City of Eugene

Stormwater Basin Master Plan

Willamette River Basin

Volume VI of VII

CITY OF EUGENE
STORMWATER
MANAGEMENT PROGRAM

August 2002
Prepared by:
City of Eugene
URS Corporation
Lane Council of Governments

Local Stormwater Planning Can Make a World of Difference

Stormwater Basin Master Plan

Volume VI of VII

Willamette River Basin

December 2002

Prepared by:

City of Eugene
URS Corporation
Lane Council of Governments

ACKNOWLEDGEMENTS

The Stormwater Basin Master Plan represents the culmination of a long term planning effort by a multi-agency team consisting of representatives from the City of Eugene, Lane Council of Governments (LCOG), and URS Corporation.

The project team would like to gratefully acknowledge the efforts of the many present and former city and consultant staff who provided input for and review of this document. The following acknowledgements include a representative from each of the divisions, departments and agencies involved over the years. The project team would like to especially acknowledge the leadership, guidance, commitment and contribution to this effort by Christine Andersen, former Public Works Director and the late Les Lyle, City Engineer (1983-2001) for Eugene.

POLICY GUIDANCE
Kurt Corey, Public Works Director
Mark Schoening, City Engineer
Jeff Lankston, Maintenance Division Manager
Peter Ruffier, Wastewater Division Manager
Johnny Medlin, Parks & Open Space Division Manager
Valerie Dixon, Administration Division Manager

PROJECT MANAGEMENT
Therese Walch, City of Eugene
Krista Reininga, URS
Tim Bingham, LCOG

TECHNICAL GUIDANCE
Mike Fowler, URS
Binhong Wu, URS
Michelle Cahill, Public Works Engineering Division
Linda Harris, Public Works Engineering Division
Paul Klope, Public Works Engineering Division
Jack Long, Public Works Parks & Open Space Division
Jim McLaughlin, Public Works Maintenance Division
James Ollerenshaw, Public Works Wastewater Division
Jerry Jacobson, Planning & Development
Sonny Chickering, Lane County Public Works
Ed Alverson, The Nature Conservancy
Patrick Condon, University of British Columbia
Deborah Evans, formerly Public Works Engineering Division

MAPPING SUPPORT
Sharon Budzier, City of Eugene
Bill Clingman, LCOG
Cress Bates, LCOG

PUBLIC OUTREACH
Public Works Stormwater Department Advisory Committee
Carol Heinkel, LCOG
Kathi Wiederhold, LCOG

The information published in this report is subject to revision. Please contact the City of Eugene's Engineering Division for potential changes before proceeding with any engineering design that uses the information published herein.

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

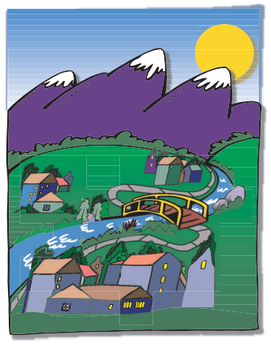
TABLE OF CONTENTS

LIST OF FIGURES

LIST OF MAPS (Located at end of Section 2)

Executive Summary

City of Eugene



Vision for a Green Infrastructure

Willamette River Basin

Stormwater Management Strategy

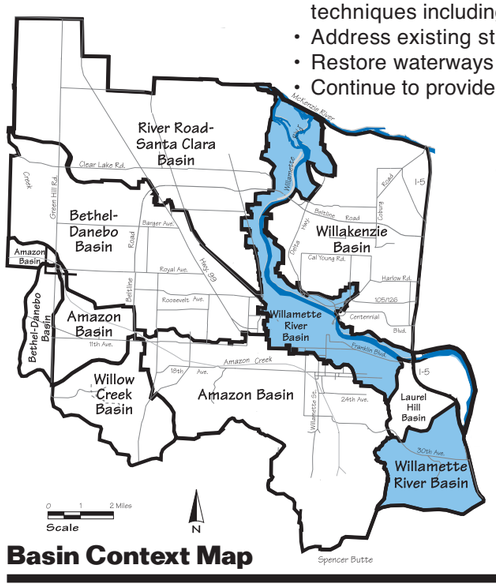
While relatively large in area, the location of this basin is limited to a narrow strip of land on either side of the Willamette River, extending from Lane Community College on the south to the McKenzie River on the north. The middle reach, from I-5 bridge to Beltline bridge, is within the urban growth boundary (UGB), and is nearly fully developed with the downtown area, University of Oregon, Alton Baker Park, and Valley River Center being significant existing land uses. For the purposes of this study, only the middle reach within the UGB is directly affected by the recommended management strategy. Results of the stormwater assessment for this basin revealed:

- Localized flooding is not a significant problem under existing or future land use conditions;
- Untreated stormwater runoff from existing land uses is the primary water quality issue in this basin;
- The Willamette River is designated as "water quality limited" for temperature and toxics and will be subject to future restrictions by the Oregon Department of Environmental Quality;
- Spring Chinook is listed as a threatened species and will effect local land use practices in this basin;
- Significant bank stability problems exist along the Willamette River in Skinner Butte Park; and
- Restoration potential is high for wildlife habitat and water quality functions at Delta Ponds.

Strategy

The recommended strategy for this basin is:

- Reduce existing pollutants to the extent feasible through system retrofits, especially in high source areas.
- Minimize future pollutants through on-site development standards.
- Protect waterways through a combination of development standards and other techniques including acquisition.
- Address existing stream bank stabilization problems through capital projects.
- Restore waterways through federal-local partnerships.
- Continue to provide flood protection services basin wide.



Basin Context Map

Willamette River Basin Facts

- Ranks fifth among all the basins in total size (7,023 acres).
- Ranks second in the amount of area designated as 100-year floodplain (2,002 acres).
- Ranks sixth in total length of local open waterways (12 miles – does not include Willamette River) and last in proportion of waterways to basin size.
- Impervious surface area in the UGB is projected to increase from 40% to 44% at full buildout .
- Is home to Spring Chinook, listed as a threatened fish species.
- The Willamette River listed by the Oregon Department of Environmental Quality as water quality limited.

August 2002

Comprehensive Plan

Cleaner, Safer, Healthier Environment

Adoption of the **Comprehensive Stormwater Management Plan** (CSWMP) in November 1993 ushered in a new vision for managing the City of Eugene's storm-water program. In addition to protecting the community from flooding problems, CSWMP expanded the program to include protection of stormwater quality and related natural resources.

Basin Planning

Bringing CSWMP into Focus

Basin planning is one of many action items for implementing CSWMP. The basin planning process includes assessing existing conditions, identifying stormwater system problems and opportunities, and recommending management strategies for implementing several CSWMP policies. Each of the City's seven drainage basins offers unique conditions and opportunities for implementing capital projects and development standards. Basin planning, therefore, is a refinement of CSWMP's broader policy direction and represents what is feasible and practical to implement at the stormwater system level.

Other Activities

In addition to Basin Planning, many other city activities are conducted to enhance water quality, protect stormwater-related natural resources, and prevent flooding. A few examples include:

- Erosion control for construction activities
- Education and outreach
- Monitor stormwater discharges of certain industrial uses
- Street sweeping
- Volunteer programs
- Vegetation management

Green Infrastructure

Green Infrastructure uses the beneficial flood control and water quality treatment characteristics of the natural landscapes to help meet stormwater management objectives. When linked with the constructed system, the two work together to form a coordinated drainage system of streams, ponds, streets, and pipes.

Why This Strategy?

Flood Control

- Capital projects are the most cost-effective solutions for correcting existing problems and will be designed to address the incremental effects of new development.

Water Quality

- *Existing Pollution Problem:* Capital projects are the most cost-effective solution for addressing existing conditions, along with other ongoing program activities.
- *Pollution Associated with New Development:* Development standards are most effective for addressing pollutants at their source.

Stormwater-Related Natural Resources

- Capital projects are the most viable method for addressing negative effects of high runoff volumes in open waterways for existing developed areas.
- Stream corridor acquisition can be used to protect a limited number of high-priority waterways.
- Development standards are effective at preventing encroachment into waterways and preserving water quality functions.

More Information

- Visit the City's website at www.ci.eugene.or.us/pw/storm or
- Contact Therese Walch at (541) 682-6839

EUGENE

The Management Strategy

Flood Control

Issue: **Flooding problems under existing and future conditions are relatively minor and occur primarily due to backwater conditions from the Willamette River.**

Desired Outcome: Flooding problems are minimized.

Actions: Increase system performance through tip-up retrofits and improved access for maintenance.

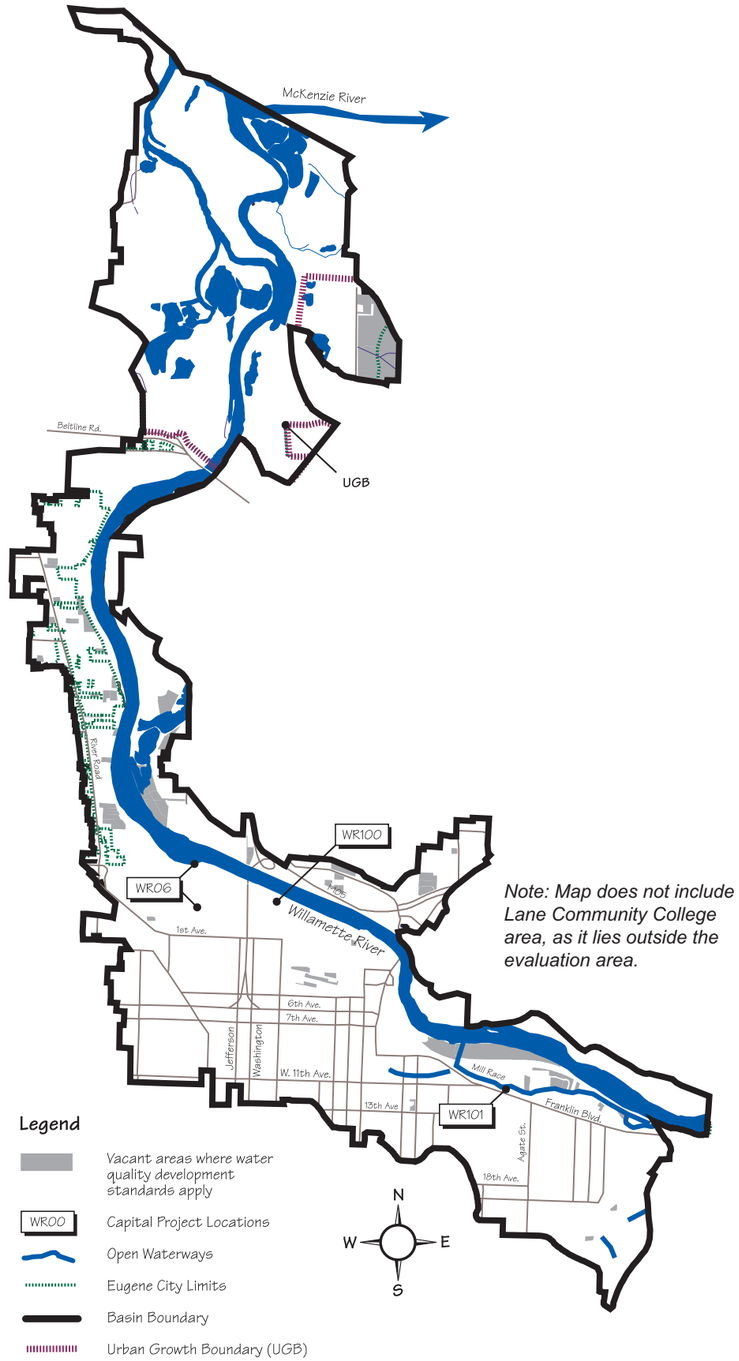
Related Natural Resources

Issue: **Natural resources functions and values are being lost due to the lack of an overall management and implementation plan.**

Desired Outcome: Maintain and improve the extent and quality of existing stormwater-related natural resources.

Actions: **Capital Projects (see map)**
- WR100 – Federal priority for Willamette River Bank Restoration.
- WR101 – Federal priority for Eugene Mill Race Enhancement.
- Ongoing: Restore waterways through federal-local partnerships (to be identified).

Development Standards (see map)
- Prohibit filling/piping of important storm waterways.
- Require streamside setbacks.



Note: Map does not include Lane Community College area, as it lies outside the evaluation area.

Water Quality: Pollution Prevention & Reduction

Issue: **Runoff from existing development is a major source of pollutants.**

Desired Outcome: Pollutants from existing land uses are reduced.

Actions: **Capital Projects (see map)**
- WR06 – Polk Street water quality facility.
- Yearly Budget Item – water quality facilities in high source areas.
- Yearly Budget Item – retrofit tip-ups.
- Yearly Budget Item – outfall stabilization.

Issue: **Runoff from future development will increase pollutant discharges.**

Desired Outcomes: Reduce stormwater pollution from new development.

Actions: **Development Standards – see map**
- New and significant redevelopment projects are required to treat all runoff from City's water quality design standard.
- Incentives – provide incentives for existing development to reduce effective impervious surface areas and treat stormwater runoff.
- Control rate of runoff into headwater streams for water quality benefits.

Other Elements of the Strategy

- General stormwater rehabilitation projects.
- Channel easement acquisition.

CITY OF EUGENE
STORMWATER
MANAGEMENT PROGRAM

SECTION 1 Introduction

Adoption of the City of Eugene's *Comprehensive Stormwater Management Plan* (CSWMP) in November 1993 marked a significant shift in the City's approach to stormwater management. In addition to drainage and flood control services, the stormwater program was expanded to include the protection and enhancement of stormwater quality and related natural resources. Since the previous *Storm Drainage Master Plan* (OTAK, 1990) was developed solely for the purpose of addressing drainage and flood control issues, an update of that Plan was necessary to bring it into compliance with current City policy. As a result, the City initiated a project to develop multiple-objective Stormwater Basin Master Plans.

In addition to CSWMP, other locally adopted policy documents were reviewed for applicability to the Basin Master Planning effort. The following were identified for containing policies related to and supportive of protection of water quality and related natural resources:

1) Eugene/Springfield Metro Area General Plan (1987 Update) in general and, specifically, the following refinement plans:

   - Bethel-Danebo, 1982
   - Eugene Downtown Plan, 1984
   - Eugene Parks and Recreation Plan, 1989
   - Jefferson/Far West, 1983
   - Public Facilities and Services Plan, December 2001
   - Laurel Hill, 1982
   - Riverfront Park Study, 1985
   - River Road-Santa Clara Urban Facilities Plan, 1985
   - South Hills Study, 1974
   - Willakenzie Neighborhood, 1991
   - Willow Creek, 1982

2) Eugene Growth Management Study, 1998

The overall goal of the Stormwater Basin Master Plans was to provide a stormwater management strategy for each basin that proactively addresses the multiple objectives of CSWMP. In addition to flood control, these multiple objectives include:

- Protect and improve water quality.
- Protect natural resources that provide beneficial stormwater functions.
- Use best management practices that promote a green infrastructure.
- Address the unique qualities of each drainage basin.
- Meet federal, state, and local laws and policies (including CSWMP, the Clean Water Act, the Endangered Species Act, and State Underground Injection Control Rules – for these broader topics and other issues, please refer to Volume I).
- Complement other existing BMPs that are part of the City's stormwater program.
- Balance responsibilities community-wide.
- Provide a dynamic and flexible program that can be refined based on a changing regulatory climate.

SECTION 1 Introduction

This report presents the integrated stormwater management strategy (integrated strategy) for the Willamette River basin. It represents Volume VI of a seven volume report generated to summarize and document the city-wide Stormwater Basin Master Plans. Volume I provides an overview of the project, describes the process for developing integrated strategies, and summarizes the information that is presented in detail in the six companion volumes, each of which covers one of the following City's six drainage basins: *Volume II - Amazon Creek, Volume III - Bethel-Danebo, Volume IV – Laurel Hill, Volume V - Willakenzie, Volume VI - Willamette River, Volume VII - Willow Creek.* Volumes II through VII provide more detailed information regarding development of stormwater management strategies for each of the six basins including: characteristics unique to the basin; results of the basin evaluation for flood control, water quality and natural resources; and resulting integrated stormwater management strategies. A basin specific plan was not produced for River Road Santa Clara, pending resolution of inter-jurisdictional issues as well as additional information gathering and analysis.

NOTE: It should be noted that the term basin is typically used to refer to a defined surface area that drains to a common discharge point. However, for the purposes of this study, the term basin is used to refer to a specific planning or study area. While the planning or study areas were developed based on topography and drainage patterns, they may include several discharge points, or they may exclude specific tributary areas based on convenience for planning purposes. In some cases, portions of the basin were not included in the planning area as they are managed by other jurisdictions. The basin areas as defined in this plan are also further divided into major subbasins and subbasins as described in Section 3.0.

The process conducted to develop integrated strategies for each of the six basins included the following thirteen steps. The details regarding each of these steps are provided in Volume I.

Step 1) Compile information regarding the unique characteristics of each basin that are related to the stormwater drainage system.
Step 2) Identify problems and opportunities associated with the stormwater drainage system with respect to flood control, water quality, natural resources, and maintenance.
Step 3) Develop potential solutions in the form of capital projects and development standards for addressing identified problems.
Step 4) Evaluate and compare potential solutions in terms of feasibility, costs, and effectiveness.
Step 5) Evaluate capital projects to address problems expected under existing conditions.
Step 6) Evaluate capital projects and development standards to address problems expected as a result of future build-out.
Step 7) Select an integrated stormwater management strategy based on the evaluations conducted in steps 5 and 6.
Step 8) Develop a maintenance strategy for the proposed solutions.
Step 9) Obtain feedback regarding integrated stormwater management strategies and the maintenance strategy from the public and refine the strategies as appropriate.
Step 10) Prioritize selected capital projects for implementation and conduct a financial analysis.

Step 11) Develop stormwater basin master plans to summarize the integrated stormwater management strategies including proposed capital projects and development standards.
Step 12) Develop an ordinance to implement the proposed development standards.
Step 13) Develop a best management practices manual to help guide developers in meeting the requirements of the development standards.

The process for conducting these steps is outlined in Figure 1-1. As a result of this process, a mix of capital projects and development standards was proposed for each of the basins. A total of 44 multiple-objective capital projects were selected for the integrated stormwater management strategies city-wide (not including the Santa Clara/River Road basin). Three of these are located in the Willamette River basin. In addition, development standards were selected for treating the quality of runoff from new development and for protecting open waterways. These standards were proposed city-wide and therefore would apply to the Willamette River basin when enacted. A development standard was adopted in April 2000 (Open Waterways Ordinance) that prohibited waterways from being filled and/or piped. The ordinance was subsequently appealed and remanded back to the City by the Oregon Court of Appeals (July 2001) and is no longer in effect. Additional methods and options for protecting open waterways are under review. In the meantime, waterway protection efforts will include stream corridor acquisitions and land use approval criteria where applicable.

Information updates related to this plan are provided at the end of this section. The integrated basin strategy specific to the Willamette River basin is described in the following sections. Section 2.0 provides a summary of the specific characteristics in the Willamette River basin. Sections 3.0, 4.0, and 5.0 provide summaries of the flood control, water quality, and natural resources evaluations respectively. Section 6.0 describes the resulting integrated basin strategy and provides information regarding the implementation of the strategy including scheduling and financing.

Information Updates

The information contained in this document represents a "snapshot-in-time." The Study Area Characteristics data (Section 2) are current through 1998, and the evaluation data (Sections 3, 4, 5, 6) are current through June, 2001. As conditions in this basin change, the information in this document will need to be updated to reflect those conditions.

The following recent or imminent changes to conditions, information, or the integrated basin strategy are not reflected in this document, but will be addressed in the next update:

- Eugene is participating in a Metropolitan Waterways Restoration project with the Army Corps of Engineers and other metro partners under authority of the Water Resources Development Act. This Study will further define and prioritize needs for waterway restoration throughout the metro area including waterways in the Willamette River basin, and will allow the City to partner with, and cost share with, the Corps and other agencies to optimize the use of local funds for stream restoration. The first phase of this study, the Reconnaissance Phase, was initiated in February 2002. The second phase, Feasibility, is

expected to begin in spring 2003. Implementation of on-the-ground projects is anticipated by 2007.

- Relationship to Eugene's ESA/Salmon response strategy.
- The narrative description of existing and future parks and schools in subsections 2.10.1 and 2.10.2 has been updated to the time of printing of this document. Map 12 (Section 2), Parks, Recreation, and Educational Facilities, has not been updated to match. Map 12 changes will be included in the next document update.
- Relationship to and compliance with the State of Oregon's Underground Injection Well requirements.
- Updates to rare plant and animal species inventories through the Oregon Natural Heritage Program data base.

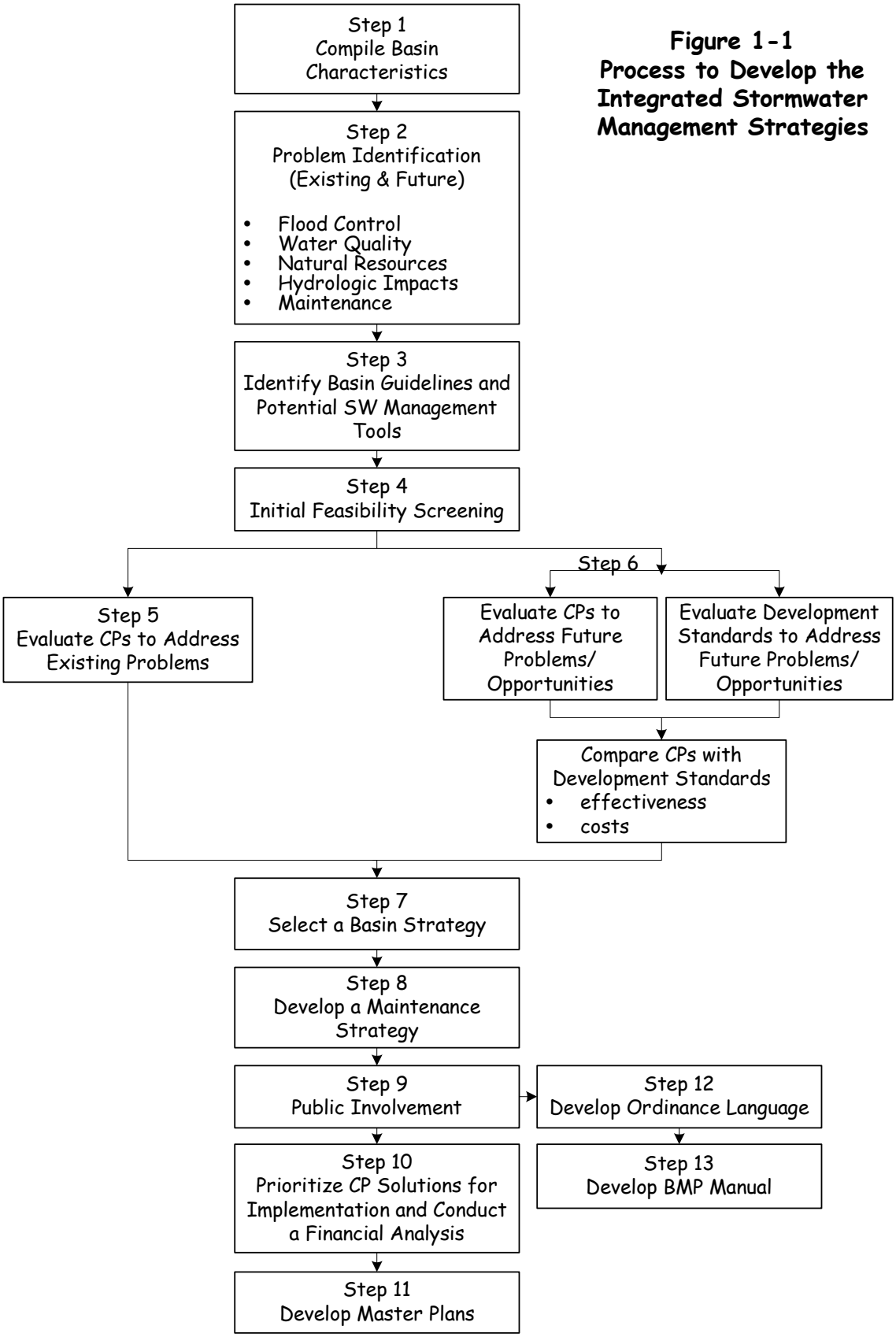


Figure 1-1
Process to Develop the Integrated Stormwater Management Strategies

SECTION 2 Study Area Characteristics

This section provides background information regarding the existing physical characteristics of the Willamette River basin. This information was used to assess opportunities and constraints for meeting the multiple-objective goals of the Stormwater Basin Master Plans. Specifically this section includes the following information for the basin: location and area; climate; land use and surface cover; land form; topography and slopes; surface water features and drainage system; water quality; rare, threatened and endangered plants, animals and communities; soils; groundwater; and recreational and educational facilities.

