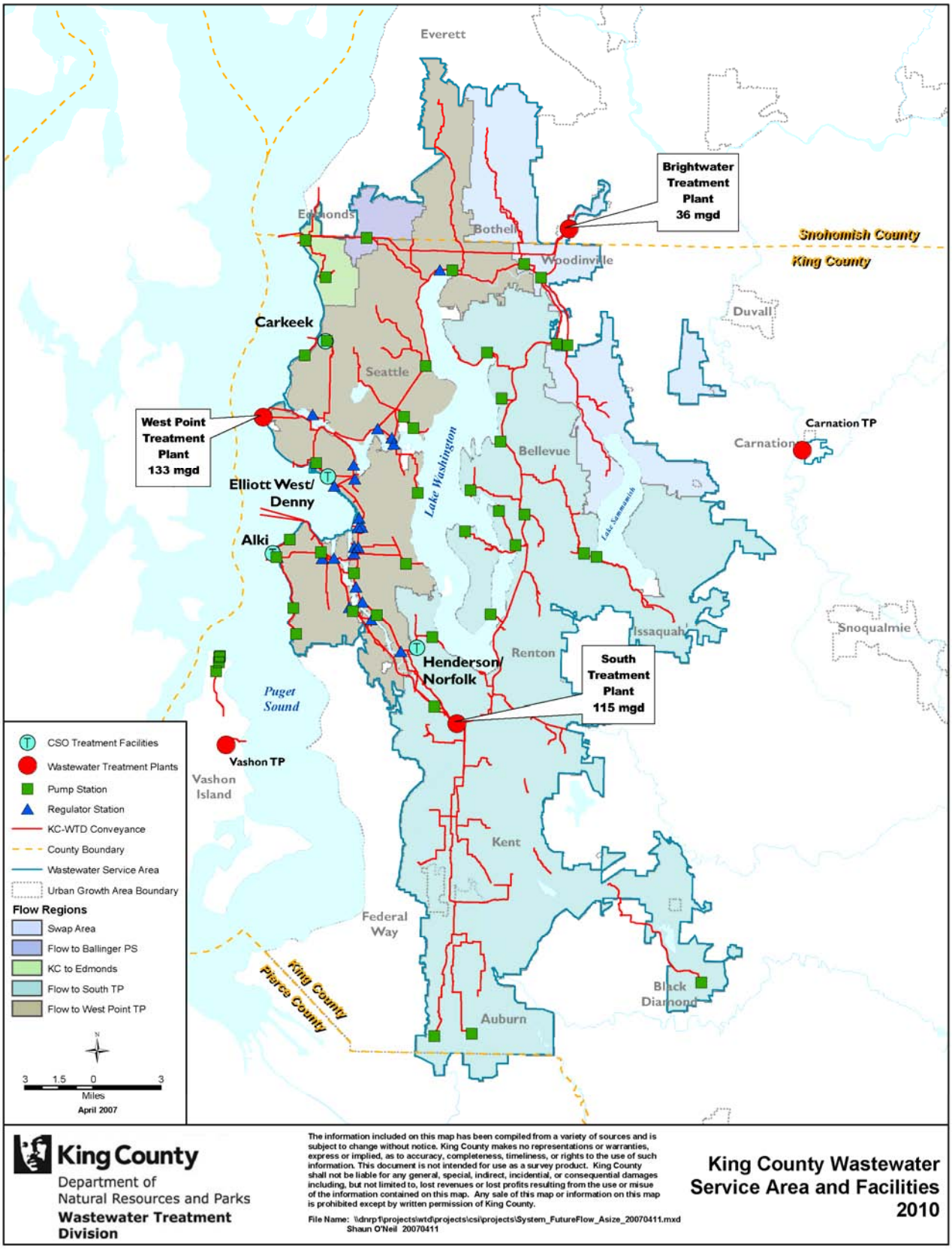

Figure 2-5. Treatment Plant Service Areas with Brightwater

2.4.2 Infiltration/Inflow Control Program

Even though they were designed to only carry wastewater, separated sewers also carry clean groundwater and stormwater that enter through leaky pipes, improper storm drain connections, and other means (Figure 2-6). This clean water, called infiltration and inflow, takes up capacity that could otherwise be used for wastewater alone and generates the need to build added capacity in pipelines, treatment plants, and other facilities. This added capacity results in higher capital and operating costs to the regional system that are born uniformly by all agencies and passed on to ratepayers in each jurisdiction.

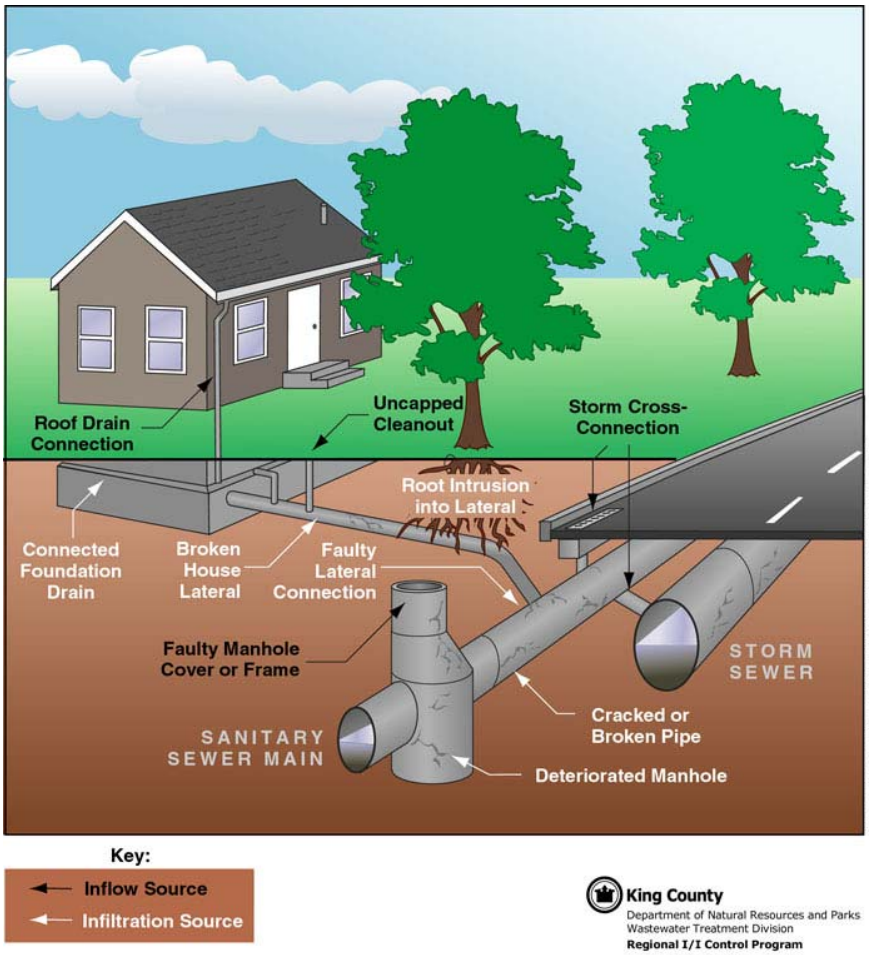

Figure 2-6. Sources of Infiltration and Inflow

In June 2006, the King County Council approved implementation of a Regional I/I Control Program.[3] The program will invest in I/I reduction in lieu of investing in larger conveyance system improvements when it is cost-effective to do so. I/I reduction is considered cost-effective when the total estimated CSI project savings is greater than the total estimated cost of I/I reduction. A benefit-cost analysis completed for the I/I control program conservatively estimated that about 5 percent of the I/I, or about 22 mgd during peak flow events, could be cost-effectively reduced. Two to three of the identified cost-effective I/I reduction projects will be completed by 2011. Each project, if successful, will eliminate the need for an identified CSI project. After completion of these initial projects, recommendations will be made to the King County Council regarding when and where to implement additional cost-effective projects.

[3] The *Executive's Recommended Regional Infiltration and Inflow Control Program* can be found at http://dnr.metrokc.gov/wtd/i-i/library/ExecRec/report.htm.

2.4.3 CSO Control Program

Combined Sewer Overflows (CSOs) are untreated wastewater and stormwater that discharge directly from CSO outfall pipes into marine waters, lakes, and rivers during heavy rainstorms when sewers are full. The combined portion of the conveyance system is within the City of Seattle. Management of this portion of the conveyance system is via the CSO Control Program. Information about the CSO system is summarized here to provide information about the entire regional conveyance system.

King County is responsible for 38 CSO sites and the City of Seattle is responsible for over 100 CSO sites (Figure 2-7). The Washington State Department of Ecology (Ecology) requires agencies with CSOs to develop plans for the greatest reasonable reduction of CSOs at the earliest possible date and defines "greatest reasonable reduction" as an average of one untreated discharge per year at each CSO location.

Ecology's CSO regulation and King County's RWSP policies require that WTD submit CSO plan updates to Ecology that coincide with National Pollution Discharge Elimination System (NPDES) permit renewals for the West Point Treatment Plant. The RWSP and the most recent CSO plan in April 2006 identify 21 projects that, when completed, will bring all county CSOs into compliance with the one-per-year discharge requirement by 2030. The plan conforms to RWSP policies by giving priority to CSO control projects in areas where discharges have the greatest potential to impact human health and/or species listed under Endangered Species Act. (For details about the need for and scope of each project, see the 2000 CSO control plan: *http://dnr.metrokc.gov/wtd/cso/library.htm#plans*.)

Currently, there are no conveyance projects planned for the combined system. If conditions change substantially over time, additional conveyance projects could be added in future updates.

2.5 Scope of This Regional Conveyance System Improvement Program Update

Policy WWPP-4 in the adopted RWSP states that "facility sizing shall take into account the need to accommodate build-out population." Therefore, this program update identifies conveyance capacity needs and projects through 2050; the year that full build-out of the regional wastewater service area is expected to be reached. Full build-out of the service area means that all sewerable portions of the service area will be connected to the wastewater system. In this update, recommended project schedules and costs through 2030 are subtotaled first before adding project schedules and costs through 2050 to allow for comparison with previous plans.

The CSI project recommendations in this program update focus on upgrades and expansions of facilities in the *separated* portion of the *existing* county-owned regional conveyance system. It does not cover planned new facilities, such as Brightwater, nor does it cover component agency systems. Each agency produces its own plans and capital improvement programs.

Figure 2-7. Combined Sewer Overflow (CSO) Locations

The level of detail in this update is greater for capacity-related than for condition-related needs and their associated projects. WTD is updating its asset management plan in order to better identify how best to maintain, repair, or replace regional wastewater conveyance and treatment facilities over time. The plan will identify least cost solutions to be implemented based on investment in capital versus ongoing maintenance on the County's conveyance system components and treatment plant facilities. Updates to the asset management plan will likely result in an update to the portion of the CSI Program that addresses system condition at that time. Information and examples of identified condition-related needs are contained in Chapter 3, Section 3.5, of this Update.

No assumptions or projections were made regarding I/I reduction across the region. The feasibility of large-scale I/I reduction has not yet been tested. Feasibility depends not only on the amount of I/I reduction but also on cost-effectiveness, which in turn depends on the projected costs of CSI projects. After the initial I/I reduction projects are completed, the recommended capital improvements contained in this update will provide the basis for completing benefit-cost analyses for possible future I/I reduction projections.

2.6 Organization of This Document

The next chapter (Chapter 3) describes the methods used for identifying conveyance system needs through 2050 and then lists these needs both in terms of capacity and condition. Once the needs were identified, CSI options and project alternatives were developed and analyzed before a list of recommended projects were developed. Chapter 4 documents these processes and recommended projects. Chapter 5, describes how projects were prioritized and provides schedules and estimated costs for recommended CSI projects. The update concludes with Chapter 6 which contains a crosswalk of current capacity projects to 2003 CSI project recommendations contained in the 2004 RWSP Update.

Appendix A provides details about the modeling processes and data used to calculate the capacity of the conveyance system and identify capacity needs. Appendix B contains details about each capacity improvement project identified in Chapter 4 of this program Update. Project details include a project description, project cost estimate, the upstream and downstream affects of the project, a description of other alternatives considered, and a map showing the location of the planned project. Appendix C provides a detailed description of capacity and condition related needs within the regional conveyance system. It also contains background information about the age of the different components of the system.

Chapter 3

Identifying Conveyance System Needs

The factors that affect King County's regional conveyance system are dynamic. The dual pressures of urban growth and system decay drive the need to expand and upgrade the system to adapt to growing flow volumes and ever-changing system conditions.

This chapter describes the standard used for the timing and sizing of capacity improvements, summarizes the processes used for identifying portions of the system in need of additional capacity or rehabilitation, and lists the identified capacity needs.

3.1 Conveyance Capacity Standard

Before determining capacity needs, peak flow standards that consider both the sizing and timing of facility improvements must be in place for a comparison of flow demands to existing regional conveyance system capacity:

- **Sizing.** What peak flow will a facility convey safely without overflowing? How does that compare to the estimated peak flows?
- **Timing.** What peak flow should be used to decide when the facility will be replaced, upgraded, or expanded? What is the expected life of a facility?

Policy CP-1.1 in the Regional Wastewater Services Plan (RWSP) established the 20-year peak storm flow as the standard to be used for both sizing and timing of facility improvements for the separated portion of the conveyance system.

The 20-year peak storm flow consists of both storm flow (infiltration and inflow) and base flow (wastewater from homes and businesses). It is projected to occur on average about every 20 years (a 20-year "return period") and to have a 5 percent chance of being exceeded in any given year.

Types of Flow

Base flow is wastewater that enters sewers during dry weather in the absence of infiltration and inflow (I/I).

Infiltration is groundwater that seeps into sewers through holes, breaks, joint failures, defective connections, and other openings.

Inflow is stormwater that rapidly flows into sewers via roof and foundation drains, catch basins, downspouts, manhole covers, and other sources.

Peak flow is the highest combination of base flow and I/I expected to enter a wastewater system during wet weather over a set time period (e.g., 30-minute increments).

The 20-year peak flow standard was established in the RWSP because the Federal Clean Water Act prohibits discharge of pollutants other than those permitted by National Pollutant Discharge Elimination System (NPDES) permits. The County's NPDES permits for the separated portion of the West Point and South Treatment Plants only allow discharges of *treated effluent* via the outfalls of each treatment plant. This permit requirement effectively prohibits overflows of untreated wastewater from the treatment plants or separated portion of the regional conveyance system. The County's adopted 20-year peak storm flow

standard is the objective measure for designing and building conveyance facilities intended to meet NPDES permit requirements.

The 20-year peak flow standard is an aggressive standard not commonly used by wastewater utilities nationwide. However, the County and component agencies concluded that designing to a lower level of service (e.g. a 5-year peak storm flow) carried too great a risk of adverse impacts to public health, the environment, and local collection systems that could result from overflows within the regional conveyance system.

To determine an appropriate planning horizon for sizing the conveyance facilities, population and economic growth projections were used in combination with flow data to calculate the ultimate population that conveyance facilities are expected to serve. This calculation is referred to as "saturation." In King County's wastewater service area, saturation is projected to occur by 2050.

Thus, regional conveyance system capacity improvements will be designed to carry the 20-year peak flow event projected to occur in 2050. For purposes of timing the improvements, a conveyance facility is considered to exceed the capacity standard once it cannot convey the projected 20-year peak flow.

3.2 Factors That Drive Capacity Needs

The two most significant factors that drive the need for expanding capacity within the regional conveyance system are infiltration and inflow (I/I), and population and employment growth over time.

Infiltration and inflow are the largest contributors to peak wastewater volumes that must be conveyed and treated in wet seasons. About 75 percent of the region's peak flows in the separated conveyance system comes from I/I.[1] Flow volumes can quadruple during rain events when the conveyance system must handle base flow plus I/I (Figure 3-1).

Figure 3-2 illustrates the projected growth rate in base flow in the portion of the regional service area served by separated sewers. Base flow will grow from approximately 75 to over 120 million gallons per day (mgd) by 2050. The relatively flat growth in base flow through 2010 reflects the expected immediate effect of water conservation efforts that are under way. Once the effects of conservation become stabilized, it is expected that population and employment growth will drive projected increases in base flow volumes.

Projections of peak flow within the regional conveyance system also account for increasing volumes of I/I within existing sewered areas due to degradation; and, I/I from newly sewered areas that are added through population and employment growth.

[1] *Regional Wastewater Services Plan, Executive's Preferred Plan,* April 1998, page 14.

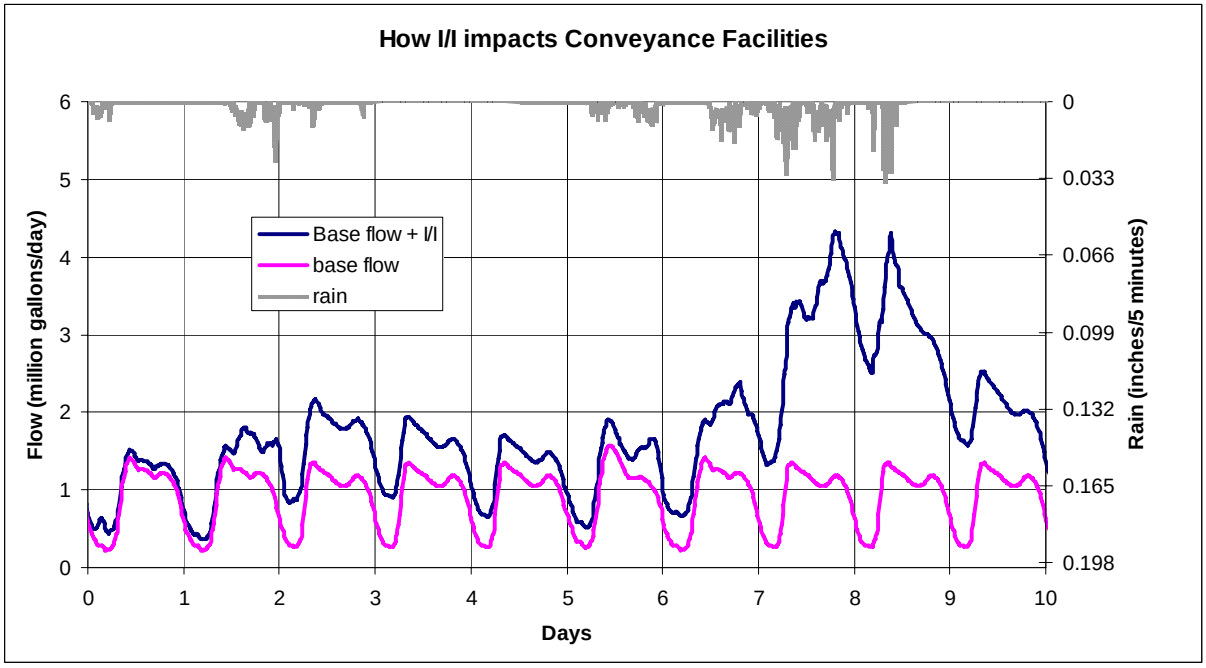

Figure 3-1. Typical Hydrograph Showing Impacts of I/I on Wastewater Flows

3.3 Process for Identifying Capacity Needs

In the past, census data, available peak flow data, service area growth assumptions, and system modeling served as the basis for identifying conveyance capacity needs. For this update, extensive flow and rainfall data collected for two years in support of the Regional I/I Control Program allowed for more accurate projections of the capacity of the individual components of the conveyance system.

The process for identifying regional conveyance capacity needs consisted of four main steps:

- Estimating current 20-year peak flow demands to establish a baseline that represents how the system currently performs during peak flow conditions.
- Projecting 20-year peak flows by decade, through 2050, using population and employment growth projections.
- Using a hydraulic model of the conveyance system to identify capacity constraints based on when the 20-year peak flow exceeds the capacity of existing conveyance facilities.
- Verifying and adjusting identified growth assumptions and capacity constraints using updated information from component agencies.

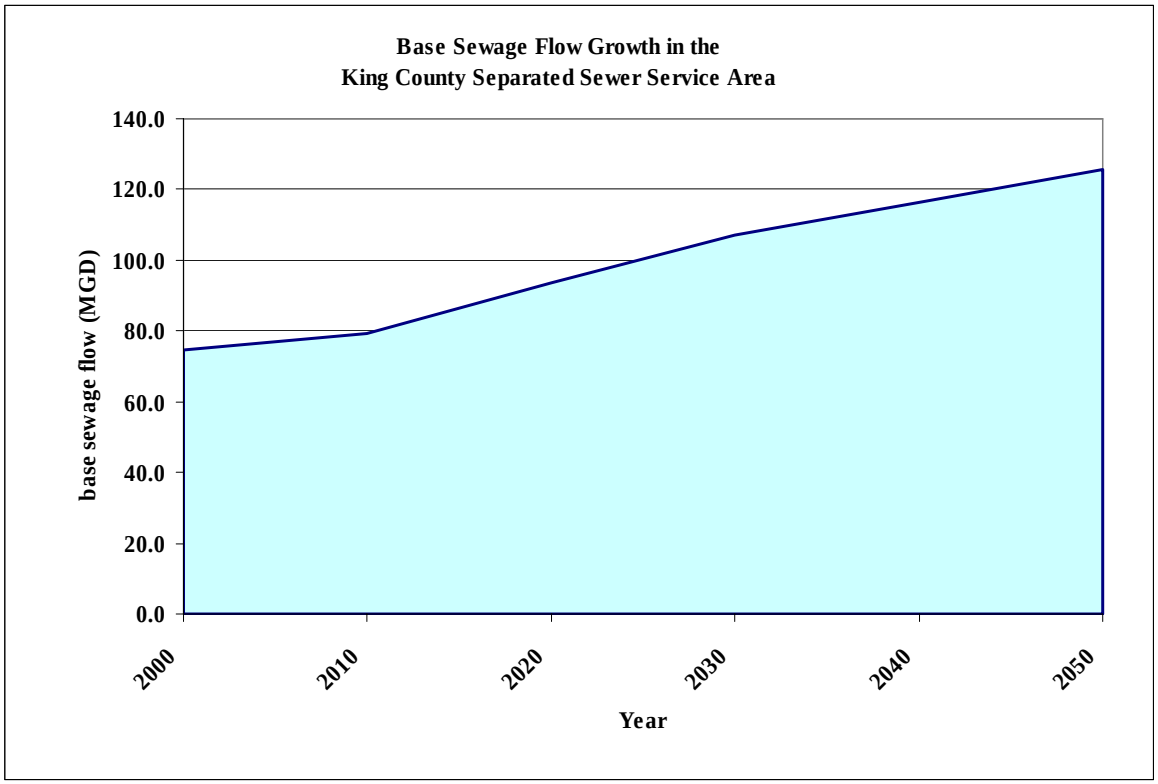

Figure 3-2. Projected Base Flow for the Regional Conveyance System (2000–2050)

This process and inputs summarized above are illustrated in Figure 3-3. A complete discussion of the data and models, and other tools used to develop flow projections and identify capacity needs is provided in Appendix A, *Conveyance System Technical Analyses – Processes and Assumptions*.

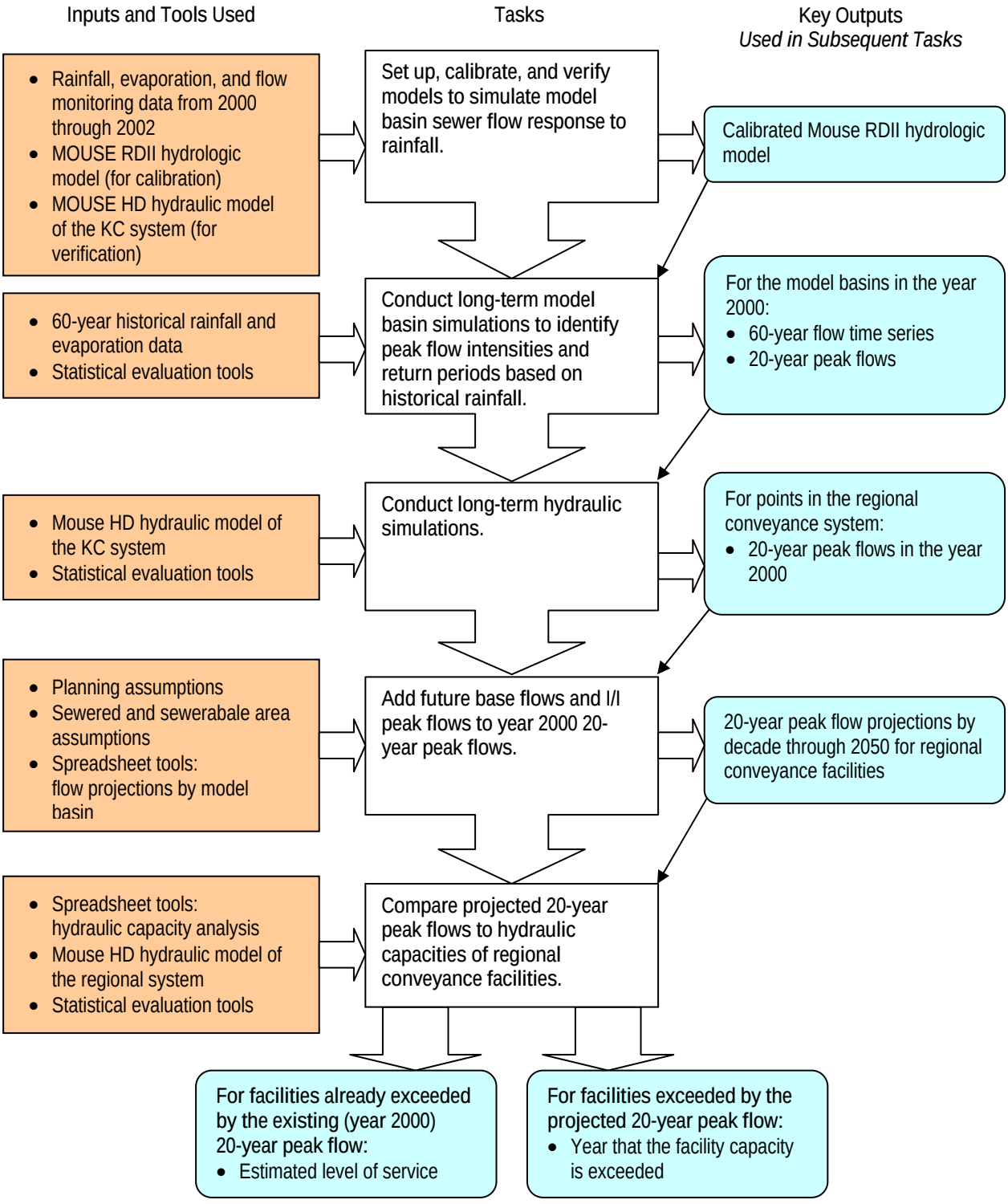

Figure 3-3. Process for Identifying Capacity Needs

3.3.1 Identifying Capacity Constraints

To identify capacity constraints in the county's regional conveyance system, the projected 20-year peak flows by decade, were mapped to a spreadsheet application tool that contains existing capacity information for all components of the regional system. The tool compares the 20-year peak flow projections to capacity and identifies when a conveyance system component is projected to exceed its capacity to convey the projected 20-year peak flow volume for that portion of the conveyance system. Figure 3-4 illustrates how the variables accumulate in one model basin to provide estimates of when capacity will be exceeded.

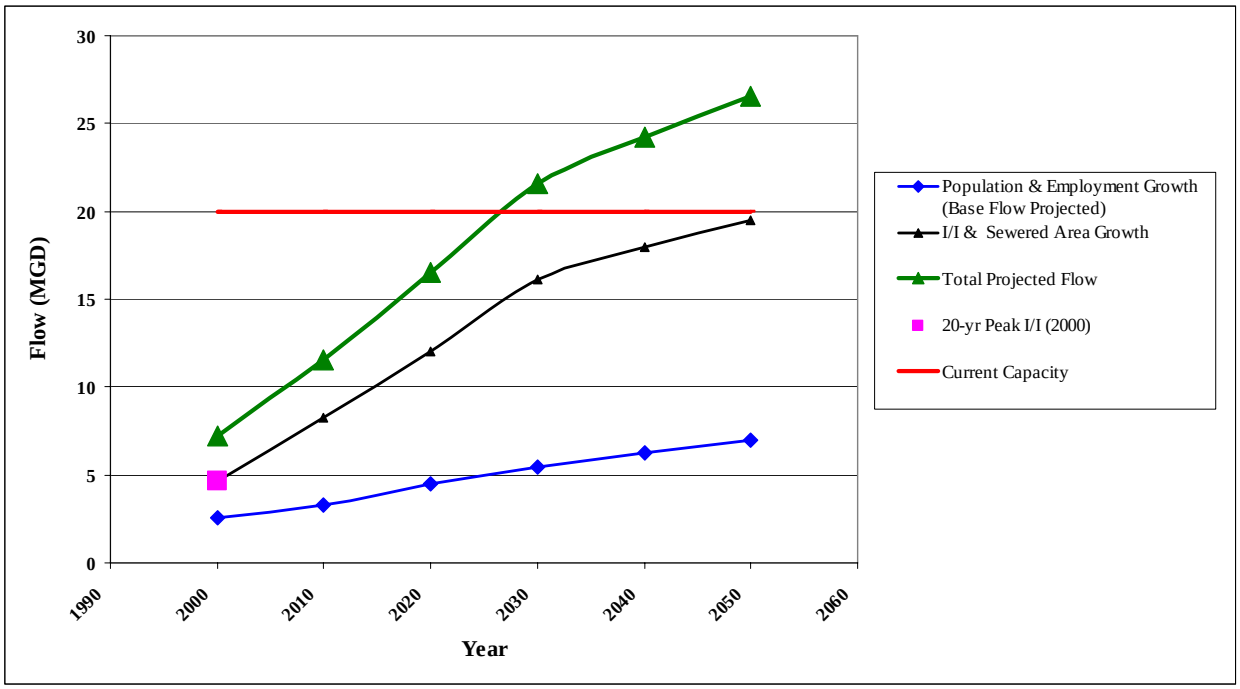

Figure 3-4. Example of Flow Projections Versus Existing Capacity in a Model Basin

3.3.2 Component Agency Input

Wastewater Treatment Division (WTD) staff met with representatives from component agencies to present identified capacity needs in the county's regional conveyance system and to obtain updated information about local growth rates and other factors affecting conveyance capacity. The meetings resulted in a more common understanding of the basis for identified regional conveyance needs and incorporation of local conditions into the needs identification process.

The flow projections and associated conveyance needs identified through flow modeling were, for the most part, consistent with component agency expectations. In some cases, information from an agency prompted changes in the estimated dates that 20-year peak flow volumes will exceed the capacity of regional conveyance facilities. The City of Issaquah, for example, provided information that demonstrates that it is experiencing urban growth at a significantly faster rate than the rest of the region. Development that is under way indicates that the portion of the service area around the city will be fully sewered by 2010 (assumed to be 2030 for the rest of

the region) and will reach population saturation by 2020 (assumed to be 2050 for the rest of the region). This information was incorporated into the county's projections of growth and flow volumes. The original and updated exceedance dates for regional conveyance facilities in the Issaquah area are listed in Table 3-1.