2.1 Location and Area

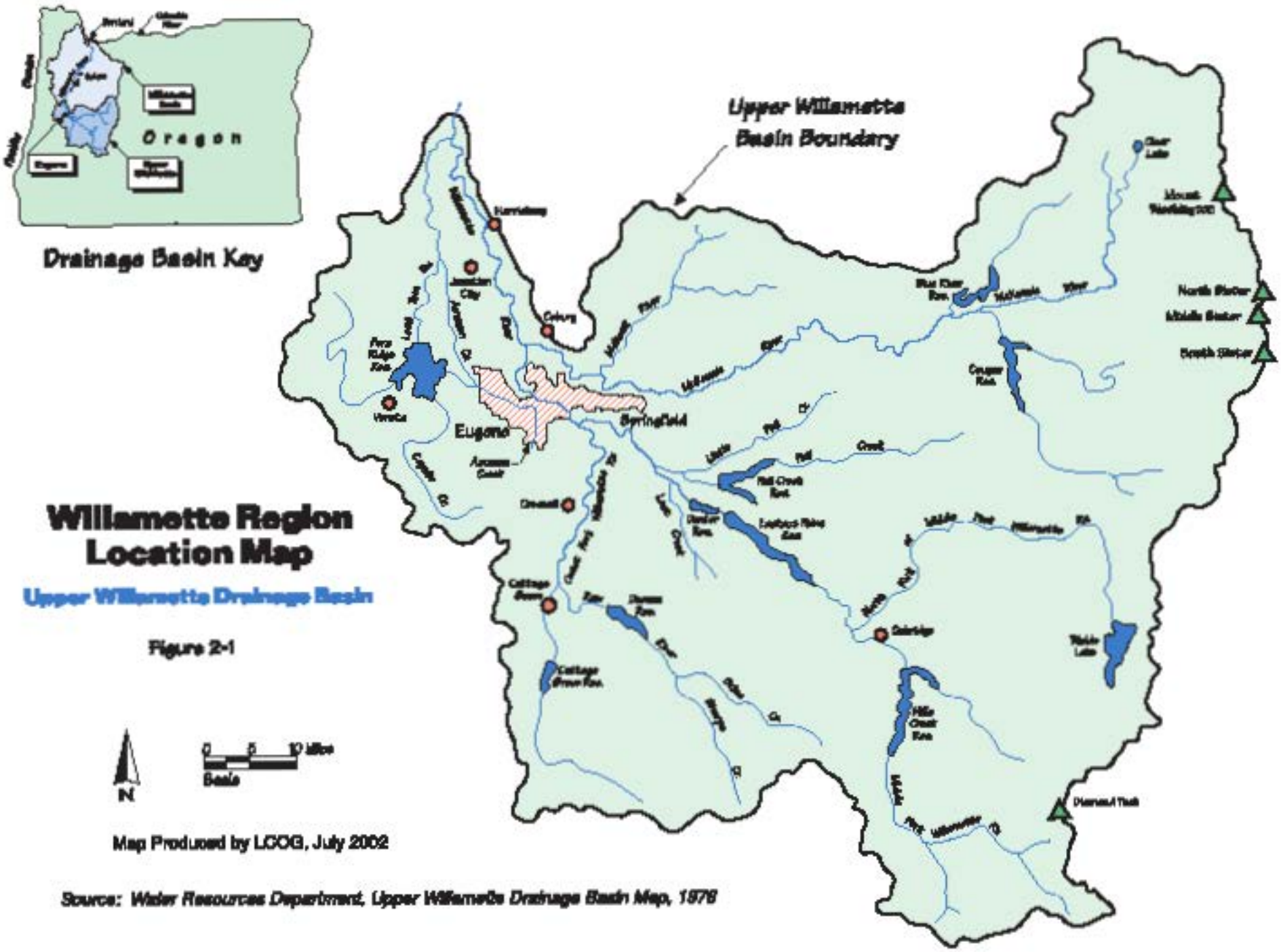
2.1.1 Regional Drainage Context

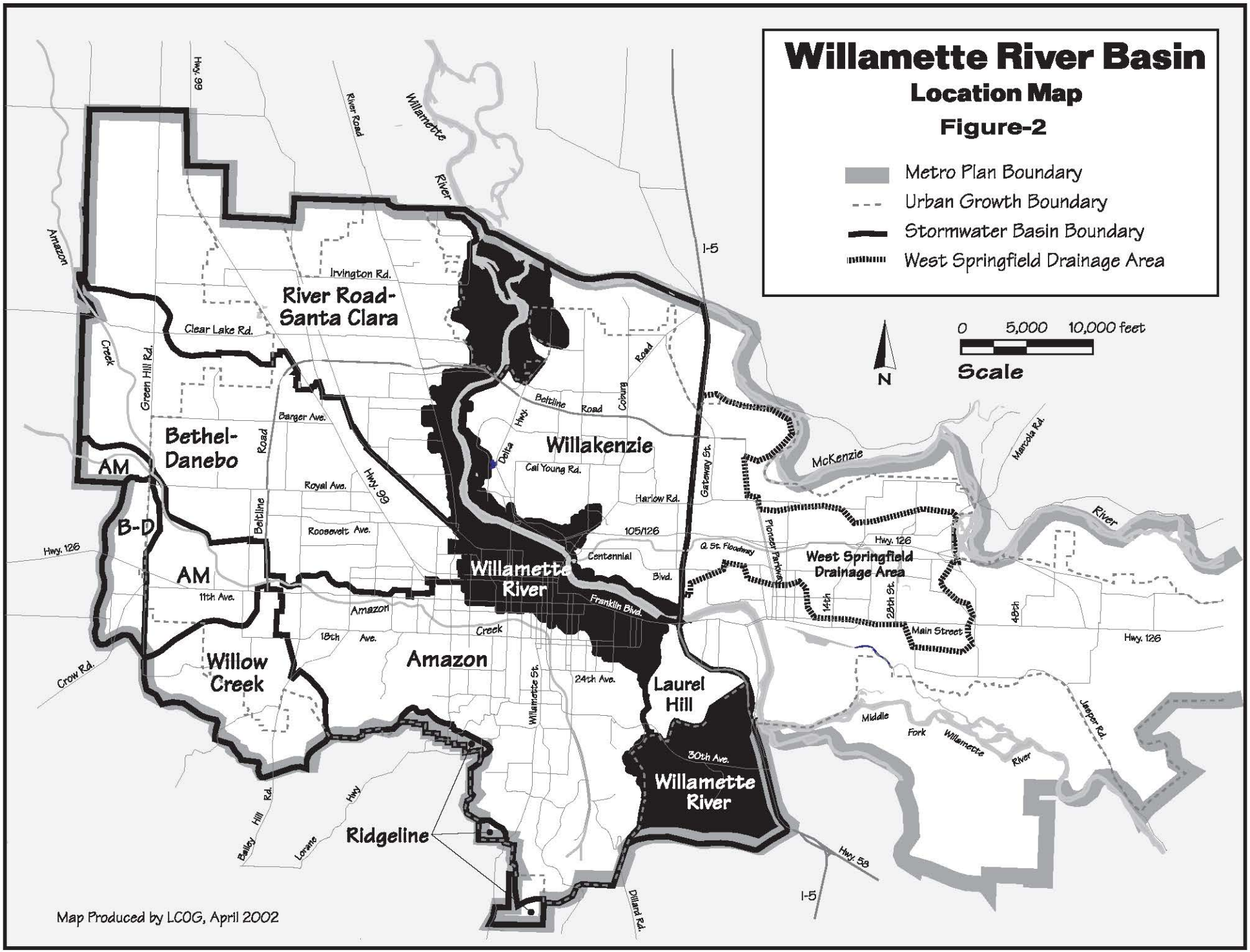
Eugene is located in the western third of the Upper Willamette Drainage Basin as shown on Figure 2-1. Drainage in the southern Willamette Valley is a combination of natural and built systems that have evolved over time. The natural system is composed of rivers, waterways, and a series of interconnected ponds and wetlands. Historically, the natural system had an extensive floodplain that typically experienced over-bank flooding every 1-2 years. The built drainage system includes a series of dams, pipes, and waterways that were built to contain over-bank flooding, and to retain water for recreational and irrigation purposes. The primary drainage features of the Upper Willamette Drainage Basin are: Main Stem of the Willamette River, Middle Fork of the Willamette River, Coast Fork of the Willamette River, McKenzie River, Amazon Creek, Coyote Creek, and the Long Tom River. From 1940 to 1960, the U.S. Army Corps of Engineers built nine dams on this system.

The cities of Cottage Grove, Creswell, and Springfield are all upstream from the City of Eugene and contribute urban runoff to the regional drainage system. Runoff from Cottage Grove, Creswell, and South Springfield flows through Eugene via the Willamette River. Approximately 4,800 acres of west Springfield's drainage area, as shown on Figure 2-2, discharges urban runoff into the Q Street Floodway, which is within Eugene's public drainage system. Eugene public drainage system refers to the system of stormwater facilities (i.e., pipes, ditches, open waterways) that Eugene is responsible for operating and maintaining.

2.1.2 City of Eugene

The City of Eugene is currently responsible for managing the stormwater quantity, quality, and related natural resources for the drainage area within its city limits. The area outside of the City limits but within the urban growth boundary (UGB) is expected to be annexed into the city as urban development occurs. Therefore, this Stormwater Basin Master Plan includes both the current city limits and the area within the UGB. The *Eugene-Springfield Metro Area General Plan (Metro Plan)* boundary covers the city limits, the UGB and, in some cases, areas beyond the UGB. For the purposes of characterizing the study area in this chapter, the area covered includes the *Metro Plan* boundary.


Oregon
Drainage Basin Key
Upper Willamette
Basin Boundary
Eugene
Springfield
Coburg
Harrisburg
Junction City
Veneta
Cottage Grove
Dexter
Lowell
Oakridge
Blue River
McKenzie River
Cougar
North Sister
Middle Sister
South Sister
Mount Washington
Diamond Peak
Willamette Region
Location Map
Upper Willamette Drainage Basin
Figure 2-1
N
0 5 10 Miles
Scale
Map Produced by LCOG, July 2002
Source: Water Resources Department, Upper Willamette Drainage Basin Map, 1976


Willamette River Basin
Location Map
Figure-2
Metro Plan Boundary
Urban Growth Boundary
Stormwater Basin Boundary
West Springfield Drainage Area
N
0 5,000 10,000 feet
Scale
River Road-
Santa Clara
Bethel-
Danebo
AM
B-D
AM
Willow
Creek
Willakenzie
Willamette
River
Amazon
Laurel
Hill
Willamette
River
Ridgeline
West Springfield
Drainage Area
Hwy. 99
River Road
Willamette
River
I-5
Irvington Rd.
Clear Lake Rd.
Green Hill Rd.
Barger Ave.
Royal Ave.
Roosevelt Ave.
11th Ave.
18th Ave.
Crow Rd.
Beltline Road
Coburg Road
Cal Young Rd.
Harlow Rd.
105/126
Centennial Blvd.
Franklin Blvd.
Gateway St.
McKenzie River
Marcola Rd.
Hwy. 126
Q St. Floodway
Pioneer Parkway
14th
28th St.
48th
Main Street
24th Ave.
30th Ave.
Willamette St.
Middle Fork Willamette River
Jasper Rd.
Hwy. 58
Dillard Rd.
Bailey Hill Rd.
Lorane Hwy
Map Produced by LCOG, April 2002

2.1.3 Willamette River Basin

As shown on Figure 2-2, the Willamette River basin is the area along either side of the Willamette River that discharge, more-or-less, directly into the river. While fairly large in size, 7,023 acres, only 50% of the basin (3,492 acres) is within the urban growth boundary (UGB). Most of the Willamette River basin within the UGB is flat and highly developed, with only 8 percent vacant. The mixture of land uses in this area is distributed fairly evenly among residential, commercial, and industrial, including nearly 7 percent in riverside parks and open space. Most of downtown Eugene and the University of Oregon are located in this area.

There are two distinct non-UGB areas located on either end of this basin. The southerly non-UGB portion is characterized by a distinct tributary basin formed by steep hillsides and drained by Russell Creek. Lane Community College is located in this area. The northerly non-UGB portion is located north of Beltline Highway and is characterized by flat, floodplain topography where the Willamette and McKenzie rivers converge. There is little development there except for on-going sand and gravel operations.

2.2 Climate

The climate in the study area is primarily affected by humid air masses from the west and south, and infrequent influxes of cold, continental air masses from the east. As a result, the year-round climate in Eugene is moderate with relatively cool, wet winters, and warm, dry summers. Average minimum winter temperatures are in the mid-30s with extremes seldom dropping below 10 degrees Fahrenheit (-12.2 Celsius). Average maximum summer temperatures are in the low 80's (26.7 to 28.9 Celsius) with extremes seldom exceeding 100 degrees Fahrenheit (37.8 Celsius). Snowfall constitutes only 2 percent of the annual precipitation in Eugene. Winter snow does not accumulate; however, quick snow melt can contribute to flooding problems throughout the Eugene area.

The National Weather Service records rainfall information at the Mahlon Sweet Airport in Eugene. Average annual precipitation is approximately 46 inches with 86 percent occurring from October to May. Figure 2-3 presents the average monthly rainfall distribution based on the airport's 48-year rainfall record from 1949-1987.

Figure 2-3
Average Monthly Rainfall

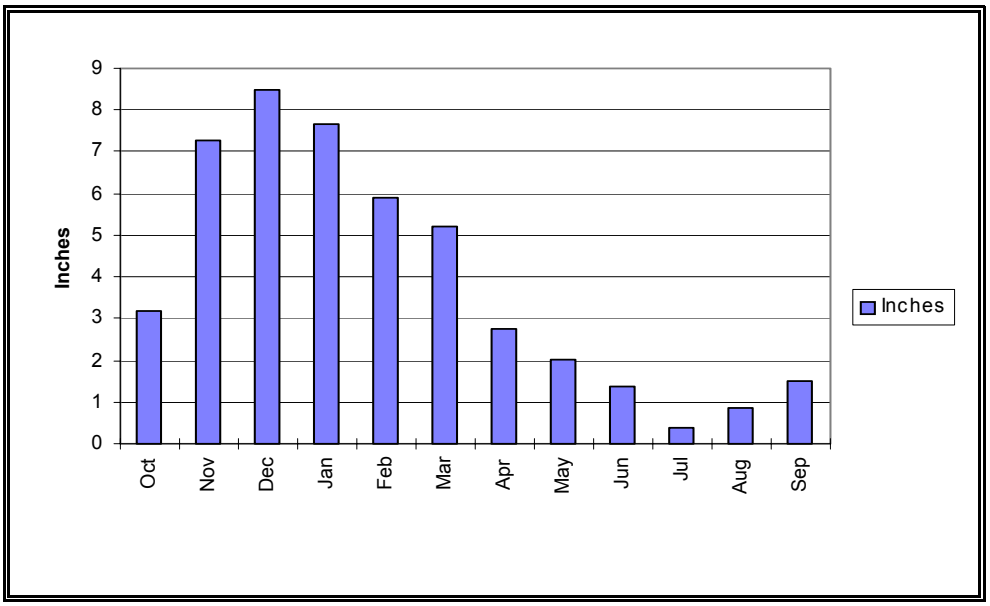


Table 2-1 characterizes a typical storm event for the Eugene area based on the historic 48-year precipitation record measured at the Eugene Airport:

Table 2-1
Average Storm Event

Storm Event Parameter	Average
Volume	0.67 inches
Duration	16.9 hours
Intensity	0.042 inches per hour

Since 1992, rainfall information has been recorded at six rain-gage stations within the Eugene city limits. Comparison of that data with the National Weather Service's Eugene Airport data indicates a significant difference between the two, with the airport data approximately 30 percent higher. For additional information regarding this issue, see Appendix A of Volume I.

Historically, performance of the City's drainage system has been very good. For example, the City's system handled the February 1996 storm event with very few problems even though this event caused widespread flooding in the Willamette River Valley.

2.3 Land Use and Surface Cover

The conversion from undisturbed to developed land uses can significantly affect the quantity and quality of stormwater runoff. Runoff volumes and velocities increase as impervious surface areas increase. Likewise, stormwater quality decreases due to nonpoint source pollution from highways and urban land uses such as commercial, industrial, and residential. The purpose of this section is to describe existing land use and impervious surface conditions within the basin and to forecast changes in these conditions due to buildout of remaining vacant lands within the UGB according to *Metro Plan* designations. Existing land use data presented in Map 1 are current to November 1998. Buildout data presented in Map 2 are based on current *Metro Plan* designations. See maps at the end of Section 2.

2.3.1 Existing Land Use

As shown in Table 2-2, the predominant land uses in the basin are: streets (right-of-way) (980 acres), agriculture (892 acres), low-medium density residential (738 acres), parks-open space-recreation (523 acres), commercial (460 acres), Willamette River and ponds (427 acres), schools-churches-cemeteries (301 acres), other government (277 acres), medium-high density residential (202 acres), and industrial (140 acres), and other undeveloped land (1,842 acres).

Table 2-2
Existing Land Use – Willamette River Basin

Land Use Categories	Acres	Percent of Area
Inside UGB		
Low-Med. Density Residential	563	8.0%
Med.-High Density Residential	202	2.9%
Commercial	434	6.2%
Industrial	54	0.8%
Railroad	1	0.0%
Communication and Utilities	122	1.7%
Parks, Open Space, & Recreation	488	6.9%
Golf Courses	86	1.2%
Schools, Churches, & Cemeteries	149	2.1%
Other Government	65	0.9%
Agriculture*	23	0.3%
Other Undeveloped Land*	272	3.9%
Streets (R.O.W.)	713	10.2%
Willamette River and Ponds	320	4.6%
Subtotal	3,492	49.7%
Outside UGB		
Low-Med. Density Residential	175	2.5%
Commercial	26	0.4%
Industrial (including sand and gravel)	86	1.2%
Parks, Open Space, & Recreation	35	0.5%
Golf Courses	13	0.2%
Schools, Churches, Cemeteries	152	2.2%

Table 2-2 (continued)

Land Use Categories	Acres	Percent of Area
Other Government	212	3.0%
Agriculture	869	12.4%
Timber/Forest	19	0.3%
Other Undeveloped Land	1,570	22.4%
Streets (R.O.W.)	267	3.8%
Willamette River and Ponds	107	1.5%
Subtotal	3,531	50.3%
Grand Total	**7,023**	**100.0%**

**These categories are used to determine the amount of vacant land for future urban development.*
Source: LCOG 1998 Parcel File

2.3.2 Buildout Land Use

The primary land use policies pertaining to the Willamette River Basin are contained in the following locally adopted policy documents:

- Eugene-Springfield Metro Area General Plan (1987).
- Eugene Downtown Plan (1984).
- Glenwood Area Refinement Plan (1990).
- Goodpasture Island Study (1975).
- Willamette Greenway Ordinance (1982, amended 1986).

Lane County zoning applies to areas outside the UGB and City Codes apply within the UGB. Table 2-3 summarizes the buildout land use for the Willamette River Basin.

2.3.2.1 Buildout Land Use Within the UGB

This area includes both the current city limits and the unincorporated UGB. The UGB portion of the basin is 3,492 acres and, of this, only 295 acres are considered vacant for future urban development.

2.3.2.2 Projected Land Use Outside the UGB

Approximately half (3,531 acres) of the Willamette River basin lies outside the UGB. The majority of this land will remain in agriculture and forest use or convert to natural resource, parks and open space uses based on current plan designation. Areas outside the UGB are not permitted to develop to urban uses and, therefore, "vacant" acres do not apply here.

Table 2-3
Buildout Land Use

Generalized Plan Designation	Designated Acres	
	Total	Vacant* (1998) for Future Urban Development
Inside UGB		
Low-Density Residential	629	82
Medium-Density Residential	288	39
High-Density Residential and Mixed	217	15
Commercial and Commercial-Residential Mixed	464	31
Industrial and Commercial-Industrial Mixed	99	2
Parks and Open Space	573	44
Government, Education, Research	299	37
Agriculture and Agriculture/Airport Reserve	0	-
Sand and Gravel	4	0
Willamette River	320	-
Streets (R.O.W.)**	599	45
Subtotal	3,492	295
Outside UGB		
Rural Residential	136	0
Low-Density Residential	1	0
Commercial and Commercial-Residential Mixed	9	0
Industrial & Commercial/Industrial Mixed	12	0
Government, Education, Research	149	0
Parks and Open Space	332	0
Sand and Gravel	598	0
Agriculture and Agriculture/Airport Reserve	286	0
Forest	1,262	0
Willamette River	107	0
Streets (R.O.W.)**	638	0
Subtotal	3,531	0
Grand Total	**7,023**	**295**

Source: LCOG and City of Eugene Geographic Information System, 1998

***For purposes of this report, vacant acres apply to lands only within the urban growth boundary.**

***Notes: Streets (Right of Way). The Metro Plan does not have a "Streets" Plan designation. This amount was estimated based on the difference between total designated area and total basin size. In undeveloped areas, 15 percent of the land area was put into the Streets (Right of Way) category to account for streets that will serve future designated development.*

2.3.3 Surface Cover

Other than precipitation, surface cover is perhaps the single most influential factor that affects the volume, quality, and velocity of stormwater runoff and the ability to treat runoff through filtration and other natural processes. Pervious surfaces are undisturbed natural areas that retain native prairie or forest vegetation or lands in developed areas that are typically covered with lawn, agricultural fields, or pasture. In both cases, water is free to infiltrate into the ground. Undisturbed natural areas provide significant beneficial stormwater functions. They help reduce the volume and velocity of runoff by facilitating infiltration of precipitation into the ground.

Stormwater quality is best in undisturbed natural areas. The vegetative cover associated with undisturbed natural areas is also important for stabilizing steep slopes and streambanks. Pervious surfaces in developed areas also provide stormwater benefits, although to a lesser degree than undisturbed natural areas. The infiltration capacity may be reduced during conversion to urban lawns and agricultural crops. Stormwater quality may also be impacted by lawn care and agricultural practices.

In contrast, impervious surfaces are lands covered by hard surfaces such as rooftops, roads, and parking lots and allow little or no infiltration of water. Impervious surfaces are unable to absorb and infiltrate precipitation, which results in greater runoff volumes, higher but shorter duration peak flows, and higher concentrations of pollutants. The transition from undisturbed to developed land uses and densities involves a significant change from pervious to impervious surfaces. As a consequence, adequate facilities must be planned, constructed, and maintained to minimize drainage and flood problems and impacts to water quality and natural resources.

The purpose of this section is to describe surface cover conditions as they exist in 1998 and as they are projected to exist at buildout of the Willamette River basin urban growth boundary (UGB).

2.3.3.1 Impervious Surfaces

Total impervious surface area for the study area was calculated using a set of impervious surface area factors (ISAF) that were applied to the existing and buildout land use data. To calculate total impervious surface area, the ISAF percentages were multiplied by the total land area in each of the land use categories.

The ISAFs used are provided in Volume I. These factors were derived through a process that used existing developed properties in Eugene to generate typical impervious percentages. Impervious surface area for residential, commercial, and industrial land uses had previously been digitized as the basis for calculating stormwater user fees. By using this data source, the resulting ISAFs have been calibrated specific to the City of Eugene and in some cases specific to the basin. The ISAFs for land use categories that were not previously digitized were derived through review of national standards and by calculating the impervious surface area on sample sites.

The amount of existing impervious surface area in the UGB portion of the Willamette River basin is estimated to be 1,412 acres or 40 percent of the basin's UGB area. [Note: calculations for these data are available from the City of Eugene.] The majority of this impervious surface area is concentrated south and west of the river in the greater downtown and east-University areas. Map 3 depicts the existing generalized impervious surface area in pink. Due to the map scale and data restrictions, developed lots are shown entirely in pink. These pink areas are a mix of impervious surface and pervious surfaces associated with the land use such as lawns, streetscapes, parking lot planting, and other landscaped areas.

Assuming that future growth in the basin will follow conventional stormwater drainage practices and will develop according to the land use categories depicted on the Eugene-Springfield Metro

Plan designations (see Map 2), the amount of impervious acres in the UGB portion of the basin is projected to increase to 1,552 acres, or 44 percent of the basin's UGB area at buildout. [Note: calculations for these data are available from the City of Eugene.]

2.3.3.2 Pervious Surfaces

The majority of the remaining large blocks of pervious surface area in this basin are located along the river as parks and open space within the UGB, and in the two non-UGB areas. The remaining pervious surface is in the form of lawns and landscaped areas associated with developed land uses, parks, and small vacant lots.

Overall, pervious area cover is expected to decrease from the current 60 percent of the UGB portion of the basin (2,081 acres) to 55 percent (1940 acres) at UGB buildout. For the purposes of this report, pervious surface areas were identified and grouped into *Forest Cover*, *Landscaping*, and *Other Vegetated Areas* (refer to Figure 2-4) for the following reasons:

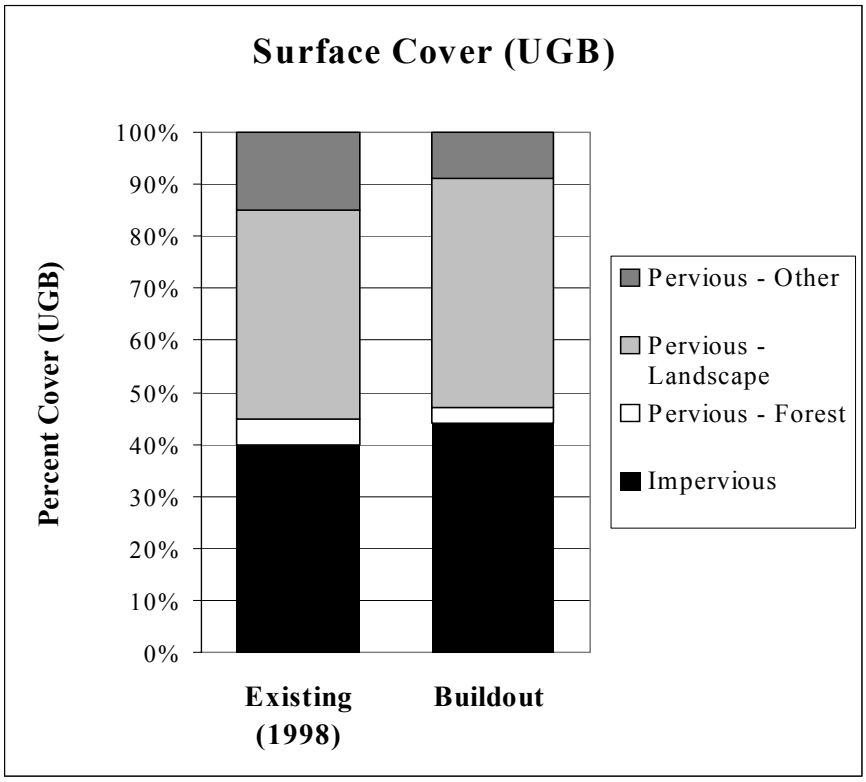
- Forest Cover is highly effective in reducing runoff volumes, and in preventing erosion (e.g., reduces soil impact by slowing down the velocity of precipitation and by intercepting up to 35 percent of it before hitting the ground) and stabilizing steep slopes (established root zones). Areas were included in this category if the forested area exceeded one acre in size. Only 5 percent of the Willamette River basin is currently in forest cover which is located outside the UGB.