Table 3-1. Original and Updated Capacity Exceedance Dates for Regional Conveyance Facilities in the Issaquah Area

Identified Capacity Need	Original	Updated
Eastgate Trunk	2005	Before 2000
Issaquah Creek Interceptor	2024	2009
Issaquah Interceptor – Section 1	2011	2007
Issaquah Interceptor – Section 2	2025	2011
Heathfield/Sunset Vasa Park Force Mains	2005	Before 2000
Lake Hills Trunk	2019	Before 2000

3.4 Identified Conveyance Capacity Needs

To identify capacity needs in the county's regional conveyance system, the information and tools described in this chapter were used to compare known capacities of pipes, pump stations, and regulator stations in the system to current and projected 20-year peak flows. Table 3-2 lists identified capacity needs; Figure 3-5 shows their locations.

Table 3-2 lists all identified conveyance system capacity needs, including those that are being addressed by improvement projects currently in design or construction. The needs are grouped according to ten sub-regional planning basins (with the South Green River Planning Basin divided into three zones). The year of exceedance is the year that the projected 20-year peak flow volume for the identified conveyance system component is expected to be greater than its built capacity to convey the 20-year peak flow. Note that many identified conveyance needs already exceed the 20-year peak flow standard. However, the conveyance system has sufficient capacity to convey lesser flow volumes. Information about how conveyance needs and associated capacity improvement projects have been prioritized is discussed in Chapter 5.

Appendix C, *Technical Memorandum—Regional Conveyance System Needs*, provides more detail on how conveyance system capacity needs were identified.

Table 3-2. Identified Capacity Needs in the Separated Conveyance System

Map ID	Identified Conveyance System Need	Year Exceeded	Current Project
	Hidden Lake Planning Basin		
1	Hidden Lake Pump Station/Boeing Creek Trunk	Before 2000	Yes
2	Richmond Beach Pump Station/Richmond Beach Force Main	Before 2000	Yes
3	Richmond Beach Interceptor	Before 2000	Yes
	Northeast Lake Washington Planning Basin		
3.5	Bellevue Influent Trunk	Before 2000	No
4	Bellevue Pump Station/Bellevue Force Main	2008[a]	Yes
5	Bellevue Interceptor	Before 2000	Yes
6	Enatai Interceptor	Before 2000	No
7	Wilburton Pump Station/Factoria Trunk	Before 2000	No
8	Holmes Point Trunk	Before 2000	Yes
9	Juanita Bay Pump Station/Juanita Bay Force Mains	Before 2000	Yes
10	Kirkland Pump Station/Kirkland Force Main	Before 2000	Yes
11	Lake Hills Interceptor	2006	No
12	Medina Pump Station/Medina Force Main	2023	No
13	Medina Trunk	2009	No
14	North Mercer Island Interceptor	2000	No
15	Sweyolocken Pump Station/Sweyolocken Force Main	Before 2000	Yes
	North Green River Planning Basin		
16	North Soos Creek Interceptor	Not needed[b]	N/A
17	Rainier Vista Trunk	Not needed[b]	N/A
18	South Renton Trunk	2011	No
	North Lake Sammamish Planning Basin		
19	Lake Hills Trunk	Before 2000	No
20	NW Lake Sammamish Interceptor	Before 2000	No
	North Lake Washington Planning Area Basin		
21	North Creek Trunk	Before 2000	Yes
22	Swamp Creek Trunk	2017	No
23	York Pump Station	2016	No
	Northwest Lake Washington Planning Basin		
24	Thornton Creek Trunk	Before 2000	No
	Southeast Lake Washington Planning Basin		
25	Coal Creek Trunk	Before 2000	No

Map ID	Identified Conveyance System Need	Year Exceeded	Current Project
	South Green River Planning Basin, Kent Planning Zone		
26	Auburn Interceptor – Section 1	2037	Yes
27	Auburn Interceptor – Section 2	2038	Yes
28	Auburn Interceptor – Section 3	2028	Yes
29	Garrison Creek Trunk	2018	No
30	Kent Cascade Interceptor	2000	Yes
31	Mill Creek Interceptor	2015	Yes
32	ULID #1 - Contract #5 Kent	Before 2000	No
33	ULID #1 - Contract #4 Kent	2021	No
	South Green River Planning Basin, Auburn Planning Zone		
34	Pacific Pump Station / Algona Pacific Trunk	Before 2000	Yes
35	Auburn - West Interceptor	2021	Yes
36	Auburn - West Valley Interceptor	Before 2000	Yes
37	Lakeland Hills Pump Station	2040	No
38	M Street Trunk	Before 2000	Yes
39	West Valley Interceptor	2025	Yes
	South Green River Planning Basin, Soos Planning Zone		
40	Black Diamond Pump Station/Black Diamond Trunk	Before 2000	Yes
	South Lake Sammamish Planning Basin		
41	Eastgate Trunk	Before 2000	No
42	Issaquah Creek Interceptor	2009	No
43	Issaquah Interceptor – Section 1	2007	No
44	Issaquah Interceptor – Section 2	2011	No
45	Sunset Heathfield Pump Stations/Vasa Park Force Mains	Before 2000	No
	South Lake Washington Planning Basin		
46	Bryn Mawr Trunk	2005	No
47	Eastside Interceptor – Section 1	2016	No
48	Eastside Interceptor – Section 3	2033	No

[a] The Bellevue Pump Station Improvement Project is part of a series of projects to manage flows in the Northeast Lake Washington Planning Area and is needed to divert flows from the Sweyolocken Pump Station.
[b] The North Soos Creek Interceptor and Rainier Vista Trunk were identified as needing capacity in the December 2005 *Technical Memorandum—Regional Conveyance System Needs*. Additional flow modeling conducted for this CSI program update indicates that these two pipes have adequate capacity to convey projected 20-year peak flows.

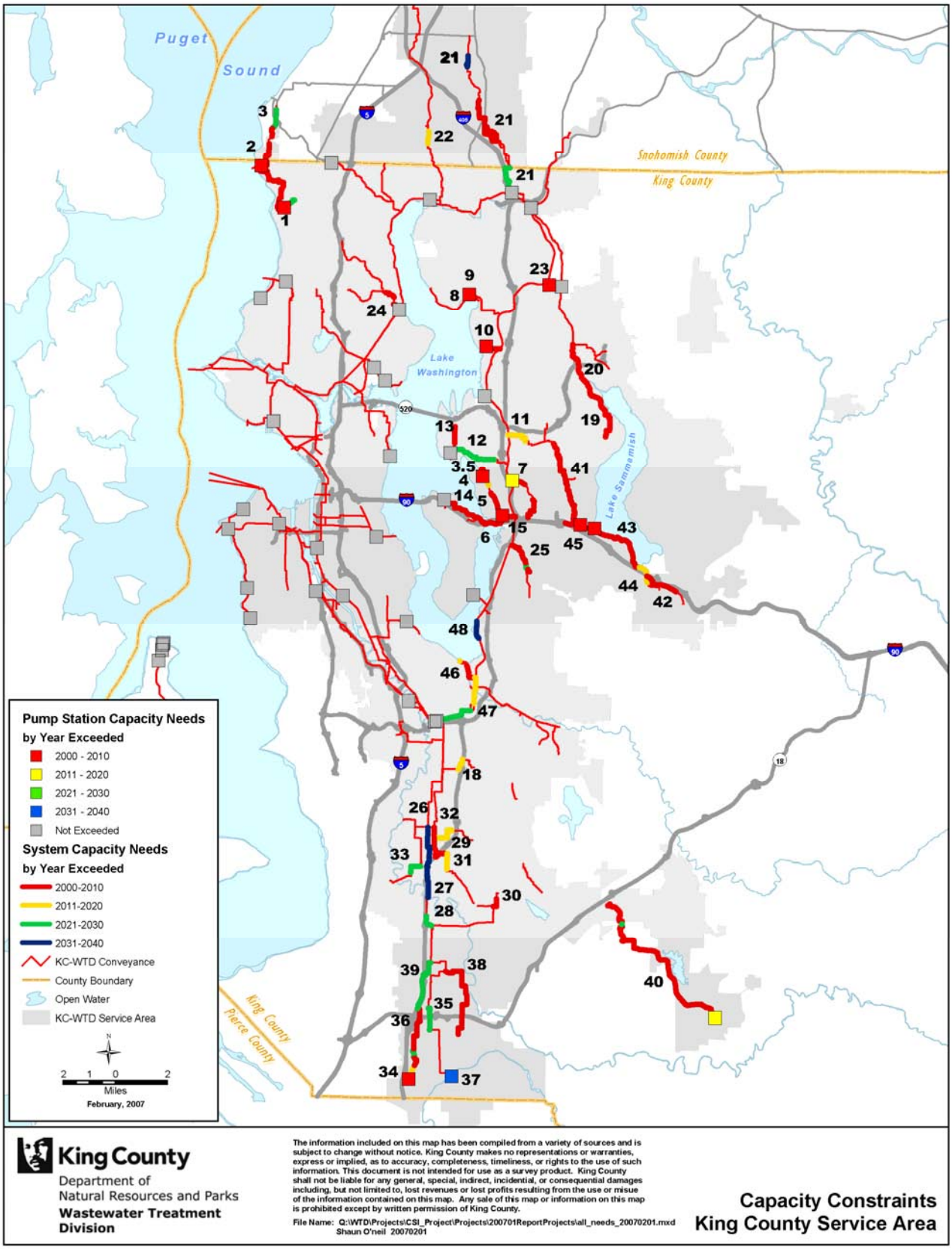

Figure 3-5. Locations of Identified Capacity Needs

3.5 Process for Identifying Condition Needs

In addition to expanding capacity, parts of the county's conveyance system must be rehabilitated or replaced to prevent sewer overflows or backups. Determination of the condition of a facility requires interpretive skills and a broad knowledge of the following:

- Performance of different conveyance system materials (such as metal, concrete, plastic, wood) over time
- Expected useful lives of the materials and mechanical components
- Effects of the environment (such as slopes and soil conditions) on the materials
- Effects of the chemical composition of the wastewater on the materials

WTD routinely inspects and documents the condition of its conveyance system to the extent access and technology allow. On average, gravity sewers are video inspected on a 10-year cycle. If deteriorating conditions are identified during inspection, a more frequent inspection schedule for the site is implemented. If conditions are identified that require immediate attention to repair, there are a number of ways for repairs to be addressed depending upon the scope and scale of the need. Force mains, pressure sewers, and siphons present challenges to inspection due to the full pipe pressurized conditions in which they operate.

While some condition deficiencies can be addressed through single repairs, others may require more significant capital investment. Capital projects necessary for addressing deteriorated conditions are referred to as asset management projects. These projects differ from major capital projects in that they replace worn facilities or extend their useful lives rather than upgrading facilities or building new facilities to provide additional system capacity. Asset management projects require capital investment in the conveyance system and must be evaluated for financial and rate impacts.

WTD uses video and sonar technology to assess the condition of gravity sewers, pressure sewers, siphons, and force mains. Because some of pipes present inspection challenges, a program is currently being implemented to construct means to access and inventory these pipes. WTD monitors the pump and regulator stations in the system and conditions of the mechanical and electrical systems at the stations.

The identified condition-driven projects listed later in Chapter 4 are based on currently available information and do not represent all such needs for the entire system. WTD has a division-wide taskforce to update its asset management plan that will evaluate the long term cost of maintaining existing assets to the cost of replacing the assets and incurring lower maintenance costs over the same period. The evaluations of all operation, maintenance activities and capital activities will be completed by 2010 and will likely result in an update to the condition-related sections of this *Regional Conveyance System Program Update*.

Chapter 4

Identifying Conveyance System Improvement Projects

Chapter 3 of this program update lists 48 components of the separated portion of the regional conveyance system that will require expansion to provide adequate capacity to convey projected 20-year peak flows through 2050.[1] It also discusses the means for identifying components of the conveyance system that will require capital investment to repair degraded conditions.

This chapter discusses the processes used to develop conveyance system improvement projects and lists recommended projects to address either identified system capacity or condition needs.

4.1 Process for Developing Recommended Capacity Improvement Projects

The process for developing a list of recommended projects to address identified capacity needs was an iterative one in which early project lists were reviewed and revised to incorporate local information and cost-saving measures. Key activities, not necessarily in order, are listed below and described in the text that follows:

- Review the list of recommended projects in the 2003 conveyance system improvement (CSI) program (see Chapter 2).
- Compare existing pipe and pump station capacities with the latest projected 20-year peak flows (see Chapter 3).
- Determine when new capacity is needed to achieve and maintain 20-year peak flow capacities (see Chapter 3).
- Assess whether to recommend replacing or paralleling an existing pipe that has an identified capacity constraint.
- Size each project to convey the projected 20-year peak flow in 2050.
- Determine possible routes for new pipelines.
- Develop initial project cost estimates.
- Evaluate whether storage projects would provide a cost-effective alternative to parallel pipes.
- Revise project alternatives, as needed, to reflect local information from component agencies.
- Refine cost estimates.

[1]By 2050, the regional wastewater service area is projected to be fully built out and all portions of the service area to be connected into the wastewater system.

The flow monitoring data gathered for the Regional I/I Control Program and the models that were calibrated to incorporate these data served as the basis for evaluating the project recommendations in the regional CSI program completed in 2003. Projects in the 2003 program were revised, as necessary, to meet latest demand forecasts, and more projects were added to meet newly identified capacity needs.(See Chapter 3 and Appendix A, *Conveyance System Technical Analysis, Processes and Assumptions,* for more detail.) Chapter 6 of this CSI Program Update contains a crosswalk for current capacity projects compared to 2003 CSI project recommendations contained in the 2004 RWSP Update.

Capital project options for addressing capacity needs typically consist of paralleling existing conveyance pipes with a new pipe, replacing undersized pipes or pump stations with larger ones, diverting flows to other conveyance facilities, or building storage facilities that reduce peak flow volumes by storing wastewater during high flow periods until it can be safely conveyed by the downstream system.

The condition, age, and composition of a pipe play an important role in deciding whether to parallel or replace existing pipes. Other factors that affect the decision are the amount of space available in a corridor for parallel pipe and the number of existing pipes. (Information on corridor space is not often available at this level of planning.) In areas where there were relatively new pipes made of durable materials like reinforced concrete or metal and there were few pipes in the corridor, it was assumed that paralleling would occur. In areas where there were older pipes and/or there was reason to believe that there was limited space for paralleling, it was assumed that the more expensive option of pipe replacement would occur. (See Section 4 of Appendix B for a detailed discussion of the age and material type of conveyance system pipes.)

The size for each new parallel or replacement pipe was then determined by projecting the 20-year peak flow in 2050 to be conveyed through the pipe. After the pipes were sized, possible pipeline routes were developed. Factors considered in developing routes included stream crossings, major street crossings and culvert crossings, wetlands, public rights-of-way, topography, water bodies, and high water tables.

In cases where pipe paralleling was the assumed method of adding capacity, an analysis of the downstream benefits of storage was conducted using the county's hydraulic model to determine if building storage capacity rather than paralleling the pipe could provide needed capacity. If the modeling indicated that storage was feasible and if the estimated cost of storage was less than increasing capacity in the downstream system, storage was assumed. Possible locations and types of storage facilities (such as box storage or underground pipe storage) were identified as part of the analysis.

In spring 2006, King County's Wastewater Treatment Division (WTD) held meetings with representatives of component agencies with identified conveyance needs in their respective jurisdictions. In addition to verifying population and growth assumptions in these meetings, WTD learned of local conditions that could affect project feasibility and, where needed, developed additional alternatives to account for topographic or permitting issues noted by the agencies.

Cost estimates for recommended new pipes, pump stations, and storage facilities were developed using the TABULA cost estimating tool. TABULA is a Web-based construction cost estimating program developed specifically for WTD. The program contains unit construction cost estimates

and allied costs associated with designing and constructing the range of conveyance facilities needed across the regional system.[2]

4.2 Recommended Conveyance Projects to Address Capacity Needs

The recommended projects in Tables 4-1 and 4-2 will address the regional conveyance system capacity needs listed in Chapter 3. Table 4-1 lists all recommended projects *planned* for future construction (project costs are in 2006 dollars). Table 4-2 lists projects that are already in design or construction and that are recommended for continued development. Costs for projects currently in design or under construction reflect the actual value of project costs in the years work was completed or is currently under way. Figure 4-1 shows the locations of both current and planned projects (by the project number listed in Tables 4-1 and 4-2).

Table 4-1. Planned Conveyance System Capacity Improvement Projects

Project Number	Project Name and Total Cost	Under-Capacity Areas Addressed by Project
Hidden Lake Planning Basin		
64	Boeing Creek Storage Expansion ($9,100,000)	Hidden Lake Pump Station/Boeing Creek Trunk Richmond Beach Pump Station/Richmond Beach Force Main Richmond Beach Interceptor
65	Richmond Beach Storage ($14,000,000)	Richmond Beach Pump Station/Richmond Beach Force Main Richmond Beach Interceptor
Northeast Lake Washington Planning Basin		
29	Bellevue Influent Trunk Parallel ($2,500,000)	Bellevue Influent Trunk
30	North Mercer and Enatai Interceptor Parallels ($24,900,000)	Enatai Interceptor North Mercer Island Interceptor
42	Medina Storage ($1,100,000)	Medina Trunk Eastside Interceptor – Section 1 Medina Pump Station/Medina Force Main Eastside Interceptor – Section 3
35	Factoria Pump Station and Trunk Diversion ($10,200,000)	Wilburton Pump Station/Factoria Trunk
73	Juanita Bay Pump Station Force Main Upgrade ($15,000,000)	Juanita Bay Pump Station/Juanita Bay Force Main
North Green River Planning Basin		
60	South Renton Interceptor Parallel ($3,600, 000)	South Renton Trunk
North Lake Sammamish Planning Basin		
47	Lake Hills Trunk Replacement ($15,000,000)	Lake Hills Trunk
44	Northwest Lake Sammamish Interceptor Parallel ($23,500,000)	NW Lake Sammamish Interceptor

[2] See Appendix A, *Conveyance System Technical Analyses, Processes and Assumptions,* for more information about TABULA. The TABULA program and user's guide can be accessed at http://dnr.metrokc.gov/wtd/csi/tabula/index.htm.

Project Number	Project Name and Total Cost	Under-Capacity Areas Addressed by Project
North Lake Washington Planning Basin		
49	[CSI] Swamp Creek – Section 1B Parallel ($9,000,000)	Swamp Creek Trunk
61	Upper North Creek Parallel ($4,800,000)	North Creek Trunk
67	Lower North Creek Interceptor Parallel ($11,500,000)	North Creek Trunk
72	York Pump Station Modifications ($8,400,000)	Eastside Interceptor – Section 1 York Pump Station Eastside Interceptor – Section 3
Northwest Lake Washington Planning Basin		
68	[CSI] Thornton Creek Trunk Parallels ($7,600,000)	Thornton Creek Trunk
Southeast Lake Washington Planning Basin		
34	Coal Creek Siphon and Trunk Parallel ($7,100,000)	Coal Creek Trunk
South Green River Planning Basin, Kent Planning Zone		
46	Garrison Creek Trunk Parallel ($6,000,000)	ULID #1 – Contract #5 Kent Garrison Creek Trunk
55	Auburn Interceptor – Section 3 Parallel Pipe Storage ($31,000,000)	Auburn Interceptor – Section 3 Auburn Interceptor – Section 1 Auburn Interceptor – Section 2
58	ULID 1 Contract 4 Parallel ($3,800,000)	ULID #1 – Contract #4 Kent
South Green River Planning Basin, Auburn Planning Zone		
50	Algona Pacific Trunk Stage 1 ($4,500,000)	Pacific Pump Station/Algona Pacific Trunk
62	Algona Pacific Trunk Stage 2 ($1,400,000)	Pacific Pump Station/Algona Pacific Trunk
63	Lakeland Hills Pump Station Replacement ($6,000,000)	Lakeland Hills Pump Station/Lakeland Hills Force Main
South Green River Planning Basin, Soos Planning Zone		
23	[CSI] Soos Alternative 3A(3) – PS D with Conveyance ($42,000,000)	Kent Cascade Interceptor Black Diamond Pump Station/Black Diamond Trunk
25	[CSI] Soos Alternative 3A(3) – PS H with Conveyance ($47,000,000)	Black Diamond Pump Station/Black Diamond Trunk
43	[CSI] Soos Alternative 3A(3) – PS B with Conveyance ($7,900,000)	Kent Cascade Interceptor
South Lake Sammamish Planning Basin		
36	[CSI] Sammamish Plateau Diversion ($24,800,000)	Heathfield/Sunset Pump Stations/Vasa Park Force Mains Eastgate Trunk Lake Hills Interceptor Issaquah Interceptor – Section 1 Issaquah Interceptor – Section 2 Eastside Interceptor – Section 1 Eastside Interceptor – Section 3
40	Heathfield/Sunset Pump Station Replacement and Force Main Upgrade ($51,000,000)	Heathfield/Sunset Pump Stations/Vasa Park Force Mains
41	Eastgate Parallel Pipe Storage ($23,800,000)	Eastgate Trunk Lake Hills Interceptor Eastside Interceptor – Section 1 Eastside Interceptor – Section 3

Project Number	Project Name and Total Cost	Under-Capacity Areas Addressed by Project
51	[CSI] Issaquah Storage ($22,900,000)	Eastgate Trunk Lake Hills Interceptor Issaquah Interceptor – Section 1 Issaquah Interceptor – Section 2 Heathfield/Sunset Pump Stations/Vasa Park Force Mains Eastside Interceptor – Section 1 Eastside Interceptor – Section 3
52	[CSI] Sammamish Plateau Storage ($33,200,000)	Heathfield/Sunset Pump Stations/Vasa Park Force Mains Eastgate Trunk Lake Hills Interceptor Issaquah Interceptor – Section 1 Issaquah Interceptor – Section 2 Eastside Interceptor – Section 1 Eastside Interceptor – Section 3
53	Issaquah Creek Highlands Storage ($2,400,000)	Issaquah Creek Interceptor Eastgate Trunk Lake Hills Interceptor Issaquah Interceptor – Section 1 Issaquah Interceptor – Section 2 Heathfield/Sunset Pump Stations/Vasa Park Force Mains Eastside Interceptor – Section 1 Eastside Interceptor – Section 3
59	Issaquah Interceptor Section 2 Parallel ($2,800,000)	Issaquah Interceptor – Section 2
South Lake Washington Planning Basin		
33	Bryn Mawr Storage ($8,700,000)	Bryn Mawr Trunk Eastside Interceptor – Section 1

PS = pump station.

Table 4-2. Conveyance System Capacity Improvement Projects in Design or Under Construction

Project No.	Project Name and Total Cost	Needs Addressed by Projects
Hidden Lake Planning Basin		
14	Hidden Lake Pump Station and Sewer Improvement Project ($38,400,000)	Hidden Lake Pump Station/Boeing Creek Trunk Richmond Beach Pump Station/Richmond Beach Force Main Richmond Beach Interceptor
Northeast Lake Washington Planning Basin		
12	Juanita Bay Pump Station Replacement Project ($37,000,000)	Juanita Bay Pump Station/Juanita Bay Force Mains Holmes Point Trunk
69	[CSI] Bellevue Pump Station Upgrade ($21,000,000)	Bellevue Interceptor Sweyolocken Pump Station/Sweyolocken Force Main Bellevue Pump Station/Bellevue Force Main
North Lake Washington Planning Basin		
66	North Creek Interceptor/Olympus Meadows Trunk Improvement ($28,400,000)	North Creek Trunk
South Lake Washington Planning Basin		
7	Fairwood Interceptor (Formerly Madesn Creek) ($21,700,000)	Replacement of Madsen Creek Interceptor
South Green River Planning Basin, Auburn Planning Zone		
9	Pacific Pump Station Replacement Project ($8,000,000)	Pacific Pump Station/Algona Pacific Trunk
70	Kent/Auburn Conveyance System Improvements Project ($44,600,000)	Auburn – West Valley Interceptor M Street Trunk ULID #1 – Contract #5 Kent Algona Pacific Trunk Mill Creek Interceptor Auburn – West Interceptor West Valley Interceptor
South Green River Planning Basin, Soos Planning Zone		
71	Black Diamond Storage ($5,600,000)	Black Diamond Pump Station/Black DiamondTrunk Kent Cascade Interceptor Auburn Interceptor – Section 3 Auburn Interceptor – Section 1 Auburn Interceptor – Section 2

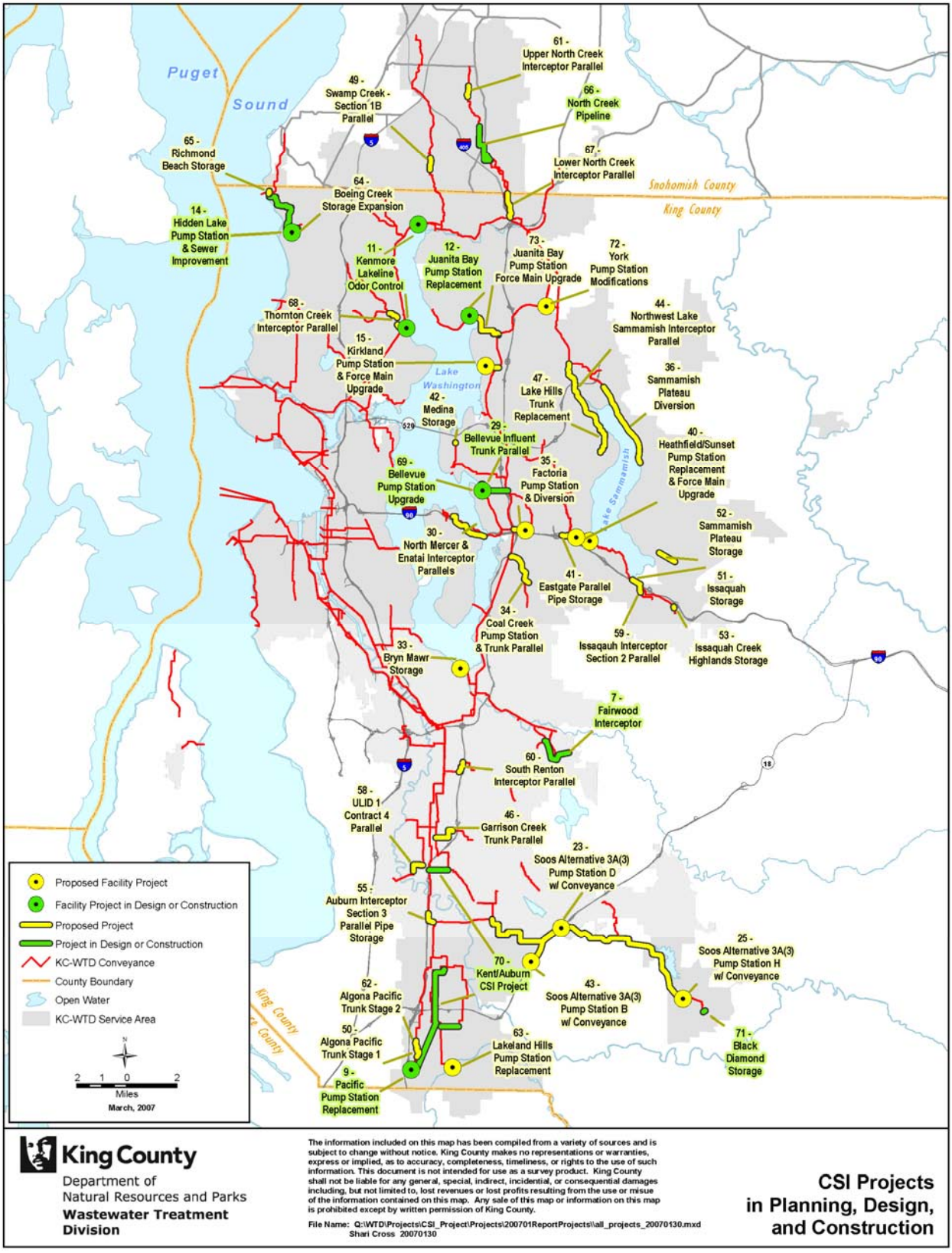

Figure 4-1. Conveyance System Capacity Improvement Projects in Planning, Design, or Construction

4.3 Recommended Conveyance Projects to Address Condition Needs

WTD's Asset Management Section is responsible for inspecting and maintaining regional conveyance pipelines. The section develops and implements an *Annual Facilities Plan*, which includes a system-wide asset condition assessment and information on proposed capital projects necessary to repair or replace degraded conveyance facilities. The *Annual Facilities Plan* is available for review from the Asset Management Section.

As discussed in Chapter 3, asset management projects differ from major capital projects in that they replace worn facilities, or extend their useful lives, but do not typically provide significant capacity expansion. WTD's Asset Management Program has approximately 40 primary projects and programs in place that account for approximately $50 million annually in capital expenditures on the wastewater treatment and conveyance systems.

Asset Management capital projects are organized into seven categories. The first category, Stand-Alone Projects, consists of large asset management projects that are generally funded as individual fully defined projects with dedicated multi-year budgets. The remaining categories are listed below, and cover minor asset management projects that address needs resulting from the continuous inspection and monitoring of the conveyance system. The projects typically cost less than $500,000 and take one to two construction seasons to complete.

- Electrical Systems and Instrumentation & Control Systems
- Mechanical Equipment
- Odor and Corrosion Control
- Pipeline Replacements (these are typically in-plant replacements related to process equipment)
- Process Replacements and Improvements (treatment plant related)
- Structure and Site Improvements

An example of an identified capital replacement project is the repair or replacement of the Ballard Siphon. The siphon is a wood stave inverted siphon constructed in 1935. It conveys combined sewage flows from north to south under Salmon Bay in the Ballard/Interbay area of Seattle. Internal inspections of the siphon using new sonar technology in late 2005 identified structural issues that were not apparent during external inspections of the siphon over 10 years ago. Additional sonar and video inspections confirmed the need to proceed with design and construction of a parallel of the existing siphons. The current project schedule calls for completion of construction in late 2008. Additional projects of this type are expected to be identified over time as the result of ongoing facility inspections.

Recent inspections of 57 known hydrogen sulfide (H_2S) corrosion sites in the conveyance system indicate that corrosion has been occurring at a faster rate than anticipated or seen in the past. H_2S is generated through a complex series of biological and chemical reactions between the wastewater and the bacteria that thrive on the interior walls of sewer pipes. The Hydrogen Sulfide Corrosion Lining Program has recently prioritized a list of the top 17 projects based on the latest inspection data. Figure 4-2 shows their locations.