- Landscaping areas, including lawns, streetscape and parking lot landscaping are associated with site improvements due to urban development. This category was distinguished to highlight both its positive and potential negative impacts on stormwater resources and is included in the area shaded pink on Map 3. Positive impacts include protection of surface soils, filtration of sediments, and some infiltration (although this is reduced from pre-development conditions). The use of chemical fertilizers, pesticides, and herbicides can cause negative impacts to water quality. The amount of landscaped area in the UGB is projected to increase from the existing 40 percent to 44 percent at UGB buildout.

- Other Vegetated Areas are pervious surfaces not in *forest cover* or *landscaping* use, such as agricultural fields, pasture, vacant lots, prairie wetlands, and small clusters of trees (less than one acre). Similar to the landscaping category, these areas have both positive and negative impacts on stormwater resources. Agriculture and pasture uses can be significant contributors of pollutants in this category due to the use of chemical fertilizers, pesticides, herbicides, and fecal coliform due to grazing. This category is expected to decrease from 15 percent of the UGB to 9 percent at UGB buildout.

Figure 2-4 compares the percentage of existing and projected surface cover for the UGB portion of the Willamette River basin.

Figure 2-4
Surface Cover in the Willamette River Basin UGB



2.4 Landform, Topography, Slopes

The Willamette River main stem is the prominent water feature in this basin. It begins at the convergence of the Middle and Coast forks near Lane Community College, then flows northwesterly through the UGB and beyond to the basin's northerly boundary where it is joined by the McKenzie River.

The topography of the Willamette River basin is predominately flat with 63 percent having slopes not greater than 5 percent. These lowlands are generally in the central and northern portions of the basin. In contrast, steep hills flank the southern border reaching elevations of 1,200 feet or greater along the ridgeline. Twenty-six percent of the basin has slopes greater than 10 percent. These slopes are primarily found in the southern portion of the basin (Lane Community College). Significant landforms include the South Hills and Skinners Butte, an intrusive formation in the central portion of the basin which is approximately 660 feet high.

The following table is keyed to Map 4, Slope and Topography, and indicates the percent of the basin affected by varying categories of slope steepness.

Table 2-4
Willamette River Basin Slope Distribution

Location	Slope Distribution (percent)				
	Slopes 0-5%	Slopes 6-10%	Slopes 11-15%	Slopes 16-25%	Slopes >25%
Within UGB	81%	8%	3%	4%	3%
Outside UGB	43%	13%	14%	21%	9%
Total Basin	63%	11%	8%	12%	6%

2.5 Surface Water Features and Drainage System

This section describes the existing drainage features of the basin including the City's stormwater facilities, open waterways, and wetlands. Refer to Map 5.

2.5.1 Waterways

Pre-settlement (prior to 1855) morphological conditions in the Willamette Valley reflected a network of shallow, broad swales that would often over-bank during storm events creating ponded conditions. Today, most of the drainages have been altered into narrow, deep and well-defined channels where the management objective of preventing flooding has been accomplished for most small storm events.

The Willamette River is the main drainage feature in the basin. Just east of the southern end of the basin boundary the Middle Fork and Coast Fork of the Willamette come together to form the main channel of the river. The Willamette then enters and flows through the study area for approximately 12 miles before exiting the study area at the river's confluence with the McKenzie River. The Willamette eventually collects almost all of the Eugene-Springfield metropolitan stormwater runoff either directly or through the McKenzie or Long Tom River watersheds at points outside the metropolitan area. Other open stream drainage features in the basin are Russell Creek and the Millrace.

2.5.1.1 Willamette River

The Willamette River enters the study area at the urban growth boundary's (UGB) upstream crossing of the river near Exit 189 on Interstate-5, river mile 187. For the first three miles the basin's boundary runs directly down the middle of the river as it curves to change direction from north to west. Once under the Interstate-5 bridge the basin boundary expands to include the eastern side of the river; it is also here that drainage from the Laurel Hill basin discharges to the Willamette. Downstream of this point the river begins to flow northwest through the most heavily urbanized section of the basin. Once past the downtown, the river flows due north and then northeast before exiting the UGB at Beltline Road. Outside the UGB the river splits into two channels shortly before its confluence with the McKenzie River. Major open drainage outfalls into the Willamette from the metropolitan area include natural drainages such as Debrick Slough and Dotson Slough as well as constructed waterways including the Eugene Millrace, West and North Beltline floodways, and the Q Street Floodway. Drainage from areas adjacent to

the Willamette River drain directly into the river via overland flow, small ditches and swales, and through piped systems.

Willamette River Natural Riparian System

Natural areas bordering the Willamette River, including all of the natural riparian areas along the Willamette within the UGB, are wide and relatively healthy and have good structural diversity. Natural areas include all of the natural riparian areas along the Willamette within the UGB. The riparian strip in Alton Baker Park near the Autzen footbridge is an example of such an environment. Natural banks provide habitat for an impressive number of tree and shrub species, birds, mammals, and reptiles, and it functions as a heavily used wildlife corridor. These areas also support fish populations by providing shade, sources of food, erosion protection, and stormwater filtration. This segment of the river is listed on the *Metropolitan Plan Natural Resources Study* (NR Study) as a riparian resource (refer to WA/WB: Willamette River Natural/Urban). The NR Study gives the Willamette River Natural area one of the highest wildlife ratings for the entire Metro area.

Willamette River Urban Riparian System

Urban portions of the riparian environment typically have a narrow riparian strip adjacent to residential, commercial, and parkland development. . These areas support the same types of wildlife as the natural areas, only fewer in number. These stretches function as a buffer between urban uses and the river and provide wildlife corridors, protection from streambank erosion, and filtration for stormwater runoff. This segment of the river is listed *on the* NR Study as a riparian resource (refer to WA/WB: Willamette River Natural/Urban).

2.5.1.2 Eugene Millrace

Almost as old as the City of Eugene, the Millrace is a human-made canal created by connecting two natural sloughs in the mid-nineteenth century for the advancement of the local timber industry. Once large enough to drive commercial mills, the waterway over time has been modified and constricted by development so that flow has diminished from its historical volume. Today the Millrace functions as a park attraction as well as serving as a municipal stormwater drainage facility. The Riverside Research Park Master Plan designates the channel as a receptor for runoff from development south of the Southern Pacific Rail Road tracks. The waterway begins at Judkins Point where pumps have replaced the original channel mouth. Pumps are necessary to keep the Millrace flowing due to years of flooding that have cut the river bed too deeply to supply sufficient water volumes. The Millrace parallels the river for approximately 1.2 miles passing through commercial, residential, and park lands before entering a culvert near the Eugene Water and Electric Board for conveyance back to the river. The area serves as habitat and corridors for some species of wildlife, a function that is accentuated by proximity to the Willamette River.

The City of Eugene purchased the Millrace in the 1940's while obtaining right-of-way for the Ferry Street Bridge at the downstream end. The remaining upstream portions were to be used for recreation. The University of Oregon bought a section north of the school, where the Riverfront

Research Park is now located, in order to use the waters in their heating process and to provide a recreational area and open space for the campus.

The Willamette Greenway Boundary includes the Millrace and the area located from north of its south bank to the river. Under this designation, development plans are subject to planned unit development or conditional use permit procedures.

The Millrace is listed on the NR Study as a riparian resource (refer to E40: Riverfront Park).

2.5.1.3 Russell Creek

The tributaries of Russell Creek originate in the western hills in the southern portion of the basin, south of the UGB and also referred to as the Lane College (LC) Major Subbasin. Several eastern flowing drainages come together at approximately 30th Avenue and Gonyea Road, west of Lane Community College, and enter a series of constructed ponds on the south side of 30th Avenue. Natural drainage continues north of 30th into a lowland area classified as a National Wetlands Inventory (NWI) wetland. The eastern side of this wetland narrows into a channel before flowing under Interstate-5 just north of its intersection with 30th. The channel then empties into the Coast Fork of the Willamette River shortly before its confluence with the Middle Fork.

2.5.2 Wetlands

A comprehensive wetlands inventory has not been conducted for the entire Willamette River basin. Wetland features described in this section were identified based on a combination of the National Wetland Inventory (NWI) and the Metrowide NR Study. The NWI provides basic data about general characteristics and the extent of the wetland's general boundaries. In many instances actual wetland boundaries and features are more extensive than what is identified through this national classification system. Although the NR Study provides a higher level of detail about many of the wetland sites within the basin, the emphasis of the NR Study is on wildlife habitat value rather than stormwater functions and values. See Map 5.

Wetlands in the Willamette River basin identified in the NWI comprise 754 acres, or about 10 percent of the entire basin. Fifty-six percent of these wetlands (424 acres) are located inside of the UGB. All basin wetlands are hydrologically linked to the Willamette River, many are located within the floodway and subject to inundation, especially in the winter months.

One of the most distinctive wetland areas in the basin is the western portion of the Delta Ponds. Delta Ponds is a system of more than 25 ponds, remnants of sand and gravel extractions, located both east and west of Delta Highway between Valley River Center and Beltline Road. Natural processes have almost completely re-vegetated these former gravel pits with more than 90 species of plants, 60 species of birds, and many mammals, reptiles, and fish species. The majority of these ponds are outside of the Willamette River study area; however, the 65-acre site within the study area is adjacent to the Willamette River and includes open water, wetland, and riparian forest. Its proximity to the river allows it a higher wildlife rating from the NR Study than other portions of the Delta Ponds system. Delta Ponds is listed on the *Metropolitan Plan Natural Resources Study* (NR Study) as a wetland resource (refer to E51: Delta Ponds A-E).

Delta Ponds is considered a jurisdictional wetland. The entire Delta pond system is within the adopted Willamette Greenway Boundary making development plans subject to planned unit development or conditional use permit procedures.

The northern section of the basin contains similar, but somewhat younger, ponds that have been created during sand and gravel mining operations. Abandoned extraction areas have been allowed to fill up with groundwater seepage and runoff and have become part of the NWI. Another area identified as a NWI wetland exists in the Russell Creek drainage near Lane Community College, north of 30th Avenue.

2.5.3 Piped System

The basin's drainage system contains about 10.5 miles of open channels and 53.9 miles of pipe. All of the piped system is within the city limits and is concentrated in Eugene's downtown area. The 12-mile stretch of the Willamette River within the basin is not included in the linear measure of open channel. The piped system primarily serves the function of carrying stormwater away from development and conveying it to the Willamette River at various discharge points.

2.5.4 Maintaining the Drainage System

The City of Eugene's Maintenance and Parks and Open Space Divisions are responsible for the maintenance of public stormwater facilities within the city limits, except for facilities within Oregon Department of Transportation or Lane County right-of-ways such as Interstate-5 and Highway 99. The City does not have maintenance responsibility for areas outside of the city limits. Lane County, the State of Oregon, and Oregon Department of Transportation (ODOT) have maintenance responsibility for facilities, depending on ownership, in both the northern and southern sections of the Willamette River basin. Open channels on private property that do not carry runoff from public property are the responsibility of the private property owner.

Maintenance activities include occasional cleaning of open channels and periodic checking and cleaning of catch basins. Channel maintenance activities are performed to ensure hydraulic capacity to prevent flooding problems.

In the late 1960's the University of Oregon and the City of Eugene entered into an agreement which divided the responsibility for maintaining the Millrace. In addition, the City's Maintenance Division and the University's Physical Plant observe a verbal agreement to support each other in common efforts to respond to and mitigate any environmentally threatening spills in the Millrace within the University's area of responsibility.

2.5.5 Floodplain

A flood insurance study for the Federal Emergency Management Agency (FEMA) has been conducted within the Willamette River basin. As part of this study, areas subject to flooding by the 100-year storm event have been identified. Twenty-nine percent of the entire basin (2,123 acres) is within the 100-year floodplain, 888 acres (23 percent) inside of the UGB and 1,235 acres (35 percent) outside of the UGB. The floodplain in this basin is exclusively associated

with the Willamette River. It is fairly narrow for the first three upstream miles but begins to fill a significant portion of the eastern side of the basin across the river from downtown Eugene and close to the Delta Ponds area. This flood hazard pattern continues until the river exits the UGB in the north. Here the floodplain combines with the McKenzie River's floodplain and spreads significantly to include most of this section of the basin. Areas of flood hazard continue out of the basin toward the flatland to the northwest, in the direction of natural drainage. See Map 5.

2.6 Water Quality

This section provides a description of water quality conditions in the Willamette River basin. Water quality conditions can vary depending on time of day, weather conditions, land use activities conducted in the watershed, and location in the water body. Therefore, without significant amounts of data, it is often difficult to adequately evaluate water quality conditions. It is even more difficult to evaluate the water quality impacts of stormwater runoff on receiving waters. Therefore, a variety of available sources of water quality-related information was reviewed in an attempt to provide a general picture of water quality conditions in the basin. The following sources of information were reviewed and are described below:

- Documented water quality problems based on existing chemical data, biological data, and field observations.
- Oregon Department of Environmental Quality's (DEQ's) designations of water quality limited water bodies.
- Natural and built environmental conditions that influence water quality.

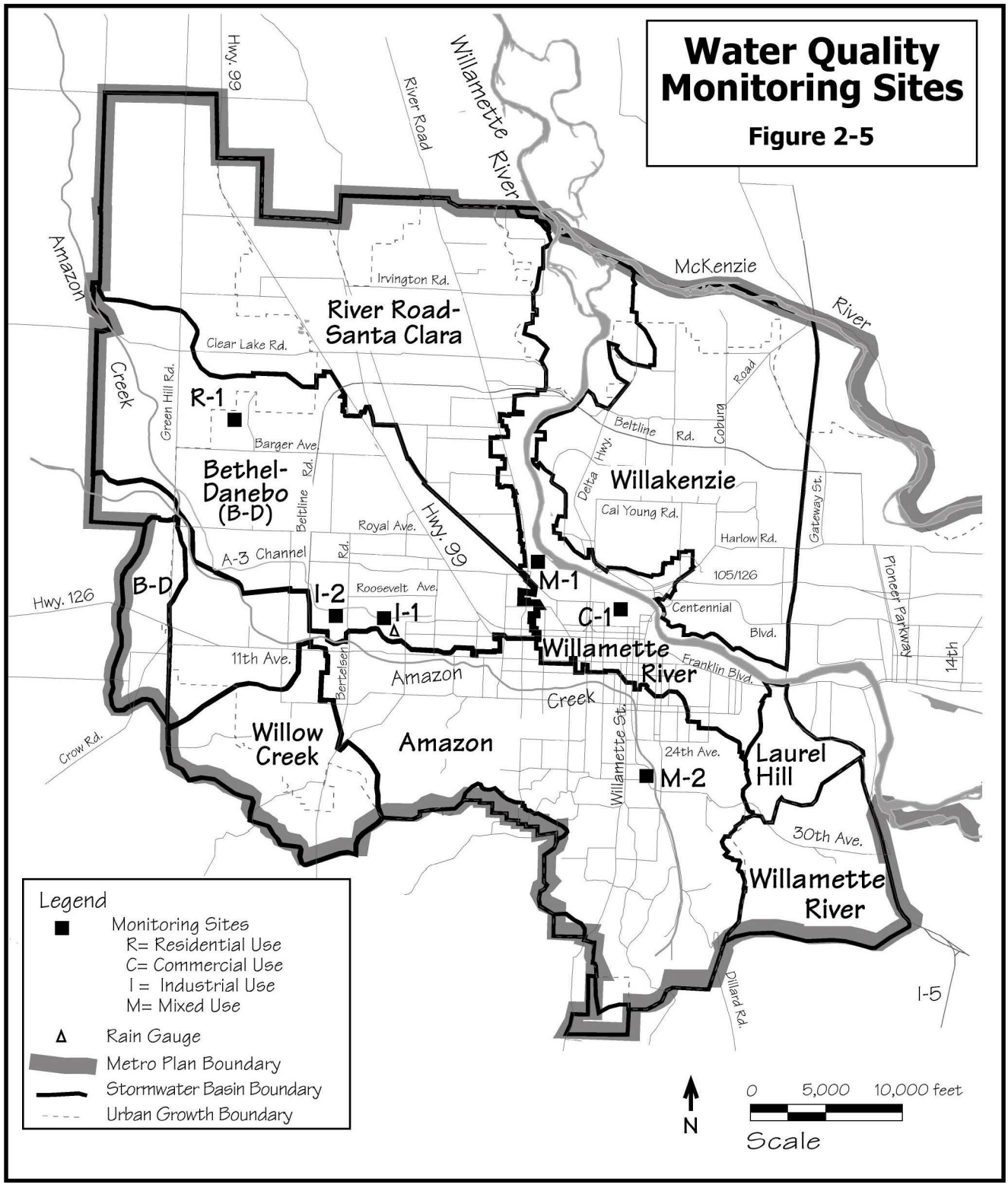
2.6.1 Documented Water Quality Problems

The following subsections describe the water quality problems that have been documented for the Willamette River basin in terms of chemical stormwater monitoring data, macroinvertebrate sampling, and field observations.

2.6.1.1 Chemical Stormwater Monitoring Data

The City collected and analyzed samples of stormwater runoff from 1992 to 1997 at 6 sampling stations in Eugene (see Figure 2-5). The 6 sampling stations were selected to represent runoff from various land uses. In 1998, the storm event monitoring at the 6 sampling stations was discontinued and a pilot project on the A3 Channel using a basin approach to water quality monitoring was implemented. The revised monitoring plan consisted of collecting monthly composite samples at the original industrial land use station on the A3 Channel (station I1) and collecting samples at selected high source areas in the piped system on the A3 Channel.

The following table provides a summary of the results collected during 1992 to 1997 from the 6 sampling stations. Table 2-5 includes a description of the problem pollutants, typical sources of the pollutants, specific results from Eugene, and potential problems associated with the pollutants. Although two of the stormwater monitoring stations were located in the Willamette River basin, all of the City-wide data were also used to provide general information regarding


Water Quality Monitoring Sites
Figure 2-5
Hwy. 99
River Road
Willamette River
McKenzie River
Amazon Creek
Irvington Rd.
River Road-Santa Clara
Clear Lake Rd.
Green Hill Rd.
R-1
Barger Ave.
Bethel-Danebo (B-D)
Beltline Rd.
Royal Ave.
A-3 Channel
Hwy. 99
B-D
Hwy. 126
I-2
Roosevelt Ave.
I-1
11th Ave.
Bertelsen Rd.
Crow Rd.
Willow Creek
Amazon Creek
Amazon
Delta Hwy.
Beltline Rd.
Coburg Road
Willakenzie
Cal Young Rd.
Harlow Rd.
Gateway St.
105/126
Centennial Blvd.
Pioneer Parkway
M-1
C-1
Willamette River
Franklin Blvd.
Willamette St.
24th Ave.
M-2
Laurel Hill
30th Ave.
Willamette River
14th
I-5
Dillard Rd.
Legend
Monitoring Sites
R= Residential Use
C= Commercial Use
I = Industrial Use
M= Mixed Use
Rain Gauge
Metro Plan Boundary
Stormwater Basin Boundary
Urban Growth Boundary
N
0 5,000 10,000 feet
Scale

stormwater quality in Eugene and were used in identifying a stormwater management strategy for this basin.

Table 2-5
Summary of Stormwater Quality Monitoring in Eugene

Pollutant	Description	Sources	Eugene's Results	Potential Problems
Bacteria	- Enterococcus, - Fecal coliform, and - Fecal streptococcus	- Animal Wastes (droppings from wild/domestic animals), - Human Wastes (leaking sanitary sewer pipes, and seepage from septic tanks).	**Results from almost all of the samples significantly exceeded the DEQ standard for water quality**.	These are commonly used indicators of human pathogens. Water contact may cause eye and skin irritations and gastro-intestinal diseases if swallowed.
Heavy Metals	Antimony Arsenic Beryllium Cadmium Chromium Copper Lead Mercury Nickel Selenium Silver Thallium Zinc	- Vehicles (combustion of fossil fuels, improper disposal of car batteries, wear/tear of tires and brake pads), - Metal Corrosion, - Pigments for Paints, - Solder, - Fungicides, - Pesticides, - Wood Preservatives	Cadmium, chromium, copper, lead, nickel, and zinc were typically present in samples. **Copper, lead, and zinc in stormwater samples frequently exceeded DEQ standards for the protection of aquatic life.**	Heavy metals are toxic to freshwater aquatic ecosystems. These metals are considered to be the most significant toxic substances which are commonly found in urban stormwater runoff.
Oil & Grease	A broad group of pollutants including: - Animal fats, and - Petroleum products.	- Food Wastes (animal and vegetable fats from garbage), - Petroleum Products (gas, engine oil, lubricants, etc.).	**Two of fifty-three samples had concentrations which exceeded discharge limitations specified for industrial stormwater discharges (i.e., > 10 mg/L).**	These compounds can coat the surface of the water limiting oxygen exchange, clog fish gills, and cling to waterfowl feathers. When ingested these compounds can be toxic to birds, animals and other aquatic life.
Sediments	Sediments in the water are considered pollutants when they exceed natural concentrations and negatively affect water quality and/or beneficial uses of the water.	- Erosion from increased stream flows, - Construction site runoff, - Landscaping activities, - Agricultural activities, - Logging, - All other activities where the ground surface is disturbed.	**Excess levels were measured at all stations. Results from the urban sampling stations in Eugene were all 40% to 70% higher than results from an open space (i.e., undeveloped) sampling.**	Sediments cause increased turbidity, reduced prey capture for sight feeding predators, clogging of gills/filters of fish and aquatic insects, and blocked light which limits food production available for fish. Sediments also accumulate in stream bottoms which reduces the capacity of the stream (and hence increases the potential for flooding) and covers stream bottom habitats. Sediment also acts as a carrier of toxic pollutants such as metals and organics.
Nutrients	- Nitrate - Ammonia - Kjeldahl Nitrogen - Phosphorus - Orthophosphate	- Landscaping activities, - Yard debris, - Human wastes (leaks from septic tanks and sanitary sewers), - Animal wastes, - Vehicle exhausts, - Agricultural activities, - Detergents (car washing), - Food Processing	**The DEQ guidance value of 0.1 mg/L for total phosphorus was exceeded in 100% of the samples collected.**	Excess levels of nutrients can lead to eutrophication in downstream receiving waters. Problems include surface algal scums, odors, reduced oxygen levels, and dense mats of algae. In addition to water quality problems, these effects have a negative impact to the aesthetic quality of water bodies.
Organics	There are many organic compounds, however, the synthetic organics are of most concern and include: - Fuels - Solvents - Pesticides - Herbicides.	- Illegal dumping, - Illicit connections, - Spills, - Leaks from drums and storage tanks, - Landscaping activities - Agricultural activities.	Although sampling for these compounds was limited, **nine volatile organic compounds were detected (including one pesticide).**	Most synthetic organics are highly toxic to aquatic life at very low concentrations, and many are carcinogenic (cancer causing) or suspected carcinogens. Diazinon has been identified in many recent studies as one of the causes of toxicity in stormwater.

Table 2-5 (continued)

Pollutant	Description	Sources	Eugene's Results	Potential Problems
Litter and other Floatable Debris	- Plastics, - Paper products, - Yard debris, - Tires, - Metal, - Glass.	- Littering, - Dumping, - Spills.	Sampling for litter and floatables was not conducted, however, **specific problem dumping areas have been identified in Eugene** (see notes below).	These pollutants degrade the aesthetic quality of water bodies. In addition, they contribute pollutants as they decompose, and they can reduce the capacity of the water body. Excess yard debris contributes to high levels of nutrients and it reduces oxygen levels as it decomposes.

Based on results from the above monitoring program and the results from state-wide monitoring efforts (ACWA, 1997), industrial and commercial land uses have been identified as significant sources of stormwater pollutants (i.e., high source areas). In the Willamette River basin, dense commercial development is located in the downtown core of Eugene, especially along W. 6th and 7th Avenues and in an area bounded by 6th and 14th to the north and south and between Olive and Hilyard Streets to the east and west.

2.6.1.2 Findings from Macroinvertebrate Sampling

Aquatic macroinvertebrate sampling is useful in evaluating water quality and ecological integrity. Pronounced changes in biological communities indicate a disruption of healthy environmental conditions and can be useful in identifying cumulative effects of pollutants, habitat alterations, effects from bioaccumulative chemicals, and other impacts that chemical monitoring may not reveal.

No macroinvertebrate sampling has occurred in the Willamette River basin.

2.6.1.3 Field Observations of Water Quality Problems

In addition to the information obtained from the stormwater monitoring data described above, specific water quality related problems/issues have been observed in this basin as follows:

- *Water Quality Issues Associated with Major Outfalls:* Discharges with visible water quality problems have been observed at major outfalls draining to the Willamette River; especially the Polk Street outfall. Public complaints have been received regarding this problem.

- *High Source Areas:* A high concentration of automobile-oriented businesses and commercial land uses drain directly to the Willamette River and/or the Delta Ponds. These uses are considered to be potential high source areas with respect to stormwater pollutants.

- *Unstable Banks:* Bank failures have been observed at outfall discharge points to the Willamette River and along the south bank of the Willamette River within Skinner Butte Park.