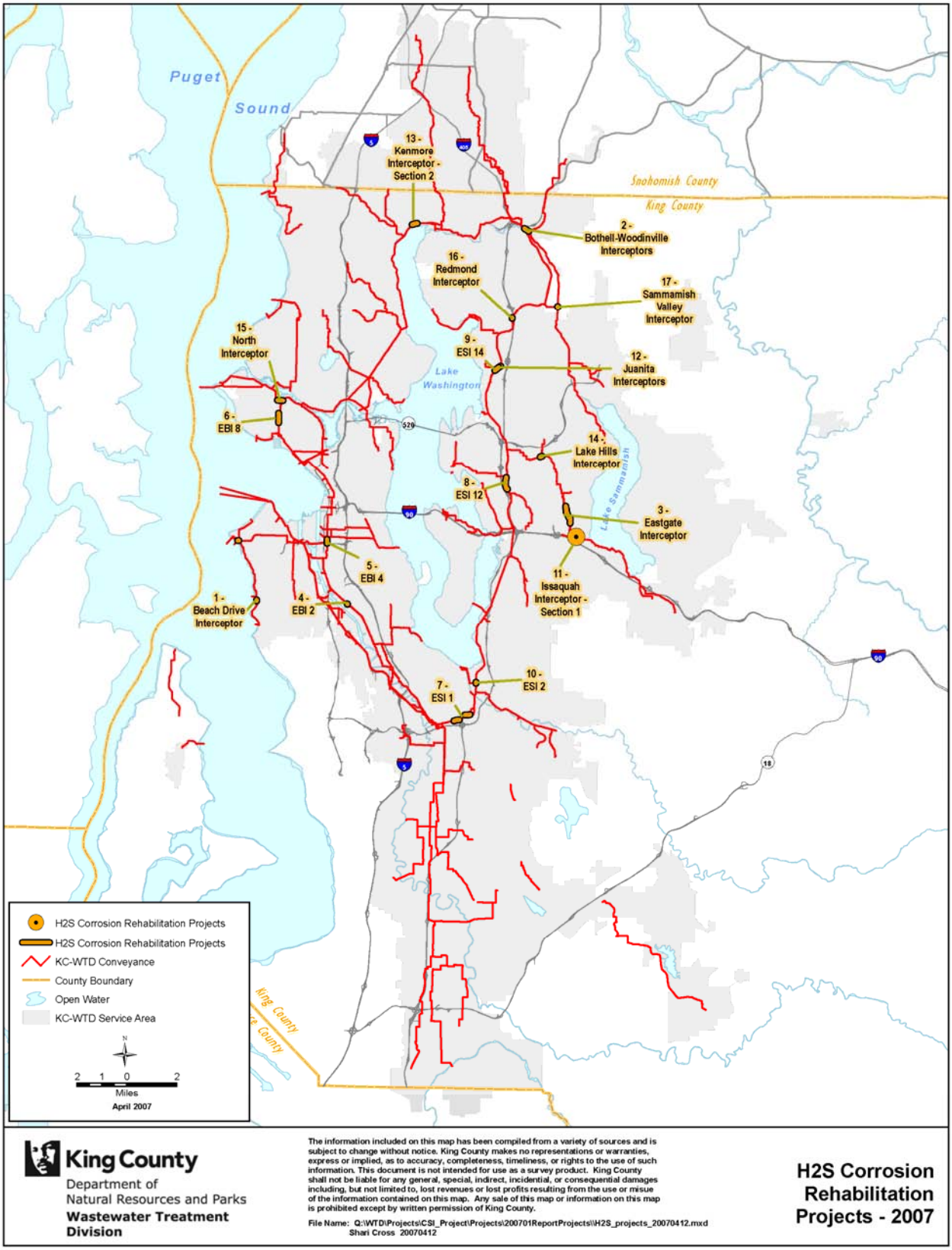

Figure 4-2. Identified High Priority Hydrogen Sulfide Corrosion Projects

Capacity planning and asset management inspection work was coordinated for this *Conveyance System Program Update*. WTD's Asset Management staff reviewed components of the conveyance system with projected capacity shortfalls to determine if there were also operational and maintenance issues. Currently, the Heathfield/Sunset Pump Station has both an identified capacity need and identified operational and maintenance issues. The Heathfield Pump Station's wet well discharge needs to be relined. The control systems, pumps, and motors at both pump stations also require frequent maintenance. This information was used along with other criteria to prioritize conveyance projects intended to address capacity needs. See Chapter 5, Table 5-2 for a listing of all project prioritization criteria and an explanation of how they were used to prioritize conveyance system improvement projects.

As Asset Management staff continue to inspect the regional conveyance system, it is likely that they will identify more areas for integrating capacity and condition issues into capital conveyance projects. These will be included in future conveyance system program updates.

Chapter 5

Schedule, Costs, and Future Planning for Recommended Projects

This chapter provides schedules and priorities for current and planned projects to address capacity needs in the separated portion of the regional conveyance system. Component (local) sewer agencies were instrumental in helping to identify needs, projects, and priorities, primarily through their participation on MWPAAC's Engineering and Planning (E&P) Subcommittee and through one-on-one meetings with Wastewater Treatment Division staff.[1]

In addition to providing schedules and priorities, this chapter describes the capacity standard for facility design, the process used to set priorities, and the estimated costs for capacity-related projects. It also describes data collected to verify the need for the two new projects planned for implementation in the next few years. The chapter concludes with a discussion of future directions for conveyance system planning.

5.1 Meeting the RWSP Policy for Conveyance Capacity Design

The conveyance capacity projects identified in Chapter 4—both those that are under way and those that are planned—represent the capital investment in the regional conveyance system necessary to meet the standard set forth in Policy CP-1 of the Regional Wastewater Services Plan (RWSP):

> *To protect public health and water quality, King County shall plan, design, and construct county wastewater facilities to avoid sanitary sewer over flows.*
>
> 1. *The twenty-year peak flow storm shall be used as the design standard for the county's separated wastewater system.*

The 20-year peak flow standard is an aggressive standard intended to protect public health and the environment. Because no uniform capacity standard was in place before the RWSP was adopted in 1999, significant portions of the regional conveyance system *do not currently meet* the 20-year peak flow standard.

To ensure that facilities are adequately sized to handle future flows and to minimize the number of facility upgrades, the Wastewater Treatment Division (WTD) is designing conveyance facilities to convey projected 20-year peak flows between now and 2050. By 2050, the regional wastewater service area is expected to be fully built out and all portions of the service area are expected to be connected into the wastewater system. This means that conveyance facilities are being designed to convey projected 20-year peak flows between now and 2050.

[1] MWPAAC = Metropolitan Water Pollution Abatement Advisory Committee.

5.2 Prioritizing Planned Capacity Improvement Projects

Upgrading the conveyance system is an ongoing task that requires significant capital investment. Since adoption of the RWSP in 1999, five conveyance system improvement projects have been constructed and are now in operation. The County has also acquired six conveyance system components from local agencies that meet RWSP criteria for inclusion in the regional conveyance system. Another five projects are currently in the design or construction phase, and this conveyance system program update has identified an additional 33 projects that will need to be completed over the next several decades to bring the regional conveyance system into compliance with the adopted 20-year peak flow standard and accommodate projected growth. Half of these planned projects address capacity needs where flow monitoring and modeling data indicate that the 20-year peak flow currently cannot be conveyed. Table 5-1 below summarizes the total estimated capital investment necessary to expand the separated portion of the regional conveyance system to convey projected 20-year peak flows through 2050.

Table 5-1. Total Estimated Capital Investment Necessary to Expand the Separated Portion of the Regional Conveyance System

Project Status	Est. Project Cost
Projects Completed Since RWSP Adoption	$92,300,000
Projects Currently in Design	$99,600,000
Projects Currently Under Construction	$105,100,000
Acquisitions	$30,600,000
Currently Invested[a]	$327,600,000
Planned New Conveyance Projects Through 2030[b]	$398,000,000
Estimated Capital Conveyance Costs Through 2030	***$725,600,000***
Planned New Conveyance Projects 2031 Through 2050[b]	$88,600,000
Estimated Capital Conveyance Costs Through 2050	***$814,200,000***

[a] Nominal dollars -- dollars in the actual years spent through 2006
[b] 2006 dollars – the current value of dollars projected to be spent in the future

Even though large portions of the conveyance system cannot convey the 20-year peak flow, it is not practical to simultaneously construct all identified CSI projects necessary to bring facilities up to this standard. Such an approach would be extremely expensive and potentially disruptive to the operation of the system. The King County Council, therefore, directed WTD to develop options for phasing capital investments in the regional conveyance system (*Ordinance No. 14942 [2] [F]*). In response to this directive, WTD and the component agencies developed an orderly strategy for prioritizing and phasing the 33 planned capacity-related projects so that the region's most pressing conveyance needs can be met with minimal risk to public health, the environment, or impact to ratepayers.

5.2.1 Factors Used in Prioritization

In 2004, WTD and its component agencies, working through MWPAAC and the E&P Subcommittee, jointly developed prioritization criteria that establish a phasing strategy for CSI projects. The criteria are as follows:

- Design new facilities to meet the 20-year peak flow expected by 2050.
  Consistent with existing policy, providing one of the best levels of service for a wastewater utility in the country by 2020.
- Determine risk of overflow vs. peak capacity.
  Analyze to determine if overflows are actually occurring or expected to occur vs. surcharging the system without causing overflows.
- Evaluate risk of public health and water quality issues.
  Give highest priority to overflows that cause public health and/or water quality impacts.
- Identify operation and maintenance (O&M) issues and costs.
  Analyze specific operation and maintenance costs and reliability in maintaining the system vs. upgrading the system.
- Determine the risk of regulatory non-compliance.
  Apply results from overflow analysis and O&M reliability.
- Identify community and local agency concerns.
  Coordinate with local agencies and review customer concerns or complaints.
- Evaluate coincident benefits.
  Review state and local capital improvement program schedules to determine if partnering options are feasible and to minimize impacts to the affected community.
- Identify financing benefits.
  Analyze opportunities to adjust schedules to better coordinate with grant and loan programs.

In the evaluation process, the current level of service (LOS) was estimated for conveyance system components where the 20-year peak flow was exceeded prior to 2000. For example, a system component that is given an estimated LOS of 5–10 years is expected to be able to convey only a 5–10 year peak flow volume without causing a backup or overflow. (See Appendix A for details.) The estimated LOS in conjunction with projections in population and sewered area growth provided the basis for determining the risk of overflows in those parts of the system.

The I/I reduction projects identified in the Regional I/I Control Program also factored into prioritizing CSI projects. Implementation of two or three initial I/I reduction projects will occur between 2007 and 2011. The CSI projects associated with the identified I/I reduction projects were given lower priority to allow adequate time to complete the initial I/I reduction projects and to assess their influence on the need for the identified conveyance projects.

5.2.2 Application of Prioritization Criteria

The prioritization criteria were applied to all planned CSI projects in order to rank the projects as High, Medium, or Lower Priority. Table 5-2 shows how each criterion was applied to each of the 33 planned projects. In Table 5-3, the 33 projects are listed by planning basin and priority according to the results of the application of the prioritization.

In the process, component agency input received via E&P Subcommittee and MWPAAC meetings gave more weight to minimizing the potential for overflows in the regional conveyance system than with potential impacts to the rate and capacity charge that may occur as a result of increased capital investment. However, the agencies also expressed concern that many of the identified conveyance system needs and their associated planned improvement projects were based on hydrologic and hydraulic flow modeling results (see Chapter 3 and Appendix A) that may overstate a project's need or timing. They recommend that prior to initiating project design and construction, WTD conduct additional flow monitoring and field inspection to ***field-verify*** capacity needs and the adequacy of planned projects to meet these needs. The agencies and WTD collectively agreed that this was the best approach for ensuring that the highest priority projects were needed and, if needed, that they would be implemented.

Table 5-2. How Prioritization Criteria Were Applied to Planned Conveyance Projects

Comments and Application	Rating Scale/ Application Guidelines
Criterion: Design facilities to meet the 20-year peak flow expected by 2050	
This criterion implements the RWSP design standard.	This criterion was applied equally to all projects. Project design and construction may be phased over time if technically feasible and/or financially beneficial. Candidate projects will likely be in high growth areas where there are significant differences in projected 20-year peak flow volumes from decade to decade. Phasing of projects typically increases their total cost, but reduces their impact to rates and capacity charge.
Criterion: Determine risk of overflow vs. peak capacity	
Higher priority will be given to projects that address capacity limitations in areas that are prone to overflow than to those that address capacity limitations in facilities that can continue to safely convey flows in a surcharged condition.[a]	High, Medium, or Low: • High = Less than 5-year LOS in 2000 or less than 10-year LOS and significant growth by 2010 • Medium = Greater than 5-year LOS in 2000 with minimal growth. Greater then 10-year LOS in 2000 with moderate to high growth causing the LOS to decrease to 5-year LOS • Low = Greater than 10-year LOS in 2010

Comments and Application	Rating Scale/ Application Guidelines
Criterion: Estimated risk of public health and water quality impacts	
This criterion relates to the immediate threats to water quality and human health from overflows.	High, Medium, or Low: • High = Risk of overflow directly to a water body or identified backups into structures • Medium = Where there is the potential to isolate and prevent the overflows to an urban drainage system from getting to a water body • Low = Risk to public health occurs only if there is a Low risk of overflow (criterion above)
Criterion: Determine risks of regulatory non-compliance	
Any overflows are a violation of WTD's NPDES permits.	High, Medium, or Low (same as for overflow criterion): • High = Less than 5-year LOS in 2000 or less than 10-year LOS and significant growth by 2010 • Medium = Greater than 5-year LOS in 2000 with minimal growth. Greater then 10-year LOS in 2000 with moderate to high growth causing a decrease to a 5-year LOS • Low = Greater than 10-year LOS in 2010
Criterion: Identify O&M issues	
Two Categories: • Coordinate with existing Asset Management capital program • Identify and coordinate with planned Asset Management capital replacement and/or repair projects[b]	Yes or No. Identified O&M issues can influence priority of either Major Capital or Asset Management capital projects. O&M assessments are an ongoing WTD function. The inspection of force mains, pressure sewers, and siphons will provide additional information for prioritization over time.
Criterion: Identify community and local agency concerns	
Coordinate with local agencies to identify any concerns and incorporate them into prioritization process.[c]	Yes or No. WTD staff met with local agencies and reviewed identified needs and planned projects with agency representatives. Information about local conditions, such as development activity that affects capacity demand, was incorporated.
Criterion: Evaluate coincident benefits	
Coincident benefits can be applied in three distinct areas: • Partnering with transportation or other capital projects in the vicinity of WTD projects • Ensuring that capital work by other jurisdictions does not prevent WTD from doing work in recently improved corridors/sites • Integrating the project into other wastewater facilities that depend on the project to fully function	Yes or No. WTD staff reviewed local agency and host city capital improvement plans and schedules to identify when and where local projects are scheduled to occur near capital conveyance project areas. WTD staff met with local jurisdiction representatives to review WTD's proposed project schedule. Potential coincident benefits were noted where project areas matched and project timing for local projects and regional conveyance projects were within 3 years or less.

Comments and Application	Rating Scale/ Application Guidelines
Criterion: Identify financing benefits	
Financing benefits will be explored during predesign after project scopes and final budgets are established. At that point, all portions of the project that qualify for grant and/or low-interest loans can be identified.	Equal across all projects. Financing concerns will be considered during the predesign or design phases and may influence project scheduling at that time.

[a] The overflow risk criteria are applied to needs or capacity constraints. In some cases, more than one project address the needs.
[b] O&M issues can be applied to either capacity needs or projects.
[c] Community and agency concerns and input can be applied to either capacity needs or projects.