- *Bacterial Contamination:* Due to the amount of resident geese and ducks, the Millrace and Alton Baker Park are suspected of being significant sources of bacteria.

- *Tip-ups:* Sediment and debris that has been observed to accumulate in tip-ups is likely getting flushed into downstream open waterways during larger storm events.

- *Debris in the Open Waterways:* Significant amounts of trash and debris are dumped into the open waterways and have specifically been noted as a problem at Beltline Highway.

2.6.2 Oregon Department of Environmental Quality Water Quality Limited Designations [303(d) List]

The federal Clean Water Act requires states to maintain a list of water bodies that do not meet water quality standards. These standards are established to protect beneficial uses such as drinking water, fisheries, industrial water supply, recreational, and agricultural uses. This list is called the 303(d) List based on the section of the Clean Water Act that mandates this requirement. The list is meant only as a means of identifying water quality problems and not the causes.

States must monitor water quality and review available data and information to determine if the standards are being met. In Oregon, this responsibility is carried out by the Department of Environmental Quality (DEQ). If available data indicate a water body is not meeting water quality standards, and the data meet listing guidelines, DEQ must assume that the water body is water quality limited. Water bodies with no information, or information incompatible with the EPA guidelines, are not included on the 303(d) list. The 303(d) list is updated and revised every two years. Once a water body is included on the 303(d) list, DEQ is required to develop a total maximum daily load (TMDL) requirement for both point and non-point sources of the pollutants of concern. It is anticipated that DEQ will develop TMDL requirements for all designated water quality limited water bodies in the State of Oregon sometime within the next ten years.

The reach of the Willamette River within the Willamette River basin is listed on the 303(d) list for temperature and mercury.

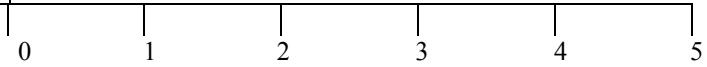
2.6.3 Natural and Built Conditions

Evaluating the natural and built conditions that influence water quality can be useful in indirectly assessing water quality conditions in the basin. As urbanization occurs, negative impacts to the health of receiving waters result from changes in the quality of stormwater runoff. Natural features such as riparian areas, wetlands, and open drainage systems have the ability to treat stormwater pollutants, prevent waterway scour by slowing down runoff rates, settle out sediments, and protect stream banks from erosion. However, with research showing that water quality degradation occurs at relatively low levels of imperviousness (10-20 percent), the implications of development on water quality are significant.[1] Figures 2-6, 2-7, and 2-8 examine natural and built conditions relative to the other Eugene drainage basins.

[1] Tom Schueler, et al. *Site Planning for Urban Stream Protection: The Importance of Imperviousness*, 1995.

Figure 2-6
Extent of Open Drainage System in the Willamette River Basin (UGB)

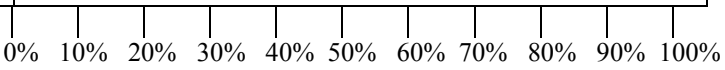
Miles per Square Mile Of Open Drainage System in the Willamette River Basin	Willamette River Basin [▼] Relative to The Range in Other Eugene Basins (miles/sq mile)
.50*	



*Represents local waterways; does not include the Willamette River

Figure 2-7
Extent of Area as a Percentage of the Willamette River Basin (UGB)

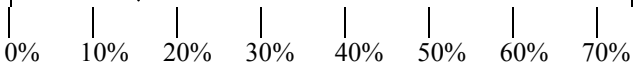
Factors	Percent in Willamette River Basin	Willamette River Basin [▼] Relative to the Range in other Eugene Basins
Remaining Vacant Lands*	8%	
Existing Impervious Surface Area	40%	
Projected Impervious Surface Area	44%	
Wetlands	11%	
100-Year Floodplain	29%	



*_Vacant land_ includes tax-lotted areas currently in vacant, agricultural, and timber uses.

Figure 2-8
Extent of 100-Year Floodway Fringe that is Vacant in the Willamette River Basin

Percent of 100-Yr. Floodway Fringe Vacant* in the Willamette River Basin	Willamette River Basin [▼] Relative to The Range in other Eugene Basins
16%	



*_Vacant land_ includes tax-lotted areas currently in vacant, agricultural, and timber uses.

2.6.4 Conclusions

A summary of the above findings suggest that degraded water quality conditions exist in the Willamette River basin as follows:

- Willamette River is on the Oregon Department of Environmental Quality's 303(d) list for temperature and mercury.

- Based on the analysis of stormwater runoff samples collected from Eugene and other urban areas in Oregon, the pollutants of concern that were identified are as follows:
  - Total Suspended Solids (TSS)
  - Nutrients
  - Heavy Metals
  - Bacteria
  - Oil and Grease
- Commercial and industrial areas have shown to be the most significant contributors of specific stormwater pollutants and a high concentration of commercial areas exists in this basin.
- At 40 percent, the basin currently has levels of imperviousness that are expected to degrade water quality. Projections indicate that the impervious surface area will increase to 44 percent.
- Discharges with visible water quality problems have been observed at major outfalls draining to the Willamette River; especially the Polk Street outfall.
- Bank failures have been observed at outfall discharge points to the Willamette River and along the south bank of the Willamette River within Skinner Butte Park.
- Due to the amount of resident geese and ducks, the Millrace and Alton Baker Park are suspected of being significant sources of bacteria.
- Sediment and debris that has been observed to accumulate in tip-ups is likely getting flushed into downstream open waterways during larger storm events.
- Significant amounts of trash and debris are dumped into the open waterways and have specifically been noted as a problem at Beltline Highway.

2.7 Rare, Threatened, and Endangered Plants, Animals, and Communities

Stormwater management decisions and practices can affect rare, threatened, and endangered plant and animal species. Local populations can be reduced or even eliminated as a result of decisions to pipe a waterway, install upstream detention, or to allow significant increases in runoff due to new development. The purpose of this section is to describe the known rare species and communities located in the study area so that the details of these resources can be consulted prior to any final decisions.

Table 2-6 indicates rare plant and animal species that have been observed in the Willamette River basin and that appear on the Oregon Natural Heritage Program's data base. Specific locations of these species are available through the Oregon Natural Heritage Database Program. Due to the WEWP and The Nature Conservancy's interest in the Willamette Valley Wet Prairies, the most extensive surveys for rare plant and animal species have occurred in the Willow Creek, Amazon Creek, and Willamette River basins. As a consequence, more species information is known about these areas than in the other basins; however, given the relatively high level of urban development in the remaining basins, the occurrence of rare species is likely to be low when compared with basins within the WEWP Boundary.

In March 1999, the National Marine Fisheries Service (NMFS) listed spring-run Chinook salmon as a threatened species under the Endangered Species Act (ESA). It includes all naturally spawned populations of Spring Chinook in the Clackamas River, and in the Willamette River

and its tributaries above Willamette Falls, Oregon. Because runoff from Eugene discharges either directly or indirectly to the Willamette River, the listing will affect the City's stormwater management program and practices.

A species that is listed as *threatened* means it is *likely to become endangered within the foreseeable future throughout all or a significant portion of its range.* Protective regulations, known as 4(d) rules have been developed that are *deemed necessary and advisable to provide for the conservation of the species*. These rules spell-out the *take* prohibitions that pertain to Spring Chinook and focus on the type of activities that are likely to lead to a *take*. The City is in the process of reviewing its own processes, procedures, and development standards for identifying and adjusting those that may not be compatible with the 4(d) rules.

Table 2-6 displays the inventoried rare plants and animal species within the Willamette River basin.

Table 2-6
Rare Plants and Animals in Willamette River Basin

Species/Communities	Federal		State		TNC Rank		Associated	ONHP
	Listed	Candidate	Listed	Candidate	Global	State	Habitat	List
Oregon Chub (*Oregonichthys crameri))*	E			SC	G2	S2	Aquatic	1
Timwort (*Cicendia quadrangularis)*					G4	S2	Wet Prairie	2
Pacific western big-eared bat (Plecotus townsendii)		SOC			G4T4	S3	Uplands-Rocks, Caves, Bridges	2
Pallid bat *(Antrozous pallidus)*				SV	G5	S3	Uplands-Rocks, Caves, Bridges	3
Purple martin (Progne subis)				SC	G5	S3	Upland Forest	1
Tall bugbane (Cimicifuga elata*)*		SOC		C	G2	S2	Coniferous Forest	1
Wayside aster (Aster vialis)		SOC	T		G2	S2	Coniferous Forest	1
Western pond turtle (*Clemmys marmorata marmorata*)		SOC		SC	G3	S2	Riparian/Wetlands	2

KEY: *Federal and State (E=Endangered, T=Threatened, C=Candidate throughout its range, SOC=Species of Concern, SC=Sensitive/Critical, SV=Sensitive/Vulnerable, *=Under Consideration for Protective Status).* ***TNC Rank*** *(State Rank: 1=critically imperiled, 2=imperilled, 3=rare, uncommon or threatened but not immediately imperiled, 4=not rare and apparently secure, and 5=demonstrably secure, widespread. Global Rank: The number is prefixed by a "G" and for the state an "S". A "T" ranks subspecific species on a global scale (but not on state scale).* ***ONHP List*** *(List 1= threatened or endangered throughout their range, List 2= threatened or endangered in Oregon but more stable elsewhere, List 3 = need more information, List 4=species of concern but are not currently threatened or endangered.)*

2.8 Soils

Soil characteristics are important factors in predicting the amount, rate, and quality of stormwater runoff and for selecting management measures for addressing the effects of runoff. This section describes the key soil parameters relative to stormwater issues and the distribution of those parameters in the Willamette River basin. All soils data were obtained from the *USDA Soil Survey of Lane County*. Refer to Tables 2-7 to 2-9 and Maps 6 to 10 for a description of the soil mapping units and relevant stormwater related data found in the Willamette River basin.

2.8.1 Permeability

Soil permeability measures the rate of water movement through the soil horizon. This factor is important in managing stormwater quantity and quality. Soils with slow permeability rates are more likely to result in higher stormwater runoff volumes than soils of high permeability. Under these conditions, larger and more extensive stormwater facilities are needed to accommodate new development where space permits. In more densely developed areas, slow permeable soils may be better suited to stormwater conveyance and storage facilities than infiltration facilities. Storage facilities could include detention ponds and treatment ponds where time is desired for settling and filtering purposes.

Soils in the Willamette River basin range from very slow to very rapid, with moderately slow having the highest percentage in the UGB at 37%. Generally, soils rated moderate to very rapid are located immediately along the Willamette River areas of and lower permeability are located in the LCC basin and east-University area.

Table 2-7
Soil Permeability in the Willamette River Basin

Location	Permeability (percent)							
	Very Rapid	Moderately Rapid	Moderate	Moderately Slow	Slow	Very Slow	No Data*	Total
Within UGB	6%	18%	10%	37%	8%	8%	13%	100%
Outside UGB	3%	9%	2%	4%	41%	17%	24%	100%
Total Basin	5%	14%	6%	21%	24%	12%	18%	100%

Source: USDA Soil Survey of Lane County Area, Oregon, 1987.
**Includes borrow pits and ponds.*

2.8.2 Runoff Potential

Soil groups have been rated according to their runoff potential under nonvegetated and saturated conditions without consideration of topographic conditions. Runoff potential measures a soil's capacity to permit infiltration and, therefore, can be used to describe the degree of runoff expected during storm events. For example, soils rated with a "low runoff potential" are more likely to have high infiltration rates, and conversely, soils rated "high runoff potential" are more likely to have a very slow infiltration rate. Hydrologic stormwater models often use this parameter in conjunction with slope and surface cover factors for estimating surface flows under undeveloped conditions.

As shown on Map 7, soils of the Willamette River basin demonstrate a range of runoff potential from high to low. High runoff soils are located in the LCC basin and downtown area and low runoff soils are immediately adjacent to the river.

The following table displays the distribution of soils by rate of runoff for the basin:

Table 2-8
Runoff Potential in the Willamette River Basin

Location	Runoff Potential (percent)					
	High	Moderately High	Moderately Low	Low	No Data*	Total
Within UGB	15%	38%	30%	6%	11%	100%
Outside UGB	50%	12%	11%	11%	16%	100%
Total Basin	32%	25%	21%	9%	13%	100%

Source:USDA Soil Survey of Lane County Area, Oregon, 1987.
**Includes borrow pits and ponds.*

2.8.3 Erodible Soils

Highly erodible soils have significant stormwater management implications. If not properly protected during construction and land clearing activities, erosion and sedimentation from these soils can have the following negative effects:

- Reduction in the conveyance capacity of downstream stormwater facilities resulting in potential drainage and flooding problems.
- Reduction or elimination of aquatic habitat and covering or destroying of spawning beds.
- Water quality impacts due to pollutants that are attached to sediments.

As shown on Map 8, highly erodible soils are located primarily in the LCC basin and east-University area.

The City's erosion prevention program has designated highly erodible soils as one of the criteria for sensitive area designation. Construction sites containing these soils are required to obtain an erosion prevention permit so that appropriate management measures can be designed and implemented to prevent and/or minimize erosion impacts.

Table 2-9
Soil Erodibility – Willamette River Basin

Location	Erodible Soils (percent)			
	High	Moderate	Low	Total
Within UGB	13%	0%	87%	100%
Outside UGB/UR	51%	11%	38%	100%
Total Basin	32%	6%	62%	100%

Source: USDA Soil Survey of Lane County Area. Oregon, 1987.

2.8.4 Unstable Slopes

Approximately 26 percent of the basin is affected by soils that are subject to slumping (see Map 10 soil types). Almost all of the soils subject to slumping in the basin coincide with steep slopes and occur in the southern portion of the basin, outside the UGB. It is notable that 46 percent of the soils outside the UGB are subject to slumping.

2.8.5 Hydric Soils

Hydric soil is one of three criteria for determining the presence of wetlands; the other two being inundated or saturated soil conditions and the presence of hydrophytic vegetation. Federal and state regulations limit activities that can occur in wetlands, including the direct discharge of untreated stormwater runoff. The Oregon DEQ has not yet established such standards for discharging into wetlands.

Map 9 displays the basin's hydric soils (about 15 percent of the basin) and the National Wetlands Inventory (NWI) wetlands in the basin. It is notable that though comparable in land area, considerably more hydric soils exist outside the UGB (743 acres) than inside (335 acres). Hydric soils and wetlands are generally found in the following areas:

- Hydric soils are clustered in the drainage ways in the southern portion of the basin.
- Inside the UGB, in the central portion of the basin, hydric soils are located around the intersection of Agate and Franklin Streets, at the base of Skinner's Butte, and in riverine strips paralleling the riparian corridor. NWI wetlands are found near Valley River Drive.
- In the northern portion, there are large areas of hydric soils around the confluence of the Willamette and McKenzie Rivers. This region is wetland rich containing many small pockets and long strips of NWI wetland features.
- NWI wetlands are found near 30th Avenue and Lane Community College.

The following table displays the percent of hydric soils found in the basin:

Table 2-10
Hydric Soils in the Willamette River Basin

Location	Hydric Soils (percent)	
	No	Yes
Within UGB	91%	9%
Outside UGB	79%	21%
Total Basin	85%	15%

Source:USDA Soil Survey of Lane County Area, Oregon, 1987.

2.9 Groundwater

Two aspects related to groundwater need to be given special consideration when planning for stormwater management. The first relates to the regional aquifer that underlies much of the lower Willamette Valley basin. This aquifer is the source of drinking water for rural residents and several nearby communities (i.e., Springfield, Coburg, Junction City) and has also been investigated as a potential future source of water for Eugene. For this reason, consideration needs to be given to the effects that stormwater management can have on groundwater quality and quantity.

A substantial supply of groundwater exists in this basin at depths of 10-150 feet. This shallow and unconfined aquifer is vulnerable to contamination from surface and subsurface activities. Previous studies and reports (Winkler, 1993) indicate that the shallow aquifer has been

contaminated in certain areas with nitrates and industrial chemicals. There is little use of groundwater for drinking water purposes in the Willamette River basin. Water service is supplied to all new development within the city limits and most existing residents. Areas of the Willamette River basin that lie outside the UGB rely on groundwater for domestic use, although the aquifers in these areas are "generally poorly permeable, yield water slowly to wells, or contain brackish water" (GEM Consulting, Inc., 1993). Because the underlying aquifer of the Willamette River basin generally flows to the northwest toward Veneta and Junction City, there are potential negative effects to the quantity and quality of groundwater due to infiltration practices.

The other groundwater issue relates to the depth of the seasonal high water table. Map 11 shows the depth of the high water table during the wet season. This information is linked to soil type and comes from the *USDA Soil Survey of Lane County* (1987). A high water table (less than three feet below the ground's surface) will play a significant role in determining both how stormwater disperses and what types of stormwater facilities might work well in a given area. In general, a high water table will contribute to high runoff levels and can limit the effectiveness of infiltration facilities.

High water table conditions in the Willamette River basin are generally greater than 6 feet deep. Shallow conditions (less than 2 feet deep) occur in the drainage areas of the LCC basin, the east-University area, and at the confluence of the Willamette and McKenzie Rivers.

2.10 Existing and Planned Educational Facilities

Schools found in the Willamette River basin currently include Oak Hill School (private K-12), Marist High School (private), the University of Oregon, and Lane Community College (LCC). No additional schools are currently planned.

There are opportunities in the basin for utilization of the stormwater drainage system and related facilities for educational purposes in conjunction with school curriculums. The University of Oregon is within an easy walk of the Willamette River, and the Millrace passes through the northern portion of the University campus. Waterways draining the forested hills in the southern portion of the basin run through both the LCC campus and the Oak Hill School property. Refer to Map 12.

2.11 Existing and Planned Park and Recreational Facilities

There are currently 550 acres of publicly owned park land on 25 City parks and one Lane County Park in the Willamette River basin. This includes Whitely Landing (Lane County), West Bank, Razor Park, East Bank, Owen Rose Garden, Maurie Jacobs Park, Washington-Jefferson Park, Sladden Park, Scobert Gardens, Monroe Park, Oakmont Park, Kaufman Senior Center, Campbell Senior Center, Gateway Park, Lincoln Park, Downtown Park Blocks, West University Park, Washburn Park, Fairmont Park, Bloomburg Park, Skinner Butte Park, and portions of Dillary/Skyline, Moon Mountain Park, Alton Baker Park, Hendricks Park, and 38 acres of Delta Ponds west of Goodpasture Island Road. In addition, the 100 acre private Riveridge Golf Course is located near the north end of the basin adjacent to the Willamette River.

The Eugene Parks and Recreation Plan (1989), identifies future acquisition or easement needs along the Willamette River west of Interstate-5 and in the McKenzie-Willamette River confluence area. The Park, Open Spaces, and Natural Areas Study-Phase 2 (1997) also identifies as a priority acquisition most of the ridgeline area in the southern end of the basin (above LCC).

The urbanized area of the basin is well served by on-street bicycle lanes and bicycle paths and TransPlan proposes extension of bicycle paths along both the east and west banks of the Willamette River to the confluence with the McKenzie.

In November, 1998, voters in Eugene passed a $25.3 million general obligation bond measure for purposes of purchasing new parkland and building parks and youth sports fields. In the Willamette River Basin, these funds will be used to develop one new neighborhood park, provide a Ridgeline corridor connection, and enhance Skinner Butte Park and Alton Baker Parks. These plans are consistent with the Parks, Open Spaces and Natural Areas Studies (1996).

Willamette River Basin

Existing Land Use *

L E G E N D

- Low-Med. Density Residential
- Med.-High Density Residential
- Commercial (Services & Trade)
- Industrial (Except Sand & Gravel)
- Sand and Gravel Operations
- Railroads
- Communication and Utilities
- Parks, Open Space, and Recreation (Except Golf)
- Golf Courses and Driving Ranges
- Schools, Churches, & Cemetaries
- Other Government
- Agriculture
- Timber/Forest
- Other Undeveloped Land
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

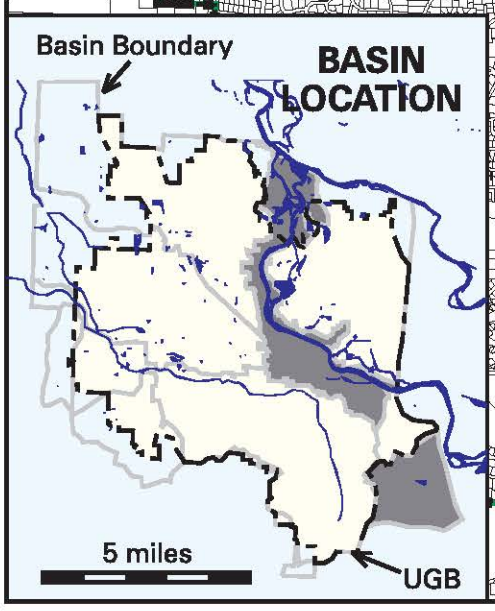
* Landuse Data Current to Nov. 1998

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 1



Willamette River Basin

Projected Land Use *

L E G E N D

- Rural Residential
- Low-Density Residential
- Med.-Density Residential and MDR Mixed Use
- High-Density Residential and HDR Mixed Use
- Commercial & Commercial-Residential Mixed Use
- Industrial & Commercial-Industrial Mixed Use
- Sand and Gravel
- Natural Resource, Parks and Open Space
- Education and University Research
- Government
- Agriculture (and Ag/Airport Reserve)
- Forest
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

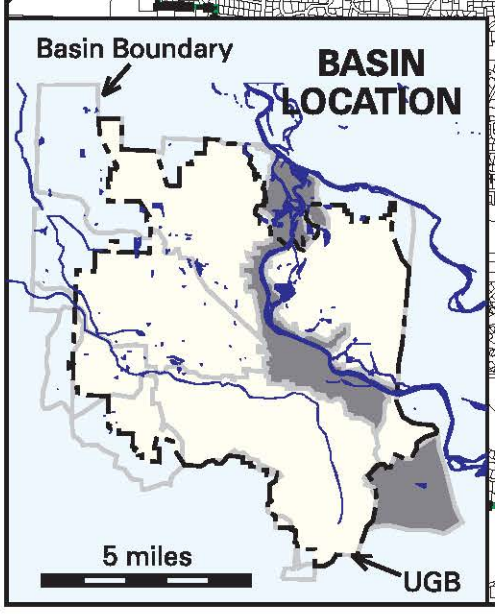
* Projected Land Use according to Metro Area General Plan, as updated to 1998, with revisions to reflect public acquisition of lands for wetland protection.

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 2



Willamette River Basin

Surface Cover*

L E G E N D

- Impervious Surface Areas
- Generalized Forest Cover
- Other Vegetated Areas
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* The Impervious Surface Areas category is derived from the 1998 Landuse layer, and includes all developed parcels and road right-of-way. The actual percentage of impervious surface present on each parcel varies by land use category (see table in text for breakdown). Generalized Forest Cover is based on 1994 Aerial Photographs, and includes all forest patches over one acre in size.