Table 5-3. Results of Application of Prioritization Criteria to Planned Conveyance Projects

I/I Project [1]	Project Name	Exceedance Year/Level of Service (LOS)/Sewered Growth				Prioritization Criteria						Coincident Benefit Comments
		Year Exceeded	Estimated LOS in 2000	Sewered Area Growth [2] (2000 to 2010)	Population Growth [2] (2000 to 2010)	Risk of Overflow vs. Surcharge	Public Health and Water Quality Impacts	Risk of Non-Compliance Relative to Overflow Risk	O&M Issues	Community and Local Agency Concerns	Coincident Benefits	
Hidden Lake Planning Basin												
	Boeing Creek Storage Expansion	Before 2000	2–5 years [3]	2%	4%	Medium	Medium	Medium	No	None identified	No	None identified
	Richmond Beach Storage	Before 2000	5–10 years [3]	3%	5%	Medium	Medium	Medium	No	None identified	No	None identified
Northeast Lake Washington Planning Basin												
	North Mercer and Enatai Interceptor Parallels	Before 2000	2–5 years [4]	1%	8%	High	High	High	No	Increased zoning density in Mercer Island Central Business District	No	None identified
	Bellevue Influent Trunk Parallel	Before 2000	2–5 years [5]	2%	27%	High	High	High	No	Increased zoning density in Bellevue Central Business District	Yes	Needed to convey peak flows to upgraded pump station
	Factoria Pump Station and Trunk Diversion	Before 2000	5–10 years	10%	7%	Medium	Medium	Medium	No	None identified	No	None identified
	Medina Storage	2009	>20 years			Low	Low	Low	No	None identified	No	None identified
	Juanita Bay Pump Station Force Main Upgrade	2020	>20 years			Low	Low	Low	Yes	None identified	No	None identified
North Green River Planning Basin												
Yes	South Renton Interceptor Parallel	2011	>20 years			Medium	Medium	Medium	No	None identified	No	None identified
North Lake Sammamish Planning Basin												
	Lake Hills Trunk Replacement	Before 2000	2–5 years	2%	13%	High	High	High	No	None identified	No	None identified
	Northwest Lake Sammamish Interceptor Parallel	Before 2000	2–5 years	2%	17%	High	High	High	No	Increased zoning density in Redmond Central Business District	Yes	Multiple transportation projects along alignment
North Lake Washington Planning Basin												
	York Pump Station Modifications	2016 [6]	N/A [6]			Low	Low	Low	No	None identified	Yes	Coincident benefit of Brightwater conveyance
	[CSI] Swamp Creek – Section 1B Parallel	2017	>20 years			Low	Low	Low	No	Increased zoning density throughout service Area	No	None identified
	Lower North Creek Interceptor Parallel	2024	>20 years			Low	Low	Low	No	Increased zoning density throughout service Area	No	None identified
	Upper North Creek Parallel	2029	>20 years			Low	Low	Low	No	Increased zoning density throughout service Area	No	None identified
Northwest Lake Washington Planning Basin												
	[CSI] Thornton Creek Interceptor Parallels	Before 2000	5–10 years	1%	7%	High	High	High	No	None identified	No	None identified
Southeast Lake Washington Planning Area												
	Coal Creek Siphon and Trunk Parallel	Before 2000	2–5 years	22%	21%	High	High	High	No	None identified	No	None identified
South Green River Planning Basin, Kent Planning Zone												
	Garrison Creek Trunk Parallel	2018	>20 years			Low	Low	Low	No	None identified	No	None identified
	ULID #1 Contract #4 Parallel	2021	>20 years			Low	Low	Low	No	None identified	No	None identified
	Auburn Interceptor – Section 3 Parallel Pipe Storage	2028	>20 years			Low	Low	Low	No	None identified	No	None identified

Table Key and Notes

Key

Planning Basin

High Priority Projects (7 total)

Medium Priority Projects (6 total)

Lower Priority Projects (20 total)

Notes

(1) Implementation of the Regional I/I Control Program includes development of two or three initial I/I reduction projects from four possible project sites identified by the county and component agencies. Implementation will occur between 2007 and 2011. The I/I reduction projects are intended to eliminate the need for planned conveyance system improvements. Therefore, the conveyance system improvement projects associated with the identified I/I reduction projects have been given lower priority to allow adequate time to develop the initial I/I reduction projects and determine if I/I reduction successfully eliminated the need for the identified conveyance projects.

(2) Population and sewered area growth calculated for high and medium priority projects only.

(3) After the Hidden Lake Pump Station Replacement and Sewer Improvement Project is complete, the level of service (LOS) is estimated to be 10 to 20 years.

(4) The current capacity restricted point is the east channel siphon and just downstream in the Enatai Trunk. In addition, it was discovered that the Mercer Trunk is restricted after the trunk sustained damage from utility work in late December 2006.

(5) The Bellevue Influent Trunk should be upgraded so that peak capacity in the Bellevue Pump Station upgrade can be used.

(6) The York Pump Station Modification Project involves valving work to enable peak flows to be diverted from the Eastside Interceptor north to the Brightwater System.

I/I Project [1]	Project Name	Exceedance Year/Level of Service (LOS)/Sewered Growth				Prioritization Criteria						Coincident Benefit Comments
		Year Exceeded	Estimated LOS in 2000	Sewered Area Growth [2] (2000 to 2010)	Population Growth [2] (2000 to 2010)	Risk of Overflow vs. Surcharge	Public Health and Water Quality Impacts	Risk of Non-Compliance Relative to Overflow Risk	O&M Issues	Community and Local Agency Concerns	Coincident Benefits	
South Green River Basin, Auburn Planning Zone												
	Algona Pacific Trunk Stage 1 [7]	Before 2000	10–20 years	19%	40%	Medium	Medium	Medium	No	None identified	No	None identified
	Algona Pacific Trunk Stage 2	2027	>20 years			Low	Low	Low	No	None identified	No	None identified
	Lakeland Hills Pump Station Replacement	2040	>20 years			Low	Low	Low	No	None identified	No	None identified
South Green River Basin, Soos Planning Zone												
	[CSI] Soos Alternative 3A(3) – Pump Station B with Conveyance	N/A [8]	N/A			Low	Low	Low	No	None identified	No	None identified
	[CSI] Soos Alternative 3A(3) – Pump Station D with Conveyance [9]	Before 2000	10-20 years			Low	Low	Low	No	None identified	No	None identified
	[CSI] Soos Alternative 3A(3) – Pump Station H with Conveyance [9]	Before 2000	2–5 years			Low	Low	Low	No	None identified	No	None identified
South Lake Sammamish Planning Basin [10]												
	Heathfield/Sunset Pump Station Replacement and Force Main Upgrade	Before 2000	5–10 years	64%	58%	High	High	High	Yes	None identified	No	None identified
	[CSI] Sammamish Plateau Diversion	Before 2000	5–10 years	80%	76%	High	High	High	N/A	None identified	Yes	City of Sammamish has phased East Lake Sammamish Pkwy plans for potential road alignment; King County Parks has plans for potential Trail Alignment
	[CSI] Sammamish Plateau Storage	Before 2000	5–10 years	80%	76%	Medium	Medium	Medium	N/A	None identified	No	None identified
Yes	[CSI] Issaquah Storage	Before 2000	5–10 years			High	High	High	N/A	None identified	Yes	Sammamish State Park plan under way: opportunity to coordinate with both the city and the state; may be able to phase storage
Yes	Eastgate Parallel Pipe Storage	Before 2000	5–10 years			High	High	High	N/A	None identified	No	None identified
	Issaquah Creek Highlands Storage	2009	>20 years			High	High	High	No	None identified	Yes	City of Issaquah
Yes	Issaquah Interceptor Section 2 Parallel	2011	>20 years			Medium	Medium	Medium	No	None identified	No	None identified
South Lake Washington Planning Basin												
Yes	Bryn Mawr Storage	2005	>20 years			Medium	Medium	Medium	No	None identified	No	None identified

Table Key and Notes

Key

Planning Basin

High Priority Projects (7 total)

Medium Priority Projects (6 total)

Lower Priority Projects (20 total)

(7) At this point in predesign of the Kent Auburn Conveyance Project, it appears that the Algona Pacific Trunk projects will be incorporated into that project. If so, the Algona Pacific projects will be removed from the planned projects list.

(8) Soos Pump Station B is planned to serve an area that currently does not have county conveyance service.

(9) Initially, Soos Pump Stations D and H were planned to serve existing customers and planned growth for the Black Diamond and Soos Creek Service areas. The Black Diamond Storage Project will delay the need for the pump stations and conveyance lines for 10 to 20 years.

(10) The South Lake Sammamish Planning Basin has seven projects that are all capable of contributing to increased level of service to downstream capacity constraints. The proposed prioritization accounts for the phasing of projects to address capacity constraints over time by including O&M issues along with coincident benefits in the decisions on the preferred course of action.

5.3 Schedules and Costs for Current Capacity Improvement Projects

The analyses conducted, along with information from component agencies, confirmed the need for all capacity-driven CSI projects already in design or construction. These projects, shown in Table 5-4, will be completed as scheduled.

Table 5-4. Schedules and Costs for Capacity-Driven Conveyance Projects in Design or Construction

Project Name	Projected Year of Completion	Estimated Project Cost
Projects in Design		
North Creek Pipeline	2010	$28,400,000
Bellevue Pump Station	2008	$21,000,000
Kent/Auburn Conveyance Improvements	2010	$44,600,000
Black Diamond Storage Facility	2010	$5,600,000
	Subtotal	**$99,600,000**
Projects Under Construction		
Fairwood Interceptor (formerly Madsen Creek)	2007	$21,700,000
Pacific Pump Station	2007	$8,000,000
Juanita Bay Pump Station	2009	$37,000,000
Hidden Lake Pump Station/Boeing Trunk	2009	$38,400,000
	Subtotal	**$105,100,000**
Total for Projects in Design/Construction		***$204,700,000*** [a]

[a] Project costs are from adopted 2007 WTD budget.

5.4 Priorities and Costs for Planned Capacity Improvement Projects

Table 5-5 lists the estimated cost for each planned capacity-driven CSI project according to their order of priority. High priority projects are shaded in yellow; medium priority projects are shaded in green; lower projects are not shaded. It is expected that through implementing these projects the 20-year peak flow standard will be attained system-wide by approximately 2045. Due to the need to field verify projects prior to initiating design and construction, completion dates for projects are only generally identified for most projects. Field verification can have the affect of raising the priority of a project, reducing the priority resulting in delay, or eliminating the need for the project all together. Current field verification data and information on Heathfield/Sunset pump stations and the Bellevue Influent Trunk will result in initiation of

design and construction in 2008 with estimated completion between 2010 and 2013. Field verification of needs will ultimately determine the timing and implementation of the remaining planned projects.

Table 5-5. Prioritized Planned Conveyance Projects

Project Name	Year Exceeded	Estimated Project Cost	Color Key
Heathfield/Sunset Pump Station Replacement and Force Main Upgrade	Before 2000	$51,000,000	Planned High Priority Projects (7 total)
Bellevue Influent Trunk Parallel	Before 2000	$2,500,000	
[CSI] Sammamish Plateau Diversion	Before 2000	$24,800,000	
Northwest Lake Sammamish Interceptor Parallel	Before 2000	$23,500,000	
Coal Creek Siphon and Trunk Parallel	Before 2000	$7,100,000	
North Mercer and Enatai Interceptor Parallels	Before 2000	$24,900,000	
Lake Hills Trunk Replacement	Before 2000	$15,000,000	
[CSI] Thornton Creek Interceptor Parallel	Before 2000	$7,600,000	Planned Medium Priority Projects (6 total)
[CSI] Sammamish Plateau Storage	Before 2000	$33,200,000	
Boeing Creek Storage Expansion	Before 2000	$9,100,000	
Algona Pacific Trunk Stage 1	Before 2000	$4,500,000	
Richmond Beach Storage	Before 2000	$14,000,000	
Factoria Pump Station and Trunk Diversion	Before 2000	$10,200,000	
[CSI] Soos Alternative 3A(3) – Pump Station D with Conveyance	Before 2000	$42,000,000	Planned Lower Priority Projects (20 total)
[CSI] Soos Alternative 3A(3) – Pump Station H with Conveyance	Before 2000	$47,000,000	
[CSI] Soos Alternative 3A(3) – Pump Station B with Conveyance	N/A[a]	$7,900,000	
[CSI] Issaquah Storage	Before 2000	$22,900,000	
Eastgate Parallel Pipe Storage	Before 2000	$23,800,000	
Bryn Mawr Storage	2005	$8,700,000	
Medina Storage	2009	$1,100,000	
Issaquah Creek Highlands Storage	2009	$2,400,000	
South Renton Interceptor Parallel	2011	$3,600,000	
Issaquah Interceptor Section 2 Parallel	2011	$2,800,000	
York Pump Station Modifications	2016	$8,400,000	
[CSI] Swamp Creek – Section 1B Parallel	2017	$9,000,000	
Garrison Creek Trunk Parallel	2018	$6,000,000	
Juanita Bay Pump Station Force Main Upgrade	2020	$15,000,000	
ULID 1 Contract 4 Parallel	2021	$3,800,000	
Lower North Creek Interceptor Parallel	2024	$11,500,000	
Algona Pacific Trunk Stage 2	2027	$1,400,000	
Auburn Interceptor – Section 3 Parallel Pipe Storage	2028	$31,000,000	
Upper North Creek Parallel	2029	$4,800,000	
Lakeland Hills Pump Station Replacement	2040	$6,000,000	
Total Planned projects		**$486,600,000[b]**	

[a] Area not currently served by regional conveyance facilities
[b] Estimated costs in 2006 dollars

Construction of both the current and planned capacity-driven CSI projects through the rate forecast period should be feasible within currently projected sewer rate and capacity charge increases. The current rate forecast period extends through 2030[2].

Projects will be implemented in order of priority over time. In order to avoid over-building the conveyance system, the local agencies and WTD staff agree that field verification of needs and projects be conducted in advance of initiating project design. Field verification will be the initial step in project planning. Field verification tasks will include facility-specific wet and dry season flow monitoring, and facility inspection to identify any evidence of high-water flows, overflows, or obstructions that may be reducing conveyance capacity, consultations with component agencies served by the particular conveyance system component, and refinement of growth and flow projections for the project area.

Field verification combined with detailed project planning will ensure that projects are properly designed and built to address conveyance system capacity needs. The Hidden Lake Pump Station upgrade project, currently under construction, provides an example of the benefits of field verification and project planning in advance of project design and construction. In advance of designing and constructing the pump station upgrade, detailed flow monitoring and refinement of growth and flow projections for the areas served by the pump station allowed for the identification and analyses of a number of upgrade alternatives. The result was identification of a working alternative with phasing options that addressed capacity needs, and helped to manage project costs. A more detailed description of the field verification and project planning work done for the Hidden Lake Pump Station Upgrade is available at *ftp://dnr.metrokc.gov/wtd/csi/csi-docs/HiddenLk/hiddenlake.pdf*.

5.5 Implementation of Planned Capacity Projects

Field verification data was gathered over the last several months that confirmed that two identified high priority projects should be implemented; the Heathfield/Sunset Pump Station Replacement and Force Main Upgrade Project, and the Bellevue Influent Trunk Parallel Project (Table 5-6). In the case of the Heathfield/Sunset Project, flow monitoring data from the 2006-07 wet season showed that the two pump station and force main were already operating at their peak design capacities. Significant growth is projected for the area, and any overflows would flow directly to Lake Sammamish. Additionally, equipment, such as pumps and force main valves are aging and become difficult to maintain. In the case of the Bellevue Influent Trunk Parallel Project, work is now under way to expand the Bellevue Pump Station from 8 MGD to 13 MGD to accommodate increasing flows in the area. Bellevue is experiencing significant population and employment growth, which is also increasing flow volumes. The capacity of the influent line into the Station needs to be upgraded to manage increasing flow volumes and match the capacity of the expanded pump station.

The two projects will move into the design phase in 2008, followed by construction over the next four to six years. For the remaining capacity-related projects, field verification of identified high and medium priority projects will be conducted over the next two to four years. Depending on

[2] The last year of the planning period for the Regional Wastewater Services Plan.

the results of field verification, it is anticipated that one to two projects will be implemented per year beginning in 2011.

Table 5-6. Capacity CSI Projects Planned for Immediate Implementation

Project Name	Year Exceeded	Estimated Project Cost
Heathfield/Sunset Pump Station Replacement and Force Main Upgrade	Before 2000	$50,950,000
Bellevue Influent Trunk Parallel	Before 2000	$2,510,000

5.5.1 Heathfield/Sunset Pump Station Replacement and Force Main Upgrade

The Heathfield/Sunset Pump Station and Force Main System currently can convey a peak flow of 18 mgd. Figures 5-1 and 5-2 (hydrographs) display flow monitoring data at the Sunset Pump Station indicating that the station was operating at 16 mgd several times during the 2005–2006 wet season and that it reached the 18-mgd peak flow level during winter of 2006. Overflows in this portion of the conveyance system would flow directly into Lake Sammamish. Given that flow monitoring data show that the pump stations and force main currently operate near or at the peak capacity during peak flow periods, upgrade of the pump stations and force main is needed.

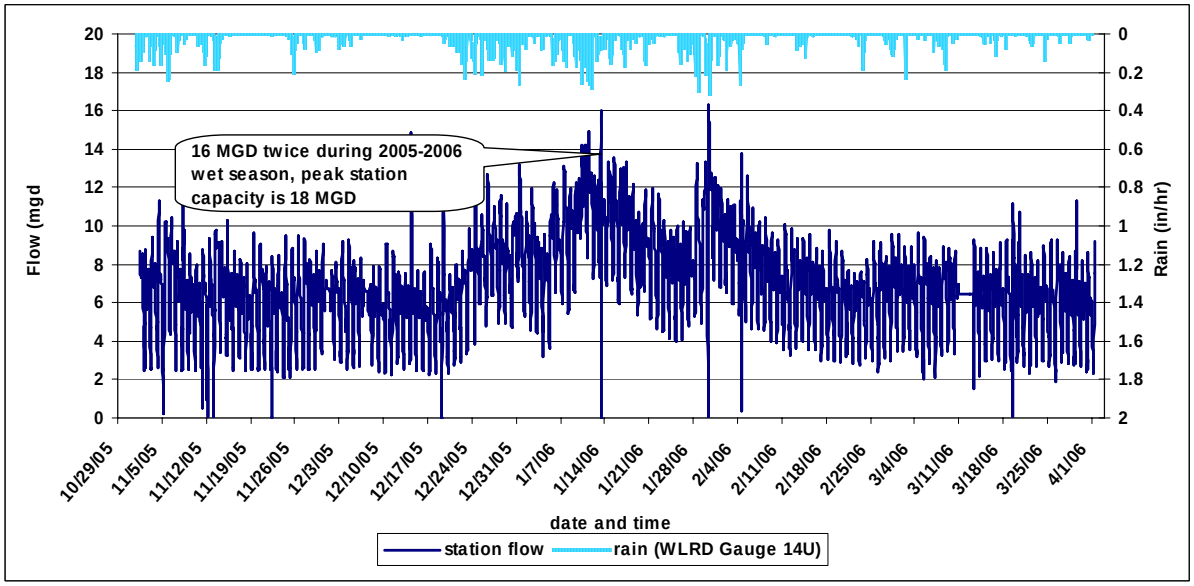

Figure 5-1. Monitored Flows at the Sunset Pump Station During the 2005–2006 Wet Season

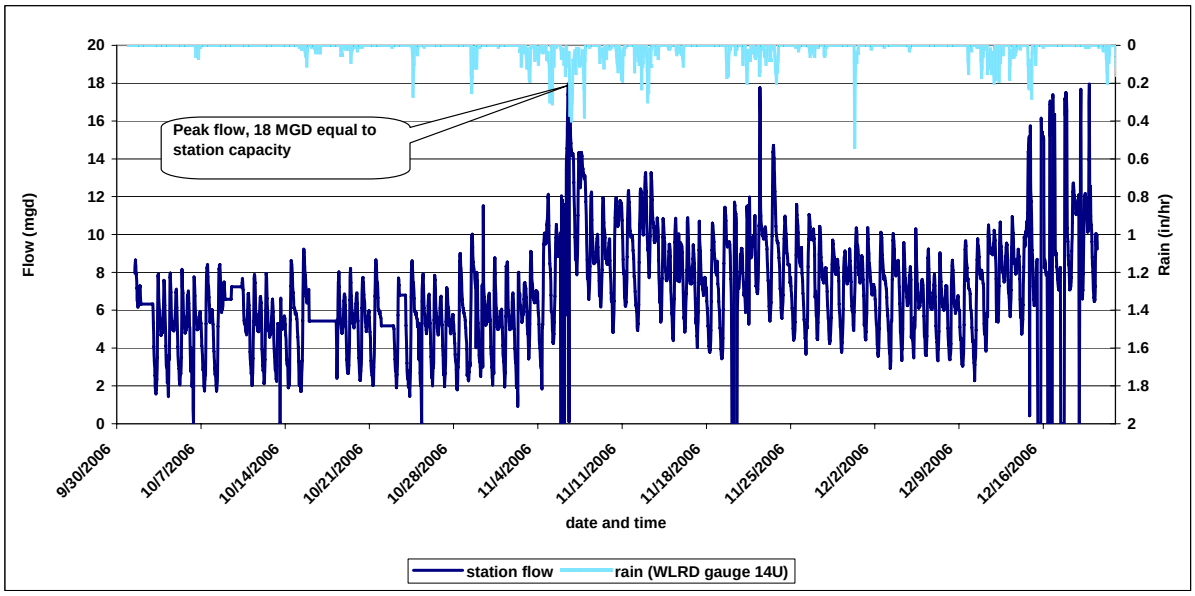

Figure 5-2. Monitored Flows at the Sunset Pump Station During Winter of 2006

5.5.2 Bellevue Influent Trunk

The Bellevue Influent Trunk is a 12 to 24 inch diameter line that connects to the Bellevue Pump Station. The influent line has a capacity of 8 mgd. As mentioned above, the City of Bellevue is experiencing significant population and employment growth, which is also increasing flow volumes. According to the City's Comprehensive Plan, the downtown area will be developed with approximately 8,200 new multi-family residential units by 2022. Significant new office space will also be added to the downtown. Development is already underway. Several large developments have been completed in the last two years. The City's Major Projects Update for the 2nd Quarter of 2007 lists 26 construction projects underway or under review in its downtown area. These will add approximately 4,000 new multi family residential units and 2.8 million square feet of office space. New hotel space and hospital facilities are also under construction. Figure 5-3 below summarizes current development activity that affects capacity at the Bellevue Pump Station.

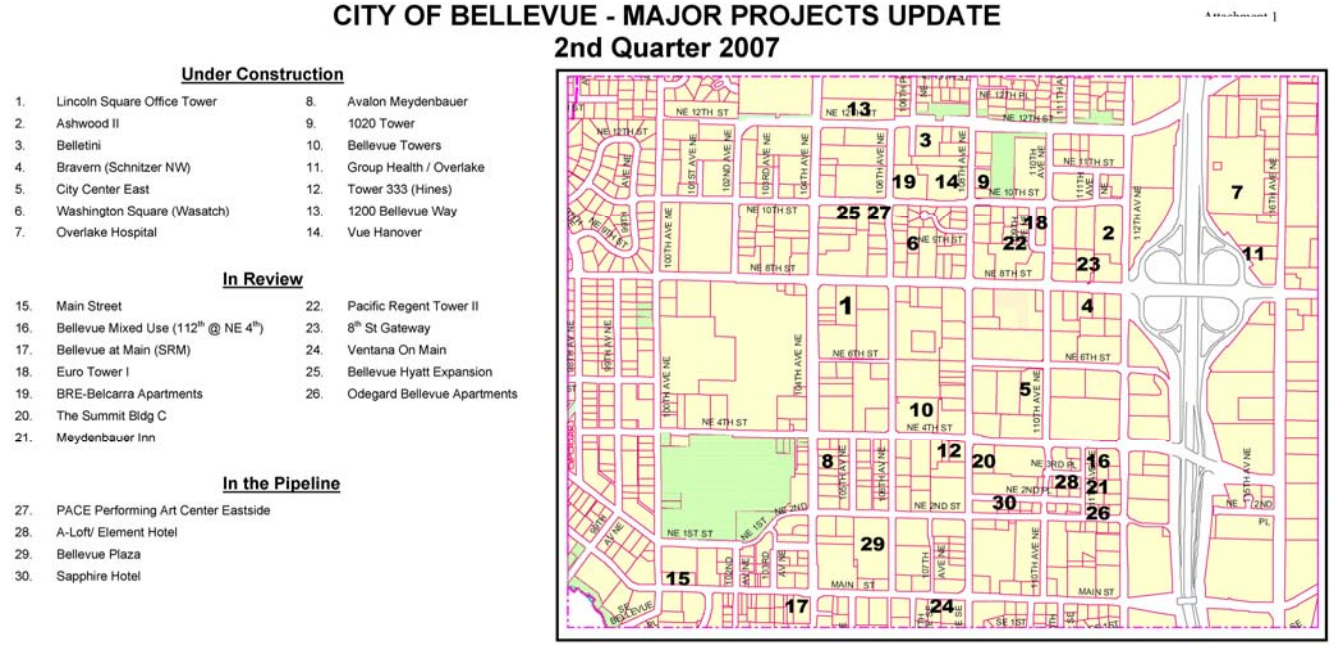

Figure 5-3. City of Bellevue – Major Projects Update

Based on growth projections for the City of Bellevue, peak flows at the Bellevue Pump Station are projected to reach 16 mgd by 2050. The Bellevue Pump Station is being upgraded now to a peak-flow capacity of 13 mgd, expected by 2025, with the capability to expand pumping capacity over time to meet projected 2050 peak flows. The Bellevue Influent Trunk also needs to be upgraded to convey projected peak flows to the newly upgraded pump station. The upgrade of the influent trunk will be to 16 mgd, which is more efficient than phasing trunk expansion over time.

5.6 Conveyance Projects to Address Condition Needs

For this Update, the identified stand alone project to address a condition need is paralleling of the Ballard Siphon. The project is under way and the new parallel siphon is scheduled to be on line in 2009. A number of minor asset management projects that address needs resulting from the continuous inspection and monitoring of the conveyance system are in various stages of implementation. WTD routinely identifies and implements a number of these types of projects on an annual basis and invests approximately $25 to 30 million annually in these types of minor maintenance and repair projects

As mentioned in Chapter 3, Asset Management staff are leading a division-wide taskforce to develop an asset management plan that will allow for business-case evaluations of how best to maintain, repair, or replace regional wastewater conveyance and treatment facilities over time. These evaluations will provide least-cost solutions regarding investment in capital versus ongoing maintenance.

5.7 Future Conveyance System Planning

The CSI projects and their implementation schedules and priorities listed in this chapter address all conveyance system capacity needs identified to date. The information is based on the best available population and employment growth projections and flow monitoring, flow modeling, and facilities inspection data. Because actual growth rates and development activity may vary from projections, observed flow volumes may substantially differ from modeled future flow volumes. As a result, adjustments will likely need to be made over time to the scope and schedule of projects intended to address capacity needs.

Inspection of the regional conveyance system is an ongoing task. New technologies such as sonar technology have recently become available for inspecting conveyance system components that could not be thoroughly inspected in the past. WTD's Asset Management staff are now employing this new technology to inspect conveyance facilities and are undertaking an asset management plan that will allow for business-case evaluations of how best to maintain, repair, or replace regional wastewater conveyance and treatment facilities over time. Inspection of facilities and the business-case evaluations will be completed in 2010. It is highly likely that this new, more detailed information will identify additional condition-related needs within the conveyance system that will require capital investment.

Flow monitoring data are vital for identifying and prioritizing needed conveyance projects. WTD routinely monitors flows in various parts of the conveyance system with about 80 flow monitors. However, experience with development of the Regional I/I Control Program demonstrated the benefit of conducting detailed system-wide flow monitoring. In 2001 and 2002, WTD conducted its first comprehensive flow monitoring of the entire regional conveyance system. The effort provided accurate information about required system capacity that served as the basis for the prioritized list of conveyance projects.

All information, no matter how accurate and detailed, must eventually be updated. The King County Executive recommends that WTD conduct comprehensive flow monitoring across the

conveyance system to correspond with the census data collected by the U.S. Census Bureau every ten years. This will require the installation of approximately 250 flow meters for two consecutive wet seasons. The estimated cost is approximately $5-million for installing and maintaining the flow meters, and for compiling the metered data. This represents 1-percent of the total planned capital investment in conveyance system improvements through 2050. The information obtained will help to ensure that appropriately sized and prioritized conveyance projects are designed and built to meet the region's most critical conveyance needs. The Executive also recommends that field verification of wastewater flows and conveyance component conditions be conducted prior to implementation of conveyance system improvement projects intended to expand system capacity.

Given that actual growth rates and flow volumes vary from projections and that the condition of the conveyance system will change over time, the Executive recommends that the conveyance system program should be updated every 5-years to ensure that the prioritized project list remains current. Five-year updates beginning in 2013 would allow WTD to identify variations in actual growth rates and patterns, assess metered flow volumes, update hydraulic models, review facilities inspection data, and update conveyance system improvement priorities and schedules.

Chapter 6

Comparison of the 2007 CSI Program Update to the 2004 RWSP Update

This chapter provides a comparison of the conveyance system improvement projects and costs presented here to those reported in the *2004 RWSP Update*. The *2004 RWSP Update* identified a total of $638 million (in 2003 dollars) in "Non-Brightwater" conveyance projects through 2030. This *2007 CSI Program Update* identifies $726 million (in 2006 dollars) in conveyance projects through 2030 plus an additional $88 million (in 2006 dollars) for conveyance projects out to 2050, for a total of $814 million (in 2006 dollars)[1].

The conveyance projects identified in the *2004 RWSP Update* were based on identified projects in design or construction since adoption of the RWSP in 1999, the implementation of projects identified in previous comprehensive plans, acquisitions from local agencies, and planned new projects based on recently completed basin planning. A detailed account of the conveyance projects identified in 2004 is contained in the Technical Memorandum entitled *Summary of Non-Brightwater Conveyance Cost Increases from the 1998 Regional Wastewater Services Plan to the 2004 Regional Wastewater Services Plan Update.*

The conveyance projects identified in this *2007 CSI Program Update* include projects completed since 1999, projects in design and construction, and planned new projects based on updated flow monitoring and modeling data that has been completed since 2004. This new data has led to the elimination of some projects that were previously thought to be necessary; the identification of other new projects to address newly identified capacity needs, and identifies conveyance projects through 2050 rather than 2030.

What follows is a summary project and cost comparison between conveyance projects reported in the *2004 RWSP Update* and this *2007 CSI Program Update*. For ease of comparison, both the 2004 and 2007 cost estimates for planned future projects are shown in 2006 dollars using the Construction Cost Index (CCI). Cost for projects completed or currently under construction reflect the actual value of construction in the years that work was completed or is currently under way. The adjustments are shown in Table 6-1. Also included are the costs associated with projects out to 2050.

[1] 2050 is the projected year when the regional service are will be fully built out.

Table 6-1. Cost Comparison of 2007 CSI Program Update to CSI Costs Reported in the 2004 RWSP

Project Status/Type		Summary of Estimated Project Costs ($2006)	
		2007 CSI Program Update	2004 RWSP Update
Projects Completed Since RWSP Adoption	(see Table 6-2)	$92,300,000	$104,100,000
Projects in Design	(see Table 6-3)	$99,600,000	$78,900,000
Projects Currently Under Construction	(see Table 6-4)	$105,100,000	$91,000,000
Acquisitions, Agreements, and Extensions	(see Table 6-5)	$30,600,000	$28,600,000
Current Investment		$327,600,000	$302,600,000
Planned CSI Projects	(see Table 6-6)	$270,800,000	$304,200,000
New CSI Projects Identified in 2007 CSI Update	(see Table 6-7)	$127,200,000	Not Applicable
CSI Projects Identified in 2004 RWSP Update & No Longer Needed[a]	(see Table 6-8)	Not Applicable	$67,000,000
CSI Projects Planned Through 2030		$398,000,000	$371,200,000
Estimated Capital Conveyance Through 2030		$725,600,000	$673,800,000
Planned Conveyance Through 2050		$88,600,000	Not Addressed
Estimated Capital Conveyance Through 2050		$814,200,000	

[a] Projects were eliminated due to updated modeling, project requirements that provided capacity more efficiently, and changed conditions in local systems over time.

The tables below provide a crosswalk between the conveyance projects and costs reported in the *2004 RWSP Update* and this report.

As can be seen in Table 6-2, seven CSI projects have been completed since the RWSP was adopted in 1999. In 2004, the estimated costs for these projects were $104.1 million. However, actual expenditures were actually slightly less ($92.3 million). These savings were due primarily to completing work under budget. Auburn Facility Assessment had its scope reduced based on additional information being developed during the design phase.