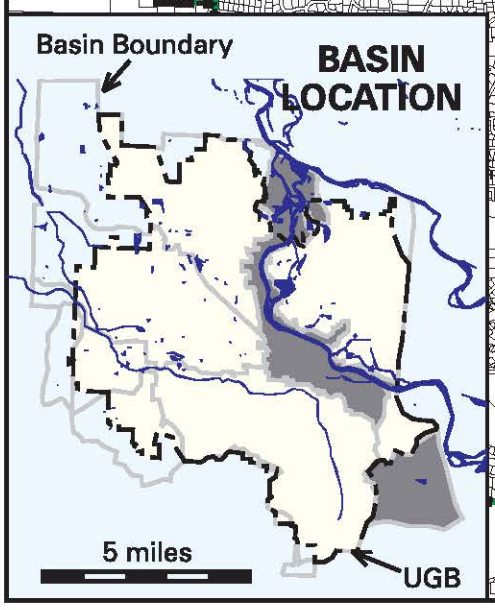
0 3200 ft

N

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 3



Willamette River Basin

Slope and Topography *

L E G E N D

- 0 - 5% Slopes
- 5 - 10% Slopes
- 10 - 15% Slopes
- 15 - 25% Slopes
- > 25% Slopes
- Waterways and Ponds

- 100-foot contours
- 20-foot contours
- Intermediate contours

- Willamette River Basin Boundary*
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels*
- Metropolitan Plan Boundary

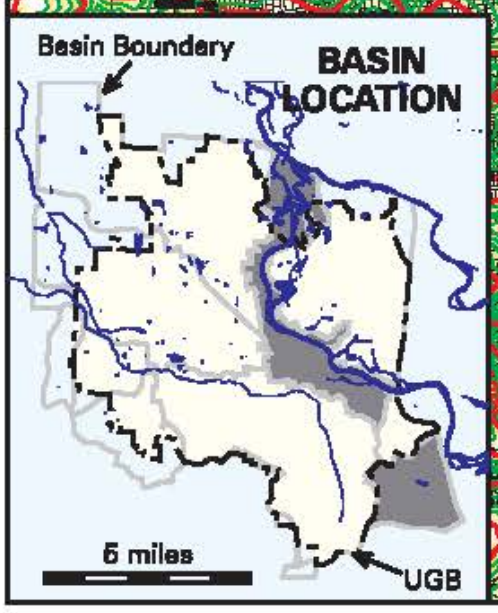
* Slopes and Contours derived from enhanced 10-meter USGS Digital Elevation Models (DEMs)

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 4



Willamette River Basin

Surface Water and Drainage System Features

L E G E N D

- 100-yr Floodplain (Hazard Zone A) *
- Floodway (from FEMA maps)
- Waterways and Ponds *
- Wetlands (from West Eugene Wetlands Plan & National Wetland Inventory)
- Storm Pipes 36″+ in Basin*
- Storm Pipes <36″ in Basin*
- Storm Pipes in Basin, size unknown*
- 100-foot Contour Lines
- Willamette River Basin Boundary*
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels*
- Metropolitan Plan Boundary

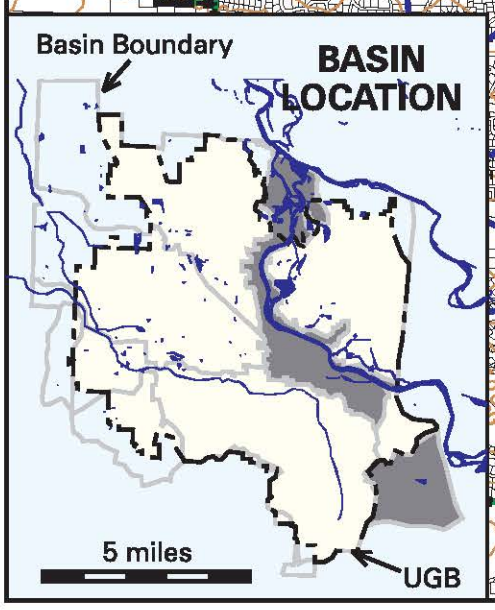
* from City of Eugene data

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 5



Willamette River Basin

Soil Permeability *

L E G E N D

- Very Rapid
- Moderately Rapid
- Moderate
- Moderately Slow
- Slow
- Very Slow
- Variable
- Pits and Water Bodies from Soil Layer (no data)
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

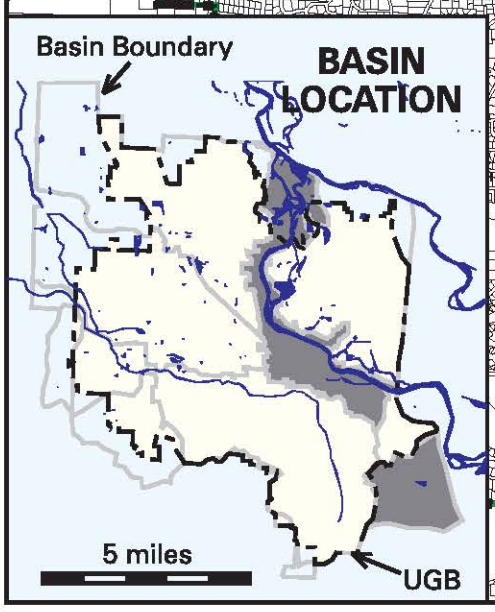
* from USDA Soil Conservation Service data

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 6



Willamette River Basin

Soil Runoff Potential *

L E G E N D

- Low
- Moderately Low
- Moderately High
- High
- Pits and Water Bodies from Soil Layer (No data)
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* from USDA Soil Conservation Service data

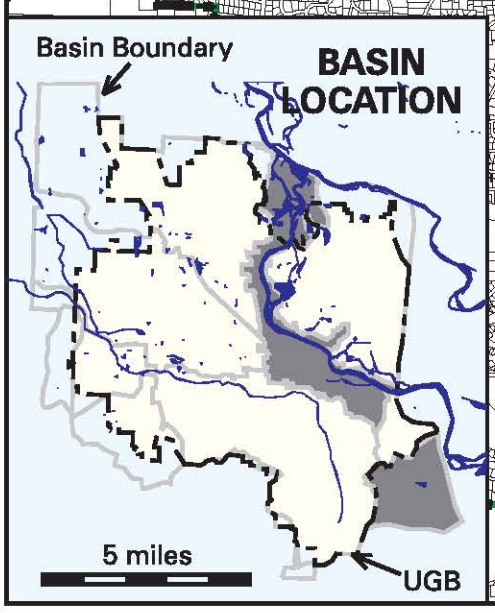
0 3200 ft

N

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 7



Willamette River Basin

Highly Erodible Soils *

L E G E N D

- Highly Erodible Soils
- Moderately Erodible Soils
- All Other Soils
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

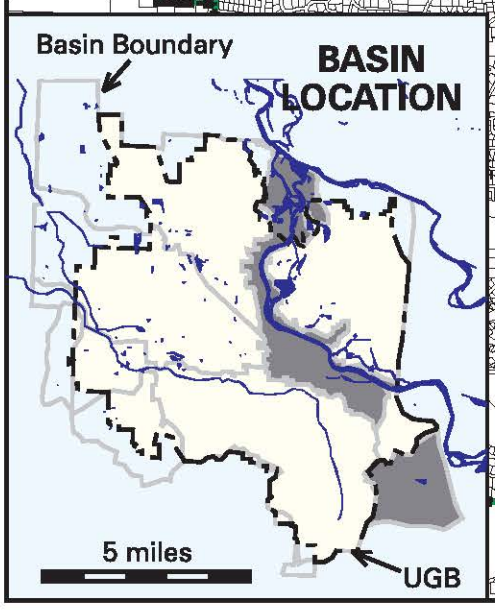
* Derived by LCOG from USDA Soil Conservation Service data

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 8



Willamette River Basin

Hydric Soils *

L E G E N D

- Hydric Soils
- All Other Soils
- Waterways and Ponds
- Wetlands (from West Eugene Wetlands Plan & National Wetland Inventory)
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

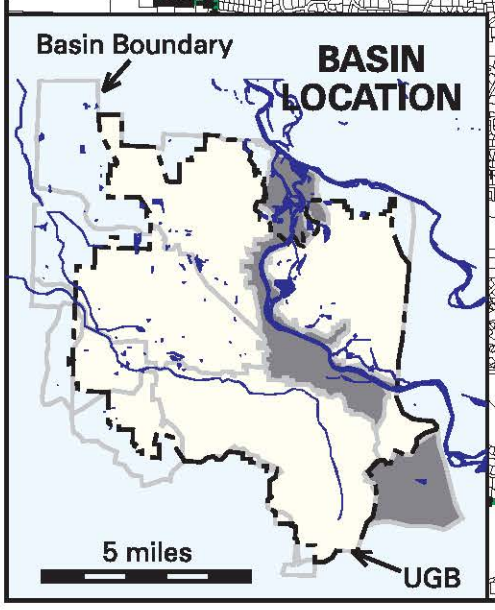
* from USDA Soil Conservation Service data

0 3200 ft

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 9



Willamette River Basin

Soil Types *

L E G E N D

Soils subject to slumping

All other soil types

11C,BELLPINE SILTY CLAY LOAM,3-12% SLOPES
11D,BELLPINE SILTY CLAY LOAM,12-20% SLOPES
11E,BELLPINE SILTY CLAY LOAM,20-30% SLOPES
22,CAMAS GRAVELLY SANDY LOAM,OCCASIONALLY FLOODED
23,CAMAS-URBAN LAND COMPLEX
25,CHAPMAN-URBAN LAND COMPLEX
26,CHEHALIS SILTY CLAY LOAM,OCCASIONALLY FLOODED
27,CHEHALIS-URBAN LAND COMPLEX
29,CLOQUATO SILT LOAM
30,CLOQUATO-URBAN LAND COMPLEX
31,COBURG SILTY CLAY LOAM
32,COBURG-URBAN LAND COMPLEX
34,COURTNEY GRAVELLY SILTY CLAY LOAM
43C,DIXONVILLE-PHILOMATH-HAZELAIR COMPLEX,3-12% SLOPES
43E,DIXONVILLE-PHILOMATH-HAZELAIR COMPLEX,12-35% SLOPES
41E,DIXONVILLE SILTY CLAY LOAM,12-30% SLOPES
41F,DIXONVILLE SILTY CLAY LOAM,30-50% SLOPES
45C,DUPEE SILT LOAM,3-20% SLOPES
48,FLUVENTS, NEARLY LEVEL
52B,HAZELAIR SILTY CLAY LOAM,2-7% SLOPES
52D,HAZELAIR SILTY CLAY LOAM,7-20% SLOPES
76,MALABON-URBAN LAND COMPLEX
79,MCBEE SILTY CLAY LOAM
95,NEWBERG FINE SANDY LOAM
96,NEWBERG LOAM
97,NEWBERG-URBAN LAND COMPLEX
99H,OCHREPTS AND UMBREPTS, VERY STEEP
102C,PANTHER SILTY CLAY LOAM,2-12% SLOPES
103C,PANTHER-URBAN LAND COMPLEX,2-12% SLOPES
105A,PENGRA SILT LOAM,1-4% SLOPES
106A,PENGRA-URBAN LAND COMPLEX,1-4% SLOPES
107C,PHILOMATH SILTY CLAY,3-12% SLOPES
108C,PHILOMATH COBBLY SILTY CLAY,3-12% SLOPES
108F,PHILOMATH COBBLY SILTY CLAY,12-45% SLOPES
109F,PHILOMATH-URBAN LAND COMPLEX,12-45% SLOPES
110,PITS
113E,RITNER COBBLY SILTY CLAY LOAM,12-30% SLOPES
113G,RITNER COBBLY SILTY CLAY LOAM,30-60% SLOPES
114,RIVERWASH
116G,ROCK OUTCROP-WITZEL COMPLEX,10-70% SLOPES
118,SALEM GRAVELLY SILT LOAM
121B,SALKUM SILTY CLAY LOAM,2-8% SLOPES
125C,STEIWER LOAM,3-12% SLOPES
126D,STEIWER LOAM,12-20% SLOPES
125F,STEIWER LOAM,20-50% SLOPES
127C,URBAN LAND-HAZELAIR-DIXONVILLE COMPLEX,3-12% SLOPES
135C,WILLAKENZIE CLAY LOAM,2-12% SLOPES
135E,WILLAKENZIE CLAY LOAM,20-30% SLOPES
135F,WILLAKENZIE CLAY LOAM,30-50% SLOPES
138E,WITZEL VERY COBBLY LOAM,3-30% SLOPES
138G,WITZEL VERY COBBLY LOAM,30-75% SLOPES
W,WATER

Waterways and Ponds

Willamette River Basin Boundary

Urban Growth Boundary

Eugene City Limits

Streams and Channels in Basin

Metropolitan Plan Boundary

* from USDA Soil Conservation Service data

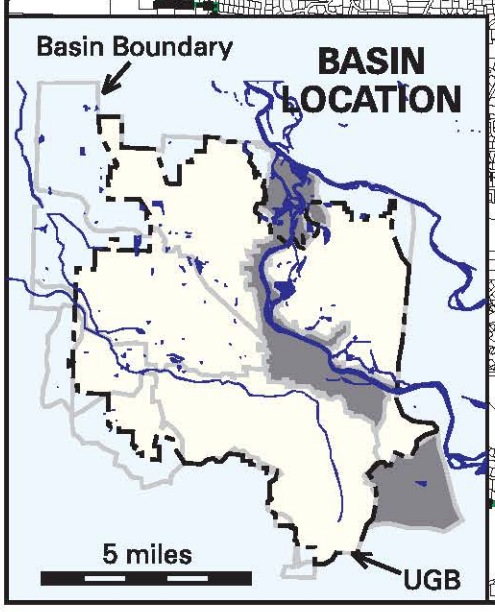
0 3200 ft

N

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 10



Willamette River Basin

High Water Table *

L E G E N D

- Soils with Shallow Water Table (generally less than 2 feet during winter months)
- Other Soils (water table generally 6 feet or deeper)
- Pits and Water Bodies from Soil Layer (no data)
- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Eugene City Limits
- Streams and Channels in Basin
- Metropolitan Plan Boundary

* from USDA Soil Conservation Service data

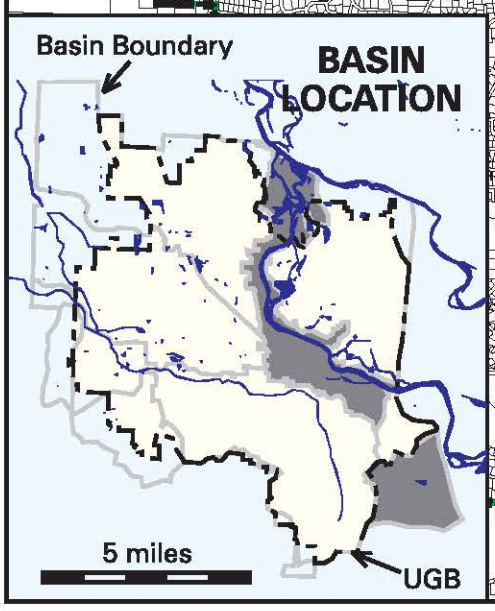
0 3200 ft

N

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 11



Willamette River Basin

Park, Recreation & Education Facilities

L E G E N D

EXISTING

- Parks
- Schools (Pub. & Pvt.)
- Golf Courses
- Bikeways in Basin
- Trails

FUTURE

- Parks in Basin *
- Bikeways in Basin **
- Trails *

- Waterways and Ponds
- Willamette River Basin Boundary
- Urban Growth Boundary
- Streams and Channels in Basin

* Eugene Parks & Recreation Plan, 1989; Parks, Open Spaces, and Natural Areas Study, 1996.

** Draft TransPlan Update, Nov. 1997.

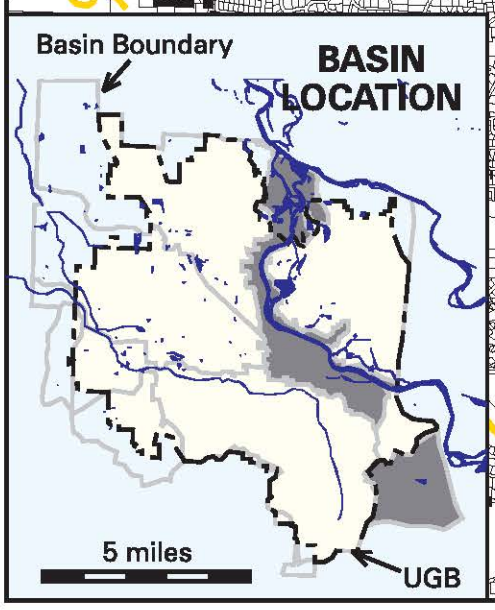
0 3200 ft

N

Map Produced by LCOG 10/99

Based on imprecise source data, subject to change

MAP 12



To identify flood control problems and opportunities, a flood control evaluation was completed for the drainage system in the Willamette River basin that is described in Section 2.5 and illustrated on Map 5. Section 3.1 describes the extent of the drainage system evaluated, the process used to identify flooding problems and a general description of each problem. Section 3.2 describes the capital project alternatives and development standard alternatives that were proposed to address the flooding problems. Section 3.3 describes the selected flood control alternatives.

3.1 Evaluation of Flood Control Under Existing and Expected Future Conditions

To develop a flood control strategy for the Willamette River basin, a computer model was used to evaluate hydrologic/hydraulic conditions of the public storm drainage system. The storm system was evaluated under both existing and buildout land use conditions using XP-SWMM model software. As the Willamette River basin is already almost completely built-out, and a major storm event occurred in February, 1996 without many major problems, only a small portion of the drainage system was modeled. The portion of the drainage system selected for modeling was based on known problems or a need for additional information for these systems. Specifically, the model was used to evaluate the capacity of 21 pipe segments (representing 7,150 lineal feet and 3 independent storm pipe systems that drain to the Willamette River) in the Willamette River basin under both existing and buildout land use conditions. The modeled storm pipe systems are:

1. Outfall A Storm Drainage System: consists of 36", 48" and 54" diameter pipe segments that run north along River Road from Hillard Lane and turn east and discharge to the Willamette River just south of Formac Avenue.
2. Outfall B Storm Drainage System: includes 30" diameter pipe segments that run upstream from River Road to the Willamette River outfall along Arbor Avenue.
3. Outfall C Storm Drainage System: consists of 27" and 30" diameter pipe segments that run north along River Road from Hansen Lane to Hawthorne Street and turn east towards the Willamette River.

The Willamette River basin drainage system is shown on Figures 3-2 through 3-6. Figure 3-1 is an index map that illustrates the relative locations of Figures 3-2 through 3-6. Modeled drainage segments and locations of the proposed capital projects are also illustrated on Figures 3-2 through 3-6.

The City-wide summary in Volume I contains detailed information regarding the process and sources of information that were used for identifying flooding problems and opportunities. Chapter 3 of Volume I specifically includes detailed information regarding the following:

- Model selection process.
- Sources of model input data.
- Model calibration.
- Design storm selection process.

This section of the Willamette River report provides a summary of the basin specific hydrologic and hydraulic data used in the models and a summary of the basin specific model results with respect to flood control.

3.1.1 Willamette River Basin Hydrologic Data

The Willamette River basin was subdivided into 6 major subbasins. The major basin boundaries are presented on Figure 3-1. The Lane Community College Major Subbasin was not modeled because of its location (i.e., entirely outside the City limits and UGB) and drainage orientation (does not flow into the Eugene drainage system). The 5 remaining major subbasins were further divided into 63 subbasins. Only 10 subbasins in the River Road major subbasin were included in the model. As mentioned above, the majority of the subbasins in the Willamette River basin were not analyzed due to the fact that flooding problems have not been observed, and the drainage areas are almost completely developed (i.e., problems are not expected to get worse). The subbasin boundaries presented on Figure 3-1 were delineated based on both topography and the storm drainage system layout. The subbasin boundaries were digitized into the City's GIS so that hydrologic data could be generated for each subbasin.

Seven-character names were assigned to each subbasin. The first two characters represent a two-letter abbreviation for the major basin; in this case WR for Willamette River. The second two characters represent a two-letter abbreviation for the major subbasin. The 6 major subbasins in the Willamette River basin are as follows:

RR = River Road Major Subbasin
ES = East Riverside Major Subbasin
WS = West Riverside Major Subbasin
PK = Polk Street Major Subbasin
MR = Millrace Major Subbasin
LC = Lane Community College Major Subbasin

The last three characters of the subbasin name consist of numbers, starting with 010 and increasing in increments of 10 for each additional subbasin. For example, the first two subbasins in the River Road major subbasin of the Willamette River basin are WRRR010 and WRRR020. In addition, each subbasin has an associated inlet node number. The hydrologic component (i.e., RUNOFF block) of XP-SWMM was used to generate a stormwater runoff hydrograph for each subbasin. This hydrograph was routed by the hydraulic component (i.e., the EXTRAN block) of XP-SWMM to model the storm drainage system. The subbasin inlet node is the point where the subbasin hydrograph enters the storm drainage system for routing.

The following parameters were required for each subbasin in the hydrology component of XP-SWMM.

1. Subbasin name or number.
2. Channel or pipe inlet node number into the storm drainage system.
3. Subbasin area (acres).

4. Hydraulically connected impervious percentage for both existing and future land use scenarios (percent).
5. Average ground slope (dimensionless, ft/ft).
6. Subbasin width (feet).
7. Manning's roughness coefficient for impervious areas.
8. Manning's roughness coefficient for pervious areas.
9. Depression storage for impervious areas (inches of water over subbasin).
10. Depression storage for pervious areas (inches of water over subbasin).
11. Green-Ampt soil infiltration parameters: average capillary suction (inches) saturated hydraulic conductivity (inches/hour), and initial moisture deficit (volume air/volume voids).

Table 3-2 (provided at the back of this section) provides the major hydrologic information for each of the modeled Willamette River subbasins. Specifically, the table provides the information for parameters 1 – 5 listed above in addition to the expected increase in impervious surface under future conditions. More detailed hydrologic information, including information described for parameters 1 – 11, can be found in Appendix E of Volume I. Table 3-2 also provides peak runoff discharge information for each modeled subbasin.

3.1.2 Willamette River Basin Hydraulic Data

The primary purpose of the modeling was to evaluate the capacity of the storm drainage system. The evaluation of the storm drainage system included a hydraulic analysis of selected storm pipes. Information for the storm pipes was obtained from the City's GIS and as-built information. In order to analyze the hydraulic capacity of the storm drainage system, the hydraulic component of XP-SWMM required the following parameters for each pipe segment:

1. Conduit name.
2. Upstream node number.
3. Downstream node number.
4. Conduit size (diameter for pipes).
5. Conduit length.
6. Conduit material.
7. Upstream and downstream invert elevations.
8. Upstream and downstream ground surface elevations.

For the Willamette River basin, the model was used to evaluate the capacity of 21 pipe segments under existing and buildout conditions. Since the drainage areas for all modeled segments are less than 640 acres, these pipes segments are required to provide 10-year levels of flood protection. Table 3-3 (provided at the back of this section) provides the major hydraulic information for each of the modeled conduits in the Willamette River basin. Specifically, the table provides the information for parameters 1 – 6 listed above in addition to the drainage area for each conduit, the design storm, and the model results for the design storm. Model results are presented in terms of peak flows and maximum water surface elevations. The results for all storm events that were routed through the models (i.e., 10-year and 25-year storms) can be found in Appendix E of Volume I.

It should be noted that the performance of the three analyzed storm drainage systems is affected by water levels in the Willamette River. The approach used in the hydraulic model was to assume that the Willamette River's water surface elevation was at the elevation associated with the storm event being modeled. For example, if the 10-year storm was being modeled, the river surface elevation at the outfall was assumed to be the 10-year flood elevation. Water surface elevations of the Willamette River for the 10-year storm were obtained from the Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS). This is considered to be a conservative approach because the river level usually rises more slowly than the pipes that are draining to it.

3.1.3 Flooding Problems Identified by the Model

This section provides a general description of model-identified flooding problems. The model results are summarized in Table 3-3 which includes peak flows and water surface elevations for the relevant design storm under both existing and buildout conditions. The last column in the table indicates which conduits are expected to be deficient and when (i.e., under existing and/or buildout land use conditions). Surcharging was considered to be acceptable and flooding problems were only identified if the models showed water getting out of the system and into the streets.

In general, none of the pipe segments were identified as deficient under existing or buildout conditions in the Willamette River basin. Although 5 out of 17 pipe segments were flooded during the 10-year design storm events under existing land use conditions, these pipe segments were not identified as capacity deficiencies due to the fact that the flooding problems were caused by high water levels in the Willamette River. Without the Willamette River backwater, these pipes would have adequate capacity to convey runoff from upstream drainage areas under both existing and buildout conditions.

3.1.4 Other Identified Flooding Related Problems

In addition to flooding problems identified as a result of system modeling, other flooding-related problems have been identified through field observations of maintenance staff. In general, for this basin these problems are associated with tip-ups. A tip-up is sloped pipe segment that conveys stormwater discharge from a deeper pipe system to a surface open waterway with a higher elevation. In most cases, the slope of the tip-up causes sediment buildup that results in localized flooding problems. The sediment buildup is difficult to remove because the tip-ups typically do not have adequate access for maintenance. The drainage system in the Willamette River basin contains at least one tip-up. There are three additional outfalls that could potentially be tip-ups, however, more information is needed regarding their invert elevations to make this determination.

3.2 Development of the Flood Control Strategy

As shown in the Stormwater Basin Planning Project process flow chart in Figure 1-1, Step 1 included a compilation of basin characteristics. These basin characteristics are summarized in Section 2.0 of this document. Step 2 in the process included problem identification under both

existing and future land use conditions. The results of this step for flood control are provided in Section 3.1 above. The next step included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems. These stormwater management tools were developed as a result of an all-day basin assessment meeting. The meeting was attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources. Preliminary ideas were developed based on the goals and objectives of the project. This section describes the capital projects and flood control development standards that were proposed to address the identified flooding problems.

3.2.1 Capital Project Alternatives

All existing and future flooding problems identified through modeling and observations, and the proposed capital projects to address these problems are presented in Table 3-1. The locations of these proposed capital projects are illustrated on Figures 3-2 through 3-6. Table 3-1 lists when the flooding problem is expected to occur (i.e., under existing or future conditions). Note that the flooding problems listed in Table 3-1 are associated with segment names. To locate a segment, one should first look up the upstream node and downstream node associated with the segment in Table 3-3, then pinpoint the segment on Figures 3-2 through 3-6.

Table 3-1
Capacity Deficiencies Identified Through Modeling and Proposed Capital Projects to Address Them

Expected Flooding Problems		Capital Project Alternatives Considered for Addressing Capacity Deficiencies	Selected Flood Control Capital Project
Segment Name	When Deficient		
Outfall A Drainage System			
WRRR010D WRRR010E	10-yr existing	**None** – Capital projects were not proposed due to the fact that these pipe segments were flooded due to high water levels in the Willamette River and the City does not have the ability to control high water levels in the Willamette River.	
Outfall B Drainage System			
WRRR060D WRRR060E WRRR060F	10-yr existing	**None** – Capital projects were not proposed due to the fact that these pipe segments were flooded due to high water levels in the Willamette River and the City does not have the ability to control high water levels in the Willamette River.	

In addition to the flooding problems identified as a result of basin modeling, the following capital project was proposed to address other identified flooding problems.

Citywide Annual Budget Line Item - Tip-ups – Tip-ups were identified as potential causes of flooding problems in this basin. There are four potential tip-ups that have been identified in the Willamette River basin. Tip-up retrofits were proposed to address potential maintenance-related flooding issues at these locations. The tip-up retrofits that were proposed include manhole or vault-like structures that would allow for the capture and removal of sediments/debris and would

also allow for maintenance access. The potential tip-up locations that have been identified in this basin are as follows:

1) Un-modeled 21" segment located just north of the intersection of Country Club Road and Coburg Road
   Node 65022 - 65011
   Page 65 (bottom center) of 97
   Segment length = 14 feet
   Tip-up offset = 2.06 feet

2) Potential tip-ups (inverts are not listed in the City's GIS)
   Node 66175 to 59066 (page 51 of 97)
   Node 72440 to 62466 (page 53 of 97)
   Node 69170 to 67171 (page 66 of 97)

Note: The page numbers listed above refer to the page numbers in the City of Eugene Wastewater and Stormwater Index Map Book.