Table 6-2. Crosswalk of CSI Projects Identified in the 2004 RWSP Update that are Completed

2007 CSI Plan Update Project Name	Actual Project Cost	2004 RWSP Update Project Name	2004 Update Estimated Project Cost	Crosswalk Discussion
North Creek Storage Facility	$28,500,000	Off-line Storage at North Creek (423519)	$33,800,000	Project completed under budget
Wilburton Siphon Parallel	$4,400,000	ESI-11 - Wilburton Siphon/Wiburton Odor Contol (423345)	$3,900,000	Parallel complete in 2006. Odor control costs transferred to Asset Management in a separate project.
ESI Section 1 Capacity Restoration	$8,400,000	ESI-1 (2) (423420)	$8,700,000	Project completed under budget
Swamp Creek Sewer Trunk Connection	$7,100,000	Swamp Creek (423272)	$10,700,000	Project completed under budget
Mill Creek Relief Sewer	$24,800,000	Mill Creek Relief Sewer (423107) *aka S. 277th Trunk*	$25,500,000	Project completed under budget
York Pump Station: Upgrade and Power Reliability	$8,500,000	Increase York PS capacity to 68 MGD (423236)	$2,300,000	Work at York PS combined into a single project and expanded to address power reliability issues.
		York PS Power Reliability (423236, not original RWSP scope)	$7,700,000	
		Subtotal	*$10,000,000*	
Auburn Facility Assessment	$10,600,000	Auburn Interceptor Extension	$11,500,000	Project scope downsized
	$92,300,000		$104,100,000	
		Net Difference	*-$11,800,000*	

Table 6-3 identifies four CSI projects currently in the design phase. The projected costs for these four projects is $20.7 million higher than what was reported in the *2004 RWSP Update*. There are two main reasons for this higher estimated cost. First, are significantly higher construction costs than those originally developed for the *2004 RWSP Update*. Both local and world-wide demand for construction materials and equipment have caused construction costs to rise. Additionally, two projects, required alignment changes due to right-of-way restrictions. This added to the scope and cost of these two projects. The Black Diamond Storage Facility project is also newly identified.

Table 6-3. Crosswalk of CSI Projects Identified in the 2004 RWSP Update that are Now in Design

2007 CSI Plan Update Project Name	2007 Update Estimated Project Cost	2004 RWSP Update Project Name	2004 Update Estimated Project Cost	Crosswalk Discussion
Bellevue Pump Station	$21,000,000	Bellevue Pump Station	$18,500,000	Subject to higher construction costs
Kent/Auburn Conveyance Improvements	$44,600,000	Southwest Interceptor (423373 sub 630, 2004-81)	$34,500,000	Subject to higher construction costs & alignment changes
Black Diamond Storage Facility	$5,600,000	Not Identified in 2004 update	$0	Newly identified project
North Creek Pipeline	$28,400,000	NC1-A	$14,200,000	Subject to higher construction costs & alignment changes
		NC1-A1	$11,700,000	
		Subtotal	*$25,900,000*	
	$99,600,000		$78,900,000	
		Net Difference	*$20,700,000*	

Table 6-4 identifies four CSI projects currently under construction. The projected costs for these four projects is $14.1-million higher than what was reported in the *2004 RWSP Update*. There are two main reasons for this higher estimated cost; additional pipe upgrade work in the Boeing Creek Trunk, and higher costs for construction materials and equipment.

Table 6-4. Crosswalk of CSI Projects Identified in the 2004 RWSP Update that are Now Under Construction

2007 CSI Plan Update Project Name	2007 Update Estimated Project Cost	2004 RWSP Update Project Name	2004 Update Estimated Project Cost	Crosswalk Discussion
Hidden Lake PS/Boeing Trunk	$38,400,000	Hidden Lake PS/Boeing Trunk	$28,500,000	Additional pipe upgrade work needed & subject to higher construction costs to be completed in 2009
Fairwood Interceptor (Formerly Madsen Creek)	$21,700,000	Fairwood Interceptor (423494, formerly Madsen Creek)	$21,600,000	To be completed in 2007
Juanita Bay Pump Station	$37,000,000	Juanita Bay Pump Station (423406)	$33,100,000	Subject to higher construction costs. To be completed in 2008
Pacific Pump Station	$8,000,000	Pacific Pump Station (423518)	$7,800,000	To be completed in 2007
	$105,100,000		$91,000,000	
		Net Difference	*$14,100,000*	

RWSP Policy CP-4 provides direction on how the County is to acquire conveyance facilities owned by the component agencies that natural drainage areas of greater than one thousand acres and meet additional related criteria. The projected costs of acquisitions, agreements, and extensions to existing conveyance facilities listed in Table 6-5 have increased by $2 million over what was projected in the *2004 RWSP Update*. The increase is attributed to the identification of two new acquisitions in the Auburn and Soos Creek systems.

Table 6-5. Crosswalk of Acquisitions, Agreements, Extensions in the 2004 RWSP Update and the 2007 CSI Program Update

2007 CSI Plan Update Project Name	2007 Update Estimated Acquisition Cost	2004 RWSP Update Project Name	2004 Update Estimated Acquisition Cost	Crosswalk Discussion
Bear Creek Interceptor Extension	$600,000	Bear Creek Interceptor Extension (423507, include. 423211)	$400,000	Acquisition cost higher due to larger number of customers connected to line (affected cost formula)
Coal Creek Acquisition	$2,100,000	Coal Creek	$2,100,000	Acquisition completed in 2003
Sammamish Plateau Water & Sewer District Acquisition	$8,400,000	Sammamish Plateau WSD	$9,400,000	Acquisition completed under budget
Auburn Facilities Acquisition	$2,300,000	Not Included	$0	Costs not included in the 2004 update
MOA with Soos Creek Water and Sewer District (Purchase of Kent Cascade)	$500,000	Not Included	$0	Costs not included in the 2004 update
Alderwood Acquisition	$16,700,000	Acquisition of North & Swamp Creek Trunks	$16,700,000	Acquisition completed in 2001
Sub Total Acquisitions, Agreements and Extensions	$30,600,000		$28,600,000	
		Net Difference	*$2,000,000*	

Table 6-6 provides a crosswalk of projects identified in the *2004 RWSP Update* with a revised version of those projects to reflect the scope and cost differences contained in the *2007 CSI Program Update*. For ease of comparison, all costs have been inflated to 2006 dollars. This allows the net difference in project costs to reflect changes in project scope. As can be seen, the net cost difference in the projects is an $18.1 million increase over what was projected in the *2004 RWSP Update*. Several projects have significantly increased in size and scope as a result of revised flow monitoring and modeling data as well as recent operation experience.

The Heathfield/Sunset Pump Station project has experienced the largest increase in scope. In 2004, the project was identified as a minor equipment upgrade. Today, flow monitoring and operational data shows that the facilities are operating at peak capacity in an area that is experiencing growth. The Heathfield/Sunset Pump Station project now involves upsizing both pump stations and the forcemain to adequately manage 20-year peak flows in the area.

Several other projects have also been reduced in scope due to updated flow information, and additional hydraulic analyses that have identified less expensive approaches to providing capacity. An example is the proposal to develop storage capacity in the Auburn area rather than replace the Auburn Interceptor, as identified in 2004. This reduced the estimated project cost from $91.6 million to $31 million while still meeting the project's objective of conveying projected 20-year peak flows.

Table 6-6. Crosswalk of Projects in the 2004 RWSP Update and as Revised in the 2007 CSI Program Update

2007 CSI Plan Update Project Name	2007 Update Estimated Project Cost	2004 RWSP Update Project Name	2004 Update Estimated Project Cost	Crosswalk Discussion
Heathfield/Sunset Pump Station Replacement and Force Main Upgrade	$51,000,000	SLS: Minor PS Improvements	$1,700,000	Changed scope due to 2006-07 wet-season operational experience & updated flow projections
[CSI] Sammamish Plateau Diversion	$24,800,000	SLS: Samm Plateau Diversion North	$18,200,000	Revised estimate based on updated construction cost estimate
Coal Creek Siphon and Trunk Parallel	$7,100,000	COAL CREEK: R13-25 to R13-20	$900,000	Revised estimate based on new alignment that avoids creek corridor
		COAL CREEK: RE13-17 to R02-28	$2,500,000	
		Subtotal	*$3,400,000*	
North Mercer and Enatai Interceptor Parallels	$24,900,000	ENATAI: R08-01D to R08-01B	$800,000	Revised estimate due to realignment of interceptor out of lake
		NORTH MERCER ISLAND: R08G-20 R08-01C	$2,400,000	
		Subtotal	*$3,200,000*	

2007 CSI Plan Update Project Name	2007 Update Estimated Project Cost	2004 RWSP Update Project Name	2004 Update Estimated Project Cost	Crosswalk Discussion
[CSI] Thornton Creek Interceptor Parallels	$7,600,000	THORNTON INTERCEPTOR Section II (W07-08A to W07-11)	$3,200,000	Projects combined and streamlined
		THORNTON INTERCEPTOR Section I (NWW10-1 to W07-08)	$1,700,000	
		THORNTON INTERCEPTOR Section III (W07-14 to W07-22)	$4,700,000	
		Subtotal	*$9,600,000*	
[CSI] Sammamish Plateau Storage	$33,200,000	SLS: Sammamish Storage	$18,200,000	Changed scope due to updated flow projections
[CSI] Soos Alternative 3A(3) - PS D w/ Conveyance	$42,000,000	Soos Creek Parallel interceptors and new pump stations	$116,900,000	Updated cost estimate
[CSI] Soos Alternative 3A(3) - PS H w/ Conveyance	$47,000,000			
[CSI] Soos Alternative 3A(3) - PS B w/ Conveyance	$7,900,000			
Subtotal	*$96,900,000*			
[CSI] Issaquah Storage	$22,900,000	SLS: Issaquah Storage	$13,600,000	Changed scope due to updated flow projections
Issaquah Creek Highlands Storage	$2,400,000	SLS: Iss Highlands Relief Sewer	$5,500,000	Storage alternative is less expensive than relief sewer alternative
2030 subtotal	$270,800,000			
[CSI] Swamp Creek - Section 1B Parallel	$9,000,000	SWAMP CREEK: SC1-B	$20,800,000	Scope reduced based on updated analysis of pipe capacity
Lower North Creek Interceptor Parallel	$11,500,000	NORTH CREEK: NC3-A	$11,500,000	No change in project scope. Project needed later than previously planned
Auburn Interceptor - Section 3 Parallel Pipe Storage	$31,000,000	New Auburn Section 1 Replacement	$18,300,000	Storage alternative is less expensive than pipe replacement
		New Auburn Section 2 Replacement	$63,300,000	
		Subtotal	$81,600,000	
2030-2050 subtotal	$51,500,000			
2050 total	$322,300,000		$304,200,000	
		Net Difference	*$18,100,000*	

Table 6-7 summarizes planned projects that have been identified since the *2004 RWSP Update*. These are projects intended to meet capacity needs that have been identified as a result of the region-wide flow monitoring and flow modeling that was conducted for the Regional Infiltration and Inflow (I/I) Control Program. The flow monitoring and modeling information is the most detailed information gathered about flow volumes and system capacity across the region. A total of nineteen new projects have been identified. Thirteen of these projects are planned to be constructed by 2030. The remaining six are planned to be constructed between 2030 and 2050.

Table 6-7. Summary of New Projects Identified in the 2007 CSI Program Update that were NOT Included in the 2004 RWSP Update

2007 CSI Plan Update Project Name	Est. Project Cost (2006$)	Project Need
Bellevue Influent Trunk Parallel	$2,500,000	Project needed due to revised growth & flow projections in Bellevue
Northwest Lake Sammamish Interceptor Parallel	$23,500,000	Project needed due to revised flow projections and pipe capacity analysis
Lake Hills Trunk Replacement	$15,000,000	Project needed due to revised flow projections and pipe capacity analysis
Boeing Creek Storage Expansion	$9,100,000	Project is a planned second phase to Hidden Lake PS/Boeing Creek Trunk upgrade
Algona Pacific Trunk Stage 1	$4,500,000	Project needed due to revised flow projections and pipe capacity analysis
Richmond Beach Storage	$14,000,000	Project is a planned second phase to Hidden Lake PS/Boeing Creek Trunk upgrade
Factoria Pump Station and Trunk Diversion	$10,200,000	Project needed due to revised flow projections and pipe capacity analysis
York Pump Station Modifications	$8,400,000	Project needed to reduce peak flows in the ESI
Eastgate Parallel Pipe Storage	$23,800,000	Project needed due to revised flow projections and pipe capacity analysis
Bryn Mawr Storage	$8,700,000	Project needed due to revised flow projections and pipe capacity analysis
Medina Storage	$1,100,000	Project needed due to revised flow projections and pipe capacity analysis
South Renton Interceptor Parallel	$3,600,000	Project needed due to revised flow projections and pipe capacity analysis
Issaquah Interceptor Section 2 Parallel	$2,800,000	Project needed due to revised flow projections and pipe capacity analysis
2030 Subtotal	$127,200,000	
ULID 1 Contract 4 Parallel	$3,800,000	Project needed due to revised flow projections and pipe capacity analysis
Garrison Creek Trunk Parallel	$6,100,000	Project needed due to revised flow projections and pipe capacity analysis
Juanita Bay Pump Station Forcemain Upgrade	$15,000,000	Project needed due to revised flow projections and pipe capacity analysis
Algona Pacific Trunk Stage 2	$1,400,000	Project needed due to revised flow projections and pipe capacity analysis
Upper North Creek Parallel	$4,800,000	Project needed due to revised flow projections and pipe capacity analysis
Lakeland Hills Pump Station Replacement	$6,000,000	Project needed due to revised flow projections and pipe capacity analysis
2030-2050 Subtotal	$37,100,000	
Costs Through 2050	$164,300,000	

Table 6-8 summarizes planned projects identified since the *2004 RWSP Update* that are now determined to be no longer needed or not capacity related. The detailed flow monitoring and modeling data gathered for the I/I Control Program was used to identify portions of the system that had lower flow volumes than those projected in the *2004 RWSP Update*, had greater system capacity, or both. In total, eight projects identified in the *2004 RWSP Update* totaling $65.4 million are no longer needed and are not included in the *2007 CSI Program Update*. A ninth project in the Lake Washington Lake Line is an odor control project and is now considered an asset management function.

Table 6-8. Summary of Planned Projects Identified in the 2004 RWSP Update that have been Eliminated

2007 CSI Plan Update Project Name	Est. Project Cost (2006$)	Project Need
North Creek: NC2-A2	$33,600,000	Project NOT needed due to revised flow projections and pipe capacity analysis
South Lake City: NWW13-02 TO NWW10-01	$200,000	Project NOT needed due to revised flow projections and pipe capacity analysis
ETS Storage	$21,600,000	Project NOT needed due to revised flow management practices
Bothell/Woodinville: BW-A1	$500,000	Project NOT needed due to revised flow projections and pipe capacity analysis
Bothell/Woodinville: BW-A2	$300,000	Project NOT needed due to revised flow projections and pipe capacity analysis
Tukwila Freeway Crossing (423520)	$6,000,000	Project NOT needed due to revised flow projections and pipe capacity analysis
Piper Creek: T-12 to T-5	$600,000	Project NOT needed due to revised flow projections and pipe capacity analysis
Piper Creek: T-23 D TO T-12	$2,600,000	Project NOT needed due to revised flow projections and pipe capacity analysis
Lake Line Connections and Flap Gates (*Odor Control)*	$1,600,000	Not capacity related. Project transferred to Asset Mgmt.
Total Cost of Projects *Eliminated* from CSI Program	$67,000,000	

Appendices

Appendix A. Conveyance System Technical Analyses – Processes and Assumptions

Appendix B. Project Descriptions Summaries

Appendix C. Regional Conveyance System Needs (Technical Memorandum)