3.2.2 Development Standard Alternatives

In addition to capital project alternatives, development standard alternatives were evaluated for addressing those problems that are expected to occur as a result of future buildout conditions. The two flood control development standards that were evaluated for the Willamette River basin were as follows:

- *Require post-development peal flows to equal pre-development peak flows* – This standard would require developers to ensure that post-development peak flow rates would not exceed pre-development peak flow rates from their sites for the flood control design storm of concern. This requirement could be met through the use of reduced effective impervious areas, infiltration, or detention.

- *Require post-development peak flows to equal available capacity* – This standard would require developers to ensure that post-development peak flow rates would not exceed the design capacity of the existing public stormwater conveyance system that would be accepting these flows. This standard would allow developers to take advantage of available surplus capacity where it exists in the public system. This standard would require that the City conduct hydraulic analyses in order to provide information to developers regarding available capacity. This requirement could also be met through the use of reduced effective impervious areas, infiltration, or detention. This standard is currently required where there are no model results and capital projects are not proposed.

3.3 Selected Alternatives

The capital project and development standards alternatives were compared in terms of both costs and effectiveness for addressing the flooding problems identified above in Table 3.1. For the Willamette River basin, the capital project alternative was estimated to be more effective than the development standard alternatives since the only significant flooding problems over which the City has control in this basin are associated with tip-ups. Development standards would not be effective at addressing these problems.

The selected flood-control strategy for this basin includes one capital project and an overall multiple objective stormwater capital improvement program as listed below. For more detail regarding the project, a capital project fact sheet is provided in the Appendix.

- **Capital Project Citywide Annual Budget Line Item– Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a sedimentation manhole that provides maintenance access.
- **Multiple Objective Stormwater Capital Improvement Program:** In general, all stormwater capital projects, including water quality and natural resources projects, will consider flood control objectives when feasible and appropriate.

TABLE 3-2
MAJOR HYDROLOGIC INPUT/OUTPUT DATA FOR THE WILLAMETTE RIVER STORM DRAINAGE SYSTEM

Subbasin Name	Inlet Node	Subbasin Area (acres)	Impervious Area (%)					Average Subbasin Slope (ft/ft)	Subbasin Peak Flow (cfs) Existing Land Use Conditions			Subbasin Peak Flow (cfs) Future Land Use Conditions		
			Existing Land Use		Future Land Use		Increase [1] (%)		10-Year	25-Year-W[2]	25-Year-S[3]	10-Year	25-Year-W[2]	25-Year-S[3]
			Mapped	Effective	Mapped	Effective								
WRRR-010	59087	14.8	40.0	34.0	48.0	40.8	6.8	0.016	3	3	6	4	4	7
WRRR-020	66178	40.9	40.0	34.0	50.0	42.5	8.5	0.005	11	12	16	13	14	20
WRRR-030	59120	14.0	28.0	23.8	44.0	37.4	13.6	0.007	2	2	4	3	3	6
WRRR-040	60606	27.8	38.0	32.3	48.0	40.8	8.5	0.000	7	8	10	8	9	12
WRRR-050	60617	37.0	43.0	36.6	50.0	42.5	6.0	0.002	13	14	16	14	15	18
WRRR-060	67889	34.8	35.0	29.8	41.1	34.9	5.2	0.023	7	7	12	8	8	14
WRRR-070 & WRRR-080[4]	60580	49.5	49.1	41.7	59.5	50.6	8.9	0.009	14	16	24	17	19	29
WRRR-090	60647	9.7	41.0	34.9	44.0	37.4	2.6	0.000	4	4	4	4	4	5
WRRR-100	62222	14.6	50.0	42.5	60.0	51.0	8.5	0.004	7	7	8	7	8	10

Note.
1. Increase in effective impervious percentage from existing land use conditions to future land use conditions.
2. W = Winter
3. S = Summer
4. Subbasins WRRR-070 and WRRR-080 are combined into one subbasin.

TABLE 3-3
HYDRAULIC PERFORMANCE OF THE WILLAMETTE RIVER STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
Outfall A												
WRRR010E	76425	59065	48" CSP	48	10	32	39	392.1	392.1	392.2	392.1	10-yr Existing
WRRR010D	76424	76425	48" CSP	100	10	32	39	392.2	392.1	392.3	392.2	10-yr Existing
WRRR010DRD	76424	76425	Roadway	100		0	0	392.1	392.1	392.2	392.2	
WRRR010C	59082	76424	48" CSP	45	10	32	39	392.2	392.2	392.3	392.3	
WRRR010CRD	76424	59082	Roadway	45		0	0	392.2	392.2	392.3	392.3	
WRRR010B	59080	59082	54" CSP	635	10	32	39	392.4	392.2	392.6	392.3	
WRRR010BRD	59080	59082	Roadway	635		0	0	392.2	392.2	392.3	392.3	
WRRR010A	59087	59080	54" CSP	247	10	32	39	392.5	392.4	392.7	392.6	
WRRR010ARD	59080	59087	Roadway	247		0	0	392.5	392.5	392.7	392.7	
WRRR020A	66178	59087	54" CSP	22	10	29	35	392.5	392.5	392.8	392.7	
WRRR020ARD	66178	59087	Roadway	22		0	0	392.5	392.5	392.7	392.7	
WRRR030A	59120	66178	48" CSP	1241	10	19	23	392.8	392.5	393.1	392.8	
WRRR030ARD	59120	66178	Roadway	1241		0	0	392.5	392.5	392.8	392.8	
WRRR040A	60606	59120	48" CSP	775	10	17	20	392.9	392.8	393.2	393.1	
WRRR040ARD	60606	59120	Roadway	775		0	0	392.8	392.8	393.1	393.1	
WRRR050B	60626	60606	42" CSP	600	10	11	12	393.5	392.9	393.6	393.2	
WRRR050BRD	60626	60606	Roadway	600		0	0	392.9	392.9	393.2	393.2	
WRRR050A	60617	60626	36" CSP	355	10	11	12	394.6	393.7	394.7	393.8	
WRRR050ARD	60626	60617	Roadway	355		0	0	394.6	394.6	394.7	394.7	
Outfall B												
WRRR060F	66175	59066	30" CSP	10	10	7	8	393.3	392.9	392.9	392.9	10-yr Existing
WRRR060E	66552	66175	30" CSP	41	10	7	8	393.4	393.3	393.1	392.9	10-yr Existing
WRRR060D	76421	66552	30" CSP	130	10	7	8	393.1	393.4	393.1	393.1	10-yr Existing
WRRR060C	59084	76421	30" CSP	38	10	7	8	393.1	393.1	393.0	393.1	
WRRR060B	59083	59084	30" CSP	109	10	7	8	393.0	393.1	393.1	393.0	
WRRR060BRD	59083	59084	Roadway	109		0	0	393.1	393.1	393.0	393.0	
WRRR060A	67889	59083	30" CSP	998	10	7	8	394.9	393.0	395.0	393.1	
WRRR060ARD	67889	59083	Roadway	998		0	0	393.0	393.0	393.1	393.1	

TABLE 3-3 (continued)
HYDRAULIC PERFORMANCE OF THE WILLAMETTE RIVER STORM DRAINAGE SYSTEM

Segment ID	Node ID		Segment Size/Type	Segment Length (ft)	Design Storm	Peak Flow (cfs) For Design Storm		Water Surface Elevation For Design Storm (ft)				When Deficient
								Existing Land Use		Future Land Use		
	US	DS				Existing	Future	US	DS	US	DS	
Outfall C												
WRRR090D	76423	60612	30" CSP	588	10	10	11	400.8	399.6	400.8	399.6	
WRRR090C	76422	76423	30" CSP	43	10	10	11	400.8	400.8	400.9	400.8	
WRRR090CRD	76422	76423	Roadway	43		0	0	400.8	400.8	400.8	400.8	
WRRR090B	60647	76422	30" CSP	12	10	10	11	400.7	400.8	400.8	400.9	
WRRR090BRD	60647	76422	Roadway	12		0	0	400.8	400.8	400.9	400.9	
WRRR090A	60658	60647	30" CSP	413	10	7	7	400.9	400.7	401.1	400.8	
WRRR090ARD	60647	60658	Roadway	413		0	0	400.9	400.9	401.1	401.1	
WRRR100A	62222	60658	27" CSP	700	10	7	7	402.1	400.9	402.2	401.1	
WRRR100ARD	62222	60658	Roadway	700		0	0	400.9	400.9	401.1	401.1	

Willamette River Basin Drainage System

INDEX MAP

This index map shows the layout of the Willamette River basin into five geographic areas depicted on Figures 3-2 through 3-6. These figures contain detailed drainage system information for areas within the city limits and urban growth boundary (UGB). The only area not shown is Lane Community College (LC). See LC note below.

L E G E N D

- Eugene City Limits
- Urban Growth Boundary
- Eugene Plan Boundary

Basin Map Coverage
(Alternating color borders to distinquish overlapping areas.)

Willamette River Basin Major Subbasins

- ES = East Side
- LC = Lane Community College
- MR = Mill Race
- PK = Polk
- RR = River Road
- WS = West Side

N
W E
S

EUGENE

1 inch equals 1 mile

0.5 0 0.5 1 Miles

Produced by LCOG - August 2002
g:/drainage_maps/willamette/WR_index.apr

Figure 3-1

LC Note:
The LC area was originally included in the Willamette River Study basin study as it lies within the Eugene-Springfield Metropolitan Plan Boundary. However, because of its location (ie entirely outside the city limits and UGB) and drainage orientation (does not flow into the Eugene drainage system), an evaluation was not needed and a map not produced.

Figure 3-2
Figure 3-3
Figure 3-4
Figure 3-5
Figure 3-6

WS
ES
RR
ES
WS
PK
MR
LC

McKenzie River
Willamette River

BEACON DR
AWBREY LN
AIRPORT RD
IRVINGTON DR
GREEN HILL RD
CLEAR LAKE RD
IRVING RD
NORTHWEST EXPSWY
MAXWELL
BARGER
HORN
PARK
ROYAL
ROOSEVELT
W 1ST
W 6TH
W 7TH
W 11 TH
W 13TH
W 18TH
E 18TH
E 24TH
E 30TH
CREST
WILLOW CREEK
BELTLINE
RIVER RD
DELTA HWY
CAL YOUNG
COBURG RD
HWY 99 N
JERRY
BELTLINE RD
DANEBO
BERTELSEN
BAILEY HILL RD
CITY VIEW
CHAMBERS
JEFFERSON
HILYARD
E AMAZON
W AMAZON
DONALD
LORANE HWY
I-105
OAKWAY
CENTENNIAL
FRANKLIN BLVD
I-5
CHAD
MCKENZIE VIEW DR
GAME FARM
GATEWAY
HARLOW
HAYDEN BRIDGE
MARCOLA RD
5TH
E ST
MOHAWK
35TH
28TH
MAIN ST
32ND
42ND
FRANKLIN BLVD

No Map

River Road Santa Clara Basin

Willakenzie Basin

McKenzie River

Willamette River

WS-000

ES-010

75521

LESTER
WENDOVER
DR
HERMAN
SCENIC
BEACON
NOTTINGHAM
WATSON
EDWARDS DR
CLAIRMONT
WARRINGTON
BEACON DR E
WENDOVER
BANOVER
SCENIC CT
KILDARE
BANNER
RIVER
LOOP 2
ANDOVER
RIO
VISTA
BURWOOD
CINDERE
ALADDIN
KENDRA
KIRSTEN
REBBIE
L P 1
CHAPMAN
WILKES DR
AMESBURY
BAYWOOD
ALAMEDA
DELAY
JAMES
ADMIRAL
TEMPE
POPLAR
ANCHOR
HOLLYVIEW
ROSEMARY
RIVER LOOP 1
COMMODORE
GRIZZLEY
DABBLEE
SILVER MEADOWS
NATCHEZ
DALEWOOD
LENOX
BANTON
MYOAK DR
AZALEA
SALTY
ECHO
MIRROR POND
MEADOWVIEW
GILHAM
CRIMSON
DON JUAN

Figure 3-3

Willamette River Basin Drainage System

Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- WS = West Side
- ES = East Side

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WRxx Water Quality
- WRxx Natural Resources
- WRxx Flood Control
- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N
W E
S

EUGENE

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
g:\projects\basins\drainage_maps\Willamette\WR_subarea01.mxd

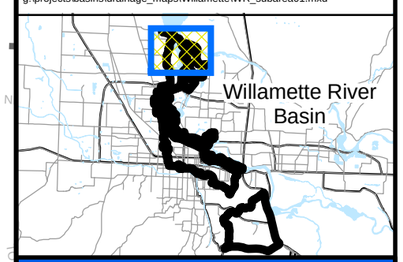


Figure 3-2

Willamette River Basin Drainage System

Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- WS = West Side
- ES = East Side
- RR = River Road

AB-123 Subbasin ID's Within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WRxx Water Quality
- WRxx Natural Resources
- WRxx Flood Control
- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
g:\projects\basins\drainage_maps\Willamette\WR_subarea02.mxd

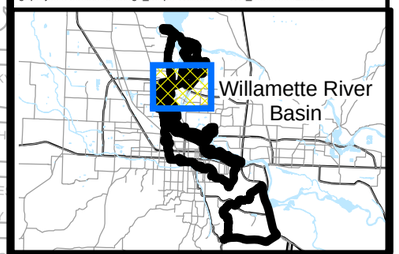


Figure 3-3

Figure 3-2

Figure 3-4

River Road/ Santa Clara Basin

Willakenzie Basin

ES-020

WS-010

WS-020

ES-030

RR-020

RR-010

WS-030

RR-030

ES-040

RR-060

RR-040

59087 66178 76424 59065 59080 59082 76425

59120

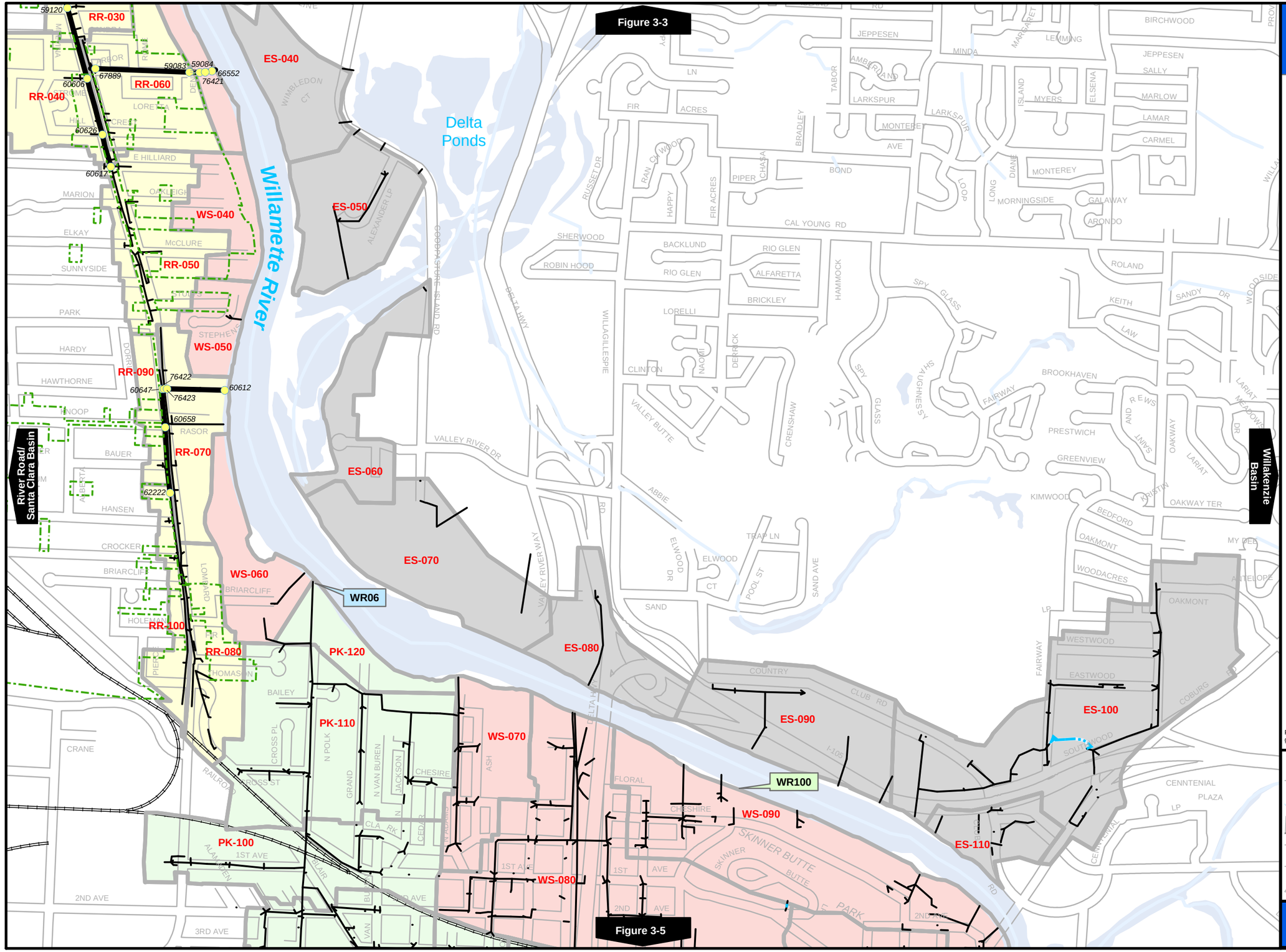
59083 59084 66552 67889 76421 60606

60626

Willamette River

Delta Ponds

Ayers Pond



Willamette River Basin Drainage System

Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- WS = West Side
- ES = East Side
- RR = River Road
- PK = Polk

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WRxx Water Quality
- WRxx Natural Resources
- WRxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

EUGENE

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
g:\projects\basins\drainage_maps\Willamette\WR_subarea03.mxd

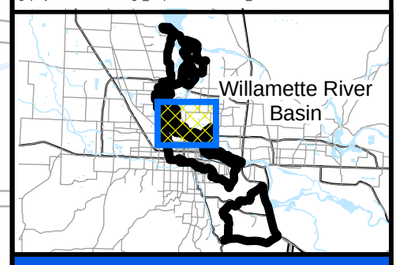


Figure 3-4

Figure 3-4

Willamette River Basin Drainage System

Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- WS = West Side
- ES = East Side
- MR = Millrace
- PK = Polk

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WRxx Water Quality
- WRxx Natural Resources
- WRxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
g:\projects\basins\drainage_maps\Willamette\WR_subarea04.mxd

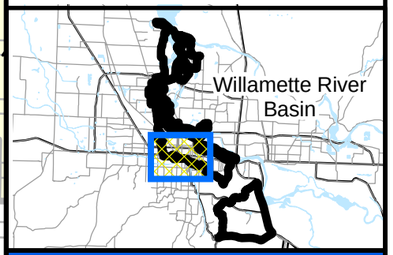
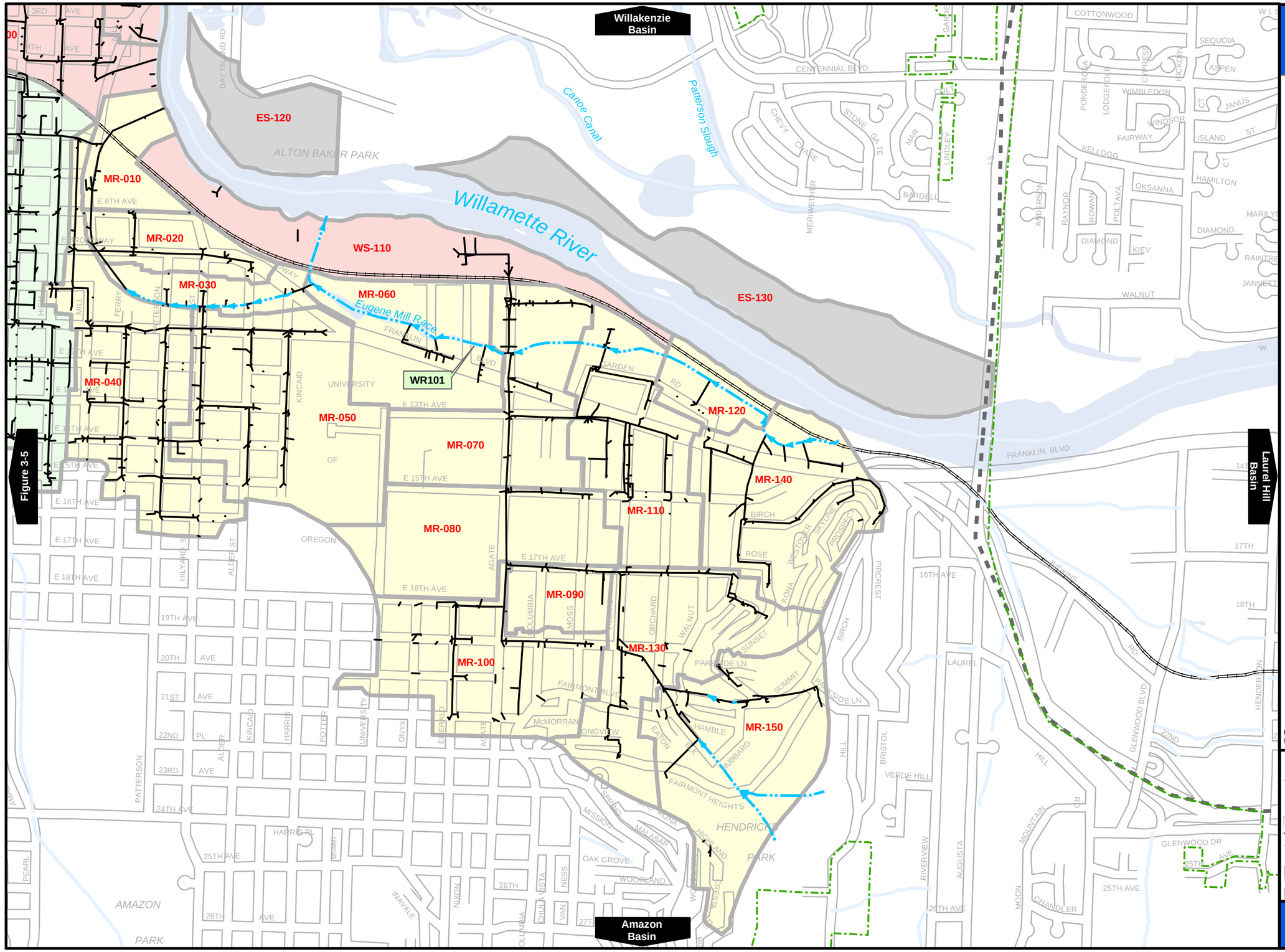


Figure 3-5

Willamette River Basin Drainage System



Legend

- Drainpipe - Modeled
- Drainpipe - Not Modeled
- Waterway - modeled
- Waterway - not modeled

Major Subbasins on this map

- WS = West Side
- ES = East Side
- MR = Mill Race
- PK = Polk

AB-123 Subbasin ID's within Major Subbasins

- Modeled Point
- *12345* Modeled Reference Numbers

Capital Projects

- WRxx Water Quality
- WRxx Natural Resources
- WRxx Flood Control

- Other Water Features
- Acquisition Corridor
- Urban Growth Boundary
- Eugene City Limits

Due to the scale of these maps, the display of some modeled pipe segments may either hide other nearby pipes, or appear connected when they are not.
To verify actual connections please refer to Table 3-3.

N W E S

EUGENE

1 inch equals 1,000 feet

500 0 500 1,000 Feet

Produced by LCOG - August 2002
g:\projects\basins\drainage_maps\Willamette\WR_subarea05.mxd

Figure 3-6

A general characterization of water quality in the Willamette River basin is described in Section 2.6. This section describes the processes that were used to further evaluate the existing water quality data (Section 4.1). Then, it describes the capital project alternatives and development standard alternatives (Section 4.2) that were proposed to address the water quality problems. Section 4.3 describes the selected water quality alternatives.

4.1 Evaluation of Water Quality Under Existing and Expected Future Conditions

To supplement the water quality information provided in Section 2.6, pollutant loads for Total Suspended Solids were calculated for the basin. Although TSS has not been shown to be directly related to all other pollutants, it was used as a general indicator of other pollutants for the purposes of making relative comparisons. The relative values and not the absolute values of the pollutant loads were used to assign priorities and to target those drainage subbasins or land uses that appear to contribute the largest pollutant loads to receiving waters. The values were also used to evaluate the relative contribution of pollutant loads expected as a result of future development. The methods used to estimate pollutant loads are described in Volume I, Section 3.2. The results for the Willamette River basin are provided in Figures 4-1 through 4-3 below. As mentioned in Section 2.6, these results are based on stormwater quality monitoring conducted in the City of Eugene. Although not all of these data were collected from within the Willamette River basin, they provide general information regarding stormwater quality in Eugene and were used in identifying a stormwater management strategy for this basin. In general, the Willamette River basin pollutant loads is 1,147,000 pounds per year under existing condition and pollutant load is expected to increase by 14% as a result of future development (based on results from the TSS pollutant loads estimations).

Figure 4-1
Estimated Total Suspended Solids Loads Per Year in the Willamette River Basin (UGB)

Estimated TSS Pounds Per Year in the Willamette River Basin	1,000 Pounds	Willamette River Basin Relative to the Range of TSS Pounds Per Year in Other Eugene Basins
From Existing Development	1,147	
From Development of Vacant Land	161	
Total Buildout	1,308	

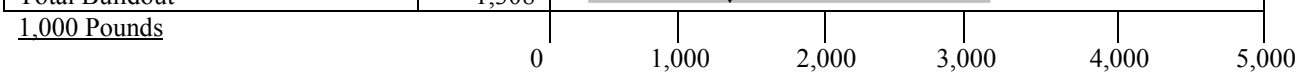


Figure 4-2
Estimated Increases in Total Suspended Solids Loads Associated with Future Buildout in the Willamette River Basin (UGB)

Estimated Increase in TSS Loads	Percent	Willamette River Basin Relative to the Range of Increase in TSS Loading in Other Eugene Basins
From Future Development	14	

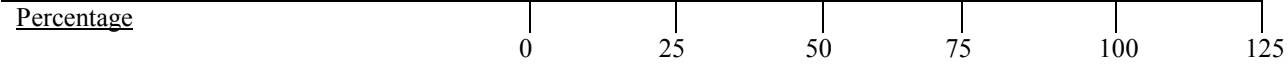
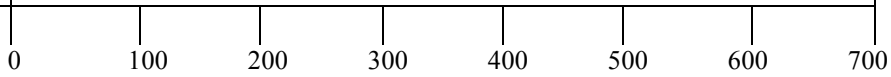


Figure 4-3
Estimated Total Suspended Solids Loads Per Acre - Per Year
in the Willamette River Basin (UGB)

Estimated TSS Pounds Per Acre Per Year in the Willamette River Basin	Pounds per Acre per Year	Willamette River Basin Relative to the Range of TSS Pounds Per Acre Per Year in Other Eugene Basins
Existing Development	328	
Development of Vacant Land	46	
Total Buildout	374	



The above information, along with the information provided in Section 2.6, was used to develop capital project and development standard alternatives for addressing water quality. The capital project alternatives and the development standard alternatives are described in Section 4.2 and the selected alternatives for the water quality portion of the basin strategy are described in Section 4.4.

4.2 Development of the Water Quality Strategy

As shown in the stormwater basin planning process flow chart in Figure 1-1, Step 1 included a compilation of basin characteristics. These basin characteristics are summarized in Section 2.0 of this document. Step 2 in the process included problem identification under both existing and future land use conditions. The results of this step for water quality are provided in Section 4.1 above. The next step included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems. These stormwater management tools were developed as a result of an all-day basin assessment meeting. The meeting was attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources. Preliminary ideas were developed based on the goals and objectives of the project. This section describes the capital projects and development standards that were proposed to address the identified water quality problems.

4.2.1 Capital Project Alternatives

Identifying potential capital projects to address water quality concerns is very different from identifying capital projects to address flooding issues. With respect to flooding, specific capacity deficiencies are identified through modeling and capital projects are proposed to address those deficiencies. With respect to water quality, pollutant discharges associated with urban runoff are ubiquitous. Therefore, with the exception of the specifically observed water quality problems, the focus of developing capital project alternatives for water quality was on identifying opportunity areas for the siting of surface water capital projects. This included looking for areas with the following characteristics: 1) sufficient space was available for a surface water quality facility, 2) space was available that was publicly owned or vacant and potentially available for

purchase, 3) the location drained a large and densely developed high source area, and 4) the location could be used to construct a capital project that addresses multiple objectives in addition to water quality control (i.e., flood control, natural resources enhancement, recreation, education).

For the Willamette River basin, there were limited opportunities for larger-scale surface water quality facilities due to the limited amount of vacant land in this basin. Therefore, the focus was on the implementation of underground structural water quality facilities to address the two specific water quality related problems identified in this basin and listed in Section 2.6 (i.e., water quality issues associated with major outfalls and high source areas). In addition, capital project alternatives were proposed to address the outfall related bank stabilization and tip-up problems observed along the Willamette River. These capital projects are listed below:

Citywide Annual Budget Line Item - Outfall Stabilization – This proposed project alternative includes inventorying and retrofitting storm system outfalls that create bank stabilization problems along the Willamette River.

Citywide Annual Budget Line Item – High Source Areas – This capital project would include retrofitting the piped stormwater drainage systems in high source areas with structural water quality facilities such as sedimentation manholes and select proprietary stormwater treatment devices to reduce the pollutant load. Single or multiple facilities may be appropriate for these high source areas and the facilities will be selected and designed to treat the particular pollutant of concern based on specific site conditions. The following fifteen potential locations for these retrofits were identified:

Outfalls draining urban runoff into the Willamette River:

1. 42” pipe that drains to Delta Pond from node 60791 to 67090
   Located south of Alexander Loop on the east side of the Willamette River.
2. 36” pipe from node 60588 to 60606
   Located at the intersection of Horn Lane and River Road.
3. 24” pipe from node 60627 to 66554
   Located along River Road from Hillcrest north to Arbor.
4. 30” pipe from node 69032 to 60511
   Located at the intersection of Knoop Lane and River Road.
5. 30” pipe from node 60647 to 60612
   Runs east to the Willamette River just north of Rasor Avenue.
6. 21” pipe from node 62540 to 62539
   Located at the intersection of Cross and Polk Streets.
7. 30” pipe from node 68361 to 64598
   Located along Monroe Street from 1st to Clark Street.
8. 24” pipe from node 68362 to 64572
   Located along Washington from 1st to Clark Street.
9. 36” pipe from node 64388 to 66762
   Located along Jefferson from 7th to 6th Avenue.
10. 66” pipe from node 62939 to 62896
    Located on the east side of the river just south of Country Club Road.
11. 36” pipe from node 65113 to 65045
    Located at the intersection of Coburg Road and 4th Avenue.
12. 24” pipe from node 65166 to 66649
    Located east of High Street from 8th to Broadway.

Outfalls draining urban runoff into the Millrace:

13. 21" pipe from node 57276 to 57455
    Located at the intersection of 13th Avenue and Agate Street.
14. 24" pipe from node 56619 to 56620
    Drains a portion of Franklin Blvd., east of Walnut Street.
15. 24" pipe from node 56572 to 56573
    Located at the intersection of Moss and Garden.

Citywide Annual Budget Line Item - Tip-ups – Tip ups were considered to be opportunity areas for addressing multiple objectives. Tip-ups cause sediment and debris buildup resulting in localized flooding problems. In addition, when large storms come through, the accumulated sediment and debris may be flushed into downstream open waterways. Typically, the existing tip-ups do not have adequate access for maintenance. Tip-up retrofits were proposed to address potential maintenance-related flooding issues at these locations as described in Section 3.2 above. To address multiple objectives, the tip-up retrofits that were proposed include manhole or vault-like structures for water quality benefits. These structures would allow for the capture and removal of sediments/debris and would also allow for maintenance access. There are four potential tip-up locations that have been identified in this basin. They are listed in Section 3.2.

WR06- Polk Street Water Quality Facilities – This capital project involves constructing offline, underground structural water quality facilities in the piped storm system within the Polk Street subbasin.

WR100 – Willamette River Bank Stabilization – This proposed project alternative includes using bioengineering techniques to stabilize the Willamette River bank at locations where problems have been observed or are expected to occur as a result of future development.

WR101- Millrace Enhancement – This capital project would implement the concept options for water quality treatment that were proposed in the Millrace Enhancement Feasibility Study in 1990. The concept options include open channel improvements, construction of stormwater wetlands and a sedimentation pond as well as natural resource enhancements.

4.2.2 Development Standard Alternatives

Potential development standards were considered for addressing the identified water quality problems in the Willamette River basin. The standards that were considered include:

- *Require Best Management Practices (BMPs) to reduce pollutants associated with stormwater runoff from new development for a design storm representing a specified amount of rainfall* – This standard would require developers to construct stormwater quality BMPs to reduce pollutants in stormwater runoff associated with a specific design event. Based on an analysis of rainfall data from Eugene, the design event was selected to represent 80% of the average total annual rainfall. An evaluation of the design storms representing 70%, 80%, and 90% of the average total annual rainfall was conducted. The design storm representing 80% was found to be the most cost effective. Significant cost increases were estimated using the 90% event with not much additional treatment. And, the cost difference between the 70% and 80% events was insignificant. Therefore, the 80% event was selected. As a result, the water

quality design storm volume for detention type facilities is 1.4 inches over a 24 hour period; and the water quality design storm intensity for flow through type facilities is 0.22 inches/hour for on-line facilities and 0.13 inches/hour for off-line facilities. For more details on the analysis conducted to develop the water quality design storm parameters, see Appendix K of Volume I.

- *Require additional BMPs for specific land uses* – This standard would be implemented in addition to the standard listed above. The standard listed above would result in a base set of water quality BMPs required for all land uses. This development standard would require additional water quality BMPs for specific land uses. Specifically, it would require oil control for high traffic areas, and structural source controls for industrial/commercial activities that are exposed to stormwater.

- *Require developers to construct stormwater quality BMPs that remove a specified percentage of pollutants (e.g., 80% removal of TSS)* - This development standard is not considered viable, however, due to its many disadvantages including: 1) this approach is very difficult for the development community to address because there are many unknowns about how to meet such a performance standard; 2) it is difficult to enforce compliance with this approach without conducting very expensive chemical monitoring of the influent and effluent; and 3) this approach does not address the fact that some constituents may be of concern in one receiving water but not another.

- *Prohibit filling and/or piping of key waterways* – This standard would prohibit filling and piping of "key" waterways that provide important stormwater functions including water quality protection and treatment. Criteria would be established for identifying "key" waterways for protection. This standard is covered in Section 5.2.2 of this plan.

4.3 Selected Alternatives

The water quality management alternatives selected address pollutant discharges from both existing and new development. For existing development, the focus was on opportunity areas for siting surface water quality capital projects. As space was limited in this basin, underground water quality structures are recommended for high source areas. For future development, a development standard is recommended for all land uses and additional BMPs are recommended for high source areas as they would effectively reduce incremental increases in pollutant discharges. The development standard also applies to significant re-development as it will reduce additional pollutant discharges resulting from the re-development and will aid in addressing the existing water quality condition. The resulting water quality management strategy for the Willamette River basin consists of the following elements. For more detail regarding each of the capital projects, capital project fact sheets are provided in the Appendix.

- **Water Quality Development Standards:**

  - Require treatment BMPs that are designed according to the BMP Manual and the City's water quality design storms.

  - Require additional BMPs for specific land use activities of concern (i.e., oil control for high traffic areas, and structural source controls for commercial/industrial activities that are exposed to stormwater).

  - Prohibit filling and/or piping of key waterways (covered in Section 5.2.2).

- **Incentives for Existing Development:** Financial incentives will be incorporated into the stormwater user fee structure to encourage existing development not subject to the new water quality development standards to construct (retrofit) new stormwater quality BMPs.

- **Capital Project Citywide Annual Budget Line Item – Outfall Stabilization:** Retrofit storm system outfalls creating bank stability problems along the Willamette River.

- **Capital Project Citywide Annual Budget Line Item – Water Quality Facilities in High Source Areas:** Retrofit the piped stormwater drainage systems in high source areas (e.g., commercial and industrial areas) with structural water quality facilities such as sedimentation manholes and other proprietary stormwater treatment devices to reduce the pollutant load. Single or multiple facilities may be appropriate for these high source areas and the facilities will be selected and designed to treat the particular pollutant of concern based on specific site conditions.

- ***Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a manhole or vault-like structure to allow for the capture and removal of sediments/debris and to allow for maintenance access.

- **Capital Project WR06 – Polk Street Water Quality Facilities:** Construct offline, underground structural water quality facilities in the piped storm system along Polk Street.

- **Capital Project WR100 – Willamette River Stream Bank Stabilization:** Use bioengineering techniques to stabilize the Willamette River bank at locations where problems have been observed or are expected to occur as a result of future development.

- **Capital Project WR101 – Millrace Enhancement:** Implement the concept options for water quality treatment that were prepared for the City in 1990.

- **Multiple Objective Stormwater Capital Improvement Program:** In general, all stormwater capital projects, including flood control and natural resources projects, will consider water quality objectives when feasible and appropriate.

* Also listed under the flood control strategy in Section 3.0.

Note: It should be noted that this basin stormwater management strategy was intended to focus on water quality management tools in the form of development standards and capital projects. To comply with the National Pollutant Discharge Elimination System (NPDES) permit for stormwater discharges, the City is or has been also implementing a significant number of other stormwater quality management practices that will supplement this strategy and help to reduce the discharge of pollutants in stormwater. These include the following:

Inspection, Enforcement, and Monitoring

- Strengthen Enforcement to Prevent and Eliminate Illicit Connections
- Field Screening to Detect and Eliminate Illicit Connections
- Monitor Stormwater Discharges from Industrial Facilities

Operations and Maintenance

- Revise Comprehensive Operation and Maintenance Plans
- On-going Evaluation of City Vegetation Management Practices to Protect Stormwater Quality
- On-going Evaluation of Ice and Snow Road Traction Practices to Protect Stormwater Quality
- Evaluate and Improve DOT Practices to Improve Stormwater Quality
- Improve Clean-up After Accidents and Fires
- Evaluate and Improve Existing Street Sweeping Program
- Evaluate and Improve Effectiveness of Storm System Cleaning
- Storm System Mapping and Data Management
- Improve Litter Pickup Programs in Public Areas and Major Events
- Prevent Leaks and Spills from Municipal Trucks
- Maintain and Equip a Trained Environmental Spill Response Team

Planning and Administration

- Review Street Design Standards with Respect to Water Quality (this has been completed)
- Erosion Prevention and Construction Site Management Program (a new ordinance was developed in 1999)
- Illegal Dumping Program
- Improve Solid Waste Management Program to Address Stormwater Quality
- Inventory and Maintain Wetland Mitigation Sites to Ensure Benefits are Maintained in Perpetuity

Public Education

- Stormwater Information and Education Activities
- Storm Drain Stenciling
- Support government and community Tree Planting Programs
- Eugene Stream Team Volunteer Activities
- Educate Commercial/Industrial Business About Good Housekeeping Practices
- Improve Reporting of Illegal Dumping
- Education for Stormwater-Friendly Design Practices
- Expand Household Hazardous Waste Disposal Program

SECTION 5 Stormwater Related Natural Resources

For purposes of the basin planning process, the term "natural resources" pertains specifically to the City's open waterways drainage system and the characteristics of it that provide or assist in providing beneficial stormwater functions such as: storm conveyance, flood storage, water quality preservation or treatment, aquatic and riparian habitat, and water temperature controls. These natural resources include the primary waterway corridors of Eugene and adjoining riparian and wetland areas, and headwater streams and wetlands. These characteristics are described in Section 2.0 of this report.

Section 5.1 describes the evaluation process used and the basin-specific problems and opportunities identified under existing and expected future conditions. A description of existing waterway protection measures, other related efforts underway, and gaps in stormwater related natural resources data is also included. Section 5.2 describes the alternatives considered for addressing these problems and opportunities, and Section 5.3 describes the selected alternatives.

5.1 Evaluation of Natural Resources Under Existing and Expected Future Conditions

The following provides the objectives, methods, and results of the stormwater related natural resources evaluation for the Willamette River basin.

Objectives of the evaluation

- Determine the extent of the open waterway drainage system that should be protected for beneficial stormwater functions.
- Determine where existing protection policies apply and where gaps exist.
- Determine where restoration efforts should be targeted to improve stormwater functions.
- Determine where intervention efforts are needed to correct streambank stability problems.
- Determine what other efforts are underway which may ultimately provide protection consistent with stormwater program objectives.

Methods used to conduct the evaluation

Several methods were used to conduct the natural resources evaluation including the following:

- The following information was compiled and reviewed to assess the location, condition, and function of the Willamette River basin waterway system. Most of the data were contained in the City's geographic information system (GIS):
  - Open waterway drainage system.
  - Draft inventory of the Eugene-Springfield Metropolitan Plan Natural Resources Study.
  - FEMA floodway and floodplain areas.
  - National wetland inventory.
  - Soil Survey of Lane County Area, Oregon (1987), Natural Resources Conservation Service.
  - Historic photos, hydric soils – to help reconstruct the historic drainage system (i.e. pre-settlement).
  - Areas with stormwater pipe system.

  - 1999 aerial photography of the Willamette River basin.
- Site visits to collect and verify GIS information about select portions of the waterway system including location, size, condition, and function. For the site visits that were conducted, functions were evaluated using a modified version of the Oregon Freshwater Assessment Methodology (OFWAM). This method was modified to focus on the stormwater related benefits of natural resources.
- Eugene Public Works Department engineering and maintenance staff were interviewed as to their knowledge of the system.
- Property owners provided site specific information at public workshops and through other contacts.
- Policy plans were reviewed to determine where and how waterways were protected in the Willamette River basin.
- Other City of Eugene and Metro area staff were consulted to identify other on-going efforts which may ultimately provide protection for waterways consistent with stormwater program objectives.

Results of the evaluation

The results are provided below in terms of both existing conditions and expected future conditions.

Existing Waterway System Conditions:
- There are about 10.5 miles of remaining open waterways in the basin.
- Most of the remaining waterways are headwater tributaries in the LCC basin.
- Significant waterways include: Eugene Millrace and Russell Creek.
- None of these waterways are currently protected through local policies.

Expected Future Waterway System Conditions:
- Future conditions for "private" waterways are expected to deteriorate due to lack of specific waterway protection policies and measures in this basin.
- Future conditions of "publicly owned and/or maintained" waterways are expected to remain the same or improve over existing conditions due to the City's commitment to environmentally friendly maintenance practices and increasing level of responsibility for managing the open waterway system.

The remainder of this section provides additional context for the stormwater related natural resources evaluation:

Existing Protection Measures

- The Waterside Protection Overlay Zone (EC 9.4700) does not apply outside the West Eugene Wetlands Plan boundary and, therefore, does not affect this basin.
- The Natural Resource Zone (EC 9.2500) is intended to protect outstanding natural resource areas in adopted plans (EC 9.2500). It currently does not apply to any specific property but could be used in the future as a waterway protection tool.

- The Planned Unit Development (EC 9.8300) provisions contain specific approval criteria for protecting significant natural resources. These criteria are to be balanced with other policy needs and standards and, therefore, offer some but no consistent protection standards for waterways.
- Site Review (EC 9.8425) provisions contain approval criteria that could be used for waterways protection if specifically identified for protection.

Other Related On-going Efforts

- Endangered Species/Salmon program is expected to develop strategies for responding to the *January 2001* listing of spring Chinook salmon. Strategies are likely to include incentives and regulatory measures for protection and restoration of salmon habitat in Eugene. The timeline for developing strategy options for Council consideration is fall 2002.
- The Metro Natural Resources Study (NR Study) is expected to provide increased protection of waterways with riparian habitat functions. The timeline for implementation of protection measures is 2005.

Data Gaps

- There are little or no available data as to existing aquatic habitat and species conditions in the Willamette River basin waterways. These data would not only help further inform the condition of the waterways, but would also allow for better evaluation of the effects of proposed capital improvements to these waterways.

5.2 Development of the Natural Resources Strategy

As shown in the stormwater basin master planning process flow chart in Figure 1-1, Step 1 included a compilation of basin characteristics. These basin characteristics are summarized in Section 2.0 of this document. Step 2 in the process included problem identification under both existing and future land use conditions. The results of this step for natural resources are provided in Section 5.1 above. The next step included the development of potential stormwater management tools (i.e., capital projects or development standards) to address the identified problems and opportunities. These stormwater management tools were developed as a result of an all-day basin assessment meeting. The meeting was attended by a large multi-disciplinary group of people including staff with experience in water quality, engineering, maintenance, natural resources, planning, and groundwater resources. Preliminary ideas were developed based on the goals and objectives of the project. This section describes the capital projects and development standards that were proposed to address the identified stormwater-related natural resource problems and opportunities.

5.2.1 Capital Project Alternatives

The following capital projects were considered that would address stormwater related natural resources problems and opportunities:

Stream Corridor Acquisition - Stream corridors and specific sites with relatively high stormwater values which are also at risk of future development would be identified for acquisition. No high priority waterways were identified for acquisition in the Willamette River basin.

Citywide Annual Budget Line Item – Streambank Stabilization – This would be an annual budget line item for identifying and implementing streambank stabilization projects to help streams adjust to increased runoff volumes while limiting negative impacts associated with downcutting, sedimentation, and erosion. Where appropriate, bioengineering techniques would be used.

Citywide Annual Budget Line Item - Outfall Stabilization – This would be an annual budget line item for identifying and retrofitting storm drainage system outfalls which are creating localized erosion and bank stability problems.

WR100 – Willamette River Bank Stabilization – This proposed project alternative includes using bioengineering techniques to stabilize the Willamette River bank at locations where problems have been observed or are expected to occur as a result of future development.

WR101- Millrace Enhancement – This capital project would implement the concept options for water quality treatment that were proposed in the Millrace Enhancement Feasibility Study in 1990. The concept options include open channel improvements, construction of stormwater wetlands and a sedimentation pond as well as natural resource enhancements.

5.2.2 Development Standard Alternatives

Potential development standards were considered for addressing identified stormwater related natural resources problems and opportunities in the Willamette River basin.

- *Prohibit filling and/or piping of key waterways* – Using this approach, criteria would be established for identifying "key" waterways to be protected. A map of the key waterways and requirements would be adopted that would prohibit filling and/or piping of the waterways unless exemptions could be obtained. The key waterways approach would recognize that certain waterways possess characteristics that provide important stormwater functions and should be protected, while other smaller, isolated, segmented waterways provide little or no stormwater function and protection would not be warranted. This code would only apply within the Eugene city limits.

- *Pursue setback protection requirements for key waterways through other appropriate processes* – There is significant overlap between the stormwater program, NR Study, and ESA/Salmon program. This approach would rely on these other processes for providing some or all natural resources protection policies.

- *Require BMPs to reduce pollutants associated with stormwater runoff from new development* – This standard would require new development to control the quality of stormwater runoff

by selecting, designing, constructing, and maintaining a water quality facility. This standard is covered in Section 4.2.2 of this plan.

5.3 Selected Alternatives

The selected natural resources management strategy includes a combination of capital projects, development standards, and other items to address existing and future stormwater related natural resources problems and opportunities, as follows:

- **Support Existing Waterway Protection Standards:** (i.e., Waterside Protection Overlay Zone, "Needed Housing", Natural Resource Zone, Planned Unit Development provisions, Site Review provisions as applicable).

- **Prohibit Filling and/or Piping of Key Waterways:**

  Note: This standard was selected and an ordinance was processed through the Eugene Planning Commission and City Council. Ultimately, this standard was replaced by an approach that would apply no-fill/no-pipe prohibitions to all waterways until the NR Study was completed. When processed for adoption, this standard was referred to as the Open Waterways ordinance. The Open Waterways ordinance was challenged and subsequently remanded back to the City by the Land Use Board of Appeals for further processing. This ordinance is no longer in effect. The strategy for protecting stormwater significant waterways from being piped and filled is currently under development.

- ***Water Quality Development Standards:** These standards are selected to prevent pollutants from entering the waterways. They include: treatment BMPs for stormwater runoff from new development and additional BMPs for specific land use activities of concern.

- **Pursue Waterway Setback Protection Measures in Coordination with Natural Resources Study and ESA/Salmon Program (described in Section 5.1):** Coordination should occur to ensure consistency with stormwater program objectives for long term stream corridor protection and to identify and fill gaps in protection measures for waterways.

- ***Citywide Annual Budget Line Item - Streambank Stabilization:** Projects to be determined on an annual basis.

- ***Citywide Annual Budget Line Item - Outfall Stabilization:** Projects to be determined on an annual basis.

- ***WR100 – Willamette River Bank Stabilization:** This proposed project alternative includes using bioengineering techniques to stabilize the Willamette River bank at locations where problems have been observed or are expected to occur as a result of future development.

- ***WR101- Millrace Enhancement:** This capital project would implement the concept options for water quality treatment that were proposed in the Millrace Enhancement Feasibility Study in 1990. The concept options include open channel improvements, construction of stormwater wetlands and a sedimentation pond as well as natural resource enhancements.

- **Multiple Objective Stormwater Capital Improvement Program:** In general, all stormwater capital projects, including flood control and water quality projects, will consider stormwater related natural resources protection and enhancement as project objectives when feasible.

- **Aquatic Habitat and Species Data Collection:** Opportunities to fill-in data gaps will be explored via local studies and/or as part of partnership arrangements with federal and state agencies.

* Also listed under the flood control strategy and/or the water quality strategy in Sections 3.0 and 4.0.

6.1 Integrated Stormwater Management Strategy

The stormwater management strategy for the Willamette River basin represents the City's recommended combined approach of capital projects and development standards to address the flood control, water quality, and stormwater related natural resources and maintenance problems and opportunities associated with stormwater discharges. The purpose of this section is to summarize the flood control, water quality, and stormwater related natural resource elements of the strategy as they were presented in Sections 3.0, 4.0, and 5.0 respectively. In addition, this section discusses the costs and priorities associated with implementing the strategy. The elements of the stormwater management strategy are presented below:

Flood Control Strategy

The following capital project is proposed:

- **Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a manhole or vault-like structure that provides maintenance access.

Water Quality Strategy

In order to reduce the pollutant load, the City proposes to implement an on-site water quality development standard for all new development and significant redevelopment throughout the basin. This development standard requires treatment BMPs that are designed according to the BMP Manual and the City's water quality design storms. The standard also requires additional BMPs for specific land use activities of concern (i.e., oil control for high traffic areas, and structural source controls for commercial/industrial activities that are exposed to stormwater).

Financial incentives will be incorporated into the stormwater user fee structure to encourage existing development not subject to the new water quality development standards to construct (retrofit) new stormwater quality BMPs.

In addition, the following capital projects are proposed:

- **Capital Project Citywide Annual Budget Line Item – Outfall Stabilization:** Retrofit storm system outfalls creating bank stability problems along the Willamette River.
- **Capital Project Citywide Annual Budget Line Item – Water Quality Facilities in High Source Areas:** Retrofit the piped stormwater drainage systems in high source areas (e.g., commercial and industrial areas) with structural water quality facilities to reduce the pollutant load.
- ***Capital Project Citywide Annual Budget Line Item – Retrofit of Tip-ups:** Retrofit the existing tip-ups located throughout the basin with a sedimentation manhole that provides maintenance access.
- **Capital Project WR06 – Polk Street Water Quality Facilities:** Construct offline, underground structural water quality facilities in the piped storm system along Polk Street.

- **WR100 – Willamette River Bank Stabilization:** This proposed project alternative includes using bioengineering techniques to stabilize the Willamette River bank at locations where problems have been observed or are expected to occur as a result of future development.
- **Capital Project WR101 – Millrace Enhancement:** Implement the concept options for water quality treatment that were prepared for the City in 1990.

* Provides flood control benefits as well and is included in the list of flood control capital projects provided above.

Natural Resources Management Strategy

The natural resources strategy is focused on the protection and enhancement of open waterways for their stormwater functions and benefits. Part of the strategy will include support for existing waterway protection standards (i.e., Waterside Protection Overlay Zone, Natural Resource Zone, Planned Unit Developments provisions, Site Review provisions as applicable). Another part of the strategy involves coordinating with other related on-going efforts (NR Study, ESA) to ensure that, ultimately, the stormwater functions and benefits of stream corridors are protected and enhanced.

In addition, the following capital projects are proposed to improve open waterways in the basin:

- ***Citywide Annual Budget Line Item - Streambank Stabilization:** Projects to be determined on an annual basis.
- ***Citywide Annual Budget Line Item - Outfall Stabilization:** Projects to be determined on an annual basis.
- ***WR100 – Willamette River Bank Stabilization:** This proposed project alternative includes using bioengineering techniques to stabilize the Willamette River bank at locations where problems have been observed or are expected to occur as a result of future development.
- ***WR101- Millrace Enhancement:** This capital project would implement the concept options for water quality treatment that were proposed in the Millrace Enhancement Feasibility Study in 1990. The concept options include open channel improvements, construction of stormwater wetlands and a sedimentation pond as well as natural resource enhancements.

* Address multiple objectives and are therefore also listed above under either flood control capital projects or water quality capital projects.

Multiple Objective Stormwater Capital Improvement Program

It should be noted that, in general, all stormwater capital projects, will consider flood control, water quality and natural resources protection and enhancement as project objectives when feasible and appropriate. All stormwater capital projects will conform to adopted code requirements for private development, including stormwater quality standards. Opportunities to

fill in aquatic habitat and species data gaps will be explored via local studies and/or as part of partnership arrangements with federal and state agencies.

6.2 Summary of Strategy Benefits

When implemented, the integrated strategy is expected to provide the following benefits:

1. Maintain the required level of flood protection basin-wide. Address flooding problems associated with tip-ups through capital projects.
2. Reduce existing pollutant loads through capital projects and financial incentives to retrofit existing developments.
3. Reduce pollutant loads associated with new developments through development standards.
4. Identify, protect and manage significant open waterways for their beneficial stormwater functions.

6.3 Summary of Strategy Implementation and Costs

For a description of implementation of water quality and stormwater related natural resources standards, refer to Volume I – Citywide Basin Master Plan Report.

This section describes the approach for capital project implementation in the Willamette River basin. It also provides estimated costs and expected funding sources for each of the capital projects.

Three specific projects were selected and prioritized for implementation over a 35-year time period (2001-2035). Eight generic capital project categories were also identified for construction city-wide on an on-going yearly basis over the same 35-year period. These generic capital project categories include retrofit of tip-ups and water quality facilities in high source areas as identified for the flood control and pollution prevention strategies above. These two categories of capital projects constitute the City's capital programming for the Willamette River basin. Refer to Figures 3-2 through 3-6 for a generalized location of these projects.

For a general description of the capital prioritization methodology and financing approach, refer to Volume I – Citywide Basin Master Plan Report. Table 6-1 shows the priority schedule, cost, and funding allocations for the three specific capital projects and the yearly line item projects.

Table 6-1
Implementation Schedule Years 2001 – 2035

Capital Project Identification	Priority	Total Estimated Cost	Estimated Funding Source and Allocation		
			SDCs	User Fees	Federal Priority Funds
WR 06 – Polk Street Water Quality Facilities*	2001 - 2005	$500,000	$0	$500,000 [100%]	$0
WR 100 – Willamette River Bank Restoration	2001 - 2005	$1,050,000	$0	$367,500 [35%]	$682,500 [65%]
WR 101 – Eugene Millrace Restoration	2001 - 2005	$3,550,000	$0	$1,242,500 [35%]	$2,307,500 [65%]
Subtotal:		**$5,100,000**	**$0**	**$2,110,000**	**$2,990,000**
Yearly Capital Program Line Items Citywide: • Water Quality Facilities in High Source Areas • Stormwater Outfall Stabilization • Streambank Stabilization • Retrofit Tip-ups • General Rehabilitation • Stream Corridor Acquisition • Services for New Development • Wetland Mitigation Bank		These costs have not been calculated on a basin specific basis. See Volume I Citywide for overall cost estimates.			

* Cost assumes approximately ten structural water quality facilities in the Polk Street Major subbasin

APPENDIX

CAPITAL PROJECT FACT SHEETS

Project Identifier	**WR01 - Citywide Annual Budget Line Item**	
Project Title	**Streambank Stabilization**	
Project Location		
Open waterways throughout the Willamette River Basin.		
Subbasin	**NA**	
GIS U/S Node Location	**NA**	
GIS D/S Node Location	**NA**	
Drainage Area Served by Capital Project	**NA**	Acres
% Impervious (1994 Existing Land Use)	**NA**	
% Impervious (Future)	**NA**	
Design Flow (Future Conditions	**NA**	cfs

Project Description

Implement streambank stabilization projects to help streams adjust to increased runoff volumes while limiting negative impacts associated with downcutting , sedimentation, and erosion. Where appropriate, use bioengineering techniques to stabilize streambanks.

Project Elements

0 SY – Streambank Stabilization

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Downcutting, sedimentation, and erosion problems have been observed in open waterways that are receiving increased runoff volumes associated with urbanization.

Opportunities

Streambank stabilization provides the opportunity to improve or restore riparian vegetation and aquatic habitat conditions.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Streambank Stabilization	Inspect vegetation and banks for erosion.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP eliminates localized erosion of streambeds and streambanks.

Natural Resources

This CP can help restore native riparian vegetation and improve aquatic habitat conditions.

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be a $150,000 annual line item in the capital project budget to address streambank stabilization projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Project Identifier	**WR02 - Citywide Annual Budget Line Item**
Project Title	**Water quality facilities in high source areas**

Project Location

Piped storm drainage systems located throughout the City of Eugene that convey stormwater runoff from mostly developed (i.e. no space for above ground water quality facilities) high pollutant source areas (i.e. commercial and industrial areas).

Subbasin	**N/A**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**N/A**	Acres
% Impervious (1994 Existing Land Use)	**N/A**	
% Impervious (Future)	**N/A**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Construct offline, underground structural water quality facilities in developed, high pollutant source areas. Types of facilities include sedimentation manholes, and proprietary stormwater treatment devices. Depending on flow rate, costs vary from $2000 for a small sedimentation manhole to $60,000 for a large Storm Filter.

Project Elements

1 EA – Underground structural water quality facility

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Based on monitoring data collected within the City of Eugene, stormwater from high pollutant source areas is a significant source of pollutant loads to receiving waters.

Opportunities

Opportunity to reduce pollutant discharges in stormwater runoff from high pollutant sources in developed areas.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Underground structural water quality facility	Depending on the facility type, maintenance may be required once every month to once every two years.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides treatment of stormwater runoff from various sized high pollutant source drainage areas. Pollutant load reductions will depend on the type of facilities used and the locations of the facilities.

Natural Resources

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:

Site Acquisition: $0

Engineering / Administration:

Capital Project Implementation Costs

There will be a $150,000 annual line item in the capital project budget to address water quality facilities for high source areas on a city-wide basis.

Annual Maintenance Costs

Design Assumptions

Possible high source retrofit locations:

1) Node 62543 - Approximate drainage area = 11 acres
Delta Hwy. Upstream of outfall to Willamette River
2) Node 62539 - Approximate drainage area = 9.2 acres
Polk St., and Cross St.
3) Node 57396 - Approximate drainage area = 6.7 acres
Alder St., between 11th and 12th
4) Node 65165 - Approximate drainage area = 8 acres
Franklin Blvd., and ferry St.
5) Node 58525 - Approximate drainage area = 10.3 acres
High St., and 12th Ave.
6) Node 64392 - Approximate drainage area = 6.9 acres
Lincoln St., and 6th Ave.
7) Node 64385 - Approximate drainage area = 15.4 acres
Blair Blvd., and 1st St.
8) Node 32527 - Approximate drainage area = 15.2 acres
South of Country Club Rd. West of Country Club Pkwy.
9) Node 56530 - Approximate drainage area = 6.7 acres
Garden Ave. between Villard St. & Walnut St.
10) Node 63743 - Approximate drainage area = 11.5 acres
Taylor St. between 6th and 7th Ave.

Project Identifier	**WR03 - Citywide Annual Budget Line Item**
Project Title	**Outfall stabilization**

Project Location

All storm drainage system outfalls draining directly to the Willamette River within the City of Eugene that are causing erosion and bank stabilization problems.

Subbasin	**N/A**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**N/A**	Acres
% Impervious (1994 Existing Land Use)	**N/A**	
% Impervious (Future)	**N/A**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Identify and retrofit storm drainage system outfalls creating bank stability problems along the Willamette River within the City of Eugene.

Project Elements

1 Ea – Outfall Protection

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Erosion and bank stabilization problems, and in some cases maintenance access problems, exist at storm drainage system outfalls draining into the Willamette River.

Opportunities

Opportunity to retrofit storm drainage system outfalls to provide maintenance access, energy dissipation, and bank stabilization.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Outfall Protection	Inspect and clean outlet, inspect vegetation and slope protection.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides bank stabilization that will reduce sedimentation from erosion caused by storm drainage system outfalls draining into the Willamette River.

Natural Resources

This CP will reduce impacts on streambank vegetation and aquatic habitat

Other City Objectives Addressed by the Capital Project

To be completed by the City

Costs

Construction Costs:	
Site Acquisition:	$0
Engineering / Administration:	
Capital Project Implementation Costs	

There will be a $125,000 annual line item in the capital project budget to address outfall stabilization projects on a city-wide basis.

Annual Maintenance Costs	**$0**

Project Identifier	**WR04 - Citywide Annual Budget Line Item**
Project Title	**Retrofit of Tip-ups**

Project Location

Tip-ups located throughout the Willamette River Basin.

Subbasin	**N/A**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**N/A**	Acres
% Impervious (1994 Existing Land Use)	**N/A**	
% Impervious (Future)	**N/A**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Retrofit the tip-ups with manholes that provide sedimentation storage and maintenance access. Re-install outlet pipe at a positive grade.

Project Elements

1 EA – Retrofit of Tip-up

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Surcharging, build up of sediment and debris, and limited access for maintenance are all problems associated with the existing tip-ups.

Opportunities

This CP provides an opportunity to reduce sedimentation problems and to facilitate maintenance.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Retrofit of Tip-up	Inspect sediment loading and debris accumulation, remove debris and sediment.

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

This CP is expected to reduce capacity problems due to sediment buildup.

Water Quality

The new manhole will provide storage of sediment and debris which can be periodically removed.

Natural Resources

N/A

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:

Site Acquisition: $0

Engineering / Administration:

Capital Project Implementation Costs

There will be a $125,000 annual line item in the capital project budget to address tip-up retrofit projects on a city-wide basis.

Annual Maintenance Costs

Design Assumptions

The following tip-ups within the Willamette River Basin were identified for retrofit:

1) Un-modeled segment - located along Country Club Rd. just north of the intersection of Country Club Rd. and Coberg Rd.
Node 65022 to 65011, Page 65 (bottom center) of 97
Tip-up offset = 2.06 feet

2) Potential tip-ups (inverts are not listed in the City's GIS)

Node 66175 to 59066 (page 51 of 97)
Node 72440 to 62466 (page 53 of 97)
Node 69170 to 67172 (page 66 of 97)

Project Identifier	**WR06**
Project Title	**Polk Street Water Quality Facilities**

Project Location

Polk Street piped storm drainage system located in downtown Eugene discharges stormwater runoff from high pollutant source areas (i.e. commercial business district) to the Willamette River through a 90" CSP outfall (page 53 of the sewer index map).

Subbasin	**WRPK**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**67136**	
Drainage Area Served by Capital Project	**770**	Acres
% Impervious (1994 Existing Land Use)	**57**	
% Impervious (Future)	**64**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

Construct offline, underground structural water quality facilities in this piped storm drainage system. Types of facilities include sedimentation manholes, and proprietary stormwater treatment devices. Depending on flow rates, costs vary from $2000 for a small sedimentation manhole to $60,000 for a large Storm Filter. Look for opportunities to take advantage of the existing vault structure located just upstream from the outfall discharge point.

Project Elements

1 EA – Underground Structural Water-Quality Facility

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Based on monitoring data collected within the City of Eugene, stormwater from high pollutant source areas is a significant source of pollutant loads to receiving waters. Observed water quality problems have frequently been reported at this outfall.

Opportunities

Opportunity to reduce pollutant discharges in stormwater runoff from high pollutant sources in developed areas.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Underground Structural Water-Quality Facility	Depending on the facility type, maintenance may be required once every month to once every two years

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This CP provides treatment of stormwater runoff from various sized high pollutant source drainage areas. Pollutant load reductions will depend on the type of facilities used and the locations of the facilities in the drainage system.

Natural Resources

N/A

Other City Objectives Addressed by the Capital Project

To be completed by the City

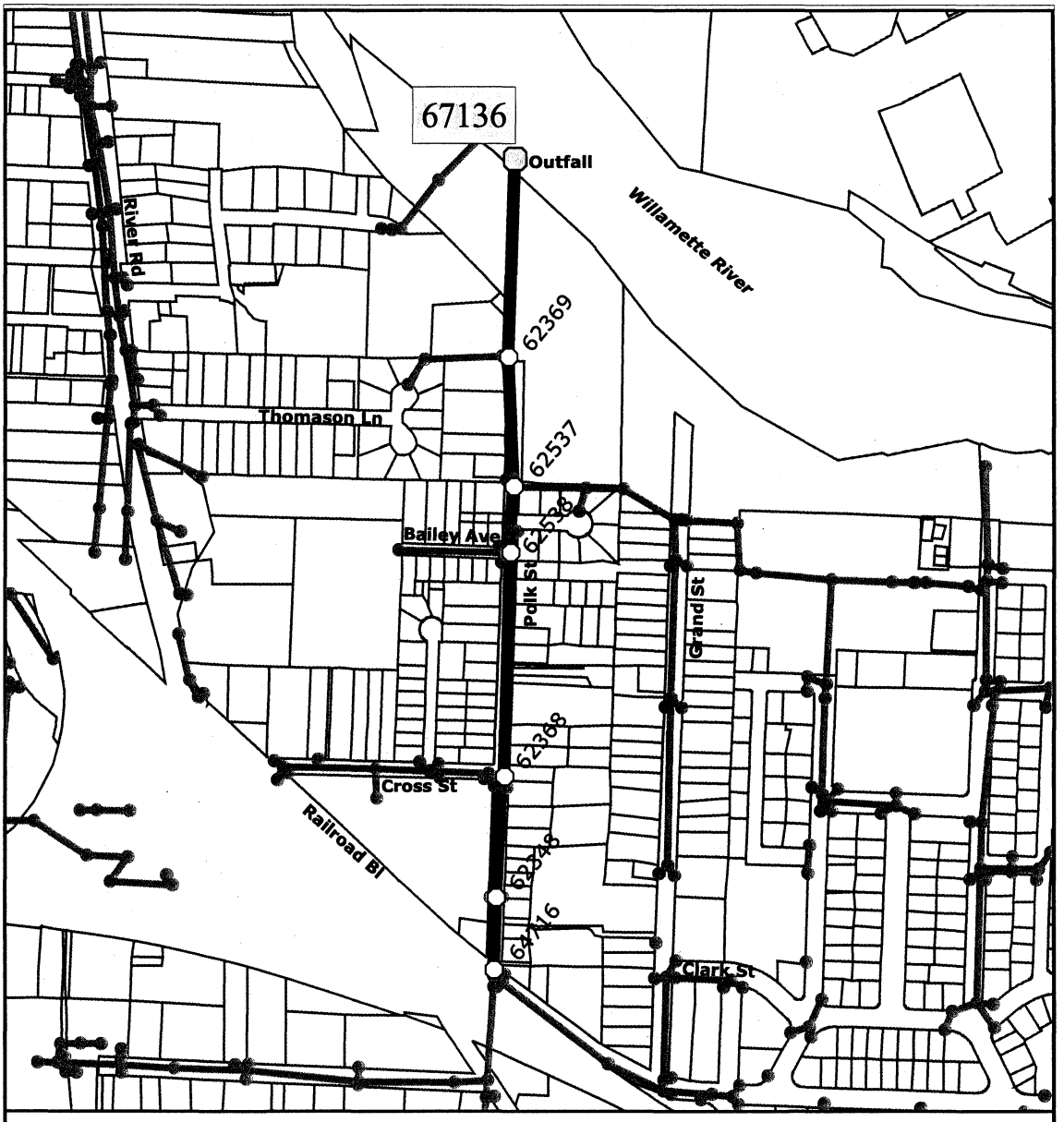
Costs

Construction Costs:	$50,000
Site Acquisition:	$0
Engineering / Administration:	$10,000

Capital Project Implementation Costs **$60,000**

This is an average cost estimate of $50,000 per treatment facility. Costs of underground structural water quality facilities will vary depending on the type of facility and the design flow. The range of costs may vary from $2,000 to $60,000 per treatment facility.

Annual Maintenance Costs **$1,000**



Property Parcel Boundary
Capital Project Location
Storm Drainage System (Pipe or Open Channel)
Capital Improvement Project Element
Upstream/Downstream Node
Upstream/Downstream Subnode
Manholes or Catch Basins

N

200 0 200 400 Feet

Site Map for CIP # WR06

Polk Street Water Quality Facilities
Willamette River Basin
City of Eugene
Capital Project

April 2001
I:\945042na\GISDATA\cip_willamette.apr

URS

WR06

Design Assumptions

N/A

Project Identifier	**WR100**
Project Title	**Willamette River Bank Stabilization**

Project Location

Willamette River banks in Eugene's Skinner Butte Park

Subbasin	**N/A**	
GIS U/S Node Location	**N/A**	
GIS D/S Node Location	**N/A**	
Drainage Area Served by Capital Project	**N/A**	Acres
% Impervious (1994 Existing Land Use)	**N/A**	
% Impervious (Future)	**N/A**	
Design Flow (Future Conditions	**N/A**	cfs

Project Description

The river bank along the heavily - used recreation area in Skinner Butte Park has a long history of erosion and slope failure, most recently as a result of the 1996 floods. Many past repair efforts are in need of repair themselves. This project would include: Armoring the existing banks with rock and bio-tech structures, terracing selected areas into typical floodplain type cross-sections, and planting of native species for further stabilization.

Project Elements

1 LS – Bank Restoration Measures

Problems and/or Opportunities Addressed by the Capital Projects

Problems

The river bank in Skinner Butte Park has a long history of erosion and slope failure most recently as a result of the 1996 floods. Valuable parkland erodes away into the river on an annual basis. Flooding in the past three years has hastened the erosion effects.

Opportunities

Opportunity to stabilize the river bank while also addresing local goals to enhance and protect local stream banks and riparian areas adjacent to salmon habitat

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Bank Restoration Measures	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This capital project would prevent erosion - associated sediment loads to the Willamette River

Natural Resources

This capital project would provide bank stabilization, floodplain enhancements and improvements to aquatic and riparian habitat.

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:	
Site Acquisition:	
Engineering / Administration:	
Capital Project Implementation Costs	$1,050,000
Annual Maintenance Costs	

Site Map for CIP # WR100

Willamette River Bank Restoration
Willamette River Basin
City of Eugene
Capital Project

April 2001
I:\945042na\GISDATA\cip_willamette.apr

URS

WR100

Project Identifier	**WR101**
Project Title	**Eugene Mill Race Restoration**

Project Location

The historic Eugene millrace along the mainstem of the Willamette River

Subbasin	**N/A**
GIS U/S Node Location	**N/A**
GIS D/S Node Location	**N/A**
Drainage Area Served by Capital Project	**N/A** Acres
% Impervious (1994 Existing Land Use)	**N/A**
% Impervious (Future)	**N/A**
Design Flow (Future Conditions	**N/A** cfs

Project Description

Restore the historic Eugene millrace along the mainstem of the Willamette River. Restoration efforts could include: improving the intake, improving salmon habitat, restoring sections of the millrace to improve riparian habitat, and creating wetlands to treat water quality.

Project Elements

1 LS – Intake Improvements, Habitat Enhancements, Wetland creation

Problems and/or Opportunities Addressed by the Capital Projects

Problems

Sice its construction, the millrace has been altered, channelized, relocated, piped, filled and misused.

Opportunities

Opportunity to restore and open the outlet of an altered millrace and to improve habitat and water quality in sections of the millrace while maintaining flood control capacity.

Maintenance Requirements

Facility Type	*Annual Maintenance Activities*
Intake Improvements, Habitat Enhancements, Wetland creation	

CSWMP Objectives and Policies Addressed by the Capital Project

Flood Control

N/A

Water Quality

This capital project would provide treatment of flows through filtering and biological uptake of created wetlands.

Natural Resources

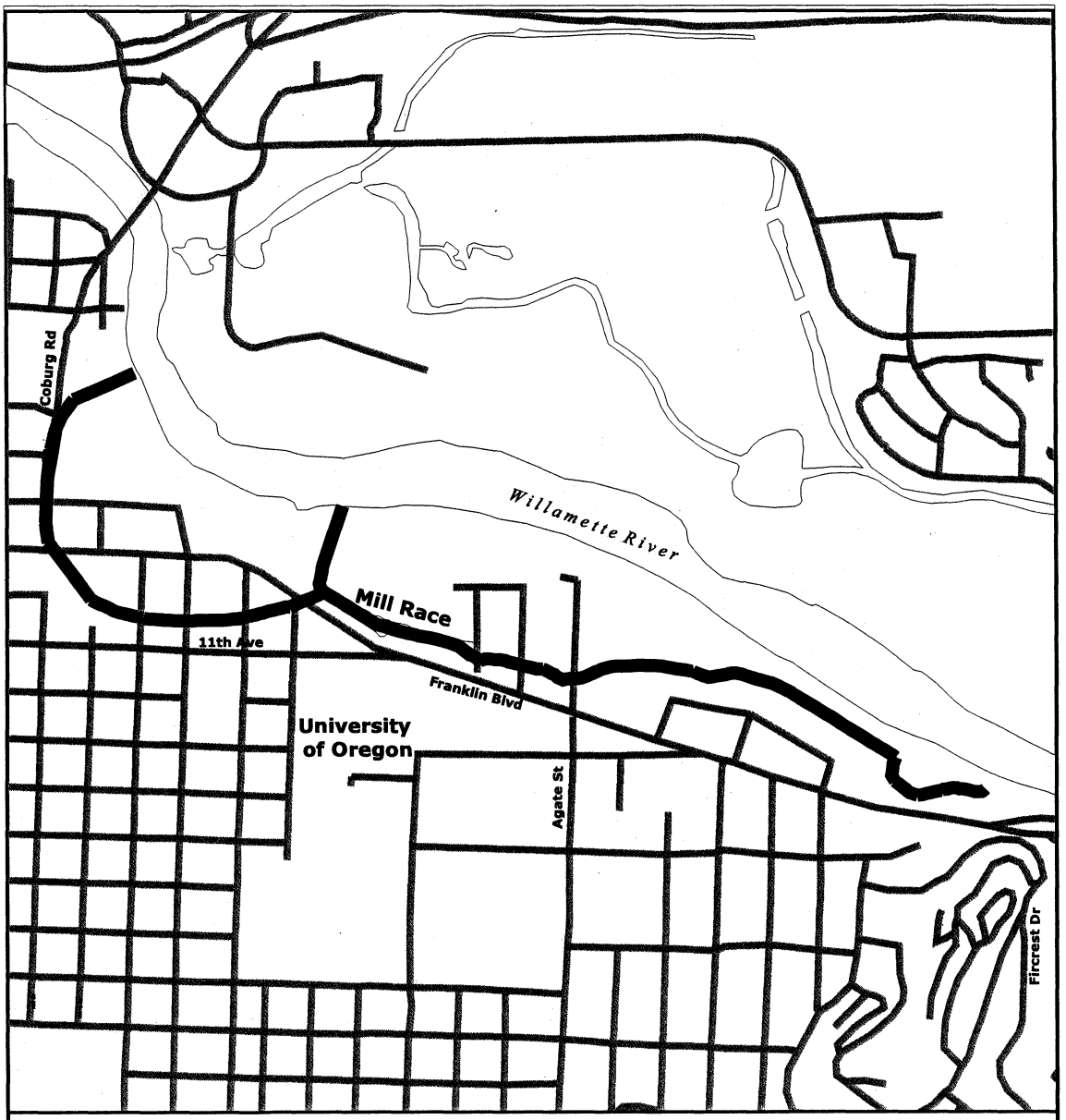
This capital project would provide natural resource enhancements through improvements to riparian habitat and creation of wetlands

Other City Objectives Addressed by the Capital Project

To be Completed by the City

Costs

Construction Costs:	
Site Acquisition:	
Engineering / Administration:	
Capital Project Implementation Costs	$3,550,000
Annual Maintenance Costs	



Capital Improvement Project Element

Water Bodies

Streets

N

250 0 250 500 750 1000 Feet

Site Map for CIP # WR101

Eugene Mill Race Restoration
Willamette River Basin
City of Eugene
Capital Project

April 2001
I:\945042na\GISDATA\cip_willamette.apr

URS

WR101